RHOSONICS
Measuring Beyond Limits

SDM WT - SLURRY DENSITY METER
MANUAL

HART
COMMUNICATION PROTOCOL

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

1. Preface

1.1 Purpose

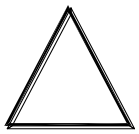
This manual explains the installation, configuration, operation and calibration of your Slurry Density Meter expressing solids in weight percentage (SDM WT), whenever settings are general for more models the SDM WT is called analyzer.
For ease of reading and understanding, the manual is organized in logical steps, divided over several chapters and sections. Where necessary, the manual provides additional information about the above mentioned issues.

1.2 Symbols and conventions

The following words and symbols indicate special messages:

WARNING:

This symbol indicates that failure to follow directions in the warning message could result in bodily harm.



CAUTION:

This symbol indicates that failure to follow directions could result in damage to the equipment or loss of information.

IMPORTANT:
This word indicates that the text that follows contains clarifying information or specific instructions.

NOTE:
This word indicates that the text that follows contains comments, sidelights or interesting points of information.

1.3 About this manual

1.3.1 Conventions

- The symbols ●, ○ and 1. indicate a step to be performed or other instructions
- Text represented as **[Bold]** indicates the button below the screen display to be pressed
- Text in *ITALIC* refers to text displayed on the screen display
- Pages on the screen display are represented as figures.
- The picture shown in the manual might differ from the picture shown on the display.

1.4 Document Issue

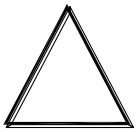
SDM WT manual

Date	Issue	Description
29-01-2019	1	Concept
01-02-2019	A	Manual released

2. Installation

2.1 Introduction

Purpose:
Installation of SDM WT unit, SDM WT adapters and cables.
The SDM WT is a 24 VDC powered standalone sensor with 4-20 mA output and HART protocol



CAUTION:

Installation should be performed by skilled installation technicians (mechanical and electrical).

The SDM WT, which is installed in a specially prepared spool section, wafer section or is used in conjunction with a pipe adapter (Weldolet) has a ceramic sensor face which should be in contact with a representative portion of the slurry to be measured.

IMPORTANT:
The surface of the ceramic front face must be aligned with the inside pipe diameter. Otherwise the SDM WT will fail to measure correctly.

Installation:

- In chapter 2.1 and 2.2 there are common instructions for mounting the SDM WT adapter in a process line. This chapter is valid for all sensor adapter types.
- In chapter 2.3 to chapter 2.5 the different SDM WT adapters mounting instructions are described. In “Provided by Rhosonics” a description of the different types of SDM WT adapters.
- In chapter 2.6 the SDM WT mounting instructions are described.

INSTALLATION

- In chapter 2.7 the electrical mounting instructions of the SDM WT are described.

Must be provided on site:

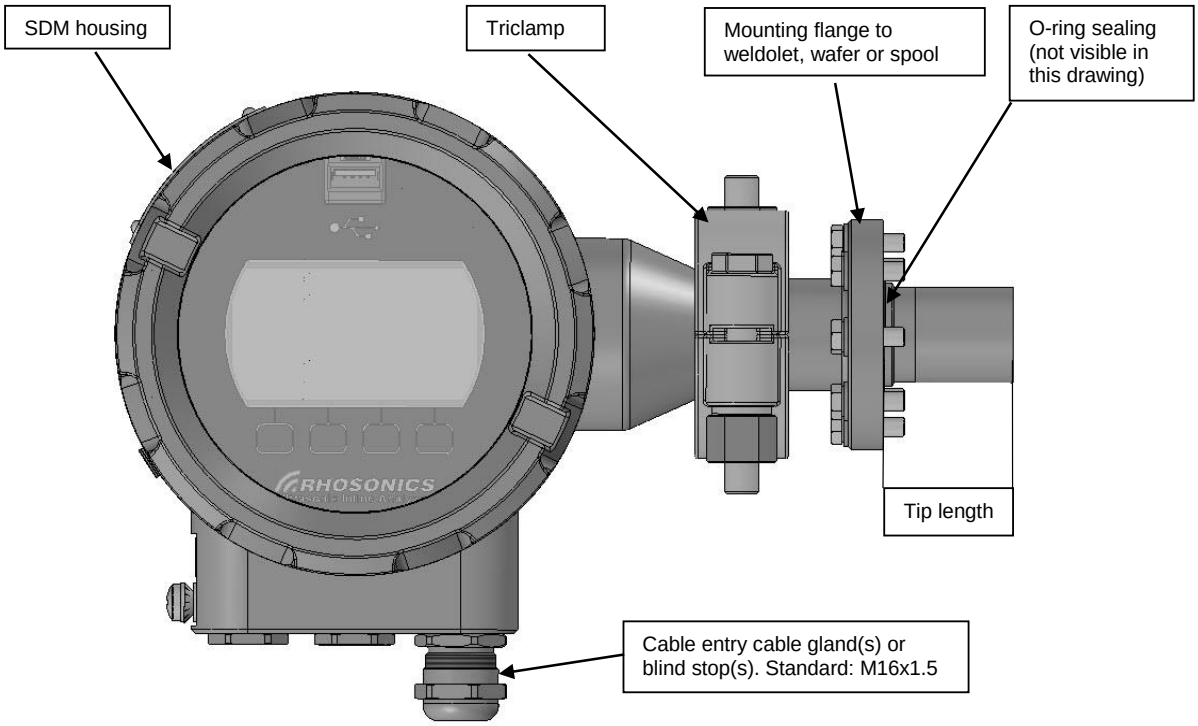
- Mounting hardware e.g. bolts, nuts, washers, gasket sealing
- Power 24 VDC
- Power cable for 24 VDC
- HART/4-20mA cable

OR

- Combined cable for Power 24 VDC and HART
-

A density SDM WT system consists of the following components:

- SDM WT (included mounting hardware to the adapter)

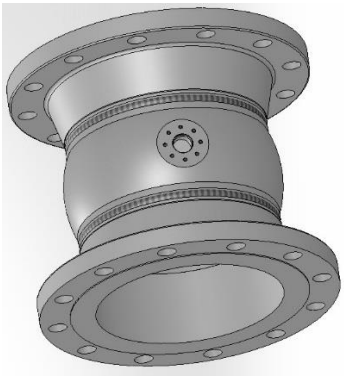


SDM WT, split version (e.g. 52 mm tip)

- Process entry hardware for SDM WT

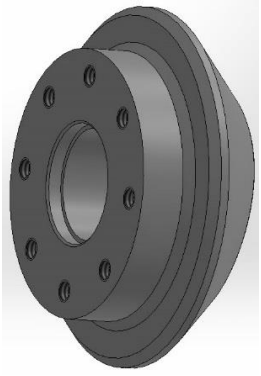
This adapter exist in five different types:

  - SDM-1: Spool for 16 mm sensor tip, see chapter 2.3

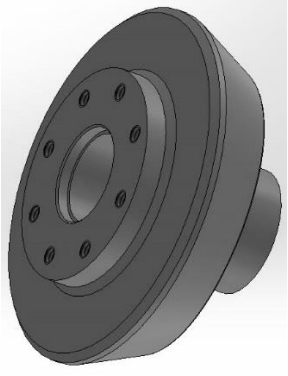


SDM-1 Spool 16 mm tip

- SDM-2: Weldolet for 34 mm sensor tip, see chapter 2.4
- SDM-3: Weldolet for 52 mm sensor tip, see chapter 2.4

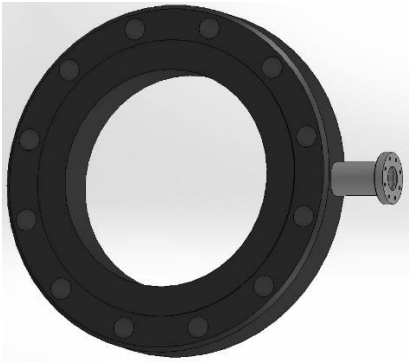


SDM-2 Weldolet 34 mm tip

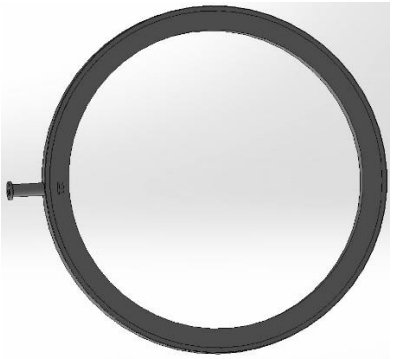


SDM-3 Weldolet 52 mm tip

- SDM-4: Wafer (UHMWPE or metal) for 146 mm sensor tip, see chapter 2.5
- SDM-5: Wafer (UHMWPE or metal) for 200 mm sensor tip, see chapter 2.5



SDM-4 wafer 146 mm tip



SDM-5 wafer 200 mm tip

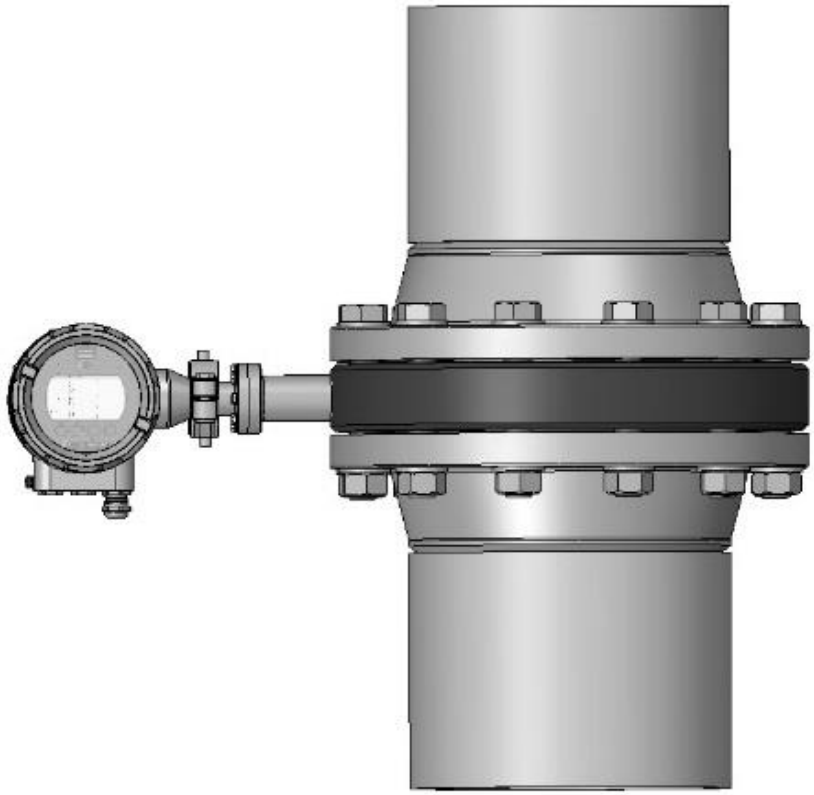
2.2 Selecting the SDM WT location

The following guidelines apply to all SDM:

- Install the SDM WT with 5xD length of straight pipe length upstream and 3xD of straight pipe length downstream.
- Avoid installation in a pipe section where the SDM WT tip may wear fast
- Avoid installation near dosing valves.
- Vertical pipe installation is preferred when the flow goes in upstream direction, see chapter 2.2.1.
- Horizontal pipe installation: Sensor must be installed sidewise, see chapter 2.2.2.

2.2.1 Vertical pipe mounting
(Only if the flow goes in upstream direction.)

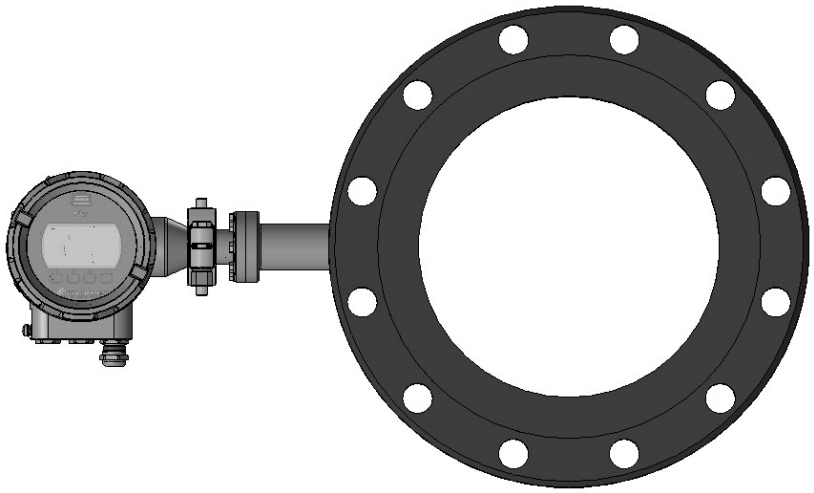
In a vertical pipe any orientation is possible. Make sure you mount the SDM WT with the display in the correct position and the cable glands pointing downwards to prevent intruding liquids.



Vertical mounting (i.e. wafer)

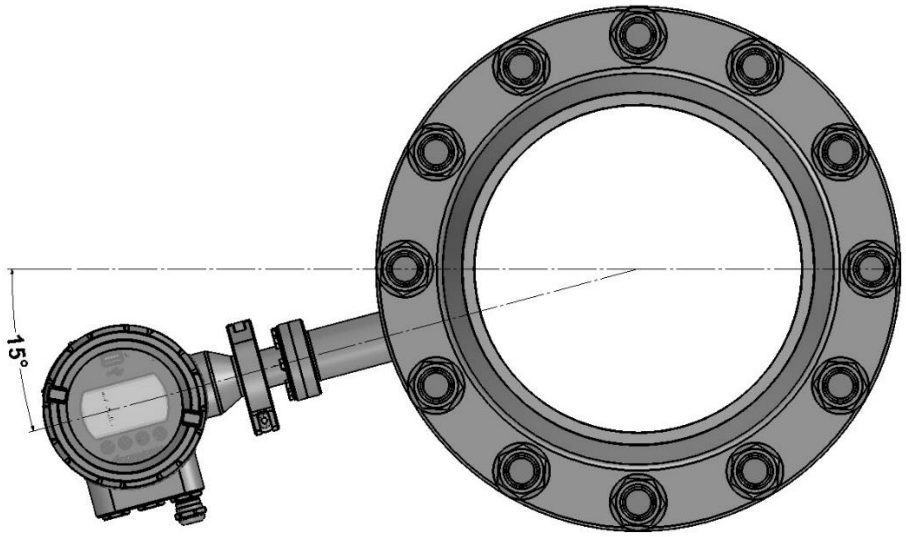
2.2.2 Horizontal pipe mounting

Some considerations need to be taken into account in case of installation in a horizontal pipe.
The preferred installation in a horizontal pipe is shown below. The SDM WT must be installed either on the left or the right hand side of the pipe.



90° Horizontal pipe mounting (i.e. wafer)

Maximum tolerance is 15^{o} from the horizontal line (downwards) as shown below.



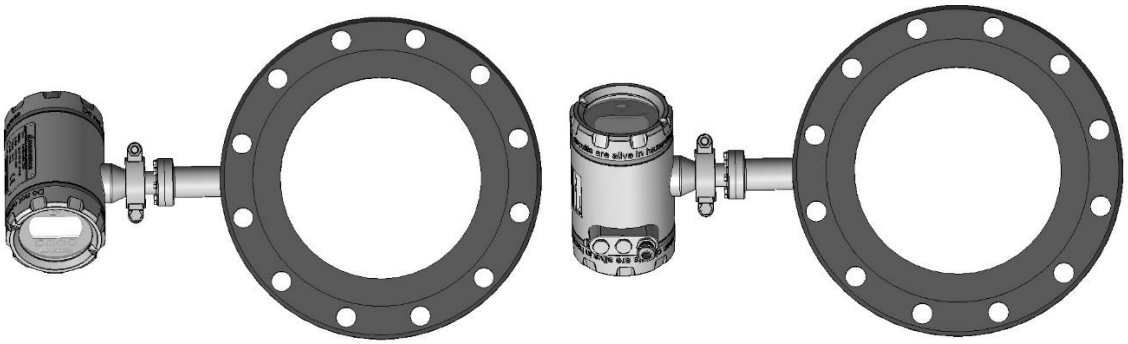
105° Horizontal pipe mounting (i.e. wafer)

2.2.3 Analyzer head rotation

The analyzer head can be rotated in any position (360°). Below some examples are shown.

CAUTION:

Please make sure you will be very careful with rotating the housing. If not handled properly you can damage the SDM WT beyond repair, especially the spring loaded contacts in the sensor part. See also chapter 6.



Different housing positions

2.3 Installation of the spool (SDM-1)

Mating components should be checked to assure that tolerances and engagements are compatible. Do not use any components that appear irregular or do not fit properly. Contact the appropriate manufacturer of the product in question to determine usability.

Spool piece mounting example

2.3.1 Sealing material

CAUTION:

Sealing metal flanges requires skills, knowledge and experience. Special requirements may apply, depending on the piping system in which the spool is installed. When you are not familiar with the necessary procedures, please consult the responsible person before installation.

2.3.2 Gasket sealing

For gasket materials, please consult the responsible person for the original design of the piping system.

2.3.3 Bolting pattern and torque

CAUTION:

UNNECESSARY OVER TORQUING WILL DAMAGE THE SPOOL.
Threads should be clean and well lubricated. Actual field conditions may require variations in these recommendations.

