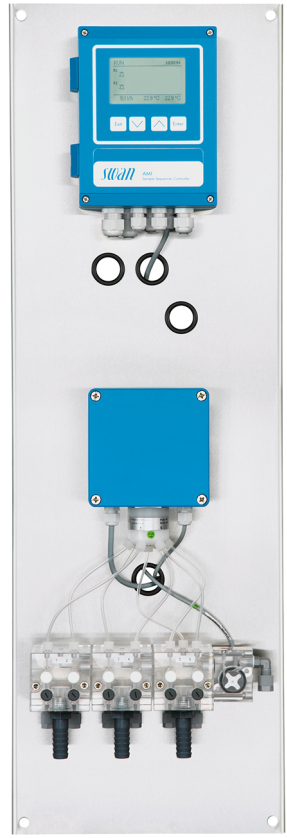
ANALYTICAL INSTRUMENTS

A-96.250.661 / 070222

Operator's Manual

Firmware V5.00 and higher



SWISS MADE

AMI Sample Sequencer

Customer Support

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

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Document Status

Title:	AMI Sample Sequencer Operator's Manual	
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Revision	**Issue**	
00	Sept. 2011	First release
01	July 2012	Extended with connection to AMI Silica
02	Feb. 2013	Extended with connection to AMI Phosphate II
03	March 2017	Extended with connection to AMI Silitrace

Table of Contents

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 range

The AMI Sample Sequencer is a complete system for the automatic, continuous multiplexing of up to six sample streams to one process analyzer. The AMI Sample Sequencer can be connected to:

- AMI Phosphate HL
- AMI Silica
- AMI Silitrace
- AMI Sodium A
- AMI Sodium P

Operating modes

The AMI Sample Sequencer provides the following two operating modes

- AMI
  Set the AMI Sample Sequencer to the mode <AMI> if it is connected to an AMI Phosphate HL, AMI Silica or AMI Silitrace. In this operating mode the AMI Sample Sequencer works as slave, either of the analyzer or of an external PLC. Communication between the instruments takes place via I^2C interface. For further information see Connect the I2C Bus Cable, p. 33.
- Internal
  Set the AMI Sample Sequencer to the mode <Internal> if it is connected to an AMI Sodium A or AMI Sodium P. In this operating mode the AMI Sample Sequencer works as master. It switches the sample streams according to the programmed cycle time. There is no communication between the instruments, only measured values are transferred via signal outputs 1 and 2 of the analyzer to the signal inputs 1 and 2 of the AMI Sample Sequencer. For further information see
  Sample Sequencer Inputs, p. 40.

Signal outputs

6 current outputs to transfer the measured values of the AMI transmitter to a PLC.

Relay

6 signal outputs for indication of the 6-way valve position.

1 signal output for flow alarm.

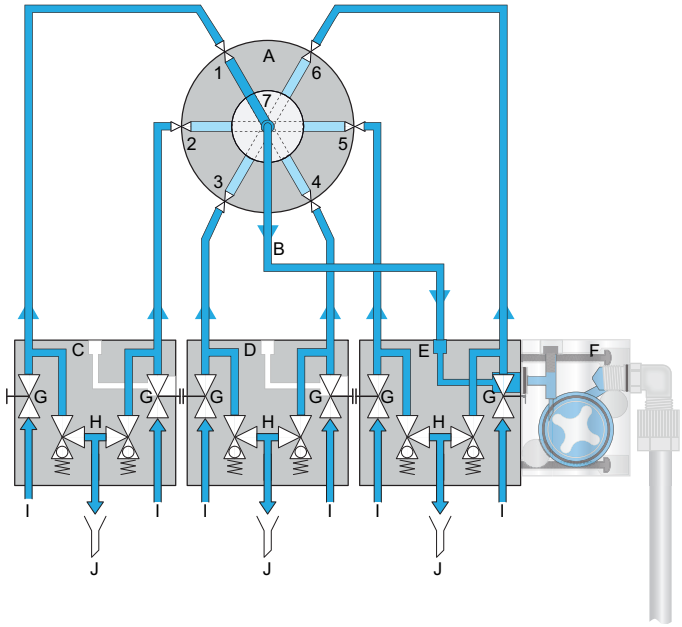
Inputs

6 signal inputs to override programmed measuring sequences, by activating or deactivating an input. The functionality depends on the settings of the instruments.

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.

Fluidics The sample enters the flow cell blocks [C, D, E] via the sample inlets [I]. Each sample inlet is equipped with a flow regulating valve [G]. The sample flows through the active sample line via 6-way valve [A] and flow meter [F] to the instrument. Excessive sample (e.g. inactive sample lines) flows via overflow [H] to the atmospheric drain [J].



A *6-way valve*
B *Sample outlet*
C *Flow cell block with sample inlet 1 and 2*
D *Flow cell block with sample inlet 3 and 4*
E *Flow cell block with sample inlet 5 and 6*
F *Flow meter*
G *Flow regulating valve*
H *Overflow*
I *Sample inlets 1–6*
J *Atmospheric drain*

2.1. Measuring Cycle for Batch Measurement

2.1.1 AMI Silica and AMI Phosphate HL

Example with two sample streams:
A measuring cycle always starts when the solenoid valve [C] closes.

Note:

- *The different squares, black with/without underline and white with/without underline are displayed on the display of the AMI Sample Sequencer, for better understanding they are integrated in the illustrations below.*
- *The meaning of the different squares is explained in chapter 5, Operation.*

Step 1 The solenoid valve [C] is open.

- The 6-way valve [A] is on position 1 and the sample stream 1 flows via constant head [B] through the photometer [D]. No measurement is performed at this time.

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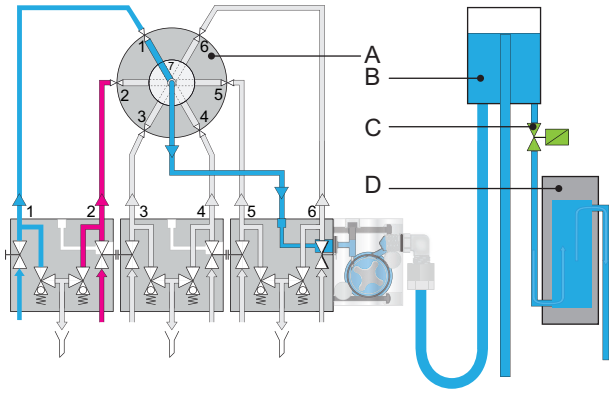
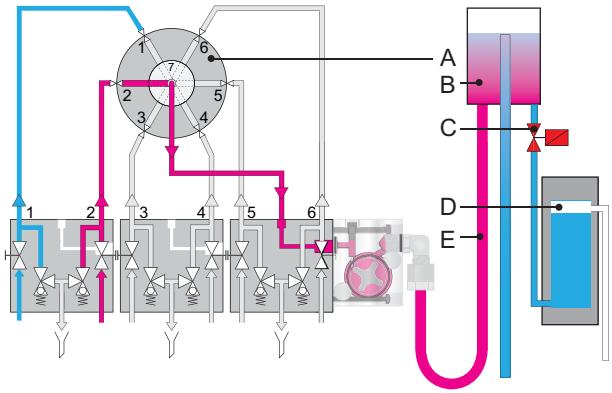


A *6-way valve*
B *Constant head*
C *Solenoid valve*
D *Photometer*

Step 2 The solenoid valve [C] closes:

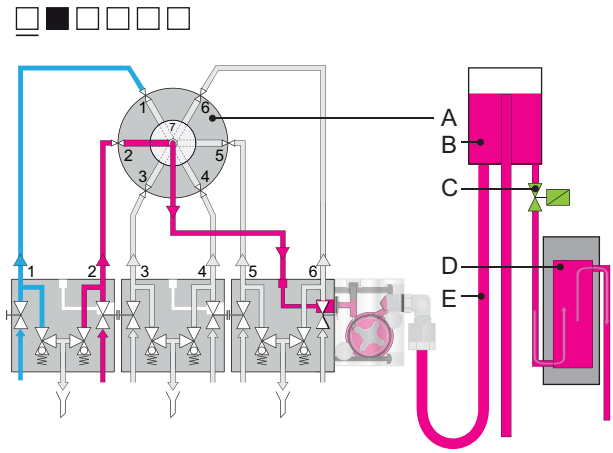
- at the same time the 6-way valve [A] switches to sample stream 2, a new measuring cycle starts.
- the sample of sample stream 1 remains in the photometer where reagents are added and a measurement is performed.
- During the measuring of sample stream 1, the tube [E] and the constant head [B] are flushed with sample stream 2.



A *6-way valve*
B *Constant head*
C *Solenoid valve*
D *Photometer*
E *Sample inlet constant head*

Step 3 The measurement of sample 1 is finished.

- The solenoid valve [C] is open and the photometer is flushed with sample stream 2.
- A valid measured value of sample stream 1 is available.



