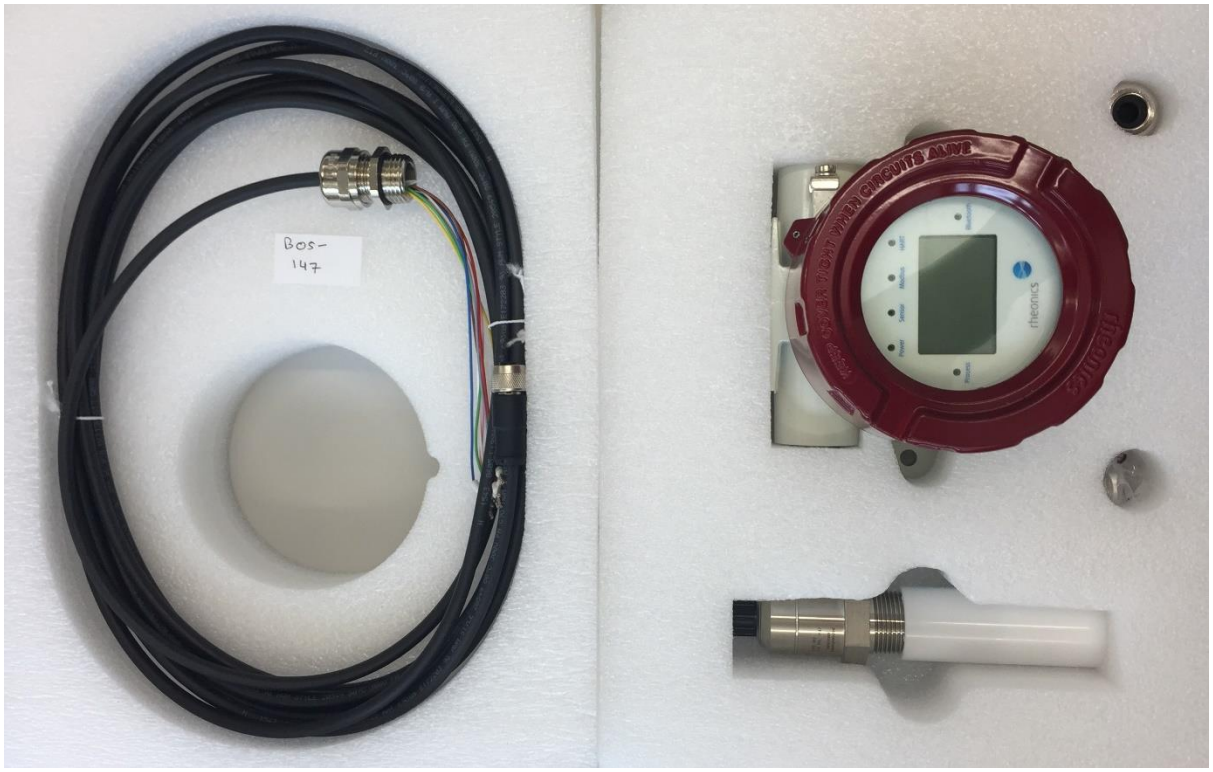
Contents

1 What's in the box 2
2 Preparing the system 2
3 Connecting and disconnecting wires to the terminal blocks on SME electronics 3
4 Connecting sensor to transmitter electronics 5
5 Powering the Transmitter 6
6 Connecting 4-20 mA outputs 7
7 Connecting Modbus RTU (RS-485) outputs 8
7.1 General 8
7.2 Wiring 8
7.3 Configuration 9
7.4 Input Registers 9
7.5 Data-Types 10
8 Operating the system 11
8.1 Viscosity measurement 12
9 Handling the Sensor 13
9.1 Cleaning the sensor 13
10 Notes/Errata: 15

1 What's in the box

The following items are delivered with the SRV system:

- Sensor cable
- Electronic transmitter, SME
- SRV sensor
- USB stick with software tool installer
- Cable glands (optional)



2 Preparing the system

The sensor measurement system consists of two components:

