

GM LS 24X Drop On Harness

MS3Pro ULTIMATE

For GM LS Engines with 24X Crank Triggers

Thank you for your purchase and support of American made products! We have designed this drop on harness to support anything from a stock motor swapped into a vintage muscle car to serious drag racing applications. If you have any questions about your installation, please contact us at support@ampefi.com. This Quick Start Guide includes installation, basic configuration and testing procedures concluding at engine start up for MS3Pro ULTIMATE-specific GM LS 24x Drop On Harness & ULTIMATE ECU. For more detailed information, please visit the MS3Pro ULTIMATE User Manual on the included flash drive or our downloads page at <https://www.ampefi.com/downloads/>

Parts Included:

- MS3Pro Ultimate ECU
- USB thumb drive with software and instructions
- Complete wiring harness with fuse block and fuses included
- RS232 (DB9) serial tuning cable and DB9 to M12 adapter
- USB tuning cable
- 6 pin gray connector for O2 sensor connections
- 6 pin black connector for transmission control or other expansion devices
- 15 crimp pins for above connectors
- 100 ohm resistor for alternator light installation
- Ground wire for fuel pump

Every MS3Pro ECU purchase includes a FULL TunerStudio registration. To register TunerStudio, please visit <https://www.efianalytics.com/ms3pro/> Your serial number is located on a silver decal on the ECU enclosure bottom. The registration code is valid for one user with up to three tuning computers, and there is no limit to how many ECUs you may use with the registered version of TunerStudio.

Applications

This harness is designed to fit all engines in the LS family using 24X crank trigger, including Corvette, F-body, and truck engines. We offer three variations based on the injector type. The harness was designed to accommodate both car and truck intake manifolds, as well as most aftermarket manifold options. The harness also requires the use of a cable operated throttle body with OEM-style TPS and IAC connectors; non stock sensors or IAC valves may require minor changes. A few unusual intake manifolds (particularly carburetor style or independent runner designs) will require basic extension of some wires to fit relocated components.



EV1 Injector



EV6 Injector



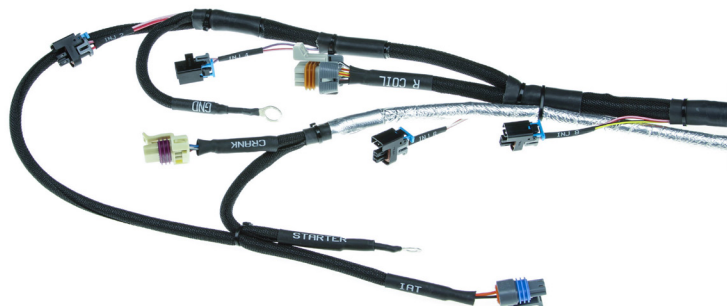
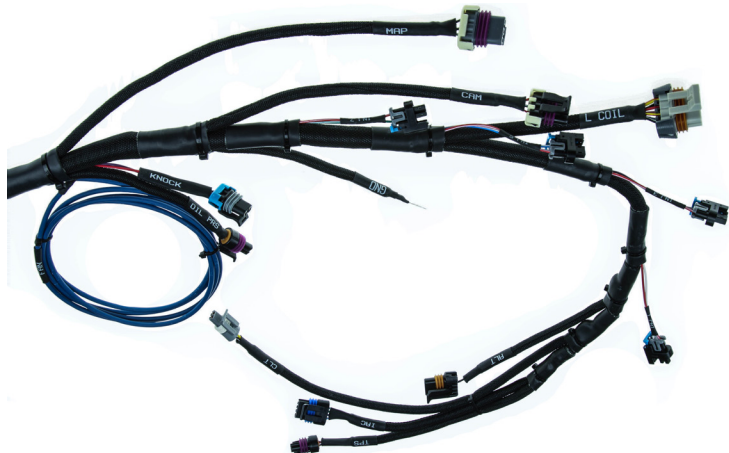
Multec Truck Injector

A few engine variations may require minor changes. For example, some truck engines used a one wire oil pressure sensor switch located behind the intake manifold. MS3Pro's oil pressure input requires swapping to a three wire oil pressure sensor. Some alternator brackets (particularly aftermarket alternator relocation kits) require a lengthened alternator connection. Avoid splicing or cutting by using p/n: [MS3Ph-LSAlt](#) (sold separately).

Pre-installation Considerations & Descriptions

This harness is designed for installing MS3Pro and the fuse block in the passenger compartment, however, the ECU and fuse block are capable of withstanding underhood heat if they are mounted at least 12" (30 cm) from the exhaust system. For unusually high vibration installations, use rubber vibration isolators to mount the ECU. MS3Pro ULTIMATE's IP65-rated enclosure is splash resistant but should not be continuously submerged. If you need continuous immersion resistance, you may reinforce the rubber seal with RTV silicone. We designed the harness using high-temp resistant wire & loom; however, avoid routing it too close to the exhaust system.

The harness splits into two main branches on the engine, which join above the bellhousing. The even numbered cylinder section includes the crank sensor, right injector and coil banks, starter solenoid, and IAT (intake air temperature) sensor connectors. The odd numbered section includes connectors for the oil pressure sensor (connected to Analog In 2), knock sensor subharness, MAP sensor, cam position sensor, left injector and coil banks, alternator, coolant temperature sensor, throttle position sensor, and IAC valve.





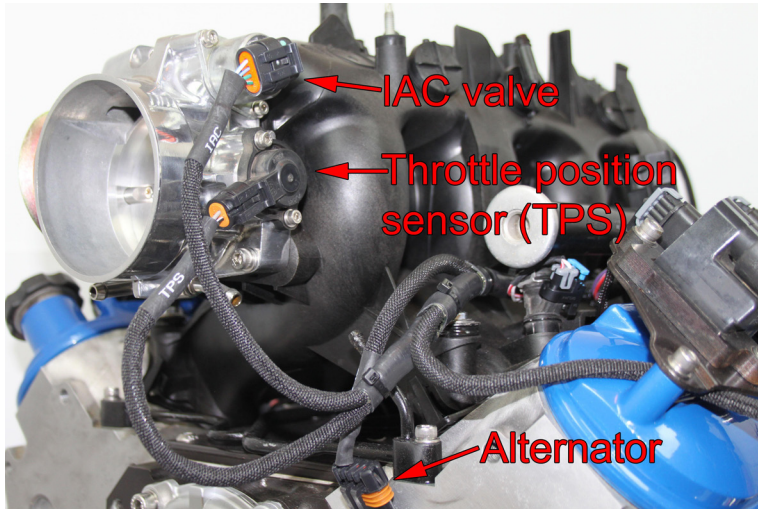
The Body Control branch contains critical connections to the vehicle electrical system:

