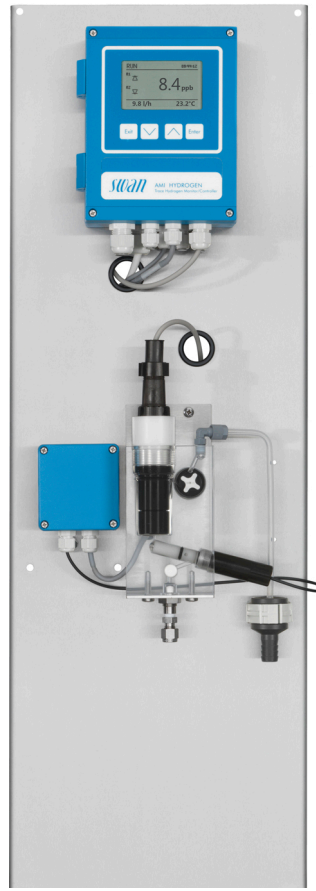
swan
ANALYTICAL INSTRUMENTS

# AMI Hydrogen QED

*Version 6.22 and higher*




## Operator's Manual

A-96.250.791 / 020720

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## Table of Contents

# AMI Hydrogen QED– 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**

**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.
- Whenever electronic service is required, disconnect instrument power and power of devices connected to.
  - relay 1,
  - relay 2,
  - alarm relay

**WARNING**

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

**WARNING**

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

# 2. Product Description

## 2.1. Description of the System

**Application Range**

The AMI Hydrogen QED is a monitor for continuous measurement of dissolved hydrogen in water.

**Signal Outputs**

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

Current loop: 0/4–20 mA

Maximal burden: 510 Ω

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

**Relay**

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

Maximum load: 1 A/250 VAC

**Alarm Relay**

One potential free contact.

Alternatively:

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

Summary alarm indication for programmable alarm values and instrument faults.

**Input**

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

**Safety Features**

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

**Communication Interface (optional)**

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

**Faraday Verification**

The Faraday verification is used to check the sensor periodically. The intervals can be freely programmed in the menu operation.

**Measuring principle**

Hydrogen is measured by an amperometric method. A small voltage, called polarization voltage, is applied between two electrodes. If a hydrogen molecule hits the positively charged platinum electrode (anode) it will be oxidized. This means that two electrons are removed under the influence of the positive voltage and the catalytic properties of the platinum. This leaves two (charged) protons and two electrons behind.

(1) $H2 \longrightarrow 2\ H^+ + 2\ e^-$

The two electrons are transported by the polarization voltage source to the negatively charged silver-silver chloride electrode (cathode), causing the following reaction:

(2) $AgCl + 2\ e^- \longrightarrow Ag + 2\ Cl^-$

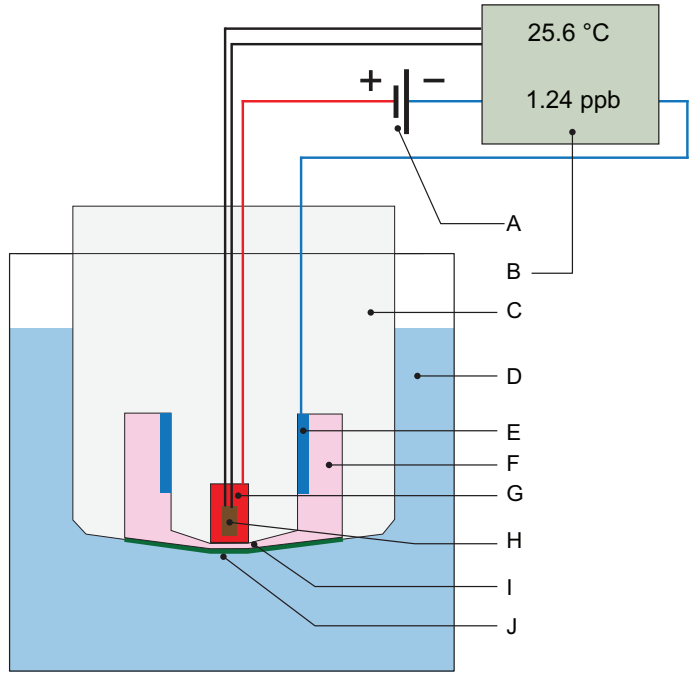
Finally the two kinds of ions produced will combine into a small amount of hydrochloric acid:

(3) $2\ H+ + 2\ Cl^- \longrightarrow 2\ HCl$

If the hydrogen concentration in the sample increases, more hydrogen molecules will hit the platinum anode within a given time. Therefore, more electrons will be transported within a given time, which corresponds to an increased electrical current. This current can be measured by the electronics. It is directly proportional to the concentration of hydrogen in the sample. Formula (2) indicates that in the course of the hydrogen measurement the silver chloride is reduced to elemental silver. If all silver chloride has been converted to silver the hydrogen sensor has to be refurbished in the factory. However, there is enough silver chloride provided to keep the sensor operational during two years under normal conditions.

The actual SWAN hydrogen-sensor design is based on the well-known Clark principle. Clark-type hydrogen sensors have been successfully in use for many years.

**Hydrogen sensor schematic view**

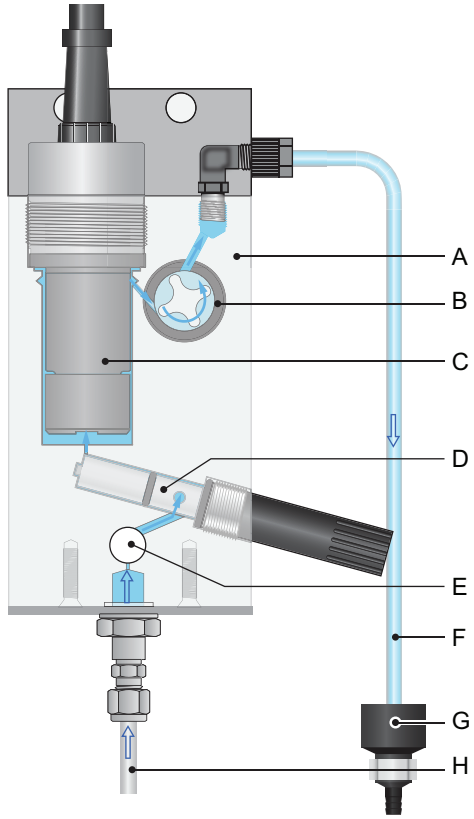



***A*** *Polarization voltage source*
***B*** *Display*
***C*** *Sensor body*
***D*** *Sample*
***E*** *Cathode*
***F*** *Electrolyte*
***G*** *Anode*
***H*** *Temperature sensor*
***I*** *Thin layer of electrolyte*
***J*** *Hydrogen permeable membrane*

**Fluidics**

Swansensor Hydrogen combined with QV-flow PMMA OTG flow cell [A].
The sample flows via sample inlet [H] through the flow regulating valve [E], where the flow rate can be adjusted. Then the sample flows through the Faraday electrode [D] into the measuring cell were the hydrogen concentration of the sample is measured.

The sample leaves the measuring cell via flow sensor [B] through the sample outlet [F] and flows into the drain funnel [G].




***A*** *Flow cell*
***B*** *Flow sensor*
***C*** *Swansensor hydrogen*
***D*** *Faraday electrode*
***E*** *Flow regulating valve*
***F*** *Sample outlet*
***G*** *Drain funnel*
***H*** *Sample inlet*

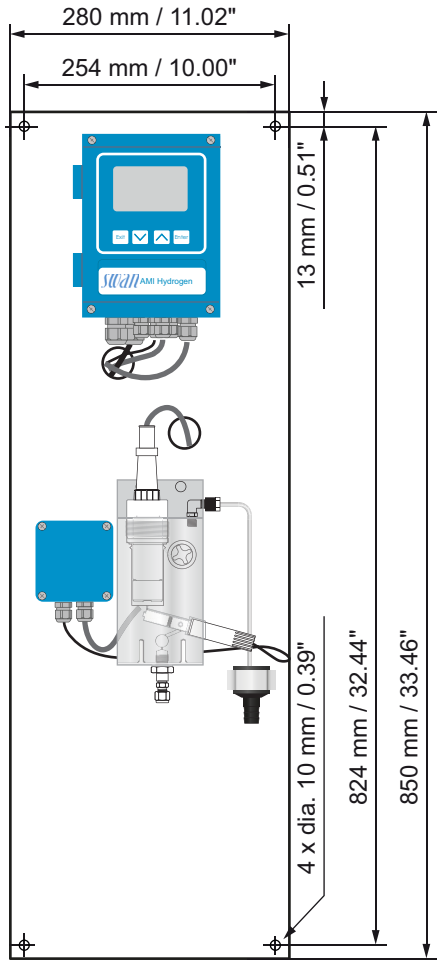
## 2.2. Technical Data

| | | |
|---|---|---|
| **Power Supply** | AC variant: | 100–240 VAC (±10%)<br>50/60 Hz (±5%) |
| | DC variant | 10–36 VDC |
| | Power consumption: | max. 35 VA |
| **Transmitter specifications** | Housing: | aluminum, with a protection degree of IP 66 / NEMA 4X |
| | Ambient temperature: | −10 to +50 °C |
| | Storage and transport: | −30 to +85 °C |
| | Humidity: | 10–90% rel., non condensing |
| | Display: | backlit LCD, 75 x 45 mm |
| **Sample requirements** | Flow rate: | 6 to 20 l/h |
| | Temperature: | up to 45 °C |
| | Inlet pressure: | 0.2 to 1 bar |
| | Outlet pressure: | pressure-free |
| **Flow cell and connection** | Flow cell made of acrylic glass with built-in flow adjustment valve and digital sample flow meter | |
| | Sample inlet: | 1/4” Swagelok tube adapter |
| | Sample outlet: | flexible tube 8x6 mm |

