Stratified MSND76 Plug and Play ECU Generic

Generic Plug and Play
Electronic Fuel Injection System based on the Megasquirt2 EFI Controller

Installation and User Guide

Thank you and congratulations on the purchase of your new Stratified MSND76 Engine Controller. This document should be followed to ensure safe and proper installation and operation of your new ECU.

WARNINGS – PLEASE READ CAREFULLY

ALL parts are sold for OFF ROAD RACE-ONLY ground vehicle use only.
Aftermarket EFI/EMS systems are not for use on pollution controller vehicles. Alteration of emission related components constitutes tampering under most local emission regulation guidelines and can lead to fines and penalties.

Stratified Automotive Controls is not responsible for any fines, injuries, or damages incurred as a result of the installation or use of our products. It is the complete responsibility of the purchaser of such products to ensure that they are used in a legal and safe manner.

DISCONNECT THE NEGATIVE BATTERY TERMINAL BEFORE PERFORMING ANY OF THIS WORK. IF YOU DO NOT FEEL COMFORTABLE ABOUT MAKING THESE MODIFICATIONS, HAVE THEM PERFORMED BY A PROFESSIONAL.

WARNING: We take no responsibility for any damage you do to your car. We strongly recommend you learn how to tune and tune your car little by little watching all relevant gauges and data logging.

Limited Warranty

This Stratified product is warranted against defects in materials and workmanship for ninety (90) days from date of purchase. During the warranty period, Stratified will repair, or at its option replace at no charge, components that prove to be defective. The product must be returned, shipping prepaid, to a Stratified facility. This limited warranty does not apply if the product is damaged by accident or misuse. The foregoing warranty is in lieu of all other warranties expressed or implied including but not limited to any implied warranty of merchantability, fitness, or adequacy for any particular purpose or use. Stratified Automotive Controls LTD. is not responsible for any fines, injuries, or damages incurred as a result of the installation or use or misuse of our products. It is the complete responsibility of the purchaser of such products to ensure that they are used in a legal, safe, and appropriate manner.

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1. Generic (Non Vehicle Specific) Setup

You have purchased a generic unit that is not specifically setup for your vehicle, and you must setup both the hardware, the firmware, and the calibration for your vehicle before you can attempt to start the car. **Stratified is not responsible for any tuning or setup errors that may damage your vehicle so please make sure you know what you are doing. The warranty strictly covers the functionality of the electronics inside the unit and nothing more. Stratified does not include any end-customer support with the generic units as the vehicle specific setup and installation is left up to the buyer.**

In terms or hardware the generic MSND76 comes with ***fully assembled electronics*** and you must simply run the jumpers that allow it to be wired correctly for your vehicle's wiring harness. This guide does not have vehicle specific information but it assumes you have a good understanding of wiring and the information can be easily found online or in factory service manuals. In order to learn more about setting up the hardware, please consult the **Stratified MSND76 Hardware Guide** section below.

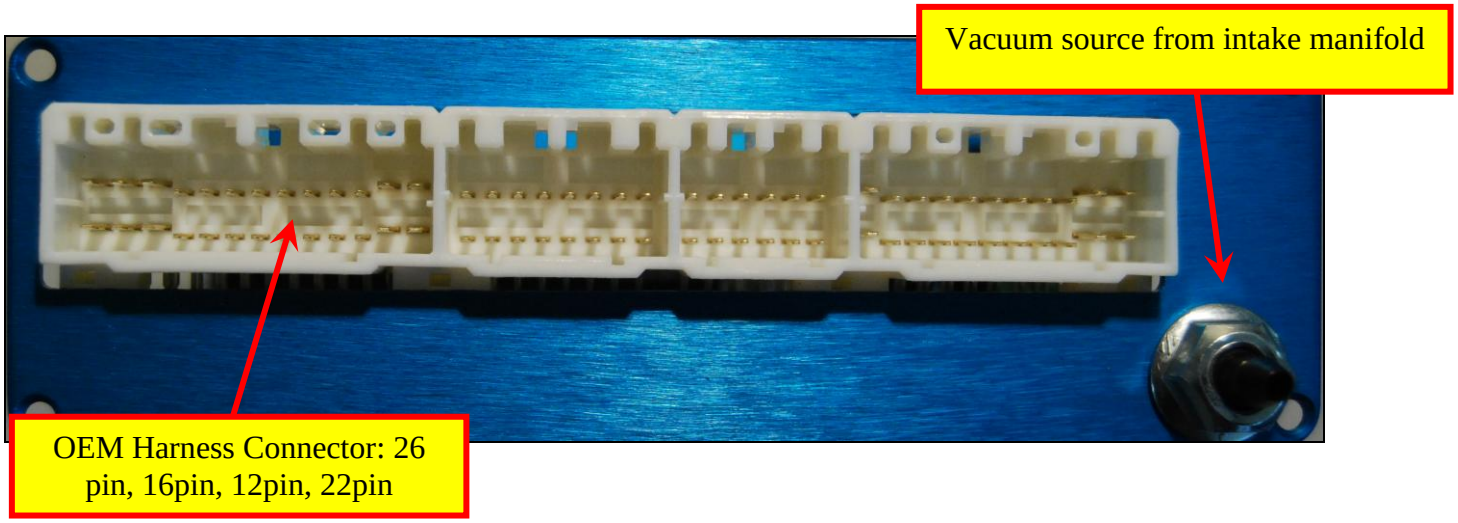
In terms of firmware, the unit can have any MegasquirtII firmware installed. We recommend the latest MSII-Extra firmware that is released. More information and the latest released firmware can be found here: http://www.msextra.com/doc/ms2extra/. Flashing the firmware is covered in the How To Section.

Each vehicle requires its own calibration for optimum performance and safety. This calibration must work with the stock hardware (ignition system, injectors, idle valve, etc.). The calibration is setup using a personal computer using one of the tuning software suites. This manual refers to TunerStudio as the software interface between the tuner and vehicle. TunerStudio: http://tunerstudio.com/index.php/tuner-studio

2. Stratified MSND76 Hardware Guide

The Hardware Guide will go through all the user-accessible features of the Stratified PNP MSND76. We start with the outside of the unit.

2.1. Front Panel



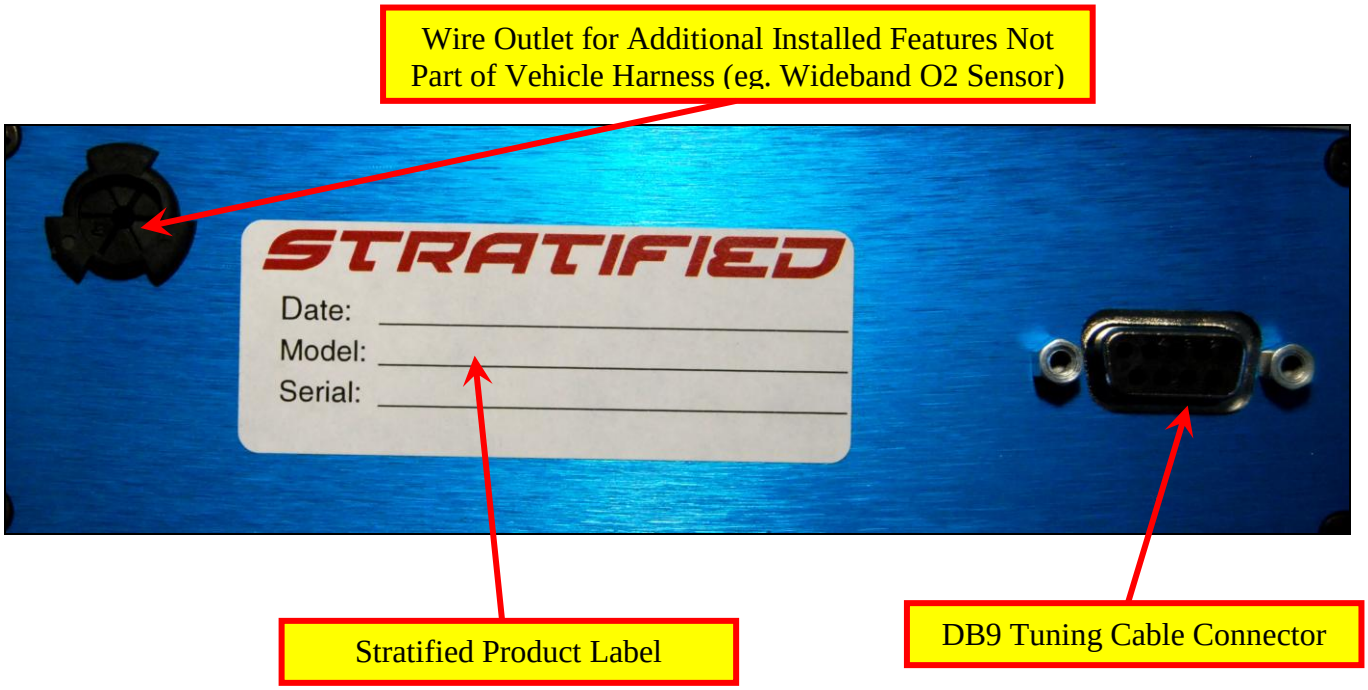
The front panel OEM harness connector can accommodate the harness plugs from a larger number of OEM vehicle as this was a very common connector. One or more of the plugs and be used. The following vehicles can plug directly into the MSND76. Note that if automatic vehicles have their transmissions controlled by the engine ECU, the MSND76 is not setup to control the automatic transmission.

Vehicle Make	Vehicle Model	Engine Used	From Year	To Year
Acura	Integra	All	1992	1995
Acura	Legend	C32A	1991	1995
Dodge	Stealth	All except SOHC '91-'92	1991	1996
Dodge	Stratus Coupe	2.4 with manual trans	2001	2005
Ford	Aspire	All	1994	1997
Ford	Escort	1.8 DOHC	1991	1995
Ford	Festiva	All	1990	1993
Ford	Probe	F2, F2T	1990	1992

Ford	Probe	KLDE	1993	1995
Eagle	Talon	4G63	1995	1998
Honda	All	All 4 cylinder	1992	1995
Lexus	LX450	1FZ-FE	1996	1997
Mazda	626	All	1990	1995
Mazda	B series pickup	2.2 and 2.6 with EFI	1990	1993
Mazda	Miata	1.6L BP	1990	1993
Mazda	Miata	1.8L BP	1994	1995
Mazda	Miata	1.8L BP	1996	1997
Mazda	Miata	1.8L BP	1999	2000
Mazda	MX-3	All	1992	1995
Mazda	MX-6	F2	1990	1992
Mazda	MX-6	F2T	1990	1992
Mazda	MX-6	FS (2.0 4 cylinder) w/ manual transmission	1993	1997
Mazda	MX-6	KLDE, KLZE (V6)	1993	1995
Mazda	Protege	All	1990	1998
Mazda	RX-7	All	1989	1995
Mitsubishi	3000GT	All	1991	1998
Mitsubishi	Diamante	6G72	1992	1996
Mitsubishi	Eclipse	4G63	1995	1999
Mitsubishi	Eclipse	2.4 w/ manual transmission	2000	2004
Mitsubishi	Lancer EVO	4G63	2003	2005
Mitsubishi	Lancer	2.0 NA w/ manual transmission	2002	2005
Mitsubishi	Galant	2.4 (4G64)	1994	2000
Mitsubishi	Mirage	1.8 SOHC 4G93	1993	2000
Mitsubishi	Montero	3.5 V6	1994	1997
Subaru	Impreza	All	1993	1995
Subaru	Legacy	All	1991	1994
Subaru	SVX	All	1992	1995
Suzuki	Sidekick	1.6 MFI	1992	1995
Suzuki	Sidekick	All w/ manual transmission	1996	1998
Toyota	Celica	3SGTE	1990	1991
Toyota	Corolla (JDM)	4AGE Blacktop	1996	2000
Toyota	Corolla	1ZZ-FE	1998	2000
Toyota	Echo	1NZ-FE	2000	2002
Toyota	MR2	3SGTE	1991	1995
Toyota	MR2	5SFE manual transmission	1993	1995
Toyota	Paseo	5E-FE	1992	1995

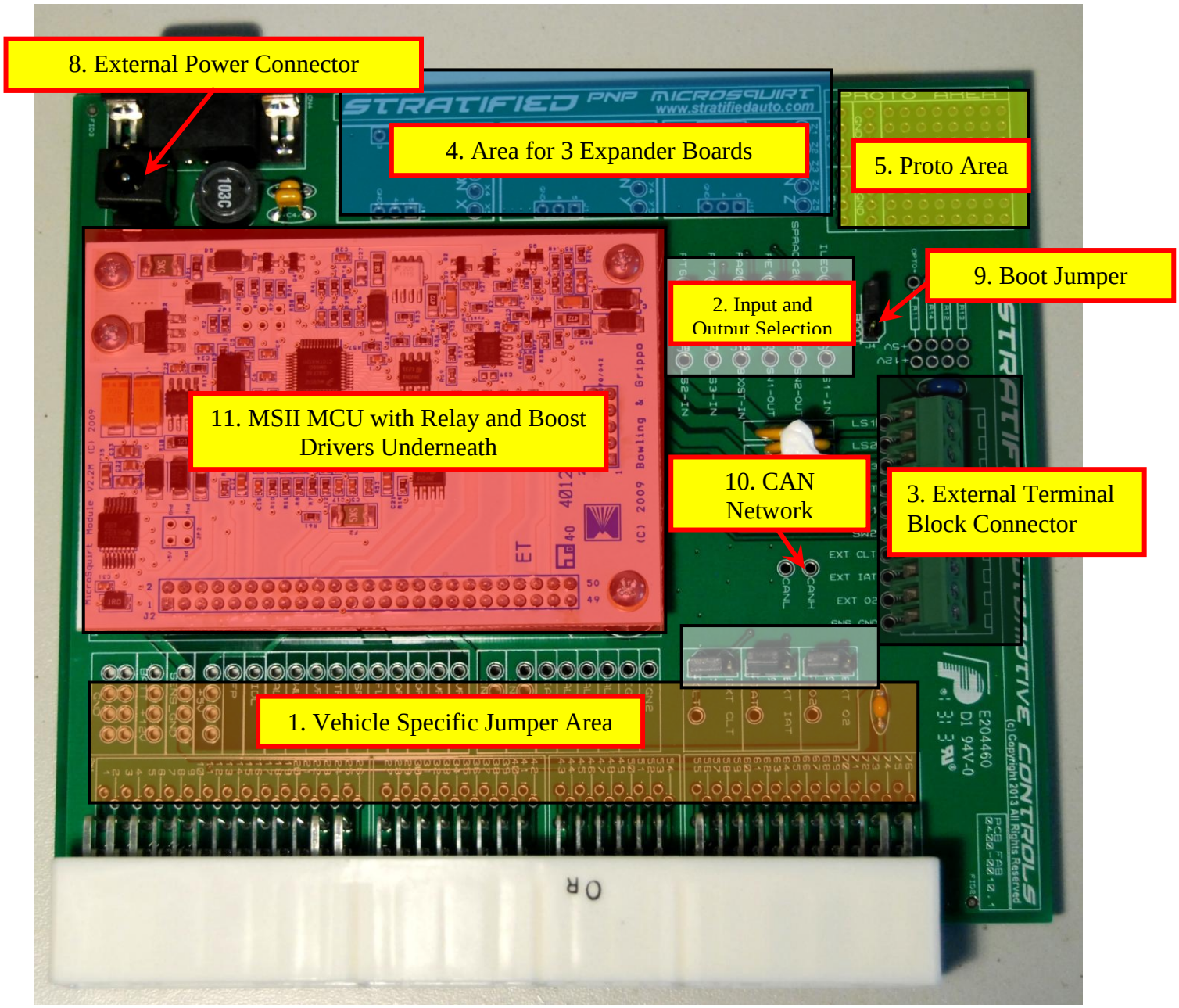
Toyota	Pickup, 4Runner	All	1992	1994
Toyota	RAV4	3E-FE	1996	2000
Toyota	Supra	All	1991	1992
Toyota	Tacoma, 4Runner	2RZ-FE, 3RZ-FE	1995	1999
Toyota	Tacoma	5VZ-FE manual transmission	1995	1997
Toyota	Tercel	All	1991	1995