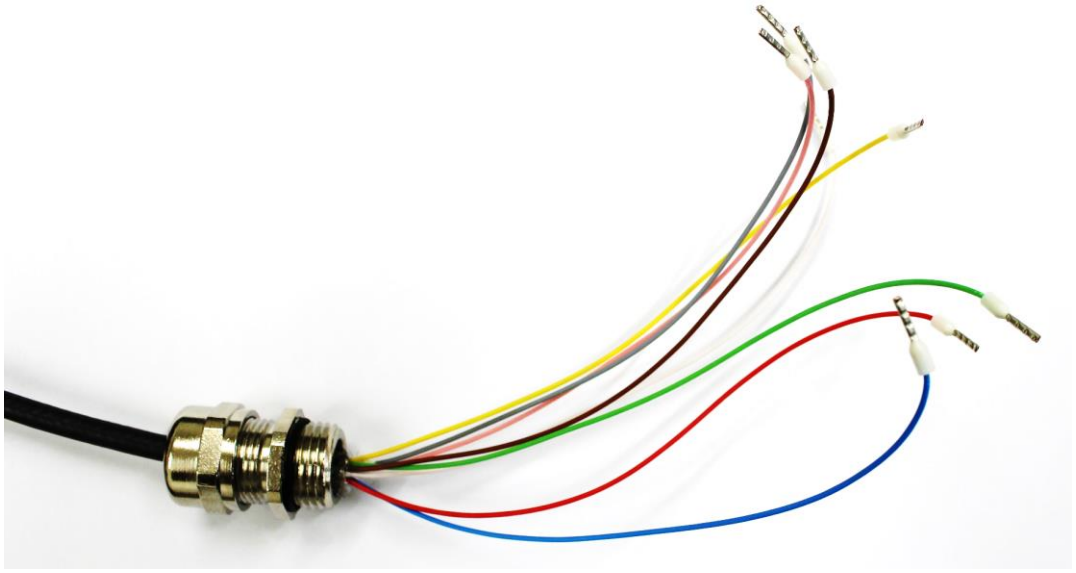
- SRV Sensor
- SME Transmitter (Electronics unit)

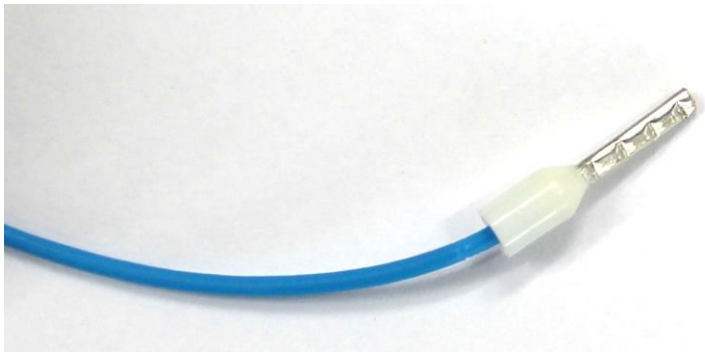
The transmitter is shipped fully assembled. Gain access to the connections by unscrewing the cover and removing the display (if ordered with display) by pulling it out. The SME electronics module is now accessible for connecting the sensor, power, and communication cables.

©Rheonics, Inc. 2013-17
Confidential to customer. Do not distribute without written permission of Rheonics, Inc.

