JWSmythe Carb Sync Tool v1.1

rev: 20220920

Introduction

This tool is to help you balance multiple carburetors or throttle bodies on vehicles. This will work on motorcycles, cars, and even piston aircraft.

Overview

This device uses an Espressif ESP32-S3 as the smart controller. As shipped, it has a web interface that you can use to have detailed information on the screen while you work. There are also per-port LEDs which will show if the devices are equal, and which way to balance them.

It is powered via USB. Your USB power source (wall charger, etc) should be 5v 2a or higher. There are 4 onboard voltage regulators for the various subsystems.

You can have from 2 to 8 sensors installed, to synchronize up to 8 carbs.   If you require more than 8 ports, please get in contact with us, and we will make a device with more ports available!

Requirements

This tool is for balancing multiple carburetors or throttle bodies. It requires an accessible vacuum port on each carburetor or throttle body.   Some of these ports will have a threaded plug sealing them, which you unscrew and then attach a barbed or tapered vacuum hose adapter.   Some will have a vacuum port nub, with a cap over it.   If your engine doesn't have vacuum ports, this device won't work for you. You may be able to drill and tap a port yourself, but that is far beyond the scope of these instructions. You'd need to work with the carburetor or throttle body manufacturer, to make sure where you drill is in the desired location, and that it doesn't intersect any passages inside the carburetor or throttle body.

Additional Parts Required

This kit has the device, and some sensors (depending on the kit purchased).   You will need to acquire ...

1. The fitting required to attach the vacuum line to the carburetor or throttle body. This may be a screw port, or the carb may just have a capped port sticking out.

2. Vacuum line, long enough to connect each port to the device. Make sure that you route them in such a way that they will not touch anything hot, like the cylinders or exhaust.

Usage

The usage of this device is pretty easy, but you really should consult a repair manual on how to do the synchronization first.

1. Do whatever disassembly is required on your vehicle, to access the carburetors or throttle bodies. This may involve removing the fuel tank, air cleaners, and trim pieces.

2. Find the sync port on each carburetor or throttle body. It may be a screw fitting or a cap over a vacuum port. If it is a screw port, you will need to acquire the appropriate adapter to go to the vacuum hose.

3. Identify which carburetor or throttle body is the "master". This one is intended to be what you balance the rest of the ports to. Put the master on port 1.

4. With the engine OFF, attach all the vacuum lines. Attach each of the other ports to any available port on the device. It's probably best if you do it in some kind of order, so it's to adjust the right one.

5. Turn on the device. It will automatically sense which sensors are installed, and calibrate them, and it will make the device available for the next step.

6. Connect to the device via WiFi with your smart phone, tablet, laptop, or any other device that has a wifi adapter and a web browser. In the WiFi settings, you'll be looking for a nearby access point with the prefix "JWSCB11". Connect to that.

7. If you are not automatically taken to a web page, browse to http://192.168.1.1 . You are now at the device's interface. You should see all the ports at the neutral position (no vacuum nor boost, approx 14.7 psia). If they are not all at the same level, you may need to check your hoses, and possibly replace a sensor.

8. Turn on the engine. You should now see all the displays come alive, showing the pressure range through it's cycle, the min, max, and median values, along with ambient pressure, temperature humidity, RPM, and any anomalous conditions detected.

9. Tune your carbs according to the manufacturer's recommendations. Remember, this device is much more precise than the devices they wrote the instructions for, so you can likely do much better than they're suggesting. ±1.0 may be in their instructions, where you can now adjust for ±0.1.

10. When the tuning is complete, unplug power from the device. Store this unit somewhere that is safe for electronics. Inside the house is preferred to being left in the garage. No electronics like humidity, large temperature variations, or dust.

Data Output

There are multiple ways to read the data from this device. The most complete is via the web interface.

1. The web interface. Use the connection information above to connect. You will see everything immediately.

2. The LEDs at each port. They are color coded for how you need to adjust the settings. This is not as precise as the web interface, but it's quick, dirty, and easy to use.

Color		Meaning
Green	🟩	Synchronized to Port 1
Red	🟥	Too high. Turn this port down.
Blue	🟦	Too low. Turn this port up.

3. The serial console. You can connect to the serial console by plugging the USB cable into your computer. The Arduino IDE is an easy and well documented way to connect to the serial console. Select the correct port in Tools -> Port.

   a. Go to Tools -> Serial Monitor. You should see the number values scroll by. The ports are in order from left to right, 1 to 8. You will adjust until they're all the same.

   b. Go to Tools -> Serial Plotter. You will see the numbers rendered on a graph. You will adjust until all the waveforms are the same.

4. Datalogging. If you select datalogging on the web interface, it will store the values for later review. It is stored in a CSV (**C**omma-**S**eparated **V**alues) file on the SD card. It is up to you to determine how you will render that into a useful form. Google Doc's Sheets and Microsoft Excel are two well documented ways to do that. Data format TBD.