2.2. Rear Panel



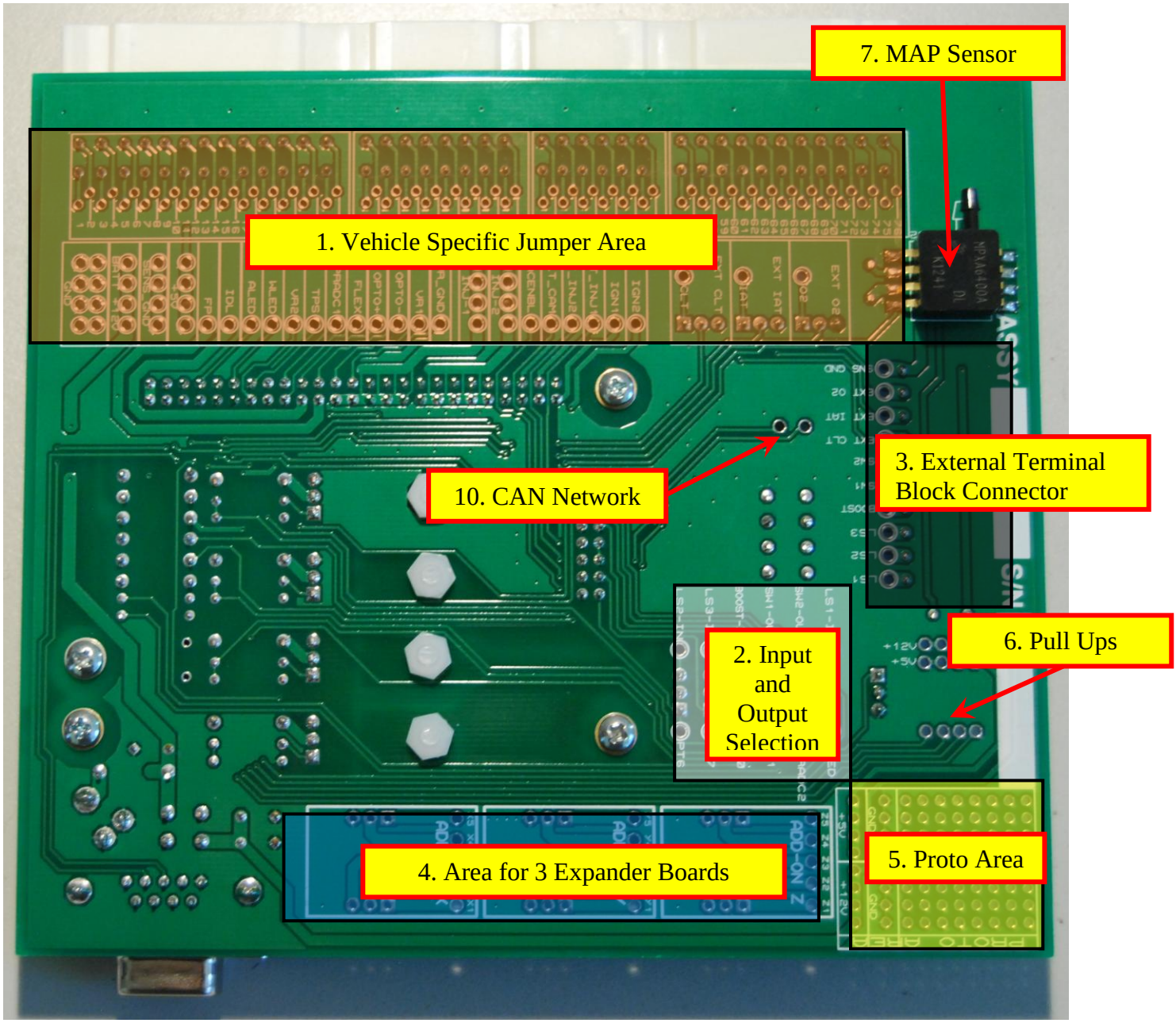
2.3. Inside - Top of Unit

Once you open the top of the case, you will see the internal electronics of the unit. Highlighted below are the key features of the MSND76. They are discussed in detail below.



2.4. Inside - Bottom of Unit

Once the case is fully disassembled and the main electronic board is slid out, the bottom is revealed. Here, the main features are once again highlighted and discussed below.



2.5. Vehicle Specific Jumper Area

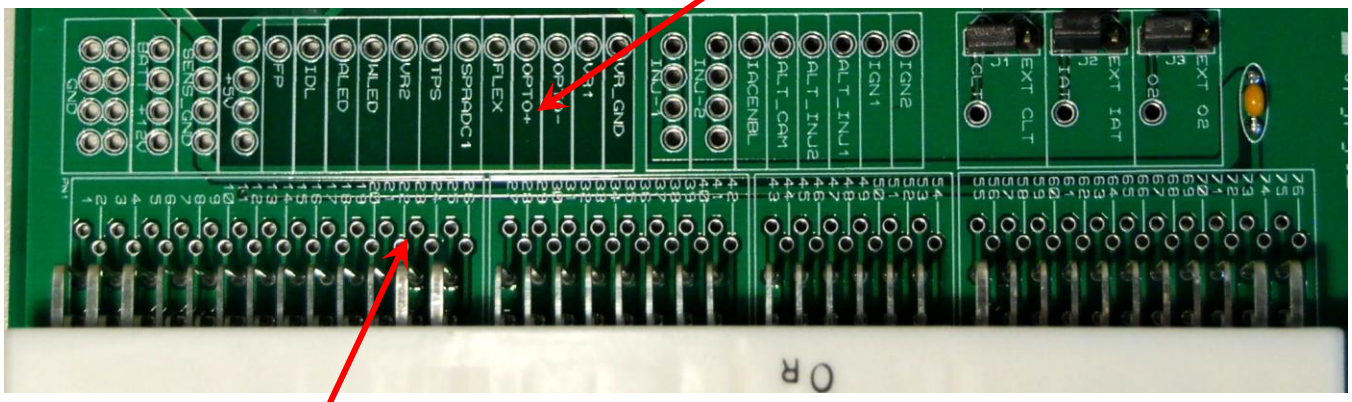
The Stratified MSND76 can be adapted to work with the OEM harness of a large number of vehicles from different manufacturers including Mazda, Ford, Honda, Toyota, Subaru, Suzuki, Chrysler, and Mitsubishi.

Modifying the unit from one vehicle to another depends on how these jumpers are configured and the software configuration. If you bought the MSND76 already built for ***A SPECIFIC*** vehicle and model you don't have to worry about these and they should be set correctly.

If you bought a generic unit, you will need to connect the jumpers so that the MSND76 is connected correctly to your factory wiring.

Jumper connections can be made on both the top and bottom of the main boards - the markings are on both sides.

MS side. These connections are labeled as per the B&G Microsquirt convention.



Vehicle harness side. The connector pins are numbered 1-76. Recommended wire size is 20AWG

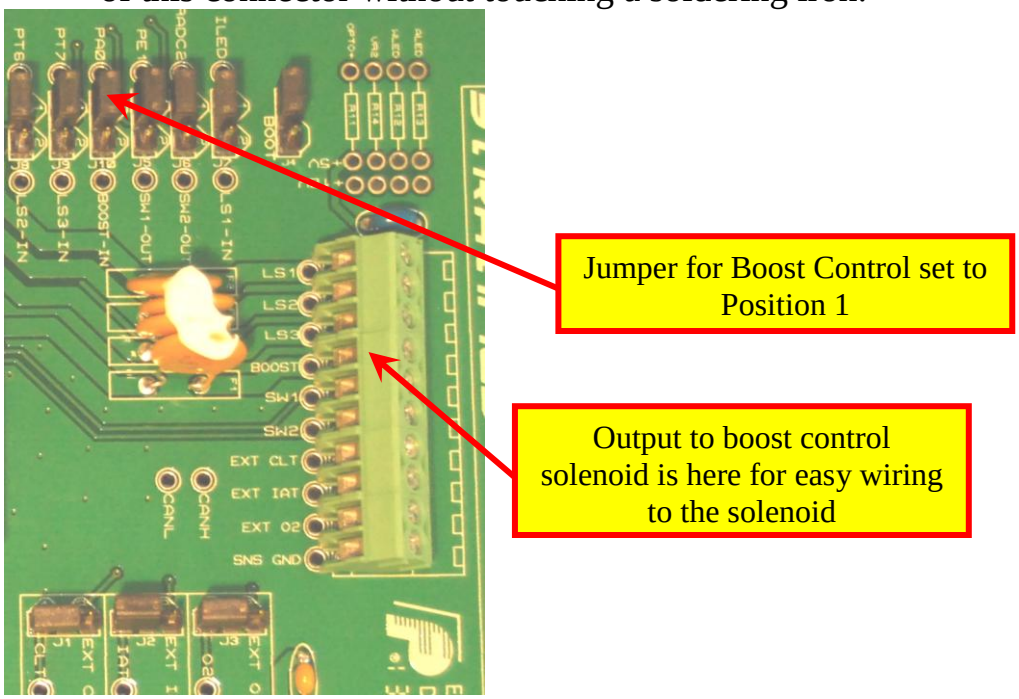
2.6. Input and Output Selection

The Stratified MSND76 is designed to be as flexible as possible in order to accommodate individual setups. The user is able to easily gain access to the following built-in features:

- 3 Relay Drivers
- 1 Boost Control Solenoid Driver
- 2 Digital Switches
- OEM or External CLT, IAT, O2 Sensors

Accessing these features involves the following steps:

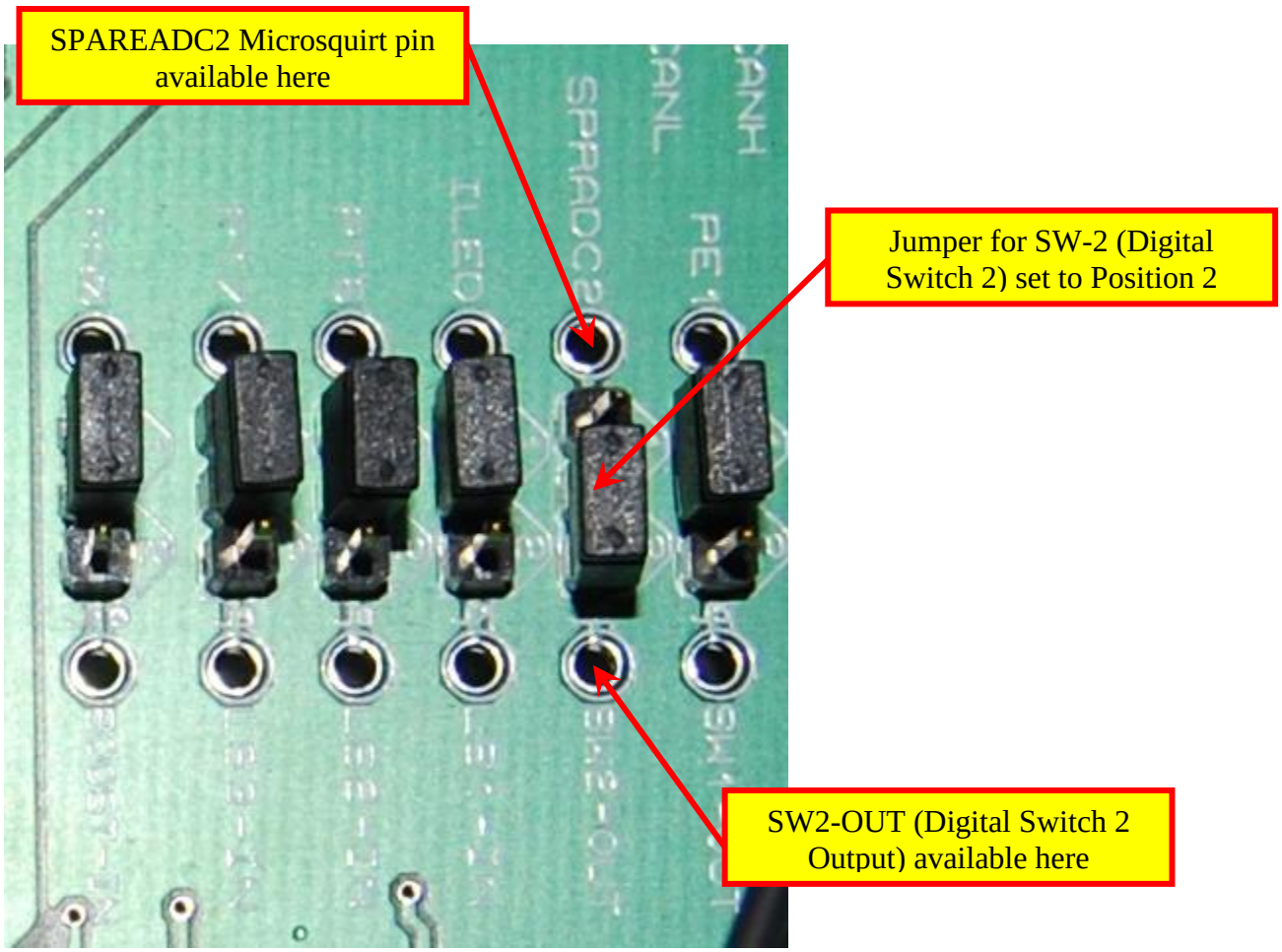
1. Setting jumpers. In this section you will see there are 9 removable jumpers that can be set in position 1 or position 2. 6 of the jumpers deal with drivers and switches, and 3 of them handle the CLT, IAT, O2 sensors
2. For the drivers and switches, setting a jumper in position 1 directly connects the Microsquirt output to the External Connector. You can then bring a wire in and out of this connector without touching a soldering iron.



