SENSIRION

Operating Guidelines for Liquid Flow Meter Kits

For SF04 based Liquid Flow Meters

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1 Introduction

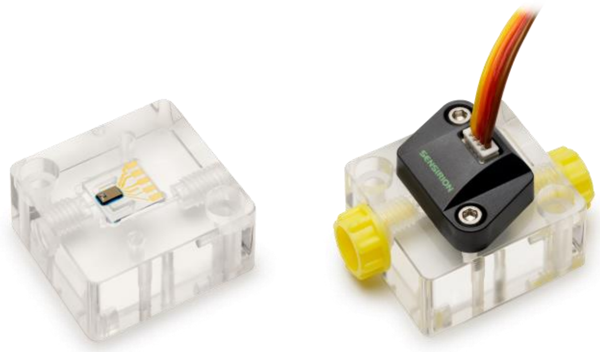
The Sensirion liquid flow meters allow (ultra-)low liquid mass flows to be measured at low power consumption and with a very fast response. The inert flow meters feature outstanding sensitivity and a unique dynamic range. Moreover, they are fully calibrated and provide a digital or analog voltage output signal. This can be accessed via Sensirion’s smart SCC1-USB Sensor Cable (included in all kits) with serial communication or via the SCC1-Analog Sensor Cable (only included in the SLx kits). The mass flow meter can be controlled from your PC with the supplied Windows Sensirion Viewer Software.

2 Getting Started

Sensirion`s **Liquid Flow Meter Kits** contain the following components:

Liquid Flow Meter Kit for **SLx Series**:
- The SLx Liquid Flow Meter of your choice:
  - **SLI-xxxx**, **SLS-xxxx**, **SLG-xxxx** or **SLQ-QTxxx**
- SCC1-USB Sensor Cable with USB connector for plug-and-play connection to a PC
- SCC1-Analog Sensor Cable with 0…10 V analog output
- A set of fluidic connectors for the selected sensor type
- Quick Start Guide

Evaluation Kit for **LPG10-1000**:
- Pre-assembled manifold body including **LPG10-1000** sensor and 4-pin Molex connector
- SCC1-USB Sensor Cable with USB connector for plug-and-play to a PC
- Adapter cable for 4-pin Molex to SCC1-USB Cable
- 4-pin Molex ribbon cable
- Quick Start Guide



2.1 PC Requirements

- Windows 7, 8, or 10. Older Windows versions may not be compatible and are not recommended.
- One available USB port for communication

2.2 Software Installation

To install the Sensirion Viewer Software, please download the latest version from our website (www.sensirion.com/file/usb-viewer).
After opening the installer file, select Run to begin the Installation Wizard and follow the instructions to allow the viewer to install software on your PC

Please note: This software is copyrighted and intended exclusively for laboratory and demonstration purposes. It may not be used or multiplied commercially. SENSIRION does not offer any warranty on Windows software features.

2.3 Connecting the Liquid Flow Meter to the PC

- Connect the SCC1-USB Sensor Cable to a USB port of the PC
- When plugging in the USB cable, the necessary Virtual Com-Port (VCP) driver should be installed automatically. After the driver has been successfully installed, the device appears in the windows device manager as USB Serial Port. If this does not happen, please install the necessary VCP driver manually from the original driver manufacturer: www.ftdichip.com/Drivers/VCP.htm
- Connect the SCC1-USB Sensor Cable to the sensor. Depending on the sensor type you may have to use the adapter cable.

Your liquid flow meter is now connected with your PC and ready to use.

2.4 Connecting the Fluidic System to the Liquid Flow Meter

Depending on the selected liquid flow meter type, a basic set of fluidic connectors may be included in your Flow Meter Kit. If other connectors are needed, we recommend purchasing them through fluidic connector manufacturers such as Idex (www.idex-hs.com), Vici (www.vici.com), or Nordson Value plastics (www.valueplastics.com). For details, consult the Application Note Sensor Ports and Tubing Connections at www.sensirion.com/download-center.

Use caution to avoid overtightening fittings that could create a leak path. Finger tight is generally acceptable (with the exception of the SLG sensors when hooked up to high pressure). Follow the recommendations of the fluidic connector manufacturer for the given fittings you work with.

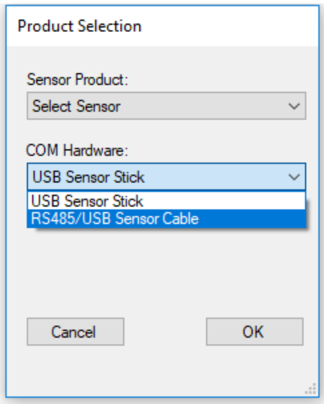
We highly recommend using inlet tubing equal to or larger than sensor's flow channel inner diameter (ID), otherwise turbulences may affect the sensor performance at higher flow rates (the sensor datasheet contains flow channel ID information for your reference).

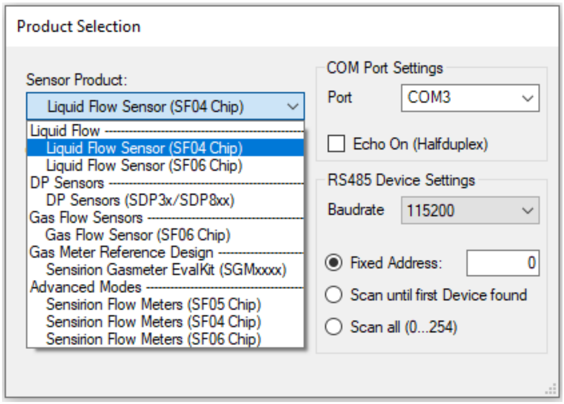
The sensor should be installed in a fixed horizontal position for best performance. However, if the sensor is mounted vertically it will also perform very well but may present a zero-shift (offset). Keep fluid temperatures within 3 degrees of the sensor temperature for best performance and preferably use dispense durations of at least 500 ms for best accuracy.

