

ME221 Engine Management System



MAZDA MX5 01-05

Hardware Installation Manual

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ME221_PNP_MX5_0105
HARDWARE INSTALLATION GUIDE (AUG18)

1 Introduction	4
1.1 Safety First!	4
1.2 Connectivity & Disclaimer	4
1.3 Getting Help & Support	4
2 Initial Board Setup	6
2.1 Board Switch/Jumper Settings	6
Mazda MX-5 01-05	6
2.2 Connected Hardware & Basemaps	6
3 ECU Installation	7
3.1 ECU Handling	7
3.2 Fitting of the ECU	7
4 Additional Sensors & Inputs/Outputs	8
4.1 Mazda MX5 01-05 Sensors	8
4.2 Additional Inputs/Outputs	9
4.2.1 Boost Control	9
4.2.2 Wideband Lambda O2	9
5 Connecting for Tuning	10
5.1 MEITE Tuning Software	10
5.2 Serial/USB Connectivity	10
5.3 Initial Connection	10
6 Pre-Start Setup	11
6.1 Firmware Update	11
6.2 Basemaps and Startup	11
6.3 Sensors and Sense Check	11
6.4 Injectors	11
6.5 Calibrating Base-Offset/Trigger Offset	11
7 First Time Startup	13
Appendix A Connectivity	14

ME221_PNP_MX5_0105
HARDWARE INSTALLATION GUIDE (AUG18)

Appendix B MAC Connector	16
Appendix C Known Issues / Model Specifics	18

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 ME221 Plug-In Engine Management System for the Mazda MX-5 01-05. The ME221 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 ME221, 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

ME221_PNP_MX5_0105
HARDWARE INSTALLATION GUIDE (AUG18)

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 PnP PCB into your vehicle, various checks must be carried out.

2.1 Board Switch/Jumper Settings

Please note that some ME221 PnP ECUs require jumper settings to facilitate different models or functionality.

Mazda MX-5 01-05

You can select to use either the normal Inlet Air Temp Sensor connector, or alternatively, the power steering switch connector for the sensors connection (as per Flyin Miata Kits). For most cases, set the IAT_SELECT jumper to NORM.

2.2 Connected Hardware & Basemaps

The ME221 (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 ME221 Engine Management System.

3.1 ECU Handling

You should always handle both the stock ECU (and its internals) as well as the ME221 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 ME221 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 ME221 PnP 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.

4 Additional Sensors & Inputs/Outputs

The ME221 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 Mazda MX5 01-05 Sensors

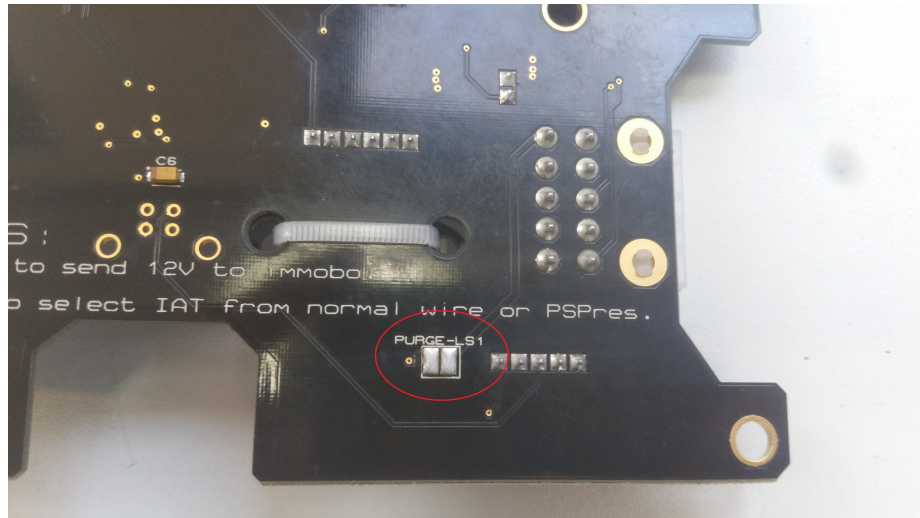
This version of the ME221 uses an onboard 21psi MAP sensor for measuring manifold pressure. Use the included 3mm vacuum hose to run from the sensor to the inlet manifold. This must be connected to a point after the throttle (i.e. between the engine's inlet ports and the throttle plate). The standard inlet has takeoffs you can tee into for this purpose. You should drill a 10mm hole in the ECU casing to allow the pipe to pass through.

