# ECUMaster EMU First Start Checklist

After installation and following through to the end of the "EMU First Start Checklist" document, see the "***FAQ and Troubleshooting***" document link on the ECUMasterUSA.com downloads page for much more information on frequently asked questions such as initial fuel tuning of the EMU Black "advanced fueling" strategy, idle tuning, troubleshooting diagnostics help, settings, and more. ***Downloads Page***

## Installation and important information to get started

### Critical Sensors required for EMU available from ECUMasterUSA.com:

**Note: Please verify critical sensors are installed before trying to run engine. These must be installed before sending base map startup issues to Support or requesting base map startup help.**
**EFI ECUs require these sensors for Fuel and Idle correction for Cranking, Afterstart, and Warm up or it will not crank and run correctly.**

**MAP Sensor (Critical to startup and run engine, unless when running Alpha-N TPS strategy):**
The **EMU Classic** and **Black** have a built in 4 bar MAP sensor which requires an 1/8" or 3/16" vacuum reference hose from the intake manifold vacuum port. An external MAP sensor connected closer to the intake manifold can be wired to the EMU Analog Input which reduces vacuum/boost reference lag and can offer better throttle response if the EMU built in MAP sensor is mounted far away from the engine.
The **EMU Pro** does not have a built-in MAP sensor and will require wiring an external MAP sensor.
**Link to ECUMasterUSA.com MAP sensors.**

**CLT Sensor (Critical for correct fueling at startup and warmup):**
All water cooled engines have a Coolant Temp Sensor. The OEM sensor is utilized with all of our adapters and does not normally need to be purchased. If a CLT sensor does need to be purchased for any reason, the **ECUMaster Fluid Temperature Sensor** can be used as CLT, oil temp, or other fluid temperature monitoring usage.

**IAT Sensor (Critical for fuel tuning and calculation, not critical for startup only):**
The EMU is speed density, (uses MAP sensor), which means an Intake Air Temperature sensor is required to calculate correct fueling.
A quick response open element IAT sensor installed in the intercooler piping or filter tube within 12" before the throttle body is highly suggested. Any IAT sensor can be used if the resistance vs temperature is known, though most OEM sensors are in the MAF sensor that will likely be removed to increase inlet air flow or when a slow response closed element OEM charge temp sensor is installed into an intake manifold which heat soaks and can cause incorrect fueling calculations. Please see the following product link for IAT sensors from ECUMasterUSA.com:
**ECUMaster USA Intake Air Temperature sensors**

**Wide band O2 Sensor "WBO" (Critical for fuel tuning, not critical for startup):**
EMU Classic can control a Bosch 4.2 sensor only.
EMU Black can control a Bosch 4.2 or 4.9 sensor. This sensor is required for Air Fuel tuning and closed loop EGO feedback. ECUMasterUSA.com offers O2 sensor kits with an assembled extension harness and without.
**Link to O2 sensor kits at ECUMasterUSA.com**

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## Installation:

### *Disconnect negative terminal of battery before installation of the EMU*

Unpack EMU and plug and play adapter. Using the included printout, verify input and output wiring on plug and play harness.

Remove any panels necessary to access the factory ECU and remove the factory computer. Remove fuses for ignition coils and injectors (crank and cam signal must be verified before connecting coils and injectors).

Connect the plug and play adapter to the vehicle's engine harness and connect the EMU to the other side of the plug and play harness. Run an 1/8" to 3/16" vacuum hose to the MAP sensor port on the EMU (located between the black and gray connectors). Route and secure the line in such a manner as to prevent pinching or chafing. Vacuum source must be from the intake manifold, located after the throttle inlet.
**Warning: Confirm the port used from the intake manifold <u>IS NOT A COOLANT PORT</u>.**

**Tools for installation:**
**-**Wire strippers
**-**Open barrel crimpers are required for EMU terminals. (2) common options provided below:
Preferred - 24-14 AWG Ratcheting Genuine Delphi Crimper PN: 12085271
Suitable - IWISS 24-14 AWG Parallel Jaw Crimpers PN: IWISS-1424A

**Terms used to describe EMU pin locations:**
B1 = black connector pin 1
G1 = gray connector pin 1

**Required connections to power on the EMU:**
EMU Black - **Battery cont 12v to B13**, **Switched 12v to G18**, **Ground to B28**
EMU Classic - **Switched 12v to G18, Ground to B17**

**EMU Black B13 constant battery connection:** Some EMU Black adapters have a red coiled wire at B13 on the black connector 39-pin EMU connector. Pin B13 Constant Battery must be connected for EMU Black to function correctly. It should be connected to a fused 12 volts. A 10-amp fuse can be used if a DBW throttle body will be used with the EMU Black, otherwise, a 3 to 5 amp fuse may be used.
A common question we get is, ***"Can B13 be connected to a switched relay?"***. B13 can connect through a relay controlled by switched ignition if the ***[Delayed Turn Off]*** feature will not be used.
***<u>Tech Note</u>: When B13 is connected with G18 switched 12v instead of directly to the battery, <u>this may result with the EMU Black not powering off after "Key off" on some vehicles</u>. Wire B13 correctly if this occurs. If the problem persists, see "Troubleshooting notes" at the end of the document for more help.***

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At this point, route any wiring necessary for additional sensors such as Flex Fuel, fuel pressure, oil pressure, wideband $O_2$, etc.

**Power Grounds: All "Power Ground" terminals must connect to ground for the EMU outputs to function correctly.** Power Ground terminals supply the ground feed to all ground outputs which include Injector outputs, Ignition outputs (to passive coils without amplifiers), Aux outputs, and the ground side of the H-Bridge/Stepper output circuits.
Each Power Ground should run to a good grounding location. The engine cylinder head or block is a preferred location.
If a custom harness is made, it is suggested to run separate 16 awg wires to each EMU Power Ground terminal.

**ECU Ground:** A separate 18 awg can be run for ECU Ground.
The ECU Ground can connect to the cylinder head, engine block, or chassis ground. This must be connected for the EMU to function correctly when power is applied to the EMU.

**Sensor Ground:** Ground only used to connect to a sensor's ground terminal. This ground does not connect to the chassis, engine block, or coil grounds.
The **EMU Classic** has (1) Sensor Ground terminal on the connector. All sensor's grounds, for 5v volt sensors, can be connected together to the (1) EMU Classic Sensor Ground pin location.
The **EMU Black** has (3) Sensor Ground terminals on the connector. All sensor's grounds, for 5v volt sensors, can be connected together to (1) of the EMU Black Sensor Ground pin locations if an OEM harness has only (1) sensor ground for all sensors or sensor grounds can be separated between the (3) sensor ground terminals if making your own adapter or harness (if desired).