Finally, please note that many pumps deliver pulsatile flow where peak values may significantly exceed average flow values. Your flow meter may crop data prematurely if the peak flow rate is too high and saturates the sensor. Verify peak flows against maximum rated flow of the sensor. You can also try dampening the flow to reduce peak rates. Sometimes an additional length of flexible tubing along with a restriction will suffice.

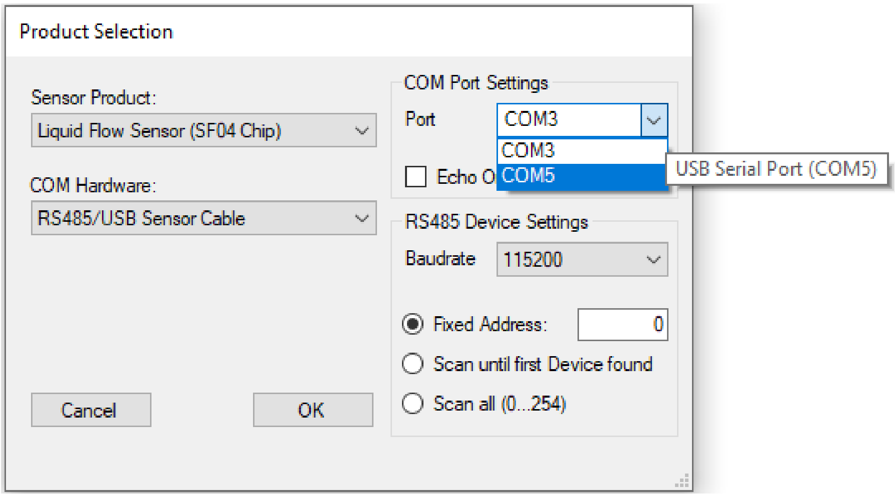
3 Sensirion Viewer Software

To start the USB/RS485 Sensor Viewer, double click its icon. When the “Product Selection” pop-up window appears, first select “RS485 Sensor Cable” under “COM Hardware” followed by the “Sensor Product” with the selection “Liquid Flow Sensor (SF04 Chip)”.

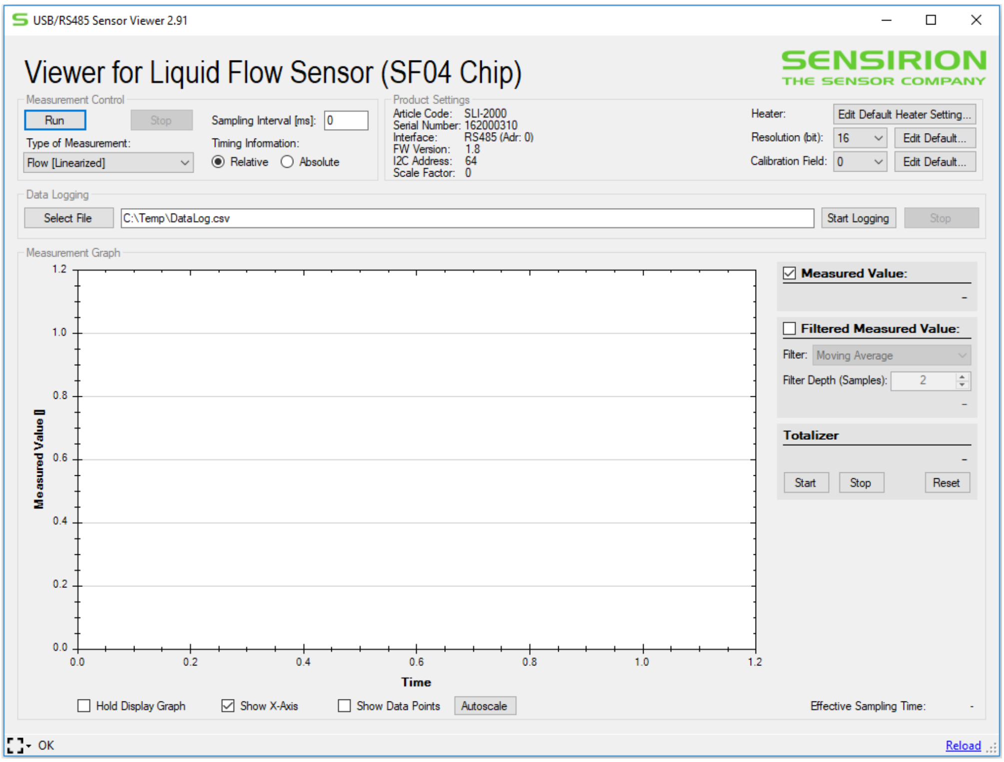




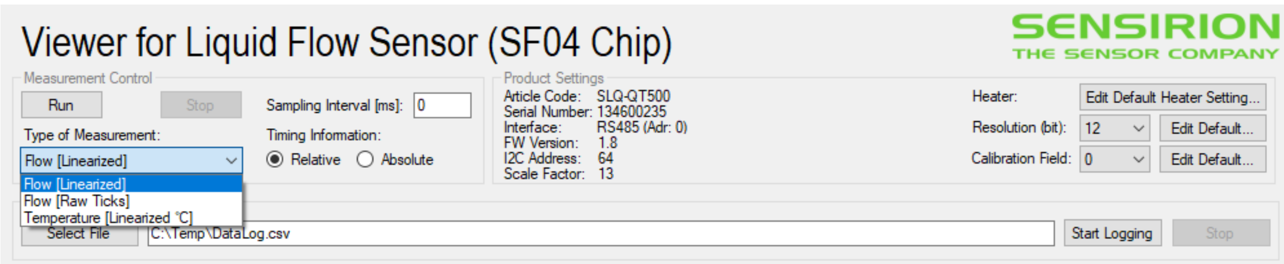
Default “COM Port Settings” and “RS485 Device Settings” are generally recommended for liquid flow meters. If you cannot communicate with the sensor, try selecting a different COM port so that “USB Serial Port” appears next to your COM port setting as shown in the screenshot below.



