ANALYTICAL INSTRUMENTS

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AMI LineTOC

Operator's Manual

SWISS MADE

Customer Support

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Operator's Manual

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

1. Safety Instructions

General

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

Target audience

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

OM location

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

Qualification, training

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

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

1.1. Warning Notices

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

DANGER

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

- Follow the prevention instructions carefully.

WARNING

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

- Follow the prevention instructions carefully.

CAUTION

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

- Follow the prevention instructions carefully.

Mandatory signs

The mandatory signs in this manual have the following meaning:

Safety goggles

Safety gloves

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


Electrical shock hazard


Corrosive


Harmful to health


Flammable


Warning general


Attention general

1.2. General Safety Regulations

Legal requirements

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

Spare parts and disposables

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

Modifications

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

WARNING

Electrical shock hazard

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

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

WARNING

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

WARNING

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

2. Product Description

Application

The determination of organic components contained in water allows an extensive statement about its purity.
The AMI LineTOC is the result of comprehensive experience in development of analytical instruments. The combination of a highly 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 are not visible in the transmitter menu, but replaced by fixed values.

Available models

The instrument is available in two models:

- AMI LineTOC: Instrument mounted on vertical panel.
- AMI LineTOC Compact Version: Instrument mounted on a smaller, horizontal panel. Protective cover for fluidic components available as an option.

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 Modbus or Profibus DP protocol
- HART interface

Safety features

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

Measuring modes

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

Operating modes

The analyzer provides the following operating modes:

- On-line mode
- Grab sample mode

In on-line mode, the sample is sucked through the system from the sample inlet and measured.
In grab sample mode, the sample is sucked through the system from a bottle and measured. The bottle is fixed on position 2.

Grab sample

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

Conductivity model

See Conductivity model CO2, p. 12 and Conductivity model coefficient, p. 13 for a detailed description of the conductivity models.

Tests

Depending on the measuring mode and conductivity model, the following tests are active:

Conductivity model Measuring mode	**CO_2**	**Coefficient**
Pharma	• Verification • Function test* • SST	• Calibration • Function test* • SST
UPW	• Verification • Function test*	• Calibration • Function test*

* The function test is not available on the compact version.

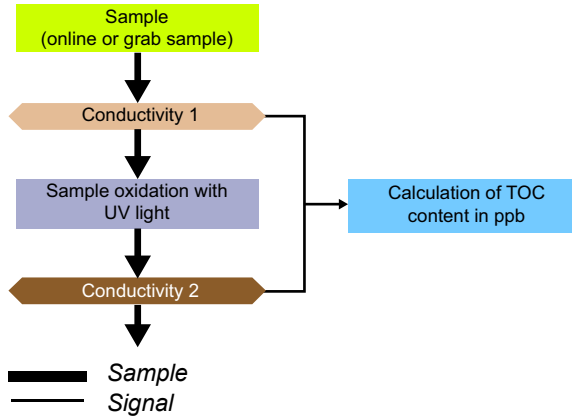
Definitions

TC	Total carbon The sum of inorganic and organic bound carbon
TIC	Total inorganic carbon The sum of inorganic carbon in dissolved and non-dissolved compounds
TOC	Total organic carbon The amount of carbon in organic compounds
AP	Aqua purificata
WFI	Water for injection
PW	Pure water
USP	United States Pharmacopoeia
EP	European Pharmacopoeia

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

If the TOC content is less than a defined amount, it is assumed that the contamination is not significant from a pharmaceutical point of view.
The TOC limit defined by the USP and EP for WFI and PW is 500 ppb regardless of the method used.
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 shown 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 between TC and 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.

If incorrect measurements occur, contact 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. 95.

2.2. Verification

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

The AMI LineTOC is calibrated at 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. 53). The calibration parameters are verified by measuring a standard solution with a known TOC concentration. Instrument verification is required by international regulations such as USP and EP.

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

- reagent water blank and
- standard solution 1 ppm C as sucrose (adjustable in measuring mode UPW)

are measured in sequence. The result of the two measured 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.

2.3. Calibration

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

The AMI LineTOC is calibrated at 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. 53). The calibration parameters are determined by measuring a standard solution with a known TOC concentration. Instrument calibration is required by 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 measured values can be used to recalculate the slope of the calibration curve in ppb/nS.

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

Note: *The function test is not available on the compact version.*

The function test allows the operator to automatically check the suitability of the system at a programmable time interval, ensuring 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 highly 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 highly concentrated stock standards allows the use of the solutions over a long period (usually >1 month) depending on ambient conditions.

UPW mode

The measured 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 measured value should rise and then fall back again.

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 pharmacopoeia requires a regularly performed system suitability test (SST) to verify the performance of the system.
The measurements of two different standards with

- reagent water blank [2]
- 500 ppb C as sucrose standard solution [3]
- 500 ppb C as 1.4-benzoquinone SST solution [4]

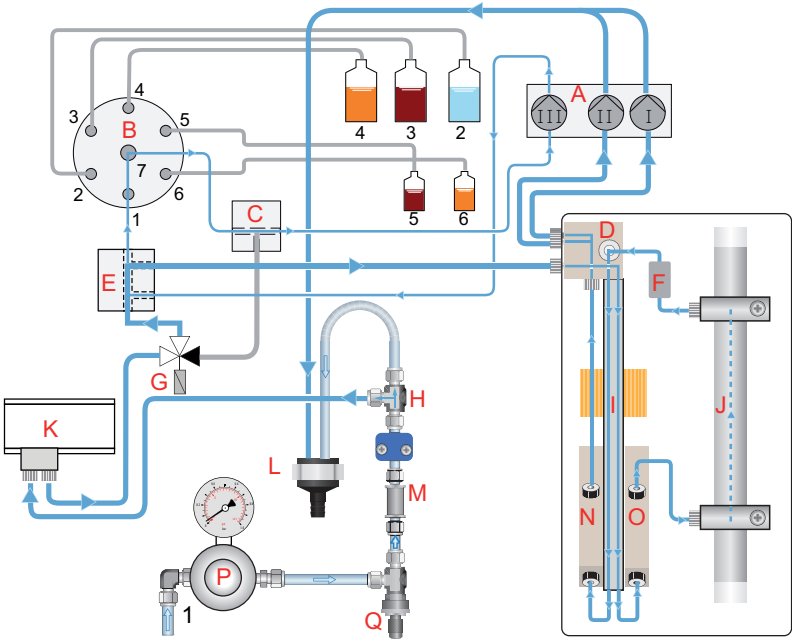
are compared. The reagent water blank [2] is used to dilute the standard solutions. It is measured first to determine its TOC content. This TOC content is then subtracted from the TOC content of the standard solutions during the SST. The two organic compounds sucrose and 1,4-benzoquinone differ in their 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 rate 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

2.6. Fluidics Overview

2.6.1 AMI LineTOC



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 bottle holders (AMI LineTOC), p. 20

Fluidics

To avoid contamination of the sample with the pump tubing material, the sample is sucked through the system via channels I and II of the peristaltic pump [A]. A small amount of 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. Excess sample is directed into 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

Flow monitoring is based on measuring the temperature difference between the heated sample and the reactor housing. As long as sample is flowing through the analyzer, the sample temperature after the heating element [I] is higher than the temperature in the reactor housing. If the sample flow is interrupted, the sample cools down and a sample flow error is output as soon as the temperature difference to the reactor housing falls below a certain value.

QA routines

The 6-way valve [B] is used to perform the various tests and is controlled by the transmitter. Depending on the selected test, it is automatically switched to the correct position to dispense 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 correspond to the input number of the 6-way valve, i.e. number 2, reagent/blank water, is connected to 6-way valve input no. 2.

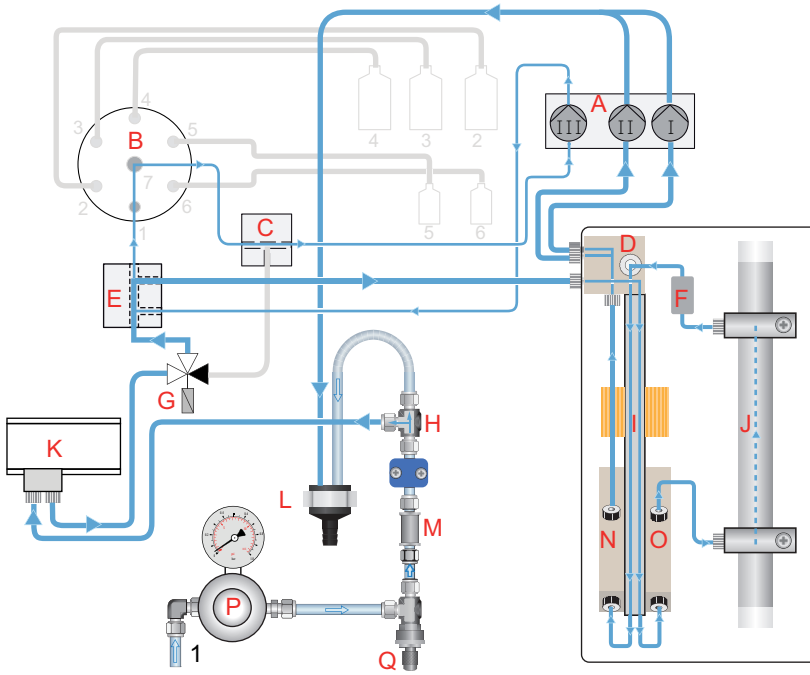
The pharmaceutical industry and the ultra pure water (UPW) applications use different bottle setups and concentrations, see table below:

Table 1: Assignment of standard and stock solutions to bottle holders (AMI LineTOC)

Measuring mode 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

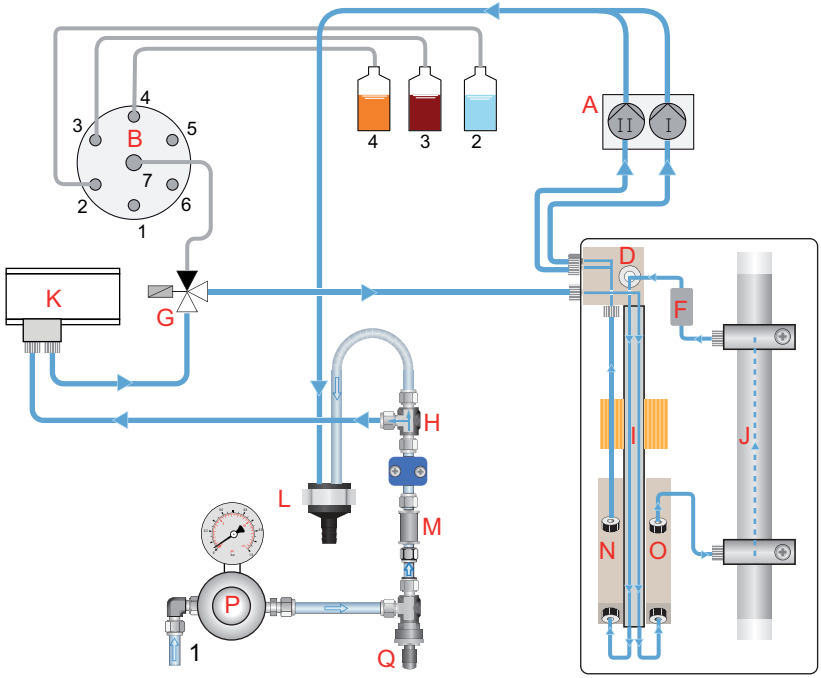
On-line mode

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 first 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 second conductivity measurement is carried out.
Then it flows through the peristaltic pump [A] into the drain [L].



