ME221/ME442 Engine Management System

ME221 / ME442 GEN 2/2B MX5 1989-1995

Plug-In Quick-Start Manual

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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 circuit board - 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 ME221/442 Plug-In Engine Management System for the Mazda MX-5 NA (1989-1995 model years with the 2-plug ECU). The ME is the core control system as used by many of our Plug-In 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 ME ECU being so flexible, and so many rolling roads and tuners supporting the ME product range, 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 ECU 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 of use of the product. DRIVE-BY-WIRE SHOULD NOT BE USED ON PUBLIC HIGHWAYS - DO SO AT YOUR OWN RISK.

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 Plug-In ECU into your vehicle, various checks must be carried out.

2.1 Board Switch Settings

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

Mazda MX-5 89-95

Variable TPS (Pre 1993 Models Only)

Early 1.6L MX5s have a switched type TPS which does not provide useful information to the ECU. Some customers choose to install a variable TPS such as the TPS from the BMW E36 (adapter plate available on the ME website). If you choose to fit a variable TPS set both dip switches on the board to the ON position as printed on the switch (Ignore any Yes/No text printed on the actual circuit board).

If you have a 1.8 engine it has a stock TPS and DOES NOT NEED the switch turned on. Set it to Off.

If you have NOT fitted a vTPS to your 1.6 (i.e it is a standard engine) ensure both switches are in the OFF position. **Failure to do will stop the ECU from powering on properly and communicating with the software.**

2.2 Connected Hardware & Basemaps

The ME Plug-In ECU (and specifically its supplied basemaps) is designed to drive stock hardware & utilise OEM sensors - it is also designed to run only High-Impedance injectors. 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 Plug-In Engine Management System.

3.1 ECU Handling

You should always handle both the stock ECU (and its internals) as well as the 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 placement.

The below outlines a simple guide for all models of the ME 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. It is located in the passenger footwell area under the carpet and kick-plate.
3. Remove any bolts to allow removal and disconnection of the factory ECU.
4. Install the new ME Plug-In ECU into the factory casing. You may also wish to pre-drill the casing to allow access to the USB and Wideband (ME442) ports.
5. Run the provided vacuum hose from the inlet manifold (after the throttle) to the on-board MAP sensor. Drill the case with a 10mm drill to allow the hose to pass through. You can route the hose through the grommets on the OEM bulkhead of the car up being the glove box.
6. See above section if you need to carry out any pin-swaps/jumper settings.
7. Ideally, install a tuning cable, modifying the OEM casing to allow the cable to run through.
8. **Remove the ST SIGN FUSE from the Drivers side, strut top fuse box. Failure to do so will damage the ECU and VOID the warranty.**
9. Reconnect the battery, but do not attempt to start - follow the manual through entirely first.

4 Additional Sensors, Wideband & Inputs/Outputs

The ME Plug-In ECU 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 MAP Sensor Plumbing / MAF-Less

The ME221/ME442 relies on its on-board 400 kPa MAP sensor. Run the provided 3mm ID silicone hose from the sensor on the ME Plug-In to the inlet manifold AFTER the throttle body. Be sure it is not crimped anywhere when passing through the bulkhead as required etc.

If you opt for forced induction, you will also need to add an IAT (Inlet Air Temperature) sensor to the inlet manifold after any intercooling stage. Wire this to the stock AFM/MAF sensors wiring. Be sure to check in MEITE in the later stages that the IAT reads correctly.

If you have removed the MAF sensor then you will need to install an Inlet Air Temperature sensor. Install it in the inlet tract AFTER any supercharging/turbocharging/intercooling stage (near the throttle plate is best), and connect it to the IAT connections on the original MAF sensor connector (Connecting to pin 2P on the ECU). Bear in mind that you will need to alter the IAT HRT table to suit the new sensor type.

You can use any 2-wire thermistor, though Bosch/GM types work best - wire it into the factory wiring harness at the AFM connector. Wire one lead of the GM Sensor to the Brown Wire at the AFM Connector (colours may vary but the pinout does not), and the other lead of the GM Sensor to the Yellow wire at the AFM Connector.

The FIVE Wire MAF uses the Black/Light Green wire and the Red/Black wire as signal & Ground for the IAT sensor.

