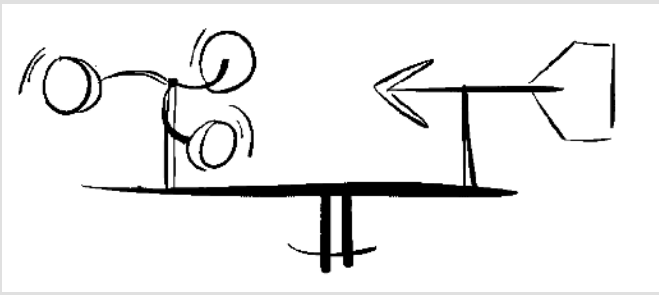


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The **WeatherPlus2 Board** is an stand alone and interface board for connecting a full featured, customizable board for Raspberry Pi and Arduino projects with an on-board ESP32 WiFi. It contains a built in I2C ADS1015 ADC and a BMP280 Barometer/Temperature sensor and contains interfaces for the following:

- SwitchDoc Labs WeatherRack Anemometer/Wind Vane/Rain Bucket
- Grove Compatible I2C Plug for additional sensors such as the SwitchDoc Labs Grove SHT30 Outside Temp/Humidity Sensor
- Any 3.3V I2C Device or Sensor
- ThunderBoard I2C Lightning Detector
- Pixel RGBW Serial LEDs (Neo Pixels)

Features and Benefits:

- Provides an excellent controller for a Weather Station hooked up to Raspberry Pi or Arduino
- Supports SwitchDoc Labs WeatherRack Wind Vane / Anemometer / Rain Bucket
- Contains I2C BMP280 Barometer/Temperature
- All onboard devices are 3.3V
- Supports I2C ThunderBoardLightning Detector
- Supports I2C SHT30 Temp/Hum Sensor
- Low Cost
- Full Test Code Supplied
- Quantity Discounts Available
- Immediate Availability

Introduction

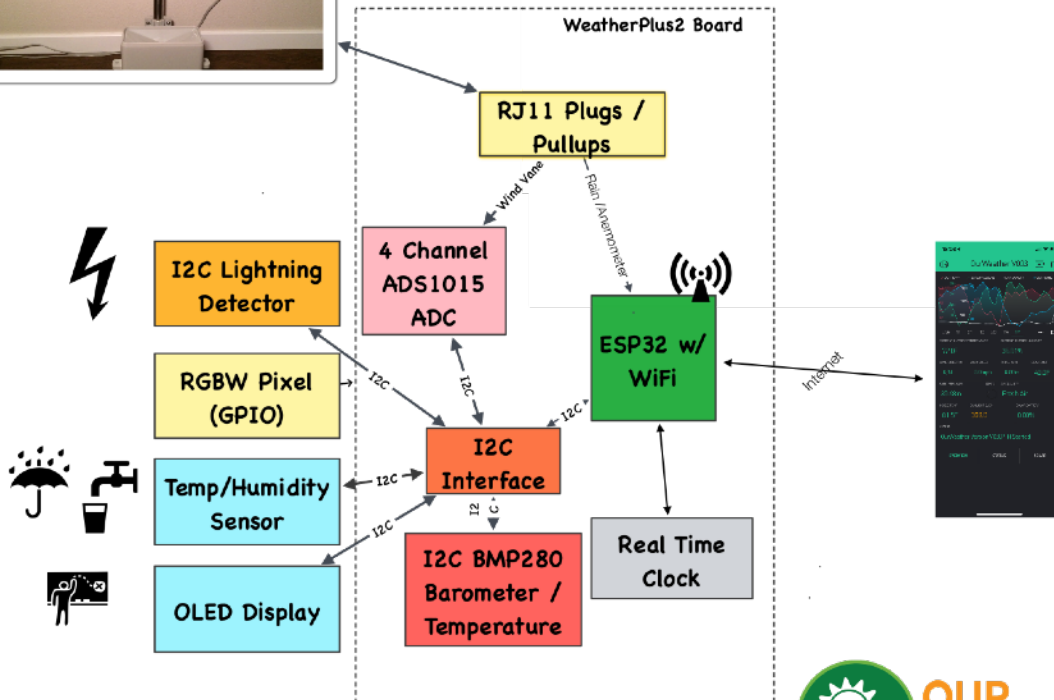


WeatherPlus2 is a complete weather station controller board designed to interface to Arduino and Raspberry Pi computers. It contains a full Arduino Compatible ESP32 Wifi computer and can run stand-alone or with a Raspberry Pi or Arduino.

Combine the WeatherPlus2 with a SunAir or SunAirPlus board to create a solar powered weather station. Additional code and examples on www.switchdoc.com on the WeatherPlus2 Product Page

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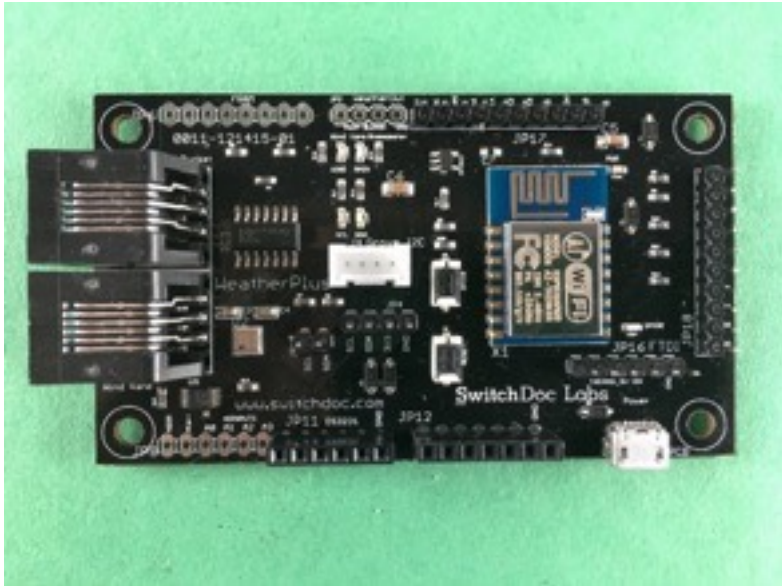
Block Diagram