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

2.6.2 AMI LineTOC Compact Version



1	*Sample inlet*	**H**	*Sample overflow*
2	*Bottle holder Pos.2* [1)]	**I**	*Heating element*
3	*Bottle holder Pos.3* [1)]	**J**	*UV reactor*
4	*Bottle holder Pos.4* [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*
D	*Reactor port*	**O**	*Conductivity sensor 1*
F	*Flow monitoring sensor*	**P**	*Pressure regulator (optional)*
G	*3-way solenoid valve 3/2*	**Q**	*Flow regulating valve*

[1)] see Assignment of standard solutions to bottle holders (AMI LineTOC Compact Version), p. 24.

Fluidics

To avoid contamination of the sample with the pump tubing material, the sample is sucked through the system via channels I and II of the peristaltic pump [A].
The sample enters the system at the sample inlet [1]. Optionally a pressure regulator [P] can be installed to keep the inlet pressure constant. Excess sample is directed into 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] 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

Flow monitoring is based on measuring the temperature difference between the heated sample and the reactor housing. As long as sample is flowing through the analyzer, the sample temperature after the heating element [I] is higher than the temperature in the reactor housing. If the sample flow is interrupted, the sample cools down and a sample flow error is output as soon as the temperature difference to the reactor housing falls below a certain value.

QA routines

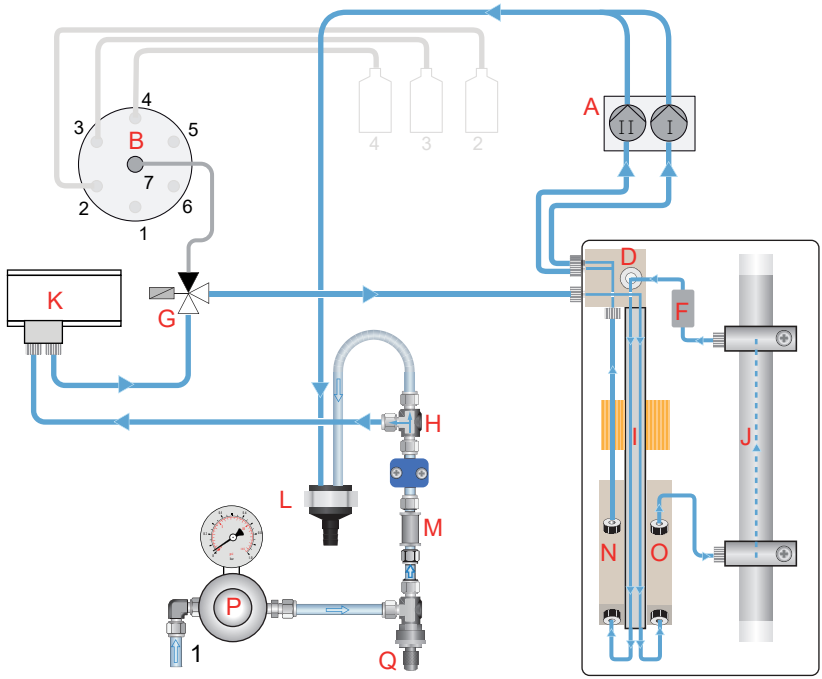
The 6-way valve [B] is used to perform the various tests and is controlled by the transmitter. Depending on the selected test, it is automatically switched to the correct position to dispense standard solutions or reagent water into the test process. The numbers of the bottles for the standard solutions or reagent/blank water correspond to the input number of the 6-way valve, i.e. number 2, reagent/blank water, is connected to 6-way valve input no. 2.
The pharmaceutical industry and the ultra pure water (UPW) applications use different bottle setups and concentrations, see table below:

Table 2: Assignment of standard solutions to bottle holders (AMI LineTOC Compact Version)

Measuring mode 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

On-line mode

In on-line mode the sample enters at sample inlet [1] and is sucked via the 3-way valve [G] to the reactor port [D]. From there the sample flows via the heating element [I] through the conductivity sensor 1 [O] where the first 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 second conductivity measurement is carried out.
Then it flows through the peristaltic pump [A] into the drain [L].



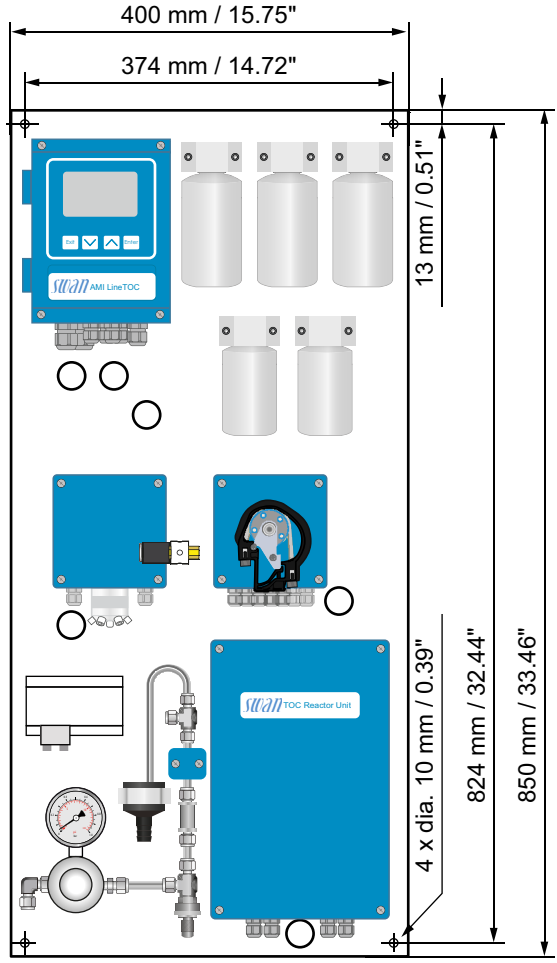
1	*Sample inlet*	**J**	*UV reactor*
7	*6-way valve output*	**K**	*Sample cooler (optional)*
A	*Peristaltic pump*	**L**	*Drain funnel*
B	*6-way valve*	**M**	*Check valve*
D	*Reactor port*	**N**	*Conductivity sensor 2*
F	*Flow monitoring sensor*	**O**	*Conductivity sensor 1*
G	*3-way solenoid valve 3/2*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

2.7. Instrument Specification

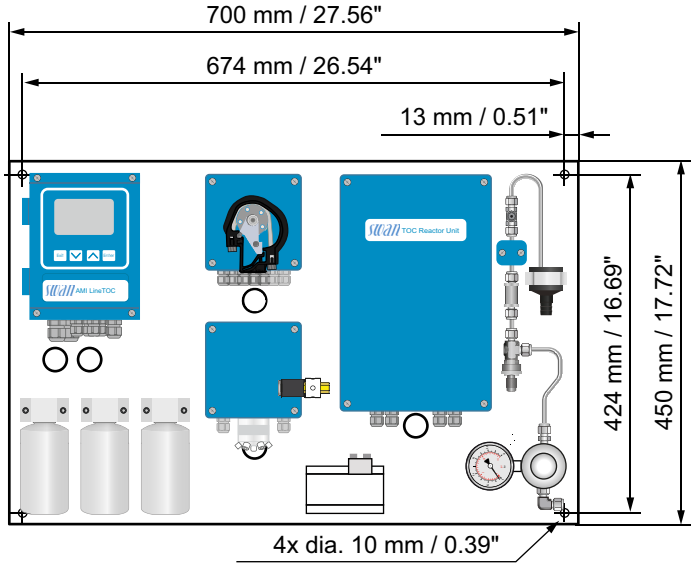
Power supply	Voltage:	100–240 VAC (±10%) 50/60 Hz (±5%) DC version not available
	Power consumption:	max. 55 VA
Transmitter specifications	Housing:	aluminum, with a protection degree of IP 66 / NEMA 4X
	Ambient temperature:	−10 to +50 °C
	Storage and transport:	−30 to +85 °C
	Humidity:	10–90% rel., non condensing
	Display:	backlit LCD, 75 x 45 mm
Measuring range	Range:	Resolution:
	0.00 to 9.99 ppb	0.01 ppb
	10.0 to 99.9 ppb	0.1 ppb
	100 to 999 ppb	1 ppb
Reproducibility	Range:	
	0.1 to 50 ppb	±1 ppb
	50 to 1000 ppb	±2%
Accuracy conductivity	Range:	
	0.055 to 2 µS/cm (25 °C)	±1%
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 2 µS/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:	for flexible tube inner diameter 15 mm

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

Dimensions (AMI LineTOC)	Panel:	stainless steel
	Dimensions:	400x850x180 mm
	Screws:	8 mm diameter
	Weight:	18 kg

