ANALYTICAL INSTRUMENTS

A-96.210.281 / 2026-08-26

AMI-II Turbisafe

Operator's Manual

MADE IN SWITZERLAND

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Document Information

Title: AMI-II Turbisafe Operator's Manual
ID: A-96.210.281
Revision: 00.03, 2026-08-26

History of Major Document Revisions

Revision	Issue	Description
00.xx	May 2026	First edition

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This manual applies to firmware V1.01 and higher.
The information contained in this document is subject to change without notice.

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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 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

General warning

Attention

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.

2. Product Description

2.1. Description of the System

Application range

The AMI-II Turbisafe is designed for measuring turbidity in drinking water, surface water, and effluent at high pressure.

Available models

The instrument is available in two models:

- Monitor on standard PVC panel (280 mm × 850 mm)
- Small PVC panel (280 mm × 570 mm) with separate transmitter

Options

The instrument can be equipped with the following options:

- Flow regulator with integrated flow meter
- U-Flow ultrasonic flow meter
- Cleaning Module-III P (only with monitor)
- Cleaning Module-III (only with monitor)

Cleaning Module-III (P)

The cleaning module is available in two variants:

- Cleaning Module-III P (one cleaning solution, mounted directly on the panel of the AMI-II Turbisafe)
- Cleaning Module-III (two cleaning solutions, mounted on a separate panel).

The following ready-to-use cleaning solutions are recommended for use with AMI-II Turbisafe:

- Oxycon Clean RL:
  citric acid-based solution to prevent acid-soluble mineral deposits such as limescale.
- Oxycon Clean RB:
  hypochlorite-based solution to prevent growth of biofilm.

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 Ω

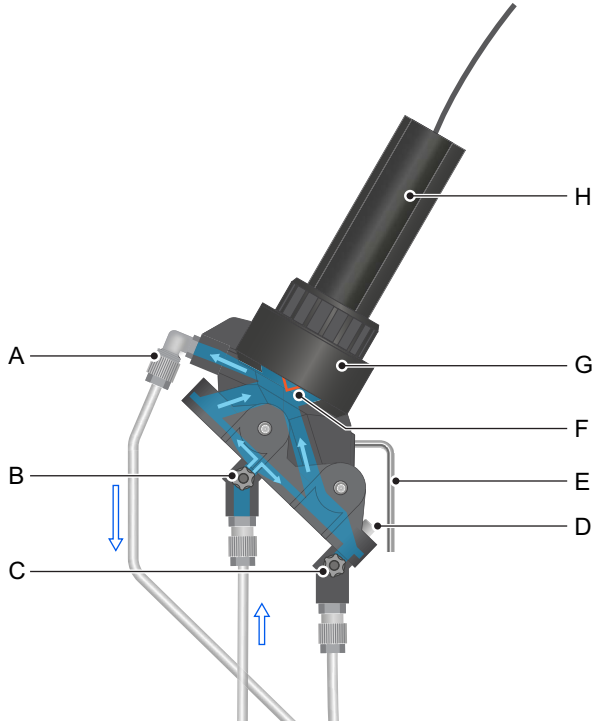
Two additional signal outputs with the same specifications available as an option.

Relays

Two potential-free contacts programmable as limit switches for measured values, controllers or timers with automatic hold function.
Maximum load: 1 A/250 VAC

Alarm relay	One potential-free contact. Summary alarm indication for programmable alarm values and instrument faults. Maximum load: 1 A/250 VAC
Input	One input for potential-free contact to freeze the measured value or to interrupt control in automated installations. Programmable as HOLD or OFF function.
Communication interface (optional)	◆ Two additional signal outputs ◆ RS485 with fieldbus protocol Modbus RTU or Profibus DP ◆ HART
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 principle	The turbidity is measured at a 90° angle according to DIN EN ISO 7027.
Fluidics	The sample flows through the sample inlet [B] into the flow cell, where the turbidity is measured and leaves the flow cell through the sample outlet [A]. The flow rate can be started and stopped using the sample inlet valve [B]. The manual drain valve [C] is used to drain the flow cell and flush out deposits. Optionally, a flow regulator with integrated flow meter can be installed downstream of the flow cell, or an ultrasonic flow meter can be installed upstream of the flow cell.

Fluidics overview

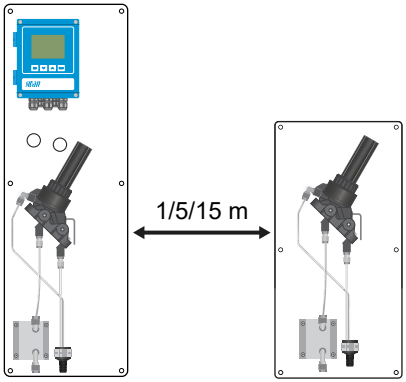


A *Sample outlet*
B *Sample inlet valve*
C *Manual drain valve*
D *Inlet for calibration standard, grab sample and cleaning solution*
E *Flow cell eject lever*
F *Light beam*
G *Flow cell*
H *Sensor*

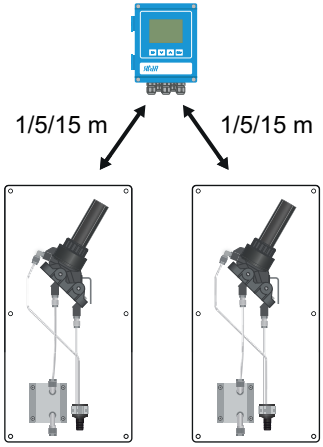
Dual-channel capability

The transmitter (whether as part of a monitor or as a standalone component) can be used with one or two Turbisafe sensors and flow meters.

Installation example 1:
Monitor with SWAN Sensor Panel Turbisafe used as an additional measuring point.



Installation example 2:
Transmitter with two SWAN Sensor Panels Turbisafe.

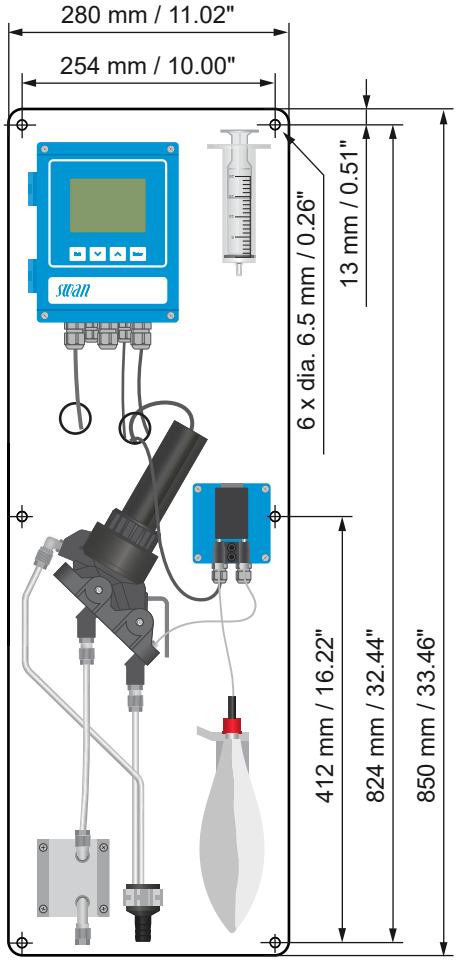


2.2. Instrument Specification

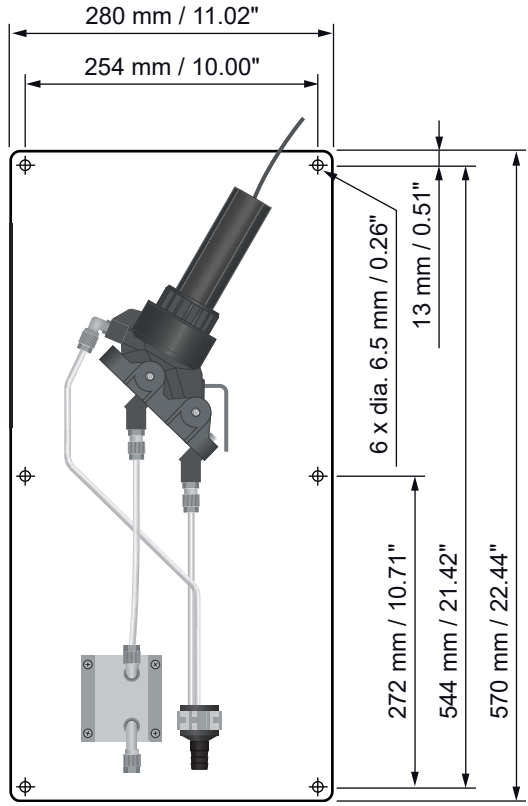
Power supply	AC variant:	100–240 VAC (±10%) 50/60 Hz (±5%)
	DC variant:	10–36 VDC
	Power consumption	max. 35 VA
Sample requirements	Flow rate:	5–50 l/h
	Temperature:	up to 40 °C
	Inlet pressure:	up to 10 bar
	Outlet pressure:	pressure free
On-site requirements	Sample inlet:	6 mm Serto tube adapter (PA)
	Sample outlet:	for flexible tube, 15 mm inner Ø
Measuring range	**Measuring range**	**Resolution**
	0.000–0.999 FNU	0.001 FNU
	1.00–9.99 FNU	0.01 FNU
	10.0–99.9 FNU	0.1 FNU
	Precision:	±0.02 FNU (limit of detection)
	Accuracy (based on formazine):	
	Range 0–1 FNU:	±0.01 FNU ±2 %
	Range 1–10 FNU:	±0.1 FNU ±3 %
	Range 10–100 FNU:	±0.5 FNU ±5 %
	Factory calibrated with formazine.	
Transmitter specifications	Housing:	aluminum, with a protection degree of IP 66 / NEMA 4X
	Ambient temperature:	-10 to +50 °C
	Humidity:	10–90% rel., non condensing
	Display:	backlit LCD, 74 × 53 mm

Dimensions

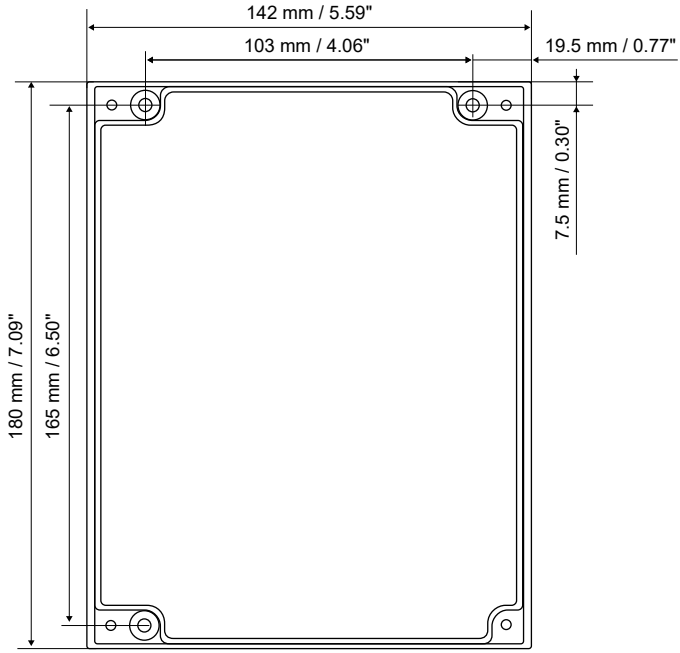
Panel:	PVC
Dimensions:	280×850×200 mm
Screws:	5 or 6 mm
Weight:	7.6 kg



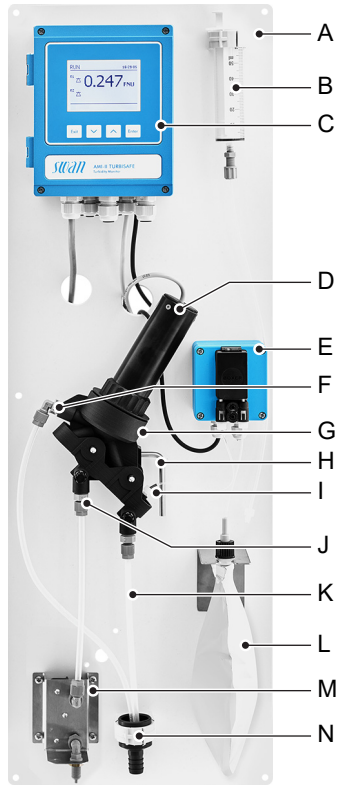
Dimensions Sensor Panel Turbisafe	Panel:	PVC
	Dimensions:	280×570×200 mm
	Screws:	5 or 6 mm
	Weight:	2.8 kg



Dimensions AMI-II transmitter



2.3. Instrument Overview



A *Panel*
B *Calibration kit (option)*
C *Transmitter*
D *Sensor*
E *Cleaning Module-III P*
F *Sample outlet*
G *Flow cell*
H *Flow cell eject lever*
I *Inlet for calibration standard, grab sample or cleaning solution*
J *Sample inlet*
K *Manual drain*
L *Cleaning solution pouch*
M *U-Flow ultrasonic flow meter (option)*
N *Drain funnel*

3. Installation

3.1. Installation Checklist

On-site requirements	AC variant: 100–240 VAC (±10%), 50/60 Hz (±5%). DC variant: 10–36 VDC. Power consumption: 35 VA maximum. Protective earth connection required. Sample line with sufficient sample flow and pressure (see p. 13).
Installation	Mount the instrument in vertical position. Display should be at eye level.
Electrical wiring	Connect all external devices like limit switches and current loops according to the connection diagram (see p. 25). Connect power cord.
Power-up	Start sample flow. Switch on power.
Instrument setup	Adjust sample flow. Program all sensor parameters. Program all parameters for external devices (interface, recorders, etc.). Program all parameters for instrument operation (limits, alarms). If a Cleaning Module-III (P) is installed, set the number of cleaning solutions and the cleaning parameters.
Run-in period	Let the instrument run continuously for 1 h.