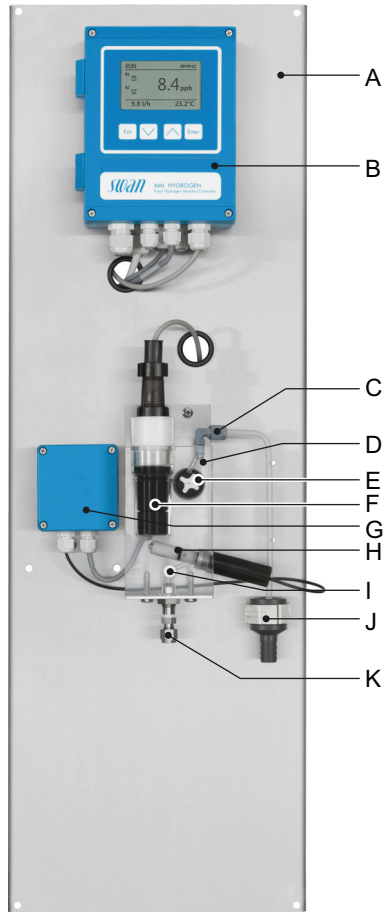
| | Range | Resolution |
|---|---|---|
| **Measuring range** | 0.01–9.99 ppb | 0.01 ppb |
| | 10.0–99.9 | 0.1 ppb |
| | 100–800 ppb | 1 ppb |
| | 0–50% saturation | 0.1% saturation |

| | |
|---|---|
| **Accuracy** | ±5% of measured value or ±0.5 ppb |
| **Reproducibility** | ±1% of measured value or ±0.5 ppb |

| | | |
|---|---|---|
| **Dimensions** | Panel: | stainless steel |
| | Mounting hole distance | 280x850x150 mm |
| | Screws: | 8 mm |
| | Weight: | 10.0 kg |



## 2.3. Instrument Overview




***A*** *Panel*
***B*** *AMI Transmitter*
***C*** *Sample outlet*
***D*** *Flow cell*
***E*** *Flow sensor*
***F*** *Hydrogen sensor*
***G*** *Faraday control*
***H*** *Faraday electrode*
***I*** *Flow regulating valve*
***J*** *Drain funnel*
***K*** *Sample inlet*

# 3. Installation

## 3.1. Installation Check List

| | |
|---|---|
| **On-site requirements** | AC variant: 100–240 VAC (± 10%), 50/60 Hz (± 5%)<br>DC variant: 10–36 VDC<br>Power consumption: 35 VA maximum.<br>Protective earth connection required.<br>Sample line with sufficient sample flow and pressure (see Technical Data, p. 11). |
| **Installation** | Connect the sample and waste line. |
| **Electrical wiring** | Connect all external devices like limit switches, current loops and pumps.<br>Connect power cord, see Electrical Connections, p. 17. |
| **Power-up** | Open the flow regulating valve.<br>Switch on power<br>Adjust the sample flow to 6–20 l/h. |
| **Instrument setup** | Program all parameters for external devices (interface, recorders, etc.) and instrument operation (limits, alarms). |
| **Run-in period** | Let the instrument run continuously for 1 h. |

## 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.
For dimensions see Dimensions, p. 12

## 3.3. Connecting Sample Inlet and Outlet

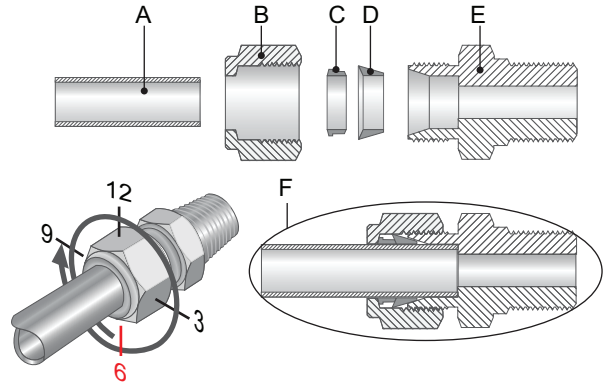
### 3.3.1 Swagelok Fitting Stainless Steel at Sample Inlet

**Preparation**

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**

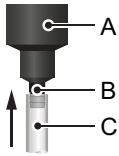
1. Insert the compression ferrule [C] and the compression cone [D] into the union nut [B].
2. Screw on the union nut onto the body, do not tighten it.
3. Push the stainless steel pipe through the union nut as far as it reaches the stop of the body.
4. Mark the union nut at 6 o'clock position.
5. While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




***A*** *Stainless steel tube*
***B*** *Union nut*
***C*** *Compression ferrule*
***D*** *Compression cone*
***E*** *Body*
***F*** *Tightened connection*

### 3.3.2 Sample Outlet

1/2” tube at waste funnel.




***A*** *Waste funnel*
***B*** *Hose nozzle*
***C*** *1/2” tube*

Connect the 1/2” tube [C] to the hose nozzle [B] and place it into a pressure free drain.

## 3.4. Electrical Connections

**WARNING**

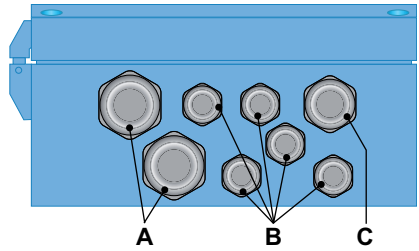
**Risk of electrical shock.**

Do not perform any work on electrical components if the transmitter is switched on. Failure to follow safety instructions can 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

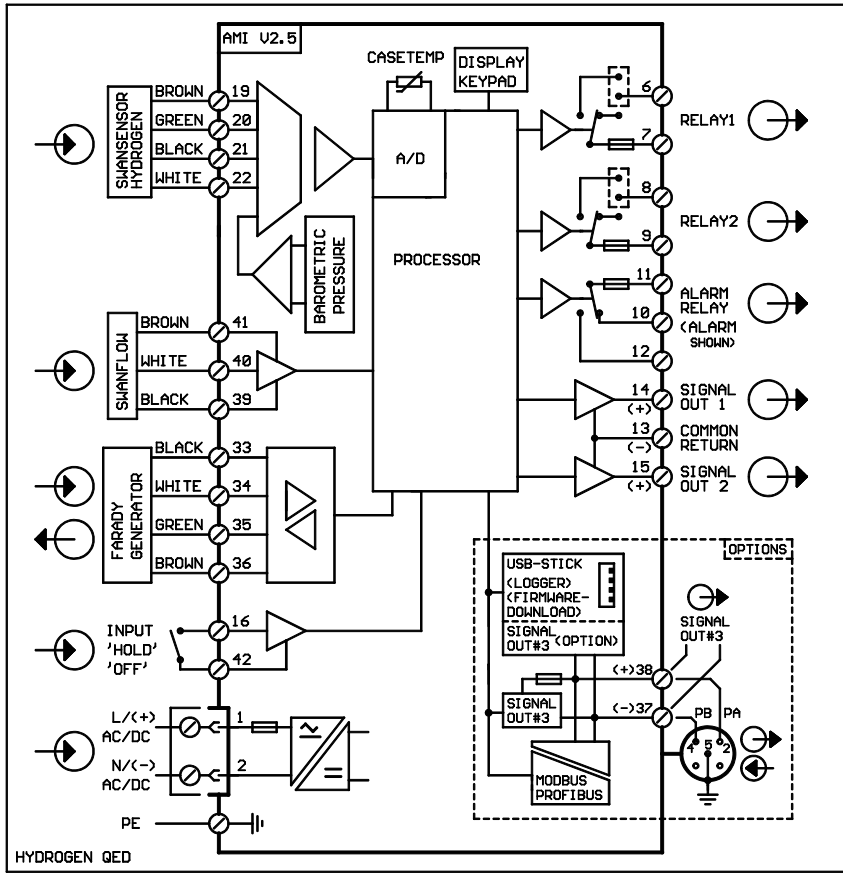
**WARNING**

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.

