# RAB1-SENSORFUSION User Manual

# Table of Contents

## Versions
*Table 1*

| Version | Date | Rationale |
|---|---|---|
| 0.1 | April 04, 2022 | First draft. Author: GDR |

## Introduction

RAB1-SENSORFUSION is an Arduino shield adapter for the environment and inertial sensors from Infineon, Sensirion and Bosch evaluation and prototyping. It is powered via Arduino headers with a single 3.3V supply. No overvoltage, polarity protection or voltage regulator included. All the sensors are configured to work with the I2C interface only, except the DPS310XTSA – it can be used with SPI as well as with I2C [I2C is default]. All the I2C addresses are fixed for all the sensors and cannot be reconfigured. Every particular sensor could be disconnected from the power supply and I2C circuits by unsoldering solder bridges. The interrupts of BMI270 and BMP581 could be connected to almost any Arduino pin using solder bridges configuration or simply using wires [the holes at every pin are provided for that purpose].

## Features

- DPS310 – Infineon's digital XENSIV$^{TM}$ barometric pressure sensor.
- BMP581 – Bosch's digital pressure sensor.
- SGP40 – Sensirion's indoor air quality sensor for VOC measurements.
- BME688 – Bosch's digital low power gas, pressure, temperature and humidity sensor with AI.
- SHT41 – Sensirion's high-accuracy and low power relative humidity and temperature sensor.
- BMI270 – Bosch's 6-axis, smart, low power inertial measurement unit.
- I2C and SPI interface via Arduino compatible ADAM-TECH connectors.
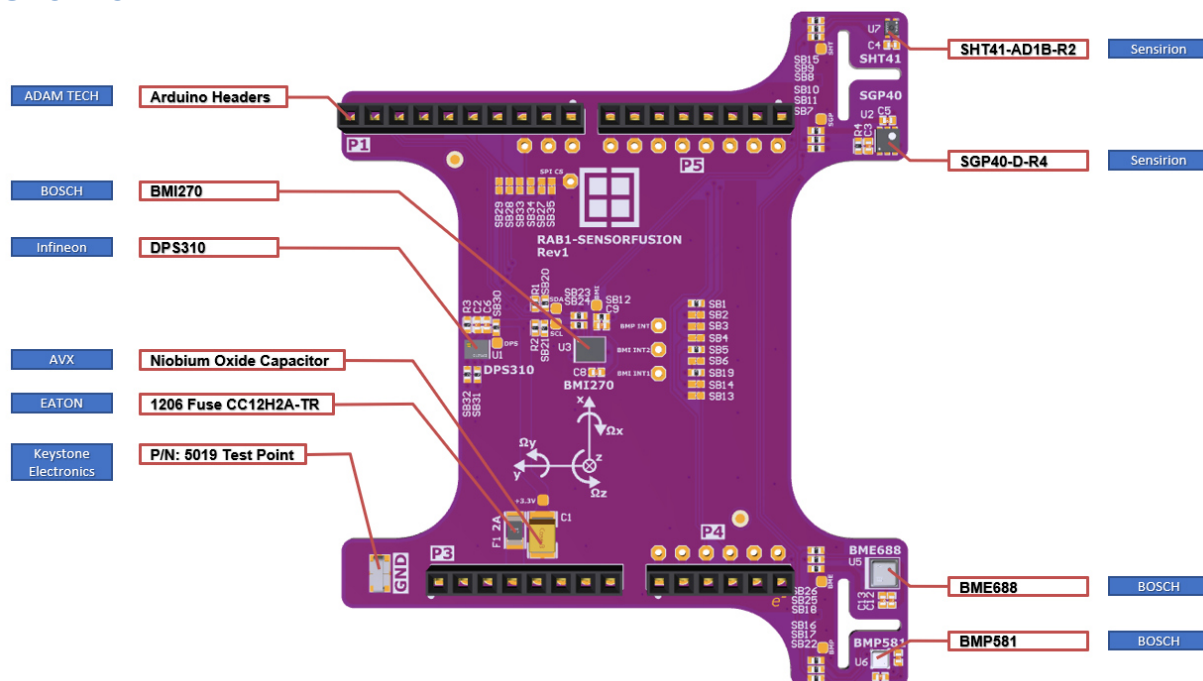- A Keystone Electronics Test Point connector for a ground signal.