3 Connecting and disconnecting wires to the terminal blocks on SME electronics

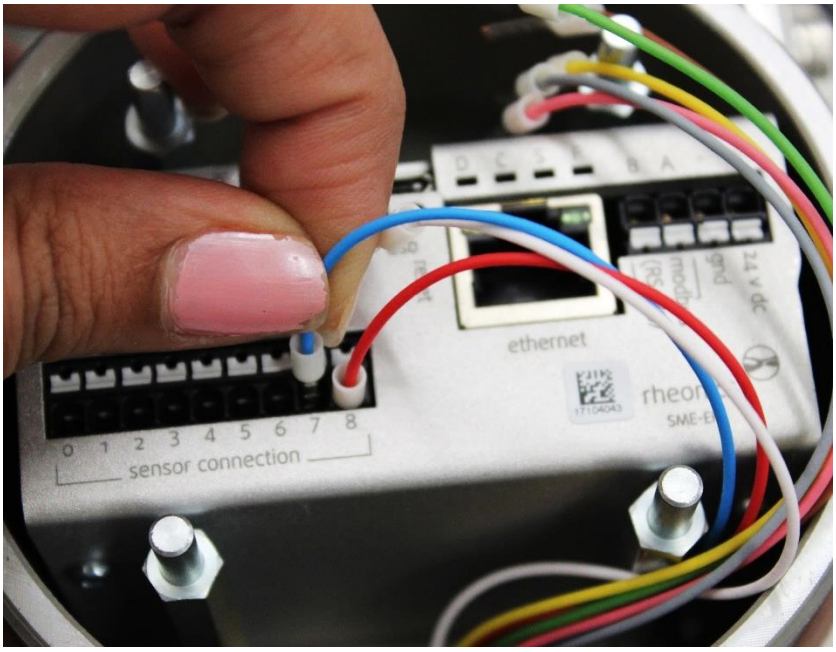
The wires are generally color coded, the ends should be crimped with 8mm diameter crimps. This connection is valid for sensor cable, power cable, Modbus cable, 4-20 mA cables.



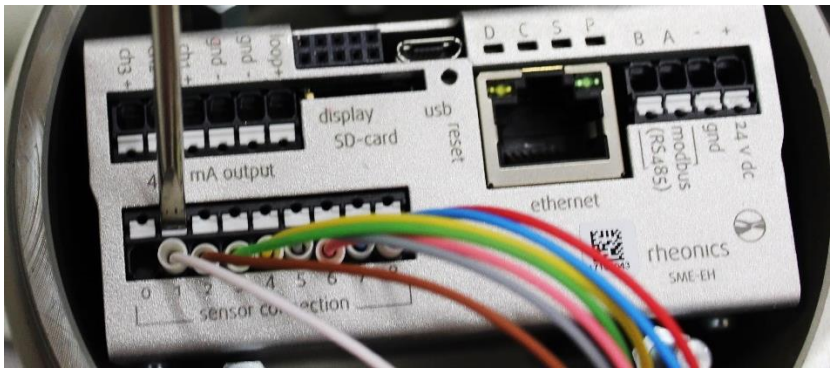


To connect the wires, insert the crimped end in the correct port on the terminal block till it clicks firmly in place and cannot be pulled out when tugging on the wires (do not tug on the wires with a lot of force as that may damage the terminal block).

©Rheonics, Inc. 2013-17
Confidential to customer. Do not distribute without written permission of Rheonics, Inc.



To disconnect the sensor wires, press the white tab for that specific port with a small flat screw driver as shown in picture below where the user is removing wire connected to port 1.



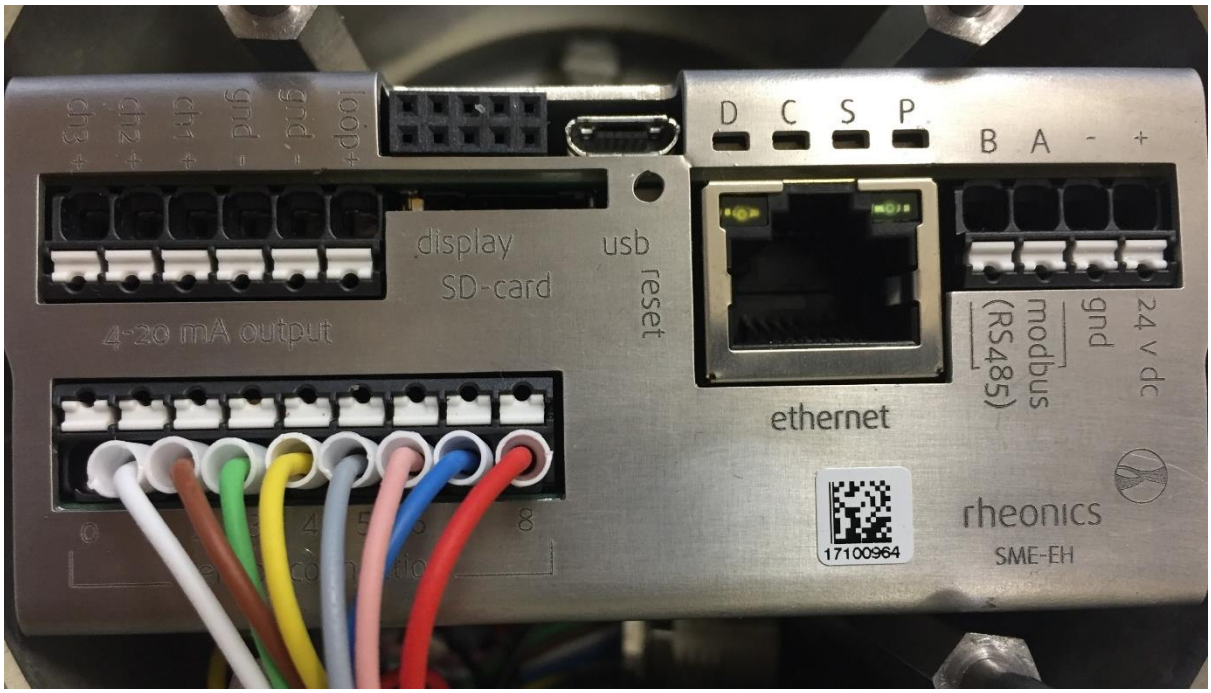
While pressing on the white part, pull out the cable connection with the other hand as shown in the picture below.