## 3.5. Connection Diagram




**CAUTION**

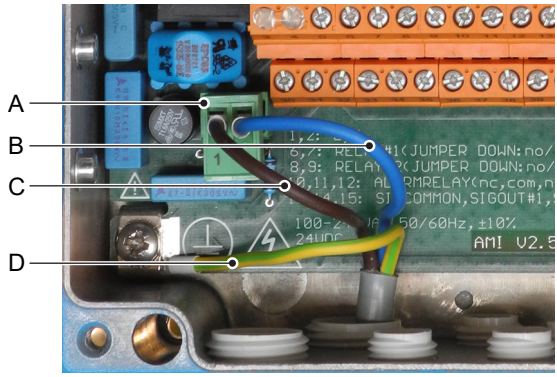
Use only the terminals shown in this diagram, and only for the mentioned purpose. Use of any other terminals will cause short circuits with possible corresponding consequences to material and personnel.

## 3.6. Power Supply

**WARNING**

**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 Hydrogen QED

## 3.7. Relay Contacts

Programming of the relay contacts see 5.3 Relay Contacts, p. 65.

### 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. 71.

### 3.7.2 Alarm Relay

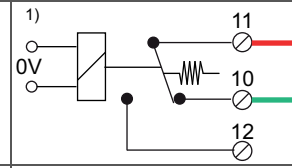
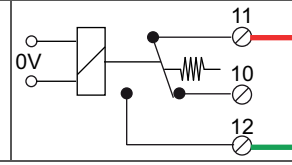
***NOTICE:*** *Max. load1 A T / 250 VAC*

Alarm output for system errors.

Error codes see Troubleshooting, p. 46

Programming see menu 5.3.1, p. 65

***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. |   |

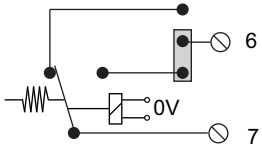
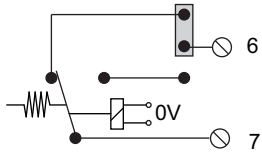
1) *usual use*

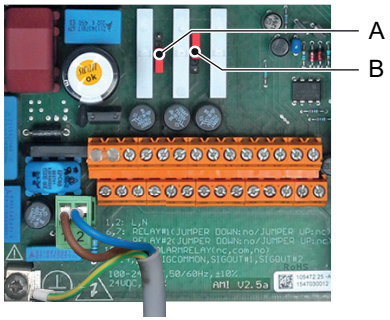
### 3.7.3 Relay Contacts 1 and 2

***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<br>8/9: Relay 2 |  | Inactive (opened) during normal operation and loss of power.<br>Active (closed) when a programmed function is executed. |  |
| Normally Closed | 6/7: Relay 1<br>8/9: Relay 2 |  | Inactive (closed) during normal operation and loss of power.<br>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. 67

**CAUTION**

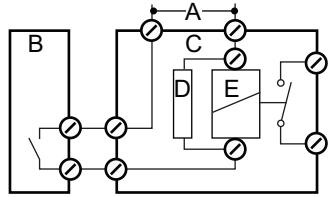
**Risk of damage of the relays in the AMI transmitter due to heavy inductive load.**

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**

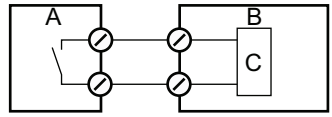
Small inductive loads (max 0.1 A) as for example the coil of a power relay can be switched directly. To avoid noise voltage in the AMI transmitter it is mandatory to connect a snubber circuit in parallel to the load.




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

**Resistive load**

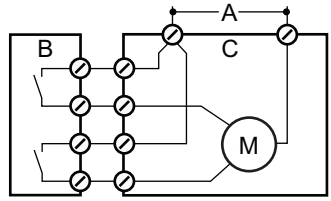
Resistive loads (max. 1 A) and control signals for PLC, impulse pumps and so on can be connected without further measures




***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*

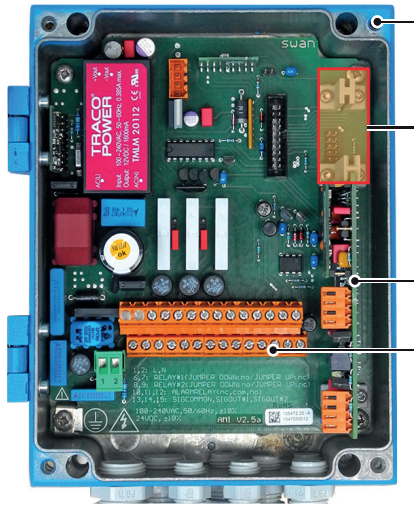
## 3.8. Signal Outputs

### 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 (-)
Programming see menu 5.2 Signal Outputs, p. 60

## 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:

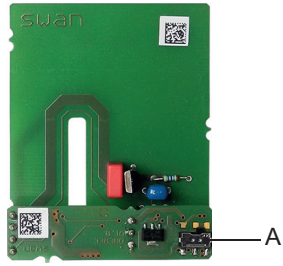
- Third signal output
- a Profibus or Modbus connection
- a HART connection
- an USB interface

### 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

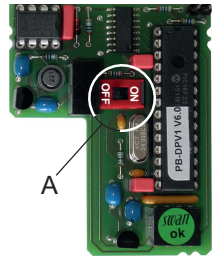
*A Operating mode selector switch*

### 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.*



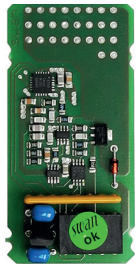

Profibus, Modbus Interface PCB (RS 485)

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.

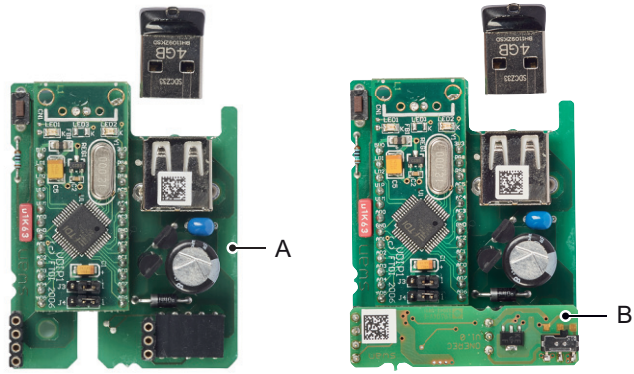


HART Interface PCB

### 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

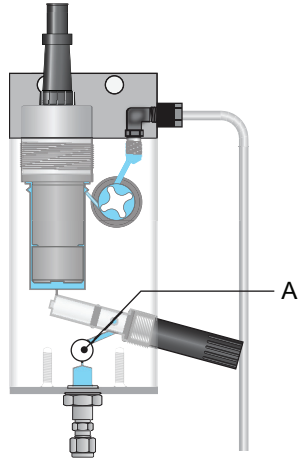
*A USB interface PCB*

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

# 4. Instrument Setup

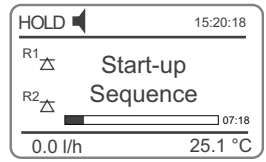
**Establish sample flow**

**1** Open the flow regulating valve [A].




**2** Switch on the instrument.

**3** The following start-up sequence lasts 8 min. During this time the instrument is on hold.




**4** Adjust the sample flow to 6–20 l/h. The actual flow is shown on the transmitter display.

## 4.1. Programming

**Sensor parameters**

Check the sensor parameters in menu <Installation> /<Sensors>/<Sensor parameters>.
The sensor characteristics are printed on the label of each sensor.

| | |
|---|---|
| SwanSensor Hydrogen | |
| A-87.260.001 | $I_s$: 3.025 µA |
| xxxxxxx | p: 953 hPa |

The following parameters are required:

- $I_s$ (saturation current)
- p (air pressure)

**External devices**

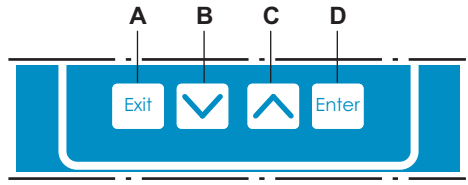
Program all parameters for external devices (interface, recorders, etc.).

**Limits, alarms**

Program all parameters for instrument operation (limits, alarms).
See Program List and Explanations, p. 55.

# 5. Operation

## 5.1. Keys



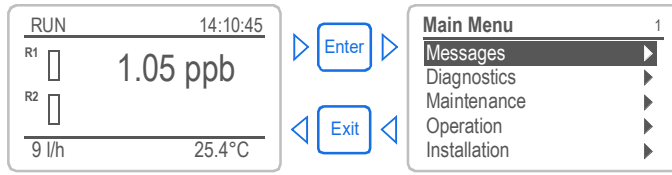

**A** to exit a menu or command (rejecting any changes)
to move back to the previous menu level

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

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

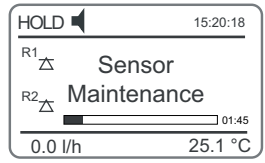
**D** to open a selected sub-menu
to accept an entry

**Program Access, Exit**

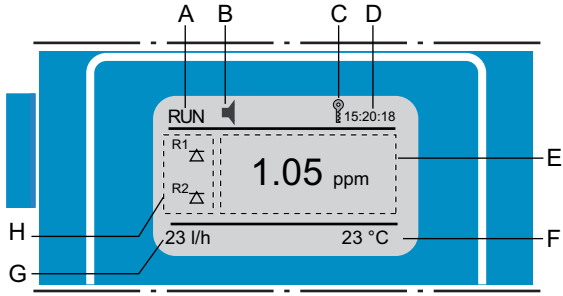



**Sensor Maintenance**

The automatic sensor regeneration is carried out at configurable intervals and takes 2 minutes. During this time the signal outputs are set to hold.