2.3.4 Instructions

1. Carefully align the pipe sections with the spool in order to avoid stress at the flange surface of the spool. In addition, the piping must be secured and supported to prevent movement which can create excess stress and flange face damage.
2. Once the gasket is in place, align the bolt holes of the spool and the adjacent flange faces
3. Lightly lubricate and insert all bolts and washers and loosely apply the nuts
4. Number all bolts for record purposes
5. Make sure the faces of the mating surfaces are flush against gasket prior to bolting down the flanges.
6. Tighten the nuts by hand until they are snug. Establish uniform pressure over the flange faces by tightening the bolts in increments up described as below.

2.3.5 4 and 8 Bolt Flanges

- First round - 30% of final torque (flange sequential order, crisscross)
- Second round- 60% of final torque (flange sequential order, crisscross)
- Third round - 100% of final torque (flange sequential order, crisscross)
- One final time after 24 hours - clockwise or counter clockwise sequentially around the flange

2.3.6 12 Bolt Flanges and More

- First round - 20% of final torque (flange sequential order, crisscross)
- Second round - 40% of final torque (flange sequential order, crisscross)
- Third round - 80% of final torque (flange sequential order, crisscross)
- Fourth round - 100% of final torque (flange sequential order, crisscross)
- One final time after 24 hours - clockwise or counter clockwise sequentially around the flange.

In below table, torque values are given for Rhosonics metal spools (SDM-1) and metal wafers (SDM-4 or SDM-5). These values assume the flanged joint connects the spool to a CLASS 150 flange. These values are for Spiral Wound Gaskets, ASME B16.5.

Nom. OD		Bolt hole	No.Bolts	Size Bolts	Preferred Torque per Bolt	
(Inch)	(mm)	(mm)		M…	(ft lb)	(Nm)
3	80	19	4	16	120	163
4	100	19	8	16	120	163
5	125	22.2	8	18	200	271
6	150	22.2	8	18	200	271
8	200	22.2	8	18	200	271
10	250	25.4	12	22	320	434
12	300	25.4	12	22	320	434
14	350	28.6	12	24	490	664
16	400	28.6	16	24	490	664
18	450	31.7	16	27	710	963
20	500	31.7	20	27	710	963
24	600	34.9	20	30	1000	1356

IMPORTANT:
Rhosonics does not take responsibility for any of these torque values, they're theoretical values. These bolt torque values are intended for use as guidelines only and are based on ideal conditions, perfect flanges, flange alignment & new well lubricated bolts/nuts. Torque values are based on using weld-neck flanges and lubricated stud bolts with a 0.16 friction factor.

Torque values for other gaskets, please contact your gasket supplier.

2.4 Weldolet installation (SDM-2 or SDM-3)

A Weldolet is a metal piece which should be welded on an existing pipe. Please follow the next procedure to mount a Weldolet.

Step 1.
Checking parts

- Weldolet
- Two brackets
- Four Allen screws
- Two installation screws

The Allen key is not included.

Step 2.
Drill a hole in the pipe. For the dimension and the right position please see attached drawing.

Step 3.
Deburr the hole.

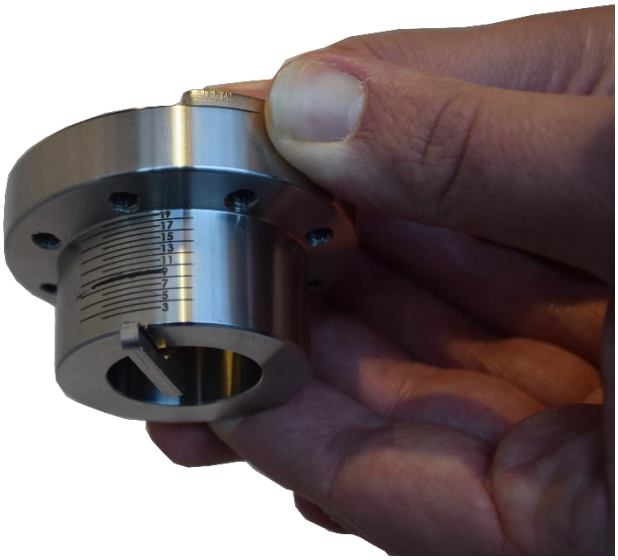
INSTALLATION

Step 4.
Measuring the wall thickness of the pipe.

Step 5.
Mark wall thickness on the engraving of the weldolet. Do this on both side of the weldolet.

Step 6.

Place one bracket inside the weldolet. Finger tight one Allen screw. Please pay attention to the alignment of the bracket. The bottom of the bracket needs to be in one line with the engraving.



Place the second bracket and finger tight one Allen screw.

Step 7.
Placing Weldolet. Move the brackets so that the weldolet, easily fits inside the pipe.

Step 8.
Mount the other Allen screws and tighten all the screws

Step 9.
Line out the weldolet, please pay attention that the engraving of the weldolet is in line with the flow direction.

INSTALLATION

Step 10.

Placing the lifting installation screws (knobs might look different from picture)

Step 11.

Lifting the weldolet.

Turn and tighten carefully the two screws. When resistance sensible: stop and check if the mark on the weldolet is visible. Only finger tight the screws.

CAUTION:

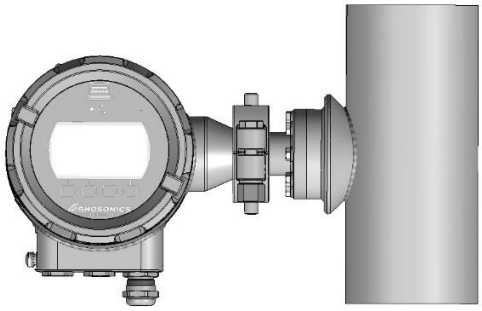
Only fix finger tight, too much torque will damage the tool.

INSTALLATION

Step 12.
Check if the weldolet is level with the pipe. Spot weld the weldolet.

Step 13.
Disassemble the tool

Step 14.
Weld the weldolet peripheral and watertight



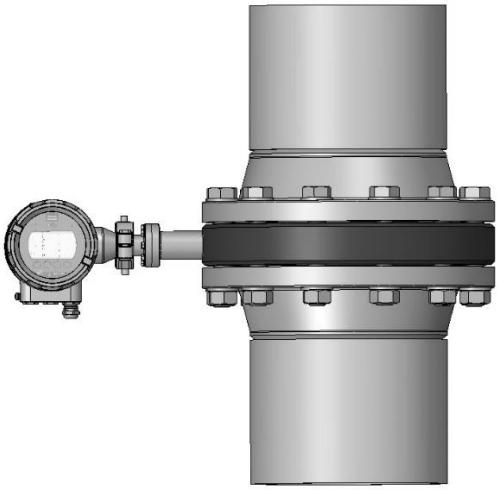
SDM WT mounted in a Weldolet (vertical mount)

2.5 Installation of the wafer (SDM-4 or SDM-5)

Mating components should be checked to assure that tolerances and engagements are compatible. Do not use any components that appear irregular or do not fit properly. Contact the appropriate manufacturer of the product in question to determine usability.
There are 2 types of wafers:

- UHMWPE (Ultra High Molecular Weight Poly Ethylene) wafers, also called HDPE (High Density Poly Ethylene) wafer, SDM-4 or SDM-5
- Metal (i.e. AISI316, Hastelloy C276, etc.) wafers, SDM-4 or SDM-5

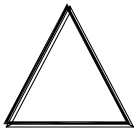
  The only difference between UHMWPE wafers and metal wafers is the torque value of the bolts, when mounted in a pipe. This is the reason that the UHMWPE wafer is mentioned separately. The torque of the metal wafers (SDM-4 or SDM-5) is the same as the torque for spool piece (SDM-1). See concerning chapter 2.3 spool installation for torques of metal wafers.



Vertical mounting (i.e. wafer)

2.5.1 Wafer (UHMWPE)

Sealing material (UHMWPE wafer)



CAUTION:

Sealing of plastic pipe joints and metal flanges to plastic components requires skills, knowledge and experience. Special requirements may apply, depending on the piping system in which the wafer is installed. When you are not familiar with the necessary procedures, please consult the responsible person for the original design of the piping system.

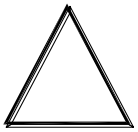
Non-gasket sealing

UHMWPE flanges may be sealed without sealing material. The “memory” of pipe-grade UHMWPE makes it an ideal flange face sealing surface. It becomes its own “gasket flange”, and seals well when un-marred and torqued to meet or exceed the UHMWPE seating stress. When properly torqued, the joint between the wafer (UMMWPE) and the mating flange becomes self-sealing.
Using this method, the specified seating torque needs to be applied, followed by a mandatory re-torque applied 4-hours to 24-hours after completion of the initial torque application. See following table for the torque to be used. Note that this is a torque table for 150 LBS flanges with a UHMWPE wafer.

Gasket sealing

The second method, (with gasket), uses a low gasket seating bolt torque, applied to a soft elastomeric gasket, for lower pressure applications (like landfill gas collection or use with torque-limited PVC or fiberglass flanges), followed by the mandatory re-torque 4 hours to 24-hours after the initial torque. Gasket material maybe either foamed PTFE, like Gylon, or an elastomer. For rubber lined pipes, additional gaskets are not recommended.

Bolting pattern and torque



CAUTION:

UNNECESSARY OVER TORQUING WILL DAMAGE THE WAFER.
Threads should be clean and well lubricated. Actual field conditions may require variations in these recommendations.

INSTALLATION

Instructions

1. For connecting to UHMWPE flange surfaces, choose a method for sealing:
    a. No gasket (the UHMWPE forms its own gasket, see previous sections)
    b. Full faced elastomer gasket of 1/8” or 2 to 3 mm thick. Shore A hardness of 70 typ.
2. Carefully align the pipe sections with the wafer in order to avoid stress at the flange surface of the wafer. In addition, the piping must be secured and supported to prevent movement which can create excess stress and flange face damage.
3. Once the gasket is in place, align the bolt holes of the wafer and the adjacent flange faces
4. Lightly lubricate and insert all bolts and washers and loosely apply the nuts
5. Number all bolts for record purposes
6. Make sure the faces of the mating surfaces are flush against gasket (if present) prior to bolting down the flanges.
7. Tighten the nuts by hand until they are snug. Establish uniform pressure over the flange faces by tightening the bolts in 7 Nm (5 ft.-lbs.) increments up to the stated “Initial Minimum Torque” in the table below, following a 180° opposing crisscross sequence.
8. Reseat after 24 hours and record all final torque values

IMPORTANT:
Care must be taken to avoid “bending” the flange when joining a UWC wafer to a “raised face” flange.

In below table, torque values are given for Rhosonics wafers. These values assume the flanged joint connects the wafer to a CLASS 150 flange, material UHMWPE.

INSTALLATION

Diameter (inch)		Initial Minimum Torque		Final Maximum Torque	
Nom.OD	No.bolts	ft.lbs	Nm	ft.lbs	Nm
2	4	22	30	33	45
2.5	4	26	35	39	53
3	4	30	41	45	61
3.5	8	30	41	45	61
4	8	30	41	45	61
5	8	44	60	66	89
6	8	44	60	66	89
8	8	58	80	87	120
10	12	58	80	87	120
12	12	75	100	113	150
14	12	140	190	210	280
16	16	140	190	210	280
18	16	140	190	210	280
20	20	160	220	240	330
24	20	180	240	270	370
26	24	180	240	270	370
28	28	180	240	270	370
30	28	180	240	270	370
32	28	240	330	360	490
34	32	240	330	360	490
36	32	260	350	390	530
38	32	280	380	420	570
40	36	310	420	465	630
42	36	310	420	465	630
44	40	310	420	465	630
46	40	310	420	465	630
48	44	310	420	465	630
50	44	365	490	550	750
54	44	365	490	550	750
56	48	365	490	550	750
58	48	365	490	550	750
60	52	365	490	550	750

IMPORTANT:
These estimated values are based on non-plated bolts and studs, using a K=0.16 for lightly greased bolts and nuts.
Bolting must be done according to a crisscross pattern. Reseating is necessary after 24 hours.

Reference: Bolt Torque For Polyethylene Flanged Joints TN-38/July 2011, www.plasticpipe.org

2.5.2 Wafer (metal, i.e. AISI 316)

The torque of the metal wafers (SDM-4 or SDM-5) is the same as the torque for spool piece (SDM-1). See chapter 2.3 for torques of metal wafers.

2.6 Installation of the SDM WT to the process adaptor

The SDM WT flange has 8 bolt holes which is used in conjunction with a pipe adapter (Weldolet, SDM-2 or SDM-3) or is intended to be fitted in a wafer section (SDM-4 or SDM-5) or a specially prepared spool section (SDM-1). The installation must be done with exclusively the following materials:

1. Hex capped bolts, M5x20 mm, AISI 316L, 8 pieces.
2. Washers M5, AISI 316L, 8 pieces
3. O-ring, Viton, 20.63x2.62 mm, 1 piece
4. O-ring, Viton, 29.82x2.62 mm, 1 piece

The user must ensure at all times that the used materials, in particular the O-rings, are compatible with the process fluid characteristics. Viton O-rings are mainly intended for acid applications.

Prior to installation, the following must be assured:

1. The Weldolet port (SDM-2 or SDM-3), sensor adapter (SDM-4 or SDM-5) or sensor port (SDM-1) to which the SDM WT is installed, must be thoroughly cleaned and inspected for surface defects.
2. The O-rings must be new and free of defects. In addition, the type of material of the O-rings must be identified and verified for compatibility with the chemical and design temperature. Do not re-use O-rings, otherwise the proper sealing may be jeopardized.
3. The grooves in the SDM WT, in which the O-rings are seated, must be clean and inspected for surface defects. Before inserting the O-rings, some high vacuum grease may be applied to improve proper seating during installation.
4. The threaded pot holes in the Weldolet (SDM-2 or SDM-3), wafer (SDM-4 or SDM-5) or flow-through cell (SDM-1) or as well as the bolts, must be clean and free of damage.

During installation, the following must be assured:

1. Insert the SDM WT as straight as possible, with respect to the axial orientation of the SDM WT port and display position.
2. The orientation of the conduit entry is preferably downwards and perpendicular to the pipe axis.
3. Tighten bolts with 4.2 Nm.
4. Do not cover the SDM WT flange with insulation material.

2.7 Electrical connections SDM WT

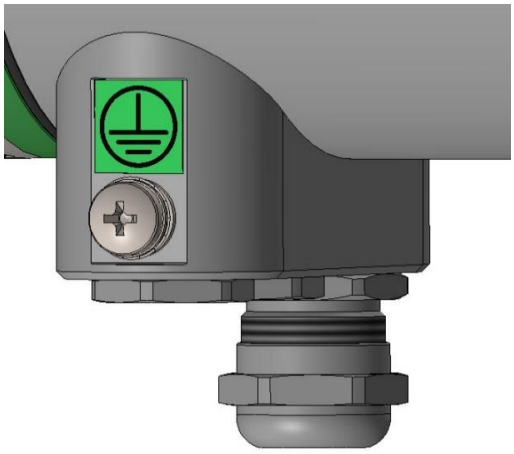
The main electrical parts, which are used in all models are called the 9D-series. Specific electrical parts for a specific model are 3A (SDM WT) parts.

Power supply

Input voltage	18 - 30 V DC	
Maximum Input Power	8 W	
Admissible ripple voltage	USS < 1V	[<100Hz]
	USS < 10mV	[100Hz . . 10kHz]

INSTALLATION

Protective Earth connect safety ground >= 4 mm^2 to housing PE post



PE post

Power Cable and Gland

Included

- Cable gland 3 – 7 mm [cable outer diameter]

Not included

- 2 Wire Cable + , - [24V nominal]
  - Conductor cross section 0.5 . . 2.5 mm² [flexible wire, with plastic sleeved ferrule]
  - Length [preferred] <= 10m [@ 0.50 mm² / 20 AWG]
  - Length [3% cable losses] 33 m [@ 0,50 mm² / 20 AWG]
    49 m [@ 0,75 mm² / 18 AWG]
    66 m [@ 1,0 mm² / 17 AWG]
    98 m [@ 1,5 mm² / 15 AWG]
    164 m [@ 2,5 mm² / 13 AWG]

HART data, with 4-20 mA Output, data cable and Gland

Included

- Cable gland 3 - 10 mm [cable outer diameter]

Not included

- Load resistance 50 to 1000 Ω [250 Ω nominal cable resistance included]
- Minimum conductor size 0.51 mm / 24AWG [runs less than 1500 m]
- Minimum conductor size 0.81 mm / 20AWG [for longer distance]
- Maximum cable length: 2700m [Cap < 70 pF/m]
- Cable type twisted single pair shielded, or multiple pair with overall shield [Cap <= 65 pF/m]
- Shield connection use grounding at one point only, at the host or DCS system

Cable examples:

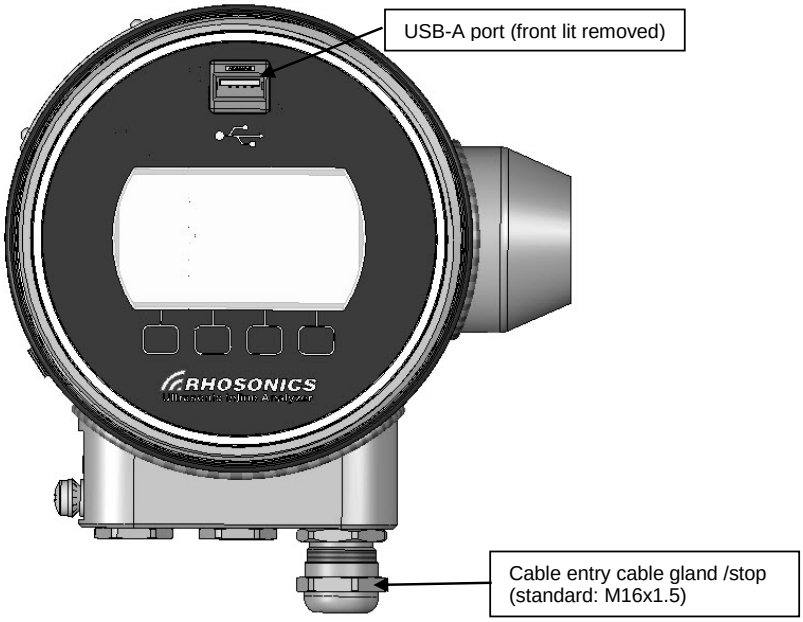
- Lapp Cable: 2170220 Unitronic BUS L2/FIP
  Size = 0.64 mm (22AWG), OD = 7.8 mm, Cap = 30 pF/m, Loop_DCR = 115 Ω/km
- Belden: 3079E DataBus ISA/SP-50
  Size = 0.64 mm (22AWG), OD = 8.0 mm, Cap = 28 pF/m, Loop_DCR = 106 Ω/km

2.7.1 USB port

The USB-A connection is located on the front of the SDM WT.

