

MoTeC

M142 MAZDA MAZDASPEED3 KIT



The MoTeC M142 MAZDA MAZDASPEED3 kit provides a complete replacement for the factory Mazda ECU utilizing the existing vehicle wiring and sensors. Using an integration patch harness and MoTeC M142 ECU the kit delivers fully programmable engine management to the platform and maintains stock vehicle systems functionality. The M1 ECU is supplied with firmware preloaded and is based on MoTeC's GPR-DI package with additional features unique to the 2007 – 2013 Mazda Mazdaspeed3 and motorsport demands.

The kit comprises of the M142 ECU, "Plug-N-Play" patch harness, MoTeC LTC and LSU 4.9 lambda sensor.

When installed, this kit gives the user total engine tuning control while supporting OEM ECU features, including:

- Push button start
- Air conditioner control
- PWM coolant fan control
- Fuel lift pump low/high speed control
- Cruise control
- Alternator control

Note: EGR is not supported

The supplied start file contains all the calibrations and settings for the direct fuel injection system, ignition coils, throttle servo, variable camshaft, alternator and fuel lift pump control. Settings for fuel delivery, ignition timing and camshaft phasing have been calibrated to a factory vehicle equipped with factory sensors.

This saves a significant amount of time by shortcutting the setup process. Users can begin tuning to their desired power and modifications right away with the assurance of a safe base tune.

Included are many ancillary features commonly found on race cars such as anti-lag, rolling launch, driver switches, gearbox control, knock control, intercooler spray-bars, launch control, coolant pumps, and traction control.

The product fully integrates with other MoTeC devices, providing pre-defined CAN messaging for all current Displays/Loggers, LTC's, E888, GPS, BR2, PDMs and SLMs.

► KIT CONTENTS (MAZDASPEED3 07-13 KIT)

Hardware

- **M142** – M142 ECU
- **M142 MAZDASPEED 3 PATCH LOOM** – Adapter loom
- **M LTC** – LTC LSU 4.9
- **M 0258 001** – Bosch Motorsport LSU 4.9 sensor
- **M H 3800-AD111A** – Gen1 adapter