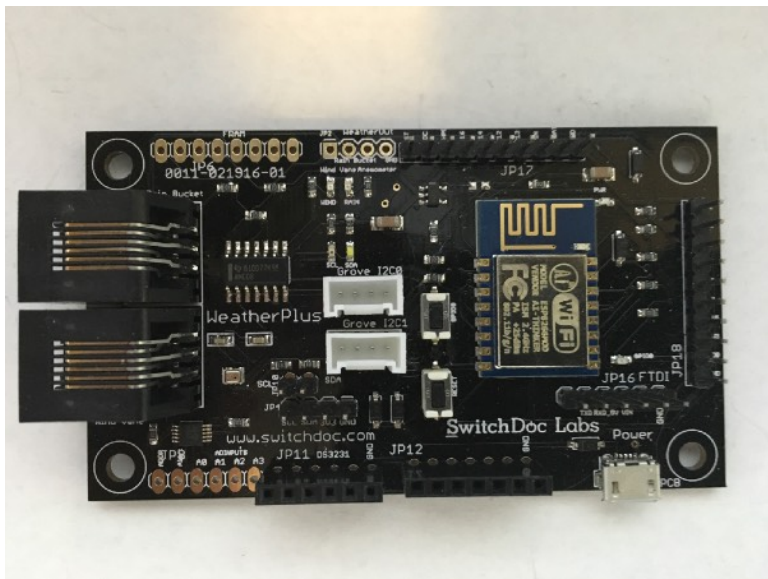
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Differences from WeatherPlus R1 and R2 to boards

Rev1 Boards (marked 0011-121415-01) have a BMP180 and one Grove I2C connector

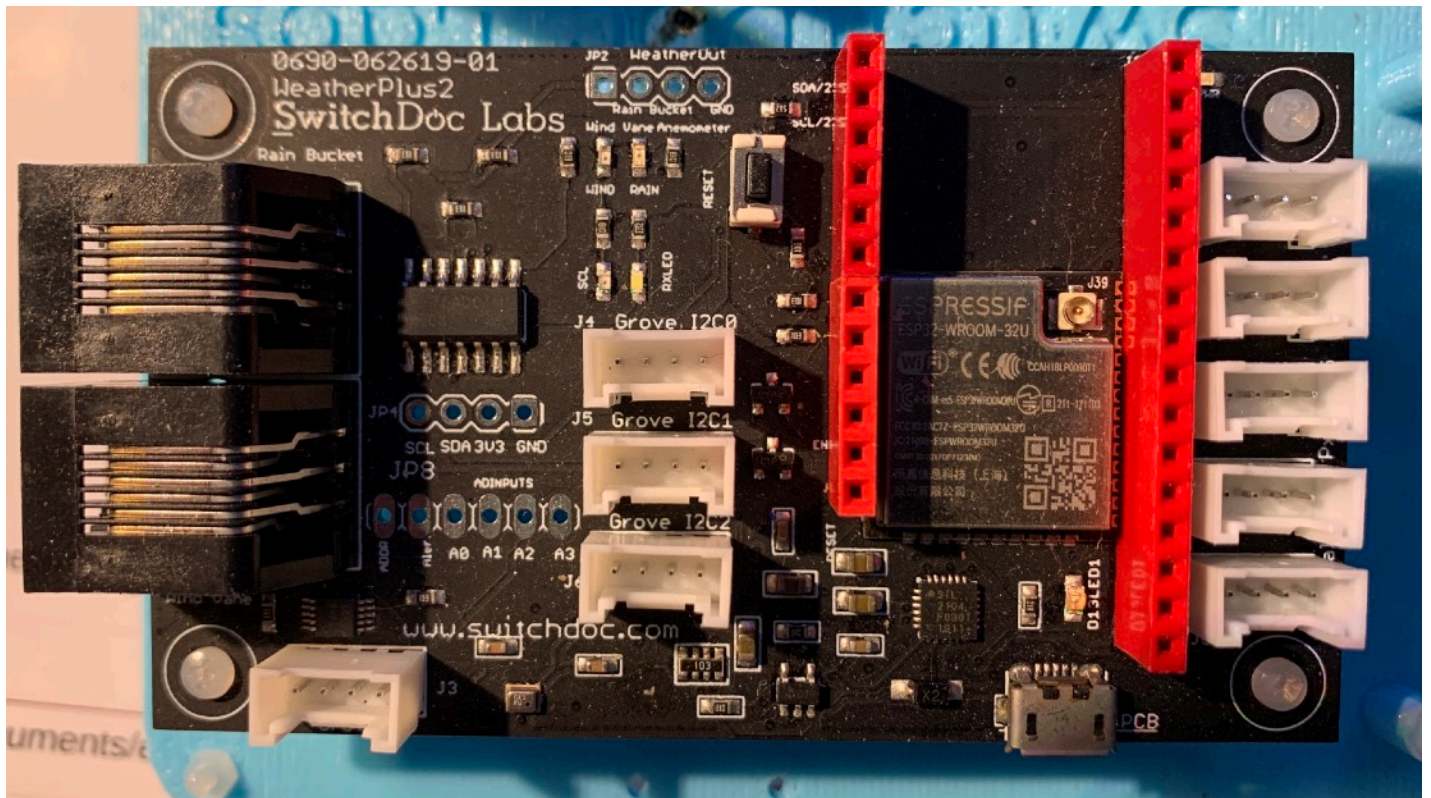


Rev 2 Boards (marked 0690-062619-01) contain a BMP280 and two Grove I2C Connectors