The SEVEN Wire MAF, use pins 1 and 6 of the connector. It does not matter which way round the IAT is connected. Either Black/Green Stripe wire can be used as the IAT GROUND and the IAT signal is RED/GREEN Stripe

Confirm the sensors operation in MEITE - unplugged, the Inlet Air Temp voltage will read approx 4.9volts, and plugged in, it will read a lower number, and the Inlet Air Temp reported in Degrees C should be correct.

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. For AEM widebands, see here: AEM Wideband Install guide.

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

Most customers choose to remove the “purge canister valve” control and use the two wires that previously went to this to connect a boost control valve such as the boost control kit available from our website. The ECU basemaps are set up to use these wires as standard. The wires can be connected either way around into the plug; one of them will read 12V and the other will connect to the ECU. This will allow you to set the boost control output easily without having to run new wiring through the cars bulkhead.

4.6 Cooling Fans

The 89-95 model supports a large range of years, as such, Mazda moved the chosen pin for the AC and Primary cooling fan relays.

Please refer to the table in appendix A to check which output you need to assign to the cooling fan in the ECU input/output. Assign primary and secondary fans as shown depending on your year, or, use test mode to work out which is which. **Be sure to do this to stop engine overheating.**

4.7 Fuel Pump Control

The 89-95 model ECU supports a large range of years, as such, Mazda moved the chosen pin for the Fuel Pump Control which can sometimes lead to a small extra step when setting up.

ME221:

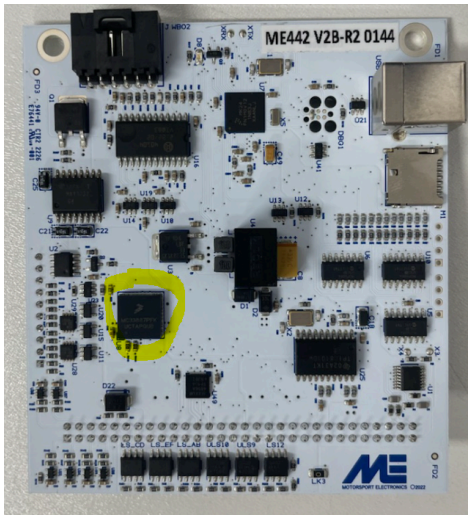
If the MAF has not been removed, you should find that the fuel pump operates correctly. This can be confirmed by listening for the fuel pump priming for two seconds when the ignition is turned on. If it has been removed, for example as part of a turbo conversion, the way the fuel pump is managed from the ECU pin now needs to change. Run a wire from the FP pin in the diagnostic port under the bonnet to pin 2T of the ECU. Assign LS14 in IO settings to 'fuel pump'.

ME442:

If the MAF has not been removed, you should find that the fuel pump operates correctly. This can be confirmed by listening for the fuel pump priming for two seconds when the ignition is turned on. If it has been removed, for example as part of a turbo conversion, the way the fuel pump is managed from the ECU pin now needs to change.

For ME442s with DBW:

If you have a DBW Variant (standard prior to August 2022, but optional factory fit thereafter) you can tell by looking for the following chip circled in yellow being fitted:

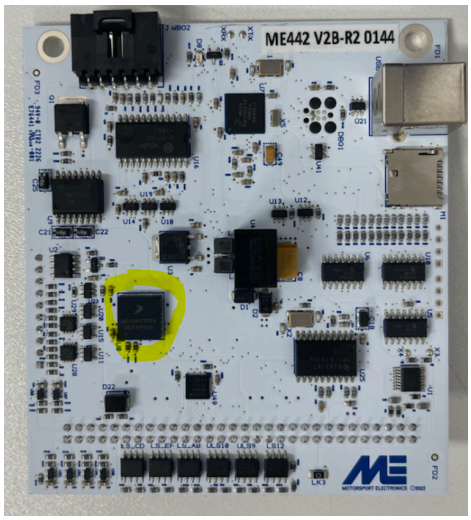


Assign HB Out + to 'Fuel Pump' in IO settings. Set LS14 to N/C (not connected). Check whether the fuel pump is now operational by listening for the fuel pump priming for two seconds when the ignition is turned off and then back on. If the fuel pump is still not operational, then you likely have the car variation whereby the fuel pump control is on a different ECU pin. Run a wire from the FP pin in the diagnostic port under the bonnet to pin 2T of the ECU. Assign LS14 in IO settings to 'fuel pump' and DBW Motor+ to 'N/C' (not connected).

