

# Cleaning and Clean Handling

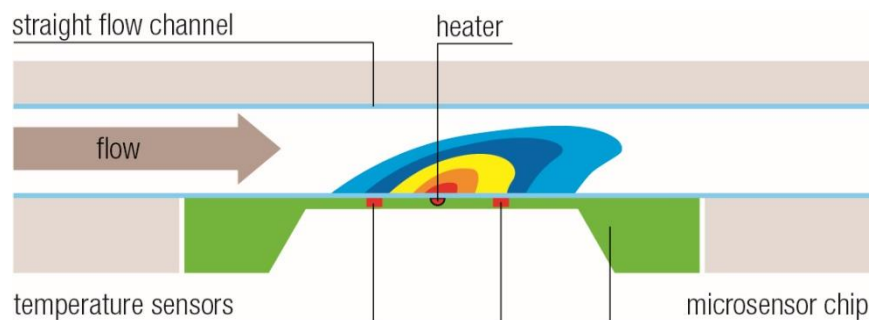
## Application Note for Liquid Flow Sensors

### Preface

Sensirion's liquid flow meters are highly sensitive measurement devices that should be properly handled and cleaned to ensure long term high performance. Improper cleaning (or no cleaning) may leave deposits on the internal flow channel wall that can cause measurement deviations. This should be avoided by cleaning the sensor after usage and especially before storing the sensor for longer periods.

### 1 Explanation

Inside Sensirion's liquid flow meters the sensor chip measures the flow through the thin wall of a flow channel or capillary. Because the measurement uses the heat propagation through this wall and into the medium, it is critical that the coupling of the chip, the flow channel wall and the medium is not altered. Formation of deposits on the wall inside the flow channel may block the heat transfer.



Due to the small size of the sensor chip and the very thin flow channel wall ( $\leq 100 \mu\text{m}$ ), even the slightest deposition can cause measurement deviations. Depending on the kind of deposits, a few micrometers might be sufficient to cause considerable measurement deviations. These deposits may be permanent (i.e. mineral or salt deposits) or transient (layer of previous liquid among alternating media types).

Typical signs of a deposition on the flow channel wall are measurement deviations over the whole flow range and/or offsets of the measurement. The measurement deviations can be positive or negative.

### 2 General Handling

Do **not** allow the liquid flow meter to dry out with residual media inside the flow channel without flushing it clean first. Also try to avoid letting the filled sensor sit for extended periods of time (depending on your liquid).

Before storing the sensor unit, always drain the fluid, flush with a suitable cleaning agent, blow out the flow meter, and dry the flow channel. If possible, plugs should be installed on the fluidic ports for storage. The cleaning agent (detergent, solvent, etc.) should be chosen for its effectiveness in removing the liquid media used for testing, and compatibility with the flow meter's wetted materials (see relevant flow meter datasheet).

In general, we recommend finishing the cleaning procedure with an IPA flush before letting the sensor dry out and closing it for storage. The advantage of using clean IPA is that it evaporates without residue (in contrast to acetone, for example).

### 3 Examples for Cleaning Procedures

#### Working with multiple liquids:

Switching between multiple liquids can leave transient deposits in the form of separated liquid layers inside the flow channel. This is especially common for insoluble liquids, but can happen even with miscible liquid combinations. For example, when IPA is followed by water in a sensor without drying in between, an offset and decreased sensitivity can be observed for up to hours after switching to water.

If possible, dedicate a discrete sensor for each different liquid to be measured. If this is not possible, plan a change of the media properly and include a cleaning step in between.

#### Working with water:

When working with water it is **not** recommended to let the sensor dry out. Salts and minerals in the water will deposit inside the flow channel and are difficult to remove. Although salt solutions are particularly prone to these problems, even clean water can contain enough dissolved minerals to form a deposition layer. Therefore, we recommend to flush with DI water on a regular basis to prevent build-up. Should you still encounter problems, occasionally flush the sensor with slightly acidic cleaning agents.

When working with non-DI water, especially when organic materials (sugars, proteins etc.) are present, microorganisms can grow on the walls of the flow channel and form an organic film that can be difficult to remove. Flush on a regular basis with solvents such as IPA, ethanol, methanol or acetone, or with cleaning detergents to remove organic films. Recommended organic film removers include *Terg-a-zyme®* and *IO-Biofilmentferner*.

**Caution:** Remember to always check the solvents for compatibility with the flow meter's wetted materials! For example, do not use acetone with the sensors of the LD20 series.

#### Working with oils:

When working with oil it is **not** recommended to let the sensor dry out. Edible oils can become rancid, dry out or simply change their composition over time and leave sticky films on the wall of the flow channel. This will typically happen if the liquid flow meter is only drained after usage but not properly cleaned. The oil film on the flow channel wall will then become a constant deposition and will be more difficult to clean. These films might not be dissolved by oil anymore and cause measurement deviations. It is recommended to clean the flow channel right after emptying the flow meter. Flush with solvents such as IPA, methanol, ethanol, acetone, etc or cleaning detergents on a regular basis to remove oil films.

**Caution:** Remember to always check the solvents for compatibility with the flow meter's wetted materials!

#### Working with silicone oils:

When working with silicone oil it is **not** recommended to let the sensor dry out. Silicone oils can be cleaned out using acetone or special cleaners. Check with your silicone oil supplier for cleaning agents which are compatible with the flow meter's wetted materials.

#### Working with paints or glues:

When working with paints or glues it is critical to **not** let the sensor dry out. Deposits of paints and glues are often hard or impossible to remove after they have dried. Flush the sensor with cleaning agents recommended by your paint or glue manufacturer. Make sure that the agents are compatible with the flow meter's wetted materials. Ensure that you have found a good cleaning procedure before performing the first tests, and always clean immediately after emptying the sensor.

### Working with alcohols or solvents:

Unlike most other fluids, alcohols and solvents are not critical and a short flush of acetone followed by IPA (or only IPA) is sufficient to clean the flow channel walls.

**Caution:** Make sure that the alcohols and solvents are compatible with the flow meter's wetted materials!

### Other liquids or applications:

If uncertain about your application and how to clean the liquid flow meter, please check your flow meter's datasheet and contact Sensirion for additional support.

## 4 Cleaning Methods that are not Recommended

In general, **any cleaning by mechanical means should be avoided. Never** enter the sensor's flow channel with rigid or sharp objects that could scratch the flow channel surface.

Furthermore, no abrasives or liquids containing solids that can grind the flow channel surface should be used. Anything that affects the flow channel wall will cause deviations in the measurement performance or permanently damage the flow meter. Abrasive liquids are not to be used for cleaning!

Strong acids and bases should also not be used to clean the flow meter. Acids can sometimes be used in low concentrations and at low temperatures. Remember to always check your fluids for compatibility with the flow meter's wetted materials.

## 5 Revision History

Date	Version	Changes
June 2011	1	Initial Version
March 2016	2	Include more capillary materials
July 2017	3	Compatibility warning, General changes and updates
June 2019	4	New format, general changes and updates

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