Data acquisition

For data acquisition, it uses up to 8 automotive style MAP sensors. These are user replaceable and upgradable. By default, it will be shipped with 2, 4, 6, or 8 1 bar MAP sensors, but the device can support 8 sensors (8 carb or 8 tbi, as applicable).

When the system boots, it checks to see what MAP sensors are plugged in, and will only use those sensors through the session. If you need to add or remove a MAP sensor, you will need to reset the board to detect the changes. We recommend only adding or removing sensors while the board is turned off. We've done our best to protect the device, but electronics really don't like surges.

The device is capable of using **any 5v 3 pin analog pressure sensors**! Be sure that the sensor's pins are in the right order. Looking into the sensor, they should be Gnd (-), Data, and 5V(+)

You can alternatively attach to the screw terminals for each port. They are numbered
1 = +5v supply
2 = Sensor Out
3 = Ground
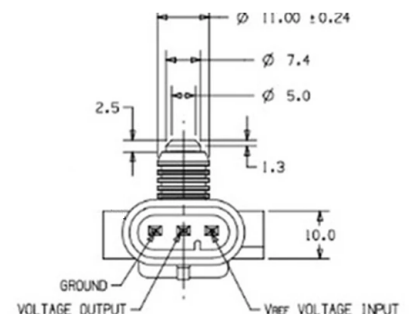
DO NOT have both the MAP sensor plugged in at the **same time** as the external sensor is attached. Bad things can happen.

Most sensors will be 2 or 3 pins. The simulator built while developing the CST had 2 pins per port. It attached to 2 (sensor) and 3 (Gnd).

If the pinout is not the same, you can use a pigtail to connect the sensor to the screwdown terminals at each sensor port.

Sensors with different ranges will have different pressures. The device simply scales that down.   If you are working on a normally aspirated engine, you will have better resolution using the 1 bar sensor. For forced induction engines, you can switch to the 1 bar if you'd like, but it will be unable to measure any boost pressures. High boost on a 1 bar sensor may damage it.

You *MUST* use the same range sensors in every port.
You *SHOULD* use the same part number on each port, and each being the same age is recommended. The device will do it's best to calibrate all ports the same.

Sensor Part Numbers and examples

Part Number	Type	Range (absolute)	Application
Delphi 21002284 09359409 12614973 16137039 16249939 213-1742 213-351 213-4434 213-796 3861321 38613212 8093594090 8161875560 8162499390 861249A1 881731 AS155 AS59 EC1636 PS10000 SU1078	1 bar	Up to 14.7psi (WOT, no boost)	1996-2005 for Chevy Astro 4.3L 2002-2006 for Chevy Avalanche 1500 5.3L and 2500 8.1L 2007-2008 for Chevy Avalanche 6.0L 1996-2005 for Chevy Blazer 4.3L 2003-2004 for Chevy Cavalier 2.2L 2005-2007 for Chevy Cobalt 2.0L, 2.2L, 2.4L 1996-2007 for Chevy Express 1500 & 2500 4.3L, 5.3L, 5.7L 1996-2005 for Chevy Express 2500 4.3L, 4.8L, 5.3L, 5.7L, 6.0L 2001-2002 for Chevy Express 3500 8.1L 2000-2005 for Chevy Impala 3.4L, 3.8L 1996-2005 for Chevy Monte Carlo 3.4L, 3.8L 1996-2003 for Chevy S10 2.2L, 4.3L 1997-2000 for Chevy S10 EV 1999-2008 for Chevy Silverado 1500 4.3L, 4.8L, 5.3L 1999-2004 for Chevy Silverado 2500 5.3L, 6.0L 2001-2008 for Chevy Silverado 2500 HD 6.0L, 6.6L, 8.1L 2004-2007 for Chevy Silverado 3500 5.7L, 6.0L, 6.6L 2003-2006 for Chevy SSR 5.3L, 6.0L 2000-2008 for Chevy Suburban 1500 5.3L, 5.7L, 6.0L
ACDelco 12615136 ACDelco 19418810 Summit ADO-19418810 Standard Motor AS314 16040609	2 bar	Up to 29 psi (14.3 psi boost)	2004-2005 Buick Park Avenue Ultra 3.8L 2004-2004 Buick Regal GS 3.8L 2006-2009 Cadillac STS V 4.4L 2006-2009 Cadillac XLR 4.4L 2005-2007 Chevy Cobalt SS 2.0L 2004-2005 Chevy Impala 3.4L, 3.8L 2004-2005 Chevy Monte Carlo 3.4L, 3.8L 2002-2005 Chevy Silverado 2500HD, 3500 6.6L 2002-2005 Chevy Silverado 3500 6.6L 2002-2005 GMC Sierra 2500HD, 3500 6.6L 2002-2005 GMC Sierra 3500 6.6L 2004-2007 Pontiac Grand Prix 3.8L 2004-2007 Saturn Ion Red Line 2.0L
Chevy Performance 12592525 Summit NAL-12592525 12223861	3 bar	Up to 44.1 psi (29.7 psi boost)	2009-2015 Cadillac CTS 6.2L 2012-2015 Chevy Camaro ZL1 6.2L 2009-2013 Chevy Corvette ZR1 6.2L

Note: Only the Delco 09359409 (1 bar) has been test fitted in this device.
This is not an all inclusive list, many other part numbers and applications exist. It is simply a starting point for shopping, and something specific to ask for at the parts store.

