swan
ANALYTICAL INSTRUMENTS

AMI Pharmacon

Version 6.20 and higher

Operator's Manual

A-96.250.561 / 060720

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

Document Status

Title:	Operator's Manual for AMI Pharmacon	
ID:	A-96.250.561	
Revision	**Issue**	
00	Nov. 2010	
01	June 2013	Update to Firmware 5.30
02	June 2017	Update to Firmware 6.20, Mainboard Rev. 2.5
03	July 2020	Mainboard Rev. 2.6

Table of Contents

AMI Pharmacon–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

Severe injuries or death will result 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

Risk of Electrical Shock

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.

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

This instrument is applicable for the measurement of conductivity in purified water and water for injection of pharmaceutical water.

2.1. Description of the System

Application Range

The conductivity is a parameter for the total quantity of ions present in the solution.

The AMI Pharmacon transmitter together with the two-electrode Inline sensor Pharmacon NPT or Pharmacon SAN is used for applications in:

- purified water (PW)
- water for injection (WFI)

Measuring Principle

The sensor is immersed in the liquid. It is connected to the AMI transmitter which supplies the sensor with alternating voltage. The AMI transmitter measures the strength of the electrical signal between the electrodes which is linearly related to the conductivity. Alternating current is used in order to reduce polarization effects. These can be caused by ions either attracting or rejecting electrons and reverting to their molecular form. The result is a “screened” electrode, which rapidly reduces the current flow and leads to wrong measured values. By applying an alternating voltage, the capacities are repeatedly discharged and the polarization effect is largely eliminated.

The temperature sensor is incorporated in order to adjust the reading to that of the standard temperature (usually 25 °C).

Temperature compensation

- None
- coefficient: in %/°C
- Neutral salts (NaCl)
- High purity water (non-linear)
- Strong Acids
- Strong bases
- Ammonia, Eth.am.
- Morpholine

Standard Temperature

The displayed conductivity value is compensated to 25°C standard temperature.

Measurement value

The compensated- (tc), the uncompensated value (uc) and the actual USP alarm value can be displayed.

USP<645>	Alarm function for limit values according to USP<645> Stage 1. By editing the Limit (100% to 20%) an action limit can be set.
Transmitter Test	Check the correct function of the transmitter using high precision resistors (available as an accessory).
QA Procedure	Menu driven inspection procedure can be carried out using a certified reference instrument (e.g. AMI Inspector).
Sensor connection	Sensor connections for a two-electrode sensor with built-in Pt1000 temperature probe like Swansensor Pharmacon and for an optional digital sample flow meter.
Signal Outputs	Two signal outputs programmable for measured values (freely scalable, linear or bilinear) or as continuous control output (control parameters programmable). Current loop: 0/4 - 20 mA Maximal burden: 510 Ω Third signal output available as an option. The third signal output can be operated as a current source or as a current sink (selectable via switch).
Relay	Two potential-free contacts programmable as limit switches for measuring values, controllers or timer for system cleaning with automatic hold function. Maximum load: 1 A / 250 VAC
Alarm Relay	One potential free contact. Alternatively: ◆ Open during normal operation, closed on error or loss of power. ◆ Closed during normal operation, open on error or loss of power. Summary alarm indication for programmable alarm values and instrument faults.
Input	For potential-free contact to freeze the measuring value or to interrupt control in automated installations (hold function or remote-off)
Safety Features	No data loss after power failure. All data is saved in non-volatile memory. Over voltage protection of in- and outputs. Galvanic separation of measuring inputs and signal outputs.
Communication Interface (optional)	◆ USB interface to store logger data. ◆ Third signal output (can be used in parallel to the USB interface) ◆ RS485 with Fieldbus protocol Modbus or Profibus DP ◆ HART interface

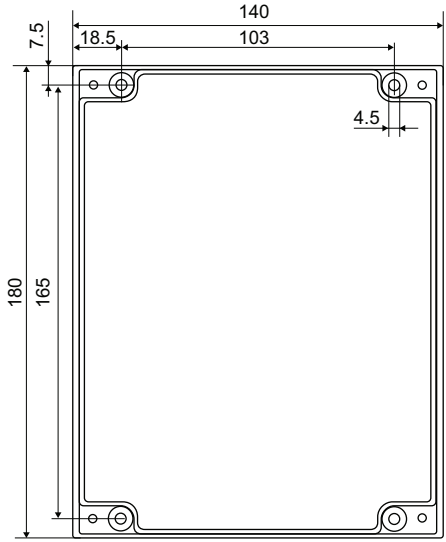
2.2. Single Components

2.2.1 Transmitter AMI Pharmacon

The AMI measuring and control transmitter is used for panel installation. It has connections for a two-electrode conductivity sensor with a built-in Pt1000 temperature probe, e.g. Swansensor Pharmacon SAN, and for a digital sample flow meter.

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
Measurement range	Conductivity:	0.005 to 2000 µS/cm with automatic range switching

Rear view Backside of the AMI transmitter with mounting holes.



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
	Electrical connectors:	screw clamps

2.2.2 Swansensor Pharmacon

Two-electrode conductivity sensor for the **inline measurement** of purified water and water for injection of pharmaceutical water.

Available in two different models:

- Swansensor Pharmacon SAN, with sanitary flange
- Swansensor Pharmacon NPT, with NPT ¾" thread

Swansensor Pharmacon SAN

Polished surface, no dead volume.
Equipped with fixed cable (~30cm, PTFE) with M16 male plug.

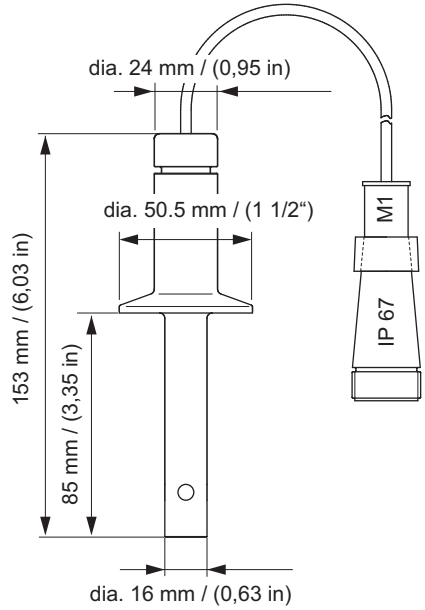
Sensor will be accompanied with following certificates:

- Cell constant,
- Material specification
- Inspection certificate according to EN 10204, surface roughness with SS Pharmacon SAN.

Specifications

	Measuring range:	0.055 - 1'000 µS/cm
	Accuracy (at 25°C):	± 2% up to 500 µS/cm ± 3% above 500 µS/cm up to 1'000 µS/cm
	Cell constant:	0.1 cm^{-1}
Material:	Shaft & Electrode:	SS 316L (1.4435) stainless steel
	Isolator:	PEEK
	Roughness:	R_a < 0.4 µm
	Temperature sensor:	Pt1000, accuracy ± 0.2 °C
	Sensor mounting:	sanitary flange 1 ½"
	Operating temperature:	-10 to +120 °C
	Sterilization temp.:	-10 to +155 °C
	Operating pressure:	17 bar at 25°C, max. 7 bar at + 95°C

Dimensions	Total length:	153 mm
	Insertion length:	85 mm



Swansensor Pharmacon NPT

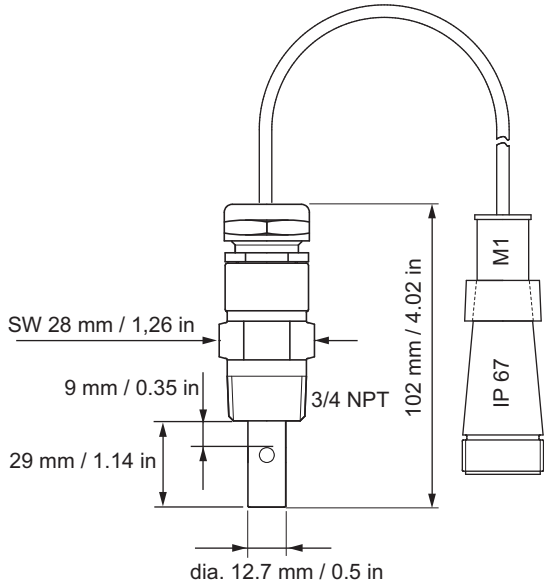
Polished surface, no dead volume.
Equipped with fixed cable (~30cm, PTFE) with M16 male plug.

Sensor will be accompanied with following certificates:

- Cell constant,
- Material specification
- Inspection certificate according to EN 10204 (surface roughness with SS Pharmacon NPT).