3. Because the Microsquirt has a limited number of inputs and outputs, a user may not want the exact configuration for the extra drivers as it is setup in the MSND76. This is when the jumper is moved to position 2.

4. In the example with the Boost Controller, moving the jumper to position 2 makes the Microsquirt output PA0 available as well as the *input* to the boost controller (BOOST-IN) if it is desirable to use another Microsquirt pin to control the Boost Control Solenoid Driver.

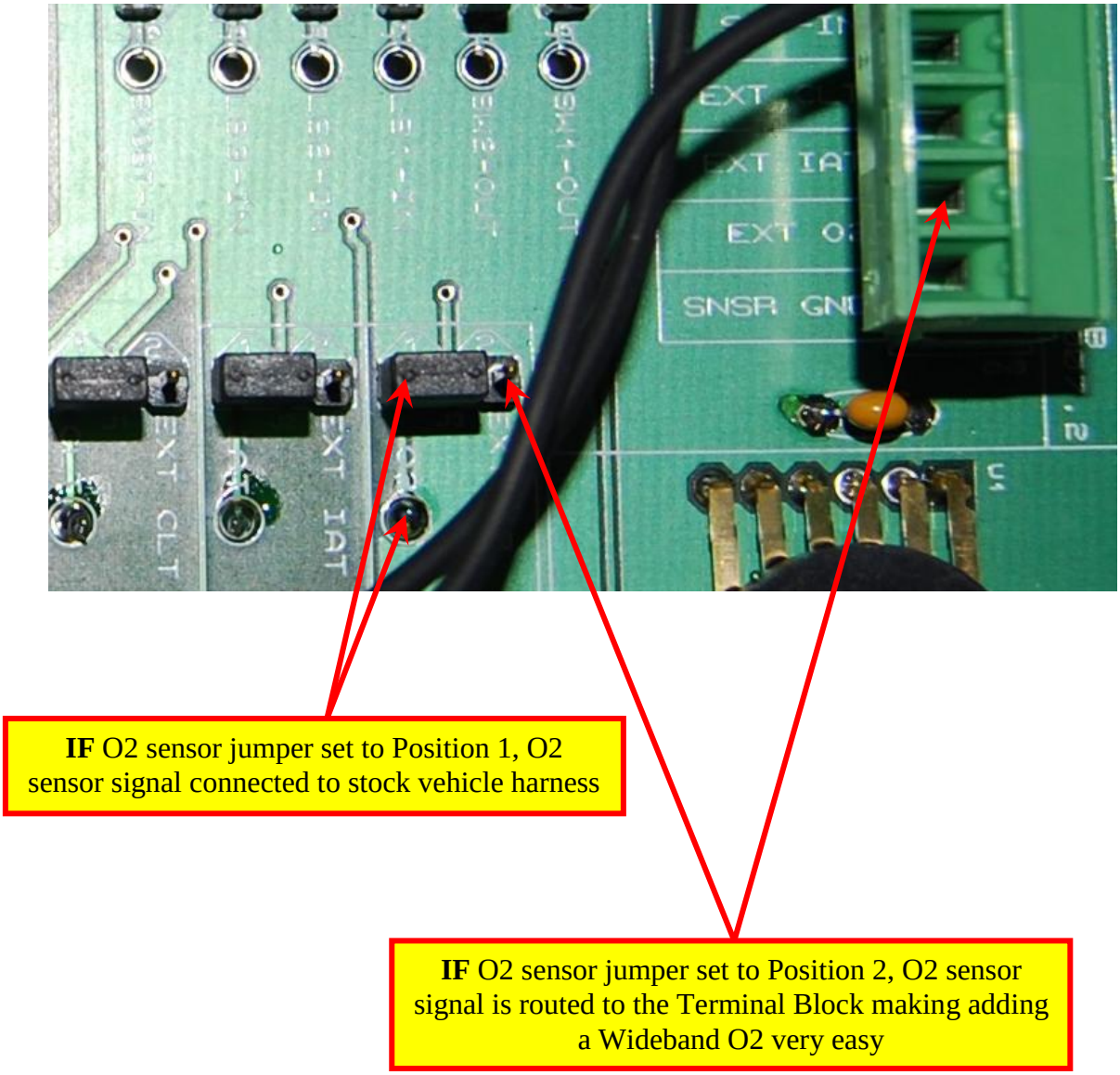
5. If position 2 is selected for any of the 6 drivers and switches, wire jumpers are used to connect the now-available Microsquirt I/O pins as well as the drivers/switches themselves. See example below



6. A similar selection can be made for the 3 sensors: Coolant (CLT), Intake Air Temperature (IAT), Oxygen Feedback (O2). If the jumper is in position 1, the sensor signal is going to be coming from the stock vehicle harness. If the jumper is in position 2, the sensor signal is routed to the terminal block entry point labelled

for that sensor. This makes adding external sensors such as Wideband O2 sensors, IAT sensors, or CLT sensors easy and without having to solder anything.

7. See the example below involving the O2 sensor.



IF O2 sensor jumper set to Position 1, O2 sensor signal connected to stock vehicle harness

IF O2 sensor jumper set to Position 2, O2 sensor signal is routed to the Terminal Block making adding a Wideband O2 very easy

8. Below is a table of all the optional inputs and outputs available on the Stratified MSND76. Remember that enabling these features also requires turning them on in the software (TunerStudio).

Feature	Description	Use	Microsquirt I/O Name
Digital Switch 1 (SW1)	Digital switch, active (ON) when SW1-IN pulled to ground	Table Switching, NOS Input,	PE1
Digital Switch 2 (SW2)	Digital switch, active (ON) when SW1-IN pulled to ground	Launch Control, Flat Shift	SPAREADC_2, AD7, JS4
Relay Driver 1 (LS1)	When activated, it makes connection to ground. Can be used for relays, solenoids, should not exceed 3A current continuous	Secondary intake runners, fans, water injection, intercooler sprayer, shift lights, etc.	TACHOUT, PM-3, Injection LED
Relay Driver 2 (LS2)	When activated, it makes connection to ground. Can be used for relays, solenoids, should not exceed 3A current continuous	Secondary intake runners, fans, water injection, intercooler sprayer, shift lights, etc.	PT6
Relay Driver 3 (LS3)	When activated, it makes connection to ground. Can be used for relays, solenoids, should not exceed 3A current continuous	Secondary intake runners, fans, water injection, intercooler sprayer, shift lights, etc.	PT7
Boost Control Solenoid Driver	When activated, it drives a boost control solenoid that controls a turbocharger waste gate	Boost control	PA0, JS11

9. As mentioned above in step 5, you can use these Microsquirt I/O pins for something else simply by setting the selection jumpers to position 2. The table on the next page is sourced from the Megasquirt documentation website and shows all the possible uses for the I/O pins.

Note: Any function in the same row (A B C D E or F) can NOT be used together!
(e.g. if you are using the stepper motor you cannot use the additional injector channels as they require the same pads, etc)

Pad	A	B	C	D	E	F
PT7 (m)	**Stepper Motor †**	Programmable Output (3)	Tacho Output	NOS Relay Output (Stage 1) (3)	**Boost Control PWM Output** (2)	Injector channel 4
PT6 (m)	**Stepper Motor †**	Programmable Output (3)	Tacho Output	NOS Relay Output (Stage 2) (3)	**Boost Control PWM Output** (2)	Injector channel 3
IACEnbl (m)	**Stepper Motor †**	...	...	...	...	...
SPAREADC (AD6)	**Constant Barometric Correction** (1)	Knock Input (4)	Launch Control Input (4)	Second O2 input (1)	NOS Input (4)	...
SPAREADC_2 (AD7)	**Constant Barometric Correction** (1) (m)	Knock Input (4)	Launch Control Input (4) (m)	Second O2 input (1) (m)	NOS Input (4) (m)	...
PE1 (m)	...	...	Launch Control Input (4)	...	NOS Input (4)	**Switch VE and or Ignition map Tables**
FLEX	...	...	Launch Control Input (4)	...	NOS Input (4)	...
TACHOUT	...	Programmable Output (3)	Tacho Output	...	...	...
PA0 (m)	...	Launch Control Input (4)	Tacho Output	Programmable Output (3)	**Boost Control PWM Output** (2)	NOS Input (4)
IGNOUT (IGN)	**Spark A (All ignition setups)**	...	Tacho Output	...	...	...
IGNOUT2	**Spark B (any COP, 4+cyl wasted spark)**	...	...	...	...	...
WLED	**Spark C (3+cyl COP, 6+cyl wasted spark)**	Programmable Output (3)	Tacho Output	NOS Relay Output (Stage 2) (3)	...	...
ALED	**Spark D (4cyl COP, 8cyl wasted spark)**	Programmable Output (3)	Tacho Output	...	...	...
IDL (FIdle)	PWM Idle Valve Control *(2 or 3 wired valves)* (2)	Tacho output	Programmable Output (3)	NOS Relay Output (Stage 1) (3)	**Boost Control PWM Output** (2)	...

Source: http://www.msextra.com/doc/ms2extra/MS2-Extra_Hardware.htm

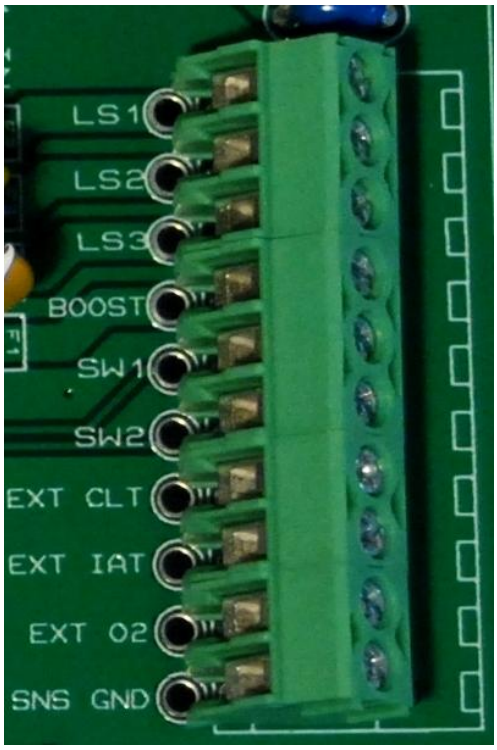
2.7. External Terminal Block Connector

This connector allows the easy (solder free) addition of wiring to and from the Stratified MSND76 unit. You can also solder the wires in for extra security.

It has 10 positions divided and labelled as follows:

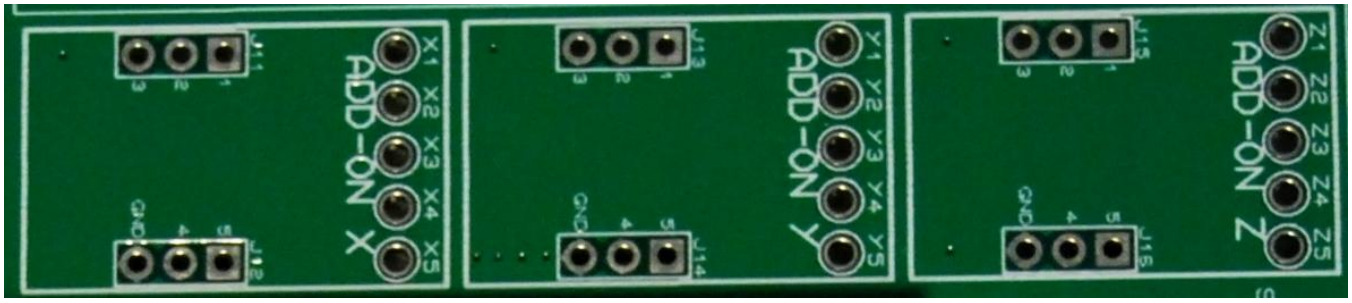
Remember that these outputs are affected by the position of the removable jumpers described in Section 2. Input and Output Selection.

Also note that in vehicle specific configurations, some of these extra drivers may already be in use to run engine peripherals such as cooling fans. If that is the case, you will see that the particular spot on the terminal block is not labelled.



- **BOOST-OUT** - Boost controlled solenoid output connection
- **LS1-OUT** to **LS3-OUT** - Relay drivers output connections (eg. fan control)
- **SW1-IN** and **SW2-IN** - Digital switch inputs (eg. clutch switch)
- **EXT CLT** - External coolant sensor connection
- **EXT IAT** - External intake air temperature sensor connection
- **EXT O2** - External oxygen sensor connection
- **SNSR GND** - Ground connection for ANY of the 3 external sensors

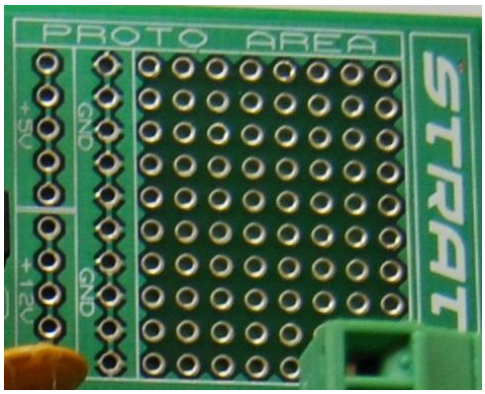
2.8. Area for 3 Expander Boards



This area is designed to allow for the expansion of the Stratified MSND76 unit for unique applications and different platforms. Although the MSND76 is a very complete unit as-is, since it covers so many different platforms and applications, we wanted to have room to grow.

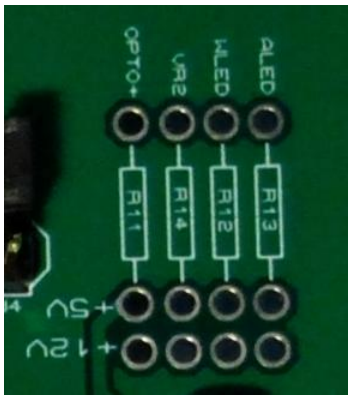
The Stratified Expander Boards will include extra injector drivers for sequential injection, knock controllers, signal conditioners ... we want to make our unit as versatile as possible and we will sell these expansion boards separately as each platform develops unique needs.

