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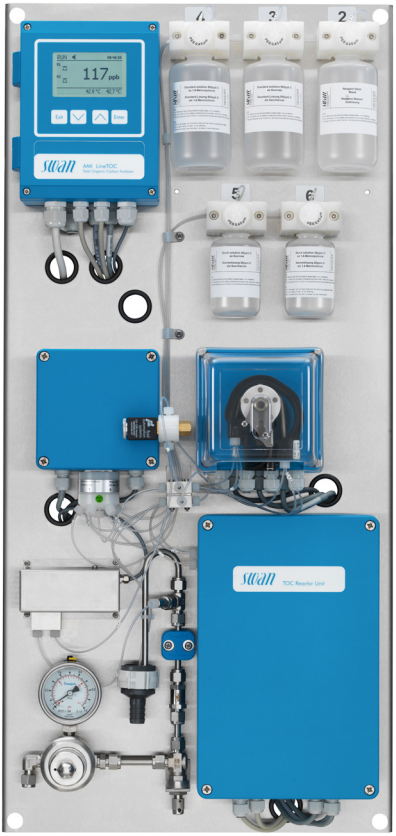
ANALYTICAL INSTRUMENTS

# AMI LineTOC

*Version 6.20 and higher*




*Operator's Manual*

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**Customer Support**
SWAN and its representatives maintain a fully trained staff of technical specialists around the world. For any technical question, contact your nearest SWAN representative, or the manufacturer:

SWAN ANALYTISCHE INSTRUMENTE AG
Studbachstrasse 13
8340 Hinwil
Switzerland

Internet: www.swan.ch

E-mail: support@swan.ch

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## Table of Content

# AMI LineTOC - Operator's Manual

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

## 1. Safety Instructions

**General**

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

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

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

Strictly follow all safety instructions in this publication.

**Target audience**

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

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

**OM Location**

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

**Qualification, Training**

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

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

## 1.1. Warning Notices

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

**DANGER**

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

- Follow the prevention instructions carefully.

**WARNING**

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

- Follow the prevention instructions carefully.

**CAUTION**

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

- Follow the prevention instructions carefully.

**Mandatory Signs**

The importance of the mandatory signs in this manual.

Safety goggles

Safety gloves

**Warning Signs**

The importance of the warning signs in this manual.


Electrical shock hazard


Corrosive


Harmful to health


Flammable


Warning general


Attention general

## 1.2. General Safety Regulations

**Legal Requirements**

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

**Spare Parts and Disposables**

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

**Modifications**

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

**WARNING**

**Risk of Electrical Shock**

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

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

**WARNING**

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

**WARNING**

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

## 1.3. Restrictions for use

**CAUTION**

The sample must not contain any particles, which may block the UV-reactor. Sufficient sample flow is coercive for the correct function of the instrument.

# 2. Product Description

**Application**

The determination of organic components contained in water allows an extensive statement about its purity.

The instrument AMI LineTOC is the result of comprehensive experiences in development of analytical instruments. The combination of a high efficient oxidation technique with modern detection- and evaluation-methods guarantees an accurate monitoring of pure and ultra-pure water.

The application range covers the demand of both, the pharmaceutical industry and ultra pure water (UPW) applications. Due to the restrictive international regulations for the pharmaceutical industry, some options in the menu of the transmitter are not visible, but replaced by fix values.

**Signal Outputs**

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

Current loop: 0/4–20 mA

Maximal burden: 510 Ohm

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

**Relays**

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

**Alarm Relay**

One potential free contact.

Alternatively:

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

Summary alarm indication for programmable alarm values and instrument faults.

**Input**

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

**Communication Interface (optional)**

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

**Safety Features**

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

**Grab Sample**

The grab sample mode can be used for measurement of external samples which are not connected to the sample inlet.

**Measuring Modes**

The menu structure of the AMI LineTOC transmitter is divided in the two different main parts “Pharma” and “UPW” called measuring modes.

**Operating Modes**

The AMI LineTOC provides the following operating modes:

- On-line mode
- Grab sample

In on-line mode the sample is sucked through the system from the sample inlet and measured (see On-line mode, p. 17).

In grab sample mode the sample is sucked through the system from a bottle and measured. The bottle is fixed on position 2 (see Instrument Specification, p. 19).

**Conductivity Model**

Description of conductivity model $CO_2$ see Conductivity Model CO2, p. 10.

Description of conductivity model coefficient see Conductivity Model Coefficient, p. 11.

**Tests**

Dependent on the measuring mode and conductivity model of the AMI LineTOC the following tests are active:

| Conductivity model<br>Measuring mode | **$CO_2$** | **Coefficient** |
|---|---|---|
| Pharma | • Verification<br>• Function Test<br>• SST | • Calibration<br>• Function Test<br>• SST |
| UPW | • Verification<br>• Function Test | • Calibration<br>• Function Test |

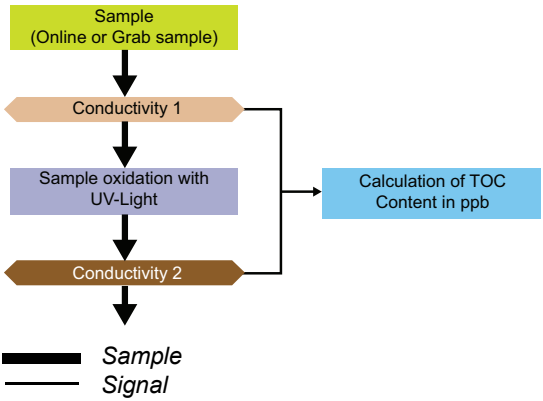
**Definitions**

| | |
|---|---|
| **TC** | Total Carbon<br>The sum of inorganic and organic bound carbon |
| **TIC** | Total Inorganic Carbon<br>The sum of inorganic carbon in dissolved and non dissolved compounds |
| **TOC** | Total Organic Carbon<br>The amount of carbon in organic compounds |
| **AP** | Aqua Purificata |
| **WFI** | Water for Injection |
| **PW** | Pure Water |
| **USP** | United States Pharmacopeia |
| **EP** | European Pharmacopeia |

## 2.1. Description of the System

**Measuring principle**

The basic principle of most TOC measurement methods is the oxidation of the organic carbon to $CO_2$ followed by detection.




**Requirements of International Pharmacopoeia**

International Standards related to the determination of the sum parameter TOC are:

- ISO 8245TOC in water
- USP (643)TOC in pharmaceutical water (AP, WFI)
- Ph. Eur. 2.2.44TOC in pharmaceutical water (AP, WFI)

It is assumed that the TOC is proportional to the concentration of microorganisms or other organic contaminants in water, which may be introduced into the water through the source, purification systems, tubes or from biofilm growing in the system.

Is the TOC-content less than a defined amount, it is assumed that the contamination is not significant from the pharmaceutical point of view.

The TOC limit value for WFI and PW defined by the USP and EP is 500 ppb. The applied method for determination of the TOC is irrelevant.

Both standardizations have established special guidelines for the qualification of the applied method through the system suitability test (SST).

System suitability refers to the ability of the instrument to efficiently oxidize a substance that is not easily oxidized.

The AMI LineTOC is able to perform the system suitability test automatically, the operator only needs to activate the program function and provide both standard solutions at the corresponding ports. Analysis and calculation is then performed automatically by the instrument and displayed on the display after termination of the measurements.

**Conductivity Model $CO_2$**

The pharmaceutical industry and the semiconductor industry require large amounts of deionized water with a TOC content in a low ppb range. This water contains no salt, but only organic compounds and dissolved carbon dioxide from the atmosphere.

If the organic carbon compounds:

- are dissolved
- are non-ionic (no organic acids, etc.),
- consist only of the elements C, H and O (carbon, hydrogen and oxygen),

it is possible to determine the TIC and TC by complete UV-oxidation and direct conductivity measurement.
If temperature and pressure are known, the conductivity of these samples is determined only by the total carbon dioxide content.

Carbon dioxide reacts with water to carbonic acid, which dissociates partially to hydrocarbonate ions and carbonate ions. The total carbon dioxide content is the sum of all these species. The composition of the sample in the chemical equilibrium is exactly determined according to the law of mass action.

Through the definite relation of conductivity and total carbon dioxide content, the TIC and TOC can be calculated from the measured conductivity of the sample.

Prior to oxidation the conductivity corresponds to the TIC, after oxidation, the conductivity corresponds to the TC. The TOC is calculated from the difference of TC - TIC.

The determination of TIC and TOC under the above described conditions is an absolute method, i.e. for a particular TIC or TOC concentration, the conductivity is given exactly. An alignment of the conductivity with TOC calibration solutions is therefore not necessary.

If the instrument does not measure the defined TOC concentration of a standard solution within the limits of measurement accuracy, it is caused by one or more of the following reasons:

- the above described conditions are not fulfilled,
- the deviation of the measurement is caused by a defect of the instrument,
- the deviation of the measurement is caused by incorrect operating parameters of the transmitter.

Should wrong measurements occur, request for a qualified service technician.

**Conductivity Model Coefficient**

The conductivity model coefficient is based on a 2-point calibration. A straight line is drawn through two points of a TOC-conductivity diagram. One point is measured with dilution water, the other point is measured with calibration standard. It is assumed that the TOC content is approximately proportional to the increase of conductivity caused by oxidation.
During the on-line measurement and the calibration the sample is kept at a constant temperature of 42–43 °C. Therefore normally it is not necessary to consider the temperature dependence for calculating the TOC content of the sample.
Under certain conditions however it may be necessary to alter the percent value of the Coefficient, see 5.1.1.1.2.1, p. 86.

## 2.2. Verification

***NOTICE:*** *A verification can be carried out only if the conductivity model "$CO_2$" is selected.*

The AMI LineTOC is calibrated in the factory. Since the accuracy of TOC measurements depends directly on the calibration of the instrument, it is recommended to verify the calibration at regular intervals (see Maintenance Schedule, p. 45). The calibration parameters are verified by measuring a standard solution with a known TOC concentration. The need of the instrument verification is also issue of international regulations such as USP and EP.

To verify the slope of the calibration curve the two solutions:

- Reagent Water Blank
- Standard Solution 1 ppm C as sucrose (adjustable in measuring mode UPW)

are measured in sequence. The result of the two measuring values is a dimensionless factor which is used to verify whether the slope of the calibration curve is within the given range calculated as TOC (TOC = TC - TIC). The range from 0 to 1'000 ppb TOC fits the demands to monitor pure and ultra pure waters with a maximum conductivity of 2 µS/cm.
Measuring procedure verification see Verification, p. 46.

## 2.3. Calibration

***NOTICE:*** *A calibration can be carried out only if the conductivity model "coefficient" is selected.*

The AMI LineTOC is calibrated in the factory. Since the accuracy of TOC measurements depends directly on the calibration of the instrument, it is recommended to calibrate at regular intervals (see Maintenance Schedule, p. 45). The calibration parameters are determined by measuring a standard solution with a known TOC concentration. The need of the instrument calibration is also issue of international regulations such as USP and EP.

To determine the slope of the calibration curve the two solutions:

- Reagent Water Blank
- Standard Solution 1 ppm C as sucrose (adjustable in measuring mode UPW)

are measured in sequence. The result of these two measuring values can be used to recalculate the slope of the calibration curve in ppb/nS.
Measuring procedure calibration see Calibration, p. 49

The calibration curve specifies the correlation between the content of carbon in the sample (or standard) and the reading of the instrument as conductivity difference. The calibration range from 0 to 1'000 ppb TOC fits the demands to monitor pure and ultra pure waters with a maximum conductivity of 2 µS/cm.

## 2.4. Function Test

The function test allows the operator to check the system suitability in a programmable time interval automatically and so assure accurate TOC monitoring.

**Pharma Mode**

Test of the sensor performance by detecting complex organic substances in accordance with the regulations of the system suitability test. The test compares the results of an easy to oxidize sucrose standard solution with a more difficult to oxidize benzoquinone test solution. The standards are prepared by automatic dilution of high concentrated stock standards of:

- stock solution 20 ppm C as sucrose
- stock solution 20 ppm C as 1,4-benzoquinone

The sample water of the instrument is used as dilution water. TOC readings of both diluted solutions are compared and describe the "response efficiency" (re) of the sensor (similar to the SST).

The dilution of high concentrated stock standards provide the usage of the solutions over a long time (usually > 1 month) depending on ambient conditions.

Measuring procedure function test see Function Test Pharma, p. 51.

**UPW Mode**

The measuring values of ultra pure water may be constant over a long time. The function test allows the operator to check the sensor's response on changing concentration of the sample. The standard solution:

- check standard

is mixed with the sample water for a certain time. As a result, the measuring value should rise and then fall back again.

Measuring procedure function test see Function Test UPW, p. 54.

## 2.5. System Suitability Test for Pharma

The AMI LineTOC analyzer is designed to meet the requirements of the USP and EP for monitoring of pharmaceutical water. A verification of the TOC results according to the European and American pharmacopeia requires a regularly performed system suitability test (SST) to control the performance of the system.

The measurement of two different standards with:

- Reagent Water Blank [2]
- Standard Solution 500 ppb C as sucrose [3]
- SST Solution 500 ppb C as 1.4-benzoquinone [4]

are compared. The Reagent water blank [2] is used to dilute the standard solutions.It is measured first to determine its TOC content. This TOC content is subtracted then from the TOC content of the standard solutions during the SST. The two organic compounds Sucrose and 1,4-benzoquinone differ in it's UV-stability. Sucrose is easier to oxidize than 1,4-benzoquinone. The system suitability test checks the oxidation performance of the analyzer by measuring the response efficiency of the two reference standard solutions.

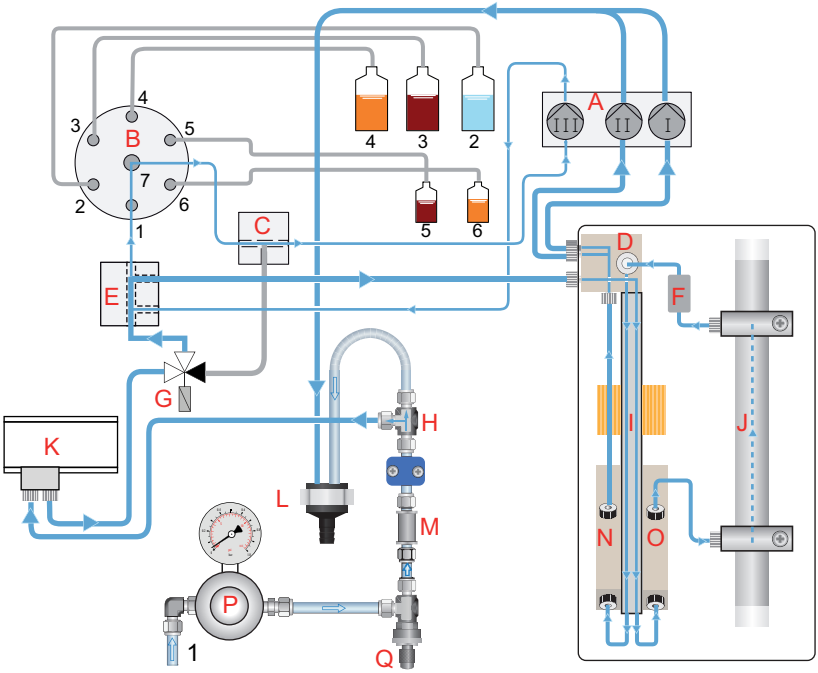
The system is suitable if the recovery rates is not less than 85% and not more than 115% of the theoretical TOC concentration.

**Definitions**

| | |
|---|---|
| **SST** | System Suitability Test |
| **Limit response** | Measured TOC concentration of the standards solution corrected by the reagent water blank |
| **$R_S$** | **S**tandard response (TOC concentration) |
| **$R_{SS}$** | **S**ystem **s**uitability response (TOC concentration) |
| **$R_W$** | **W**ater response (TOC reagent water blank) |
| **Response efficiency** | Calculated quotient of the standard and test solution concentrations, corrected by the reagent water blank |

See chapter System Suitability Test (SST), p. 56 in the maintenance section for more details to the process itself.

## 2.6. Fluidics Overview




| | | | |
|---|---|---|---|
| **1** | *Sample inlet* | **F** | *Flow monitoring sensor* |
| **2** | *Bottle holder Pos.2* [1)] | **G** | *3-way solenoid valve 3/2* |
| **3** | *Bottle holder Pos.3* [1] | **H** | *Sample overflow* |
| **4** | *Bottle holder Pos.4* [1)] | **I** | *Heating element* |
| **5** | *Bottle holder Pos.5* [1)] | **J** | *UV-Reactor* |
| **6** | *Bottle holder Pos.6* [1)] | **K** | *Sample cooler (optional)* |
| **7** | *6-way valve output* | **L** | *Drain funnel* |
| **A** | *Peristaltic pump* | **M** | *Check valve* |
| **B** | *6-way valve* | **N** | *Conductivity sensor 2* |
| **C** | *Triple distributor “T”* | **O** | *Conductivity sensor 1* |
| **D** | *Reactor port* | **P** | *Pressure regulator (optional)* |
| **E** | *Fourfold distributor “X”* | **Q** | *Flow regulating valve* |

[1)] *see Assignment of Standard and Stock Solutions to the bottle holders, p. 17*

In order to avoid any contamination of the sample with material of the pump tubes, the sample is sucked through the system by the channels I and II of the peristaltic pump [A]. A small amount of the sample circulates in channel III in an open loop through the 6-way valve [B].
The sample enters the system at the sample inlet [1]. Optionally a pressure regulator [P] can be installed to keep the inlet pressure constant. Any overflow is released to the drain funnel [L]. The flow quantity can be adjusted with the flow regulating valve [Q].
In on-line mode the sample is sucked via the 3-way valve [G], the fourfold distributor [E] and the heating element [I] through the conductivity sensor 1 [O] where the first measurement is carried out. Then the sample flows through the UV-Reactor [J] where it is converted into carbon dioxide by oxidation. After oxidation the sample flows via flow monitoring sensor [F] through the conductivity sensor 2 [N] where a second conductivity measurement is carried out.
Finally it flows through the peristaltic pump [A] into the drain funnel [L]. The flow monitoring sensor [F] triggers an alarm if the sample flow is too low.