Specifications	Measuring range	0.055 - 1'000 µS/cm
	Accuracy (at 25°C):	± 2% up to 500 µS/cm
		± 3% above 500 µS/cm up to 1'000µS/cm
	Cell constant:	0.1 cm^{-1}
Material:	Shaft & Electrode:	SS 316L (1.4435) stainless steel, Titan
	Isolator:	PEEK
	Roughness:	R_a < 0.4 µm
	Temperature sensor:	Pt1000, accuracy ± 0.2 °C
	Sensor mounting:	NPT thread ¾"
	Operating temperature:	-10 to +120 °C
	Sterilization temp.:	-10 to +155 °C
	Operating pressure:	17 bar at 25°C, max. 7 bar at + 95°C

Dimensions	Total length:	102 mm
	Insertion length:	29 mm



3. Installation

3.1. Installation Check List

On site requirements	AC variant: 100–240 VAC (± 10%), 50/60 Hz (± 5%) DC variant: 10–36 VDC Power consumption: 35 VA maximum. Protective earth connection required.
Installation	Mounting of Transmitter, p. 16. Install the Swansensor Pharmacon SAN, p. 17. or Install the Swansensor Pharmacon NPT, p. 19 Connect the Conductivity Sensor, p. 21
Electrical Wiring	Connect all external devices like limit switches and current loops. Connect power cord, see Power Supply, p. 25
Power-up	Turn on sample flow Switch on power
Instrument Setup	Program all sensor specific parameters (cell constant, temp. correction, cable length). Program all parameters for external devices (interface, recorders, etc.). Program all parameters for instrument operation (USP mode and setpoint, limits, alarms).
Run-in period	Let the instrument run continuously for 1 h.

3.2. Mounting of Transmitter

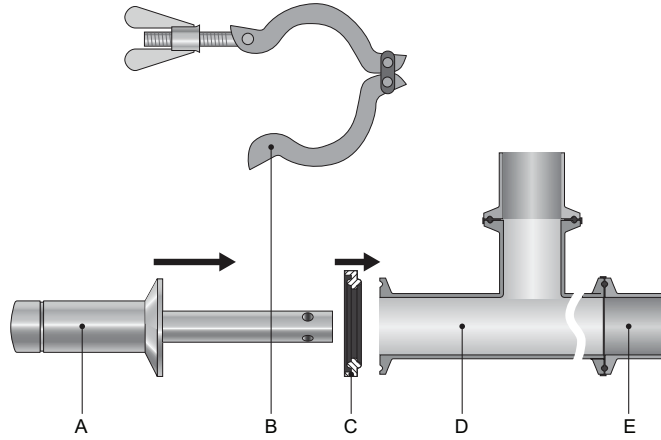
The first part of this chapter describes the preparing and placing of the instrument for use.

- The transmitter must only be installed by trained personnel.
- Mount the transmitter in vertical position.
- For ease of operation mount it so that the display is at eye level.
- For the installation use 4 Screws 4x30 mm

Mounting requirements

The instrument is only intended for indoor installation.
For dimensions see: Dimensions, p. 10

3.3. Install the Swansensor Pharmacon SAN

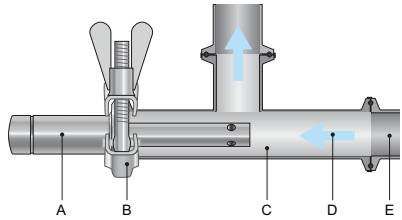


A *Swansensor Pharmacon SAN*
B *Clamp*
C *Gasket*
D *T-Pipe*
E *Pipe*

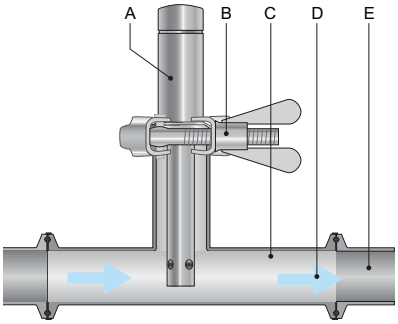
To install the Swansensor Pharmacon SAN into a pipe flange proceed as follows:

1. Make sure, that the surface of the T-Piece flange [D] is clean.
2. Put the gasket [C] onto the flange.
3. Insert the Swansensor Pharmacon SAN into the T-Piece [D].
4. Install the clamp [B] and tighten it well.
5. Connect the Swansensor Pharmacon SAN to the AMI Transmitter according to the connection diagram, see Connection Diagram, p. 24

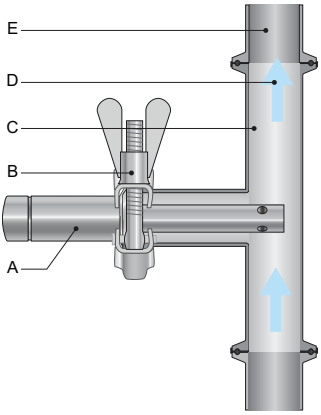
Recommended Installation



The flow direction should be towards the sensor tip. This avoids air or solids becoming trapped in the sensor.



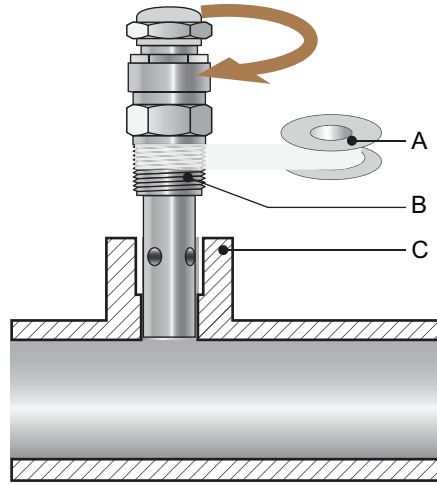
Vertical installation is possible if the pipe is always full and no air can be trapped between the electrodes.



Install the sensor in a vertical pipe with upward flow direction.

A *Swansensor Pharmacon SAN*
B *Clamp*
C *T-piece*
D *Flow direction*
E *Pipe*

3.4. Install the Swansensor Pharmacon NPT

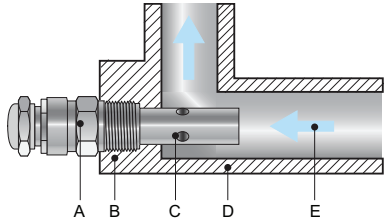


A *Teflon tape*
B *Swansensor Pharmacon NPT*
C *Flange*

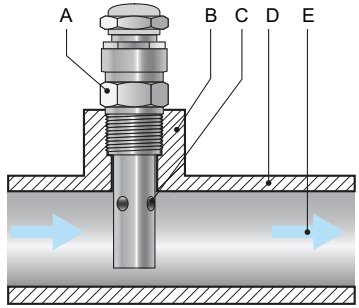
To install the Swansensor Pharmacon NPT into a pipe flange proceed as follows:

1. Wrap 7 turns of teflon tape around the sensor thread.
2. Screw the sensor into the pipe flange.
3. Tighten the sensor well with a 28 mm open-ended spanner.
4. Connect the Swansensor Pharmacon NPT to the AMI Transmitter according to the connection diagram, see Connection Diagram, p. 24

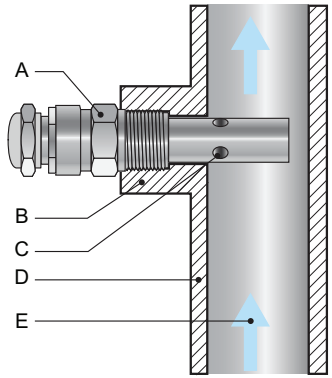
Recommended Installation



The flow direction should be towards the sensor tip. This avoids air or solids becoming trapped in the sensor.



Vertical installation is possible if the pipe is always full and no air can be trapped between the electrodes.



Install the sensor in a vertical pipe with upward flow direction.

A *Swansensor Pharmacon NPT*
B *Flange*
C *Air holes*
D *Pipe*
E *Flow direction*

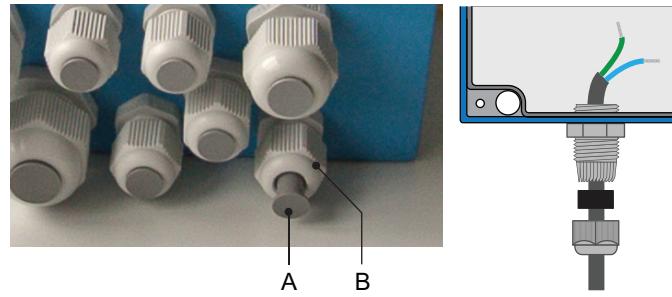
3.5. Connect the Conductivity Sensor

Connect the Sensor Cable

To connect the conductivity sensor cable to the AMI Transmitter proceed as follows:

WARNING

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



1. Choose a suitable cable gland, see chapter Electrical Connections, p. 22
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. 24.
6. Close the AMI transmitter housing.
7. Switch on power.

