

ME221/442 Engine Management System



**TOYOTA EP82/EP91
(STARLET/GLANZA)**

GEN 2 / 2B

WHITE PCB

Plug-In Quick-Start Manual

www.motorsport-electronics.co.uk

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1 Introduction

Thank you for using our system in your pursuit of power! The Motorsport Electronics core system stems from over 15 years of electronics design and engineering, from a small, active development team. With tuners all across the world, and an ever expanding network of users, the ME experience is more than just a PCB - we are here to help and we actively encourage and welcome feedback, both via our normal support system as well as community support via our “ME Users” Facebook group. Get involved - if you have an idea for a feature, there’s no reason it can’t be implemented!

This guide covers the physical installation of the ME Plug-In Engine Management System for the Toyota EP82 & EP91. The ME is the core control system as used by many of our Plug’n’Play ECUs - so this guide applies to some of them also.

Visiting a rolling road and an experienced mapper will sometimes be the best option for most users (the ones who just want their car to perform how they want, without much interest in as to how to get it to) - for others, the experience of doing it themselves is what matters, and with the ME221 being so flexible, and so many rolling roads and tuners supporting the ME, as well as a user friendly tuning system, plus a growing support network, both styles of approach are equally accessible.

This guide does not cover the basics of using the MEITE tuning software (i.e the menus, keys etc) - that is covered in the MEITE guide [here](#).

1.1 Safety First!

It must be said first and foremost that tuning an engine can be an exciting experience, as well as a risky one. If you really don't know what you're doing, or even where to start, read all the manuals until you do, and if you're still lost - seek professional advice from one of our world-wide installation agents. **Failure to do so may damage your engine, and even yourself!**

If you have no experience of engine management - follow the manual closely, ask for support if you get stuck, and aim only to get the basic physical install done - leave the rest to a reputable tuner to avoid engine damage or personal injury. NEVER tune your ME221 on the public highway!

1.2 Connectivity & Disclaimer

While we develop the connectivity, products and basemaps on REAL cars in house, that doesn't mean to say there isn't some weird and wonderful cross-over that moved a certain connection - we detail any of these “special” cases in the appendix if applicable. It is however always the installers obligation to check the compatibility of the ECU with the OEM harness - Motorsport Electronics Limited cannot be held liable for any costs incurred through incorrect installation or use of the product.

1.3 Getting Help & Support

There are various avenues for support - the first being the online manuals and documentation. Almost all support can be answered with a simple “it's on this page” - but in those rare cases, you can either raise a support ticket via our website, or call us Mon-Fri 9am-5pm GMT on +44 (0) 1373 710610 where one of our support engineers will be happy to guide you through any queries. Please bare in mind while we will try and offer some tuning support, in most cases a visit to your nearest ME approved agent will be the best advice for tuning. Our basemaps are provided “as-is” and should be used at your own risk. Note they are from REAL cars, tuned on the rolling road at our

headquarters and validated by our agents across the globe - but just like wiring 'oddities' this is no guarantee of their suitability for your specific modifications - using a basemap for more than startup testing prior to calibration is not advised!

There is also a vast and vibrant user community online that can offer helpful insight - check Facebook for "ME Users", and feel free to get involved!

2 Initial Board Setup

Before you install the new ME221/ME442 Plug-In into your vehicle, various checks must be carried out.

2.1 Board Switch/Jumper Settings

Please note that some ME Plug-In ECUs require jumper settings to facilitate different models or functionality.

TOYOTA STARLET/GLANZA EP82 & EP91 ECU

There are no jumper settings to be carried out for this version of the ME221/442 - Unless you're converting to Coil-On-Plug Ignition.

2.1.1 Coil-On-Plug Conversion

A typical upgrade for the Toyota's is to remove the distributor rotor system and single coil and upgrade to sequential COP ignition.