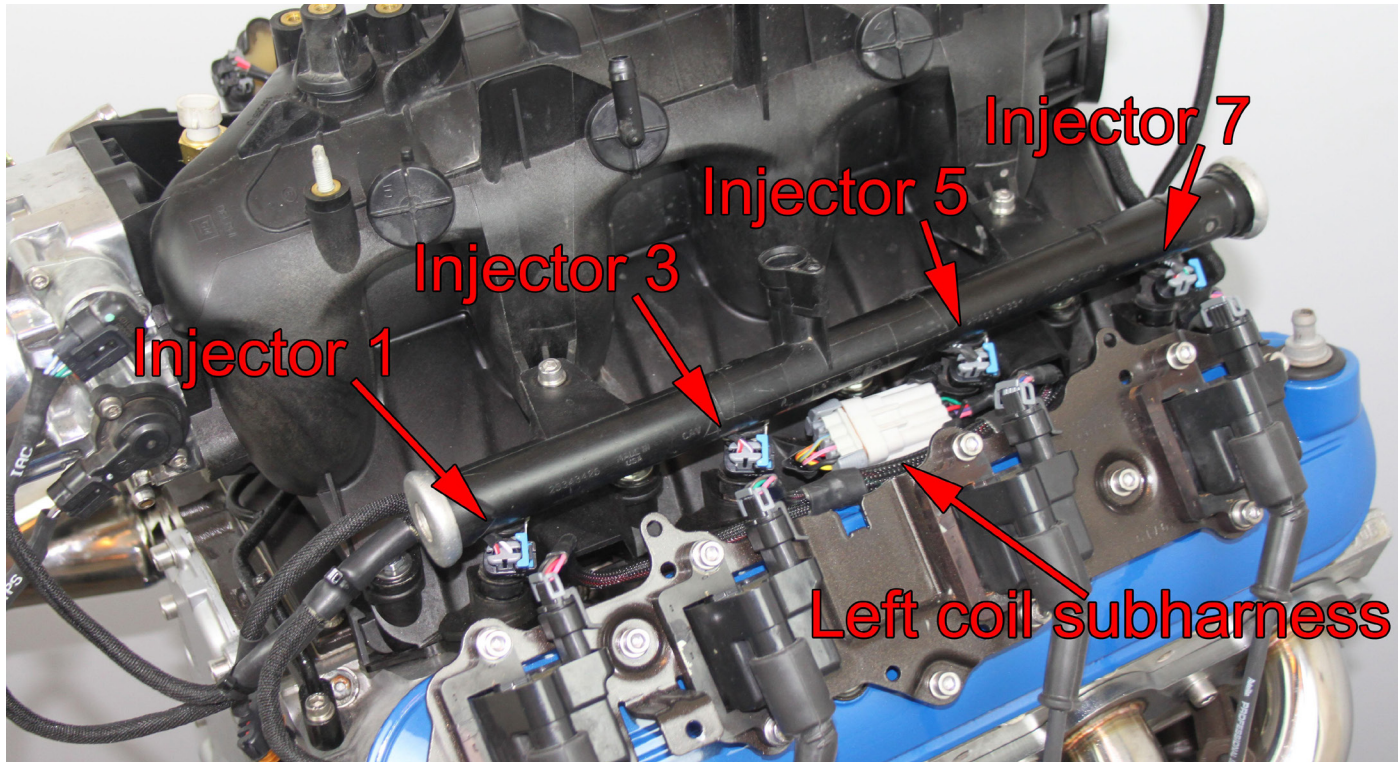
- Purple: Starter solenoid power. Connect to starter relay. (14 AWG)
- Brown: Alternator light. The alternators on these motors use the same wire to supply a turn on signal and activate a warning light at low output. (20 AWG)
- White / Red: 12 volt switched power. (20 AWG)
- Purple / Red: Supplies 12 volts for the fuel pump. (10 AWG)
- Light green / Purple: Tach output signal. Supplies a tach signal to stock or aftermarket tachometers or RPM signal to shift lights, fuel pump controllers and other components accepting a tach signal. Output is a 0-12V square wave; some OEM tachs require a high voltage adapter. (20 AWG)

Before installing the harness, check to be sure you have access to the rear of the engine. On some swaps, you may have an easier time installing the harness if you first unbolt the hood to improve accessibility.

Step-by-step Wiring Directions

1. Disconnect the battery.
2. Begin by cutting a hole in the firewall and feeding the harness through from the inside to the engine. The minimum recommended hole diameter for the wiring harness is 1.75" (45 mm).
3. Under the hood, position the odd numbered cylinder branch of the harness along or under the injector fuel rail. Connect the IAC, TPS, coolant temperature, odd numbered injectors, left coil subharness, and alternator connections. If the alternator does not mount in the stock F-body or truck location high on the left side, splice and extend the alternator connection wire, or use p/n: [MS3Ph-LSAlt](#) plug-in extension.





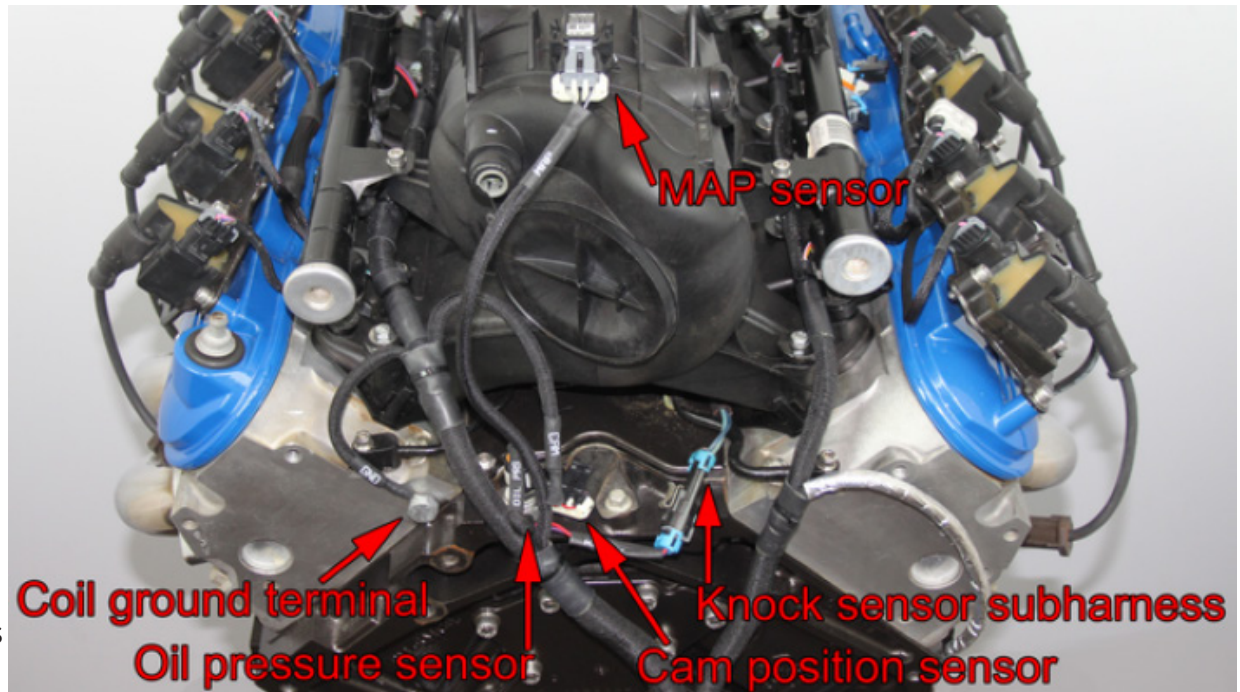
4. No alternator charging wire is included with the harness due to the large number of possible battery locations. Connect the alternator output terminal lug to the battery positive terminal. Use a minimum of 4 gauge for a 150 amp alternator & 6 gauge for 100 amp alternator. For additional protection, we recommend installing a circuit breaker on this lead.

