ANALYTICAL INSTRUMENTS

A-96.250.131 / 130421

Operator's Manual

Firmware V6.24 and higher

SWISS MADE

AMI Turbitrace

Customer Support

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Table of Content

AMI Turbitrace–Operator's Manual

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

1. Safety Instructions

General

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

Target audience

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

OM Location

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

Qualification, Training

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

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

1.1. Warning Notices

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

DANGER

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

- Follow the prevention instructions carefully.

WARNING

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

- Follow the prevention instructions carefully.

CAUTION

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

- Follow the prevention instructions carefully.

Mandatory Signs

The mandatory signs in this manual have the following meaning:

Safety goggles

Safety gloves

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


Electrical shock hazard


Corrosive


Harmful to health


Flammable


Warning general


Attention general

1.2. General Safety Regulations

Legal Requirements

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

Spare Parts and Disposables

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

Modifications

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

WARNING

Electrical Shock Hazard

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

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

WARNING

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

WARNING

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

2. Product Description

Application

The AMI Turbitrace is used for the measurement of low level turbidity in pure and ultra pure water.

Measuring Principle

Turbidity is a measure of how much of the light traveling through water is scattered by suspended particles. The scattering of light increases with increasing suspended solid. The intensity of light scattered at 90° as a beam of light passes through a water sample is measured and indicates turbidity of the sample.

Signal Outputs

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

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

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

Relay

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

Maximum load: 1 A / 250 VAC

Alarm Relay

One potential free contact.

Alternatively:

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

Summary alarm indication for programmable alarm values and instrument faults.

Input

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

Safety Features

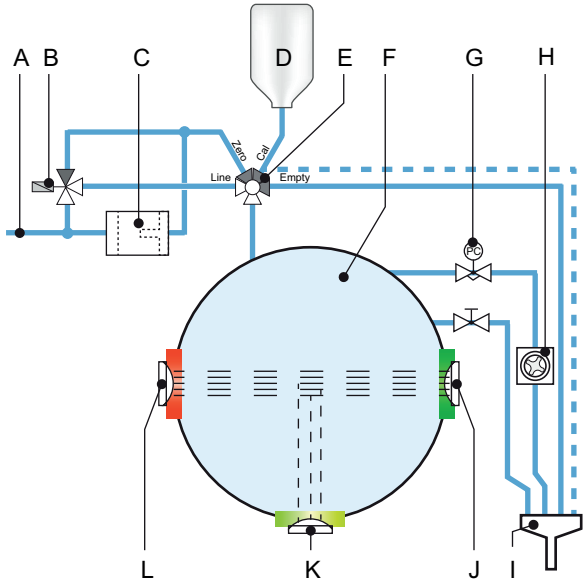
No data loss after power failure. All data is saved in non-volatile memory. Over voltage protection of in- and outputs.Galvanic separation of measuring inputs and signal outputs.

Communication Interface (optional)

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

Measuring Principle

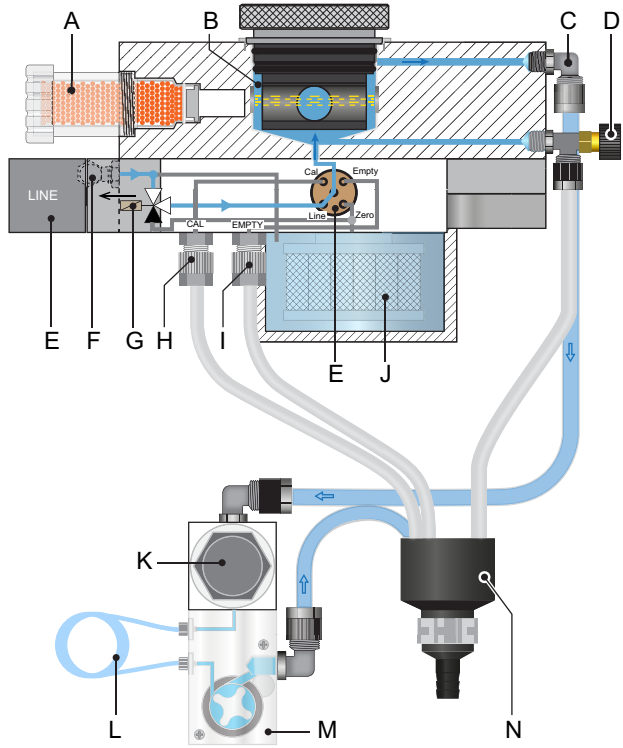
The light beam emitted by the emitter LED [L] passes through the sample and is received by the transmitted light beam sensor [J]. Some light will be scattered by particles contained in the sample and received by the scattered light sensor [K], which is placed in a 90° angle to the emitter LED. The ratio between the signal strength of the signal receiver and the reference receiver is a measure for the turbidity of the sample.



A *Sample inlet*
B *3 way solenoid valve*
C *Zero point filter*
D *Calibration or grab sample*
E *Manual 5 way valve*
F *Flow cell*
G *Pressure regulator valve*
H *Flow meter*
I *Waste funnel*
J *Transmitted light beam sensor*
K *Scattered light sensor*
L *Emitter LED*

On-line Operation

The sample flows through the sample inlet [F] via solenoid valve [G] and the manual 5 way valve [E] into the measuring chamber [B], where the turbidity is measured. From there it flows through the sample outlet [C] and the pressure regulator [K]. The pressure regulator is used to regulate the sample flow. Then the sample flows via capillary [L] and flow meter [M] into the drain funnel [N].
To keep the measuring chamber clean and free from deposits it can be cleaned by opening the drain valve [D].



A *Humidity absorber*
B *Measuring chamber*
C *Sample outlet*
D *Drain valve*
E *Manual 5 way valve*
F *Sample inlet*
G *Solenoid valve*
H *Calibration inlet*
I *Manual outlet*
J *Zero point filter*
K *Pressure regulator valve*
L *Capillary*
M *Flow meter*
N *Drain funnel*

2.1. Instrument Specification

Power Supply	AC variant:	100–240 VAC (± 10%) 50/60 Hz (± 5%)
	DC variant	10–36 VDC
	Power consumption:	max. 35 VA
Transmitter specifications	Housing:	aluminum, with a protection degree of IP 66 / NEMA 4X
	Ambient temperature:	−10 to +50 °C
	Storage and transport:	−30 to +85 °C
	Humidity:	10–90 % rel., non condensing
	Display:	backlit LCD, 75 x 45 mm
Sample requirements	Flow rate:	5–20 l/h
	Temperature:	1–40 °C
	Inlet pressure	1–10 bar
	Outlet pressure:	pressure free

CAUTION

The measuring chamber is under the pressure of the sample line

If the inlet pressure is too high, moisture can enter the housing of the measuring electronics and lead to incorrect measurements and failure of the instrument.

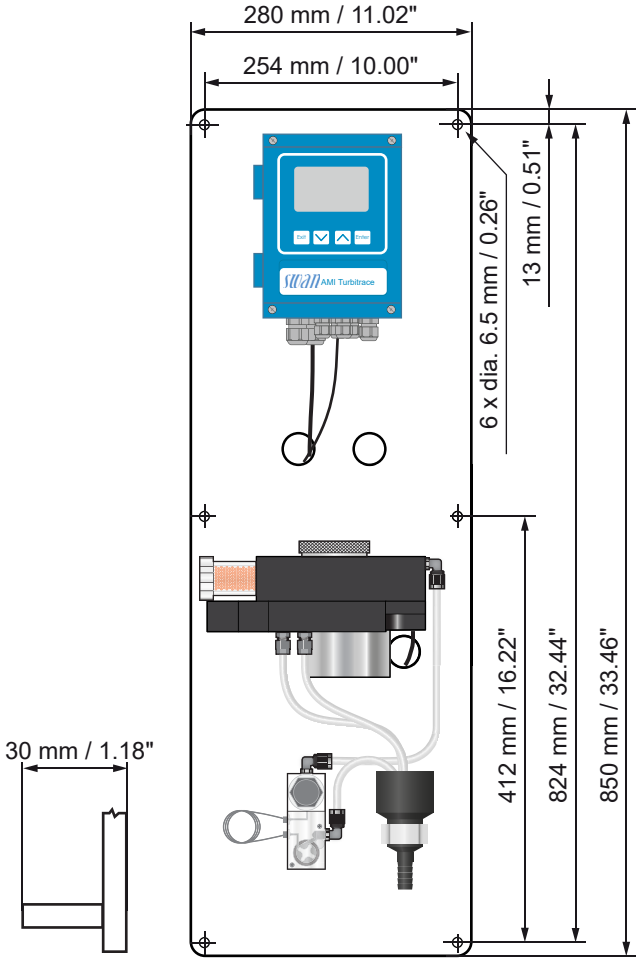
- The maximum inlet pressure of 10 bar must never be exceeded, not even for short time periods. Take appropriate measures to protect the instrument from pressure surges in the sample line.