**Shielded Wire (Drain) Termination:** Shields should only be terminated to ground on one end of the shielded cable. The shield should be terminated on one end by tapping it onto an EMU Power Ground wire, chassis ground, or engine ground only. The shield wire should NOT be connected to EMU Sensor Ground. The opposite end of the shield should be folded back and heat shrink applied over the cable insulation so the shield cannot make contact with ground.

It is common to connect VR sensor wire shields at the EMU end or the wire. Terminating the shield on both ends of the wire could cause the shield to become an antenna which will negate the purpose of shielding.
The OEM Toyota JZ crank VR sensor termination is connected to the engine ground by the VR sensor bolt from the factory. It is likely the OEM terminated the shield at the engine block to quickly drain alternator noise directly to the engine block due the close proximity to the alternator on the JZ engines to prevent alternator noise from traveling up the drain to the ECU

circuit. When creating an EMU engine harness, observe the location of the OEM shield terminations.

**About the EMU Inputs:**

-**Analog Inputs** can be wired to a Ground switch, 5v switch or 12v switch and is used for:
(3 wire) 0-5v pressure sensors - (Does not require a pullup resistor)
(2 wire) temperature sensors - (Requires a pullup resistor. Resistor value based on sensor manufacturer recommendation or based on the resistance range of the sensor)
Switch or Button input to ground: Connect one terminal to ground and the other terminal to Analog Input. With this configuration, assign "*Analog Input #x (inverted)*" as input.
(Physical 5v pullup resistor required between Analog input and 5v on EMU Classic only).
Switch or Button inputs to 5v: Connect one terminal to 5v supply and the other terminal to Analog Input. With this configuration, assign "*Analog Input #x*" as input when 0v OFF/5v ON.
(Physical pulldown resistor required between Analog Input and Sensor Ground on EMU Classic only).
**For EMU Black**, physical pullup/pulldown resistors are not required on Analog Inputs. The EMU Black has built in pullup and pulldown resistors which are configurable under *Sensor Setup/Analog Input* window. A pulldown does not need to be set in the Black for a 5v referenced switch or button.

-**Switch#1, 2, and 3 Inputs MUX Switch (EMU Black with micro-USB only):**
Switch/Button inputs. One switch/button terminal **must connect to Sensor Ground only**, the other switch/button terminal connects to **Switch #1, 2, or 3** In. Note: Using chassis ground, power ground, or positive voltage as a reference will make Switch inputs unstable.
**For EMU Black with USB-C connection**: Both sensor ground or chassis ground can be used to activate the Switch inputs without issues. Hardware was changed to work with either ground reference.

-**Flex Fuel input (EMU Black only):** (Frequently asked)
Connect to sensor **Vout**. (EMU Classic only: connect **Vout** to **CAMSYNC #2**)
Sensor **Vcc**- Switched 12 volts (from any key switched 12-volt source)
Sensor **GND**- Can connect to engine ground, chassis ground, or EMU sensor ground

-**TPS Input:** Connects to the TPS sensor on cable driven throttle bodies.
For DBW throttle bodies and pedal position sensors, TPS connects to the pedal position main non-inverted signal with current EMU Black V2 firmware and EMU Classic (Classic with ECUMaster DBW module).

## Critical Inputs:

**-CLT In:** One coolant sensor terminal to CLT In. One sensor terminal to Sensor Ground.
**-IAT In:** One coolant sensor terminal to IAT In. One sensor terminal to Sensor Ground.

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**-Primary trigger:** One primary (crank or CAS) sensor signal terminal to Primary trigger In. One sensor terminal to Sensor Ground.
**-Camsync#1 and #2:** One secondary (cam or CAS) sensor signal terminal. One sensor terminal to Sensor Ground.
A (2) wire trigger sensor is a "VR sensor". VR sensors do not need a 5v pullup which can cause the sensor to not function. Low resistance pulldown resistors can sometimes be used on VR sensors to slightly delay the signal.
A (3) wire trigger sensor is a "Hall/Optical sensor". Hall sensors require a 5v or 12v pullup resistor to function. Some hall sensors have built in pullups and the majority of OEM sensors do not.

**About EMU Outputs:**

**EMU outputs are intended for low current components (Relays, LEDs, and Solenoids)**

**NEVER connect EMU Aux or H-Bridge outputs directly to ground of a high current radiator fan, water pump, fuel pump, or other high amperage component over the rated amperage of the output. A relay should be installed on high current (amperage) components and the EMU outputs activate the relay.**

**-Power Grounds must be connected for all grounded outputs to function! (See "Power Grounds:" above for more information.)**

-All **AUX #1-AUX #6** outputs are (-) Negative/Ground when active.

-**Injector** outputs are (-) Negative/Ground. Switched 12v supply must be connected to the other injector terminal. Using "Invert Output" (in features where Aux outputs are used) will make the Aux (ground output) active when the EMU is commanding the output to be OFF and not active when the EMU commands the output to be ON. "Invert Output" should only be used for H-Bridges/Stepper outputs or to activate an Aux output when EMU is commanding the output OFF only for testing. (See H-Bridge and Stepper info below)
***Tools/Test Outputs*** is mainly used to test outputs.

-**Ignition Outputs** see **"Initial Engine Displacement, Injector Settings, and Ignition Coil Settings". Tech note on wiring coils:** Never wire ignition 12v coil power to G18 adapter wire. This can cause a great amount of electrical noise into the system and inputs. Wire coil 12v power to its own switched 12v relay to feed battery 12v to the coil 12v terminals, to the original OEM 12v coil supply from the body/engine harness for OEM coils, or to a dedicated ECUMaster PMU16/24 25A output. High current IGN1A coils will require a dedicated relay 12v supply.

-EMU Black **H-Bridge** or EMU Classic **Stepper** outputs are bi-polar which can be (-) Negative/Ground or 12 volts depending on when they are active or not active. "Invert Output" check mark in the output

assignment parameters can be checked or unchecked to make these outputs Ground or 12v when active. *See **"Troubleshooting Notes:"** at the end of this document for information on installing a diode in series when connecting **H-Bridge** and **Stepper outputs** to relays, 2-wire solenoids, and incandescent bulbs.*

### 2 wire solenoid wiring of Boost solenoids, VVT solenoids, and PWM Idle Valves:

Most all 2 wire solenoid wiring including **Boost solenoids**, **VVT solenoids**, and **Idle valves**.
**For EMU Classic**, **diode PN: 1N4007** should be installed **(parallel)** "bridged" as a fly-back diode between the switched 12v wire to the Aux output wire when a PWM/Duty Cycle% signals are applied. (Diode band facing toward 12v wire)
**For EMU Black**, **diode PN: 1N4007** will only be required when PWM solenoids are connected to Aux #1 and Aux#2. Aux#3 through Aux#6 already have built-in flyback diodes.

