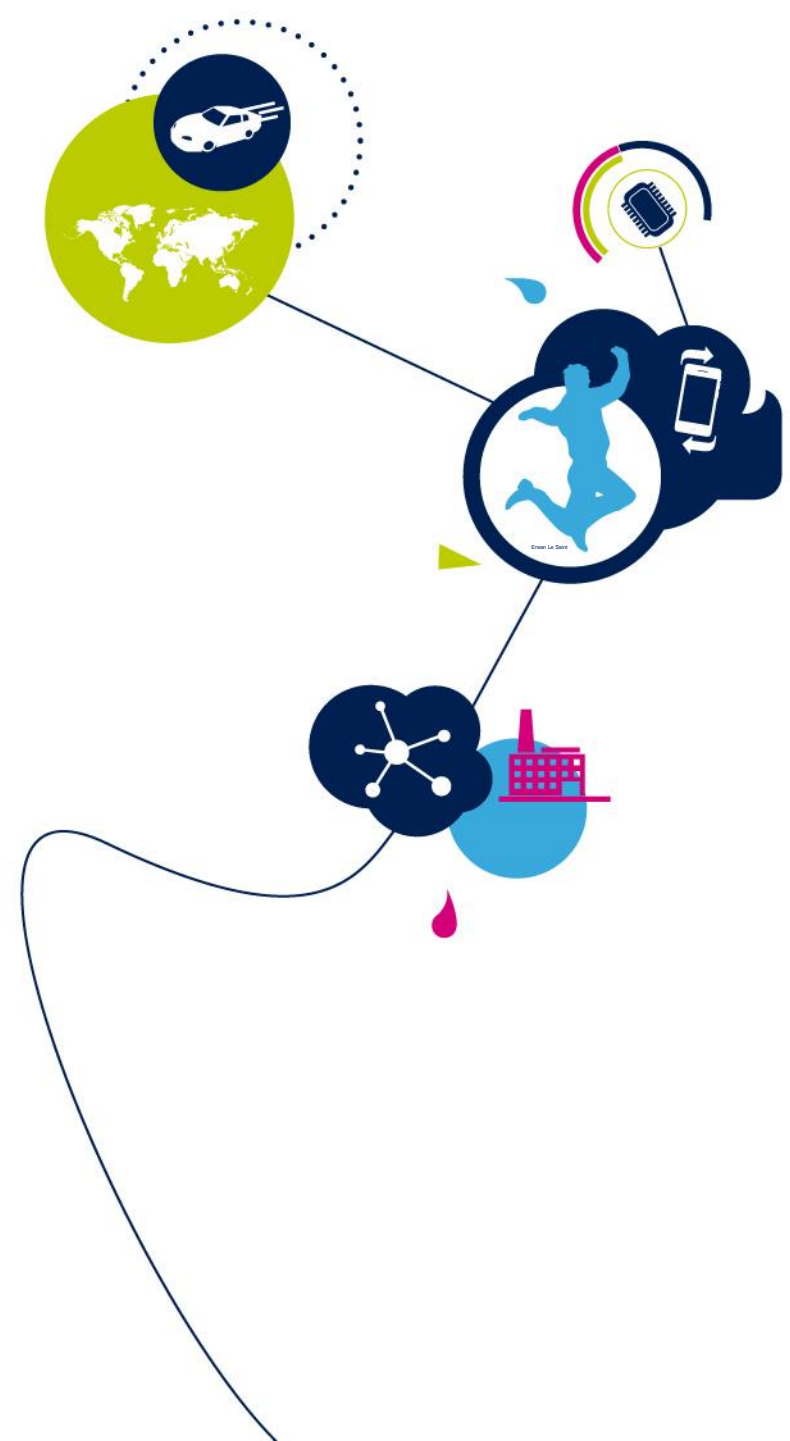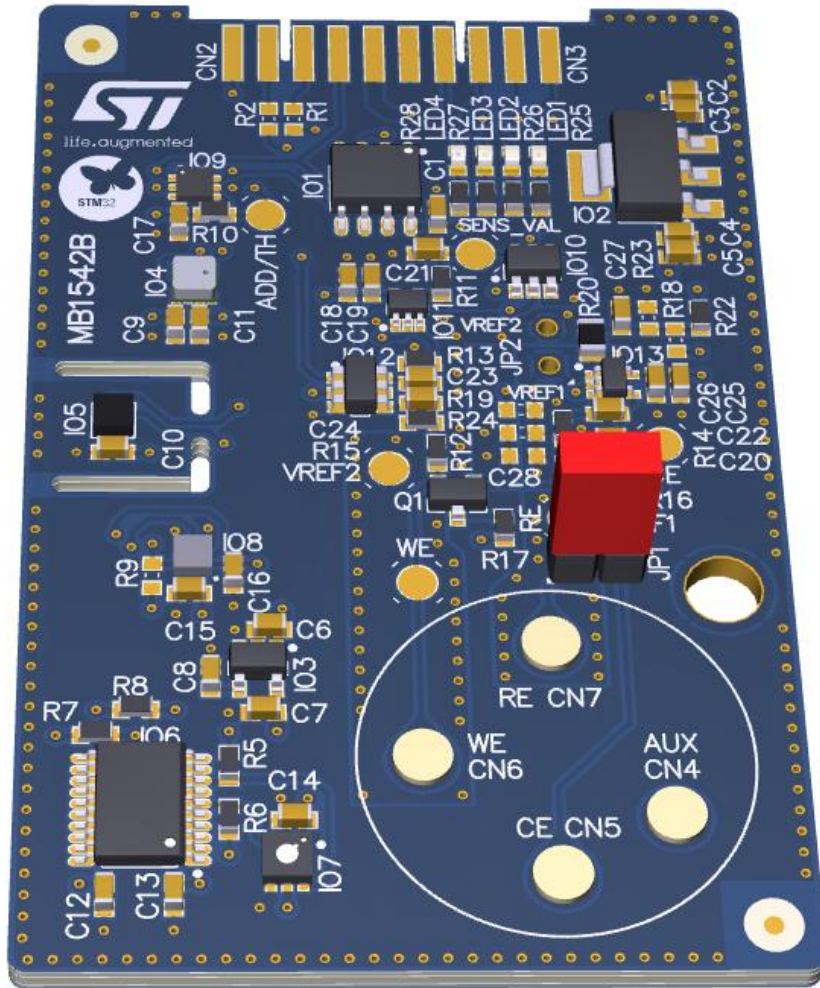# Environmental V2 AddOn