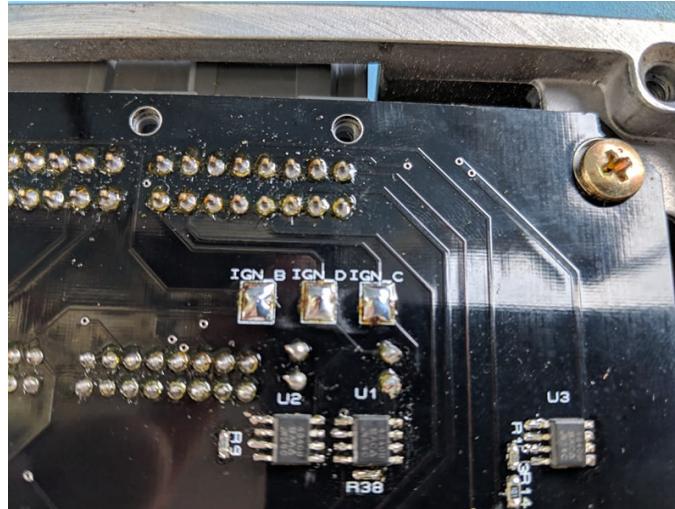
Note the standard distributor pickup is still used for engine sync/position. You can upgrade to a 36-1 wheel if needed.

If you wish to run wasted spark, you can simply use COIL A and COIL B lines, and then active coils paired off of them (such as Toyota COPs) wired as Cyl 1 & 4 to COIL A and Cyl 2 & 3 to COIL B. (Then set Ignition Driver to "WASTED SPARK")

Fully sequential is also an option, the Plug-In already supports this, simply solder bridge the 3x Ignition channels on the back of the PCB (only on EP82, EP91 doesn't have solder jumpers to do) (as shown below), and the 4 trigger signals for Toyota COPs (Logic Level) are then presented at the following pins:

Trigger Signal	EP82 OEM Pin	EP91 OEM Pin
COIL 1 (COIL 1)	6	22
COIL 2 (COIL 2)	20	18
COIL 3 (COIL 3)	B7	19
COIL 4 (COIL 4)	B8	6

EP82 / EP91 Gen2 Plug-In



Once you have carried out the wiring, set the Ignition Mode (under Ignition Driver) to “Fully Sequential” and also set the IO settings (in the IO Tab) to:

t. Boost Limiters ALS/Launch Knock VVT FlexFuel Diagnost

Output Settings

Coil Outputs		Relay Low Side	
Coils Rest State:	Normal	?	Relay
Coil 1:	Coil 1	?	Relay
Coil 2:	Coil 2	?	Relay
Coil 3:	Coil 3	?	Relay
Coil 4:	Coil 4	?	Relay
Coil 5:	N/C	?	Relay
Coil 6:	N/C	?	Relay
Coil 7:	N/C	?	Relay
Coil 8:	N/C	?	Others

Injector Outputs

Inj 1:	Inj 1	?	HB
Inj 2:	Inj 2	?	H
Inj 3:	Inj 3	?	
Inj 4:	Inj 4	?	
Inj 5:	N/C	?	
Inj 6:	N/C	?	
Inj 7:	N/C	?	

Note that the OEM coil drives the tachometer, so this function may stop if you upgrade to COPs.

2.2 Connected Hardware & Basemaps

The ME221/442 (and specifically its supplied basemaps) is designed to drive stock hardware & utilise OEM sensors - it is also designed to run only High-Impedance injectors (Low impedance can be used with ballast resistors however.). If you have changed your sensors/coils etc, you will need to configure them using the MEITE tuning studio.

3 ECU Installation

This section provides information on the physical install of the ME Engine Management System.

3.1 ECU Handling

You should always handle both the stock ECU (and its internals) as well as the ME PCB with due care and attention, protecting them from anti-static discharge. Use a grounded wrist-strap where possible as damage can occur. Also be wary of physical damage to the ECUs which can be caused by applying force or subjecting them to contamination from oil/dirt. A workshop environment is NOT a safe environment for working with electronics!



1. Carry out the install on a conductive, and earthed metal workspace.
2. Wear a grounded to earth wrist-strap when working with electronics.
3. Avoid contact with any of the components, contacts or metal work of the PCBs.

3.2 Fitting of the ECU

The ECU is designed to fit into the OEM casing, therefor retaining the OEM mounting hardware, fit, and finish.

The below outlines a simple guide for all models of the ME221 Plug-In range. Specific models are detailed (where available) on our youtube channel.