3.2. Mounting the Instrument

Mounting requirements

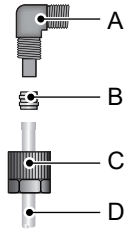
Mount the instrument in vertical position. The display should be at eye level to simplify operation and maintenance.
The instrument is intended for indoor installation or weather-protected installation in cabinets.

Dimensions

For panel dimensions, see p. 14 and p. 15.
For transmitter dimensions, see p. 16.

3.3. Serto Fitting at Sample Inlet

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



A *Elbow union*
B *Compression ferrule*
C *Knurled nut*
D *Flexible tube*

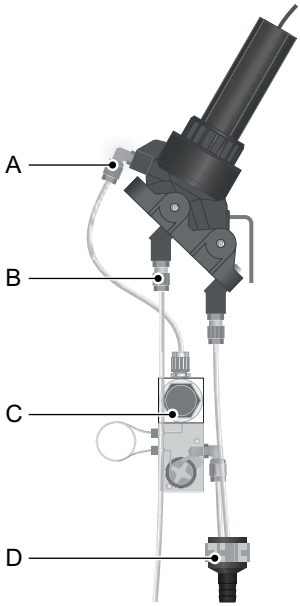
3.4. Installation of Flow Regulator (Option)

1 Screw the flow regulator to the designated position on the instrument panel.

2 Cut the tube included with the flow regulator option into two pieces, one 200 mm long and the other 85 mm long.

3 Use the 200 mm tube piece to connect the flow regulator downstream of the flow cell.

4 Use the 85 mm tube piece to connect the sample outlet of the flow regulator with the drain funnel.

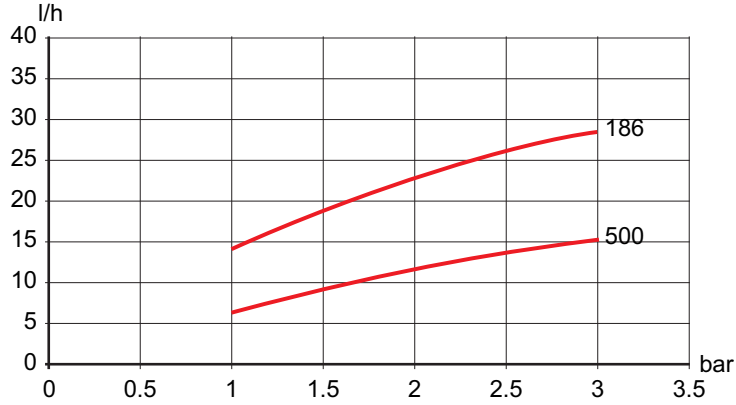


A *Sample outlet*
B *Sample inlet*
C *Flow regulator*
D *Waste funnel*

5 Connect the flow meter to the transmitter according to the electrical connection scheme.

Exchanging the capillary

The capillary determines the flow resistance and the maximum flow rate. The pressure regulator on the inlet side of the capillary can be used to set the flow rate within the specified range, see figure below.

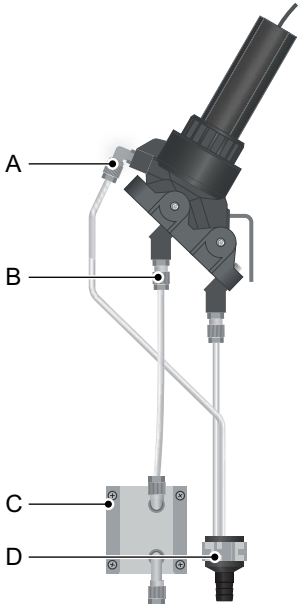


The standard capillary is an FEP tube with an inner diameter of 1 mm and a length of 500 mm. For low sample pressure or high sample flow, a shorter capillary with a length of 186 mm can be used.

3.5. Installation of Swansensor U-Flow (Option)

1 Screw the flow regulator to the designated position on the instrument panel.

2 Connect it upstream of the flow cell.

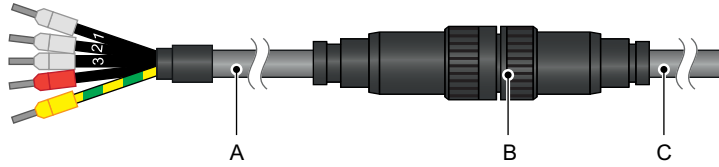


A *Sample outlet*
B *Sample inlet*
C *Swansensor U-Flow*
D *Waste funnel*

3 Connect the flow meter to the transmitter according to the electrical connection scheme.

3.6. Connecting the Turbisafe Sensor

Each Turbisafe sensor has a built-in 1-meter cable. For the monitor and the SWAN Sensor Panel Turbisafe with 1 meter cable length, this cable is connected directly to the transmitter as shown in the connection diagram.
On the SWAN Sensor Panel Turbisafe models with 5-meter and 15-meter cable lengths, an extension cable with plug connector is factory-installed on the sensor's built-in cable.



A *Extension cable to transmitter (5 or 15 m)*
B *Plug connector*
C *Sensor cable (1 m)*

The extension cable is connected to the transmitter as follows.

Wire in the extension cable	**Terminals at transmitter**	
	Turbisafe #1	Turbisafe #2
1	24	8
2	25	9
3	26	10
Shield	27	11
PE	34	19

3.7. Electrical Connections

WARNING

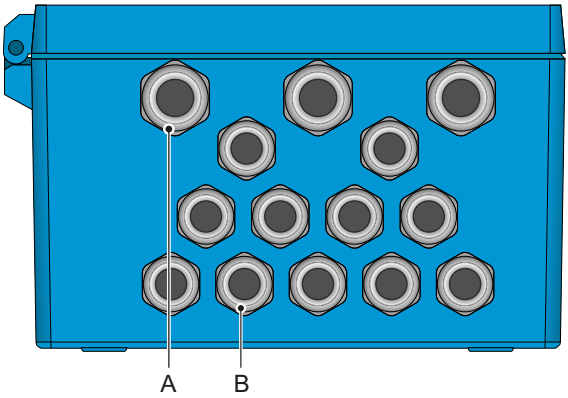
Risk of electrical shock

Failure to follow safety instructions can result in serious injury or death.

- Before working on electrical components, turn off power to the instrument. External power sources connected to relay 1 or 2 or to the alarm relay must also be turned off.
- Do not connect the instrument to power unless the ground wire (PE) is connected.
- 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. Protect unused cable glands.

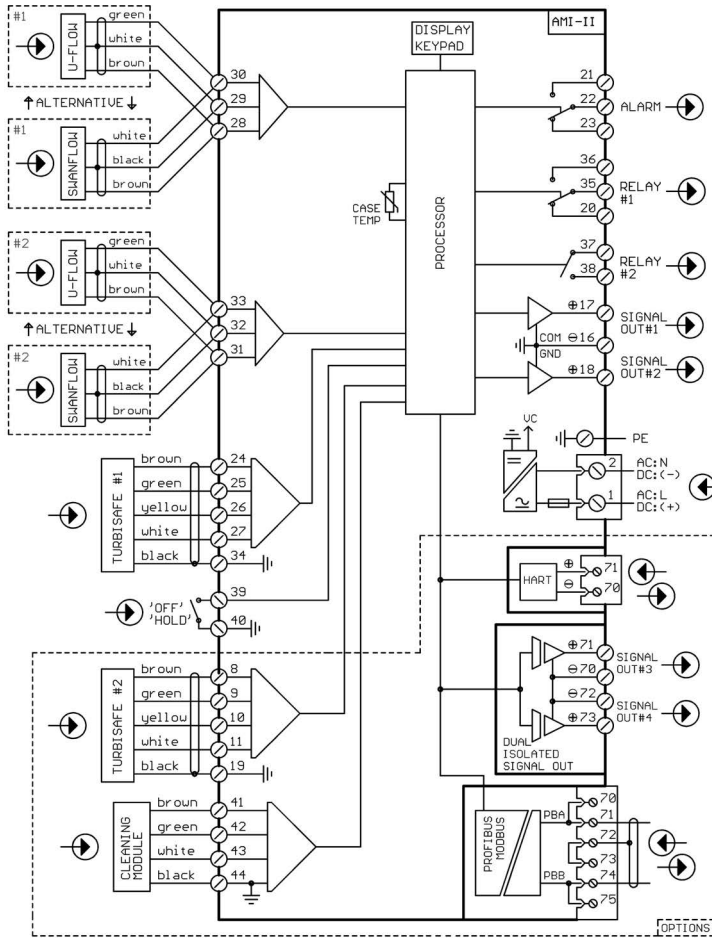


A *M16 cable glands (3x): cable $Ø_{outer}$ 5–10 mm*
B *M12 cable glands (11x): cable $Ø_{outer}$ 3–6 mm*

Wires

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.

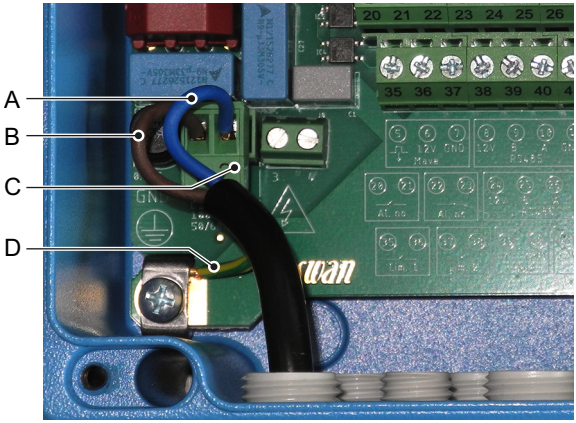
3.7.1 Connection Diagram



CAUTION

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

3.7.2 Power Supply



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

Installation requirements

The installation must meet the following requirements.

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

3.8. Relay Contacts

3.8.1 Input

Use only potential-free (dry) contacts.
Terminals: 39/40

3.8.2 Alarm Relay

One alarm output for system errors.

- Normally open contact (terminals: 21/22):
  Active (closed) when no error is present. Inactive (opened) on error and loss of power.
- Normally closed contact (terminals: 22/23):
  Active (opened) when no error is present. Inactive (closed) on error and loss of power.

Max. load: 1 A/250 VAC.
For switching inductive loads, please observe the information in section Types of Loads, p. 28.

3.8.3 Relay 1 and 2

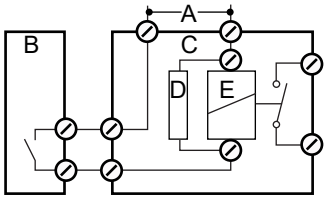
- Relay 1:
  - terminals 35/36 (normally open) or
  - terminals 35/20 (normally closed).
- Relay 2: terminals 37/38 (normally open).

Max. load 1 A/250 VAC.
For switching inductive loads, please observe the information in section Types of Loads, p. 28.

3.8.4 Types of Loads

Inductive loads

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-II transmitter it is mandatory to connect a snubber circuit in parallel to the load.

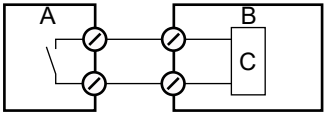


A *AC or DC power supply*
B *AMI-II transmitter*
C *External power relay*
D *Snubber*
E *Power relay coil*

To switch inductive loads higher than 0.1 A, use suitable power relays.