4.8 Drive-By-Wire [ME442 Only with Optional DBW Upgrade]

Some variants of the 89-95 ME442 DBW model support the control of drive-by-wire throttles.

If you have a DBW Variant (standard prior to August 2022, optional thereafter) you can tell by looking for the following chip circled in yellow being fitted:



The Throttle Motor should be connected to OEM pins 1c(fuel pump drive) and 1i(spare). Prior to DBW conversion, as standard, the fuel pump is triggered from the DBW+ (H BRIDGE+) pin. As this is now used for DBW, you will need to trigger the fuel pump relay separately. One common method of doing this is to run a wire from the FP pin in the diagnostic connector to a spare low side (LS) pin on the ECU auxiliary connector. Then assign the fuel pump to the relevant LS pin in Input Settings in the MEITE software.

You can then use the following sensor wiring table below:

Pin	Function to Set Pin To / Wire To	Software Pin Name in IO
DBW Motor +	DBW A +	HBA Out +
DBW Motor -	DBW A -	HBA Out -
OEM Pin 2L*	DBW A Throttle Pos Raw 1 [25]	ANA V2
MAC AUX ANA-V5	DBW A Throttle Pos Raw 2 [26]	ANA V5
MAC AUX ANA-V6	DBW A Pedal Pos Raw 1 [23]	ANA V6
MAC AUX ANA-V7	DBW A Pedal Pos Raw 2 [24]	ANA V7
MAC 5V REF	5V Supply to sensors	n/a
MAC GND	GND reference to sensors	n/a

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 guide 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 unusable - 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 ECU, 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 100 KPa at sea level, with the engine not running), Throttle (moving from 0-100% with throttle actuation). If they do not, refer to the 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 ECUs 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.
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 to attempting 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).

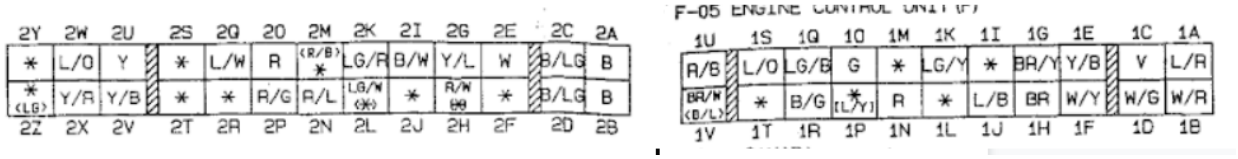
Remember that ultimately an engine is a simple mechanical system - it needs, air, fuel, compression and a spark (at the right time, usually around 10* BTDC at idle for most common engines). Check for these basics and you can narrow down the issue. If still in doubt, give us a call or email and we will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

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 | OEM Header Connectivity

Pinout below is shown looking into the ECU connector - Wire Side of the plugs.