## Overview



*Fig. 1. Adapter Board's layout.*

## I2C Addresses
*Table 2*

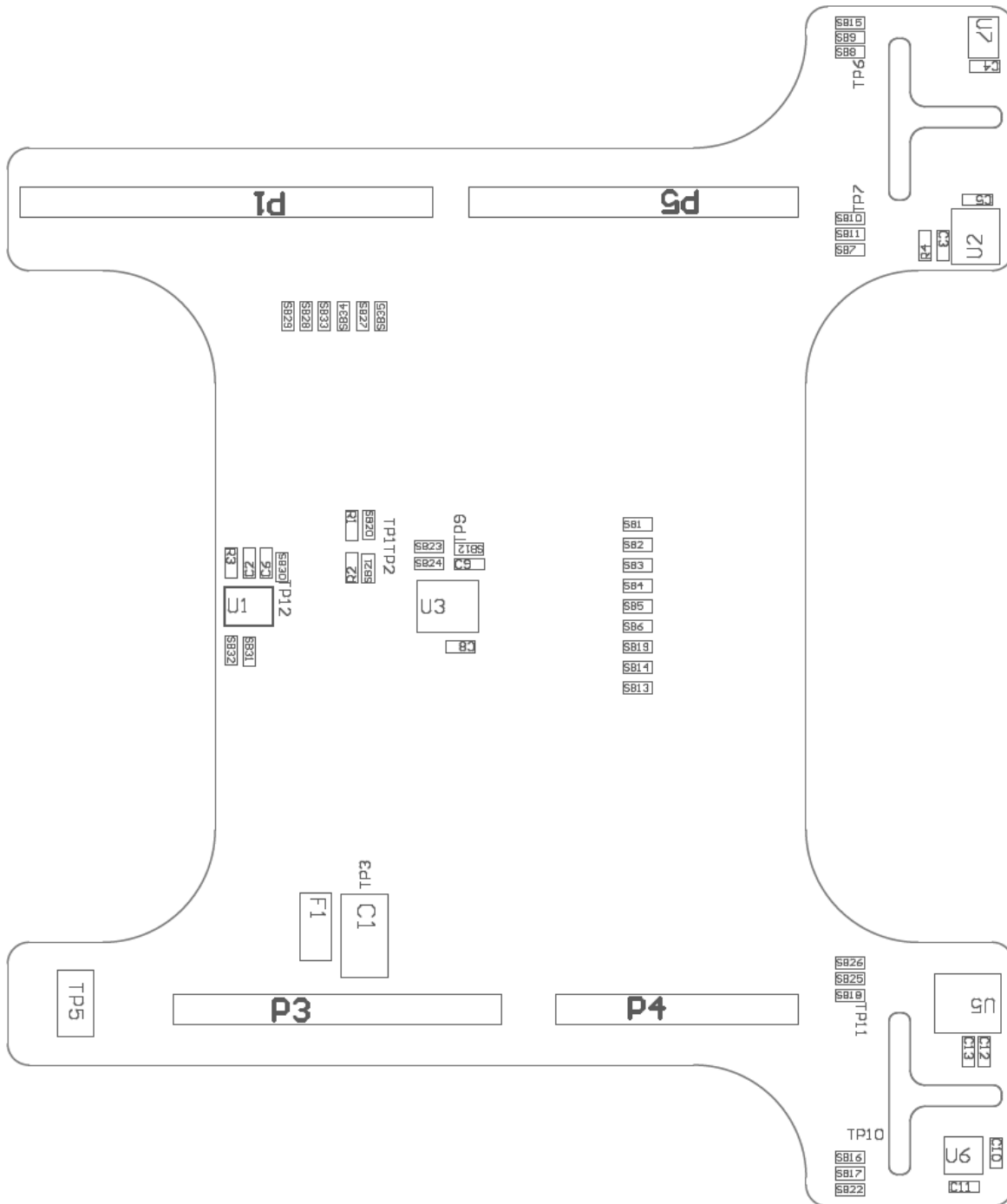| Designator | Device | 7-bit Hex I2C Address |
|------------|--------|----------------------|
| U1 | DPS310XTSA1 | 0x77 |
| U2 | SGP40-D-R4 | 0x59 |
| U3 | BMI270 | 0x68 |
| U5 | BME688 | 0x76 |
| U6 | BMP581 | 0x47 |
| U7 | SHT41-AD1B-R2 | 0x44 |