## 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 in l/h

**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

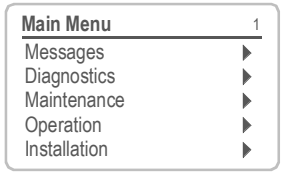
motor valve closed

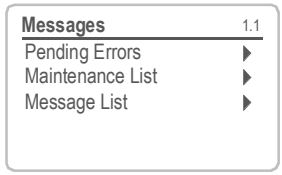
motor valve: open, dark bar indicates approx. position

timer

timer: timing active (hand rotating)

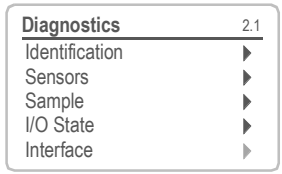
## 5.3. Software Structure



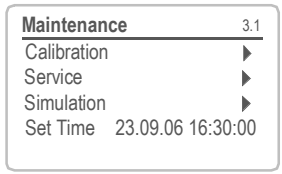

Menu **Messages 1**

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.



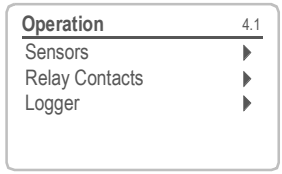

Menu **Diagnostics 2**

Provides user relevant instrument and sample data.



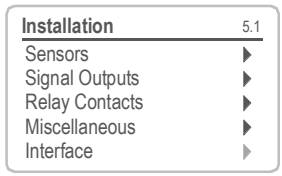

Menu **Maintenance 3**

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.



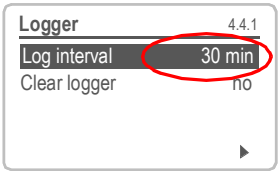

Menu **Installation 5**

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

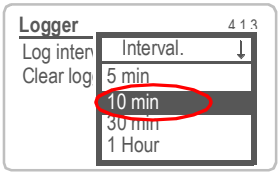
**Changing parameters**

The following example shows how to change the logger interval:



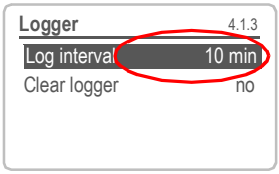

1 Select the parameter you want to change.

2 Press [Enter].



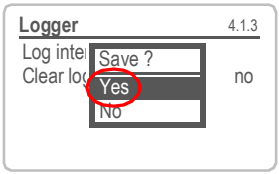

3 Press [▲] or [▼] key to highlight the required parameter.

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




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

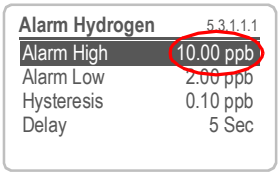
5 Press [Exit].




⇒ *Yes is highlighted.*

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

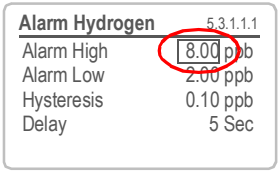
**Changing values**




1 Select the value you want to change.

2 Press [Enter].

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




4 Press [Enter] to confirm the new value.

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

6 Press [Enter] to save the new value.

# 6. Maintenance

## 6.1. Maintenance Table

| | |
|---|---|
| **If required** | ◆ Perform a calibration. |
| **Two years or if required** | ◆ Send the sensor to Swan for revision.<br>◆ After installation of the revised sensor, program saturation current and air pressure (5.1.3.1, p. 60 and 5.1.3.2, p. 60) as indicated on the sensor label.<br><br>To avoid a longer interruption of the measuring operation, a second hydrogen sensor can be purchased. The two sensors can then be used alternately. If two sensors are available, the following procedure is recommended:<br>◆ Send the replacement sensor to Swan for revision shortly before replacement.<br>◆ After installing the revised sensor, store the unused sensor in its original packaging in a cold, dry and dark place. |

## 6.2. Stop of Operation for Maintenance

1 Shut off power of the instrument.

2 Stop sample flow by closing the flow regulating valve.

## 6.3. Maintenance of the Hydrogen Sensor

### 6.3.1 Hydrogen Sensor Handling

- Never attempt to open the hydrogen sensor.
- Always store the sensor in water or in the wet flow cell.
- Always keep the sensor connected to the AMI transmitter.
- Always keep the sensor polarized. Without polarization the sensor suffers a loss of sensitivity.
  The AMI Hydrogen QED has a buffered polarization source which will keep the hydrogen sensor polarized for some days, even if the AMI Hydrogen QED is switched off.
  However, it is a good idea to keep the AMI running all the time. The AMI Hydrogen QED should be connected to the power supply and switched on even if it is not in use.
- During calibration, do not expose the sensor to 100 % hydrogen for more than 6 minutes. Otherwise the extremely dry gas might dry out the capillary layer of electrolyte between platinum anode and plastic membrane, which makes the sensor response unstable.
- The hydrogen molecule is very small and migrates into almost any material including electrolyte, plastics and even metals and will remain there for some time. After a calibration it may take a few hours until the residual current of the sensor has dropped enough to measure very low levels of hydrogen again.
- The hydrogen sensor usually shows a small positive offset, which means there is a small positive value in air (without hydrogen, normally below one ppb). This value can be set to zero: <Installation>/<Sensors>/<Miscellaneous>/<Offset>. Use with caution!

### 6.3.2 Calibration

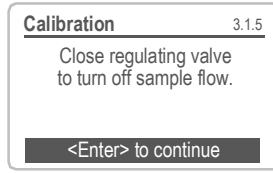
The hydrogen sensor of the AMI Hydrogen QED is calibrated with pure hydrogen. To perform a calibration proceed as follows:

***NOTICE:*** *Do not expose the sensor to 100% hydrogen for more than 6 minutes.*

**1** Stop the sample flow at the main tap.

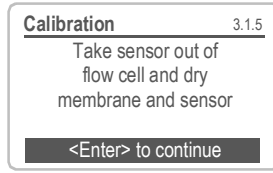
**2** Navigate to menu <Maintenance> /<Calibration>.

**3** Press [Enter] to start the calibration and follow the dialog on the display.

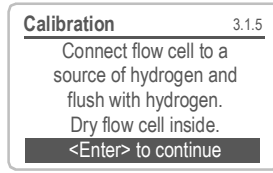



**4** Unscrew and remove the threaded sleeve [A].

**5** Remove the hydrogen sensor [B] from the flow cell.



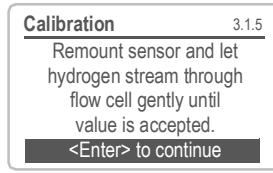

**6** Dry the sensor membrane and the flow cell with a soft paper tissue.




**7** Flush the flow cell with hydrogen.

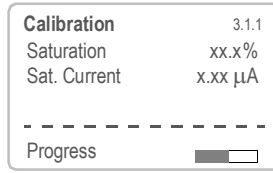
**8** Stop hydrogen flow and dry the flow cell.

**9** Re-insert the hydrogen sensor into the flow cell.
⇒ *Make sure that the sensor membrane is dry.*

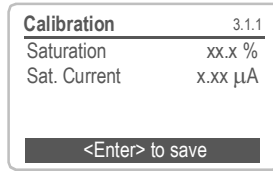



**10** Start the hydrogen flow.

**11** Press [Enter] to start the calibration measurement.




The saturation should reach 100 %, the saturation current should be about 2.0 µA to 4.5 µA. If the measuring values are not stable during the measuring period, the calibration will be discarded.




If this is the case, check and if necessary correct your measurement arrangement and try again.

If the calibration was successful press [Enter] to save.

If the calibration fails again, the hydrogen sensor has to replaced by a new one.

### 6.3.3 Faraday Verification

The Faraday verification works only for hydrogen concentrations below 40–50 ppb. If automatic Faraday verification is enabled, a periodic check of the system is performed. A manual verification can be started for test purposes.

**Automatic verification**

Per default the instrument performs an automatic Faraday verification every 3 hours. To change the settings for automatic verification navigate to menu <Operation>/<Faraday Parameter>, see menu 4.1.3, p. 58 for details.