This USB-A port is used for:

- Software update
- Collecting Log data
- Diagnostics



USB-A port on the front and cable entry cable glands

NOTE:

The cable glands can also be replaced by a Blind plug (standard: M16x1.5), if the entry is not used.

2.7.2 Connection 24 VDC power and HART

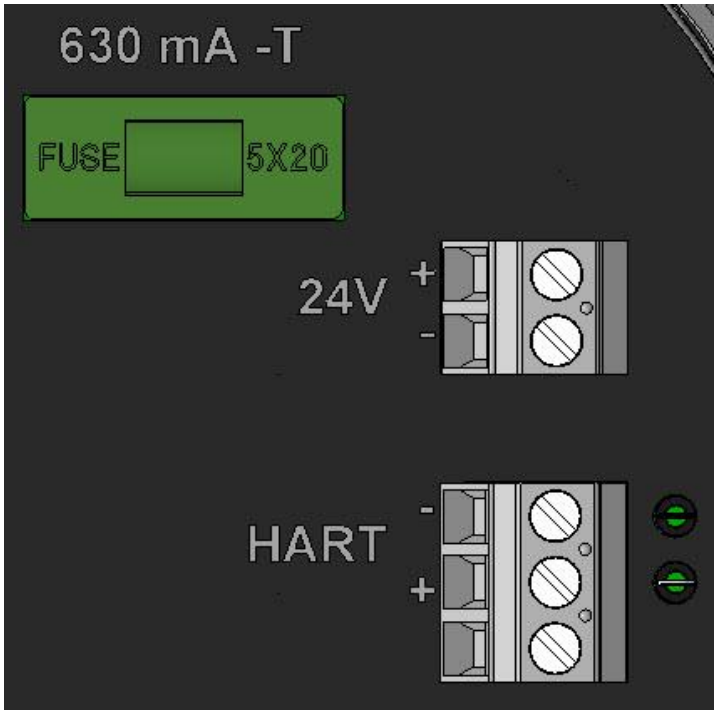
The connection for the power and Hart is located in the inside of the SDM WT. The cable(s) entering the SDM WT housing through (a) cable gland(s). Inside the housing the cable(s) are connected to a screw connector. Below picture shows how to connect the power and HART.

NOTE: Fuse specification

- Blow Characteristic: Fast Acting
- Fuse Current: 630mA
- Fuse Size: 5mm x 20mm
- Voltage Rating VAC: 250V

INSTALLATION

Rear view SDM WT (back lit removed), including cable gland entries

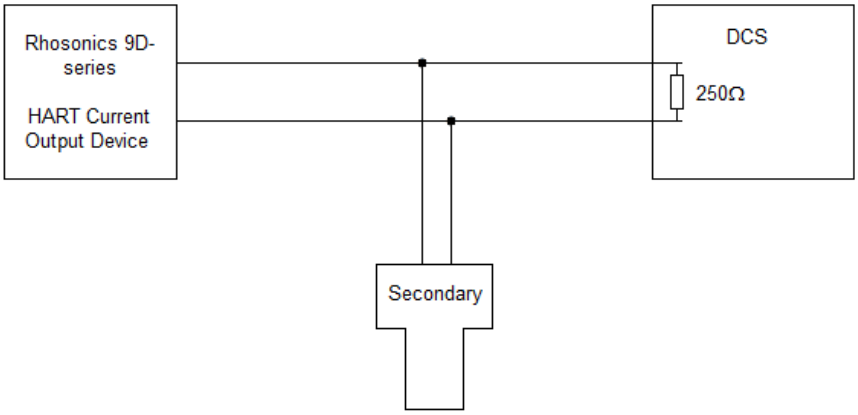


Connection 24 VDC and HART on rear side SDM (detail)

2.7.3 HART installation configurations

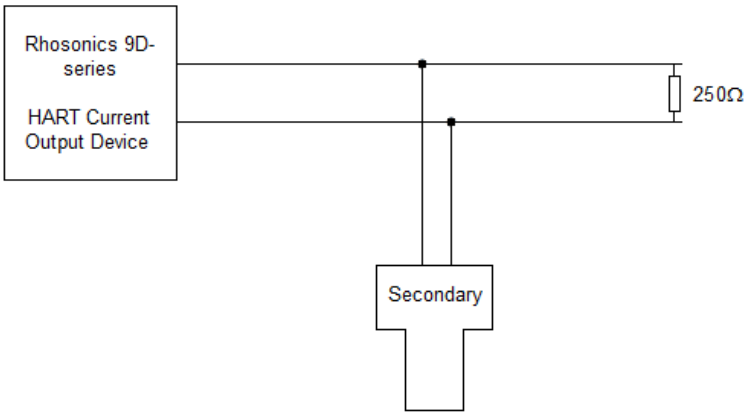
The analyzer has an active 4-20mA HART output.
This makes the physical device a Current Output Device. (Formerly Type C Field Device)

Point to Point configuration in control loop:
In the point to point hardware configuration, data is communicated both analog and digital.
The secondary master is the communicator



Analyzer in a Point to Point configuration

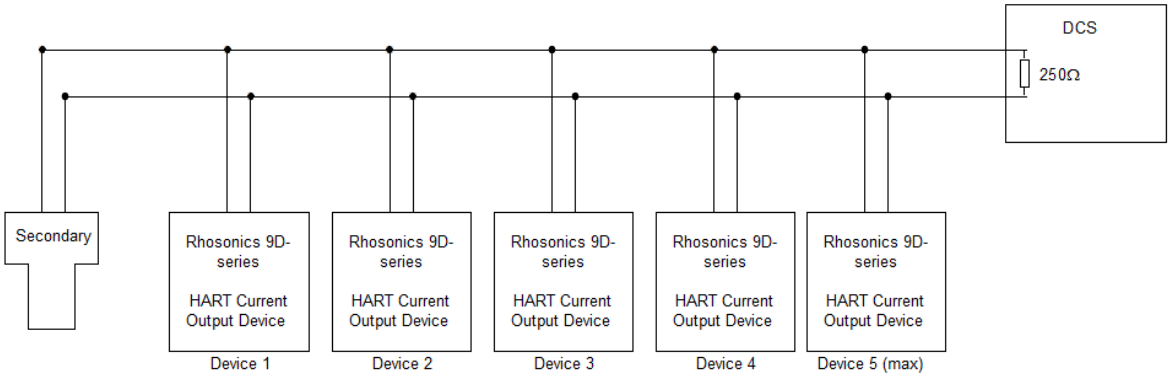
2.7.3.1 Connection out of the control loop:
For service and maintenance it might be necessary to connect with HART while the analyzer is disconnected from the DCS. The secondary master is connected across a 250Ω resistor. Both analog and digital communication is possible.



Analyzer connected out of the control loop

2.7.3.2 Multidrop configuration:
The analyzer can be connected in multidrop-mode. This has some restrictions since it is a current output device.

No more than 5 devices can be connected in multidrop-mode to the DCS to keep the current in the loop below 20mA. The loop current mode of the SDM WT has to be set to disabled and each device must have a unique polling address.



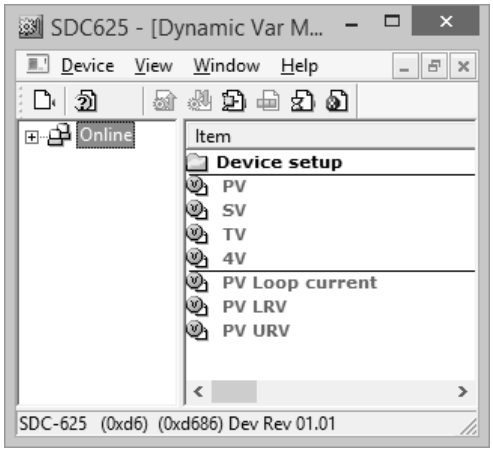
Analyzer connected in multidrop-mode

2.7.4 HART connecting the secondary master to the analyzer

Standard digital communication to DCS is via HART. This is to change settings and monitoring communication with the DCS.
The secondary master can be a HART communicator or a HART modem connected to a computer.

Procedure for point to point mode:

- Make sure the correct DD is in the database of the secondary master
- \YOUR_PATH\Library\0060C2\E35D
  Manufacturer ID Rhosonics: 0x60C2
  Device Type: 0xE35D
  Device Type Name: 9D-series Analyzer
  Polling address: 0
- Open the DD via e.g. SDC625.



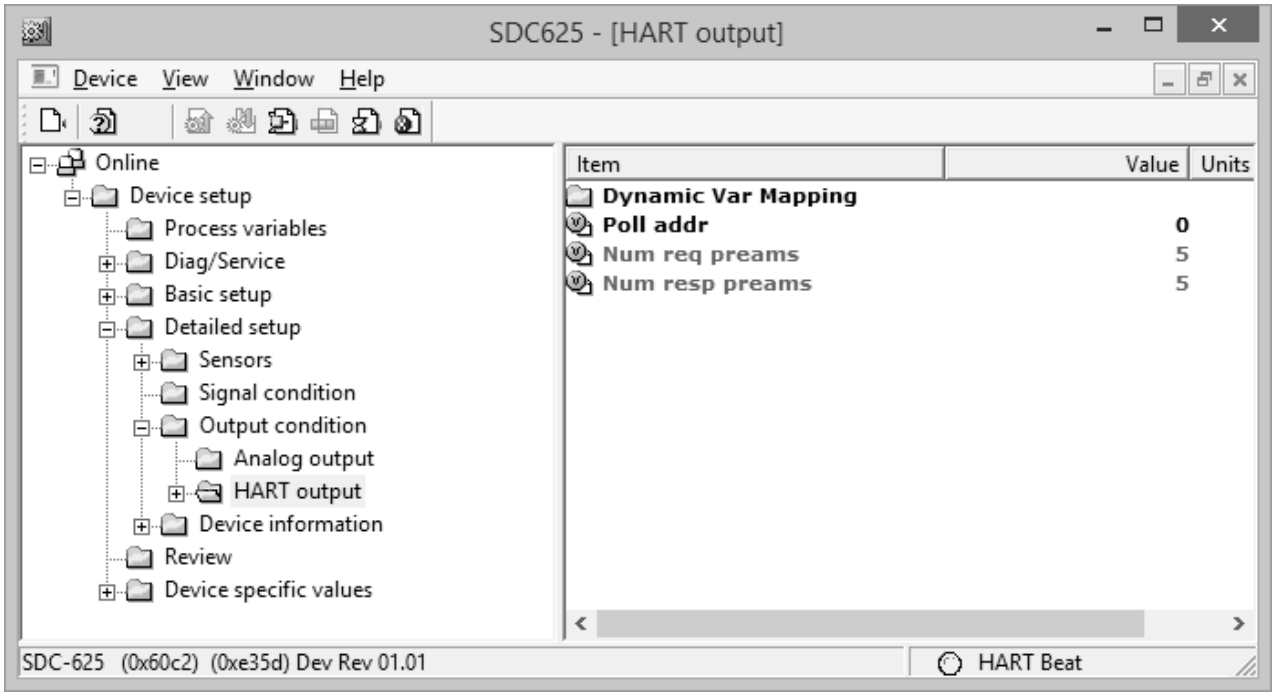
SDC625 Map structure (start)

Procedure for multi-drop mode:
The analyzer is configured for point to point mode.
When the device has to be put into multi-drop mode additional action is necessary.

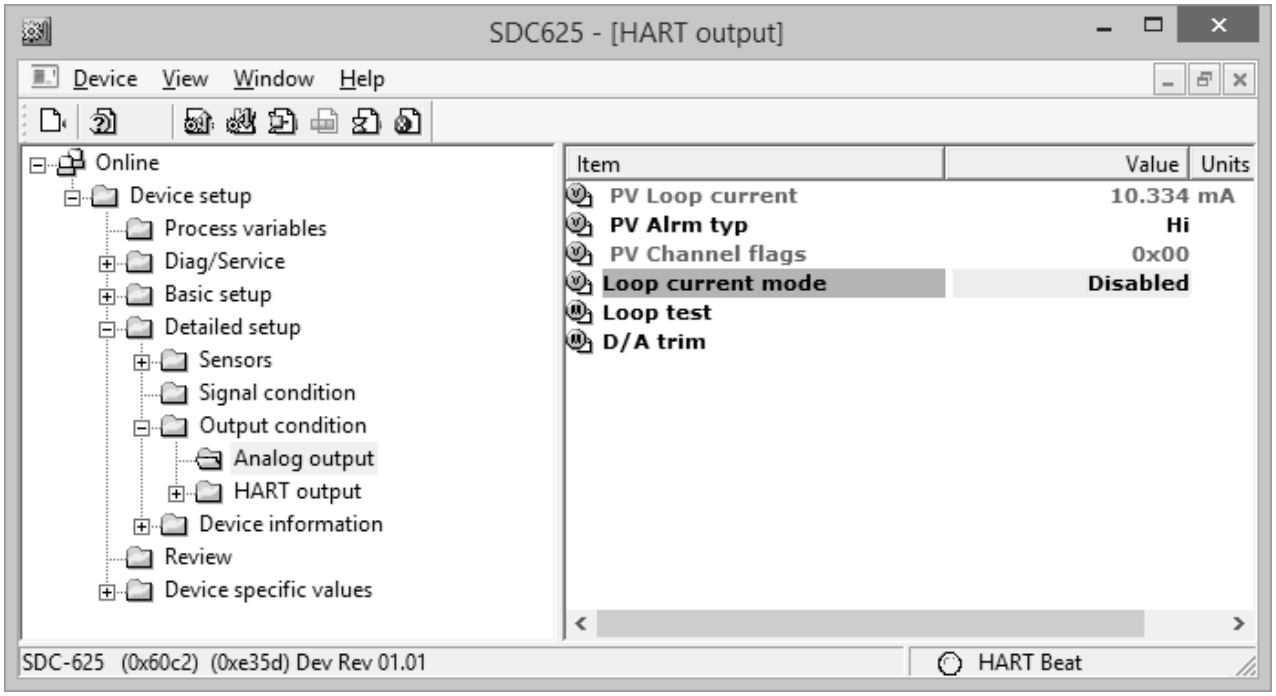
- Take the analyzer out of the control loop as is described in the configuration in the previous paragraph.
- Make sure the correct DD is in the database of the secondary master Manufacturer ID
- Open the DD via e.g. SDC625.

INSTALLATION

- Make sure that polling address 0 is checked for making connection.
- When connection is established give the device a unique polling address (preferably smaller than 15) .
- Do this by changing Poll addr: Device setup->Detailed setup->Output condition->HART output->Poll addr



- For multidrop mode it is necessary to disable the current output:
  Device setup->Detailed setup->Output condition->Analog output->Loop current mode.

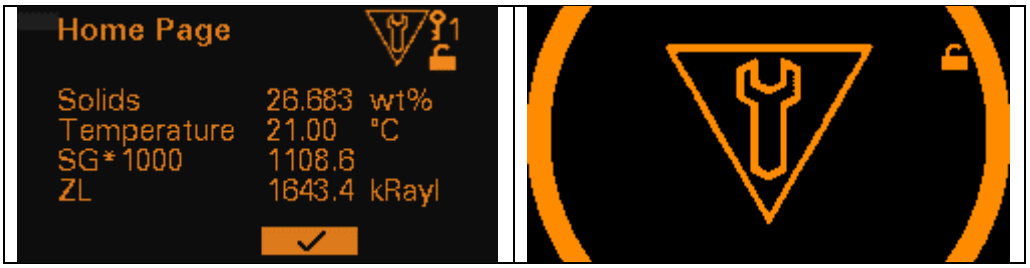


- The analyzer can now be installed according the multi-drop mode configuration.
- When reconnecting the secondary master make sure the correct polling address is checked.