Firmware

We consider our firmware to be perfect when shipped. Despite that, we may have changes and improvements over time. These updated firmware are available on our site.

You can use your own firmware too!

We can't guarantee results with your firmware, but if you totally screw it up, simply download the official firmware from our site, and flash it to the board. If you do contact us for support or hardware replacement, we will ask you to first install our firmware, just to eliminate that as a potential problem.

We will try to help if you need, but that help may be limited. We will happily design new products to your spec. Standard development rates will apply.

You can hack this!

Everyone likes a nice development board. I know I do. I don't like it when I'm given a great device, but there's a missing feature that I'd like to add.

We provide the USB connector with data lines, so you can modify this device! You can write your own software for it, and customize it for your application!

There are two SPI buses used. I labeled them VSPI and HSPI, just as a way to tell them apart.

VSPI (GPIO 4,5,6)	HSPI (GPIO 10,11,13)
ADC MCP3208	ENV BME680, TFT/Touchscreen header

GPIO	Assignment	GPIO	Assignment
GPIO0	Boot Button	GPIO12	CS Touch T_CS 0
GPIO1	SD Card Data 2	GPIO13	HSPI CLK (SCK/CLK/SCL)
GPIO2	SD Card Data 3	GPIO14	TFT DC/RS
GPIO4	VSPI CLK (SCK/CLK/SCL)	GPIO21	TFT Reset
GPIO5	VSPI MISO (MISO/SDO/DOUT)	GPIO38	SD Card Detect
GPIO6	VSPI MOSI (MOSI/SDI/DIN)	GPIO39	SD Card D1
GPIO7	CS ADC MCP3208	GPIO40	SD Card D0
GPIO8	CS BME280	GPIO41	SD Card CLK
GPIO9	TFT Touch IRQ	GPIO42	SD card CMD
GPIO10	HSPI MISO (MISO/SDO/DOUT)	GPIO48	WS2812 chain
GPIO11	HSPI MOSI (MOSI/SDI/DIN)		

Warranty

We want to make you happy. You have a 1 year warranty on parts, starting at the date of purchase if a receipt is available. If not, 1 year from the date of manufacture.

If your device fails in the first year, excluding unusual damage, we will replace the parts or device at our discretion.

Inclusion examples:

If it's damaged in shipping. If the device just stops working, a component, or the MCU just falls off, we'll probably replace it. We will require the board or device to be shipped back to us, so we can refurbish it.

This is not an all inclusive list of inclusions.

Exclusion examples:

If you attached 120vac wires to any port on the device, causing it to release the magic smoke. That's not covered by the warranty.

If you drove over it with the vehicle you had been adjusting, that's also not covered by the warranty.

This is not an all inclusive list of exclusions.

Extensions:

We may, at our discretion, provide some warranty services beyond the 1 year. It shouldn't just stop working a day or a year after the warranty expires. If it had an unusual failure, we'll take care of you.

Warranty replacements are done exclusively by our discretion. But our discretion wants our customers to be happy.

Serviceability

This device is a tool, just like a screwdriver and multimeter. It requires you to be competent in using the tool. Damage to your vehicle or other components around it are not protected by any warranty or guarantee. There is no reason that this device could cause damage, it simply reads the data, and makes no adjustments on its own. With that said, you should be able to accomplish excellent results with this tool. The resolution and accuracy far exceeds what other similar devices provide.

We cannot be responsible for injuries or damage related to the possession or operation of this tool.   Do not attempt to eat or drink the device. Do not insert this device into any orifice, or the orifices of others. Do not put the device in water, fire, or the vacuum of space.

Included Parts

If you wish to write your own firmware for this device, these are the devices that may require a driver, or specific knowledge about it.   Datasheets are all available at their respective sites, or with your preferred IC distributor.

Function	Manuf	Part
Microcontroller	Espressif	ESP32-S3-WROOM-1(N8R2)
UART to USB	Silicon Labs	CP2102N-A02-GQFN28R
VRM	Texas Instruments	TPS63070RNMR
VRM	Advanced Monolithic Systems	AMS1117-3.3
VRM	Advanced Monolithic Systems	AMS1117-5.0
ADC	Microchip Technology	MCP3208-CI/SL
Environmental Sensor	Bosch	BME280
RGB LED	Worldsemi	WS2812C-2020-V1

Legal