2nd Jan 2020

X slides, ~ X minutes

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Environmental Sensing V2

- Features:
  - RH (ST HTS221TR, I2C)
  - mBar (ST LPS22HHTR, I2C [I3C])
  - mBar+RH+Temp (Bosch BME280, I2C)
  - CO_2 ppm (Sensirion SGP30-2.5K, I2C*)
  - Temp (ST STTS751-0DP3F, I2C)
  - Electrochemical Gas Sensing (Analog)

- Prototype
  - 50 pcs produced

- Plug and Play:
  - Int ID: B_ENV_GAS_V2_BOARD
  - String ID: "B_ENV_GAS_V2"

Notes for Gas Sensing

- There are 3 types of gas sensors
  - Cheap one based on gas sensitive alloy resistor change when heated (>100mA)
    - This type of sensor is not supported by this board
  - Electrochemical 2 terminals, generates nA current proportional to gas ppm
    - Supported, place the jumper on the board for proper operation
  - Electrochemical 3 terminals
    - Remove the jumper for proper operation

- Each gas sensor is unique and board provide some means of tuning
  - STM32 DAC used to offset the gas sensor analog output going to STM32 ADC
  - One GPIO used to change the amplification gain
  - For very demanding sensors, the board can be reworked to provide dual Vref controls

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- This pressure sensor can support I3C

- LPS_INT signal is used at power up to define I3C operating mode
  - MCU can't SW control this, as it can't control its own boot pin
  - If LPS_INT is no connect or ground, pressure sensor boot in I2C
    - I3C mode can be enabled using I2C activation sequence
  - If LPS_INT is pull-up, pressure sensor boot in I3C
    - This undesired mode is the default when power up brisk with its add-on board
    - Cut LPS_INT line or solder a pull-down when using STM32Brisk