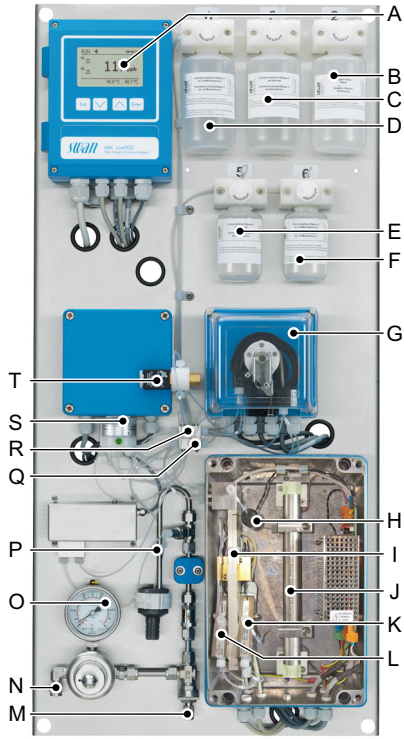


Dimensions (AMI LineTOC Compact Version)	Panel:	stainless steel
	Dimensions:	450 x 700 x 180 mm
	Screws:	8 mm diameter
	Weight:	18 kg



2.8. Instrument Overview

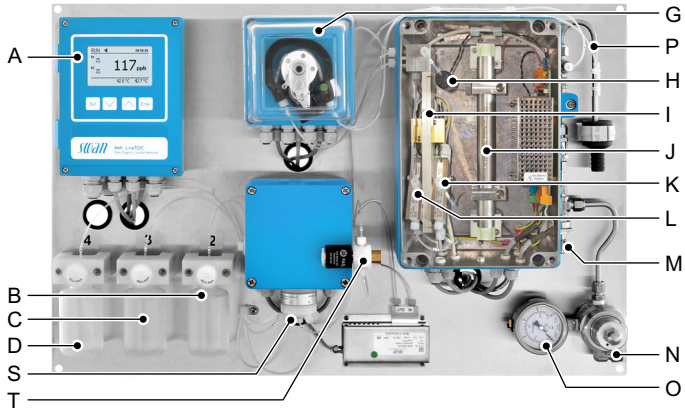
AMI LineTOC



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 bottle holders (AMI LineTOC), p. 20

AMI LineTOC Compact Version



A *Transmitter*
B *Bottle holder Pos. 2* [1)]
C *Bottle holder Pos. 3* [1)]
D *Bottle holder Pos. 4* [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*
S *6-way valve*
T *3-way valve*

[1)] see Assignment of standard solutions to bottle holders (AMI LineTOC Compact Version), p. 24

3. Installation

3.1. Installation Checklist

On-site requirements	100–240 VAC (±10%), 50/60 Hz (±5%) Power outlet with ground connection and 55 VA Sample line with at least 1 l/h Sample outlet with pressure free drain
Installation	Install the instrument in vertical position. Display should be at eye level. Connect the sample and waste lines. See Connect Sample and Waste, p. 32.
Electrical wiring	Connect all external devices. Connect power cord.
Standard and stock solutions	Prepare all necessary standard and stock solutions and screw them into the respective bottle holders. See Assignment of standard and stock solutions to bottle holders (AMI LineTOC), p. 20 or Assignment of standard solutions to bottle holders (AMI LineTOC Compact Version), p. 24.
Power-up	Open the sample tap and adjust the sample flow to 1–5 l/h. If the optional pressure regulator is installed, set the input pressure to 0.2 bar. Switch on power.
Instrument setup	Set the measuring mode to UPW or Pharma. Set the compensation model to coefficient or CO_2. Program all parameters for external devices (interface, etc.). 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	Once the run-in time is over and the measured value is stable, perform a verification.

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 27 and 28.

3.3. Connect Sample and Waste

Sample inlet

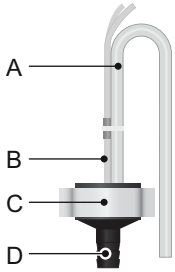
Use plastic tube 4x6 to connect the sample line.

Mounting of Swagelok fitting

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

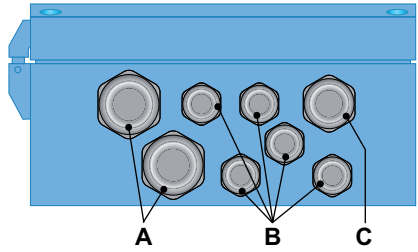
Risk of electrical shock.

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

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

Cable thicknesses

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



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

Note: *Protect unused cable glands.*

Wire

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

WARNING

External voltage

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

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

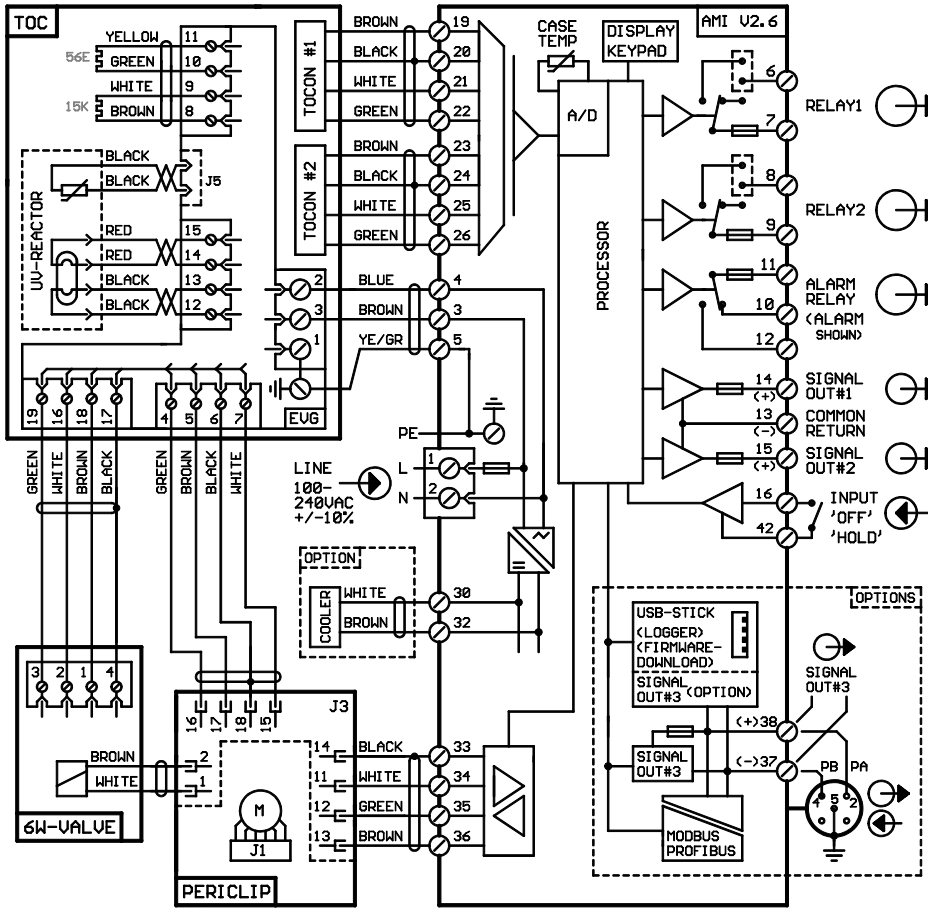
WARNING

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

WARNING

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

3.4.1 Electrical Connection Scheme



CAUTION

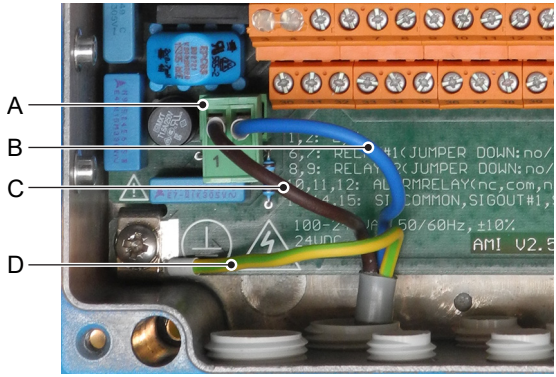
Use only the terminals shown in this diagram, and only for the mentioned purpose. Use of any other terminals will cause short circuits with possible corresponding consequences to material and personnel.

3.4.2 Power Supply

WARNING

Electrical shock hazard

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



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

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

Installation requirements

The installation must meet the following requirements.

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

3.5. Relay Contacts

3.5.1 Input

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

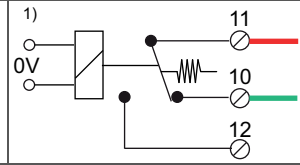
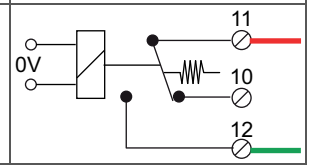
Terminals 16/42
For programming see program list end explanation 5.3.4, p. 103.

3.5.2 Alarm Relay

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

Alarm output for system errors.
Error codes see Troubleshooting, p. 80.

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

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

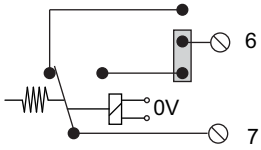
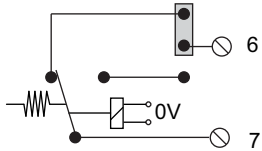
1) *usual use*

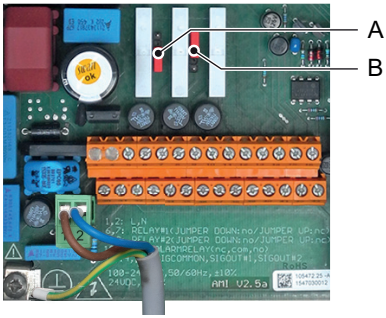
3.5.3 Relay 1 and 2

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

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

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

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



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

For programming see 5.3 Relay Contacts, p. 99.

CAUTION

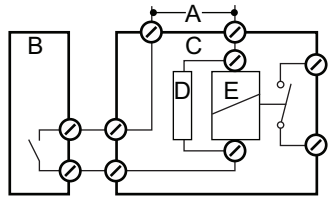
Risk of damage of the relays in the AMI transmitter due to heavy inductive load.

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

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

Inductive load

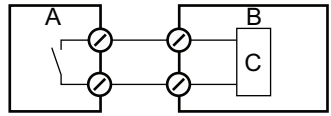
Small inductive loads (max 0.1 A) as for example the coil of a power relay can be switched directly. To avoid noise voltage in the AMI transmitter it is mandatory to connect a snubber circuit in parallel to the load.
A snubber circuit is not necessary if an AMI relay box is used.



