FAQs of Smart Module

1. Why is there no response when the target gas is introduced into the module?

Troubleshooting Steps:

- **Module Check:**
  Use communication software or a serial port tool to test the module. If communication is successful, the module is functioning properly.
- **Sensor Check:**
  Measure resistance between each pair of sensor pins. Abnormally high resistance may indicate damage. (Resistance increase varies by sensor type, ranging from several tens to several hundred kiloohms.)
- **Gas Supply Check:**
  Ensure the target gas is properly delivered to the sensor. For adsorptive gases (e.g., NH_3, HCl, Cl_2), verify that the gas reaches the sensor surface.
  Please refer to AN230215 Calibration with Reactive Gases

2. Why does the smart module show abnormal output when the target gas is introduced?

Troubleshooting Steps:

- **Bias Voltage Requirement:**
  Some sensors require a bias voltage and warm-up time before accurate readings. Stabilize the sensor under the required bias voltage before exposing it to the target gas (see Question 7 in the EC Sensor Q&A for details).
- **Sensor-Board Matching:**
  Each sensor and board pair is uniquely calibrated. Mixing components may cause abnormal readings.
- **Gas Delivery Verification:**
  Adsorptive gases may be blocked by tubing or regulators.
- Consider the possibility of a damaged module or sensor. Please refer to AN230215 for detailed procedures.

3. How to troubleshoot if the module fails to connect to the computer?

Connection Checklist:

- Use a TTL-to-USB converter.
- Connect TX ↔ RX and RX ↔ TX correctly.
- Ensure power and GND are properly connected.
- Select the correct COM port.
- Use correct serial port settings (see datasheet for the specific serial port configuration).

4. Can the module use I²C communication?

- **4-Series Modules:** Not supported by default.
- **7-Series Modules:** Supported with proper configuration:
  - Assigns correct I²C address. （refer to application notes of 7-series module for address modification instructions.）
  - Hosts must support Clock Stretching.

5. How to perform zero calibration on the module?

Calibration Gas Selection:

- **Non-environmental grade:** Ambient air.
- **Environmental-grade (AQM, 7E4):** Zero calibration gas.
- **O_2 sensors:** Nitrogen gas.

Procedure:

1) Place module in zero gas for ≥5 minutes.
2) Send zero-calibration command.
3) Wait for success response.

6. How to perform target gas calibration on the module?

Calibration Gas Selection:

- **O_2 sensors:** Ambient air.
- **Other sensors:** Specified concentration gas.

Procedure:

- **4-Series Modules:**
  - Use default or modified calibration concentration.
  - If necessary, adjust it using the [Modify Calibration Concentration] command (Refer to the communication protocol in the 4-Series Module datasheet for details).
  - 120-second countdown after command.
  - Return a calibration success response, indicating completion of calibration.
- **7-Series Modules:**
  - Customize concentration in command.
  - 300-second countdown after command.
  - Return a calibration success response, indicating completion calibration. Countdown times vary by sensor type.

Series	Sensor Type	Product Model	Part Number	Response Time, T90 (Sec)	7SMART Count Down Time（Sec）
7S	CO	7CO-50	051-1300-000	≤30	120
		7CO-1000	051-0200-000	≤30	120
		7CO-2000	051-0600-000	≤30	120
		7CO-10000	051-0700-000	≤30	120
	H2S	7H2S-20	052-1800-000	≤30	120
		7H2S-50	052-0300-000	≤30	120
		7H2S-100	052-0500-000	≤30	120
		7H2S-200	052-0200-000	≤30	120
		7H2S-500	052-1300-000	≤30	120
		7H2S-1000	052-0800-000	≤50	120
		7H2S-2000	052-0900-000	≤50	120
		7H2S-5000	052-1100-000	≤60	120
		7H2S-10000	052-1400-000	≤60	120
	H2	7H2-1000	054-0200-000	≤50	180
		7H2-10000	054-0300-000	≤110	180
	ETO	7ETO-20	055-0400-000	≤120	180
		7ETO-100	055-0300-000	≤120	180
	SO2	7SO2-5	056-0600-000	≤30	120
		7SO2-20	056-0700-000	≤45	120
		7SO2-20B	056-1200-000	≤60	120
		7SO2-20BF	056-1100-000	≤90	120
		7SO2-100	056-0200-000	≤70	120
		7SO2-2000	056-0300-000	≤70	120
	NO2	7NO2-5AOF	057-0400-000	≤90	120
		7NO2-20	057-0200-000	≤30	120
		7NO2-100	057-0500-000	≤30	120
		7NO2-500	057-0600-000	≤60	120
	NO	7NO-5	058-0400-000	≤15	120
		7NO-100	058-0200-000	≤30	120
	NH3	7NH3-50	059-2600-000	≤60	120
		7NH3-100	059-0200-000	≤60	120
		7NH3-100S	059-2300-000	≤45	120