On-site requirements	The analyzer site must permit connections to:	
	Sample inlet:	Serto 4x6 mm
	Sample outlet:	Hose nozzle, 15x20 mm

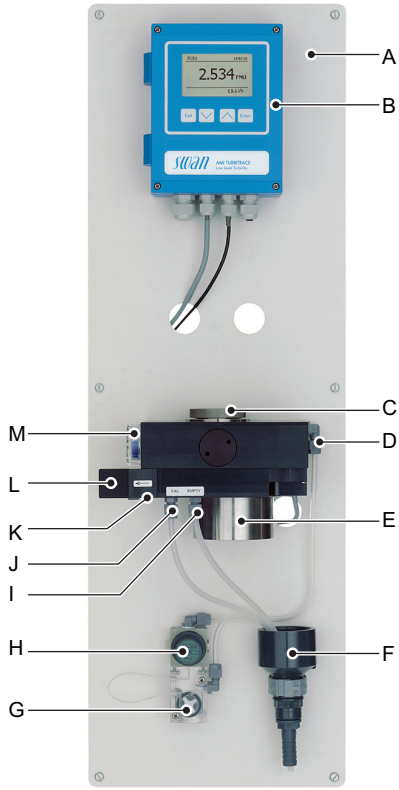
Turbidimeter Specifications	Instrument type:	High precision nephelometer complying with ISO 7027(EN 27027, DIN 38404)
	Measuring range:	0.000–100.0 FNU/NTU
	Precision:	±0.001 FNU/NTU or 1% of reading (whichever is greater)
	Response Time:	t_{90} typically <15 sec (after sample entry at 10 l/h)
	Calibration:	Factory calibrated with formazine
	Verification kit (optional):	Zero point; approx. 0 FNU

Dimensions

Panel:	PVC
Dimensions:	280 x 850 x 200 mm
Screws:	6 piece, 5 or 6 mm diameter
Weight:	9 kg



2.2. Instrument Overview



A *Panel*
B *Transmitter*
C *Cover measuring chamber*
D *Sample outlet*
E *Zero point filter*
F *Drain funnel*
G *Flow meter*
H *Pressure regulator valve*
I *Manual measuring cell drain*
J *Calibration solution inlet*
K *Sample inlet*
L *5/4-way manual valve*
M *Humidity Absorber*

3. Installation

3.1. Installation and Setup Check List

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 a flow rate of 5–20 l/h and a maximum pressure of 10 bar. ***Note:*** *The maximum inlet pressure of 10 bar must never be exceeded, not even for short time periods. Protect the instrument from pressure surges in the sample line.* Waste line with pressure free drain.
Installation	Install the AMI Monitor, p. 17. Connect Sample and Waste, p. 18.
Electrical Wiring	Connect all external devices like limit switches, current loops and pumps, see Connection Diagram, p. 23. Connect power cord, see Power Supply, p. 24.
Power-up	Establish Sample Flow, p. 31, wait until the measuring chamber is completely filled. Switch on power.
Instrument Setup	Program all parameters for external devices (interface, etc.). Program all parameters for instrument operation (limits, alarms)
Run-in time	Let the instrument run at least for 2 hours, better overnight to rinse out any pollution from transport and manufacturing.
Verification	Never perform a verification before the run-in time is over and before the measuring value is stable. A verification may be done to prove the instrument functions.

3.2. Install the AMI Monitor

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

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

Mounting requirements

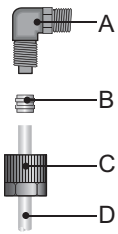
The instrument is only intended for indoor installation. For dimensions see figure Dimensions, p. 14.

3.3. Connect Sample and Waste

3.3.1 Connect Sample Inlet

Use plastic tube (FEP, PA, or PE 4x6 mm) to connect the sample line.

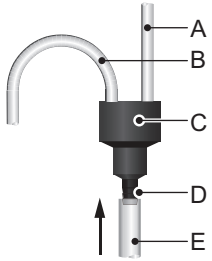
Mounting of SERTO fitting



A *Serto fitting*
B *Compression ferrule*
C *Knurled nut*
D *Flexible tube*

Push the flexible tube [A] into the Serto fitting [D] and tighten the knurled nut [B].

3.3.2 Connect Sample Outlet



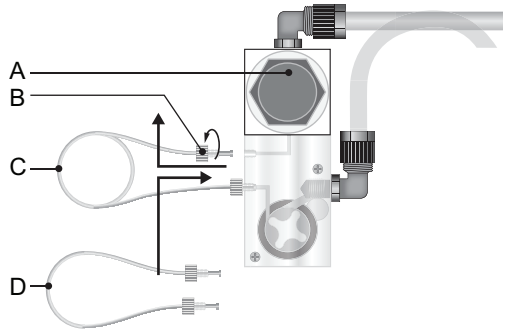
A *Tube from drain valve*
B *Sample outlet*
C *Drain funnel*
D *Hose nozzle*
E *1/2” tube*

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

3.3.3 Adjust the Sample Flow with a Capillary Tube

The AMI Turbitrace is as standard delivered with the capillary FEP tube with an inner diameter of 1 mm and a length of 500 mm.

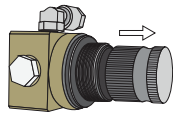
If you have a low sample pressure or you need a high sample flow, a shorter capillary with 186 mm length can be used.



A *Pressure regulator valve*
B *Tube fitting*
C *500 mm capillary*
D *186 mm capillary*

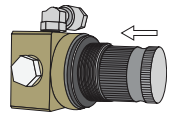
To replace the capillary proceed as follows:

1 Pull out the knob of the pressure regulator valve [A].



2 Close the valve.

3 Push in the knob to lock the valve in closed position.



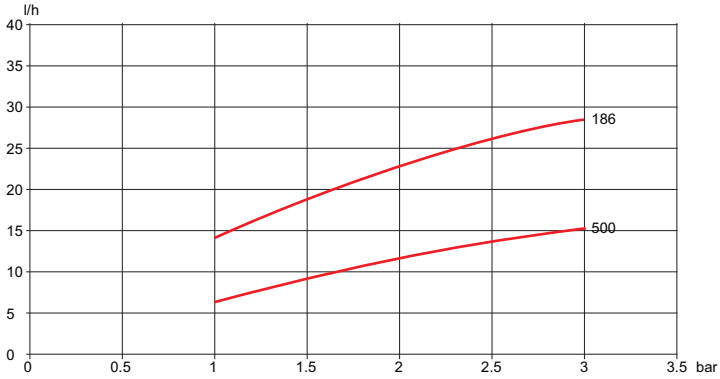
4 Unscrew and remove the tube fittings [B] of the capillary [C].

5 Then screw in the tube fittings of the 186 mm capillary.

6 Tighten them well.

7 Open the pressure regulator valve.

The capillary tube determines the flow resistance and the maximal flow rate. With the pressure regulator at the inlet side of the capillary the flow rate can be adjusted within the given range, see diagram below.
The standard capillary is an FEP tube with an inner diameter of 1 mm and length of 500 mm. If you have a low sample pressure or you need a high sample flow, a shorter capillary with 186 mm length can be used.



3.4. Electrical Connections

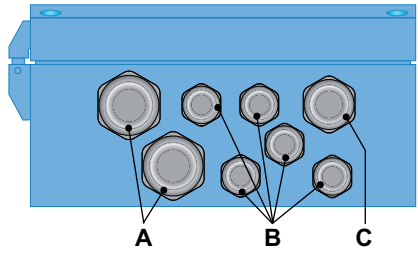
WARNING

Electrical hazard.

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

Cable thicknesses

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



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

Note: *Protect unused cable glands*

Wire

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

WARNING

External Voltage.

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

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

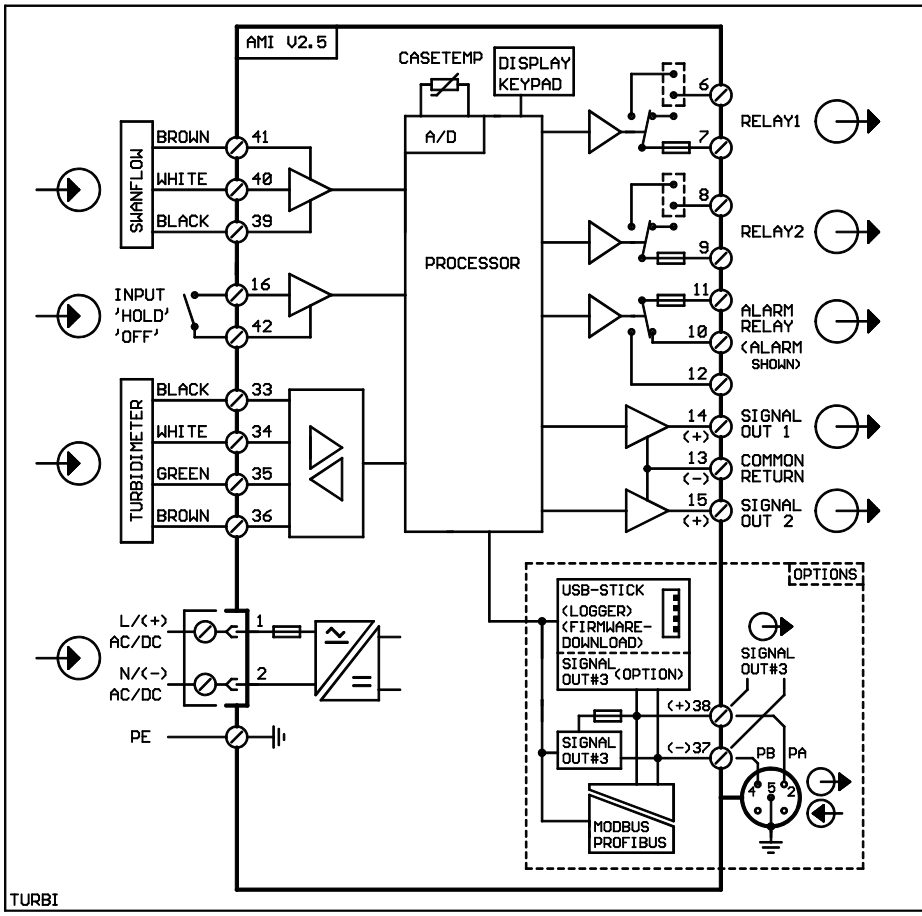
WARNING

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

WARNING

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

3.5. Connection Diagram



CAUTION

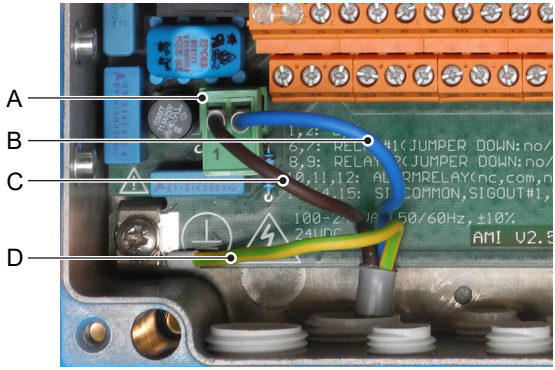
Use only the terminals shown in this diagram, and only for the mentioned purpose. Use of any other terminals will cause short circuits with possible corresponding consequences to material and personnel.