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

4.2.1 Boost Control

For the MX5 01-05 PnP, you can set the boost control signals to be brought to the two wires that run the OEM 'purge solenoid' under the bonnet (Pin 3C on the ECU). To do this, solder bridge the 'PURGE-LS1' Jumper on the underside of the PCB:



Note that the MAC (Motorsport Auxiliary Connector) Low Side Driver 1 ('AUX LS1') is now used for boost control in this case, and as such should not be used via the white MAC port.

Use TEST MODE: FAST TOGGLES on the MAC LS1 line to confirm the valve buzzes.

Simply extend the purge valve wires and replace this solenoid with a standard MAC/3 Port Boost Control solenoid plumbed into your turbo housing -> wastegate vacuum line, and then use the boost control settings in the MEITE to configure closed or open loop boost control. The wiring polarity does not generally matter.

A boost control kit is also available from the ME online store.

4.2.2 Wideband Lambda O2

If you wish to use wideband O2, use an external controller that outputs a 0-5v signal. Connect this either to the original Lambda/O2 signal line going into the OEM connector (Pin 4W on the ECU), or into one of the unused analog channels, and be sure to select the WBO2 signal source in the Input configuration driver from within the MEITE, and also set its HRT table correctly to match your chosen controller's output. Most give 0v(RAW 0)=10:1, 5v(RAW 65535)=20:1 AFR.

5 Connecting for Tuning

5.1 MEITE Tuning Software

ME221/ME442 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 Serial/USB Connectivity

If using an ME221 based PnP, you will likely be using a serial connection to connect to the laptop/PC, and we advise the use of a genuine FTDI Serial->USB adapter if your laptop does not feature a serial connection. Always ensure you download the latest drivers from the FTDI website - which are also listed under support on our website.

5.3 Initial Connection

Once you have installed MEITE, and the USB->Serial 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 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). If they do not, refer ME221 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 ME221 Software guide - which details specifics of the ME221s 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).

ME221_PNP_MX5_0105
HARDWARE INSTALLATION GUIDE (AUG18)

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 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 [ME221 Tuning Manual](#) for more on idle tuning).

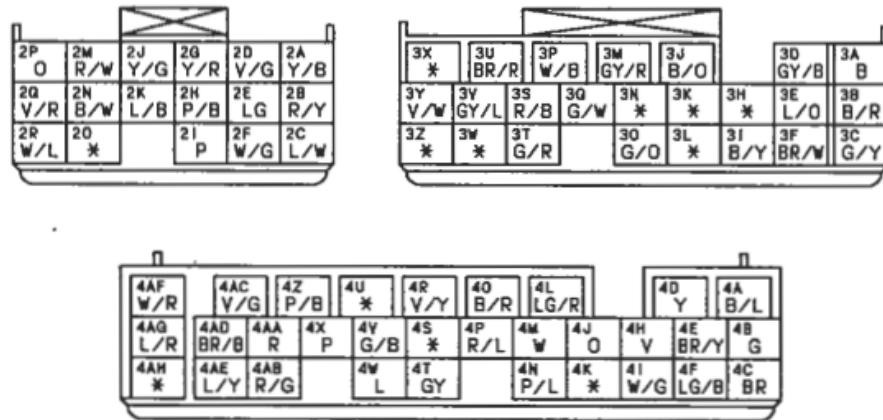
Remember that ultimately an engine is a simple mechanical system - it needs, air, fuel, compression and a spark (at the right time, usually around 10° BTDC at idle for most common engines). Check for these basics and you can narrow down the issue. If still in doubt, give us call, e-mail and we will help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

ME221_PNP_MX5_0105
HARDWARE INSTALLATION GUIDE (AUG18)