Once the connection has been set up, the USB/RS485 Sensor Viewer main window will appear:



From the main window a wide variety of functions can be accessed. The main window functions are described below:



Run: Starts the measurement. In the default setting you will see the sensor's response graphically displayed as a running green line that rises and falls with the flow rate.

Stop: Stops the measurement. For many functions on the main screen you will need to stop the current measurement before making changes.

Type of Measurement: Choose from:

Flow [Linearized]: This is the most common setting. It accesses the active calibration field stored on the sensor chip to provide a linear response to changes in flow.

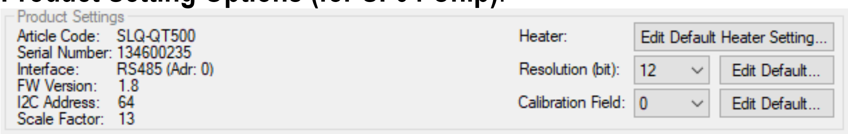
Flow [Raw Ticks]: In some cases, it may be useful to use the raw data mode without influence from the linearization. This mode has an inherently nonlinear behavior.

Temperature [Linearized °C]: You may access the temperature reading on board the sensor chip. This is neither a direct measurement of the fluid nor a measurement of ambient conditions. It is a combination of the two (and on-chip electronics) that provides a coarse temperature reading near the flow measurement location.

Sampling Interval [ms]: The sampling interval determines how often the viewer will trigger the sensor to capture data with the selected data bit resolution (see 'Resolution (bit)'). Value 0 will automatically select the fastest sampling time for a given data bit resolution setting. Signal integration time (averaging) is controlled by the data bit resolution, see next page.
You may enter non-zero values to add 'artificial waiting times' between measurements. For example, a 10 ms sampling time with a 9 bit resolution means the sensor collects a data point during the first 1 ms then waits 9 ms (for total of 10 ms) before collecting the next data point. No data is collected during the 9 ms waiting time. A better match for 9 bit resolution is a 1ms sampling time to avoid having the sensor sit idle and possibly miss important flow information. Set Sampling Time to 0 to automatically achieve this.
If you would like to collect data during a long time with steady flow conditions, enter a long sampling time to reduce the amount of data and select 16 bit resolution for approximately 64 ms long measurements.

Timing Information: Default setting of "Relative" is generally preferred. This means data files saved will show initial reading taking place at time zero and every reading thereafter incrementally increasing by sampling time (or averaging time determined by bit resolution, whatever is larger). When "Absolute" is selected the actual time at measurement (according to the PC clock) is inserted instead. Either setting has no effect on real time graphical representation of the flow rate in the Viewer main window.

Product Setting Options (for SF04 Chip):



Article Code: Displays the Sensirion sensor model name. Not user adjustable.

Serial Number: Displays Sensirion serial number which is unique to each flow meter. Not user adjustable.

Interface: Displays existing communication link (typically RS485 for liquid flow meters).

FW Version: Displays current RS485 cable firmware version for reference.

I2C Address: Displays flow meter I^2C address for reference. Not user adjustable. When integrating flow sensors in custom software, customer will set RS485 cable addresses not the flow sensor I^2C address.

Scale Factor: The scale factor is a number used by the viewer software to convert linearized flow data into units of flow (such as µL/min or mL/min). Flow in physical units is equal to linearized flow data (2 byte integers) divided by the scale factor. The scale factor is accessed from flow meter memory and is generally the same within a sensor model for a given fluid. However, Sensirion may modify this value in production to meet product specifications. The viewer software automatically displays the physical flow units if "Flow [linearized]" is chosen as measurement mode. The scale factor is not user adjustable.

Heater (Edit Default Heater Setting…): This button opens a dialog which allows changing the default configuration of the sensor's micro-heater. This feature allows the specially configured flow meters of the SLQ-QTxxx series to be used in general purpose applications. There is no need to change this setting when working with the viewer software, with the analog cable, or with other sensors than the SLQ-QTxxx.

Resolution (bit): This controls the time period over which the sensor averages (integrates) the signal. With a longer integration time, a higher number of significant data bits is achieved. The following table shows the correspondence of data bit resolution and typical integration (measurement) time per data point:

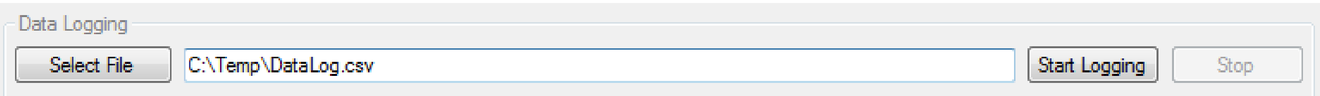
9 Bit:	1 ms
10 Bit:	2 ms
11 Bit:	3 ms
12 Bit:	6 ms
13 Bit:	10 ms
14 Bit:	20 ms
15 Bit:	40 ms
16 Bit:	80 ms

Although higher resolution settings are preferred for lower signal noise, resolution settings should be as fast as necessary to capture important flow profile details. For example, very short dispenses (500 ms or so) may demand 9 or 10 bit settings while slower events (many seconds) may be fine with 15 or 16 bit settings. The best way to find out what works is to test and compare various settings. For most dispenses a 12 or 13 bit setting is recommended as a good compromise.