3.6. Power Supply

WARNING

Risk of electrical shock

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



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

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

Installation requirements

The installation must meet the following requirements.

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

3.7. Relay Contacts

3.7.1 Input

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

Terminals 16/42

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

For programming see menu 5.3.4, p. 72

3.7.2 Alarm Relay

Programming of the relay contacts see 5.3 Relay Contacts, p. 67

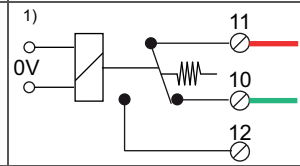
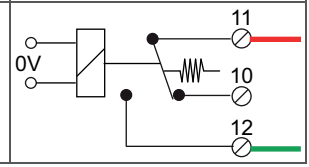
Note: *Max. load1 A T / 250 VAC*

Alarm output for system errors.

Error codes see Troubleshooting, p. 50

Programming see menu 5.3.1, p. 67

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

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

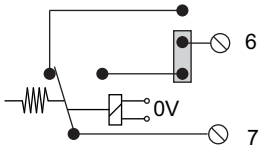
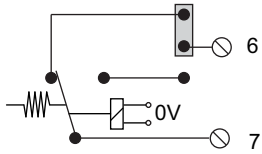
1) *usual use*

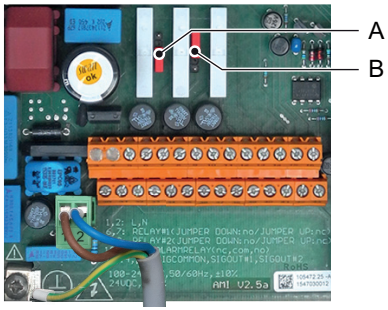
3.7.3 Relay Contacts 1 and 2

Note: *Rated load 1 AT / 250 VAC*

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

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

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



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

For programming see Menu Installation 5.3.2 & 5.3.3, p. 69

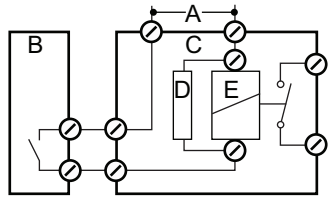
CAUTION

Risk of damage of the relays in the AMI Transmitter due to heavy inductive load.
Heavy inductive or directly controlled loads (solenoid valves, dosing pumps) may destroy the relay contacts.

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

Inductive load

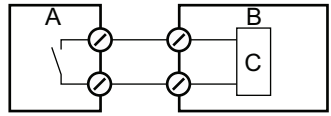
Small inductive loads (max 0.1 A) as for example the coil of a power relay can be switched directly. To avoid noise voltage in the AMI Transmitter it is mandatory to connect a snubber circuit in parallel to the load. A snubber is not necessary if an AMI relaybox is used.



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

Resistive load

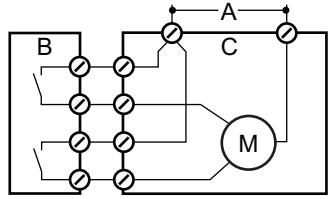
Resistive loads (max. 1 A) and control signals for PLC, impulse pumps and so on can be connected without further measures



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

Actuators

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



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

3.8. Signal Outputs

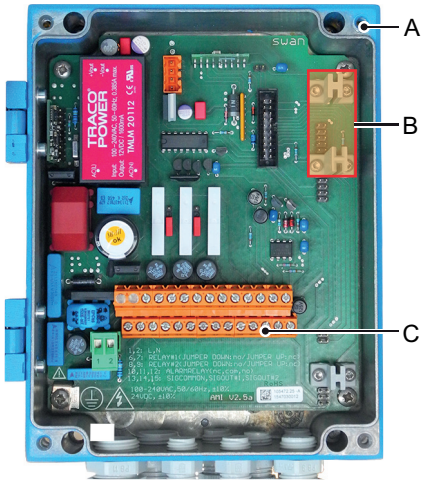
3.8.1 Signal Output 1 and 2 (current outputs)

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

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

For programming see Program List and Explanations, p. 59, menu installation.

3.9. Interface Options



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

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

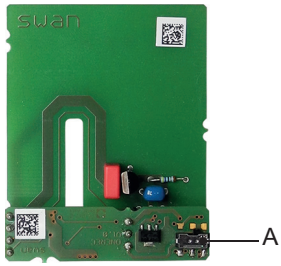
- a third signal output
- a Profibus or Modbus connection
- a HART connection
- a USB Interface

3.9.1 Signal Output 3

Terminals 38 (+) and 37 (-).

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

Note: *Max. burden 510 Ω.*



Third signal output 0/4 - 20 mA PCB

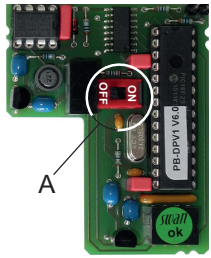
A *Operating mode selector switch*

3.9.2 Profibus, Modbus Interface

Terminal 37 PB, Terminal 38 PA

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

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



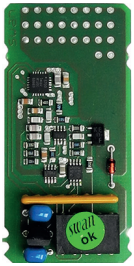
Profibus, Modbus Interface PCB (RS 485)

A *On - OFF switch*

3.9.3 HART Interface

Terminals 38 (+) and 37 (-).

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

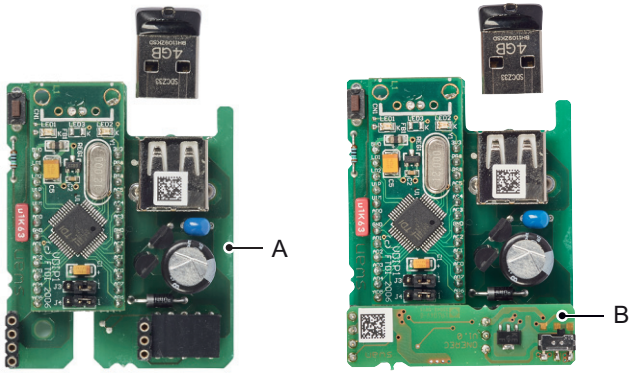


HART Interface PCB

3.9.4 USB Interface

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

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



USB Interface

A *USB interface PCB*

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

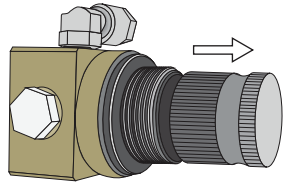
4. Instrument Setup

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

4.1. Establish Sample Flow

Note: *The pressure regulator valve only works if the inlet pressure at the main flow control valve is 0.5 bar higher than the outlet pressure. The 500 mm capillary tube reduces the pressure by a further 0.5 bar. Therefore, the pressure within the sample tube must be at least 1 bar, or better 1.5 bar.*
Periodic pressure variations in the sample tube can cause pulsations of the pressure regulator valve. This can be eliminated by using a pulsation attenuator in the inlet tube.

1 Pull out the adjusting knob of the pressure regulator valve and open the valve.

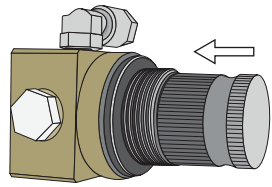


2 Wait until the measuring chamber is full and the sample flows via overflow into the waste.

3 Switch on power.
⇒ *First, the analyzer performs a self test, displays the firmware version and then starts normal operation.*

4 Regulate the sample flow with the pressure regulator valve to 6–18 l/h.
⇒ *The sample flow (in l/h) is shown on the transmitter display.*

5 Push in the adjusting knob to lock the valve.



4.2. Programming

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

4.3. Run-in Period

To assure correct measurement, run the instrument at least for 2 hours, better overnight to rinse out any pollution from transport and manufacturing and to adjust the temperature of the sample and the instrument.

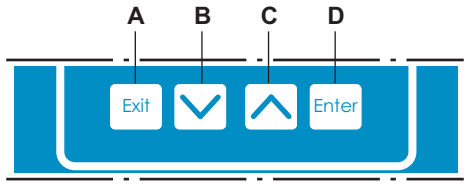
CAUTION

Wrong measured values caused by air bubbles in the sample.

- Assure that the sample does not contain any air bubbles.
- If the sample contains air bubbles, let the instrument run in for some time so that the air bubbles can escape from the sample.
- Pressurized gas can cause an explosion.

