swan
ANALYTICAL INSTRUMENTS

AMI Rescon

Version 6.20 and higher

Operator's Manual

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

SWAN ANALYTISCHE INSTRUMENTE AG
Studbachstrasse 13
8340 Hinwil
Switzerland

Internet: www.swan.ch

E-mail: support@swan.ch

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Table of Contents

AMI Rescon–Operator's Manual

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

1. Safety Instructions

General

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

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

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

Strictly follow all safety instructions in this publication.

Target audience

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

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

OM Location

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

Qualification, Training

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

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

1.1. Warning Notices

The symbols used for safety-related notices have the following 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 can be the consequence if such warnings are ignored.

- Follow the prevention instructions carefully.

Mandatory Signs

The meaning of the mandatory signs in this manual.

Safety goggles

Safety gloves

Warning Signs The meaning of the warning signs in this manual.


Electrical shock hazard


Corrosive


Harmful to health


Flammable


Warning general


Attention general

1.2. General Safety Regulations

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

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

Modifications

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

WARNING

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.

1.3. Restrictions for use

The AMI Rescon is designed for determination of specific conductivity or resistivity in high purity water.

To avoid clogging the flow cell, prevent sand, oil or solids, from entering into the flow cell.

Sufficient sample flow is coercive for the correct function of the instrument. To determine values near 18.18 MOhm-cm exactly, a sample flow of 70–100 l/h is needed.

2. Product Description

2.1. Description of the System

This instrument is applicable for the determination of specific resistivity or specific conductivity in high purity water.

Measuring Principle

The resistivity of high purity water is determined with a sensor consisting of two metal electrodes. The characteristics of each sensor is expressed as cell constant. An alternating voltage (to minimize polarization effects) is applied to two electrodes. Depending on the concentration of ions in the sample, a signal results between the electrodes which is proportional to the resistivity of the water.

The measuring result is indicated as resistivity or conductivity. The conductivity measurement depends on temperature, as the mobility of ions increase with rising temperature. To eliminate these effects, the temperature is determined simultaneous with an incorporated NT5K temperature sensor. Several temperature compensation curves for different applications are available.

Signal Outputs

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

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

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

Relays

Two potential-free contacts programmable as limit switches for measuring values, controllers or timer for system cleaning with automatic hold function.

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

One input for potential-free contact to freeze the measuring value or to interrupt control in automated installations. Programmable as HOLD or OFF function.

Communication interface (optional)

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

Safety Features

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

Standard flow cell

A QV-Hflow flow cell is supplied with the Monitor as standard.

USP Operating Mode

The USP Operating Mode implemented in the firmware of the AMI Rescon transmitter allows the measurement of pharmaceutical water according to the USP <645>.
If the USP Operating Mode is set to <off> conductivity or resistivity standard measurement with automatic temperature compensation is performed.

If the USP Operating Mode is set to <on>, the temperature compensation function is disabled. The uncompensated measuring values are compared with the values of an implemented table defined by USP (see table below). If the deviation of the measured values is too high, the Error 15 (USP Error) is issued.

Temperature [°C]	Conductivity [µS/cm]	Temperature [°C]	Conductivity [µS/cm]
0	0.6	55	2.1
5	0.8	60	2.2
10	0.9	65	2.4
15	1.0	70	2.5
20	1.1	75	2.7
25	1.3	80	2.7
30	1.4	85	2.7
35	1.5	90	2.7
40	1.7	95	2.9
45	1.8	100	3.1
50	1.9		

Conductivity QC-Kit Test Plug

The implemented Transmitter Test together with Conductivity QC-Kit Test Plug containing a traceable high precision resistor allows to perform a verification of he measuring electronics at any time.

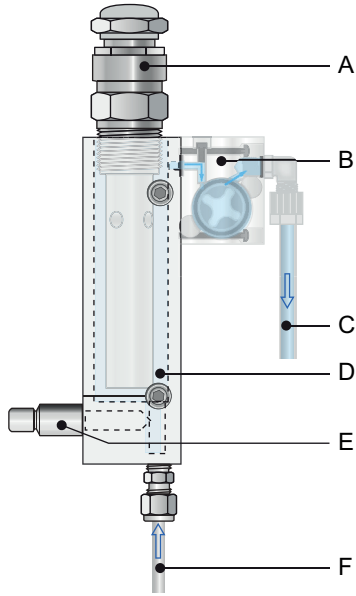
Fluidics

The flow cell QV-Hflow consists of the flow cell block [D], the flow sensor [B] and the flow regulating valve [E].

The conductivity sensor RC-U [A] with integrated temperature sensor is screwed into the flow cell block [D].

The sample enters at the sample inlet [F]. It flows through the flow regulating valve [E], where the flow rate can be adjusted. Then the sample flows through the flow cell block [D] were the resistivity of the sample is measured.

The sample leaves the flow cell block via flow meter through the sample outlet [C].

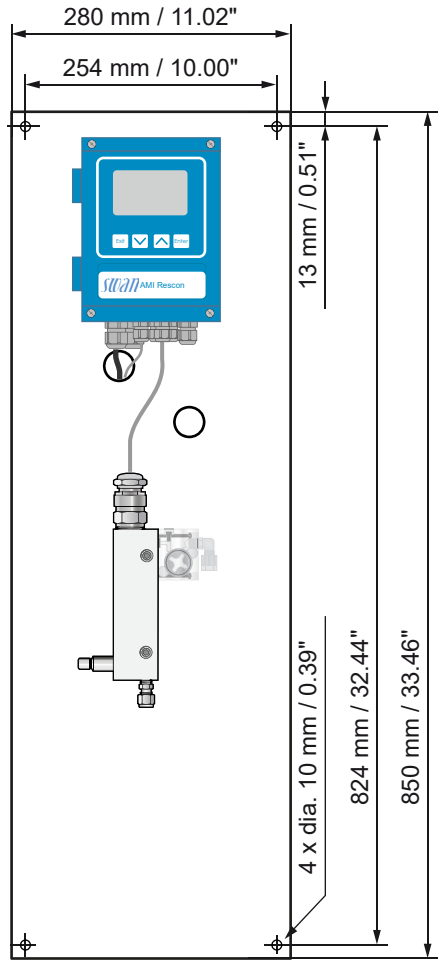


A *Sensor RC-U*
B *Flow sensor*
C *Sample outlet*
D *Flow cell block*
E *Flow regulating valve*
F *Sample inlet*

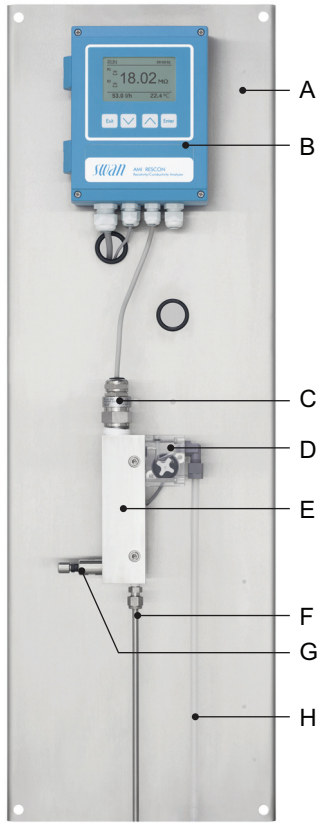
2.2. Instrument Specification

Power Supply	AC variant:	100–240 VAC (± 10%) 50/60 Hz (± 5%)
	DC variant	10–36 VDC
	Power consumption:	max. 35 VA
Transmitter specifications	Housing:	aluminum, with a protection degree of IP 66 / NEMA 4X
	Ambient temperature:	−10 to +50 °C
	Storage and transport:	−30 to +85 °C
	Humidity:	10–90% rel., non condensing
	Display:	backlit LCD, 75 x 45 mm
Measuring range	Resistivity:	0.01–18.18 MΩ-cm
	Conductivity:	0.055–1000 µS/cm
Sample requirements	Flow rate:	70–100 l/h
	Temperature	up to 95 °C
	Sample inlet pressure:	up to 2 bar
	Sample outlet pressure:	pressure free
On-site requirements	The analyzer site must permit connections to:	
	Sample inlet:	Swagelok tube 1/4” adapter
	Sample outlet:	FEP flexible tube 6 mm

Dimensions	Panel:	Stainless steel
	Dimensions:	280 x 850 x 180 mm
	Screws:	8 mm diameter
	Weight:	7.0 kg



2.3. Instrument Overview

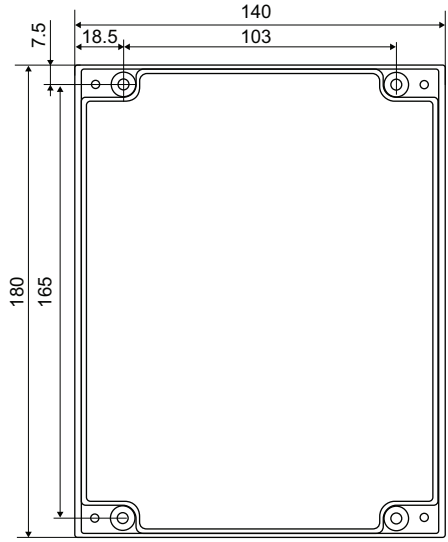


A *Panel*
B *Transmitter*
C *Sensor RC-U*
D *Flow sensor*
E *Flow cell*
F *Sample inlet*
G *Flow regulating valve*
H *Sample outlet*

2.4. Single Components

2.4.1 Transmitter AMI Rescon

Electronic transmitter and controller for conductivity measurement.