**Flow Monitoring**

The flow monitoring is based on the measurement of the temperature difference of the sample temperature and the reactor housing temperature. Normally the sample temperature is higher than the reactor housing temperature. If the sample flow is interrupted, the sample gradually cools down to the reactor housing temperature. As soon as the sample temperature is lower than the predefined limit a flow alarm is triggered.

The 6-way valve [B] is used to carry out the different tests. It is controlled by the transmitter. According to the selected test it is automatically switched to the correct position to add standard solutions, stock solutions or reagent water into the test process. The numbers of the bottles for the standard solutions, stock solutions or Reagent/ Blank Water corresponds to the input number of the 6-way valve i.e. number 2, Reagent/Blank Water, is connected to the 6-way valve input No. 2.

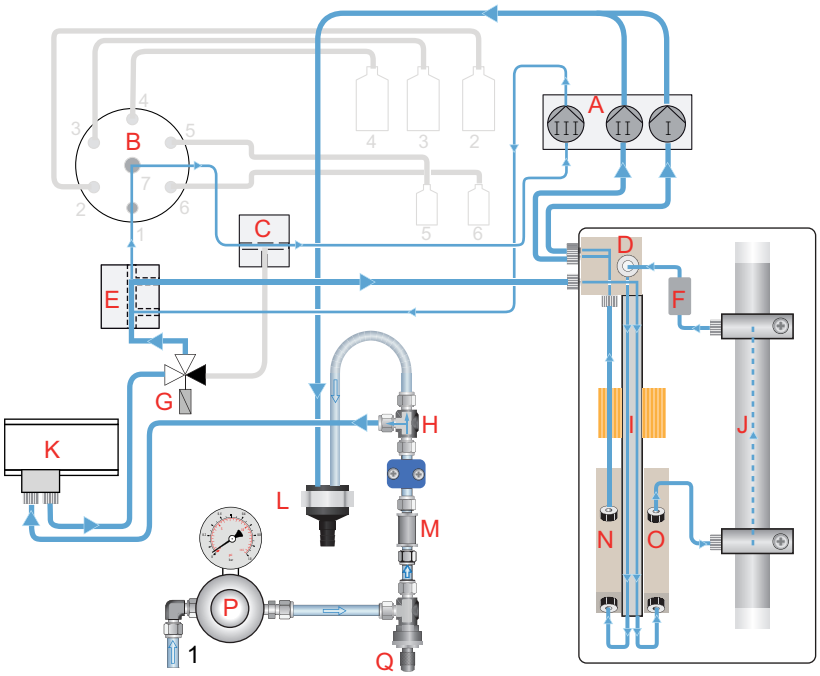
The pharmaceutical industry and the ultra pure water (UPW) applications uses different bottle setups and concentrations, see table below:

*Tab - 3 Assignment of Standard and Stock Solutions to the bottle holders*

| Measuring mode<br>Bottle holder | **Pharma** | **UPW** |
|---|---|---|
| Pos. 2 | Reagent Water Blank or Grab Sample | Reagent Water Blank or Grab Sample |
| Pos. 3 | Standard Solution 500 ppb C as Sucrose | Standard, (programmable value) |
| Pos. 4 | SST Solution 500 ppb C as 1,4-Benzoquinone | Not used |
| Pos. 5 | Stock Solution 20 ppm C as Sucrose | Check Standard (programmable value) |
| Pos. 6 | Stock Solution 20 ppm C as 1,4-Benzoquinone | Not used |

**On-line mode**

In the on-line mode the sample enters at sample inlet [1] and is sucked via the 3-way valve [G], and the fourfold distributor [E] to the reactor port [D]. From there the sample flows via the heating element [I] through the conductivity sensor 1 [O] where the 1$^{st}$ measurement is carried out. Then it flows through the UV-Reactor [J] where the organic carbon content is converted into carbon dioxide by oxidation. After oxidation the sample flows via flow monitoring sensor [F] through the conductivity sensor 2 [N] where a 2$^{nd}$ conductivity measurement is carried out.
Then it flows through the peristaltic pump [A] into the drain [L].




| | | | |
|---|---|---|---|
| ***1*** | *Sample inlet* | ***I*** | *Heating element* |
| ***7*** | *6-way valve output* | ***J*** | *UV-Reactor* |
| ***A*** | *Peristaltic pump* | ***K*** | *Sample cooler (optional)* |
| ***B*** | *6-way valve* | ***L*** | *Drain funnel* |
| ***C*** | *Triple distributor “T”* | ***M*** | *Check valve* |
| ***D*** | *Reactor port* | ***N*** | *Conductivity sensor 2* |
| ***E*** | *Fourfold distributor “X”* | ***O*** | *Conductivity sensor 1* |
| ***F*** | *Flow monitoring sensor* | ***P*** | *Pressure regulator (optional)* |
| ***G*** | *3-way solenoid valve 3/2* | ***Q*** | *Flow regulating valve* |
| ***H*** | *Sample overflow* | | |

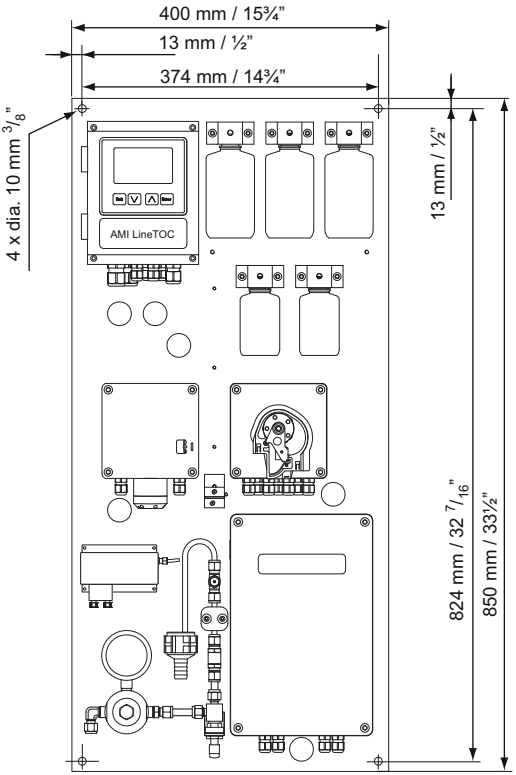
## 2.7. Instrument Specification

| | | |
|---|---|---|
| **Power Supply** | Voltage: | 100–240 VAC (± 10%)<br>50/60 Hz (± 5%)<br>DC version not available |
| | Power consumption: | max. 55 W |
| **Electronics housing** | Aluminium with a protection degree of IP 66/NEMA 4X | |
| | Ambient temperature: | -10 to +50 °C |
| | Limit range of operation: | -25 to +65 °C |
| | Storage and transport: | -30 to +85 °C |
| | Humidity: | 10–90% rel., non condensing |
| | Display: | backlit LCD, 75 x 45 mm |
| **Measuring Accuracy** | Measuring range: | 0.1 to 1'000.0 ppb TOC |
| | Resolution: | 0.1 ppb |
| | Reaction Time: | < 2 min |
| | Reproducibility: | 0.1 to 50 ppb, ± 1 ppb<br>50 to 1000 ppb, ± 2% |
| | Precision: | 0.055 to 2 µs/cm (20°C) ± 2% |
| **Sample conditions** | Flow rate: | 1–5 l/h |
| | Temperature: | 10–40 °C |
| | **with sample cooler:* | up to 90 °C |
| | Inlet pressure$_{Abs}$ (25°C): | up to 1.5 bar |
| | **with pressure regulator:* | up to 5 bar |
| | Outlet pressure: | pressure free |
| | Conductivity range: | 0.055 to 2µS/cm |
| | Particle size: | < 100 µm |
| | No sand, no oil. | |
| **On-site requirements** | The analyzer site must permit connections to: | |
| | Sample inlet: | Swagelok 1/4" tube adapter |
| | Sample outlet: | G 1/2" adapter for flexible tube<br>diam. 20x15 mm |
| | Max. Altitude: | 2000 m above sea level |

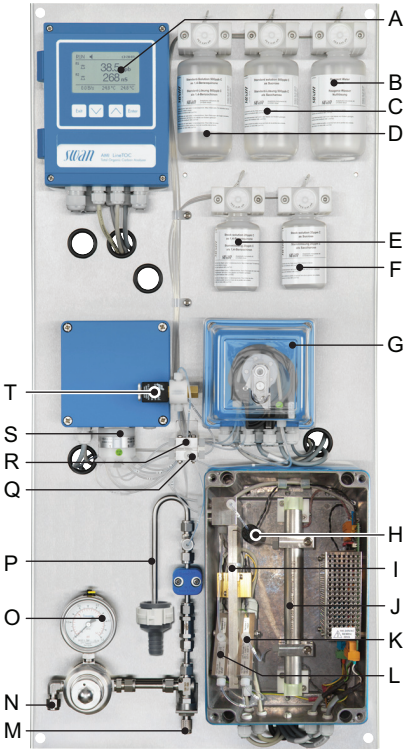
If the sample temperature is higher than 40 °C, the sample has to be cooled before measurement.

**Option*

| | | |
|---|---|---|
| **Dimensions** | Panel: | 400 x 850 x 180 mm |
| | Material: | stainless steel |
| | Mounting hole distance | 374x824 |
| | Screws: | 8 mm diameter |
| | Weight: | 20.0 kg |



## 2.8. Instrument Overview




***A*** *Transmitter*
***B*** *Bottle holder Pos. 2* [1)]
***C*** *Bottle holder Pos. 3* [1)]
***D*** *Bottle holder Pos. 4* [1)]
***E*** *Bottle holder Pos. 5* [1)]
***F*** *Bottle holder Pos. 6* [1]
***G*** *Peristaltic pump*
***H*** *Temperature sensor for flow monitoring*
***I*** *Heating element*
***J*** *UV-Reactor*
***K*** *Conductivity sensor 1*
***L*** *Conductivity sensor 2*
***M*** *Flow regulating valve*
***N*** *Sample inlet*
***O*** *Pressure regulator with Manometer (option)*
***P*** *Waste*
***Q*** *Fourfold distributor*
***R*** *Triple distributor*
***S*** *6-way valve*
***T*** *3-way valve*

[1)] see Assignment of Standard and Stock Solutions to the bottle holders, p. 17

# 3. Installation

## 3.1. Installation Checklist

| | |
|---|---|
| **Check** | Instrument's specification must conform to the National Electrical Code, all state and local codes, and all plant codes and standards for electrical equipment. |
| **On site requirements** | 100–240 VAC (± 10%), 50/60 Hz (± 5%)<br>Isolated power outlet with ground connection and 55 W.<br>Sample line with at least 1 l/h<br>Sample outlet with pressure free drain. |
| **Installation** | Install the instrument in vertical position.<br>Display should be at eye level.<br>Connect the sample and waste lines. See Connect Sample and Waste, p. 23 |
| **Electrical wiring** | ***NOTICE:*** *Do not switch on the Instrument until all electrical connections are made.*<br>Connect all external devices.<br>Connect power cord. |
| **Standard- and stock solutions** | Prepare all necessary standard and stock solutions and screw them into the respective bottle holders. See table Assignment of Standard and Stock Solutions to the bottle holders, p. 17. |
| **Power-up** | Open the sample tap and adjust the sample flow to 1–5 l/h.<br>If the optional pressure regulator is installed, set the input pressure to 0.2 bar.<br>Switch on power. |
| **Instrument set-up** | Set the measuring mode to UPW or Pharma.<br>Set the compensation Model to coefficient or $CO_2$.<br>Program all parameters for external devices (interface, etc.).<br>Program all parameters for instrument operation (limits, alarms). |
| **Fill system** | Start "Fill System" in Menu <Maintenance/Service> |
| **Run-in time** | Let instrument operate 4 h without interruption at normal sample conditions to rinse out any pollution from transport and manufacturing. |
| **Verification** | Never perform a verification before the run-in time is over and before the measuring value is stable. |

## 3.2. Mounting of Instrument Panel

The first part of this chapter describes the preparing and placing of the instrument 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

**Mounting requirements**

The instrument is only intended for indoor installation.
For dimensions see , p. 19

## 3.3. Connect Sample and Waste

**Sample inlet**

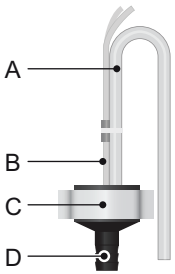
Use plastic tube 4x6 to connect the sample line.

**Mounting of Swagelok**

Insert the plastic tube into the Swagelok fitting. Make sure that the tube rests firmly on the shoulder of the fitting and the nut is finger-tight.While holding the fitting body steady with a backup wrench, tighten the nut 1 1/4 turns.

**Waste**

Connect the 1/2” tube to the hose nozzle [D] of the drain funnel [C] and place it into a pressure free drain of sufficient capacity.




***A*** *Tube from overflow*
***B*** *Tubes from the peristaltic pump*
***C*** *Drain funnel*
***D*** *Hose nozzle*

## 3.4. Electrical Connections

**WARNING**

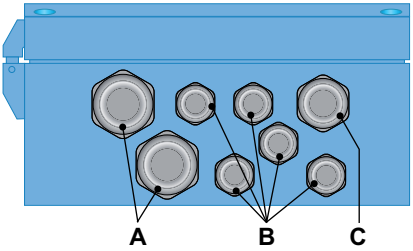
**Risk of electrical shock.**

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*

***NOTICE:*** *Protect unused cable glands*

**Wire**

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

**WARNING**

**External Voltage.**

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

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

**WARNING**

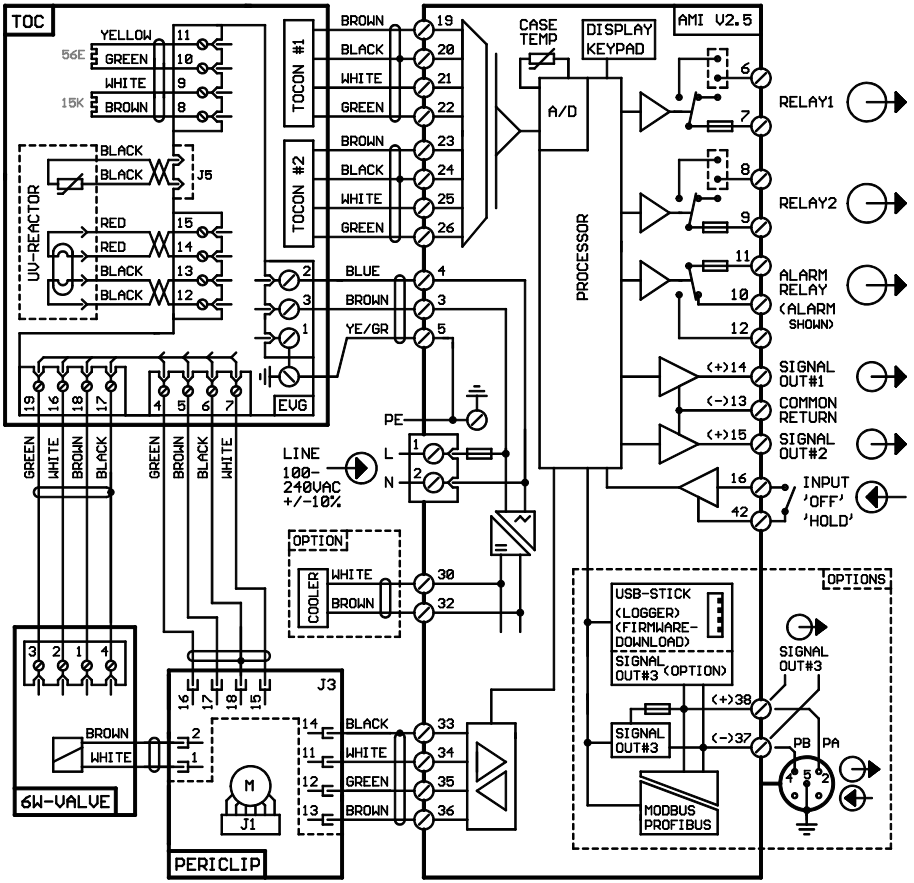
To prevent from electrical shock, do not connect the instrument to the power unless the ground wire (PE) is connected.

- 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 Electrical Connection Scheme



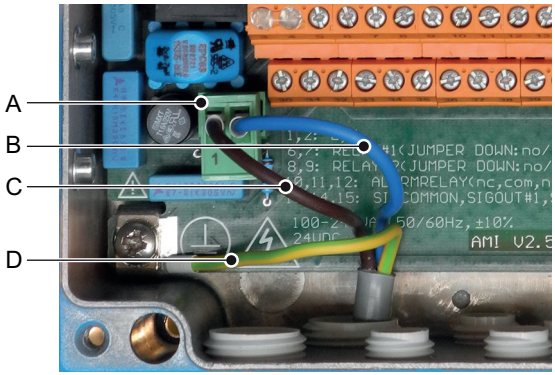

**CAUTION**

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**
**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 AC power before manipulating electric parts.
- Installation and maintenance of electrical parts must be performed by professionals.




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

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

**Installation requirements**

The installation must meet the following requirements.