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WeatherPlus 2 board



Theory of Operation

Software

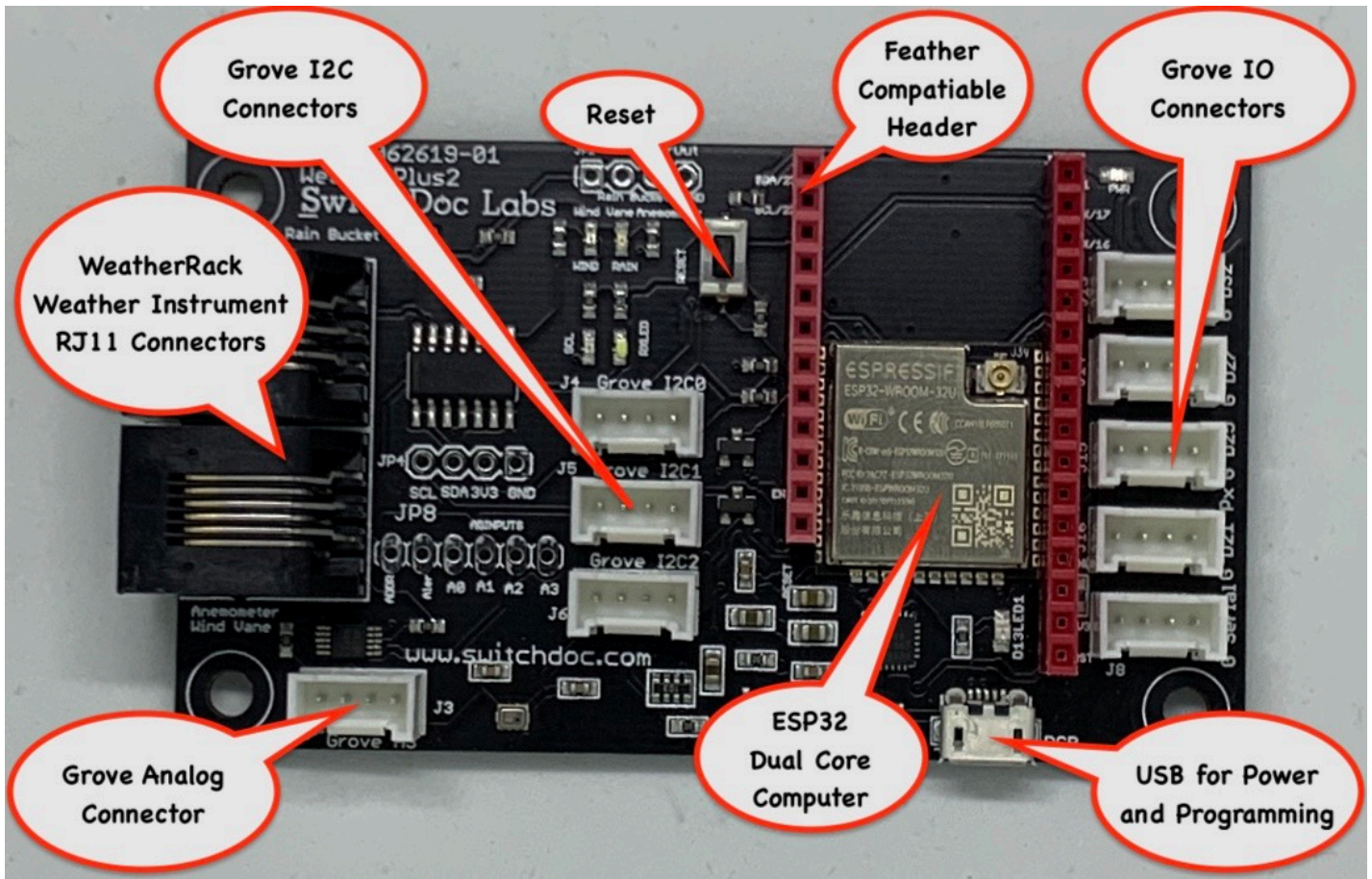
Software and drivers for the WeatherPlus2 boards can be located on the SwitchDoc Labs WeatherPlus2 product page (shop.switchdoc.com).