## Solder Bridges



*Fig. 2. Locations of the Solder Bridges [SBxx] (please check the schematics and layout document to see in detail).*

*Table 3*

| Solder Bridge | Circuit | Default |
|---|---|---|
| SB1 | BMI270 INT1 connection with Arduino INT1. | Closed |
| SB2 | BMI270 INT2 connection with Arduino INT1. | Opened |
| SB3 | BMP581 INT connection with Arduino INT1. | Opened |
| SB4 | BMI270 INT1 connection with Arduino INT2. | Opened |
| SB5 | BMI270 INT2 connection with Arduino INT2. | Closed |
| SB6 | BMP581 INT connection with Arduino INT2. | Opened |
| SB7 | SGP40 I2C SDA connection. | Closed |
| SB8 | SHT41 +3.3V power supply. | Closed |
| SB9 | SHT41 I2C SCL connection. | Closed |
| SB10 | SGP40 +3.3V power supply. | Closed |
| SB11 | SGP40 I2C SCL connection. | Closed |
| SB12 | BMI270 +3.3V power supply. | Closed |
| SB13 | BMI270 INT1 connection with Arduino INT3. | Opened |
| SB14 | BMI270 INT2 connection with Arduino INT3. | Opened |
| SB15 | SHT41 I2C SDA connection. | Closed |
| SB16 | BMP581 +3.3V power supply. | Closed |
| SB17 | BMP581 I2C SCL connection. | Closed |
| SB18 | BME688 +3.3V power supply. | Closed |
| SB19 | BMP581 INT connection with Arduino INT3. | Closed |
| SB20 | I2C SCL Pull-up resistor R1 enable. | Closed |
| SB21 | I2C SDA Pull-up resistor R2 enable. | Closed |
| SB22 | BMP581 I2C SDA connection. | Closed |
| SB23 | BMI270 I2C SCL connection. | Closed |
| SB24 | BMI270 I2C SDA connection. | Closed |
| SB25 | BME688 I2C SDA connection. | Closed |
| SB26 | BME688 I2C SCL connection. | Closed |
| SB27 | DPS310 SPI CS connection with Arduino IO. | Opened |
| SB28 | DPS310 SPI MISO connection with Arduino IO. | Opened |
| SB29 | DPS310 SPI SCK connection with Arduino IO. | Opened |
| SB30 | DPS310 +3.3V power supply. | Closed |
| SB31 | DPS310 I2C SDA connection. | Closed |
| SB32 | DPS310 I2C SCL connection. | Closed |
| SB33 | DPS310 SPI MOSI connection with Arduino IO. | Opened |
| SB34 | Arduino SPI CS select between P4[3] and P1[3]. | Opened |
| SB35 | Arduino SPI CS select between P4[3] and P1[3]. | Opened |

## Fuses

The RAB1-SENSORFUSION board has only one 2A fast acting fuse F1 in a 1206 package; Part No: CC12H2A-TR „Eaton".
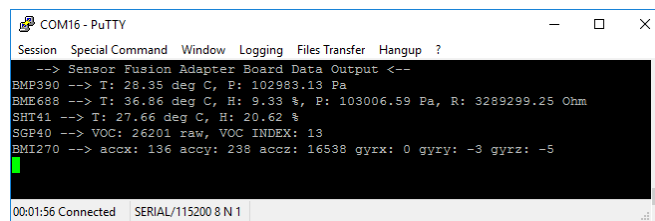
## Changing the fuses or solder bridges

The SMD „Chipping Tool" is recommended to use for SMD solder bridges or fuses soldering on the RAB1-SENSORFUSION development board.

## Supported firmware and software examples
### RutDevKit-PSoC62_SensorFusionAdapter_Demo

The firmware example uses KitProg3 Debug UART for debugging output. All sensor raw values are presented once per second: BMP390 Temperature & Pressure; BME688 Temperature, Humidity, Pressure & Gas Resistance with Index; SHT41 Temperature and Humidity; SGP40 VOC Raw Value and VOC Index; BMI270 Accelerometer and Gyroscope x, y, z-axis values.
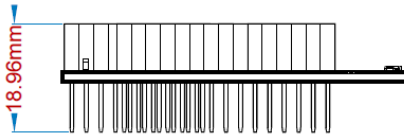