©Rheonics, Inc. 2013-17
Confidential to customer. Do not distribute without written permission of Rheonics, Inc.



4 Connecting sensor to transmitter electronics

The sensor is connected to the transmitter electronics by a sensor cable. Follow the color code table below to connect the correct wires from the sensor cable to the sensor connection terminal strip on the transmitter. The leads are delivered with crimped ends; cable can be shortened if needed, but sleeves should be crimped on the stripped ends.



©Rheonics, Inc. 2013-17
Confidential to customer. Do not distribute without written permission of Rheonics, Inc.

Wire Color	Sensor connection terminal #
Red	8
Blue	7
Pink (Rose)	6
Grey	5
Yello	4
Green	3
Brown	2
White	1
---not connected---	0

5 Powering the Transmitter

Connect a 24V DC supply to the power input terminals on the transmitter.

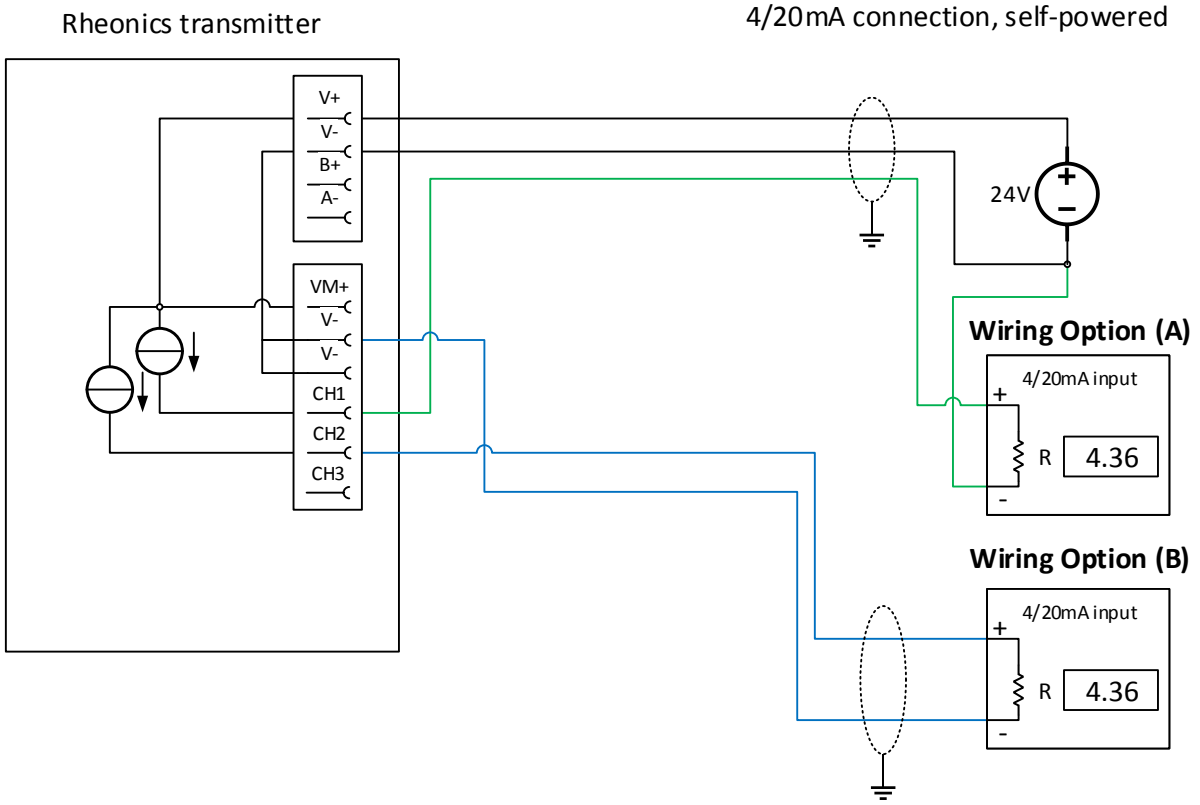
Power input terminals are labeled with 24 V DC + and – GND.

