

SEN6x – Quick Testing and Evaluation Guide

Verify proper performance of SEN6x



Proper performance verification of the SEN6x module can be a challenging task. Different applications require differing complexity in terms of performance testing. This document aims to give the reader a starting point on which types of tests to perform.

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1 Important Considerations

Before starting your evaluation of the SEN6x, it is helpful to review a few key resources and conditions that support reliable results:

- It is recommended to become familiar with the SEN6x datasheet [1].
- Reviewing the datasheets of the individual subcomponents [2,3,4,5,6] can provide additional useful background.
- The SEN6x Mechanical Design and Assembly Guidelines [7] offer helpful recommendations for proper integration.
- Where available, the testing guides of the subcomponents [8, 9, 10, 11] can support a deeper understanding of their behavior.
- Please follow the SEN6x handling instructions [12] to ensure safe and correct use.
- Make sure the sensor is operated within its specified environmental conditions (temperature, humidity, pressure) [1].
- Avoid placing the SEN6x in environments with strong vibrations [7], as this may affect performance.
- After integration into your device, applying temperature compensation is recommended for optimal accuracy. The procedure is described in [13].
- For users developing their own firmware, the SEN6x software drivers [15] offer a convenient way to implement communication with the sensor.

2 Test Categories

This document is organized into distinct test categories, defined by the environment and purpose of the evaluation. The following classifications are applied:

- **Testing with SEK-SEN6x + SensorBridge** (see Section 3)
- **Event Testing of the SEN6x Module** (see Section 4)
- **Electronic Self-Testing of the SEN6x Module** (see Section 5)
- **Production Performance Testing of the SEN6x Module** (see Section 6)
- **Laboratory Performance Testing of the SEN6x Module** (see Section 7)

The procedures described herein primarily address PM performance testing. For all other SEN6x subcomponents, readers are directed to the corresponding technical documentation and datasheets (see references in **Section 1**).

Sensirion performs electrical end-of-line testing on every SEN6x module to verify correct functionality after production; therefore, an incoming inspection is generally not required. It should also be noted that measuring PM performance is a complex task influenced by numerous factors. Thus, to ensure reliable and consistent quality, each component of the SEN6x is factory-calibrated at the chip level, and the complete PM performance is fully calibrated again at the module level. This guarantees that every shipped device meets Sensirion's specified performance standards. Nonetheless, performance verification can be done by performing the tests described below during or after integration of the module into the device in production, as well as during the design-in stage.

3 Testing with SEK-SEN6x + Sensorbridge

A simple and efficient method for verifying the functionality and performance of the SEN6x module is by using the Sensirion SEK-SEN6x evaluation kit together with the Sensorbridge and Sensirion ControlCenter software.

The SEN6x module can be directly connected to the Sensorbridge via the appropriate cable. Once connected, measurements can be started immediately using the ControlCenter software without the need for custom firmware or software development.

This setup allows users to:

- Quickly verify basic sensor functionality
- Monitor real-time measurement data (PM, temperature, humidity, VOC, CO₂, HCHO depending on variant)
- Perform initial evaluation and debugging during development

This approach does not require the use of SEN6x software drivers, as all communication is handled internally by the Sensorbridge and ControlCenter software. For custom hardware integration, Sensirion provides SEN6x software drivers [15], which implement the I²C communication described in the datasheet.

4 Event Testing of the SEN6x Module

An initial PM functional verification of the SEN6x module can be performed by generating a controlled particulate event in close proximity to the sensor. A simple method is to tear a sheet of paper into two pieces near the module. This action produces a transient increase in airborne particles, which the SEN6x should register as a distinct peak in measured concentration. Within several seconds, the particle concentration is expected to return to baseline levels consistent with pre-event measurements.

This test serves to confirm the basic detection capability of the module. At this stage, device-to-device performance comparisons are not required; the objective is solely to verify that the event is detected. The procedure can be executed at any stage of production, including inline testing, and end-of-line testing, and requires minimal effort.