3.6. Electrical Connections

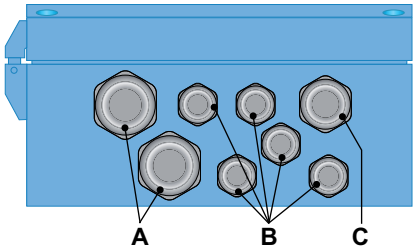
WARNING

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*

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

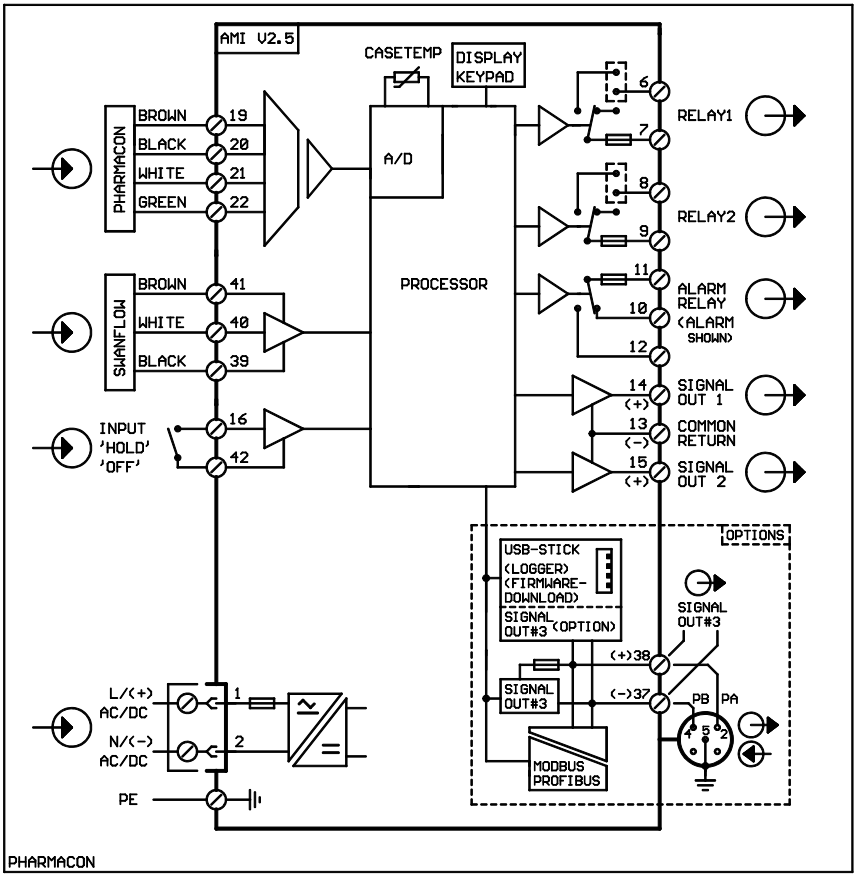
WARNING

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.

3.6.1 Connection Diagram



CAUTION

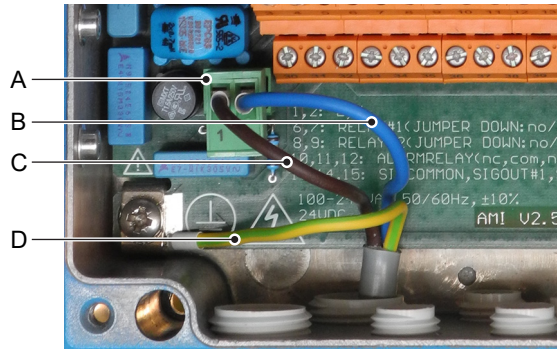
Use only the terminals shown in this diagram, and only for the mentioned purpose. Use of any other terminals will cause short circuits with possible corresponding consequences to material and personnel.

3.6.2 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 Pharmacon

3.7. Relay Contacts

3.7.1 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. 72

Programming of the relay contacts see 5.3 Relay Contacts, p. 66

3.7.2 Alarm Relay

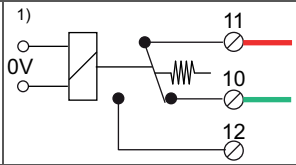
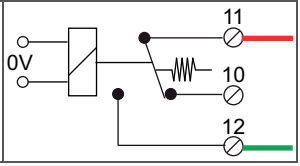
NOTICE: *Max. load 1 AT / 250 VAC*

Alarm output for system errors.

Error codes see Troubleshooting, p. 47

Programming see menu 5.3.1, p. 66

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.	

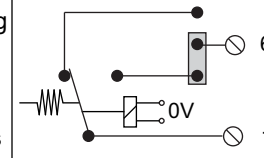
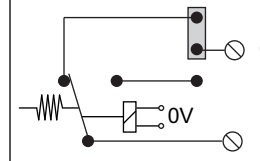
1) *usual use*

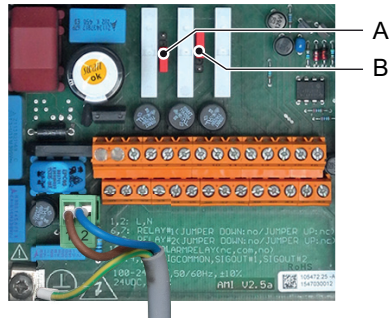
3.7.3 Relay Contacts 1 and 2

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. 68

CAUTION

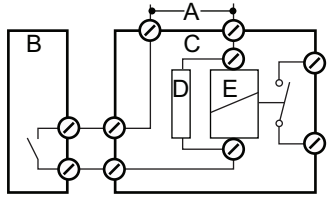
Risk of damage of the relays in the AMI Transmitter due to heavy inductive load.

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

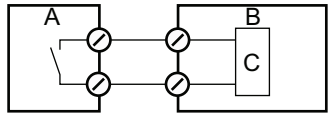
Small inductive loads (max 0.1 A) as for example the coil of a power relay can be switched directly. To avoid noise voltage in the AMI Transmitter it is mandatory to connect a snubber circuit in parallel to the load.



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

Resistive load

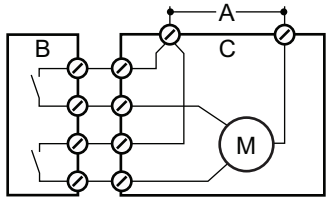
Resistive loads (max. 1 A) and control signals for PLC, impulse pumps and so on can be connected without further measures



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

Actuators

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



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

3.8. Signal Outputs

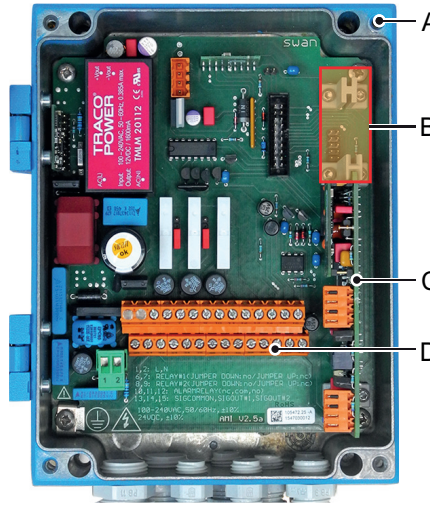
3.8.1 Signal Output 1 and 2 (current outputs)

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 Program List and Explanations, p. 56, Menu Installation

3.9. 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:

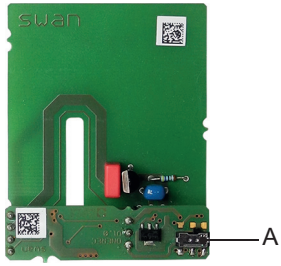
- a third signal output
- a Profibus or Modbus connection
- a HART connection
- a USB Interface

3.9.1 Signal Output 3

Terminals 38 (+) and 37 (-).