2.7.5 Connection USB-port to a PC

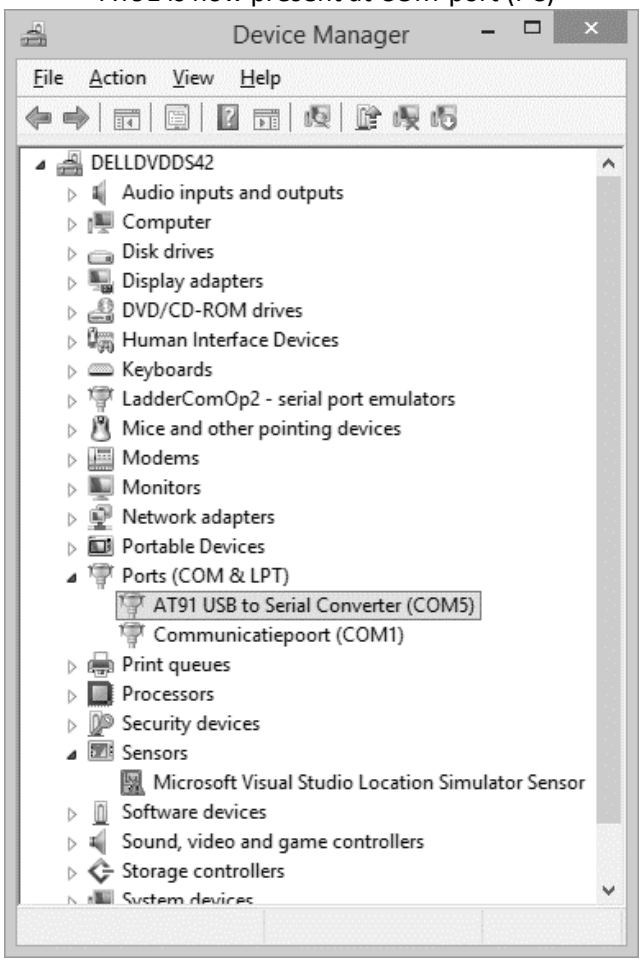
Procedure for connecting the analyzer to a PC using the USB-port on the front

- Connect USB-port to the service PC (use USB-A male to male cable)
- To avoid communication problems it is recommended to put the device into the HART write protect mode. This is set via the display on the sensor.
- Navigate to Check Function on the analyzer
- Access code: 1802 necessary
- Set Check Function to On, screen becomes orange



Result of Check Function set to On

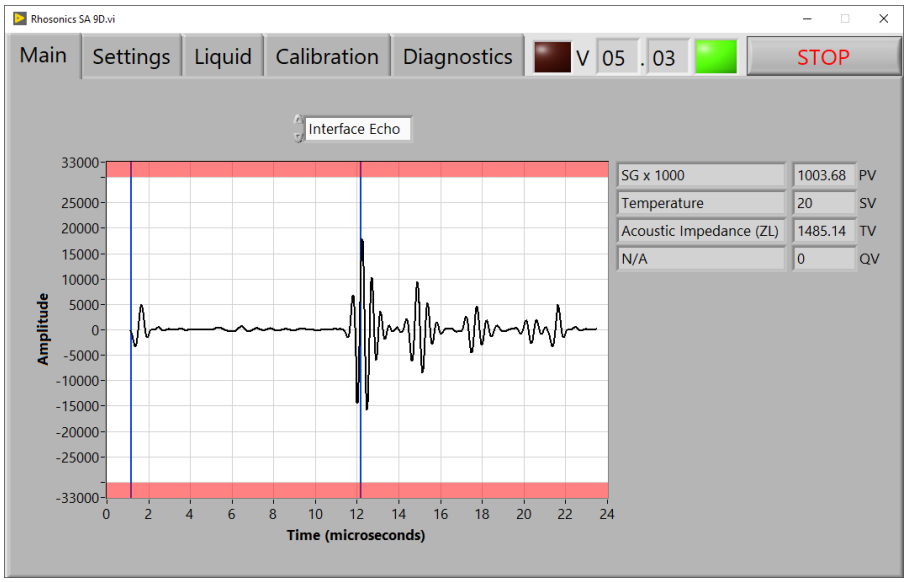
- Go to the Device Manager on the PC.
- AT91 is now present at COM-port (PC)



Device manager.
AT91 USB on COM-port number 5 (COM5)

INSTALLATION

- Start-up Rhosonics_SA _9D_##_##.exe



- Connection is made between sensor and service program. Whenever the green light is on and the echo is visible between the red bars.

3. Operation

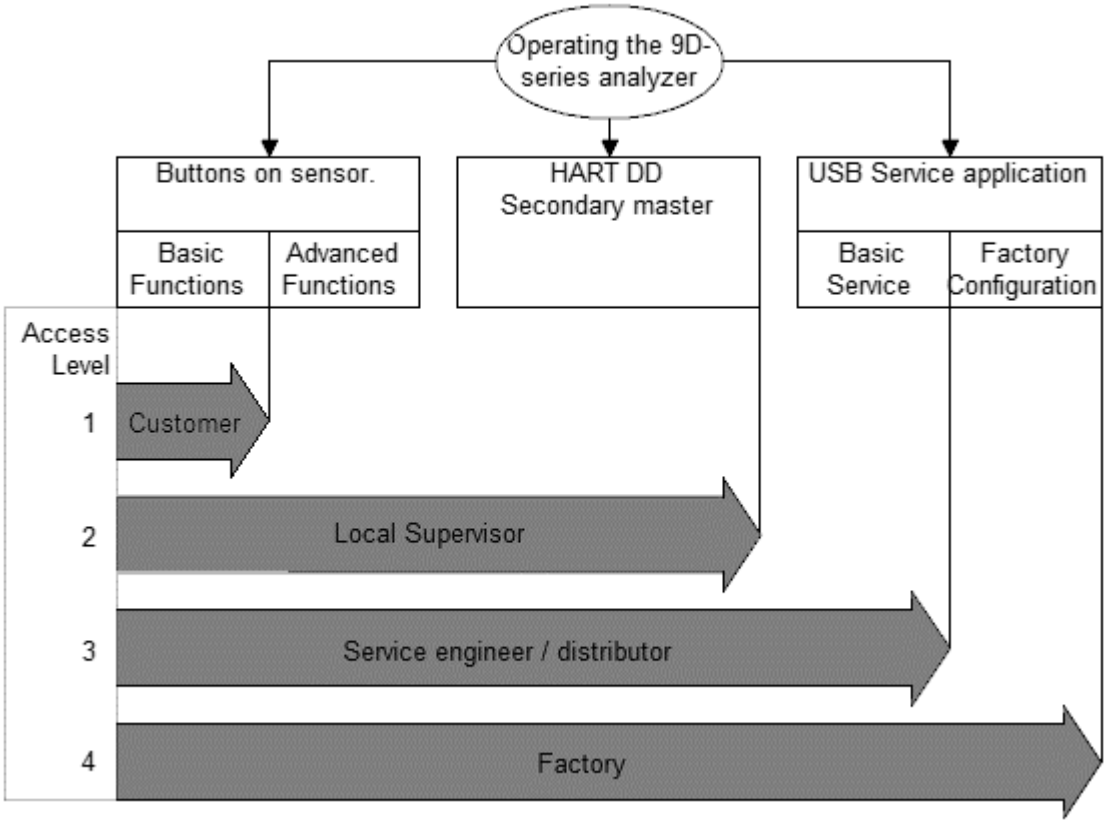
3.1 Introduction

The Operations for the analyzer can be divided in 3 options each with its own user interface:

- Operations on the LCD screen, see chapter 3.2
- Operations via HART, see chapter 3.3
- Operations through the USB-port, see chapter 3.4

The choice for each user interface is dependent on the type of user.

Setup is as follows:



Operating overview with: type of user interface, type of user and access level

3.1.1 Functionality per user interface

Each User Interface has a different set of functions. They are categorized based on access level and accessibility of each type of user interface.

	Available via			
Functionality	Button / LCD	HART DD	USB stick	USB * interface
Measurements				
Measured values digital	✓	✓		✓
mA out		✓		✓
Settings				
Manually changing sensor settings		✓		
Averaging outputs (decay time/damping)	✓	✓		✓
Liquid select	✓	✓		
Configuring output values (type and range)	✓	✓		✓
Loading of settings from file				✓
Loading liquid calibration				✓
Setting real time clock	✓	✓		
Backlight setting	✓			
Calibration				
Factory calibrations				✓
Local offset and span calibrations	✓	✓		
mA out calibration		✓		✓
Local calibration reset	✓	✓		✓
Diagnostic				
NAMUR state	✓	✓		
General error code	✓			✓
Diagnostic measured values		✓		✓
Condensed status map (HART)		✓		
Real time echo monitoring				✓
Saving log data			✓	
Loading liquids				✓
Loading firmware			✓	
Save settings			✓	
Error log			✓	
Reading writing device location		✓		
Reading version information		✓		✓
Reading model type		✓		✓

* Only for Distributors

3.2 LCD screen

3.2.1 Schedule operation LCD screen

The LCD screen in combination with the buttons support a low access level functionality.
Because of its location which is close to the process it is possible to do basic calibrations.
Since retreiving log data will go by USB stick it is possible to set time and date for time stamp values during log, as well as setting the log interval.

A minor system status displays the most relevant error in case of measurement problems.To assure settings can only be changed by authorized personal most menu's are hidden behind an access level.

3.2.2 Convention

Icons:

- 1 — Current access level
- — Unlocked (Local access)
- — Locked (Remote access)
- — Warning (value out of range)
- — Device is in maintenance / Check function is on
- — Maintenance required
- — Failure Functions

Buttons below screen:

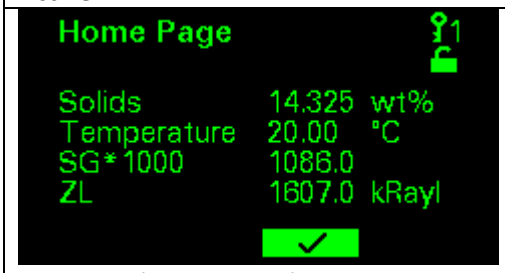
- First button: → / ▲ — Go right / Go up
- Second button: ▼ — Go down
- Third button: ✓ — Accept or Main menu
- Fourth button: ⮌ — Back / Page level higher (see schedule 3.2.1)

If the button colors are reversed (only first and second button) means that this button is used last.

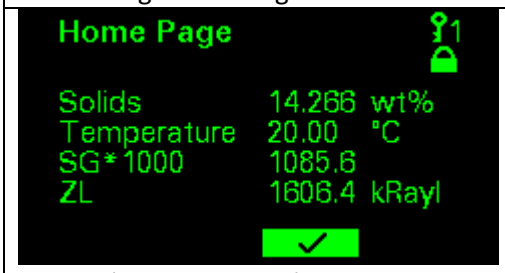
3.2.3 Status analyzer

Status of the device is displayed according NAMUR recommendation NE107. Each backlight color and icon describes a different status.

When a button on the sensor is pressed the screen goes from time out to active. When a button isn't pressed for a while the screen goes to time out.

<table>
<tr><td colspan="2">NOTE: Indicated variables can differ for your analyzer.</td></tr>
<tr><td>Active</td><td>Time Out</td></tr>
<tr><td> 

Unlocked (Local access)
Normal operation
• Device is operating within specified range
• Output is valid
The backlight color is green.</td><td> 

Unlocked (Local access)
Normal operation
• Device is operating within specified range
• Output is valid
The backlight color is green.</td></tr>
<tr><td> 

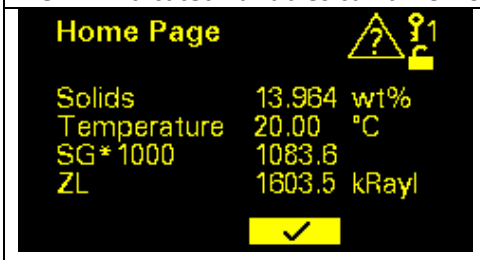
Locked (Remote access)</td><td> 

Locked (Remote access)</td></tr>
<tr><td> 

Access level 2</td><td>In time Out Access level will be reset to level 1.</td></tr>
</table>

OPERATION

NOTE: Indicated variables can differ for your analyzer.



Value Out Of Range

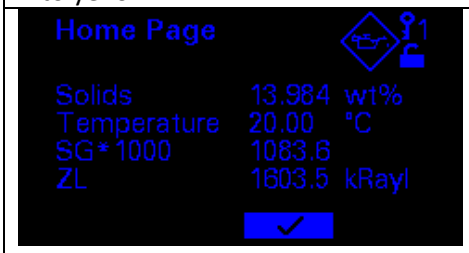
- Device is operating outside specified range
- Internal diagnoses indicate deviations from measured or set values
- Output is still valid

Icon in upper right corner and backlight change into yellow.

Value Out Of Range

- Device is operating outside specified range
- Internal diagnoses indicate deviations from measured or set values
- Output is still valid

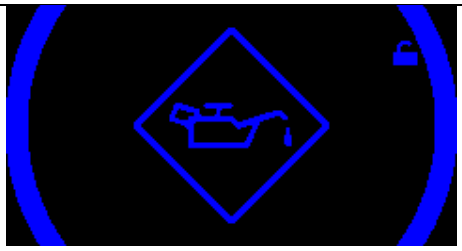
Backlight in yellow. Icon and measurement values are alternating.



Maintenance Required

- Maintenance on device necessary
- Output values still valid

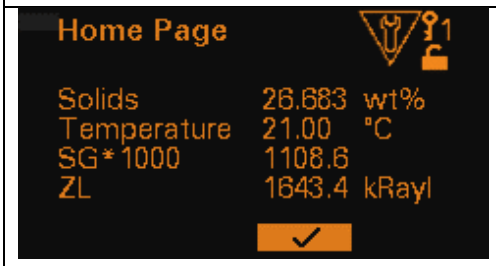
Icon in upper right corner and backlight change into blue.



Maintenance Required

- Maintenance on device necessary
- Output values still valid

Backlight in blue. Icon and measurement values are alternating.



Function check

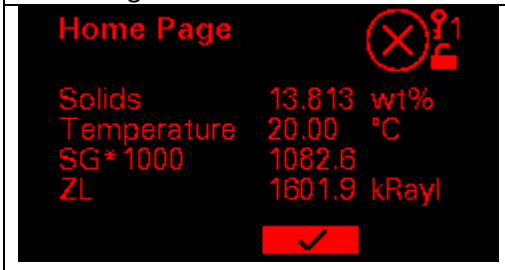
- Device is in maintenance
- Check Function is on
- Output values temporarily invalid

Icon in upper right corner and backlight change into orange.

Function check

- Device is in maintenance
- Check Function is on
- Output values temporarily invalid

Backlight in orange. Icon and measurement values are alternating.



Failure

- Replace device

Icon in upper right corner and backlight change into red.

Failure

- Replace device

Backlight in red. Icon and measurement values are alternating.

3.3 Operation via HART

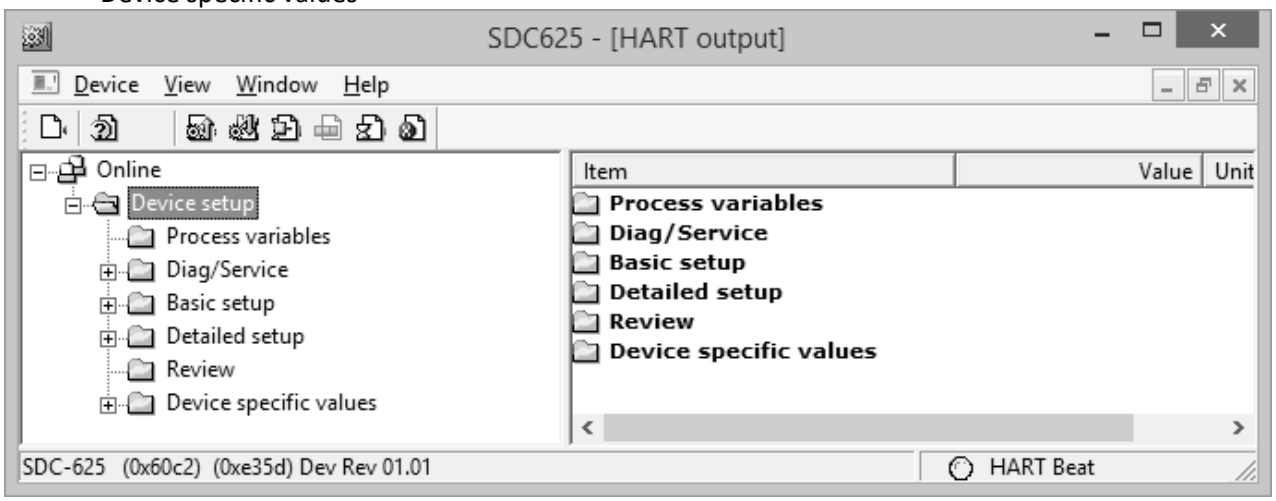
Standard digital communication to DCS is via HART.