Analogous functionality checks are recommended for the other integrated subcomponents in the SEN6x. For example, the temperature sensor can be verified by exposing the module (or device) to a warmer environment and observing the corresponding response.

It should be noted at this point of the document that, following integration of the SEN6x module in a device, a measurable offset in the temperature and relative humidity readings may occur. This behavior is expected and results from self-heating of the device during operation. To correct for this offset and eliminate the influence of self-heating effects, the temperature compensation and acceleration procedure shall be applied as described in the SEN6x Temperature Compensation and Acceleration Guide [13].

5 Electronic Self-Testing of the SEN6x Module

After verifying the event tests, the next step is to perform an electronic self-test of the SEN6x module. This procedure confirms proper operation of the key components, including the PM sensor, fan, and all the subcomponents in the SEN6x. If any component fails or behaves unexpectedly, the device status register will indicate the condition by setting the corresponding flag, which is checked as part of this test.

Implementing the self-test requires a short script to automate the checks, but once in place the procedure can be completed in 60 seconds. It may be executed at any stage of production, including after assembly.

The self-testing script should be set up as follows:

1. **Start Measurement:** Use the appropriate I²C command (refer to the SEN6x datasheet [1]) to start a measurement on the SEN6x.
2. **Wait 60 Seconds:** Allow sufficient time for the device to check all the subcomponents and update its status.
3. **Read Device Status:** Use the appropriate I²C command to read the device status register. If any of the returned status bits are non-zero, consult the SEN6x datasheet [1] for detailed information on the corresponding error or warning condition.
4. **Stop Measurement:** Send the appropriate I²C command to terminate the measurement.

This script can be implemented using the official SEN6x software drivers [15], which provide ready-to-use implementations of the required I²C commands and simplify integration into embedded systems.

6 Production Performance Testing of the SEN6x Module

To evaluate the PM performance of the SEN6x module during or after production, a simplified in-house test setup may be employed. The measured performance is strongly dependent on the test environment and aerosol source; therefore, results obtained with this setup are not directly comparable to the datasheet specifications. Nevertheless, the procedure provides a practical means of verifying whether integration of the SEN6x into the device yields consistent performance over time.

Sensirion recommends performing this production PM performance testing on a sample basis, selecting a small percentage of all devices. During safe launch, every sensor should be tested. This approach supports production consistency and verification of the desired performance. Compared with the other two test methods demonstrated previously, performance testing is more involved and requires additional time. Once established, the procedure typically requires around 15 minutes per device.

To assess PM performance during production, select a sample of sensors or devices from the production line. Allow the sampled units to stabilize for approximately 10 minutes in a location with standard conditions (25 °C $\pm$ 3 °C, 50% $\pm$ 20% relative humidity, > 10m³ size, no air conditioning active) before starting measurements. Record data at this location for at least 150 seconds, then calculate the mean value for each sensor. Use these averages to perform the precision analysis described in the Sensor Specification Statement [14]. Note that the specified precision values are based on a more accurate laboratory setup; this simplified procedure will likely yield lower precision.

7 Laboratory Performance Testing of the SEN6x Module

To evaluate PM sensor performance in a laboratory environment, the setup illustrated in **Figure 1** can be used. This represents a simplified configuration suitable for general performance testing; however, it may not achieve the full precision defined in the Sensor Specification Statement [14].

- **Test environment:** The test should be performed at standard room conditions (25°C $\pm$ 3°C, 50% $\pm$ 20% rel. Humidity).
- **Test chamber:** 60-liter plastic container serving as the controlled environment.
- **Sensor positioning:** Metal grid placed inside the container, enabling positioning of SEN6x modules at least 10 cm away from any walls.
- **Aerosol distribution:** Electrical fan or computer fan to ensure homogeneous mixing of the aerosol within the chamber.
- **Test devices:** Four SEN6x modules (three references + one device under test), either standalone, integrated into the final device, or as disassembled device parts, depending on the production stage.
- **Aerosol source:** One tea candle (normal size), used to generate the test aerosol.