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

Resistive load

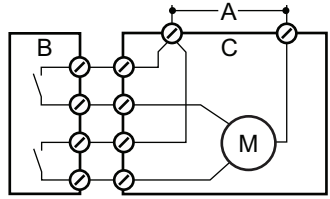
Resistive loads (max. 1 A) and control signals for PLC, impulse pumps and so on can be connected without further measures.



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

Actuators

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



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

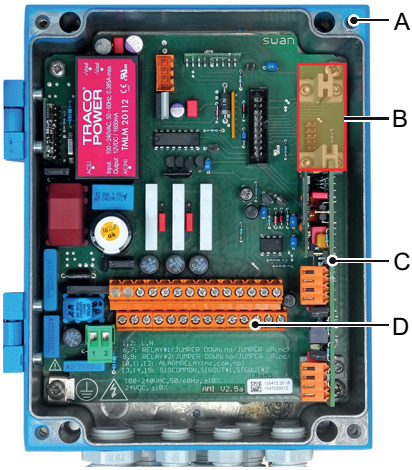
3.6. Signal Outputs

3.6.1 Signal Output 1 and 2 (Current Outputs)

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

Signal output 1: Terminals 14 (+) and 13 (-)
Signal output 2: Terminals 15 (+) and 13 (-)
For programming see 5.2 Signal Outputs, p. 97.

3.7. Interface Options



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

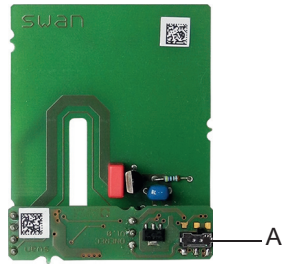
The slot for interfaces can be used to expand the functionality of the AMI instrument with either:

- Third signal output
- a Profibus or Modbus connection
- a HART connection
- a 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.

Note: *Max. burden 510 Ω.*



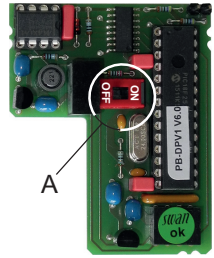
Third signal output 0/4 - 20 mA PCB

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.

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

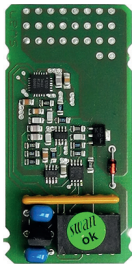


Profibus, Modbus Interface PCB (RS 485)

A *On - OFF switch*

3.7.3 HART Interface

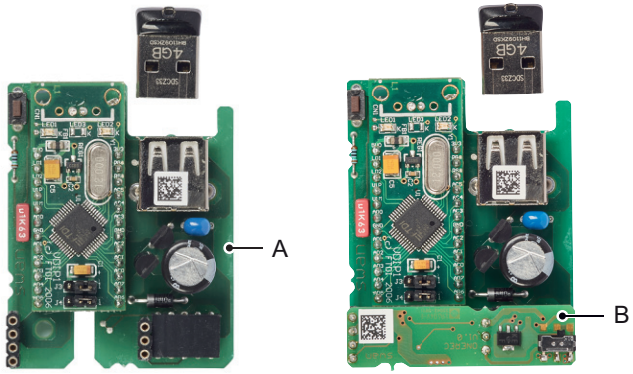
Terminals 38 (+) and 37 (-).
The HART interface PCB allows for communication via the HART protocol. For detailed information, consult the HART manual.



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

4.1. Standard and Stock Solutions

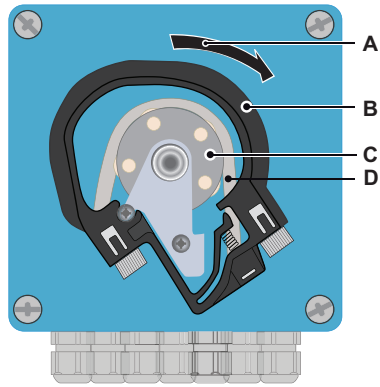
Handling of TOC solutions

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

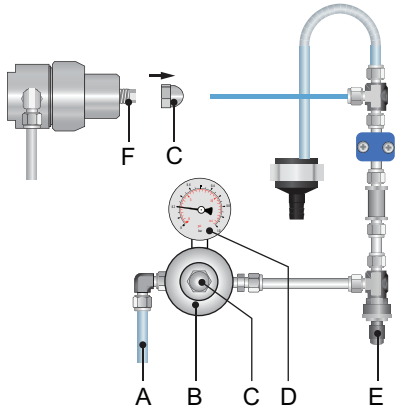
The instrument is delivered with opened occlusion frames.

1 Activate the peristaltic pump tubes by closing the occlusion frames [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 follows:
- 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 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: either CO_2 or coefficient according to your requirements. See Conductivity model CO2, p. 12 and Conductivity model coefficient, p. 13.

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 Assignment of standard and stock solutions to bottle holders (AMI LineTOC), p. 20 or Assignment of standard solutions to bottle holders (AMI LineTOC Compact Version), p. 24.

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

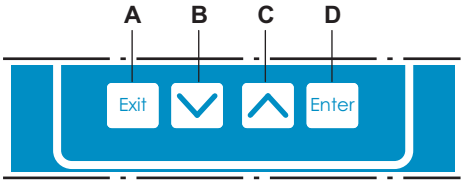
Pharma For pharmaceutical applications please follow the IQ/OQ/PQ procedures in the optional validation package.

SST System Suitability Test for verification according USP and EP regulations.

UPW Perform a verification or a calibration.

5. Operation

5.1. Keys, Display



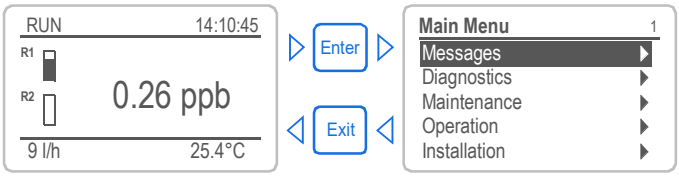
A *to exit a menu or command*
to reject any changes
to move back to the previous menu level

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

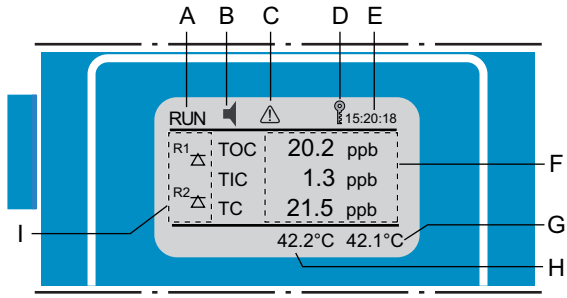
C *to move UP in a menu list*
to increase digits
to switch between display 1 and 2

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

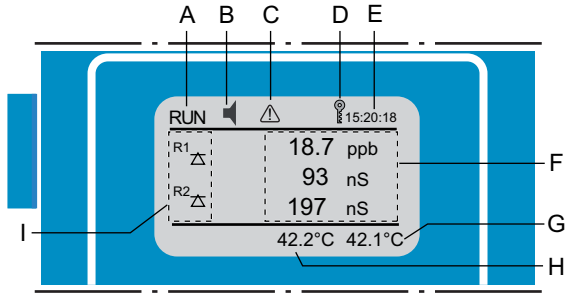
Program access, exit



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

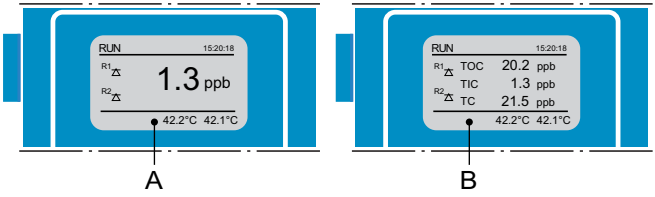
upper/lower limit not yet reached

upper/lower limit reached

Relay on hold, or controlled via Profibus

Note: *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 values measured at the actual sample temperature.

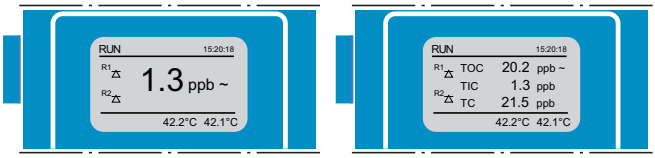
Switch between display 1 and 2 with the [▲] key.



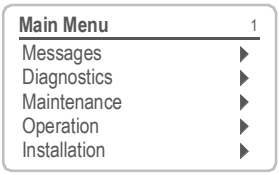
A *Display 1* ***B*** *Display 2*

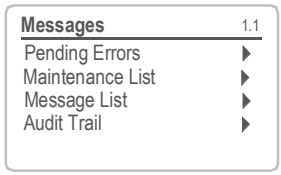
If the AMI LineTOC is set to operation mode UPW:

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

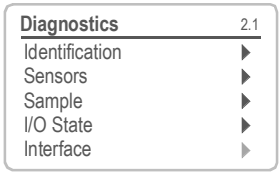


5.2. Software Structure

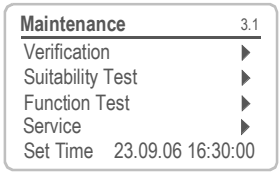




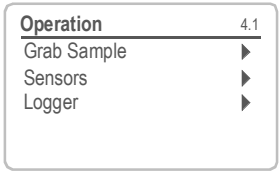
Menu **Messages 1**
Reveals pending errors as well as an event history (time and state of events that have occurred at an earlier point of time).
It contains user relevant data.



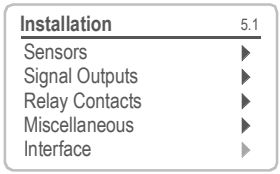
Menu **Diagnostics 2**
Provides user relevant instrument and sample data.



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.

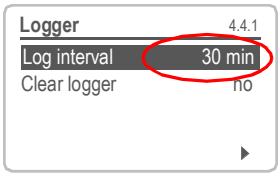


Menu **Installation 5**
For initial instrument set up by Swan authorized person, to set all instrument parameters. Can be protected by means of password.

5.3. Changing Parameters and values

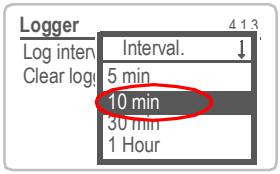
Changing parameters

The following example shows how to change the logger interval:



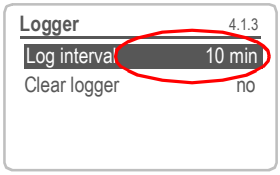
1 Select the parameter you want to change.