It is important to avoid ground loops in the setup / plant where the SMET is used. Ground loops can lead to excessive currents on the ground / return wire of the SMETs 24V power supply which can damage the unit.

To prevent this, we strongly recommend that the SMET is powered by a separate 24V power supply with galvanic separation. Otherwise, the SMET might be permanently damaged.

©Rheonics, Inc. 2013-17
Confidential to customer. Do not distribute without written permission of Rheonics, Inc.

6 Connecting 4-20 mA outputs



Load impedance: 0 to 720 Ohms
Output range: 4-20mA, (3.5mA error)
Galvanic isolation: none

Wiring Option (A)

- Connect positive terminal of current input module to desired channel terminal of SME device
- Connective negative terminal of current input module to negative power supply terminal used for SME device

Wiring Option (B)

- Connect positive terminal of current input module to desired channel terminal of SME device
- Connective negative terminal of current input module to V- terminal of SME device

Notes

- The 4/20mA outputs are not galvanically isolated. It is not recommended to route the 4/20mA to off-site locations if the corresponding 4/20mA input does not provide galvanic isolation.

©Rheonics, Inc. 2013-17
Confidential to customer. Do not distribute without written permission of Rheonics, Inc.

7 Connecting Modbus RTU (RS-485) outputs

7.1 General

All SME devices implement a MODBUS RTU compliant RTU slave. The default configuration of the MODBUS RTU slave is 38400 and ODD parity. Connection is by RS485-2W where the interface is not electrical isolated.

7.2 Wiring

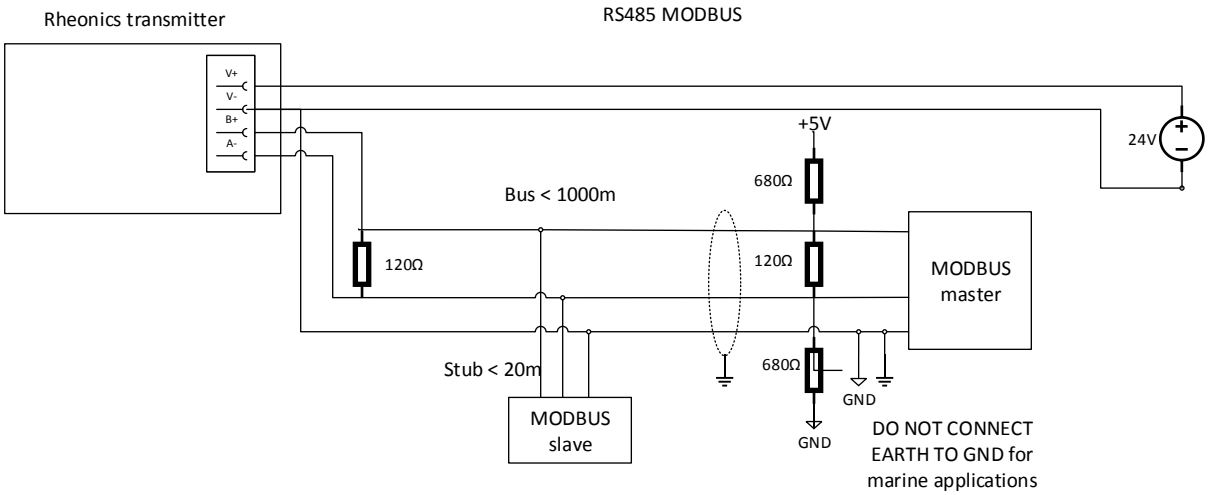
Wiring is RS485-2W. The device does not have internal biasing resistors and termination resistors and proper setup of the RS485 network has to be ensured.