Required diode information on Aux 1 and Aux 2 only applicable with custom wiring to PWM solenoids. ECUMaster adapters and ECUMaster plug and plug EMU Black units with OEM header will have built in diodes when those devices are using Aux 1 and 2 for PWM solenoids in the base map.

**Wiring to solenoid:**
-AUX output from EMU to one solenoid terminal or H-Bridge/Stepper output (set to "Inverted" or "Reversed" for idle valves).
-Switched 12v to other solenoid terminal
**Note:** Honda is an exception on some factory solenoids such as VVT and VTEC solenoids. Instead of switched 12v, these are grounded in the harness and require a 12v output from a relay or H-Bridge output from EMU to function. **Always check factory wiring diagrams before manually wiring EMU.**
**Tech Note: Honda VTec solenoids we have worked is common ground on one terminal and require a 12v output from the ECU to activate the solenoid. An EMU Black H-Bridge output or EMU Classic Stepper output can be used since those outputs are bi-polar (12v or Ground when activated).**

**3 wire PWM idle valves** are commonly switched 12v and (2) ECU outputs . Follow information above on diode requirements.

### 4 wire Idle Stepper motor wiring (IACV):

**EMU Classic**, Stepper outputs 1A, 1B, 2A, and 2B (Diodes not required)
**For EMU Black**, H-Bridge outputs 1A, 1B, 2A, and 2B (Diodes not required)
Idle Parameters **[Idle valve type]** Stepper or Unipolar Stepper depending on IACV.
*See troubleshooting notes at end of document for removing 12v from IACV connector.*
- **Toyota JZ IACV wiring diagram** link from our Base Maps dive / Toyota-Lexus folder:
Toyota_ISCV_6_pin_Idle_diagram_EMU_Classic_EMU_Black_Rev1_1.png
- **JDM 1JZ IACV vs US 2JZ IACV:** The 1JZ IACV is a different part number than the US 2JZ. Idle Parameters / **[Reverse]** option may need to be enabled in our base maps when using our 1JZ adapters. See ***How to Adjust Idle*** section in our *FAQ AND TROUBLESHOOTING DOCUMENT*. (Link also located on our https://ecumasterusa.com/pages/software-downloads page)

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**Wideband O2 Sensor wiring to EMU:**
(**Note for 4.2 or 4.9 wideband O2 sensor: Do not splice into any WBO wires between the EMU and PnP adapter or it can result in damage to the wideband sensor!**)
Click here for the Bosch O2 sensor installation pinout diagrams: O2 Sensor Installation Diagrams
When wiring a 4.2 or 4.9 wideband sensor, be sure to remove any wire connected between the EMU "WBO" terminals and the PnP adapter (if adapter installed). All wideband wires will only terminate directly to the EMU connector. The only wire that can be professionally tapped is the switched WBO +12 volt Heater (fused) wire from the sensor.

(**Bosch 4.2 sensor note for the EMU Classic only):** Before installing a 4.2 wideband $O_2$ sensor directly to an EMU Classic, use a multimeter to measure the calibration resistor value across pins 2 and 6. Resistance should be in the range of 80-200 Ohms. Write this number down, as it will need to be entered in the software after the EMU is powered up.) See "**Configuring a Wideband O2 Sensor (Lambda Sensor):"** for configuring O2/Lambda sensor.

**External O2 sensor controller:** If using an external O2 sensor gauge controller with a 0v to 5v (+) analog output, the (+) analog output should be connected to an available EMU **"analog input"** channel and assigned in the Oxygen Sensor parameters in the "Sensor Setup" menu, then set the voltage calibration per the external controller's ***voltage vs AFR*** specifications from the manufacturer's manual.
Connect the external O2 sensor controller Sensor Ground (or 0v reference wire) to the EMU Sensor Ground. See "***Using an External Wideband Controller like an AEM gauge***" in this document on **page 20** for configuring an external controller input in the EMU Client.
Caution: To prevent damage to the EMU or the external controller, please refer to the external O2 sensor documentation or the manufacturer of the device to ensure if the controller has an analog output for this purpose before making any connection.
Note on Grounding: Connecting analog voltage outputs to analog voltage inputs from different controllers can present ground differential issues causing fluctuating voltages which may be unavoidable with some configurations. If any fluctuation issues are observed between the readings from the external controller gauge and the EMU Lambda/AFR reading after the engine is running, check again if the Oxygen Sensor analog voltage calibration values are correct or connect the external controller main ground to the same ground to the same ground as the EMU if it is not already connected this way.
Example, if the EMU is grounded from the engine block, connect the main ground from the external controller to the engine block. If the device has an analog out sensor ground, it may cause this type of ground issue if connected to the EMU Sensor Ground. If connected, try removing the external controller sensor ground from the EMU sensor ground to observe if the issue still exists.

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**DO NOT CONNECT THE EXTERNAL CONTROLLER'S MAIN POWER GROUND TO THE EMU "SENSOR GROUND" TERMINAL.**

**Sensors, Software, and Firmware:**
After all sensors are installed, connect the included USB cable to both the EMU and your laptop. Ensure that you have downloaded the latest released software and drivers from https://www.ecumaster.com/download.
**-For BETA firmware:**
The latest BETA versions can be downloaded from http://www.ecumaster.com/testVersions.html**.**
**-Updating EMU firmware:**
**EMU Firmware can be updated by connecting the laptop to the EMU, powering on, clicking "*File/Upgrade Firmware...*" in the EMU Client, then selecting the newest version Firmware file with the highest number unless an older BETA FW version is required.**
**-Location of Project files (base maps):**
Project Files (base maps) are located in the "Base Maps and Manuals" drive link at the bottom of the ECUMaster USA Downloads page https://ecumasterusa.com/pages/software-downloads page.

**Note: If using a Wiring Specialties or custom harness, if injectors have been rewired sequentially from OEM batch-fire configuration, or using other aftermarket harness built to connect directly to the EMU, download a Project File (base map) that closely matches your engine configuration. Before uploading the base map into the EMU, open the base map and use the input/output assignment sheet that is supplied with the harness to change the inputs and outputs in the base map then "*Save Project As*" a new Project File.**
**You can see the Inputs and Outputs already assigned in a base map by clicking "Tools" at the top of the EMU Client, then select "Show Assigned Inputs" or "Show Assigned Outputs". This also shows the path to find each feature to which they are assigned. Only one of these windows can be opened at a time and must be closed before continuing to assign I/O.**

**Injectors need to be assigned the "Injectors Phase" window under Fueling / Injectors / Injectors Phase.**

**Warning: If injector outputs are assigned as an output to activate other components or if injector outputs are highlighted in RED in "Show Assigned Outputs" after configuring**

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**[Injectors Phase], the injector outputs may be assigned as a Main Relay output or assigned to other outputs such as the ECUMaster 7M-GTE base map and adapter. You must unassign that that injector from that output feature or this will result in that injector opening fully and flooding the engine.**

After verifying that the power for the coils and injectors has been disconnected (by removing fuses or relays or simply unplugging the connectors at the injectors and coils), reconnect the negative battery terminal, open the EMU software on your laptop, and turn the ignition key to the "ON" position. In the lower left corner of the EMU screen, the connection status box should change from a flashing red "Disconnected" indicator, to a solid green "Connected" indicator.