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

NOTICE: *Max. burden 510 Ω.*



Third signal output 0/4 - 20 mA PCB

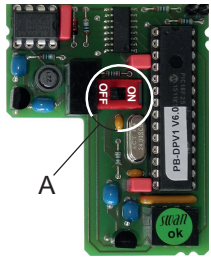
A Operating mode selector switch

3.9.2 Profibus, Modbus Interface

Terminal 37 PB, Terminal 38 PA

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

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



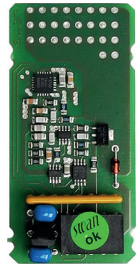
Profibus, Modbus Interface PCB (RS 485)

A *On - OFF switch*

3.9.3 HART Interface

Terminals 38 (+) and 37 (-).

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

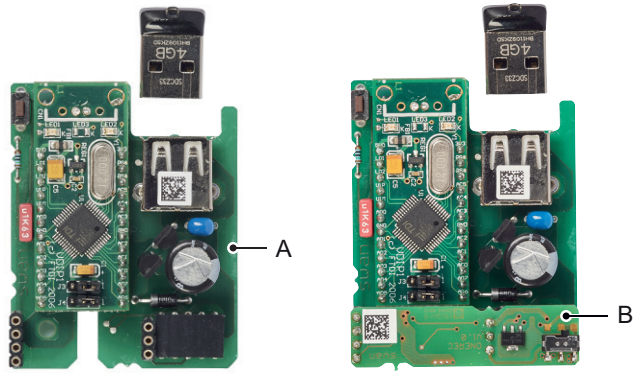


HART Interface PCB

3.9.4 USB Interface

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

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



USB Interface

A USB interface PCB

B Third signal output 0/4 - 20 mA PCB

4. Instrument Setup

After the instrument and its components are installed according to the previous instructions, connect the power cord. Then proceed as follows:

1 Switch on power.

2 Let the instrument run-in for 1 h.

4.1. Programming

USP Parameters

Menu 5.1.2 (Activate if required)
Set Operating mode to ON
Set the Limit according your requirements.

Sensor parameters

Program all sensor parameters in Menu 5.1.3 <Installation> <Sensors> <Sensor parameters>:
Enter the:

- Cell constant [cm^{-1}]
- Temperature correction [°C]
- Cable length
- Temperature compensation

Cell Constant

Menu 5.1.3.1
The sensor characteristics are printed on the label of each sensor.

SW-xx-xx-xx	ZK = 0.0417	Cell constant
SWAN AG	DT = 0.06 °C	Temperature correction

Temp. Corr

Menu 5.1.3.2
Enter the temperature correction DT printed on the label.

Cable length

Menu 5.1.3.3
Enter the cable length of the cable between AMI transmitter and sensor.

Measuring unit

Menu 5.1.3.4
Set the <Measuring unit> according to your requirements:

- µS/cm
- µS/m

Temp. Compensation

Menu 5.1.4
Choose between:

- none
- Coefficient
- Neutral salts
- High-purity water
- Strong acids
- Strong bases
- Ammonia, Ethanolamine
- Morpholine

Quality Assurance

Menu 5.1.5 (Activate if required)
Set the Level according to your requirements, details see Quality assurance of the instrument, p. 41.

External devices

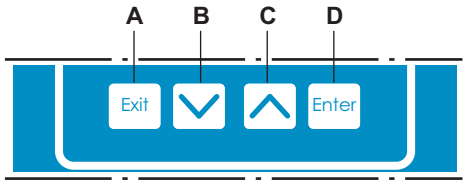
Program all parameters for external devices (interface, recorders, etc.) See program list and explanations 5.2 Signal Outputs, p. 62 and 5.3 Relay Contacts, p. 66.

Limits, Alarms

Program all parameters for instrument operation (limits, alarms). See program list and explanations 5.3 Relay Contacts, p. 66.

5. Operation

5.1. Keys



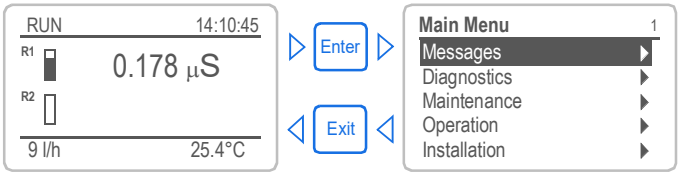
A to exit a menu or command (rejecting any changes)
to move back to the previous menu level

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

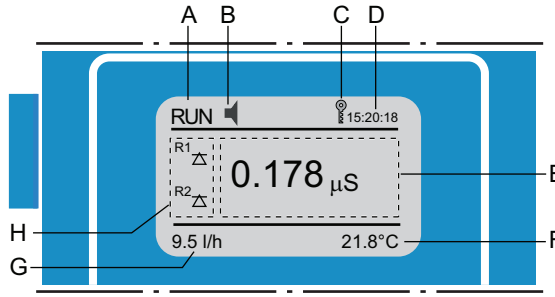
C to move UP in a menu list and to increase digits
to switch between display 1 and 2

D to open a selected 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 value

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

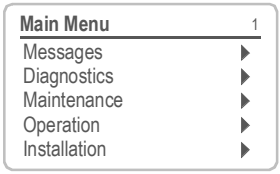
motor valve closed

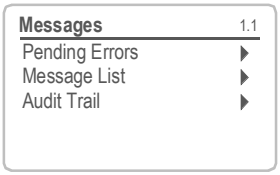
motor valve: open, dark bar indicates approx. position

timer

timer: timing active (hand rotating)

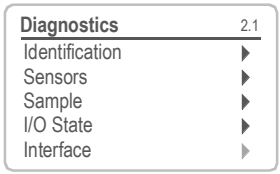
5.3. Software Structure





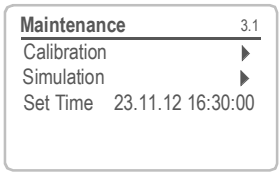
Menu **Messages 1**

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.



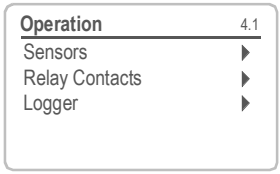
Menu **Diagnostics 2**

Provides user relevant instrument and sample data.



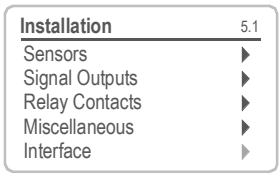
Menu **Maintenance 3**

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.



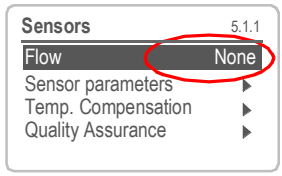
Menu **Installation 5**

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

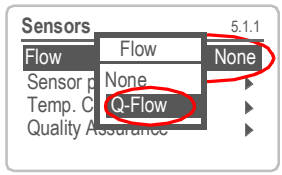
Changing parameters

The following example shows how to set the Q-Flow sensor:



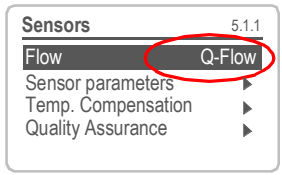
1 Select the parameter you want to change.

2 Press <Enter>



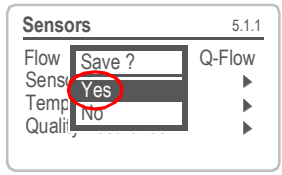
3 Press [▲] or [▼] key to highlight the required parameter.

4 Press <Enter> to confirm the selection or <Exit> to keep the previous parameter).



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

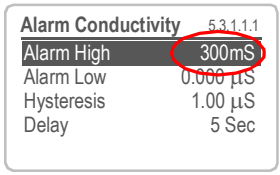
5 Press <Exit>.



⇒ *Yes is highlighted.*

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

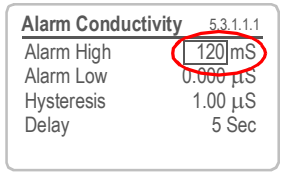
Changing values



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 Schedule

WARNING

Stop operation before maintenance.
- Stop sample flow.
- Shut off power of the instrument.

Monthly	Check sample flow
Yearly	According to USP<645>
If required	Clean sensor

Further Maintenance Work

Quality Assurance test If an AMI INSPECTOR Pharmacon is available perform the Quality Assurance test according to the time interval of the set level, see Quality assurance level, p. 41.

Transmitter check If test resistor is available perform Transmitter check if required.

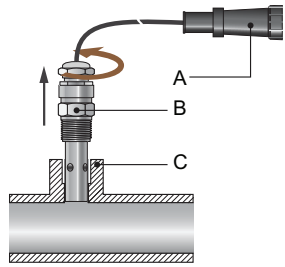
6.2. Stop of Operation for Maintenance

- Shut off power of the instrument.

6.3. Cleaning the sensor

The Swansensor Pharmacon NPT/SAN is largely maintenance free. However, depending on the application, it can be contaminated, which may cause problems.