A *6-way valve*
B *Constant head*
C *Solenoid valve*
D *Photometer*
E *Sample inlet constant head*

2.2. Measuring Cycle for Continuous Measurement

2.2.1 AMI Sodium A and AMI Sodium P

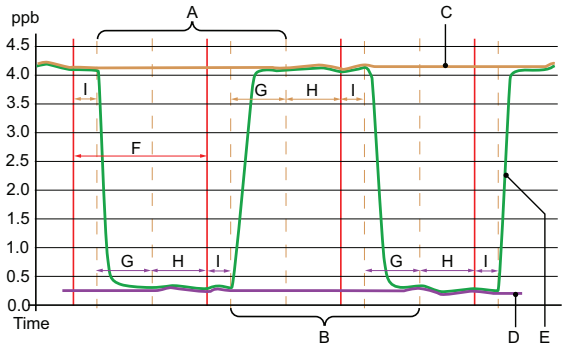
A new measuring cycle always starts when the 6-way valve [A] is switched to the next programmed sample stream.

> ***Note:*** *The following parameters are only available if the AMI Sample Sequencer is set to mode <Internal>.*

Cycle time The time of switchover between the sample streams is defined as -cycle time-. The cycle time includes the “Flush Time” and the measuring time of the active sample line.
The measuring time can not be set, but can be calculated as follows:
Measuring time = “Cycle Time” - “Flush Time” + “Valid After”
The -cycle time- can be set individually for each sample line in 5 min steps from 5 min to 600 min. A sample line is deactivated if the cycle time is set to 0 min.

Flush time The parameter -Flush Time- defines how long the measuring cell of the AMI Sodium A or an AMI Sodium P is flushed with the active sample before the measurement starts. (see 5.1 Sequence, p. 62)

Valid after The parameter -Valid After- defines the remaining measuring time of the sample stream x after the 6-way valve has switched to the next sample stream (see 5.1 Sequence, p. 62).



A *Sample stream 1 on hold*
B *Sample stream 2 on hold*
C *Sample stream 1, high conc.*
D *Sample stream 2, low conc.*
E *Measuring signal*
F *Cycle time*
G *Flush time*
H *Measuring time*
I *Valid after*

Example with two sample streams:

Note:

- *The different squares, black with/without underline and white with/without underline are displayed on the display of the AMI Sample Sequencer, for better understanding they are integrated in the illustrations below.*
- *The meaning of the different squares is explained in chapter 5, Operation.*

Step 1

- The 6-way valve [A] is on position 1 and sample stream 1 [D] flows via constant head [B] through the measuring cell [C] where the sodium concentration is continuously measured.

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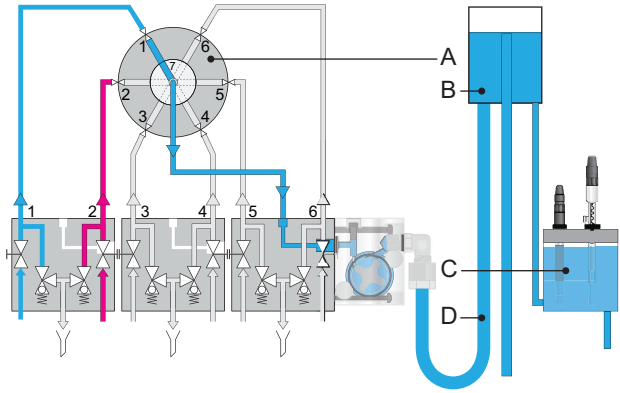
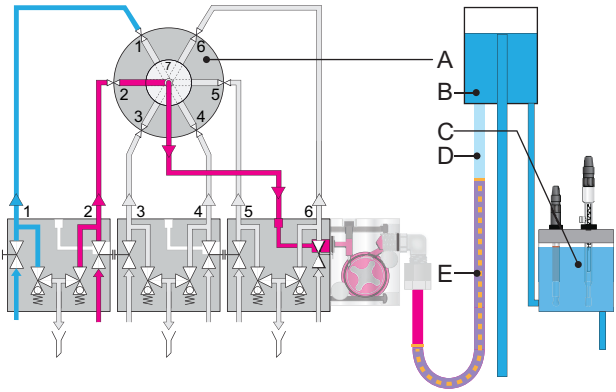


A *6-way valve*
B *Constant head*
C *Measuring cell*
D *Sample 1*

Step 2

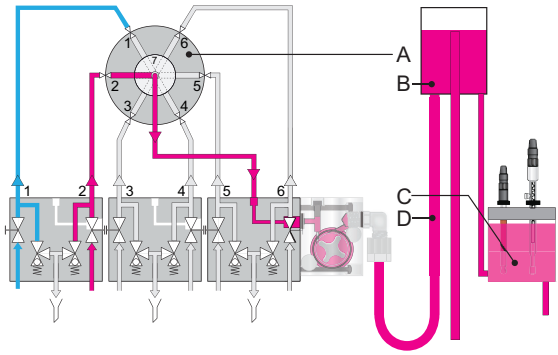
- The 6-way valve [A] has switched to sample stream 2
  - The -Valid after- time [I] is active. The instrument still measures channel 1.
  - The -Flush time- [G] is active. No valid measured value is available for channel 2 yet.



A *6-way valve*
B *Constant head*
C *Measuring cell*
D *Sample 1*
E *Mixing zone Sample 1 and 2*

Step 3

- The -Valid after- time is finished:
  - Sample stream 2 is selected and measured.



A *6-way valve*
B *Constant head*
C *Measuring cell*
D *Sample 2*

2.2.2 AMI Silitrace

The switch to the next channel is initiated by the AMI analyzer according to the programmed switching time.

Example with two sample streams, switching time set to 30 min:

Note:

- *The different squares, black with/without underline and white with/without underline are displayed on the display of the AMI Sample Sequencer, for better understanding they are integrated in the illustrations below.*
- *The meaning of the different squares is explained in chapter 5, Operation.*

Step 1

- The 6-way valve [B] is on position 1 and sample stream 1 flows through the flow cell block [D]. From there, it is pumped to the photometer by the peristaltic pump [C].

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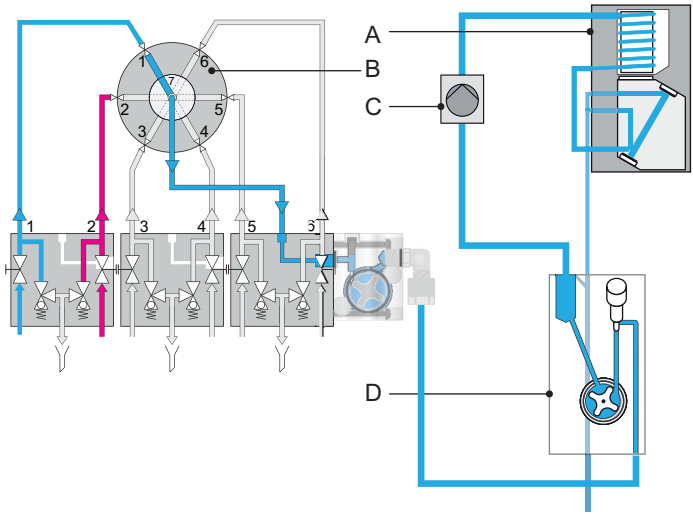
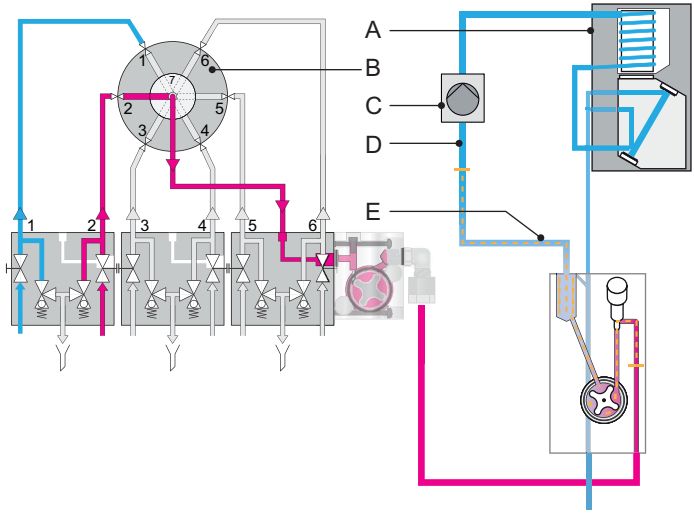


A *Photometer*
B *6-way valve*
C *Peristaltic pump*
D *Flow cell block*

Step 2a

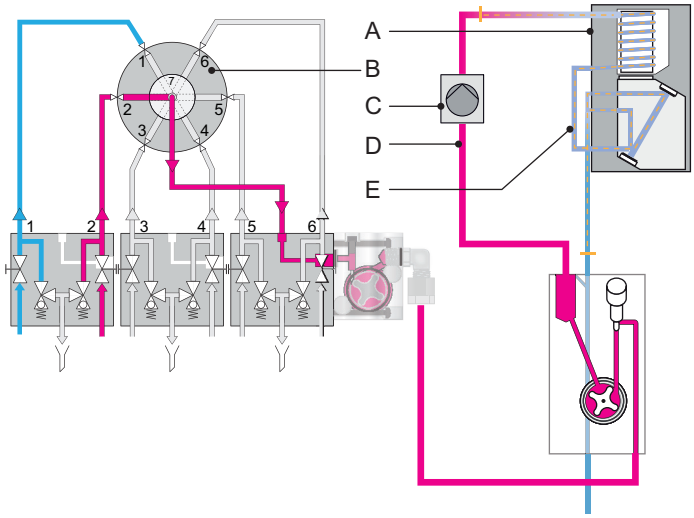
- The 6-way valve [B] has switched to sample stream 2:
  - The instrument still measures sample 1
  - Channel 2 is selected but not yet measured