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- Sensirion I2C bus CO2 sensor SGP30-2.5K has special behavior
  - Need I2C clock stretching to function properly
  - Sensirion provides I2C bitbang SW driver for this (implemented)
  - Polling needs to be 1 second
  - Measurement data starts to be output about 7 seconds after initialized
  - A single I2C read transaction can take up to 600 msec
   - Keep this in mind for your application

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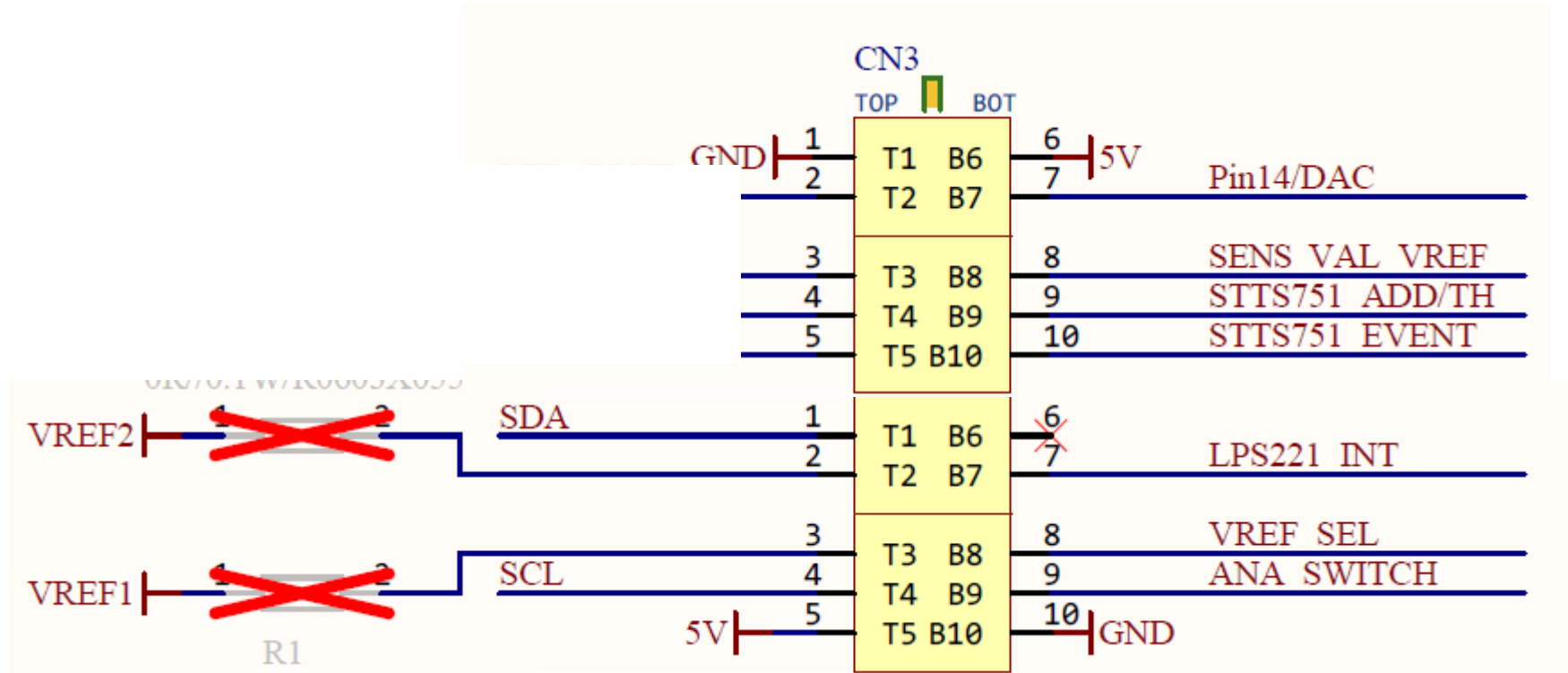
Note: LPS221_INT determines I3C behavior, should be cut to boot device in I2C default mode

