BULLSEYE - Industrial Wireless IoT solution

1. Bullseye Package Content

A. Anti-static bag
   a. 1x Bullseye PCB assembly ....Part#: FUT-BULLSEYE-0
   b. 1x Flex PCB Antenna (AE3)..............................Part#: 2108792-1
B. Plastic zip bag
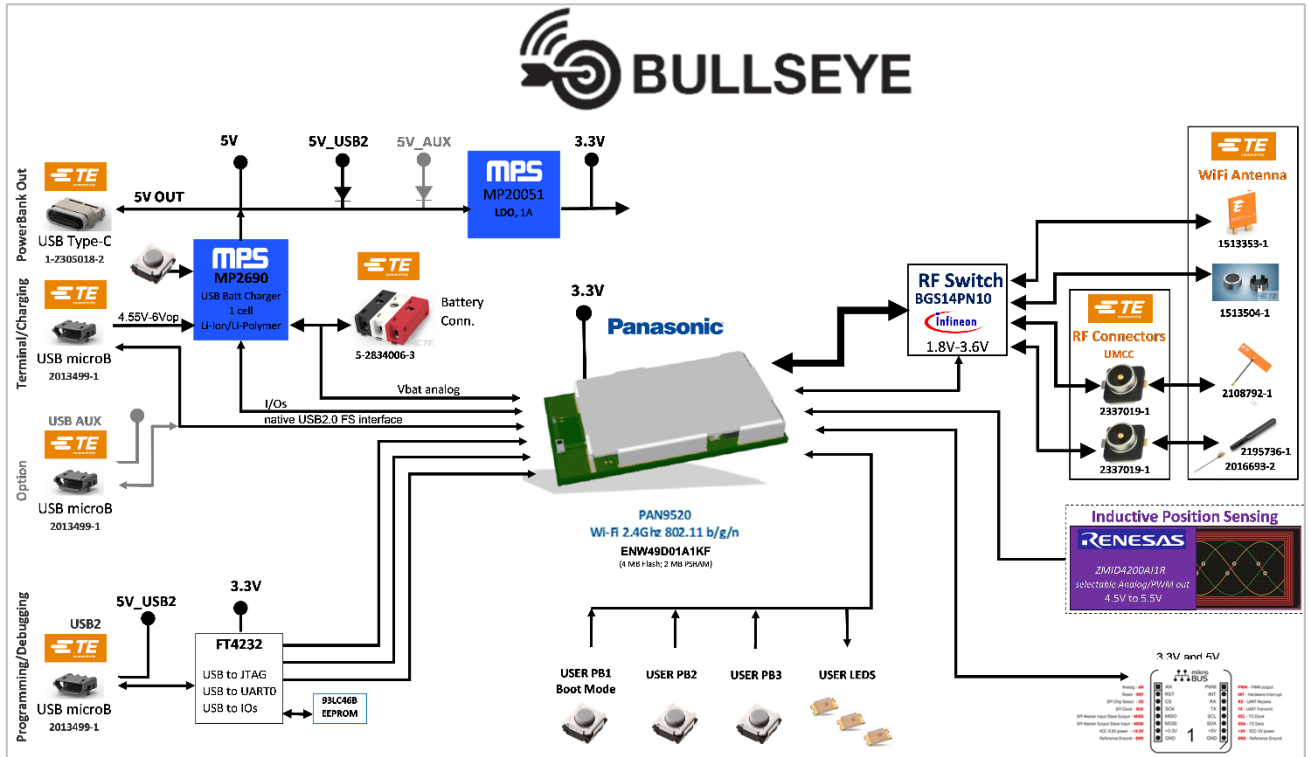   a. 1x Paddle Antenna with cable (AE4).................Part#: 2195736-1 & 2016693-2