The structure of the DD consist of the standard folders for HART DD's which are:

- Process variables
- Diag/Service
- Basic setup
- Detailed setup
- Review

There are also folders which are specific for the analyzer:

- Device specific values



Process variables show the output values.
All settings and measured values are visible in Analyzer variables

3.4 USB-port

The USB-port is used for:

- Software update
- Saving settings and log data (see chapter 7.1.4)
- Connecting to the service app on laptop via USB cable

3.4.1 Software update

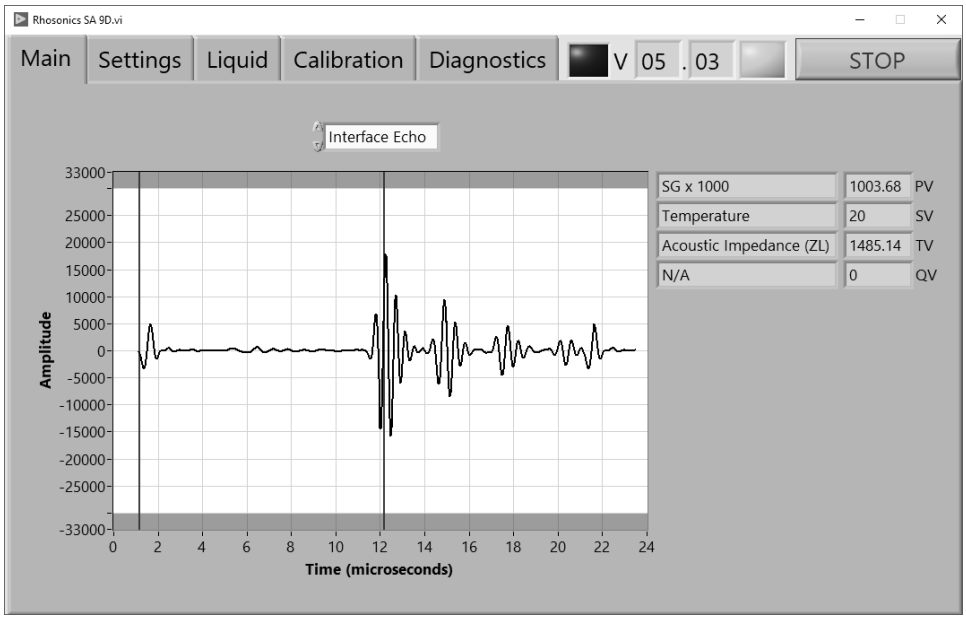
The procedure for software update:

- Power off the analyzer
- Insert an USB-stick with the latest software and the file bootscript.img
- Power on the analyzer
- Wait a few seconds
- Disconnect the USB-stick

The analyzer is updated.

3.4.2 Rhosonics service application (Rhosonics SA 9D)

The Rhosonics service application has 5 tabs
Main, Settings, Liquid, Calibration, and diagnostics.



4. Configuration

4.1 Introduction

The Configurations for the analyzer can be divided in 3 options.

- Operations on the LCD screen, see chapter 4.2
- Operations through the HART communication, see chapter 4.3
- Operations through the USB-port, see chapter 4.4

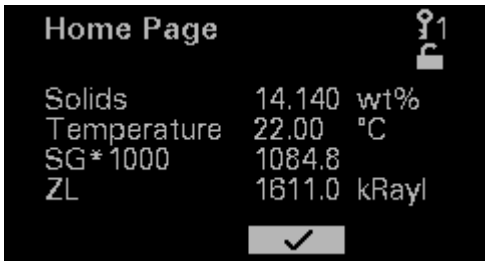
4.2 LCD screen

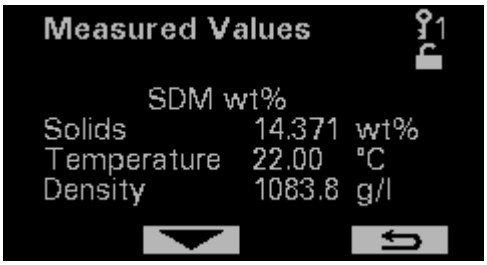
On the LCD screen there are several configurations possible.
When the analyzer is started up, the first page you will see is the *Start Page.*

NOTE:
Except for the *Start Page*, *Measured Value* page and *Decay Time* page you will need a higher *Access Code,* see chapter 4.2.4.

4.2.1 Start page / Measured Values

The *Start Page* contains only four values. These four values are the HART communication values.
If you want to view all values, go to the *Measured Values* pages. First to the *Main Menu* then to the *Measured Values* page.





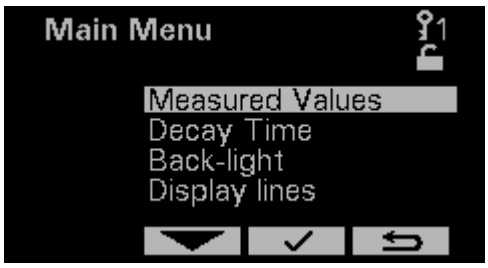
- Press ✓ to go to the *Main Menu*.

IMPORTANT:
If you are in Time Out mode press any key first to go to the *Start Page*.

4.2.2 Main menu

In the Main menu you can choose between 5 options:

- Measured Values
- Decay Time
- Back-light
- Display lines
- Advanced Function (higher Access Code required)



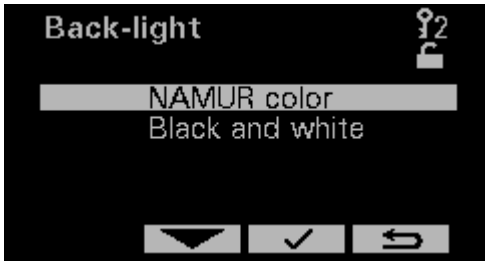
4.2.3 Decay time

Smoothing is strongly recommended, since it gives the device more accuracy. In addition, rapid changes in concentration are smoothened, hence the output value gives a better indication of the “bulk” value of the liquid. When fast response is not required, we strongly recommend setting the *Decay Time* between 5 and 20 seconds. Since smoothing affects the response time, the best setting is a trade-off between accuracy and response time.

A *Decay Time* of 5 seconds is recommended for most applications.

4.2.4 Back-light

Back light changes with the status of the analyzer. Certain statuses can cause the back light color to be too weak. It is possible to set the back-light into black and white mode to make sure that independent of the status the screen is visual.



4.2.5 Display Lines (not applicable for the SDM WT)

At this point there are no additional relevant measurements to show. It is recommended to leave the number of display lines as they are.

4.2.6 Access Code

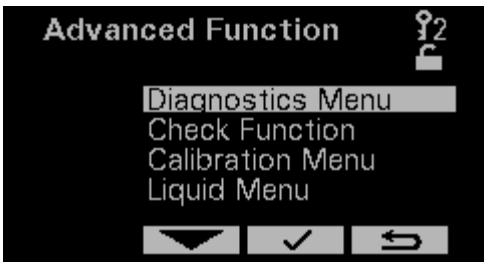
To enter the *Advanced Function* and all function after the *Advanced Function* page a higher *Access Code* is necessary. *Access code* for level 2 is *1802.*
To enter this Access Code please follow below procedure:

- On the *Start Page* press ✓
- In *Main Menu* scroll to *Advanced Function*, using ▼ and ▲ buttons.
- *Access Code* page will pop-up if you are not already in *Access Code 2*
- Enter Access Code using ▼ and → buttons.
- After entering the *Access Code* press the ✓ button.
- The *Advanced Function* page is on the screen now.

4.2.7 Advanced Function

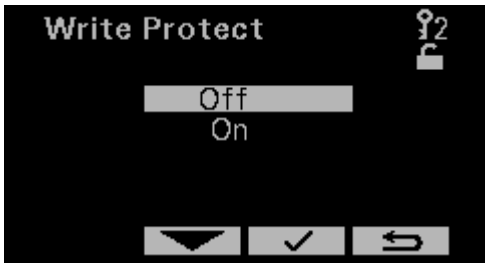
On the *Advanced Function* page you can choose between six options:

- Diagnostics Menu, see chapter 7
- Calibration Menu, see chapter 5
- Liquid Menu
- Write protect
- Check Function
- Output mA Range



4.2.8 Write protect

Write protect is used to disable write commands via HART, read commands are still possible.



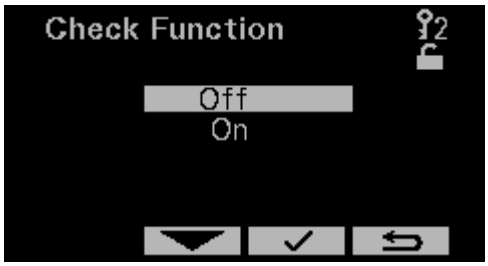
4.2.9 Liquid menu

At this point there is only 1 liquid for the SDM WT it is recommended to leave the settings as configured by the factory.

4.2.10 Check Function

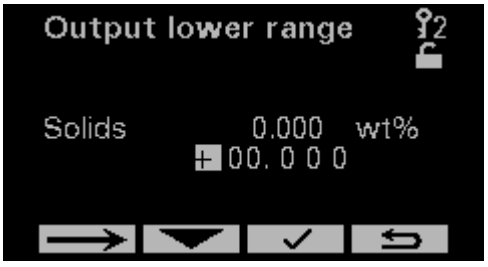
The *Check Function* can be used for two things:

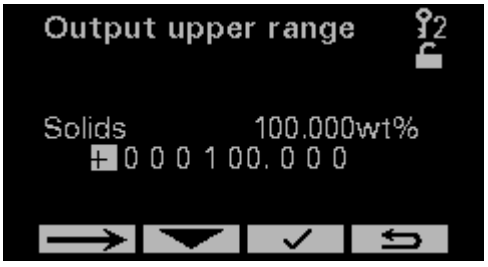
- When HART is used the DCS is warned that the analyzer is in maintenance/service, so values sent to the DCS can be wrong values.
- Another function is that a COM-port is configured for a service PC



4.2.11 Output mA range

Setting *Output mA range* is used to assign which value is corresponding to the 4 and 20mA range of the analog output. As a consequence the analyzer (and mA out) will go into the out of specification status, when the measured value will go out of these range. Screens below show the pages where the upper and lower range value can be set.





4.3 HART communication

To set up the HART configuration you need a program called *DD edit*
With this program you can setup the HART communication.

Even without using HART there is a possibility to use the 4-20 mA Output of the HART. Therefore you only need to setup the Primary Variable.

This is described in this chapter.

HART has four standard digital outputs namely:

- PV Primary Variable
- SV Secondary Variable
- TV Ternary Variable
- 4V Quaternary Variable

NOTE:
The analog signal (4-20 mA Output) is the same as the Primary Variable. This must be set correctly whether the customer uses HART or not.

4.3.1 Setting the Primary Variable / assigning 4-20mA output

It is possible to assign 4 variables for the HART communication, these are called Dynamic Variables. The first one is called the Primary Variable (PV) this value is assigned to the 4-20mA analogue. All 4 dynamic variables (PV, SV, TV and 4V) can be obtained digitally by a DCS which support HART.

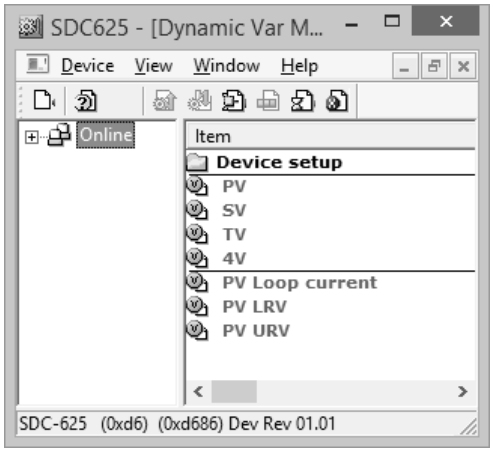
There are 9 standard variables you can choose from:

- Device Variable 0: Concentration 1 (Solids [wt%])
- Device Variable 1: Concentration 2
- Device Variable 2: Sound Speed
- Device Variable 3: Temperature
- Device Variable 4: SGX1000
- Device Variable 5: Acoustic Impedance
- Device Variable 6: Solids
- Device Variable 7: Power Liquid Echo
- Device Variable 8: Conductivity

NOTE:
It can be that the specific analyzer model doesn't measure a specific Device Variable. In that case it is not recommended to select this Device Variable.

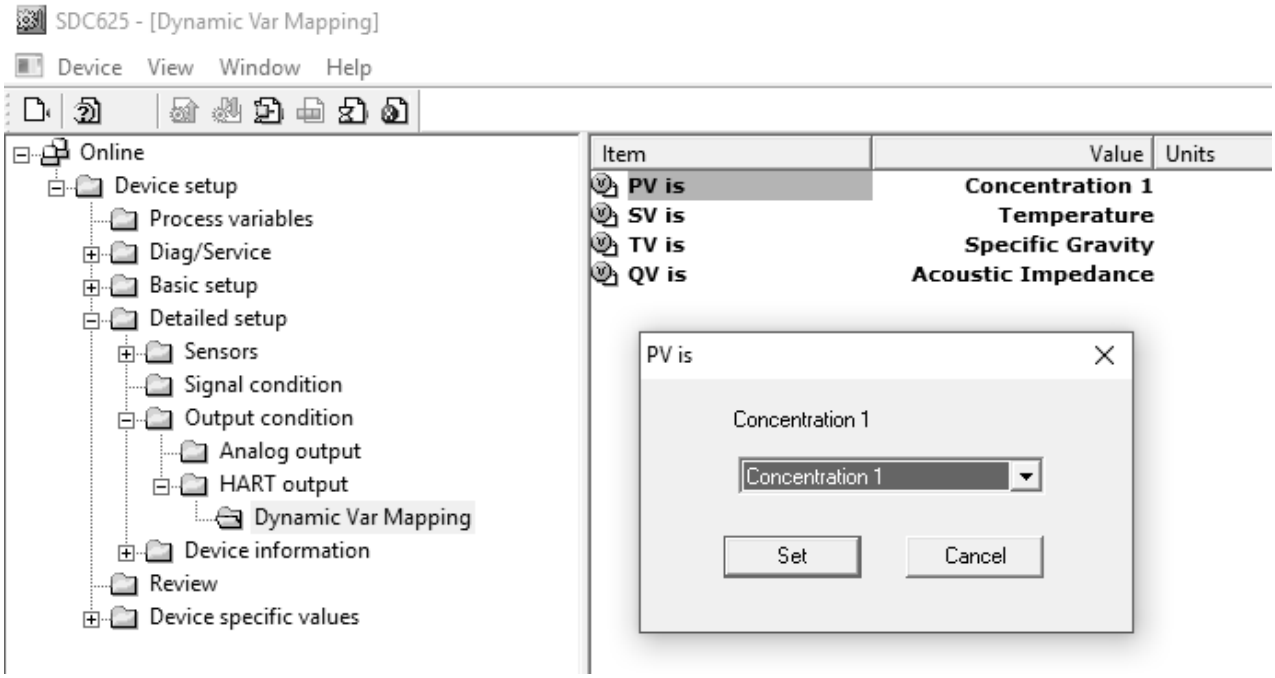
Procedure:

- Connect the secondary master to the analyzer
- Make sure the correct DD is in the database:
  - \YOUR_PATH\Library\0060C2\E35D
  - (Manufacturer ID = 0x60C2)
  - (Device ID = 0xE35D)
- Open Analyzer.ddl
- Build DD [Ctrl + M]
- Execute [Ctrl + F5]
- SDC625 is opened



SDC625 Map structure (start)

- Open Map Dynamic Var Mapping (Online➔Device Setup ➔ Detailed setup ➔ Output condition ➔ HART output ➔ Dynamic Var Mapping)
- Double click PV is, SV is, TV is or QV(=4V) is



PV is setting in map Dynamic Var Mapping

- Choose variable for PV is, SV is, TV is and QV is

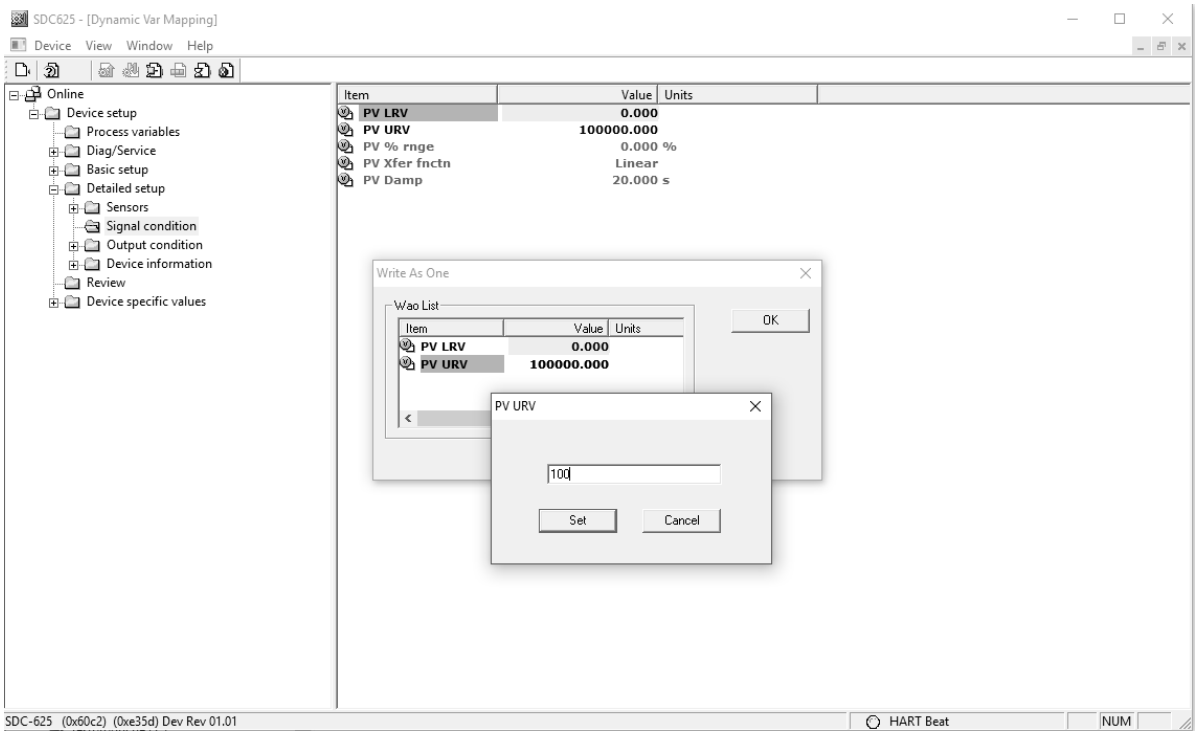
4.3.2 Configure 4-20 mA Output

This procedure is to specify the 4-20 mA Output.