Appendix A | Connectivity



Covers NB2 2001-2005 1.6 / 1.8 & MSM

ME221 I/O Pin	FM Default Function	OEM Header Pin
Injector A	Injector A	2A
Injector B	Injector B	2D
Injector C	Injector C	2G
Injector D	Injector D	2J
Coil A	Coil A (Inverted)	3F
Coil B	Coil B (Inverted)	3i
LS1	Alternator Driver	3M
LS2	VVT (or BOOST on MSM) See Note (3).	4R
LS3	Idle Valve	2Q
TACHO	Tacho	3O
AuxIN_HS2	Flex Fuel Signal	4X (OEM MAF Signal)
MAC_LS1	Boost Control	4E (via MOD)
MAC_LS2	--	MAC Pin 4
AuxIn HS 1 Pin	VSS	3T
Aux Out HS Pin	--	--
EXT_OUT1	Fuel Pump Control	2M

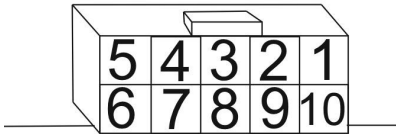
ME221_PNP_MX5_0105
HARDWARE INSTALLATION GUIDE (AUG18)

EXT_OUT2	Check Engine Light	2R
EXT_OUT3	Battery Light	3U
EXT_OUT4	Cooling Fan 1 (Primary)	2B
EXT_OUT5	Cooling Fan 2 (AC)	2C
EXT_OUT6	AC Clutch Drive	2K
EXT_OUT7	VICS	2N
EXT_OUT8	--	--
EXT_IN1	Clutch Switch	4i
EXT_IN2	--	--
EXT_IN3	AC Switch	4F
EXT_IN4	--	--
EXT_IN5	--	--
MAC_DIG_IN1	Optional Switch Input	MAC Pin 6
MAC_DIG_IN2	Optional Switch Input	MAC Pin 8
MAC_DIG_IN3	Optional Switch Input	MAC Pin 10
ANALOG		
MAP	Onboard 21PSI	-- (3mm Hose Barb)
TPS	TPS Signal (TPS RAW)	4V (5Vref is on 4L)
IAT	IAT RAW	4N or 4C (Note 2)
CLT	CLT RAW	4P
O2	Lambda - See Note (1)	4W
Spare 1 (ADC Spare 1)	Spare Analogue Input	MAC Pin 9
Knock	Integrated Knock Controller	4M

Appendix B | MAC Connector

On the baseboard is the 10 Way MAC PORT (pictured below) that allows connecting of other sensors, switches, as well as 2x Low Side Drivers that can drive up to 6A each. These spare inputs/outputs can be configured to any function in the ME221's input/output settings drivers - though please refer to the ME221 software manual available from our website (www.motorsport-electronics.co.uk) as this guide refers only to the hardware connectivity.

The AUX/MAC PORT pinout is shown below, and is standard across all our PNP ECU range:



Note the above is of the Connector on the PCB 'looking at the pins'.

Pin #	Function/Notes
1	GROUND (ADC Referenced and LOW Current Ground Return)
2	5V Reference :: 50mA MAX
3	12V Power Out (On with Ignition, 2A Max)
4	MAC-LS2 :: Low Side Driver - 6A Max
5	MAC-LS1 :: Low Side Driver - 6A Max (useable with firmware version >2.1 only)
6	MAC-Digital Input 1 :: Pulled high to 5V. Use 10K resistor in series with switch to GROUND.
7	NOT CONNECTED
8	AUX/MAC-Digital Input 2 :: Pulled high to 5V. Use 10K resistor in series with switch to GROUND
9	AUX/MAC-Analog In :: Protected 0-5V Analog Input.
10	AUX/MAC-Digital Input 3 :: Pulled high to 5V. Use 10K resistor in series with switch to GROUND

AUX/MAC PORT CONTINUED...

Please note the following:

1. The Low Side drivers can handle up to 6A each continuous.
2. All Digital Switches are pulled high to 5V. They require a switch to ground in order to work. They also require a 10K resistor in series to help protect the port from accidental over-voltage/noise.
3. The 5V output should have no more than 50mA current draw - it is generally used as a low current VREF line only. It is ON with the ignition.
4. The 12V output should have no more than 2A current draw - it is ON with the ignition.
5. The AUX_ADC line is designed for 0-5V, and is over and under voltage protected.

The wiring connector part numbers are shown below:

-Connector: Molex **39-01-2100**

-Pins: Molex **39-00-0078 (You will need 9 of these)**

A good source is RS Online for the parts if you want to make your own connector loom, however we offer a complete, pre-crimped AUX PORT connection and wiring kit in the online store, part number #ACC-221APK.