OR

- **M H 3800-AD111B** – Gen2 adapter

Licenses

- **23459** – M1 LIC – MOTEC USA MAZDASPEED3

► FEATURES

- Configurable Launch Control with anti-lag containing tables for engine speed, throttle limit, boost aim and closed loop ignition timing control as well Spool Mode to optimize turbocharger response at the starting line.
- Pre-stage setting for Launch Control.
- Traction Control. Closed loop system featuring the ability to use alternate wheel speed inputs for differential ground speed control. Ability to control engine torque using ignition timing, fuel cut, ignition cut and drive by wire throttle using a flexible user-configurable strategy.
- Pre-configured OE coolant fan control.
- Pre-configured OE alternator control.
- Pre-configured OE fuel lift pump control.
- Pre-configured air conditioner control.
- Pre-configured Gear detection with simplified Gear Estimate table.
- Gearbox shift support with ignition cut, fuel cut, throttle blip and engine speed matching in forward gears.
- Transmission pump output with differential temperature threshold and hysteresis control.
- Pre-configured Drive by Wire throttle servo control.
- Pre-configured Throttle Pedal sensor with translation table based on driver switch.
- Configurable driver switches for various systems.
- Vehicle speed limiting (pit speed control).
- Mode switching via factory cruise control dial using the engine speed read out as the mode indicator.
- Configurable pulsed tachometer output.
- Pre-configured vehicle speed measurement using wheel speed sensors.
- Downshift Rev Matching feature utilizing factory sensors and standard 6 speed manual transmission.
- Adjustable fuel economy gauge calibration
- Pre-configured No Lift Shift ignition timing and cut based strategy for the stock 6 speed manual gearbox.
- Differential pump output with differential temperature threshold and hysteresis control.
- Pre-configured warning system that activate the factory MIL indicator on the dash.
- Test settings for most outputs, including injection and ignition outputs for easier setup.
- Exhaust Pressure based engine efficiency compensation table.
- Data acquisition of numerous factory sensors on the factory CAN Bus. Including Longitudinal Acceleration, Yaw Rate, Steering Angle, Wheel Speeds, and Brake Pressure.
- Pre-configured calibrations for Original Equipment sensors.
- Pre-configured reference mode for engine synchronization.
- Pre-configured physical settings for engine displacement, fuel density, stoichiometric ratio, fuel pressure and injector characterization which allows for simplified engine start-up prior to tuning.
- Pre-configured settings for ethanol fuel density, ethanol stoichiometric ratio to allow fuel blending ("flex fuel").
- Powerful Efficiency Model with configurable load axis that allows for flexibility in Engine Efficiency mapping for a wide array of modifications from single throttle body with intake plenum to boost over trumpets.
- Pre-configured Engine Efficiency map that allows for quick and easy tuning.
- Pre-configured secondary (port injector) fuel control with tunable balance table. **Note:** Only saturated (high-ohm) secondary injectors are supported.
- Optional Flex Fuel using an ethanol composition sensor allows for ethanol composition blending including integration of the Fuel Temperature reading provided by the sensor.
- Optional Water/Methanol injection system with fail-safes to provide additional fueling.
- Pre-configured throttle rate of change based transient fuel for simplified transient fuel tuning.
- Engine Load Average channel with tables for engine speed limit, ignition trim, fuel mixture aim and throttle limit.
- Pre-configured ignition output and coil settings.
- Pre-configured individual cylinder knock system with multiple knock level control modes, non-linear decay, ability to mask out noise on initial knock detection (to help filter noise) and a retained knock level that can be used to apply a global knock trim to compensate for fuel quality.
- Pre-configured camshaft control of inlet cam.
- Pre-configured engine start fuel, idle and ignition settings.
- Pre-configured Closed Loop Idle control systems using ignition and drive by wire actuation, including active adjustments for coolant and air conditioning activation.
- Pre-configured boost control via factory wastegate solenoid and factory turbocharger.
- Boost control system with targets based on Engine Speed, Gear, Flex Content, Throttle Position, Driver Mode Switch, Coolant Temperature, Engine Load Average, Exhaust Temperature, Race Time, Inlet Air Temperature and Vehicle Speed.
- Optionally configurable turbocharger bypass control.
- Intercooler temperature and spray control.
- Supports nitrous with two activation stages and additional fuel pumps, bottle heater control and pressure sensor.
- Race time system with tables for ignition trim, fuel mixture aim and throttle limit.
- Engine run time total for engine hour logging.
- GPS acquisition and logging via CAN or RS232.
- Race time system with tables for ignition trim, fuel mixture aim and throttle limit.
- Engine run time total for engine hour logging.

► MoTeC FEATURES

- Support of MoTeC devices: E8XX, PDM, SLM.
- ECU CAN Receive from other MoTeC devices.
- ECU CAN Transmit of most common channels using standard MoTeC CAN templates.
- Configurable security for multiple users with differing access options.
- Support for the RaceGrade IMU.
- Turbocharger Speed, Inlet and Outlet Temperature.
- Wastegate Pressure and Position.
- Wheel Speed (preconfigured).

► OPERATION

Reference Mode

The M1 Reference Mode in this Package is locked to the Mazda Mazdaspeed3 pattern.

Generation

Both generations of the Mazda Mazdaspeed3 platform are supported:

- 07 – 09 Gen1
- 10 – 13 Gen2

The vehicle generation must be indicated in Mazda Vehicle for proper vehicle communications. A start file is available for each generation. If the start file on your ECU does not match your vehicle generation, email ecusupport@motec.com.

ECU Power

The M1 ECU will be powered only when the ignition switch is turned on. The M1 ECU utilizes a power on hold via the ECU Power Relay using the factory Main relay when M1 Tune is connected to the ECU and for a short time after the ignition switch is turned off.