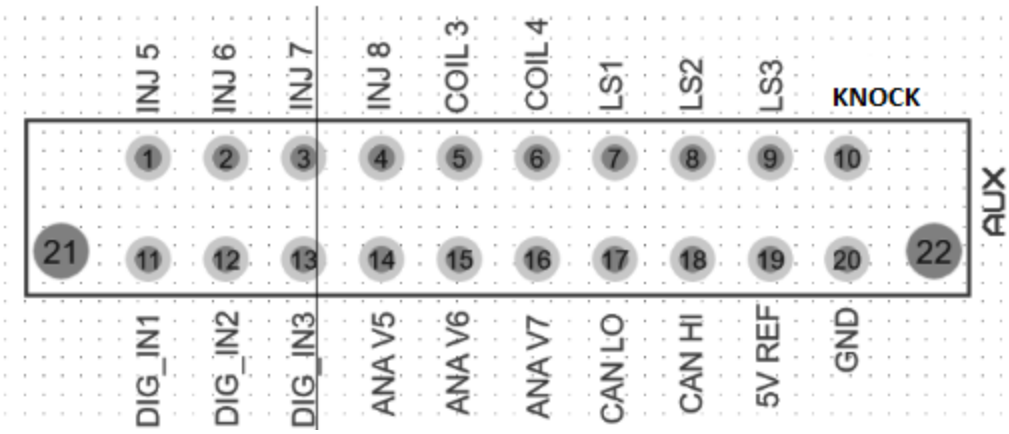
Pin #	Function/Mapping	Pin #	Function/Mapping
1B	Ignition 12V	2i	12V output for four-pin coil pack driven tacho.
1C	Fuel Pump (Early) / DBW +	2K	5V REF
1D	LS4 SPARE / LS4	2L	TPS Signal / ANA V2
1E	CEL / LS11	2M	>94 TPS Signal
1F	Alternative Tachometer Output (see appendix C)	2N	O2 Sensor Signal / ANA V3
1G	Ignition 1&4 / COIL 1	2O	AirFlow Signal / ANA V4
1H	Ignition 2&3 / COIL 2	2P	Inlet Air Temp Signal / ANA T1
1i	DBW MOTOR - (Aux)*	2Q	Coolant Sensor Signal / ANA T2
1J	Air Con Relay / LS15	2S	Air Con Blower Relay (1995) / LS16
1K	EGT K-Type + */ EGT1	2T	Fuel Pump Relay (1993+) / LS14
1L	Primary Fan Relay (1.8 Engines)** / LS12	2U	Injector 1 (&3 <1993)
1M	VSS Speed / DIGIN 4	2V	Injector 2 (&4 <1993)
1N	VTPS 5V REF (Via VTPS Dipswitch)	2W	PWM Idle Valve / LS9
1Q	Air Con Switch / DIGIN 5	2X	Purge / Boost Solenoid / LS10
1R	Primary Fan Relay (1.6 Engines)** / LS13	2Y	Injector 3
1V	Clutch Switch / DIGIN 6	2Z	Injector 4
2A/B/C/D	Grounds		
2E	CAS Sensor Signal / VR_CRANK	MAP	On-Board MAP Sensor / ANA V1
2G	CAS Sensor Signal / VR_CAMA		

*Auxillary - not used by OEM, and only on ME442 Variant. DBW version dependant
**Set your Primary Fan using TEST MODE to establish which is correct under IO Settings.

Appendix B | Auxiliary Connector

The Auxiliary Connector allows a host of other functions. This is the image of the connection, and they are detailed in the table.

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



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 (Digital Input 3, 1K, 5V Pull-up)
4	Injector 8 (3.5A FB protected)	14	Analogue Volt 5 (0-5V Input)
5	Coil 3 (50mA TTL Output)	15	Analogue Volt 6 (0-5V Input)
6	Coil 4 (50mA TTL Output)	16	Analogue Volt 7 (0-5V Input)
7	LS1 (2A PWM-Able)	17	CANBus 1 Low (Terminated 120ohm)
8	LS2 (2A PWM-Able)	18	CANBus 1 High (Terminated 120ohm)
9	LS3 (2A PWM-Able	19	5V Reference (100mA Max Load)
10	KNOCK Signal	20	Knock & Sensor Ground

If you wish to use EGT on an ME442 8995, please contact us for specific instructions on connectivity.

Appendix C | Known Issues / Model Specifics

C.1 Tachometer Does Not Operate

Some late 1995 models have the tachometer wire routed to another pin. On the underside of the ME ECU is a solderable jumper labeled “ODD TACH”. Solder this bridge and the tacho will then provide a tacho signal at pin 1F.

C.2 NON-START & No RPM in MEITE When Cranking

Some late 1995 two-plug cars have one of the CAS signal wires in a different pin than all other <1995 cars - swap the wires running into pins 2E & 2F. In some cases 2E may not have a wire in it already - so in that case, simply move the wire that is in 2F to 2E by extracting the pin from the connector with a small paper clip.

C.3 Air Conditioning Not Triggering

If your board version is 1.3 or less (On the baseboard, not the core) if after checking settings you find AC does not trigger, you can change Q1 on the baseboard (small black 3 legged device) to a 2N7000 MOSFET (we can supply if needed) to make it more acceptable for your car. Note this is now standard since February 2021. Remove the core by undoing the two retaining nuts and pulling the boards apart carefully. Desolder Q1 and then fit the 2N7000 in the same orientation as marked on the PCB in place of Q1.