*Fig. 3. Running the demo.*

## Board Pinout
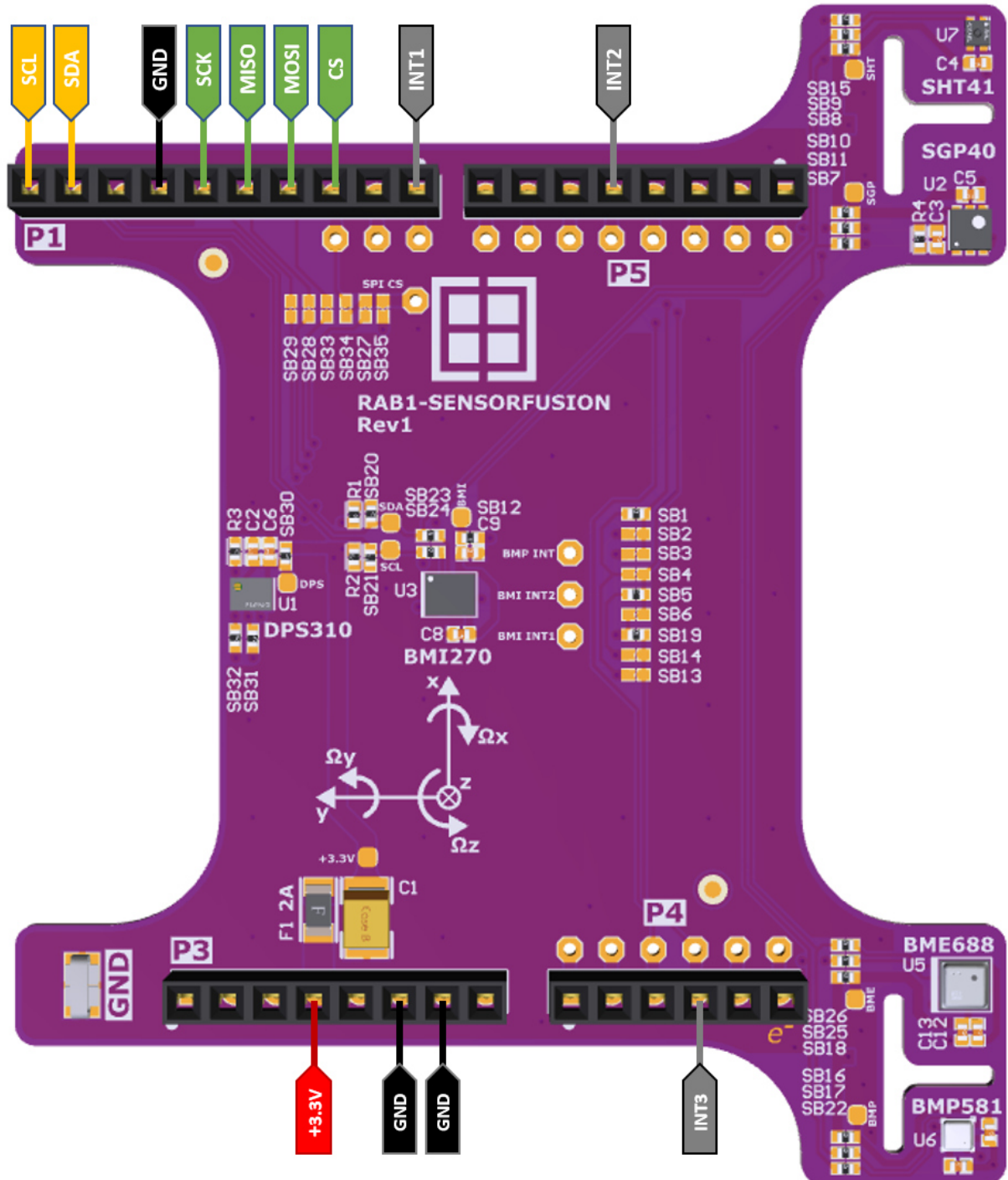
## Mechanical Layout
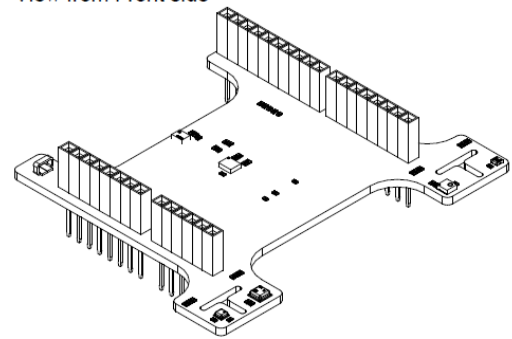
View from Front side