Calibration Field (CF): Some Sensirion Flow Meters contain multiple calibration fields for different types of liquid (such as water or hydrocarbons on the SLI Series) or different flow ranges (e.g. Precision Mode vs. Extended Mode of SLG-0075). Selecting a calibration field that does not exist in the sensor will create an error message in our Viewer software. Please refer to the datasheet of your specific flow meter for details on what calibrations are available.

Edit default (Nonvolatile change of calibration field): When starting the sensor measurement, in general the default calibration field (factory setting: CF 0) is read from the memory and used for measuring. If you change the calibration field in the Viewer Software, this change is only temporary and not stored on the sensor. On the next restart, the default calibration field will be used again. To change the default calibration field, click "Edit Default…" and make a selection in the dialog box. This is particularly important for using the SCC1-Analog sensor cable with a calibration field that is different from the original default.

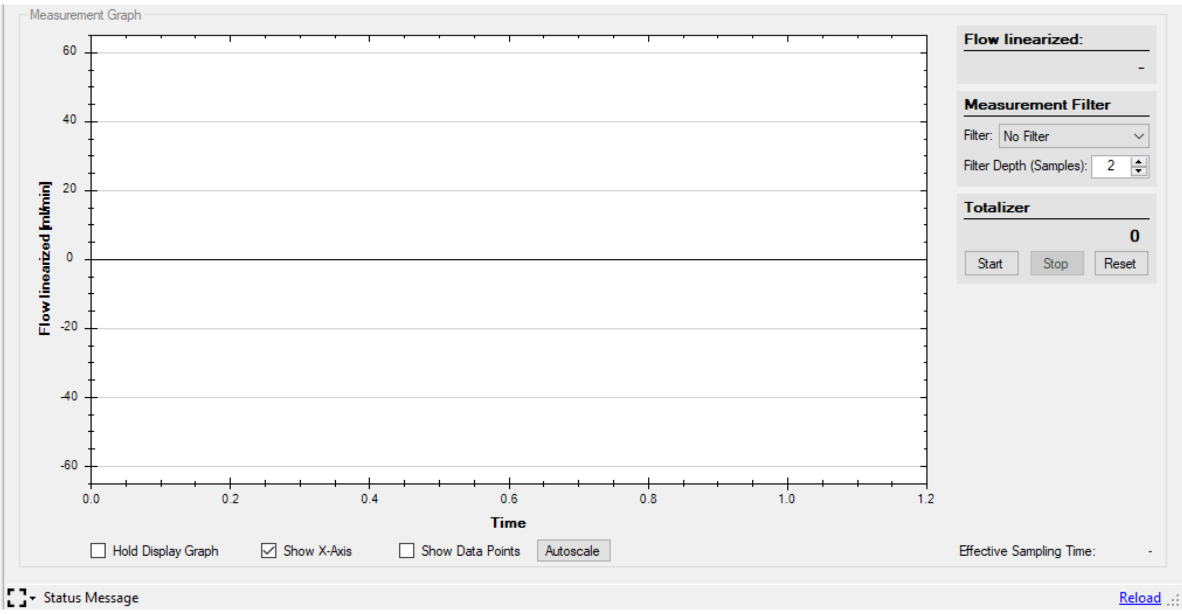
Data Logging:



Select File: By default, the Viewer Software will save to a "DataLog.csv" file in your Temp folder. This button allows you to select a different folder location or edit the file name. You may also type this information directly into the field next to the "Select File" button.

Start Logging: Select this button to save data on your computer. Once you have started logging, you must also press "Run" to start measurements otherwise the data file will be empty. You have the option to pause data collection and resume saving to the same data file. Or you can stop logging as described below.

Stop: Stops logging of data on to data file. You may resume data collection by either writing to a new file or overwriting the existing file.



Flow Rate: The display shows the real time flow rate measurement of the flow meter, averaged over and updated every 500 ms.

Measurement Filter: Select the filter type ('No Filter' or 'Average') as well as the number of samples to be used for the filter. The 'Average' filter is a simple moving average over the number of samples selected. The averaged flow signal is displayed as a blue line in the graph.

Totalizer: Use this tool for a simple volume measurement by integrating the flow rate over time.
'Start' starts the volume integration, 'Stop' stops the volume integration and 'Reset' resets the volume to zero.

Hold Display Graph: Selecting this checkbox turns off the real time display of flow events on the graph window.

Show X-Axis: Selecting this shows values for time on the X-Axis of the graph. If timing was previously set to "Relative", scale will start at zero with first data measurement. If set to "Absolute", scale will show real time in the format [hh:mm:ss:ms].

Show Data Points: Selecting this displays the individual data points.

Autoscale: Automatically scales the display graph to current measurement values.

Effective Sampling Time: Shows sampling rate currently used by flow meter.

Flow Graph and Zoom Level: Place your pointer over the graph and use your mouse scroll wheel to zoom in or out. You can also click and hold a region of interest to zoom into when you release. Right-click of the mouse will allow you to reset the zoom level.

Reload: Selecting this link will restart the Viewer Software.

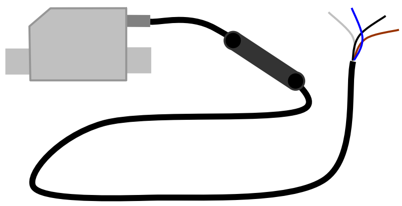
4 Analog User Interface for Easy Integration

For easy integration into your control system, an analog interface cable (SCC1-Analog) is included in the Flow Meter Kits for the SLx series. This cable provides the current flow rate as a 0..10 V analog output signal and additionally an open collector digital output which may be configured to work as a flow switch or as a volume counter.