Resistive loads

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



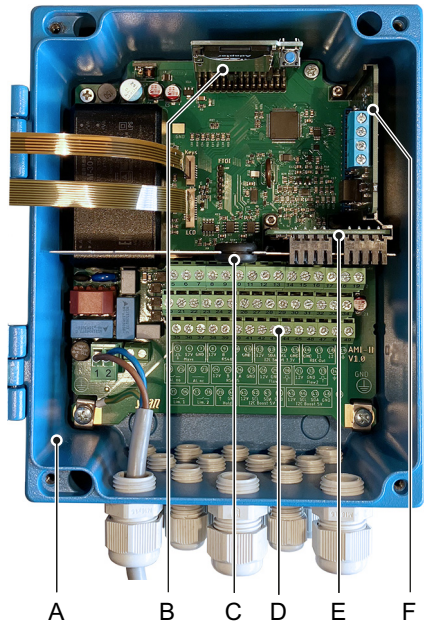
A *AMI-II transmitter*
B *PLC or controlled pulse pump*
C *Logic*

3.9. Signal Outputs

3.9.1 Signal Output 1 and 2 (Current Outputs)

Max. burden 510 Ω.
If signals are sent to two different receivers, use signal isolator (loop isolator).
Signal output 1: Terminals 17 (+) and 16 (-)
Signal output 2: Terminals 18 (+) and 16 (-)

3.10. Interface Options



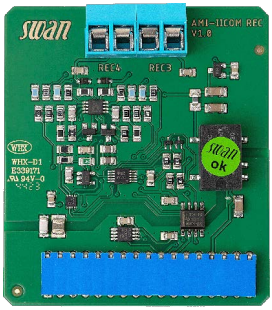
A *AMI-II transmitter*
B *SD card slot*
C *Cable grommet*
D *Screw terminals*
E *Frontend*
F *Communication option*

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

- Two additional signal outputs
- Profibus or Modbus
- HART

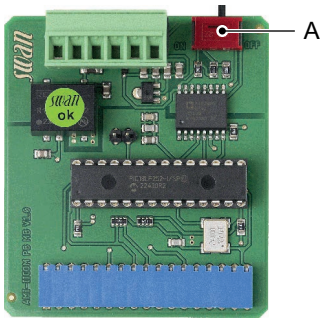
3.10.1 Signal Outputs 3 and 4

Max. burden 510 Ω.
If signals are sent to two different receivers, use signal isolator (loop isolator).
Signal output 3: terminals 71 (+) and 70 (-).
Signal output 4: terminals 73 (+) and 72 (-).



3.10.2 RS485 (Profibus or Modbus Protocol)

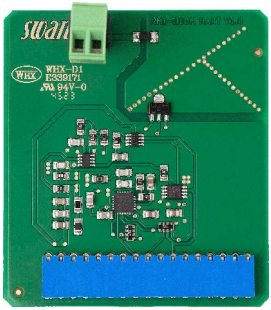
Terminal 74/75 PB, terminal 70/71 PA, terminal 72/73 shield
The switch [A] must be set to “ON” if only one instrument is installed or on the last instrument in the bus.



A *On/off switch*

3.10.3 HART

Terminals 71 (+) and 70 (-).



4. Instrument Setup

4.1. Tube Connections with Cleaning Module-III (P)

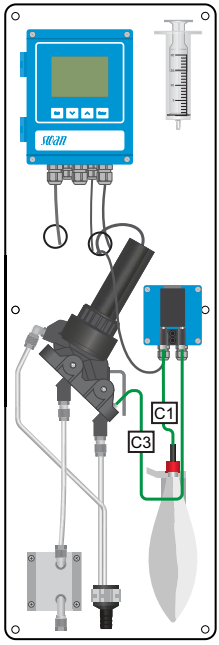
When to use the check valve

If the flow cell is under pressure, it is mandatory to install the check valve. The check valve prevents backflow into the pouches at operating pressures of up to 10 bar. To ensure that the cleaning solutions can be pumped into the flow cell, the operating pressure must not exceed 3 bar.
The check valve is not required with Swansensor U-Flow and an atmospheric drain.

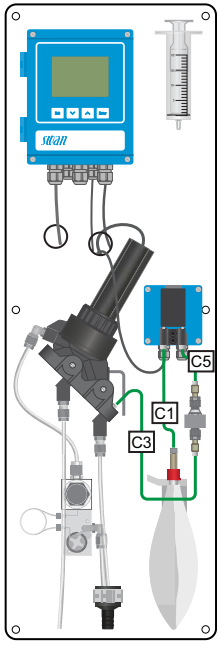
Cleaning Module-III P

If a Cleaning Module-III P is installed, connect the tubes as shown below.

Without check valve



With check valve



Cleaning Module-III

If a Cleaning Module-III is installed, refer to the enclosed installation instructions.

4.2. Establish Sample Flow

1. Open the needle valve at the inlet of the flow cell.
2. If installed, pull out the adjusting knob of the SWAN Flow Regulator and open the valve.
3. Wait until the flow cell is completely filled.
4. Switch on power.

4.3. Programming

Operation with one sensor

Menus 5.1.1 to 5.1.3
Select the unit (FNU or NTU), assign a name to the Turbisafe sensor and select the type of flow measurement (none, Q-Flow, U-Flow).

Operation with two sensors

To connect a second Turbisafe sensor, proceed as described in Connecting a Second Turbisafe Sensor, p. 34.

Menus 5.1.1 to 5.1.5
Select the unit (FNU or NTU), the type of difference calculation (Ch1-Ch2 or Ch2-Ch1), assign a name to each Turbisafe sensor and select the type of flow measurement (none, Q-Flow, U-Flow).

Cleaning Module-III (P)

Menu 5.1.5.1 Cleaning
If a Cleaning Module-III P is installed, select “1 Solution”.
If a Cleaning Module-III is installed, select “2 Solutions”.

Menu 3.31.1/2/3
Set the cleaning parameters.
Insert the cleaning solution pouch(es) into the holder(s).
Connect and fill the tube(s).

External devices

Menu 5.2 Signal Outputs
Menu 5.4 Interface

Limits and alarms

Menu 5.3 Relay Contacts
Program all parameters for instrument operation (limits, alarms).

4.4. Connecting a Second Turbisafe Sensor

Upon delivery, the bus address is set to “1” on all Turbisafe sensors. If two sensors are to be connected to a transmitter, the bus address of one of the sensors must first be set to “2”.
The sensors are numbered in the user interface according to their bus address (e.g., “Turbisafe 1,” “Turbidity 1,” or “Ch1”).

Changing the bus address

1. Switch off power.
2. Disconnect turbidity probe 1 from the transmitter and connect turbidity probe 2.
3. Switch on the instrument.
4. Navigate to **Installation** > **Sensors** > **Change Address** and select “2” as the bus address. Confirm with “<Enter> to finish”.
5. Switch off the instrument.
6. Reconnect turbidity probe 1.

Configuration

1. Switch on power.
2. Navigate to **Installation** > **Sensors** > **Settings** > **Dual Turbisafe** and select “Yes”.
   ⇒ *The configuration menus for the second Turbisafe sensor become available.*
3. Make the necessary settings in the menus **Installation** > **Sensors** > **Turbisafe 2** and **Installation** > **Sensors** > **Flow 2**.

4.5. Connecting the Cleaning Solution Pouch(es)

This section applies if the optional Cleaning Module III (P) is installed.

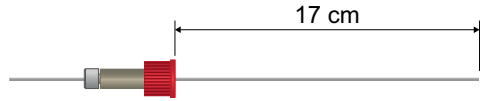
WARNING

Multiple Hazards

For safe handling of the cleaning solutions, you must read and understand the corresponding Material Safety Data Sheets (MSDS). These can be downloaded from **www.swan.ch**.

Installing the cleaning solution pouch

1. Insert the cleaning solution pouch into the holder.
2. Cut tube C1 to length if necessary.
3. Make sure that the end of tube C1 protrudes about 17 cm from the screw cap.



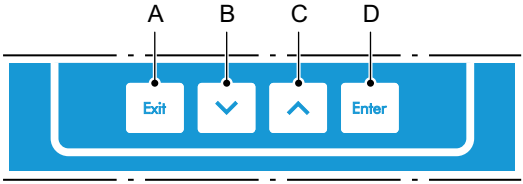
4. Insert the tube into the cleaning solution pouch and tighten the screw cap.
5. Navigate to menu **Maintenance** > **Cleaning** > **Fill Channel 1** and wait until the pump stops.

Cleaning module with two solutions:

6. Repeat steps 1 to 4 with tube C2.
7. Navigate to menu **Maintenance** > **Cleaning** > **Fill Channel 2** and wait until the pump stops.

5. Operation

5.1. Keys



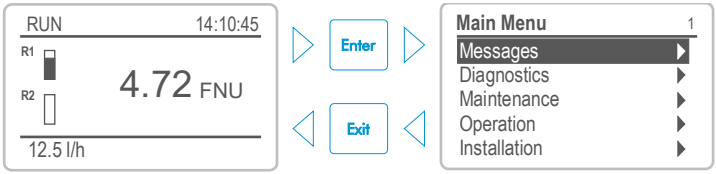
A to exit a menu or command (rejecting any changes)
to move back to the previous menu level

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

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

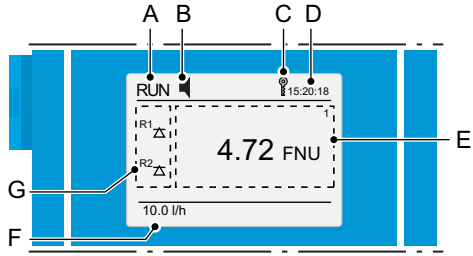
D to open a selected menu item
to accept an entry

Program access, exit



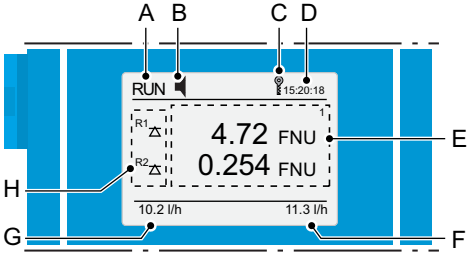
5.2. Display

Example: Monitor with one turbidity probe and one flow meter:



A	RUN	Normal operation
	HOLD	Input active or cal delay: Instrument on hold (shows status of signal outputs)
	OFF	Input active: Signal outputs go to 0/4 mA.
B	Error	Non-fatal error / Fatal error
C	Keys locked, transmitter control via Profibus	
D	Time	
E	Process value	
F	Sample flow	
G	Relay status	

Example: Transmitter with two turbidity probes and two flow meters measuring at separate sampling points:



A RUN — Normal operation

HOLD — Input active or cal delay: Instrument on hold (shows status of signal outputs)

OFF — Input active: Signal outputs go to 0/4 mA.

B Error — Non-fatal error — Fatal error

C Keys locked, transmitter control via Profibus

D Time

E Process values

F Sample flow 2

G Sample flow 1

H Relay status

Symbols used for relay status:

Upper/lower limit not yet reached

Upper/lower limit reached

Control upw./downw. no action

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

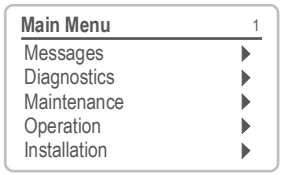
Timer

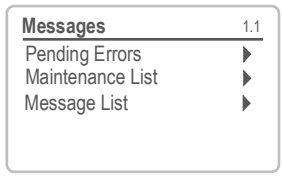
Timer: timing active (hand rotating)

Relay inactive (controlled via fieldbus)

Relay active (controlled via fieldbus)

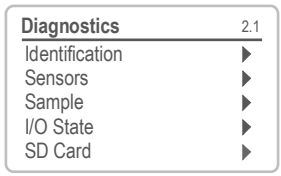
5.3. Software Structure





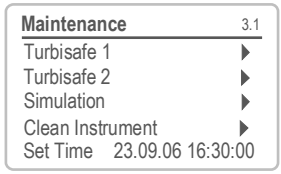
Menu 1 Messages

Shows pending errors as well as the event history (time and state of events that have occurred at an earlier point of time).
Contains user-relevant data.



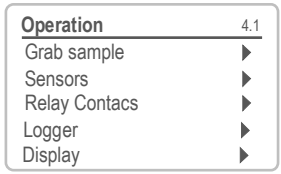
Menu 2 Diagnostics

Provides user-relevant instrument and sample data.



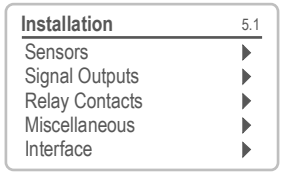
Menu 3 Maintenance

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



Menu 4 Operation

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.



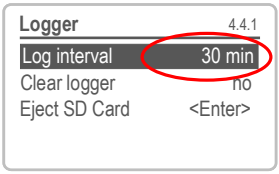
Menu 5 Installation

For initial instrument set up by Swan authorized person.
Password protection strongly recommended.

5.4. Changing Parameters and Values

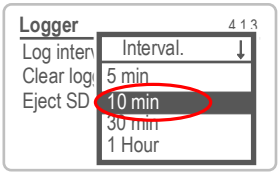
Changing parameters

The following example shows how to change the logger interval:



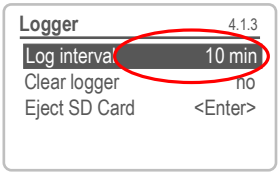
1 Select the parameter you want to change.