- Fuse 1.6 AT
- 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 LineTOC

## 3.5. Relay Contacts

### 3.5.1 Input

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

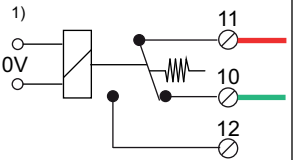
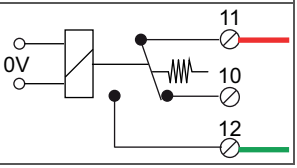
Terminals 16/42
For programming see program list end explanation 5.3.4, p. 94.

### 3.5.2 Alarm Relay

***NOTICE:*** *Max. load1 A / 250 VAC*

Alarm output for system errors.
Error codes see Error List, p. 71.

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

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

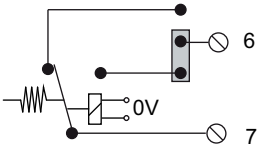
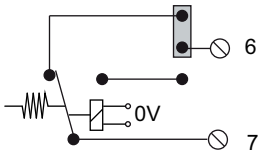
1) *usual use*

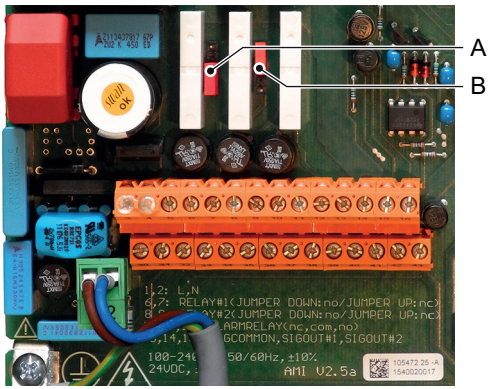
### 3.5.3 Relay 1 and 2

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

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

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

| Relay config. | Terminals | Jumper pos. | Description | Relay configuration |
|---|---|---|---|---|
| Normally Open | 6/7: Relay 1<br>8/9: Relay 2 |  | Inactive (opened) during normal operation and loss of power.<br>Active (closed) when a programmed function is executed. |  |
| Normally Closed | 6/7: Relay 1<br>8/9: Relay 2 |  | Inactive (closed) during normal operation and loss of power.<br>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 Program Overview, p. 51, Menu Installation.

**CAUTION**

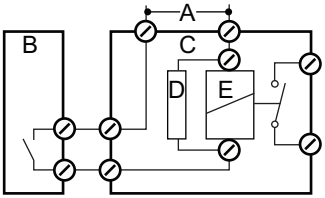
**Risk of damage of the relays in the AMI Transmitter due to heavy inductive load.**

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

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

**Inductive load**

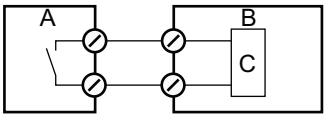
Small inductive loads (max 0.1 A) as for example the coil of a power relay can be switched directly. To avoid noise voltage in the AMI Transmitter it is mandatory to connect a snubber circuit in parallel to the load.
A snubber circuit is not necessary if an AMI relaybox is used.




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

**Resistive load**

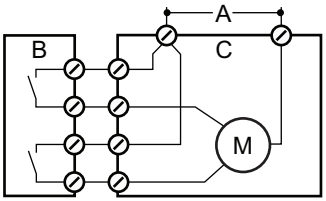
Resistive loads (max. 1A) and control signals for PLC, impulse pumps and so on can be connected without further measures




***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 0.1A must be controlled via external power relays or an AMI relay box.




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

## 3.6. Signal Outputs

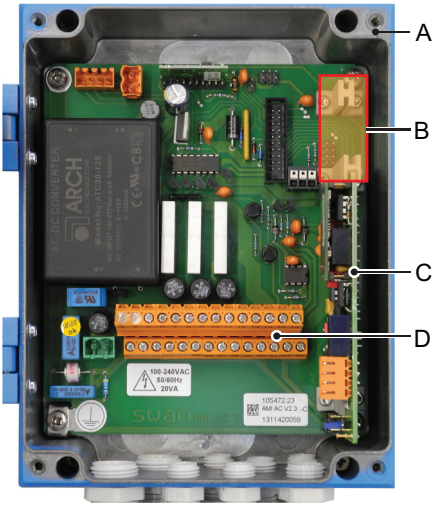
### 3.6.1 Signal Output 1 and 2 (current outputs)

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

Signal output 1: Terminals 14 (+) and 13 (-)
Signal output 2: Terminals 15 (+) and 13 (-)

For programming see Program Overview, p. 51, Menu Installation

## 3.7. Interface Options




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

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

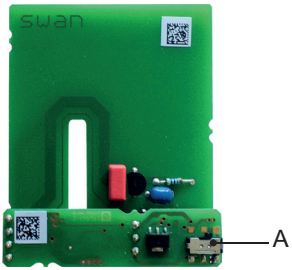
- Third signal output
- a Profibus or Modbus connection
- a HART connection
- an USB Interface

### 3.7.1 Signal Output 3

Terminals 38 (+) and 37 (-).

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

***NOTICE:*** *Max. burden 510 Ω.*




Third signal output 0/4 - 20 mA PCB

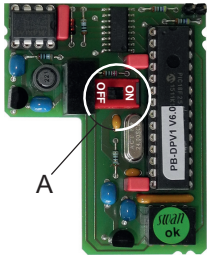
*A Operating mode selector switch*

### 3.7.2 Profibus, Modbus Interface

Terminal 37 PB, Terminal 38 PA

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

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



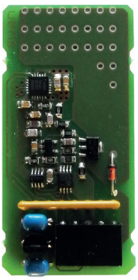

Profibus, Modbus Interface PCB (RS 485)

A *On - OFF switch*

### 3.7.3 HART Interface

Terminals 38 (+) and 37 (-).

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

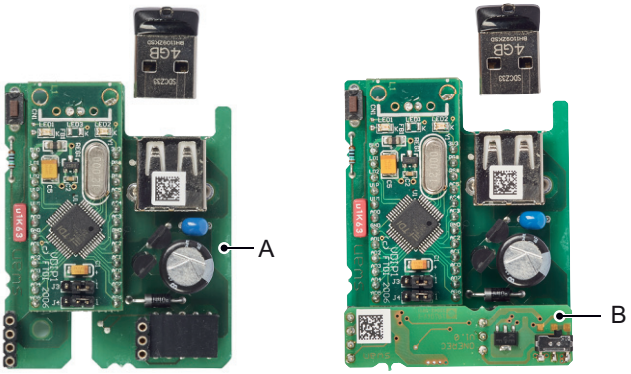


HART Interface PCB

### 3.7.4 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 the analyzer is installed according to the previous instructions, connect the power cord. Do not switch on power, yet!

## 4.1. Standard- and stock solutions

**Handling of TOC Solutions**

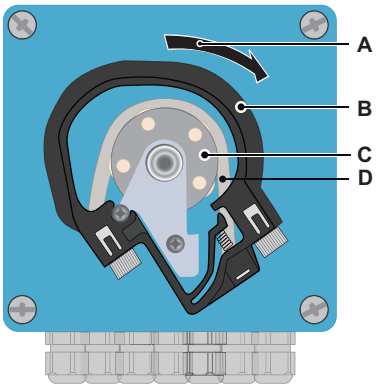
The SST solution and the calibration solution for the AMI LineTOC have a shelf live of 4 weeks. The solutions are packed shortly before delivery and sent to the customer via an express service.

If you order TOC solutions please consider the delivery time of 3 weeks after order. After receipt of the solutions keep them at max. 5 °C.

## 4.2. Peristaltic Pump

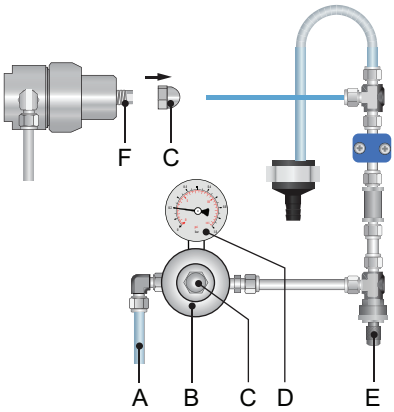
The instrument is delivered with opened occlusion frames.

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




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

## 4.3. Establish Sample Flow




***A*** *Sample inlet*
***B*** *Pressure regulator*
***C*** *Screw cap*
***D*** *Manometer*
***E*** *Flow regulating valve*
***F*** *Shaft*

**1** If a pressure regulator [B] is installed set the input pressure to 0.2 bar. Proceed as following:

**–**Unscrew and remove the screw cap [C] with a 17 mm open end wrench.

**–**Adjust the inlet pressure to 0.2 bar by turning the shaft [F] with a 7 mm open end wrench.

**2** Open the flow regulating valve [E].

**3** Switch on power.

**4** Navigate to Menu <Maintenance>/<Service>/<Fill System> and press [Enter].
⇒*The peristaltic pump starts and all tubes from channel 6 to 1 are filled.*

## 4.4. Programming

**Pharma**

For pharmaceutical applications use the default settings of the instrument:

- operation mode: pharma
- compensation model: $CO_2$

Other settings should only be made in consultation with the manufacturer.

**UPW**

For UPW applications set the instrument to:

- operation mode: UPW
- compensation model: according to your requirements either $CO_2$ or coefficient. See Conductivity Model CO2, p. 10 and Conductivity Model Coefficient, p. 11.

Program all parameters for external devices (interface, etc.). Set all parameters for instrument operation (limits, alarms).

## 4.5. Commissioning

**Standard- and stock solutions**

Prepare all necessary standard and stock solutions and screw them into the respective bottle holders. See table Assignment of Standard and Stock Solutions to the bottle holders, p. 17.

**Run-in Period**

Let the instrument run in for 4 hours on normal sample conditions to flush out contaminants caused by manufacturing and transport.

**Pharma**

For pharmaceutical applications please follow the IQ/OQ/PQ procedures in the optional Validation package.

**SST**

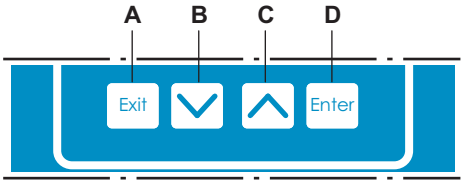
System Suitability Test for verification according USP and EP regulations.

**UPW**

Perform a verification or a calibration

# 5. Operation

## 5.1. Keys, Display



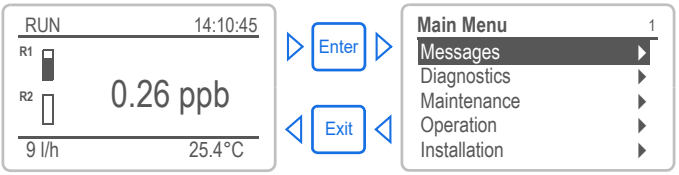

***A*** *to exit a menu or command*
*to reject any changes*
*to move back to the previous menu level*

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

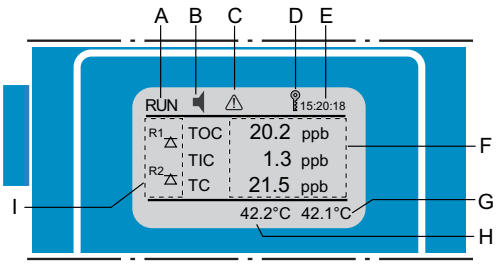
***C*** *to move UP in a menu list*
*to increase digits*
*to switch between display 1 and 2*

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

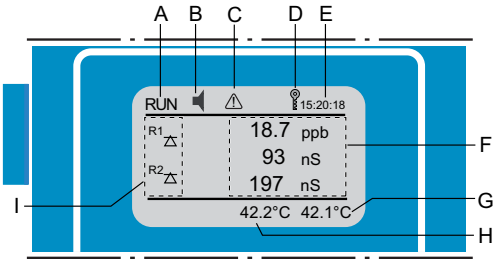
**Program Access, Exit**



**Display conductivity Model $CO_2$**




**Display conductivity Model Coefficient**




***A*** RUN *normal operation*

HOLD *input closed or cal. delay, instrument on hold*

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

***B*** ERROR Error Fatal Error

***C*** *See Maintenance List for detailed information*

***D*** *Transmitter control via Profibus*

***E*** *Time*

***F*** *Process values (conductivity model $CO_2$ in ppb, conductivity model Coefficient in nS)*

***G*** *Sample temperature reactor output*

***H*** *Sample temperature reactor input*

***I*** *Relay status*

**Relay, status symbols**

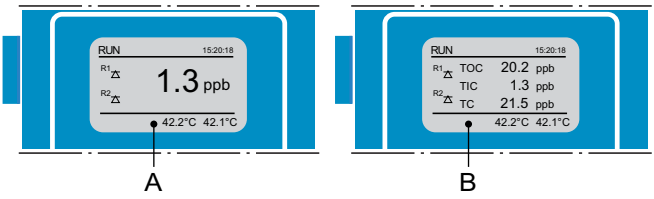
*upper/lower limit not jet reached*

*upper/lower limit reached*

*Relay on hold, or controlled via Profibus*

***NOTICE:*** *Changing the percent value Coefficient in the menu <Installation/TOC/Measurement/Compensation> has an effect on the values displayed as process values [F] in the conductivity model Coefficient. These values are converted to a reference temperature of 25 °C and compensated with the preset percent value of the Coefficient.*
*It has no effect on the values displayed in the menu <Diagnostics/Sensors>. These are the uncompensated measuring values, measured at the actual sample temperature.*

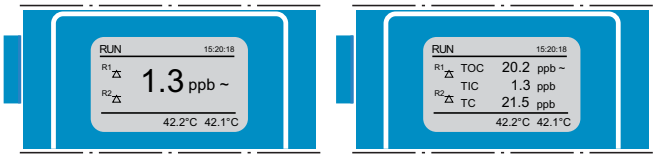
Switch between display 1 and 2 with the [ ] key.



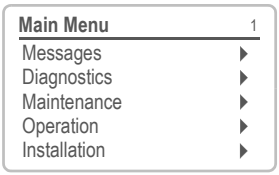

A Display 1 B Display 2

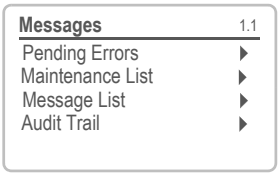
If the AMI LineTOC is set to operation mode UPW:

- A tilde appears behind the TOC measuring value if the Offset or Slope in menu <Installation>/<Sensors>/<TOC>/<Parameters> has been modified.



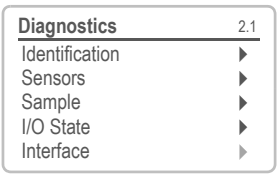
## 5.2. Software Structure



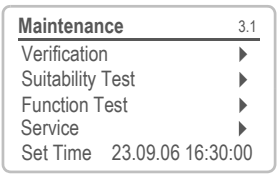

Menu **Messages 1**

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.



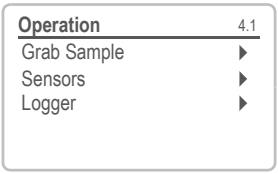

Menu **Diagnostics 2**

Provides user relevant instrument and sample data.




Menu **Maintenance 3**

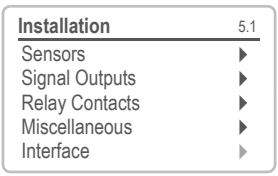
For instrument calibration, relay and signal output simulation, and to set the instrument time.
It is used by the service personnel.




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.



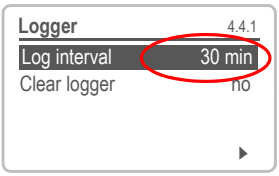

Menu **Installation 5**

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

## 5.3. Changing Parameters and values

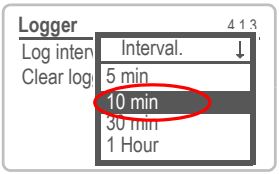
**Changing parameters**

The following example shows how to change the logger interval:



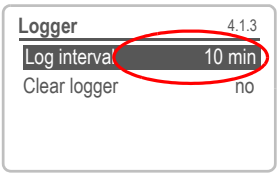

1 Select the parameter you want to change.

2 Press [Enter]



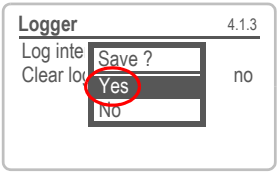

3 Press [▲] or [▼] key to highlight the required parameter.

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




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

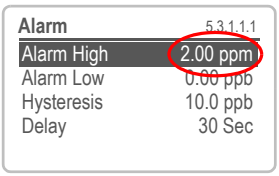
5 Press [Exit].




⇒*Yes is highlighted.*

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

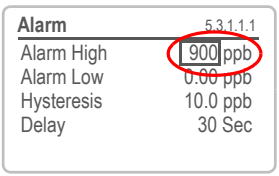
**Changing values**




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.

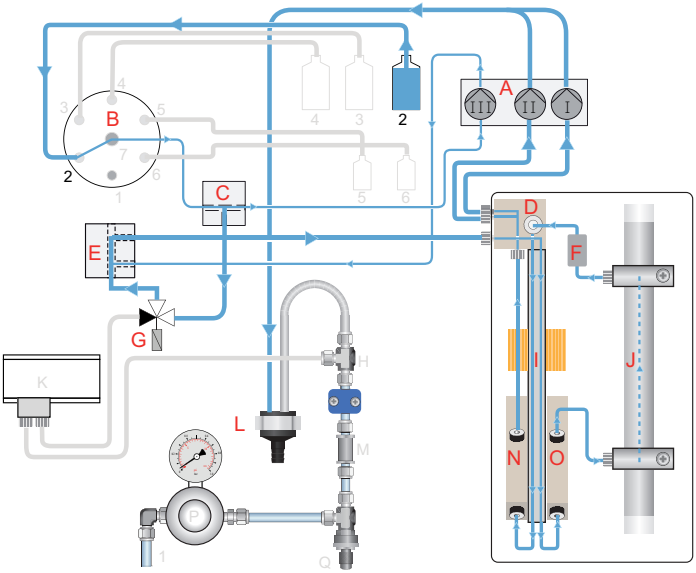
5 Press [Exit].
⇒*Yes is highlighted.*

6 Press [Enter] to save the new value.

## 5.4. Grab Sample

The grab sample mode is used for measurements of samples which can not be connected to the sample inlet. The sample is filled into a bottle which is screwed into the sample holder on position 2.