		7NH3-200	059-0800-000	≤60	120
		7NH3-200S	059-2800-000	≤45	120
		7NH3-500	059-0400-000	≤60	120
		7NH3-500S	059-2400-000	≤55	120
		7NH3-1000	059-0300-000	≤60	120
		7NH3-1000S	059-2500-000	≤45	120
		7NH3-2000	059-0700-000	≤90	120
	PH3	7PH3-5	060-0300-000	≤30	120
		7PH3-2000	060-0200-000	≤60	120
	ClO2	7ClO2-1	061-0200-000	≤60	120
		7ClO2-20	061-0300-000	≤60	120
	Cl2	7Cl2-20	062-0300-000	≤45	120
		7Cl2-50	062-0400-000	≤45	120
	HCl	7HCl-20	063-0400-000	≤70	120
		7HCl-50	063-0100-000	≤70	120
		7HCl-100	063-0300-000	≤70	120
	HCN	7HCN-50	064-0100-000	≤120	180
		7HCN-50s	064-1200-000	≤105	180
	CH3SH	7CH3SH-10	065-0100-000	≤60	120
	THT	7THT-50	066-0100-000	≤60	120
	C2H3Cl	7C2H3Cl-50	067-0300-000	≤120	180
		7C2H3Cl-100	067-0100-000	≤120	180
	O3	7O3-1	068-0300-000	≤45	120
		7O3-20	068-0200-000	≤45	120
		7O3-100	068-0500-000	≤45	120
	HF	7HF-10	069-0300-000	≤120	180
		7HF-50	069-0200-000	≤120	180
	CH2O	7CH2O-10	072-0200-000	≤90	120
		7CH2O-50	072-0300-000	≤90	120
7E3	CO	7E3-CO-50	051-1300-100	≤60	120
	SO2	7E3-SO2-5	056-0600-100	≤60	120
	NO2	7E3-NO2-5	057-0400-100	≤60	120
	O3	7E3-O3-1	068-0300-100	≤60	120

7E4	CO	7E4-CO-10	051-1900-200	≤35	60
	SO2	7E4-SO2-5	056-0600-200	≤60	60
	NO2	7E4-NO2-5	057-0400-200	≤60	60
	O3	7E4-O3-5	068-0900-200	≤40	60
	H2S	7E4-H2S-10	052-1900-200	≤90	60
	NO	7E4-NO-10	058-0700-200	≤45	60
	NH3	7E4-NH3-10	059-3500-200	≤120	60

7. What do the special pins and indicator lights on the module mean?

- Refer to the module's specification sheet.
- **7-Series:** Status LED flashes once per second when powered and turns off when powered down.
- **4-Series C01:** No status indicator LED.

8. What is the module's response time?

- Normal response: ≤200 milliseconds.
- During calibration: May delay other commands.
- **7-Series:** Zero calibration executes immediately upon command, returning a response without delay. During vent calibration, sending the same command again returns a "calibrating" status, while other commands are processed normally.

9. Does the module include environmental compensation?

- **Included:** Temperature compensation (pre-programmed).
- **Not included:** Humidity and pressure compensation.
- Sudden pressure changes may cause temporary fluctuations in sensor reading
- However, values will stabilize shortly and do not affect actual detection accuracy.

10. What is the purpose of the module enclosure?

- Provides dustproof and waterproof protection.
- Optional if instrument already has environmental protection.

11. How to implement one-to-many communication?

Protocols Supported:

- **UART (4-Series & 7-Series):**
  - Use RS-485 bus.
  - Assign unique device IDs.
  - After assigning unique device IDs via the communication protocol, modules can be polled sequentially.
- **I²C (7-Series only):**
  - Use I²C bus.
  - Assign unique I²C addresses.
  - Communication with each module can then be performed individually via the I²C protocol specified in the documentation.

12. Do 4-Series modules include temperature and humidity sensors?

- **Temperature sensor:** Yes. 4-series module PCB equipped, suitable for controlled-humidity environments (such as laboratories)
- **Humidity sensor:** Not equipped.
- **7-Series:** For ambient humidity changes exceeding 30%RH, 7-series sensor modules are recommended for enhanced environmental compensation and they also support both via communication protocol.

13. Is the 12-hour stabilization period required every time?

- Stabilization period is required only at first power-up for biased sensors.
- Not needed if bias voltage is maintained after shutdown.
- Recalibration intervals depend on factors such as ambient temperature, humidity, pressure, gas type, and exposure conditions.
- Once stabilized, intervals may extend to 3, 6, or 12 months per the instrument's user manual, which should be followed strictly.

14. Why does the module show negative concentration values?

Possible Causes:

1. **Temperature Drift:** Smart modules use temperature compensation algorithms for accurate output; without calibration, thermal effects may cause drift. For example, the 7SO_2-20BF sensor baseline is highly sensitive to temperature changes.
2. **Cross-Gas Interference:** Negative readings may result from zero calibration offsets or cross-sensitivity to gases like NO_2 or O_3.