ESP32 w/WiFi

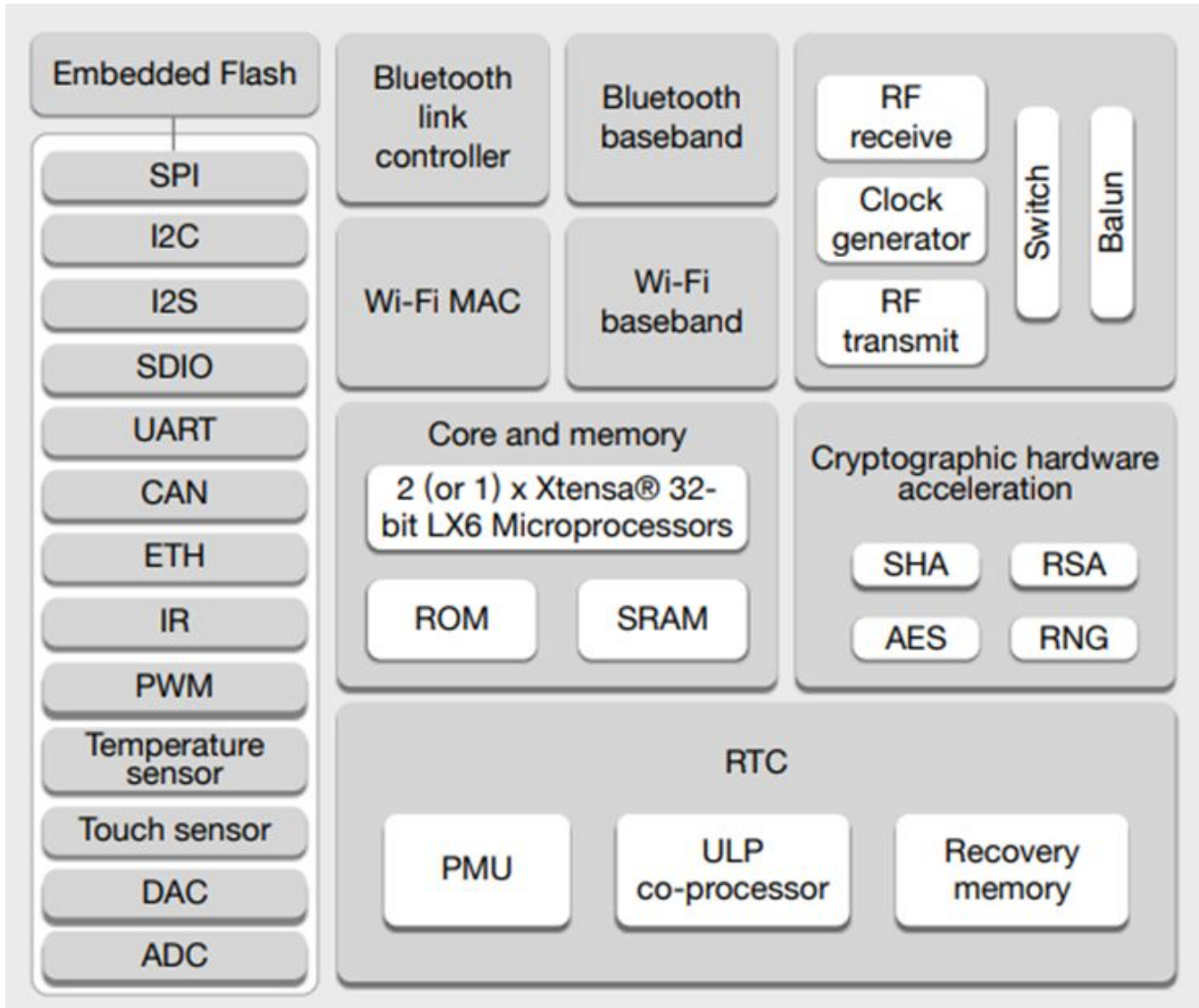
The heart of the WeatherPlus2 board is an ESP32-12 Module. It contains an Arduino IDE Compatible Dual Core CPU, 4Mbytes of program flash and over 80K bytes of usable RAM. The firmware implements a full WiFi interface compatible with most routers.

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While there are many firmware options for the ESP8266 available, SwitchDoc Labs uses the Arduino IDE and Arduino libraries to provide the best experience and functionality to WeatherPlus users.



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RJ11 Plugs / Pullups

The RJ11 Plugs on the WeatherPlus2 are designed to hook into inexpensive Anemometers, Wind Vanes and Rain Buckets. These plugs are wired to directly support the plugs coming from:

- SwitchDoc Labs WeatherRack (<http://www.switchdoc.com/weatherrack-weather-sensors/>). Available on the SwitchDoc Store and on Amazon.
- ArgentData (<http://www.argentdata.com>)

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- SparkFun (<http://www.sparkfun.com>)