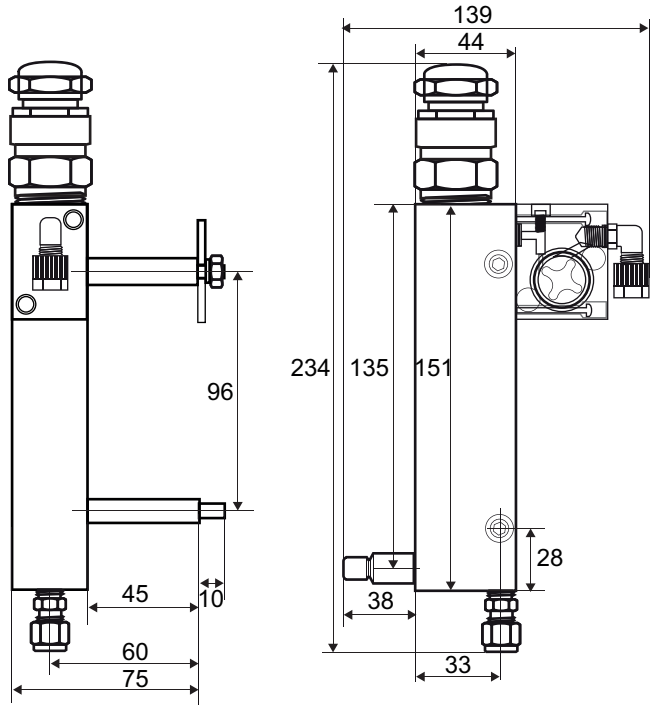


Dimensions	Width:	140 mm
	Height:	180 mm
	Depth:	70 mm
	Weight:	1.5 kg
Specifications	Electronics case:	Cast aluminum
	Protection degree:	IP 66 / NEMA 4X
	Display:	backlit LCD, 75 x 45 mm
	Electrical connectors:	screw clamps

2.4.2 Flow Cell QV-Flow and QV-HFlow SS316L 130

Flow cell made of stainless steel with flow sensor for the connection to SWAN transmitter and with manual flow regulating valve. Connection to tube with Swagelok adapter.

For one sensor with ¾" NPT thread

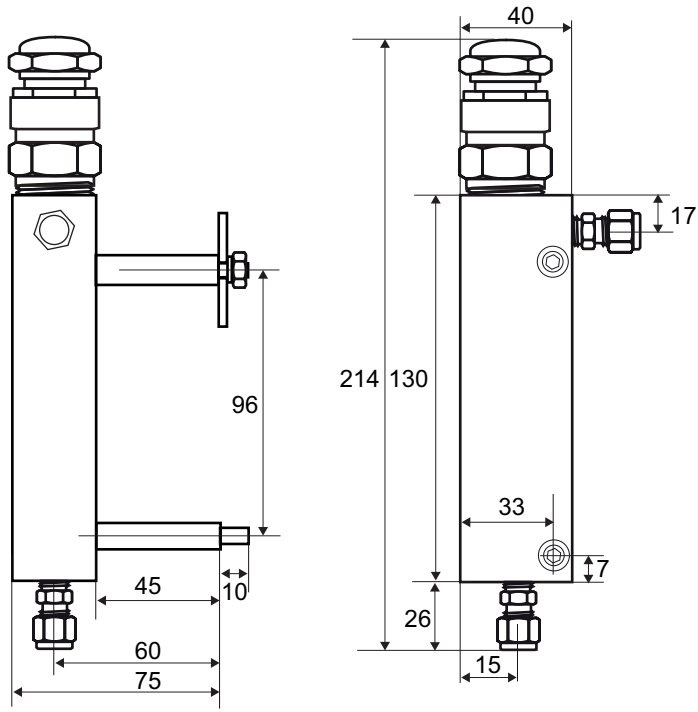


Technical data

Sample inlet:	Swagelok G 1/4” thread
Sample outlet:	Serto elbow for 6 mm flexible tube
Sample temperature:	0–60 °C
Sample flow, QV-Flow:	3–25 l/h
Sample flow, QV-HFlow:	10–120 l/h
Sample inlet pressure:	max. 15 bar at 50 °C
Sample outlet pressure:	pressure free

2.4.3 Flow Cell B-Flow SS316L 130

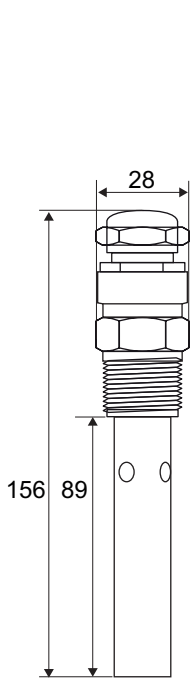
Flow cell made of stainless steel SS316L to connect to tubes.
For one sensor with ¾" NPT thread, fitting length 89 mm.



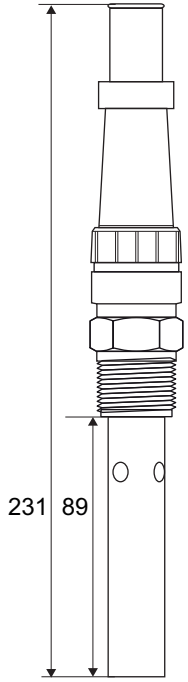
Technical data	Sample inlet:	Swagelok G 1/8” thread
	Sample outlet:	Swagelok G 1/8” thread
	Sample temperature:	-10–130 °C
	Sample inlet pressure:	max. 10 bar at 130 °C

2.4.4 Swansensor RC U

Sensor for the measurement of the specific conductivity and specific resistivity in high purity water.



Swansensor RC U
with integrated cable



Swansensor RC U
with Plug

Specifications RC U-Sensor

Measuring range:	0.055–1000 µS/cm
respective:	0.01–200 MΩ
Operating temperature:	-10 to + 90 °C
Pressure:	max. 10 bar at + 90 °C
Accuracy (at 25 °C):	> +/- 0.5% up to 20 µS/cm
	+/- 1% from 20 µs/cm to 1000 µS/cm
Temperature sensor:	NT5K
Thread:	3/4” NPT

3. Installation

3.1. Installation Checklist

On site requirements	AC variant: 100–240 VAC (± 10%), 50/60 Hz (± 5%) DC variant: 10–36 VDC Power consumption: 35 VA maximum. Protective earth connection required. Sample line with sufficient sample flow and pressure (see Instrument Specification, p. 10).
Installation	Mounting of Instrument Panel, p. 18 Connecting Sample Inlet and Outlet, p. 19
Connect sensors	Only if single components have been ordered. Connect the Resistivity Sensor Cable, p. 22. Connect the Flow Sensor Cable, p. 22.
Electrical wiring	Connect all external devices like limit switches, current loops and pumps.
Power-up	Establish Sample Flow, p. 33. Switch on power. Adjust sample flow according to flow cell specifications.
Instrument set-up	Program all necessary parameters see Programming, p. 33 Program the flow cell type Program the measuring mode (resistivity or conductivity). Program all sensor data (cell constant, temperature correction, cable length). Program the required temperature compensation. Program all parameters for external devices (interface, recorders, etc.). Program all parameters for instrument operation (limits, alarms).
Run-in period	If the conductivity value of the sample is very low, the sensor might need some time until the correct reading is displayed

3.2. Mounting of Instrument Panel

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.
Instrument Specification, p. 10

3.3. Connecting Sample Inlet and Outlet

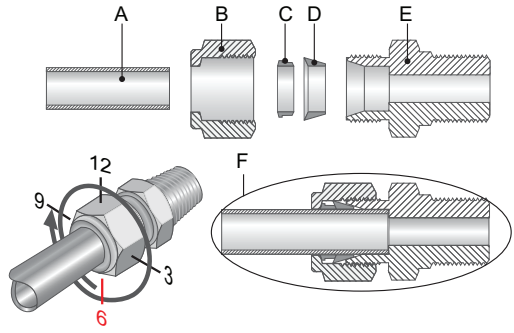
3.3.1 Sample Inlet

Preparation

For the sample inlet a stainless steel tube is connected to the Swagelok fitting at the flow cell. Cut the tube to length and deburr it. The tube must be straight and free from blemishes for approximately 1,5 x tube diameter from the end.
Lubrication with lubricating oil, MoS2, Teflon etc. is recommended for the assembly and reassembly of bigger sized unions (thread, compression cone).