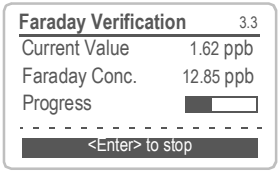
Possible settings are:

- off
- interval
- daily
- weekly

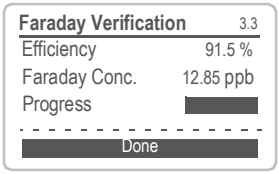
**Manual verification**

To start a manual verification:

1 Navigate to menu 3.2.2 <Maintenance>/<Service>/<Faraday Verification>.




2 Press [Enter] to start the Faraday Verification.
⇒ *The verification then starts immediately.*

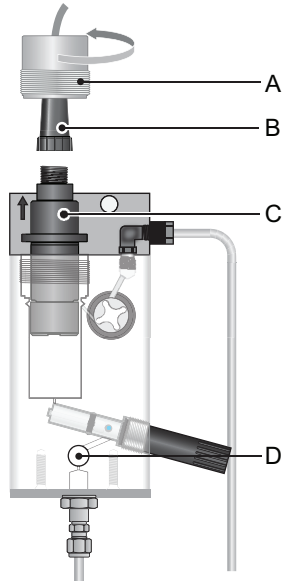



3 Press [Enter] to confirm the Faraday Verification.

Results are saved in the Verification history menu 2.2.1.5

If the Faraday efficiency is below 50%, message E018 is displayed and the Faraday electrode needs to be cleaned, see Maintenance of the Faraday Electrode, p. 38.

### 6.3.4 Replace Hydrogen Sensor




***A*** *Threaded sleeve*
***B*** *Sensor connector*
***C*** *Hydrogen sensor*
***D*** *Flow regulating valve*

To replace the hydrogen sensor proceed as follows:

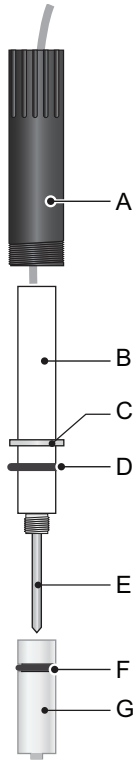
**Remove the old sensor**

1. Switch off the AMI Hydrogen QED.
2. Close the flow regulating valve [D].
3. Unscrew and remove the threaded sleeve [A] from the flow cell.
4. Remove the hydrogen sensor [C] from the flow cell.
5. Unscrew and remove the sensor connector [B] from the hydrogen sensor.

**Install the new sensor**

1. Screw the connector onto the hydrogen sensor and tighten it.
2. Put the hydrogen sensor into the flow cell.
3. Screw the threaded sleeve into the thread of the flow cell to fix the hydrogen sensor.
4. Open the flow regulating valve and adjust the sample flow to 6–20 l/h.
5. Switch on the AMI Inspector Hydrogen.
6. Let the new sensor run in for at least 1h.

## 6.4 Maintenance of the Faraday Electrode




***A*** *Fixing sleeve*
***B*** *Electrode body*
***C*** *Washer*
***D*** *O-ring*
***E*** *Inner electrode*
***F*** *O-ring*
***G*** *Hollow electrode*

**1** Switch off the instrument and close the flow regulating valve.

**2** Open the Faraday control unit.

**3** Disconnect and remove the cable from the Faraday control unit.

**4** Unscrew and remove the fixing sleeve (A).

**5** Remove the Faraday electrode from the flow cell, do not pull on the cable.

**6** Remove the washer (C) and the o-ring [D] from the electrode body (B).

**7** Unscrew the electrode tip containing the hollow electrode (G).

8 Clean the inner electrode (E) with a tissue and the hollow electrode with a pipe cleaner.
⇒ *The electrode surfaces should be shining metallic after cleaning. If necessary, use a polishing detergent or a small amount of toothpaste.*

9 Rinse all parts well with water.

10 Replace the O-ring and the washer if necessary.

11 Screw the hollow electrode finger-tight onto the electrode body.

12 Insert the faraday electrode into flow cell.

13 Tighten fixing sleeve firmly.

14 Feed the electrode cable through the cable gland of the faraday control unit.

15 Connect the electrode cable to terminal 5 (green) and terminal 6 (white).

16 Switch the instrument on.

17 Open the flow regulating valve and adjust the sample flow between 6 and 20 l/h.

## 6.5. Quality Assurance of the Instrument

Every SWAN on-line instrument is equipped with integrated, autonomous quality assurance functions to survey the plausibility of each measurement.
For the AMI Hydrogen QED these are:

- continuous monitoring of sample flow
- 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. The AMI Inspector is connected to the same sample point and provides the reference value. 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. hydrogen, saturation). 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 (valve, dosing unit, etc.).

Additional level:

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

| Quality Level | max. deviation temperature [°C][a)] | max. deviation result [%] | min. inspection interval |
|---|---|---|---|
| **0: Off** | Off | Off | Off |
| **1: Trend** | 0.5 °C | 10% | annual |
| **2: Standard** | 0.4 °C | 5% | quarterly |
| **3: Crucial** | 0.3 °C | 5% | monthly |
| **4: User** | 0–2 °C | 0–20% | annual, quarterly, monthly |

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

**Procedure** The standard workflow contains following procedures:

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

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

### 6.5.1 Activate SWAN Quality assurance procedure

Enable quality assurance procedure at each instrument to be verified by selecting the quality level in menu 5.1.4.
The corresponding submenus are then activated.

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

### 6.5.2 Pre-test

- Reference instrument: AMI Inspector Hydrogen:
  - Check certificate; reference instrument certificate not older than one year.
  - Check battery; Battery of the AMI Inspector Hydrogen should be completely charged. Remaining operating time on display minimum 20 hours.
  - Sensor is in working condition.
- On-line instrument: Monitor AMI Hydrogen:
  - Good order and condition; Flow cell free of particles, Sensor surface free of deposits.
  - Check message list; Review the message list in menu 1.3 and check for frequently occurring alarms (as for example flow alarms). If alarms occur frequently remove cause before starting the procedure.

### 6.5.3 Connect the sample lines

See corresponding chapter in the manual of the process monitor which shall be checked with a reference instrument.

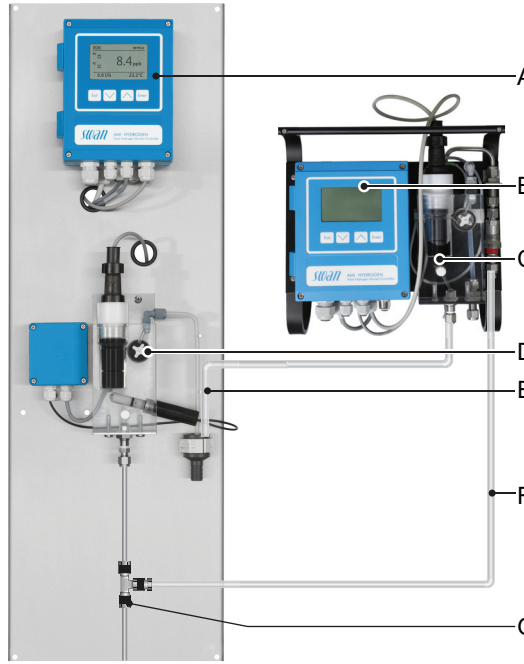
The choice of sampling depends strongly on local conditions on site. Possible sampling:

- via sample point,
- via T-fitting or
- via piggyback/downstream

***NOTICE:***

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

Example As an example following picture shows the connection of the reference instrument via T-fitting to the process monitor.




***A*** *Monitor AMI Hydrogen QED*
***B*** *AMI Inspector Hydrogen*
***C*** *Reference flow cell*
***D*** *On-line flow cell*
***E*** *Sample outlet*
***F*** *Sample inlet*
***G*** *T-fitting*

**1** Stop sample flow to the monitor AMI Hydrogen QED by closing the appropriate valve, e.g. back pressure regulator, sample preparation or flow regulating valve at flow cell.

**2** Connect sample line of the monitor AMI Hydrogen QED [A] with the sample inlet of the reference instrument AMI Inspector Hydrogen [B]. Use the supplied tube.

**3** Connect sample outlet of the reference instrument AMI Inspector Hydrogen to the sample outlet funnel of the monitor.

**4** Switch on the AMI Inspector Hydrogen. Open the flow regulating valve and regulate the sample flow to 10 l/h. The actual flow is shown on the transmitter.

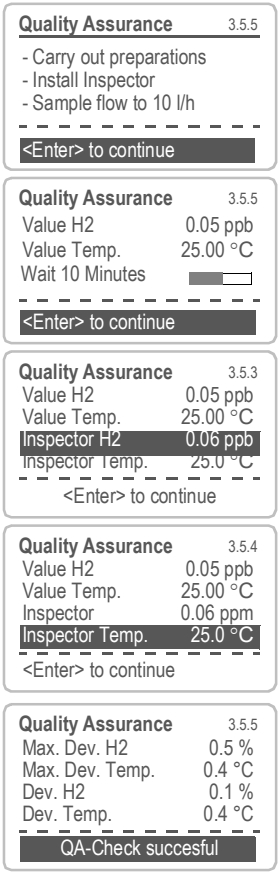
### 6.5.4 Carry out comparison measurement

The comparison measurement is menu driven. Start by selecting Quality Assurance in menu 3.5 of the monitor AMI Hydrogen QED.