A *Photometer*
B *6-way valve*
C *Peristaltic pump*
D *Sample 1*
E *Mixing zone Sample 1 and 2*

Step 2b

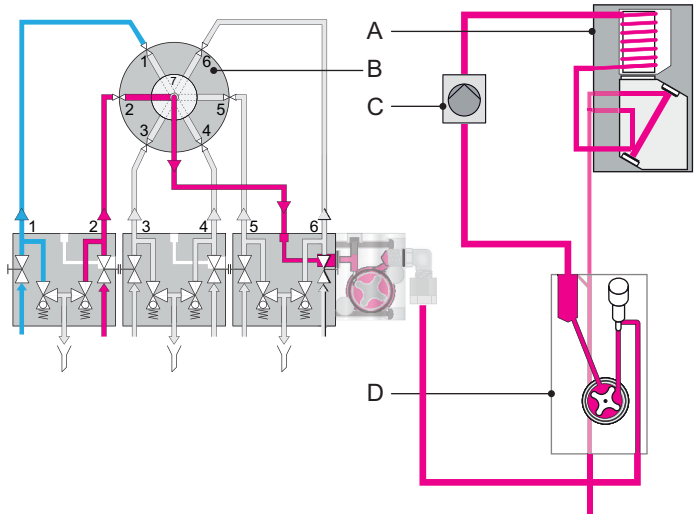
- The mixing zone [E] flows through the photometer [A]
  - No valid measured value is available.



A *Photometer*
B *6-way valve*
C *Peristaltic pump*
D *Sample 1*
E *Mixing zone Sample 1 and 2*

Step 3

- The instrument has finished flushing the photometer with sample stream 2.
  - Sample stream 2 is selected and measured.



A *Photometer*
B *6-way valve*
C *Peristaltic pump*
D *Flow cell block*

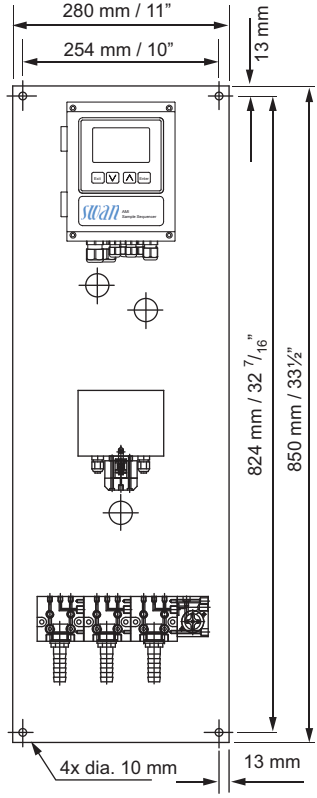
2.3. Instrument Specification

Power supply	AC variant:	100–240 VAC (±10%) 50/60 Hz (±5%)
	DC variant:	24 VDC (±10%)
	Power consumption:	max. 8 VA
Sample requirements	Flow rate:	according to the attached analyzer plus min. 5 l/h per stream
	Sample pressure inlet:	0.5–3 bar (2–43 PSI)
	Sample temperature:	5–45 °C (41–122 °F)

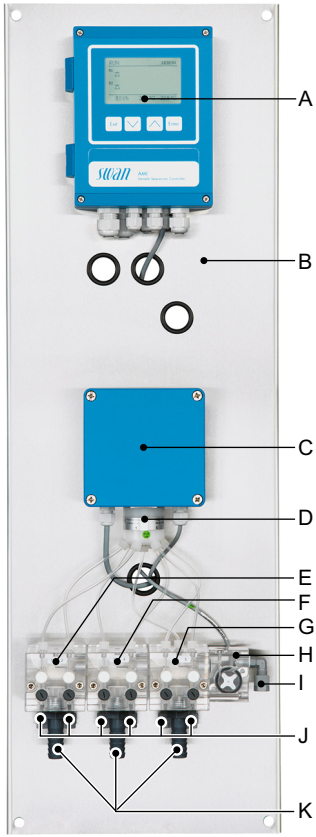
Note: *The sample must not contain any oil, grease, or sand.*

On-site requirements	The analyzer site must permit connections to:	
	Sample inlet (6):	Tube 4 x 6 mm
	Sample outlet (1):	Tube 4 x 6 mm
	Sample overflow (3):	each 15 x 20 mm (1/2” hose nozzle)
	Outlet pressure:	atmospheric
Electronics housing	Aluminum with a protection degree of IP 66 / NEMA 4X	
	Ambient temperature:	-10 to +50 °C
	Limit range of operation:	-25 to +65 °C
	Storage and transport:	-30 to +85 °C
	Humidity:	10 to 90 % relative, non-condensing
	Display:	backlit LCD, 75 mm x 45 mm

Dimensions	Dimensions:	280 x 850 x200 mm
	Distance between mounting holes:	254 x 824 mm
	Screws:	8 mm diam.
	Panel material:	Stainless steel
	Weight:	8 kg



2.4. Instrument Overview



A *AMI transmitter*
B *Panel*
C *6-way valve control unit*
D *6-way valve*
E *Flow cell block sample stream 1 and 2*
F *Flow cell block sample stream 3 and 4*
G *Flow cell block sample stream 5 and 6*
H *Flow meter*
I *Sample outlet*
J *Sample inlet 1 to 6*
K *Hose nozzles for waste connection*

3. Installation

3.1. Installation Checklist

On-site requirements	◆ AC variant: 100–240 VAC (±10%), 50/60 Hz (±5%), DC variant: 24 VDC (±10%) ◆ Isolated power outlet with ground connection and 8 VA ◆ Sample line with min. 5 l/h and 0.5–3 bar ◆ Waste line with atmospheric drain
Installation	◆ Install the AMI Sample Sequencer, p. 26 ◆ Connect Sample and Waste, p. 27 ◆ Install the connection tube to the AMI analyzer ◆ Replace the flow regulating valve of the following analyzers with the enclosed blind plug: – AMI Sodium A / P – AMI Silitrace
Electrical wiring	◆ Connect the AMI analyzer to the AMI Sample Sequencer ◆ Connect the AMI Sample Sequencer to the mains; do not switch on power yet! See Power Supply, p. 46
Power-up	◆ Turn on the sample flow. See Instrument Setup, p. 48 ◆ Adjust the sample flow on all connected sample inlets of the sample sequencer ◆ Switch on power. See Instrument Setup, p. 48
Instrument setup	◆ Program all parameters for operation (sequence, alarms).

3.2. Install the AMI Sample Sequencer

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:
  - 4 screws 8x60 mm
  - 4 dowels
  - 4 washers 8.4/24 mm

Mounting requirements

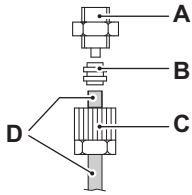
The instrument is only intended for indoor installation.
For dimensions see 23.

3.3. Connect Sample and Waste

Sample inlet

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

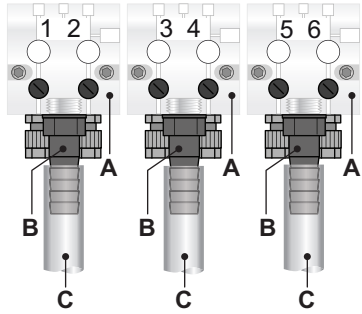
Mounting of SERTO fitting



A *Screw connection*
B *Compression ferrule*
C *Knurled nut*
D *Flexible tube*

Waste

Connect the 1/2” tubes to the nozzle of the waste funnels and place them into an atmospheric drain of sufficient capacity.