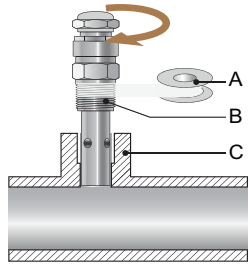
If the sensor is contaminated proceed as follows to clean the sensor.



A *Sensor plug*
B *Conductivity sensor*
C *Pipe flange*

Remove and clean the sensor

1. Disconnect the sensor cable plug [A].
2. Unscrew and remove the sensor [B] from the pipe flange [C] with a 28 mm open-ended spanner.
3. Remove the teflon tape from the sensor thread.
4. Clean the sensor with a small brush or a soft tissue and soapy water.
5. Rinse the sensor well with high purity water.



A *Teflon tape*
B *Conductivity sensor*
C *Pipe flange*

Install the sensor

1. Wrap 7 turns of teflon tape around the sensor thread.
2. Screw the sensor into the pipe flange.
3. Tighten the sensor well with a 28 mm open-ended spanner.

6.4. Alarm function according USP<645>

Display

Set the display to show all available conductivity values, i.e:

- tc: Temperature compensated conductivity
- uc: Uncompensated conductivity
- usp: Conductivity Limit at given temperature

Setpoint

Setpoint of the USP limit can be modified from 100% to 20%. [Installation / Sensors / USP parameters].

If the programmed limit is overstepped E015 Error will be issued.

6.5. Transmitter Test

Using high precision test resistors (available as accessory) the transmitter function can be checked.

Test Resistor

Two test plugs consisting of two high precision resistors for conductivity and temperature each.

- Test plug 1:
  1'500 Ω, ± 0.1% for temperature (130.45°C)
  600'000 Ω, ± 0.01% for conductivity (0.1333µS/cm)

- Test plug 2:
  1'000 Ω, ± 0.1% for temperature (0.0°C)
  10'000 Ω, ± 0.01% for conductivity (8.0µS/cm)

NOTICE: *Keep test resistor kit absolutely dry.*

Procedure

Navigate to <Maintenance/Transmitter Test> and follow the instructions on the display.

6.6. Quality assurance of the instrument

Every SWAN on-line instrument is equipped with integrated, autonom quality assurance functions to survey the plausibility of each measurement.

For AMI Pharmacon these are:

- continuous monitoring of the temperature inside the transmitter case.
- periodic accuracy test with ultra high precision resistors

Further a manual, menu driven inspection procedure can be carried out using a certified reference instrument. Running at the same sampling point as an inspection equipment, the AMI Inspector Conductivity verifies the measuring results. After enabling the quality assurance procedure, by defining the quality assurance level, the instrument reminds the user periodically to run the procedure and results are stored in a history for review.

Quality assurance level

Central feature of the quality assurance function is the assignment of the monitored process to a Quality assurance level.

There are three predefined levels plus a user level. Hereby the inspection interval, the deviation limits of temperature and measuring result between the inspection equipment and the monitoring instrument are defined.

- Level 1: **Trend;** Measurement used as an additional information to follow the process indicating trends.
- Level 2: **Standard;** Monitoring of several parameters of a process (e.g. Temp., TOC, etc.). In case of instrument failure, other parameters can be used for process monitoring.
- Level 3: **Crucial;** Monitoring of critical processes, value is used for control of another part or subsystem (acceptance, dosing, etc.).

Additional level:

- Quality level 4: **User;** User defined inspection interval, maximal deviation of temperature and measuring result.

Tab. 6-1 Limits and interval for AMI Pharmacon

Quality Level	max. deviation temperature [°C][a)]	max. deviation result [%]	min. inspection interval
0: Off	**Off**	**Off**	Off
1: Trend	**0.5 °C**	**10.0 %**	annual
2: Standard	**0.4 °C**	**5.0 %**	quarterly
3: Crucial	**0.3 °C**	**3.0 %**	monthly
4: User	**0 - 2.0 °C**	**0 - 20 %**	annual, quarterly, monthly, weekly

a) sample temperature must be 25°C +/- 5°C.

Procedure The standard workflow contains following procedures:

1. Activate SWAN Quality assurance procedure, p. 43
2. Pre-test, p. 43
3. Connect instruments, p. 43
4. Carry out comparison measurement, p. 45
5. Completion of the measurement, p. 46

NOTICE: *The procedure should only be carried out through qualified personnel.*

Materials / Inspection equipment:

- Reference instrument: AMI Inspector Pharmacon
- Two tubes made of FEP

6.6.1 Activate SWAN Quality assurance procedure

Enable quality assurance procedure at each instrument by selecting the quality level in menu 5.1.5, p. 62, Quality Assurance <Installation\Sensors>.
The corresponding submenus are then activated.

NOTICE: *The activation is necessary the first time only.*

6.6.2 Pre-test

- Reference instrument: AMI Inspector:
  - Check certificate; reference instrument certificate not older than one year.
  - Check battery; Battery of the AMI Inspector should be completely charged. Remaining operating time on display minimum 20 hours.
  - Disable temperature compensation (set to “none”)
- In-line instrument: AMI Pharmacon:
  - Good order and condition; Sensor surface free of deposits.
  - Check message list; Review the message list (menu 1.2) and check for frequently alarms (as for example flow alarms). If alarms occur frequently remove cause before starting the procedure.

6.6.3 Connect instruments

The choice of sampling depends strongly on local conditions on site. Possible sampling:

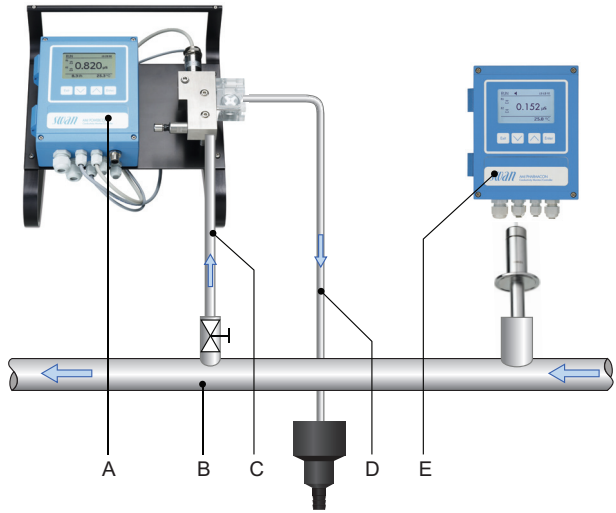
- via Sample point,
- via T-fitting or
- as piggyback / downstream

NOTICE: *Important for correct measurements are in any case:*

- *avoid ingress of air, use screwed fitting,*
- *sample as near as possible to the in-line sensor,*
- *wait approx. 10 minutes, whilst measurement is running, until measurement value and temperature are stabilized.*

Example: Sampling via Sampling Point

The reference instrument, AMI Inspector Pharmacon, is connected up-stream to the In-line Sensor Pharmacon at a sampling point (Grab sample).



A *Reference instrument*
B *Sample line*
C *Sample inlet to reference instrument*
D *Sample outlet from reference instrument*
E *Transmitter AMI Pharmacon*

1 Connect the reference instrument [A] to the sample line [B]. Use the supplied tube, made of FEP. The connection must be leak-proof against fluids and air.

2 Connect sample outlet [D] of the reference instrument AMI Inspector to any waste.

3 Switch on AMI Inspector. Open the flow regulating valve of the AMI Inspector completely.

4 Start sample flow again and regulate sample flow.
Run in time >15min.

6.6.4 Carry out comparison measurement

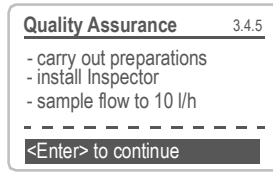
The comparison measurement is menu driven. Start by selecting Quality assurance in menu Quality assurance of the instrument, p. 41 of the Transmitter AMI Pharmacon.

NOTICE: *Temperature compensation is automatically deactivated during comparison measurement.*

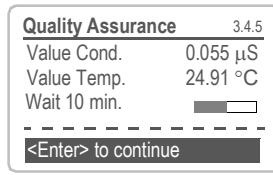
1 Navigate to menu <Maintenance>/<Quality Assurance>.

2 Press [Enter].

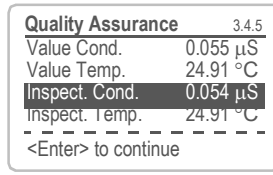
3 Follow the dialog on the Display.