Installation

1. Insert the compression ferrule [C] and the compression cone [D] into the union nut [B].
2. Screw on the union nut onto the body, do not tighten it.
3. Push the stainless steel pipe through the union nut as far as it reaches the stop of the body
4. Mark the union nut at 6 o'clock position.
5. While holding the fitting body steady, tighten the nut union 1¼ rotation using an open ended spanner.



A *Tube*
B *Union nut*
C *Compression ferrule*
D *Compression cone*
E *Body*
F *Tightened connection*

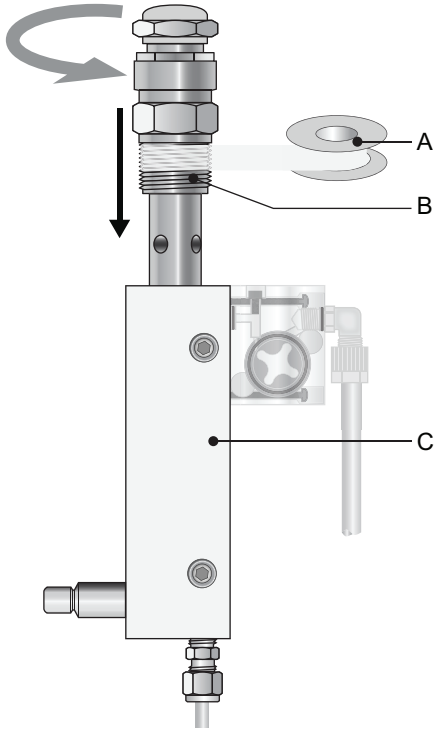
3.3.2 Sample Outlet

FEP flexible tube 6 mm. Connect the tube to the serto elbow union and Insert it into an atmospheric drain of sufficient capacity.
Max. tube length is 1.5 m. Do not connect longer tubes.

3.4. Install Sensor RCU

The following instruction applies for all flow cells and pipe flanges. To install the sensor RC U into a flow cell or a pipe flange proceed as follows:

Install Sensor into Flow Cell

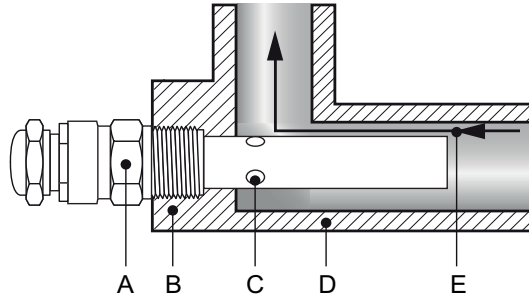


A *Teflon tape*
B *Sensor thread*
C *Flow cell*

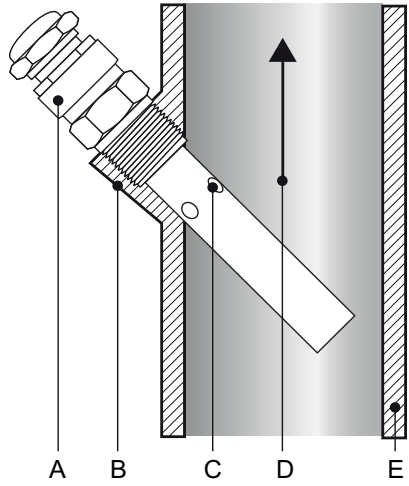
Install Sensor into a tube

Installation in a by-pass is recommended. Choose the installation point carefully, to ensure the sensor is always filled with water, even if sample flow is interrupted. To avoid the formation of air bubbles inside the sensor make sure that the air vent holes are always submerged.

Installation examples for tube installation



A *Sensor*
B *Flange*
C *Air vent hole*
D *Tube*
E *Flow direction*



A *Sensor*
B *Flange*
C *Air vent hole*
D *Flow direction*
E *Tube*

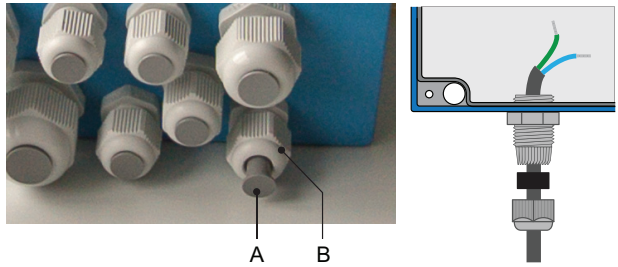
1 Wrap 7 turns of teflon tape around the sensor thread.
2 Screw the sensor into the flow cell or the pipe flange.
3 Tighten the sensor well with a monkey spanner.

3.5. Connect the Resistivity Sensor Cable

WARNING

Electrical shock hazard!
Before opening the AMI Transmitter switch power off.

Use one of the cable glands to feed the sensor cable into the sensor housing.



1. Choose a suitable cable gland, see chapter Electrical Connections, p. 23.
2. Remove the plug [A] from the cable gland [B].
3. Open the AMI transmitter housing.
4. Feed the sensor cable through the cable gland [B] into the transmitter housing.
5. Connect the cable to the terminals according to the connecting diagram see Connection Diagram, p. 25.
6. Close the AMI transmitter housing.
7. Switch on power.

3.6. Connect the Flow Sensor Cable

If a flow cell with a flow sensor was ordered (QV-Flow) connect it to the AMI Transmitter. Proceed according to chapter Connect the Resistivity Sensor Cable, p. 22.