A *Flow cell blocks for sample inlets 1 to 6*
B *Hose nozzles*
C *1/2” tube to atmospheric drain*

Sample Connection

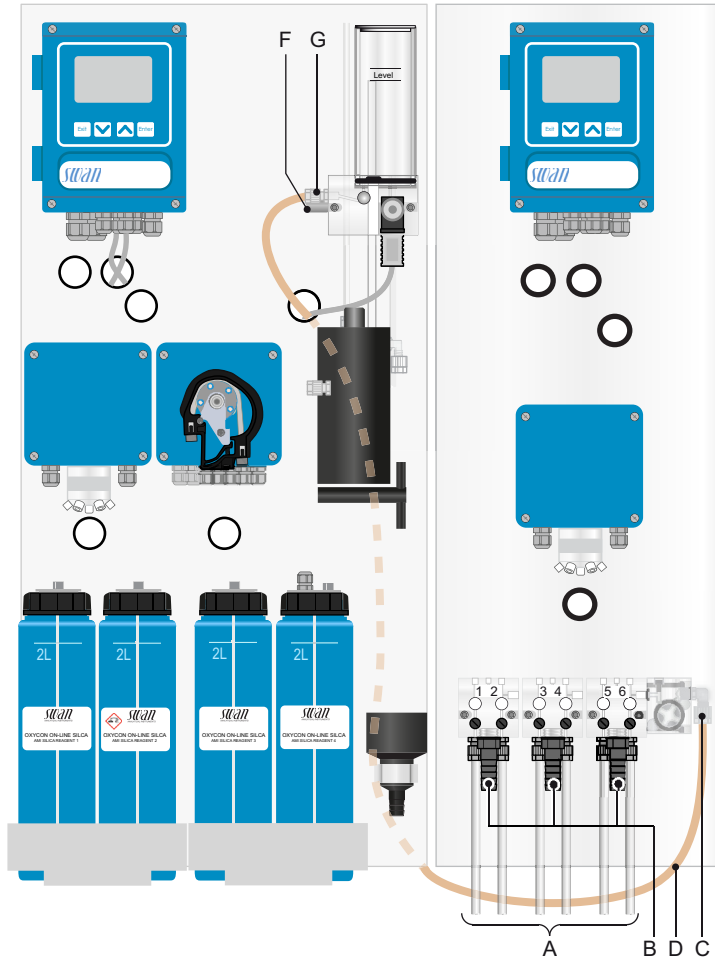
Examples see
- Connecting example with AMI Silica, p. 29
- Connecting example with AMI Silitrace, p. 30
- Connecting example with AMI Phosphate HL, p. 31
- Connecting example with AMI Sodium A / P, p. 32

To connect the AMI Sample Sequencer to an AMI analyzer proceed as follows:

1. Connect the 1/2” tubes to the hose nozzles [B] and put them into an atmospheric drain.
2. Connect sample streams 1 to 6 to sample inlets 1 to 6 [A] of the AMI Sample Sequencer.
3. When used with the following analyzers, replace the flow regulating valve at the flow cell block of the analyzer with the enclosed blind plug [E].
   - AMI Sodium A / P
   - AMI Silitrace

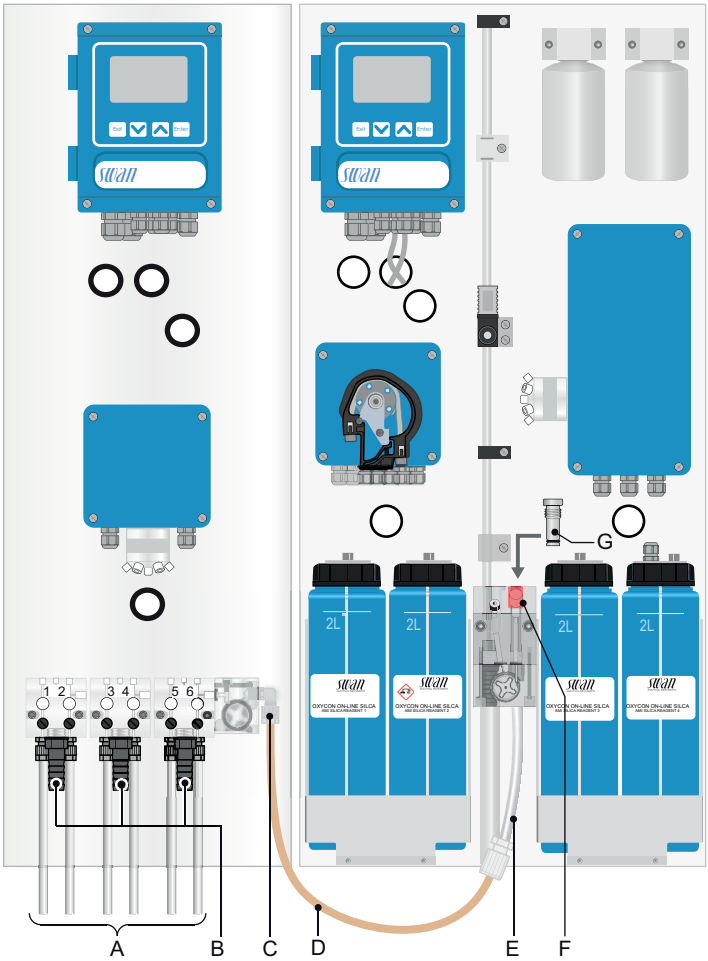
   Note: *On AMI Silica and AMI Phosphate HL, leave the flow regulating valve installed.*
4. Connect tube [D] to the sample outlet [C] of the AMI Sample Sequencer and to the sample inlet of the AMI analyzer.
5. Adjust sample flow, see Instrument Setup, p. 48.
6. Set the firmware according to chapter
   - Firmware Settings (Mode <Internal>), p. 43 or
   - Firmware Settings (Mode <AMI>), p. 38.

Connecting example with AMI Silica



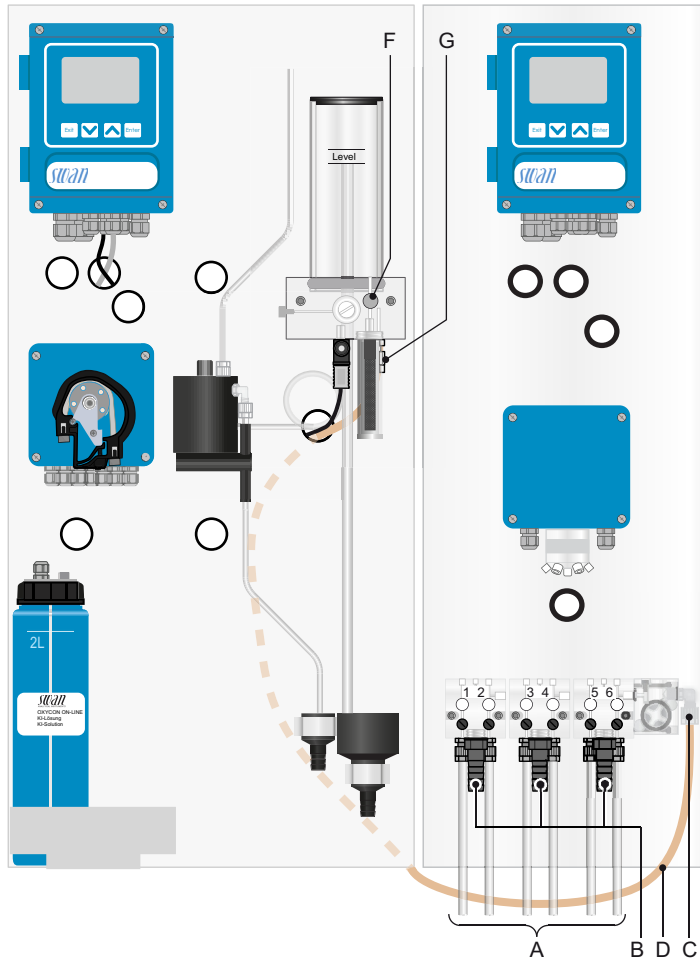
A *Sample inlet 1 to 6*
B *Hose nozzles for waste connection*
C *Sample outlet of AMI Sample Sequencer*
D *Connection tube*
E *-*
F *Flow regulating valve*
G *Sample inlet of AMI Silica*

Connecting example with AMI Silitrace



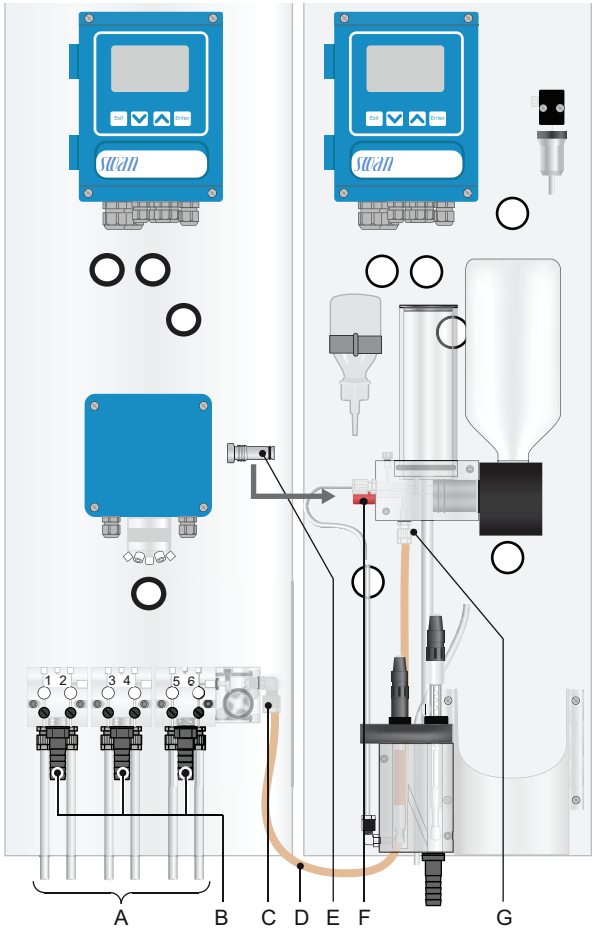
A *Sample inlet 1 to 6*
B *Hose nozzles for waste connection*
C *Sample outlet of AMI Sample Sequencer*
D *Connection tube*
E *Sample inlet of AMI Silitrace*
F *Flow regulating valve*
G *Blind plug*

Connecting example with AMI Phosphate HL



A *Sample inlet 1 to 6*
B *Hose nozzles for waste connection*
C *Sample outlet of AMI Sample Sequencer*
D *Connection tube*
E *-*
F *Flow regulating valve*
G *Sample inlet of AMI Phosphate HL*

Connecting example with AMI Sodium A / P



A *Sample inlet 1 to 6*
B *Hose nozzles for waste connection*
C *Sample outlet of AMI Sample Sequencer*
D *Connection tube*
E *Blind plug*
F *Flow regulating valve*
G *Sample Inlet of AMI Sodium*

3.4. Connect the Instrument (Mode <AMI>)

This section applies to:

- AMI Silica
- AMI Silitrace
- AMI Phosphate HL

hereinafter referred to as AMI analyzer.