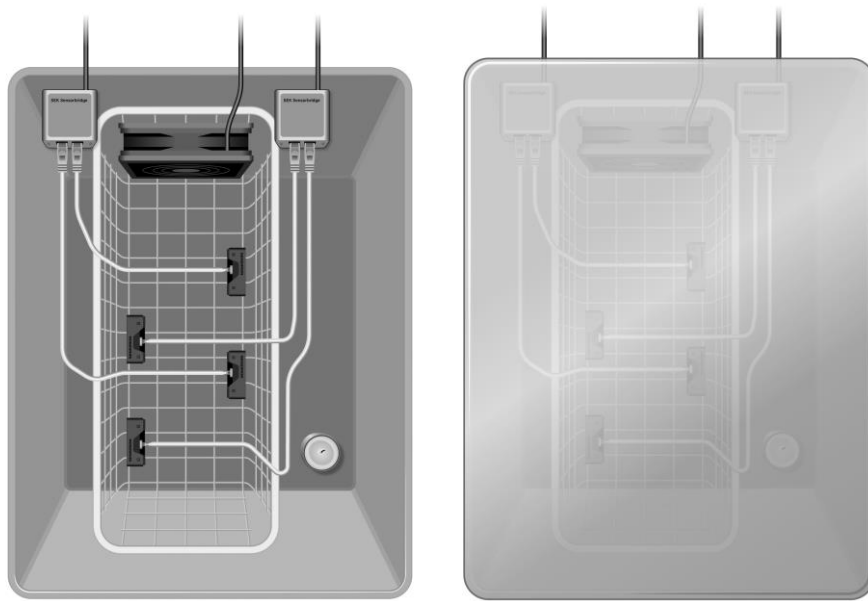


Figure 1: Simple Laboratory Setup for PM Testing. Left image: Four SEN6x modules on a metal grid in a 60-liter plastic container, electrical fan, candle (aerosol source) and connection cables. Right image: same setup with closed lid.

Procedure:

1. Introduce smoke into the test chamber using the aerosol source for about 5 minutes (light candle + blow it out).
2. Operate the fan for several minutes to achieve uniform aerosol distribution.
3. Switch off the fan to minimize turbulence and allow a short stabilization period for concentration equilibration.
4. Start PM measurements with the SEN6x modules and record data for at least 150 seconds.
5. Calculate the mean value of the measurements for each sensor over this interval.
6. Evaluate these mean values according to the Sensor Specification Statement [14].

Important Note:

Sensirion specifies sensor precision in the Datasheet [1] and Sensor Specification Statement [14] using KCl aerosol as the reference. Deviations from the stated precision values are expected due to the simplified setup and the use of a different aerosol. Nevertheless, this method provides better stability than the production-line test described in **Section 6**. Because of the inherent difficulties of testing PM performance, Sensirion calibrates and verifies 100% of sensors in production before shipment. Each SEN6x is individually adjusted to meet the accuracy requirements specified in the datasheet. Users can therefore rely on the fact that every outgoing sensor has been validated for accuracy.