2.9. Proto Area



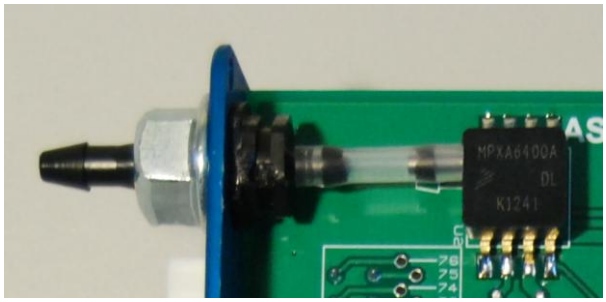
Similar to the Expander Board area, the Proto area allows for unique customizations of the unit. 12V, 5V and GND pads are available nearby. *Please note that the 5V source should not be loaded with any more than 200mA of current. The 12V source should not be loaded with any more than 3A of current.*

2.10. Pull-ups



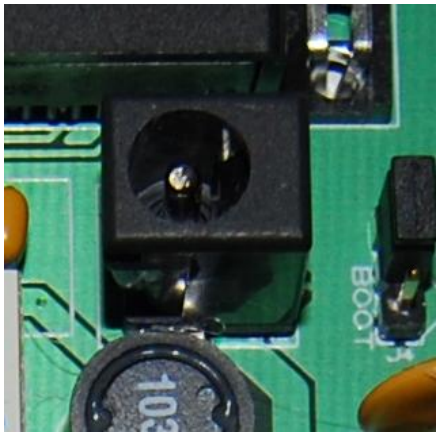
In some applications the ignition inputs require pull-up resistors to either 5V or 12V or the outputs require flyback diodes. The OPTO+, VR2, ALED, WLED pins are located here next to 12V and 5V pull-up locations for convenience.

2.11. MAP Sensor



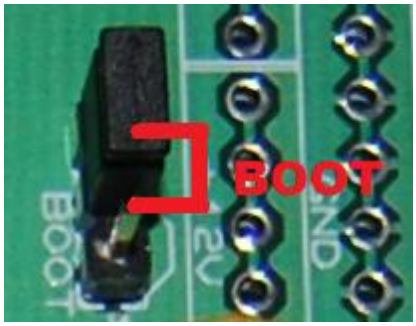
The Stratified MSND76 base unit comes with a pre-installed 4 bar MAP sensor good for up to 44psi of boost and this should handle most applications

2.12. External Power Connector



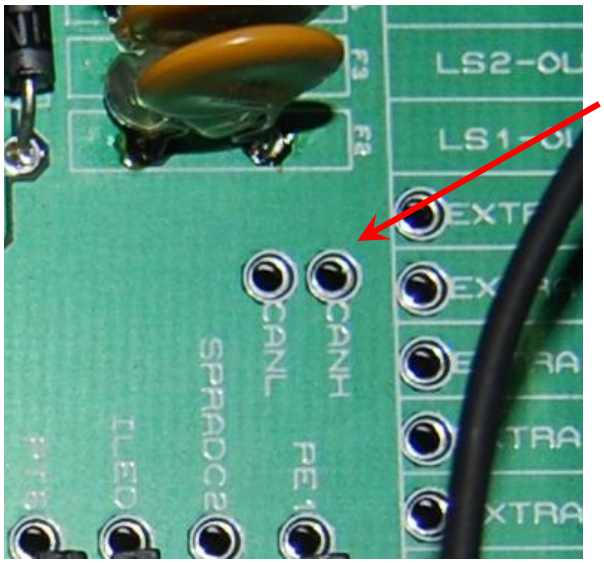
If you would like to flash the flash a new calibration on the unit at home or re-flash the firmware with the unit out of the vehicle, you will need to power the MSND76 using a 12V AC adapter similar to the one pictured above. The connector specifications are: 2.1mm ID, 5.5mm OD.

2.13. Boot Jumper



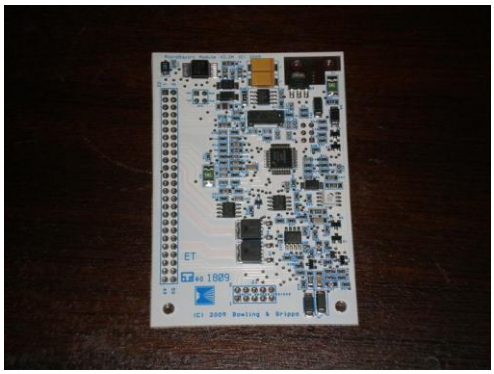
If for some reason the firmware needs to be re-flashed and processor put into boot mode, move this jumper into the boot position as shown. Follow the procedure in Section 3.3.

2.14. CAN Network



The MSII Processor has CAN integration and the backbone can be reached at these two pins. A terminating 120 ohm resistor is already included.

2.15. MSII ECU - Microsquirt Module



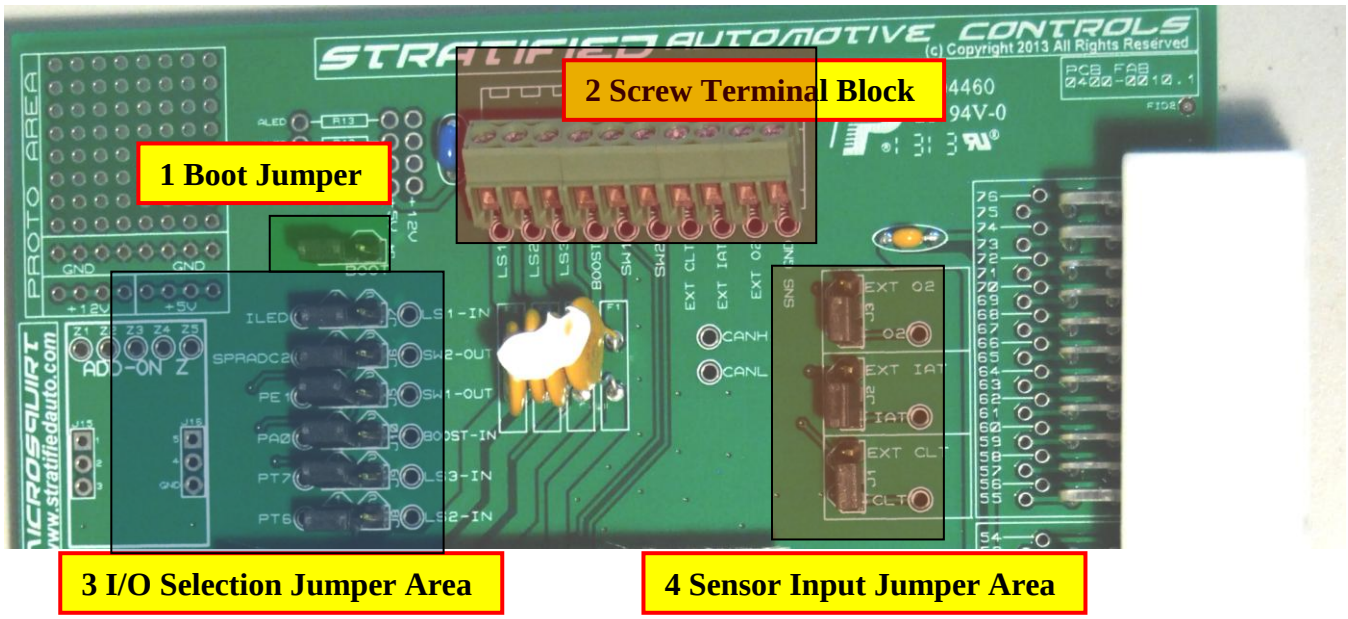
The Stratified MSND76 is powered by a fast and proven Megasquirt II (MSII) processor on a Microsquirt module board. This powerful processor is driven by MSII-Extra firmware and it supports and MSII firmware.

A detailed firmware feature list, firmware downloads and setup instructions can be found here: http://www.msextra.com/doc/ms2extra/

3. How-To Procedures

To complete the following how to procedures, you need to be familiar with the following parts of the MSND76 circuit board:

1. Boot Jumper
2. Screw Terminal Block
3. I/O Selection Jumper Area
4. Sensor Input Jumper Area



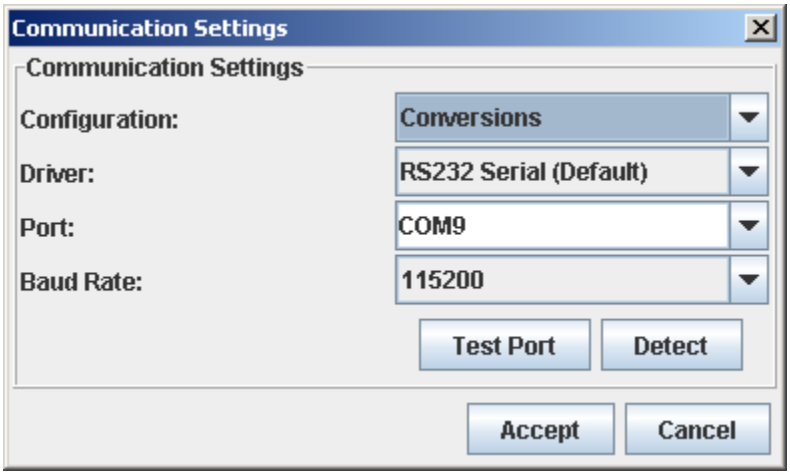
3.1. Establishing Communications with the MSND76 ECU

1. Ensure your tuning computer or laptop is connected to the Stratified MSND76 with the supplied serial tuning cable. The cable connects to the DB9 Tuning Cable Connector, located on the rear panel of the enclosure.

2. With the MSND76 installed in your vehicle, turn the vehicle's key to the "ignition on" position. This will turn on the power to the MSND76 , and it will begin to send data to your computer.

3. If the TunerStudio gauges do not respond and you see a Not Connected message across them, this means the communications is not setup properly.

4. Go to the **Communications** Menu → **Settings…**



5. Ensure the selected Port is correct. For computers with a DB9 serial COM port, the Port setting should be set to **COM1**.

6. For computers with a USB serial port, where a USB-to-RS232 cable is used, the Port number must be verified by viewing the Window's Device Manager. In the case shown above, **COM4** is selected.

7. The **Serial date rate** must be set to **115200**.

8. Once these settings have been properly selected, click the “Test Port” button. You should see “Success” to indicate that communications has now been established. Close the window.

3.2. Looking at and Burning a Calibration/Map to the MSND76 ECU

1. If you want to burn a saved calibration/map on your ECU or to look at the values in a different map you will need to open it using TunerStudio. *Please note that you can only properly view maps that are saved from ECUs with the same firmware installed. If you are opening a map saved using different firmware, TunerStudio will show a number of warnings.*

2. Go to **File Menu → Open Tune**… and select the Engine Calibration msq file.
3. After opening this file, TunerStudio will ask to send the entire set calibration value to the ECU. If you would like to flash this calibration on your ECU, ensure the ignition key is ON and hit "Yes".

4. If you want to just look at the values in TunerStudio, then make sure the ignition key is off and you will be able to modify an offline tune this way.

5. After hitting "Yes", TunerStudio will send all the calibration values to the Megasquirt processor. This process may take a minute or 2, and TunerStudio will be completely unresponsive during this time. **Do NOT** interrupt the communication or shut off TunerStudio.

6. Once completed, the Megasquirt processor and the TunerStudio software will be synchronized.

3.3. Flashing the MSND76 Base Firmware

You will need to flash the firmware on the Stratified MSND76 ECU in the following scenarios:

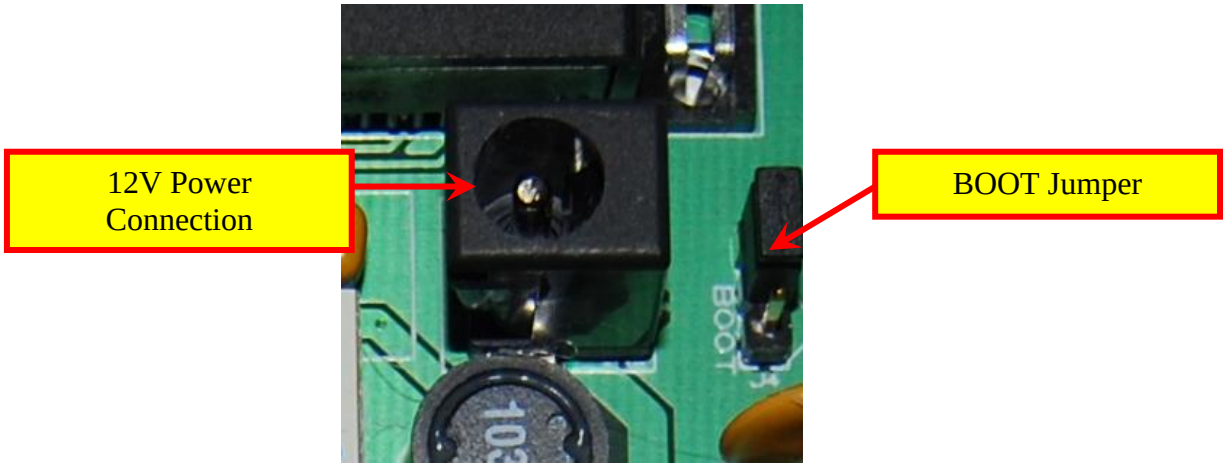
- You bought a generic unit and would like to run the firmware of your choice
- You would like to upgrade to a new code base because new features are available
- The MSND76 becomes unresponsive and you can no longer communicate using TunerStudio although all the settings are correct.

Before you start, you will need a wall wart type **DC 12V power supply**. The power connectors is very generic (2.1mm ID, 5.5mm OD) and the power supply can be found at most electronics stores or online

1. Disconnect and remove the Stratified MSND76 from your vehicle.

2. Remove the top half of the MSND76 enclosure by removing the upper screws on each end panel.

3. Plug in the 12V wall wart power supply into the power jack located near the DB9 serial connector.

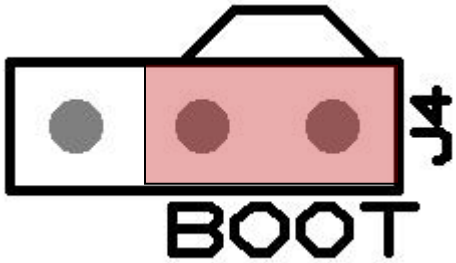


4. Ensure the serial communications cable is connected between the MSND76 and your computer.

5. Locate the folder on your PC where the new firmware is stored. *If you bought a vehicle specific MSND76 unit from Stratified, the installed firmware is on our*

website. The firmware version originally installed on the ECU is printed on the label on the back of the ECU.