- The *PV LRV* (Primary Variable Lower Range Value) correspond to 4 mA
- The *PV URV* (Primary Variable Upper Range Value) correspond to 20 mA
- The *PV Alrm typ* (Primary Variable Alarm Type) is the Error reaction mode
- The *Loop current mode* has to be *Enabled* (*Disabled* is Multidrop-mode)
- The *Loop test* sets the output to a set value
- The *D/A trim* trims the low and high value on digital level

Setting Low and High value

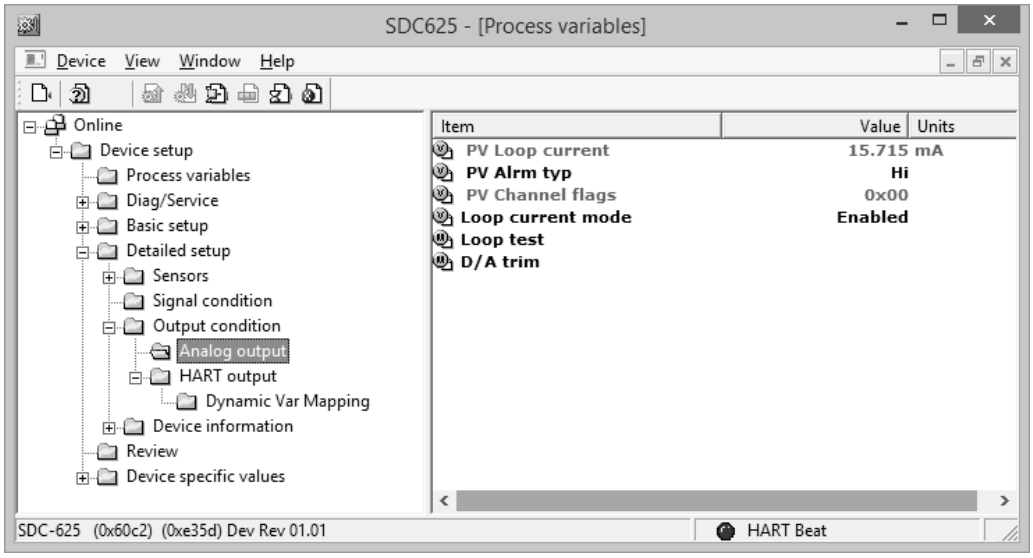
- Open Map Signal condition (Online➔Device Setup ➔ Detailed setup ➔Signal condition)
- Set value for *PV LRV* (i.e. Solids = 0 wt%)
- Set value for *PV URV* (i.e. Solids = 100wt%)



Low and High value 4-20 mA output

Setting Analog output condition

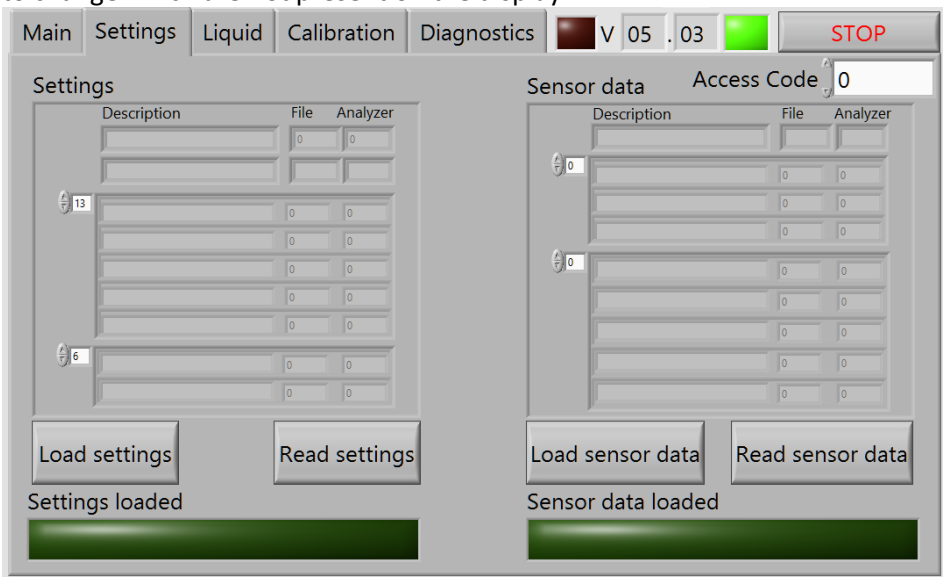
- Open Map Signal condition (Online➔Device Setup ➔ Detailed setup ➔Output condition➔Analog output)
- Set mode for PV Alrm typ (choose from Hi, Lo, Hold last value or None)
- Set Loop current mode to Enabled
- Use *D/A trim* to fine-tune the 4 mA and 20 mA value digitally. After this trim a power down and power up must be done.



Analog output condition

4.4 Load and read settings via service app

Loading settings and sensor data happens in the factory and is only necessary if some configurations need to change which are not present on the display.



Settings loaded

1 Load settings

For loading settings, the file SETTING.CSV needs to be on this exact location:
C:\Users\"USERNAME"\Documents\LabVIEW Data\
("USERNAME" is the name of the Windows user that is logged in.)\
When this location doesn't exist please create this location.

- Press *Load settings*
- When Lamp *Settings loaded* is green the settings are loaded

2 Read settings

For reading settings, the file SETTING.CSV needs to be on this exact location:
C:\Users\"USERNAME"\Documents\LabVIEW Data\
In this case the files are necessary to get the description for the settings.
When this location doesn't exist please create this location.

- Press *Read settings*
- When the descriptions and values in analyzer are visible and the file column is greyed out the settings are read from the analyzer

3 Load sensor data

NOTE:

Procedure described in the maintenance chapter 6 is preferred!

For loading settings, the file 3ASENSOR.CSV needs to be on this exact location:
C:\Users\"USERNAME"\Documents\LabVIEW Data\
("USERNAME" is the name of the Windows user that is logged in.)\
When this location doesn't exist please create this location.

- Press *Load settings*
- When Lamp *Settings loaded* is green the settings are loaded

4 Read sensor data

For reading settings, the file 3ASENSOR.CSV needs to be on this exact location:
C:\Users\"USERNAME"\Documents\LabVIEW Data\
("USERNAME" is the name of the Windows user that is logged in.)\

In this case the files are necessary to get the description for the settings.

When this location doesn't exist please create this location.

- Press *Read settings*
- When the descriptions and values in analyzer are visible and the file column is greyed out the settings are read from the analyzer

<u>Changing Primary, Secondary, Ternary and Quaternary values for HART output</u>

- Open "SETTING.csv" file.
- Change the values for "primary/secondary/ternary/quartinary dynamicVarConfig", all available quantities have been included in the csv-file
- Save the file (keep .csv extension)
- Press *Load settings*
- When Lamp *Settings loaded* is green the settings are loaded

The Primary, Secondary, Ternary and Quaternary values for HART output are now set.

4.5 Load and read liquid settings via service app

There is 1 liquid for the SDM WT. When this needs to be replaced on recommendation of Rhosonics please follow the instructions below.

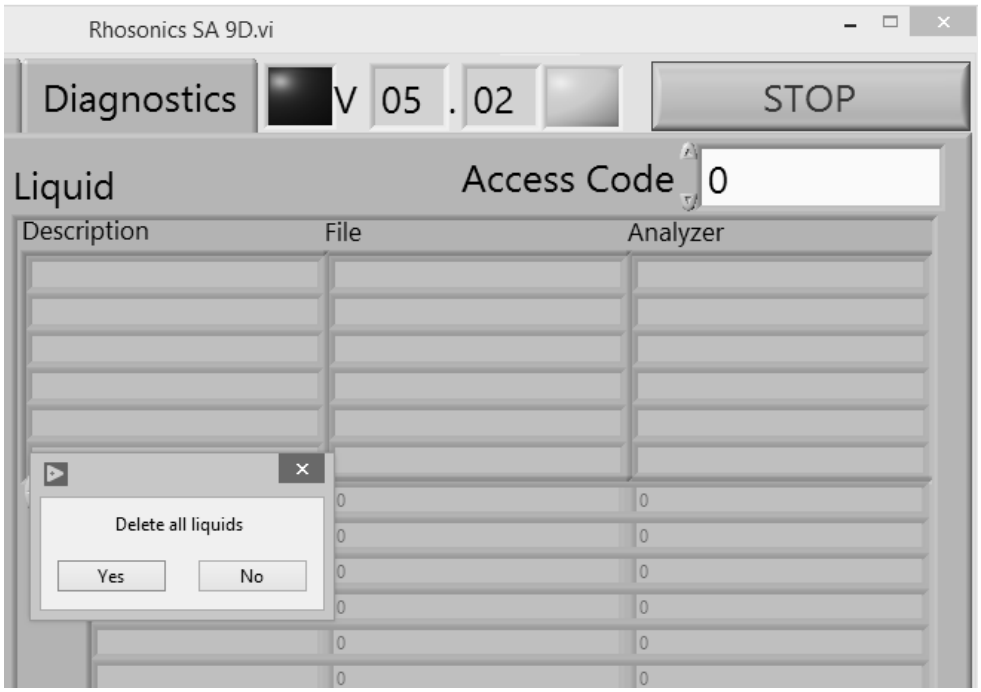
3 Load liquid

The liquid calibration is loaded from a liquid file this file starts with RLS and has the csv file-extension.

This file needs to be on this exact location:
C:\Users\"USERNAME"\Documents\LabVIEW Data\
When this location doesn't exist please create this location.

- Press *Load liquid*
- When Lamp *Liquid loaded* is green the settings are loaded.

NOTE: When a new liquid is loaded into an SDM WT with an existing liquid calibration a pop up appears asking to remove all liquids see picture below.



4 Read liquid

To read the liquid from the analyzer a liquid file is needed. The name of this file starts with RLS and has the csv file-extension.

This file needs to be on this exact location:
C:\Users\"USERNAME"\Documents\LabVIEW Data\
The file is needed to provide the description.

When this location doesn't exist please create this location.

- Press *Read liquid*
- When the descriptions and values in the analyzer are visible and the file column is grey, the liquid calibration is read from the analyzer

5. Calibration LCD screen

5.1 Calibration Menu

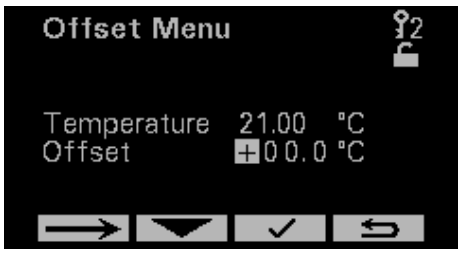
In the *Calibration Menu* you can choose out of three calibrations:

- Temperature
- S.G. x 1000
- Field

5.1.1 Set Temperature

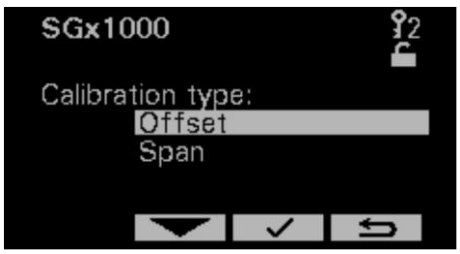
On the temperature *Offset Menu* page the current fixed temperature is displayed.
The temperature should be equal to the average process temperature and can be set by changing the offset. The temperature must be ± 5 °C the real process temperature.

- Enter temperature *Offset* using ▼ and → buttons.
- After entering the *Offset* press the ✓ button.



5.1.2 S.G. x 1000 calibration

On the *S.G. x 1000* page you can calibrate the *Offset* and *Span*.



Offset Menu page:
The offset shifts the indicated SGx1000 to the desired value, without influencing the sensitivity.
If possible, pump water or fill the line with water.

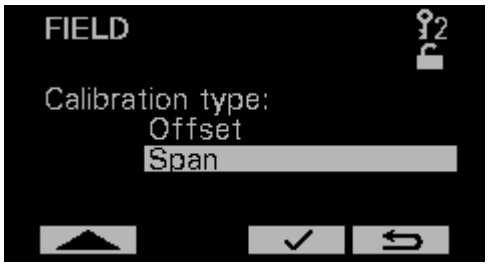
- Enter *S.G. x 1000 Offset* using ▼ and → buttons. (1000 for water)
- After entering the *Offset* press the ✓ button.

NOTE:
This step can be omitted on initial install should pumping water prove difficult due to the process configuration. However, Rhosonics recommends you undertake this calibration later to compensate for sensor aging.

Span Menu page:
NOTE:
Do not perform the SG span calibration.

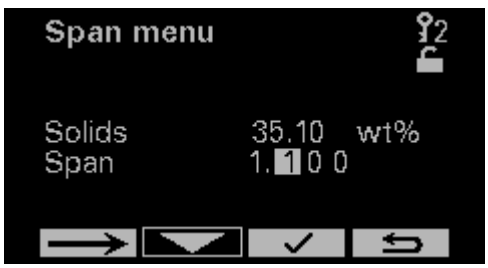
5.1.3 Field calibration (solids calibration)

On the *Field* page you can calibrate the *Offset* and *Span*.



Offset Menu page:
NOTE:
Do not perform the *Field offset* calibration.

Span Menu page: (Solids)
On initial install or after the SG Offset has been set, go to the Field – Span calibration. The solids will be displayed and will hold for 18 hours. Take a sample. Submit this sample to the lab and when you have the results, adjust the Span until the displayed value matches the lab result.



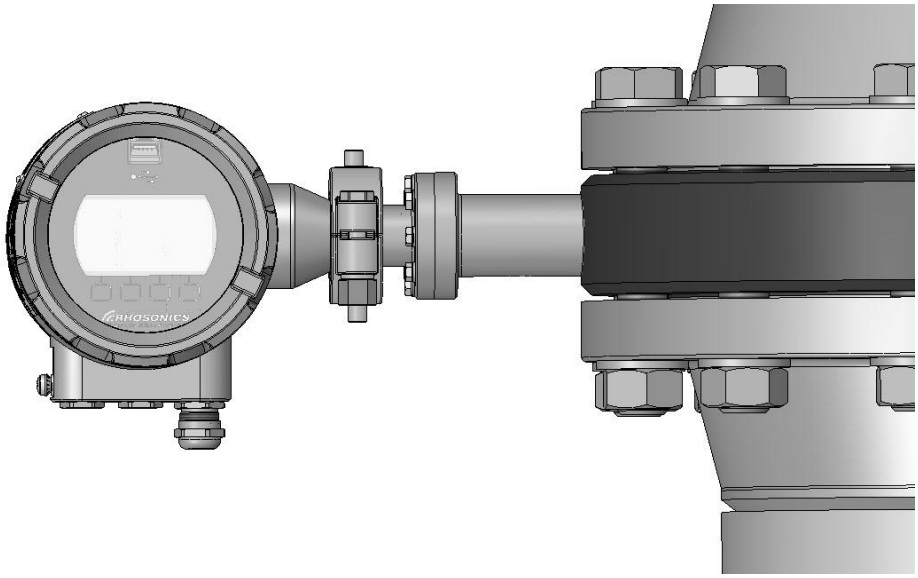
6. Maintenance

6.1 Replacing / mounting a sensor

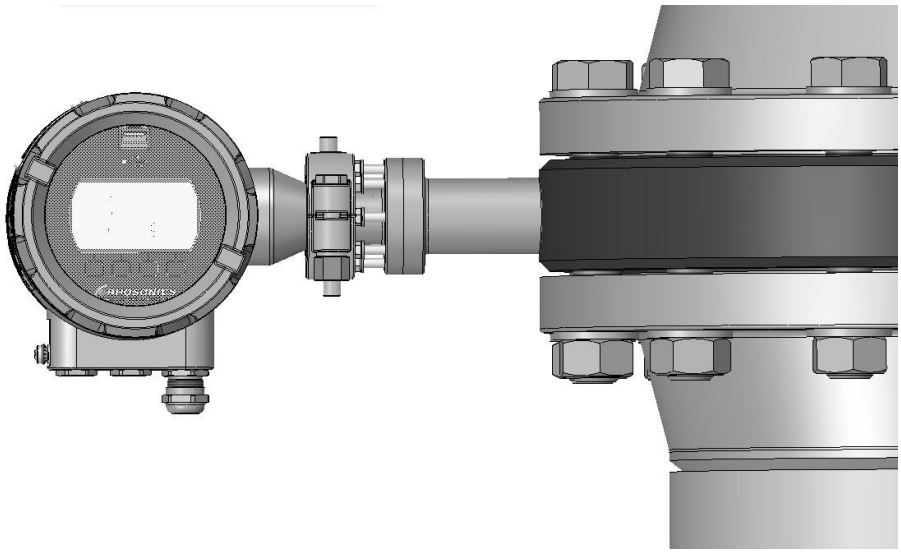
Dismounting in black
Mounting in blue

CAUTION:

Please make sure you follow this procedure. Deviating (dis)mounting procedure can damage the SDM WT beyond repair, especially the spring loaded contacts in the sensor part.