2 Press [Enter].



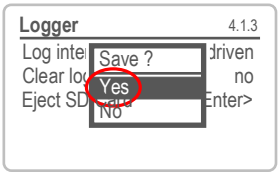
3 Press ^ or v to highlight the required parameter.

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



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

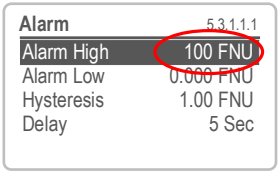
5 Press [Exit].



⇒ *Yes is highlighted.*

6 Press [Enter] to save the new parameter.

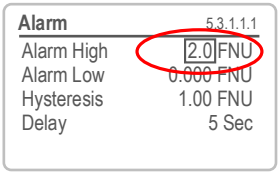
Changing values



1 Select the value you want to change.

2 Press [Enter].

3 Set required value with ^ or v.



4 Press [Enter] to confirm the new value.

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

6 Press [Enter] to save the new value.

5.5. Grab Sample

1 Navigate to **Operation** > **Grab Sample 1/2**.

2 Open the manual drain valve [C] and remove the screw plug [D] to flush out all accumulated particles from the flow cell.

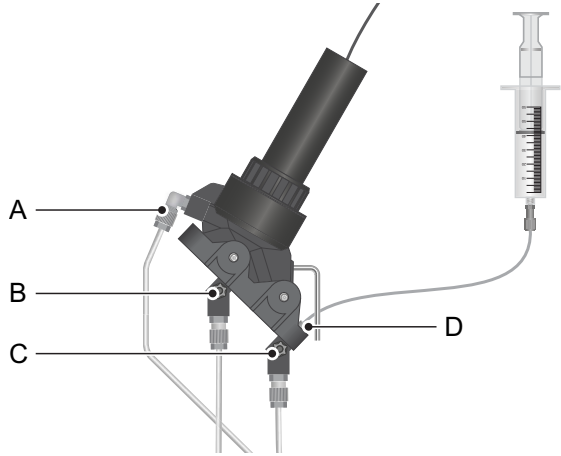
3 Stop sample flow to the instrument and wait until the flow cell is empty.

4 Clean the flow cell and the sensor thoroughly as described in Cleaning the sensor, p. 43 and Cleaning the flow cell, p. 44.

5 Close the manual drain valve [C].

6 Fill the 60 ml syringe with the grab sample.

7 Connect the syringe to the flow cell.



A *Sample outlet*
B *Sample inlet*
C *Manual drain valve*
D *Inlet for grab sample*

8 Fill the sample into the flow cell until it is visible in the sample outlet tube.

9 Place the syringe in the provided holder.

10 Confirm with “<Enter> to continue” and follow the instructions on the screen.

6. Maintenance

6.1. Maintenance Schedule

Depending on the sample matrix of the water (total suspended solids, bioactivity, total dissolved ions, etc.) the maintenance intervals vary. The following schedule applies to surface water applications. For pretreated water, such as drinking water, the maintenance schedule can be adapted according to the needs.

Daily to every week	◆ Check sample supply for dirt. ◆ Check sample flow.
Weekly to monthly	◆ Drain the flow cell. ◆ Unmount and clean the sensor. ◆ If necessary, disassemble and clean the flow cell.
Quarterly	◆ Perform a verification.

If the optional Cleaning Module-III (P) is installed:

Yearly	◆ Replace the peristalic pump tube(s).
As needed	◆ Replace the cleaning solution pouch(es) when message E067 is displayed (approximately 20 % of cleaning solution left) and reset the counter(s).

6.2. Cleaning Flow Cell and Sensor

Signal outputs and relays

During the cleaning routine, no turbidity or flow alarms are issued. The measured value is kept at the last value and relays 1 and 2 are inactive.

Preparations

1 Navigate to **Maintenance** > **Clean Instrument**.

⇒ *The instrument counts down 1200 seconds, during which the flow cell can be inspected and cleaned. The cleaning procedure can be terminated at any time by pressing [Exit] or the counter restarted by pressing an arrow key.*

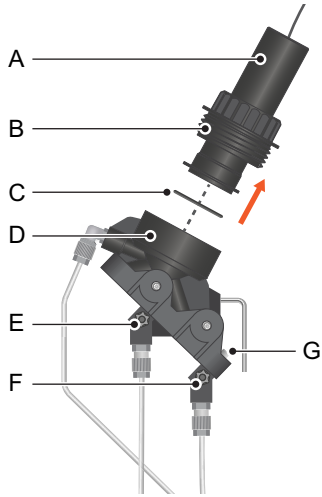
2 Open the manual drain valve [F] and remove the screw plug [G] to flush out all accumulated particles from the flow cell.

3 Stop sample flow to the instrument and wait until the flow cell is empty.

Cleaning the sensor

1 Unscrew the lock ring [B].

2 Pull the sensor out of the flow cell.



A *Sensor*
B *Lock ring*
C *O-ring*
D *Flow cell*
E *Sample inlet*
F *Manual drain valve*
G *Screw plug*

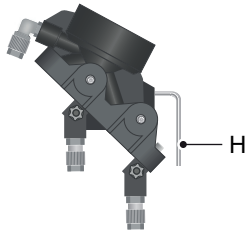
3 Carefully wipe the sensor with a soft, damp cloth. Be careful not to scratch the windows.

Cleaning the flow cell

Disassembling the flow cell is only necessary if significant deposits have formed.

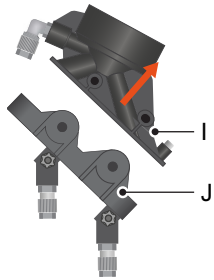
1 Disconnect all tubes from the flow cell.

2 Pull the eject lever [H] forward and remove the flow cell from the panel.



H *Eject lever*

3 Separate the upper and lower parts of the flow cell.



I *Upper part of flow cell* ***J*** *Lower part of flow cell*

4 Clean the two parts with a brush and rinse them.

Final steps

1 Reassemble the flow cell.

2 Install the sensor.

3 Connect all sample tubes.

6.3. Verification

The verification can be carried out with a formazine standard between 10 and 100 FNU/NTU.

1 Navigate to **Maintenance** > **Turbisafe 1/2** > **Verification**.

2 Enter the reference value of the standard and confirm with “<Enter> to continue”.

3 Open the manual drain valve [C] and remove the screw plug [D] to flush out all accumulated particles from the flow cell.

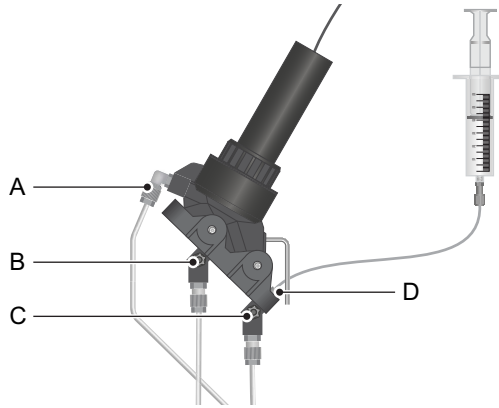
4 Stop sample flow to the instrument and wait until the flow cell is empty.

5 Clean the sensor and the flow cell thoroughly as described in Cleaning the sensor, p. 43 and Cleaning the flow cell, p. 44.

6 Close the manual drain valve [C].

7 Fill the 60 ml syringe with the standard.

8 Connect the syringe to the flow cell.



A *Sample outlet*
B *Sample inlet*
C *Manual drain valve*
D *Inlet for calibration standard*

9 Fill the standard into the flow cell until it is visible in the sample outlet tube [A].

10 Place the syringe in the provided holder.

11 Confirm with “<Enter> to continue” and follow the instructions on the screen.

6.4. Standard Calibration

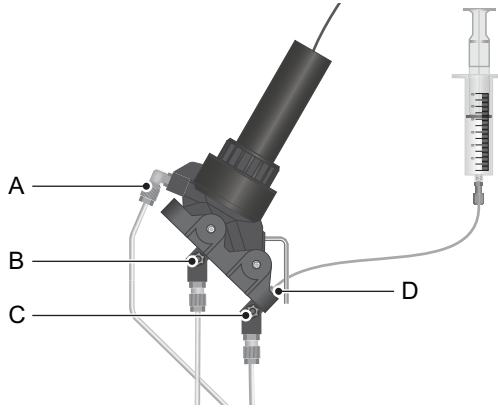
The Turbisafe sensor is factory-calibrated, and the calibration curve is permanently stored in the sensor. No further calibration is required before use. Calibration is possible if required by local regulations. Instead of calibration, it is recommended to perform a verification regulary.

6.4.1 Slope

The slope is always determined using a 20 FNU/NTU formazine standard.

1. Navigate to **Maintenance** > **Turbisafe 1/2** > **Calibration** > **Slope**.
2. Enter the reference value of the standard and confirm with “<Enter> to continue”.
3. Open the manual drain valve [C] and remove the screw plug [D] to flush out all accumulated particles from the flow cell.
4. Stop sample flow to the instrument and wait until the flow cell is empty.
5. Clean the sensor and the flow cell thoroughly as described in Cleaning the sensor, p. 43 and Cleaning the flow cell, p. 44.
6. Close the manual drain valve [C].
7. Fill the 60 ml syringe with the standard.

8 Connect the syringe to the flow cell.



A *Sample outlet*
B *Sample inlet*
C *Manual drain valve*
D *Inlet for calibration standard*

9 Fill the standard into the flow cell until it is visible in the sample outlet tube.

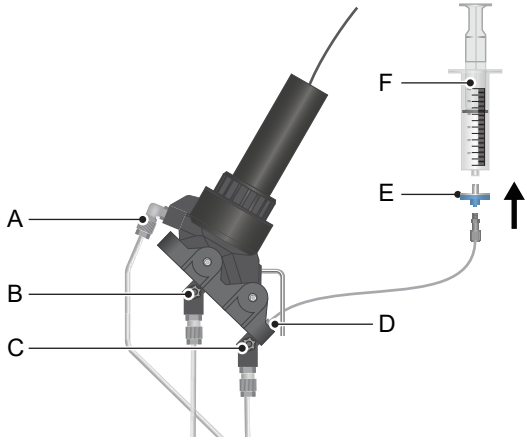
10 Place the syringe in the provided holder.

11 Confirm with “<Enter> to continue” and follow the instructions on the screen.

6.4.2 Offset

Use a 60 ml syringe, a syringe filter and drinking water to produce particle-free water.

1. Navigate to **Maintenance** > **Turbisafe 1/2** > **Calibration** > **Offset**.
2. Open the manual drain valve [C] and remove the screw plug [D] to flush out all accumulated particles from the flow cell.
3. Stop sample flow to the instrument and wait until the flow cell is empty.
4. Clean the sensor and the flow cell thoroughly as described in Cleaning the sensor, p. 43 and Cleaning the flow cell, p. 44.
5. Close the manual drain valve [C].
6. Draw water into the syringe [F].
7. Place the filter [E] on the syringe.



A *Sample outlet*
B *Sample inlet*
C *Manual drain valve*
D *Inlet for calibration standard*
E *Syringe filter*
F *60 ml syringe*

8 Connect the syringe to the flow cell.

9 Fill the particle-free water into the flow cell until it is visible in the sample outlet tube.

10 Place the syringe in the provided holder.

11 Confirm with “<Enter> to continue” and follow the instructions on the screen.

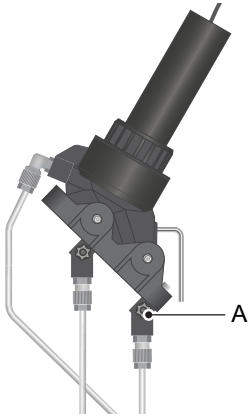
6.5. Process Calibration

The process calibration is based on a comparative measurement of the on-line instrument with a reference instrument and adjusts the slope of the sensor.
The process calibration can be carried out for both the turbidity and for the concentration of total suspended solids.

6.5.1 Turbidity

Taking a sample from the flow cell

1. Navigate to **Maintenance** > **Turbisafe 1/2** > **Process Cal.** > **Turbidity**.
2. With the sample flow turned on, open the manual drain valve [A] and wait at least one minute to flush out all accumulated particles from the flow cell.
3. Take a sample from the flow cell through the manual drain valve.
4. Close the manual drain valve.



A *Manual drain valve*

Saving measured value

1. Navigate to **Maintenance** > **Turbisafe 1/2** > **Process Cal.** > **Turbidity** > **Take a sample**.
2. Wait for the value to stabilize and confirm with “<Enter> to save”.