**Loading a Base Map and Warning Window:**
Verify that the correct map is loaded in the EMU. To load a map, go to "File", "Open Project" and select the correct file from your computer.
**If a Warning window appears in the upper left of the EMU Client window stating the Project File was created using a higher firmware version:** This is only showing the extra data that is different from the software/firmware revision currently on your laptop or EMU device. You can **click "OK" to continue loading the selected Project File and the Project File will successfully load.** You can update the Firmware to the report revision if necessary.
**If the *EMU Client SHUTS DOWN* after clicking "OK" to a warning window that opens in the *center* of the EMU Client window stating that the EMU Client must be updated:** Visit *http://www.ecumaster.com/testVersions.html* to download and install the newest Beta version of the EMU Client higher than the released FW version 2.113. (see **Sensors, Software and Firmware** above). After opening and proceeding to write the project file to the EMU device, **press [F2] to Make Permanent** (or Make Permanent chip icon button) or changes will be lost when the key is turned off.
Proceed to set up all the outputs and inputs correctly.

**Important note for "Import EMU Project" Classic file into EMU Black:**
There are differences between the Classic and Black files to check and correct when importing a Classic project file into the EMU Black. Check the path locations to the settings below for these values:
- **Fueling/Fuel Tables/Lambda Trgt.#1 and #2** - If any Lambda value in the tables show "1.47", then follow these steps

1. Left click mouse and drag diagonally across cells to highlight all the cells in the Lambda table.
2. Type the following exactly: 1.47/
3. Press <ENTER>.
4. Verify that any cells showing "1.47" now show "1.00".

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- **Ignition/Triggers/Primary and Secondary Trigger Tables** - Pullup values are "Pullup 4K7"
"Pullup 820 Ohm" works best with the Nissan CAS configuration.
The 820 Ohm pullup may help with other configurations converting from Classic to Black as well.

-**Engine start/Parameters/"Use Injector cal." -** Verify "Use Injector Cal." is enabled so the EMU can add the "Inj Cal." deadtime or offset values into the fueling calculation.

**-Sensor calibration - IAT and CLT will convert correctly**, though it is best to verify. Most alternate sensor calibration tables like **Oil Psi** and **Fuel Psi** tables, for example, are a different resolution in the Black Client. These psi sensors are normally linear calibration values, so they have been reduced to simple (2) or (4) cells. Check and re-calibrate all alternate sensor calibration tables after conversion.

-**Boost Parameters** - [Boost Parameters] settings convert correctly, though extra settings options were added which should be verified. [Boost Ref DC] and [Boost Target] tables are required to be copied from the Classic to the Black tables.

**More settings may not carry over with future firmware improvements. Please check all parameters and tables to confirm it matches your configuration.**

**Parameters Panel (Tuning Menu Panel - Left Menu Window):**

The ***Parameters Panel*** on the left side of the screen in the EMU Client software shows all of the Tuning Parameters settings and Tuning Tables to tune the engine.

The left **Parameters Panel size** depends on the Windows display resolution settings. If the panel is not wide enough, click the  **Configuration button** at the top of the Client to increase **"Parameters Panel Size"**. Maximum is **"300"**. You can change the resolution of your display if it needs to be wider.

**Tip: Toggle the function button <F9> to make this window hidden or visible.**

**Necessary Step, Graph Log and Scope Log if issues cranking:**

In the left ***Parameters Panel*** window of the EMU Client software, expand ***"Log"*** and select ***"Graph 1"*** and ***"Scope"***. These (2) log windows are the most important when first trying to start an engine!

The selected visible parameters and all unselected parameters are logged in the Graph 1 Log.

**To Save A Graph Log or Scope log:**

**Trigger Scope log procedure is located on page 14 of this document.**

Click the  icon in the upper left of ***"Graph 1"*** Log window or the ***"Scope"*** window to save the Graph or Scope logs to email. The extension of a Graph Log is **".emublog"** for EMU Black and **".emulog"** for EMU Classic. The extension for the Scope log is **".emubscp"** for EMU Black and

**".emuscp"** for EMU Classic.
Default save location is under Documents/EMU Black/<SN of the EMU unit folder> or Documents/EMU Classic/<SN of the EMU unit folder>. Save this in a more accessible folder location if desired.

**The saved Graph Log, saved Scope Log, and saved Project file (also called map or tune) must be attached and included in an email to Support@ecumasterusa.com if you have an issue. Please go over any issue a few times before emailing the issue. Most issues can normally be resolved more quickly by stopping to consider all possible reasons that can cause the problem before initially concluding a hardware failure exists.**

**Graph Log -** is a tool used to analyze engine performance and the device state of the ECUMASTER EMU. Data is shown as a linear graph as a function of time, with time represented on the lower axis. Detailed information about the exact value of a particular channel can be displayed by using the cursor to select a point on the graph, then data related to that exact point will be shown. This logging tool is of key importance when creating an engine calibration, as well as for troubleshooting. More info can be found in the "?" help button in the Graph Log window.

**Scope** - is a built-in scope tool that allows you to measure signals present at *primary trigger*, *CAM#1* and *CAM#2* inputs. This will be a necessary tool if you have trouble starting an engine. Using this tool, it is possible to determine the trigger pattern for crankshaft and camshafts trigger wheels, check if the polarity of the signal is correct, and save the trace for further analysis or for technical support for troubleshooting.

To record a log, a signal at *primary trigger* input is required. To activate the scope functionality, the option *enable scope* needs to be checked in the Primary trigger configuration window. The scope tool is available in log/Scope options.

The "**Trigger Scope Procedure for testing trigger settings:"** on page 13 will take you through the procedure for using the Scope.
More info can be found in the "?" help button in the Scope Log window.

**TPS Calibration for cable throttle bodies and DBW (Driveby wire) PPS (Pedal position sensor): (Important step to make Idle control and Acceleration enrichment function)**
From the tuning menu in the left window panel of the EMU Client, expand "***Sensors setup***" and select "***TPS***" parameters (used to input TPS calibration voltage). Then, expand "***Log***" and select "***Analog Inputs***" to see "***TPS Voltage***" (used to view the **TPS voltage**). Press <F9> to toggle the tuning menu if the left Parameters Panel is not visible.