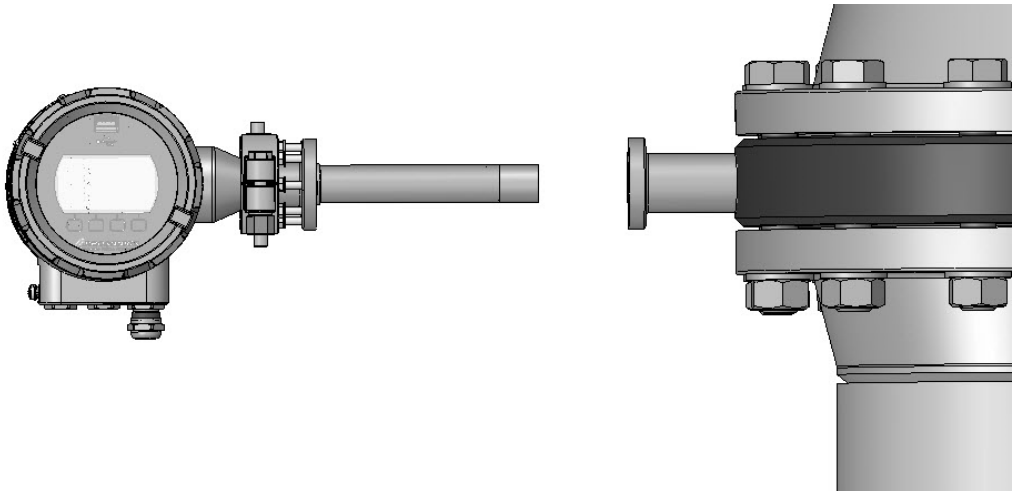


Sensor mounted in wafer/spool/Weldolet

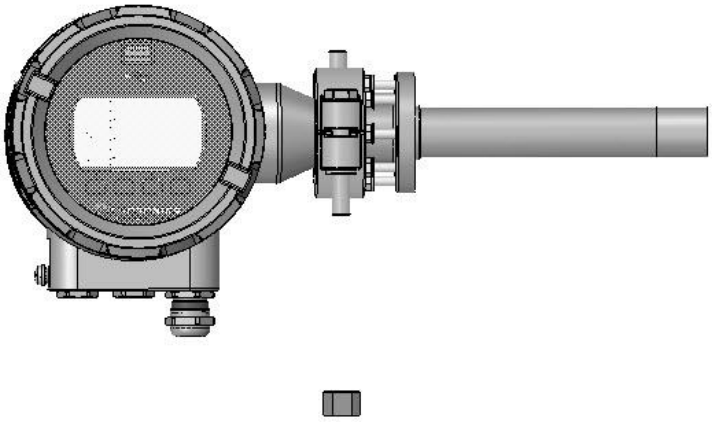


Dismounting: Untighten 8 M5x16 bolts / Mounting: tighten bolts with 4.2 Nm

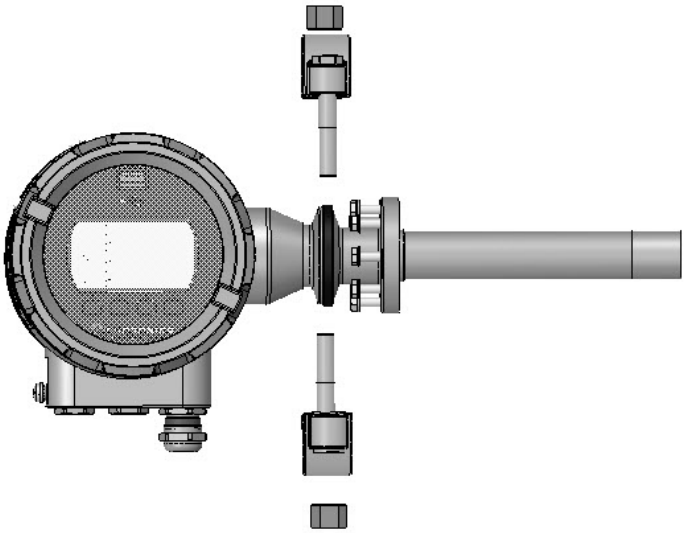
MAINTENANCE



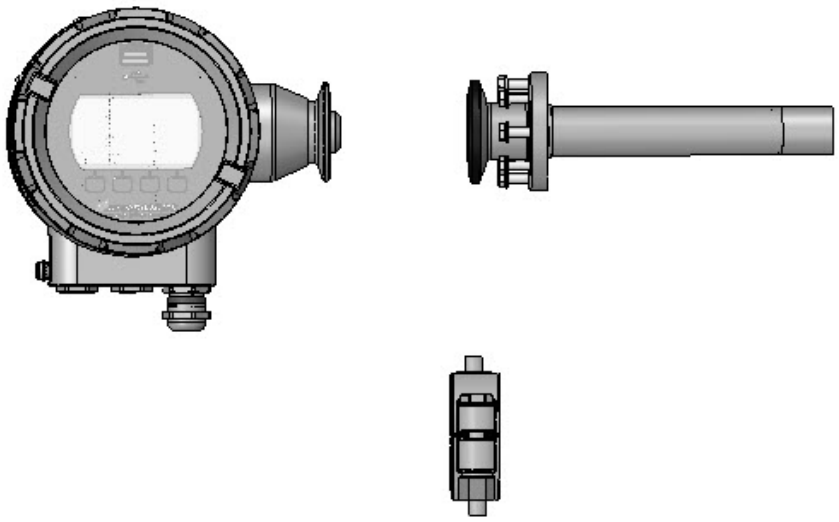
Dismounting: Remove sensor from pipe(adapter) / Mounting: place sensor into pipe(adapter)



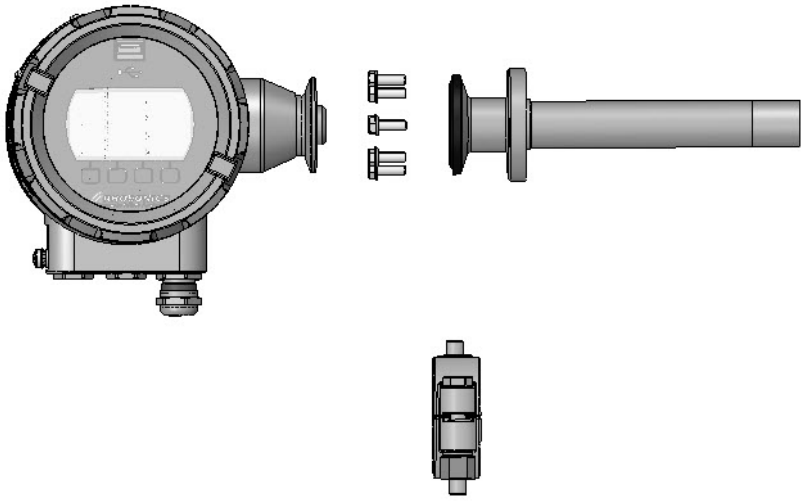
Dismounting: Remove nuts from Tri-clamp / Mounting: Tighten nuts to Tri-clamp with 25 Nm



Dismounting: Remove Tri-clamp / Mounting: Place Tri-clamp



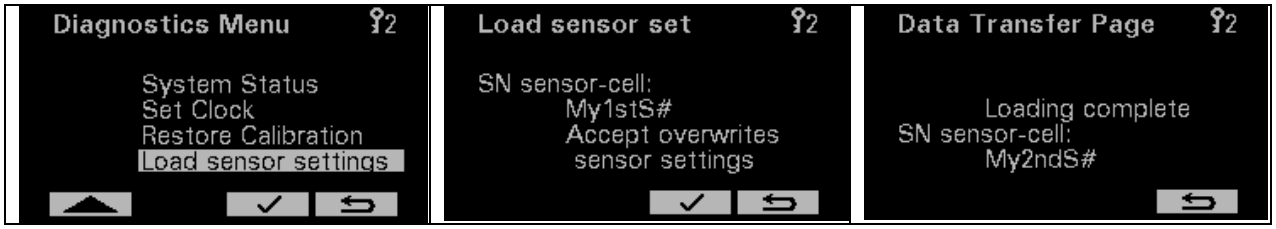
Dismounting: Separate sensor and housing, NOTE take care of the tiny spring loaded contacts in the sensor part / Mounting: Connect sensor and housing, NOTE take care of the tiny spring loaded contacts in the sensor part



Dismounting: Remove the M5x16 bolts and M5 washers / Mounting: Place the M5x16 bolts and M5 washers

6.2 Update sensor settings after replacement

- Put the stick with the sensor settings 3ASENSOR.CSV in the analyzer.
- Load sensor settings provided with the sensor in the analyzer via load sensor settings in the diagnostics menu.
- Check if the serial number of the sensor is OK after update (check the sticker)
- The sensor is calibrated and installed



7. Diagnostics & Service

7.1 Diagnostics Menu

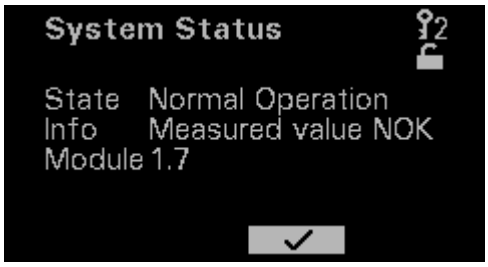
In the *Diagnostics Menu* you can choose out of 6 options:

- Logging Menu
- Erase log
- System status
- Set Clock
- Restore Calibration
- Load sensor settings (see chapter 6 Maintenance)

7.1.1 System Status

On this page you will find the status of the analyzer.

- When the analyzer is running OK it shows Normal Operation.
- When the analyzer is not running OK anymore, it shows the error and information about that error.



7.1.2 Restore calibration

Preparations
Please read this section carefully before starting!

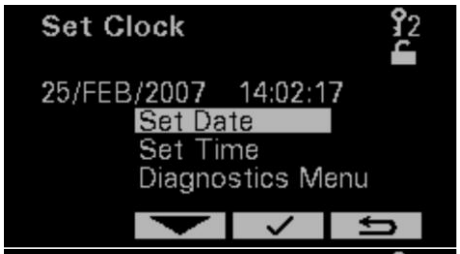
On this page you can restore all calibrations to the factory calibrations.

CAUTION:

Pay attention before pressing ✓ . When accepted, all settings, calibrations and configurations will be lost and reset to the factory settings.

7.1.3 Set clock and Date

On these pages the Time and date can be set.



7.1.4 Logging and Settings for diagnostics & evaluation

For trouble shooting this is the proper way to solve the problem:

1. Check System Status and inform Rhosonics / the Distributor
2. Save a log-file and analyzer settings and send them to Rhosonics / the Distributor
3. Restore factory settings, only when Rhosonics tells you to do so.

*A log file is automatically started when the power is turned on.

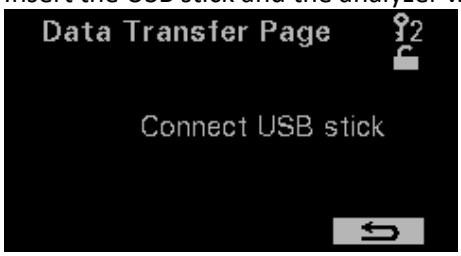
For trouble shooting or for your own diagnostics evaluation, you can save a Log-file.
When this Log-file is stored to the USB stick the settings from the analyzer will be stored as well. The settings from the analyzer can then be interpreted by the factory.

The *Logging Menu* page has 2 functions:

- The *Sample time* can be set. You can choose from the following Sample times *1, 2, 5, 10* or *30 Seconds*, *1, 2, 5* or *10 Minutes*. Keep in mind that the log file has room for 65535 entries.
- By selecting *Get data* the log-date will be written to the USB-stick

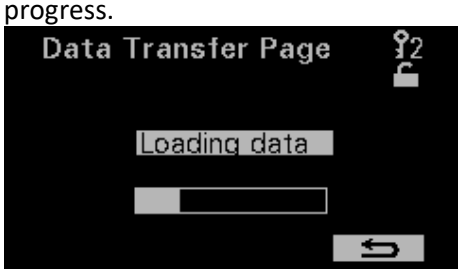
7.1.5 Collect log data using USB

When the log data screen is opened a request follows to connect the USB stick.
Insert the USB stick and the analyzer will automatically check the USB stick.

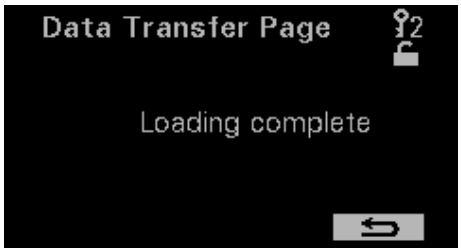


The USB stick is checked. This is followed by saving the echoes and settings and measured values. Within 20 seconds this should be finished. If failed, the display shows so.

After this the log is retrieved from the logging memory. This will take several minutes.
The flashing of *loading data* as well as the updating of the progress bar indicates that saving the data is in progress.



When saving data is finished the message *loading complete* appears. It is now possible to leave this page and remove the USB-stick.



The table below shows the files
The file with the interface echo is starting with “I” followed by the date.

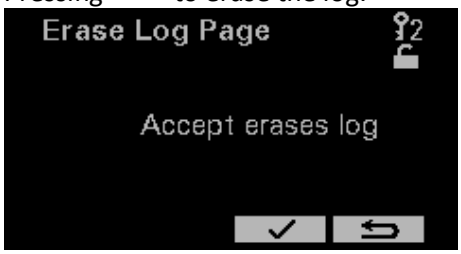
Following table gives an explanation about the filenames:

Filename	Description
L”YYMMDD”.txt	Log
E”YYMMDD”.txt	Error/Status report
I”YYMMDD” .txt	Interface echo
M”YYMMDD”.txt	All measured values at time of “Get Log”
RLS-FILE.csv	Liquid calibration in analyzer (Loadable for distributors)
S”YYMMDD”.txt	Settings (Not loadable)
SETTING.csv	Settings (Loadable for distributors)
3ASENSOR.csv	Settings and calibration of sensor

7.1.6 Erase Log

The device is permanently logging. This has the advantage that after an incidental measurement error the log can be retrieved.

When a test is started there can be a desire to clear the data already present in the analyzer.
Pressing ✓ to erase the log.



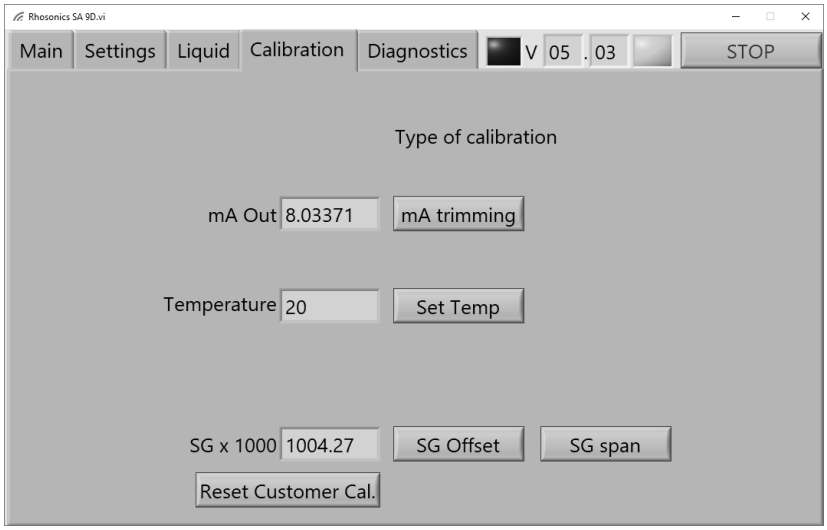
8. Distributors calibration via service app

Calibrations are model dependent.

The following calibrations are present for every model:

- mA trimming
- Temperature

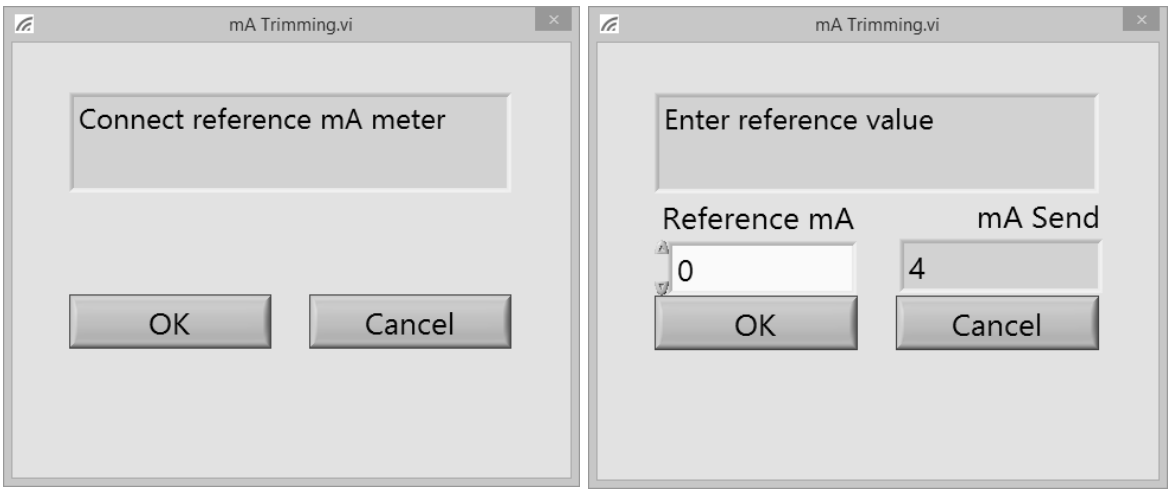
These Factory calibrations can also be made by trained distributors.