5. Next, attach the connections at the rear of the engine. Connect the knock subharness connector, cam position sensor, oil pressure sensor, and MAP sensor.

6. The harness also includes a ring terminal to ground the coils that connects to the bolt hole on the back of the cylinder head using an M10 x 1.5 mm bolt. Make sure the bolt is torqued tightly and the ring terminal is not able to rotate while the bolt is tightened. Using an excessively long bolt often results in a bad connection and intermittent sparks.

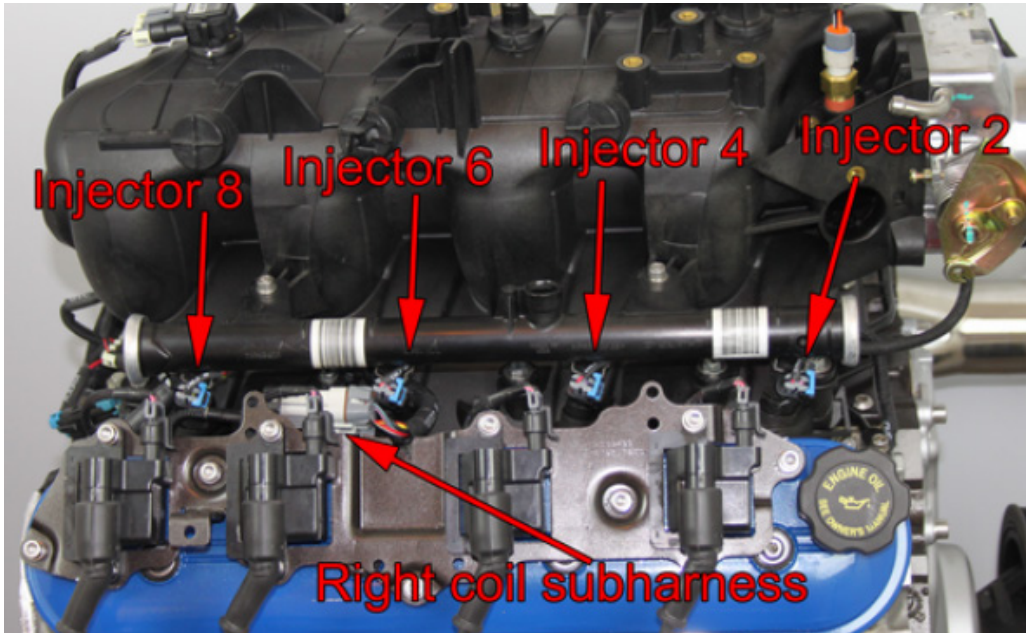
7. The harness also incorporates a single heavy gauge green wire that supplies 12 volt fused power, which can be used to run a cooling fan or other ECU controlled device through a relay inside the fuse box. MS3Pro drives this output through High Current Out 1.

8. Run the even numbered cylinder harness under or along the

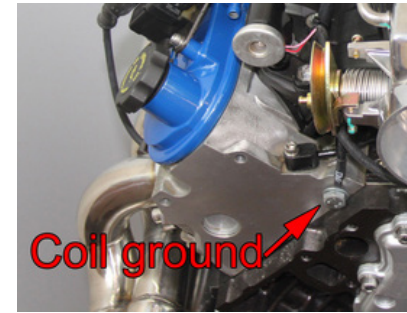


GM LS 24X v1.0

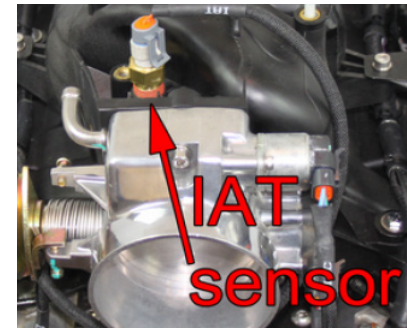
fuel rail. Connect the even numbered injector plugs and the right hand coil subharness plug.



9. Bolt the ring terminal at the front of the even numbered cylinder harness to the front of the cylinder head using a M10 x 1.5 mm bolt. Make sure the ring terminal is not able to rotate on the bolt.



10. Connect the IAT sensor. If your engine does not have a provision for the IAT, mount it using a bung in the charge pipe, or tap into a suitable location on the intake manifold and thread in an [IAT sensor](#). On many truck intake manifolds, the canister purge solenoid location is a good place to tap for the sensor. If you are using a metal intake manifold, we recommend mounting the IAT sensor in the charge pipe instead.



11. Support the front end of the vehicle on jackstands and remove the starter. Run the foil wrapped wire down to the vicinity of the starter.

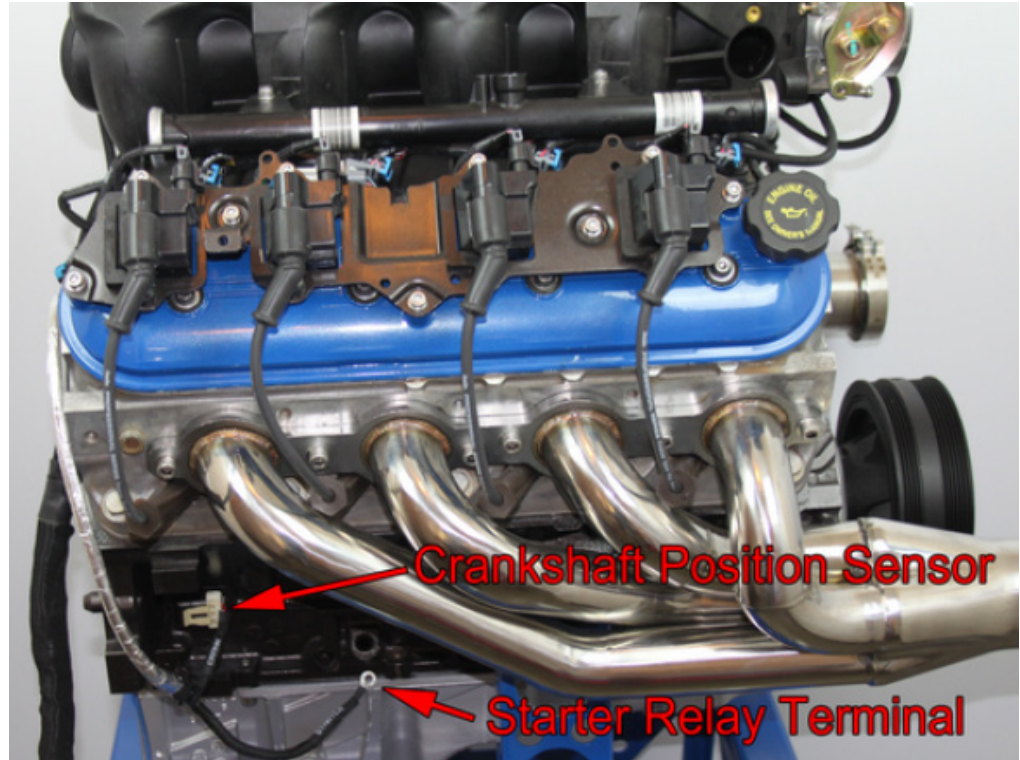
12. Connect the crankshaft position (CKP) and starter relay wires.