3.7. Electrical Connections

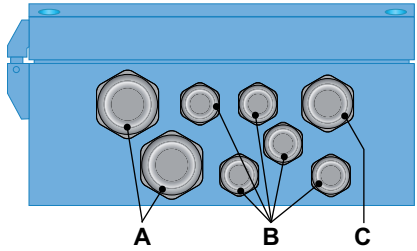
WARNING

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

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

Cable thicknesses

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



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

NOTICE: *Protect unused cable glands*

Wire

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

WARNING

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

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

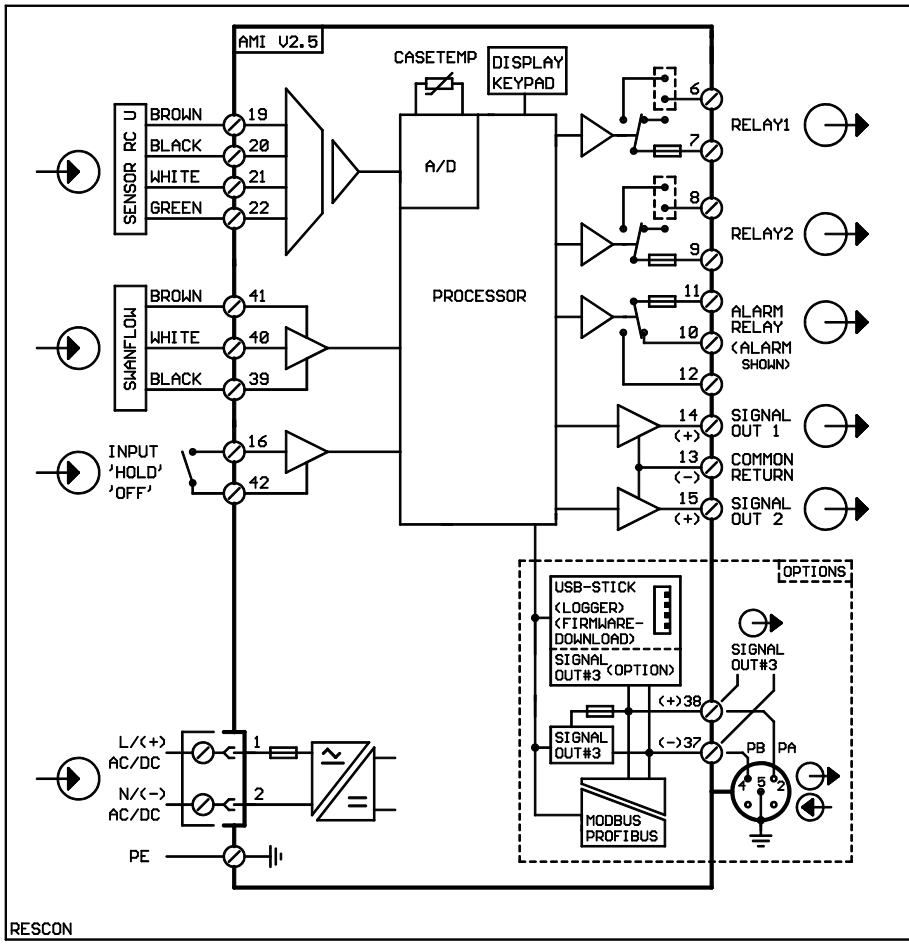
WARNING

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

WARNING

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

3.7.1 Connection Diagram



CAUTION

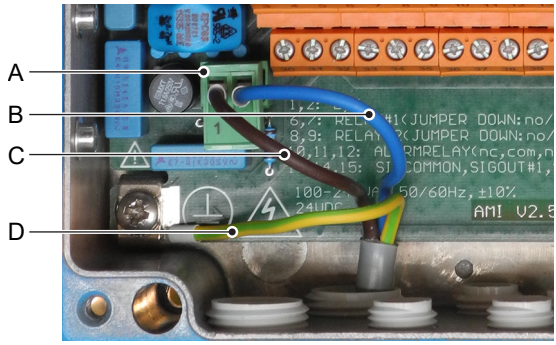
Use only the terminals shown in this diagram, and only for the mentioned purpose. Use of any other terminals will cause short circuits with possible corresponding consequences to material and personnel.

3.7.2 Power Supply

WARNING

Electrical shock hazard

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



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

NOTICE: *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 Rescon

3.8. Relay Contacts

Programming of the relay contacts see 5.3 Relay Contacts, p. 64

3.8.1 Input

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

- *Terminals 16/42*

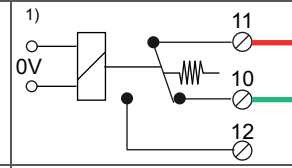
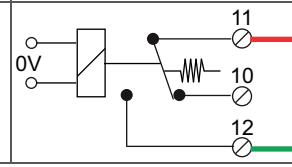
If signal output is set to hold, measurement is interrupted if input is active.
For programming see menu 5.3.4, p. 70

3.8.2 Alarm Relay

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

Alarm output for system errors.
Error codes see Troubleshooting, p. 46
Programming see menu 5.3.1, p. 64

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

	Terminals	Description	Relay connection
NC[1] Normally Closed	10/11	Active (opened) during normal operation. 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.	

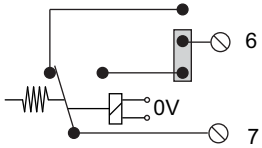
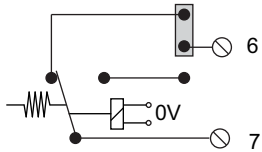
1) *usual use*

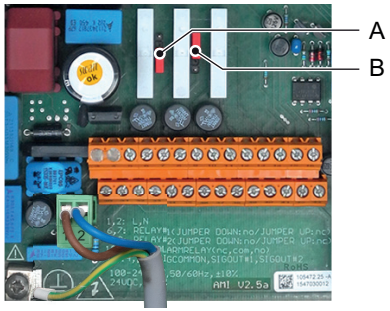
3.8.3 Relay Contacts 1 and 2

NOTICE: *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.

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

Relay config.	Terminals	Jumper pos.	Description	Relay configuration
Normally Open	6/7: Relay 1 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 and 5.3.3, p. 66

CAUTION

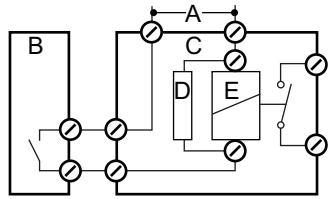
Risk of damage of the relays in the AMI Transmitter due to heavy inductive load.

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

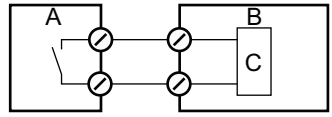
Small inductive loads (max 0.1 A) as for example the coil of a power relay can be switched directly. To avoid noise voltage in the AMI Transmitter it is mandatory to connect a snubber circuit in parallel to the load. A snubber is not necessary if an AMI relaybox is used.



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

Resistive load

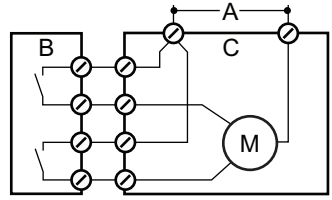
Resistive loads (max. 1 A) and control signals for PLC, impulse pumps and so on can be connected without further measures



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*

3.9. Signal Outputs

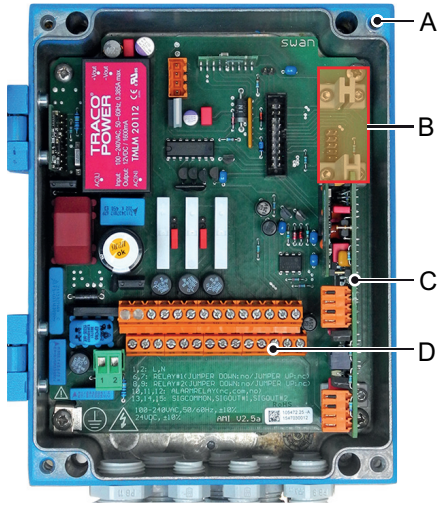
3.9.1 Signal Output 1 and 2 (current outputs)

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

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

For programming see Chapter 9, 5.2 Signal Outputs, p. 59, Menu Installation

3.10. Interface Options



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

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

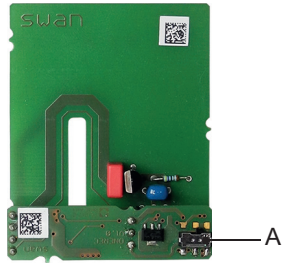
- Third signal output
- a Profibus or Modbus connection
- a HART connection
- an USB Interface

3.10.1 Signal Output 3

Terminals 38 (+) and 37 (-).

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

NOTICE: *Max. burden 510 Ω.*



Third signal output 0/4 - 20 mA PCB

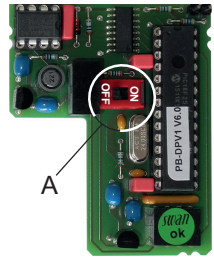
A Operating mode selector switch

3.10.2 Profibus, Modbus Interface

Terminal 37 PB, Terminal 38 PA

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

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



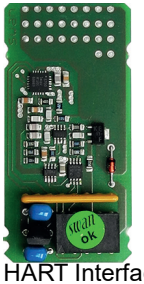
Profibus, Modbus Interface PCB (RS 485)

A *On - OFF switch*

3.10.3 HART Interface

Terminals 38 (+) and 37 (-).

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

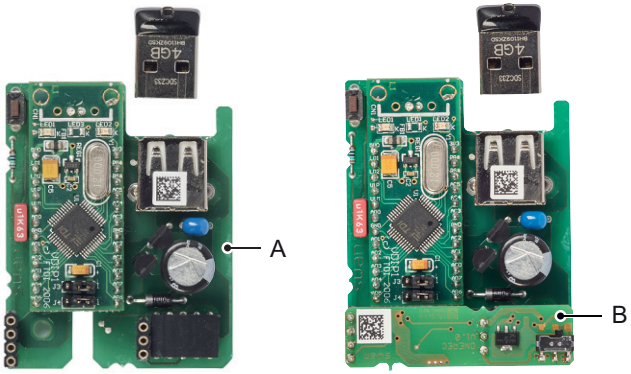


HART Interface PCB

3.10.4 USB Interface

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

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



USB Interface

A USB interface PCB

B Third signal output 0/4 - 20 mA PCB

4. Instrument Setup

4.1. Establish Sample Flow

1 Open the flow regulating valve.
2 Wait until the flow cell is completely filled.
3 Switch on power.

NOTICE: *To allow a precise measurement in the range between 18–18.18 MΩ, set the sample flow to 70–100 l/h.*

4.2. Programming

Set all necessary parameters in menu 5 <Installation>, further information about sensor parameters see 5.1 Sensors, p. 58.