1. Ensure the ignition is off, and disconnect the negative terminal of the battery. Note saved stereo settings etc may be lost.
2. Locate the factory ECU, which in most cases is in the left hand kick plate or passenger footwell.
3. Remove any security bolts to allow removal and disconnection of the factory ECU.
4. Working in an ESD safe, well lit environment, open and remove the factory PCB from the casing, and place into an antistatic bag for storage.
5. Install the new ME core - be sure any jumper settings (detailed in section 2.1 above) are set for your model.
6. Ideally, install a tuning cable, modifying the OEM casing to allow the cable to run through.
7. Some models of the ME Plug-In feature an on-board MAP sensor - you may need to run a vacuum hose to inlet manifold, see the relevant section below (if applicable) on MAP sensor plumbing.
8. Close the ECU casing, and reinstall into the vehicle.
9. Reconnect the battery, but do not attempt to start - follow the manual through entirely first.

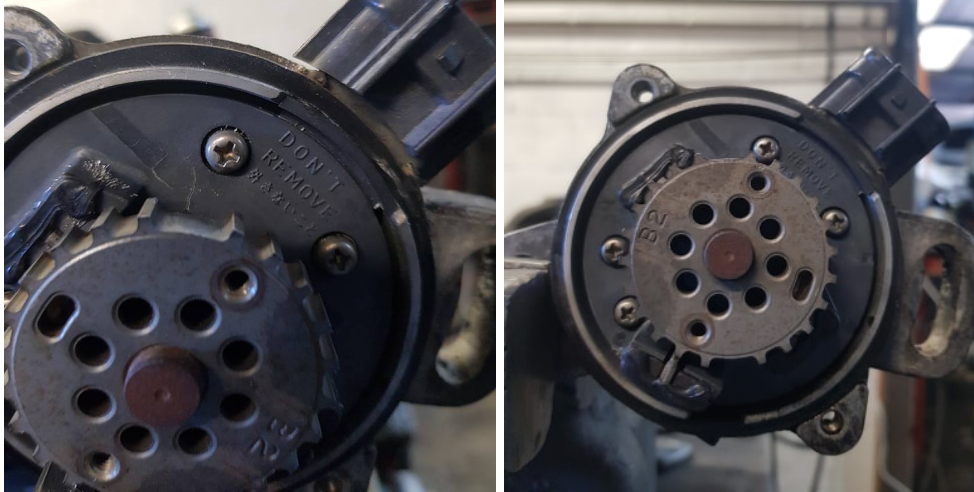
3 Distributor Modification

Because of the age of the distributor system, and its proximity to the ignition system, we ask that the below modification be carried out to enable a more modern “12-1” triggering system as opposed to a “12+1” system.

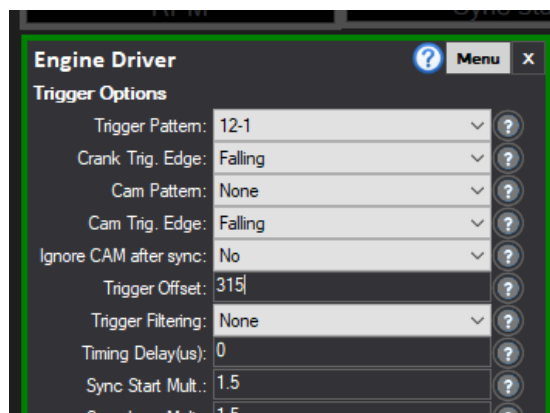
Some distributor pickups are seriously worn, and show a lot of electrical noise on the CAM pickup. This can be verified using the trigger scope.

The remedy is to convert the distributor to a simple 12-1 pickup, and then not use the TDC (single lobe wheel) for positioning.

Remove the distributor from the engine, and remove two of the teeth from the 24 tooth wheel directly opposite each (180°) other, as shown below. Take note of the positioning of the chosen teeth to remove in relation to the “B2” marking. These teeth will give a final trigger offset of approx 315°.