13. Re-install the starter.

14. The branch with 4 gauge wire and the 20 gauge white wire connects to the battery or master disconnect switch. The red wire and the white both connect to the positive terminal, while the black wire connects to the negative terminal. Optionally, you can use a circuit breaker on the 4 gauge red wire. (125 to 150 amp circuit breaker recommended)



GM LS 24X v1.0



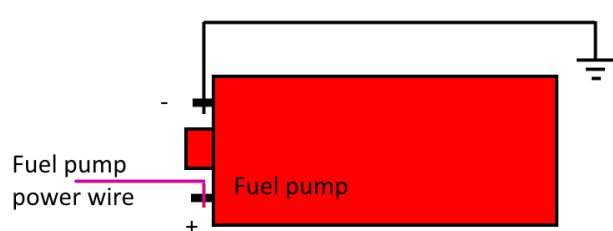
15. Your MS3Pro ULTIMATE uses a 3rd (center) flying lead harness with black 23 pin connector that contains much of the ECU's expanded input/ output capability. **At minimum, pin 23 of the black connector (Keep Alive Memory- red wire/ white stripe) MUST connect to a 12 volt constant power source in order for ULTIMATE to power up.**

16. Connect the five wires on the Body Connection lead.
(reference p.4)

17. Connect the solid purple starter wire to the vehicle's starter relay wire. This will trigger the starter solenoid.

18. Connect the brown alternator wire to the alternator warning light wire. We recommend putting a 100 ohm, 2 watt or greater resistor (included with the harness) in parallel with the alternator light to energize the alternator if the light fails. If the vehicle does not have an alternator warning light, connect to switched +12V through the supplied resistor.

19. Connect the white and red wire to a wire from the ignition key that



GM LS 24X v1.0

receives 12 volt power with the key in both the Run and Start positions.

20. The purple and red wire supplies 12 volts to the fuel pump. Connect this wire to the fuel pump positive terminal. If you do not have a wire for the negative terminal, you can use the

Pin	Function	Color	Stripe
1.	PWM Out 5	Lt. Green	Red
2.	PWM Out 4	Lt. Green	Orange
3.	Digital Out 2	Brown	Dk. Blue
4.	Digital Out 1	Brown	Dk. Green
5.	Digital I/O 4	Brown	Pink
6.	Digital I/O 2	Brown	Orange
7.	Analog In 8	Lt. Blue	Purple
8.	+5V VREF Out 2	Gray	Black
9.	Fuel Only Coil -	Black	Red
10.	Digital Switched In 5	Gray	Orange
11.	Digital Switched In 4	Gray	Pink
12.	Digital I/O 5	Brown	Red
13.	Digital I/O 3	Brown	Lt. Green
14.	Digital I/O 1	Brown	—
15.	+5V VREF Out 2	Gray	Black
16.	Fuel Only Batt.12V +	Red	Black
17.	Power Ground	Black	—
18.	Power Ground	Black	—
19.	Power Ground	Black	—
20.	Power Ground	Black	—
21.	Power Ground	Black	—
22.	+5V VREF Out	Gray	—
23.	Battery 12V + In	Red	White

supplied fuel pump ground wire to connect the negative terminal to chassis ground.

21. Connect the light green & purple wire to the vehicle's tachometer signal wire, if so equipped.

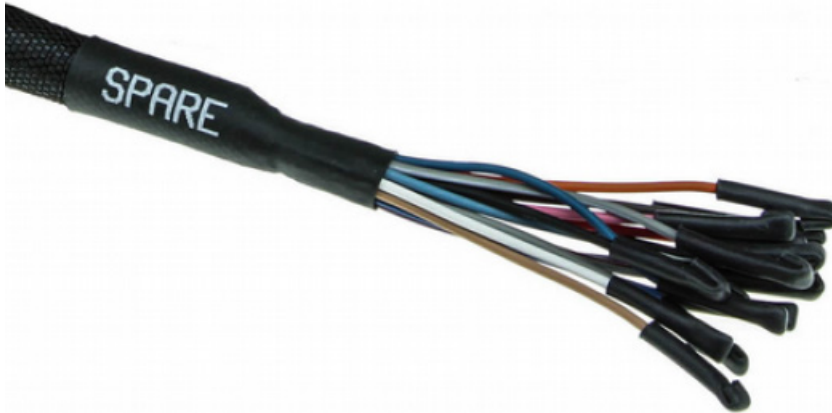
As this is a racing harness, it does not include *all* the connectors on an OEM wiring harness. You may have several devices on your engine that do not have a connector provided in the MS3Pro harness, including the following items:

- Mass air flow (MAF) sensor
- Clutch switch
- OBD2 diagnostic port
- Evaporative emission canister purge solenoid
- Oil level sensor
- EGR control solenoid

The MS3-Pro is a racing engine controller and does not require these features to run. The O2 sensor inputs are brought out to a separate 6 pin connector, as we anticipate that most users are more likely to run aftermarket wide-band O2 sensor systems instead of factory O2 sensors.

Connecting Optional Features

All unused wires to the MS3Pro are brought out on the Spare wire trunk and the (center) flying lead harness with black 23 pin connector.



Use these wires for A/C control, boost control, additional sensors, traction control, or other inputs and outputs. Vehicle speed input is optional; the MS3Pro does not require vehicle speed for most of its calculations. See the [MS3Pro User Manual](#) for details on using these connections.

All wires on the spare harness are 20 gauge.

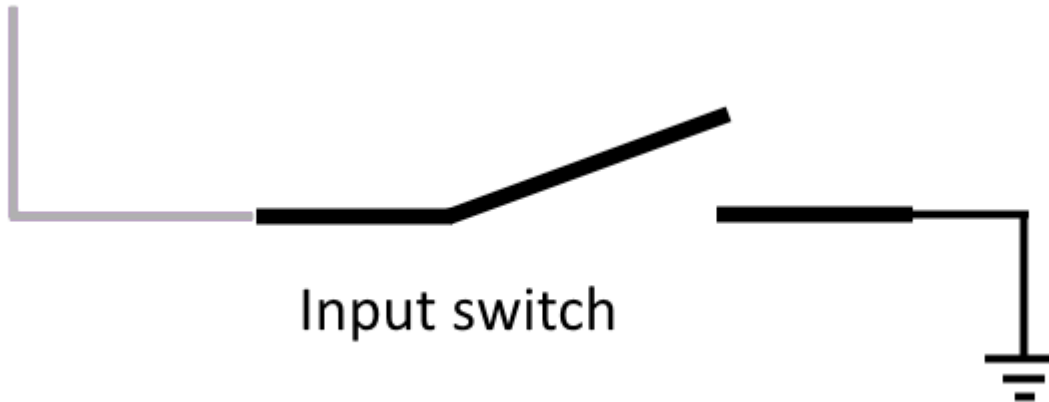
Connector	Pin number	Function	Wire color	Stripe color
White	2	High current out 2	Light green	Dark blue
White	3	Injector out J	White	Yellow
White	4	Injector out I	White	Gray
White	5	High current out 3	Light green	Red
White	14	PWM out 1	Light green	-----
White	17	Analog in 7	Green	Orange
White	18	Sensor ground	Black	White
White	21	Analog in 3	Light blue	Purple
White	22	Analog in 4	Light blue	Pink
White	23	Analog in 5	Blue	Orange
White	29	PWM out 2	Light green	Pink
White	30	PWM out 3	Light green	Dark green
White	32	Digital switched in 1	Gray	Orange
Gray	17	Digital frequency in 2	Purple	Red
Gray	19	Digital switched 12V in	Gray	Dark blue
Gray	20	Digital switched in 2	Gray	Red
Gray	21	Digital frequency in 3	Purple	Dark blue
Gray	22	Digital frequency in 3 VR+	Purple Shielded	-----
Gray	23	Digital frequency in 3 VR-	Blue Shielded	-----
Gray	28	Digital frequency in 1	Purple	White
Gray	29	Digital switched in 3	Gray	Purple
Gray	34	Digital frequency in 1VR+	Purple Shielded	-----
Gray	35	Digital frequency in 1 VR-	White Shielded	-----