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With the throttle plate closed or DBW Pedal released, input the [***TPS min voltage***].
With the Throttle plate fully open or DBW Pedal pressed, input the [***TPS max voltage***].
**Press <F2> to Make Permanent or click the "Make Permanent" button** (the upper left chip button seen directly below "***File***").
TPS Notes:
This and more information can be seen in the "**?**" Help file under the TPS Setup window.
If you are using an alternate TPS that has inverted signals (high voltage when closed and lower voltage when fully open, the same procedure will be used.
If the TPS voltage does not move in the "***Analog Inputs***" log window when the throttle is pressed, the wiring will need to be checked if 5 volts, TPS signal, and Signal ground is terminated correctly or check resistance of the Throttle Position sensor for possible failure.

**DBW Calibration:**
**For EMU Classic:** After ***TPS Calibration*** has been set, use the DBW wizard selection for the specific part number throttle body. The *ECUMaster Community forum* and Facebook ***EMU Tuning, Tips, and Builds*** group can help with DBW settings.
**For EMU Black:** After ***TPS Calibration*** has been set, run ***DBW calibration tool*** under ***Tools*** at the top of the software. (See *section 31* in the *FAQ and Troubleshooting document* for more information including on EMU wiring connections, troubleshooting DBW issues, and settings.)

**Initial Engine Displacement, Injector Settings, and Ignition Coil Settings:**
These are very important for initial setup in the EMU Client. Below are the locations of these settings. Click the  Icon in the windows for more information on the settings.
*ECUMaster Base maps will normally have the correct information already set for unmodified OEM configuration, though injector size may be different in some cases so please check.*
***Engine Displacement, Injector size, and Fueling Type*** - ***"General"*** settings window under ***"Fueling"***.
If your injectors have flow vs fuel psi specifications, match the size with your static set fuel psi.
***Injector Offset or Deadtime*** - ***"Injectors Cal"*** table under ***"Fueling/Injectors"*** (Black) ***"Fueling"*** (Classic).
Injector Deadtime or Offset vs Battery Volts is entered here if specifications are available.offset
If stock injectors are used, 1.0ms at 12v is fine for most stock injectors. To include the injector offset data in the fueling calculations, put a checkmark in the ***"Use injectors cal"*** box under ***"Engine Start/Parameters".***
***Coil Type (Logic "Smart", Passive "Dumb" and Firing Order*** - ***"Ignition Outputs"*** settings under ***"Ignition/Coils"***.
Note: Damage to coils and ignition drivers can occur If the *"Coils Type"* setting is not correct.

# ECUMaster EMU First Start Checklist

Please research to ensure what coils type you have. There are two choices below.
***"Coils without amplifiers"-(Direct control of Passive/Dumb coils without Igniter)*** This is known as a **low side** trigger. This setting is used when a stock igniter is not present or has been removed. This is used when ignition outputs have been wired directly to (2) wire and some (3) wire "**Passive or (Dumb)**" ignition coils. Examples of passive coils and when this may need to be set:
(2) wire coils
-Some early SR20 (3) wire Nissan coils (When ignitor bypassed and coil connected directly to EMU)
-Some (3) wire BMW coils
When aftermarket wiring harnesses, (like Wiring Specialties, Tweak'd Performance harnesses), are made to bypass a stock igniter. **It is important to check with the harness manufacturer first before connecting coils!**
***"Coils with built in amplifier"-(Stock Igniter, Logic/Smart coils)*** This setting is used mostly with stock (unmodified) wire harnesses when ignition outputs are connected to a stock igniter and the igniter fires the coils.
Also used when connected to (3), (4), or (5) wire "**Active**" or (**Smart)**" coils that have a "Built in" amplifier which requires a positive voltage to trigger a coil known as **logic trigger or high side trigger**.
Warning: Beware when installing aftermarket wire harnesses! Ask the manufacturer if the harness uses the stock igniter or bypasses the stock igniter and set accordingly.
**If the setting is incorrect, ignition coils will get melting hot and both the ignition coils and the EMU ignition drivers can be damaged!**

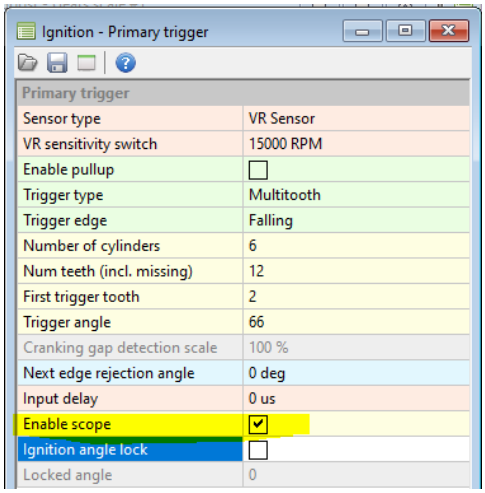
**Test Outputs:**
This tool is located at the top of the EMU Client under ***Tools/Test Outputs***. ***Test Outputs*** will send a pulsed On/Off signal to the components and has an "On Time" and "Off Time" milliseconds value that can be adjusted if necessary. The engine will not run when certain components such as relays, injectors, and ignition coils do not function properly.
**Important note: If the fuel pump is wired to be on constant with the key, disconnect the fuel pump before testing injector outputs to prevent flooding the engine with fuel.**
**To use Test Outputs:** Click the field to the right out [Output], then click the arrow to select an output from the list to test Aux outputs, H-Bridge, Stepper, Ignition outputs, etc.. to verify each function correctly before trying to start the engine. It is suggested to test the assigned Fuel Pump relay outputs and Injectors last. Use "200" ON and OFF time to test relays and solenoids and "10" ON time for ignition coils. Test all outputs before moving onto the Trigger ***"Scope"***.

# ECUMaster EMU First Start Checklist

**FOR THE FOLLOWING *TRIGGER SCOPE* AND *TIMING LIGHT* SECTIONS, IT IS SUGGESTED TO DISCONNECT THE FUEL PUMP POWER OR DISABLE THE FUEL PUMP IN THE *"OUTPUTS"* SECTION BEFORE TESTING THE INJECTOR OUTPUTS TO PREVENT FLOODING THE ENGINE WITH FUEL. The Fuel Pump or Fuel Pump Relay can be reconnected and tested last after the injectors have been tested.**

**Trigger Scope Procedure for testing trigger settings:**

After verifying all inputs/outputs, ignition trigger settings, coil settings (active/passive coils), sensor settings, and injector settings, you are ready to test the cam and crank signals (again, do this with the coils and injectors disconnected). In the left-hand *Parameters Panel* navigation window under the ***Ignition*** menu, go to "***Primary Trigger***" settings and ensure that the "***Enable Scope***" box is check marked (see below). Then under the "***Log***" menu on the left-hand Parameters Panel navigation window, open the "***Scope***" log feature. The scope feature will record trigger events as seen by the EMU. Once the *Scope* window is open, follow the steps below.