You can then set the engine driver to the following to allow support of it:



EP82 / EP91 Gen2 Plug-In

You may also find electrical noise is massively reduced after carrying out this mod by cutting the middle two wires of the connector on the distributor connector. (the now unused “cam” signal.) You should also trace these wires back through to the ECU and cut them there to further aid noise rejection. For example, on the EP91 cut the blue wire (pin 5) and white wire (pin 18) **at both ends**. **It is particularly important that the wires are cut at both ends ie near to the ECU and near to the distributor so do not skip this step.**

If you’ve having issues getting reliable sync after performing the mod, please try setting the “Sync Start Mult.” and “Sync Loss Mult” in the engine driver to ‘1.7’

4 Additional Sensors & Inputs/Outputs

The ME221/442 offers more connectivity than the factory ECU, allowing upgrades such as MAF-Less fuelling (utilising an IAT & MAP sensor), or spare control lines for nitrous, boost control etc.

4.1 Toyota Sensors

The EP82/EP91 versions of the ME ECU rely on the factory MAP sensor. This can of course be upgraded to any 5V MAP sensor (for turbo/supercharged applications). You can also add a MAP sensor to one of the spare analog connections.

Be sure to calibrate the MAP Sensors 'HRT' table in the MEITE tuning software if you change from the OEM one.

The stock IAT sensor is also retained for fuelling calculations. You should always measure the temperature of the air AFTER any turbo charging or intercooling stages, ideally just in front of the throttle body - take care to avoid heat soak where possible.

4.2 Additional Inputs/Outputs/CANbus/Drive-by-Wire/etc

The Auxiliary connector inside the ECU alloys a host of spare connections. These are detailed in the Appendix. Some spare I/O can only be used when using the ME442 version of the Plug-In.

4.2 Bosch Wideband Lambda (ME442 Only)

The 6-way black connection on the core allows you to connect using our WBO2 Kit a Bosch LSU 4.9 Sensor which can be installed in place of the first stock lambda sensor. This allows the ME442 to have accurate AFR measurements useful for either manual or auto-tuning, as well as engine protection. You can order the wideband sensor and cable kit from our website.

4.3 On-Board Logging (ME442 Only)

The ME442 has an SD-Card slot for onboard logging. Install an SDHC card here (4Gb is a good size) and you can configure the ECU to datalog within MEITE. It also features a real-time clock so each log will be date-stamped for easy later review.

4.4 Exhaust Gas Temperature Measurement (ME442 Only)

The ME442 has the ability to have an EGT (K-Type thermocouple) directly connected to it for safety and control purposes. Check the Appendix to see where to wire it as some models use the Aux. port, and others use unused pins of the factory connector. K-Type thermocouple kits are available from our website.

4.5 Electronic Boost Control

The stock boost control solenoid can be replaced with a 3 port or similar boost control valve. It is controlled by LS10.

Wiring wise, the signal arrives on Pin 11 for the EP91, and Pin 15 on the EP82 - the pinout image is in the appendix.

The standard boost button can be used for map switching of boost control. Its signal arrives on Digital Input 3. Configure Boost table switching as per map switching in the main manual in MEITE.

5 Connecting for Tuning

5.1 MEITE Tuning Software

ME Plug-In ECUs utilise the Motorsport Electronics Integrated Tuning Environment (MEITE for short) for carrying out diagnostics, calibration and setup. You can download the latest copy of MEITE from the www.motorsport-electronics.co.uk website. After downloading, install, and if prompted to auto-update, be sure to, to bring the PC tuning software to the most current version. MEITE supports Windows x32 and x64 versions 7/8/10 and above.

5.2 USB Connectivity

MEITE will automatically install the correct USB drivers when it is first installed. Simply connect the unit with the provided USB cable to a spare port on your laptop. The ECU must be powered by the car for the connection to be established - i.e ignition on.

5.3 Initial Connection

Once you have installed MEITE, and the drivers, connect the ECU to the laptop, and turn the ignition to position 2 - also, be sure to disable any immobiliser so the dashboard Check Engine Light is illuminated.

Open MEITE. If MEITE is already running, press 'Connect' under the 'File' menu. A green bar will progress across the screen as the ECU data is downloaded to the laptop. If this does not happen, check that the correct comm-port is selected in the lower right section of the MEITE window. Refer to the MEITE help (Help menu) for further help with getting connected.

6 Pre-Start Setup

Be sure to follow this section carefully. Firmware updates, basic sensor checks and calibrations need to be carried out, as well as loading of a default calibration to allow successful operation of the ECU.