6. Move the BOOT Jumper so the black jumper is positioned directly above the word BOOT.



7. On your computer, run the download file located in the firmware folder. This file is often called **download-MS2-firmware**

8. When asked, select Microsquirt Module.

9. When asked if you are upgrading from standard code, select No

10. Follow the procedure as prompted by the software.

11. If there are any problems, where the process does not complete successfully, RESTART the process from the start. The firmware download is also documented online at: http://www.msextra.com/doc/ms2extra/upgrade.html#download

IMPORTANT NOTE:
You must open and burn/flash your vehicle's engine calibration after re-flashing the base firmware.

3.4. Calibrating the Throttle Position Sensor (TPS)

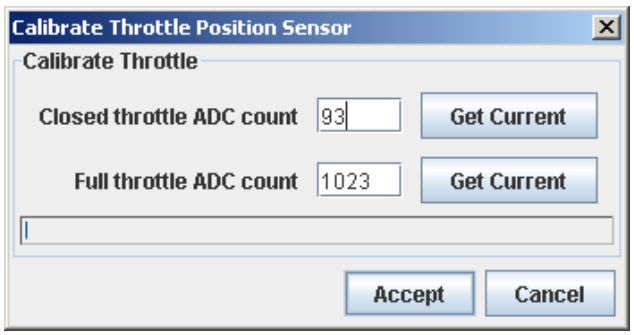
1. Many of the Megasquirt fueling processes depend on precise measurement of your vehicle's throttle position. If your vehicle has such a variable TPS sensor, follow the directions below to send its calibration to the Megasquirt processor. *Please note: not all vehicles have a variable TPS. If this is the case the MSND76 ECU is setup to use the other sensors (MAP) to compensate for this. A TPS is NOT needed to run the MSND76 on your car.*

2. Connect the Stratified ECU to your tuning computer and turn on the ignition key.

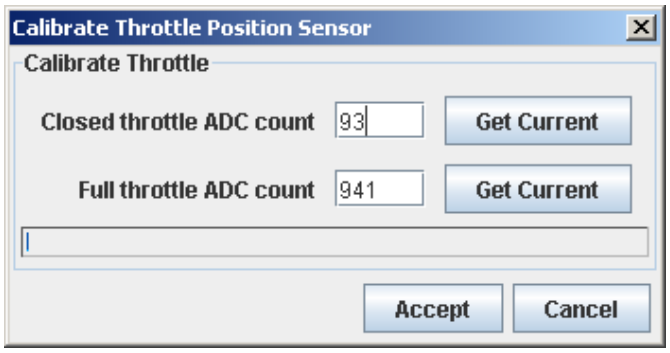
3. Start TunerStudio.

4. Go to: **Tools → Calibrate TPS…**

5. Without pressing on the throttle pedal, click the **Get Current** button next to the C**losed throttle ADC count**.



6. Next, press down completely on the throttle pedal and click the **Get Current** button next to the **Full throttle ADC count**.



7. Click **OK**.

8. To verify the calibration, right click one of the gauges and switch it to show the **Throttle Position**. The Throttle Position gauge is under **Sensor Inputs 1.**

9. Press your foot on your throttle pedal and make sure the gauge value corresponds properly.

3.5. Adding a Wideband Oxygen Senor

A wideband oxygen sensor is essential for tuning your vehicles volumetric efficiency (VE)/fueling table. The Stratified MSND76 allows for the addition of a wideband oxygen sensor. In order to add the Wideband sensor, follow the instructions below.

3.5.1. Hardware Setup

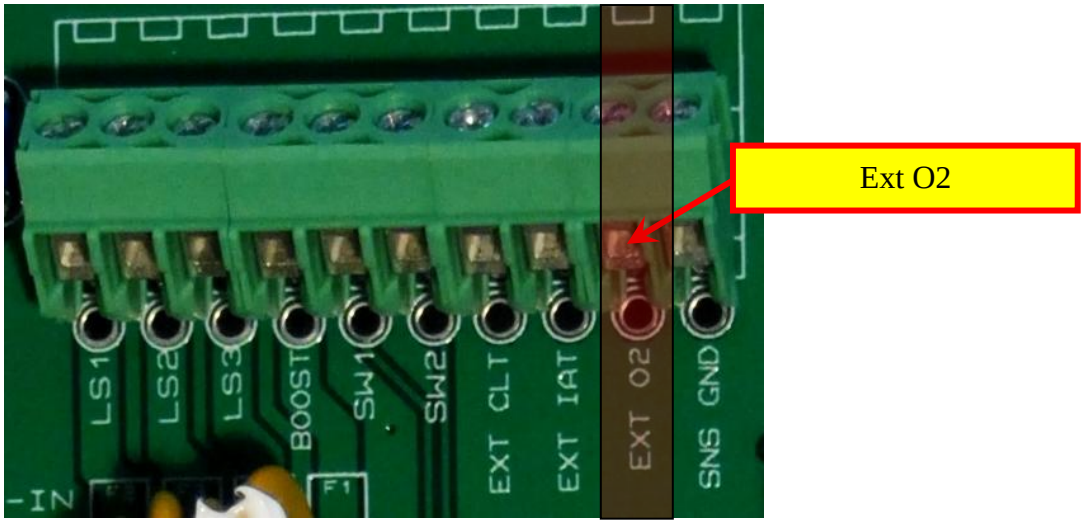
To change the initial hardware configuration to send the wideband sensor's signal to the Megasquirt processor please do the following:

1. On your wideband sensor's wire harness, determine the wire which is the 0V-5V analog voltage signal representing the wideband AFR.

2. Strip approx ¼" (6mm) of wire insulation from this wire.

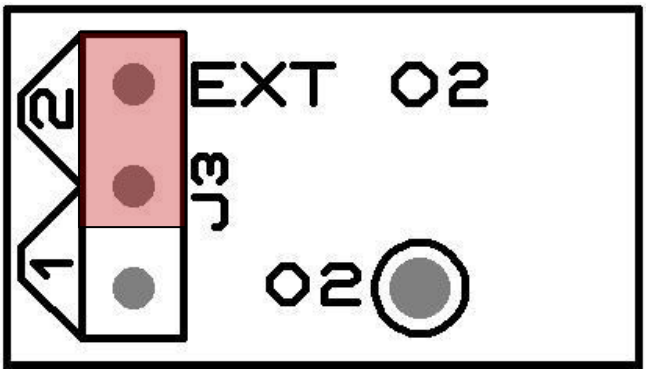
3. Remove the top half of the Stratified MSND76 enclosure by removing the top two screws on each end panel.

4. On the large green screw terminal connector block, locate the **EXT O2**.



5. Insert the wideband signal wire through the rubber grommet on the rear panel and into the screw terminal block position. Tighten the screw to hold the wire steady. You can also choose to solder this wire into the board for an even more secure connection.

6. Locate the jumper **J3**, and move the black jumper to position 2, to select **EXT O2**.



Note that when the jumper is position 1, the sensor inputs are routed to the stock vehicle harness.

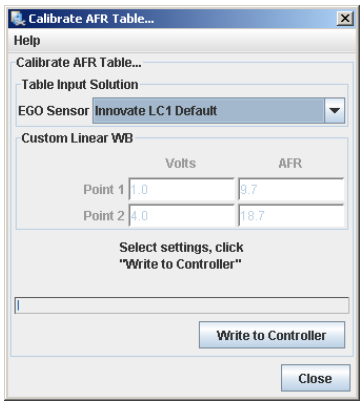
The wideband sensor signal is now properly routed to the MSND76's sensor input. Don't forget to power the ground the wideband sensor and controller as per their manufacturer's instructions

3.5.2. Software Setup

The newly installed wideband sensor must have its signal calibration values sent to the Megasquirt processor in order to be interpreted properly. To setup the software, please do the following:

1. In TunerStudio navigate to **Tools → Calibrate AFR Table…**

2. Select the Oxygen **Sensor Type** from the list available, and click **Write to Controller**.



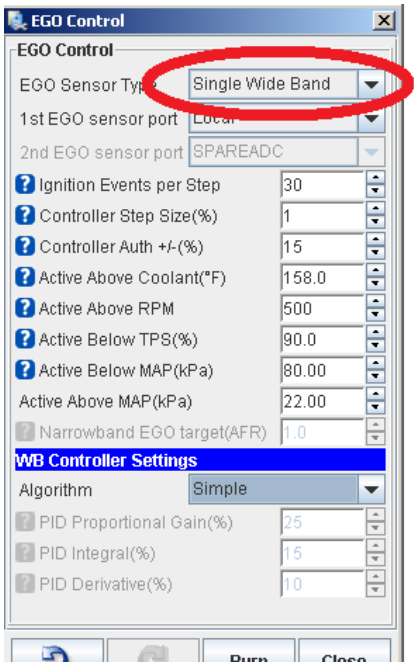
3. In the example below, an Innovate LC-1 wideband sensor has been selected. Ensure you select your particular brand of senor.

4. If your particular wideband sensor does not appear on this list, you may select the bottom option "Custom Linear WB". In this case, you must enter the sensor voltage and corresponding AFR values, for the bottom and the top of the sensor's range.

5. Once the calibration has been completely sent, close the window.

6. Go to **Basic setup** Menu → **EGO Control**

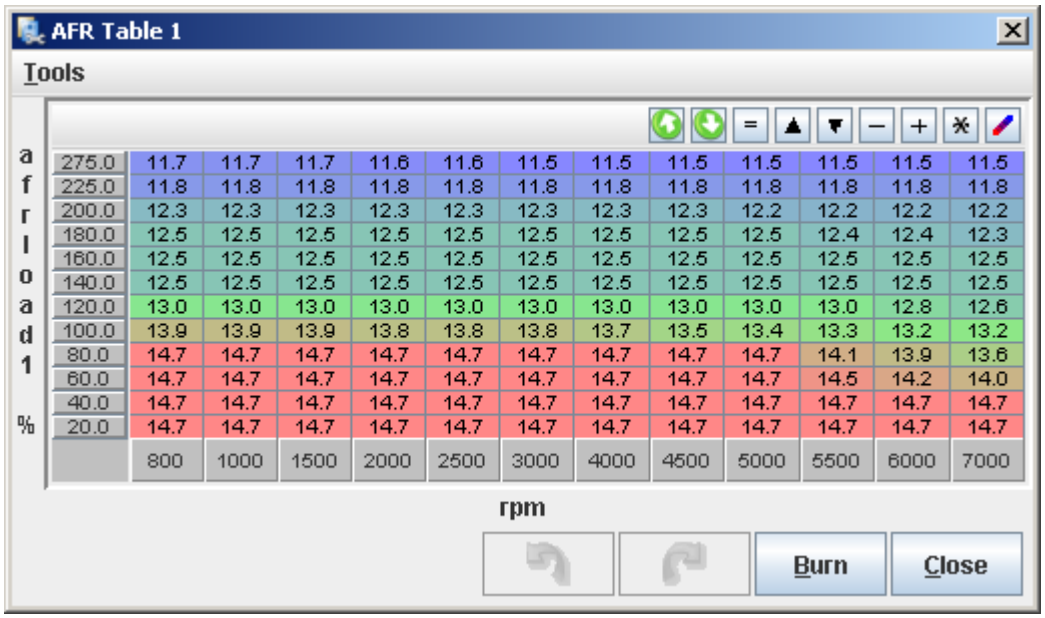
7. Select the **EGO Sensor Type** as **Single Wide Band.**



8. Set the other settings as desired.

9. Click **Burn To ECU**. Close the window.

10. Go to **Basic Settings** → **AFR Table 1.** Adjust the desired AFR values for your vehicle.



afrload1 %	800	1000	1500	2000	2500	3000	4000	4500	5000	5500	6000	7000
275.0	11.7	11.7	11.7	11.6	11.6	11.5	11.5	11.5	11.5	11.5	11.5	11.5
225.0	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8
200.0	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.2	12.2	12.2	12.2
180.0	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.4	12.4	12.3
160.0	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
140.0	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
120.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	12.8	12.6
100.0	13.9	13.9	13.9	13.8	13.8	13.8	13.7	13.5	13.4	13.3	13.2	13.2
80.0	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.1	13.9	13.6
60.0	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.5	14.2	14.0
40.0	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
20.0	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7

3.6. Using an External Air or Coolant Temperature Sensor

If you have opted to use a separate 2-wire air temperature sensor, other than your vehicle's stock sensor, you will need to follow this simple procedure to ensure the temperature signal is properly setup. These sensors should be installed in the coolant or air stream and the 2 wire harness connected inside the MSND76.

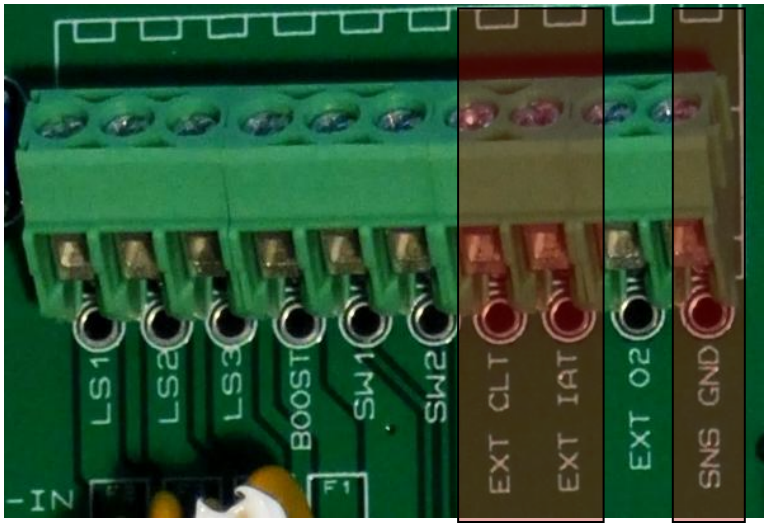
Note: If you vehicle uses a VAF or MAF air flow meter with an integrated air temperature sensor, you may now completely remove the factory airflow measurement system from your vehicle. Please see Section 3.11 below and follow the procedure to perform this operation.