2 Press [Enter]



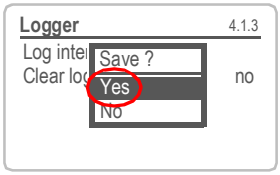
3 Press [▲] or [▼] key to highlight the required parameter.

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



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

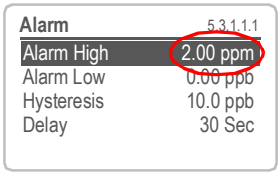
5 Press [Exit].



⇒*Yes is highlighted.*

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

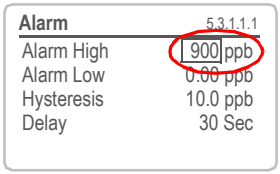
Changing values



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.

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.

Note: *General information on the following test procedures:*

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

The duration of a test procedure depends on the stability of the measured value. If the measured value is stable over a certain time, the test procedure can be finished by pressing [Enter] and the measured 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 measured value are ignored.

Swan recommends to use the automatic standard measuring procedure of the AMI LineTOC.

6.1. Maintenance Schedule

Pharma applications

Every week	Check sample flow.
Monthly	Perform function test, see 6.5., 59 (not applicable for AMI LineTOC Compact Version).
Half-yearly	Perform system suitability test, see 6.7., 65. Replace UV reactor, see 6.10., 75. Replace pump tubing, see 6.8., 67.
Yearly	Replace air filters (5 pcs.), see 6.11., 78. Perform calibration, see 6.4., 57 or Perform verification, see 6.3., 54.

UPW applications

Every week	Check sample flow.
Monthly	Perform function test, see 6.6., 62 (not applicable for AMI LineTOC Compact Version).
Every 9 to 12 months	Replace UV reactor, see 6.10., 75.
Yearly	Replace pump tubing, see 6.8., 67. Replace air filters (5 pcs.), see 6.11., 78. Perform calibration, see 6.4., 57 or Perform verification, see 6.3., 54.

6.2. Stop of Operation for Maintenance

Before starting any maintenance work, all tubes as well as the UV reactor have 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

Note:

- *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>.

Note:

- *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] and
- standard solution 1 ppm C as sucrose [3] (adjustable in measuring mode UPW)

onto the bottle holder with the corresponding number. During the verification, the 3-way valve is activated to close the sample inlet.
Measured value 1: The 6-way valve is automatically rotated to position 2. Reagent water blank [2] is sucked through the system and measured.
Measured value 2: The 6-way valve is automatically rotated to position 3. Standard solution [3] is sucked through the system and measured.

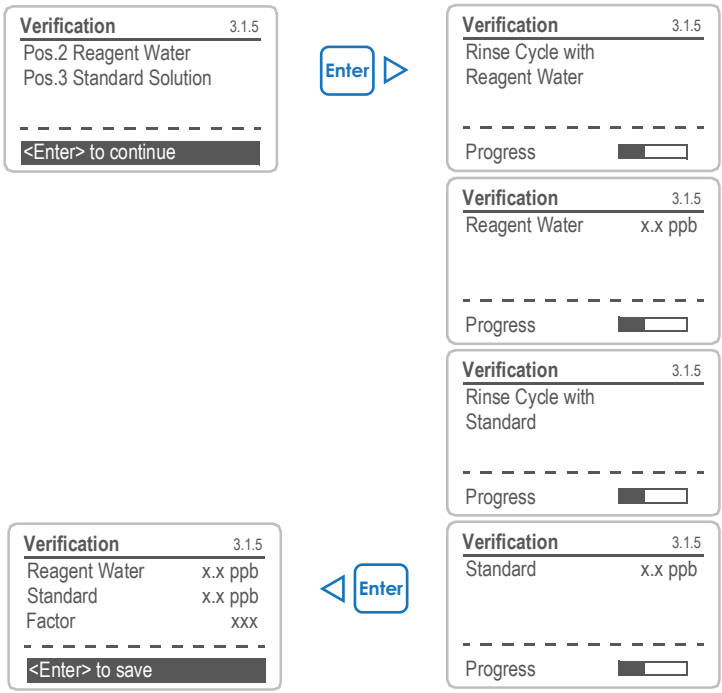
Procedure

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. Press [Enter] to save the factor in the history or [Exit] to discard it.
The calculated factor shows the operator whether the verification of the AMI LineTOC is within the given limit. It does not replace the current factor and it has no influence on further measurements.
The verification history can be viewed in <Diagnostics>/<Sensors>/<History>/<Verification>.

Note: *The calculated factor must be in a 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. 98 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

Note:

- *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 is adjustable. According to the regulations of the USP and EP the TOC content of the reagent water blank has to be <100 ppb TOC.

Note:

- *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] and
- standard solution 1 ppm C as sucrose [3] (adjustable in measuring mode UPW)

onto 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. 54.

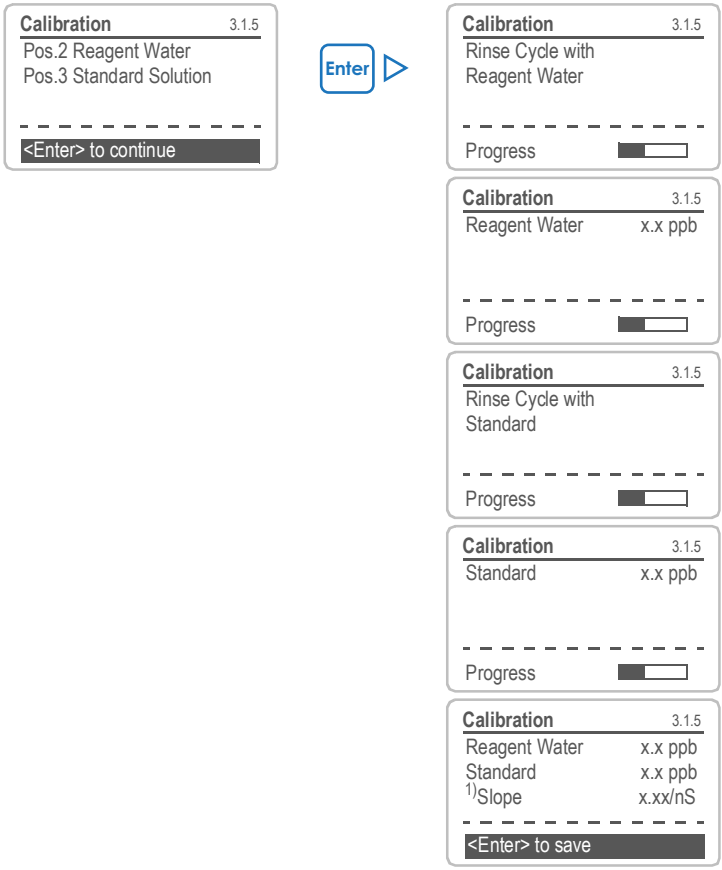
Procedure

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. Press [Enter] to save the new calculated slope or [Exit] to discard it.
The calibration history can be reviewed in <Diagnostics>/<Sensors>/<History>/<Calibration>.

***Note:** The calculated calibration factor (slope) should be in a 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. 98, 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

Note: *The function test is not available on AMI LineTOC Compact Version.*

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 online sample serves as reagent water to dilute the stock standards to a certain concentration.
The highly concentrated, durable standard solutions (20 ppm) 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 from 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

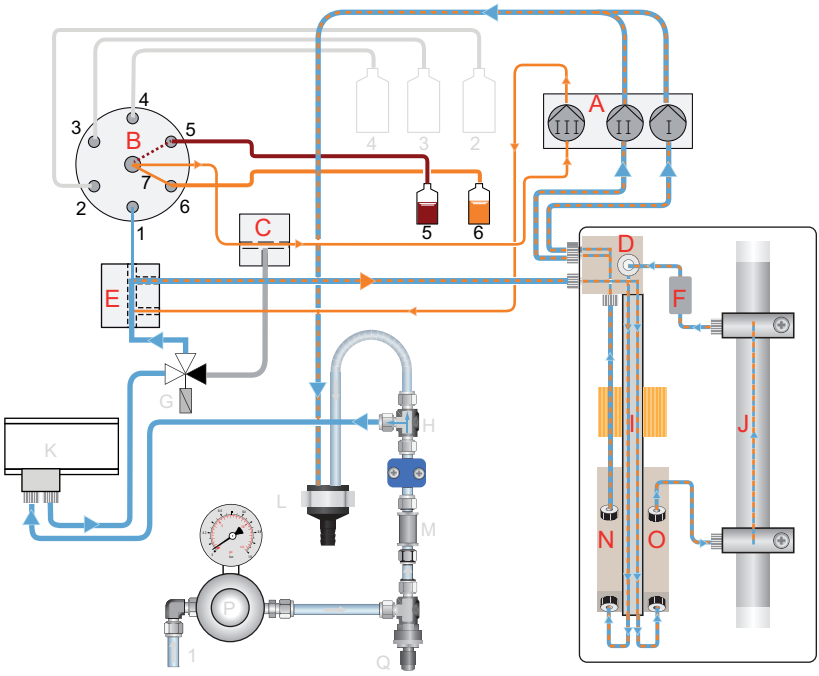
- manually by activating the procedure under Maintenance/ Function Test
- automatically in a fixed time interval.

Reagents and fluidic

For this test screw the two bottles containing

- stock solution 20 ppm C as sucrose [5] and
- stock solution 20 ppm C as 1,4-benzoquinone [6]

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

Signal outputs, limits

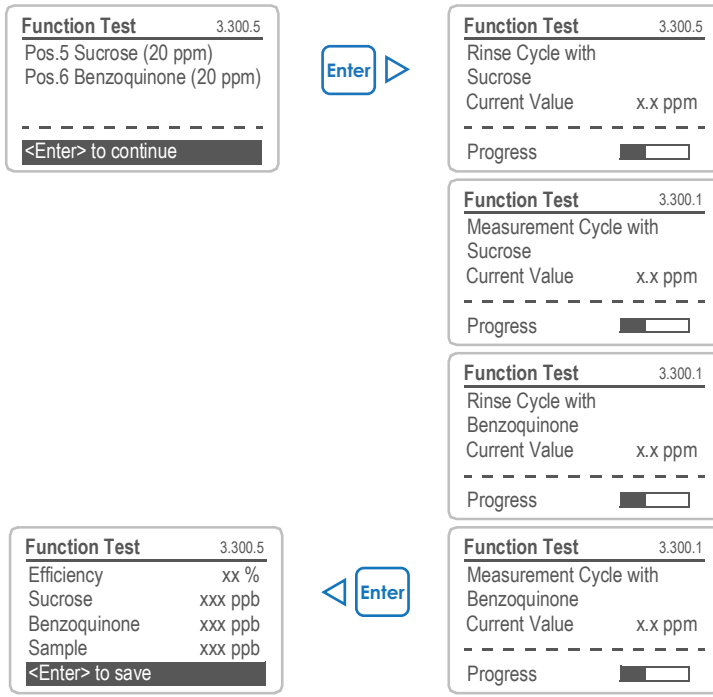
During the function test the signal outputs are on hold by default and all programmed limits are inactive (see Program List and Explanation 5.2.1.4, p. 98).