Calibration page

8.1 mA trimming

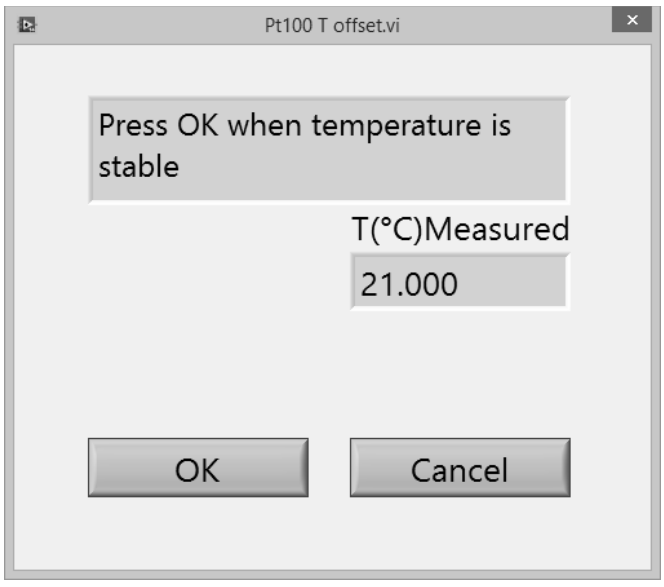
For mA trimming a calibrated mA meter is necessary.
The SDM WT is calibrated at Rhosonics. A step by step instruction is given on the service application via several pop ups.



8.2 Temperature

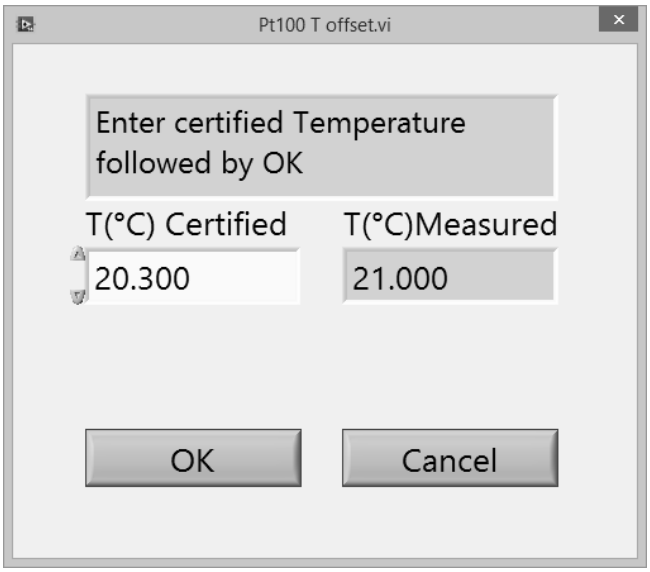
Check the temperature reading regularly, and perform a calibration when the reading error exceeds 5 ºC. It is advised to configure the set temperature with a calibrated sensor, as other temperature sensors in the same process may lack accuracy or may not be representative for the temperature at the installation location of the probe.
The SDM WT doesn't measure the temperature. The value for the offset is the temperature.
The temperature for the SDM WT is actually a setting.

- Press *Temperature* button

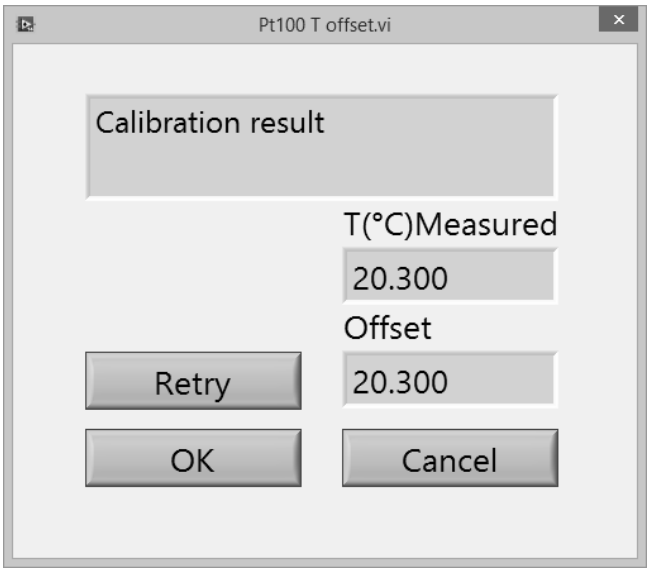


- Press OK when the reference temperature is measured

- Enter the certified temperature followed by pressing OK



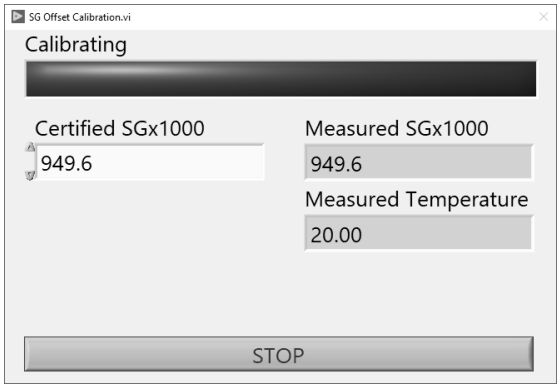
- OK stores the result



8.3 SGx1000 calibration

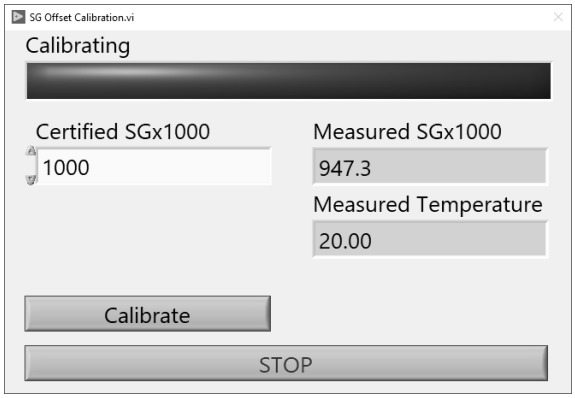
8.3.1 SGx1000 offset calibration

- Press SG offset calibration
- Enter a certified *SGx1000*



Enter Certified SGx1000

- A button *Calibrate* will appear on the screen



- The calibration is done, the *Measured SGx1000* should be near the *Certified SGx1000*

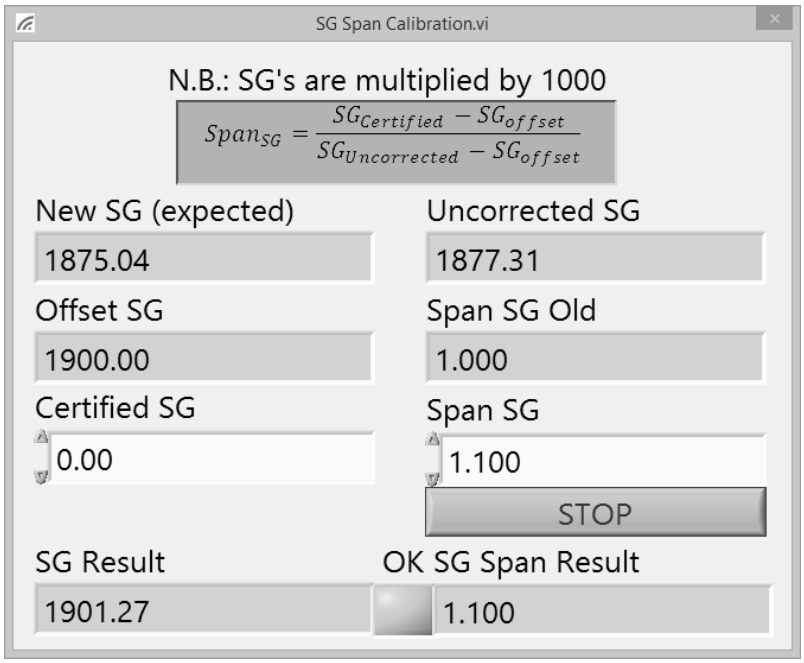
8.3.2 SGx1000 span calibration

NOTE:
Do not perform this calibration unless it is on request from Rhosonics.

The SGx1000 span calibration can be performed by 2 methods.

1 By entering the certified SGx1000. This should not be performed at the same SGx1000 as the offset calibration.

2 By changing the span factor. This can be performed at any current reading for SGx1000. The span factor changes the sensitivity for the SGx1000. If necessary it can be calculated by using the formula at the top of the calibration screen. In that case it is however easier just to enter the certified SGx1000 as is described in method 1.



9. Technical specifications

9.1 Operation characteristics

Solids:

Resolution	0.02 wt%
Accuracy	+/- 0.005 wt%
Reproducibility	0.1 wt%
Range	0 … 80 wt%

HART 4-20mA Output (1x):

Type	Active sourcing
Resolution	± 0.002 % of FS
Repeatability	± 0.02 % of FS
Output current	± 4-20 mA into 250 Ω load

Interfaces:

Serial interface HART, USB

9.2 SDM WT housing

Dimensions (SDM, housing)	Ø125x212 mm, (ØxL)
Dimensions (SDM, sensor tip)	Ø60x65 + Ø25x(16/34/52/146/200) mm, (ØxL)
Display effective area	65x35 mm (WxH)
IP rating (with covers)	IP 68
IP rating (without covers)	IP 54
Ambient Temperature	-5°C to +50°C
Relative humidity	< 95% at 40ºC (noncondensing)
Display resolution and color	240x128 dots (WxH), 5 colors
Control push-buttons	Pillow embossed metal dome, 4 pieces
Weight	6.4-6.8 kg
Power consumption	maximum 8 W
Fuse (24 VDC)	5x20 mm, 630 mA (T)
Storage conditions	-40°C to +75°C

WARNING:

Do not open the covers when circuits are alive in hazardous areas.

9.3 SDM WT sensor

Wetted parts:

(Alloyed) Silicon nitride	Si3N4
Duplex Steel	ASTM/ASME: A240 UNS S32205/S31803 EURONORM: 1.4462 X2CrNiMoN 22.5.3 AFNOR: Z3 CrNi 22.05 AZ DIN: W.Nr 1.4462 ISO: 4462-318-03-I BS: 318S13 SS: 2377 JIS: SUS 329J3L

9.4 Spool / Weldolet / Wafer

Specific dimensions:

- Spool: Diameters up-to 30” (NW 750 mm)
- Weldolet:
  - SDM-2 up to wall thickness 19 mm
- Wafer: Diameters up-to 60” (NW 1500 mm)

Please contact Rhosonics for exact dimensions. All is depending on the pipe schedule and flange specifications.

10. Appendices

10.1 List of spare parts

- Fuses Ø5x20 mm, 630 mA, Slow, Art#: **ZEPC-FUSE-T630MA-5X20**
- Sensor (incl. Seal ring), Art# : **3A0-322-043-A**
- Sensor (excl. Seal ring), Art#: **3A0-322-032-A**
- Seal ring, Art#: **TRI-CLAMP-1½Z-ENVELOP**
- Clamp for sensor, Art#: **TRI-CLAMP-HEAVY-1½Z**
- Cover front, Art#: **3A0-212-027-A** (also fits on the back side)
- Housing with electrical parts inside, Art#: **3A0-210-031-A**

10.2 Options

- Power supply/converter, 24VDC out, 90…264 VAC in,
  Art#: **ZEAS-PS-24VDC-DNR18US24**
- HART to Modbus RTU converter,
  Art#: **9999-GATEWAY-GW-800-B**
- Service kit,
  Art#: **9D-SERVICE-KIT** (contains USB-A male to USB-A male cable, 2 meter and Rhosonics software for service), Distributors only

10.3 Appendix A: Sound speed of water at 0 to 100 °C

T [°C]	c [m/s]	T [°C]	c [m/s]	T [°C]	c [m/s]	T [°C]	c [m/s]
0	1402.388	25	1496.687	50	1542.551	75	1555.133
1	1407.367	26	1499.323	51	1543.619	76	1555.081
2	1412.232	27	1501.883	52	1544.636	77	1554.991
3	1416.985	28	1504.37	53	1545.601	78	1554.862
4	1421.628	29	1506.784	54	1546.517	79	1554.696
5	1426.162	30	1509.127	55	1547.382	80	1554.492
6	1430.589	31	1511.399	56	1548.199	81	1554.251
7	1434.912	32	1513.603	57	1548.967	82	1553.974
8	1439.132	33	1515.738	58	1549.687	83	1553.66
9	1443.251	34	1517.806	59	1550.36	84	1553.31
10	1447.27	35	1519.81	60	1550.986	85	1552.924
11	1451.191	36	1521.745	61	1551.566	86	1552.504
12	1455.016	37	1523.618	62	1552.101	87	1552.048
13	1458.747	38	1525.428	63	1552.59	88	1551.558
14	1462.384	39	1527.176	64	1553.035	89	1551.034
15	1465.931	40	1528.863	65	1553.437	90	1550.476
16	1469.387	41	1530.489	66	1553.794	91	1549.884
17	1472.755	42	1532.066	67	1554.109	92	1549.259
18	1476.036	43	1533.564	68	1554.381	93	1548.602
19	1479.231	44	1535.015	69	1554.611	94	1547.912
20	1482.343	45	1536.409	70	1554.799	95	1547.19
21	1485.372	46	1537.746	71	1554.947	96	1546.436
22	1488.319	47	1539.028	72	1555.053	97	1545.651
23	1491.187	48	1540.256	73	1555.12	98	1544.834
24	1493.976	49	1541.43	74	1555.146	99	1543.987
						100	1543.109

Sound speed of water [m/s] at different temperatures [°C]

10.4 Appendix B: Density of water at 0 to 100 °C

T [°C]	RHO [g/l]	T [°C]	RHO [g/l]	T [°C]	RHO [g/l]	T [°C]	RHO [g/l]
0	999.86341	25	997.04784	50	988.00825	75	974.85658
1	999.91390	26	996.78615	51	987.55238	76	974.25961
2	999.94857	27	996.51495	52	987.09017	77	973.65750
3	999.96773	28	996.23442	53	986.62172	78	973.05025
4	999.9717	29	995.94474	54	986.14709	79	972.43790
5	999.96082	30	995.64608	55	985.66636	80	971.82046
6	999.93537	31	995.33859	56	985.17959	81	971.19794
7	999.89566	32	995.02246	57	984.68686	82	970.57037
8	999.84198	33	994.69781	58	984.18822	83	969.93776
9	999.77462	34	994.36483	59	983.68373	84	969.30013
10	999.69386	35	994.02363	60	983.17346	85	968.65748
11	999.59998	36	993.67438	61	982.65745	86	968.00984
12	999.49325	37	993.31720	62	982.13577	87	967.35721
13	999.37393	38	992.95224	63	981.60845	88	966.69961
14	999.24227	39	992.57962	64	981.07555	89	966.03705
15	999.09854	40	992.19946	65	980.53711	90	965.36954
16	998.94297	41	991.81189	66	979.99318	91	964.69708
17	998.77580	42	991.41702	67	979.44379	92	964.01969
18	998.59727	43	991.01497	68	978.88899	93	963.33739
19	998.40761	44	990.60585	69	978.32881	94	962.65017
20	998.20703	45	990.18976	70	977.76328	95	961.95804
21	997.99576	46	989.76681	71	977.19245	96	961.26103
22	997.77400	47	989.33709	72	976.61633	97	960.55912
23	997.54196	48	988.90070	73	976.03496	98	959.85235
24	997.29984	49	988.45772	74	975.44837	99	959.14070
						100	958.42421

Density of water [g/l or kg/m3] at different temperatures [°C]

10.5 Appendix C: SDM WT HART Commands

The SDM WT supports all universal and common practice commands as described in the:
"HART Field Device Specification: Rhosonics 9D-series analyser"

10.5.1 Relevant SDM WT device specific commands

All device specific commands are supported the following have relevance for the SDM WT:

Command nr.	Description
150	Read factory configuration model
215	Read interface measurements
217	Read temperature offset
218	Write temperature offset
219	Read SGx1000 offset
220	Write SGx1000 offset
221	Read SG span
222	Write SG span
224	Undo customer calibrations
225	Read measurement types
236	Read density

10.5.2 Relevant SDM WT device variables

Following device variables have relevance for the SDM WT, because it is either measured with a sensor or a result of a calculation:

Device variable nr.	Description
3	Temperature
4	SGx1000

ABOUT US

RHOSONICS
Measuring Beyond Limits

MEASURING BEYOND LIMITS

Rhosonics is based in the Netherlands near Amsterdam. We design, produce and supply state-of-the-art measuring instruments for virtually any industry. The company cooperates with partners worldwide to offer the best technology solutions. We use craftmanship, capability and creativity to create measurement beyond limits.

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