3.4.1 Connect the I^2C Bus Cable

The AMI analyzers listed above require an I^2C bus connection to enable communication between the two instruments.

WARNING

Risk of electrical shock

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

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

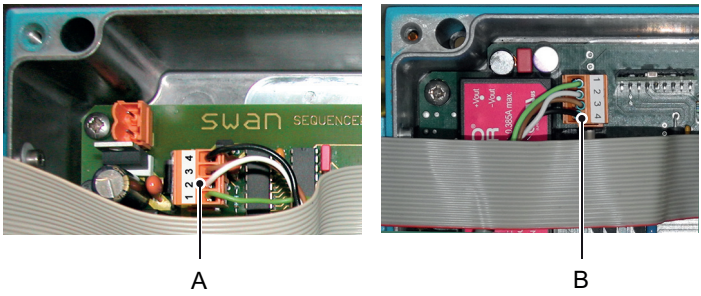
Connect the AMI analyzer and the AMI Sample Sequencer as follows:

1. Switch off the Instrument.
2. Open the transmitter cover.
3. Feed one cable end through a PG 7 cable gland into the transmitter housing of the AMI analyzer and the other one into the transmitter housing of the AMI Sample Sequencer.
4. Connect the cable to the plugs according to the following table.

   Note: *Due to technical reasons the data signal wires green and white of the I^2C bus need to be connected to the plug in inverse order if the transmitter of the AMI analyzer is equipped with main board V2.4.*

	Terminal number		
Wire color	**Plug AMI Sample Sequencer**	**Plug AMI analyzer**	
		Mainboard V2.3 and ≥V2.5	**Mainboard V2.4**
green	1	1	2
white	2	2	1
brown	3	3	3
black	4	4	4

5 Insert the plugs into the sockets on the main boards according to the picture below.



A *Plug AMI Sample Sequencer* ***B*** *Plug AMI analyzer*

AMI analyzer with 2nd sample stream option

If an AMI analyzer is already equipped with a 2nd sample stream option and an AMI Sample Sequencer is connected, the 2nd sample stream option is deactivated and its solenoid valve is switched to sample inlet 1.

> ***Note:*** *Swan generally does not recommend connecting an AMI Sample Sequencer to an AMI analyzer equipped with a 2nd sample stream option.*

If it is not possible to remove the 2nd sample stream option for any reasons, proceed according to Sample Connection, p. 28, steps 1 to 3:

- Close the flow regulating valve of sample inlet 2.
- Connect tube [D] from the sample outlet [C] of the AMI Sample Sequencer to sample inlet 1 of the 2nd sample stream option.
- Then proceed according to Sample Connection, p. 28, step 5.

3.4.2 Sample Sequencer Inputs

Unused signal inputs

The following signal inputs of the AMI Sample Sequencer are not applicable if an AMI analyzer is connected.

Terminals	Signal
23/25	Mark end of measurement
27/29	System alarm
34/32	Signal input 1
31/32	Signal input 2

Signal inputs from PLC

Each sample stream is assigned to an input channel of the AMI Sample Sequencer. The sample stream number corresponds with the channel number.

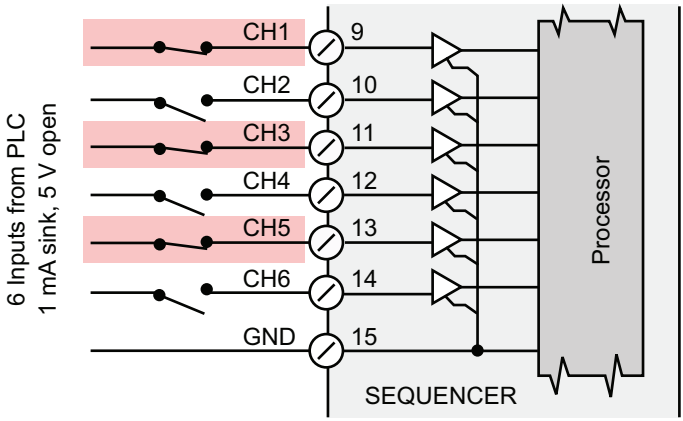
The functionality of the inputs depends on the selected mode of the AMI analyzer.

Mode internal

If the AMI analyzer is set to mode internal, the programmed number of sample streams is sequentially measured. Any sample inlet can be deactivated by closing one or more of the contacts 9 to 14 (6 inputs from PLC) via a PLC.

In the example below, the channels highlighted in red will not be measured.

Note: *If all contacts are closed, the AMI analyzer switches to standby mode.*



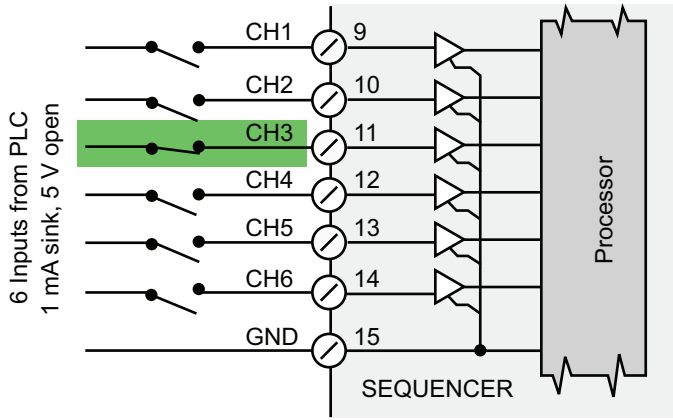
Mode external

If the AMI analyzer is set to mode external, each sample stream to be measured has to be activated by closing the respective contact.

In the example below, sample stream 3 (CH3) highlighted in green will be measured as soon as the AMI analyzer has finished the previous measurement.

Note:

- *Closing more than one of the inputs will cause an undefined state.*
- *If all inputs are open the AMI analyzer switches to standby mode.*



Connect the signal inputs according to the connection diagram.

Mode fieldbus

The same function as external, but with Profibus or Modbus protocol. Further information concerning <Channel Selection> can be found in the manual of the corresponding AMI analyzer.

Note: *The AMI Sample Sequencer cannot be connected to a Profibus or Modbus system.*
Install the Profibus or Modbus interface on the AMI analyzer.

3.4.3 Sample Sequencer Outputs

Current outputs

The current outputs 17 to 22 can be used to display the measured values on a remote location.
Each sample stream is assigned to an output channel on the terminal of the AMI Sample Sequencer. The sample stream number corresponds with the channel number.

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

Signal outputs 1 to 6 to PLC

The outputs 1 to 6 to a PLC are used to transfer the current position of the AMI Sample Sequencer's 6-way valve to a PLC. The PLC needs this information to:

- control the measuring cycles if the AMI analyzer is set to external mode.
- assign the current outputs of the AMI analyzer to the measured sample stream.

3.4.4 Firmware Settings (Mode <AMI>)

AMI Sample Sequencer

In menu 5.1.1 <Installation>/<Sequence>/<Mode> set mode to <AMI>, further information see chapter 9 Program List and Explanations, p. 60, section 5.1 Sequence, p. 62.

AMI analyzer

If the AMI Sample Sequencer is connected correctly, it is automatically recognized by the firmware of the AMI analyzer. Make the following settings in the firmware:

- In menu 5 <Installation>/<Sensors>/<Channels>, program the number of samples you have connected to the AMI Sample Sequencer.
- In menu 5 <Installation>/<Sensors>/<Channel Selection>, set the channel selection to:
  - Internal
  - External
  - Fieldbus

Further information about settings of AMI analyzer can be found in the corresponding manual.

3.5. Connect the Instrument (Mode <Internal>)

This section applies to:

- AMI Sodium A
- AMI Sodium P

hereinafter referred to as AMI analyzer.

3.5.1 Connect the Two-Wire Signal Cable

The instruments listed above do not need any communication with the AMI Sample Sequencer, therefore they are connected to the AMI Sample Sequencer via a two-wire signal cable from the signal outputs of the AMI analyzer to the signal inputs of the AMI Sample Sequencer.