6.1 Firmware Update

Because we offer free feature updates and additions through firmware updates, it is always best to check the current firmware version and the version available from the www.motorsport-electronics.co.uk website. You can check which version you have currently by going to Help>About when connected to the ECU. The ECU FW Version is the number to take of. If you have a version that is older than the current latest firmware, then follow the firmware update procedure in the [MEITE Guide](#) to update your ECU to the latest version. Note if your car has been tuned, major FW changes can make the map unuseable - only update if you are aware of changes that could happen.

6.2 Basemaps and Startup

We provide a number of basemaps on our calibrations server which can be accessed from the ME website (Under support). We offer various startup files, one of which will be always provided based on (and calibrated on) an OEM, low mileage car utilizing OEM sensors and hardware. This should only be used as a guide - professional tuning/advice should still be sought.

Ensure you're connected to the ME221, then go to **Calibrations>Load Calibration** to load on a chosen calibration. Try to use a calibration that closely matches your specification. If none are available, or not yet released, start with the OEM basemap for your model. Be sure to load "Tuning data only". A green bar will progress to show the calibration being loaded. Power cycle the ignition after downloading an entire calibration.

6.3 Sensors and Sense Check

Using the 'Sensor Cals' tab of MEITE, check all sensors read sane values. IAT, Coolant, MAP (which should be around 99KpA at sea level, with the engine not running), Throttle (moving from 0-100% with throttle actuation - only if you have fitted a linear TPS). If they do not, refer ME Software guide to tune the HRT tables to suit your sensors.

If you have changed any sensors, such as MAP, or IAT sensors, then you will need to calibrate them using the MEITE. Refer to ME Software guide - which details specifics of the MEs functions, for details on this.

6.4 Injectors

If you have changed your injectors to ones that have a different flow rate, be sure to enter their cc/min into the **System>Injection Driver** settings window available on the 'START' tab in MEITE.

6.5 Calibrating Base-Offset/Trigger Offset

If all of the above has been carried out successfully, and everything is reading correctly, it is time to attempt a first-start. The base-maps contain trigger offset numbers for the crank/cam sensors that relate to OEM cars. You should still confirm that the ECU's commanded advance (shown under **Ignition>Ignition Advance**) matches the actual advance angle seen when using a timing light (while cranking).

If it does not, adjust it by modifying the Trigger Offset number under the ***System>Engine Driver*** window.

You can turn the fuel supply off to stop wetting of plugs during this stage by going to the ***System>Injection Driver*** and turning Fuelling Mode to “OFF”. Remember to reset this to its original setting (usually ‘Fully Seq’) when trying to finally run the engine.

Once you have the engine running and idling, reconfirm the offset as low RPMs can prove difficult to time truly accurately.

7 First Time Startup

If you have made it this far, a base-map suitable for your engine has been loaded, the engine ignition is timed and all sensors are reading sane values. You're now ready to start the engine!

Follow the below process as a final checklist and startup procedure:

1. With the ignition on, and MEITE connected, check the following from the "MAPPING" tab:
 - a. MAP sensor reads around 98-100KPa (at sea level).
 - b. Battery voltage reads around 12+ volts.
 - c. Engine Coolant and Intake Air Temp values read sanely.
 - d. The TPS/Throttle percent number moves from 0-100% as you sweep the throttle (some models such as Mk1 MX5 & EP82/EP91 do not have a VTPS so this can be ignored in that instance).
2. Rectify any issues with the above checklist - there is no point progressing further if the basics above are incorrect!
3. Turn the ignition OFF then back ON - listen for the fuel pump priming for around 2 seconds (if ECU controlled)
4. Crank the engine - you may need some throttle to help it. While cranking you should see an RPM reading of around 200-300rpm on most engines with charged batteries. The engine may be running excessively rich/lean - adjust the "Engine Size" under the System>Engine Driver to richen/enlean the mixture - note this is a "get you running" hack and it should only need to be changed by around 20% maximum either way - the Engine Size should be reset to the actual size when starting tuning.
5. If you do not get a stable RPM, use the diagnostics tab in MEITE to confirm CRANK and CAM IRQs (pulses from the sensors) - also check for "Lost Sync Count" increasing while cranking as this can indicate failing sensors or electrical noise. Resolve these issues before continuing. If you have attempted multiple starts, check to ensure spark plugs are not wet - ideally replace as opposed attempt drying them.
6. Once the engine is running, allow it to warm, and then adjust the engine size number to get as good a running as possible.
7. Adjust the idle control in "Manual Mode" under the IDLE tab to help maintain a steady idle without throttle use. (Refer to the [Tuning Manual](#) for more on idle tuning).