Termination: Termination should be only at the end and beginning of the bus to avoid reflections. Requirements on termination differ not only on the baud-rate used but also on the slew-rate of device internal drivers. As a general rule, if there are devices on the RS485 bus that allow fast transmission speeds, and cable lengths exceed a few meters, then termination is required.

Biasing: Biasing of the RS485 BUS is required. If biasing is omitted, communication may work unreliably or not at all. See figure below for Pull-Up/Pull-Down resistors.

Connections: Connection stubs on the RS485 bus should be kept to the minimum.

Common: RS485 does allow common mode voltages of +12V / -7V. It is therefore recommended to use a common wire to ensure common mode voltage is within safe limits for all receivers. In case of problems it might be necessary to introduce RS485 isolators into the network. The common terminal for the SME device is the 0V terminal (GND) for the power supply.



©Rheonics, Inc. 2013-17
Confidential to customer. Do not distribute without written permission of Rheonics, Inc.

7.3 Configuration

The SME device allows the configuration of the Modbus address using the RCP software. Please refer to the RCP manual for instructions.

Factory default settings of Modbus parameters:

address=0 or 1

baudrate=38400

parity=odd

The system is capable of supporting:

- parity settings of odd, even and none
- baudrates of 9600, 19200 and 38400

7.4 Input Registers

The table uses PDU addressing; addresses start at zero. Depending on the PLC used it might be required to add 1 to the addresses in the table below

Table 1: Modbus input registers.

Address (Dec)	Length of registers	Type	Description
Parameter 1			
40	2	Float	Parameter 1 value as float
42	1	Int16	Parameter 1 value scaled by 100 as signed integer
43	1	Uint16	Parameter 1 status (See datatypes)
Parameter 2			
48	2	Float	Parameter 2 value as float
50	1	Int16	Parameter 2 value scaled by 100 as signed integer
51	1	Uint16	Parameter 2 status (See datatypes)
Parameter 3			
58	2	Float	Parameter 3 value as float
60	1	Int16	Parameter 3 value scaled by 100 as signed integer
61	1	Uint16	Parameter 3 status (See datatypes)
Parameter 4			
64	2	Float	Parameter 4 value as float
66	1	Int16	Parameter 4 value scaled by 100 as signed integer
67	1	Uint16	Parameter 4 status (See datatypes)
Parameter 5			
72	2	Float	Parameter 5 value as float
74	1	Int16	Parameter 5 value scaled by 100 as signed integer

©Rheonics, Inc. 2013-17
Confidential to customer. Do not distribute without written permission of Rheonics, Inc.

75	1	Uint16	Parameter 5 status (See datatypes)
Parameter 6			
80	2	Float	Parameter 6 value as float
82	1	Int16	Parameter 6 value scaled by 100 as signed integer
83	1	Uint16	Parameter 6 status (See datatypes)
Parameter 7			
88	2	Float	Parameter 7 value as float
90	1	Int16	Parameter 7 value scaled by 100 as signed integer
91	1	Uint16	Parameter 7 status (See datatypes)
Parameter 8			
96	2	Float	Parameter 8 value as float
98	1	Int16	Parameter 8 value scaled by 100 as signed integer
99	1	Uint16	Parameter 8 status (See datatypes)

7.5 Data-Types

Float: IEEE754 floating point. This data type spans two registers which should be read together. Depending on the endianness of the host it might be necessary to swap high/low byte and/or the respective registers.