Note: *If an AMI analyzer is already equipped with a 2nd sample stream option, it is not possible to operate it with an AMI Sample Sequencer. Before connecting an AMI Sample Sequencer remove the 2nd sample stream option.*

WARNING

Risk of electrical shock

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

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

1. Feed one cable end through a PG 7 cable gland into the transmitter housing of the AMI analyzer and the other one into the transmitter housing of the AMI Sample Sequencer.
2. Connect the cable to the terminals for signal output 1 and 2 of the AMI analyzer according to the Connection Diagram, p. 45.
3. Connect the cable to the terminals for signal input 1 and 2 of the AMI Sample Sequencer according to the Connection Diagram, p. 45.

3.5.2 Sample Sequencer Inputs

Signal inputs from AMI analyzer

The values of the AMI analyzer are transferred to the AMI Sample Sequencer via signal outputs 1 and 2. From there the measured values can be transferred and displayed at a remote location.

Connect the signal inputs according to the table below.

Terminals	Signal	Use
34/32	Signal input 1	Measured value 1
31/32	Signal input 2	Measured value 2

Signal inputs from external devices

Terminals	Signal	Use
23/25	Mark end of measurement	Not applicable
27/29	System alarm	Flow alarm

Signal inputs from PLC device

Each sample stream is assigned to an input channel of the AMI Sample Sequencer. The sample stream number corresponds with the channel number.

If a PLC device is connected to the signal inputs 9 to 14 any sample stream can be switched off or on by the PLC device.

3.5.3 Sample Sequencer Outputs

Current outputs

The current outputs 17 to 22 can be used to display the measured values on a remote location.

The assignment of the terminals to the sample streams depends on the selected parameter

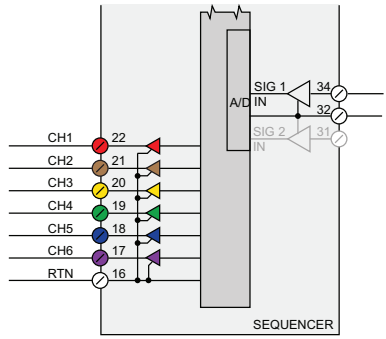
- Signal inputs = 1
- Signal inputs = 2 (only up to 3 sample streams)

in the menu <Installation>/<Sequence>/<Signal Inputs> of the AMI Sample Sequencer.

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

If signal inputs = 1

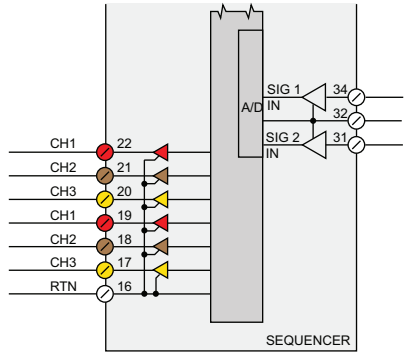
If signal inputs = 1 is selected, 6 sample streams can be measured. 1 signal (measured value) can be transmitted from the transmitter of the AMI analyzer to the transmitter of the sample sequencer. The signal outputs are connected to the terminals according to the table below.



Channel	Terminals for signal 1
CH 1	22/16
CH 2	21/16
CH 3	20/16
CH 4	19/16
CH 5	18/16
CH 6	17/16

If signal inputs = 2

If signal inputs = 2 is selected, 3 sample streams can be measured. 2 signals (e.g. measured value and temperature) can be transmitted from the transmitter of the analyzer to the transmitter of the sample sequencer.
The signal outputs are connected to the terminals according to the following table:

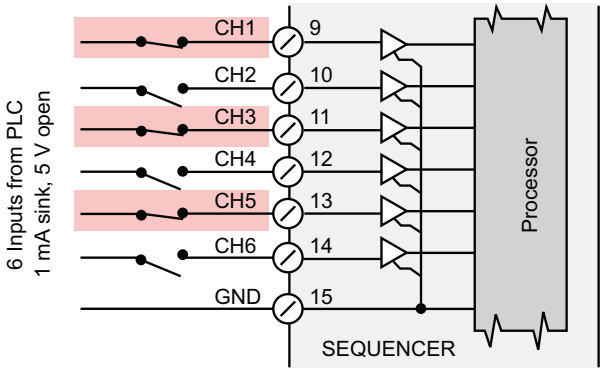


Channel	Terminals for signal 1	Terminals for signal 2
CH 1	22/16	19/16
CH 2	21/16	18/16
CH 3	20/16	17/16

Deactivate channels

If signal inputs = 1:
In the example below, the channels highlighted in red will not be measured.

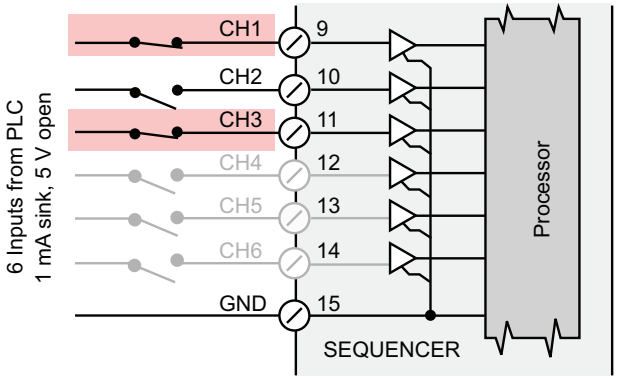
Note: *If all contacts are closed, the AMI analyzer remains in stand by mode.*



Deactivate channels

If signal inputs = 2:
In the example below, the channel highlighted in red will not be measured.

Note: *If all contacts are closed, the AMI analyzer remains in stand by mode.*



Signal outputs 1 to 6 to PLC

The Outputs 1 to 6 to a PLC are used to transfer the current position of the AMI Sample Sequencer's 6-way valve.

3.5.4 Firmware Settings (Mode <Internal>)

AMI sample sequencer

In menu 5.1.1 <Installation>/<Sequence>/<Mode> set Mode to <Internal>, further information see chapter 9 Program List and Explanations, p. 60, Section 5.1 Sequence, p. 62.

In menu 5.1.2 <Installation>/<Sequence>/<Signal Inputs>, the signal inputs can be set to:

- 1

or

- 2

Further information see Current outputs, p. 40.

AMI analyzer

No firmware settings necessary.

3.6. Electrical Connections

WARNING

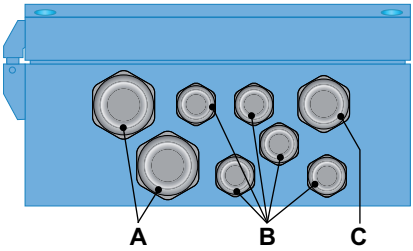
Risk of electrical shock.

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

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

Cable thicknesses

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



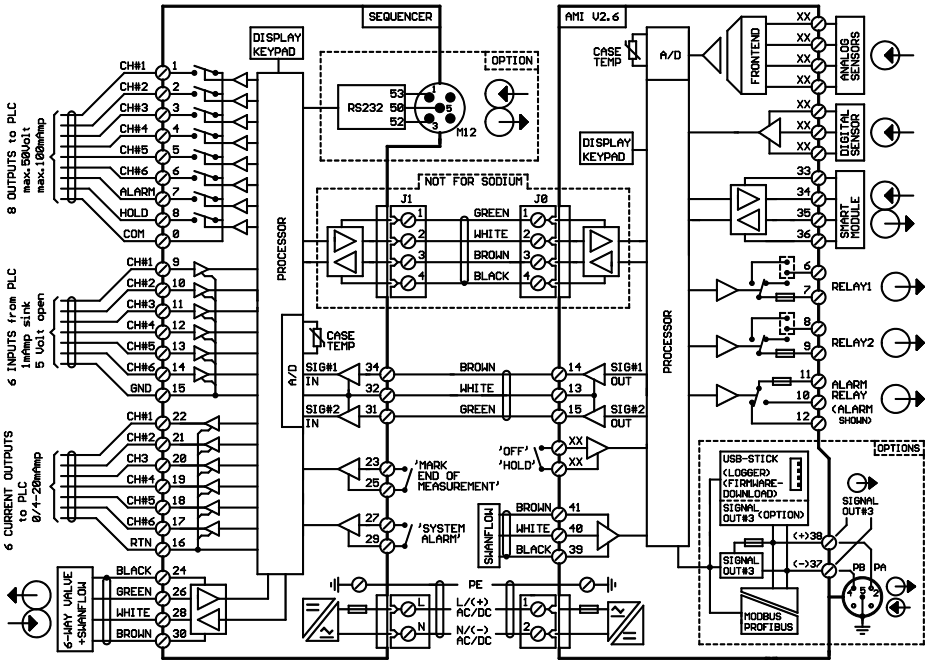
A *PG 11 cable gland: cable $Ø_{outer}$ 5–10 mm*
B *PG 7 cable gland: cable $Ø_{outer}$ 3–6.5 mm*
C *PG 9 cable gland: cable $Ø_{outer}$ 4–8 mm*

Note: *Protect unused cable glands*

Wire

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

3.7. 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.