5. Operation

5.1. Function of the Keys



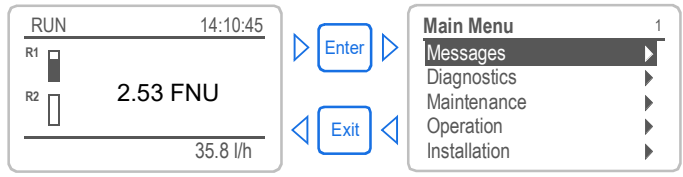
A to exit a menu or command (rejecting any changes) to move back to the previous menu level

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

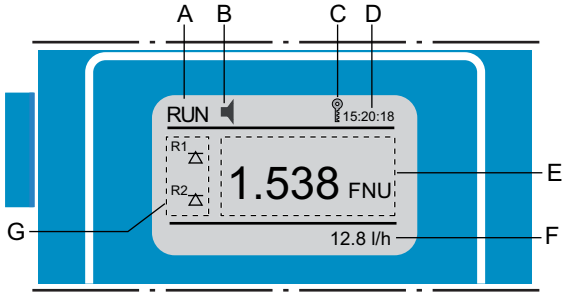
C to move UP in a menu list and to increase digits

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

Program Access, Exit



5.2. Measured Values and Symbols on the Display



A RUN — normal operation

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

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

B ERROR — Error — Fatal Error

C Transmitter control via Profibus

D Time

E Process values

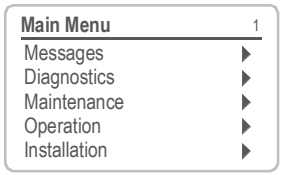
F Sample flow

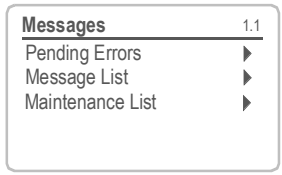
G Relay status

Relay status, symbols

- upper/lower limit not yet reached
- upper/lower limit reached
- control upw./downw. no action
- control upw./downw. active, dark bar indicates control intensity
- motor valve closed
- motor valve: open, dark bar indicates approx. position
- timer
- timer: timing active (hand rotating)

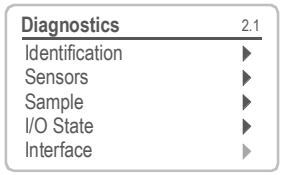
5.3. Software Structure





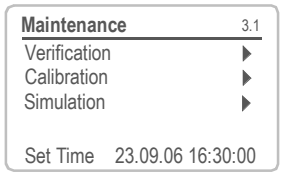
Menu **Messages 1**

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



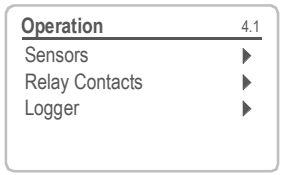
Menu **Diagnostics 2**

Provides user relevant instrument and sample data.



Menu **Maintenance 3**

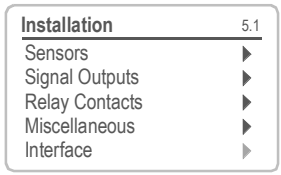
For instrument calibration, relay and signal output simulation, and to set the instrument time.
It is used by the service personnel.



Menu **Operation 4**

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

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



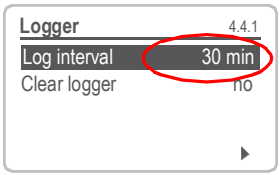
Menu **Installation 5**

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

5.4. Changing Parameters and Values

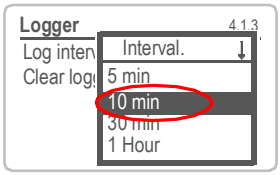
Changing parameters

The following example shows how to change the logger interval:



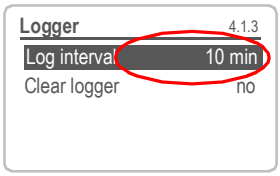
1 Select the parameter you want to change.

2 Press [Enter]



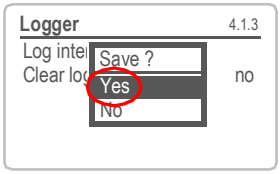
3 Press [▲] or [▼] key to highlight the required parameter.

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



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

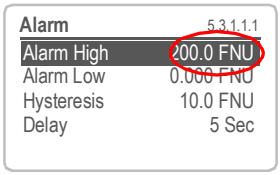
5 Press [Exit].



⇒ *Yes is highlighted.*

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

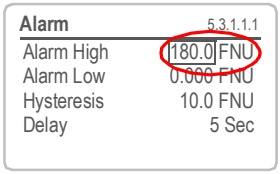
Changing values



1 Select the value you want to change.

2 Press [Enter].

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



4 Press [Enter] to confirm the new value.

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

6 Press [Enter] to save the new value.

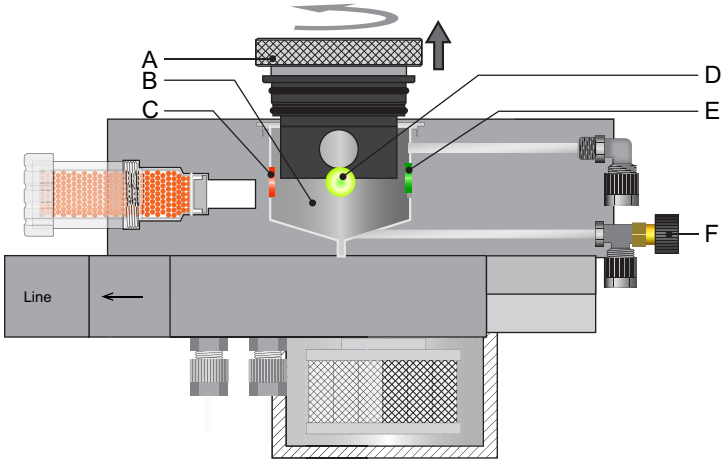
6. Maintenance

6.1. Maintenance Schedule

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

Every week	Check sample flow.
If necessary	Clean the measuring chamber. Replace the 0-point filter
When maintenance message E068 appears	Replace the humidity absorber. *Recommendation:* When replacing the humidity absorber, check also the O-ring of the bayonet lock cover and replace it if necessary.

6.2. Cleaning the Measuring Chamber



A *Bayonet lock cover*
B *Measuring chamber*
C *Emitter LED*
D *Scattered light sensor*
E *Transmitted light beam sensor*
F *Drain valve*

Cleaning

To clean the measuring chamber proceed as follows:

1 Close the pressure regulator valve to stop the sample flow.

2 Open the drain valve [F] to empty the flow cell.

3 Turn the cover [A] out of the bayonet connection and remove it from the measuring chamber [B].

4 Clean the measuring chamber using a clean, soft tissue.

5 Clean the optical elements [C], [D] and [E] with another soft, clean tissue.

6 Close the measuring chamber with the cover.

7 Close the drain valve.

8 Open the pressure regulator valve.

6.3. Replacing the Humidity Absorber

Dew point calculation

The instrument continuously measures the humidity and temperature inside the turbidimeter housing and calculates the dew point based on these values. The dew point gives an indication of whether the humidity absorber still has sufficient capacity to prevent condensation inside the housing.

The dew point is visible in menu <Diagnostics>/<Sensors>/<Miscellaneous>.

When to replace the humidity absorber

The user is automatically prompted to replace the humidity absorber when the dew point exceeds the following limits:

- If the dew point is 3 °C or higher, maintenance message E068 “Replace absorber” appears. The instrument continues to measure normally, but the humidity absorber should be replaced as soon as possible.
- If the dew point is 5 °C or higher, error message E006 “Absorber exhausted” appears. The instrument stops measuring and the humidity absorber must be replaced immediately.

CAUTION

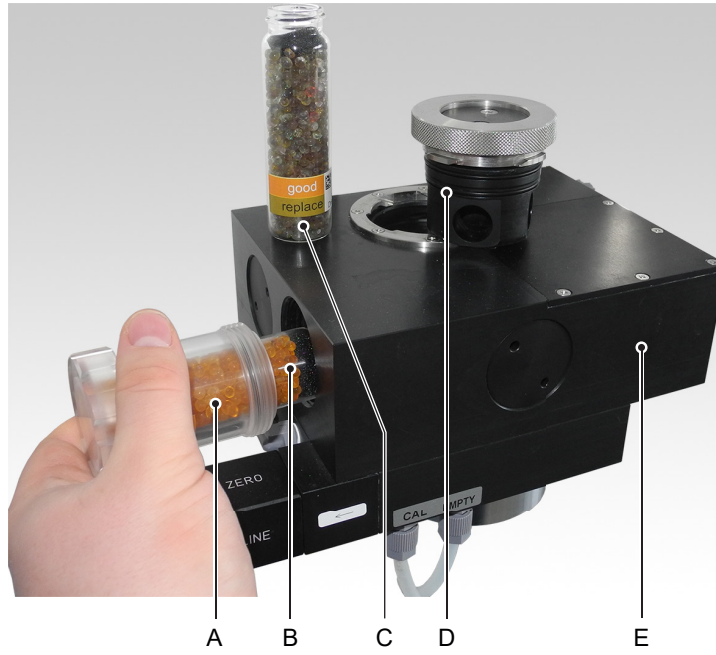
If the humidity absorber is not replaced in time, condensation may occur inside the housing.

This condensation can lead to incorrect measurements and failure of the instrument.