Int16: Signed 16 bit integer (register)

Uint16: Unsigned 16 bit integer

Parameter status: The parameter status is a bitmask of individual status bits. As a general rule Bit 0 checking should be implemented where a set bit corresponds to an error/warning condition. In case of a critical error the parameter value is also set to NAN (not a number – See IEE754)

Bit 0: General error – Check other bits for more detailed configuration

Bit 1: Internal configuration error – Restart. If error persists call Rheonics for support

Bit 2: Hardware error, e.g. broken temperature sensor. Call Rheonics for support and arrange RMA

Bit 3: Dependency error: a parameter is calculated from other parameters and one of the source parameter has an error. Check all other parameters for errors.

Bit 4: Device is starting up and no results are ready.

Bit 5: Internal error – Restart. If error persists call Rheonics for support.

Bit 8: Parameter result is not stable. Check measurement conditions (flow, vibration, etc.)

Bit 15: Parameter exceeds sensor upper limit. No results available.

Bit 14: Parameter below sensor lower limit. No results available.

©Rheonics, Inc. 2013-17
Confidential to customer. Do not distribute without written permission of Rheonics, Inc.

Bit 13: Parameter value above upper warning range. Measurements might not be accurate and sensor performance might be reduced.

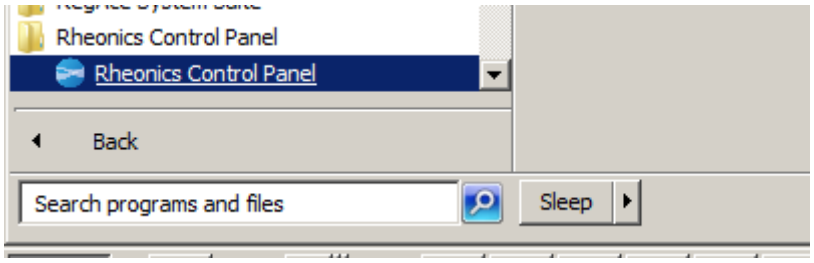
Bit 12: Parameter value below lower warning range. Measurements might not be accurate and sensor performance might be reduced.

8 Operating the system

After installing the software and setting up the port, the system may now be started. The installation of the Rheonics Control Panel (RCP) Software and its settings are described in the RCP manual.

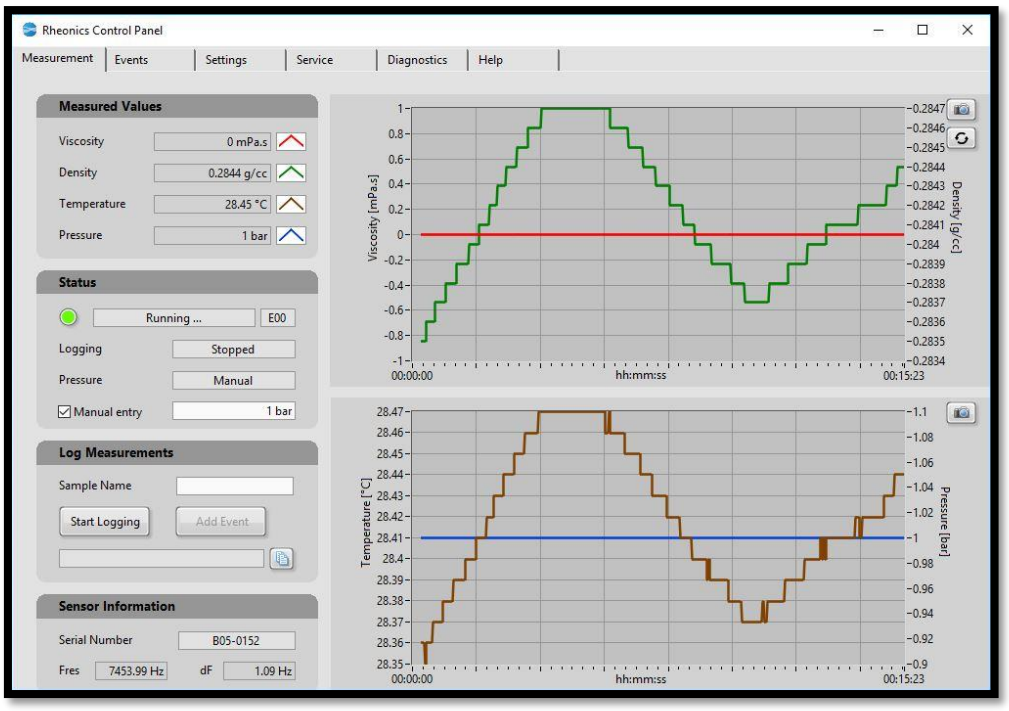
THE ELECTRONIC BOX MUST BE ATTACHED TO THE COMPUTER WITH THE USB CABLE AND POWERED UP IN ORDER FOR THE SYSTEM TO OPERATE