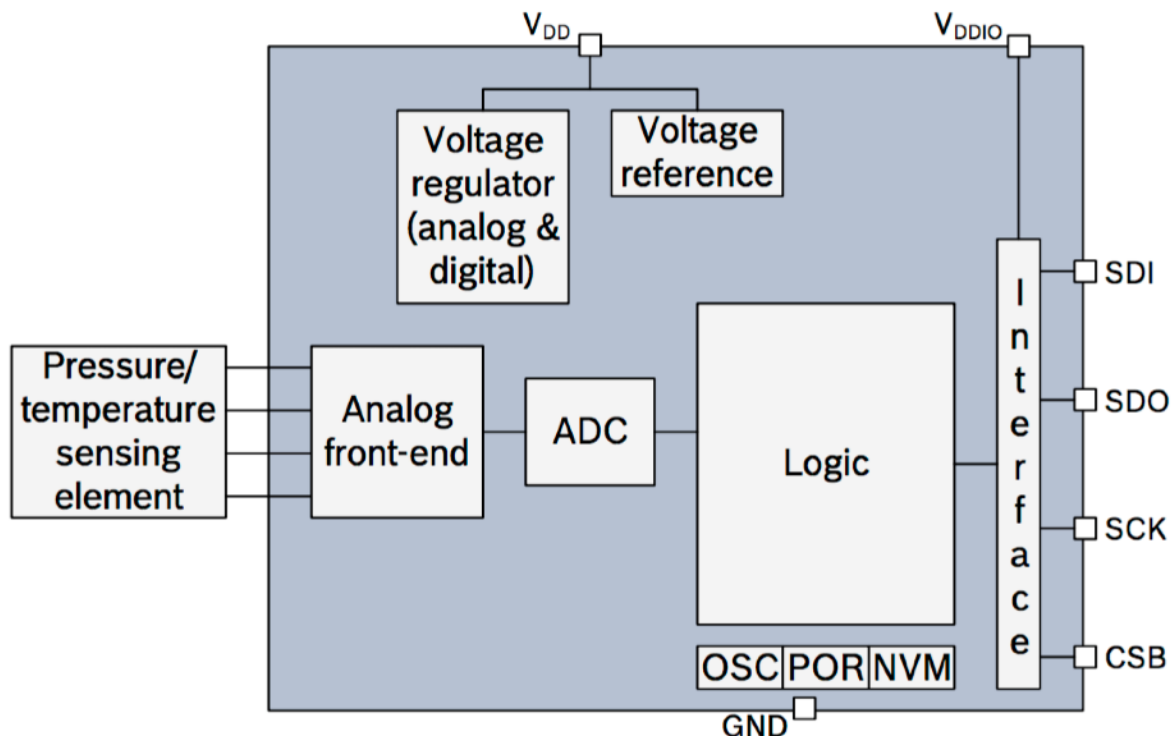
I2C Interface

The I2C interface has two parts. There are three Grove I2C connectors on the WeatherPlus2 Boards. These are 3.3V I2C Grove connectors. More about Grove Connectors on www.switchdoc.com. Note that you can plug these into a Raspberry Pi. If you do, make sure that the on board ESP32 is not also accessing the I2C Bus (this is easy to do with the Arduino IDE and an FTDI cable to program the Weather Plus board).

BMP280 Barometer / Temperature

The WeatherPlus2 board has an on board BMP280 Barometer / Temperature sensor connected to the I2C bus from the computer. The BMP280 is the functionally compatible successor of the BMP085 and BMP180 (the BMP180 is present on some early WeatherPlus2 R1 Boards).

With a low altitude noise of merely 0.25m at fast conversion time, the BMP280 offers superior performance. The BMP280 is based on piezo-resistive technology for EMC robustness, high accuracy and linearity as well as long term stability. The BMP280 consists of a piezo-resistive sensor, an analog to digital converter and a control unit with EEPROM and a serial I2C interface. The BMP280 delivers the uncompensated value of pressure and Temperature. Pressure data is 16 to 19 bits and temperature data is 16 bits. The resolution of the barometer is 0.16Pa and the temperature sensor is 0.01C.



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The BMP280 as shown above is a high precision I2C Barometer / Temperature sensor. Older WeatherPlus2 board (before revision 0690-062619-01) have the BMP180, the previous member of this family.

The specifications for this device is on the SwitchDoc Labs WeatherPlus2 product page.

ADS1015 4 Channel ADC

WeatherPlus2 contains an excellent built-in 12 bit 4 channel A/D converter an I2C device known as the ADS1015. The ADS1015 is a precision analog-to-digital converter (ADC) with 12 bits of resolution. The ADS1015 features an onboard reference and oscillator. Data are transferred via an I2C-compatible serial interface; four I2C slave addresses can be selected.

The ADS1015 can perform conversions at rates up to 3300 samples per second (SPS). An onboard PGA is available on the ADS1015 that offers input ranges from the supply to as low as $\pm 256\text{mV}$, allowing both large and small signals to be measured with high resolution. The ADS1015 also features an input multiplexer (MUX) that provides two differential or four single-ended inputs.

The ADS1015 operates either in continuous conversion mode or a single-shot mode that automatically powers down after a conversion and greatly reduces current consumption during idle periods.

Software for the ADS1015 for both the Raspberry Pi and Arduino is readily available from Adafruit and others.

The Default I2C address is 0x49. If you have more than one 0x49 address in your system, consider using a SwitchDoc Labs I2C 4 channel Mux to avoid address conflicts.

WeatherPlus2 Sensor Compatibility

The anemometer and rain bucket pins are pulled to 3.3V via a 10K Ohm pullup resistor. These are intended to connect to interrupt inputs on the host computer.

The standard Anemometer in these devices measures wind speed by closing a contact as a magnet moves past a switch. One contact closure a second indicates 1.492 MPH (2.4 km/h). If you use a different anemometer, this constant can be changed in software.

The tipping bucket Rain Gauge is used the SwitchDoc Labs WeatherRack, the SparkFun Weather Sensor and the ArgentData Sensors. The standard rain gauge used in these devices makes one momentary contact closure that can be recorded with a micro controller interrupt input. Each contact closure of the standard unit indicates 0.011 inch (0.2794 mm). If you use a different tipping rain gauge you can adjust these values in software.

The Wind vane has 8 switches, each connected to a different resistor. The WeatherPlus2 measures the resistance value of the resistor by measuring the voltage on a resistor divider (with 10K Ohm onboard

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resistor). With a WeatherPlus2 board, it is measured either with the on-board ADS1015. See the SwitchDoc Labs WeatherRack Product Specification for more information on the Wind Vane.

See the SwitchDoc Labs drivers provided on www.switchdoc.com.

Note that most RJ11 cables only have 4 wires instead of the six allowed by the plug.

The specifications for this device is on the SwitchDoc Labs WeatherPlus2 product page.