The sample is led via the triple distributor [C], the 3-way valve [G], and the fourfold distributor [E] to the reactor port [D]. From there the sample flows via the heating element [I] through the conductivity sensor 1 [O] where the 1st measurement is carried out. Then it flows through the UV-Reactor [J] where the organic carbon content is converted into carbon dioxide by oxidation. After oxidation the sample flows via flow monitoring sensor [F] through the conductivity sensor 2 [N] where a 2nd conductivity measurement is carried out.
Then it flows through the peristaltic pump [A] into the waste [L].




***2*** *Grab sample*
***A*** *Peristaltic pump*
***B*** *6-way valve*
***C*** *Triple distributor*
***D*** *Reactor port*
***E*** *Fourfold distributor*
***F*** *Flow monitoring sensor*
***G*** *3-way valve*
***I*** *Heating element*
***J*** *UV-Reactor*
***L*** *Waste*
***N*** *Conductivity sensor 2*
***O*** *Conductivity sensor 1*

To start a grab sample measurement proceed as follows:

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

⇒*You will be prompted to enter a name for the sample. The name can be a maximum of 8 characters.*

**2** Press [Enter].
⇒*A cursor appears under the first digit.*

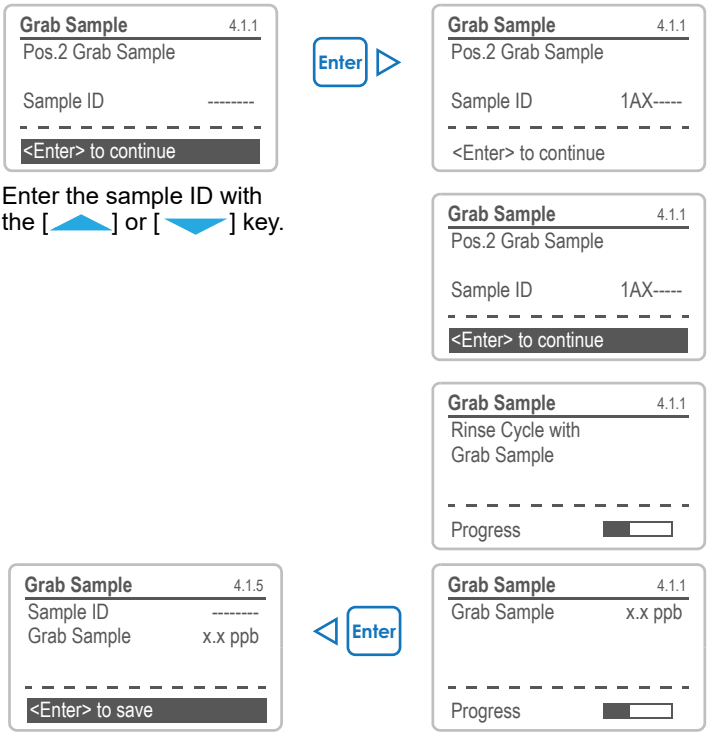
**3** Press the [▲] or [▼] key to enter a character.

**4** Press [Enter].
⇒*The next digit is active.*

**5** Repeat step 3 and 4 until the name is entered.

**6** If the name is shorter than 8 digits press [Enter] until the cursor has passed the last digit.

**7** Press [Enter] to start the grab sample measurement.



# 6. Maintenance

Some countries have found national regulations about surveillance of analyses.
In case no such regulations are applicable, you find recommendations below.

**WARNING**

Stop operation before maintenance.

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

***NOTICE:*** *General information about the following test procedures:*

- *Verification*
- *Calibration*
- *SST*
- *Function Test UPW and Pharma*

*The duration of a test procedure depends on the stability of the measuring value. If the measuring value is stable over a certain time, the test procedure can be finished by pressing [Enter] and the measuring value is saved.*
*If required the duration can be shortened manually after a minimal time of 5 minutes. Be aware that thereby the stability criteria of the measuring value is ignored.*
*SWAN recommends to use the automatic standard measuring procedure of the AMI LineTOC.*

## 6.1. Maintenance Schedule

Preventive maintenance frequency depends on water quality, on the application, and on national regulations.

**Pharma Applications**

| | |
|---|---|
| **Every week** | Check sample flow. |
| **Monthly** | Perform function test, see 6.5., 🗎 51 |
| **Half-yearly** | Perform system suitability test, see 6.7., 🗎 56<br>Replace UV-Reactor. See 6.10., 🗎 65<br>Replace pump tubing. See 6.8., 🗎 60 |
| **Yearly** | Replace air filters (5 pcs.) See 6.11. , 🗎 7-68<br>Perform calibration, see 6.4., 🗎 49<br>or<br>Perform verification, see 6.3. , 🗎 7-46 |

**UPW applications**

| | |
|---|---|
| **Every week** | Check sample flow. |
| **Monthly** | Perform function test, see 6.6., 🗎 54 |
| **Every 9 to 12 months** | Replace UV-Reactor. See 6.10., 🗎 65 |
| **Yearly** | Replace pump tubing. See 6.8., 🗎 60<br>Replace air filters (5 pcs.) See 6.11. , 🗎 7-68<br>Perform calibration, see 6.4., 🗎 49<br>or<br>Perform verification, see 6.3. , 🗎 7-46 |

## 6.2. Stop of Operation for Maintenance

Before starting any maintenance work, all tubes as well as the UV-reactor has to be emptied. To empty the system proceed as follows:

1. Close the tap of the sample inlet.
2. Select <Exchange Lamp> in menu <Maintenance>/<Service>/<Lamp>/<Exchange Lamp>
   ⇒*The peristaltic pump runs in reverse mode.*
3. Wait until the peristaltic pump stops.
4. Shut off power of the instrument.

## 6.3. Verification

***NOTICE:***

- *The verification procedure is available if the AMI LineTOC Transmitter is set to conductivity model $CO_2$.*
- *The concentration of the standard solution 1 ppm C as sucrose applies only for the pharmaceutical industry.*
- *For UPW applications the upper limit of the standard solution is programmable.*

The verification of the AMI LineTOC is based on a two point method. The lower end is given by the TOC concentration of reagent water blank, the upper limit is fixed by the known concentration of a standard solution 1 ppm C as sucrose. During verification the slope of a straight line, based on the two measuring points, is calculated. According to the regulations of the USP and EP the TOC content of the reagent water blank has to be < 100 ppb TOC.

The verification process starts by activating the procedure <Maintenance>/<Verification>.

***NOTICE:***
*Pharma:*
*Make sure that the standard has the expected TOC concentration of 1 ppm (= 1'000 ppb) and corresponds to the working range of 0 to 1'000 ppb TOC.*
*UPW:*
*Make sure that the TOC concentration of the standard is equal to the programmed value and corresponds to the working range of 0 to 1'000 ppb TOC.*

**Reagents and fluidic**

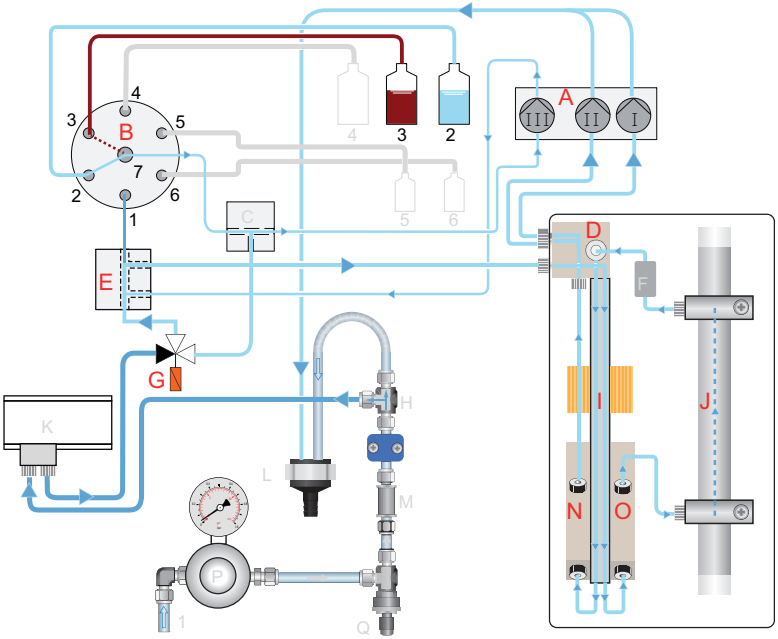
For a verification screw the two bottles containing:

- Reagent/Blank Water [2]
- Standard Solution 1 ppm C as sucrose [3] (in measuring mode UPW adjustable)

into the bottle holder with the corresponding number. During the verification, the 3-way valve is activated to close the sample inlet.

Measuring value 1: The 6-way valve [B] is automatically rotated to position 2. reagent water blank [2] is sucked through the system and measured.

Measuring value 2: The 6-way valve [B] is automatically rotated to position 3. Standard Solution [3] is sucked through the system and measured.




| | | | |
|---|---|---|---|
| ***2*** | *Reagent water blank* | ***D*** | *Reactor port* |
| ***3*** | *Standard Solution 1 ppm C as Sucrose* | ***E*** | *Fourfold distributor "X"* |
| | | ***G*** | *3-way valve* |
| ***7*** | *6-way valve output* | ***J*** | *UV reactor* |
| ***A*** | *Peristaltic pump* | ***N*** | *Conductivity sensor 2* |
| ***B*** | *6-way valve* | ***O*** | *Conductivity sensor 1* |

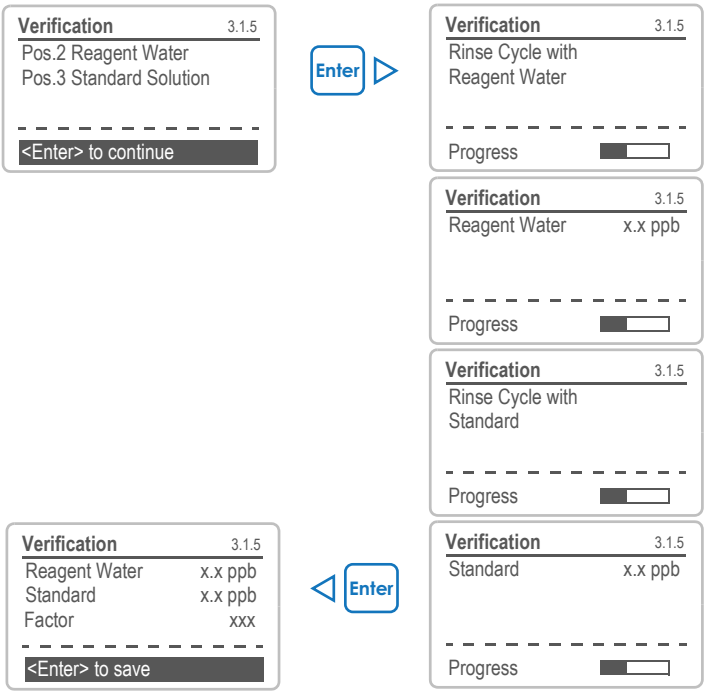
**Procedure**

Based on the $CO_2$ concentrations of the Reagent Water Blank and the standard solution the instrument performs a linear regression and calculates a factor.
At the end of the procedure the results are displayed. By selecting [Enter] the operator stores the factor of the sensor in the history or neglects it by pressing [Exit]. The calculated factor shows the operator whether the verification of the AMI LineTOC is within the given limit. It does **not** replace the actual factor and it has **no** influence on further measurings.
The verification history can be viewed in <Diagnostics>/<Sensors>/<History>/<Verification>.

***NOTICE:*** *The actual calculated factor should be in a expected range of 1.0 ± 15%.*

**Signal Outputs, Limits**

During the verification the signal outputs are on hold by default, see Program List and Explanation 5.2.1.4, p. 89 and all programmed limits are inactive.
To start a verification select menu 3.1 <Maintenance>/<Verification> and follow the instructions on the display:



## 6.4. Calibration

***NOTICE:***

- *The calibration procedure is available if the AMI LineTOC transmitter is set to conductivity model "Coefficient".*
- *The concentration of the standard solution 1 ppm C as sucrose applies only for the pharmaceutical industry.*
- *For UPW applications the concentration of the standard solution is programmable.*

The calibration of the AMI LineTOC is based on a two point method. The lower end is given by the TOC concentration of reagent water blank, the upper limit is fixed by the known concentration of a standard solution 1 ppm C as sucrose for pharmaceutical industry. For UPW applications the upper limit adjustable. According to the regulations of the USP and EP the TOC content of the reagent water blank has to be < 100 ppb TOC.

***NOTICE:***

- *Pharma: Make sure that the standard has the expected TOC concentration of 1 ppm (= 1'000 ppb) and corresponds to the working range of 0 to 1'000 ppb TOC.*
- *UPW: Make sure that the TOC concentration of the standard is equal to the programmed value and corresponds to the working range of 0 to 1'000 ppb TOC.*

**Reagents and fluidic**

For a calibration screw the two bottles containing:

- Reagent/Blank Water [2]
- Standard Solution 1 ppm C as sucrose [3] (in measuring mode UPW adjustable)

into the bottle holder with the corresponding number. During the calibration, the 3-way valve is activated to close the sample inlet. Fluidic see Verification, p. 46.

**Procedure**

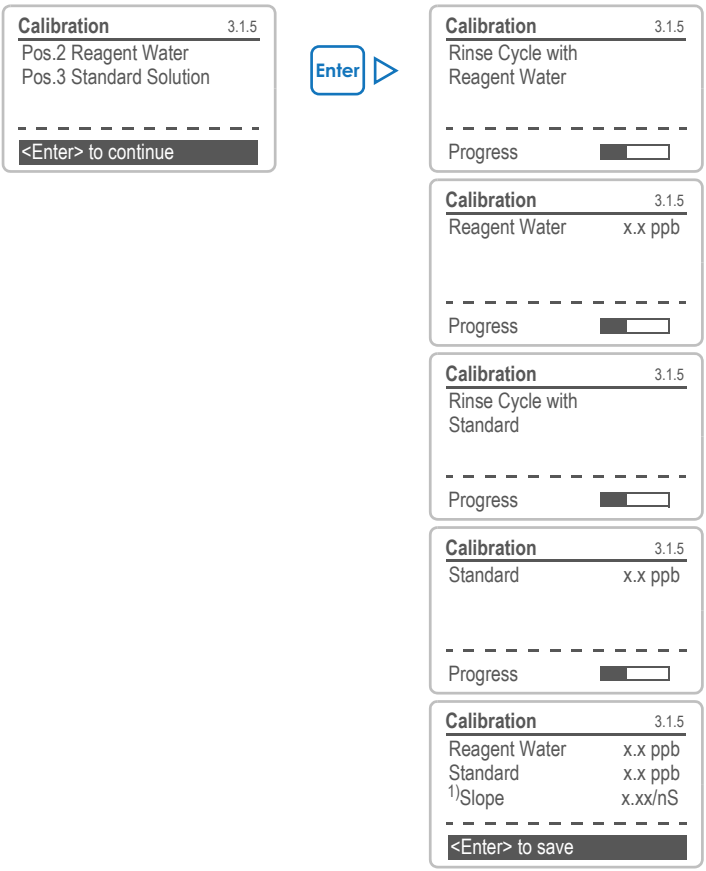
Based on the conductivity readings of Reagent Water Blank and the standard solution the instrument performs a linear regression and calculates the slope of the calibration curve.
At the end of the procedure the results are displayed. By pressing [Enter] the operator activates and stores the new calculated slope of the sensor or neglects it by pressing [Exit].
The calibration history can be reviewed in <Diagnostics>/<Sensors>/<History>/<Calibration>.

***NOTICE:*** *The actual calculated calibration factor (slope) should be in a expected range of 0,2 and 1.0 ppb/nS.*

**Signal Outputs, Limits**

During the calibration the signal outputs are on hold by default, see Program List and Explanation 5.2.1.4, p. 89 and all programmed limits are inactive.

To start a calibration select menu 3.1 <Maintenance>/<Calibration> and follow the instructions on the display




1) Slope in [ppb/nS]

## 6.5. Function Test Pharma

The function test Pharma allows to check the system in a programmable time interval automatically. The solutions are prepared by automatic dilution of the stock standards installed on the sensor panel. The monitored online sample serves as reagent water to dilute the stock standards to a certain concentration.

The highly concentrated, durable standard solutions (20ppm) are added to the sample through the 0.38 mm tube of the peristaltic pump. The sample is sucked into the system through the two 2.3 mm tubes of the peristaltic pump.
The dilution factor results by the different tube diameters through which the sample and the standard solutions are sucked.

The TOC concentration of the online sample is measured at the beginning and end of the automatic test procedure.
The current TOC value will be compared with the expected one. Based on this result you can see if your system runs in an optimal range.