Connect one side of the Analog Sensor Cable SCC1-Analog to the 4-pin M8 connector on the sensor and the other side according to the table below:

Wire Assignment

Wire	Function	Symbol	Values
Blue	Supply voltage	V_{supp}	**24 V** (min 12 V, max 36 V)
White	Ground	GND	
Brown	Analog output	A_{Out}	**0…10 V** max 10 mA
Black	Digital output	D_{Out}	Open collector



WARNING!
Incorrect connection may lead to permanent damage of the cable. Check the wire assignment carefully.

The analog output provides a voltage which corresponds to the measured flow rate. The flow rate is linearly mapped to the voltage across a user-specified range and can be calculated by the following formula:

$$flowrate = V_{AOut} \cdot \frac{flow_{at\ Vmax} - flow_{at\ 0V}}{\mathrm{Vmax}} + flow_{at\ 0V}$$

The values $flow_{atVmax}$ and $flow_{at0V}$ are set to the maximum and minimum (negative) flow rate of the sensor by default. Vmax is set to 10 V by default. See the table on the following page for specifications of different sensors. The SCC1-Analog Sensor Cable works with the default calibration field (factory setting: CF 0). This default can be changed with the USB/RS485 Sensor Viewer, version 2.30 and higher (see “Edit default”, page 9).

Example: The SLQ-QT500 has a maximum sensing range of +/-2500 µl/s. If the whole flow range is to be covered by the analog output, the two parameters $flow_{at10V}$ and $flow_{at0V}$ are set to -2500 µl/s and +2500 µl/s, respectively. A measured voltage of 8V at the analog output is then converted to the actual flow rate as follows:

$$8V \cdot \frac{2500\frac{ul}{s} - \left(-2500\frac{ul}{s}\right)}{10V} + \left(-2500\frac{ul}{s}\right) = 1500\frac{ul}{s}$$

4.1 Advanced Features

- Setting user-specified values for $flow_{atVmax}$, $flow_{at0V}$, and V_{max}.
- Using the digital output as
  - Flow switch
  - Volume counter
- Averaging function for analog and digital outputs

For using those features, please refer to the SCC1-Analog cable datasheet on [www.sensirion.com/download-center.](www.sensirion.com/download-center)

4.2 Max. Outputs for Sensor Types

The following tables list the minimum and maximum outputs of selected liquid flow meter types as of June 2019. Values are subject to change. Please consult www.sensirion.com/download-center for the latest versions of the datasheets for your liquid flow meter and the SCC1-Analog sensor cable. Note that some liquid flow meters have several different calibration fields (CF) available.

SLI-0430 *(Serial numbers 1440-00000 and higher)*

Medium	CF	min. output ($flow_{at0V}$)	max. output ($flow_{atVmax}$)
H_2O	0	-120 µl/min	120 µl/min
IPA	1	-600 µl/min	600 µl/min

SLI-1000

Medium	CF	min. output ($flow_{at0V}$)	max. output ($flow_{atVmax}$)
H_2O	0	-1100 µl/min	1100 µl/min
IPA	1	-11000 µl/min	11000 µl/min

SLI-2000

Medium	CF	min. output ($flow_{at0V}$)	max. output ($flow_{atVmax}$)
H_2O	0	-5500 µl/min	5500 µl/min
IPA	1	-90 ml/min	90 ml/min

SLG-0025

Medium	CF	min. output ($flow_{at0V}$)	max. output ($flow_{atVmax}$)
H_2O	0	-1500 nl/min	1500 nl/min

SLG-0075

Medium	CF	min. output ($flow_{at0V}$)	max. output ($flow_{atVmax}$)
H_2O	0	-5500 nl/min	5500 nl/min
H_2O (extended)	1	1800 nl/min	22000 nl/min

SLG-0150

Medium	CF	min. output ($flow_{at0V}$)	max. output ($flow_{atVmax}$)
H_2O	0	-10500 nl/min	10500 nl/min

SLQ-QT105

Medium	CF	min. output ($flow_{at0V}$)	max. output ($flow_{atVmax}$)
IPA	0	-2400 µl/s	2400 µl/s

SLQ-QT500

Medium	CF	min. output ($flow_{at0V}$)	max. output ($flow_{atVmax}$)
IPA	0	-2500 µl/s	2500 µl/s
H_2O	2	-2500 µl/s	2500 µl/s

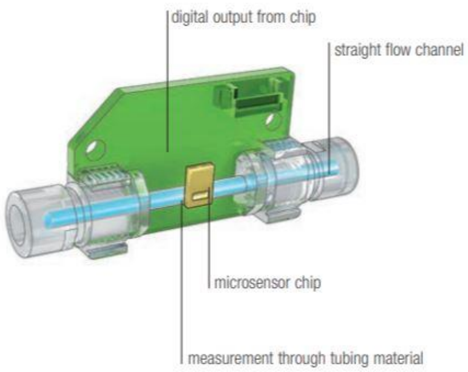
SLS-1500

Medium	CF	min. output ($flow_{at0V}$)	max. output ($flow_{atVmax}$)
H_2O	0	-65 ml/min	65 ml/min

5 Understanding your Measurements

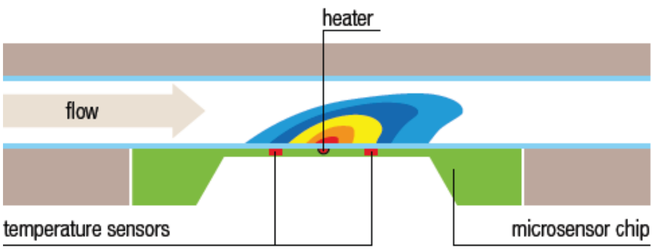
5.1 Liquid Flow Meter Operating Principle

Sensirion's highly advanced CMOSens® technology combines all associated electronics from signal conditioning circuitry to calibration memory and MEMS micro heater structure on a single integrated CMOS chip. The extremely compact chip creates a small thermal mass for very fast responses and consumes very little power. The chip is bonded to the outside of the flow channel and due to its media isolated sensing principle, there is no direct contact between the digital microchip and the fluid. Measurements are taken through the flow channel wall.