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

Note: *The function test is not available on AMI LineTOC Compact Version.*

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 from the different tube diameters through which the sample and the check standard are sucked.

The function test can be started:

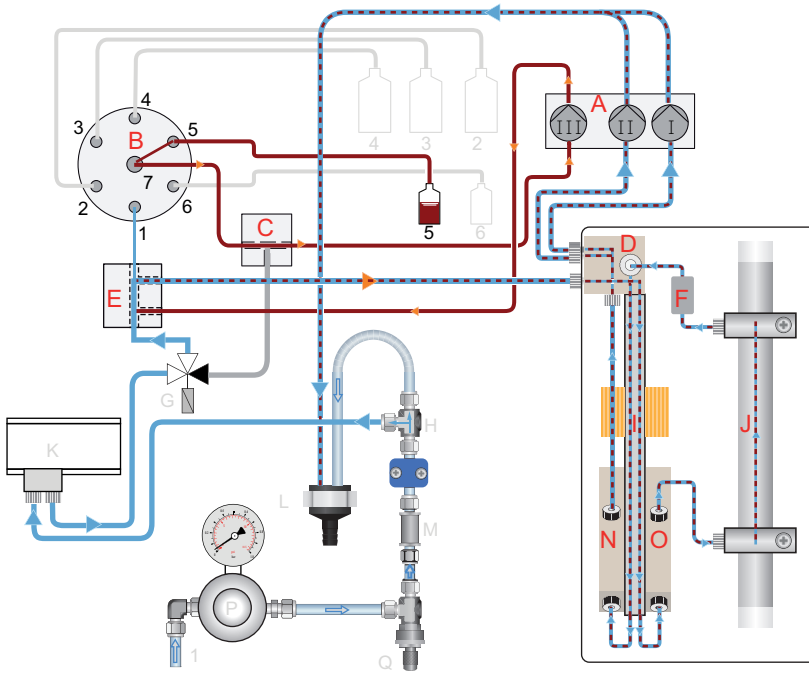
- manually by activating the procedure under <Maintenance>/<Function Test>.
- automatically in a programmable time interval.

Reagents and fluidic

The function test allows to check the system automatically in a programmable time intervals. 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 automatically saved in the history if the test has been started automatically.
If the function test has been activated manually, the results are saved in the history after manual confirmation.
The results of the function test are saved in the menu <Diagnostics>/<Sensors>/<History>/<Function Test>.

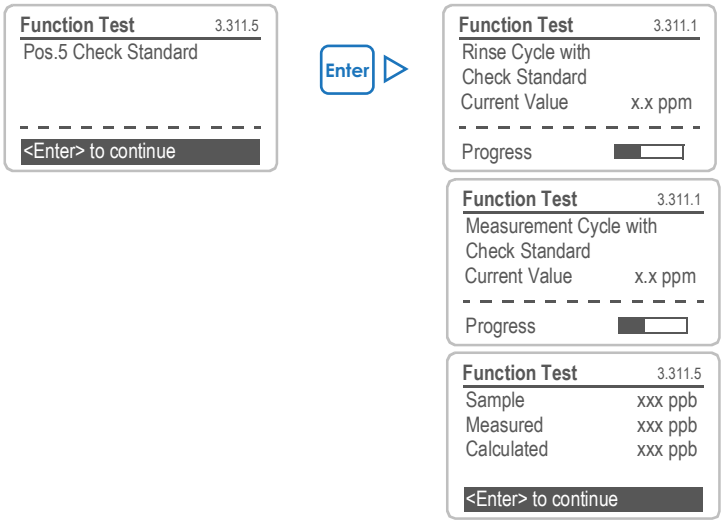
Signal outputs, limits

During the function test, the signal outputs are on hold by default, see Program List and Explanation 5.2.1.4, p. 98 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] and
- SST solution 500 ppb C as 1.4-benzoquinone [4]

onto the bottle holder with the corresponding number.
The six-way valve is automatically rotated to position 2 and the reagent water blank [2] is sucked via reactor port 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 switched to position 3
- SST solution 500 ppb C as 1.4-benzoquinone [4] and 6-way valve switched to position 4.

Procedure

The procedure of the system suitability test is menu-guided. 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 is started via the <Maintenance>/<Suitability Test> menu item.
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>.

Note:

- *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.*

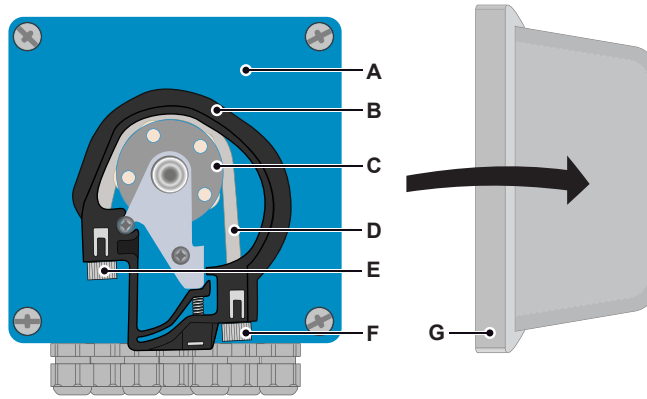
Signal outputs, limits

During the System Suitability Test the signal outputs are on hold by default, see Program List and Explanation 5.2.1.4, p. 98 and all programmed limits are inactive.
To start the system suitability test select menu <Maintenance>/<Suitability Test> and follow the instructions on the display.

6.8. Replace the Peristaltic Pump Tubes

The pump tubes [D] of the peristaltic pump are exposed to a minimal wear. The replacement intervals depend on the application and are specified in the Maintenance Schedule, p. 53.

Overview



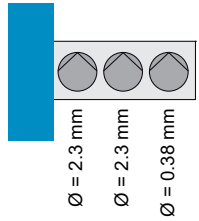
A *Pump housing*
B *Occlusion frame closed*
C *Rotor*
D *Pump tube*
E *Pump inlet*
F *Pump outlet*
G *Protection cap*

Tube diameters

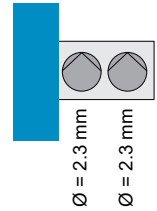
Note: *The AMI LineTOC uses two different tube diameters. These are important to obtain the correct dilution ratio between sample water and stock solution during the function test. The AMI LineTOC Compact Version uses only one tube diameter.*

- *See also Tube Numbering, p. 69.*

AMI LineTOC:

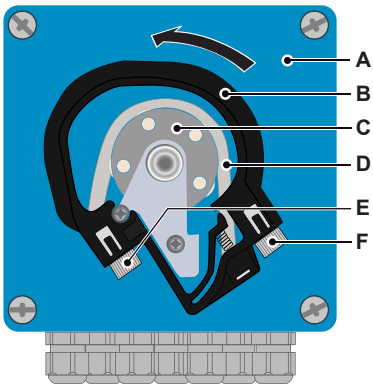


AMI LineTOC Compact:



Dismount pump tubes

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

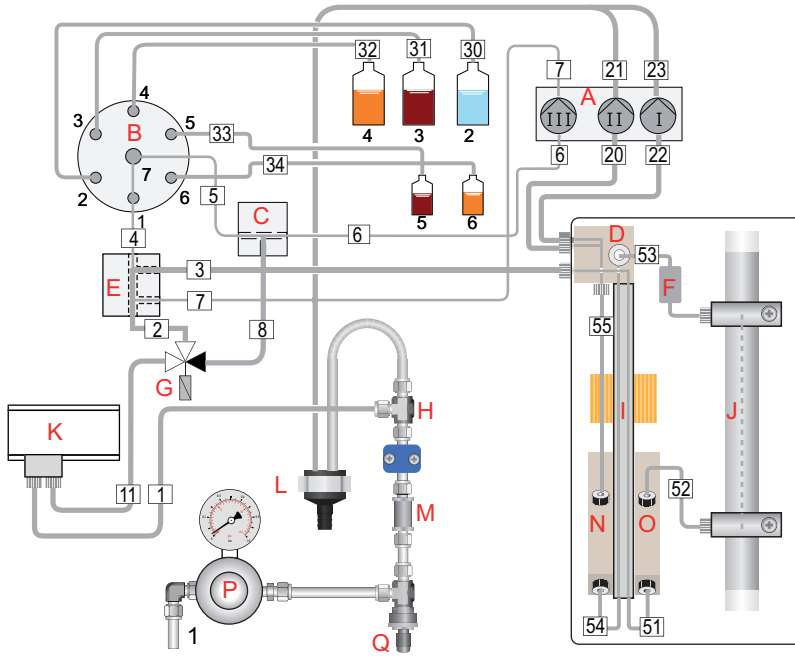


A *Pump housing*
B *Occlusion frames relaxed*
C *Rotor*
D *Pump tubes*
E *Pump inlet*
F *Pump outlet*

1. Switch off the instrument according to the instructions in Stop of Operation for Maintenance, p. 54.
2. Remove the protection cap.
3. Open the occlusion frames [B] by turning them counter-clockwise.
4. Remove the pump tubes [D] from the rotor [C] by pulling the complete occlusion frames [B] out of the holder.
5. Disconnect the reagent tubes from the old pump tubes and connect them to the new pump tubes
6. Install the new pump tubes by pushing the occlusion frames onto the holder.
7. Lock the occlusion frames. Check that the occlusion frames and the tubes are aligned perpendicular to the axis of the rotor.
8. Start the <Fill system> function.