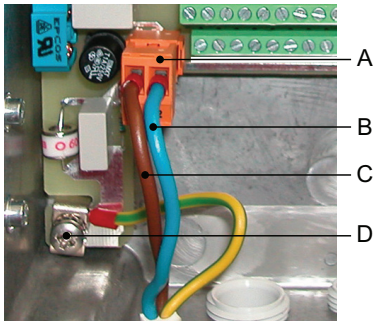
3.8. Power Supply

WARNING

Risk of electrical shock

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

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



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

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 analyzer
  - easily accessible to the operator
  - marked as interrupter for AMI Sample Sequencer

3.9. Communication, Error Handling

3.9.1 Mode <AMI>

The I^2C connection allows a communication between the AMI analyzer and the AMI Sample Sequencer.

Sample switch command

The AMI analyzer sends a command to the AMI Sample Sequencer to switch the 6-way valve to the next sample stream.

Sample flow error in mode internal

If the Sample Sequencer detects a flow error on a sample stream, it immediately switches to the next sample stream until it finds a sample stream with sample flow. The flow error is indicated on the respective sample stream on the AMI analyzer display with a tilde.

During this time the AMI analyzer detects sample flow from the constant head, therefore no flow alarm is triggered.

Sample flow error in mode external

If the Sample Sequencer detects a flow error on a sample stream, it is waiting for the command to switch to the next sample stream. A flow alarm is issued via relay contact 7 “ALARM” of the outputs to PLC.

3.9.2 Mode <Internal>

The signal outputs 1 and 2 of the AMI analyzer can be connected to the signal inputs 1 and 2 of the AMI Sample Sequencer. This allows to transfer the measured values of each measured sample stream to a remote device.

There is no communication between the AMI analyzer and the AMI Sample Sequencer!

Sample switch command

The command to switch to the next channel is triggered by the AMI Sample Sequencer according to its programmed cycle time.

Sample flow error

If the Sample Sequencer detects a flow error on a sample stream it remains on this sample stream until the cycle time is over. During this time it displays a flow alarm.

4. Instrument Setup

After the installation according to checklist has been finished, adjust the sample flow.

Without back pressure regulator

1. Open all main sample taps.
2. Open all flow regulating valves at the sample inlets of the AMI Sample Sequencer.
3. Adjust the sample flow of each sample inlet to min. 5 l/h.
4. Check all sample inlets for leakage.
5. If leakage occurs, stop sample flow and repair it.
6. Repeat step 1 to 4.
7. Switch on power.

With back pressure regulator

The Swan Back Pressure Regulator is used to stabilize, reduce and control the flow rate of sample for water analyzing systems. If a back pressure regulator is installed adjust the sample flow as follows:

1. Open all main sample taps.
2. Open all flow regulating valves at the sample inlets of the AMI Sample Sequencer.
3. Open the shut off valves on the back pressure regulators.
4. The sample flow of each sample inlet should be min. 5 l/h.
5. Check all sample inlets for leakage.
6. If leakage occurs, stop sample flow and repair it.
7. Repeat step 1 to 5.
8. Switch on power.

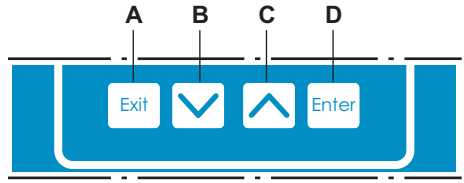
4.1. Programming

Programming

Program all parameters for instrument operation (sequence, alarms).
See Program List and Explanations, S. 60.

5. Operation

5.1. Keys



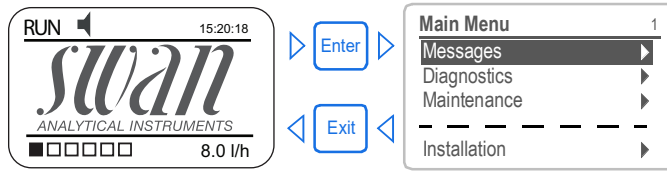
A to exit a menu or command (rejecting any changes)
to move back to the previous menu level

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

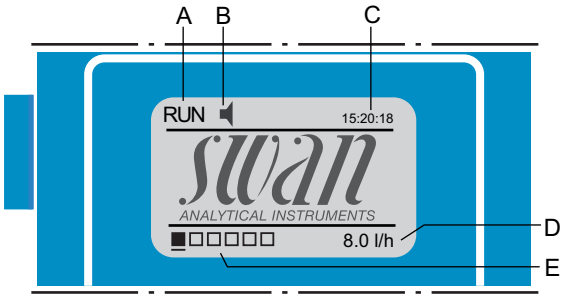
C to move UP in a menu list and to increase digits

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

Program access, exit



5.2. Display



A RUN normal operation

HOLD AMI Sample Sequencer on hold

B ERROR Error Fatal error

C Time

D Sample flow

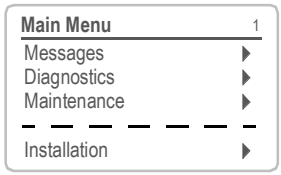
E Status of channels 1 to 6

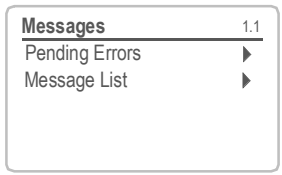
☐ Sample line inactive

■ Sample line active

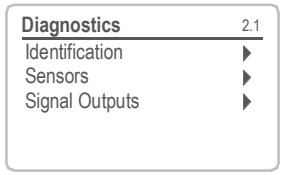
Underlined square: Last valid measurement

5.3. Software Structure

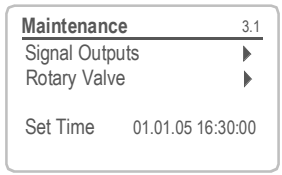




Menu 1 Messages
Reveals pending errors as well as an event history (time and state of events that have occurred at an earlier point of time). Contains user-relevant data.

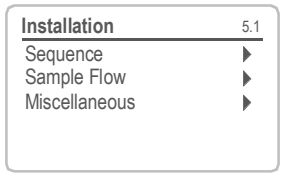


Menu 2 Diagnostics
Provides user-relevant instrument and sample data.



Menu 3 Maintenance
For instrument calibration, relay and signal output simulation, and to set the instrument time. Used by service personnel.

Menu 4 Operation
Not applicable.

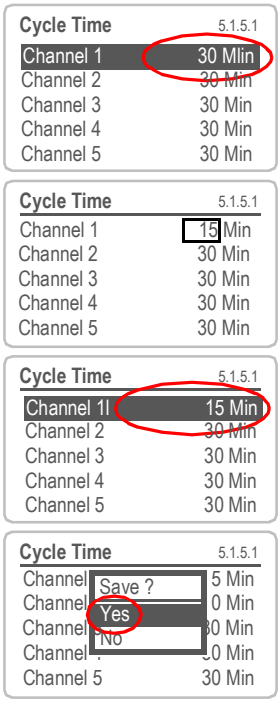


Menu 5 Installation
For initial instrument set up by a Swan authorized person. Can be protected by means of password.

5.4. Changing Parameters or Values

Changing parameters

The following example shows how to change the cycle time:



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 indicated (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.*

6. Maintenance

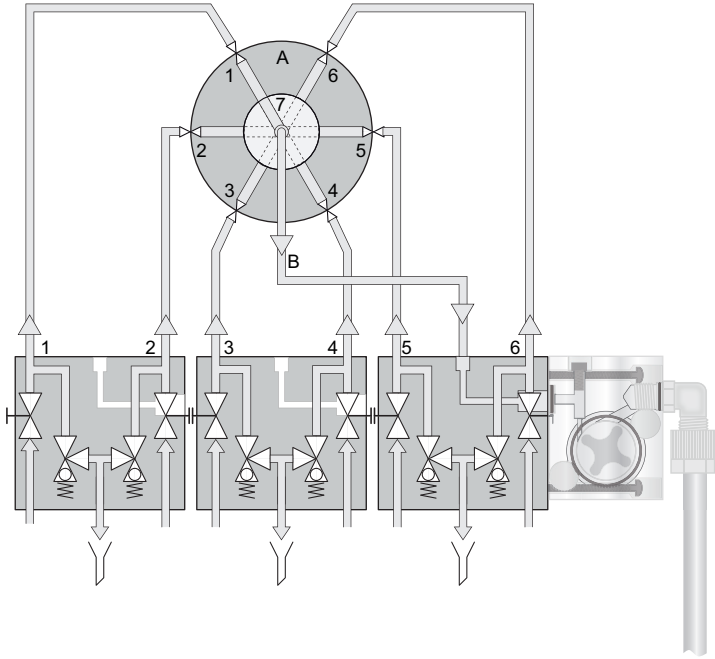
6.1. Maintenance Schedule

Monthly	Check sample flow.
By occurrence	Replace tubes. Clean flow meter.

6.2. Stop of Operation for Maintenance

1. Stop sample flow.
2. Shut off power of the instrument.

6.3. Tube Connections



The connection tubes between the flow cell block outlet and the 6-way valve inlet are not numbered. If you replace the tubes make sure that the numbering of the flow cell block outlets corresponds to the numbering of the 6-way valve inlets.