Schematic layout of a liquid flow meter

Your Sensirion liquid flow meter operates on a microthermal sensing principle. A negligible amount of heat is introduced to the fluid and monitored to correlate temperature differentials to actual flow. Temperature sensors before and after the heater detect temperature changes as flow transfers heat from one side to another. The illustration below highlights the temperature profile during flow:

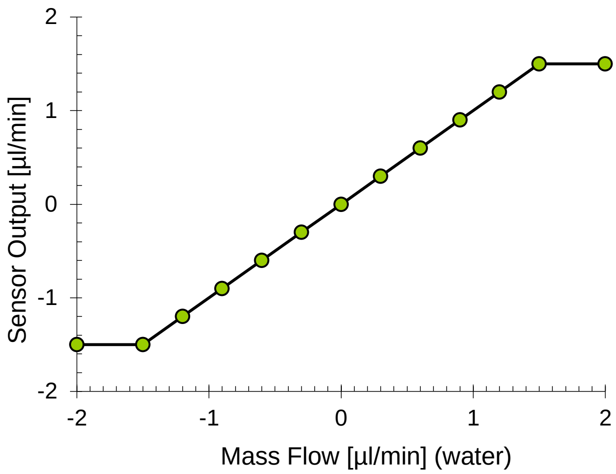


Fluid thermodynamic properties (i.e., heat capacity, thermal conductivity) will directly affect sensor response. The standard sensor calibrations for H_2O and IPA cover most commonly used fluids.

It is important to maintain laminar flow within the capillary during measurements. The flow meter maximum flow ranges have been specified having this in mind. Use inlet tubing with the same inner diameter or larger than the sensor's capillary inner diameter. More viscous fluids reduce turbulence although one must use caution to avoid exceeding the recommended pressure limits of the flow meter (see the datasheet for specifications of recommended maximum operating pressure and burst pressure).

5.2 Sensor Linearization

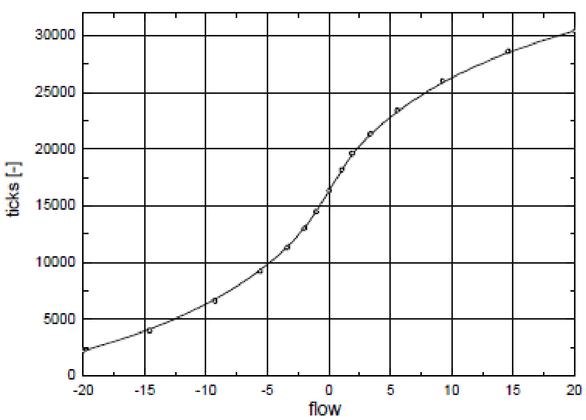
Sensirion liquid flow meters are 100% factory calibrated for at least one standard fluid (typically H_2O or IPA). Most sensors are also bidirectional allowing for flow measurements in both directions of flow.



Exceeding the flow range will not damage the sensor or stress components that will affect calibration. Flow meters typically respond linearly up to about 10% beyond the specified maximum flow range before saturating. Reference your specific sensor datasheet for more information.

5.3 Raw Data Output

The raw data signal of the sensor is inherently non-linear but can be accessed for reference.



For applications where different types of media are used and repeatability is more important than accuracy, the mass flow meter can be switched to raw data mode ("Flow [Raw Ticks]"). By doing this the non-linear sensor curve without any influence of the internal calibration data, is active. In this mode the sensor output becomes a simple digital number without reference to a measurement unit. Maintaining a very high repeatability, this signal corresponds directly to the actual flow. In some cases, this change makes it possible to exceed the maximum flow defined by the calibrated flow range. If the flow meter is equipped with a temperature compensation feature this will be de-activated in the raw data mode. This means that temperature coefficients may be larger.

5.4 Monitoring Different Fluids

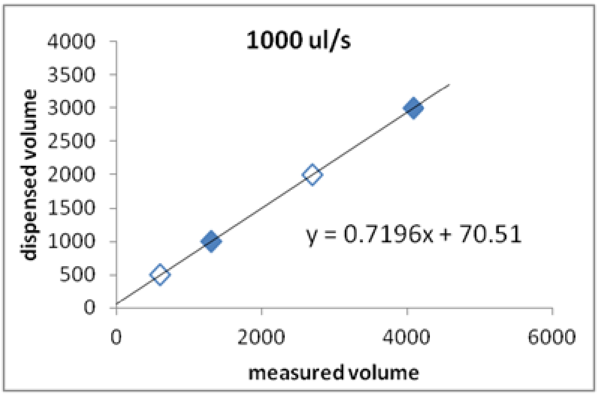
Your Sensirion flow meter can be used to monitor fluids not originally calibrated at the factory. Select a standard calibration field that most closely matches your fluid. For example, water calibration for saline solution or hydrocarbon calibration for lubricant oil (a matching calibration field increases the possibility of a linear response from the sensor).
Regardless of the fluid, your flow meter is capable of very high repeatability. Typical error range is 0.8% to 1.5% for all media. This allows you to use the sensor as a very precise relative gauge when flow is required to stay within an acceptable range. In such a case, sensor response can be recorded at maximum and minimum flow rates and used as upper and lower guard bands for reference. The flow meter can then monitor process repeatability within verified acceptable limits. Since absolute values may vary from sensor to sensor, this guard band must be set for each individual flow meter.