- Replace the humidity absorber when prompted.

Note: *The color indicator of the humidity absorber is no longer relevant for newer instruments with dew point calculation.*

Replacement procedure



A *Screw cover*
B *New humidity absorber flask*
C *Saturated humidity absorber*
D *Bayonet lock cover with o-ring*
E *Turbidimeter housing*

To replace the humidity absorber proceed as follows:

1 Select <Maintenance>/<Replace Absorber> and confirm with [Enter].

⇒ *This makes the two messages E068 and E006 disappear for three days.*

2 Unscrew and remove the screw cover [A] from the measuring cell [E].

3 Pull the flask [C] containing the saturated humidity absorber out of the screw cover.

4 Remove the cover of the new humidity absorber flask [B].

5 Push the new humidity absorber flask into the screw cover.

6 Screw the screw cover with the new humidity absorber flask into the measuring cell.

7 Tighten it well.

Note: *After replacing the humidity absorber, the dew point decreases only slowly. It may take several days until the dew point is below 3 °C again.*

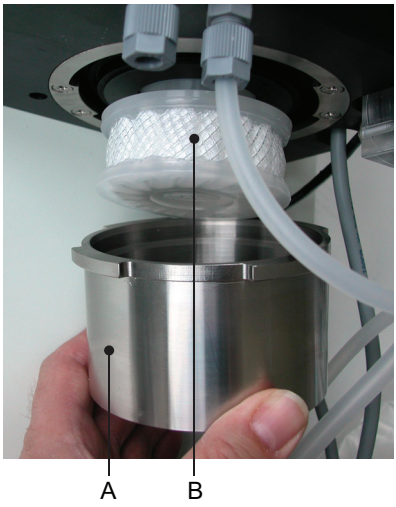
Check O-ring

When replacing the humidity absorber, also check the bayonet lock cover for leaks.

1 Remove the bayonet lock cover and check the O-ring for damage.

2 Replace the O-ring if it is damaged.

6.4. Replacing the Zero Point Filter

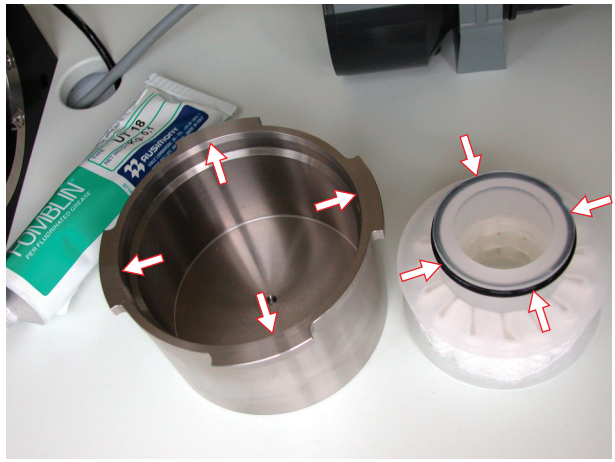


A *Filter cover*
B *Zero point filter*

1 Stop sample flow.

2 Turn the filter cover [A] out of the bayonet connection and remove it from the measuring chamber.

3 Pull out the zero-point filter.



4 Apply a thin film of PTFE grease to sealing surface of filter shell and to zero-point filter O-ring.

5 Insert the zero-point filter.

6 Turn the filter cover [A] into the bayonet connection.

7 Open the sample flow.

6.5. Verification

The following two test units are available:

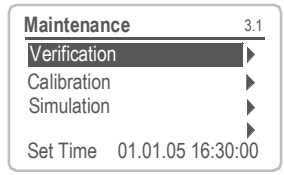
- Verification kit Turbi Zero (~ 0 FNU)
- Verification kit Turbi Low (~ 5 FNU)

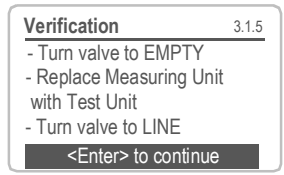
The test unit consists of a cover with a bayonet lock and a cylinder with 3 plain areas on it. The plain areas are arranged at an angle of 90°.

The test unit is calibrated for a sample temperature of 25 °C. If your sample has a temperature other than 25 °C, you have to measure the sample temperature externally and convert the nominal value to the corresponding temperature. The variation is +0.3 to + 0.4 % per °C. That means, the lower the temperature, the smaller the scattering.

If the deviation of the measured value is larger than ±10 % compared to the nominal value of the test unit, try again. If the deviation is again too large, clean the measuring chamber, see Cleaning the Measuring Chamber, p. 38.

To start a verification proceed as follows:

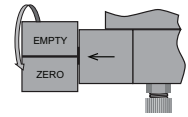




1 Navigate to menu <Maintenance>/ <Verification> and press [Enter].

2 Stop sample flow.

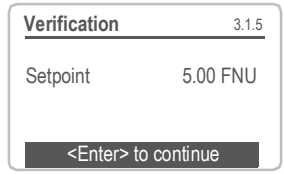
3 Empty measuring chamber by turning the manual 5/4 valve to EMPTY.



4 Open the measuring chamber.

5 Insert the test unit into the measurement chamber.

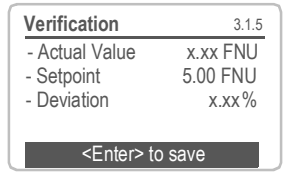
6 Turn the manual 5/4 valve to LINE and start sample flow.



7 Press [Enter].
⇒ *Setpoint is displayed.*

8 Press [Enter].

9 Enter the setpoint printed on the label of the test unit with the [▲] or [▼] key.



10 Press [Enter] to confirm.
The verification is running now.
If the deviation is within ± 10%, press [Enter] to save the value.

Error message: Deviation too big
If the value is lower or higher than ±10%, proceed as follows:

- Check the sample temperature and if necessary adjust it.
- Clean the measuring chamber.

6.6. Cleaning the Test Unit

Note: *To avoid scratches on the surface of the test unit do not use scrubbing materials.*

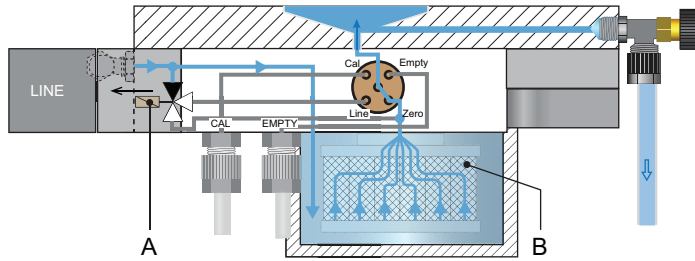
After each verification dry the test unit with a soft, clean tissue.

6.7. Calibration

The AMI Turbitrace is factory calibrated with formazine and does not require a recalibration. With this calibration the zero-point is set, to compensate the signal drift due to a film building on the measuring cell window.
For this purpose, the solenoid valve [A] is switched over and the sample is led through the zero point filter [B].

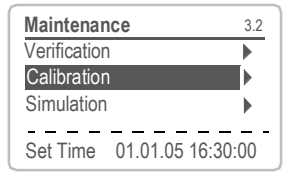
Note: *When measuring turbidity in pure and ultrapure water it is important to start a zero-point calibration periodically. This has very little influence on the slope.*

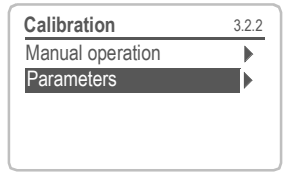
Calibration flow

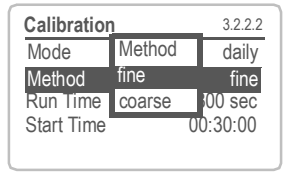


Manual calibration

A calibration can be started manually or automatically.To start a manual calibration proceed as follows:



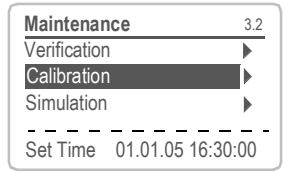




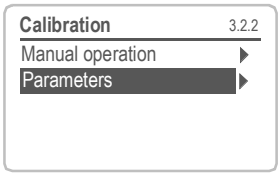
1. Navigate to menu <Maintenance>/ <Calibration>.
2. Press [Enter].
3. Select <Parameters>.
4. Press [Enter].
5. Select <Method>.
   ⇒ *If measuring turbidity in pure and ultrapure water, set method to <fine>. For measuring turbidity >0.5 FNU set method to <coarse>.*
6. Press [Enter], then press [Exit
7. Select <Yes> to confirm.
8. Press [Enter]
9. Select <Manual operation>
10. Press [Enter]
    ⇒ *The calibration starts.*

Automatic calibration

To program an automatic calibration proceed as follows:

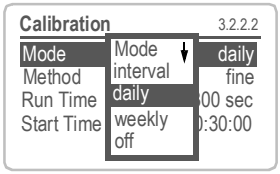


1. Navigate to menu <Maintenance>/ <Calibration>.
2. Press [Enter].



3 Select <Parameters>.

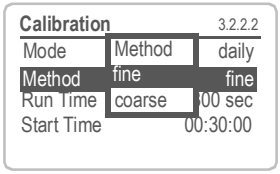
4 Press [Enter].



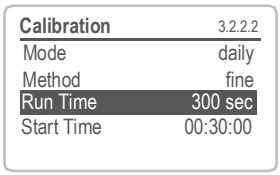
5 Select <Mode> and press [Enter].