Black	1	PWM out 5	Light green	Red
Black	2	PWM out 4	Light green	Orange
Black	3	Digital out 2	Brown	Dark blue
Black	4	Digital out 1	Brown	Dark green
Black	5	Digital I/O 4	Brown	Pink
Black	6	Digital I/O 2	Brown	Orange
Black	7	Analog in 8	Light blue	Purple
Black	8	5V+ VREF out 2	Gray	Black
Black	9	Fuel only coil negative (do not use with factory LS ignition)	Black	Red
Black	10	Digital switched in 5	Gray	Orange
Black	11	Digital switched in 4	Gray	Pink
Black	12	Digital I/O 5	Brown	Red
Black	13	Digital I/O 3	Brown	Light green
Black	14	Digital I/O 1	Brown	----
Black	15	5V+ VREF out 2	Gray	Black
Black	16	Fuel only battery 12V+ (do not use with factory LS ignition)	Red	Black
Black	17	Sensor ground	Black	White
Black	18	Sensor ground	Black	White
Black	19	Sensor ground	Black	White
Black	20	Sensor ground	Black	White
Black	21	Sensor ground	Black	White
Black	22	5V+ VREF out 1	Gray	----
Black	23	Keep alive power [KAM] (REQUIRED)	Red	White

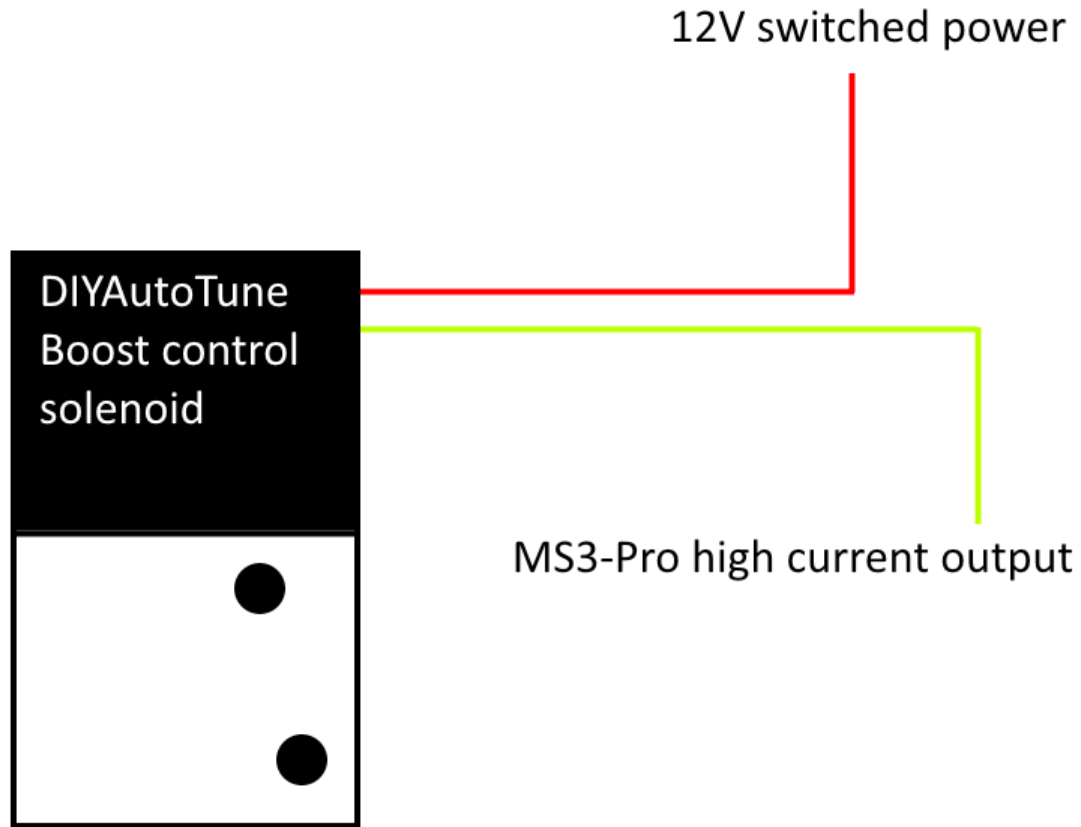
Sample Device Wiring

2 Step Input Switch:

To MS3Pro switched input

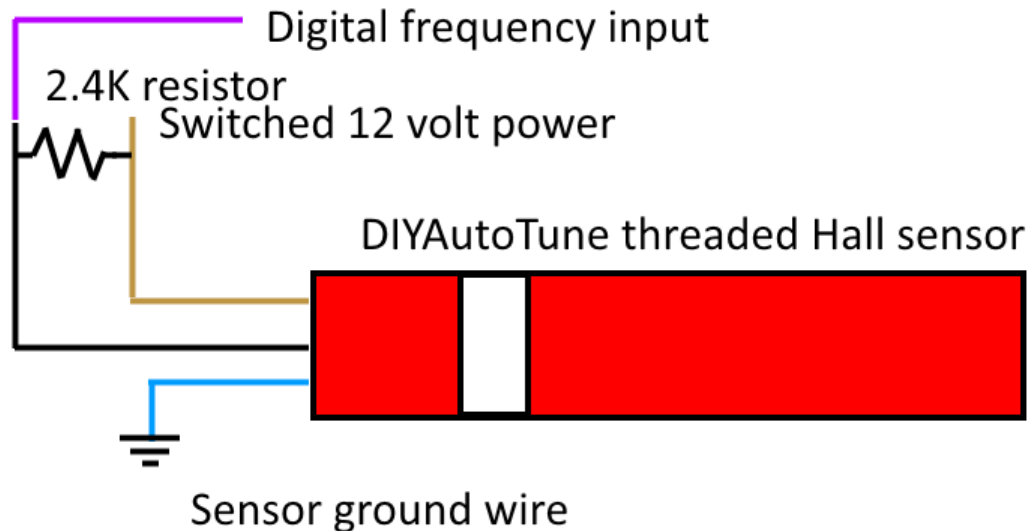


Boost control solenoid:



Vehicle Speed Sensor (VSS):

Use the following diagram to wire a [threaded body Hall Effect Sensor](#) as a driveshaft or wheel speed sensor. This particular sensor requires a 2.4K resistor between its power and signal wires; **PAY SPECIAL ATTENTION TO THE WIRE COLOR SCHEME:** BROWN = POWER, BLACK = SIGNAL, and BLUE = GROUND.