4 Carry out pre test preparations
Connect instruments.
Regulate sample flow to 10 l/h using the appropriate valve.

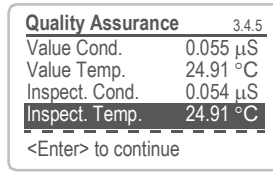


5 Wait 10 minutes whilst measurement is running.
Press [Enter] to continue.



6 Read the µS value of the reference instrument and enter under “Inspector.” by using the [▲] or [▼] keys.

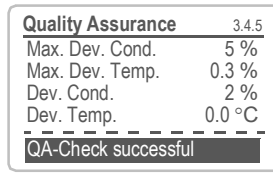
7 Press [Enter] to confirm.



8 Read temperature value of the reference instrument and enter under “Inspector Temp.” by using the [▲] or [▼] keys.

9 Press [Enter] to confirm.

10 Press [Enter] to continue.
⇒ *The results are saved in QA history regardless if successful or not*



NOTICE: *If the QA check is not successful, it is recommended to clean the sensor, see* *Cleaning the sensor, p. 39**. If the QA check fails again contact your local SWAN distributor for support.*

6.6.5 Completion of the measurement

1. Close the flow regulating valve of the AMI Inspector.
2. Disconnect the AMI Inspector by removing the tubes.
3. Shutdown the AMI Inspector.

6.7. Longer Stop of Operation

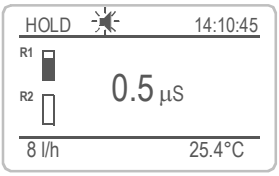
- Stop sample flow.
- Shut off power of the instrument.

7. Troubleshooting

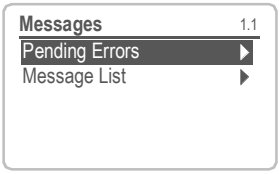
7.1. Error List

Error
Non-fatal Error. Indicates an alarm if a programmed value is exceeded.
Such Errors are marked **E0xx**.
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:

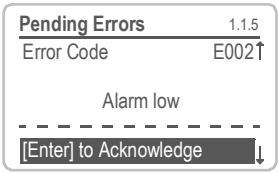
- Errors which disappear if correct measuring conditions are recovered (i.e. Sample Flow low).
  Such Errors are marked **E0xx**
- Errors which indicate a hardware failure of the instrument.
  Such Errors are marked **E0xx**



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	Cond. Alarm high	– check process – check program value 5.3.1.1, p. 66
E002	Cond. Alarm low	– check process – check program value 5.3.1.1, p. 66
E007	Sample Temp. high	– check sample temperature – check program value 5.3.1.3, p. 67
E008	Sample Temp. low	– check sample temperature – check program value 5.3.1.3, p. 67
E009	Sample Flow high	– check sample flow – check program value 5.3.1.2, p. 67
E010	Sample Flow low	– establish sample flow – clean instrument – check program value 5.3.1.2, p. 67
E011	Temp. shorted	– check wiring of temperature sensor – check temperature sensor
E012	Temp. disconnected	– check wiring of temperature sensor – check temperature sensor
E013	Case Temp. high	– check case/environment temperature – check program value 5.3.1.4, p. 67
E014	Case Temp. low	– check case/environment temperature – check program value 5.3.1.5, p. 67
E015	USP Error	– Measured value above programmed USP limit (% setpoint)
E017	Control Timeout	– check control device or programming in Installation, Relay contact, Relay 1/2 5.3.2 and 5.3.3, p. 68
E018	Quality Assurance	– Perform QA Procedure using reference instrument, e.g. AMI Inspector.

Error	Description	Corrective action
E024	Input active	– See If Fault Yes is programmed in Menu 5.3.4, p. 72
E026	IC LM75	– call service
E028	Signal output open	– check wiring on signal outputs 1 and 2
E030	EEprom Frontend	– call service
E031	Calibration Recout	– call service
E032	Wrong Frontend	– call service
E033	Power-on	– none, normal status
E034	Power-down	– none, normal status

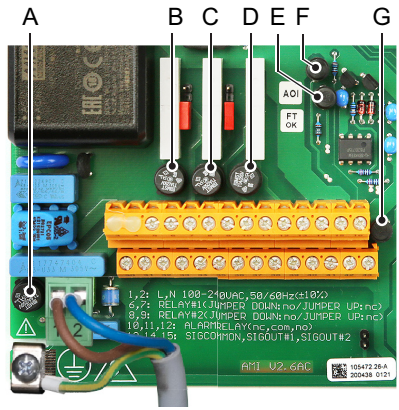
7.2. Replacing Fuses

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, p. 56.

- 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* *Date, Time*	1.2.1*	
Audit Trail 1.3*	*Audit Trail* *Number, Date, Time*	1.3.1*	

8.2. Diagnostics (Main Menu 2)

Identification	Designation	*AMI Pharmacon*		* 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*		
2.2*	2.2.1*	*(Raw value)*		
		Test History	*Number*	2.2.1.4.1*
		2.2.1.4*	*Date, Time*	
			Deviation Cond.	
			Deviation Temp.	
			Check successful	
		QA History	*Number*	2.2.1.5.1*
		2.2.1.5*	*Date, Time*	
			Deviation Cond.	
			Deviation Temp.	
			Check successful	
	Miscellaneous	*Case Temp.*	2.2.2.1*	
	2.2.2*			
Sample	*Sample ID*	2.3.1*		
2.3*	*Temperatur*			
	(Pt 1000)			
	Sample flow			
	(Raw value)			
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)

Transmitter Test	*Mount Test*	3.1.5*	* Menu numbers
3.1*	*(Progress)*		
Simulation	*Alarm Relay*	3.2.1*	
3.2*	*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)*		
3.3*			
Quality Assurance	*Quality Assurance*	3.4.x*	
3.4*	*(Progress)*		

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 Conductivity**	*Alarm High*	4.2.1.1.1*
4.2*	4.2.1*	4.2.1.1*	*Alarm Low*	4.2.1.1.x*
			Hysteresis	4.2.1.1.x*
			Delay	4.2.1.1.x*
	Relay 1/2	*Setpoint*	4.2.x.x*	
	4.2.2* - 4.2.3*	*Hysteresis*	4.2.x.x*	
		Delay	4.2.x.x*	
	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*		
Display	**Screen 1**	*Row 1/2/3*	4.4.1.x*	
4.4*	4.4.1*			
	Screen 2	*Row 1/2/3*	4.4.2.x*	
	4.4.2*			* Menu numbers

8.5. Installation (Main Menu 5)

Sensors	*Flow*	5.1.1*		* Menu numbers
5.1*				
	USP parameters	*Operating Mode*	5.1.2.1*	
	5.1.2*	*Limit*	5.1.2.2*	
	Sensor parameters	*Cell Constant*	5.1.3.1*	
	5.1.3*	*Temp. Corr.*	5.1.3.2*	
		Cable length	5.1.3.3*	
		Meas. unit	5.1.3.4*	
	Temp. Compensation	*Comp.*	5.1.4.1*	
	5.1.4*			
	Quality Assurance	*Level*	5.1.5.1*	
	5.1.5*	*Deviation Cond.*	5.1.5.2*	
		Deviation Temp.	5.1.5.3*	
		Interval	5.1.5.4*	
Signal Outputs	**Signal Output 1/2**	*Parameter*	5.2.1.1 - 5.2.2.1*	
5.2*	5.2.1* - 5.2.2*	*Current Loop*	5.2.1.2 - 5.2.2.2*	
		Function	5.2.1.3 - 5.2.2.3*	
		Scaling	*Range Low*	5.2.x.40.x*
		5.2.x.40	*Range High*	5.2.x.40.x*
Relay Contacts	**Alarm Relay**	**Alarm Conductivity**	*Alarm High*	5.3.1.1.1*
5.3*	5.3.1*	5.3.1.1*	*Alarm Low*	5.3.1.1.x*
			Hysteresis	5.3.1.1.x*
			Delay	5.3.1.1.x*
		Sample Flow	*Flow Alarm*	5.3.1.2.1*
		5.3.1.2*	*Alarm High*	5.3.1.2.x*
			Alarm Low	5.3.1.2.x*
		Sample Temp.	*Alarm High*	5.3.1.3.1*
		5.3.1.3*	*Alarm Low*	5.3.1.3.x*
		Case Temp. high	5.3.1.4*	
		Case Temp. low	5.3.1.5*	
	Relay 1/2	*Function*	5.3.2.1* - 5.3.3.1*	
	5.3.2* - 5.3.3*	*Parameter*	5.3.2.x* - 5.3.3.x*	
		Setpoint	5.3.2.x* - 5.3.3.x*	
		Hysteresis	5.3.2.x* - 5.3.3.x*	
		Delay	5.3.2.x* - 5.3.3.x*	

	Input	*Active*	5.3.4.1*	
	5.3.4*	*Signal Outputs*	5.3.4.2*	
		Output/Control	5.3.4.3*	
		Fault	5.3.4.4*	
		Delay	5.3.4.5*	
Miscellaneous	*Language*	5.4.1*		
5.4*	*Set defaults*	5.4.2*		
	Load Firmware	5.4.3*		
	Access	*Administrator*	5.4.4.1*	
	5.4.4*	*User 1-4*	5.4.4.2*- 5.4.4.5*	
	Sample ID	5.4.5*	*Name/Function/Password*	
Interface	*Protocol*	5.5.1*		(only with RS485
5.5*	*Baud Rate*	5.5.x*		interface)
				* Menu numbers

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).