Sensor Add-on STMod+ pinout

LED (wrong implant)	1		11	STTS751_EVENT
LED (wrong implant)	2		12	STTS751_ADD/TH
LED (wrong implant)	3		13	Sens_Val (gas sensor) input
LED (wrong implant)	4		14	DAC Vref1 analog output
GND	5		15	5V
5V	6		16	GND
SCL	7		17	Ana_switch (analog mux, gain control)
Vref1 (if 0 Ohm populated)	8		18	Vref_sel (analog mux)
Vref2 (if 0 Ohm populated)	9		19	LPS_INT
SDA	10		20	

ST Humidity RH %

ST pressure (mb)

Bosch Humidity RH %

Bosch pressure (mb)

ST Temperature degC

Bosch Temperature degC

Sensirion CO2 ppm sensor
(on V2 board, may malfunction, SW fix needed)
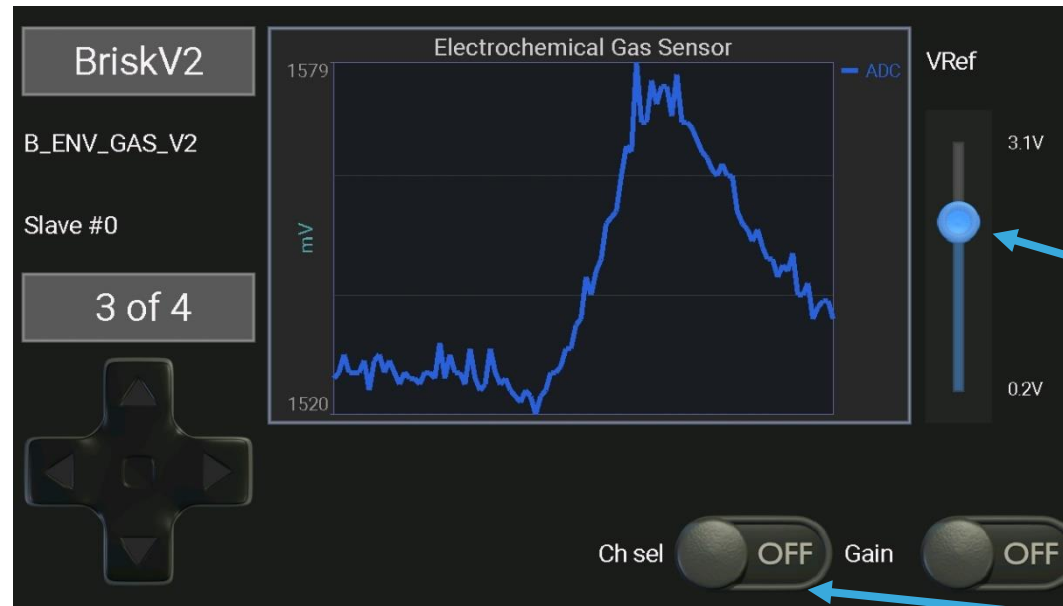(digital I2C sensor timing is delicate)
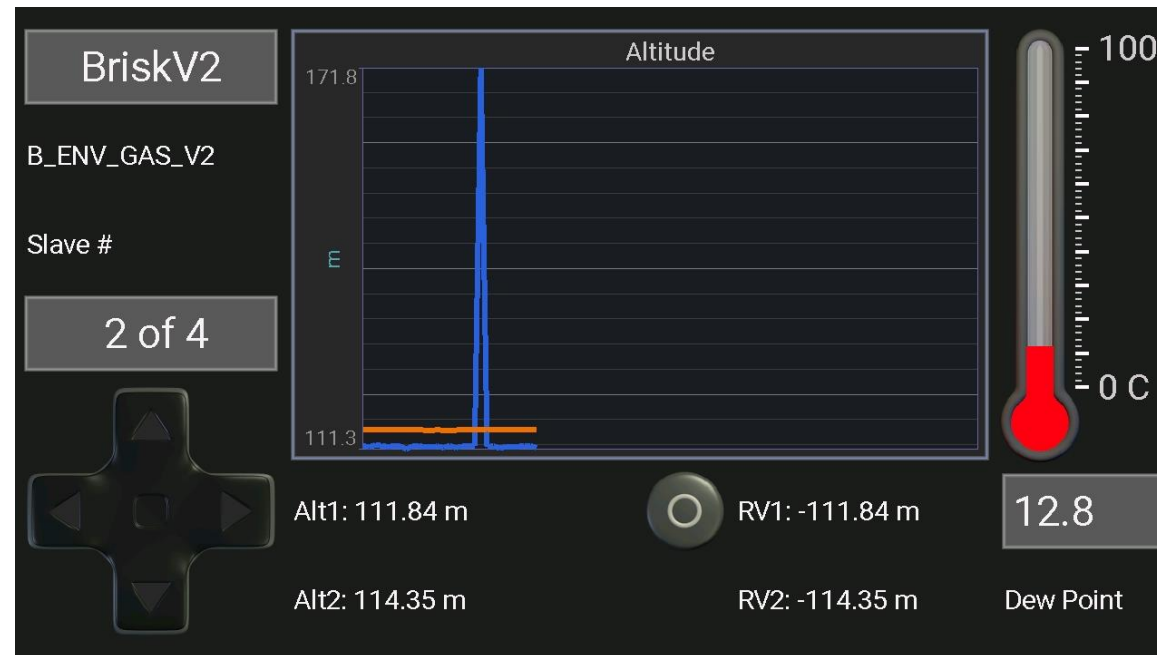
Shows standard pressure altitude with delta measurement
Based on US Standard Atmosphere 1976
Dew point is based on humidity and temperature (deg C)
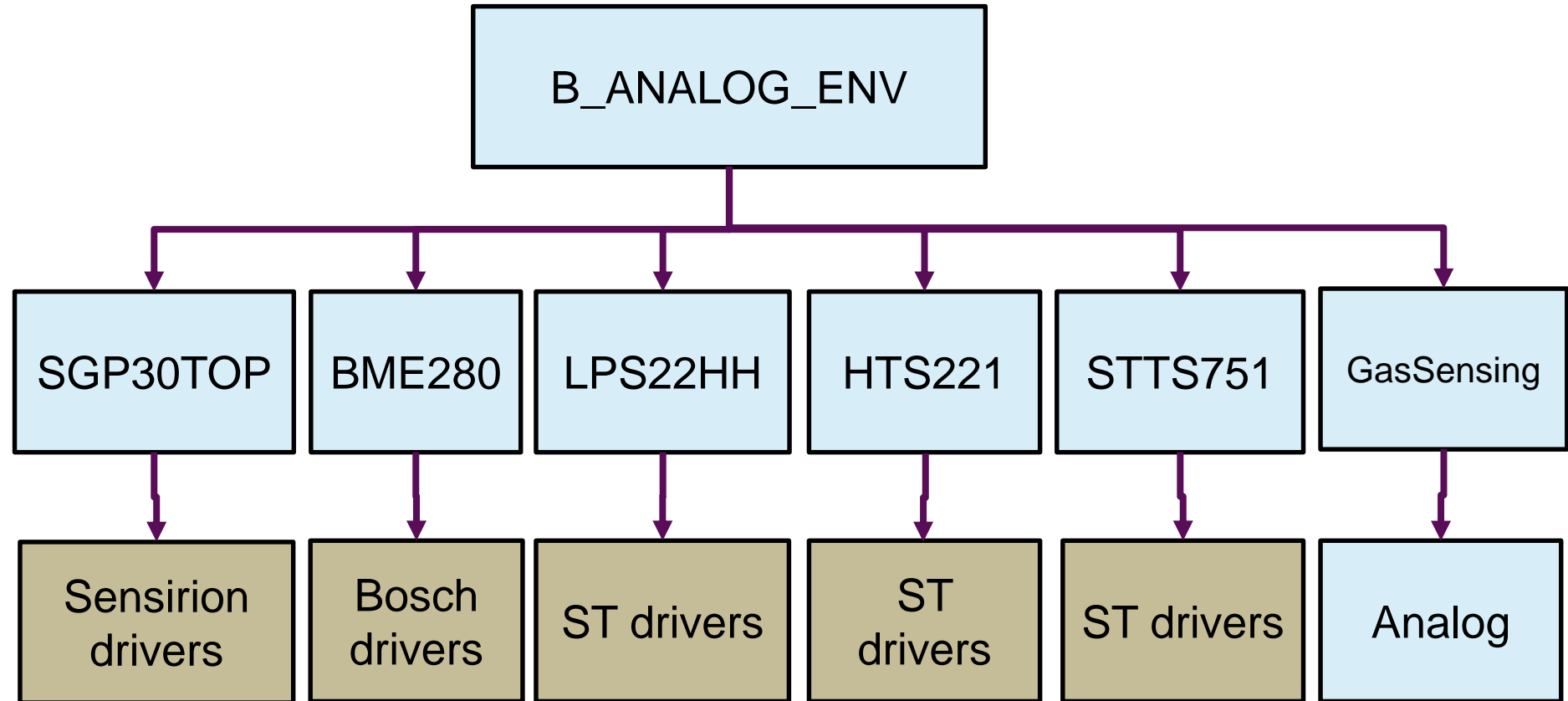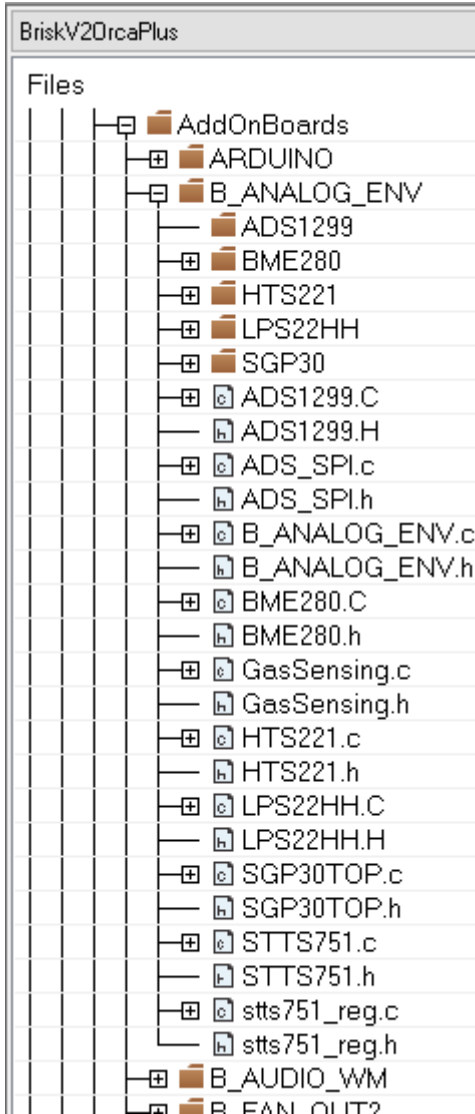On V2 boards, the interface maybe glitchy (SW fix TODO)