C.4 USDM Wiring changes

If your car is originally a USDM car (including, but not limited to, MazdaSpeed vehicles) then you need to cut the wire coming into the 4AF pin on the car side of the ECU plug.

Appendix D | 36-2 and 36-1 Trigger Wheel

If you fit a 36-2 or 36-1 trigger wheel, set the trigger pattern (in Engine Driver -> Trigger options) to the relevant pattern. To obtain sync, you will likely have to reduce the “Sync Start Mult.” and “Sync Loss Mult” to a lower value eg 1.1.

Appendix E | VVT Engine Swap

If you are planning to install an NB or NB2 engine into the NAs engine bay, and keeping the NA wiring (and the 8995 ECU), there are a couple of mods you will need to do - the 8995 ECU fully supports the NB and VVT engine.

A technical article can be found on our website also.
https://motorsport-electronics.co.uk/mazda-mx-5-vvt-swap/

In the Engine bay:

1. Firstly you will need to wire the Crank and Cam sensors from the NB/NB2 engine into the NA’s CAS sensor connector - this allows you to remove the CAS. Use shielded cable for this.
2. You will need to link up the Injectors, TPS and Idle harness to the NA loom - there are plenty of guides on this and the wiring is straightforward.
3. It is recommended to change the alternator to the 89-98 NA (self regulated) type, as that is usually easier than wiring the smart alternator to the ECU - change the alternator pulleys if required, but otherwise, they should bolt in.

Modifying the ECU:

YOU DO NOT NEED TO DO THIS ON REV R1.4 BASEBOARDS AND ABOVE! PLEASE CONTACT US IF YOU ARE UNSURE!

Older ECUs requires its pullup resistors removed, and changed/added externally to support the OEM Cam/Crank sensors:

1. Remove the ME221/442 8995 ECU from the car.
2. Carefully unbolt the core from the baseboard. There are 2 nuts that need to be undone, then carefully prise the core up being sure not to bend any pins.
3. Replace the now visible R1 and R2 resistors with 82Kohm. (These)
    a. NOTE IF YOU PLAN TO RUN a 36-2 CRANK TRIGGER, CHANGE R2 to 22K.
4. Refit the core back into the ECU, and tighten the retaining nuts.

MEITE Settings:

Now ensure you change the settings in the MEITE for the Crank/Cam in the System>Engine Driver to MX5 NB, and cycle power. You should then get a steady RPM when cranking, you may need to change your trigger offset angle to approx 642 (or confirm with timing light/load an NB basemap onto your ECU).

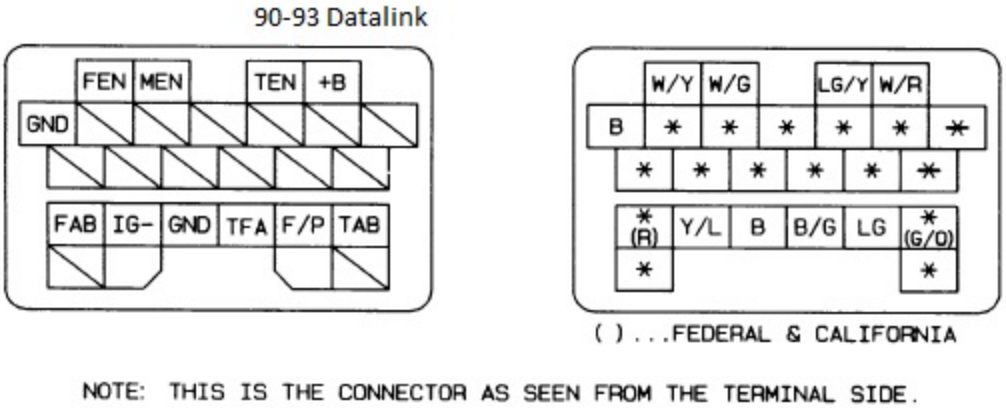
If you don't get a steady RPM, check the Diagnostics tab - both Crank & Cam IRQs should count up when cranking - if one (or both) doesn't, then the signal is not making it to the ECU correctly - check wiring for the one which isn't working.