Engine Start

The engine is started via the key or push button depending on vehicle generation and trim. Both methods are supported and require no calibration changes to function. The Starter relay in the Mazda section is held on by the M1 ECU until the engine is off and Mazda State Immobilizer is OK. **The Mazda Immobilizer function can be disabled under Mazda State.**

Staged Injection (Port Injectors)

An 8 pin DTM connector is included that contains 12v power and outputs to run saturated port injectors. These resources must be assigned to the Fuel Cylinder N Secondary Output Resource after being installed. Fuel Injector Secondary calibration must also be done.

Spares

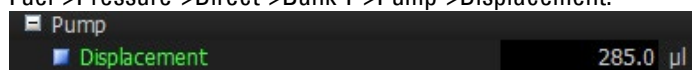
The integration harness includes a 12 pin DTM where additional resources can be pinned.

Adapter Harness

While a single "Plug and Play" harness is supplied for both generations of the vehicle, the generation specific (Gen1 or Gen2) adapter harness must be requested when the kit is purchased to join the "FACTORY" and "M1" connectors in the Plug and Play harness. Failure to join these connectors may result in a no-start condition. **Failure to use the matching generation specific adapter may result in damage to components in the vehicle.**

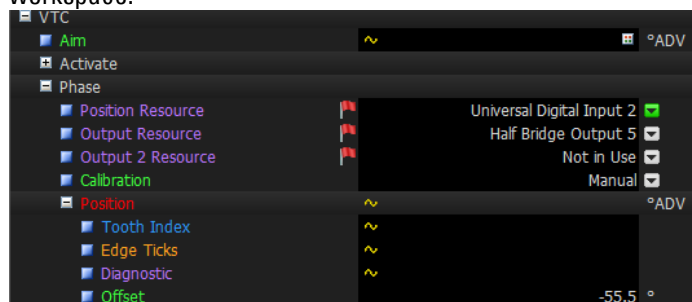
DI Pump Control

The start files are setup for the factory DI pump internals. If using upgraded internals such as the KMD internals, the Displacement setting in the M1 ECU should be updated. The KMD internals create a pump displacement of **425 microliters**. This setting can be found on the "DI" workspace under Fuel->Pressure->Direct->Bank 1->Pump->Displacement.



Camshaft Control

If using aftermarket camshafts, particularly on the intake cam, the VTC Phase Position Offset may need to be updated. The Output Resource should be unassigned, then ECU reset and the VTC Phase Position Offset adjusted until VTC Phase Position reads approximately 0 degrees. The Output Resource can then be reassigned and VTC phaser control will resume after the ECU is reset. These settings can be viewed under "All Calibrate" workspace.



► M142 PINOUT

M142 Connector A – 34 Way

A1	AT5	Analogue Temperature Input 5	MAF IAT
A2	AT6	Analogue Temperature Input 6	Cruise Control Switch
A3	AV15	Analogue Voltage Input 15	Spares AV15
A4	AV16	Analogue Voltage Input 16	Spares AV16
A5	AV17	Analogue Voltage Input 17	Spares AV17
A6	INJ_D1A_NEG	INJ_D1A_NEG	Injector 1
A7	INJ_D1A_POS	INJ_DA1_POS	Injector 1/4 Power
A8	INJ_D1B_POS	INJ_D1B_POS	-
A9	INJ_D1B_NEG	INJ_D1B_NEG	Injector 4
A10	SEN_5V0_C	Sensor 5.0V C	“M1” 5V
A11	LA_NB1	Lambda Narrow Input 1	-
A12	LA_NB2	Lambda Narrow Input 2	-
A13	KNOCK3	Knock Input 3	-
A14	KNOCK4	Knock Input 4	-
A15	DIG2	Digital Input 2	Spares DIG2
A16	DIG3	Digital Input 3	Neutral Switch
A17	DIG4	Digital Input 4	Brake Switch
A18	SEN_5V0_C	Sensor 5.0V C	Spares 5V
A19	SEN_5V0_B	Sensor 5.0V B	-
A20	LIN	LIN Bus	-
A21	RS232_RX	RS232 Receive	-
A22	RS232_TX	RS232 Transmit	-
A23	DIG1	Digital Input 1	Clutch Pedal
A24	BAT_NEG	Battery Negative	Ground
A25	BAT_NEG	Battery Negative	Ground
A26	SEN_0V_C	Sensor 0V C	“M1” 0V
A27	SEN_0V_C	Sensor 0V C	Spares 0V
A28	CAN3_HI	CAN Bus 3 High	LTC CAN, Spares CAN
A29	CAN3_LO	CAN Bus 3 Low	LTC CAN, Spares CAN
A30	CAN2_HI	CAN Bus 2 High	-
A31	CAN2_LO	CAN Bus 2 Low	-
A32	BAT_NEG	Battery Negative	Ground
A33	SEN_0V_B	Sensor 0V B	-
A34	SEN_0V_A	Sensor 0V A	-