3.6.1. Hardware Setup

1. Strip approx ¼" (6mm) of wire insulation from each wire on the temperature sensor harness.

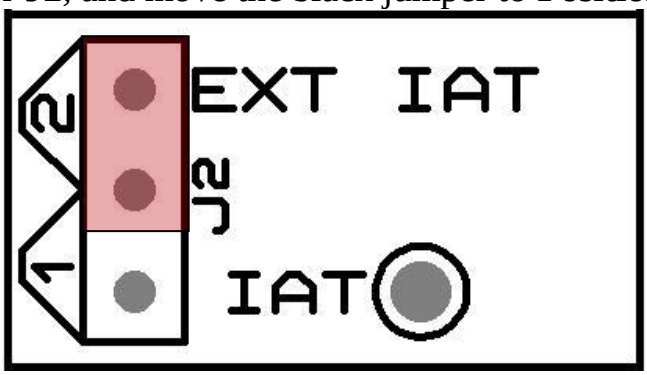
2. Remove the top half of the Stratified MSND76 enclosure by removing the upper screws on each end panel.

3. On the large green screw terminal connector block, locate the terminals **EXT IAT** or **EXT CLT** depending on what sensor you are installing and **SNS GND**.



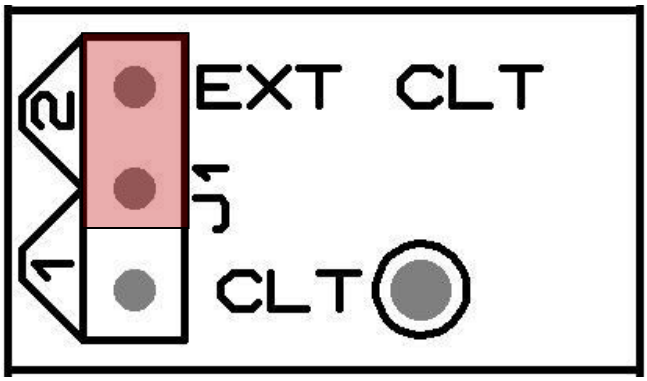
4. If you are installing an air temperature sensor, insert both wires through the rubber grommet on the rear panel and into the **EXT IAT** and **SNS GND** terminal positions. It does not matter which wire goes into which position. Tighten the screws to hold the wires steady.

5. Located the jumper **J2**, and move the black jumper to **Position 2**, labelled **EXT IAT**.



Note that when the jumper is position 1, the sensor inputs are routed to the stock vehicle harness.

6. If you are installing an **external coolant sensor** the procedure is the same except you will insert the coolant sensor wires in the terminal block connector positions **EXT CLT** and **SNSR GND** and you will move **J1** to position 2.



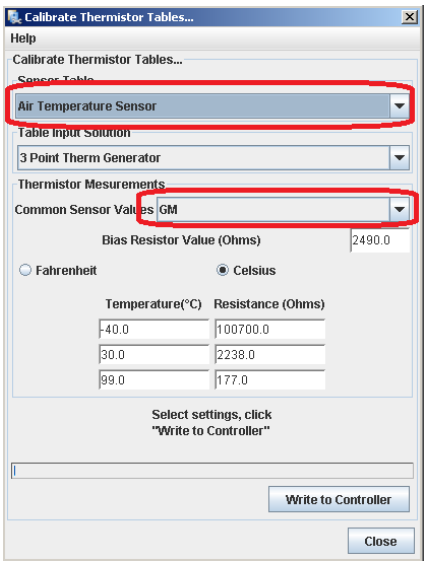
The external air temperature or coolant temperature sensor signal is now properly routed to the ECU's sensor input.

3.6.2. Software Setup

The newly installed temperature sensor must have its signal calibration values sent to the Megasquirt processor in order to be interpreted properly. To setup the software, please do the following:

7. Go to **Tools** Menu → **Calibrate Thermistor Tables…**

8. When the window opens, select either **Air Temperature or Coolant Temperture** from the list box Next under **Common Sensor Values** select the type of sensor you have installed and click Write to Controller. Repeat for all temperature sensor installed.



3.7. Enabling an Output for a Fan, Shift Light or Other Device

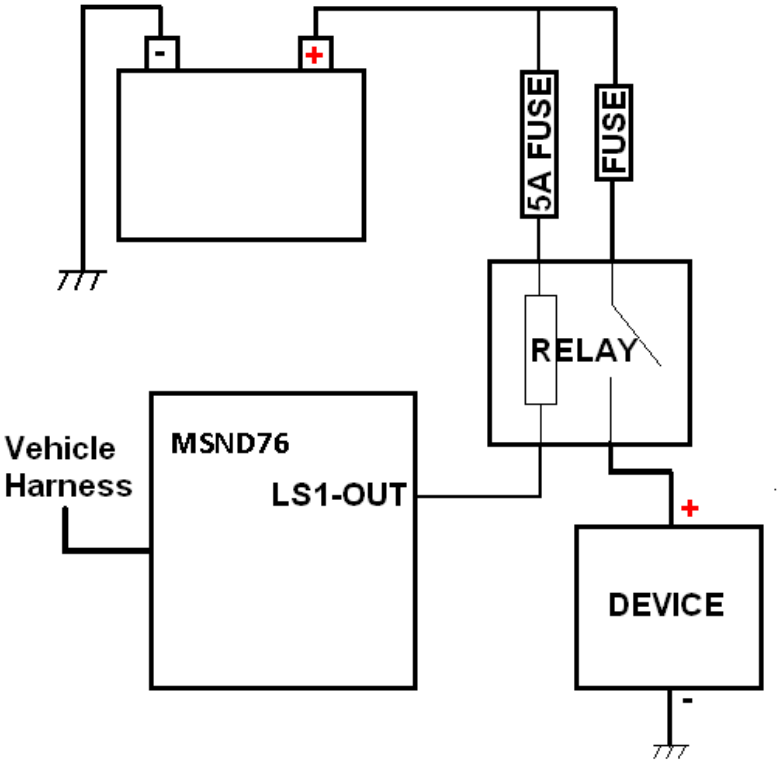
In order to use the MSND76 to control other devices in your vehicle, the ECU comes fully equipped with 3 output low side drivers, which are intended to drive relays or other low current loads such as solenoids. Each driver can support up to 3 Amps.

IMPORTANT NOTE:
If you are using a low side driver for a fan or other type of motor, you must use a relay. LED shift lights and secondary intake runners or other solenoids with a ~10ohm or above resistance can be powered directly from the MSND76 circuit.

Also note that on OEM implementations of the ECU, some of these low side drivers may already be used (to drive cooling fans for example).

3.7.1. Hardware Setup

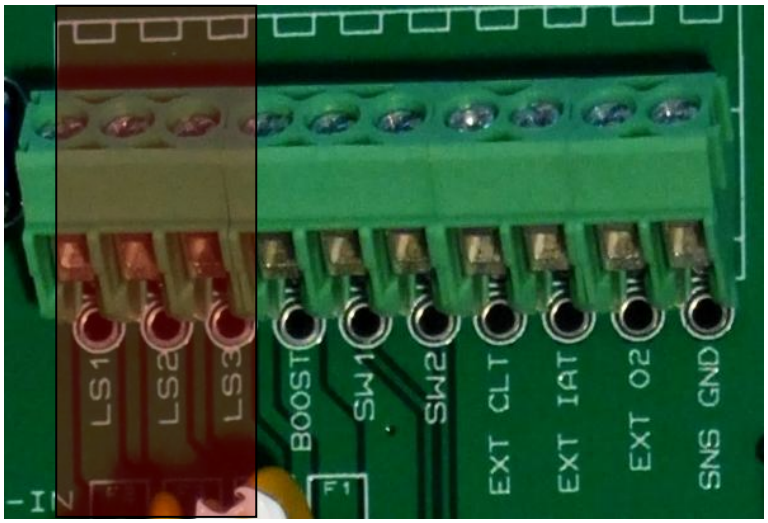
This hardware setup shows you how to connect your device through a relay to the MSND76 drivers. The image below shows a typical circuit involving a relay being controlled with the MSND76 though the LS1-OUT control signal.



1. From the circuit seen above, connect the one side of the relay coil through a 5A fuse to the battery terminal, or an ignition switched power source.

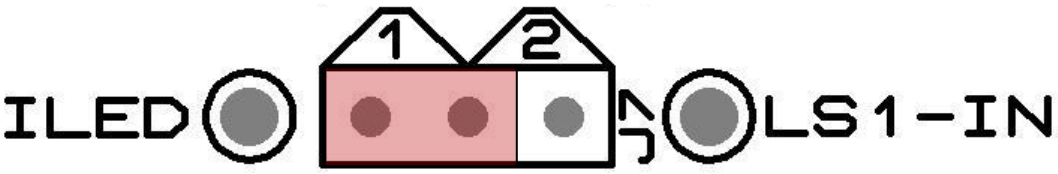
2. Remove the top half of the Stratified MSND76 enclosure by removing the upper screws on each end panel.

3. On the large green screw terminal connector block, locate the **LS1** terminal. You may optionally use **LS2** or **LS3.**



4. Connect a wire to the other side of the relay coil, insert it through the rubber grommet on the rear panel and into the **LS1** terminal and tighten the screw to hold the wire steady. You can also choose to solder this into place.

5. In the Input and Output Selection area of the circuit board, ensure the jumper **J7** is in **Position 1**, in the ILED position.



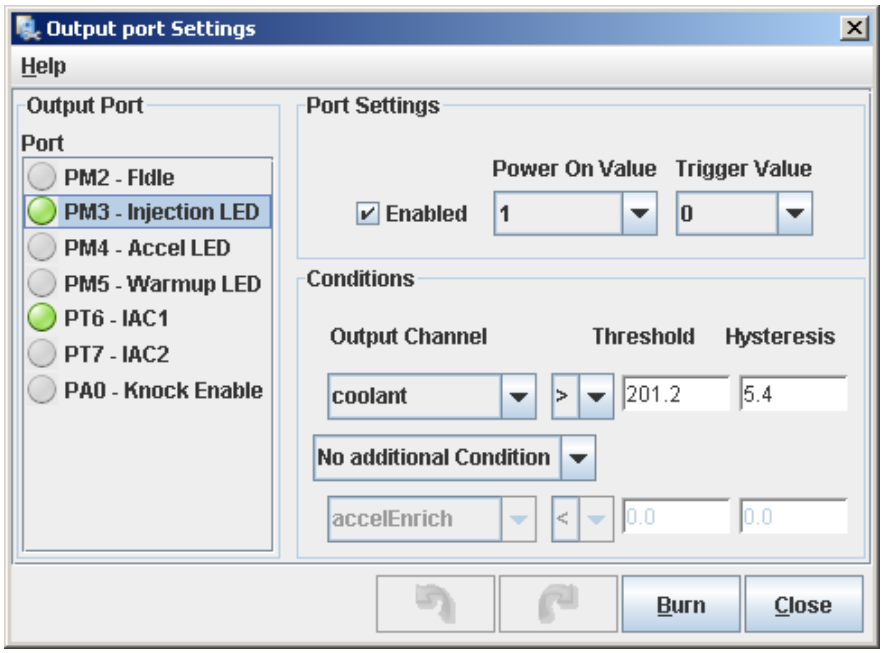
NOTE: If you wish to access an I/O port directly from the Megasquirt and want to decouple it from its low side driver circuit, this is done by setting the jumper for that port to position 2.

3.7.2. Software Setup

In TunerStudio, setup the output control with the following procedure:

6. Go to **Extended** Menu → **Output Port Settings**

7. From the **Port** selection box, choose one of the following:
   For LS1 connection, select: "PM3 – Injection LED"
   For LS2 connection, select: "PT6 – IAC1"
   For LS3 connection, select: "PT7 – IAC2"



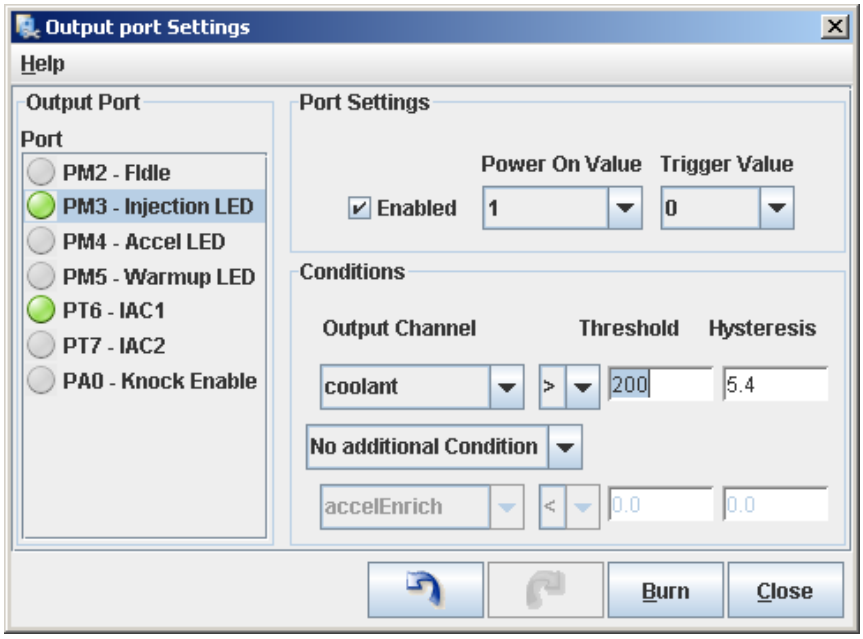
8. Ensure the "Enable" box is checked.

9. Select the variable and the corresponding thresholds you would like to govern when the output is turned on and off.

   NOTE: You must turn the MSND76 off and on in order for the settings to properly take effect.

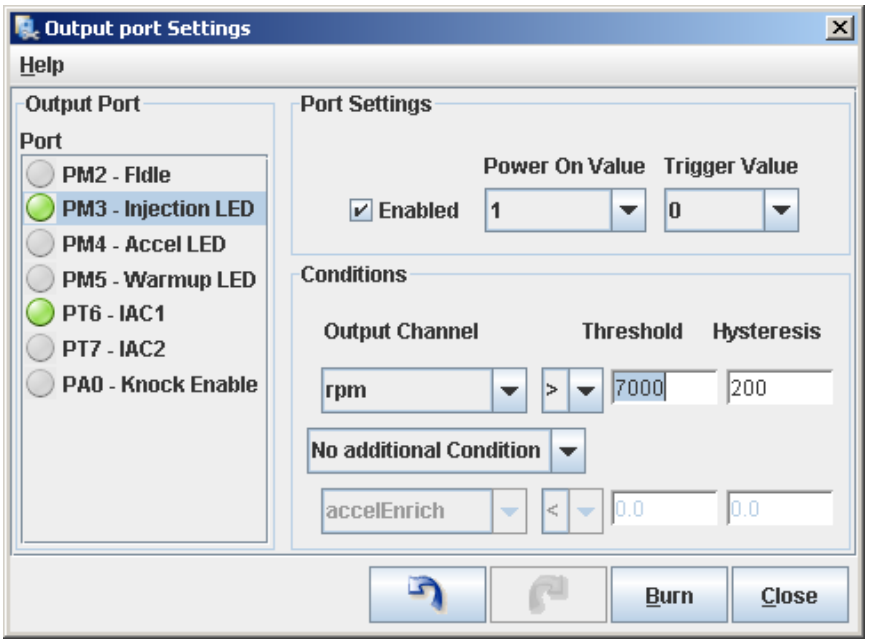
   <u>Example Radiator Fan setting:</u>

   If you have a radiator fan you want to turn on at 200°F, and turn back off at 195°F, you would choose the following settings.