**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 hydrogen 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*

### 6.5.5 Completion of the measurement

1. Stop the sample flow to the AMI Hydrogen QED by closing the appropriate valve, e.g. back pressure regulator, sample preparation or flow regulating valve at flow cell again.
2. Close flow regulating valve of the AMI Inspector.
3. Disconnect the AMI Inspector by removing the tubes.
4. Start sample flow again.
5. Adjust the sample flow to 6–20 l/h. The actual flow is shown on the transmitter display.
6. Shut down the AMI Inspector Hydrogen.

If the AMI Inspector will not be used for a longer period of time, proceed according to section Longer Stop of Operation in the manual of the AMI Inspector.

## 6.6. Longer Stop of Operation

1. Stop sample flow.
2. Do not shut off power of the instrument.

   ***NOTICE:*** *The hydrogen sensor is polarized and a loss of polarization will result in loss of sensitivity. If the AMI Hydrogen QED is switched off, the polarization buffer will be discharged within a few days.*
3. Leave the sensor in the wet flow cell.

# 7. Troubleshooting

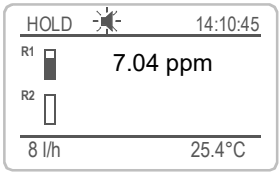
## 7.1. Error List

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

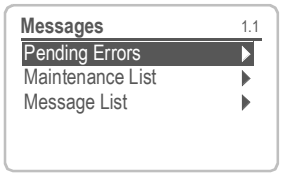
**Fatal error** (blinking symbol)
Control of dosing devices is interrupted.
The indicated measured values are possibly incorrect.

Fatal errors are divided in the following two categories:

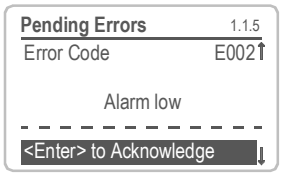
- Errors which disappear if correct measuring conditions are recovered (i.e. Sample Flow low).
  Such errors are marked **E0xx** (bold and orange)
- Errors which indicate a hardware failure of the instrument.
  Such errors are marked **E0xx** (bold and red)




**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** | Hydrogen Alarm high | – check process<br>– check programmed value, see 5.3.1.1.1, p. 65 |
| **E002** | Hydrogen Alarm low | – check process<br>– check programmed value, see 5.3.1.1.25, p. 65 |
| **E003** | Saturation Alarm high | – check process<br>– check programmed value, see 5.3.1.4, p. 66 |
| **E004** | Saturation Alarm low | – check process<br>– check programmed value, see 5.3.1.4, p. 66 |
| **E007** | Sample Temp. high | – check process<br>– check programmed value, see 5.3.1.3.1, p. 66 |
| **E008** | Sample Temp. low | – check process<br>– check programmed value, see 5.3.1.3.25, p. 66 |
| **E009** | Sample Flow high | – check sample flow<br>– check programmed value, see 5.3.1.2.2, p. 66 |
| **E010** | Sample Flow low | – establish sample flow<br>– clean instrument<br>– check programmed value, see 5.3.1.2.35, p. 66 |
| **E011** | Temp. shorted | – check wiring of sensor<br>– check sensor |
| **E012** | Temp. disconnected | – check wiring of sensor<br>– check sensor |

| Error | Description | Corrective action |
|---|---|---|
| **E013** | Case Temp. high | – check case/environment temperature<br>– check programmed value, see 5.3.1.5.1, p. 67 |
| **E014** | Case Temp. low | – check case/environment temperature<br>– check programmed value, see 5.3.1.5.2, p. 67 |
| **E017** | Control Timeout | – check control device or programming in Installation, Relay contact, Relay 1/2 see 5.3.2 and 5.3.3, p. 67 |
| **E018** | Faraday Efficiency | – clean Faraday electrode, see Maintenance of the Faraday Electrode, p. 38 |
| **E019** | Quality Assurance | – perform QA Procedure using a reference instrument, e.g. AMI Inspector |
| **E024** | Input active | – see If Fault Yes is programmed in Menu see 5.3.4, p. 71 |
| **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**

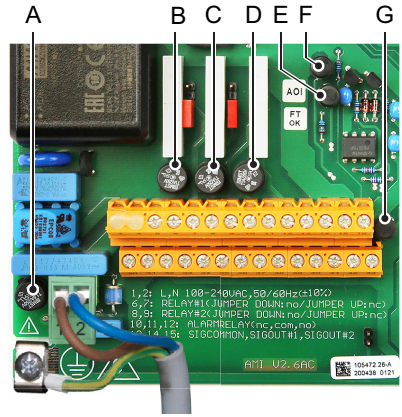
**External Voltage.**

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/250V 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. 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 |
| **Maintenance List** 1.2* | Maintenance List | 1.2.5* | |
| **Message List** 1.3* | *Number* | 1.3.1* | |
| | *Date, Time* | | |

## 8.2. Diagnostics (Main Menu 2)

| | | | | |
|---|---|---|---|---|
| **Identification** **2.1*** | Desig. | AMI Hydrogen | | |
| | Version | 6.22-08/18 | | |
| | **Factory Test** 2.1.3* | *Instrument* | 2.1.3.1* | |
| | | *Motherboard* | | |
| | | *Front End* | | |
| | **Operating Time** 2.1.4* | *Years / Days / Hours / Minutes / Seconds* | | 2.1.4.1* |

| | | | | |
|---|---|---|---|---|
| **Sensors** | **Sensor** | *Current Value* | | * Menu numbers |
| 2.2* | 2.2.1* | *(Raw value tc)* | | |
| | | *(Raw value)* | | |
| | | *Saturation* | | |
| | | **Cal. History** | *Number* | 2.2.1.5.1* |
| | | 2.2.1.5* | *Date, Time* | |
| | | | *Sat. Current* | |
| | | | *Air pressure* | |
| | **Miscellaneous** | *Case Temp.* | *2.2.2.1** | |
| | 2.2.2* | *Air pressure* | | |
| | **QA History** | *QA History* | *2.2.3.1** | |
| | 2.2.3* | | | |
| **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* | | |
| 2.5* | *USB Stick* | | | |

## 8.3. Maintenance (Main Menu 3)

| | | | |
|---|---|---|---|
| **Calibration** | *Calibration* | 3.1.5 | |
| 3.1* | | | |
| **Sevice** | **Electrolyte** | *Last filling* | |
| 3.2* | 3.2.1* | *Remaining amount* | |
| | | *Remaining time* | |
| | | *New Filling* | 3.2.1.5* |
| | **Faraday Verification** | *Progress* | |
| | 3.2.2 | | |
| **Simulation** | *Alarm Relay* | 3.2.1* | |
| 3.3* | *Relay 1* | 3.2.2* | |
| | *Relay 2* | 3.2.3* | |
| | *Signal Output 1* | 3.2.4* | |
| | *Signal Output 2* | 3.2.5* | |

| | | | | |
|---|---|---|---|---|
| **Set Time** 3.4* | *(Date), (Time)* | | | * Menu numbers |
| **Quality Assurance** 3.5* | Quality Assurance | 3.5.5* | | |

## 8.4. Operation (Main Menu 4)

| | | | | |
|---|---|---|---|---|
| **Sensors** 4.1* | *Filter Time Const.* | 4.1.1* | | |
| | *Hold after Cal.* | 4.1.2* | | |
| | **Faraday Parameter** 4.1.3 | *Mode* | | |
| | | *Interval* | | |
| | | *Delay* | | |
| | | *Signal outputs* | | |
| | | *Output/Control* | | |
| **Relay Contacts** 4.2* | **Alarm Relay** 4.2.1* | **Alarm Hydrogene** 4.2.1.1* | *Alarm High* | 4.2.1.1.1* |
| | | | *Alarm Low* | 4.2.1.1.25* |
| | | | *Hysteresis* | 4.2.1.1.35* |
| | | | *Delay* | 4.2.1.1.45* |
| | | **Alarm Saturation** 4.2.1.2* | *Alarm High* | 4.2.1.2.1* |
| | | | *Alarm Low* | 4.2.1.2.25* |
| | | | *Hysteresis* | 4.2.1.2.35* |
| | | | *Delay* | 4.2.1.2.45* |
| | **Relay 1/2** 4.2.2* - 4.2.3* | *Setpoint* | 4.2.x.100* | |
| | | *Hysteresis* | 4.2.x.200* | |
| | | *Delay* | 4.2.x.30* | |
| | **Input** 4.2.4* | *Active* | 4.2.4.1* | |
| | | *Signal Outputs* | 4.2.4.2* | |
| | | *Output / Control* | 4.2.4.3* | |
| | | *Fault* | 4.2.4.4* | |
| | | *Delay* | 4.2.4.5* | |
| **Logger** 4.3* | *Log Interval* | 4.3.1* | | |
| | *Clear Logger* | 4.3.2* | | |
| | *Eject USB Stick* | 4.3.3* | | |