6.4. Replacing Fuses

WARNING

Risk of electrical shock

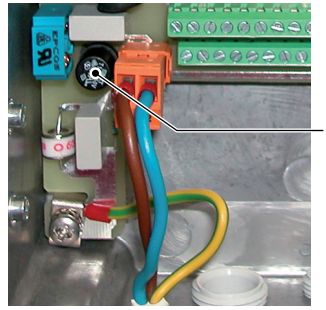
Do not perform any work on electrical components if the transmitter is switched on. Failure to follow safety instructions could result in serious injury or death.

- Disconnect the instrument from the mains before opening the cover.

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 *1 AT/250V instrument power supply*

6.5. Longer Stop of Operation

1 Stop sample flow.

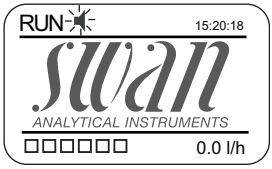
2 Shut off power of the instrument.

7. Error List

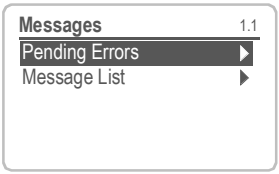
Error
Non-fatal error. Indicates an alarm if a programmed value is exceeded.
Such errors are marked **E0xx** (bold and black).

Fatal error (blinking symbol)
The indicated measured values are possibly incorrect. Fatal errors are divided in the following two categories:

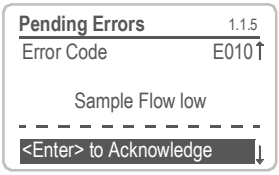
- Errors which disappear if correct measuring conditions are recovered (e.g. sample flow low).
  Such errors are marked **E0xx** (bold and orange)
- Errors which indicate a hardware failure of the instrument.
  Such errors are marked **E0xx** (bold and red)



Error or fatal error
Error not yet acknowledged.
Check **pending errors 1.1.5** and take corrective action.



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



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

Error	Description	Corrective action
E009	Sample flow high	– check Inlet pressure – readjust sample flow – check programmed value, see 5.2.1, p. 63
E010	Sample flow low	– check Inlet pressure – readjust sample flow – clean instrument – check programmed value, see 5.2.2, p. 63
E024	Rovalve	– call service
E030	I2C rovalve	– call service
E031	Calibration recout	– call service
E049	Power-on	– none, normal status
E050	Power-down	– none, normal status

8. Program Overview

For explanations about each parameter of the menus see Program List and Explanations, S. 60.

- Menu 1 **Messages** is always accessible for everybody. No password protection. No settings can be modified.
- Menu 2 **Diagnostics** is always accessible for everybody. No password protection. No settings can be modified.
- Menu 3 **Maintenance** is for service: Calibration, simulation of outputs and set time/date. Please protect with password.
- Menu 4 **Operation** not applicable.
- Menu 5 **Installation**: Defining operating parameters. 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		

8.2. Diagnostics (Main Menu 2)

Identification 2.1*	Designation	*AMI Sequencer*		
	Version	*V5.00 - 12/16*		
	Version ROVALVE	*1.50*		
	Factory Test 2.1.4*	*Instrument*	2.1.4.1	
		Motherboard		
	Operating Time 2.1.5*	*Years / Days / Hours / Minutes / Seconds*		2.1.5.1*
Sensors 2.2*	**Miscellaneous 2.2.1**	**Case Temp.**	**2.2.1.1***	
Signal Outputs 2.3*	*Signal Output 1–6*	2.3.1*		
Signal Inputs 2.4	*Signal Input 1*	2.4.1*		
	Signal Input 2			

8.3. Maintenance (Main Menu 3)

Signal Outputs	*Signal Output 1–6*	3.1.1	* Menu numbers
3.1*	3.1.1*		
Rotary Valve			
3.2*			
Set Time	*(Date), (Time)*		
3.5*			

8.4. Operation (Main Menu 4)

Not applicable

8.5. Installation (Main Menu 5)

Sequence	*Mode*	5.1.1*	
5.1*	*Signal Inputs*	5.1.2*	only at continuous measurement
	Flush Time	5.1.3*	only at continuous measurement
	Valid After	5.1.4*	only at continuous measurement
	Cycle Time	*Channel 1–6*	only at continuous measurement
	5.1.5		
Sample Flow	*Alarm High*	5.2.1*	
5.2*	*Alarm Low*	5.2.2*	
	Hysteresis	5.2.3*	
	Delay	5.2.4*	
Miscellaneous	*Language*	5.3.1*	
5.3*	*Set defaults*	5.3.2*	
	Load Firmware	5.3.3*	
	Password	*Messages*	5.3.4.1*
	5.3.4*	*Maintenance*	5.3.4.2*
		Operation	5.3.4.3*
		Installation	5.3.4.4*

9. Program List and Explanations

1 Messages

1.1 Pending Errors

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

1.2 Message List

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

2 Diagnostics

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

2.1 Identification

Designation: View the designation of the instrument.
Version: Firmware of instrument (e.g. V5.00-12/16)
Version: ROVALVE 1.50

2.1.4 Factory Test: Test date of the Instrument and Motherboard.

2.1.5 Operating Time: Years / days / hours / minutes / seconds.

2.2 Sensors

2.2.1 Miscellaneous:

2.2.1.1 *Case Temp:* Shows actual temperature in [°C] inside the transmitter.

2.3 Signal Outputs

2.3.1 Signal Output 1 to 6: Review the actual measured value in mA.

2.4 Signal Inputs

2.4.1 Signal Input 1 and 2: Review the actual measured value in mA.

3 Maintenance

3.1 Signal Outputs

3.1.1 Signal Output 1 to 6:

Possibility to simulate a current output manually for test purposes. To simulate a value proceed as follows:

1. Select one of the 6 signal outputs with the [▲] or [▼] key.
2. Press [Enter].
3. Change the value with the [▲] or [▼] key.
   Range: 0–20 mA
4. Press [Enter].
   ⇒ *The value is simulated at the corresponding signal output.*

3.2 Rotary Valve

Possibility to switch the 6-way valve manually to any channel for test purposes.

To switch the 6-way-valve to a certain position proceed as follows:

1. Press [Enter].
2. Select the position you want to switch to with the [▲] or [▼] key.
3. Press [Enter].
   ⇒ *The 6-way-valve rotates to the defined position.*

3.5 Set Time

Adjust date and time.

4 Operation

Not Applicable.

5 Installation

5.1 Sequence

5.1.1 *Mode:* Internal, AMI
Mode Internal: Set mode to Internal if the AMI Sample Sequencer is connected to an AMI Sodium A or an AMI Sodium P. In this mode the AMI Sample Sequencer automatically switches from sample 1 to max. 6.

Mode AMI: Set mode to AMI if the AMI Sample Sequencer is connected to an AMI Silica, AMI Silitrace or AMI Phosphate HL. In this mode the AMI Sample Sequencer works as a slave of the AMI analyzer. No further settings are available in the mode AMI.

> ***Note:*** *Do not set the AMI Sample Sequencer to mode Internal if it is connected to an AMI Silica, AMI Silitrace or AMI Phosphate HL.*

5.1.2 *Signal Inputs:* The signal inputs are used to receive the measuring signal(s) from the current output of the AMI Sodium A or an AMI Sodium P. The signal(s) are then transferred to a remote device where the measured value(s) are displayed.

- If one signal input is selected, six sample channels are available.
- If two signal inputs are selected, three sample channels are available.

Range: 1 or 2

5.1.3 *Flush Time:* Set the flush time duration after channel switching.
Range: 10–3600 sec

5.1.4 *Valid after:* Set the remaining measuring time for channel x after the 6-way valve has switched to the next channel.
Range: 0–3600 sec

5.1.5 *Cycle Time:* Set the cycle time of each channel (1 to max. 6). If the cycle time is set to 0, the channel is switched off.
Range: 0–600 min

5.2 Sample Flow

5.2.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay is activated and E009 is displayed in the message list.
Range: 0.00–50.00 l/h

5.2.2 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay is activated and E010 is displayed in the message list.
Range: 0.00–50.00 l/h

5.2.3 *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: 0.5–5 l/h

5.2.2 *Delay:* Time period during which the activation of the alarm relay is retarded after the messured value has risen above/fallen below the programmed alarm.
Range: 0–28‘800 sec

5.3 Miscellaneous

5.3.1 *Language:* Set the desired language.
Available settings: German/English/French/Spanish

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

- calibration
- in parts
- completely

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

5.3.4 Password: Select a password different from 0000 to prevent unauthorized access to the menus <Messages>, <Maintenance> and <Installation>.

Each menu may be protected by a different password.

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

10. Default Values

Installation:

Sequence:	Mode: ..... Internal
	Signal Inputs: 1
	Flush Time: ..... 60 s
	Valid After: ..... 0 s
	Sequence: Cycle Time: Channel 1–6 ..... 15 min
Sample Flow	Alarm high: ..... 25 l/h
	Alarm low: ..... 5 l/h
	Hysteresis: ..... 0.5 l/h
	Delay: ..... 10 s
Miscellaneous	Language: ..... English
	Set default: ..... no
	Load firmware: ..... no
	Password: ..... for all modes 0000

11. Index

12. Notes

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ANALYTICAL INSTRUMENTS

A-96.250.661 / 070222

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SWISS MADE

AMI Sample Sequencer