1. Connect the sensor to the Transmitter (instructions in section 2)
2. Connect power to Transmitter (instructions in section 3)
3. Connect the micro USB cable to the Transmitter electronics. Connect the other end to a free USB port on the computer.
4. Now that the proper operating mode has been established, run the Rheonics Control Panel software. The Rheonics Control Panel application is operned from the Start menu.



When the software is running, you will see a screen similar to the following:

©Rheonics, Inc. 2013-17
Confidential to customer. Do not distribute without written permission of Rheonics, Inc.



For help about the Rheonics Control Panel (RCP) and its settings see:
Help -> RCP – Rheonics Control Panel Software manual

8.1 Viscosity measurement

The SRV measures the density-viscosity product of the fluid:

Density-Viscosity Product = ρ*η ρ = Density [g/cc]
η = Dynamic viscosity [mPa.s]

The Rheonics Control Panel allows you to enter the appropriate fluid density to obtain the dynamic viscosity (η, in mPa.s) or kinematic viscosity (η/ρ, in cSt). By default, the electronics and software use 1 g/cc as the density. To enter the actual density of the fluid in the software, follow the instructions in the RCP manual.

NOTE:

Electronics box can be programmed to set a constant or temperature-dependent density value. Please check RCP manual for instructions on changing the density in the transmitter electronics.

©Rheonics, Inc. 2013-17
Confidential to customer. Do not distribute without written permission of Rheonics, Inc.

9 Handling the Sensor

The SRV is a stable, robust sensor system that operates over a wide range of temperatures and pressures. The sensor is made of 316L stainless steel, which resists attack by a wide variety of highly corrosive fluids.



In order to get optimum performance from the system, some simple guidelines must be followed.

9.1 Cleaning the sensor

The SRV is based on a resonant sensing element that operates in the range of approximately 7-8 kHz. The sensor measures viscosity in a thin layer of fluid surrounding the resonant element.

In any measurement scenario in which the sensor could become coated with tenacious fluids and solids, it is recommended that the sensor be removed and mechanically cleaned at appropriate intervals.

Adherent films can be removed by using appropriate solvents, ultrasonic cleaning, and/or wiping with solvent-saturated cloth or paper. Under no circumstances should abrasives be used to clean the resonator, as these will change the geometry and destroy its calibration.



Cleaning the sensor with solvent-saturated cloth or paper

Please note that it is difficult to get accurate measurement with plain water stationary in the SRV measurement area. Even degassed water tends to have air dissolved in it, which eventually forms micro bubbles on the surface of the sensor, disturbing its geometry. This is not a problem at higher pressures, which tend to re-dissolve any gases present. Hydrocarbons, glycols, and other fluids with low surface tension are less prone to bubble formation.

©Rheonics, Inc. 2013-17
Confidential to customer. Do not distribute without written permission of Rheonics, Inc.

The SRV will operate in static fluids as well as flow rates in excess of 100 l/min. Flow may be in either direction, subject to the above caution about the effects of bubbles.

©Rheonics, Inc. 2013-17
Confidential to customer. Do not distribute without written permission of Rheonics, Inc.

10 Notes/Errata:

©Rheonics, Inc. 2013-17
Confidential to customer. Do not distribute without written permission of Rheonics, Inc.