Scope Procedure:

1. PRESS and **HOLD** the blue arrow  .

2. Activate the starter to crank over the engine while continuing to hold the blue arrow button. Let the engine crank over for about **4 seconds**.

3. When the 4 seconds have passed, release the blue arrow **first**, then release the key to stop cranking the engine.

Note: If the crank stops rotating before the blue arrow is released, the Scope will not show trigger lines. If the Graph log shows an [RPM] value higher than "0", you will have Scope

The trigger log data lines will appear and you should see a Primary trigger pattern that matches the number of teeth on the crank trigger wheel (or Distributor wheel), and Secondary trigger pattern that matches the Cam teeth patterns (or Distributor wheel). If the cam and crank signals read correctly you are ready to move on. Verify ignition coil and dwell settings one last time and then connect the power supply to the coils.

**Save the Scope log:**

Click the Save  button in the upper left of "**Scope**" log window to save Scope logs to email. The extension for the Scope log is "**.emubscp**" for EMU Black and "**.emuscp**" for EMU Classic.

**Trigger Troubleshooting:**

**1.** If there are no Primary or Secondary lines, please try this procedure again exactly as it is stated in the steps above. The timing in the procedure is necessary for the best results.

**2.** If you are not getting one or both triggers while running a ECUMaster PnP adapter on an engine with a Distributor (**2JZ-GE or 3SGTE** for example), some adapters, like the JZA80 MK4 Supra adapter, have trigger resistors that can make a Distributor signal weak. If you measure resistance between the EMU pin and the OEM Primary or Secondary Camsync#1 terminals, you may need to simply remove the Primary and/or the Secondary wires from the OEM ECU connector to wire them directly into the EMU connector to bypass the adapter. Then try the Scope again.

***Section 2 JZA80 adapter- Removing Camsync#1 resistor for 2JZ-GE distributor*** of the *FAQ and Troubleshooting Document link* on the ECUMasterUSA.com Downloads page covers the procedure of removing or jumping this camsync#1 (secondary) signal resistor in the adapter or just bypass the adapter to wire directly to the EMU camsync#1 terminal.

**3.** If you have a **Nissan S13/S14A or S15 configured 64 pin adapter**, no scope trigger lines may be present and no power to the coils when using "Test Outputs". The ECCS Relay activation is required to provide power to the CAS (Cam Angle Sensor) and the ignition coils. Click this document link "Nissan SR20 S13 64 Pin Adapter and 62/63/E5 Conversion" for instructions on your specific stock ECU model number.

**Using the Timing Light after verifying correct Trigger data from Scope:**
**Below is information on the trigger settings that affect base timing.**
**The "Complete procedure for setting base timing:" is located on (page 16).**

Expand the "**Ignition**" menu to open the ***"Primary Trigger"*** parameters in the EMU Client ***Parameters Panel*** on the left of the screen.
For EMU Black, it is under Ignition/Triggers/Primary Trigger.

# ECUMaster EMU First Start Checklist

For EMU Classic, it is under Ignition/Primary Trigger.
Enable the **[Ignition Angle Lock]** feature in the "***Primary Trigger"*** parameters window. The **[Locked Angle]** value can be set to any Degree number that is visible on the TDC (Top Dead Center) Timing Indicator mark located directly above the crank pulley. Usually, 0, 10, or 15 deg marks will be visible. Ensure that the mark on the crank pulley is cleaned for visibility. It helps to carefully apply a very bright narrow white or neon colored paint to make the mark more visible. (If no TDC indicator is visible and no spark plug wires are installed, see "Note" below procedure).

Please refer to the manual or manufacturer of timing light for correct setup and usage.

Connect the timing light, activate the starter to start cranking the engine, use the timing light to verify the timing mark on crank pulley lines up with the degree angle indicator mark that was used for the **[Locked Angle]** value.
If timing marks do not line up, **[Trigger Angle]**, **[First Trigger Tooth] (in Primary trigger settings)**, or **[Ignition Offset] (in Ignition Outputs settings)** adjustments are required.
-***Tip:*** **If the timing light does not light up when cranking the engine over:**
1. Use **"Test Outputs"** under **"Tools"** to trigger "Ignition Output #1" to check if the timing light will flash. If not, unclamp the timing light clamp from the wire, remove the timing light clamp from the wire to rotate the clamp 180 degrees.
2. Verify the Graph log shows **[RPM]** and continues to show a solid **[Cam Sync Trigger Tooth]** value after 2 seconds of cranking over the engine. **[Executed sparks count]** in the graph log shows the EMU is firing coils. This value counts from 0 to 255, then resets back to 0 to 255 which will look like a saw tooth in the log with the engine running.
If **[Executed sparks count]** is not counting up during cranking or is counting up and TDC is jumping around at different degrees during cranking, then the triggers are not reading correctly and you will need to start back at the Trigger Scope and trigger settings to correct the Primary and/or secondary trigger settings.

3. If the timing light still does not flash during cranking (like on some Toyota JZ configurations with igniter removed), confirm fuel pump is disabled, then remove coils and spark plugs from all cylinders EXCEPT Cyl #1. This will increase cranking RPMs to allow the timing light to work and continue setting base ignition timing.
This issue could be due to low dwell times in the [Coil dwell time] table at cranking voltage or from insufficient voltage or current from the 12v wire for multiple reasons. Toyota JZ passive coils require roughly 1 ms higher dwell times at all battery voltages when the igniter has been removed. This may also be true with other vehicle manufacturers with igniters.

# ECUMaster EMU First Start Checklist

**First Trigger Tooth** - Rotates the crank pulley TDC mark clockwise or counter clockwise the degree angle of each tooth.
Example,.. if it has a 36-2 crank wheel, calculate 360 degrees divided by the number of teeth. (360/36=10 degrees). Each first tooth trigger change with this wheel rotates the TDC timing mark 10 degrees clockwise or counter clockwise.

**Trigger Angle** = Rotates the crank pulley TDC mark clockwise or counter clockwise 1 degree for each single degree change. The best suggestion

**Output Offset** (found in "**Ignition/Ignition Outputs**") = Rotates the crank pulley TDC mark clockwise or counter clockwise to fire the next cylinder first represented in the Firing Order.
Example,.. if the timing light is on Cyl 1 on a 4 cylinder, firing order 1-3-4-2, and the TDC mark on the crank pulley is pointing to the ground when the light fires (180 degrees where it should be), then the triggering could be trying to to fire cyl 3 first instead of cyl 1. This can be caused by the First Tooth value or is sometimes not avoidable due to some trigger systems. It's ok…
If this is the case, Output Offset value can be changed from Offset 0 (firing cyl 1 first 1-3-4-2) to Offset 1 (firing cyl 3 first 3-4-2-1) which is the same firing order with cyl 3 sequenced as the first firing cylinder.
This might be fixed by First Trigger Tooth and Trigger Angle combination or it may not. Either way, it will still run as long as you are not 360 deg out (firing on cyl 4 when it should be cyl 1).
This problem can be discovered by shining the timing light on the cam gears while cranking over. In this case, the crank timing mark will be TDC at the locked degree angle, but the timing belt alignment marks on the cam gears are rotated 180 degrees out facing away from the cam timing alignment marks.
This can simply be fixed by changing Offset 0 to Offset 2 in the Ignition Output settings.