Required (not included)
   A. 1x USB 5V power source and/or 1x standard computer USB port
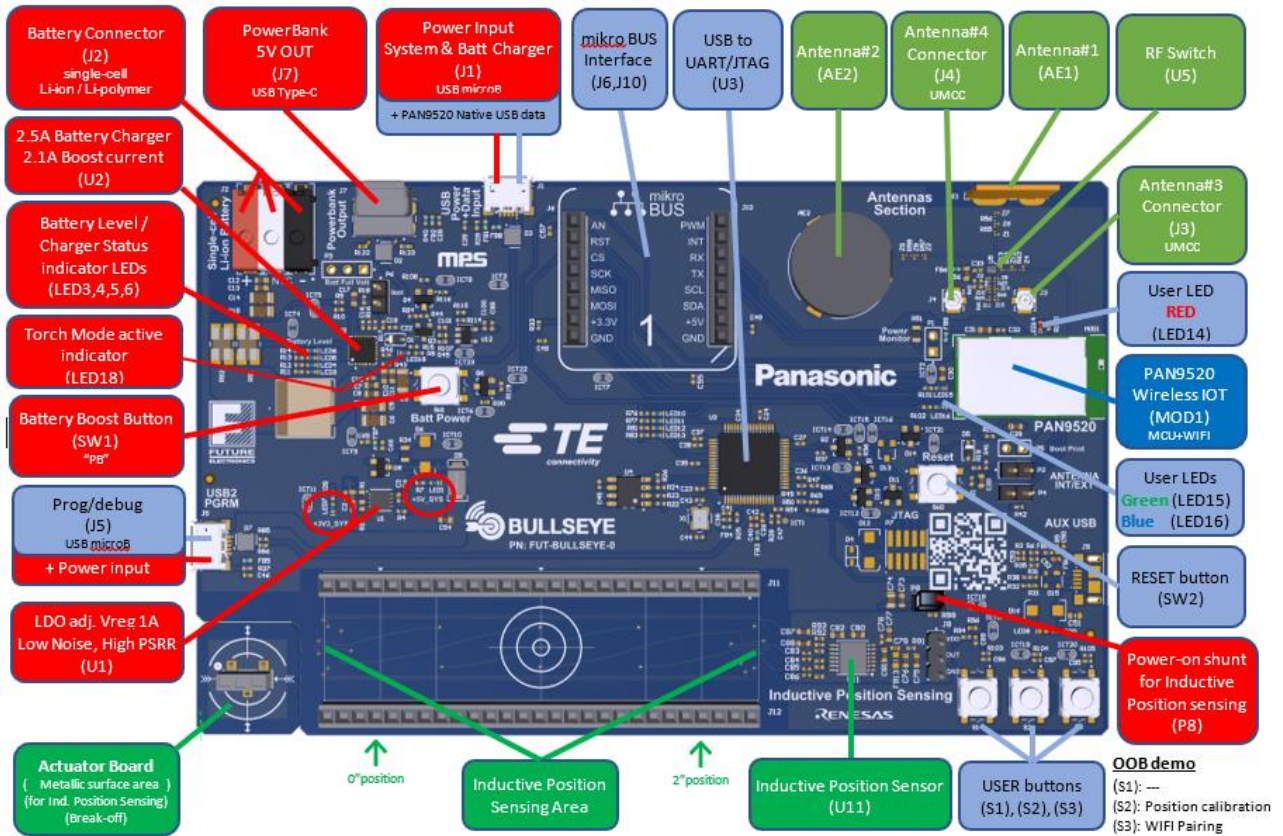   with USB micro-B cable connector

Optional (not included) for Battery operation
   A. 1x single-cell Lithium Battery Cell
   B. 1x USB Type-C cable

2. Bullseye Block Diagram

3. PCB Assembly Details

4. SETUP Instructions

4.1. Bullseye Board Setup

- Verify Jumper on is present on P8 (to power the Inductive position sensor circuitry) (Fig.1)
- Break-off the small Actuator PCB attached to the lower left corner of the Bullseye board, by twisting up/down with your hand or using cutters. (Fig.2)
  - ⇨ Place this small actuator board anywhere in between the two guiderails (J11) & (J12), as shown in Fig 2.
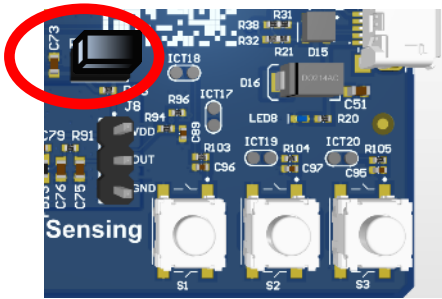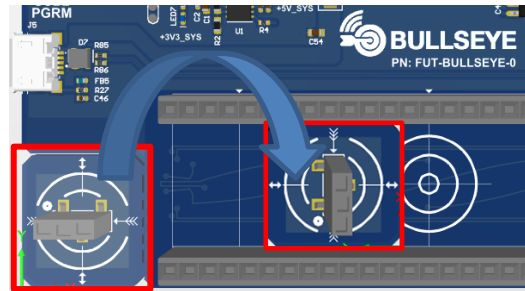