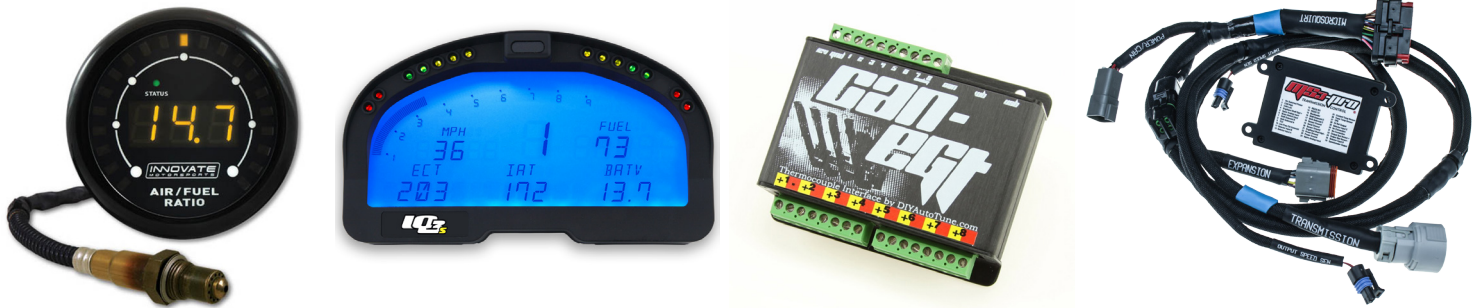
NOTE: Any digital frequency input can be used as a speed input. It is also possible to use a switched input for speed input, although the maximum speed it can measure is significantly lower.

If using an [AMP EFI Trans Controller](#) to control the transmission, vehicle speed is transmitted to MS3Pro over the CAN connection. Tip: To get a vehicle speed signal from a front wheel, you may often use a Hall Effect Sensor and have it pick up the rear of the wheel lug studs.

O2 System & TCU

Connect your factory O2 or aftermarket wide band O2 sensors to the gray 6 pin Amphenol AT connector according to the pinout below:

1. No connection
2. Second O2 sensor signal (MS3Pro Analog Input 1)
3. Primary O2 sensor signal (MS3Pro O2 Input)
4. Sensor Ground (If using a 4 wire O2 sensor, connect the sensor returns here. If using a wideband controller with a separate analog ground, connect it to this wire.)
5. Power Ground (If your sensor or controller has a heater ground, connect it to this wire. If your wideband controller has only one ground, connect it to this wire.)
6. Switched 12 V+ Power (Use for powering a 4 wire sensor heater or for powering your wideband controller.)



The black TCU connector can be used for [controlling the transmission](#), a [CAN-EGT](#), [aftermarket dash](#), or other CAN enabled devices according to the pinout below:

1. Clean power. Use for powering the Trans Controller, CAN-EGT Thermocouple Interface, or other digital device.
2. CAN bus high (CAN-H)
3. CAN bus low (CAN-L)
4. No connection
5. Ground
6. Solenoid power (Use for powering transmission shift solenoids or other actuators.

Relay Module

The harness is equipped with a sealed module that uses mini (ATM type) fuses and micro relays. Note that inserting a fuse (any size) into the empty slot marked “Test” will cause the fuel pump, injectors, and coils to power up at any time the key is on, bypassing the MS3-Pro fuel pump output control. This is to help with troubleshooting.

The four holes at the corners of the relay module are threaded for #10-32 machine screws. Use caution while tightening these, as the maximum torque is 24 in-lbs.

MS3Pro allows testing the injectors and coils prior to starting the engine for the first time or after making substantial engine changes. A good rule of thumb is to remove the fuel pump relay before running this test to prevent the fuel pump from pressurizing the fuel rails. MS3Pro will switch the fuel pump on for two seconds after first receiving power, so do this prior to turning on the key.

Getting ready to start

Once you have the harness on the engine, connect to the ECU with TunerStudio and select a suitable base map for the engine.

Main	ECU 2A
	TCU 2A
Fuel Pump	Pump 30A
	Test
Coils Inj.	Inj. 7.5A
	Coils 15A
Fan Aux.	Fan 30A
	Empty
O2 Shift	O2 7.5A
	Shift 7.5A



Installing the software

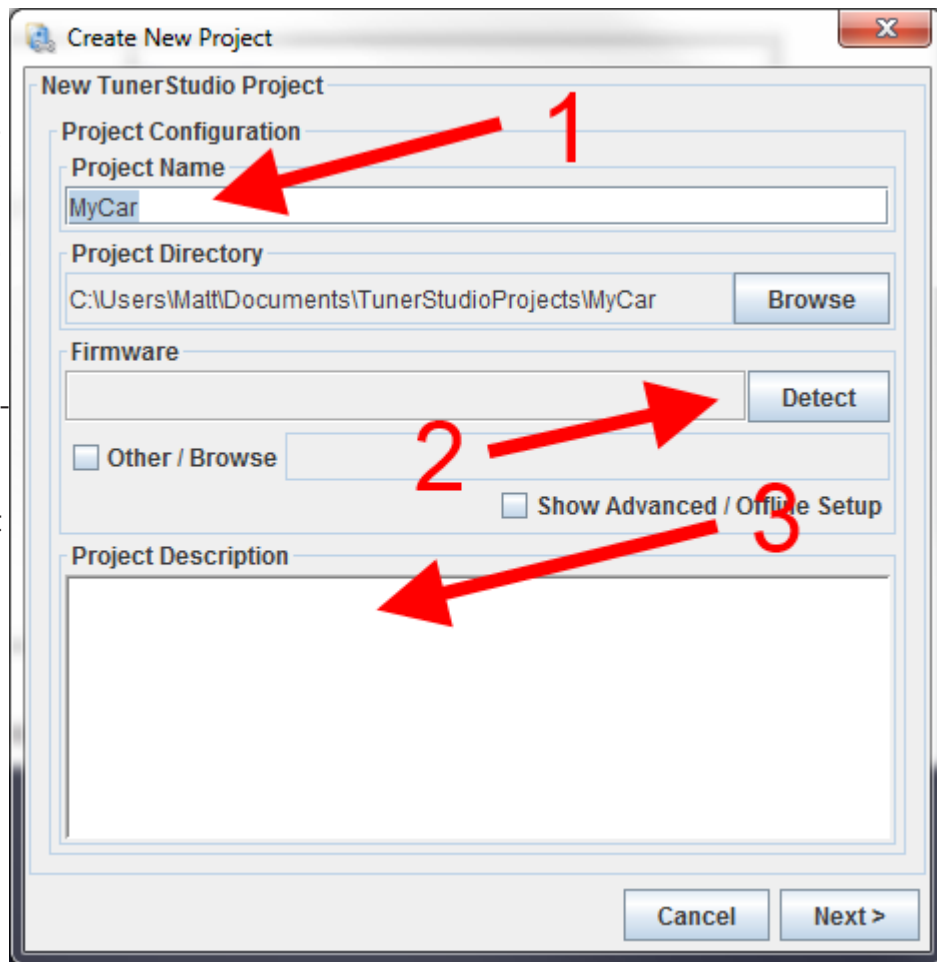
The USB stick should install TunerStudio when you plug it into your laptop. If the installer does not begin automatically, select the USB stick manually from Windows Explorer or Finder and run the **Setup.exe** file. We'll present a short walk-through of how to set it up here; for full details, consult section 2 of the [MS3Pro User Manual](#).