5.5 Dispense Volume Measurement Correction

Some applications require not only great repeatability but also high accuracy that tightly correlates sensor readings to actual flows. This is particularly true for dispense applications. The following procedure can significantly improve accuracy when monitoring liquids which have not been originally calibrated at the factory.

Please note the volume correction steps below require *fixed flow rates* during the dispense event. If the dispense flow rate is changed then the process below should be repeated with the new dispense flow rate to ensure accuracy. The intention below is to compare actual vs. dispensed volumes calculated from sensor readings and to apply a simple correction factor to adjust for accuracy.

- Program your pump to the flow rate you intend to use during your actual dispense process. In the example below, 1000 µL/s was the fixed flow rate chosen.
- Use the flow meter to measure several dispenses with varying dispense times. The range of dispense times should be limited to the expected dispense times in your application.
- For each dispense, also use a secondary measurement (such as measuring weight) to verify actual dispense volume.
- Plot the measured volume from sensor output vs. actual dispensed volume as in the example below:



solid symbols:

dispense time	1	3
dispensed volume	1000	3000
measured volume	1291.6	4070.8

open symbols:

dispense time	0.5	2
dispensed volume	500	2000
measured volume	598.6	2679.8

- The data points should fit a straight line through the measured points allowing you to determine the variables a and b from the formula below:

$$V_{dispensed} = a \cdot V_{measured} + b$$

- Implement the correction factors above in your software and repeat several dispense events using dispense times within the range you tested to confirm accuracy against a secondary measurement. If the readings match, then you are ready to use the flow sensor.

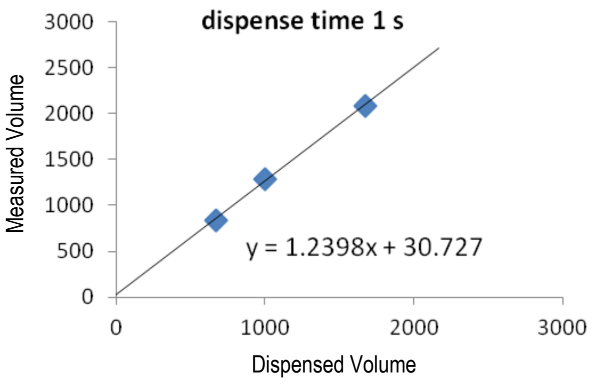
- If the collected data points show a non-linear behavior, you will likely need to reduce the dispense flow rate. The next section will explain how to determine whether your preferred dispense flow rate is a good match for the flow sensor you are testing.

5.6 Verify Sensor Performance

The steps below will help you evaluate whether a specific dispense flow rate is a good match for your sensor when using a fluid not originally calibrated by the factory. Start by selecting a calibration (water vs. IPA for example) that most closely matches your fluid. If you are unsure, try both calibration fields (if available): the data will show you what is best.

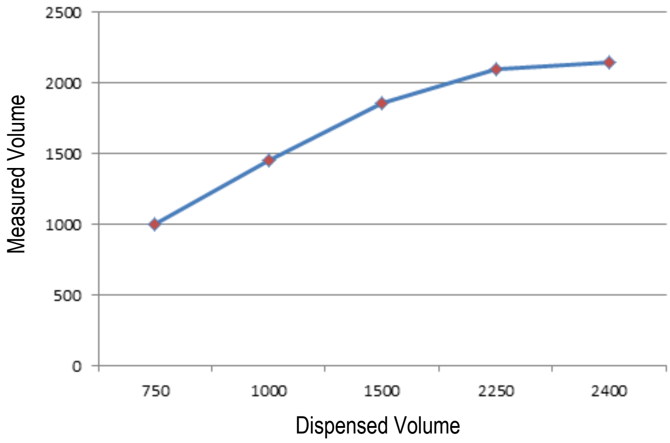
The intent is to compare several calculated vs. actually dispensed volumes using *fixed dispense times* and varying flow rates.

- Set a fixed dispense time (in the example below, 1 second was chosen). We recommend a dispense time of at least one second for this exercise. Three seconds is usually a good choice. It is not necessary to use dispense times that match your application's expected dispense times.
- Set your pump to the first of three dispense flow rates. We recommend starting with your expected dispense flow rate.
- Using the fixed dispense time from above, collect dispense data and calculate volume. Also verify actual dispensed volume through a secondary measurement such as weighing sample.
- Repeat dispense and data collection (calculated & actual volumes) two more times with different flow rates (try 50% higher flow and 50% lower flow).
- Plot measured volume vs. actual dispensed volumes of all three dispenses:



If all three flow rates are a good match for the sensor the dispense data will lie on a straight line as shown above.

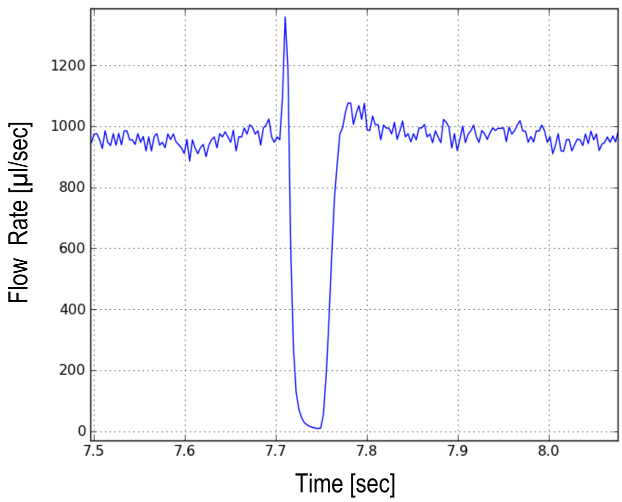
Sometimes the higher flows will fall noticeably off the linear path. The maximum flow range of the sensor has likely been exceeded for the particular liquid being evaluated. Reduce maximum flow rates and collect data again. The maximum measurable flow for the unknown fluid being tested will correspond to the highest linear data point on your plot. For example, in the plot below the top two dispense volumes are not linear so their corresponding flow rates would not be recommended for the sensor tested.