Fig.1 **P8 Jumper**

Fig.2 **Break Out Actuator Board**

- Connect the "Flex PCB" antenna (TE# 2108792-1, Fig.3) to connector (J3)
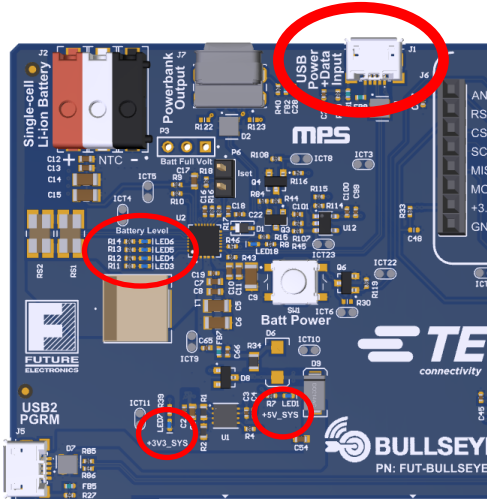- Connect the "Paddle" antenna (TE# 2195736-1 & 2016693-2, Fig.4) to connector (J4)

2108792-1

2195736-1

2016693-2

Fig.3 Flex PCB Antenna Connect to (J3)   **Fig.4** Paddle Antenna Connect to (J4)

4.2. Power the Bullseye Board

- For demonstration purposes, connect a +5V USB power supply, or a computer USB port, to the USB micro-B connector **(J1)** "USB Power+Data" at the top left of the Bullseye board (Fig.5).

(Fig.5)

- For programming and debugging, connect a computer port to "USB2 PGRM" (J5) . This port can also power the board by itself. Note: The "USB Power+Data" (J1) port can be used simultaneously with (J5) in order to provide more power, or to charge an optional battery.
- If an optional battery (not provided) is connected at (J2):
  - o To power the board from the battery, press the "Batt Power" button (SW1) once
  - o Make sure (LED18) turns ON after a small delay to indicate that the MP2690's Torch Mode is activated. This mode disables its 16sec-minimum-load power down when load is less than ~60mA drawn from the battery while in Boost mode.
  - o On power-up the Torch mode is toggled ON automatically by the PAN9520. Regular reset will toggle this mode off /on
  - o To toggle the Torch mode manually, press the "Batt Power" button (SW1) twice within the same second
  - o To turn OFF the battery boost mode, first deactivate the torch mode then press the "Batt Power" button once hold it down for more than 2.5sec

4.3. Phone or Tablet App Setup

- Connect your device to the WIFI network

- Download and install the Espressif ESPTOUCH application from the Web Store

  Developer:
  ESPRESSIF SYSTEMS (SHANGHAI) CO., LTD.,

Android: https://play.google.com/store/apps/details?id=com.espressif.iot_esptouch_demo_ko&hl=es&gl=US

IOS : https://apps.apple.com/us/app/espressif-esptouch/id1071176700

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5. Out-Of-The-Box (OOB) Demo

5.1. Power-up

See Setup instruction in Section 4.2

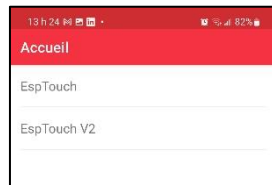### 5.2. WIFI Pairing

5.2.1. Bullseye Board:

- Press Button (S3) once to initiate pairing mode => **Blue LED** flashing 2 times/sec

5.2.2. Phone or Tablet

- Connect your device to the WIFI network (2.4Ghz)
  (Internet access is required for some of the webpage buttons/images)
- Start the Espressif ESPTouch application downloaded in the setup Section 4.3