Once the TunerStudio software install is complete, connect MS3Pro to your laptop using either the USB or RS232 serial cable. From Choose Create New Project and the adjacent screen will appear.

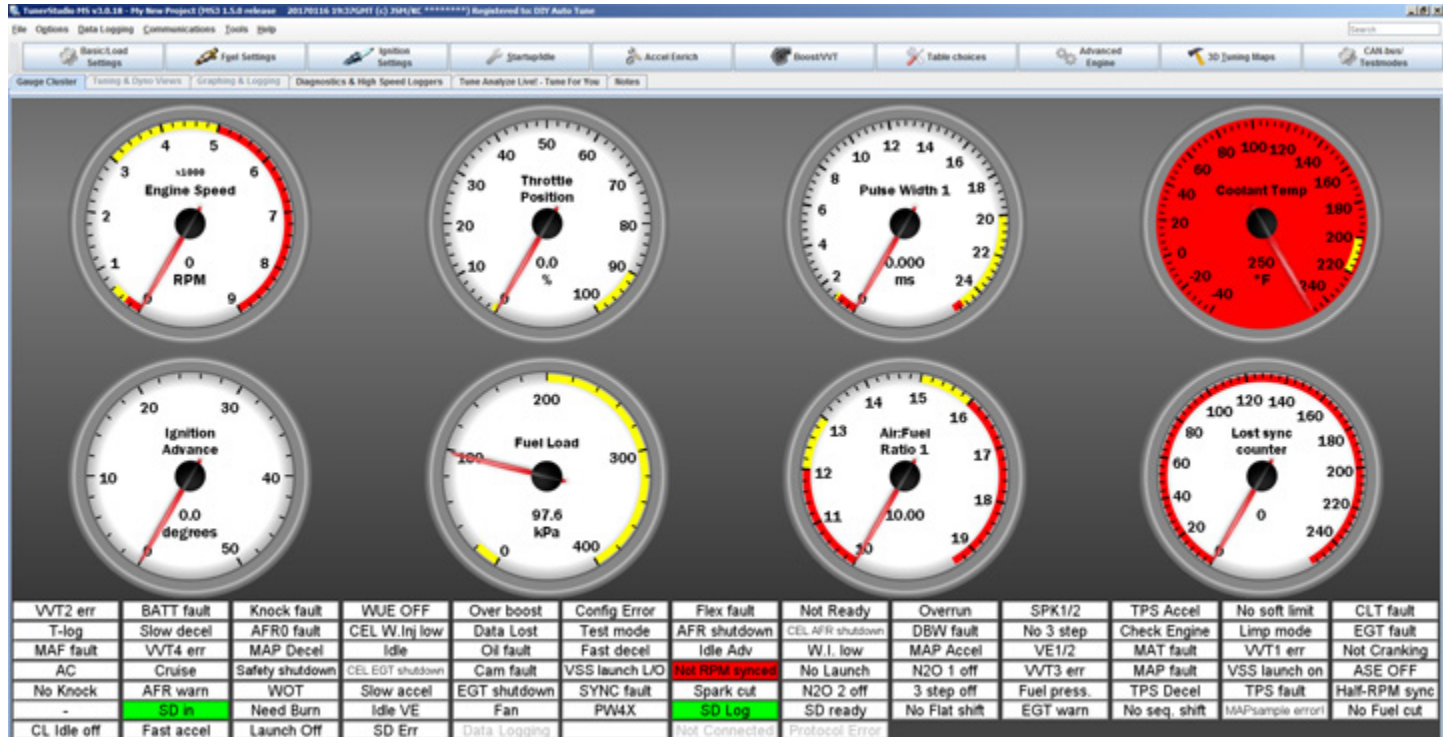
1. Enter a name for your project

2. Click DETECT; TunerStudio will detect the firmware on your MS3Pro. If there is no definition file, TunerStudio will use your internet connection and prompt you to download one automatically for any standard release firmware versions.

3. Enter any notes about your project.



Clicking NEXT will launch a project specific settings screen. The first option allows you to display the air/fuel ratio if using a wideband oxygen sensor, or voltage from a narrow band oxygen sensor. Option 2 sets the temperature display for Fahrenheit or Celsius. You may leave the other options at their defaults. Click NEXT again to test communications. Click NEXT again to customize and select your gauge layout; click NEXT to finish creating the project. Once your project is created, TunerStudio will display the HOME screen.

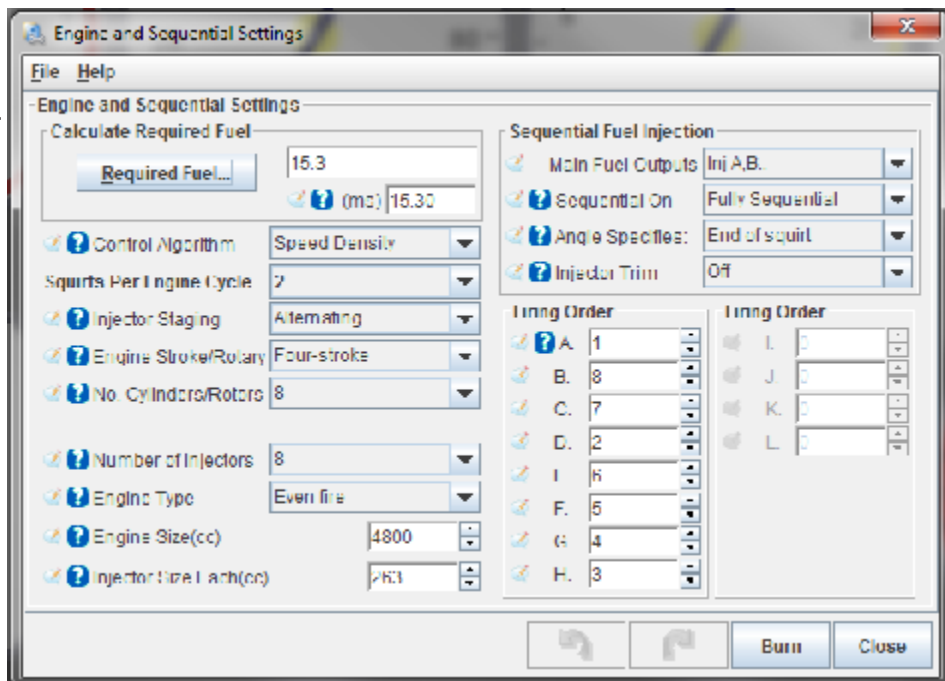


Entering your specific engine settings

If ordered as a package with the LS drop on harness, the MS3-Pro will ship with a startup tune based on a stock 4.8 truck motor. You will need to make a number of adjustments to match what engine variant and sensors you are using. The USB flash drive includes alternate startup tunes. Some third party resellers may also provide tunes for specific packages as well. To select an alternate startup tune, go to File -> Open Tune (MSQ). If using a tune from the USB drive, browse to the USB drive and double click on the tune to open it.