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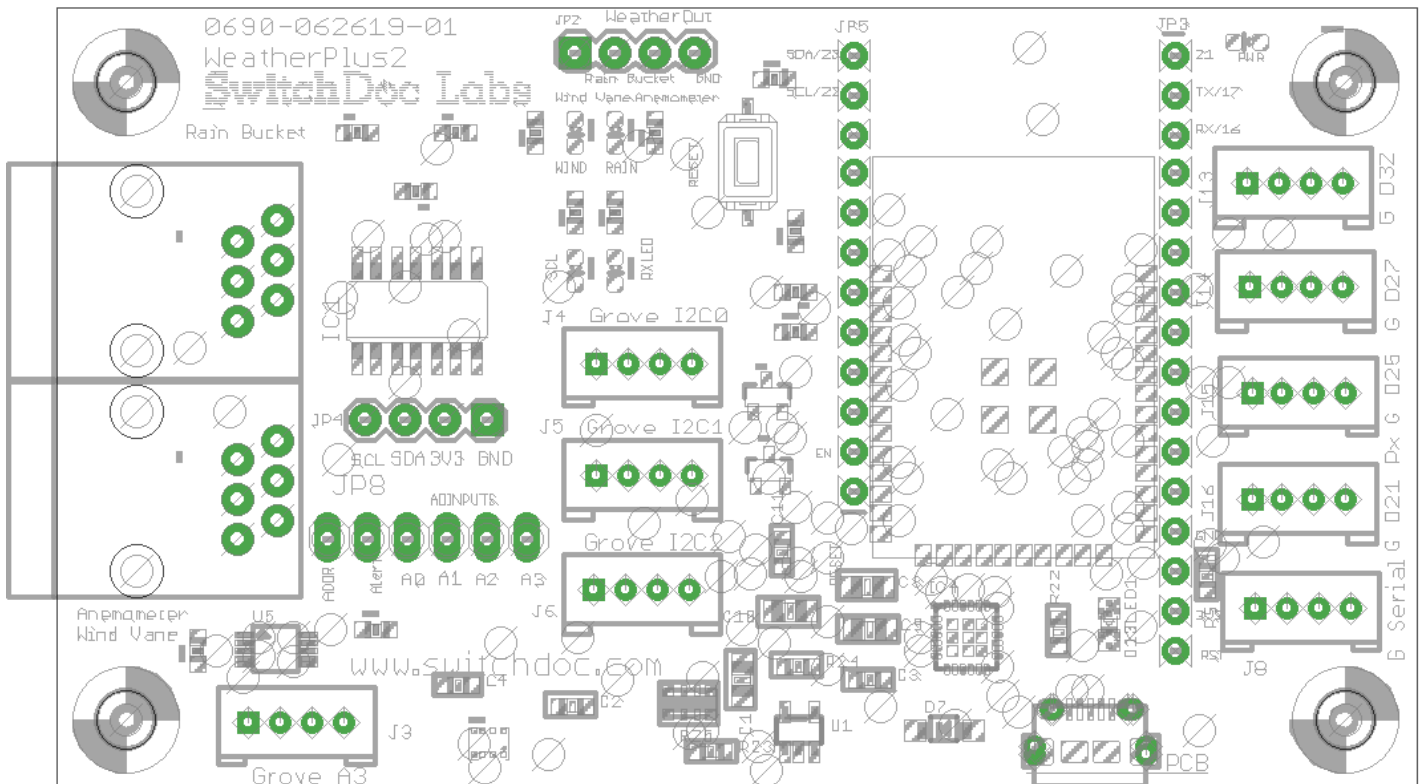
Default I2C Addresses

The default I2C addresses for the on board devices are shown below.

DEVICE	DESCRIPTION	HEX ADDRESS	COMMENTS
BMP280	Barometer / Temperature	0x77	Included
ADS1015	ADC	0x49	Included

Operating Values

	Min	Normal	Max	Unit
3V3	3.313V	3.3V	3.465	V



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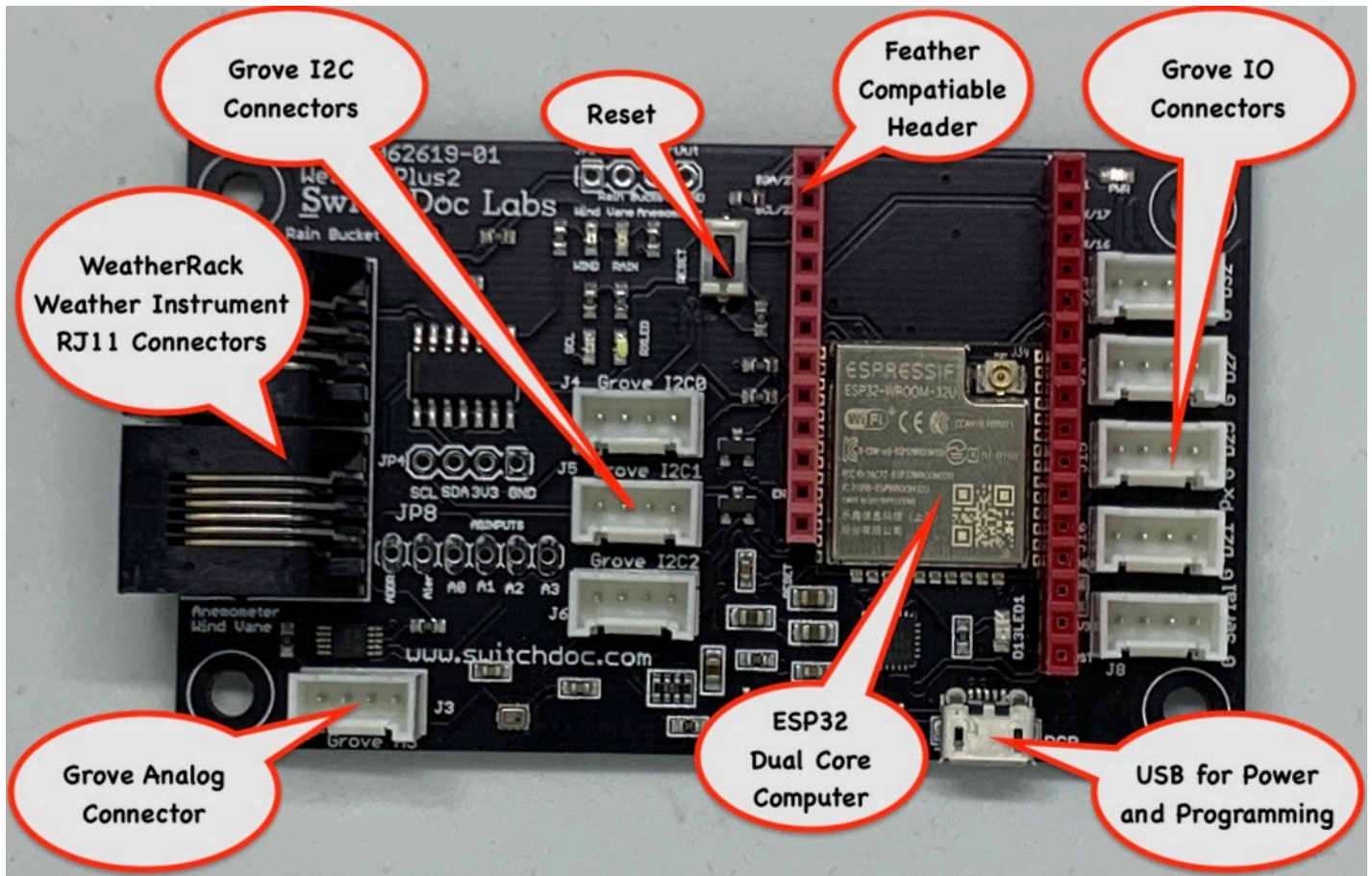
*WeatherPlus2 Power Consumption depends on what other devices you have added to the board.