6 Select the <Mode> according your requirements.
⇒ *Additionally, the Modes <Input> and <Fieldbus> are available which you can chose by scrolling down with the* [▼] key.

7 Select <Yes> to confirm.



8 Select <Method>.
⇒ *If measuring turbidity in pure and ultrapure water, set method to <fine>. For measuring turbidity > 0.5 FNU set method to <coarse>.*



9 Select <Run time> and set it according your requirements.

10 Depending on your settings set the interval or the start time.

6.8. Longer Stop of Operation

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

If water hardness is very high, lime deposition may precipitate.

1. Stop sample flow.
2. Switch off power.
3. Empty measuring chamber by turning the manual 5/4 valve to EMPTY.
4. If necessary clean the measuring chamber (see Cleaning the Measuring Chamber, p. 38)

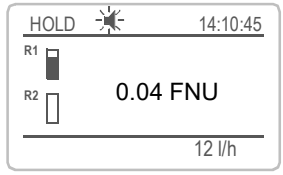
7. Troubleshooting

7.1. Error List

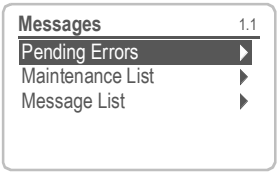
Error
Non-fatal Error. Indicates an alarm if a programmed value is exceeded.
Such Errors are marked **E0xx** (bold and black).

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

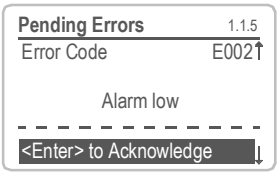
- Errors which disappear if correct measuring conditions are recovered (i.e. Sample Flow low).
  Such Errors are marked **E0xx** (bold and orange)
- Errors which indicate a hardware failure of the instrument.
  Such Errors are marked **E0xx** (bold and red)



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



Navigate to <Messages>/ <Pending Errors>



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

Error	Description	Corrective action
E001	Alarm high	– check process – check programmed value 5.3.1.1.1, p. 68
E002	Alarm low	– check process – check programmed value 5.3.1.1.25, p. 68
E005	Range	– turbidity out of range – disappears if measuring chamber is filled
E006	Absorber exhausted (dew point inside the turbidimeter housing is 5 °C or higher)	– call the <Maintenance>/<Replace Absorber> menu item. – replace the humidity absorber, see Replacing the Humidity Absorber, p. 40 – if the error appears again after a few days, proceed as follows: ◆ make sure that a new, unused humidity absorber has been installed. ◆ call the <Replace Absorber> function again and wait for another three days. During this time, observe the dew point and make sure that it decreases. ◆ if the dew point does not decrease, call service.
E009	Sample Flow high	– check sample flow – check programmed value 5.3.1.2.2, p. 68
E010	Sample Flow low	– check inlet pressure – re-adjust the sample flow – clean instrument – check programmed value 5.3.1.2.31, p. 68
E013	Case Temp. high	– check case/environment temperature – check programmed value 5.3.1.4, p. 68

Error	Description	Corrective action
E014	Case Temp. low	– check case/environment temperature – check programmed value 5.3.1.5, p. 68
E017	Control Timeout	– check control device or programming in Installation, Relay contact, Relay 1 & 2 5.3.2 & 5.3.3, p. 69
E018	Turbi disconnected	– shut off power – check wiring
E024	Input active	– See If Fault Yes is programmed in Menu 5.3.4, p. 72
E026	IC LM75	– call service
E028	Signal output open	– check wiring on signal outputs 1 and 2
E030	EEProm Frontend	– call service
E031	Calibration Recout	– call service
E032	Wrong Frontend	– call service
E033	Power-on	– none, normal status
E034	Power-down	– none, normal status
E068	Replace absorber (dew point inside the turbidimeter housing is 3 °C or higher)	– call the <Maintenance>/<Replace Absorber> menu item. – replace the humidity absorber, see Replacing the Humidity Absorber, p. 40

7.2. Replacing Fuses

WARNING

External Voltage.

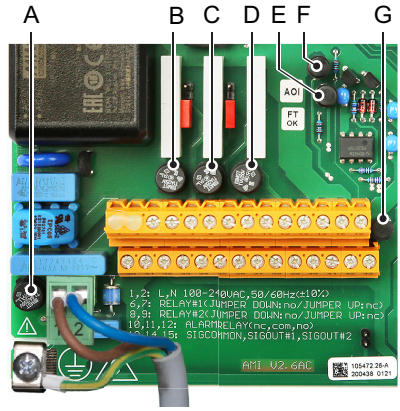
External supplied devices connected to relay 1 or 2 or to the alarm relay can cause electrical shocks

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

Find and repair the cause for the short circuit before replacing the fuse.

Use tweezers or needle-nosed pliers to remove the defective fuse.

Use original fuses provided by SWAN only.



A *AC variant: 1.6 AT/250 V Instrument power supply*
DC variant: 3.15 AT/250 V Instrument power supply

B *1.0 AT/250V Relay 1*

C *1.0 AT/250V Relay 2*

D *1.0 AT/250V Alarm relay*

E *1.0 AF/125V Signal output 2*

F *1.0 AF/125V Signal output 1*

G *1.0 AF/125V Signal output 3*

8. Program Overview

For explanations about each parameter of the menus see Program List and Explanations, S. 59

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

8.1. Messages (Main Menu 1)

Pending Errors 1.1*	*Pending Errors*	1.1.5*	* Menu numbers
Message List 1.2*	*Number*	1.2.1*	
	Date, Time		
Maintenance List 1.3*	*Maintenance List*	1.3.5*	

8.2. Diagnostics (Main Menu 2)

Identification	Designation	AMI Turbitrace		* Menu numbers
2.1*	Version	V6.20-09/16		
	Version TURBI3	1.01		
	Factory Test			
	2.1.4*			
	Operating Time			
	2.1.5*			
Sensors	**Turbidity**	*Turbidity FNU/NTU*		
2.2*	2.2.1*	*(Raw value)*		
		(Quotient)		
		Scale Factor 1		
		Scale Factor 2		
	Miscellaneous	*Case Temp.*	2.2.2.1*	
	2.2.2*	*Dew point*	2.2.2.1*	
	History	**Cal. History**	*Number*	2.2.3.1.1*
	2.2.3*	2.2.3.1*	*Date, Time*	
			Zero	
			Flow deviation	
		Ver. History	*Number*	2.2.3.2.1*
		2.2.3.2*	*Date, Time*	
			Actual value	
			Setpoint	
			Deviation	
Sample	*Sample ID*	2.3.1*		
2.3*	*Sample Flow*			
I/O State	*Alarm Relay*	2.4.1*		
2.4*	*Relay 1/2*	2.4.2*		
	Input			
	Signal Output 1/2			
Interface	*Protocol*	2.5.1*		(only with RS485
2.5*	*Baud rate*			interface)

8.3. Maintenance (Main Menu 3)

Verification	*Follow screen instructions*		
3.1*			
Calibration	**Manual operation**	*Progress*	
	3.2.1*		
3.2*	**Parameters**	*Mode*	3.2.2.1*
	3.2.2*	*Method*	3.2.2.2*
		Run time	3.2.2.3*
		Start time	3.2.2.4*
Simulation	*Alarm Relay*	3.3.1*	
3.3*	*Relay 1*	3.3.2*	
	Relay 2	3.3.3*	
	Signal Output 1	3.3.4*	
	Signal Output 2	3.3.5*	
Replace Absorber	*Follow screen instructions*		
3.4*			
Set Time	*(Date), (Time)*		
3.5*			

* Menu numbers

8.4. Operation (Main Menu 4)

Sensors	*Filter Time Const.*	4.1.1*		
4.1*	*Hold after Cal.*	4.1.2*		
Relay Contacts	**Alarm Relay**	**Alarm**	*Alarm High*	4.2.1.1.1*
4.2*	4.2.1*	4.2.1.1*	*Alarm Low*	4.2.1.1.25*
			Hysteresis	4.2.1.1.35*
			Delay	4.2.1.1.45*
	Relay 1and 2	*Setpoint*	4.2.x.100*	
	4.2.2* and 4.2.3*	*Hysteresis*	4.2.x.200*	
		Delay	4.2.x.30*	
	Input	*Active*	4.2.4.1*	
	4.2.4*	*Signal Outputs*	4.2.4.2*	
		Output / Control	4.2.4.3*	
		Fault	4.2.4.4*	
		Delay	4.2.4.5*	
Logger	*Log Interval*	4.3.1*		
4.3*	*Clear Logger*	4.3.2*		

8.5. Installation (Main Menu 5)

Sensors	*Sensor type*	*5.1.1**		* Menu numbers
5.1*	*Dimension*	*5.1.2**		
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*
		5.2.x.40	*Range High*	5.2.x.40.20*
Relay Contacts	**Alarm Relay**	**Alarm**	*Alarm High*	5.3.1.1.1*
5.3*	5.3.1*	5.3.1.1*	*Alarm Low*	5.3.1.1.25
			Hysteresis	5.3.1.1.35
			Delay	5.3.1.1.45
		Sample Flow	*Flow Alarm*	5.3.1.2.1*
		5.3.1.2*	*Alarm High*	5.3.1.2.2*
			Alarm Low	5.3.1.2.36*
		Case Temp. high	5.3.1.4*	
		Case Temp. low	5.3.1.5*	
	Relay 1 & 2	*Function*	5.3.2.1 & 5.3.3.1*	
	5.3.2* & 5.3.3*	*Parameter*	5.3.2.20 & 5.3.3.20*	
		Setpoint	5.3.x.300	
		Hysteresis	5.3.x.400	
		Delay	5.3.2.50 & 5.3.3.50*	
	Input	*Active*	5.3.4.1*	
	5.3.4*	*Signal Outputs*	5.3.4.2*	
		Output/Control	5.3.4.3*	
		Fault	5.3.4.4*	
		Delay	5.3.4.5*	
Miscellaneous	*Language*	5.4.1*		
5.4*	*Set defaults*	5.4.2*		
	Load Firmware	5.4.3*		
	Password	*Messages*	5.4.4.1*	
	5.4.4*	*Maintenance*	5.4.4.2*	
		Operation	5.4.4.3*	
		Installation	5.4.4.4*	
	Sample ID	5.4.5*		
	Line break detection	5.4.6*		
Interface	*Protocol*	5.5.1*		(only with RS485
5.5*	*Baud Rate*	5.5.23*		interface)

9. Program List and Explanations

1 Messages

1.1 Pending Errors

Provides the list of active errors with their status (active, acknowledged). If an active error is acknowledged, the alarm relay is active again. Cleared errors are moved to the Message list.