The following acceptance criteria are checked:

- TOC concentration of the reagent water < 100 ppb
- Difference of the TOC values for Benzoquinone + Sucrose < 20% (depending on customer requirements)

The Function Test can be started:

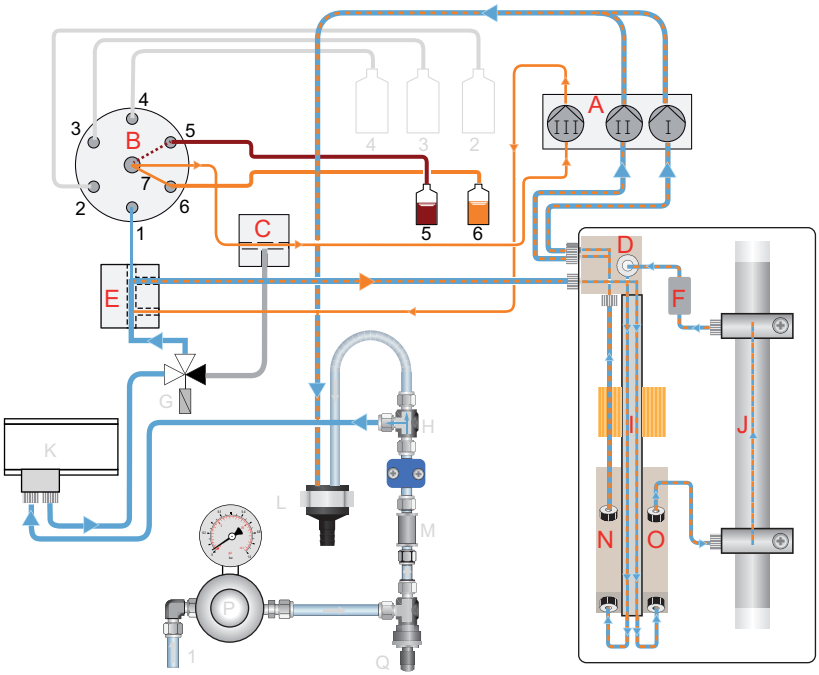
- manually by activating the procedure under Maintenance/ Function Test
- automatically in a fixed time interval.

**Reagents and fluidic**

For this test screw the two bottles containing:

- Stock Solution 20 ppm C as sucrose [5]
- Stock Solution 20 ppm C as 1,4-benzoquinone [6]

into the bottle holder with the corresponding number.
The automatic, internal dilution of the stock solution is done by the peristaltic pump [A]. The dilution factor is given by different tube diameters for sample stream and for the stock solution.
The six-way valve [B] is automatically rotated to position 5 and the stock solution [5] is added to the sample and sucked through the sensors 1 and 2 by the peristaltic pump [A]. This procedure is repeated with the stock solution [6].




***5*** *Stock Solution 20 ppm C as sucrose*
***6*** *Stock Solution 20 ppm C as 1,4-benzoquinone*
***7*** *6-way valve output*
***A*** *Peristaltic pump*
***B*** *6-way valve*
***C*** *Triple distributor "T"*
***D*** *Reactor port*
***E*** *Fourfold distributor "X"*
***I*** *Heating element*
***J*** *UV reactor*
***N*** *Conductivity sensor 2*
***O*** *Conductivity sensor 1*

**Procedure**

The test itself proceeds automatically. After completion the calculated response efficiency is displayed. The results of the function test are stored in the history automatically if the test had been started automatically.
If the function test has been activated manually, you are prompted to press [ENTER] to continue. By pressing [ENTER], the test results are stored in the history.

The results of the function test are stored in the menu <Diagnostics>/<Sensors>/<History>/<Function Test>.

**Signal Outputs, Limits**

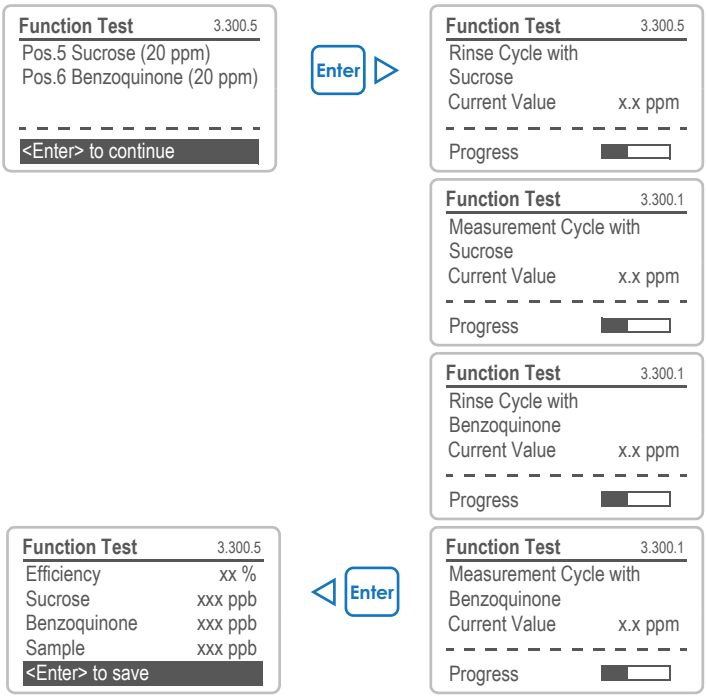
During the Function Test the signal outputs are on hold by default, and all programmed limits are inactive (see Program List and Explanation 5.2.1.4, p. 89).

**Flush Time**

Before the online measurement starts again, the tubes are flushed with sample. The flush time can be set in the menu <Installation>/<Sensors>/<Function Test>.

**Function Test Pharma**

To start the function test navigate to menu <Maintenance>/<Function Test> and follow the instructions on the display



## 6.6. Function Test UPW

The check standard is installed at position 5. The online sample serves as reagent water to dilute the stock standards to a certain concentration.

The concentration of the check standard can be set between 100 ppb and 25 ppm.The programmed value must be equal to the concentration of the check standard. The concentration can be programmed in menu <Installation>/<Sensors>/<TOC>/<Parameters>.

The check standard is added to the sample through the 0.38 mm tube of the peristaltic pump. The sample is sucked into the system through the two 2.3 mm tubes of the peristaltic pump.

The dilution factor results by the different tube diameters through which the sample and the check standard are sucked.

The Function Test can be started:

- manually by activating the procedure under <Maintenance>/<Function Test>.
- automatically in a programmable time interval.

**Reagents and fluidic**

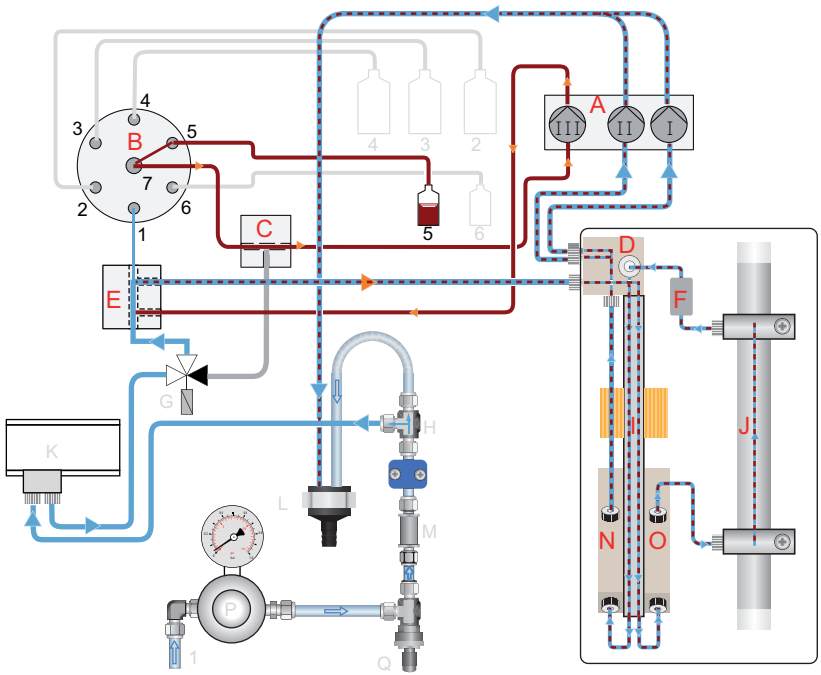
The function test allows to check the system in a programmable time interval automatically. For this test the bottle containing:

- Check standard [5]

has to be screwed into the bottle holder at position 5.

The automatic, internal dilution of the stock solution is done by the peristaltic pump [A]. The dilution factor is given by different tube diameters for sample stream and for the check standard.

The six-way valve [B] is automatically rotated to position 5 and the check standard [5] is added to the sample and then sucked through the sensors 1 and 2 by the peristaltic pump [A].




***5*** *Check Standard*
***7*** *6-way valve output*
***A*** *Peristaltic pump*
***B*** *6-way valve*
***C*** *Triple distributor “T”*
***E*** *Fourfold distributor “X”*
***D*** *Reactor port*
***I*** *Heating element*
***J*** *UV reactor*
***N*** *Conductivity sensor 2*
***O*** *Conductivity sensor 1*

**Procedure**

The function test proceeds automatically. It allows the operator to check the sensors response on changing concentration of the sample. The results of the function test are stored in the history automatically if the test had been started automatically.
If the function test has been activated manually, the results are stored in the history after manual confirmation.

The results of the function test are stored in the menu <Diagnostics>/<Sensors>/<History>/<Function Test>.

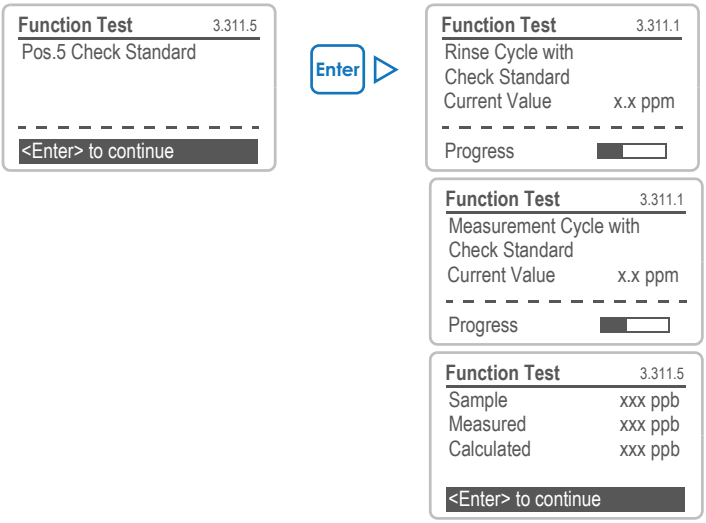
**Signal Outputs, Limits**

During the Function Test the signal outputs are on hold by default, see Program List and Explanation 5.2.1.4, p. 89 and all programmed limits are inactive.

**Flush Time**

Before the online measurement starts again, the tubes are flushed with sample. The flush time can be set in the menu <Installation>/<Sensors>/<Function Test>.

To start the function test navigate to menu <Maintenance>/<Function Test> and follow the instructions on the display




## 6.7. System Suitability Test (SST)

The System Suitability Test is only available in the measuring mode “Pharma”.

**Reagents and fluidic**

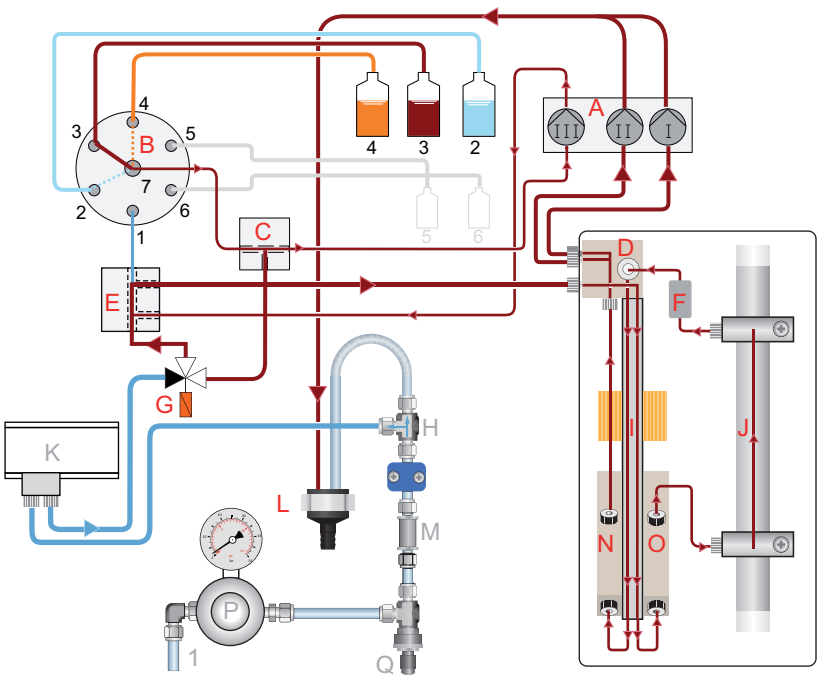
For this test screw the three bottles containing:

- Reagent/Blank Water [2]
- Standard Solution 500 ppb C as sucrose [3]
- SST Solution 500 ppb C as 1.4-benzoquinone [4]

into the bottle holder with the corresponding number.

The six-way valve [B] is automatically rotated to position 2 and the reagent water blank [2] is sucked via reactor port [D] through the sensors 1 and 2 and measured.This procedure is repeated with:

- Standard Solution 500 ppb C as sucrose [3] and 6-way valve [B] switched to position 3
- SST Solution 500 ppb C as 1.4-benzoquinone [4] and 6-way valve [B] switched to position 4.




| | | | |
|---|---|---|---|
| ***2*** | *Reagent water blank* | ***D*** | *Reactor port* |
| ***3*** | *Standard Solution 500 ppb C as Sucrose* | ***E*** | *Fourfold distributor "X"* |
| | | ***F*** | *Flow monitoring sensor* |
| ***4*** | *Standard Solution 500 ppb C as 1,4-Benzoquinone* | ***G*** | *3-way valve 3/2* |
| | | ***I*** | *Heating element* |
| ***7*** | *6-way valve output* | ***J*** | *UV-Reactor* |
| ***A*** | *Peristaltic pump* | ***N*** | *Conductivity sensor 2* |
| ***B*** | *6-way valve* | ***O*** | *Conductivity sensor 1* |
| ***C*** | *Triple distributor "T"* | | |

**Procedure**

The procedure of the system suitability test is part of the analyzer's firmware and organized in dialogue with the operator. According to the regulations of the USP and EP the standard and the test solution have a certified TOC concentration of 500 ppb TOC. The TOC content of the reagent (dilution) water is < 100 ppb TOC.

The system suitability test starts by activating the procedure <Maintenance/Suitability Test>.

Based on the measured TOC results of reagent (dilution) water $R_W$, standard solution $R_S$ and test solution $R_{SS}$ the instrument calculates the response efficiency as follows:

$$\textit{Response efficiency (\%)} = \frac{R_{SS} - R_W}{R_S - R_W} \times 100$$

The test is successful if the Response efficiency is within a range of 85 to 115%. Otherwise the system suitability test fails.

The history of the system suitability performance can be reviewed. See <Diagnostics>/<Sensors>/<History>/<Suitability Test>.

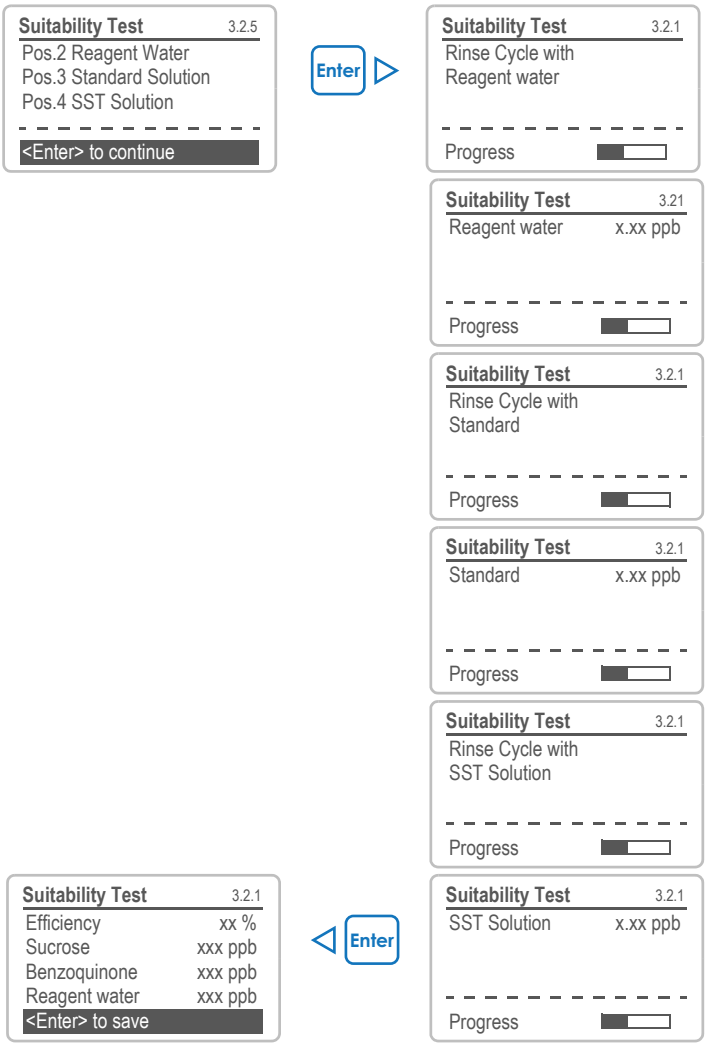
***NOTICE:***

- *In accordance to the regulations of USP and EP only certified (NIST traceable) standards are used to proceed the system suitability test.*
- *The reagent water blank for standard dilution is part of the system suitability standard set.*

**Signal Outputs, Limits**

During the System Suitability Test the signal outputs are on hold by default, see Program List and Explanation 5.2.1.4, p. 89 and all programmed limits are inactive.