1.3 Audit Trail

1.3.1 Shows the audit trail: event, menu, date and time of issue.

2 Diagnostics

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

2.1 Identification

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

2.1.3 **Factory Test**: Test date of the Instrument -, Motherboard - and Frontend quality control factory test.

2.1.4 **Operating Time**: Years / Days / Hours / Minutes / Seconds

2.2 Sensors

2.2.1 **Cond. Sensor:**

Current value: Current conductivity value in µS.
Raw value: Uncompensated current conductivity value in µS.

2.2.1.4 **Test History:** Review the transmitter test values (Number, Date,Time, Deviation Conductivity, Deviation Temperature, Test Result) compared to the high precision test resistors.

2.2.1.5 **QA History:** Review QA values (Number, Date, Time, Deviation Conductivity, Deviation Temperature, Status of QA check) of the last quality assurance procedures.

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 **Sample ID:** Review the programmed code. The code is defined by the user to identify the sample point in the plant.

Temperature: Actual temperature in °C and Ohm (Pt 1000)

Sample flow: Only available if flow meter is used. Sample flow in l/h and raw value in Hz.

2.4 I/O State

Shows current status of all in- and outputs.

2.4.1/2.4.2

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

2.5 Interface

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

3 Maintenance

3.1 Transmitter Test

3.1.5 Follow the commands on the screen.
See Transmitter Test, p. 40

3.2 Simulation

To simulate a value or a relay state, select the

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

with the [▲] or [▼] key.

Press the [Enter] key.

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

Press the [Enter] key.

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

Alarm Relay:	Active or inactive
Relay 1 and 2:	Active or inactive
Signal Output 1 and 2:	The preset current is simulated in mA
Signal Output 3: (option)	The preset current is simulated 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.

3.3 Set Time

Adjust date and time.

3.4 Quality Assurance

Follow the commands on the screen.
See Carry out comparison measurement, p. 45

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: 5–6‘000 Sec

4.2 Relay Contacts

See 5.3 Relay Contacts, p. 66

4.3 Logger

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

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

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

4.4 Display

Process values are displayed on two screens. Toggle screens with the [ ] key. Each screen displays max. 3 process values.

4.4.1 Screen 1

4.4.1.1 Row 1

4.4.1.2 Row 2

4.4.1.3 Row 3

Possible settings for all rows are:

- None
- Conductivity compensated (tc)
- Conductivity uncompensated (uc)
- USP conductivity alarm (usp)

4.4.2 Screen 2

Same as screen 1.

5 Installation

5.1 Sensors

5.1.1 *Flow:* Select “Q-Flow” if the sample flow should be monitored and displayed when using a Swan flow meter.
Available values: Q-Flow or None

5.1.2 USP parameter: Alarm (E015) according to limits of USP <645>.

5.1.2.1 *Operating Mode:* Enable USP mode. Available values: off / on

5.1.2.2 *Limit:* Possibility to lower the official USP limits in % of the USP values.
Range: 20–100%

5.1.3 Sensor parameters:

5.1.3.1 *Cell Constant:* Enter the cell constant (ZK). It is printed on the label of the used sensor.
Range: 0.005000–11.00 cm^{-1}

5.1.3.2 *Temperature Correction:* Enter the temperature correction (DT). It is printed on the label of the used sensor.
Range: -1.00 to +1.00 °C

5.1.3.3 *Cable length:* Enter the cable length
Range: 0.0–30.0 m

5.1.3.4 *Measuring unit:* Select measuring unit.
Available values: µS/cm or µS/m

5.1.4 Temp. Compensation:

5.1.4.1 *Compensation:* Select temperature compensation.
Available values:

- Coefficient
- Neutral salts
- High-purity water
- strong acids
- strong bases
- Ammonia
- Eth. am.
- Morpholine
- None.

5.1.5 **Quality Assurance:** See Quality assurance of the instrument, p. 41

5.1.5.1 *Level.*: Choose the quality level according to your requirements.

- 0: Off; Quality Assurance is not active.
- 1: Trend (details see Quality assurance level, p. 41)
- 2: Standard (details see Quality assurance level, p. 41)
- 3: Crucial (details see Quality assurance level, p. 41)
- 4: User; edit user specific limits in menu 5.1.5.2 - 5.1.5.4

If Level is set to User to following additional settings are possible:

5.1.5.2 *Deviation Conductivity:* Enter the maximum deviation of the process value (conductivity) for quality level “4 User”.
Range: 0.0–20.0%

5.1.5.3 *Deviation Temperature:* Enter the maximum deviation of the temperature for quality level “4 User”. Range: 0.0–2.0°C

5.1.5.4 *Interval:* Enter the inspection interval for quality level “4 User”.
Range: annual, quarterly, monthly, weekly.

5.2 Signal Outputs

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

> ***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.*

5.2.1.1 *Parameter:* Assign one of the process values to the signal output.
Available values: Conductivity, Temperature, Sample flow, and Conductivity uc

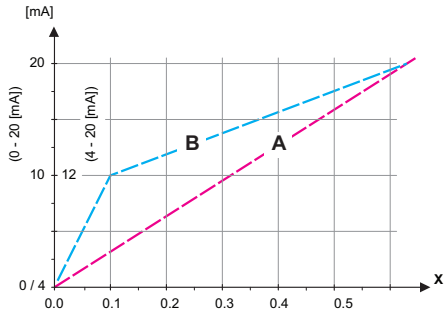
5.2.1.2 *Current Loop:* Select the current range of the signal output.
Make sure the connected device works with the same current range.
Available ranges: 0–20 [mA] or 4–20 [mA]

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:

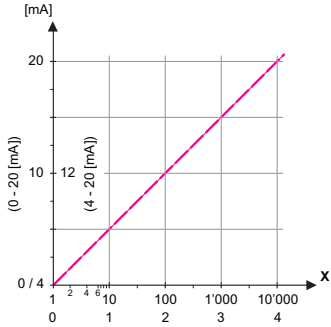
- Linear, bilinear or logarithmic for process values.
  See As process values, p. 63
- Control upwards or control downwards for controllers.
  See As control output, p. 64

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.x.40 **Scaling:** Enter beginning and end point (Range low & high) of the linear or logarithmic scale. In addition, the midpoint for the bilinear scale.

Parameter Conductivity:

5.2.1.40.10 *Range low*: 0 µS–300 mS

5.2.1.40.20 *Range high*: 0 µS–300 mS

Parameter Temperature

5.2.1.40.11 *Range low*: -25 to +270 °C

5.2.1.40.21 *Range high*: -25 to +270 °C

Parameter Sample flow

5.2.1.40.12 *Range low*: 0 –50 l/h

5.2.1.40.22 *Range high*: 0 –50 l/h

Parameter Cond. uc:

5.2.1.40.13 *Range low*: 0 µS–300 mS

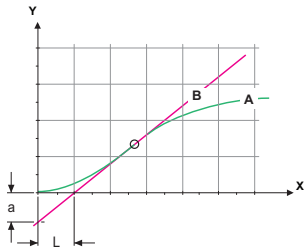
5.2.1.40.23 *Range high*: 0 µS–300 mS

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:



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

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

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

Control upwards or downwards

Setpoint: User-defined process value for the selected parameter.

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

5.2.1.43 **Control Parameters**: if Parameters = Conductivity

5.2.1.43.10 *Setpoint*
Range: 0.000 µS–300 mS

5.2.1.43.20 *P-Band*:
Range: 0.000 µS–300 mS

5.2.1.43 **Control Parameters**: if Parameters = Temperature

5.2.1.43.11 *Setpoint*
Range: -25 to +270 °C

5.2.1.43.21 *P-Band*:
Range: -25 to +270 °C

5.2.1.43 **Control Parameters**: if Parameters = Sample flow

5.2.1.43.12 *Setpoint*
Range: 0 –50 l/h

5.2.1.43.22 *P-Band*:
Range: 0 –50 l/h

5.2.1.43 **Control Parameters**: if Parameters = Cond. uc.