1.2 Message List

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 error (circular buffer).

1.3 Maintenance List

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

2 Diagnostics

In diagnostics mode, the values can only be viewed, not modified.

2.1 Identification

2.1.1 *Designation*: of instrument: AMI Turbitrace

2.1.2 *Version*: firmware version, e.g. V6.20-09/16

2.1.3 *Version TURBI:*, e.g. 1.B4

2.1.4 Factory test: date of instrument, mother board and front-end QC test.

2.1.5 Operating time: years, days, hours, minutes, seconds

2.2 Sensors

2.2.1 Turbidity:

- *Turbidity*: in FNUor NTU
  (Raw value): Turbidity in counts.
  (Quotient): Division of detector signal by reference signal.
- *Scale factor 1*: correction factor 1 determined during factory calibration.
- *Scale factor 2*: correction factor 2 determined during factory calibration.

2.2.2 Miscellaneous

2.2.2.1 *Case Temp.*: Temperature in °C inside the housing of the AMI transmitter.

2.2.2.1 *Dew point:* Calculated dew point in °C inside the housing of the turbidimeter.

2.2.3 History

2.2.3.1 Cal. history: Only for diagnostic purpose. Review the values of the last verifications. Max. 64 data records are memorized.

2.2.3.1.1
- o *Number*: Verification counter.
- o *Date, Time*: Date and time of the verification.
- o *Zero*:
- o *Flow deviation*: Shows the flow deviation in %.

2.2.3.2 Ver. history: Only for diagnostic purpose. Review the values of the last verifications. Max. 64 data records are memorized.

2.2.3.2.1
- o *Number*: Verification counter.
- o *Date, Time*: Date and time of the verification.
- o *Actual value*: The measuring value of the verification.
- o *Setpoint*: The value printed on the label of the verikit.
- o *Deviation*: Shows the deviation from the setpoint in % or FNU.

2.3 Sample

2.3.1
- o *Sample ID:* Shows the identification assigned to a sample. This identification is defined by the user to identify the location of the sample.
- o *Sample flow:* Flow in l/h

2.4 I/O State

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

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

2.5 Interface

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

3 Maintenance

3.1 Verification

3.1.1 Press [Enter] to start the verification and follow the instructions on the screen. Further details see Verification, p. 44.

3.2 Calibration

3.2.1 Manual operation

Start calibration manually at any time.

3.2.2 Parameters

3.2.2.1 *Mode*: The following modes are available:

Mode	
interval	The interval can be set between 1 to 12 h.
daily	Set the time of day to start a calibration.
weekly	Set the day(s) and time of day to start a calibration.
off	Automatic calibration is switched off.
Input	A calibration can be started via input.
Fieldbus	A calibration can be started via fieldbus.

3.2.2.1 Mode Interval

3.2.2.2 *Method*: The following methods can be chosen

Method	
fine	For pure and ultra pure water
coarse	If the turbdity is >0.5 FNU

3.2.2.3 *Run time*: Measuring time, set the run time with the [▲] or [▼] key.
Range: 30–1800 sec

3.2.2.40 *Interval:* Set the interval with the [▲] or [▼] key.
Range: 1–12 h

3.2.2.1 Mode daily, details see 5.3.2.24, p. 71

3.2.2.2 *Method*: see Mode interval, 3.2.2.1, p. 61

3.2.2.3 *Run time*: see Mode interval, 3.2.2.1, p. 61.

3.2.2.41 *Start time*: The start time can be set daily at any time of a day with the [▲] or [▼] key.
Range: 00:00:00–23:59:59

3.2.2.1	Mode weekly, details see 5.3.2.24, p. 71
3.2.2.2	*Method*: see Mode interval, 3.2.2.1, p. 61
3.2.2.3	*Run time*: see Mode interval, 3.2.2.1, p. 61.
3.2.2.42	**Calendar**:
3.2.2.42.1	*Start time*: The programmed start time is valid for each of the programmed days. To set the start time, see 3.2.2.41, p. 61.
3.2.2.42.2	*Monday*: Possible settings, on or off
	to
3.2.2.42.8	*Sunday*: Possible settings, on or off
5.3.2.1	Mode off
	The automatic calibration is switched off.
5.3.2.1	Mode Input
	The calibration can be started via an external PLC connected to the input of the AMI Transmitter.
5.3.2.1	Mode Fieldbus
	The calibration can be started via Fieldbus connected to the AMI Transmitter.

3.30 Simulation

To simulate a value or a relay state, select the

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

with the [▲] or [▼] key.

Press the [Enter] key.

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

Press the [Enter] key.

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

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

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

3.4 Replace Absorber

If maintenance message E068 or error message E006 appears, call this menu item and replace the humidity absorber. This will make both messages disappear for 3 days. This time is needed for the new humidity absorber to dry the housing.

3.5 Set Time

Adjust date and time.

4 Operation

4.1 Sensors

4.1.1 *Filter time constant:* Used to damp noisy signals. The higher the filter time constant, the slower the system reacts to changes of the measured value. Range: 5–300 sec

4.1.2 *Hold after cal:* To allow the instrument to stabilize again after calibration. During cal. and hold time the signal outputs are frozen, alarms and limits are not active. Range: 0–6000 sec

4.2 Relay Contacts

See chapter 5 Installation.

4.3 Logger

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

The logger can save approx. 1500 data records. Records consists of: Date, time, alarms, measured value, temperature, flow.

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

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

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

5 Installation

5.1 Sensors

o *Sensor type*: Display of the used sensor type Trace

5.1.2 *Dimension*: Choose the measurement unit (FNU or NTU)

5.2 Signal Outputs

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

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

5.2.1.1 *Parameter:* Assign one of the process values to the signal output. Available values: Meas. value, Sample flow.

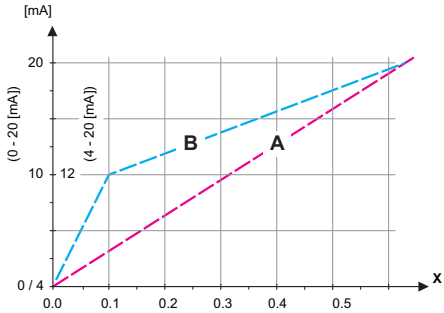
5.2.1.2 *Current Loop:* Select the current range of the signal output. Make sure the connected device works with the same current range. Available ranges: 0–20 mA or 4–20 mA

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

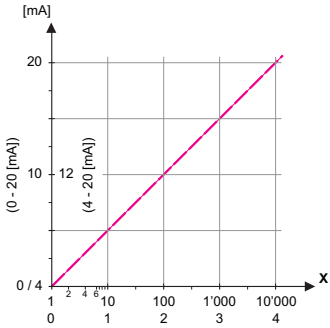
- Linear, bilinear or logarithmic for process values.
  See As process values, p. 65
- Control upwards or control downwards for controllers.
  See As control output, p. 66

As process values

The process value can be represented in 3 ways: linear, bilinear or logarithmic. See graphs below.