## 8.5. Installation (Main Menu 5)

| | | | | |
|---|---|---|---|---|
| **Sensors** | **Miscellaneous** | *Flow* | 5.1.1.1* | * Menu numbers |
| 5.1* | 5.1.1* | *Offset* | 5.1.1.2* | |
| | | *Maintenance Int.* | 5.1.1.3* | |
| | **Quality Assurance** | *Level* | 5.1.2.1* | |
| | 5.1.2* | | | |
| | **Sensor parameters** | *Sat. current* | 5.1.3.1* | |
| | 5.1.3* | *Air pressure* | 5.1.3.2* | |
| **Signal Outputs** | **Signal Output 1/2** | *Parameter* | 5.2.1.1 - 5.2.2.1* | |
| 5.2* | 5.2.1* - 5.2.2* | *Current Loop* | 5.2.1.2 - 5.2.2.2* | |
| | | *Function* | 5.2.1.3 - 5.2.2.3* | |
| | | **Scaling** | *Range Low* | 5.2.x.40.10/11* |
| | | 5.2.x.40 | *Range High* | 5.2.x.40.20/21* |
| **Relay Contacts** | **Alarm Relay** | **Alarm Hydrogen** | *Alarm High* | 5.3.1.1.1* |
| 5.3* | 5.3.1* | 5.3.1.1* | *Alarm Low* | 5.3.1.1.25 |
| | | | *Hysteresis* | 5.3.1.1.35 |
| | | | *Delay* | 5.3.1.1.45 |
| | | **Sample Flow** | *Flow Alarm* | 5.3.1.2.1 |
| | | 5.3.1.2* | *Alarm High* | 5.3.1.2.2* |
| | | | *Alarm Low* | 5.3.1.2.35* |
| | | **Sample Temp.** | *Alarm High* | 5.3.1.3.1* |
| | | 5.3.1.3* | *Alarm Low* | 5.3.1.3.25* |
| | | **Alarm Saturation** | *Alarm High* | 5.3.1.4.1* |
| | | 5.3.1.4* | *Alarm Low* | 5.3.1.4.25 |
| | | | *Hysteresis* | 5.3.1.4.35 |
| | | | *Delay* | 5.3.1.4.45 |
| | | **Case Temp.** | *Case Temp. high* | 5.3.1.5.1* |
| | | 5.3.1.5* | *Case Temp. low* | 5.3.1.5.2* |
| | **Relay 1/2** | *Function* | 5.3.2.1–5.3.3.1* | |
| | 5.3.2* - 5.3.3* | *Parameter* | 5.3.2.20–5.3.3.20* | |
| | | *Setpoint* | 5.3.2.300–5.3.3.301* | |
| | | *Hysteresis* | 5.3.2.400–5.3.3.401* | |
| | | *Delay* | 5.3.2.50–5.3.3.50* | |

| | | | |
|---|---|---|---|
| | **Input** | *Active* | 5.3.4.1* |
| | 5.3.4* | *Signal Outputs* | 5.3.4.2* |
| | | *Output/Control* | 5.3.4.3* |
| | | *Fault* | 5.3.4.4* |
| | | *Delay* | 5.3.4.5* |
| **Miscellaneous** | *Language* | 5.4.1* | |
| 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* | USB Stick | |
| 5.5* | 5.5.1* | | |

* 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 Maintenance List

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

### 1.3 Message List

1.3.1 Shows the error history: Error code, date / 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. 6.22-08/18)

**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** **Sensor**

| | |
|---|---|
| *Current value:* | Shows the actual measuring value in ppb. |
| *Raw value tc:* | Shows the actual temperature compensated measuring value in mA. |
| *Raw value*: | Shows the actual uncompensated measuring value in mA. |
| *Saturation* | Shows the actual saturation in % |

**2.2.1.5** **Cal. History**
Review the diagnostic values of the last calibration of the hydrogen sensor. Max. 64 data records are memorized.

- *Number*
- *Date, Time*
- *Sat. Current*
- *Air pressure*

**2.2.2** **Miscellaneous**:

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

*Air pressure*: Shows the actual air pressure in hPa

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

## 2.3 Sample

**2.3.301** *Sample ID*: Shows the assigned sample identification. This identification is defined by the user to identify the location of the sample.

- *Temperature:* Shows temperature in °C.
- *(Nt5K)*: Shows raw value of the temperature in Ω.
- *Sample Flow*: Shows the sample flow in l/h
- *(Raw value)* Shows the sample flow in Hz

## 2.4 I/O State

Shows actual status of all in- and outputs.

2.4.1

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

## 2.5 Interface

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

# 3 Maintenance

## 3.1 Calibration

3.1.1 Start a calibration and follow the instructions on the screen. Displayed values are saturation in % and the saturation current in mA. The indication bar shows the progress. Detailed explanation see Calibration, p. 34.

## 3.2 Service

### 3.2.1 Electrolyte

Not applicable.

### 3.2.2 Faraday Verification

Start a manual faraday verification. Displayed values are current value in ppb and the faraday concentration in %.

- *Current value*: Measuring value in ppb
- *Faraday conc.*: Hydrogen concentration in % after activating the faraday verification.
- *Progress*: The progress bar shows the progress of the faraday verification.

## 3.3 Simulation

In this menu the following relays and signal outputs can be tested:

- Alarm relay
- Relay 1and 2
- Signal output 1and 2
- Signal output 3 (if option is installed)

Select a relay or signal output with the [▲] or [▼] keys, press the [Enter]> key to confirm. Then change the value with the [▲] or [▼] keys. After confirming the setting with the [Enter] key, the value is simulated by the relay/signal output.

| | |
|---|---|
| *Alarm Relay:* | Active or inactive |
| *Relay 1 and 2:* | Active or inactive |
| *Input:* | Open or closed |
| *Signal Output 1 and 2:* | Current in mA |
| *Signal Output 3:* | Current in mA (if option is installed) |

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

### 3.4 Set Time

Adjust date and time.

### 3.5 Quality Assurance

Performs a Quality Assurance according to your settings. Follow the commands on the screen. Detailed explanation see Quality Assurance of the Instrument, p. 40.

## 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 s

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 s

**4.1.3 Faraday Parameter**

4.1.3.1 *Mode*: Can be set to Interval, daily, weekly or off. If Mode is set to “Off”, no further settings are available. The Faraday Verification has to be started manually.

4.1.3.20 *Interval*: The interval can be set between 1 h and 12 h

4.1.3.21 *Start Time*: Start time appears if Mode is set to daily, how to set the start time see 5.3.2.341, p. 70.

**4.1.3.22 Calendar**: Calendar appears if Mode is set to weekly, how to set the Calendar see 5.3.2.342, p. 70.

4.1.3.3 *Delay*: During Faraday Verification plus the delay time the signal and control outputs are held in the operating mode programmed below.
Range: 0–6’000 s

4.1.3.4 *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.

4.1.3.5 *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.

## 4.2 Relay Contacts

See Relay Contacts, p. 21

## 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 values, raw values, 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 Miscellaneous

5.1.1.1 *Flow*: If a flow cell without flow measurement (e.g. B-Flow) is used, choose none. With flow measurement select Q-Flow

5.1.1.2 *Offset*: Manual, small correction of the offset. Range 0–3 ppb.

5.1.1.3 *Maintenance Int.:* Select the interval of the automatic sensor regeneration:

- Off
- 3 hours
- 6 hours
- 12 hours

### 5.1.2 Quality Assurance

5.1.2.1 *Level*: Choose the quality level according to your requirements:

- Level 0: Off
  Quality assurance procedure switched off. Any additional QA menus are hidden.
- Level 1: Trend
- Level 2: Standard
- Level 3: Crucial
- Level 4: User

Edit user-specific limits in menu 5.1.2.2

### 5.1.3 Sensor parameters

5.1.3.1 *Saturation current:* Enter the saturation current printed on the sensor label.
Range: 2.000–4.500 µA

5.1.3.2 *Air pressure:* Enter the air pressure printed on the sensor label.
Range: 900–1100 hPa

## 5.2 Signal Outputs

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

**5.2.1 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:

- Hydrogen
- Temperature
- Sample Flow (if a flow sensor is selected)
- Saturation

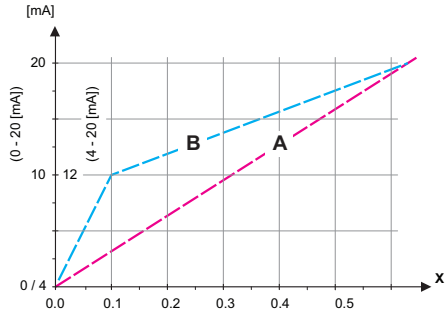
5.2.1.2 *Current Loop:* Select the current range of the signal output. Make sure the connected device works with the same current range.
Available ranges: 0–20 mA or 4–20 mA

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:

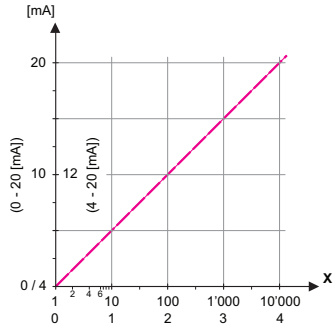
- Linear, bilinear or logarithmic for process values.
  See As process values, p. 61
- Control upwards or control downwards for controllers.
  See As control output, p. 63

**As process values**

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




A linear
B bilinear
X Measured value




X Measured value (logarithmic)

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

### Parameter: Hydrogen.

Range low: 0.00 ppb – 20.00 ppm
Range high: 0.00 ppb – 20.00 ppm

### Parameter: Temperature

Range low: -30 to +130 °C
Range high: -30 to +130 °C

### Parameter: Sample flow

Range low: 0 – 50 l/h
Range high: 0 – 50 l/h

### Parameter: Saturation

Range low: 0 – 200 %
Range high: 0 – 200 %

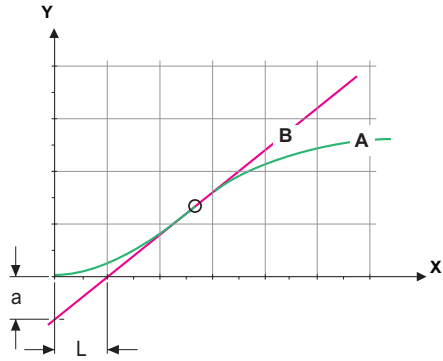
**As control output**

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.