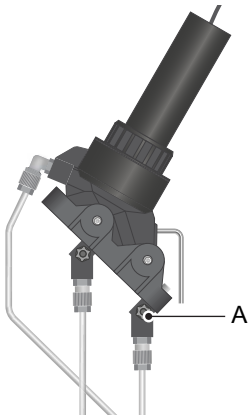
Inserting reference value

1. Analyze the sample with a reference instrument.
2. Navigate to **Maintenance** > **Turbisafe 1/2** > **Process Cal.** > **Turbidity** > **Insert ref. value**.
3. Enter the reference value and confirm with “<Enter> to continue”.
   ⇒ *The new slope is displayed.*
4. Confirm with “<Enter> to save”.

6.5.2 TSS

Taking a sample from the flow cell

1. Navigate to **Maintenance** > **Turbisafe 1/2** > **Process Cal.** > **TSS**.
2. With the sample flow turned on, open the manual drain valve [A] and wait at least one minute to flush out all accumulated particles from the flow cell.
3. Take a sample from the flow cell through the manual drain valve.
4. Close the manual drain valve.



A *Manual drain valve*

Saving measured value

1. Navigate to **Maintenance** > **Turbisafe 1/2** > **Process Cal.** > **TSS** > **Take a sample**.
2. Wait for the value to stabilize and confirm with “<Enter> to save”.

Inserting reference value

1. Analyze the sample with a reference instrument.
2. Navigate to **Maintenance** > **Turbisafe 1/2** > **Process Cal.** > **TSS** > **Insert ref. value**.
3. Enter the reference value and confirm with “<Enter> to continue”.
   ⇒ *The new slope is displayed.*
4. Confirm with “<Enter> to save”.

6.6. External Calibration (TSS)

The external calibration allows the manual entry of a calibration curve based on data points collected over an extended period of time.
Before carrying out the external calibration, make sure that the offset is set to 0.000 ppm and that the slope is set to 1.000.
To obtain the calibration equation, proceed as follows:

1. Take a minimum of five samples at representative time points. Each time, write down the TSS reading of the AMI-II Turbisafe.
2. Analyze the samples in the laboratory to obtain the reference values.
3. Perform a linear regression of the data pairs in a spreadsheet. Use the unit ppm.
4. Enter the offset in the menu **Maintenance** > **Turbisafe 1/2** > **Process Cal.** > **TSS** > **External calibration** > **Offset**.
5. Enter the slope in the menu **Maintenance** > **Turbisafe 1/2** > **Process Cal.** > **TSS** > **External calibration** > **Slope**.

6.7. Replacing the Cleaning Solution Pouch(es)

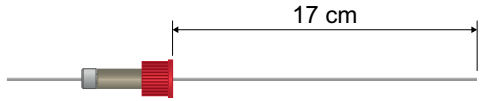
The level in each cleaning solution pouch is monitored by a counter. When message E067 appears, the pouch has to be replaced (approximately 20 % of cleaning solution left).
The remaining cleaning solution can be viewed at any time in menu **Diagnostics** > **Sensors** > **Miscellaneous** > **Cleaning**.

WARNING

Multiple Hazards
For safe handling of the cleaning solutions, you must read and understand the corresponding Material Safety Data Sheets (MSDS). These can be downloaded from **www.swan.ch**.

Replacing the cleaning solution pouch

1 Insert the new cleaning solution pouch into the holder.
2 Make sure that the end of the tube protrudes about 17 cm from the screw cap.



3 Insert the tube into the cleaning solution pouch and tighten the screw cap.

Cleaning Module-III P:

4 Reset the counter in menu
Maintenance > **Cleaning** > **Reset Counter 1**.

Cleaning Module-III:

4 Reset the counter(s) in menu(s)
Maintenance > **Cleaning** > **Reset Counter 1** and/or
Maintenance > **Cleaning** > **Reset Counter 2**.

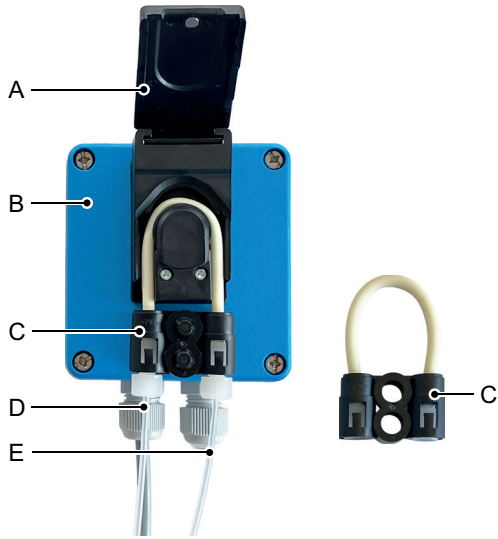
Consumption of cleaning solutions

- Cleaning Module-III P:
  A cleaning cycle takes 5 minutes and uses about 5 ml of cleaning solution.
- Cleaning Module-III:
  A cleaning cycle takes 10 minutes and uses about 5 ml of each cleaning solution.

6.8. Replacing the Peristaltic Pump Tube

The peristaltic pump tube of the optional Cleaning Module-III (P) is subject to wear. Therefore it is recommended to replace it after one year of use.

Overview



A *Cover*
B *Pump housing*
C *Pump tube*
D *Pump inlet*
E *Pump outlet*

Emptying tubes of cleaning pump

1. Remove the tube from the cleaning solution pouch and place it in a beaker filled with clean water.
2. Fill the tubes with water by selecting the menu **Maintenance** > **Cleaning** > **Fill Channel 1**.
3. Empty the tubes by selecting the same menu again.

Cleaning module with two solutions:

4. Repeat steps 1 to 3 with the second pump/channel 2.

Dismount pump tube

1. Open the cover [A].
2. Remove the pump tube [C] from the pump.
3. Disconnect the cleaning solution tubes from the old pump tube and connect them to the new pump tube.
4. Install the new pump tube onto the pump.
5. Close the cover [A].

Start-up

6. Fill the tubes by selecting the menu **Maintenance** > **Cleaning** > **Fill Channel 1** and/or **Maintenance** > **Cleaning** > **Fill Channel 2**.

6.9. Longer Stop of Operation

1. If the optional Cleaning Module-III (P) is installed, flush and empty its tubes as described in Emptying tubes of cleaning pump, p. 55.
2. Stop sample flow.
3. Shut off power of the instrument.
4. Empty the flow cell by opening the manual drain valve.
5. If necessary, clean the flow cell.

7. Troubleshooting

This chapter provides some hints to make troubleshooting easier.
For information on how to handle/clean parts refer to Maintenance, p. 42.
For information on how to program the instrument refer to Program List and Explanations, p. 72.
If you need help please contact your local distributor. Note serial number of instrument and all diagnostic values before.

7.1. Troubleshooting List

Problem	Possible reason	Solution
Sample flow decreases	Sample inlet valve clogged.	– The sample inlet valve is not intended to regulate the sample flow. Always open it completely.
Measured value is noisy	Macroscopically inhomogeneous sample	– Increase flow rate. – Increase filter time constant in menu **Operation** > **Sensors** > **Filter Time Const.**
	Outgassing sample	– Install the flow regulator option and measure under high sample pressure.

7.2. Error List

Two categories of messages are distinguished:

Non-fatal error

Non-fatal instrument error or exceeding of a programmed limit value. Such errors are marked **E0xx** (bold and black) in the following list.

Fatal error (flashing symbol)

Fatal instrument error. Control is interrupted and the displayed measured values may not be correct.
Fatal errors are divided into the following two subcategories:

- Errors which disappear when correct measuring conditions are recovered (i.e. sample flow low).
  Such errors are marked **E0xx** (bold and orange) in the following list.
- Errors which indicate a hardware failure of the instrument.
  Such errors are marked **E0xx** (bold and red) in the following list.

Error	Description	Corrective action
E001	Turbidity 1 high	– Check process. – Check programmed value.
E002	Turbidity 1 low	– Check process. – Check programmed value.
E003	Turbidity 2 high	– Check process. – Check programmed value.
E004	Turbidity 2 low	– Check process. – Check programmed value.
E005	TSS 1 high	– Check process. – Check programmed value.
E006	TSS 1 low	– Check process. – Check programmed value.
E007	Turbisafe 2 Calibration.	– Call support.
E008	Turbisafe 2 Status	– Write down the error code shown in the “Status” field in the **Diagnostic** > **Sensors** > **Turbisafe 2** menu. – Call support.
E009	Sample Flow 1 high	– Check process. – Check programmed value.
E010	Sample Flow 1 low	– Check process. – Check programmed value.
E011	Sample Flow 2 high	– Check process. – Check programmed value.
E012	Sample Flow 2 low	– Check process. – Check programmed value.
E013	Case Temp. high	– Check case/environment temperature. – Check programmed value.
E014	Case Temp. low	– Check case/environment temperature. – Check programmed value.
E015	Turbisafe 1 disconn.	– Check wiring of Turbisafe sensor.
E016	Turbisafe 1 Init.	– Check wiring of Turbisafe sensor.

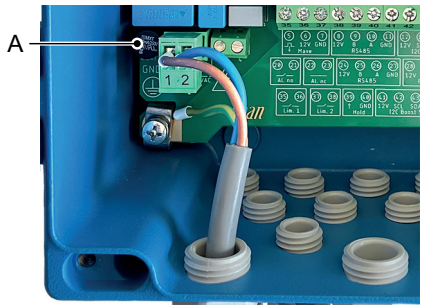
Error	Description	Corrective action
E017	Control timeout	– Check control device or programming in menus **Installation** > **Relay contacts** > **Relay 1** and **Installation** > **Relay contacts** > **Relay 2**.
E018	Turbisafe 1 Calibration	– Call support.
E019	Turbisafe 1 Status	– Write down the error code shown in the “Status” field in the **Diagnostic** > **Sensors** > **Turbisafe 1** menu. – Call support.
E020	Turbisafe 2 disconn.	– Check wiring of Turbisafe sensor.
E021	Turbisafe 2 Init.	– Check wiring of Turbisafe sensor.
E022	Cleaning Status	– Write down the error code shown in the “Status 1” and “Status 2” fields in the **Diagnostic** > **Sensors** > **Miscellaneous** > **Cleaning** menu. – Call support.
E023	Cleaning Solution (10 % left)	– Replace the cleaning solution pouch(es) and reset the counter(s).
E024	Input active	– Message informing that the relay input has been actuated. – Can be deactivated in menu **Installation** > **Relay contacts** > **Input** > **Fault**.
E026	IC LM75	– Call support.
E030	I2C Frontend	– Call support.
E031	Calibration Recout	– Call support.
E032	Wrong Frontend	– Call support.
E033	Turbisafe 1 dirty	– Not applicable. For future use.
E034	Turbisafe 2 dirty	– Not applicable. For future use.
E035	TS1 Humidity High	– Call support.
E036	TS2 Humidity High	– Call support.
E037	Turb. Diff. high	– Check process. – Check programmed value.

Error	Description	Corrective action
E038	Turb. Diff. low	– Check process. – Check programmed value.
E039	TSS Diff. high	– Check process. – Check programmed value.
E040	TSS Diff. low	– Check process. – Check programmed value.
E041	TSS 2 high	– Check process. – Check programmed value.
E042	TSS 2 low	– Check process. – Check programmed value.
E049	Power-on	– None, normal status.
E050	Power-down	– None, normal status.
E067	Cleaning Solution (20 % left)	– Replace the cleaning solution pouch(es) and reset the counter(s).

7.3. Replacing Fuses

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

AMI-II transmitter



A *AC variant: 0.8 AT/250 V Instrument power supply*
DC variant: 6.3 AT/250 V Instrument power supply

8. Program Overview

Explanations of each parameter in the menus can be found in chapter Program List and Explanations, p. 72.