- Flow measurement
- Measuring Mode
- USP Operating Mode
- Sensor parameters
- Temperature compensation
- Program all parameters for external devices (interface, recorders, etc.). Program all parameters for instrument operation (limits, alarms). See Program List and Explanations, p. 55.

Flow Measurement

Menu 5.1.1
Select the flow cell you are using:

- None
- Q-Flow
- Q-HFlow

Q-Flow can be used for flow rates up to 25 l/h.
Q-HFlow can be used for flow rates up to 120 l/h.

Meas. Mode

Menu 5.1.2
Select Resistivity or Conductivity according to your application.

USP Operating Mode

Menu 5.1.3

The USP Operating Mode implemented in the firmware of the AMI Rescon transmitter allows the measurement of pharmaceutical water according to the USP <645>.

If the USP Operating Mode is set to <off> conductivity or resistivity standard measurement is performed.

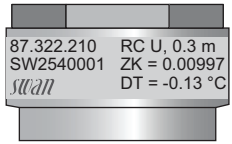
If the USP Operating Mode is set to <on>, the uncompensated measuring values are compared with the values of an implemented table defined by USP. If the deviation is too high, the Error 15 (USP Error) is issued.

Further information see USP Operating Mode, p. 8

Sensor Parameters

Menu 5.1.4:

Enter the following parameters printed on the sensor label.



- Cell constant ZK
- Temperature correction DT
- Sensor cable length.If the sensor cable length is 0.3 m, set the cable length to 0 m.

Temp. Compensation

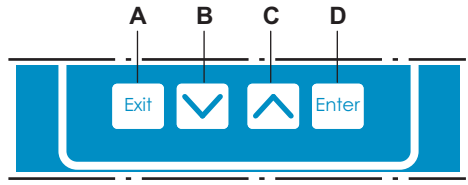
Menu 5.1.5

Choose between:

- none
- coefficient
- neutral salts
- high purity water
- strong acids
- strong bases
- ammonia, ethanolamine
- morpholine

5. Operation

5.1. Keys



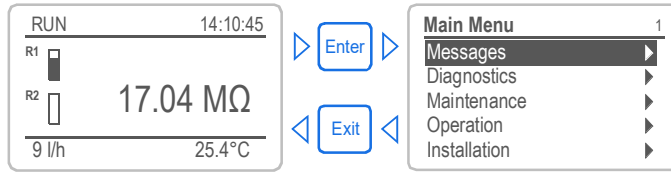
A to exit a menu or command (rejecting any changes)
to move back to the previous menu level

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

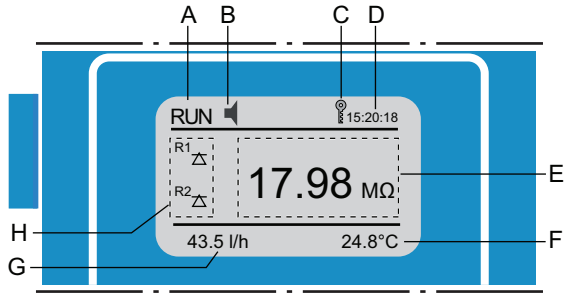
C to move UP in a menu list and to increase digits

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

Program Access, Exit



5.2. Display



A RUN — normal operation

HOLD — 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 Keys locked, transmitter control via Profibus

D Time

E Process values

F Sample temperature

G Sample flow

H 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

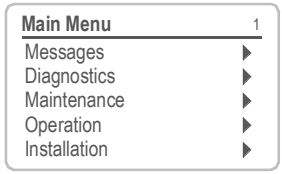
motor valve closed

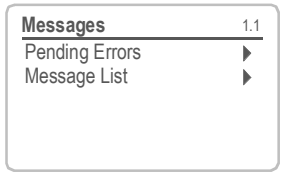
motor valve: open, dark bar indicates approx. position

timer

timer: timing active (hand rotating)

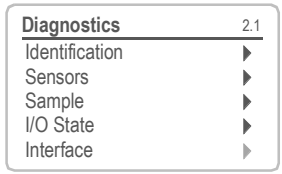
5.3. Software Structure





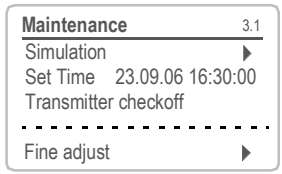
Menu **Messages 1**

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.



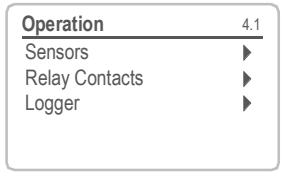
Menu **Diagnostics 2**

Provides user relevant instrument and sample data.



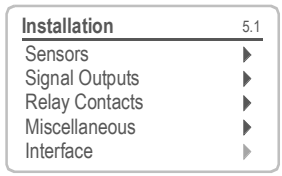
Menu **Maintenance 3**

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.



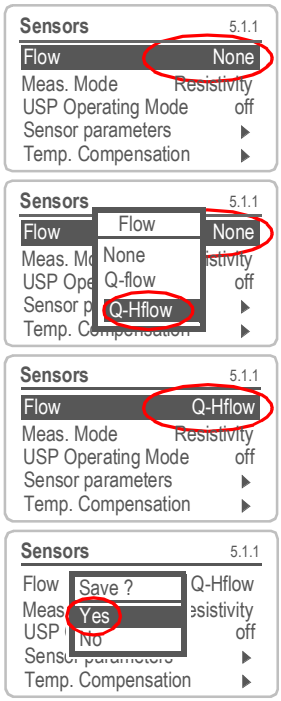
Menu **Installation 5**

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 set the Q-Hflow sensor:

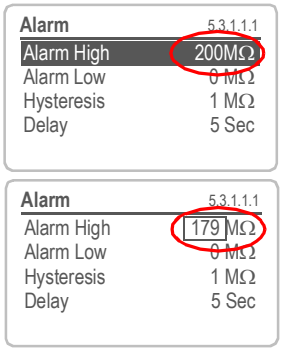


1. Select the parameter you want to change.
2. Press [Enter]
3. Press [▲] or [▼] key to highlight the required parameter.
4. Press [Enter] to confirm the selection or [Exit] to keep the previous parameter).

   ⇒*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.*

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 Table

If necessary	Clean sensor
According to USP regulations	Perform a transmitter check

6.2. Stop of Operation for Maintenance

1 Shut off power of the instrument.

2 Stop sample flow by closing the flow regulating valve [C].

6.3. Maintenance of Sensor

6.3.1 Clean Sensor

The Swansensor RC-U is largely maintenance free. However, depending on the application, it can be contaminated, which may cause problems.

The Swansensor RC-U is available in the following 2 different versions:

- Sensor with fix installed cable
- Sensor with plug

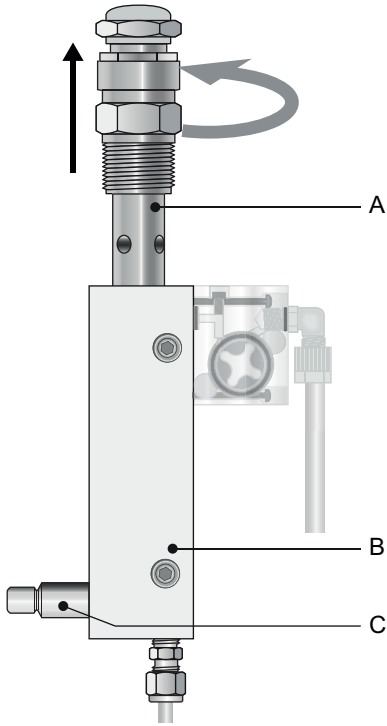
NOTICE: *Sensor with fix installed cable*

- *To avoid damage of the sensor cable due to torsion when screwing the sensor out of the flow cell, disconnect the cable from the terminals in the AMI transmitter.*

Remove the sensor with fix cable

To remove the sensor with fix installed cable from the flow cell proceed as follows:

1. Open the transmitter housing.
2. Disconnect the sensor cable from the terminals.
3. Remove the sensor cable from the transmitter housing.
4. Unscrew and remove the sensor [A] from the flow cell block [B], use a monkey spanner.
5. Remove the teflon tape from the sensor thread.
6. Clean the sensor with soap water.
7. Rinse the sensor well with high purity water.



A Sensor
B Flow cell
C Flow regulating valve

Install the sensor with fix cable

1. Wrap 7 turns of teflon tape around the sensor thread.
2. Screw the sensor into the flow cell and tighten it well.
3. Feed the sensor cable into the transmitter housing.