8 Further Documentation

- [1] Sensirion, "Datasheet SEN6x" December 2025. [Online]. Available: <https://sensirion.com/resource/datasheet/SEN6x>.
- [2] Sensirion, "Datasheet SHT4x" April 2025. [Online]. Available: <https://sensirion.com/resource/datasheet/sht4x>.
- [3] Sensirion, "Datasheet SGP40" September 2021. [Online]. Available: <https://sensirion.com/resource/datasheet/sgp40>.
- [4] Sensirion, "Datasheet STCC4" June 2025. [Online]. Available: <https://sensirion.com/resource/datasheet/STCC4>.
- [5] Sensirion, "Datasheet SCD4x" April 2025. [Online]. Available: <https://sensirion.com/resource/datasheet/scd4x>.
- [6] Sensirion, "Datasheet SFA40" [Online]. Available: <https://sensirion.com/resource/datasheet/datasheetsfa40>
- [7] Sensirion, "SEN6x - Mechanical Design and Assembly Guidelines," May 2025. [Online]. Available: https://sensirion.com/resource/application_note/SEN6x_mechanical_design_assembly_guidelines.
- [8] Sensirion, "Testing Guide SHT4x" October 2022 [Online]. Available: https://sensirion.com/resource/application_note/testing_ambient_conditions/sht.
- [9] Sensirion, "Testing Guide SGP40" August 2020 [Online]. Available: https://sensirion.com/resource/user_guide/sgp40.
- [10] Sensirion, "Testing Guide SGP41" November 2021 [Online]. Available: https://sensirion.com/resource/user_guide/sgp41.
- [11] Sensirion, "Testing Guide SCD4x" [Online] Available: https://sensirion.com/resource/user_guide/scd4x/testing_guideline.
- [12] Sensirion, "Handling Instructions for SEN6x" December 2026 [Online]. Available: <https://sensirion.com/resource/sen6x-handling>
- [13] Sensirion, "Temperature Compensation and Acceleration Application Note" December 2025 [Online]. Available: <https://sensirion.com/resource/SEN6x-temp-compensation>
- [14] Sensirion, "Sensor Specification Statement" January 2026 [Online]. Available: <https://sensirion.com/resource/sen6x-spec-statement>
- [15] Sensirion, "Drivers SEN6x" [Online]. Available: <https://drivers.sensirion.com/#/?search=sen6>

9 Revision History

Date	Version	Pages	Changes
July 2026	1	all	Initial version

Important Notices

Warning, Personal Injury

Do not use this product as safety or emergency stop devices or in any other application where failure of the product could result in personal injury (including death). Do not use this product for applications other than its intended and authorized use. Before installing, handling, using or servicing this product, please consult the data sheet and application notes. Failure to comply with these instructions could result in death or serious injury.

If the Buyer purchases or uses SENSIRION products for any unintended or unauthorized application, Buyer shall defend, indemnify and hold harmless SENSIRION and its officers, employees, subsidiaries, affiliates and distributors against all claims, costs, damages and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if SENSIRION is allegedly negligent with respect to the design or the manufacture of the product.

ESD Precautions

The inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation, take customary and statutory ESD precautions when handling this product. See application note "ESD, Latchup and EMC" for more information.

Warranty

SENSIRION solely warrants to the original purchaser of this product for a period of 12 months (one year) from the date of delivery that this product is of the quality, material and workmanship defined in SENSIRION's published specifications of the product. Within such period, if proven to be defective, SENSIRION shall as sole and exclusive remedy, in SENSIRION's discretion, repair this product or send a replacement product, free of charge to the Buyer, provided that:

- notice in writing describing the defects shall be given to SENSIRION within fourteen (14) days after their appearance;
- such defects shall be found, to SENSIRION's reasonable satisfaction, to have arisen from SENSIRION's faulty material or workmanship;
- the defective product shall be returned to SENSIRION's factory at the Buyer's expense; and
- the warranty period for any repaired or replaced product shall be limited to the unexpired portion of the original period.

The Buyer shall at its own expense arrange for any dismantling and reassembly that is necessary to repair or replace the defective product. This warranty does not apply to any product which has not been installed or used within the specifications recommended by SENSIRION. EXCEPT FOR THE WARRANTIES EXPRESSLY SET FORTH HEREIN, SENSIRION MAKES NO WARRANTIES, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO THE PRODUCT. ANY AND ALL WARRANTIES, INCLUDING WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY EXCLUDED AND DECLINED.

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SENSIRION does not assume any liability arising out of any application or use of any product or circuit and specifically disclaims any and all liability, including without limitation indirect, consequential, and incidental damages, and loss of profit. No obligation or liability shall arise or grow out of SENSIRION's rendering of technical advice, consulting, or implementation instructions or guidelines. All operating parameters, including without limitation recommended parameters, must be validated for each Buyer's applications by Buyer's technical experts. Recommended parameters can and do vary in different applications.

SENSIRION reserves the right, without further notice, (i) to change the product specifications and/or the information in this document and (ii) to improve reliability, functions and design of this product.

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