Tacho Function after Mk2/Mk2.5 engine swap:

The 2001-2005 coil pack usually has 3-pins so to use the stock tacho/rev counter, one solution is to use/source the earlier 4-pin coil pack (one pin being the tacho signal feed).

As standard, this connects to the

- Black/white wire on the instrument cluster (94-95).
- Yellow/Blue wire on the instrument cluster (91-93 1.6)



Alternatively, you can link the 'odd tacho' bridge on the underside of the ECU, as described in appendix C. This reroutes the signal to pin 1F of the ECU which is connected to the "FEN" pin of the diagnostics connector (see diagram above). With ignition off, bridge the FEN pin to the IG- pin in the diagnostics box with a wire. Your rev counter should then function as normal.

Enabling VVT Control:

If you have an NB2 VVT engine, you will also need to run some additional wires to make full use of the VVT system:

1. The connector for the VVT solenoid is a standard 2-pin mini-timer type.
2. Run a 12v, ignition switched supply to the VVT solenoid Pin 1 (from the Purge Valve or injector harness is a safe bet), and then run a wire from the VVT solenoid Pin 2 to where the ECU is in the passenger footwell - connect using the MAC/AUX Port guide above to a spare LS (LS1, LS2 or LS3 are preferred for VVT.)
3. Fit an SB340 Diode across the power and signal wires running to the VVT solenoid, A diagram is shown below.
4. In the I/O Settings in MEITE, be sure to set your chosen LS to 'VVT' in the output settings. You can then tune the VVT control using the settings under the VVT tree item, or simply import the VVT settings and tables from an 0105 VVT basemap.

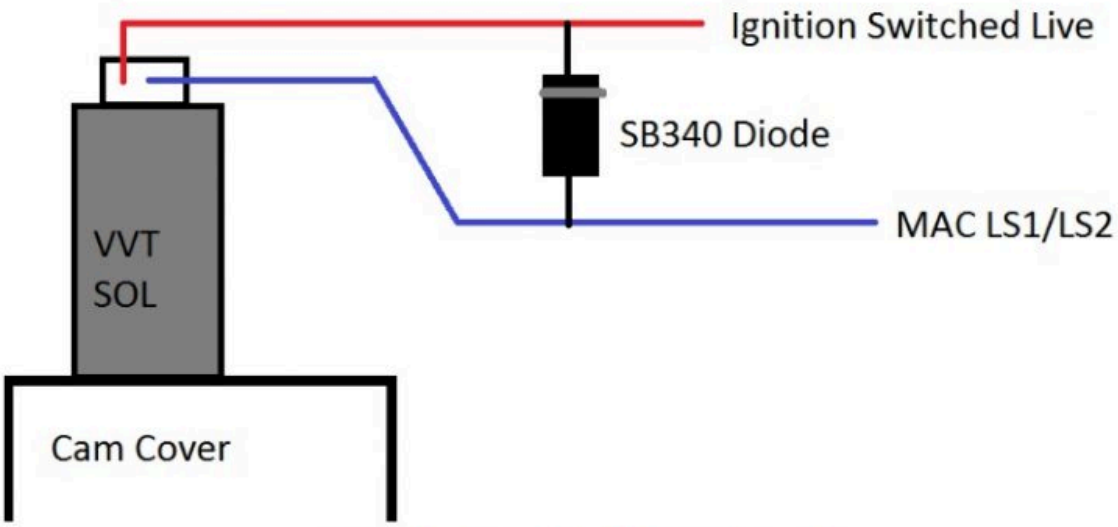


Fig: Wiring of the VVT Solenoid

Appendix E | Fitting COPs

If you plan to run COPs - please see the main ME Online Manual (on the website under support) for details of the pinouts of Toyota & VAG coils. After wiring, use “TEST MODE: Coils” to test for a spark at each COP. Note due to the user wiring being present, we do not supply support for COP installs. The below guide can be given to a suitable auto-electrician if you are not sure how to follow it.

The below section details the end point connections to be made on the car from your chosen coils; use 22AWG at least wire gauge:

Mk1 1.6 and 94-95 1.8:

Ignition module is located on the driver's inner wing.