4 Connect the sensor cable to the terminals of the AMI transmitter, see Electrical Connections, S. 23.

5 Close the transmitter housing.

6 Open the flow regulating valve [C].

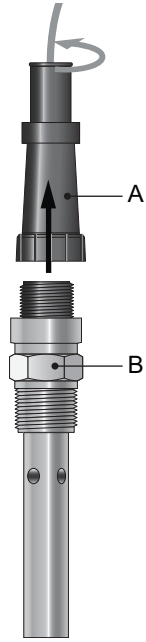
7 Switch on power.

Remove the sensor with plug

To remove the sensor with plug from the flow cell proceed as follows:

1 Unscrew and remove the sensor plug [A] from the sensor [B].

2 Proceed according to “Remove the Sensor with fix cable”, step 4.



A Sensor plug
B Sensor

Install the sensor with plug

1 Wrap 7 turns of teflon tape around the sensor thread.

2 Screw the sensor into the flow cell and tighten it well.

3 Screw the sensor plug on to the senor

4 Open the flow regulating valve [C].

5 Switch on power.

6.4. Conductivity-Resistivity QC-Kit Test Plug

The QC-Kit test plug fulfills the requirements of the United States Pharmacopeia (USP).

6.4.1 Introduction

The test plug consists of 2 high precision resistors for conductivity and temperature.

The plug has a resistor of

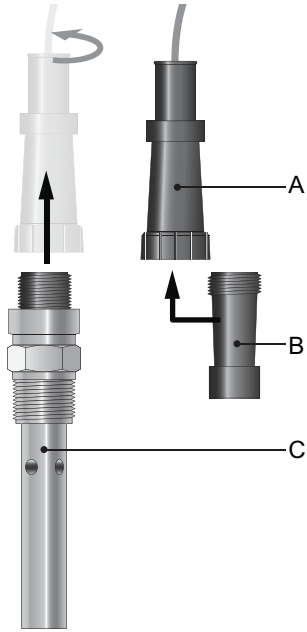
- 5000 Ω (+/- 1%) for temperature
- 181800 Ω (+/- 1%) for conductivity.

NOTICE: *Keep test kit absolutely dry!*

Several variables enter into the calculation of specific conductivity. Values like the cell constant, temperature compensation algorithm, cable length and temperature correction of the sensor are stored in the memory of the conductivity instrument.

Test mode For a quick and easy test, the AMI Rescon transmitter has the test mode <Transmitter check> that enables testing without changing any of these values. When leaving the test mode, all parameters will be set back to their original value.

6.4.2 Carry out a transmitter check



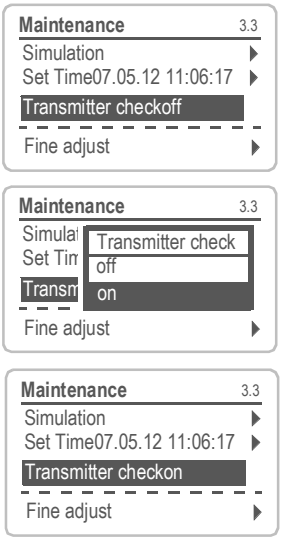
A *Sensor plug*
B *Test resistor*
C *Sensor RC U*

Connect the test resistor

1. Unscrew and remove the sensor plug [A] from the sensor [C]
2. Screw the sensor plug onto the test resistor [B].

Start transmitter check

NOTICE: *If Transmitter Check is switched on, the main menus <Operation> and <Installation> are not accessible.*



1 Navigate to menu <Maintenance> / <Transmitter check>.

2 Press [Enter].

3 Select <on> and confirm with [Enter]

⇒ *The Transmitter check is now active*

4 Leave the menu by pressing the exit key twice.

5 Compare the displayed resistivity or conductivity value and the temperature value with the value printed on the test resistor.

6.5. Fine Adjust

The function fine adjust is only available if the AMI Rescon is set to the measuring mode resistivity.

The function “Fine Adjust” is performed automatically every night at 00:30 h.

It is also possible to start the function “Fine Adjust” manually in the menu <Maintenance/Fine adjust>.

6.6. Longer Stop of Operation

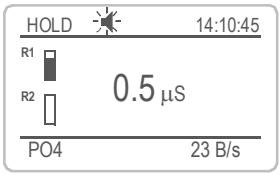
1. Stop sample flow.
2. Shut off power of the instrument.
3. Unscrew and remove the sensor.
4. Empty and dry the flow cell

7. Troubleshooting

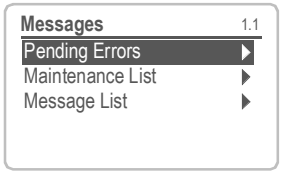
7.1. Error List

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:

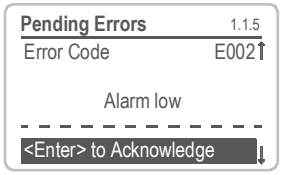
- Errors which disappear if correct measuring conditions are recovered (i.e. Sample Flow low).
  Such Errors are marked **E0xx** (bold and orange)
- Errors which indicate a hardware failure of the instrument.
  Such Errors are marked **E0xx** (bold and red)



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



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



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

Error	Description	Corrective action
E001	Alarm high	– check process – check programmed value
E002	Alarm low	– check process – check programmed value
E007	Sample Temp. high	– check process – check programmed value
E008	Sample Temp. low	– check process – check programmed value
E009	Sample Flow high	– check sample flow – check programmed value
E010	Sample Flow low	– establish sample flow – clean instrument – check programmed value
E011	Temp. shorted	– Check wiring of sensor – Check sensor
E012	Temp. disconnected	– Check wiring of sensor – Check sensor
E013	Case Temp. high	– check case/environment temperature – check programmed value
E014	Case Temp. low	– check case/environment temperature – check programmed value
E015	USP Error	– check process
E017	Control Timeout	– check control device or programming in Installation, Relay contact, Relay 1/2 see 5.3.2 and 5.3.3, S. 66
E019	Sensor shorted	– Check wiring of sensor – Check sensor
E020	Sensor interrupted	– Check wiring of sensor – Check sensor
E024	Input active	– See If Fault Yes is programmed in Menu see 5.3.4, S. 70

Error	Description	Corrective action
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
E065	Transmitter check	–

7.2. Replacing Fuses

WARNING

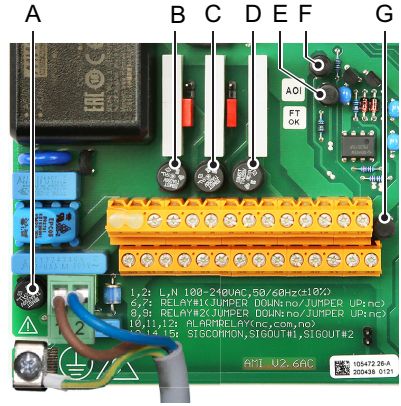
External Voltage.

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

When a fuse has blown, find out the cause and fix it before replacing it with a new one.

Use tweezers or needle-nosed pliers to remove the defective fuse. Use original fuses provided by SWAN only.



A *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. 55.

- 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: Calibration, 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		

8.2. Diagnostics (Main Menu 2)

Identification	Designation	AMI Rescon		* Menu numbers
2.1*	Version	V6.20-11/16		
	Factory Test	*Instrument*	2.1.3.1*	
	2.1.3*	*Motherboard*		
		Front End		
	Operating Time	*Years / Days / Hours / Minutes / Seconds*		2.1.4.1*
	2.1.4*			
Sensors	Cond. Sensor	*Current Value MOhm*		
2.2*	2.2.1*	*(Raw value) MOhm*		
		Cell Constant		
		Cal. History	*Number*	2.2.1.5.1*
		2.2.1.5*	*Date, Time*	
			RSlo (KOhm)	
	Miscellaneous	*Case Temp.*	*2.2.2.1**	
	2.2.2*			
Sample	*Sample ID*	2.3.1*		
2.3*	*Temperature °C*			
	Nt5K Ohm			
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)

Simulation	*Alarm Relay*	3.2.1*	* Menu numbers
3.1*	*Relay 1*	3.2.2*	
	Relay 2	3.2.3*	
	Signal Output 1	3.2.4*	
	Signal Output 2	3.2.5*	
Set Time	*(Date), (Time)*		
3.2*			
Transmitter check			
3.3*			
Fine adjust	*Current Value*	3.5.1*	
3.5*	*RSlo*		