Overall, if the crank TDC mark matches the "Ignition Angle Lock" value with the timing light and the cam gear timing marks line up closely, then the base timing is correct! Once base timing is set, Disable the "Locked Angle" feature. All that is left for the engine to run is air, enough fuel pressure, fuel from injectors, and ignition from coils to spark plugs.

**Timing Mark Note**: Some vehicles do not have this TDC indicator point or timing mark on the crank pulley from the factory. If this is the case, the engine will need to TDC accurately, a TDC pointer fabricated, and a TDC slot applied onto the crank pulley. We highly suggest hiring a professional shop or installer for this modification.

**Plug Wire Note:** If the coils are single coil on plug (COP) with no spark plug wire and the timing light model being used cannot is not designed to function using the coil control wiring, then cyl 1 coil will need to be lifted from spark plug and a plug wire will need to be affixed to the coil in a way in which the coil end of the plug wire is making positive connection with the spring or spark

plug terminal contact in the single coil. A large amount of electrical tape has been used in the past to affix the wire to the coil.

## Complete procedure for setting base timing:

- For engines with a Secondary trigger: In the Graph log during cranking, verify **[Cam sync trigger tooth]** value locks onto a steady value after 2 seconds of cranking. If **[Cam sync trigger tooth]** continuously fluctuates during 4 to 5 seconds of cranking, base timing can not be set correctly. You will have to adjust the trigger settings **Tools/Test Outputs** has been used first to verify you can hear the light snapping of the coils/plugs when each Ignition Output channel is selected, the injectors function correctly when Injector Output channels are selected, and FP and other relays activating.

**Known [Cam sync trigger tooth] values in the Graph log on some stock trigger patterns:**
**- Nissan SR/RB stock CAS**: "120"

- **Toyota VVT 36-2 crank and 3 tooth cam**: [Cam syn trigger tooth] = "57" to "58" is common for stock engines. Values from **"55" to "58"** has been seen with aftermarket cams.
If values between 40 to 51 is shown with the OEM 36-2 crank and 3 tooth cam triggers, the Secondary trigger may need to be changed from Falling to Rising or Rising to Falling, then crank over again to check sync tooth, or the timing belt was installed with the cam gear DOTS on the indicator mark instead of the cam gear LINES making the mechanical timing incorrect. The incorrect timing belt installation has been a common issue with many customers.

-**Toyota JZ NON-VVT 12 tooth multitooth primary and 1 tooth cam**: [Cam sync trigger tooth] = **"24"** .
**Troubleshooting note when engine cranking over or running (causes engine stalls):**
If [cam sync trigger tooth] **fluctuates from "24" to "1"** in the Graph log, Primary and/or Secondary [Trigger edge] is incorrect. This occurs when the Secondary trigger is lined up too close with a Primary tooth and the Secondary trigger crosses over the Primary tooth and will change your base timing by 30 deg with a 12 tooth crank trigger. This can be seen by taking a Scope log. The secondary should trigger between (2) Primary triggers to prevent this issue.
**Simple resolution:**
**- GTE engines with (2) separate sensors-** Primary and Secondary **[Trigger edge]** commonly set to **"Falling"** using ECUMaster adapters.
**- GE engines w/distributor-** Commonly, Primary=Falling / Secondary may need to be set to Rising
**- Wiring Specialties harnesses** Cam sensor polarity is reversed Primary=Falling / Sec=Rising

**Setting Base Timing:**
-To set base timing, Ignition Outputs "Firing order" Events are set correctly per the engine.
Start off by setting Ignition Outputs **[Output offset]** to "0" and Primary trigger settings **[Trigger angle]** to "60", then crank over with a light and Ignition Angle locked and click the up or down arrows in the **[First trigger tooth]** field until TDC gets close to the locked angle value.
**NOTE:** Left click the UP/DN arrows for the EMU to immediately accept the value change. If a value is typed in, you must press <ENTER> or click out of that field for the new typed in value to be accepted for TDC mark to change.

# ECUMaster EMU First Start Checklist

-Once TDC is as close to the deg indicator as possible with **[First trigger tooth]**, then click the up or down arrow in the **[Trigger angle]** field until TDC is set to the locked angle deg value.
**NOTE:** Left click the UP/DN arrows for the EMU to immediately accept the value change. If a value is typed in, you must press <ENTER> or click out of that field for the new typed in value to be accepted for TDC mark to change.

**Tech note:** After crank TDC has been adjusted correctly and if the cam gears cam be exposed by removing the cam gear cover (like Toyota JZ engines), you can shine the timing light on the cam gears to confirm the timing light flashes on the the cam gear mechanical timing marks at there TDC indicator positions when [Ignition angle lock] is set to "0" during cranking. This will confirm the cam and ignition events are in phase and not 180 deg out.

-Unlock the **Primary [Ignition angle lock]**, "**Make Permanent**", then crank over the engine to confirm it runs.

-If the engine does not run with enough fuel and air, or backfires, the cam phase may be 180 deg out with the ignition. To correct this, change **Ignition Outputs/ [Output Offset]** value from "0" to "2" for a 4 cylinder engine or to "3" for a 6 cylinder engine which will fire cyl#1 on the correct cam phase, if it was 180 deg out, then "**Make Permanent**".

-If the engine does not start, the best way to continue is to check if the Ignition is correct by adding a little accelerant (starting fluid) into the intake through the throttle body to check again if it will start. If the engine runs for a couple of seconds, this confirms Ignition timing is correct and you will need to put attention onto the fueling system or make Cranking fuel adjustments.

**Note:** You may have to change **[Output Offset]** back to "0" again if it still does not try to run with accelerant and recheck base timing.

End of setting base timing

**Engines with VVT cams:**
**VVT Solenoid Install:** One solenoid terminal connects to switched 12v and one solenoid terminal connects to Aux Output of the EMU and requires a diode. Research the factory wiring diagram first to confirm which wire goes on which terminal since some factory solenoids may already have a diode built into the solenoid that will instantly be damaged when activated if wire polarity is backwards.
**Install Tip:** If a VVT solenoid is installed on EMU Classic Aux outputs and EMU Black Aux 1 or 2, a diode must first be installed between the Aux output wire and the switched 12v wire with the diode band facing the 12v wire. No diodes are required to be installed if connected to EMU Black Aux 3-6. Those outputs already have built-in diodes.