6.9. Tube Numbering

6.9.1 AMI LineTOC

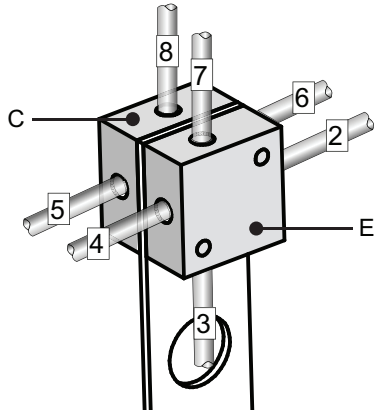


Tube no.	Tube length [mm]	from	to
1	250	Sample inlet	3-way valve (G), see 71 or, if installed, sample cooler [K] inlet
2	125	3-way valve (G), see 71	Fourfold distributor (E), see 71
3	125	Fourfold distributor (E), see 71	Reactor port (D), (1)
4	125	Fourfold distributor (E), see 71	6-way valve (B), (1)
5	125	6-way valve (B), (7)	Triple distributor (C), see 71
6	125	Triple distributor (C), see 71	Peristaltic pump (A) inlet, 0.38 mm tube

Tube no.	Tube length [mm]	from	to
7	250	Peristaltic pump (A) outlet, 0.38 mm tube	Fourfold distributor (E), see 71
8	160	Triple distributor (C), see 71	3-way valve (G), see 71
11	400	If installed, sample cooler [K] outlet	3-way valve (G), see 71
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)

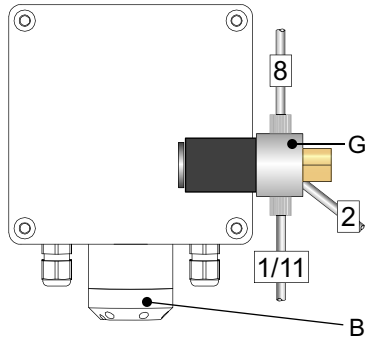
*Shorten to the appropriate length after laying.

Connections on triple and fourfold distributor



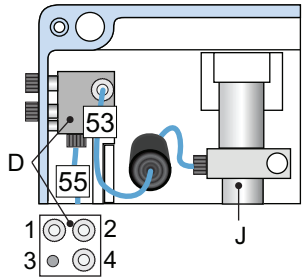
C *Triple distributor*
E *Fourfold distributor*

Connections on 3-way valve



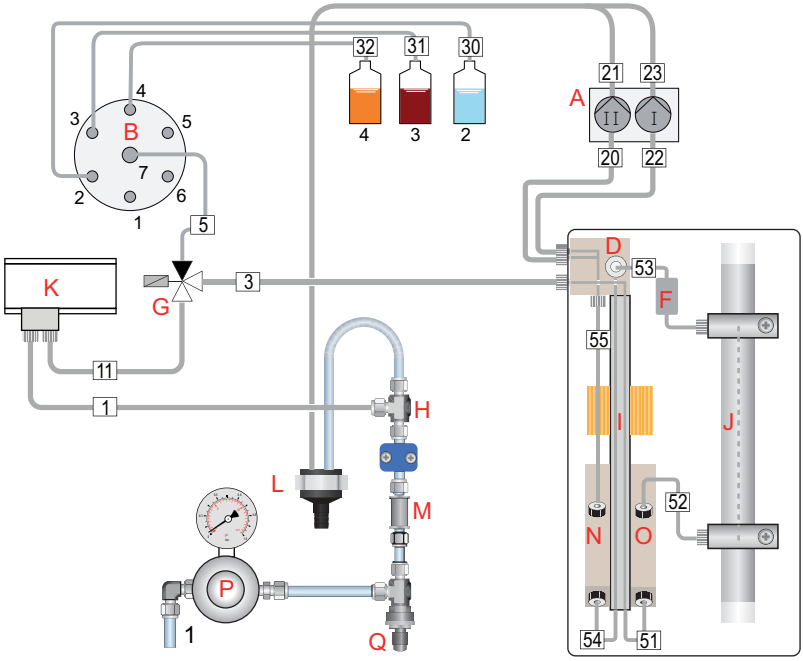
G *3-way valve*
B *6-way valve*

Connections on reactor



D *Reactor port*
J *UV reactor*

6.9.2 AMI LineTOC Compact Version

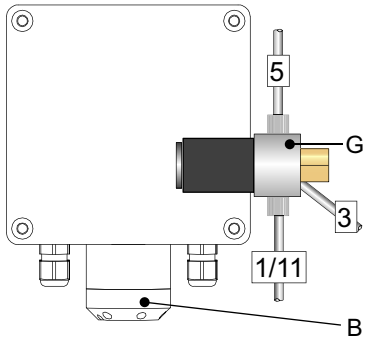


Tube no.	Tube length [mm]	from	to
1	750	Sample inlet	3-way valve (G), see 74 or, if installed, sample cooler [K] inlet
3	440	3-way valve (G), see 74	Reactor port (D), (1)
5	400	6-way valve (B), (7)	3-way valve (G), see 74
11	400	If installed, sample cooler [K] outlet	3-way valve (G), see 74
20	250	Reactor port (D), (2)	Peristaltic pump (A) inlet, 2.3 mm tube
21	1200*	Peristaltic pump (A) outlet, 2.3 mm tube	Waste [L]

Tube no.	Tube length [mm]	from	to
22	250	Reactor port (D), (4)	Peristaltic pump (A) inlet, 2.3 mm tube
23	1200*	Peristaltic pump (A) outlet, 2.3 mm tube	Waste [L]
30	450*	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)
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)

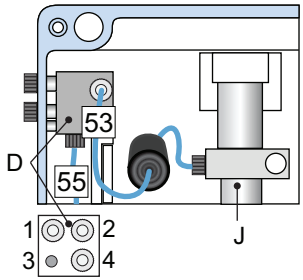
*Shorten to the appropriate length after laying.

Connections on 3-way valve



G *3-way valve*
B *6-way valve*

Connections on reactor



D *Reactor port*
J *UV reactor*

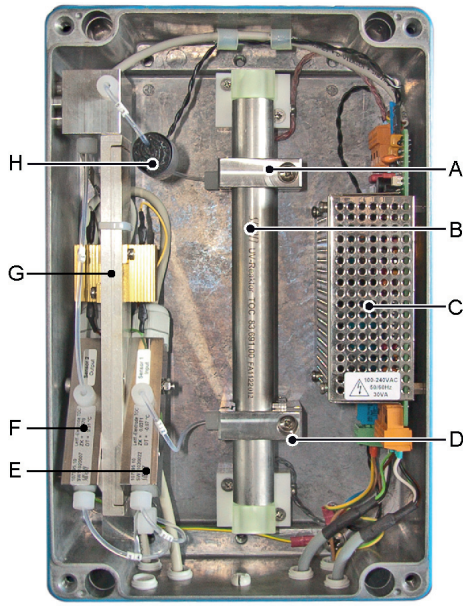
6.10. Replace the UV Reactor

WARNING

Electrical hazard

Risk of electrical shock caused by high ignition voltage.

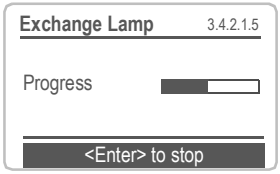
- Disconnect main power supply before exchanging the UV reactor.



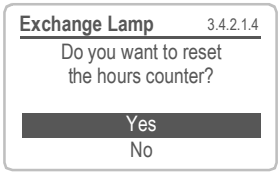
A *UV reactor holder neutral*
B *UV reactor*
C *Electric lamp ballast (EVG)*
D *Lower UV reactor holder (mechanically coded)*
E *Conductivity sensor 1*
F *Conductivity sensor 2*
G *Heating element*
H *Temperature sensor for flow monitoring*

Remove the UV reactor

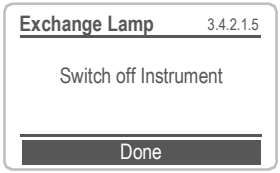
1 Navigate to menu <Maintenance>/<Service>/<Lamp>/ <Exchange Lamp>.



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

Note:

- *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).*

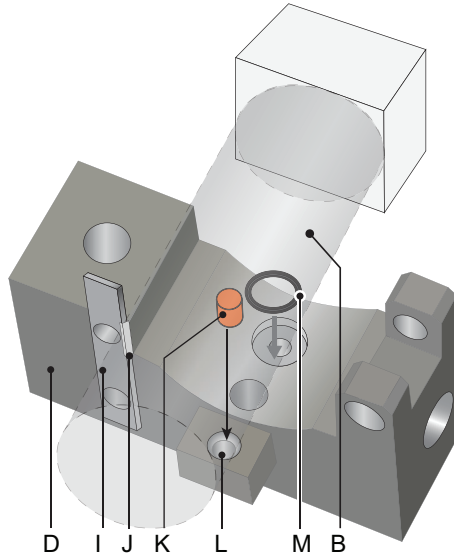
Install the UV reactor

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.

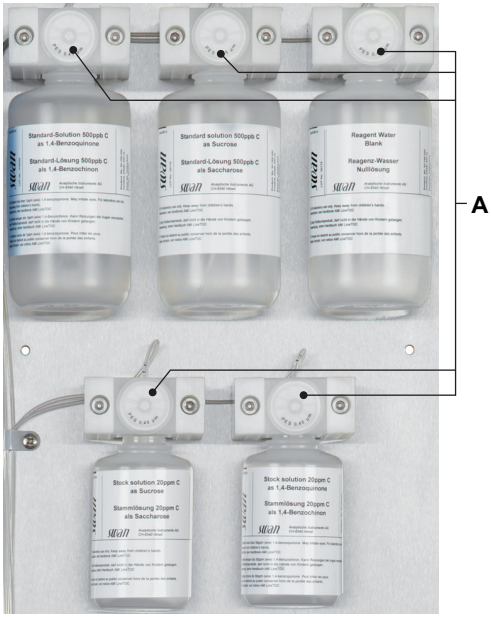
⇒ *After <Fill System> has been finished, the instrument switches automatically to measuring mode and the UV lamp is switched on.*

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. 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. 54.