A *linear*
B *bilinear*
X *Measured value*



X *Measured value (logarithmic)*

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

Parameter Meas. value

5.2.1.40.10 Range low: 0.000–250 FNU/NTU

5.2.1.40.20 Range high: 0.000–250 FNU/NTU

Parameter Sample Flow

5.2.1.40.11 Range low: 0.0–100 l/h

5.2.1.40.21 Range high: 0.0–100 l/h

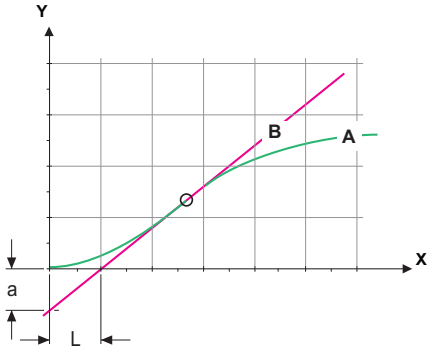
As control output

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, Control Timeout



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 (Measured value or flow)

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

5.2.1.43 **Control Parameters**: Meas. value

5.2.1.43.10 *Setpoint*: 0–250 FNU/NTU

5.2.1.43.20 *P-Band*: 0–250 FNU/NTU

5.2.1.43 **Control Parameters**: Sample flow

5.2.1.43.11 *Setpoint*: 0–100 l/h

5.2.1.43.21 *P-Band*: 0–100 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: 0–9'000 sec

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

5.2.1.43.5 *Control 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:

Meas. value, Sample Flow

5.3.1.1 Alarm

5.3.1.1.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay is activated and E001, is displayed in the message list.
Range: 0–250 FNU/NTU

5.3.1.1.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay is activated and E002 is displayed in the message list.
Range: 0–250 FNU/NTU

5.3.1.1.35 *Hysteresis:* Within the hyst. range, the relay does not switch. This prevents damage of relays contacts when the measured value fluctuates around the alarm value.
Range. 0–250 FNU/NTU

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

5.3.1.2 Sample Flow: Define at which sample flow a flow alarm should be issued.

5.3.1.2.1 *Flow Alarm:* Program if the alarm relay should be activated if there is a flow alarm. Choose between yes or no. The flow alarm will always be indicated in the display, pending error list, saved in the message list and the logger.
Available values: Yes or no

> ***Note:*** *Sufficient flow is essential for a correct measurement. We recommend to program yes.*

5.3.1.2.2 *Alarm High:* If the measuring values rises above the programmed value E009 will be issued.
Range: 0–100 l/h

5.3.1.2.31 *Alarm Low:* If the measuring values falls below the programmed value E010 will be issued.
Range: 0–100 l/h

5.3.1.4 *Case Temp. high:* Set the alarm high value for temperature of electronics housing. If the value rises above the programmed value E013 is issued.
Range: 40–75 °C

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

5.3.2 & 5.3.3 **Relay 1 and 2:** The contacts can be set as normally open or normally closed with a jumper. See Relay Contacts 1 and 2, p. 26.
The function of relay contacts 1 and 2 is defined by the user.

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

1 First select the functions as:
- Limit upper/lower,
- Control upwards/downwards,
- Timer
- Fieldbus,

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

5.3.2.1 Function = Limit upper/lower:

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

5.3.2.20 *Parameter*: select a process value
Available values: Meas. value, Sample flow.

5.3.2.300 *Setpoint*: If the measured value rises above respectively falls below the set-point, the relay is activated.
Range: 0–250 FNU/NTU

5.3.2.400 *Hysteresis:* within the hysteresis range, the relay does not switch. This prevents damage of relay contacts when the measured value fluctuates around the alarm value.
Range: 0–250 FNU/NTU

5.3.2.50 *Delay:* Duration, the activation of the alarm relay is retarded after the measuring value has risen above/fallen below the programmed alarm.
Range. 0–7200 Sec

5.3.2.1 Function = Control upwards/downwards::

The relays may be used to drive control units such as solenoid valves, membrane dosing pumps or motor valves. When driving a motor valve both relays are needed, relay 1 to open and relay 2 to close the valve.

5.3.2.22 *Parameter*: select a process value (Meas. value, flow)

5.3.2.32 **Settings:** Choose the respective actuator:
- Time proportional
- Frequency
- Motor valve

Actuator = Time proportional

Examples of metering devices that are driven time proportional are solenoid valves, peristaltic pumps.
Dosing is controlled by the operating time.

5.3.2.32.20 *Cycle time:* duration of one control cycle (on/off change).
Range: 0–600 sec.

5.3.2.32.30 *Response time:* Minimal time the metering device needs to react.
Range: 0–240 sec.

5.3.2.32.4 **Control Parameters:**
Range for each Parameter same as 5.2.1.43, p. 67

Actuator = Frequency
Examples of metering devices that are pulse frequency driven are the classic membrane pumps with a potential free triggering input.
Dosing is controlled by the repetition speed of dosing shots.

5.3.2.32.21 *Pulse frequency:* Max. pulses per minute the device is able to respond to. Range: 20–300/min.

5.3.2.32.31 **Control Parameters:**
Range for each Parameter same as 5.2.1.43, p. 67

Actuator = Motor valve
Dosing is controlled by the position of a motor driven mixing valve.

5.3.2.32.22 *Run time:* Time needed to open a completely closed valve
Range: 5–300 Sec.

5.3.2.32.32 *Neutral zone:* Minimal response time in % of the runtime. If the requested dosing output is smaller than the response time, no change will take place.
Range: 1–20 %

5.3.2.32.4 **Control Parameters:**
Range for each Parameter same as 5.2.1.43, p. 67

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 Sec.

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

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

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

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

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

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

Cont.: Controller continues normally.

Hold: Controller continues based on the last valid value.

Off: Controller is switched off.

5.3.2.24 *daily*

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

5.3.2.341 *Start time*: to set the start time proceed as follows:

1 Press [Enter], to set the hours.

2 Set the hour with the [▲] or [▼] keys.

3 Press [Enter], to set the minutes.

4 Set the minutes with the [▲] or [▼] keys.

5 Press [Enter], to set the seconds.

6 Set the seconds with the [▲] or [▼] keys.

Range: 00:00:00–23:59:59

5.3.2.44 *Run Time*: see Interval

5.3.2.54 *Delay*: see Interval

5.3.2.6 *Signal Outputs*: see Interval

5.3.2.7 *Output/Control*: see Interval

5.3.2.24 *weekly*

The relay contact can be activated at one or several days, of a week. The daily starting time is valid for all days.

5.3.2.342 **Calendar**:

5.3.2.342.1 *Start time*: The programmed start time is valid for each of the programmed days. To set the start time see 5.3.2.341, p. 71.
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 will be switched via the Profibus input. 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 if the input relay is closed
When open:	Input is active if the input relay is open

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

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

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

Continuous:	Controller continues normally.
Hold:	Controller continues 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 close when input is active. Message E024 is stored in the message list.
Yes:	Message E024 is issued and stored in the message list. The Alarm relay closes when input is active.

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

5.4 Miscellaneous

5.4.1 *Language:* Set the desired language.

Language
German
English
French
Spanish

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

Set defaults
no
Calibration
In parts
Completely

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

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

Load Firmware
no
yes

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

5.4.4.1 Messages

5.4.4.2 Maintenance

5.4.4.3 Operation

5.4.4.4 Installation.

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

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

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

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

Choose between <Yes> or <No>.

5.5 Interface

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

5.5.1 *Protocol:* **Profibus**

5.5.20 Device address: Range: 0–126

5.5.30 ID-Nr.: Range: Analyzer; Manufacturer; Multivariable

5.5.40 Local operation: Range: Enabled, Disabled

5.5.1 *Protocol:* **Modbus RTU**

5.5.21 Device address: Range: 0–126

5.5.31 Baud Rate: Range: 1200–115200 Baud

5.5.41 Parity: Range: none, even, odd

5.5.1 *Protocol:* **USB stick**

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

5.5.1 *Protocol:* **HART**

Device address: Range: 0–63

10. Default Values

Operation:

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

Installation:

Sensor:	Sensor type:	Trace
	Dimension:	FNU
Signal Output 1 and 2	Parameter:	**Meas. value**
	Current loop:	4 – 20 mA
	Function:	linear
	Scaling: Range low:	0.000 FNU
	Scaling: Range high:	10.0 FNU
	Parameter:	**Sample Flow**
	Current loop:	4 – 20 mA
	Function:	linear
	Scaling: Range low:	0.0 l/h
	Scaling: Range high:	20.0 l/h
Alarm Relay:	Alarm high:	200 FNU
	Alarm low:	0.000 FNU
	Hysteresis:	10 FNU
	Delay:	5 s
	Sample Flow: Flow Alarm:	yes
	Sample Flow: Alarm High:	40.0 l/h
	Sample Flow: Alarm Low:	6.0 l/h
	Case temp. high:	65 °C
	Case temp. low:	0 °C
Relay1 and 2	Function:	limit upper
	Parameter:	Meas. value
	Setpoint:	100 FNU
	Hysteresis:	5.00 FNU
	Delay:	5 s

If Function = Control upw. or dnw:

Parameter: ..... **Meas. value**
Settings: Actuator: ..... Frequency
Settings: Pulse Frequency: 120/min
Settings: Control Parameters: Setpoint: ..... 100 FNU
Settings: Control Parameters: P-band: ..... 5.00 FNU

Parameter: ..... **Sample flow**
Settings: Actuator: ..... Frequency
Settings: Pulse Frequency: 120/min
Settings: Control Parameters: Setpoint: ..... 20.0 l/h
Settings: Control Parameters: P-band: ..... 1.0 l/h

Common settings:

Settings: Control Parameters: Reset time: .....0 s
Settings: Control Parameters: Derivative Time: .....0 s
Settings: Control Parameters: Control Timeout: .....0 min

Settings: Actuator: ..... Time proportional
Cycle time: .....60 s
Response time: .....10 s

Settings: Actuator ..... Motor valve
Run time: .....60 s
Neutral zone: 5%

If Function = Timer:

Mode: ..... Interval
Interval: .....1 min

Mode: .....daily
Start time: 00.00.00

Mode: ..... weekly
Calendar; Start time: 00.00.00
Calendar; Monday to Sunday: .....Off

Run time: ..... 10 s
Delay: ..... 5 s
Signal output: ..... cont
Output/Control: ..... cont

Input: Active ..... when closed
Signal Outputs ..... hold
Output/Control ..... off
Fault ..... no
Delay ..... 10 s

Miscellaneous	Language:	English
	Set default:	no
	Load firmware:	no
	Password:	for all modes 0000
	Sample ID:	- - - - - - - -
	Line break detection	no

11. Index

12. Notes

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ANALYTICAL INSTRUMENTS

A-96.250.131 / 130421

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