**Setting Cam Angle Offset for VVT control:** After the primary and secondary triggers have been confirmed, base ignition timing has been set, and the engine is running, you will need to view

[Cam #1 Angle] in the *Graph 1 log* or *Tune Display* to adjust and verify cam angle is “0” (zero) when VVT solenoid is set to “None”.
Note: [Cam #2 Angle] should be configured the same if (2) cams are being controlled through VVT. Cam angle offset will change if primary and secondary trigger settings are changed, so always check that cam angle is “0” at idle after a trigger settings change with VVT solenoid temporarily set to “None”.
To adjust the [Cam #x angle] to “0”:
- Expand VVT in the left Parameters Panel window in the Client,
- Open the VVT “Cam 1” or “Cam #2” parameters,
- Record which output is assigned to [Solenoid Output #] then temporarily set to “None”,
- Adjust the [CAM Offset] value until [Cam Angle #1 or #2] in the log of Tune Display shows “0”,
**Tuner Tip:** If [Cam angle #1 or 2 Angle] shows “-500” deg when [CAM Offset] is “0”, then changing [CAM Offset] to “500” should adjust [Cam #1 or #2 Angle] to “0”.
- Once configured, re-assign [Solenoid Output #] to the correct previously assigned output channel.
All other settings in the VVT parameters must be configured per specific vehicle cam type and how that cam functions. VVT parameters are normally configured correctly on base maps.

**Configuring a Wideband O2 Sensor (Lambda Sensor):**
The EMU Black will control a Bosh 4.2 or 4.9 sensor. The EMU Classic can only control the Bosch 4.2.
**For EMU Black**, go to **“Sensor Setup/Oxygen Sensor”** to select the **Bosch 4.2** or **4.9** if a wideband sensor is directly wired to the EMU.
**For EMU Classic:** go to **“Sensor Setup/Oxygen Sensor”** to select the **Bosch 4.2.**
The 4.2 sensor **Rcal Ohms value** measured from sensor terminals 2 and 6**,** (covered on Page 1), is required to be entered into the **“Rcal”** field.
**Using an External Wideband Controller like an AEM gauge**, go to **“Sensor Setup/Oxygen Sensor”** to select the **“External Controller”** for “Sensor Type”, **”Ext controller input**” select the Analog Input# channel to which the controller’s analog output was connected, then set the AFR value in the AFR at 0v and AFR at 5v fields which will need to be acquired from the manufacturer of the external controller. Common values from external controllers are:
0v=10 AFR
5v=20 AFR

For AEM 30-0334 Model
0v= 7.31 AFR
5v= 19.19 AFR
See Page 1-3 for wiring information.

# ECUMaster EMU First Start Checklist

After all sensor readings, ignition timing, and outputs have been verified, connect power to the injectors and crank the engine over. If the engine does not start readily, try adjusting the injector trims up or down in 10 percent increments. Try to start with a fully charged battery. Do not crank the engine for extended periods of time, and if the engine does not start readily after a few tries, remove a spark plug to see if the plugs are wet with fuel. If the plug is wet, pull all spark plugs and allow the fuel to evaporate before starting again, this time with reduced fuel trims.

From this point forward, the EMU Client tuning software has a "?" help button in each of the parameter and table windows. These are pages from the EMU Client manual which is filled with descriptions of parameter settings and other helpful links with very useful information.

Enjoy your project!

**Troubleshooting notes:**
**EMU power and vehicle components won't power off after Key Off:** If this issue is observed, some stock or modified wiring configurations can cause this:
**1. On the EMU Black, when B13 is connected with G18** or other switched 12v within the main relay instead of directly to the battery.
**2. Toyota (6) wire idle stepper motors** from the (2) center 12v wires in the connector causing power feedback through the H-Bridge/Stepper outputs.
**3. Mazda (6) wire stepper motors on Mazda oil metering pump (OMP)** on rotary engines from the (2) center 12v wires in the connector causing power feedback.
**4. EMU Black H-Bridge outputs and EMU Stepper outputs are connected to incandescent bulbs (CEL lights for example) or 2-wire solenoids as Ground activation or PWM.** (due to 12v from the bulb or 2-wire solenoid or relay coil backfeeding through the H-Bridge or Stepper circuit.)
Common Example: H-Bridge or Stepper outputs connected to:
-Nissan RB and possible SR Fuel Pump relay

<u>Troubleshooting this issue:</u>
***1.*** For the EMU Black, if B13 is connected with G18 or other switched 12 v within the Main Relay, remove B13 Cont Battery wire from G18 or switched 12v source to wire it correctly to the battery with a fuse.
*If the problem persists after correcting, continue below.*
With the key off, start disconnecting peripheral devices until the EMU powers off.
**NEVER DISCONNECT THE 24 PIN OR 39 PIN EMU CONNECTORS WHEN TROUBLESHOOTING**

# ECUMaster EMU First Start Checklist

**WHILE THE BATTERY IS CONNECTED! (see caution below).**

***2. For the (6) pin connector***- Pull the (6) pin connector from the Toyota idle motor or Mazda oil metering pump first (if installed). If the issue no longer exists, it is common to remove the (2) center 12v wires in the (6) pin connector to eliminate the problem. The H-Bridges supply the correct voltage to control this motor with the (4) H-Bridge connections.

***3. See "2." above and follow the same steps.*** The Mazda OMP stepper motor is the same design as the Toyota IACV idle motor.

***4. HBridge and Stepper outputs connected and assigned to OEM and aftermarket relays, incandescent bulbs, and 2-wire solenoids can be the cause for EMU Black or EMU Classic staying powered on after key OFF.***

Physical test: <u>With the ignition key OFF and EMU still powered ON</u>, remove the connector of each component connected to a H-Bridge or Stepper output until the EMU powers off. If the H-Bridge or Stepper is connector to a CEL light or other incandescent lights in the gauge cluster, disconnect the power from the battery, remove the Gray EMY connector, de-pin and temporarily remove the specific H-Bridge or Stepper wire from the EMU connector, reinstall EMU connector, reattach battery, then power ON and OFF to check if that output was the cause.

If the EMU powers off normally after removing the component from the EMU H-Bridge or Stepper circuit, this can be corrected by adding a **1N4007 diode in series (diode band facing the EMU connector)**, supplying the 12v side of the solenoid with key switched 12v (instead of main relay controlled by the EMU), or by moving that EMU output wire to an Aux output and reassigning in the EMU Client.

**<u>Caution on disconnecting EMU connectors while battery connected</u>**: This can cause damage to the EMU, coils, and/or cause the fuel pump to activate and injectors to open 100% which can fill the intake and cylinders with fuel until it pours out of the throttle body. Always disconnect the battery before removing the EMU connectors!

Also, disconnect the USB cable from EMU before removing EMU connectors to prevent damage to the USB port.