Next, make sure the tune is set up for your engine size. Go to Basic / Load Settings and select Engine and Sequential Settings. Enter the engine size in cc and the injector size in cc/min in the lower right hand corner of the box that opens. (If you only have the injector size in lb/hr, multiply your lb/hr injector size by 10.5 for a cc/min. conversion).

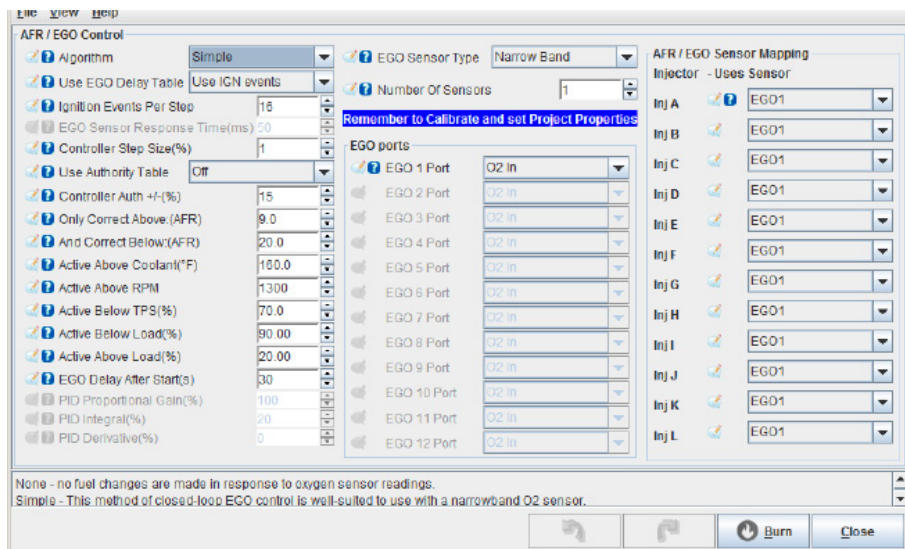
Once you have entered these settings, click "Required Fuel..." button in the upper left hand corner. Make sure all the settings in this box are correct for your application, then click OK. Once this is complete, click BURN and close the Engine and Sequential Settings dialogue box.



The other main setting that needs addressing to match your build is for oxygen sensor(s).

Go to the Tools menu and select "Calibrate AFR Table." (If this is grayed out, first unlock it under Tools -> Un / Lock Calibrations.) Select your sensor type from the drop-down menu, then click Write to Controller.

We also recommend calibrating the TPS at this point. Go to Tools -> Calibrate TPS. With the throttle closed, choose "Get Current" on the closed throttle. Next, fully open the throttle and choose "Get Current" on the open throttle. Then click "Accept." If you are running other non-stock sensor types, such as a 3 bar MAP sensor, calibrate these from the Tools menu. Once all calibrations are complete, use Tools -> Un / Lock Calibrations to lock these settings so they cannot accidentally be changed.



A second place to set the oxygen sensors. Go to Fuel Settings -> AFR / EGO Control; enter your O2 sensor type and the number of O2 sensors in use (top middle column). If you are using two O2 sensors, set EGO 2 Port to "Analog In 1" to use the second O2 connection in the 6 pin collector.

Next, assign each injector output to a specific O2 sensor when using two O2 sensors. Once you have set everything needed on this page, click Burn and close the AFR / EGO Control window.

Once sensor calibration is complete, check them from the main dash for proper readings. To change any gauge, right-click it and simply choose a different gauge. The ones needed here are under the “Sensor Inputs” categories.

Check each of the following with the key on and engine off:

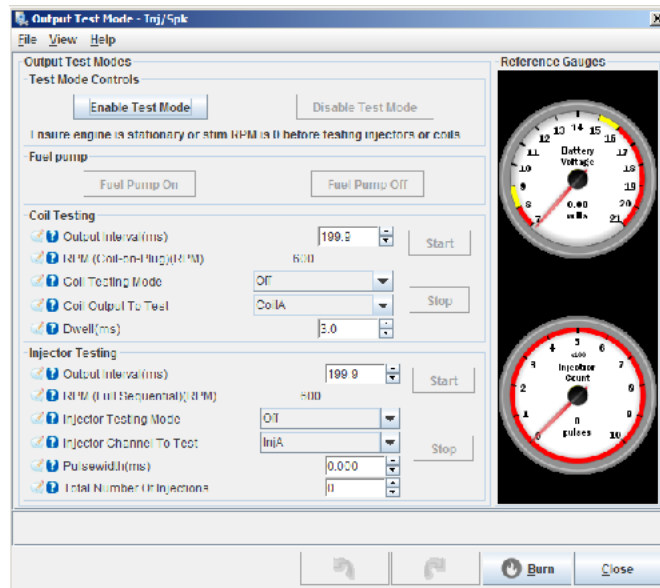
- Make sure the coolant temperature is a reasonable value.
- Manifold air temperature should be close to the CLT reading if the engine is cold.
- Confirm the throttle position reads 0 with closed throttle and close to 100% at full throttle.
- MAP sensor should read approximately 100 kPa if you are close to sea level. It may drop as low as 80 kPa at high altitude (over one mile). If the MAP sensor is reading < 80 kPa or > 105 kPa, check MAP sensor calibration.
- The air/fuel ratio will not give a useful reading with the engine off.
- Engine speed should be zero. If RPM ever reads anything like 65000 rpm, it means you have made an error in your configuration settings. Normally, this will appear as an error when you first connect. In the unlikely case that it does not, open up Communications, MiniTerminal and turn MS3Pro off, then back on again. You should receive a message explaining what is wrong. Close MiniTerminal, fix the faulty settings and power cycle MS3Pro again.

Testing Outputs

A confidence building feature within MS3Pro is Output Test Mode, which allow you to confirm that your outputs are working through the TunerStudio interface, prior to running your engine. To test your outputs, navigate to the CAN Bus menu and select Test Modes -> Output Test Mode – Inj / Spk. (The “Enable Test Mode” button will be locked out unless the RPM reading is zero). To test, choose “Enable Test Mode” and to return to normal operation, choose “Disable Test Mode.”

Prior to testing, remove the fuel pump relay (as MS3Pro will activate the fuel pump for 2 seconds on key on), and if necessary, depressurize the fuel rail. You will, however, need the fuel pump output set to on to test the injector and coil outputs, as this output also commands the relay that controls the coils and injectors.

To fire the coils and injectors, we recommend setting the output interval to 100 ms, the testing mode to Sequence, and the coil or injector to test as H. This will force MS3Pro fire the coils/ injectors in an A through H sequence according to the firing order. For the injectors, set the total number of injections to 60000. Then click Start and have the ECU fire the outputs. Both the coils and the injectors typically make enough noise that you can hear them fire. Caution – sometimes an engine, even one that has been sitting for months, may have enough fuel in one or more chambers to light off a cylinder or two in coil test mode. Once you have confirmed that the injector and coil outputs work, re-install the fuel pump relay and use the fuel pump control buttons to insure the fuel pump is working properly.



At this point, you're almost ready to start your engine. Just prior to cranking the engine, it is a good rule of thumb to save the tune file again with a different file name (in case you need to refer back to it) and start a data log.

For more details on how to tune MS3Pro and how to use ALL inputs and outputs, visit the complete MS3Pro manual available on the USB drive or at the link below:

<https://www.ampefi.com/downloads/>

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