Power/12V Feed
You can take power for the COPs from the BLUE wire at the ignition module.

Ground
Ground the COPs at the cylinder head using a suitable eyelet.

Trigger for Cylinders 1 & 4
Brown/Yellow wire at the ignitor module.

Trigger for Cylinders 2 & 3
Brown wire at the ignitor module.

For the tachometer to work:
1. follow the “odd-tach” instructions in the manual above.
2. Run a wire from pin 1F to the black/white wire on the instrument cluster.

If you wish to run fully sequential, run the triggers for Cyl 3 + 4 to the AUX port on the ECU, and use Brown/Yellow and Brown from the ignition module as Triggers for 1 + 2. Set the ECU Outputs accordingly. Your tuner can aid with this.

Further information, including on the fitment of a noise suppressing capacitor, can be found in the main online manual.

Appendix F | USB Intermittent communication loss

USB, while usually stable, can be subjected to electrical noise from ignition systems and cause intermittent communications dropouts while tuning.

Please follow the below steps to remedy this.

1. Ensure you are using resistive plugs and leads. Even race plugs that claim to be resistant are sometimes not. Use modern resistive plugs and leads, and swap back after tuning if required.
2. Ensure the ECU is fully cased and grounded to the chassis.
3. Use a premium quality shielded USB cable.
4. Ground the car to the dyno (using a jump lead), and also check with an electrician that the dyno is suitably earthed.
5. Coils packs and ignitors should be properly earthed to the engine block.
6. All electrical grounds on the engine must be in a good state of repair.
7. If using coil-on-plug ignition, it is common practice to install a noise suppressing capacitor. Check for information with the supplier and also in our online manual.

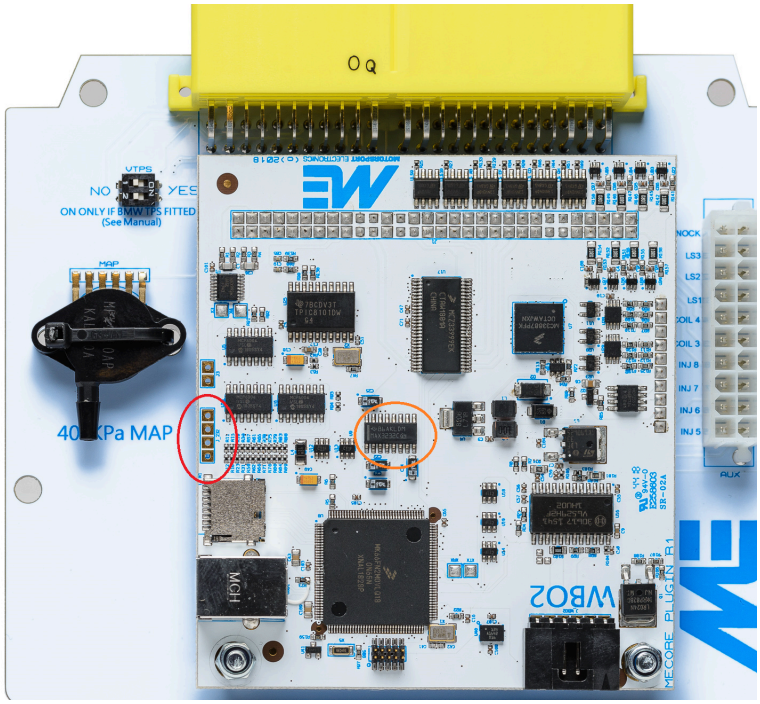
The final solution is to use a USB->RS232 adapter module and run directly with serial.

Connecting Direct RS232 to a GEN2 ME221/442 Core

The previously mentioned points should solve any issue but at a last fallback option, you could connect to the RS232 connector.

The ME core circuit board (the smaller one at the top) has a four pin header near the SD card slot - circled in red.

Check whether the RS232 chip circled in orange is fitted with your revision of ECU.



Use an RS232 Extension cable like the ones that we supply on our website to connect directly to an RS232 Port equipped laptop (or more commonly use an FTDI serial to usb adapter cable if you do not have such a port)

Using a meter to work out which wire goes where in your cable connect as per the below diagram: