

SERVICE AND WARRANTY

Spectre Performance™ is a company run by car enthusiasts just like you. We are dedicated to Customer Satisfaction, Value, and Service. All of our products go through closely controlled testing procedures with our own specially developed equipment prior to shipment. Because we are confident that your Spectre eMS-pro unit was built to the highest standards, Spectre Performance™ stands behind it for one full year after purchase. Terms of Warranty and Service are as follows:

Limited One Year Warranty

Spectre Performance™ warrants for a period of one year from date of purchase that Spectre eMS-pro products (a) conform to Spectre Performance's™ published specifications and (b) are free from defects in material and workmanship. Upon purchase of any Spectre eMS-pro product, the buyer must complete a warranty registration by either visiting the Spectre Performance™ website or calling Spectre Performance™ at the number listed below. If the buyer discovers a failure of the product to conform to specifications, or a defect in material or workmanship, within one year from the date of purchase, Spectre Performance™ will replace or repair the product at its own expense. These remedies are the only remedies of purchaser against Spectre Performance™. IN NO EVENT WILL SPECTRE PERFORMANCE™ BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES BASED ON BREACH OF WARRANTY, BREACH OF CONTRACT, NEGLIGENCE, STRICT TORT, OR ANY OTHER LEGAL THEORY. DAMAGES THAT SPECTRE PERFORMANCE™ WILL NOT BE RESPONSIBLE FOR INCLUDE, BUT ARE NOT LIMITED TO: LOSS OF PROFITS; LOSS OF SAVINGS OR REVENUE; LOSS OF USE OF THE PRODUCT OR ANY ASSOCIATED EQUIPMENT; COST OF CAPITAL; COST OF ANY SUBSTITUTE EQUIPMENT, FACILITIES, OR SERVICES; DOWNTIME; THE CLAIMS OF THIRD PARTIES, INCLUDING CUSTOMERS; AND INJURY TO PROPERTY. This warranty is only valid to the original purchaser on Spectre eMS-pro products purchased from an authorized Spectre Performance™ dealer. Spectre Performance™ does not warrant (a) any product, components, or parts not manufactured by Spectre Performance™; (b) damage caused by use of the product for purposes other than those for which it was designated; (c) damage caused by improper installation or maintenance of the product; (d) damage caused by unauthorized attachments or modifications; (e) damage during shipment; or (f) any other abuse or misuse by the purchaser.

Service

All repair or replacement services will be performed at Spectre Performance™, Ontario, California. Before returning your Spectre eMS-pro for warranty service, on-line or phone warranty registration must be completed for warranty validation. After the warranty period has expired, repair service is charged based on our current charge rate. (Contact Customer Service for current rate).

IMPORTANT RETURN FOR REPAIR INFORMATION

Before returning your **Spectre eMS-pro** for warranty service, we recommend contacting tech support or going on-line for installation information that may solve your problem.

Return Merchandise Authorization (RMA) Procedure

Spectre's Return Merchandise Authorization (RMA) procedure is as easy as a phone call. An RMA number is required for all products shipped to our Customer Tech Department. Call the number below to get your RMA number and instructions for shipment.

When returning a **Spectre eMS-pro** for repair, disconnect wire harness and leave all wires installed in the vehicle. Our testing procedure will alert us to any miss-wiring during installation. Also, include a detailed account of the problems experienced and what components and accessories are installed on the vehicle. Send the **Spectre eMS-pro** unit prepaid with RMA info to the attention of:

**Customer Tech Dept - eMS-pro
Spectre Performance
1720 So Carlos Ave.
Ontario, California 91761**

The repaired unit will be returned as soon as possible after receipt (usually 10 - 14 working days). For more information on repairs, call our Customer Tech Line at (909) 673-0701. Our **Spectre eMS-pro** technicians are available from 7:00 am to 3:30 pm, Pacific Time, Monday - Friday.

Thank You for Racing with Spectre.





eMS-pro™ Installation Guide



I. Introduction

The Spectre eMS-pro is a complex electronic component and knowledge of power train management is required. Spectre Performance will not be held responsible for damage caused by improper installation; therefore, professional installation is recommended.

1. Before you begin

The Spectre eMS-Pro is a universal electronic fuel injection controller that can be made to work on any spark ignition internal combustion engine, with the right external parts. However, the success of your installation depends on YOU. In order to make the eMS-Pro work on YOUR engine, you will need:

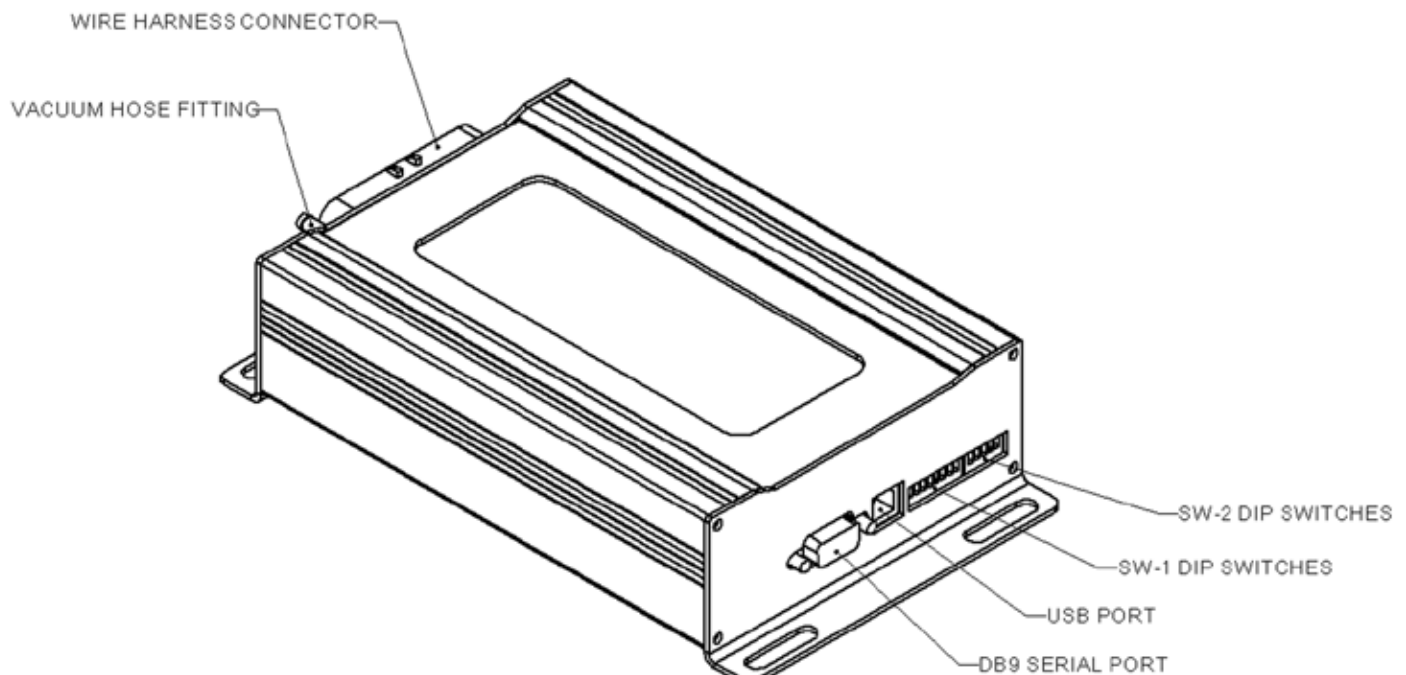
- Additional parts to suit your installation, including:
 - o Coolant and air temperature sensors (GM type) P/N 7142
 - o Oxygen sensor and bung is highly recommended (either narrow-band or wide-band) P/N 7144
 - o Wiring and various connectors for the sensors, injectors, etc. P/N 7143
 - o Injectors and bungs/manifold
 - o Throttle body
 - o High pressure fuel pump and supply/return lines
 - o Fuel pressure regulator
- Knowledge and skills to install all of the necessary sensors and wiring
 - o Basic use of voltmeter (measurement of resistance [ohms], DC voltage, and continuity)
 - o Understanding of basic electrical/electronics wiring principles, ability to make solder or crimp joints that are reliable and safe
- Knowledge and experience to be able to install or adapt a complete high-pressure fuel system in your vehicle for the eMS-Pro
- Windows 98 (or better) laptop computer with a **USB or Serial port** to configure and tune your eMS-Pro
- Enough mechanical aptitude to know how much fuel, and what ignition timing, the engine needs to run properly

Installing the eMS-Pro in a vehicle that already has EFI means you will need to consider how you will run the ignition and any other devices the OEM ECU controls [such as the transmission, speedometer and other gauges, and emissions devices], how you will interface the eMS-Pro to your existing wiring harness, and whether you can reuse your existing temperature and position sensors. The eMS-Pro does NOT control electronic transmissions; however, it does have up to 4 spare outputs to control automotive relays.

2. Tools Required

- Voltmeter
- Variety of screwdrivers
- Soldering iron and solder
- Wire cutting pliers
- Wire stripping tool
- Assorted crimp connectors and tool (if you plan on crimp connecting your wiring)
- 3/8" NPT tap
- Heat Shrink tubing (or electrical tape)
- IBM-PC compatible laptop computer running Windows 98 or later
- Ignition Timing Light
- Wideband O2 sensor and controller

3. eMS-pro Unit Overview



4. Installation Overview

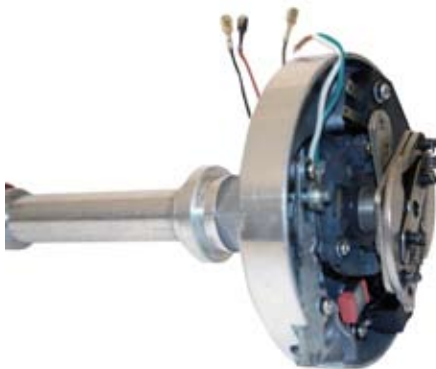
The Spectre eMS-pro standalone engine management system is a programmable microcontroller specifically designed to control electronically fuel injected engines. This system is based on the proven Megasquirt™ system, which is already running on thousands of engines that range from tiny 2-strokes, to 1000+hp street-driven engines, top speed racing engines, and more!



Typical 36-1 crankshaft position wheel and sensor, as found in many Ford engines

During this installation, you will mount two temperature sensors (coolant and intake air), attach the Spectre eMS-pro harness to your throttle position sensor, and run a vacuum line to the onboard manifold pressure sensor in the Spectre eMS-pro. You'll also connect the Spectre eMS-pro to your fuel injectors, connect the Spectre eMS-pro to your "tach source" (sensor or device that supplies the Spectre eMS-pro with the engine's RPM and position information), and attach the Spectre eMS-pro's harness to 12 volt power and grounds.

To control ignition timing, the Spectre eMS-pro **requires** a position sensor with at least one trigger per spark event (example: V8 distributor with internal 8-tooth trigger), OR (using the advanced Wheel Decoder mode) evenly-spaced triggers on a crank- or camshaft-mounted sensor. **Note: If you are using a distributor pickup/sensor, you must disable vacuum or mechanical advance. This means, "locking out" the distributor advance mechanically, as the eMS-Pro will now control ignition timing advance.**



Example of a typical V8 distributor with internal magnetic trigger / pickup wheel

At the conclusion of the installation process, you will be ready to tune your engine for proper startup and idling (see Spectre eMS-pro Tuning Guide).

II. Installation

Note: Install tuning software prior to installation of the unit for testing and verification purposes.

1. Selecting a location to mount your Spectre eMS-pro

The Spectre Spectre eMS-pro **is not** waterproof, it is designed to be installed inside the passenger compartment of your vehicle. Possible mounting locations include: underneath drivers or passenger seat, passenger footwell, or anywhere else the unit can be mounted where it will not be kicked, disturbed, damaged etc.



Properly mounted Spectre eMS-pro

We also recommend using the included rubber feet to mount the unit for vibration resistance. Remember to leave the ECU accessible enough to be able to access the USB and serial communications ports for future tuning and configuration.

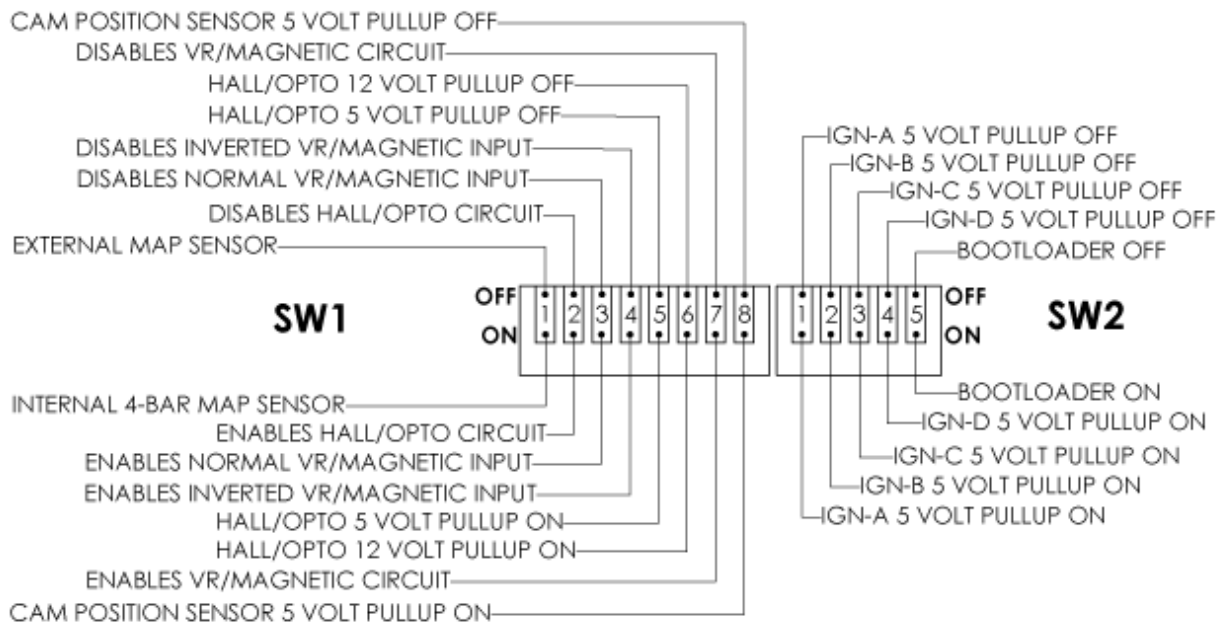
2. Wire Harness layout

Now, route the wire harness from the Spectre eMS-pro location to the necessary input sensors and outputs. Most of the wires in the Spectre eMS-pro harness will go to sensors, fuel injectors, etc. under the hood. You will need to find a suitable hole in your car's firewall, or make one, that will allow the Spectre eMS-pro harness to be routed from its installation location to the engine compartment. **Make sure to use a rubber grommet in any holes the harness passes through, as chafing/rubbing will cause short circuits and tuning difficulty later on.**

Try to "lay out" your wiring plan before you drill holes or run the wires through the firewall! For example, on a late model vehicle with factory electronic fuel injection, it's suitable to use the existing harness by tapping into existing wires (e.g., fuel injectors, temp sensors, etc.). On older vehicles originally equipped with a carburetor, this will probably not be an option! Think before you drill a hole!

3. DIP switch configuration

In order to make the Spectre eMS-pro compatible with as many different engine position sensors as possible, it was built with multiple "tach input" circuits which are configurable using DIP switches. Locate the DIP switch panel (under the Identification plate on the Spectre eMS-pro). Notice that there are two separate dip switches. The first group (SW1) has 8 switches; the second (SW2) has 5 switches.



Beginning with SW1 here are the functions for each:

Dip Switch	Switch Position	Functionality
1-1	Description	Selects either Internal MAP sensor, or External MAP sensor
	Down/On	Uses the Spectre eMS-pro uses onboard 4-bar MAP sensor.
	Up/Off	Uses an external MAP sensor which is connected to the "MAP" wire in the harness
1-2	Description	Tach Circuit Output select. This switch works with switch 1-7 below to route the signal out of the Opto circuit into the Spectre eMS-pro CPU. If you are using a Hall or Optical sensor (square wave) as your engine position input, you want this switch in the DOWN/ON position (example 1-2)
	Down/On	Enables the Hall/Opto circuit
	Up/Off	Disables the Hall/Opto circuit
1-3	Description	Tach Circuit Output select. If you will use a VR/Magnetic/Inductive pickup sensor for your engine position input to the Spectre eMS-pro, this switch must be in the DOWN position (example 1-3)
	Down/On	Enables the VR/Magnetic tach input circuit
	Up/Off	Disables the VR/Magnetic circuit
1-4	Description	Tach Circuit Output select
	Down/On	Enables and inverts the VR/magnetic tach input circuit. Exception: the signal coming from the sensor will be "inverted" – that means: <ul style="list-style-type: none"> • sensor outputs negative voltage = positive signal going into the Spectre eMS-pro CPU • sensor outputs positive signal = "negative" signal seen by Spectre eMS-pro CPU. This is NOT the same as inverting the polarity (changing the positive and negative wires at the VR sensor) of your VR input circuit
	Up/Off	Disables the VR/Magnetic circuit
1-5	Description	Tach Input 5 volt pullup. Used only for Hall/Opto installations. Some installations using square wave (hall/opto) inputs to the Spectre eMS-pro will require the pullup enabled as the Spectre eMS-pro might draw too much current from the device or sensor providing the signal (for example, in a fuel-only installation you might use a Dash tach signal, or the tach signal from your factory ECU, to drive the Spectre eMS-pro and it may need a pullup circuit to keep the signal working properly). Never use BOTH switch 1-5 and 1-6 enabled together, as it will link the 5 volt and 12 volt power circuits together, possibly causing damage to your Spectre eMS-pro controller!
	Down/On	Applies a 5 volt "pullup" to tach signal input
	Up/Off	
1-6	Description	Tach Input 12 volt pullup. Used only for Hall/Opto installations. Some installations using square wave (hall/opto) inputs to the Spectre eMS-pro will require the pullup enabled as the Spectre eMS-pro might draw too much current from the device or sensor providing the signal (for example, in a fuel-only installation you might use a Dash tachometer signal, or the tach signal from your factory ECU, to drive the Spectre eMS-pro and it may need a pullup circuit to keep the signal working properly). Never use BOTH switch 1-5 and 1-6 enabled together, as it will link the 5 volt and 12 volt power circuits together, possibly causing damage to your Spectre eMS-pro controller!
	Down/On	Applies a 12 volt "pullup" to tach signal input
	Up/Off	

1-7	Description	VR Input to Tach In – this switch works in conjunction with switches 1-3 and 1-4 above
	Down/On	If either of switches 1-3 or 1-4 are in the DOWN/ON position, this switch also needs to be in the DOWN/ON position
	Up/Off	If using a Hall/Optical sensor tach source, this switch must be in the UP/OFF position
1-8	Description	Cam position sensor input pullup –adds a 5 volt pullup signal to the incoming Cam position sensor signal. Only needed if using a cam signal that requires a pullup circuit. Note: the Spectre eMS-pro only supports VR/magnetic/inductive pickups for cam signals, however our testing shows that square wave / hall / opto outputs will also work with our VR circuit. Talk to Technical Support if you need help with your cam sensor input. Only a few installations will require a cam sensor input (rotary engines, engines with no missing teeth on their crankshaft position sensor, etc.)

Here are the functions for each switch in SW2:

2-1	Description	Ignition Output A 5 volt pullup. Use this if you are driving an ignition transistor (also called “ignitor”) that requires a 5 volt signal for triggering. These are usually OEM units, like that in a Mitsubishi Eclipse or an LS1 coilpack. If you are driving an inductive or “points” output (for example, attaching to the “white wire” on an MSD ignition), leave this switch in the UP/OFF position. You will use this switch if you are running any kind of ignition output, whether it’s a distributor ignition, or wasted spark system.
2-2	Description	Ignition Output B 5 volt pullup. Note: Use this if you are driving an ignition transistor (also called “ignitor”) that requires a 5 volt signal for triggering. If you are driving an inductive or “points” output (for example, attaching to the “white wire” on an MSD ignition), leave this switch in the UP/OFF position. You will only use this ignition output only if you are running MORE than one spark output, as with a wasted spark system.
2-3	Description	Ignition Output C 5 volt pullup. Note above in 2-2 applies here as well.
2-4	Description	Ignition Output D 5 volt pullup. Note above in 2-2 applies here as well.
2-5	Description	Enable Bootloader. This switch should ALWAYS remain in the UP/OFF position. It is only used for reloading firmware into your Spectre eMS-pro, in the event of future firmware/software upgrades or enhancements.

Here are some example DIP switch configurations to get you started:

Example 1: Domestic V-8 with magnetic pickup distributor. Magnetic pickup wire from distributor, ne+ goes to ground; ne- wires to eMS-Pro “tach input.” DIP switches as follows: 1, 3, 7 enabled (down/on). All others in “off/up” position.

Example 2: Import 4-cylinder with Hall sensor camshaft mounted sensor. Sensor output wires to eMS-Pro “tach input.” DIP switches as follows: 1, 2, 6 (enable switch 6 if your setup requires a 12 volt pullup circuit, or switch 5 for a 5 volt pullup)

See included wiring diagrams for other common applications. Also check our website for other diagrams (www.spectreperformance.com/emspro).

4. Power and Grounds

Before you perform wiring tasks, make sure to disconnect battery by removing the negative terminal! Shorted circuits can cause internal damage to your eMS-Pro! First, take a look at the ground wires on the Spectre eMS-pro. Notice that there are eight separate ground leads. The reason for this many leads is so the Spectre eMS-pro can reject noise, and carry injector current to ground properly. You may notice that on OEM fuel injected vehicles, multiple ground leads are also used.

You can ground the Spectre eMS-pro to either a chassis ground, or battery negative terminal. If you use the chassis ground, we recommend inside the passenger compartment, away from engine compartment heat. Test the grounds using an ohm meter when you are finished, (acceptable readings should be less than 1 ohm total resistance or as close to zero as is possible). It is acceptable to group the grounds together into a smaller number of ring terminals for easier installation. We highly recommend soldering the ground wires into the crimp terminals for maximum continuity. It is essential that all engine inputs, temp sensors, TPS, map Sensors share the same electrical ground as the Spectre eMS-pro system ground.

Next, find a suitable location for your 12 volt power supply. The Spectre eMS-pro doesn't require much current (less than 300 milliamps), but it does require the 12 volt source to be "hot" while the ignition key is in both "run" and "cranking" positions. Double check your chosen power source to see that it maintains 12 volts when cranking the starter – many 12 volt sources inside the vehicle are NOT powered when the ignition is in the cranking position. In the case of a vehicle already equipped with an OEM ECU, the original 12 volt power to that ECU will suffice for power to the Spectre eMS-pro. **Note that there are two wires in the Spectre eMS-pro harness that require 12 volts. Both can be connected to the same source** (the fv12 lead is used to direct noise from the Fuel Injector driver circuitry outside the Spectre eMS-pro).

At this point, it's a good idea to test power to the unit. Reconnect the negative terminal on the battery. Make sure none of the remaining leads are touching each other or the ground, then power up your unit by turning on the ignition key to the run position. Inside you should see blue LEDs light up indicating the board has power. Once you have completed this step, turn the ignition off and disconnect the negative battery terminal.

5. Intake Air Temperature sensor (IAT)

The Intake Air Temperature sensor (also called Manifold Absolute Temperature sensor) is used to measure the temperature of the air entering the combustion chamber. Cold air is more dense than warmer air, thus requiring more fuel to maintain the appropriate air:fuel ratio in your engine.



Top: Coolant Sensor (CLT); Bottom: Intake Air Temperature sensor (IAT)

First, find a suitable location to install the sensor itself. The best location is in the intake air stream, right before or after the throttle body. The sensor itself is a 3/8" NPT thread (typical GM temp sensor size). Many engines already have a suitable location for installation of this sensor – so check yours before drilling and tapping holes unnecessarily! In a naturally aspirated engine, air temp sensor location is less critical than when using forced induction – however, you want to install the sensor so it gets the most realistic sampling of intake air possible. If you install the sensor under the hood but not in the intake airstream, the sensor may "heat soak" causing the Spectre eMS-pro to see hotter air temps and have less accuracy calculating required fuel for given conditions. It's best to have the sensor fitted in the intake tract for best results. Forced induction applications MUST use an air temp sensor inside the intake tract, especially on intercooled engines, for accurate fuel calculations!

Note: On forced induction engines, BE SURE to install the intake air temp sensor AFTER any turbochargers, superchargers, or water/alcohol injection systems in order to accurately measure air temperature right before it enters the combustion chamber.

Once the sensor has been fitted to the intake air stream, you must connect one of its two leads to the Spectre eMS-pro harness lead labeled "IAT". The other sensor lead must go to a good ground – if possible, ground this at the same location as the Spectre eMS-pro grounds. It's recommended to use one of the Spectre eMS-pro ground wires as a return for all three sensors in the engine compartment that require grounding: Coolant Temp, Air Temp, and Throttle Position. Temp sensors do NOT have any particular polarity, so it does not matter which lead gets grounded and which lead attaches to the Spectre eMS-pro harness. The eMS-Pro harness wires for the temperature sensors are color-matched to the pigtailed in the Spectre Accessory Kit.

6. Coolant Temperature sensor (CLT)

The coolant temperature is used by the Spectre eMS-pro to determine whether the engine needs extra fuel when cold starting or during engine warmup. This allows the tuner to adjust the fuel demands of the engine during these periods.

First, check your engine for existing locations to install the CLT sensor. Many engines already have a 3/8" NPT fitting for temp sensors used for coolant temp gauges, or for existing ECUs (if the engine was originally fuel injected). **It's important to find a location BETWEEN the engine block and thermostat! If the CLT sensor is mounted after the thermostat, it will only see the temperature of the coolant in the radiator, which does not change until the thermostat opens. This causes the eMS-pro to miss the warmup period, only seeing cold coolant, making warmup enrichments difficult to**

tune. If you are installing the Spectre eMS-pro on an air-cooled or oil-cooled engine, the CLT sensor can be installed either directly in the engine block or in the oil supply to determine engine temperature.

If your engine does not have a suitable location for the CLT sensor, a T-fitting can be used either with existing coolant temp sensor locations, or in a heater hose before it enters the passenger compartment.

If you must drain the engine coolant to install the CLT sensor, make sure you are familiar with the proper procedure for refilling, and bleeding air from, your engine's coolant system after you are done.

Connecting the CLT sensor to the Spectre eMS-pro harness is similar to the IAT sensor: one wire goes to a good ground (same as System ground and an interior location) and the other goes to the harness lead labeled "CLT". Temp sensors do NOT have any particular polarity, so it does not matter which lead gets grounded and which lead attaches to the Spectre eMS-pro harness. The eMS-Pro harness wires for the temperature sensors are color-matched to the pigtailed in the Spectre Accessory Kit.

7. Throttle Position Sensor (TPS)

Next we'll install the Throttle Position Sensor. Hopefully, your engine's throttle body already has a TPS installed, and all you need to do is connect the three wires going to it. The Spectre eMS-pro works with *any* 0-5 volt sensors, found in almost every vehicle equipped with a TPS.