- Select EspTouch in the Main menu
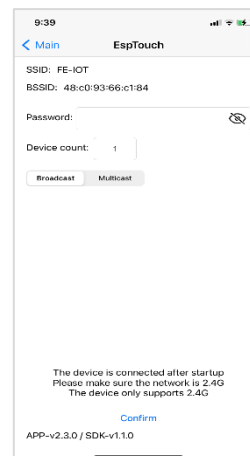
Android App	*iPhone App*

- Verify SSID name is correct
- Enter the WIFI network access password
- Click "Start" on Android app or "Confirm" on iPhone App at bottom of screen (Close virtual keypad)
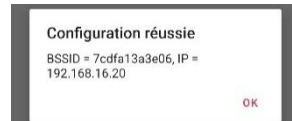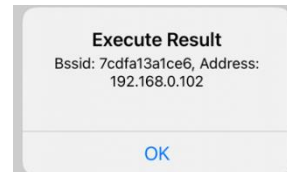
Android App	*iPhone App*

⇨ After several seconds (30 – 60 seconds typically), a confirmation of successful pairing message with IP address should be shown on the screen. The PAN9520 on Bullseye is now paired with the selected WIFI Network.

Important: Note the IP address indicated

Example shown: 192.168.16.20

Android

iPhone

⇨ On the Bullseye board, once pairing successful, the Blue LED will stop blinking

Note: If unsuccessful, clear the message window and:
- Verify the SSID name your device is connected to
- Verify the WIFI network access password
- Verify the Bullseye board is in pairing mode (Blue LED blinking 2times/sec). If not, press the (S3) button again to re-start the pairing process, or press Reset (SW2) and then (S3)

To stop the pairing process at any time, press the Reset (SW2) button

▪ Open an internet browser on a PC connected to the same WIFI network (Chrome or Microsoft Edge) or on your mobile device
▪ In the web browser address bar, type the IP address noted above

Example: 192.168.16.20

This will connect to the Bullseye (PAN9520) embedded webpage server which provides remote control and monitoring interface for the OOB functional demonstrations.
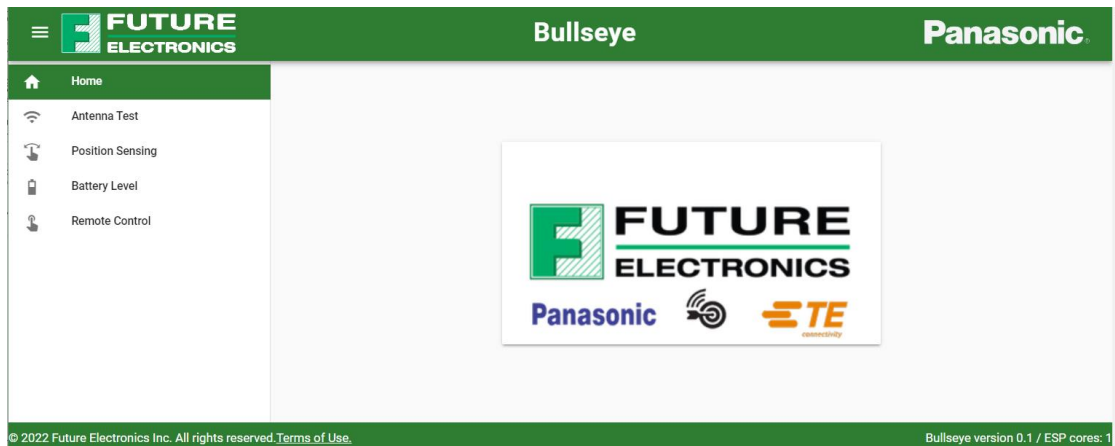
6. Bullseye (PAN9520) Embedded Web Page

Bullseye's OOB demo application aims at demonstrating the PAN9520 features and advantages for IoT solutions. Through its embedded web page interface, the demo application provides antenna test, inductive position sensing demo, battery / charging voltage monitoring and remote control functions.

6.1. Home

Displays Future's and main components manufacturers' logos
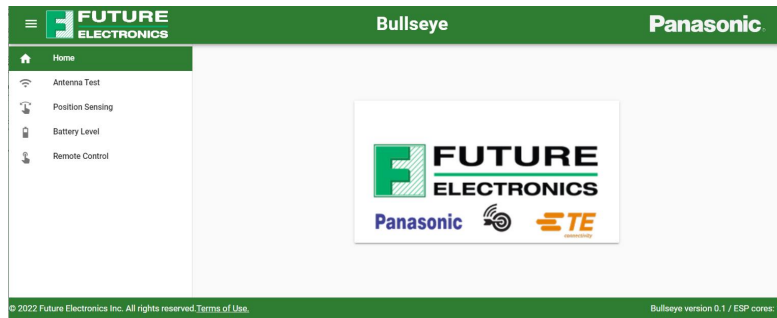
6.2. Antenna Test

#### 6.2.1. Bullseye WiFi Antennas

Allows the remote selection one of the four Bullseye's WIFI antennas.

Select an antenna and perform a WIFI scan by clicking on the "WIFI SCAN" button on the web page. The web page will display the SSID, RSSI, Channel, Security information for each WIFI access point detected with the selected antenna.
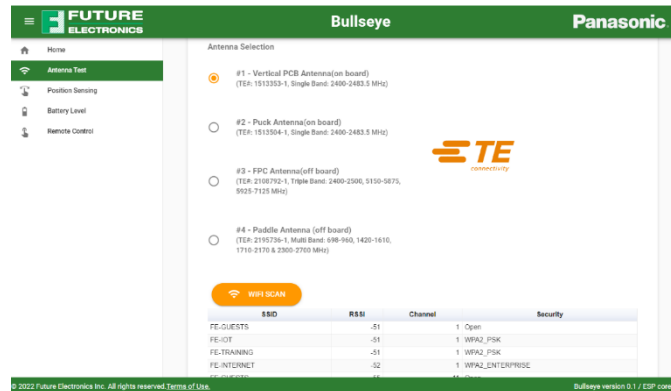

6.2.2. PAN9520 Embedded Antenna

To use the PAN9520's built-in embedded antenna, place jumpers on both P2 and P4. The WIFI connection and WIFI Scan will then go through the PAN9520's embedded antenna, no matter which external antenna appears to be selected on the web page. Remove the two jumpers to allow the selection of the four external antennas.
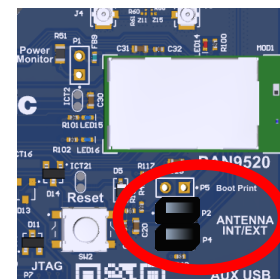
6.3. Position Sensor

Displays live graph of the Inductive Position Sensor. The graphic bar will move to indicate the center position of the break out actuator board as it moving along the 2 inch long sensing track. The bar graph scale is 2 inches. (Note: The Web Page refresh rate is set at ~0.5 second. The refresh rate of the sensor itself can be ~50µs to 500µs depending on oversampling setting).
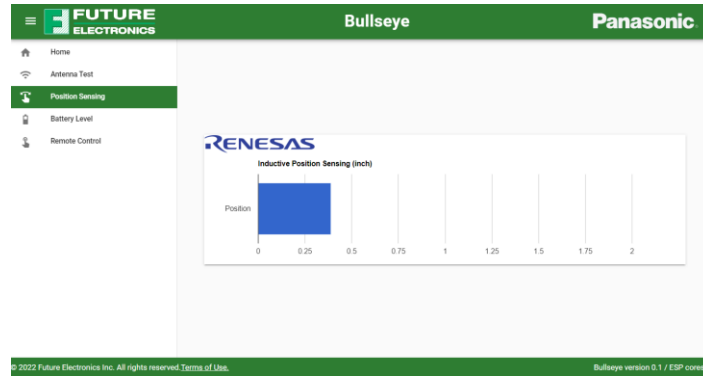