5.2.1.43.13 *Setpoint*
Range: 0 µS–300 mS

5.2.1.43.23 *P-Band*:
Range: 0 µS–300 mS

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
- Lack of reagents
- Process values out of programmed ranges.

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

- Alarm Conductivity
- Sample Flow
- Sample Temp.
- Case Temp. high
- Case Temp. low

5.3.1.1 Alarm Conductivity

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 µS–300 mS

5.3.1.1.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay is activated and E002 is displayed in the message list.
Range: 0.000 µS–300 mS

5.3.1.1.35 *Hysteresis:* Within the hyst. range, the relay does not switch. This prevents damage of relays contacts when the measured value fluctuates around the alarm value.
Range: 0.000 µS–300 mS

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

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

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

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

5.3.1.2.x *Alarm High:* If the measuring values rises above the programmed value E009 will be issued.
Range: 10.0–50.0 l/h

5.3.1.2.x *Alarm Low:* If the measuring values falls below the programmed value E010 will be issued.
Range: 0.0–9.0 l/h

5.3.1.3 **Sample temperature:** Define the measuring value, which should issue an alarm high respectively low.

5.3.1.3.1 *Alarm High:* If the sample temperature rises above the programmed value E007 is issued.
Range: 30–200 °C

5.3.1.3.x *Alarm Low:* If the sample temperature falls below the programmed value E008 is issued.
Range: -10 to +20 °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. 27. 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
Conductivity	0 µS–300 mS
Temperature	-25 to +270 °C
Sample flow	0–50 l/h
Cond. uc	0 µS–300 mS

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
Conductivity	0 µS–300 mS
Temperature	-25 to +270 °C
Sample flow	0–50 l/h
Cond. uc	0 µS–300 mS

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:* Choose on of the following process values.

- Conductivity)
- Temperature
- Sample Flow
- Cond. uc

5.3.2.32 **Settings***:* Choose the respective actuator:

- Time proportional
- Frequency
- Motor valve

5.3.2.32.1 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. 65

5.3.2.32.1 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. 65

5.3.2.32.1	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. 65
5.3.2.1	Function = Timer:
	The relay will be activated repetitively depending on the programmed time scheme.
5.3.2.24	*Mode:* Operating mode (interval, daily, weekly)
5.3.2.24	*Interval*
5.3.2.340	*Interval:* The interval can be programmed within a range of 1–1440 min.
5.3.2.44	*Run Time*: Enter the time the relay stays active. Range: 5–32400 sec.
5.3.2.54	*Delay*: during run time plus the delay time the signal and control outputs are held in the operating mode programmed below. Range: 0–6'000 Sec.
5.3.2.6	*Signal Outputs*: Select operating mode of the signal output: *Cont.:* Signal outputs continue to issue the measured value. *Hold:* Signal outputs hold the last valid measured value. Measurement is interrupted. Errors, except fatal errors, are not issued. *Off:* Signal outputs are switched off (set to 0 or 4 mA). Errors, except fatal errors, are not issued.
5.3.2.7	*Output/Control*: Select operating mode of the controller output: *Cont.:* Controller continues normally. *Hold:* Controller continues based on the last valid value. *Off:* Controller is switched off.

5.3.2.24 *daily*

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

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

1 Press [Enter], to set the hours.
2 Set the hour with the [▲] or [▼] keys.
3 Press [Enter], to set the minutes.
4 Set the minutes with the [▲] or [▼] keys.
5 Press [Enter], to set the seconds.
6 Set the seconds with the [▲] or [▼] keys.

Range: 00:00:00–23:59:59

5.3.2.44 *Run Time*: see Interval
5.3.2.54 *Delay*: see Interval
5.3.2.6 *Signal Outputs*: see Interval
5.3.2.7 *Output/Control*: see Interval

5.3.2.24 *weekly*

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

5.3.2.342 Calendar:

5.3.2.342.1 *Start time*: The programmed start time is valid for each of the programmed days. To set the start time see 5.3.2.341, p. 71.
Range: 00:00:00–23:59:59

5.3.2.342.2 *Monday*: Possible settings, on or off
to
5.3.2.342.8 *Sunday*: Possible settings, on or off

5.3.2.44 *Run Time*: see Interval
5.3.2.54 *Delay*: see Interval
5.3.2.6 *Signal Outputs*: see Interval
5.3.2.7 *Output/Control*: see Interval

5.3.2.1 Function = Fieldbus:

The relay will be switched via the Profibus input. No further parameters are needed.

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

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

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

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

Cont.:	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):

Cont.	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 No.: Range: Analyzer; Manufacturer; Multivariable

5.5.40 Local operation: Range: Enabled, Disabled

5.5.1 *Protocol:* **Modbus RTU**

5.5.21 Device address: Range: 0–126

5.5.31 Baud Rate: Range: 1200–115 200 Baud

5.5.41 Parity: Range: none, even, odd

5.5.1 *Protocol:* **USB stick**

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

5.5.1 *Protocol:* **HART**

5.5.24 Device address: Range: 0–63

10. Default Values

Operation:

Sensors:	Filter Time Const.:	10 s
	Hold after Cal.:	300 s
Alarm Relay		same as in Installation
Signal Output		same as in Installation
Relay 1/2		same as in Installation
Input		same as in Installation
Logger:	Logger Interval:	30 min
	Clear Logger:	no

Installation:

Sensor:	Flow:	None
	USP parameters: Operating Mode	off
	USP parameters: Limit:	100%
	Sensor parameters: Cell Constant:	0.08000 cm^{-1}
	Sensor parameters: Temp. corr.:	0.00 °C
	Sensor parameters: Cablel lenght:	0.0 m
	Sensor parameters: Meas. unit:	µS/cm
	Temp. Compensation: Comp.	none
	Quality Assurance: Level 0:	off
Signal Output 1/2	Parameter:	Conductivity
	Current loop:	4 - 20 mA
	Function:	linear
	Scaling: Range low:	0.000 µS
	Scaling: Range high:	1.00 mS
	Scaling: Temperature: Range low:	0.0 °C
	Scaling: Temperature: Range high:	50.0 °C
	Scaling: Conductivity uc: Range low:	0.000 µS
	Scaling: Conductivity uc: Range high:	1.00 mS
	Scaling: Sample Flow: Range low:	0 l/h
	Scaling: Sample Flow: Range high:	200 l/h
Alarm Relay	Alarm Conductivity: Alarm high:	300 mS
	Alarm Conductivity: Alarm low:	0.000 µS
	Alarm Conductivity: Hysteresis:	1.00 µS
	Alarm Conductivity: Delay:	5 s
	Sample Flow: Flow Alarm:	yes
	Sample Flow: Alarm High:	20 l/h
	Sample Flow: Alarm Low:	5 l/h
	Sample Temp.: Alarm High:	160 °C
	Sample Temp.: Alarm Low:	0 °C

	Case temp. high:	65 °C
	Case temp. low:	0 °C
Relay1/2	Function:	Limit upper
	Parameter:	Conductivity
	Setpoint:	30 mS
	Hysteresis:	10.0 µS
	Delay:	30 s
	If Function = Control upw. or dnw:	
	Parameter:	Conductivity
	Settings: Actuator:	Frequency
	Settings: Pulse Frequency:	120/min
	Settings: Control Parameters: Setpoint:	30 mS
	Settings: Control Parameters: P-band:	10.0 µS
	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:	1 min
	Mode: daily/weekly:	Starting time: 00:00:00
	Run time:	10 s
	Delay:	5 s
	Signal output:	cont
	Output/Control:	cont
Input:	Active	when closed
	Signal Outputs	hold
	Output/Control	off
	Fault	no
	Delay	10 s
Miscellaneous	Language:	English
	Set default:	no
	Load firmware:	no
	Password:	for all modes 0000
	Sample ID:	- - - - - - - -
	Line break detection	no

11. Index

12. Notes

SWAN

is represented worldwide by subsidiary companies and distributors.

cooperates with independent representatives all over the world.

SWAN Products

Analytical Instruments for:

- High Purity Water
- Feedwater, Steam and Condensate
- Potable Water
- Pool and Sanitary Water
- Cooling Water
- Waste Water and Effluents

Made in Switzerland