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

8.1. Messages (Main Menu 1)

Pending Errors 1.1*	*Pending Errors*	1.1.5*	* Menu numbers
Maintenance List 1.2*	*Number*	1.2.1*	
	Date, Time		
Message List 1.3*	*Number*	1.3.1*	
	Date, Time		

8.2. Diagnostics (Main Menu 2)

				* Menu numbers
Identification	*Designation*			
2.1*	*Version*			
	Bootloader			
	Peripherals	*Turbisafe 1*	2.1.4.1*	
	2.1.4*	*Turbisafe 2*		
	Factory Test	*Motherboard*	2.1.5.1*	
	2.1.5*	*Turbisafe 1*		
		Turbisafe 2		
	Operating Time	*Years, days, hours, minutes, seconds*		2.1.6.1*
	2.1.6*			
Sensors	**Turbisafe 1**	*Status*		
2.2*	2.2.1*	*Values*	2.2.1.2*	
		History	*Turb. History*	2.2.1.3.1*
		2.2.1.3*	*TSS History*	2.2.1.3.2*
			Grab Sample History	2.2.1.3.3*
			Verification History	2.2.1.3.4*
		A/D	2.2.1.4*	
		Factory Data	2.2.1.5*	
		Device Data	2.2.1.6*	
	Turbisafe 2	*Status*		
	2.2.2*	*Values*	2.2.2.2*	
		History	*Turb. History*	2.2.2.3.1*
		2.2.2.3*	*TSS History*	2.2.2.3.2*
			Grab Sample History	2.2.2.3.3*
			Verification History	2.2.2.3.4*
		A/D	2.2.2.4*	
		Factory Data	2.2.2.5*	
		Device Data	2.2.2.6*	
	Miscellaneous	*Case Temp.*	2.2.3.1*	
	2.2.3*	*Cleaning*	2.2.3.2*	

Sample	*Sample ID*			* Menu numbers
2.3*	**Flow**	**Flow 1**	*Sensor*	2.3.2.1.1*
	2.3.2*	2.3.2.1*	*Sample Flow*	
			(Raw value)	
		Flow 2	*Sensor*	2.3.2.2.1*
		2.3.2.2*	*Sample Flow*	
			(Raw value)	
I/O State	**Relays**	*Alarm Relay*	2.4.1.1*	
2.4*	2.4.1*	*Relay 1/2*		
		Input		
	Signal Outputs	*Signal Output 1/2/3/4*	2.4.2.1*	
	2.4.2*			
SD Card	*State*	2.5.1*		
2.5*				
Interface	*Protocol*	2.6.1*		(only with RS485
2.6*	*Baud rate*			interface)

8.3. Maintenance (Main Menu 3)

Turbisafe 1	**Verification**	Process		
3.1*	3.1.1*			
	Calibration	*Slope*	Process	
	3.1.2*	3.1.2.1*		
		Offset	Process	
		3.1.2.2*		
		Appl. Offset	Process	
		3.1.2.3*		
	Process Cal.	**Turbidity**	*Take a sample*	3.1.3.1.1*
	3.1.3*	3.1.3.1*	*Insert ref. value*	3.1.3.1.2 *
		TSS	*Take a sample*	3.1.3.2.1*
		3.1.3.2*	*Insert ref. value*	3.1.3.2.2 *
			External calibration	3.1.3.2.3 *

Turbisafe 2	**Verification**	Process		* Menu numbers
3.2*	3.2.1*			
	Calibration	*Slope*	Process	
	3.2.2*	3.2.2.1*		
		Offset	Process	
		3.2.2.2*		
		Appl. Offset	Process	
		3.2.2.3*		
	Process Cal.	*Turbidity*	*Take a sample*	3.2.3.1.1*
	3.2.3*	3.2.3.1*	*Insert ref. value*	3.2.3.1.2 *
		TSS	*Take a sample*	3.2.3.2.1*
		3.2.3.2*	*Insert ref. value*	3.2.3.2.2 *
			External calibration	3.2.3.2.3 *
Clean Instrument	Process			
3.3*				
Simulation	**Relays**	*Alarm Relay*	3.4.1.1*	
3.4*	3.4.1*	*Relay 1*	3.4.1.2*	
		Relay 2	3.4.1.3*	
	Signal Outputs	*Signal Output 1*	3.4.2.1*	
	3.4.2*	*Signal Output 2*	3.4.2.2*	
Cleaning	*Parameters*	3.5.1*		
3.5*	*Fill Channel 1*	3.5.2*		
	Fill Channel 2	3.5.3*		
	Reset Counter 1	3.5.4*		
	Reset Counter 2	3.5.5*		
Set Time	*(Date), (Time)*			
3.6*				

8.4. Operation (Main Menu 4)

Grab Sample 1	Process			* Menu numbers
4.1*				
Grab Sample 2	Process			
4.2*				
Sensors	*Filter Time Const.*	4.3.1*		
4.3*	*Hold after Cal*	4.3.2*		
	Hold after Dark	4.3.3*		
Relay Contacts	**Alarm Relay**	**Turbidity 1/2**	*Alarm High*	4.4.1.x.1*
4.4*	4.4.1*	4.4.1.1/4.4.1.2*	*Alarm Low*	4.4.1.x.25*
			Hysteresis	4.4.1.x.35*
			Delay	4.4.1.x.45*
		TSS 1/2	*Alarm High*	4.4.1.x.1*
		4.4.1.3/4.4.1.4*	*Alarm Low*	4.4.1.x.25*
			Hysteresis	4.4.1.x.35*
			Delay	4.4.1.x.45*
		TSS Diff.	*Alarm High*	4.4.1.5.1*
		4.4.1.5*	*Alarm Low*	4.4.1.5.25*
			Hysteresis	4.4.1.5.35*
			Delay	4.4.1.5.45*
		Sample Flow 1/2	*Alarm High*	4.4.1.x.1*
		4.4.1.6/4.4.1.7*	*Alarm Low*	4.4.1.x.25*
			Hysteresis	4.4.1.x.35*
			Delay	4.4.1.x.45*
		Case Temp.	*Alarm High*	4.4.1.8.1*
		4.4.1.8*	*Alarm Low*	4.4.1.8.25*
			Hysteresis	4.4.1.8.35*
			Delay	4.4.1.8.45*
	Relay 1/2	*Setpoint*	4.4.x.200*	
	4.4.2*/4.4.3*	*Hysteresis*	4.4.x.300*	
		Delay	4.4.x.40*	
	Input	*Active*	4.4.4.1*	
	4.4.4*	*Signal Outputs*	4.4.4.2*	
		Output / Control	4.4.4.3*	
		Fault	4.4.4.4*	
		Delay	4.4.4.5*	
Logger	*Log Interval*	4.5.1*		
4.5*	*Clear Logger*	4.5.2*		
	Eject SD Card	4.5.3*		

Display	**Screen 1**	*Row 1*	4.6.1.1*	* Menu numbers
4.6*	4.6.1*	*Row 2*	4.6.1.2*	
		Row 3	4.6.1.3*	
	Screen 2	*Row 1*	4.6.2.1*	
	4.6.2*	*Row 2*	4.6.2.2*	
		Row 3	4.6.2.3*	

8.5. Installation (Main Menu 5)

Sensors	**Settings**	*Dual Turbisafe*	5.1.1.1*	* Menu numbers
5.1*	5.1.1*	*Dimension*	5.1.1.2*	
		Difference	5.1.1.3*	
	Turbisafe 1	**Device Data**	*TS Name*	5.1.2.1.1*
	5.1.2*	5.1.2.1*		
	Turbisafe 2	**Device Data**	*TS Name*	5.1.3.1.1*
	5.1.3*	5.1.3.1*		
	Flow 1	*Flow Measurement 1*	5.1.4.1*	
	5.1.4*			
	Flow 2	*Flow Measurement 2*	5.1.5.1*	
	5.1.5*			
	Change Address	5.1.6*		
	Cleaning	*Cleaning*	5.1.7.1*	
	5.1.7*			
Signal Outputs	**Signal Output 1/2**	*Parameter*	5.2.1.1/5.2.2.1*	
5.2*	5.2.1/5.2.2*	*Current Loop*	5.2.1.2/5.2.2.2*	
		Function	5.2.1.3/5.2.2.3*	
		Scaling	*Range Low*	5.2.x.40.10/11*
		5.2.x.40	*Range High*	5.2.x.40.20/21*
Relay Contacts	**Alarm Relay**	**Turbidity 1/2**	*Alarm High*	5.3.1.x.1*
5.3*	5.3.1*	5.3.1.x*	*Alarm Low*	5.3.1.x.25*
			Hysteresis	5.3.1.x.35*
			Delay	5.3.1.x.45*
		Turbidity Diff.	*Alarm High*	5.3.1.3.1*
		5.3.1.3	*Alarm Low*	5.3.1.3.25*
			Hysteresis	5.3.1.3.35*
			Delay	5.3.1.3.45*
		TSS 1/2	*Alarm High*	5.3.1.x.1*
		5.3.1.x*	*Alarm Low*	5.3.1.x.25*
			Hysteresis	5.3.1.x.35*
			Delay	5.3.1.x.45*
		TSS Diff.	*Alarm High*	5.3.1.6.1*
		5.3.1.6*	*Alarm Low*	5.3.1.6.25*
			Hysteresis	5.3.1.6.35*
			Delay	5.3.1.6.45*

		Sample Flow 1	*Sample Flow*	5.3.1.7.1*
		5.3.1.7*	*Warning High*	5.3.1.7.2*
			Warning Low	5.3.1.7.3*
		Sample Flow 2	*Sample Flow*	5.3.1.8.1*
		5.3.1.8*	*Warning High*	5.3.1.8.2*
			Warning Low	5.3.1.8.3*
		Case Temp.	*Case Temp. high*	5.3.1.9.1*
		5.3.1.9*	*Case Temp. low*	5.3.1.9.2*
	Relay 1/2	*Function*	5.3.2.1/5.3.3.1*	
	5.3.2/5.3.3*	*Parameter*	5.3.2.20/5.3.3.20*	
		Setpoint	5.3.2.300/5.3.3.301*	
		Hysteresis	5.3.2.400* / 5.3.2.401*	
		Delay	5.3.2.50* / 5.3.3.50*	
	Input	*Active*	5.3.4.1*	
	5.3.4*	*Signal Outputs*	5.3.4.2*	
		Output/Control	5.3.4.3*	
		Fault	5.3.4.4*	
		Delay	5.3.4.5*	
Miscellaneous	*Language*	5.4.1*		* Menu numbers
5.4*	*Set defaults*	5.4.2*		
	Load Firmware	5.4.3*		
	Password	*Messages*	5.4.4.1*	
	5.4.4*	*Maintenance*	5.4.4.2*	
		Operation	5.4.4.3*	
		Installation	5.4.4.4*	
	Sample ID	5.4.5*		
Interface	*Protocol*	5.5.1*		(only with RS485
5.5*	*Device Address*	5.5.21*		interface)
	Baud Rate	5.5.31*		
	Parity	5.5.41*		

9. Program List and Explanations

1 Messages

1.1 Pending Errors

1.1.5 Provides the list of active errors with their status (active, acknowledged). When all active errors have been acknowledged, the alarm relay is active again. Cleared errors are moved to the message list.

1.2 Maintenance List

1.2.5 Provides the list of necessary maintenance. Cleared maintenance messages are moved to the message list.

1.3 Message List

1.3.1 Shows the error history: Error code, date and time of issue and status (active, acknowledged, cleared). 64 errors are memorized. Then the oldest error is cleared to save the newest one (circular buffer).

2 Diagnostics

2.1 Identification

Designation: Designation of the instrument.
Version: Version of the instrument firmware.
Bootloader: Version of the bootloader.

2.1.4 Peripherals

2.1.4.1 *Turbisafe 1/2:* Version of the turbidity sensor firmware.

2.1.4.1 *OnePeri #1/2:* Version of the peristaltic pump firmware (if a cleaning module is installed)

2.1.5 Factory Test: Test date of the mainboard and Turbisafe sensor(s).

2.2 Sensors

2.2.1 Turbisafe 1

2.2.1.1 *Status:* Error code sent by the Turbisafe sensor. "00000000" means that no errors are present.

2.2.1.2 *Values:*

- Current Value: Measured value in FNU.
- (Raw value): Measured value in FNU without user calibration.
- Laser Power: Measured intensity of the light source.
- Temperature: Temperature measured inside the Turbisafe sensor.
- Humidity: Humidity measured inside the Turbisafe sensor.

- Dew Point: Calculated dew point.
- Dark FNU HG: Dark measurement of the turbidity photo diode (high gain).
- Dark FNU LG: Dark measurement of the turbidity photo diode (low gain).

2.2.1.3 History

2.2.1.3.1 *Turb. History:* Shows previous standard and process calibrations of the turbidity measurement.

2.2.1.3.2 *TSS History:* Shows previous process calibrations of the total suspended solids measurement.

2.2.1.3.3 *Grab Sample History:* Shows previous grab sample measurements.

2.2.1.3.4 *Verification History:* Shows previous verifications of the turbidity measurement.

2.2.1.4 *A/D:* Raw values of the analog-to-digital converter.

2.2.1.5 *Factory data:* Values of the factory calibration.

2.2.1.6 *Device data:*

- Art. N.: Article number of the sensor.
- TS name: Name assigned to the sensor during installation.
- Ser. N.: Serial number of the sensor.

2.2.2 Turbisafe 2: See Turbisafe 1.

2.2.3 Miscellaneous

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

2.2.3.2 Cleaning (only available if a cleaning module is installed)
Status 1: Error code sent by pump 1 of the Cleaning Module-III (P). "0000" means that no errors are present.
Solution 1: Estimated fill level in the cleaning solution pouch.
Status 2: Error code sent by pump 2 of the Cleaning Module-III. "0000" means that no errors are present.
Solution 2: Estimated fill level in the cleaning solution pouch.