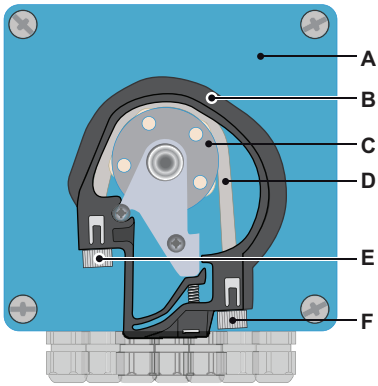
To start the system suitability test select menu <Maintenance>/<Suitability Test> and follow the instructions on the display.


Suitability Test 3.2.5
Pos.2 Reagent Water
Pos.3 Standard Solution
Pos.4 SST Solution
<Enter> to continue
Enter
Suitability Test 3.2.1
Rinse Cycle with
Reagent water
Progress
Suitability Test 3.21
Reagent water x.xx ppb
Progress
Suitability Test 3.2.1
Rinse Cycle with
Standard
Progress
Suitability Test 3.2.1
Standard x.xx ppb
Progress
Suitability Test 3.2.1
Rinse Cycle with
SST Solution
Progress
Suitability Test 3.2.1
SST Solution x.xx ppb
Progress
Enter
Suitability Test 3.2.1
Efficiency xx %
Sucrose xxx ppb
Benzoquinone xxx ppb
Reagent water xxx ppb
<Enter> to save

## 6.8. Replace the peristaltic pump tubes

The pump tubes [D] of the peristaltic pump are exposed to a minimal wear. SWAN recommend to exchange the pump tubes depending on the application according to the Maintenance Schedule, p. 45.

**Overview**




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

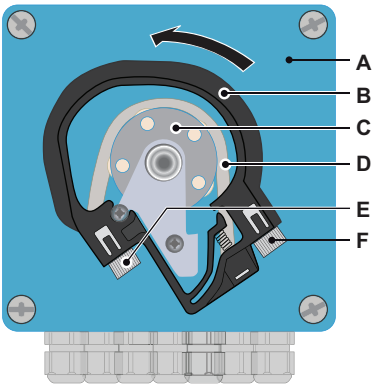
**Dismount pump tubes**

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

***NOTICE:*** *The dilution ratio of the sample and test solution for all tests is determined by the different tube diameters installed on the peristaltic pump. To get correct test results, only use the specified tube diameters.*

- *Two occlusion frames are equipped with Ø 2.3 mm tubes.*
- *One occlusion frame is equipped with a Ø 0.38 mm tube*
  *See Tube Numbering, p. 62*

1 Switch off the instrument according to the instructions in Stop of Operation for Maintenance, p. 46.




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

2 To relax the pump tubes, open the occlusion frame (B) by turning it counter-clockwise.

3 Remove the occlusion frame (B) from the rotor (C) by pulling the complete occlusion frame out of the holder.

4 Dismount all reagent tubes from the occlusion frames.

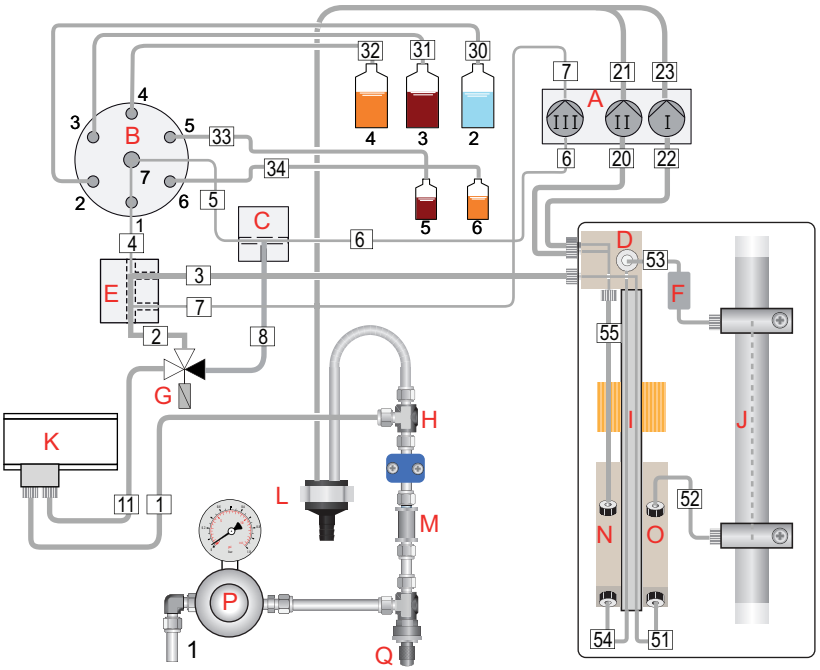
5 Install all reagent tubes to the new occlusion frames.

6 Push the occlusion frames onto the rotor.

7 Lock the occlusion frames.

8 Start <Fill system>.

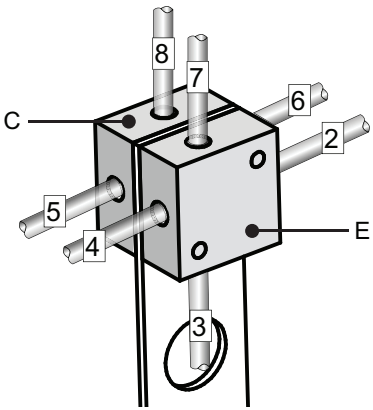
## 6.9. Tube Numbering




| Tube Nr. | Tube length [mm] | from | to |
|---|---|---|---|
| **1** | 250 | Sample inlet | 3-way valve (G), see 64 or, if installed, sample cooler [K] inlet |
| **2** | 125 | 3-way valve (G), see 64 | Fourfold distributor (E), see 64 |
| **3** | 125 | Fourfold distributor (E), see 64 | Reactor port (D), (1) |
| **4** | 125 | Fourfold distributor (E), see 64 | 6-way valve (B), (1) |
| **5** | 125 | 6-way valve (B), (7) | Triple distributor (C), see 64 |
| **6** | 125 | Triple distributor (C), see 64 | Peristaltic Pump (A) inlet, 0.38 mm tube |

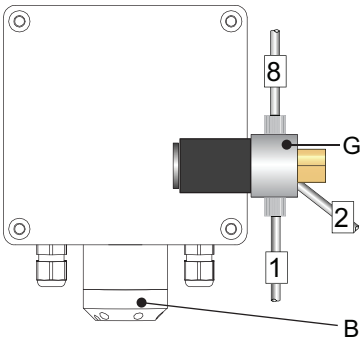
| Tube Nr. | Tube length [mm] | from | to |
|---|---|---|---|
| **7** | 250 | Peristaltic Pump (A) outlet, 0.38 mm tube | Fourfold distributor (E), see 64 |
| **8** | 160 | Triple distributor (C), see 64 | 3-way valve (G), see 64 |
| **11** | | If installed, sample cooler [K] outlet | 3-way valve (G), see 64 |
| **20** | 250 | Reactor port (D), (2) | Peristaltic Pump (A) inlet, 2.3 mm tube |
| **21** | 400 | Peristaltic Pump (A) outlet, 2.3 mm tube | Waste [L] |
| **22** | 250 | Reactor port (D), (4) | Peristaltic Pump (A) inlet, 2.3 mm tube |
| **23** | 400 | Peristaltic Pump (A) outlet, 2.3 mm tube | Waste [L] |
| **30** | 1200 | Reagent Water Blank (2) SST | 6-way valve [B] (2) |
| **31** | 1200 | Standard Solution 500 ppb C as sucrose (3) | 6-way valve [B] (3) |
| **32** | 1200 | Solution 500 ppb C as 1.4-benzoquinone (4) | 6-way valve [B] (4) |
| **33** | 1200 | Stock solution 20 ppm C as sucrose (5) | 6-way valve [B] (5) |
| **34** | 1200 | Stock Solution 20 ppm C as 1,4-benzoquinone (6) | 6-way valve [B] (6) |
| **Tubes within reactor housing** | | | |
| **51** | | Heating element [I] out 1 | Conductivity sensor 1 [O] in |
| **52** | | Conductivity sensor 1 [O] out | UV-Reactor [J] in |
| **53** | | UV-Reactor [J] out | Heating element in [I] via reactor port [D] |
| **54** | | Heating element [I] out 2 | Conductivity sensor 2 [N] in |
| **55** | | Conductivity sensor 2 [N] out | reactor port (D) |

**Connections on Triple- and Fourfold Distributor**



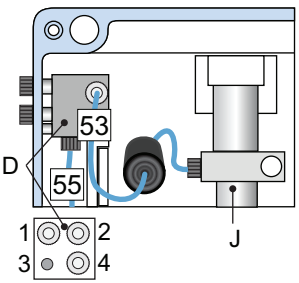

***C*** *Triple distributor*
***E*** *Fourfold distributor*

**Connections on 3-way valve**




***G*** *T3-way valve*
***B*** *6-way valve*

**Connections on Reactor Port**




***D*** *Reactor port*
***J*** *UV-Reactor*

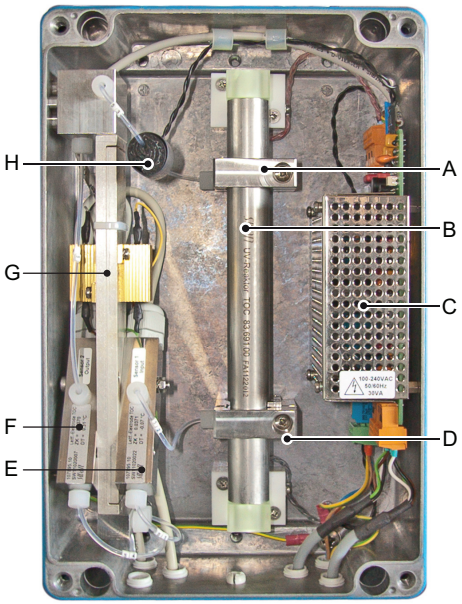
## 6.10. Replace the UV-Reactor

**WARNING**

**Electrical hazard**

Risk of electrical shock caused by high ignition voltage

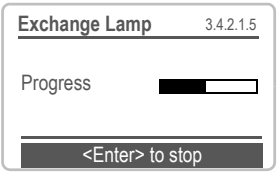
- Disconnect main power supply before exchanging the UV-Reactor



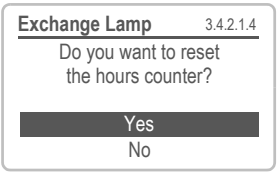

***A*** *UV-Reactor holder neutral*
***B*** *UV-Reactor*
***C*** *Electric lamp ballast (EVG)*
***D*** *Lower UV-Reactor holder (mechanically coded)*
***E*** *Conductivity sensor 1*
***F*** *Conductivity sensor 2*
***G*** *Heating element*
***H*** *Temperature sensor for flow monitoring*

**Remove the UV-Reactor**

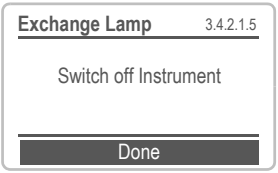
**1** Navigate to menu <Maintenance>/<Service>/<Lamp>/<Exchange Lamp>




**2** Press [Enter].
⇒*The peristaltic pump runs in reverse Mode to empty all tubes.*




**3** Press [Enter] to reset the counter or select <No> if you want to perform an other maintenance task.




**4** Press [Enter] to quit the menu.

**5** Switch off the instrument.

**6** Open the UV-reactor case.

**7** Unscrew both clamps of the reactor holders [A] and [D] and open them.

**8** Remove the complete UV-reactor form the reactor holders.

**9** Remove the O-rings form the reactor holders.

UV-Radiation and Recycling

***NOTICE:***

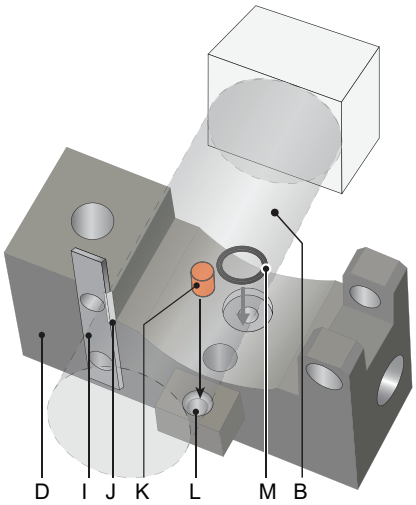
- *Any radiation of the UV-lamp (ozone-generating lamp) is absorbed by the polycarbonate cap of the complete UV-Reactor.*
- *The UV-lamp contains heavy metal (Mercury). Therefore avoid breakage of glass and assure proper disposal (recycling).*

**Install the UV-Reactor**

The replacement set for the UV-reactor contains:

- 1 UV-reactor
- 2 O-rings 1.78 x 1.78 mm

The guide plate [I] on the lower UV-reactor holder [D] ensures together with the positioning pin [K] on the UV-reactor, that the UV-reactor can only be installed in one position. The guide hole [L] on the lower UV-reactor holder ensures the precise alignment of the UV-reactors sample input and output with the O-rings [M].




***D*** *UV-reactor holder*
***I*** *Guide plate*
***J*** *Groove*
***K*** *Positioning pin*
***L*** *Guide hole*
***M*** *O-ring*
***B*** *UV-Reactor*

**1** Put the O-rings [M] into the bores (sample inlet and outlet) of the reactor holders [A] and [D].

**2** Install the new UV-reactor so that the guide plate [I] slides into the groove [J] of the UV-reactor and the positioning pin [K] slides into the guide hole [L].

**3** Carefully push the UV-reactor into the contact sockets.

**4** Close the clamps of the reactor holders and tighten the screws.

**5** Switch ON main power.

**6** Start <Fill System> in menu <Maintenance>/<Service>

**7** Check the UV-Reactor input and output for leakage.

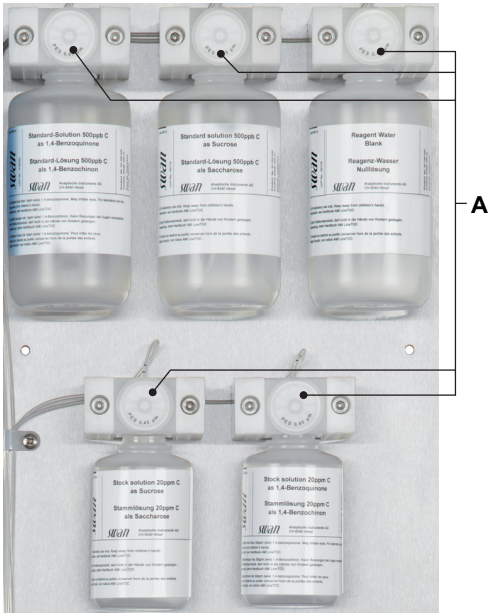
⇒*After <Fill System> has been finished, the instrument switches automatically to measuring mode and the UV-lamp is switched on.*

8 If no leakage occurs and the UV-lamp is on screw the cover onto the case.

9 If not already done, reset the hours counter.

## 6.11. Replace Air Filters

The air filters are located on the bottle holders. They prevent the standard solutions and the stock solutions from contamination with any particles via the air.
Replace the air filters annually.




***A*** *Air filters*

To replace the air filters proceed as follows:

1 Pull the old air filter out of the bottle holder.

2 Push the new air filter into the bottle holder.

## 6.12. Replace Fuses

**WARNING**

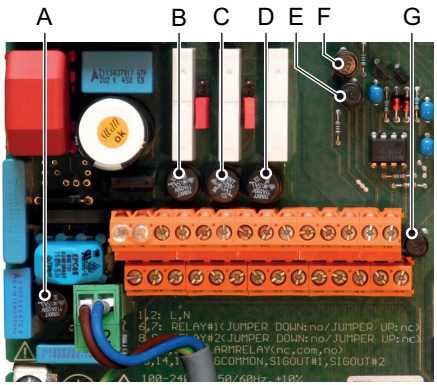
**External Voltage.**

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*** *1.6 AT/250V 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*

## 6.13. Longer Stop of Operation

Do not switch off the instrument if your operation is suspended for less than a week. Power consumption is very low and the analyzer remains ready for use.

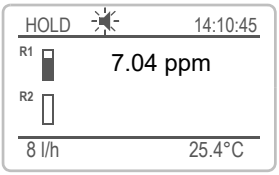
1 Switch off the instrument according to the instructions in Stop of Operation for Maintenance, p. 46.

2 Relax the occlusion frames of the peristaltic pump.

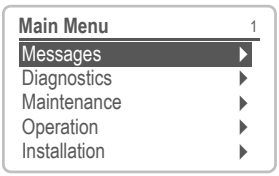
# 7. Error List

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

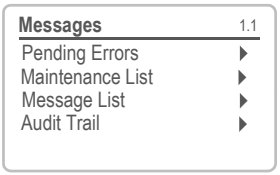
- Errors which disappear if correct measuring conditions are recovered (i.e. Sample Flow low).
  Such Errors are marked **E0xx** (bold and orange)
- Errors which indicate a hardware failure of the instrument.
  Such Errors are marked **E0xx** (bold and red)



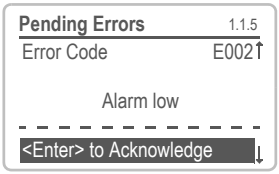

**Error or fatal Error**
Error not yet acknowledged.
Check **Pending Errors 1.1.5 *** and take corrective action.
Press [ENTER].




Navigate to menu Messages.
Press [ENTER].




Navigate to menu Pending Errors.
Press [ENTER].