The TPS works by taking a 5 volt signal from the Spectre eMS-pro, routing that voltage through a potentiometer in the TPS, and returning it to the Spectre eMS-pro. With a closed throttle, the voltage returned to the Spectre eMS-pro is small (0-2 volts). When the throttle is opened, the potentiometer is turned, and the voltage returned to the Spectre eMS-pro increases (3-5 volts) thus allowing the Spectre eMS-pro to determine the throttle angle at any given time. Later, in the Tuning Guide, we will calibrate the TPS configuration for your engine. **It is not important that your TPS reaches exactly zero volts when closed, or 5 volts when opened, only that it increases in voltage with increased throttle opening.**

The first wire to connect to your TPS is a ground. Like the other sensors, connect this lead to a suitable ground location near the Spectre eMS-pro grounds, or even to one of the Spectre eMS-pro ground leads itself.

The second wire is the TPS sensor's 5 volt power supply which comes from the Spectre eMS-pro: this lead is labeled "TPS VREF" in the Spectre eMS-pro wire harness. Connect it to the 5 volt input of the TPS sensor. Typically the center wire in the connector plug is the TPS signal wire (or wiper of the Potentiometer that is used for this application), with the outer two pins being ground and Vref, as you have already determined which of the pins required the ground, you may assume that the other outer pin is where Vref should go.

The third and final lead is the sensor return wire, which carries the signal (anywhere from 0 – 5 volts, depending on throttle position) back to the Spectre eMS-pro. The lead in the Spectre eMS-pro harness is simply labeled "TPS."

How to determine which TPS wires go where:

Disconnect the TPS, and use a digital multi-meter. Switch it to measure resistance. The resistance between two of the connections will stay the same when the throttle is moved. Find those two - one will be the +5 Vref and the other a ground. **The third is the sense wire to the eMS-Pro.** To figure out which wire is the +5 Vref and which is the ground, connect your meter to one of those two connections and the other to the TPS sense connection.

If you read a high resistance which gets lower as you open the throttle, the **disconnected wire is the one which goes to ground**, the other one which had the continuous resistance goes to the +5 Vref from the eMS-Pro, and the remaining wire is the TPS sense wire.

8. Fuel Injectors

Next, we'll connect the Fuel Injectors to the Spectre eMS-pro.

The fuel injectors, like the temperature sensors, have no specific polarity. Each injector is operated by feeding vehicle power (12 volts) to one lead, and briefly connecting the other lead to ground. The Spectre eMS-pro opens your injectors by connecting them briefly to a ground. This way, the Spectre eMS-pro does NOT have to supply the voltage to drive the injectors, it only must sink the current passing through them, to a ground. Thus, you must supply the 12 volt power for your injectors. **We strongly recommend you use a standard automotive relay (Spectre P/N 7145) to power the fuel injectors with battery voltage, triggered by ignition power.** See the eMS-Pro Wiring Diagram below for proper power wiring for your fuel injectors. Make sure to use an appropriate fuse as close as possible to the power source for your injectors!

Once the injectors have power, you must decide how you will connect them to the Spectre eMS-pro. The Spectre eMS-pro has two driver circuits for injectors. You can connect up to 8 high or low impedance injectors to each driver. You can fire all injectors in "batch mode" (all together) or you can "alternate" the firing sequence by installing half of your injectors on one driver circuit, and the other half to the remaining driver circuit. **It's up to you to decide how to use the dual injector drivers and wire your injectors.** The injector driver circuits are labeled INJ1 and INJ2 in the Spectre eMS-pro harness. You may choose to run each "bank" of cylinders on

a V-6 or V-8 engine on individual injector drivers from the eMS-Pro. Advanced users (turbocharged or rotary engine users) may want to run “staged injection”, which means a secondary set of injectors are used to add fuel only in certain conditions. **When complete, disconnect the fuel injectors from their pigtail connectors until you are ready to start the engine. You will likely crank the engine to test the Tach input, so you do not want to inadvertently add fuel to the cylinders until you are ready to start it the first time!**

9. Fuel Pump Relay

The Spectre eMS-pro harness lead labeled “FUEL PUMP” triggers the Fuel Pump relay. If your car is not already equipped with a fuel pump relay, do so with an appropriately sized automotive relay (**Spectre P/N 7145**). The Spectre eMS-pro lead is designed to **ground** the relay’s trigger circuit (or coil circuit), and it’s wise to supply the trigger circuit’s power source from the same ignition source as the Spectre eMS-pro’s 12 volt source. This way, the fuel pump is turned off when either the ignition is turned off, or the Spectre eMS-pro decides to turn off the pump (for example, when there is no RPM signal). This is for safety reasons.

Test this circuit by manually applying a ground to the same lead that the Spectre eMS-pro’s FUEL PUMP lead will connect to (with the ignition on). The fuel pump should activate when this circuit is grounded, and when the ignition power source is active (key on). **Once you have completed this step, turn the ignition off and disconnect the negative battery terminal.**

10. Oxygen Sensor (also called Exhaust Gas Oxygen sensor)

Your installation may have a variety of Oxygen Sensors (or none at all!). **It is strongly recommended that you use a wideband oxygen sensor if you plan on tuning the Spectre eMS-pro and engine yourself! Narrowband Oxygen Sensors are fine for part throttle driving, but Wide Open Throttle (especially with forced induction, or nitrous applications) needs to be run “richer” than a 14.7:1 AFR. A wideband oxygen sensor, unlike a narrowband, is capable of measuring a wider range of AFR and will help you develop a more accurate part throttle, and wide open throttle tune.** Whether you use a narrowband or wideband sensor, you need to attach the sensor or controller’s OUTPUT wire to the Spectre eMS-pro harness lead labeled “O2.” If you are using a wideband oxygen sensor, most likely it will come with a control unit that houses the actual output leads which will connect to your Spectre eMS-pro. The Spectre eMS-pro can read either a 0-1 volt or 0-5 volt oxygen sensor – you will configure the exact type and curve later, when you configure the Spectre eMS-pro unit with your SpecTune software. **Make sure to follow the Oxygen Sensor Manufacturers directions when installing your Oxygen sensor! Some sensors are sensitive to exhaust heat and require installation a certain distance from the exhaust manifold or turbocharger turbine outlet. Additionally, take care to follow the grounding instructions per manufacturers guide, as the heater element for some Wideband Sensors may be prone to causing noise on its ground return, you may be asked to locate this ground some distance away from your system and sensor grounds.**

If you are not using an oxygen sensor, snip or tape the O2 lead in the Spectre eMS-pro harness so it does not contact ground or power, and secure it with other unused wires in the harness.

11. Engine position sensor input (tach input)

Next is the “tach input” or engine position sensor input. The Spectre eMS-pro can receive this signal from a variety of sensor types: VR/ Magnetic/Inductive, or Hall/Optical.