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*	4.2.1.1.26*
			Hysteresis	4.2.1.1.36*
			Delay	4.2.1.1.46*
	Relay 1 and 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*		* Menu numbers

8.5. Installation (Main Menu 5)

				* Menu numbers
Sensors	*Flow*			
5.1*	5.1.1*			
	Meas. Mode			
	5.1.2*			
	USP Operating Mode			
	5.1.3			
	Sensor Parameters	*Cell Constant*		
	5.1.4	*Temp. Corr.*		
		Cable length		
	Temp. Compensation	*Comp.*	5.1.5.1	
	5.1.5*			
Signal Outputs	**Signal Output 1 and 2**	*Parameter*	5.2.1.1 - 5.2.2.1*	
5.2*	5.2.1* and 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.40.10/10*
		5.2.x.40	*Range High*	5.2.x.40.20/20*
Relay Contacts	**Alarm Relay**	**Alarm**	*Alarm High*	5.3.1.1.1*
5.3*	5.3.1*	5.3.1.1*	*Alarm Low*	5.3.1.1.26
			Hysteresis	5.3.1.1.36
			Delay	5.3.1.1.46
		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*
		Sample Temp.	*Alarm High*	5.3.1.3.1*
		5.3.1.3*	*Alarm Low*	5.3.1.3.26*
		Case Temp. high	5.3.1.4*	
		Case Temp. low	5.3.1.5*	
	Relay 1 and 2	*Function*	5.3.2.1–5.3.3.1*	
	5.3.2* - 5.3.3*	*Parameter*	5.3.2.20–5.3.3.20*	
		Setpoint	5.3.2.300–5.3.3.301*	
		Hysteresis	5.3.2.400–5.3.3.401*	
		Delay	5.3.2.50–5.3.3.50*	

	Input	*Active*	5.3.4.1*	* Menu numbers
	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*	*Device Address*	5.5.21*		interface)
	Baud Rate	5.5.31*		
	Parity	5.5.41*		

9. Program List and Explanations

1 Messages

1.1 Pending Errors

1.1.5 Provides the list of active errors with their status (active, acknowledged). If an active error is acknowledged, the alarm relay is active 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

Desig.: Designation of the instrument.
Version: Firmware of instrument (e.g. V6.20-11/16)

2.1.3 **Factory Test**: Test date of the Instrument and Motherboard.

2.1.4 **Operating Time:** Shows the operating time in Years, Days, Hours, Minutes and Seconds.

2.2 Sensors

2.2.1 **Cond.Sensor:**

- *Current value*: Shows the actual measuring value in MΩ or µS.
- *Raw value*: Shows the actual measuring value in MΩ or µS.
- *Cell Constant*: shows the cell constant.

2.2.1.5 **Cal. History:** Only visible in resistivity mode. Shows the values of the last fine adjust.

- *Number*: Calibration counter
- *Date, Time*: Date and time of calibration
- *RSlo*: Measured resistance

Max. 64 data records are memorized.

2.2.2 **Miscellaneous**:

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

2.3 Sample

2.3.1
- o *Sample ID*: Shows the assigned sample identification. This identification is defined by the user to identify the location of the sample
- o *Temperature:* Shows temperature in °C.
- o *(Nt5K)*: Shows raw value of the temperature in Ω.

2.4 I/O State

Shows actual status of all in- and outputs.

2.4.1

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

2.5 Interface

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

3 Maintenance

3.1 Simulation

To simulate a value or a relay state, select the
- alarm relay,
- relay 1or 2
- signal output 1or 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.*

3.4.1	*Alarm Relay:*	Active or inactive
3.4.2	*Relay 1:*	Active or inactive
3.4.3	*Relay 2*	Active or inactive
3.4.4	*Signal Output 1:*	Actual current in mA
3.4.5	*Signal Output 2*	Actual current in mA

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

3.2 Set Time

Adjust date and time.

3.3 Transmitter check

Transmitter check is used to check the accuracy of the AMI transmitter's electronic parts. The test fulfills the requirements of the United States Pharmacopeia (USP). See Conductivity-Resistivity QC-Kit Test Plug, p. 42.

3.5 Fine adjust

The function fine adjust is only available if the AMI Rescon is set to the measuring mode resistivity.

The function "fine adjust" performs an internal resistor adjustment.

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:* Delay permitting the instrument to stabilize again after calibration. During calibration plus hold-time, the signal outputs are frozen (held on last valid value), alarm values, limits are not active.
Range: 0–6'000 Sec

4.2 Relay Contacts

See Relay Contacts 1 and 2, p. 28

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. The Records consists of: Date, time, alarms, measuring value, raw value (MΩ), case temperature, flow.

4.3.1 *Log Interval:* Select a convenient log interval. Consult the table below to estimate the max logging time. When the logging buffer is full, the oldest data record is erased to make room for the newest one (circular buffer).
Range: 1 Second to 1 hour

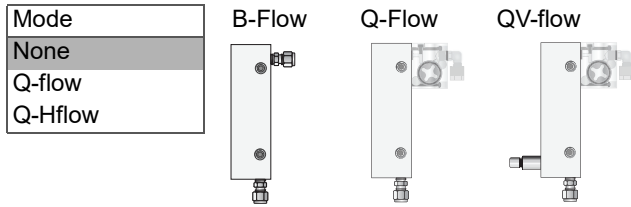
Interval	1 s	5 s	1 min	5 min	10 min	30 min	1 h
Time	25 min	2 h	25 h	5 d	10 d	31 d	62 d

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

5 Installation

5.1 Sensors

5.1.1 **Flow:** With the Monitor a QV-Hflow flow cell is supplied as standard. Select the type of flow cell, possible flow cells:



Selection of the suitable flow cell.

Flow cell type	**Mode**
B-Flow	None
Q-Flow or QV-Flow	Q-flow
Q-Hflow or QV-Hflow	Q-Hflow

5.1.2 **Meas. Mode:** The two measuring modes Conductivity or Resistivity are available.

5.1.3 **USP Operating Mode:** Switch the USP Operating Mode on or off (see USP Operating Mode, p. 8).

5.1.4 **Sensor parameters:**

5.1.4.1 *Cell Constant*: Enter the cell constant ZK printed on the label of the sensor (see Sensor Parameters, p. 34).

5.1.4.2 *Temp. Corr*: Enter the temperature correction value DT printed on the label of the sensor (see Sensor Parameters, p. 34).

5.1.4.3 *Cable length*: Enter the cable length of the sensor. If the flow cell is installed on the monitor, set the cable length to 0 m

5.1.5 **Temp. Compensation:** Choose between

- none
- coefficient
- neutral salts
- high purity water
- strong acids
- strong bases
- ammonia, ethanolamine
- morpholine

5.2 Signal Outputs

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

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

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

Resistivity	**Conductivity**
Meas. Value	Meas. Value
Temperature	Temperature
Sample Flow	Sample Flow
Meas. uc	Meas. uc

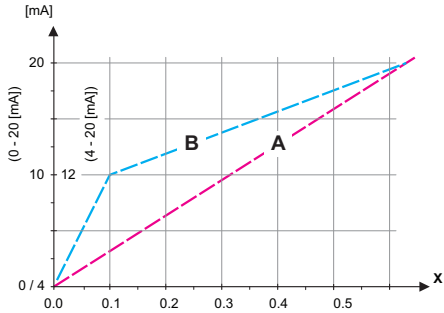
5.2.1.2 *Current Loop:* Select the current range of the signal output. Make sure the connected device works with the same current range.
Available ranges: 0–20 mA or 4–20 mA

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:

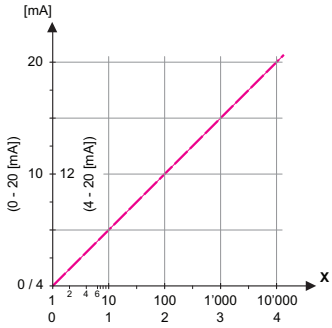
- Linear, bilinear or logarithmic for process values.
  See As process values, p. 60
- Control upwards or control downwards for controllers.
  See As control output, p. 62

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.