Remember that ultimately an engine is a simple mechanical system - it needs, air, fuel, compression and a spark (at the right time, usually around 10° BTDC at idle for most common engines). Check for these basics and you can narrow down the issue. If still in doubt, give us call, e-mail and we will help you out - if you can have an internet connection available we can remote connect and check things enabling

Congratulations!

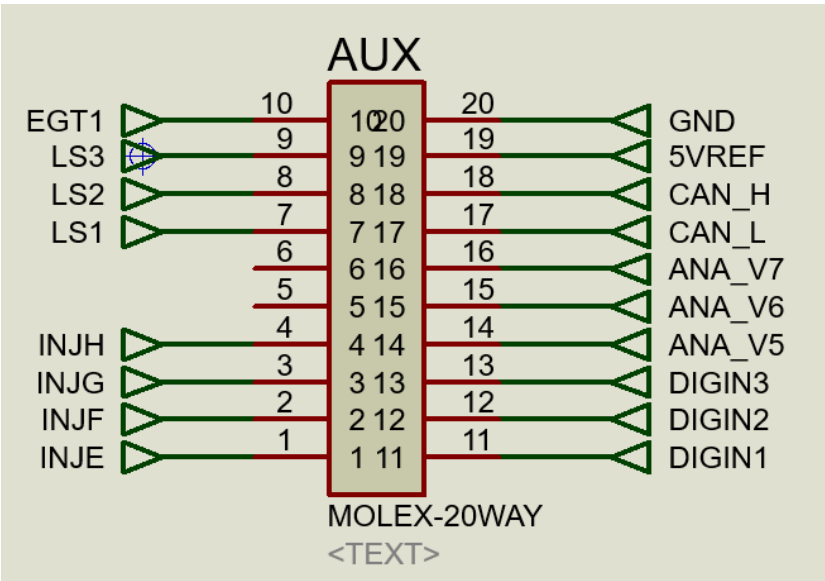
You now have a running engine that is ready for full calibration under load. Please visit our website for a list of approved tuning agents, or, contact us about your tuner of choice and we can get in touch to offer training or assistance where needed. That being said, the ME221/ME442, although advanced in areas of knock and boost control etc, is similar to most modern performance ECUs in that it is a VE based engine management system and any competent tuning professional should find it very easy to use.

Appendix A | Connectivity

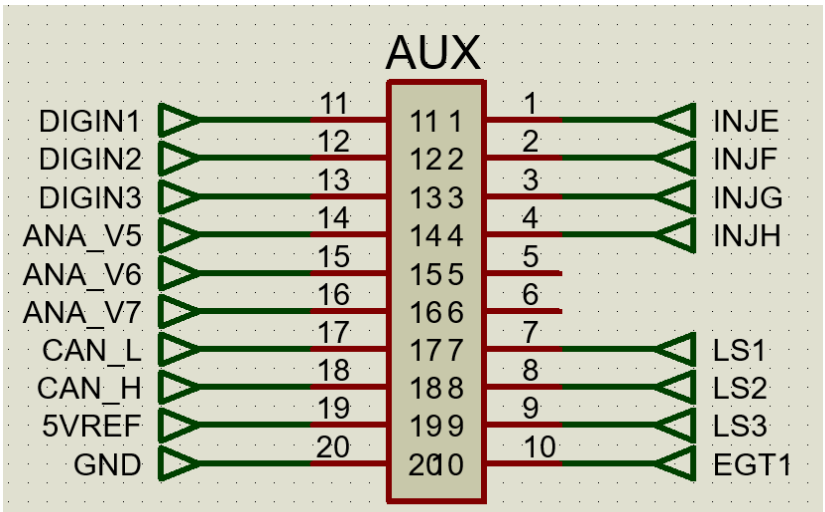
When viewed from above, with the main ECU connector at the top, the following is the pinout for the AUX connector (note the orientation differs between EP82 and EP91 versions).