Magnetic/Inductive/VR sensors: If your engine uses a Magnetic/Inductive/VR signal for triggering engine position, there will be two wires coming from the position sensor. The sensor itself may either be on the crankshaft, connected to the camshaft (spinning at half engine speed) or in the distributor. For example, a V8 distributor engine typically has a sensor inside the distributor with EIGHT teeth (one for every ignition event). Or, it may have a four tooth sensor on the crankshaft (again, one for every firing event – four cylinders fire per every one revolution on a V8 4-cycle engine). The Spectre eMS-pro does NOT require an exact number of teeth as ignition events (one thing that separates the Spectre eMS-pro from other standalone EMS’s), but it DOES require you to know how many teeth are on the position sensor, and what speed the trigger wheel spins (either full or half engine speed). If your sensor has one tooth for every ignition event, you will configure the Spectre eMS-pro to run in *Distributor mode*. If your sensor has more teeth than ignition events per engine cycle, or if it has a wheel with missing teeth (such as a Ford EDIS wheel, with 35 teeth spaced every ten degrees and one missing tooth to denote TDC), you will configure the Spectre eMS-pro to run in **Wheel Decoder mode**. **It is important that you know what type of sensor your engine uses and what the tooth pattern on the trigger/sensor is. This information is usually available on web forums, in shop/service manuals, or by looking at the trigger wheels and sensors themselves. If in doubt, contact our Technical Support department for help!**

12. Ignition output(s)

The Spectre eMS-pro lets you configure up to four ignition outputs.

- A. Distributor engines: Engines that use a distributor to route spark to individual cylinders only require a single spark output to trigger a single ignition coil. **Do not, under any circumstances, connect the Spectre eMS-pro directly to an ignition coil!! This will cause immediate damage to your unit and void its warranty.** Instead, you must use some type of ignition transistor (also called an “ignitor”), or a Capacitive Discharge Ignition (such as MSD, Pertronix, Crane, or Jacobs CDI ignition box

and coil) system. On most CDI ignition systems, there is a “white wire” which triggers spark by grounding that wire. This is the wire to connect to the Spectre eMS-pro Ignition A lead.

- B. Wasted Spark or COP engines: Engines that use coilpacks (either one cylinder per coil, or two cylinders per coil which is called “wasted spark”) will use more than one spark output from the Spectre eMS-pro. **Do not, under any circumstances, connect the Spectre eMS-pro directly to an ignition coil!! This will cause immediate damage to your unit and void its warranty.**

You will first need to determine your engines firing order, then connect the ignition outputs to your CDI ignition, or ignition coil transistor, appropriately. How to determine this: For a wasted spark ignition take your firing order (for example, 1,3,4,2) and align the numbers with the two ignition outputs you’ll use on a wasted spark four cylinder ignition, ABAB. So, cylinder 1 is attached to the A ignition output, cylinder 3 is connected to the B output, cylinder 4 is ignited by the ignition A output, and cylinder 2 is ignited by the ignition B output. What this means is, on your wasted spark coilpacks, cylinders 1 & 4 are connected to the “ignition A” coilpack, and cylinders 2 & 3 are connected to the “ignition B” coilpack. V6 and V8 wasted spark systems are configured the same way: six cylinder systems will use Ignition outputs A, B, and C; wasted spark V8 systems will use ignition outputs A, B, C, and D.

When finished, do NOT connect the ignitor to the Spectre eMS-pro ignition outputs until you have configured the DIP switches, and the ignition output behavior in the Spectre eMS-pro tuning software! The default configuration may inadvertently trigger the ignitor/CDI ignition and cause ignition components, or the Spectre eMS-pro, to malfunction! Connect these only after the Spectre eMS-pro has been configured, and you are ready to test the system for proper spark.

After these installation steps are complete, we recommend starting the engine and tuning a stable idle BEFORE adding features such as nitrous oxide control, two-step rev limiter, etc.

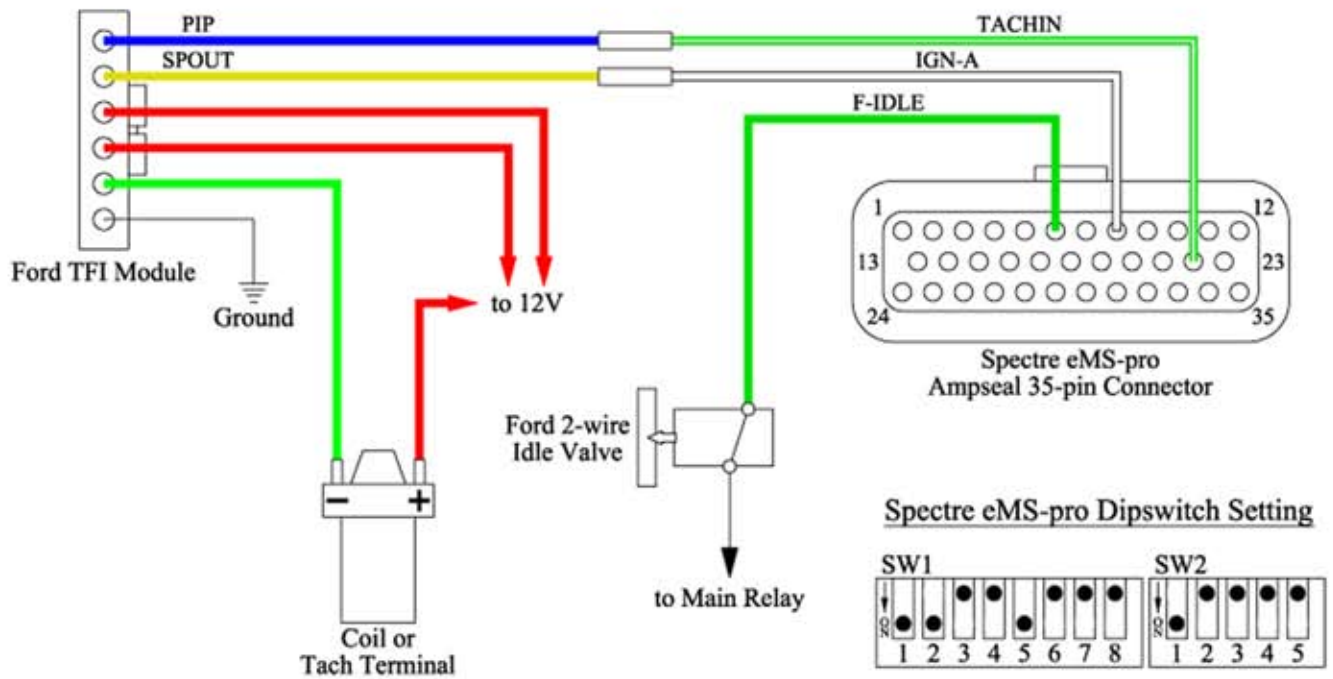
Proceed to the Tuning guide for “First Start” instructions.