   For example, the 7E4-SO2-5 sensor can show negative responses due to NO_2 and O_3 interference, which must be subtracted to determine true SO_2 levels.

Using all three sensors simultaneously is common for compensation. Please see the datasheet for specific cross-interference values.

3. **Test Condition Variations:** In test gas composition, ventilation or atmospheric pressure can cause data deviations.

Recommendations:

- Recalibrate in controlled environment.
- Use 7-Series testing software.
- Ensure the firmware's real-time temperature compensation is active

15. Why does the 7-Series module fluctuate between 1–8 ppb near zero?

- **Negative Output Mechanism in 7-Series Modules**: Due to ozone interference compensation algorithm. This is implemented in all SO_2 sensors within the 7-Series and 7E4(AQM)-Series.
- **Designed for High Precision:** specifically intended for high-accuracy applications in ozone-rich environments. Indicates sensor's advanced capability to quantify and compensate for interference, not error.

16. Is a negative working electrode value normal?

- **Yes**, if within baseline fluctuation range specified in the sensor's datasheet.
- **If abnormal, the possible causes are as follows:**
  - **Baseline Shift**: recalibrate by using the instrument's calibration function to see if the baseline returns to normal.
  - **Electrode Contamination**: Check for contamination and reinstall the sensor's shorting spring and expose it to fresh air for at least one day to stabilize the baseline.
  - **Insufficient Warm-Up for Biased Sensors**: Ensure proper warm-up for at least 12 hours for first use. Insufficient warm-up may prevent baseline stabilization, causing abnormal reading.

17. Can multiple modules communicate via I²C in the same gas?

Yes, using different addresses for each set of equipment when using I²C.

18. Should both raw sensor and module be replaced?

- **Recommended:** Replace entire module if gas calibration cannot be performed on-site
- **If replacing only sensor, two conditions must be met:**
  - Replacement is the same model.
  - Full calibration via module communication protocol after replacement

19. Are calibration results stored in the sensor?

- **No**, raw sensor has no memory for calibration results

- **Yes**, smart module stores:
  - Zero offset
  - Span Calibration Value
  - Temperature calibration
  - Linearization data
  - Temperature and linearization data collected during the calibration process
- SemeaTech's 7-Series Smart Sensor Modules retain all of the above calibration data.

20. Does the module support humidity compensation?

No, SemeaTech electrochemical sensor modules lack built-in humidity compensation, so sudden humidity or pressure changes (e.g., near vents, open doors/windows, or air conditioning) can cause significant transient errors, but transient errors can be mitigated by:

- Avoiding airflow exposure
- Using wind shields
- Implementing system-level compensation

21. Can the baud rate be lowered from 115200 bps?

- Users can utilize **7 SMART MODULE TEST** software to modify the module's serial baud rate and I2C address
- Current version does not support 38400 bps.
- Contact technical support for customization.

Please Download the software via the following link:
https://semeatech.com/uploads/App_Tools/7_SMART_MODULE_TEST_V1.7.zip

22. What is the default I²C address?

- The I²C address depends on sensor type.
- Example: H_2S = 0x09 (8-bit format).
- Can be modified using 7 SMART MODULE TEST software.
- Users must also update the communication settings of the host controller accordingly to ensure proper communication

23. Will recalibration affect NH_3 sensor performance?

- All modules are factory calibrated.
- Built-in temperature compensation minimizes fluctuation.
- **Airflow direction** and **pressure** are critical for stability, which can affect accuracy

24. Why does NH_3 module show I^2C address as 0x08 instead of 0x10?

- For I^2C address discrepancies, the datasheet lists the 8-bit address (LSB = R/W bit), while some scanners use 7-bit format. Thus, 0x08 and 0x10 both refer to the same device under different conventions.
- For UART communication issues, first verify the CRC16 checksum. If correct but no response occurs, check the USB-to-TTL cable and connections, as poor contact or voltage mismatches may cause failure.

UART Issue:

- Check CRC16 checksum.
- Verify cable and voltage levels.
- Confirm baud rate and power supply.

Please calculate the CRC and compare it with the CRC check code in our specifications to confirm whether it is correct and whether it should be placed at the front or the back.

25. Why does the module output 0 ppb baseline?

- Normal if raw current and concentration are zero. Typically, when the measured concentration is below 8 ppb, the system is designed to randomly output a value between 1 and 7 ppb to avoid consistently reporting zero.
- For 7E4 series sensors, ultra-low ppb readings may be impacted by baseline drift and sensitivity limits, preventing accurate conversion, whereas ppm-level measurements remain accurate.
- We recommend to verify if the environment approximates a true zero-gas condition and perform baseline calibration if needed to ensure output accuracy.

26. Why does the 10 ppm H_2S sensor show 0.001 ppm resolution in 7-Series Smart Module?

- The 7-Series Smart module supports high-resolution format for various sensors
- Actual meaningful resolution should be based on the sensors' specifications in their datasheet.
- Please ignore insignificant digits and refer to datasheet.