WeatherPlus2 Board Jumper Pin and Plug Locations

Physical dimensions of board: 89mm x 50mm x 14.5mm(max). Mounting holes inset 3.8mm x 3.8mm from each corner to center of hole. Diameter of hole 2mm.

I/O Key:

- I - Digital Input
- O - Digital Output
- A - Analog



LED Displays

- SCL - Blinks White when I2C bus is accessed
- WInd - Blinks when the anemometer is moving
- Rain - Blinks when the Rain bucket is clicking (getting rain)
- D13LED - Can be controlled with GPIO 13
- PWR - On when Power is applied to board

Push Button Switch Functions

RESET Push Button

Pushing this button resets the ESP32 and restarts the sketch.

Arduino IDE

In order to install the Arduino IDE with support for the ESP32 on the WeatherPlus2 board, please follow the excellent Adafruit tutorial here:

<https://learn.adafruit.com/adafruit-huzzah-ESP32-breakout/using-arduino-ide>

Programming Sequence

In order to upload code to the ESP32 and use the serial console, you USB Type A to Micro USB cable. It can be programmed directly from Arduino IDE with no button pushing.

Plug Functions

J1 - Anemometer / Wind Vane RJ11 Plug

Used to connect the WeatherPiArduino board to a wind vane and anemometer such as used in the SwitchDoc Labs WeatherRack, the SparkFun Weather Sensor and the ArgentData Sensors. The standard Anemometer in these devices measures wind speed by closing a contact as a magnet moves past a switch. One contact closure a second indicates 1.492 MPH (2.4 km/h). If you use a different anemometer, this constant can be changed in software. The Wind vane has 8 switches, each connected to a different resistor. The WeatherPlus2 measures the resistance value of the resistor by measuring the voltage on a resistor divider (with 10 K Ohm resistor). With an Arduino, it is measured either with the optional ADS1015 or the internal A/D converters. In the case of a Raspberry Pi measuring this voltage requires an external A/D converter such as the ADS1015. See the SwitchDoc Labs WeatherRack Product Specification for more information on the Wind Vane.

NAME	PIN	I/O	DESCRIPTION
N/C	J1 / 1		No Connection
GND	J1 / 2	A	Connected to GND
GND	J1 / 3	A	Connected to GND
Anemometer	J1 / 4	A	Connected to Anemometer pin on JP2 and 10K Ohm Pullup to 3V3
Wind Vane	J1 / 5	A	Connected to Wind Vane Pin on JP2 and also to ADC-A1 on JP5 and JP8 for use by the optional ADS1015 ADC and 10K Ohm Pullup to 3V3
N/C	J1 / 6		No Connection

J2 - Rain Bucket RJ11 Plug

Used to connect the WeatherPlus2 to a tipping bucket Rain Gauge used in the SwitchDoc Labs WeatherRack, the SparkFun Weather Sensor and the ArgentData Sensors. The standard rain gauge used in these devices makes one momentary contact closure that can be recorded with a micro controller interrupt input. Each contact closure of the standard unit indicates 0.011 inch (0.2794 mm). If you use a different tipping rain gauge you can adjust these values in software.

Note that most RJ11 cables only have 4 wires instead of the six allowed by the plug.

NAME	PIN	I/O	DESCRIPTION
N/C	J2 / 1		No Connection
N/C	J2 / 2		No Connection
GND	J2 / 3	A	Connected to GND
RainBucket Contact	J2 / 4	A	Connected to Rain Gauge ping on JP2 and 10K Ohm Pullup to 3V3
N/C	J2 / 5		No Connection
N/C	J2 / 6		No Connection

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Jumper Pin Functions

JP1 - Power / Programming

This is a MicroUSB plug used to supply 5V power to the WeatherPlus2 board. It is also used for programming. There is an onboard 3.3V regulator.

JP5 and JP3

These two headers are Adafruit Feather compatible. Please see <https://learn.adafruit.com/adafruit-feather-m0-wifi-atwinc1500/pinouts> for information on individual pins.