Glossary

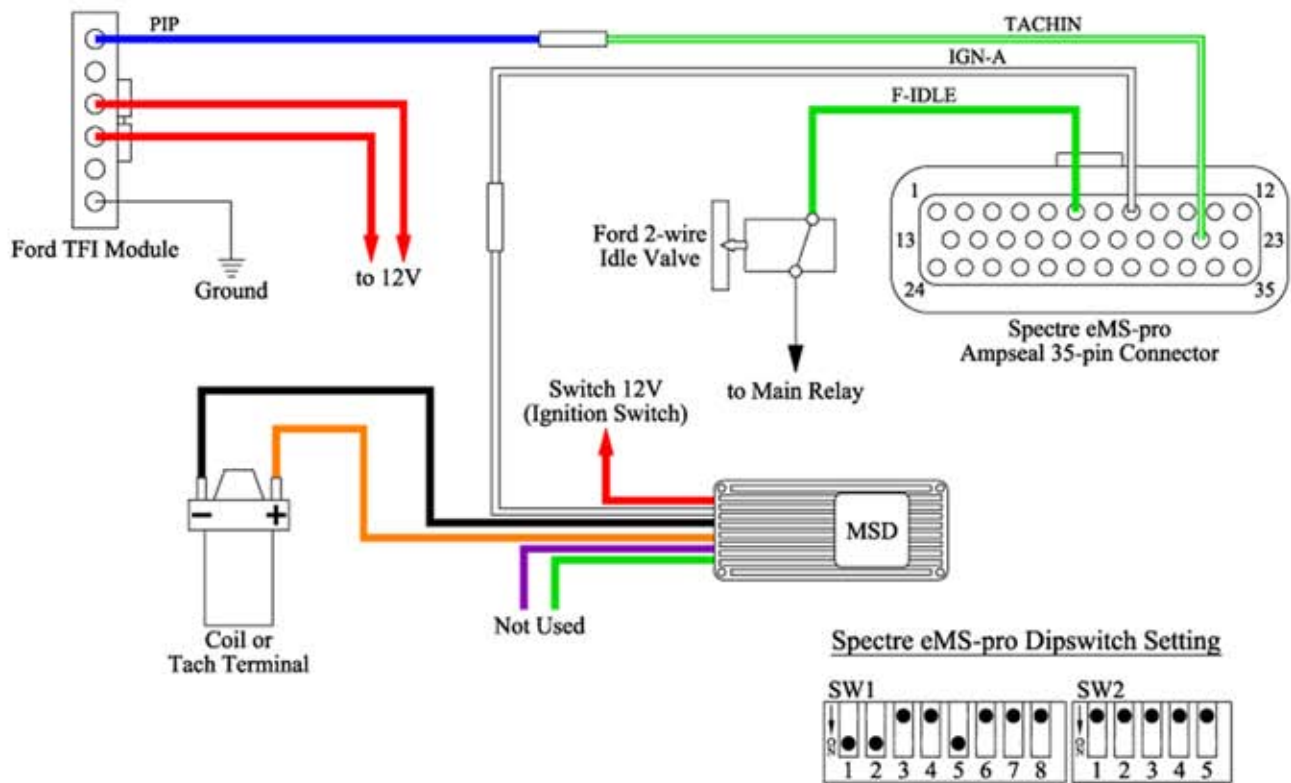
Description	Definition
4-Bar	A measurement of a pressure sensor's usable measurement range. 4-bar means "4 atmospheres" or the equivalent of 44psi of boost on a turbocharged engine
5v Pullup	5-volt pullup. Some Hall/Opt sensors require you to enable the "5 volt pullup" option via DIP switch 1-5
5v signal	Also called "TTL" or "ECU" triggering: the use of a 5 volt pulse to trigger ignition events
Cam position sensor	Sensor mounted to camshaft or that runs at camshaft speed, which gives a single-tooth signal for every camshaft revolution
CDI	Capacitive Discharge Ignition
COP	Coil-On-Plug. This is an ignition system configuration that uses one coil for each cylinder, triggered separately by the engine management system.
CPU/ECU	Central Processor Unit / Engine Control Unit. Other names for the computer that manages your engine and powertrain.
DIP switch	Switches on the endplate of the eMS-Pro that allow a user to configure MAP sensor type (internal or external); tach input signal type (VR/magnetic/inductive or Hall/Optical); spark output configuration; and enabling the bootloader program
ECU	Engine Control Unit. Another name for an eMS-Pro, or any other powertrain control computer.
EDIS wheel	Ford's typical crankshaft position sensor "trigger wheel" for wasted spark 4-, 6, and 8-cylinder engines.
Engine position input	The signal, or wire carrying the signal, that tells the eMS-Pro what RPM the engine is turning, and when Top Dead Center occurs (for accurate ignition timing)
Engine position sensor	Component or components that determine engine speed and position, and provide that information to the eMS-Pro
Firmware	The "Operating System" software that runs on your eMS-Pro computer. Similar to Linux or MS-Windows on a Personal Computer.
Hall	Type of sensor that outputs a square wave signal.
Ignition transistor	A device that lets the eMS-Pro remotely trigger an ignition coil or coilpack.
Ignitor	Same as Ignition Transistor above.
Inductive pickup sensor	Same as "VR sensor" – the device that reads a toothed-wheel and outputs an AC sine wave to the eMS-pro's tach input circuit.
Magnetic input	Same as VR input above.
MAP sensor	Manifold Absolute Pressure sensor. Senses air pressure in the intake manifold, used by the eMS-Pro to determine how much load is being placed on the engine. This sensor is critical to proper air:fuel mixtures at all times.
Narrowband O2 sensor	Oxygen sensor that measures free Oxygen in the exhaust stream. Narrowband sensors can connect directly to the eMS-Pro, but only allow measurement of a stoich air-fuel ratio (14.7:1 for gasoline engines). Fine for part throttle closed-loop tuning, but not good for WOT or forced induction applications.
OEM	Original Equipment Manufacturer.
Opto	Type of sensor that outputs a square wave signal.
Square wave	The signal observed coming from Hall/Optical sensors, or a signal that switches between "High" (usually 12 or 5 volts DC) and "Low" (ground or zero volts)
Tach input	Signal (or signal wire) that tells the eMS-Pro engine position and speed information. Can be square wave (Hall/Optical sensors), or AC sine wave (magnetic/inductive sensors)
Tach output	The wire in the eMS-Pro harness that can supply a signal to an aftermarket tachometer or other electronics that require a "tach input signal"
VR input	Variable Reluctance Input: the signal from a magnetic or inductive sensor, which reads a toothed-wheel, and is fed to the eMS-Pro via the "tach input" wire in the eMS-Pro harness.
Wasted spark	Wasted Spark is an ignition system configuration that uses one coil for paired cylinders, triggered in pairs by the engine management system.
Wheel decoder mode	eMS-Pro software configuration for reading single or multiples toothed-wheels
Wideband O2 sensor	Oxygen sensor, which usually requires "controller," that measures free Oxygen in the exhaust stream. A Wideband O2 sensor is capable of measuring a wider range of air-fuel ratios, and is good to use when tuning forced induction engines.