6.4. Battery Level

Displays live graph of Battery Voltage or Charge Voltage.
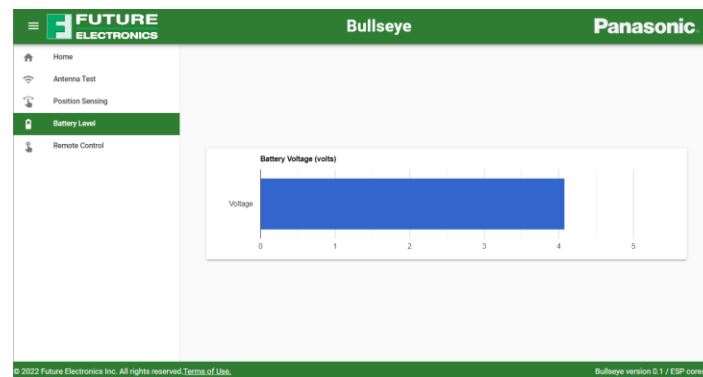
6.5. Remote Control

This page demonstrate remote control function of the PAN9520 via its embedded web page interface. The OOB demo firmware allows ON/OFF remote control of the three user LEDs on the Bullseye board by simply clicking the corresponding slide button on this web page interface.
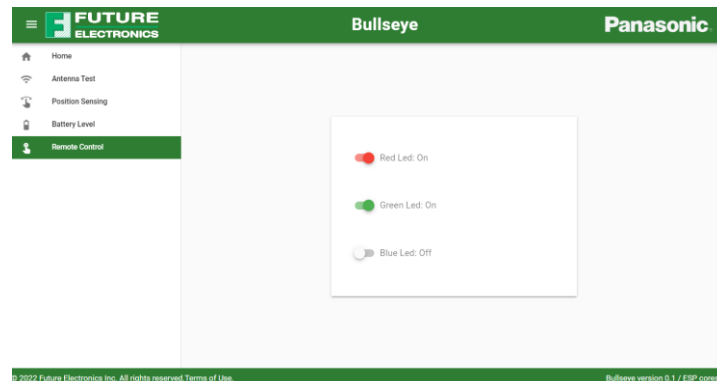
## 7. Appendix 1 - Inductive Position Sensor Calibration

The Bullseye board features the Renesas ZMID4200 inductive position sensor, which is configured to provide a proportional voltage output relative to the actuator position (between 0 to 2 inches), and the output voltage range is set at 5% to 50% of the ZMID4200 supply voltage (~5V) to comply with the ADC input requiremments (~2.5Vmax). The OOB demo firmware default setting assumes the ZMID4200 supply is at 5.1V for the voltage-to-position conversion. When powering the Bullseye board via J5 micro USB port, instead of J1, due to the ORing diode in series, the sensor supply voltage may become as low as 4.6V instead of 5.1V. In order to get a more accurate position sensing, the OOB demo software provides an easy way to compensate different supply level by performing the following simple calibration process.

Inductive position sensor calibration:

- **Press once the User Button (S2)** on the Bullseye board to start the position calibration process
  - ⇨ Green LED will start blinking 2 times/sec to indicate "0 inch" position calibration step.

- **Place the Actuator board on the "0 inch"** position between the guide rails **(Leftmost position)** by lining-up the arrows on the Actuator board with the corresponding top and bottom arrow tips on the outside of the two guide rails.
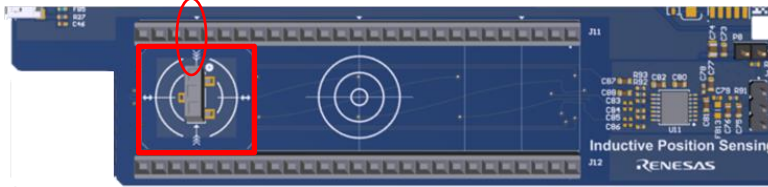
- **Press again the User Button (S2) once** to capture the current voltage for the "0 inch" position
  - ⇨ Green LED will turn off
  - ⇨ The Red LED will start blinking 2 times/sec to indicate "End position (2 inches)" calibration step.