2 Relax the occlusion frames of the peristaltic pump.

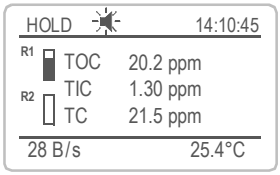
7. Troubleshooting

7.1. Error List

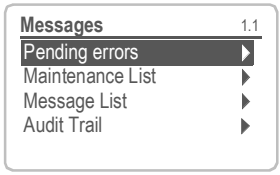
Error
Non-fatal Error. Indicates an alarm if a programmed value is exceeded. Such Errors are marked **E0xx** (bold and black).

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

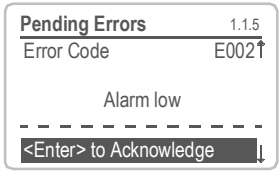
- Errors which disappear if correct measuring conditions are recovered (i.e. Sample Flow low).
  Such Errors are marked **E0xx** (bold and orange)
- Errors which indicate a hardware failure of the instrument.
  Such Errors are marked **E0xx** (bold and red)



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



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



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

Error	Description	Corrective action
E001	TOC Alarm high	– check process – check programmed value, see 5.3.1.1.1.1, p. 99
E002	TOC Alarm low	– check process – check programmed value, see *5.3.1.1.1.25, p. 99*
E003	Cond. 1 Alarm high	– check process – check programmed value, see 5.3.1.1.2.1, p. 100
E004	Cond. 1 Alarm low	– check process – check programmed value, see *5.3.1.1.2.25, p. 100*
E005	Cond. 2 Alarm high	– check process – check programmed value, see 5.3.1.1.3.1, p. 100
E006	Cond. 2 Alarm low	– check process – check programmed value, see *5.3.1.1.3.25, p. 100*
E007	Temp. 1 Alarm high	– check sample temperature – check heating element – check programmed value, see 5.3.1.2.1.1, p. 101
E008	Temp. 1 Alarm low	– check sample temperature – check heating element – check programmed value, see 5.3.1.2.1.2, p. 101
E009	Sample Flow high	– check Inlet pressure, see Establish Sample Flow, p. 44 – readjust sample flow – check flow monitoring sensor
E010	Sample Flow low	– check Inlet pressure, see Establish Sample Flow, p. 44 – readjust sample flow – check flow monitoring sensor
E011	Temp. 1 shorted	– replace sensor
E012	Temp. 1 disconnected	– check sensor connection, see Electrical Connection Scheme, p. 35
E013	Case Temp. high	– check environment temperature
E014	Case Temp. low	– check environment temperature

Error	Description	Corrective action
E015	Lamp	– check for other Errors – check lamp
E016	Rovalve	– check 6-way valve – check connection
E018	Periclip	– check connection, see Electrical Connection Scheme, p. 35
E019	Temp.2 shorted	– replace sensor
E020	Temp.2 disconnected	– check sensor connection, see Electrical Connection Scheme, p. 35
E021	Temp. 2 Alarm high	– check sample temperature – check heating element – check programmed value, see 5.3.1.2.2.1, p. 101
E022	Temp. 2 Alarm low	– check sample temperature – check heating element – check programmed value, see 5.3.1.2.2.2, p. 101
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 – see Message List for detailed information
E066	Exchange Lamp	– The maximum permissible operating time of the lamp has been reached. Exchange the lamp, see Replace the UV Reactor, p. 75

[1)] FT = Function Test

7.2. Replace Fuses

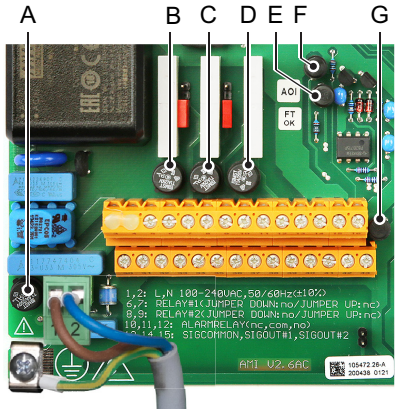
WARNING

External voltage

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

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

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*

8. Program Overview

All menus are password-protected as soon as an administrator password has been defined.

- Menu 1 **Messages** informs about pending errors and maintenance tasks and shows the error history. Access by administrator, service and operator. No settings can be modified.
- Menu 2 **Diagnostics**: Access by administrator, service and operator. No settings can be modified.
- Menu 3 **Maintenance**: Calibration, simulation of outputs and set time/date. Access by administrator and service.
- Menu 4 **Operation**: Allows to set limits, alarms values, etc. Access by administrator and service.
- Menu 5 **Installation**: Defining assignment of all inputs and outputs, measuring parameters, interface, passwords, etc. Access by administrator only.

Depending on the instrument model and the chosen parameters some menus listed below may not be visible on your 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*	V6.24-11/22		
	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	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 3.100*	*(Progress)*	(only mode CO2)	* Menu numbers
Calibration 3.101*	*(Progress)*	(only mode Coefficient)	
Suitability Test 3.2*	*(Progress)*	(only Pharma)	
Function Test 3.300*	*(Progress)*	(not available on AMI LineTOC Compact Version)	
Service 3.4*	**Simulation** 3.4.1*	*Relay 1/2*	3.4.1.1/2*
		Signal Output 1/2	3.4.1.3/4*
	Lamp 3.4.2*	*Exchange Lamp*	3.4.2.1*
		Reset hours counter	3.4.2.2*
	Fill System 3.4.3*	*(Progress)*	
	Test Modules 3.4.4*	*Lamp*	3.4.4.1*
		PeriClip	3.4.4.2*
		Solenoid Valve	3.4.4.3*
		Rotary Valve	3.4.4.4*
	Flow Calibration 3.4.5*	*Progress*	
Set Time 3.5*	*(Date, Time)*		

8.4. Operation (Main Menu 4)

Grab Sample 4.1*	*Pos. 2: Grab Sample*	4.1*
	Sample ID	4.1.3*
Sensors 4.2*	*Filter Time Const.*	4.2.1*
	Hold after Cal.	4.2.2*
Logger 4.3*	*Log Interval*	4.3.1*
	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*	(only with RS485 interface)	
5.5*	*Device Address*			
	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. V6.24-11/22

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/mainboard/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

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

> ***Note:*** *The <Function Test> menu item is not visible on the compact version.*

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

- *o Sample ID:* Shows the programmed code. The code is defined by the user to identify the sample point in the plant.
- *o Ambient Temp.:* Shows the actual temperature of the temperature sensor installed on the EVG.
- *o 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 inputs 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. 54.

3.101 Calibration

Calibration: Visible in conductivity model “Coefficient”.

Start calibration procedure. Follow instructions on the screen. Further details see Calibration, p. 57.

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. 65.

3.3xx Function Test

Note: *The function test is not available on the compact version.*

Function Test: Start test procedure. Follow the instructions on the screen. Further details see Function Test Pharma, p. 59 or Function Test UPW, p. 62

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
3.4.1.6	*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 Compensation CO_2	Pharma and UPW 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 is started automatically when the temperature in the reactor housing rises or falls by 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. 51.

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. 10)

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. 12)

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. 13).
Range: 0–10%

5.1.1.2 Parameters: *(only visible in UPW mode)*

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

5.1.1.2.2 *Factor:* The factor is set to 1.00 by default. After a calibration, it may be overwritten. In this menu, the factor can be set back or to any other value 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 has been 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

Note: *This menu item is not visible on AMI LineTOC Compact Version.*

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 to +1.00 °C

5.1.4 Function Test

Note: *The function test is not available on the compact version.*

5.1.4.1

Mode
off
daily
weekly
monthly

- *off*: No function test will be performed.
- *daily:* Additionally to the flush time, the start time can be set.
  Range: 0–23 (h)
- *weekly:* Additionally 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)
- *monthly:* Additionally 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 period during which you want to flush the tubes after the function test.
Range: 1 min 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.

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

5.2.1.1 *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	TIC (Conc. 1) and TC (Conc. 2), *comp. model CO2 only*

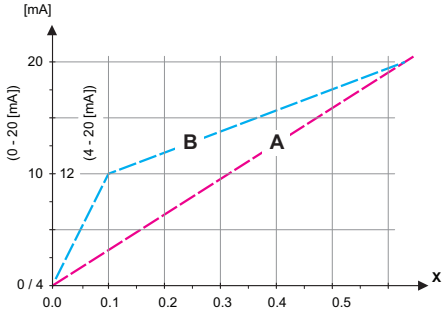
5.2.1.2 *Current Loop:* Select the current range of the signal output.
Make sure the connected device works with the same current range.
Available ranges: 0–20 mA or 4–20 mA

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:

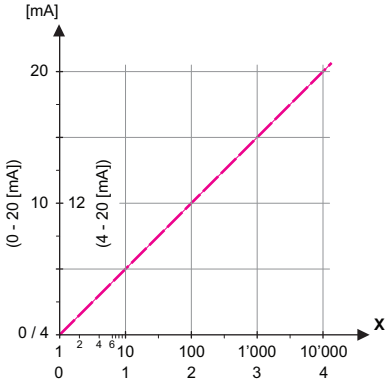
- Linear, bilinear or logarithmic for process values.
  See As process values, p. 98.

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 measured 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 and 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. 38.
The function of relay contacts 1 or 2 are defined by the user.

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

1 First select the functions as:
- Limit upper/lower,
- 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. 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 to prevent unauthorized access to the menus <Messages>, <Diagnostics>, <Maintenance>, <Operation> and <Installation>.

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

- *Enter an administrator password different from <0000>.*
- *After defining the administrator password, users 1–4 are also automatically activated. The default password for all users is <1234>. If necessary, change the passwords.*

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

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

5.4.4.1.3 *Password:* The password is set to <0000> by default. If an administrator password different from <0000> is set, it is no 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 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 no.:	Range: Analyzer; manufacturer; multivariable
5.5.40	Local operation:	Range: Enabled, disabled

5.5.1 *Protocol:* **Modbus RTU**

5.5.21	Device address:	Range: 0–126
5.5.31	Baud rate:	Range: 1200–115 200 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 s
Hold after Calibration: ..... 300 s

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

	Hysteresis: ..... 10.0 ppb
	Delay: ..... 30 s
	Parameter: Conc. 2
	Setpoint: ..... 1.00 ppm
	Hysteresis: ..... 10.0 ppb
	Delay: ..... 30 s
Input	Active: ..... when closed
	Signal Outputs: ..... hold
	Output: ..... off
	Fault: .....yes
	Delay: ..... 10 s
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

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12. Notes

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