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

* Menu numbers see Program Overview, p. 75

| Error | Description | Corrective action |
|---|---|---|
| **E001** | TOC Alarm high | – check process<br>– check programmed value, see 5.3.1.1.1.1, p. 90 |
| **E002** | TOC Alarm low | – check process<br>– check programmed value, see 5.3.1.1.1.25, p. 90 |
| **E003** | Cond. 1 Alarm high | – check process<br>– check programmed value, see 5.3.1.1.2.1, p. 90 |
| **E004** | Cond. 1 Alarm low | – check process<br>– check programmed value, see 5.3.1.1.2.25, p. 90 |
| **E005** | Cond. 2 Alarm high | – check process<br>– check programmed value, see 5.3.1.1.3.1, p. 91 |
| **E006** | Cond. 2 Alarm low | – check process<br>– check programmed value, see 5.3.1.1.3.25, p. 91 |
| **E007** | Temp. 1 Alarm high | – check sample temperature<br>– check heating element<br>– check programmed value, see 5.3.1.2.1.1, p. 91 |
| **E008** | Temp. 1 Alarm low | – check sample temperature<br>– check heating element<br>– check programmed value, see 5.3.1.2.1.2, p. 91 |
| **E009** | Sample Flow high | – check Inlet pressure, see Establish Sample Flow, p. 35<br>– readjust sample flow<br>– check flow monitoring sensor |
| **E010** | Sample Flow low | – check Inlet pressure, see Establish Sample Flow, p. 35<br>– readjust sample flow<br>– check flow monitoring sensor |
| **E011** | Temp. 1 shorted | – replace sensor |
| **E012** | Temp. 1 disconnected | – check sensor connection, see Electrical Connection Scheme, p. 26 |
| **E013** | Case Temp. high | – check environment temperature |
| **E014** | Case Temp. low | – check environment temperature |
| **E015** | Lamp | – check for other Errors<br>– check lamp |

| Error | Description | Corrective action |
|---|---|---|
| **E016** | Rovalve | – check 6-way valve<br>– check connection |
| **E018** | Periclip | – check connection, see Electrical Connection Scheme, p. 26 |
| **E019** | Temp.2 shorted | – replace sensor |
| **E020** | Temp.2 disconnected | – check sensor connection, see Electrical Connection Scheme, p. 26 |
| **E021** | Temp. 2 Alarm high | – check sample temperature<br>– check heating element<br>– check programmed value, see 5.3.1.2.2.1, p. 91 |
| **E022** | Temp. 2 Alarm low | – check sample temperature<br>– check heating element<br>– check programmed value, see 5.3.1.2.2.2, p. 92 |
| **E023** | EVG | – call service |
| **E024** | Input active | Information that the Input is active (see programming Installation, Input, Fault “Yes”) |
| **E026** | IC LM75 | – Hardware failure, call service |
| **E028** | Signal output open | – check wiring on signal outputs 1 and 2 |
| **E030** | EEprom Front-End | – Hardware failure, call service |
| **E031** | Calibration RecOut | – call service |
| **E032** | Wrong Front-End | – call service |
| **E049** | Power-on | – none, status message |
| **E050** | Power-down | – none, status message |
| **E051** | FT[1)] Cond. 1 high | – conductivity of dilution water >3 µs |
| **E052** | FT[1)] Temp. 1 high | – dilution water temp. too high > 45°C |
| **E053** | FT[1)] Conc. high | – dilution water concentration >100 ppb |
| **E054** | FT[1)] Quotient | – calculated quotient out of range (< -15% or > + 15%) |

| Error | Description | Corrective action |
|---|---|---|
| **E055** | FT[1)] Flow | – No sample flow |
| **E056** | FT[1)] Stability | – TOC value not stable |
| **E065** | Function Test | – automatically started Function Test aborted<br>– see Message List for detailed information |
| **E066** | Exchange Lamp | – The maximum permissible operating time of the lamp is reached. Exchange the lamp, see Replace the UV-Reactor, p. 65 |

[1)] FT = Function Test

# 8. Program Overview

- Menu 1 **Messages** is password protected as soon as a administrator-password has been defined. Access for Administrator, Service and Operator is possible. No settings can be modified.
- Menu 2 **Diagnostics** is password protected as soon as a administrator-password has been defined. Access for Administrator, Service and Operator is possible. No settings can be modified.
- Menu 3 **Maintenance** is password protected as soon as a administrator-password has been defined. Access for Administrator and Service is possible. Calibration, simulation of outputs and set time/date.
- Menu 4 **Operation** is password protected as soon as a administrator-password has been defined.Access for Administrator and Service is possible. Allows to set limits, alarms values, etc.
- Menu 5 **Installation**: is password protected as soon as a administrator-password has been defined. Access for Administrator only is possible. Defining assignment of all inputs and outputs, measuring parameters, interface, passwords, etc.

Further information see chapter 9, 5.4.4, p. 95.

Depending on the chosen parameters some menus listed below may not be visible on your AMI LineTOC transmitter.

## 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* | *Message List* | 1.3.1* |
| **Audit Trail** 1.4* | *Audit Trail* | 1.4.1* |

## 8.2. Diagnostics (Main Menu 2)

| | | | | |
|---|---|---|---|---|
| **Identification** | *Designation* | AMI LineTOC | | * Menu numbers |
| 2.1* | *Version* | V6.20-08/16 | | |
| | **Peripherals** | *PeriClip 1.05* | 2.1.3.1* | |
| | 2.1.3* | *EVG 1.40* | | |
| | | *RoValve 1.50* | | |
| | **Factory Test** | *Instrument* | 2.1.4.1* | |
| | 2.1.4* | *Motherboard* | | |
| | | *Front End* | | |
| | **Operating Time** | *Years, Days, h, min, s* | 2.1.5.1* | |
| | 2.1.5* | | | |
| **Sensors** | **Sensors** | *Current value* | 2.2.1.1* | |
| 2.2* | 2.2.1* | *Cond.1 and 2* | | |
| | | *Temp.1 and 2* | | |
| | **History** | *Verification (CO2)* | 2.2.2.100* | |
| | 2.2.2* | *Calibration (Coefficient)* | 2.2.2.101 | |
| | | *Suitability Test (Mode = Pharma)* | 2.2.2.2* | |
| | | *Function Test* | 2.2.2.3* | |
| | | *Grab Sample* | 2.2.2.4* | |
| | **Miscellaneous** | *Case Temp.* | 2.2.3.1* | |
| | 2.2.3* | | | |
| | **Lamp** | Hours counter | 2.2.4.1* | |
| | 2.2.4 | Last exchange | | |
| **Sample** | *Sample ID* | 2.3.1* | | |
| 2.3* | *Ambient Temp.* | | | |
| | *Sample Temp.* | | | |
| | *Delta T* | | | |
| | *Limit* | | | |
| **I/O State** | *Alarm Relay* | 2.4.1* | | |
| 2.4* | *Relay 1 and 2* | | | |
| | *Input* | | | |
| | *Signal Output 1 and 2* | | | |
| **Interface** | *Protocol* | 2.5.1* | | (only with RS485 |
| 2.5* | *Device Address* | | | interface) |
| | *Baud rate* | | | |
| | *Parity* | | | |

## 8.3. Maintenance (Main Menu 3)

| | | | | |
|---|---|---|---|---|
| **Verification** | *(Progress)* | (only Mode CO2) | | * Menu numbers |
| 3.100* | | | | |
| **Calibration** | *(Progress)* | (only Mode Coefficient) | | |
| 3.101* | | | | |
| **Suitability Test** | *(Progress)* | (only Pharma) | | |
| 3.2* | | | | |
| **Function Test** | *(Progress)* | | | |
| 3.300* | | | | |
| **Service** | **Simulation** | *Relay 1/2* | 3.4.1.1/2* | |
| 3.4* | 3.4.1* | *Signal Output 1/2* | 3.4.1.3/4* | |
| | **Lamp** | *Exchange Lamp* | 3.4.2.1* | |
| | 3.4.2* | *Reset hours counter* | 3.4.2.2 | |
| | **Fill System** | *(Progress)* | | |
| | 3.4.3* | | | |
| | **Test Modules** | *Lamp* | 3.4.4.1* | |
| | 3.4.4* | *PeriClip* | 3.4.4.2* | |
| | | *Solenoid Valve* | 3.4.4.3* | |
| | | *Rotary Valve* | 3.4.4.4* | |
| | **Flow Calibration** | *Progress* | | |
| | 3.4.5* | | | |
| **Set Time** | *(Date, Time)* | | | |
| 3.5* | | | | |

## 8.4. Operation (Main Menu 4)

| | | | |
|---|---|---|---|
| **Grab Sample** | *Pos. 2: Grab Sample* | 4.1 | * Menu numbers |
| 4.1* | *Sample ID* | 4.1.3 | |
| **Sensors** | *Filter Time Const.* | 4.2.1* | |
| 4.2* | *Hold after Cal.* | 4.2.2* | |
| **Logger** | *Log Interval* | 4.3.1* | |
| 4.3* | *Clear Logger* | 4.3.2* | |

## 8.5. Installation (Main Menu 5)

| | | | | |
|---|---|---|---|---|
| **Sensors** | **TOC** | **Measurement** | **Operation Mode** | *Pharma* |
| 5.1* | 5.1.1* | 5.1.1.1 | 5.1.1.1.1* | *UPW* |
| | | | **Compensation** | *CO2* |
| | | | 5.1.1.1.2* | *Coefficient* |
| | | **Parameters** (UPW only) | *Offset* | 5.1.1.2.1 |
| | | 5.1.1.2 | *Factor* | 5.1.1.2.2 |
| | | | *Slope correction* | 5.1.1.2.3 |
| | | | *Standard* | 5.1.1.2.4 |
| | | | *Check Standard* | 5.1.1.2.5 |
| | **Cond. 1 and 2** | Cell Constant | 5.1.x.1* | |
| | 5.1.2/3* | Temp. Corr. | 5.1.x.2* | |
| | **Function Test** | *Mode* | 5.1.4.1* | |
| | 5.1.4* | *Flush Time* | 5.1.4.2* | |
| **Signal Outputs** | **Signal Output 1 and 2** | *Parameter* | 5.2.1.1* | |
| 5.2* | 5.2.1 and 5.2.2* | *Current Loop* | 5.2.1.2* | |
| | | *Function* | 5.2.1.3* | |
| | | *HOLD Mode* | 5.2.1.4* | |
| | | **Scaling** | *Range Low* | 5.2.1.50.10* |
| | | 5.2.1.50* | *Range High* | 5.2.1.50.20* |
| **Relay Contacts** | **Alarm Relay** | **Sensors** | **TOC** | *Alarm High* |
| 5.3* | 5.3.1* | 5.3.1.1* | 5.3.1.1.1 | *Alarm Low* |
| | | | | *Hysteresis* |
| | | | | *Delay* |
| | | | **Cond. 1 and 2** | *Alarm High* |
| | | | 5.3.1.1.2/3 | *Alarm Low* |
| | | | | *Hysteresis* |
| | | | | *Delay* |
| | | **Sample Temp.** | **Temp. 1 and 2** | *Alarm High* |
| | | 5.3.1.2* | | *Alarm Low* |
| | | **Case Temp.** | *Alarm High* | 5.3.1.3.1* |
| | | 5.3.1.3* | *Alarm Low* | 5.3.1.3.2* |

| | | | | |
|---|---|---|---|---|
| | **Relay 1 and 2** | *Function* | 5.3.2.1* | * Menu numbers |
| | 5.3.2 / 5.3.3* | *Parameter* | 5.3.2.2* | |
| | | *Setpoint* | 5.3.2.300* | |
| | | *Hysteresis* | 5.3.2.400* | |
| | | *Delay* | 5.3.2.5* | |
| | **Input** | *Active* | 5.3.4.1* | |
| | 5.3.4* | *Signal Outputs* | 5.3.4.2* | |
| | | *Output* | 5.3.4.3* | |
| | | *Fault* | 5.3.4.4* | |
| | | *Delay* | 5.3.4.5* | |
| **Miscellaneous** | *Language* | 5.4.1* | | |
| 5.4* | *Set defaults* | 5.4.2* | | |
| | *Load Firmware* | 5.4.3* | | |
| | **Access** | **Administrator** | *Name* | |
| | 5.4.4* | 5.4.4.1* | *Function* | |
| | | | *Password* | |
| | | **User 1–4** | *Name* | |
| | | 5.4.4.x* | *Function* | |
| | | | *Password* | |
| | *Sample ID* | 5.4.5* | | |
| | *Line Break Detection* | *5.4.6** | | |
| **Interface** | *Protocol* | 5.5.1* | | |
| 5.5* | *Device Address* | | (only with RS485 interface) | |
| | *Baud rate* | 5.5.x* | | |
| | *Parity* | | | |

# 9. Program List and Explanations

## 1 Messages

### 1.1 Pending Errors

1.1 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 Provides the list of necessary maintenance. Cleared maintenance messages are moved to the Message list.

### 1.3 Message List

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

### 1.4 Audit Trail

1.4 Shows the audit trail: event, menu, date and time of issue.
96 events are memorized. Then the oldest events 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

2.1.1 *Designation:* View the Designation of instrument: AMI LineTOC

2.1.2 *Version*: Firmware version, e.g. V6.20-08/16

**2.1.3 Peripherals:**

2.1.3.1
- o *PeriClip:* Firmware version of peristaltic pump (e.g. 1.05)
- o *EVG:* Firmware version of UV-Reactor (e.g. 1.40)
- o *RoValve:* Firmware version of 6-way valve (e.g. 1.50)

**2.1.4 Factory Test:** Test date of the Instrument-, Motherboard- Frontend - QC factory test.

**2.1.5 Operating Time:** Years / Days / Hours / Minutes / Seconds.

## 2.2 Sensors

**2.2.1** **Sensors**:

2.2.1.1

- *Current value:* Shows the actual value of TOC in ppb.
- *Cond. 1 and 2*: Shows the actual conductivity of the sensor 1 and 2 in nS/cm, uncompensated.
- *Temp. 1 and 2*: Shows the actual temperature of Sensor 1 and 2.

**2.2.2** **History**:

2.2.1.100 *Verification:* Visible in conductivity model “CO2”.

Review values of the last calibrations. Only for diagnostic purpose. Max. 65 data records are memorized.

2.2.1.101 *Calibration:* Visible in conductivity model “Coefficient”.

Review values of the last calibrations. Only for diagnostic purpose. Max. 65 data records are memorized.

2.2.2.2 *Suitability Test:* Visible in measuring mode “Pharma”.

Shows the values of the last system suitability tests. Only for diagnostic purpose. Max. 65 data records are memorized.

2.2.2.3 *Function Test*: Shows the values of the last function tests. Only for diagnostic purpose. Max. 65 data records are memorized.

2.2.2.4 *Grab Sample:* Shows the values of the last grab samples. Only for diagnostic purpose. Max. 65 data records are memorized.

**2.2.3** **Miscellaneous**:

*Case Temperature*: Shows the actual temperature in °C inside the transmitter.

## 2.3 Sample

2.3.1

- *Sample ID:* Shows the programmed code. The code is defined by the user to identify the sample point in the plant.
- *Ambient Temp.*: Shows the actual temperature of the temperature sensor installed on the EVG.
- *Sample Temp.*: Shows the actual temperature of the temperature sensor installed on tube 53.
- *Delta T*: Shows the temperature difference of Sample Temp. minus Ambient Temp.
- *Limit*: Shows the limit of the temperature difference which triggers a flow alarm.
  Depending on the ambient temperature the limit temperature automatically changes.

## 2.4 I/O State

**2.4.1- 2.4.2** Shows the actual status of all in- and outputs.

- *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

## 2.5 Interface

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

# 3 Maintenance

## 3.100 Verification

Verification: Visible in conductivity model “CO2”.

Start verification procedure. Follow the instructions on the screen. Further details see Verification, p. 46.

## 3.101 Calibration

Calibration: Visible in conductivity model “Coefficient”.

Start calibration procedure. Follow instructions on the screen. Further details see Calibration, p. 49.

## 3.2 Suitability Test

Suitability Test: Visible in measuring mode “Pharma”.

Start suitability test procedure. Follow the instructions on the screen. Further details see System Suitability Test (SST), p. 56.

## 3.3xx Function Test

*Function Test:* Start test procedure. Follow the instructions on the screen. Further details see Function Test Pharma, p. 51 or Function Test UPW, p. 54

## 3.4 Service

**3.4.1** **Simulation**: Simulate signal output and relays.

To simulate a value or a relay state, select the

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

with the [▲] or [▼] key.

Press the [Enter] key.

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

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

| | | |
|---|---|---|
| 3.4.1.1 | *Alarm Relay:* | Active or inactive |
| 3.4.1.2 | *Relay 1 and 2:* | Active or inactive |
| 3.4.1.4 | *Signal Output 1:* | Set current strength in mA. |
| 3.4.1.5 | *Signal Output 2:* | Set current strength in mA |
| 3.1.4.5 | *Signal Output 3 (optional):* | Set current strength in mA |

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

**3.4.2 Lamp**

3.4.2.1 *Exchange Lamp*: Starts the pump in reverse mode to empty the system. Follow the instructions on the screen.

3.4.2.2 *Reset hours counter*: Reset the counter after the lamp has been exchanged.

**3.4.3 Fill System:** Starts the peristaltic pump to fill the system e.g. after start-up or maintenance. Follow the instructions on the screen.