- **Place the Actuator board at the "2 inches"** position **(Rightmost position)** with the same arrows lining up procedure
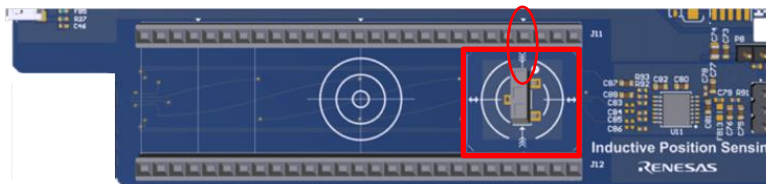
- **Press once the Button (S2) again** to capture the current voltage for the "2 inches" position
  - ⇨ Red LED will turn off. The calibration process is completed.

> *Notes: These calibration values are not saved in non-volatile memory. After a reset or changing power source input, repeating the calibration process is needed to get accurate position output.*
>
> *For developers, another option is to measure the +5V_SYS rail with an ADC input to automatically adjust the equation. ex: using the mikroBUS interface, connect a resistor divider (÷2) between the +5V pin, GND pin and to the AN pin (max~2.5V). Multiply the measured voltage by 2, then used that as the 100% value in the equation.*

8. Appendix 2 – Bullseye Firmware Programming

All Bullseye boards has been pre-programmed at the factory. However new firmware update may be needed from time to time. Please verify your Bullseye board firmware version by checking the bottom right of the PAN9520's embedded web page interface once connected. The latest firmware version is 0.2 as of now.

In case reprogram or upgrade is needed, please follow the steps below.

8.1. Firmware Image

Download the latest Firmware image from the Future Electronics' DC Engine share point site or ask your local Future Electronics representative.

8.2. Firmware Download Tool Setup

- Download the Firmware Download Tool from this link:
  https://www.espressif.com/en/support/download/other-tools
  or from the Future Electronics' DC Engine share point site

This procedure has been tested with tool version 3.9.2.

- After downloading the zip file, unzip it and double click the executable file:

  flash_download_tool_3.9.2.exe

- In the dialog window on the right select initial settings
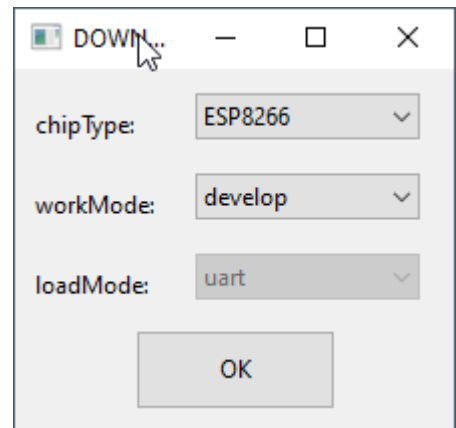
- Select chipType "ESP32S2", workMode "develop" and loadMode "uart"
  Click OK to continue
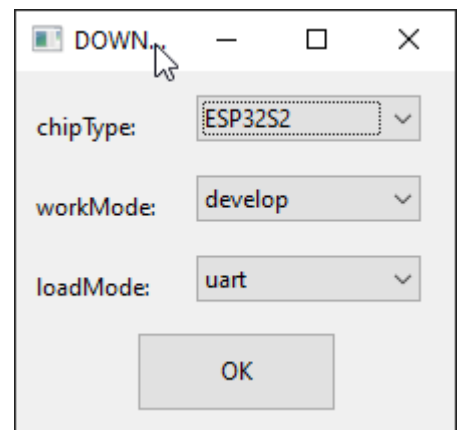
- In the first row, click the three dots to select the binary file, and the offset "0x0", then click the check mark on the left to select this file to be programmed.

- Make sure to use the following setting:
  - SPI SPEED: 40MHz
  - SPI MODE: DIO
  - Check the DoNotChgBin option
  - BAUD rate: 460800

- When connecting the USB cable to the Bullseye USB2 PGRM port (J5), four USB COM ports will be shown on your PC/Laptop as image example below

  - Ports (COM & LPT)
    - USB Serial Port (COM10)
    - USB Serial Port (COM11)
    - USB Serial Port (COM12)
    - USB Serial Port (COM9)

- Select the second one in regarding to the COM port enumeration number. In the above image example, it is the COM10 (which is shown at the beginning)

- Now click START Button at the bottom left of the screen to start programming

- Once programming is completed, press the "RESET" button (SW2) on the Bullseye board to reset the Bullseye board, and now the Bullseye board is ready to go.