18.96mm

View from Left side

71.69mm

View from Top side

54.80mm

60.15mm
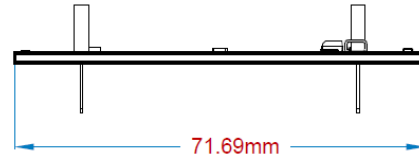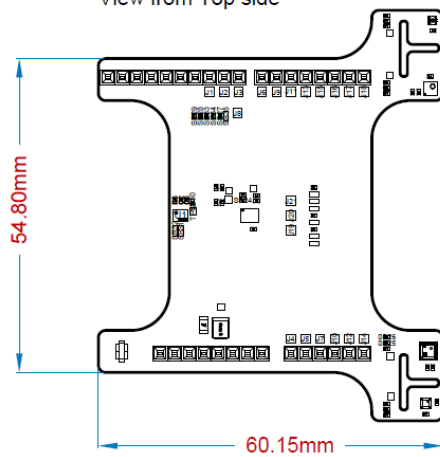
View from Front side

## Bill of Materials

| Designator | Value | Specification | Quantity | Manufacturer | Manufacturer Part No. | Supplier | Supplier part number |
|---|---|---|---|---|---|---|---|
| C1 | 47uFx6V | 6V, 20% | 1 | AVX | NOJB476M006RWJ | Rutronik | KTA6684 |
| C2, C4, C6, C8, C9, C10, C11, C12, C13 | 100nF | X7R, 25V, 10% | 9 | AVX | 04023C104KAT2A | Rutronik | KKK20175 |
| C3, C5 | 1uF | X5R, 25V, 10% | 2 | Samsung EM | CL05A105KA5NQNC | Rutronik | KKS2216 |
| F1 | CC12H2A-TR | 63V, 2A | 1 | EATON | CC12H2A-TR | Rutronik | FUSE10755 |
| P1 | RS1-10-G-413 | 10 pos. 2,54mm | 1 | ADAM TECH | RS1-10-G-413 | Rutronik | CONN9323 |
| P3, P5 | RS1-08-G-413 | 8 pos. 2,54mm | 2 | ADAM TECH | RS1-08-G-413 | Rutronik | CONN9321 |
| P4 | RS1-06-G-413 | 6 pos. 2,54mm | 1 | ADAM TECH | RS1-06-G-413 | Rutronik | CONN9319 |
| R1, R2 | 10K | 5% 0,063W | 2 | Yageo | RC0402JR-1310KL | Rutronik | WRC51147 |
| R4 | 4.7R | 5% 0,063W | 1 | Yageo | RC0402JR-074R7L | Rutronik | WRC34495 |
| SB1, SB5, SB7, SB8, SB9, SB10, SB11, SB12, SB15, SB16, SB17, SB18, SB19, SB20, SB21, SB22, SB23, SB24, SB25, SB26, SB27, SB28, SB29, SB30, SB33, SB34 | 0R | 5% 0,063W | 26 | Yageo | RC04020R | Rutronik | WRC52534 |
| TP5 | P/N5019 | 3.81*2.03 | 1 | Keystone Electronics | P/N5019 | Rutronik | BAT4950 |
| U1 | DPS310XTSA1 | 1.7V,3.6V,1mA | 1 | Infineon | DPS310XTSA1 | Rutronik | ICMEMS1148 |
| U2 | SGP40-D-R4 | 3.6V, 3mA | 1 | Sensirion | SGP40-D-R4 | Rutronik | ICENVI1294 |
| U3 | BMI270 | 1.7V, 1mA | 1 | Bosch | BMI270 | Rutronik | ICMEMS1423 |
| U5 | BME688 | 1.7V, 3.9mA | 1 | Bosch | BME688 | Rutronik | ICENVI1322 |
| U6 | BMP581 | 30 .. 125kPa | 1 | Bosch | BMP581 | Rutronik | ICENVI1434 |
| U7 | SHT41-AD1B-R2 | 1.08V, 0.5mA | 1 | Sensirion | SHT41-AD1B-R2 | Rutronik | ICENVI1393 |

## Legal Disclaimer

The evaluation board is for testing purposes only and, because it has limited functions and limited resilience, is not suitable for permanent use under real conditions. If the evaluation board is nevertheless used under real conditions, this is done at one's responsibility; any liability of Rutronik is insofar excluded.