The connector body is MOLEX 39-01-2205 and the pins are MOLEX Mini Fit Jr. All available from mouser.co.uk

EP91



EP82



EP82 / EP91 Gen2 Plug-In

Pin #	Function	Pin #	Function
1	Injector 5 (3.5A FB protected)	11	DI 1 (Digital Input 1, 1K, 5V Pull-up)
2	Injector 6 (3.5A FB protected)	12	DI 2 (Digital Input 2, 1K, 5V Pull-up)
3	Injector 7 (3.5A FB protected)	13	DI 3 NOT AVAILABLE (Boost Button)
4	Injector 8 (3.5A FB protected)	14	Analogue Volt 5 (0-5V Input)
5	NC	15	Analogue Volt 6 (0-5V Input)
6	NC	16	Analogue Volt 7 (0-5V Input)
7	LS1 (2A PWM-Able)	17	CANBus 1 Low (Unterminated)*
8	LS2 (2A PWM-Able)	18	CANBus 1 High (Unterminated)*
9	LS3 (2A PWM-Able)	19	5V Reference (100mA Max Load)
10	K-Type EGT +Ve*	20	EGT* & Sensor Ground

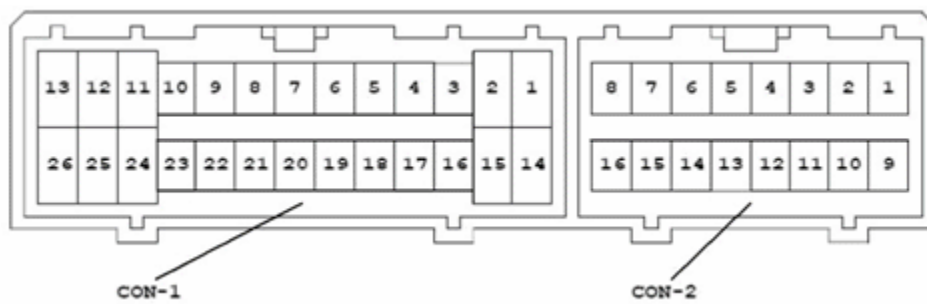
Appendix B | OEM Connectivity

EP82 Pin	EP91 Pin	Function / Assignment
21	4	“Crank” 24 Tooth Signal (VR CRANK +)
8	5	“Cam” Single Lobe (VR CAMA +)
B8	6	Spare / COIL 4
14	10	PWM IDLE Valve / LS 9
15	11	Boost Valve / LS 10
12	12	Injector 1
B16	14	Injector 3
9	17	Trigger Grounds
20	18	Spare / Coil 2
B7	19	Spare / Coil 3
B15	20	Boost Switch / Digital In 3
B3	21	Injector 4
6	22	Ignition Coil / Coil 1
24, 26		Ground
25	25	Injector 2
4	B2	MAP Signal / Analog V1
5	B3	Inlet Air Temp / Analog T1
3	B4	Coolant Temp. Signal / Analog T2
10	B6	Lambda Sensor / Analog V3
22	B9	Sensor Ground
17	B10	Throttle Sensor Signal / Analog V2
18	B11	Sensor 5V Reference
19	B12	TPS Ground

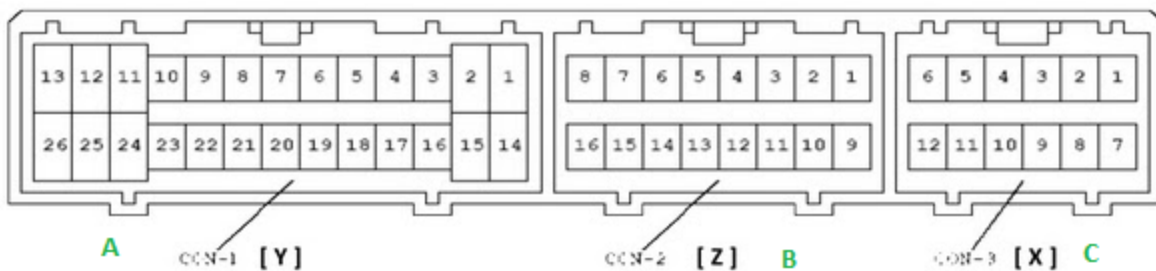
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23	B14	Knock Signal / Knock 1
B4	C4	Fuel Pump Relay / LS 11
B9	C7	12V Ignition Feed
B10	C8	Check Engine Light / LS 13
B13	C11	Vehicle Speed Sensor / Digital Input 4

