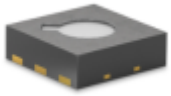
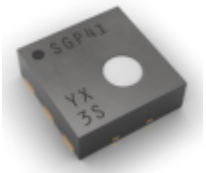
LamaPLC: SGP Sensirion TVOC/VOC sensors with I²C communication

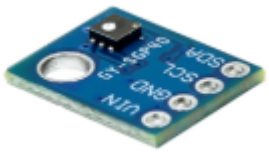
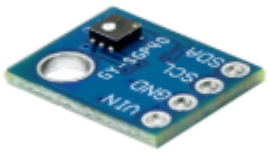
The Sensirion SGP sensor family includes high-performance, multi-pixel gas sensors tailored for indoor air quality monitoring. Using metal-oxide (MOx) technology on a single chip, these sensors detect multiple pollutants and remain stable against contamination.

Core Sensor Models

- **SGP30 (Legacy standard):** The first of its kind to offer multiple sensing elements on one chip. It provides calibrated signals for Total Volatile Organic Compounds (TVOC) in parts per billion (ppb) and a calculated CO_2 equivalent (eCO_2) based on hydrogen concentrations.
- **SGP40 (VOC optimized):** Designed specifically for VOC detection in indoor environments. It replaced the SGP30's raw ppb output with a more robust VOC Index (1–500) that automatically adapts to the surrounding environment.
- **SGP41 (VOC + NOx):** The current flagship for air treatment devices like purifiers. It includes all the VOC capabilities of the SGP40 but adds a dedicated sensor for Nitrogen Oxides (NOx), a common combustion byproduct from stoves and vehicle exhaust.
- **SGPC3 (Ultra-low power):** A variant optimized for mobile and battery-operated devices, offering reliable gas sensing with minimal power drain.

Key Comparisons

Feature	Sensirion SGP30	Sensirion SGP40	Sensirion SGP41
			
Primary Output	TVOC (ppb) & eCO_2 (ppm)	VOC Index (1-500)	VOC & NOx Index
Detection Focus	Broad VOCs & H_2	Volatile Organic Compounds	VOCs + Nitrogen Oxides
Power Consumption	~48 mA (active)	~2.6 mA (at 3.3V)	~3.2 mA (at 3.3V)
Stability	Excellent (siloxane resistant)	Enhanced long-term stability	Enhanced long-term stability
I²C Address	0x58	0x59	0x59
Supply Voltage (VDD)	1.62V – 1.98V (1.8V typ)	1.7V – 3.6V (3.3V typ)	1.7V – 3.6V (3.3V typ)
TVOC / VOC Output	0 – 60,000 ppb	1 – 500 Index	1 – 500 Index
eCO_2 Output	400 – 60,000 ppm	N/A	N/A
NOx Output	N/A	N/A	1 – 500 Index
Max Sampling Frequency	1 Hz	Up to 10 Hz (raw data)	Up to 10 Hz (raw data)

Feature	Sensirion SGP30	Sensirion SGP40	Sensirion SGP41
Moduls			
	GY-SGP30	GY-SGP40	GY-SGP41

The SGP sensors can be integrated with the Tasmota system. For more information, see here.

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Arduino & SGP41 Modul

The GY-SGP41 module operates on a flexible 3.3V to 5V DC power supply. The core SGP41 sensor chip, however, has a narrower supply voltage range of 1.7V to 3.6V.

- SCL: A5
- GND: GND
- SDA: A4
- Vdd: 5V

Arduino code

When interfacing the SGP41 VOC and NOx sensor with an Arduino, the most reliable approach is to use the official Sensirion I2C SGP41 library or the **Adafruit SGP41** library.

This basic example initializes the sensor and retrieves raw VOC and NOx signals.

```
#include <Arduino.h>
#include <SensirionI2CSgp41.h>
#include <Wire.h>

SensirionI2CSgp41 sgp41;

void setup() {
    Serial.begin(115200);
    while (!Serial) { delay(100); }

    Wire.begin();
    sgp41.begin(Wire);
```

```
    // Initial self-test
    uint16_t testResult;
    if (sgp41.executeSelfTest(testResult) || testResult != 0xD400) {
        Serial.println("SGP41 Self-test failed!");
    }
}

void loop() {
    uint16_t error;
    uint16_t srawVoc = 0;
    uint16_t srawNox = 0;

    // Use default compensation (25°C, 50% RH)
    // For better accuracy, feed real T/RH from another sensor here
    error = sgp41.measureRawSignals(0x8000, 0x6666, srawVoc, srawNox);

    if (!error) {
        Serial.print("Raw VOC: "); Serial.print(srawVoc);
        Serial.print("\tRaw NOx: "); Serial.println(srawNox);
    } else {
        Serial.println("Measurement error!");
    }

    delay(1000); // Wait 1 second
}
```

SGP30, SGP40, SGP41, Sensirion, gas-sensor, i2c, communication, sensor, arduino, code, eCO_2, VOC, TVOC, indoor air quality, IAQ, NOx, hydrogen