If your plot is strongly non-linear, try a different calibration field and repeat the experiment. In rare cases, a linear relationship is not possible and a higher-order interpolation must be used. Please contact Sensirion for additional support.

5.7 Air-in-line/Bubble Detection

Bubbles cause the flow rate measurement to drop to near zero flow rates when they pass through the flow sensor. Since the measurement is made at a distinct location along the sensor's flow channel, ideally one should mount the sensor such that the sensor chip is positioned on top where a bubble is most likely to travel and most likely to be detected. A typical flow profile response to a bubble is shown below.



5.8 Cleaning, Preventive Maintenance, and Storage Instructions

Your flow meter has been robustly designed for its intended application, however, it is also a sensitive instrument that must be well cared for to maintain a high level of performance.

The basic rules are simple:

- avoid letting fluid dry in the liquid flow meter
- avoid strong mechanical shocks that could dislodge internal components or compromise the fluidic seals.

Since the sensor relies on a thermal measurement principle through the wall of the capillary tube, one must take precautions to avoid any build-up or deposits that could alter the thermal properties of the capillary and thus influence the sensor's reading.

Before storing the sensor, always drain the fluid, flush with cleaning agent. In most cases flushing with distilled water, then acetone, and finally IPA will suffice. Then blow the senor dry with pressurized air. Sensor plugs should be installed for storage. The cleaning agent (detergent, solvent, etc) should be chosen for its effectiveness in removing the liquid media and compatibility with wetted materials.

Flow meters do not need periodic cleaning unless the medium has a tendency to leave deposits, or flow meters have been disconnected from the fluidic path and not properly flushed. The residue left by the drying fluids can alter sensor performance or even plug the capillary. You may try cleaning it by flushing with acetone and IPA.

Never attempt to mechanically clean the sensor's flow channel.

For more details please read the applications notes on "Cleaning and Clean Handling" and on the "Formation, Prevention and Removal of Biofilms".

6 Frequently Asked Questions

Problem	Possible Cause	Possible Solution
No function at all, software cannot find sensor	1. COM port not available 2. Windows operating system too old 3. USB cable driver (Virtual COM port) not installed correctly	1. Check if USB driver is providing a virtual COM port and use its number. Make sure all other programs using COM ports are closed. Maybe it is necessary to reboot the computer. Stop all programs working with COM-ports. 2. Verify recent version of Windows software is installed on your PC. 3. Install virtual com port driver.
Flow signal of sensor is different compared to reference	1. Sensor is saturated high 2. Fluid does not match reference fluid of calibration; or wrong calibration field is chosen 3. Reference not accurate. 4. Flow is pulsating with high frequency 5. Little air bubble is caught in sensor or at inlet of sensor	1. Reduce flow rates 2. When using media other than the one the sensor is calibrated for, the sensor output may significantly change. Try a different calibration field. When using the SCC1-Analog sensor cable, set a different default calibration field (“Edit default”, page 9). 3. Please check if reference is working properly. 4. If the flow rate is pulsating (e.g. due to pumping mechanism) try to eliminate this, e.g. by fluidic damping. 5. Flush the sensor.
Sensor output is inaccurate compared to reference at higher flows	1. Turbulence caused by small inlet tubing relative to sensor capillary inner diameter (ID) 2. Flow deviations by strong tubing bends on inlet side	1. Use inlet tubing with inner diameter at least as big as the sensor’s capillary inner diameter. 2. Keep connection tubing on inlet side straight.
Sensor output appears to have drifted compared to readings taken in the past	Deposits in capillary inner diameter affecting performance.	Follow cleaning procedures provided in this document.
Flow signal out of range	Flow higher than calibrated flow range or different medium than the one the sensor is calibrated for. For selecting the right flow meter look at the *peak* flow rates in your application, not at the average flow rates.	Check if type of medium and calibration match. Try to work with smaller maximum flows.
Signal not 0 at zero flow in calibrated mode.	1. Offset changed or differs because type of medium and calibration mismatch. 2. Depositions inside the sensor.	Offsets within the specifications are normal (see datasheet). For larger offsets please refer to

	3. Mounting position not horizontal. See datasheet.	cleaning procedures in this document. Contact Sensirion if the problem remains.
Flow signal shows unexpected behaviour (e.g. fluctuations, increasing/decreasing flow although pump is working steadily)	Note: Sensor is highly sensitive and fast. It may show effects which have not previously been observable.	Analyze the fluidic system in order to understand the effects monitored. In most cases the sensor is just representing the reality. Contact Sensirion for additional support. Please provide flow data, graphs, and description of fluidic system set-up.
Flow signal changes although static conditions apply.	There may be several causes, such as change of physical properties of the medium or strong temperature change, increasing blockage of fluidic path, fluid supply, e.g. pump, not properly working, system leaking	Make sure environmental conditions and physical properties of the medium don't change. Check fluidic path and fluid supply for possible errors.
Strong signal noise	Vibrations in the fluidic system.	Make sure the fluidic system is not influenced by mechanical disturbances. Vibrations make the fluid in the system move which is obviously visible on the sensor signal.

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