2.3 Sample

2.3.1 *Sample ID:* Shows the ID used to identify the location of the sample.

2.3.2 Flow

2.3.2.1 *Flow 1:*

- Sensor: Shows the type of flow meter (Q-Flow, U-Flow or none).
- Sample Flow: Shows the current sample flow in l/h.
- (Raw value): Raw value in Hz.

2.3.2.1 *Flow 2:* See flow 1.

2.4 I/O State

2.4.1 Relays

2.4.1.1

Alarm Relay:	Active or inactive
Relays 1 and 2:	Active or inactive
Input:	Open or closed

2.4.2 Signal Outputs

2.4.2.1

Signal Outputs 1 and 2:	Current in mA
Signal Outputs 3 and 4:	Current in mA (if option is installed)

2.5 SD Card

2.5.1 *Status:* Shows the status of the SD card.

2.6 Interface

Settings of the installed communication option (if any).

3 Maintenance

3.1 Turbisafe 1

3.1.1 *Verification:* See Verification, p. 45.

3.1.2 Calibration

3.1.2.1 *Slope:* See Slope, p. 46.

3.1.2.2 *Offset:* See Offset, p. 48.

3.1.2.3 *Appl. Offset:* Not applicable.

3.1.3 Process Cal.

3.1.3.1 *Turbidity:* See Process Calibration, p. 50.

3.1.3.2 *TSS:* See Process Calibration, p. 50.

3.3.3.3 *External calibration:* See External Calibration (TSS), p. 53.

3.2 Turbisafe 2

See Turbisafe 1.

3.3 Clean Instrument

See Cleaning Flow Cell and Sensor, p. 43.

3.4 Set Time

Adjust date and time.

3.5 Cleaning

3.5.1 Parameters

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

If Mode = Interval

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

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

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

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

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

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

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

Cont.: Controller continues normally.

Hold: Controller continues based on the last valid value.

Off: Controller is switched off.

If Mode = Daily

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

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

3.5.1.3 *Delay:* see mode interval.

3.5.1.4 *Signal Outputs:* see mode interval.

3.5.1.5 *Output/Control:* see mode interval.

If Mode = Weekly

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

3.5.1.2 Calendar

3.5.1.2.1 Start time: Time of the automatic start of the cleaning process (valid for all selected weekdays).

3.5.1.2.2 Monday: Possible settings: on or off
to

3.5.1.2.8 Sunday: Possible settings: on or off

3.5.1.3 *Delay:* see mode interval.

3.5.1.4 *Signal Outputs:* see mode interval.

3.5.1.5 *Output/Control:* see mode interval.

all modes

3.5.1.2 *Fill Channel 1:* Turns on the cleaning pump for two minutes.

3.5.1.3 *Fill Channel 2:* Turns on the cleaning pump for two minutes.

3.5.1.4 *Reset Counter 1:* Resets the counter used to calculate the remaining cleaning solution.

3.5.1.5 *Reset Counter 2:* Resets the counter used to calculate the remaining cleaning solution.

4 Operation

4.1 Grab Sample 1

See Grab Sample, p. 41.

4.2 Grab Sample 2

See Grab Sample, p. 41.

4.3 Sensors

4.3.1 *Filter Time Constant:* Used to reduce noise in the measured value. The higher the filter time constant, the slower the system reacts to changes of the measured value.
Range: 5–300 s

4.3.2 *Hold after Cal.:* Delay permitting the instrument to stabilize again after calibration. During calibration plus hold time, the signal outputs are frozen (held on last valid value), alarm values, limits are not active.
Range: 0–6000 s

4.3.3 *Hold after Dark.:* Delay permitting the instrument to stabilize again after the dark calibration, which is performed automatically at startup and every hour. During dark calibration plus hold time, the signal outputs are frozen (held on last valid value), alarm values, limits are not active.
Range: 30–300 s

4.4 Relay Contacts

See Relay Contacts, p. 84.

4.5 Logger

The instrument is equipped with an internal logger. The logger data can be copied to the SD card.

4.5.1 *Log Interval:* Select a convenient log interval.
Range: 1 s, 5 s, 1 min, 5 min, 10 min, 30 min or 1 h.

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

4.5.3 *Eject SD Card:* With this function all logger data are copied to the SD card and the SD card can be removed.

4.6 Display

Process values are displayed on two screens. Toggle screens with the ^ key. Each screen displays a maximum of three process values.

4.6.1 Screen 1

4.6.1.1 *Row 1*

4.6.1.2 *Row 2*

4.6.1.3 *Row 3*

Possible settings for all rows are:

- None
- Turbidity 1
- Turbidity 2
- Turbidity Diff.
- TSS 1
- TSS 2
- TSS Diff

4.6.2 Screen 2

See screen 1.

5 Installation

5.1 Sensors

5.1.1 *Dual Turbisafe:* Set to “Yes” if a second sensor is installed.
- No
- Yes

5.1.2 *Difference:* Select how the difference between the two measured values should be calculated.
- Ch1 - Ch2
- Ch2 - Ch1

5.1.3 *Dimension:* Select the unit (FNU or NTU).

5.1.x Turbisafe 1/2

5.1.x.1 *Device Data*
TS Name: Enter a meaningful name for the sensor.

5.1.x Flow 1/2

5.1.x.1 *Flow measurement 1/2:* Select the installed flow meter type.
- None
- Q-Flow
- U-Flow

5.1.8 *Change Address:* See Changing the bus address, p. 34.

5.1.9 Cleaning

5.1.9.x *Cleaning:* If a cleaning module is connected, set the number of available cleaning solutions.
Available options: 1 solution, 2 solutions, none.

5.2 Signal Outputs

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

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

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

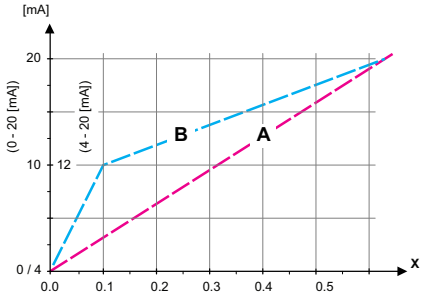
- Turbidity 1
- Turbidity 2
- Turbidity Diff.
- TSS 1
- TSS 2
- TSS Diff.
- Sample flow 1 (if a flow meter is selected)
- Sample flow 2 (if a flow meter is selected)

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

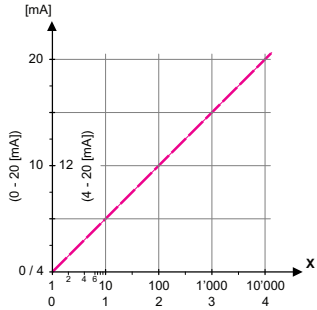
5.2.1.3 *Function:* Define if the signal output is used to transmit a process value or to drive a control unit. Available functions are:

- Linear, bilinear or logarithmic for process values.
- Control upwards or control downwards.

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



A *Linear*
B *Bilinear*
X *Measured value*



X *Measured value (logarithmic)*

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

Parameter Turbidity 1/2:
5.2.1.40.10 *Range low:* 0–10000 FNU/NTU
5.2.1.40.20 *Range high:* 0–10000 FNU/NTU

Parameter Turbidity Diff.:
5.2.1.40.10 *Range low*: -10000–10000 FNU/NTU
5.2.1.40.20 *Range high*: -10000–10000 FNU/NTU

Parameter TSS 1:
5.2.1.40.11 *Range low*: 0.000–100000 ppm
5.2.1.40.21 *Range high*: 0.000–100000 ppm

Parameter TSS 2:
5.2.1.40.11 *Range low*: 0.000–100000 ppm
5.2.1.40.21 *Range high*: 0.000–100000 ppm

Parameter TSS Diff.:
5.2.1.40.11 *Range low*: -100000 –100000 ppm
5.2.1.40.21 *Range high*: -100000 –100000 ppm

Parameter Sample flow 1:
5.2.1.40.11 *Range low*: 0–50 l/h
5.2.1.40.21 *Range high*: 0–50 l/h

Parameter Sample flow 2:

5.2.1.40.13 *Range low*: 0–50 l/h

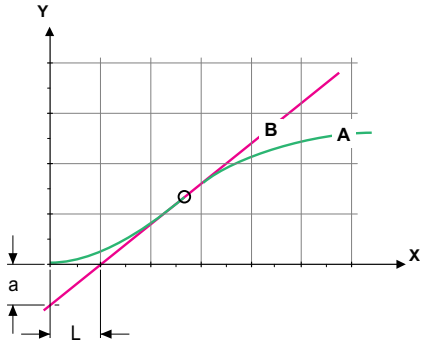
5.2.1.40.23 *Range high*: 0–50 l/h

As control output

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

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

Ziegler-Nichols method for the optimization of a PID controller:
Parameters: Setpoint, P band, reset time, derivative time.



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

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

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

Control upwards or downwards

Setpoint: User-defined process value for the selected parameter.
P band: Range below (upwards control) or above (downwards control) the setpoint, within which the dosing intensity is reduced from 100% to 0% to reach the setpoint without overshooting.

5.2.1.43 **Control Parameters:** if Parameter = Turbidity 1/2
5.2.1.43.10 Setpoint: 0–10000 FNU/NTU
5.2.1.43.20 P-Band: 0–1000 FNU/NTU

5.2.1.43 **Control Parameters:** if Parameter = Turbidity Diff.
5.2.1.43.10 Setpoint: -10000–10000 FNU/NTU
5.2.1.43.20 P-Band: 0–1000 FNU/NTU

5.2.1.43 **Control Parameters:** if Parameter = TSS 1/2
5.2.1.43.11 Setpoint: 10000 ppm
5.2.1.43.21 P-Band: 10000 ppm

5.2.1.43 **Control Parameters:** if Parameter = TSS Diff.
5.2.1.43.11 Setpoint: -10000–10000 ppm
5.2.1.43.21 P-Band: -10000–10000 ppm

5.2.1.43 **Control Parameters:** if Parameter = Sample flow 1/2
5.2.1.43.12 Setpoint: 0–50 l/h
5.2.1.43.22 P-Band: 0–50 l/h

5.2.1.43.3 *Reset time:* The reset time is the time till the step response of a single I-controller will reach the same value as it will be suddenly reached by a P-controller.
Range: 0–9000 s

5.2.1.43.4 *Derivative time:* The derivative time is the time till the ramp response of a single P-controller will reach the same value as it will be suddenly reached by a D-controller.
Range: 0–9000 s

5.2.1.43.5 *Control timeout:* If a controller action (dosing intensity) is constantly over 90% during a defined period of time and the process value does not come closer to the setpoint, the dosing process will be stopped for safety reasons.
Range: 0–720 min

5.3 Relay Contacts

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

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

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

- Turbidity 1
- Turbidity 2
- Turbidity Diff.
- TSS 1
- TSS 2
- TSS Diff.
- Sample flow 1 (if a flow sensor is installed)
- Sample flow 2 (if a flow sensor is installed)
- Case Temperature high
- Case Temperature low

5.3.1.1 Turbidity 1

5.3.1.1.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay becomes inactive and E001 is displayed in the message list.
Range: 0–10000 FNU/NTU

5.3.1.1.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay becomes inactive and E002 is displayed in the message list.
Range: 0–10000 FNU/NTU

5.3.1.1.35 *Hysteresis:* Within the hysteresis range, the relay does not switch. This prevents damage to the relay contacts when the measured value fluctuates around the limit.
Range: 0–1000 FNU/NTU

5.3.1.1.45 *Delay:* Waiting time before the alarm relay becomes inactive after the measured value has risen above or fallen below the programmed alarm value.
Range: 0–28800 s

5.3.1.2 Turbidity 2

5.3.1.2.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay becomes inactive and E003 is displayed in the mes-

sage list.
Range: 0–10000 FNU/NTU

5.3.1.2.2 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay becomes inactive and E004 is displayed in the message list.
Range: 0–10000 FNU/NTU

5.3.1.2.35 *Hysteresis:* Within the hysteresis range, the relay does not switch. This prevents damage to the relay contacts when the measured value fluctuates around the limit.
Range: 0–1000 FNU/NTU

5.3.1.2.45 *Delay:* Waiting time before the alarm relay becomes inactive after the measured value has risen above or fallen below the programmed alarm value.
Range: 0–28800 s

5.3.1.3 Turbidity Diff.

5.3.1.3.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay becomes inactive and E037 is displayed in the message list.
Range: -10000–10000 FNU/NTU

5.3.1.3.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay becomes inactive and E038 is displayed in the message list.
Range: -10000–10000 FNU/NTU

5.3.1.3.35 *Hysteresis:* Within the hysteresis range, the relay does not switch. This prevents damage to the relay contacts when the measured value fluctuates around the limit.
Range: 0–1000 FNU/NTU