Wiring and Configuration Examples

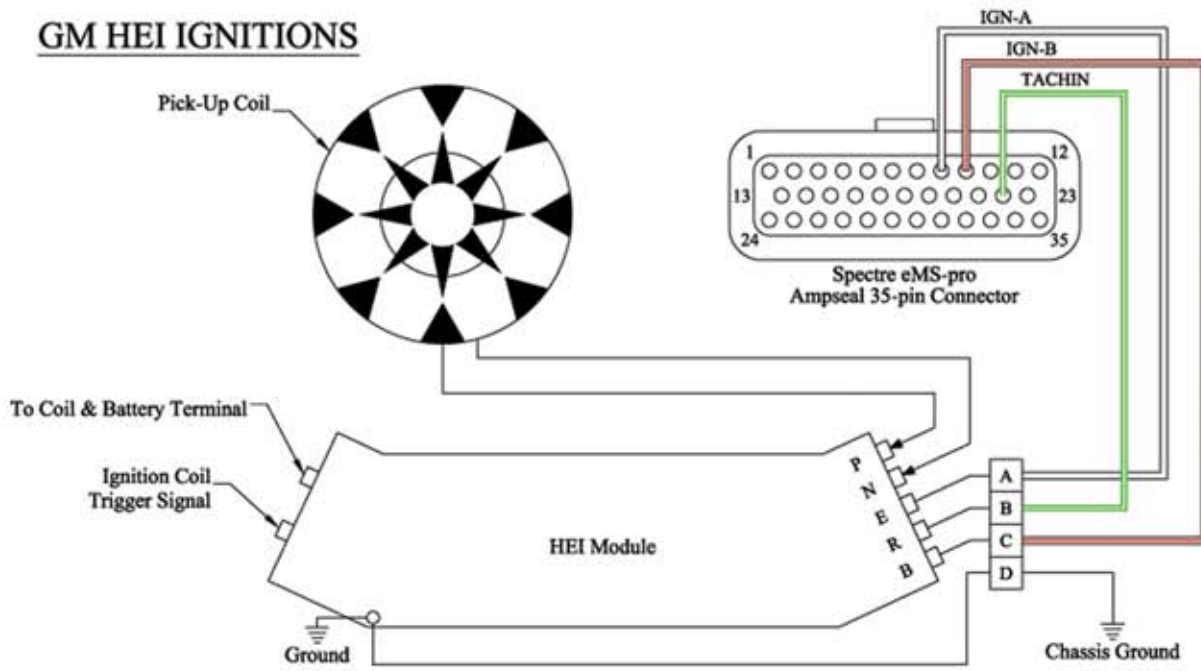
FORD TFI IGNITIONS



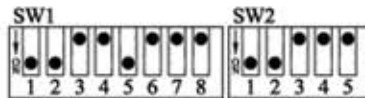
FORD TFI/MSD IGNITIONS



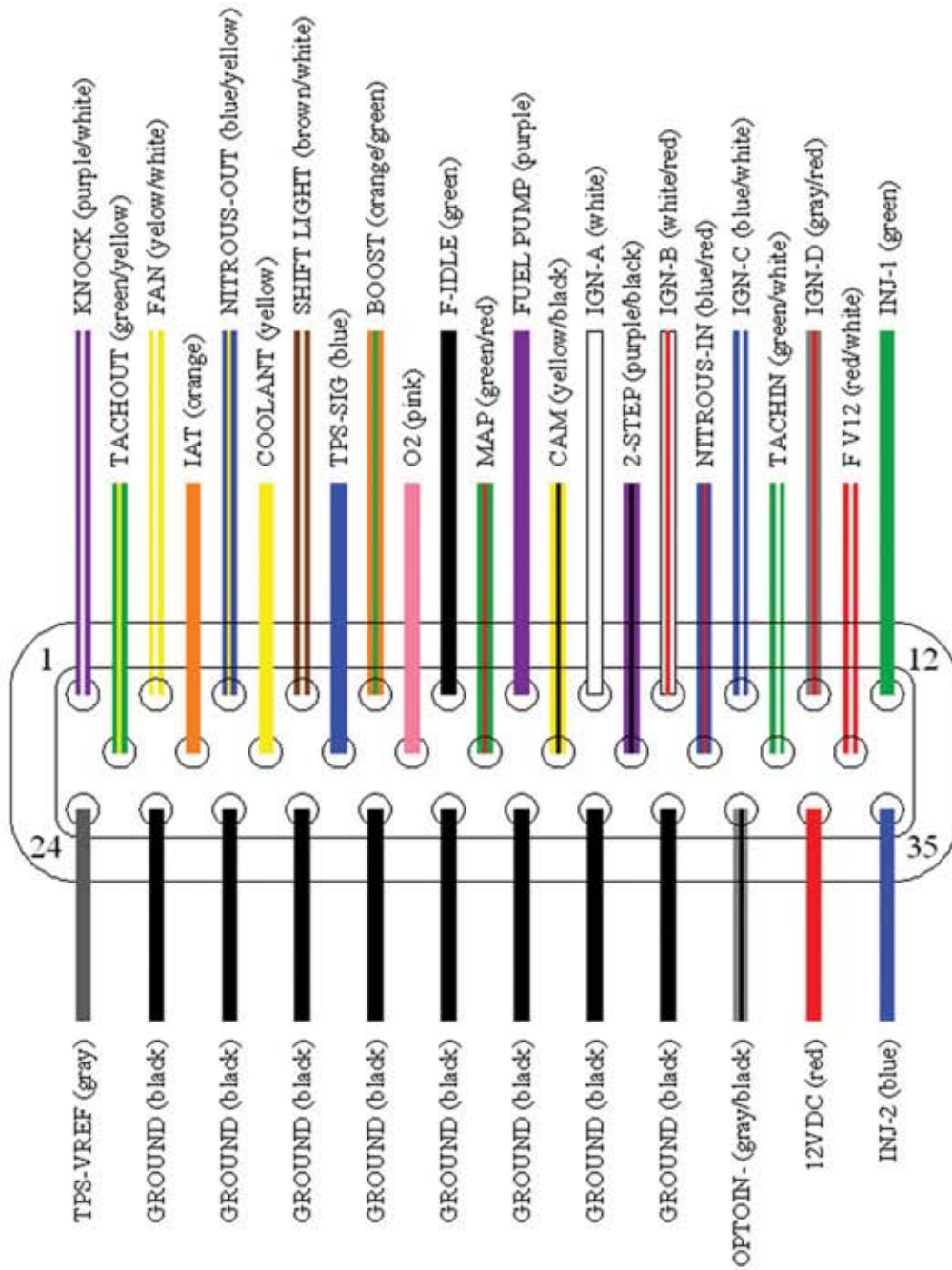
GM HEI IGNITIONS



Spectre eMS-pro Dipswitch Setting



eMS-pro AMP Connections



Spectre eMS-pro Wiring Diagram