DAC set Vref voltage

2 scales available (op-amp)

Sensor ⇔ Vref output (mux)

Electrochemical Low power gas sensor
Put jumper if gas sensor has 2 metal pin
Remove jumper if gas sensor has 3 metal pins
It may take few minutes for gas sensor to take off, be patient.
Compatible with O_2, O_3, CO, CO_2, H_2S, etc..

BriskV2OrcaPlus

Files
- AddOnBoards
  - ARDUINO
  - B_ANALOG_ENV
    - ADS1299
    - BME280
    - HTS221
    - LPS22HH
    - SGP30
    - ADS1299.C
    - ADS1299.H
    - ADS_SPI.c
    - ADS_SPI.h
    - B_ANALOG_ENV.c
    - B_ANALOG_ENV.h
    - BME280.C
    - BME280.h
    - GasSensing.c
    - GasSensing.h
    - HTS221.c
    - HTS221.h
    - LPS22HH.C
    - LPS22HH.H
    - SGP30TOP.c
    - SGP30TOP.h
    - STTS751.c
    - STTS751.h
    - stts751_reg.c
    - stts751_reg.h
  - B_AUDIO_WM
  - B_FAN_OUT2

B_ANALOG_ENV

SGP30TOP	BME280	LPS22HH	HTS221	STTS751	GasSensing
Sensirion drivers	Bosch drivers	ST drivers	ST drivers	ST drivers	Analog

These drivers have their own versioning control

TI ADS1299 is for the environmental V1 add-on board for medical application