JP2 - WeatherOut

This is the WeatherPlus2 WeatherRack optional sensor outputs.

NAME	PIN	I/O	DESCRIPTION
WindVane	JP2 / 1	O	Connect to A/D Input on Arduino. N/C for Raspberry Pi. Use an external ADC for Raspberry Pi (such as the ADS1015 on the WeatherPlus2 board)
RainBucket	JP2 / 2	O	Active Low Interrupt on each click of the Rain Bucket - Not Debounced. 10K pullup resistor
Anemometer	JP2 / 3	O	Active Low Interrupt on each click of the Anemometer - Not Debounced. 10K pullup resistor
GND	JP2 / 4	A	Connected to GND

JP8 - A/D Inputs for ADS1015 ADC

Connect up external A/D Inputs using this header. The ADS1015 chips have a base 7-bit I2C address of 0x48 and an addressing scheme that allows four different addresses using just one address pin. To program the address, connect the address pin as follows:

- 0x48 (1001000) ADDR -> GND
- 0x49 (1001001) ADDR -> VDD
- 0x4A (1001010) ADDR -> SDA
- 0x4B (1001011) ADDR -> SCL

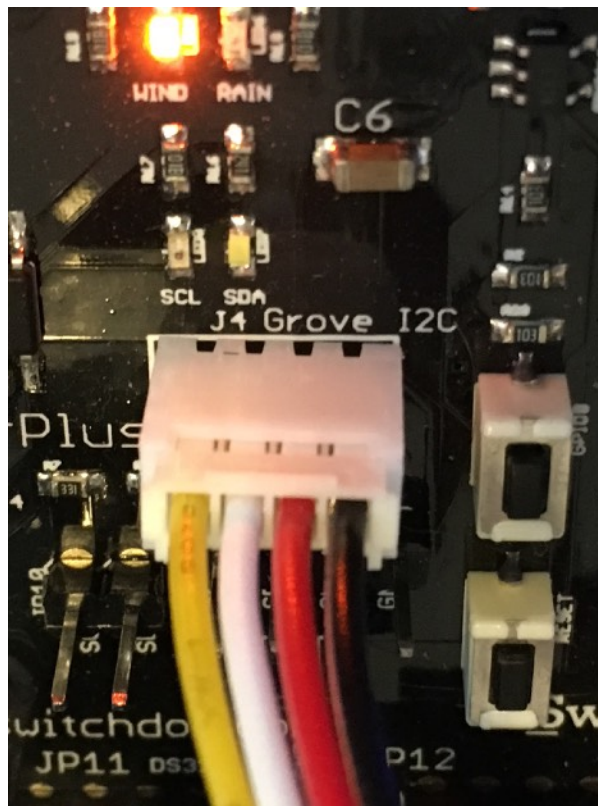
The ADDR is internally connected to VDD through a 10K Resistor, for address 0x49.

NAME	PIN	I/O	DESCRIPTION
ADDR	JP8 / 1	I	I2C slave address select
ALRT	JP8 / 2	O	Digital comparator output or conversion ready
A0	JP8 / 3	A	Differential channel 1: Positive Input or single-ended channel 1 input
A1	JP8 / 4	A	Differential channel 1: Negative Input or single-ended channel 2 input. Connected to WindVane Input on JP1
A2	JP8 / 5	A	Differential channel 2: Positive Input or single-ended channel 3 input.
A3	JP8 / 6	A	Differential channel 2: Negative Input or single-ended channel 4 input

Grove Connectors

I2C Grove Connectors

The WeatherPlus2 has three identical Grove I2C connectors, I2C0, IC01 and I2C2. These are for plugging in Grove I2C devices, such as the Grove OLED Display and the Grove AM2315 Outside Temperature/Humidity Sensor. These are 3.3V I2C Grove Connectors.



J4, J5, J6 - Grove I2C Connectors

These are 3.3V Grove Connectors.

J4, J5, J6 - Grove I2C		
Pin 1	SCL	I2C Clock
Pin 2	SDA	I2C Data
Pin 3	3.3V	Power for Grove Module
Pin 4	GND	Ground

J8 - Grove Serial - 3.3V

Grove Digital		
Pin 1	RX	Serial Receive (from base point of view)
Pin 2	TX	Serial Transmit (from base point of view)
Pin 3	3.3V	Power for Grove Module
Pin 4	GND	Ground

J13 - Grove Digital - D32 - 3.3V

J1 - Grove Digital		
Pin 1	D32	Digital I/O Pin 32
Pin 2	N/C	No Connection
Pin 3	3.3V	Power for Grove Module
Pin 4	GND	Ground

J14 - Grove Digital - D27 - 3.3V

J1 - Grove Digital		
Pin 1	D27	Digital I/O Pin 27
Pin 2	N/C	No Connection
Pin 3	3.3V	Power for Grove Module
Pin 4	GND	Ground

J15 - Grove Digital - D25 - 3.3V

J1 - Grove Digital		
Pin 1	D25	Digital I/O Pin 25
Pin 2	N/C	No Connection
Pin 3	3.3V	Power for Grove Module
Pin 4	GND	Ground

J16 - Grove Digital - D21 - 3.3V (Designed for Pixel / NeoPixel use)

J1 - Grove Digital		
Pin 1	D21	Digital I/O Pin 21 - has a 100 ohm resistor in series
Pin 2	N/C	No Connection
Pin 3	3.3V	Power for Grove Module
Pin 4	GND	Ground

Software

The Arduino software for WeatherPlus2 is available on:

https://github.com/switchdoclabs/SDL_ESP32_OurWeather