**3.4.4 Test Modules:**

3.4.4.1 *Lamp*: Switch Lamp [ON] or [OFF]

3.4.4.2 *PeriClip*: Switch Peristaltic pump [ON] or [OFF]

3.4.4.3 *Solenoid Valve*: Switch Valve [ON] or [OFF]

3.4.4.4 *Rotary Valve*: Switch 6-way valve manually from position 1 to 6

**3.4.4.5 Current values**: shows the current values in ppb or nS of:

3.4.4.5.1

| | |
|---|---|
| Pharma and UPW | Pharma and UPW |
| Compensation $CO_2$ | Compensation Coefficient |
| *TOC in ppb* | TOC in ppb |
| *(TIC in ppb)* | *(Cond 1 in nS)* |
| *(TC in ppb)* | *(Cond 2 in nS)* |

**3.4.5 Flow Calibration:**

The flow calibration normally is started automatically if the temperature in the reactor housing rises or falls more than 3 °C. If necessary it can be started manually.

## 3.5 Set Time

Adjust date and time.

# 4 Operation

## 4.1 Grab Sample

4.1.3 *Sample ID:* Enter the name of the sample. This identification is defined by the user to identify the location of the sample. The name can be a maximum of 8 characters.
To enter the name see Grab Sample, p. 42.

## 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: 8–300 sec

4.2.2 *Hold after Cal.:* Delay permitting the instrument to stabilize again after a test has been performed. 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 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. A record consists of:
Date, time, alarms, measured value, (TOC, Cond. 1 and 2, Temp. 1 and 2, Conc. 1 and 2, case temperature.
Range: 1 Second to 1 Hour

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

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

4.3.2 *Clear logger:* If confirmed with yes, all data is erased and a new data series is started.

# 5 Installation

## 5.1 Sensors

### 5.1.1 TOC

#### 5.1.1.1 Measurement

5.1.1.1.1 *Operation Mode* (see Operating Modes, p. 8)

| Operation Mode | |
|---|---|
| Pharma | Set the instrument to pharma mode |
| UPW | Set the instrument to UPW mode |

##### 5.1.1.1.2 Compensation

5.1.1.1.2.1 Compensation

| Compensation |
|---|
| CO2 |
| Coefficient |

*CO2*: Set the instrument to conductivity model CO2
(see Conductivity Model CO2, p. 10)

5.1.1.1.2.2 *Coefficient*: Changing the percent value “Coefficient” has an effect on the values displayed as process values in the conductivity model “Coefficient”. These values are converted to a reference temperature of 25 °C and compensated with the preset percent value of the Coefficient (see Conductivity Model Coefficient, p. 11).
Range: 0–10%

#### 5.1.1.2 Parameters: *(only visible in UPW Mode)*

5.1.1.2.1 *Offset:* The Offset is by default set to -0.40 ppb. If the Offset is modified the displayed TOC value is marked with a **~**.
Range: -200 ppb to + 200 ppb

5.1.1.2.2 *Factor:* The Factor is by default set to 1.00. After a calibration it may be overwritten. In this menu the factor can be set back or to any other vale within the given range.
Range: 0.25–5.0

5.1.1.2.3 *Slope correction*: The slope correction is set to 1.0 by default. Modifying the slope correction has an influence to the steepness of the slope and as a consequence also the measuring value will change. If the Slope correction is modified, the displayed TOC value is marked with a **~**.
Range: 0.1–10.0

5.1.1.2.4 *Standard:* Set the concentration of the calibration standard sucrose
Range: 100 ppb–1.00 ppm

5.1.1.2.5 *Check Standard:* Set the concentration of the check standard 1.4-Benzoquinone
Range: 100 ppb–25.0 ppm

**5.1.2 and 5.1.3 Cond. 1 and 2**

5.1.x.1 *Cell Constant:* Set cell constant (zk) of the conductivity sensor 1 and 2. See label on the conductivity sensor 1 and 2.
Range: 0.0100–0.0800 $cm^{-1}$

5.1.x.2 *Temp. Corr:* Set temperature correction (dt) of the conductivity sensor 1 and 2. See label on the conductivity sensor 1 and 2.
Range: -1.00 o + 1.00 °C

**5.1.4 Function Test**

5.1.4.1

| Mode |
|---|
| off |
| daily |
| weekly |
| monthly |

- o *off*: No Function Test will be performed.
- o *daily:* Additional to the flush time, the start time can be set
  Range: 0–23 (h)
- o *weekly:* Additional to the flush time, one or more days as well as the start time can be set. The start time applies for each day.
  Range: Monday to Sunday; 0–23 (h)
- o *monthly:* Additional to the flush time, the day and the start time can be set.
  Range: Day 1–28; 0–23 (h)

5.1.4.2 *Flush Time*: Set the time you will flush the tubes after the function test.
Range: 1min to 60 min

## 5.2 Signal Outputs

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

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

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

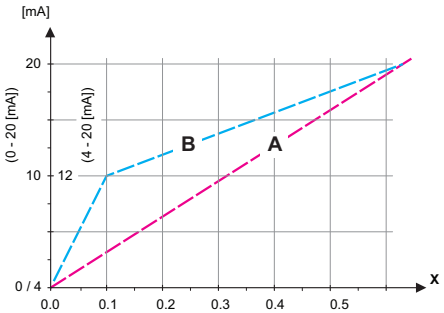
| Parameter | |
|---|---|
| TOC | |
| Cond.1 and 2 | Conductivity 1 and 2 |
| Temp 1 and 2 | Temperature 1 and 2 |
| Conc. 1 and 2 | Concentration 1 and 2 (*Comp. model CO2 only*) |

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

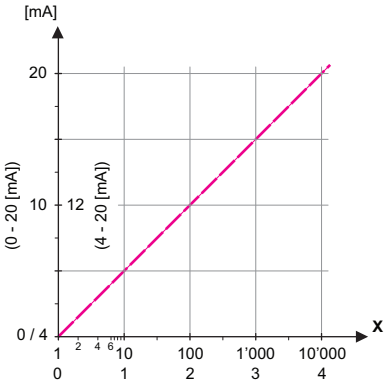
5.2.1.3 *Function:* Define if the signal output is used to transmit a process value or to drive a control unit. Available functions are:

- Linear, bilinear or logarithmic for process values.
  See As process values, p. 88

**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)

5.2.1.4 *HOLD Mode:* If HOLD Mode is set to “hold”, the last measuring value is displayed during a test.
If HOLD Mode is set to “cont”, the actual test value is displayed during a test.
Available values: hold, cont

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

**Parameter: TOC**

5.2.1.50.10 *Range Low:* 0.00 ppb to 2.0 ppm
5.2.1.50.20 R*ange High:* 50 ppb to 2.0 ppm

**Parameter: Cond.1 and Cond. 2**

5.2.1.50.11 *Range Low:* 0.00 nS to 20.0 µS
5.2.1.50.21 R*ange High:* 0.00 nS to 20.0 µS

**Parameter: Temp. 1 and Temp. 2**

5.2.1.50.13 *Range Low:* -30 °C to + 130 °C
5.2.1.50.23 R*ange High:* -30 °C to + 130 °C

**Parameter: Conc. 1 and Conc. 2**

5.2.1.50.15 *Range Low:* 0.00 ppb to 2.0 ppm
5.2.1.50.25 R*ange High:* 50 ppb to 2.0 ppm

## 5.3 Relay Contacts

### 5.3.1 Alarm Relay

The alarm relay is used as cumulative error indicator.
Under normal operating conditions the contact is active.

The contact is inactive at:

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

#### 5.3.1.1 Sensors

##### 5.3.1.1.1 TOC

5.3.1.1.1.1 *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 ppb–2.00 ppm

5.3.1.1.1.25 *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 ppb–2.00 ppm

5.3.1.1.1.35 *Hysteresis*: Within the hyst. range, the relay does not switch. This prevents damage of relay contacts when the measured value fluctuates around the alarm value.
Range: 0.000 ppb–2.00 ppm

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

##### 5.3.1.1.2 **Cond. 1**: Define the measuring value, which issues an alarm high respectively low

5.3.1.1.2.1 *Alarm high*: If the measured value rises above the alarm high value, the alarm relay is activated and E003 is displayed in the message list.
Range: 0.0 nS–5.00 µS

5.3.1.1.2.25 *Alarm low*: If the measured value falls below the alarm low value, the alarm relay is activated and E004 is displayed in the message list.
Range: 0.0 nS–5.00 µS

5.3.1.1.2.35 *Hysteresis*: Within the hyst. range, the relay does not switch. This prevents damage of relay contacts when the measured value fluctuates around the alarm value.
Range: 0.0 nS–5.00 µS

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

**5.3.1.1.3** **Cond 2**: Define the measuring value, which issues an alarm high respectively low.

5.3.1.1.3.1 *Alarm high*: If the measured value rises above the alarm high value, the alarm relay is activated and E005 is displayed in the message list.
Range: 0.0 nS–7.00 µS

5.3.1.1.3.25 *Alarm low*: If the measured value falls below the alarm low value, the alarm relay is activated and E006 is displayed in the message list.
Range: 0.0 nS–7.00 µS

5.3.1.1.3.35 *Hysteresis*: Within the hyst. range, the relay does not switch. This prevents damage of relay contacts when the measured value fluctuates around the alarm value.
Range: 0.0 nS–7.00 µS

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

**5.3.1.2** **Sample Temp**: Define the sample temperature, which issues an alarm high respectively low.

**5.3.1.2.1** **Sample Temp. 1**

5.3.1.2.1.1 *Alarm high*: If the sample temperature rises above the programmed value E007 is issued.
Range: 30–50 °C

5.3.1.2.1.2 *Alarm low*: If the sample temperature falls below the programmed value E008 is issued.
Range: 5–45 °C

**5.3.1.2.2** **Sample Temp. 2**

5.3.1.2.2.1 *Alarm high*: If the sample temperature rises above the programmed value E021 is issued.
Range: 30–50 °C

5.3.1.2.2.2 *Alarm low*: If the sample temperature falls below the programmed value E022 is issued.
Range: 5–45 °C

**5.3.1.3 Case Temp.**:

5.3.1.3.1 *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

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

**5.3.2 and 5.3.3** **Relay 1 and 2:** The contacts can be set as normally open or normally closed with a jumper. See Relay 1 and 2, p. 29.
The function of relay contacts 1 or 2 are defined by the user

***NOTICE:*** *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,
- Fieldbus
- Hold

**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:

5.3.2.2 *Parameter*: Select a process value (TOC, Conductivity, Temperature, Concentration).

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

| Parameter | Range | |
|---|---|---|
| TOC | 0.00 ppb–2.00 ppm | |
| Cond 1 and 2 | 0.0 nS–3.00 mS | |
| Temp. 1 and 2 | -30 °C to + 130 °C | |
| Conc. 1 and 2 | 0.00 ppb–2.00 ppm | In conductivity model “CO2” only. |

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 | |
|---|---|---|
| TOC | 0.00 ppb–2.00 ppm | |
| Cond 1 and 2 | 0.0 nS–3.00 mS | |
| Temp. 1 and 2 | 0 °C to + 100 °C | |
| Conc. 1 and 2 | 0.00 ppb–2.00 ppm | In conductivity model “CO2” only. |

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

5.3.2.1 Function = Fieldbus:

The relay will be switched via the Profibus input. No further parameters are needed. For more information, see manual Profibus which you can get from a local dealer.

5.3.2.1 Function = Hold:

If the relay output is set to HOLD, the output is closed if the on-line measurement is interrupted.

**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:
The measurement is interrupted during this time.

| | |
|---|---|
| *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.<br>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

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** **Access:** Select a password different from 0000 to prevent unauthorized access to the menus <Messages>, <Diagnostics>, <Maintenance>, <Operation> and <Installation>.

***NOTICE:*** *The password protection becomes active under the following conditions:*

- *Enter an administrator password different from <0000>. If no user password is set, only the administrator has access to the menus. The user passwords 1 to 4 can be set when required.*
- *Enter 1 to 4 user passwords in advance.The Password protection for all passwords is activated when entering an administrator password different from <0000>.*

**5.4.4.1** **Administrator:** The administrator owns all rights and has access to all menus. Only an administrator can assign user rights for the users 1 to 4.

| | | |
|---|---|---|
| Name: | Admin | predefined, not changeable |
| Function: | Administrator | predefined, not changeable |

5.4.4.1.3 Password:0000Default settings, changeable

The password is set to <0000> by default. If an administrator password different from <0000> is set, it is not longer possible to enter a menu without entering the password.
If you have forgotten the administrator password, contact your nearest SWAN representative or the manufacturer.

**5.4.4.2 User 1**

5.4.4.2.1 *Name*: Enter the name of the user.

5.4.4.2.2 *Function*:

| Function |
|---|
| Administrator |
| Service |
| Operator |

Administrator: All rights
Service: Access to all menus except of menu <Installation>
Operator: Access to the menus <Messages> and <Diagnostic>

**5.4.4.3 User 2**

see User 1

**5.4.4.4 User 3**

see User 1

**5.4.4.5 User 4**

see User 1

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** | |
| 5.5.24 | Device address: | Range 0–63 |

# 10. Default Values

**Operation:**

Sensors:
Filter time constant: ..... 30 sec
Hold after Calibration: ..... 300 sec

Logger:
Logger Interval: ..... 30 min
Clear Logger: ..... no

**Installation:**

Sensors:
TOC: Measurement: Operation Mode: ..... Pharma
TOC: Measurement: Compensation: ..... CO2
*If Compensation = Coefficient*:
Coefficient: ..... 4.50 %

*Operation Mode UPW only*
TOC: Parameters: Offset: ..... -0.40 ppb
TOC: Parameters: Factor: ..... 1.00
TOC: Parameters: Slope correction ..... 1.0
TOC: Parameters: Standard: ..... 1.00 ppm
TOC: Parameters: Check Standard: ..... 1.00 ppm
Cond. 1 and 2: Cell Constant: ..... 0.0360 $cm^{-1}$
Cond. 1 and 2: Temp. corr.: ..... 0.00 °C
Function Test: Mode. ..... off
Function Test: Flush Time: ..... 15 Min

Signal Output 1:
Parameter: ..... TOC
Current loop: ..... 4–20 mA
Function: ..... linear
HOLD Mode: ..... hold
Scaling: Range low: ..... 0.00 ppb
Scaling: Range high: ..... 1.00 ppm
Parameter: Scaling: Cond. 1 and Cond. 2
Scaling: Range low: ..... 0.0 nS
Scaling: Range high: ..... 10.0 µS
Parameter: Scaling: Temp. 1 and Temp. 2
Scaling: Range low: ..... 0.0 °C
Scaling: Range high: ..... 50 °C
Parameter: Scaling: Conc. 1
Scaling: Range low: ..... 0.00 ppb
Scaling: Range high: ..... 100 ppb
Parameter: Scaling: Conc. 2
Scaling: Range low: ..... 0.00 ppb
Scaling: Range high: ..... 1.00 ppm

| | |
|---|---|
| Signal Output 2: | Parameter: ..... Temperature 1<br>Current loop: ..... 4–20 mA<br>Function: ..... linear<br>Scaling: Range low: ..... 0.0 °C<br>Scaling: Range high: ..... 50.0 °C |
| Alarm Relay: | Sensors: TOC: Alarm high: ..... 2.00 ppm<br>Sensors: TOC: Alarm low: ..... 0.00 ppb<br>Sensors: TOC: Hysteresis: ..... 10.0 ppb<br>Sensors: TOC: Delay: ..... 30 sec<br>Sensors: Cond. 1: Alarm high: ..... 3.00 µS<br>Sensors: Cond. 1: Alarm low: ..... 0.0 nS<br>Sensors: Cond. 1: Hysteresis: ..... 100.0 nS<br>Sensors: Cond. 1: Delay: ..... 30 sec<br>Sensors: Cond. 2: Alarm high: ..... 5.00 µS<br>Sensors: Cond. 2: Alarm low: ..... 0.0 nS<br>Sensors: Cond. 2: Hysteresis: ..... 100.0 nS<br>Sensors: Cond. 2: Delay: ..... 30 sec<br>Sample Temp.: Temp. 1 and 2: Alarm High: ..... 50 °C<br>Sample Temperature: Temp. 1 and 2: Alarm Low: ..... 30 °C<br>Case temperature: Alarm High: ..... 65 °C<br>Case temperature: Alarm Low: ..... 0 °C |
| Relay 1 and 2 | Function: ..... Limit upper<br>Parameter: ..... TOC<br>Setpoint: ..... 1.00 ppm<br>Hysteresis: ..... 10.0 ppb<br>Delay: ..... 30 sec<br>Parameter: Cond. 1<br>Setpoint: ..... 10.0 µS<br>Hysteresis: ..... 1.00 µS<br>Delay: ..... 30 sec<br>Parameter: Cond. 2<br>Setpoint: ..... 10.0 µS<br>Hysteresis: ..... 100 nS<br>Delay: ..... 30 sec<br>Parameter: Temp. 1 and 2<br>Setpoint: ..... 50 °C<br>Hysteresis: ..... 1.0 °C<br>Delay: ..... 30 sec<br>Parameter: Conc. 1<br>Setpoint: ..... 100 ppb<br>Hysteresis: ..... 10.0 ppb<br>Delay: ..... 30 sec |

| | |
|---|---|
| | Parameter: Conc. 2 |
| | Setpoint: ..... 1.00 ppm |
| | Hysteresis: ..... 10.0 ppb |
| | Delay: ..... 30 sec |
| Input | Active: ..... when closed |
| | Signal Outputs: ..... hold |
| | Output: ..... off |
| | Fault: ..... yes |
| | Delay: ..... 10 sec |
| Miscellaneous | Language: ..... English |
| | Set default: ..... no |
| | Load firmware: ..... no |
| | Access: Password: Administrator: ..... for all modes 0000 |
| | Access: Password: User 1 ... 4 : ..... for all modes 1234 |
| | Line break detection ..... no |
| Interface | Protocol: ..... depending on interface |

# 11. Index

# 12. Notes

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