EP82 2 Plug Diagram CON2 is Connector “B”



EP91 3 Plug Diagram

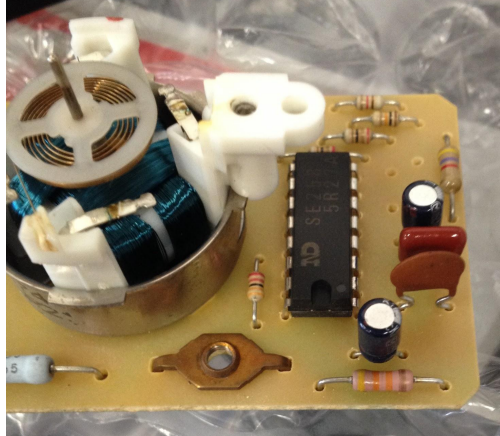


Appendix C | Known Issues / Model Specifics

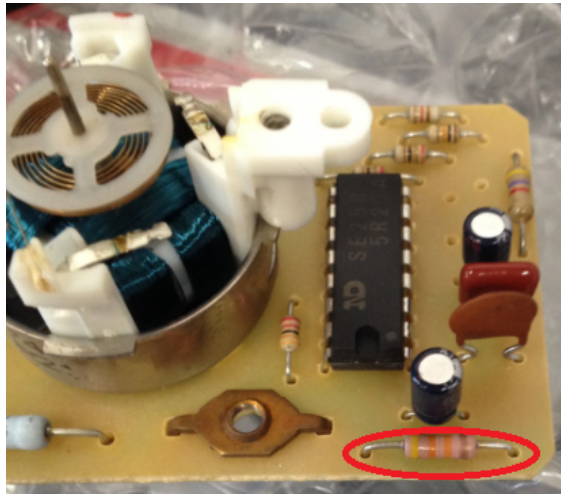
Using factory Tachometer After COP conversion

If you would like to feed in a tacho signal to the factory rev counter after removing the OEM coil. Please follow the below steps:

1. Remove the dash cluster, open it and remove the circuit board that drives the rev counter.

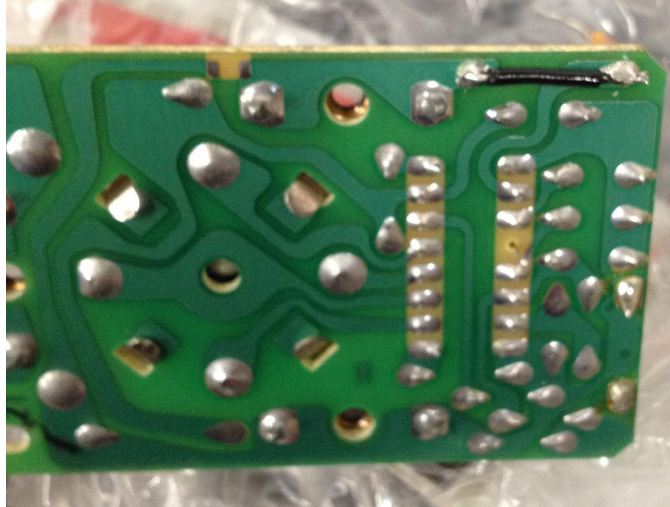


2. Next, remove the resistor circled in red in the below image:



3. Link a wire across where the resistor was situated on the underside.

EP82 / EP91 Gen2 Plug-In



Connect the IG- of the tachometer to a spare low side on the auxiliary connector of the ECU eg LS1, pulled up to 12V with a 1k resistor. Assign this to tachometer in the input/output settings in MEITE. In the tachometer settings driver, set it to toggles per revolution.