Example Shift Light setting:

If you would like your shift light to turn on above 7000rpm, you would choose the following settings:



3.8. Adding a Clutch Switch for Launch Control or Flat Shifting

To enable more advanced features such as launch control, flat shift, or other input control mechanisms, the Stratified MSND76 offers 2 separate inputs. The Stratified MSND76 is compatible with digital inputs that are active when the input is connected to the vehicle's chassis ground.

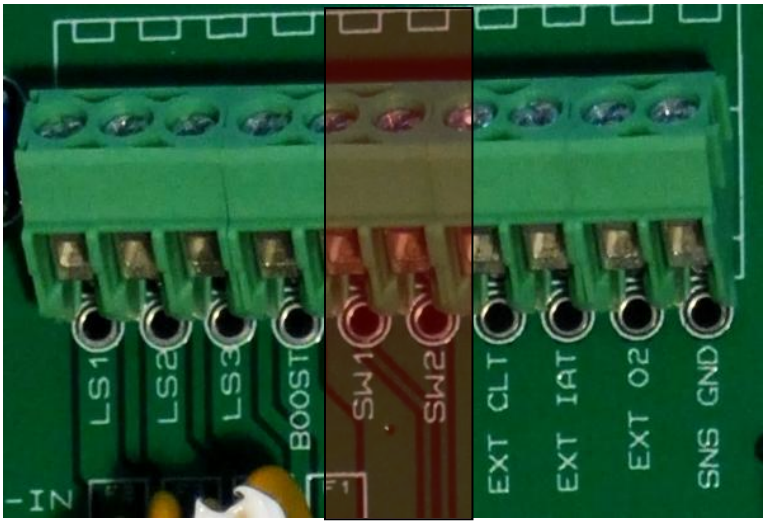
To enable an input switch, such as a clutch switch, follow the procedure below:

3.8.1. Hardware Setup

1. Strip approx ¼" (6mm) of wire insulation from the wire coming from the input switch.

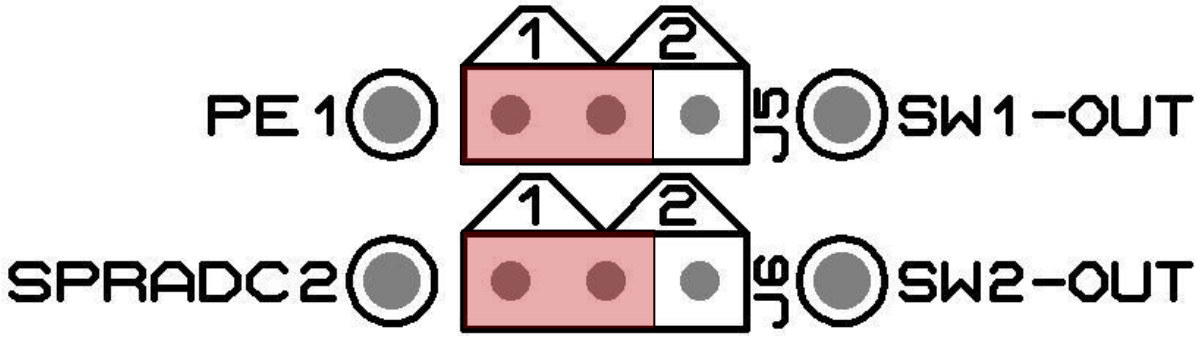
2. Remove the top half of the Stratified MSND76 enclosure by removing the upper screws on each end panel.

3. On the large green screw **terminal connector block**, locate the terminals **SW1** or **SW2**. You may use either one as an input.



4. Insert the wire through the rubber grommet on the rear panel and place it into the screw terminal position and tighten the screw to hold the wire steady.

5. Locate the jumper **J5** (if using SW1-IN) or **J6** (if using SW2-IN), and ensure the black jumper is in **position 1**.



For SW1-IN, ensure the jumper is in position 1 for **PE1**.
For SW2-IN, ensure the jumper is in position 1 for **SPRADC2**.

The input switch signal is now properly routed to the Megasquirt's input.

NOTE: If you wish to access an I/O port directly from the Megasquirt and want to decouple it from its digital input conditioning circuitry, this is done by setting the jumper for that port to position 2.

3.8.2. Software Setup

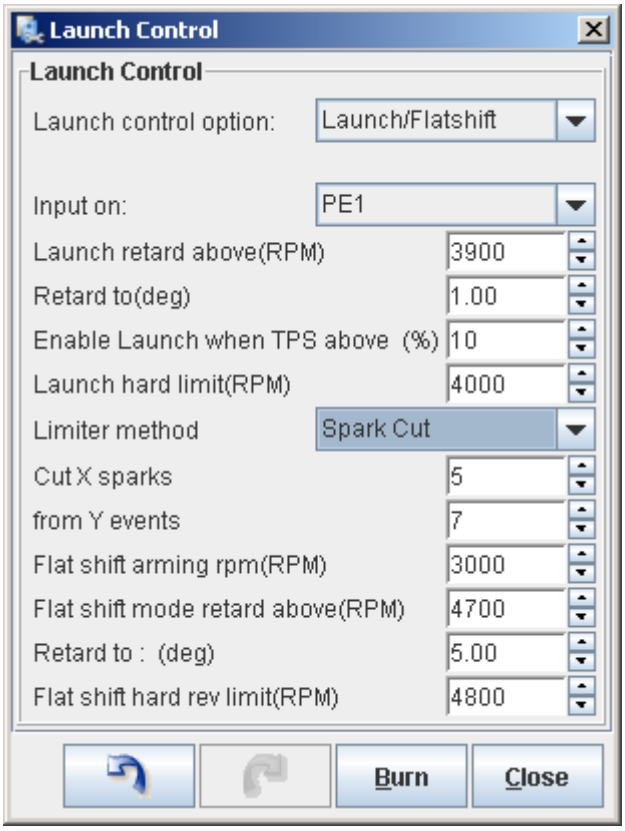
In TunerStudio, the following procedure must be followed to enable the input for the Megasquirt processor.

1. Ensure TunerStudio is connected to your MSND76, and your ECU is powered.

2. Go to **Extended** Menu → **Launch Control**

3. Select the Launch Control Option to either **Launch** or **Launch/Flatshift**.

4. If you wired your clutch switch to SW1-IN, select Input On: **PE1**
   If you wired your clutch switch to SW2-IN, select Input On: **JS4**



5. Set the remaining Launch control and Flatshift settings, and click **Burn to ECU**. Close the window.

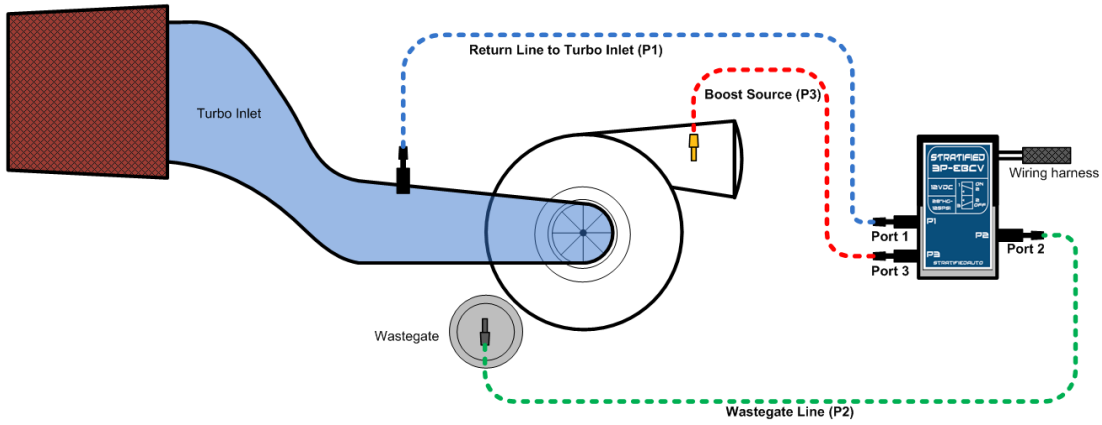
3.9. Adding a Boost Control Solenoid Valve

The MSND76 has a built-in boost control solenoid driver. This means that you can add a boost control solenoid such as the one we offer to electronically control your boost very easily.

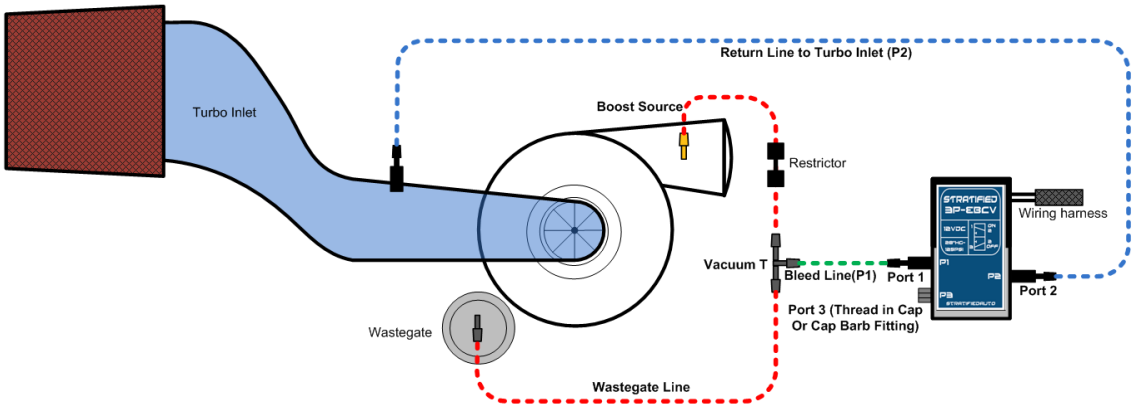
3.9.1. Hardware Setup

1. First decide whether you will be running the boost control solenoid in 3 port (interrupt) or 2 port (bleed) mode and plumb it into the vehicle as shown below

Stratified 3 Port EBCV in Interrupt (3 Port) Mode



Stratified 3 Port EBCV in Bleed (2 Port) Mode

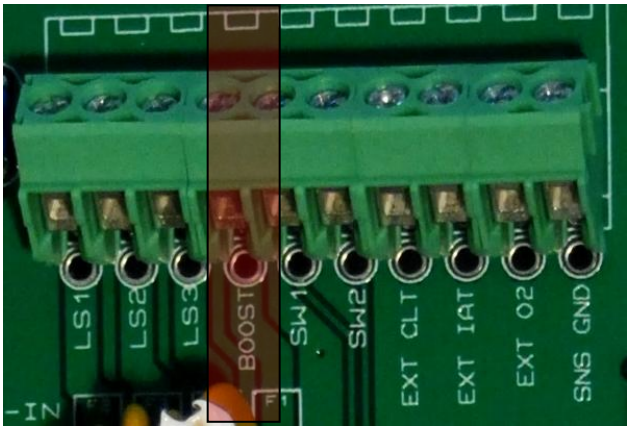


2. On the electrical side connect one wire of the boost control solenoid (EBCV) to a 12V source that is switched on with the ignition switch. The polarity is not important.

3. Strip approx ¼” (6mm) of wire insulation from the other wire.

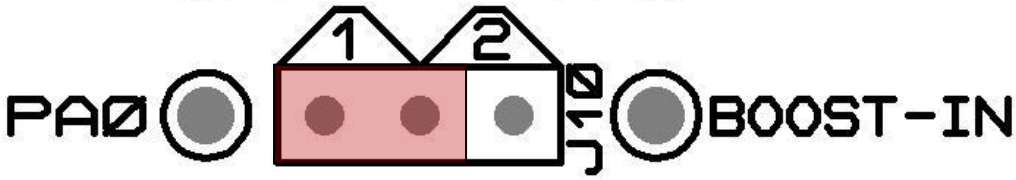
4. Remove the top half of the Stratified MSND76 enclosure by removing the upper screws on each end panel.

5. On the large green screw terminal connector block, locate the terminal: **BOOST**.



6. Insert the wire through the rubber grommet on the rear panel and place it into the screw terminal position and tighten the screw to hold the wire steady.

7. Located the jumper **J10**, and ensure the black jumper is located in **position 1**, **PA0**.



The boost control signal is now properly routed from the Megasquirt to your boost solenoid valve.

NOTE: If you wish to access an I/O port directly from the Megasquirt and want to decouple it from the boost control circuitry, this is done by setting the jumper for that port to position 2.

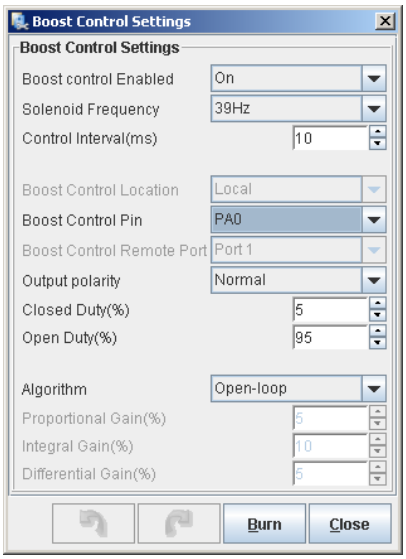
3.9.2. Software Setup

1. Ensure TunerStudio is connected to your MSND76, and your ECU is powered.

2. Go to **Advanced** Menu → **Boost Control Settings**

3. Change **Boost control Enabled** to **On** and set the **Solenoid Frequency** to 39Hz if using the Stratified EBCV

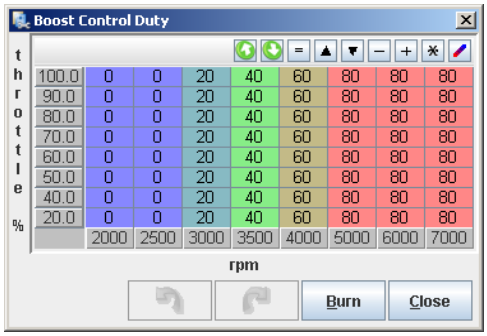
4. Select the **Boost Control Pin** as **PA0/JS11**.