If Parameter = **Meas. Value**

5.2.1.40.10 Range low: 0.00–200 MΩ or 0.000–2000 µS

5.2.1.40.20 Range high: 0.00–200 MΩ or 0.000–2000 µS

If Parameter = **Temperature**

5.2.1.40.11 Range low: -30.0 to +130 °C

5.2.1.40.21 Range high: -30.0 to +130 °C

If Parameter = **Sample flow**

5.2.1.40.12 Range low: 0–200 l/h

5.2.1.40.22 Range high: 0–200 l/h

If Parameter = **Meas. uc**

5.2.1.40.13 Range low: 0.00–200 MΩ or 0.000–2000 µS

5.2.1.40.23 Range high: 0.00–200 MΩ or 0.000–2000 µS

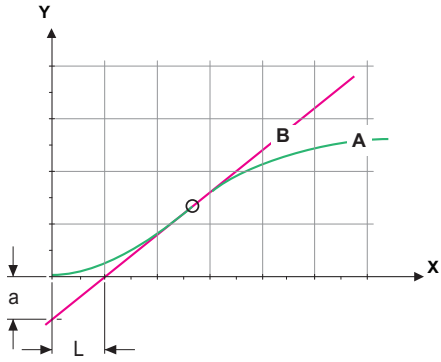
As control output

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

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

Ziegler-Nichols method for the optimization of a PID controller:

Parameters: Setpoint, P-Band, Reset time, Derivative time



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

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

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

If Control upwards or Control downwards is active
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:** if Parameter = Meas. value
5.2.1.43.10 *Setpoint*: 0.00–200 MΩ or 0.000–2000 µS
5.2.1.43.20 *P-Band*: 0.00–200 MΩ or 0.000–2000 µS

5.2.1.43 **Control Parameters:** if Parameter = Temperature
5.2.1.43.11 *Setpoint*: -30 to +130 °C
5.2.1.43.21 *P-Band*: 0 to +100 °C

5.2.1.43 **Control Parameters:** if Parameter = Sample Flow
5.2.1.43.12 *Setpoint*: 0–200 l/h
5.2.1.43.22 *P-Band*: 0–200 l/h

5.2.1.43 **Control Parameters:** if Parameter = Meas. uc
5.2.1.43.13 *Setpoint*: 0.00–200 MΩ or 0.000–2000 µS
5.2.1.43.23 *P-Band*: 0.00–200 MΩ or 0.000–2000 µS

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 for the following parameters:

- Meas. Value
- Temperature
- Sample Flow (if a flow sensor is selected)
- Case Temperature high
- Case Temperature low

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: 0.000–2000 µS or 0.00–200 MΩ

5.3.1.1.26 *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: 0.000–2000 µS or 0.00–200 MΩ

5.3.1.1.36 *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. 0.000–2000 µS or 0.00–200 MΩ

5.3.1.1.46 *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

NOTICE: *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: 0–200 l/h

5.3.1.2.36 *Alarm Low:* If the measuring values falls below the programmed value E010 will be issued.
Range: 0–200 l/h

5.3.1.3 **Sample Temp.:** Define at which sample temperature an alarm should be issued.

5.3.1.3.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay is activated and E007 is issued.
Range: -30 to +160 °C

5.3.1.3.26 *Alarm Low:* If the measured value rises above the alarm high value, the alarm relay is activated and E008 is issued.
Range: -30 to +130 °C

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: 30–75 °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 +20 °C

5.3.2 and 5.3.3 **Relay 1 and 2:** The contacts can be set as normally open or normally closed with a jumper. See Relay Contacts 1 and 2, p. 28. The function of relay contacts 1 or 2 are defined by the user.

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

1 First select the functions as:
- Limit upper/lower
- 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

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

Parameter	**Range**
Meas. Value	0.00–200 MΩ or 0.000–2000 µS
Temperature	-30 to +130 °C
Sample flow	0–200 l/h
Meas. uc (uncompensated)	0.00–200 MΩ or 0.000–2000 µS

5.3.2.400 *Hysteresis:* within the hysteresis range, the relay does not switch. This prevents damage of relay contacts when the measured value fluctuates around the alarm value.

Parameter	**Range**
Meas. Value	0.00–200 MΩ or 0.000–2000 µS
Temperature	-30 to +130 °C
Sample flow	0–200 l/h
Meas. uc (uncompensated)	0.00–200 MΩ or 0.000–2000 µS

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. 0–600 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, Temperature, Sample flow, Meas. uc)

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. 63

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. 63

	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. 63
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

Mode
interval
daily
weekly

5.3.2.24	*Interval*
5.3.2.340	*Interval:* The interval can be programmed within a range of 1–1'440 min.
5.3.2.44	*Run Time*: Enter the time the relay stays active. Range: 5–32'400 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. 69.
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 issue the last valid measured value. Measurement is interrupted. Errors, except fatal errors, are not issued.
Off:	Set to 0 or 4 mA respectively. Errors, except fatal errors, are not issued.

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

Continuous:	Controller continues normally.
Hold:	Controller continues on the last valid value.
Off:	Controller is switched off.

5.3.4.4 *Fault:*

No:	No message is issued in pending error list and the alarm relay does not close when input is active. Message E024 is stored in the message list.
Yes:	Message E024 is issued and stored in the message list. The Alarm relay closes when input is active.

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

5.4 Miscellaneous

5.4.1 *Language:* Set the desired language.

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

5.5.1 *Protocol:* **USB-Stick:**
Only visible if an USB interface is installed. No further settings are possible.

5.5.1 *Protocol:* **HART**
Device address: Range: 0–63

10. Default Values

NOTICE: *The AMI Rescon has two different measuring modes (Resistivity or Conductivity) which can be set in menu <Installation>/<Sensors>/<Meas. Mode>. The instrument remains in the selected operating mode even after the <Default Values> are reset completely. Therefore this default value list is divided in the two parts Resistivity and Conductivity where necessary.*

Operation:

Sensors:	Filter Time Const.: ..... 20 s
	Hold after Cal.: ..... 300 s
Alarm Relay	..... same as in Installation
Relay 1 and 2	..... same as in Installation
Input	..... same as in Installation
Logger:	Logger Interval: ..... 30 min
	Clear Logger: ..... no

Installation:

Sensors	Flow: ..... None
	Meas. Mode: .....remains as set, Resistivity or Conductivity
	USP Operating Mode: ..... Off
	Sensor parameters
	Cell Constant: .....0.01000cm^{-1}
	Temp. Corr. ..... 0.00 °C
	Cable length ..... 0.0 m
	Temp. Compensation
	Comp ..... None
Signal Output 1	Parameter: ..... Meas. Value
	Current loop: ..... 4 –20 mA
	Function: ..... linear
Resistivity	Scaling: Range low: ..... 0.00 MΩ
	Scaling: Range high: ..... 20.00 MΩ
Conductivity	Scaling: Range low: .....0.000 *µ*S
	Scaling: Range high: .....1000 *µ*S
Signal Output 2	Parameter: ..... Temperature
	Current loop: ..... 4 –20 mA
	Function: ..... linear

	Scaling: Range low:	0.0 °C
	Scaling: Range high:	50.0 °C
Alarm Relay:	Alarm:	
Resistivity	Alarm high:	200 MΩ
	Alarm low:	0.00 MΩ
	Hysteresis:	1.00 MΩ
Conductivity	Alarm high:	2000 µS
	Alarm low:	0.000 µS
	Hysteresis:	10.00 µS
	Delay:	5 s
	Sample Flow; Flow Alarm	yes
	Sample Flow; Alarm high	120 l/h
	Sample Flow; Alarm low	5 l/h
	Sample Temp; Alarm high:	90 °C
	Sample Temp; Alarm low:	0 °C
	Case temp. high:	65 °C
	Case temp. low:	0 °C
Relay 1 and 2	Function:	limit upper
	Parameter:	Meas. Value
Resistivity	Setpoint:	200 MΩ
	Hysteresis:	1 MΩ
Conductivity	Setpoint:	1000 µS
	Hysteresis:	10.00 µS
	Delay:	30 s
	If Function = Control upw. or dnw:	
	Parameter:	**Meas. Value**
	Settings: Actuator:	Frequency
	Settings: Pulse Frequency:	120/min
Resistivity	Settings: Control Parameters: Setpoint:	200 MΩ
	Settings: Control Parameters: P-band:	1 MΩ
Conductivity	Settings: Control Parameters: Setpoint:	1000 µS
	Settings: Control Parameters: P-band:	10.00 µS
	Parameter:	**Temperature**
	Settings: Actuator:	Frequency
	Settings: Pulse Frequency:	120/min
	Settings: Control Parameters: Setpoint:	50 °C
	Settings: Control Parameters: P-band:	1 °C
	Parameter:	**Sample flow**
	Settings: Actuator:	Frequency

Settings: Pulse Frequency: 120/min
Settings: Control Parameters: Setpoint: ..... 25.0 l/h
Settings: Control Parameters: P-band: ..... 1 l/h
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

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12. Notes

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