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

**5.2.1.43** **Control Parameters**: if Parameter = Hydrogen

5.2.1.43.10 Setopint:
Range: 0.00 ppb – 20.00 ppm

5.2.1.43.20 P-Band:
Range: 0.00 ppb – 20.00 ppm

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

5.2.1.43.11 Setopint:
Range: -30 to +130 °C

5.2.1.43.21 P-Band:
Range: 0 to +100 °C

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

5.2.1.43.12 Setopint:
Range: 0 – 50 l/h

5.2.1.43.22 P-Band:
Range: 0 – 50 l/h

**5.2.1.43** **Control Parameters**: if Parameter = Saturation

5.2.1.43.13 Setopint:
Range: 0 – 200 %

5.2.1.43.23 P-Band:
Range: 0 – 200 %

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 s

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

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

## 5.3 Relay Contacts

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

The contact is inactive at:

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

Program alarm levels 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 Hydrogen**

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: 0.00 ppb – 20.00 ppm

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: 0.00 ppb – 20.00 ppm

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. 0.00 ppb – 20.00 ppm

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 s

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: 12–20 l/h

5.3.1.2.35 *Alarm Low:* If the measuring values falls below the programmed value E010 will be issued.
Range: 5–20 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: 30–100 °C

5.3.1.3.25 *Alarm Low:* If the measured value rises above the alarm high value, the alarm relay is activated and E008 is issued.
Range: -10 to +20 °C

**5.3.1.4 Alarm Saturation**

5.3.1.4.1 *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: 0.00–200 %

5.3.1.4.25 *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: 0.00–200 %

5.3.1.4.35 *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. 0.00–200 %

5.3.1.4.45 *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 s

**5.3.1.5 Case Temp.**

5.3.1.5.1 *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

5.3.1.5.2 *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 function of relay contacts 1 or 2 are defined by the user

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

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

**2** Then enter the necessary data depending on the selected function. The same values may also be entered in menu 4.2 Relay Contacts, p. 59

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:* choose one of the following process values
- Hydrogen
- Temperature
- Sample Flow
- Saturation

5.3.2.300 *Setpoint*: If the measured value rises above respectively falls below the set-point, the relay is activated.
- Parameter Hydrogen: Range: 0.00 ppb–20.00 ppm
- Parameter Temperature: Range: -30 to + 130 °C
- Parameter Sample flow: Range: 0–50 l/h
- Parameter Saturation: Range: 0–200 %

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 Hydrogen; Range: 0.00 ppb – 20.00 ppm
- Parameter Temperature; Range: 0 – 100 °C
- Parameter Sample flow; Range: 0 – 50 l/h
- Parameter Saturation; Range: 0 – 200 %

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 s

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 one of the following process values

- Hydrogen
- Temperature
- Sample Flow
- Saturation

**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 s

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

**5.3.2.32.4 Control Parameters:**
Range for each Parameter same as 5.2.1.43, p. 64.

| | |
|---|---|
| | 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. 64 |
| | 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 s. |
| 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. 64 |
| 5.3.2.1 | Function = Timer |
| | The relay will be active repetitively depending on the programmed time scheme. |
| 5.3.2.24 | *Mode:* Operating mode (interval, daily, weekly) |
| 5.3.2.24 | *Interval* |
| 5.3.2.340 | *Interval:* The interval can be programmed within a range of 1–1440 min |
| 5.3.2.44 | *Run Time*: Enter the time the relay stays active. Range: 5–32400 s |
| 5.3.2.54 | *Delay*: during run time plus the delay time the signal and control outputs are held in the operating mode programmed below. Range: 0–6’000 s |

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. 70.
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.

5.3.2.6 *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.

**5.3.4** **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.
Available settings: German / English / French / Spanish

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

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

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

5.4.4 **Password:** Select a password different from 0000 to prevent unauthorized access to the menus "Messages", "Maintenance", "Operation" and "Installation".

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

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

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

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

Choose between <Yes> or <No>.

## 5.5 Interface

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

**5.5.1** *Protocol:* **Profibus**

5.5.20 Device address: Range: 0–126

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

5.5.40 Local operation: Range: Enabled, Disabled

**5.5.1** *Protocol:* **Modbus RTU**

5.5.21 Device address: Range: 0–126

5.5.31 Baud Rate: Range: 1200–115200 Baud

5.5.41 Parity: Range: none, even, odd

**5.5.1** *Protocol:* **USB-Stick:**

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

**5.5.1** *Protocol:* **HART**

Device address: Range: 0–63

# 10. Default Values

**Operation:**

Sensors:
- Filter Time Const.: 10 s
- Hold after Cal.: 300 s
- Faraday Parameter:
  - Mode: Interval
  - Interval: 4 h
  - Delay 60 s
  - Signal Outputs hold
  - Output/Control hold

Alarm Relay: same as in Installation

Relay 1/2: same as in Installation

Input: same as in Installation

Logger:
- Logger Interval: 30 min
- Clear Logger: no

**Installation:**

Sensors
- Miscellaneous; Flow: None
- Miscellaneous; Offset: 0.0 ppb
- Maintenance Interval 3 h
- Quality Assurance; Level: 0: Off
- Sensor parameters; Saturation current 3.500 µA
- Sensor parameters; Air pressure 1013 hPa

Signal Output 1
- Parameter: Hydrogen
- Current loop: 4 –20 mA
- Function: linear
- Scaling: Range low: 0.00 ppb
- Scaling: Range high: 10.00 ppm

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 Hydrogen; Alarm high: 10.00 ppm
- Alarm Hydrogen; Alarm low: 0.00 ppb
- Alarm Hydrogen; Hysteresis: 100 ppb
- Alarm Hydrogen; Delay: 5 s

If Flow = Q-Flow
- Sample Flow, Flow Alarm: yes
- Sample Flow, Alarm high: 14.0 l/h

Sample Flow, Alarm low: ..... 6.0 l/h
Sample Temp., Alarm High: ..... 50 °C
Sample Temp., Alarm Low: ..... 0 °C
Alarm Saturation; Alarm high ..... 120 %
Alarm Saturation; Alarm low ..... 0.0 %
Alarm Saturation; Hysteresis ..... 2 %
Alarm Saturation; Delay ..... 5 s

Case temp. high: ..... 65 °C
Case temp. low: ..... 0 °C

Relay 1
Function: ..... limit upper
Parameter: ..... Hydrogen
Setpoint: ..... 10.00 ppm
Hysteresis: ..... 100 ppb
Delay: ..... 30 s

Relay 2
Function: ..... limit upper
Parameter: ..... Temperature
Setpoint: ..... 50 °C
Hysteresis: ..... 1 °C
Delay: ..... 30 s

**If Function = Control upw. or dnw:**

Parameter: ..... Meas. Value
Settings: Actuator: ..... Frequency
Settings: Pulse Frequency: ..... 120/min
Settings: Control Parameters: Setpoint: ..... 10.00 ppm
Settings: Control Parameters: P-band: ..... 100 ppb
Settings: Control Parameters: Reset time: ..... 0 s
Settings: Control Parameters: Derivative Time: ..... 0 s
Settings: Control Parameters: Control Timeout: ..... 0 min
Settings: Act. Time prop.: Cycle time: ..... 60 s
Settings: Act. Time prop.: Response time: ..... 10 s
Settings: Act. Motor valve: Run time: ..... 60 s
Settings: Act. Motor valve: Neutral zone: ..... 5 %

**If Function = Timer:**

Mode: ..... Interval
Interval: ..... 1 min
Mode: ..... daily
Start time: ..... 00.00.00
Mode: ..... weekly
Calendar; Start time: ..... 00.00.00
Calendar; Monday to Sunday: ..... Off
Run time: ..... 10 s
Delay: ..... 5 s

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

# 11. Index

# 12. Notes

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