5.3.1.3.45 *Delay:* Waiting time before the alarm relay becomes inactive after the measured value has risen above or fallen below the programmed alarm value.
Range: 0–28800 s

5.3.1.4 TSS 1

5.3.1.4.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay becomes inactive and E005 is displayed in the message list.
Range: 0–100000 ppm

5.3.1.4.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay becomes inactive and E006 is displayed in the message list.
Range: 0–100000 ppm

5.3.1.4.35 *Hysteresis:* Within the hysteresis range, the relay does not switch. This prevents damage to the relay contacts when the measured value fluctuates around the limit.
Range: 0–10000 ppm

5.3.1.4.45 *Delay:* Waiting time before the alarm relay becomes inactive after the measured value has risen above or fallen below the programmed alarm value.
Range: 0–28800 s

5.3.1.5 TSS 2

5.3.1.5.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay becomes inactive and E007 is displayed in the message list.
Range: 0–100000 ppm

5.3.1.5.2 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay becomes inactive and E008 is displayed in the message list.
Range: 0–100000 ppm

5.3.1.5.35 *Hysteresis:* Within the hysteresis range, the relay does not switch. This prevents damage to the relay contacts when the measured value fluctuates around the limit.
Range: 0–10000 ppm

5.3.1.5.45 *Delay:* Waiting time before the alarm relay becomes inactive after the measured value has risen above or fallen below the programmed alarm value.
Range: 0–28800 s

5.3.1.6 TSS Diff.

5.3.1.6.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay becomes inactive and E039 is displayed in the message list.
Range: -100000–100000 ppm

5.3.1.6.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay becomes inactive and E040 is displayed in the message list.
Range: -100000–100000 ppm

5.3.1.6.35 *Hysteresis:* Within the hysteresis range, the relay does not switch. This prevents damage to the relay contacts when the measured value fluctuates around the limit.
Range: -100000–100000 ppm

5.3.1.6.45 *Delay:* Waiting time before the alarm relay becomes inactive after the measured value has risen above or fallen below the programmed alarm value.
Range: 0–28800 s

5.3.1.7 Sample Flow 1

5.3.1.7.1 *Flow Alarm:* Program if the alarm relay should become inactive if there is a flow alarm. The flow alarm will always be indicated on the display, in the pending error list, saved in the message list and the logger.
Range: yes or no

Note: *Sufficient flow is essential for a correct measurement. It is recommended to program yes.*

5.3.1.7.2 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay becomes inactive and E009 is displayed in the message list.
Range: 0–50 l/h

5.3.1.7.35 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay becomes inactive and E010 is displayed in the message list.
Range: 0–50 l/h

5.3.1.8 Sample Flow 2

5.3.1.8.1 *Flow Alarm:* Program if the alarm relay should become inactive if there is a flow alarm. The flow alarm will always be indicated on the display, in the pending error list, saved in the message list and the logger.
Range: yes or no

Note: *Sufficient flow is essential for a correct measurement. It is recommended to program yes.*

5.3.1.8.2 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay becomes inactive and E011 is displayed in the message list.
Range: 0–50 l/h

5.3.1.8.35 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay becomes inactive and E012 is displayed in the message list.
Range: 0–50 l/h

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

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

5.3.x Relay 1 and 2: The function of relay contacts 1 or 2 is defined by the user.

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

1 First select the functions as:

– Limit upper/lower,
– Control upwards/downwards,
– Timer
– Fieldbus

2 Then enter the necessary data depending on the selected function. The same values can also be entered in menu 4.2.

5.3.5.3.2.1 Function = Limit upper/lower

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

5.3.2.20 *Parameter:* select a process value.

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

Parameter	Range
Turbidity 1	0–10000 FNU/NTU
Turbidity 2	0–10000 FNU/NTU
Turbidity Diff.	-10000–10000 FNU/NTU
TSS 1	0–100000 ppm
TSS 2	0–100000 ppm
TSS Diff.	-10000–10000 ppm
Sample Flow 1	0–50 l/h
Sample Flow 2	0–50 l/h

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 limit.

Parameter	Range
Turbidity 1	0–1000 FNU/NTU
Turbidity 2	0–1000 FNU/NTU
Turbidity Diff.	0–1000 FNU/NTU
TSS 1	0–10000 ppm
TSS 2	0–10000 ppm
TSS Diff.	0–10000 ppm
Sample Flow 1	0–50 l/h
Sample Flow 2	0–50 l/h

5.3.2.50 *Delay:* Time by which the switching of the relay is delayed after the measured value has risen above or fallen below the programmed setpoint.
Range. 0–600 s

5.3.2.1	Function = Control upwards/downwards
	If the relays are used to control dosing units, program the following.
5.3.2.22	*Parameter:* Choose one of the following process values. ◆ Turbidity 1 ◆ Turbidity 2 ◆ Turbidity Diff. ◆ TSS 1 ◆ TSS 2 ◆ TSS Diff. ◆ Sample Flow 1 ◆ Sample Flow 2
5.3.2.32	**Settings***:* Choose the respective actuator: ◆ Time proportional ◆ Frequency
5.3.2.32.1	Actuator = Time proportional
	Dosing is controlled by the operating time.
5.3.2.32.20	*Cycle time:* Duration of one control cycle (on/off change). Range: 0–600 s.
5.3.2.32.30	*Response time:* Minimal time the dosing device needs to react. Range: 0–240 s.
5.3.2.32.4	**Control Parameters** Range for each parameter same as 5.2.1.43.
5.3.2.32.1	Actuator = Frequency
	Dosing is controlled by the repetition speed of dosing shots.
5.3.2.32.21	*Pulse frequency:* Max. pulses per minute the device is able to respond to. Range: 20–300/min.
5.3.2.32.31	**Control Parameters** Range for each parameter same as 5.2.1.43.
5.3.2.1	Function = Timer
	The relay will be activated repetitively depending on the programmed time scheme.
5.3.2.24	*Mode:* Operating mode (interval, daily, weekly).
5.3.2.24	Interval
5.3.2.340	*Interval:* The interval can be programmed within a range of 1–1440 min.
5.3.2.44	*Run Time:* Enter the time the relay stays active. Range: 5–32400 s.

5.3.2.54 *Delay:* During run time plus the delay time the signal and control outputs are held in the operating mode programmed below.
Range: 0–6000 s.

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

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

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

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

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

Cont.: Controller continues normally.

Hold: Controller continues based on the last valid value.

Off: Controller is switched off.

5.3.2.24 daily

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

5.3.2.341 *Start time:* Time of day at which the relay is activated.
Range: 00:00:00–23:59:59

5.3.2.44 *Run Time:* see Interval.

5.3.2.54 *Delay:* see Interval.

5.3.2.6 *Signal Outputs:* see Interval.

5.3.2.7 *Output/Control:* see Interval.

5.3.2.24 weekly

The relay contact can be activated on one or several days of a week.

5.3.2.342 Calendar

5.3.2.342.1 *Start time:* The programmed start time is valid for each of the programmed days.
Range: 00:00:00–23:59:59

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

5.3.2.342.8 *Sunday:* Possible settings, on or off.

5.3.2.44 *Run Time:* see Interval.

5.3.2.54 *Delay:* see Interval.

5.3.2.6 *Signal Outputs:* see Interval.

5.3.2.7 *Output/Control:* see Interval.

5.3.2.1 Function = Fieldbus

The relay is switched via Profibus or Modbus. No further parameters are needed.

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

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

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

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

Continuous:	Signal outputs continue to issue the measured value.
Hold:	Signal outputs hold the last valid measured value. Errors, except fatal errors, are not issued.
Off:	Sets the signal outputs to 0 or 4 mA. Errors, except fatal errors, are not issued.

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

Continuous:	Controller continues normally.
Hold:	Controller continues based 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 become inactive when the input is active. Message E024 is stored in the message list.
Yes:	Message E024 is issued and stored in the message list and the alarm relay becomes inactive when the input is active.

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

5.4 Miscellaneous

5.4.1 *Language:* Set the required language.
The choice of languages depends on the installed language pack:
- LP0 (Europe-1): German, English, French, Spanish
- LP1 (Asia-1): Chinese, English

5.4.2 *Set defaults:* Reset the instrument to factory default values in three different ways:
- **Calibration:** Sets calibration values back to default. All other values are kept in memory.
- **In parts:** Communication parameters are kept in memory. All other values are set back to default values.
- **Completely:** Sets back all values including communication parameters.

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

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

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

5.5 Interface

Select one of the following communication protocols.

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: 1 200–115 200 Baud
5.5.41	Parity:	Range: none, even, odd

5.5.1 *Protocol:* **HART**

	Device address:	Range: 0–63

10. Default Values

Operation

Sensors	Filter Time Const.: 30 s
	Hold after Cal.: 300 s
	Hold after Dark: 30 s
Relay Contacts	Alarm Relay: same as in Installation
	Relay 1/2: same as in Installation
	Input: same as in Installation
Logger	Logger Interval: 30 min
	Clear Logger: no
Display	Screen 1 and 2; Row 1: Turbidity 1
	Screen 1 and 2; Row 2: None
	Screen 1 and 2; Row 3: None

Installation

Sensors	Settings: Dual Turbisafe: no
	Settings: Dimension: FNU
	Turbisafe 1/2: Device Data: TS Name: Turbisafe
	Flow 1: Flow measurement 1: none
	Flow 2: Flow measurement 2: none
	Cleaning (if a cleaning module is installed) none
Signal Output 1	Parameter: Turbidity 1
	Current loop: 4 –20 mA
	Function: linear
	Scaling: Range low: 0.000 FNU
	Scaling: Range high: 100 FNU
Signal Output 2	Parameter: Turbidity 1
	Current loop: 4 –20 mA
	Function: linear
	Scaling: Range low: 0.000 FNU
	Scaling: Range high: 100 FNU
Alarm Relay	Alarm: Turbidity 1: Alarm high: 100 FNU
	Alarm: Turbidity 1: Alarm low: 0.000 FNU
	Alarm: Turbidity 1: Hysteresis: 1.00 FNU
	Alarm: Turbidity 1: Delay: 5 s
	Alarm: Turbidity 2: Alarm high: 100 FNU
	Alarm: Turbidity 2: Alarm low: 0.000 FNU
	Alarm: Turbidity 2: Hysteresis: 1.00 FNU
	Alarm: Turbidity 2: Delay: 5 s
	Alarm: Turbidity Diff.: Alarm high: 100 FNU

Alarm: Turbidity Diff: Alarm low: 0.000 FNU
Alarm: Turbidity Diff: Hysteresis: 1.00 FNU
Alarm: Turbidity Diff: Delay: 5 s
Alarm: TSS 1: Alarm high: 1000 ppm
Alarm: TSS 1: Alarm low: 0.000 ppm
Alarm: TSS 1: Hysteresis: 100 ppm
Alarm: TSS 1: Delay: 5 s
Alarm: TSS 2: Alarm high: 1000 ppm
Alarm: TSS 2: Alarm low: 0.000 ppm
Alarm: TSS 2: Hysteresis: 100 ppm
Alarm: TSS 2: Delay: 5 s
Alarm: TSS Diff.: Alarm high: 1000 ppm
Alarm: TSS Diff: Alarm low: 0.000 ppm
Alarm: TSS Diff: Hysteresis: 100 ppm
Alarm: TSS Diff: Delay: 5 s
Case temp.: Case temp. high: 65 °C
Case temp.: Case temp. low: 0 °C

Relay 1/2

Function: limit upper
Parameter: Turbidity 1
Setpoint: 10.0 FNU
Hysteresis: 1.00 FNU
Delay: 30 s

If Function = Control upw. or dnw:

Parameter: Turbidity 1
Settings: Actuator: Frequency
Settings: Pulse Frequency: 120/min
Settings: Control Parameters: Setpoint: 10.0 FNU
Settings: Control Parameters: P-band: 1.00 FNU
Settings: Control Parameters: Reset time: 0 s
Settings: Control Parameters: Derivative Time: 0 s
Settings: Control Parameters: Control Timeout: 0 min
Settings: Actuator: Time proportional
Cycle time: 60 s
Response time: 10 s

If Function = Timer:

Mode: Interval
Interval: 1 min
Mode: daily
Start time: 00.00.00
Mode: weekly
Calendar; Start time: 00.00.00
Calendar; Monday to Sunday: Off

	Run time:	10 s
	Delay:	5 s
	Signal output:	cont
	Output/Control:	cont
Input	Active	when closed
	Signal Outputs	hold
	Output/Control	off
	Fault	no
	Delay	10 s
Miscellaneous	Language:	English
	Set default:	no
	Load firmware:	no
	Password:	for all modes 0000
	Sample ID:	- - - - - - - -

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ANALYTICAL INSTRUMENTS

A-96.210.281 / 2026-08-26

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AMI-II Turbisafe