5. Click **Burn To ECU**. Close the window.

6. Go to **Advanced** Menu → **Boost Control Duty Table**

7. Enter the desired Duty Cycle Values within this table. This will be an iterative process that will take an understanding of your solenoid valve's characteristics.



3.10. Changing Injector Sizes

The base engine calibration that comes with the Stratified MSND76 is setup for the vehicle's stock injector size. If you have changed your fuel injector size, you will need to make adjustments in TunerStudio in order to recalibrate the fuel maps. Follow the instructions below to change your injector size.

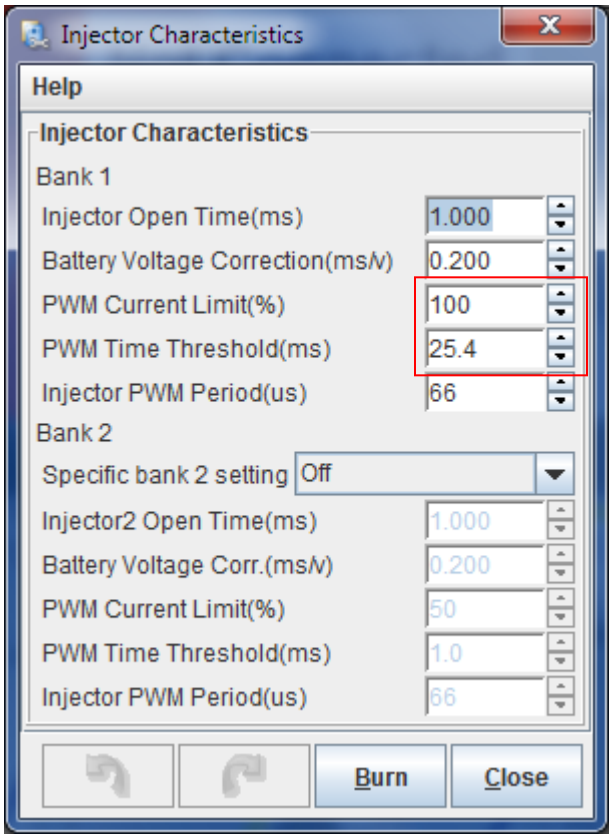
3.10.1. Software Setup

1. Ensure TunerStudio is connected to your MSND76, and your ECU is powered.

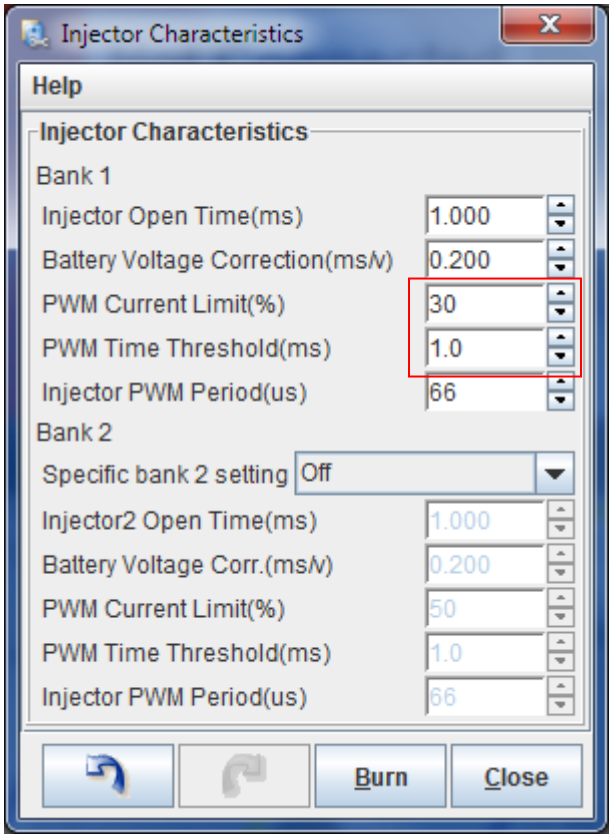
2. First, find out if your injectors are HIGH Impedance or LOW Impedance.

3. Go to **Basic Setup** Menu → **Injector Characteristics**

4. If the injectors are **HIGH** impedance, make sure the following values are entered



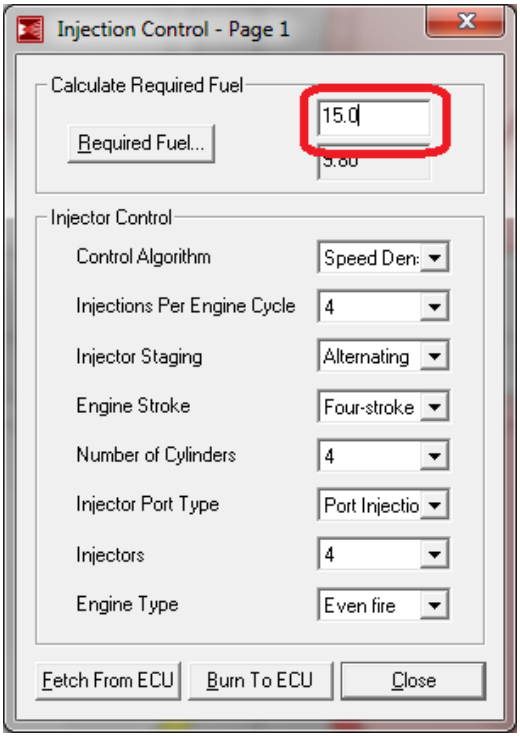
5. If the injectors are **LOW** impedance, make sure the following values are entered



6. Go to **Basic Setup** Menu → **Engine Constants**

7. Change the Required Fuel value using the following formula:
   New Req. Fuel = Old Req. Fuel × Old Injector Size ÷ New Injector Size

<u>Example:</u> original injector size = 230cc, new injector size is 460cc
New Req. Fuel = 15.0 × 230 ÷ 460 = **7.5**



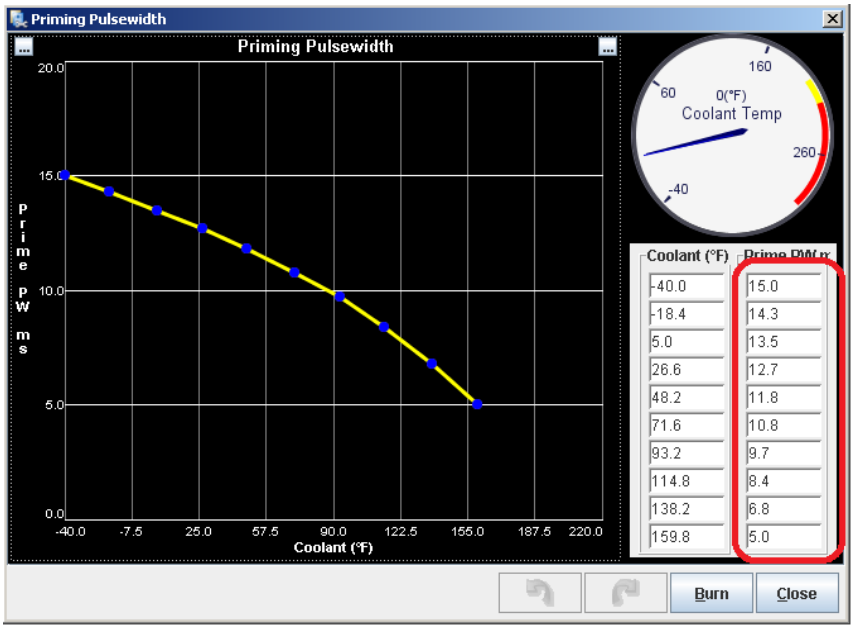
8. Click "Burn To ECU". Close the window.

9. Adjust your Fueling Priming Pulses as follows

10. Go To **Startup/Idle** Menu → **Priming Pulse**

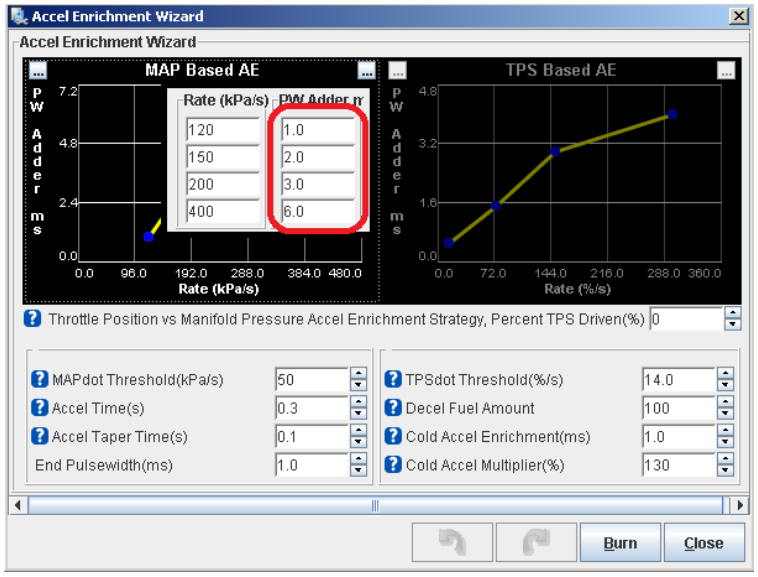
11. Adjust all the pulse widths as indicated below using the following formula:
    New Pulse = Old Pulse × Old Injector Size ÷ New Injector Size.

<u>Example:</u> Old Injector Size = 230cc, New Injector Size = 460cc
New Pulse = 15.0ms × 230 ÷ 460 = **7.5ms**



12. Go to **Accel Enrich** Menu → **Acceleration Wizard** and open the enrichment values by clicking on the "..." symbol at the top right of the graph.

13. Adjust the enrichment values (ms) values using the same formula as shown above.



Note that All CRANKING PULSES are based on your fueling VE table and the required fuel value previously setup. So the injector cranking pulse widths do not need to be adjusted.

3.11. Removing the Vehicle's VAF Air Meter System

If your vehicle uses a Vane Air Flow (VAF) meter system you may be able to completely remove this system from the intake air stream.

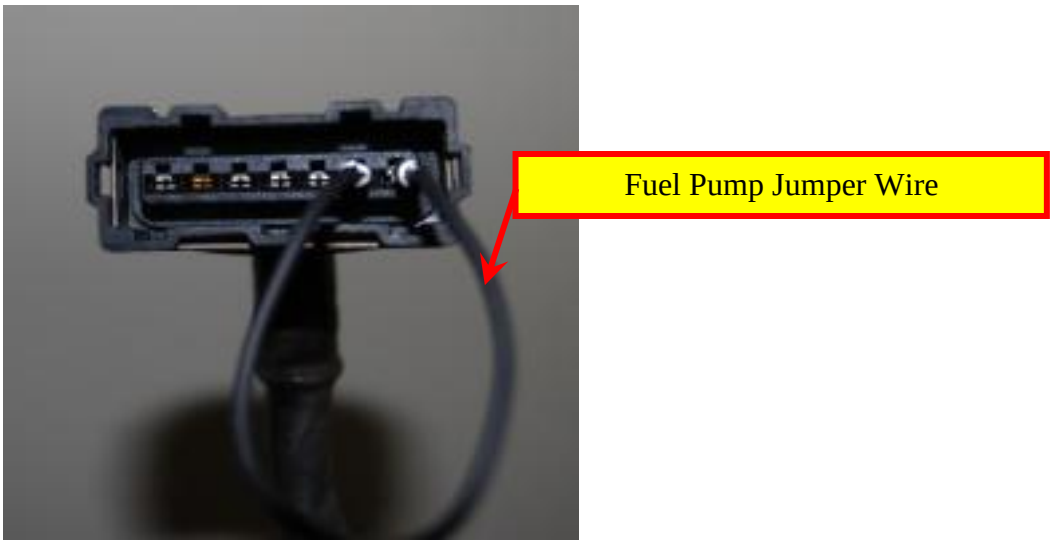
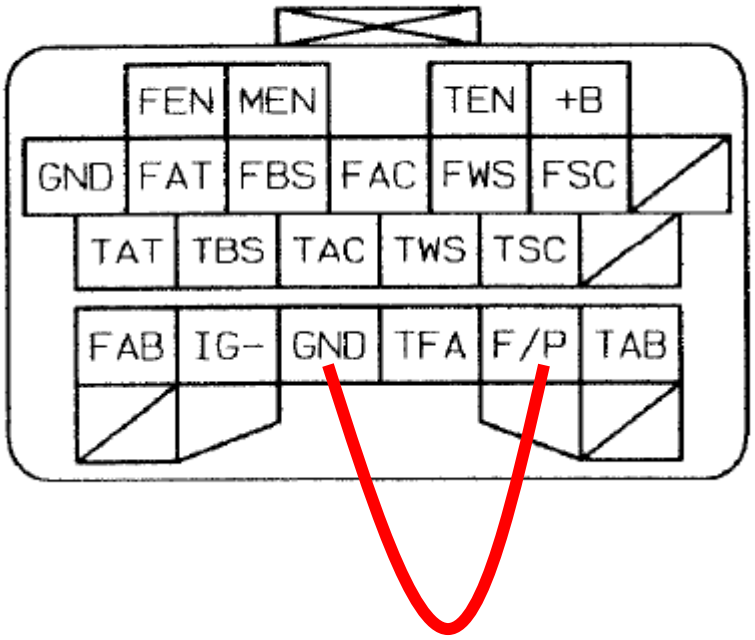
If you ordered the Stratified VAF removal kit, this kit comes with a replacement air temperature sensor and a Fuel Pump Jumper Wire. Please follow the directions below to properly perform the VAF removal.

Some VAF meters contain an integrated air temperature sensor. This is common on Ford and Mazda systems. If your system does contain an integrated air temperature sensor, in order to remove the VAF system you will need to replace this air temperatures sensor with an external temperature sensor.

1. If needed, install the external Air Temperature Sensor as described in the procedure Section 3.6 above.
2. Locate the VAF in your engine bay and unplug the VAF electrical connector.
3. Remove any intake air tubing connected to the VAF meter.
4. Remove all fasteners that mount the VAF into your vehicle and remove the VAF meter.

The next steps are for Mazda/Ford vehicles powered by a B series engine. If you don't have such a vehicle skip this.

5. The Mazda B engine-series (BP, B8, B6) vehicles have a fuel pump cutoff switch inside the VAF. If you are removing the VAF on one of these vehicles, you must jump this switch. On the VAF connector, insert the Fuel Pump Jumper Wire between Pin 1 and Pin 2, as shown below. This jumper wire allows your vehicle's fuel pump to remain operational.



6. If your vehicle's VAF connector does not contain wires in the Pin 1 and Pin 2 positions, you will need to install the Fuel Pump Jumper Wire in the vehicle's Diagnostic connector port.