► M142 PINOUT

M142 Connector B – 26 Way

B1	HB9	Half Bridge Output 9	Wastegate Control Solenoid
B2	HB10	Half Bridge Output 10	Variable Swirl Solenoid
B3	UDIG8	Universal Digital Input 8	Throttle Pedal Tracking
B4	UDIG9	Universal Digital Input 9	-
B5	UDIG10	Universal Digital Input 10	-
B6	UDIG11	Universal Digital Input 11	-
B7	UDIG12	Universal Digital Input 12	Variable Swirl Shutter Valve Switch
B8	INJ_LS5	Low Side Injector 5	Start Relay
B9	INJ_LS3	Low Side Injector 3	Port Injection - Injector 3
B10	AV9	Analogue Voltage Input 9	-
B11	AV10	Analogue Voltage Input 10	-
B12	AV11	Analogue Voltage Input 11	-
B13	BAT_POS	Battery Positive	Battery Positive
B14	INJ_LS6	Low Side Injector 6	Fuel Pump Relay
B15	INJ_LS4	Low Side Injector 4	Port Injection - Injector 4
B16	AV12	Analogue Voltage Input 12	-
B17	AV13	Analogue Voltage Input 13	-
B18	AV14	Analogue Voltage Input 14	-
B19	BAT_POS	Battery Positive	Battery Positive
B20	HB7	Half Bridge Output 7	Fuel Injector Relay (Gen1)
B21	HB8	Half Bridge Output 8	Spares HB8
B22	INJ_D2A_NEG	INJ_D2A_NEG	Injector 2
B23	INJ_D2A_POS	INJ_D2A_POS	Injector 2/3 Power
B24	INJ_D2B_POS	INJ_D2B_POS	-
B25	INJ_D2B_NEG	INJ_D2B_NEG	Injector 3
B26	SEN_5V_A	Sensor 5.0V A	-

► M142 PINOUT

M142 Connector C – 34 Way

C1	HB2	Half Bridge Output 2	Throttle Servo
C2	SEN_5V_A	Sensor 5.0V A	Sensor 5.0V A
C3	IGN1	Low Side Ignition 1	Coil 1
C4	IGN2	Low Side Ignition 2	Coil 2
C5	IGN3	Low Side Ignition 3	Coil 3
C6	IGN4	Low Side Ignition 4	Coil 4
C7	IGN5	Low Side Ignition 5	A/C Relay
C8	IGN6	Low Side Ignition 6	Fuel Pump Speed Relay
C9	SEN_5V_B	Sensor 5.0V B	Sensor 5.0V B
C10	NEG1	Battery Negative	Ground
C11	NEG2	Battery Negative	Ground
C12	IGN7	Low Side Ignition 7	Cooling Fan Control
C13	IGN8	Low Side Ignition 8	Main Relay
C14	AV1	Analogue Voltage Input 1	Throttle Pedal Main
C15	AV2	Analogue Voltage Input 2	MAF
C16	AV3	Analogue Voltage Input 3	DI Rail Fuel Pressure
C17	AV4	Analogue Voltage Input 4	Inlet Manifold Pressure
C18	HB1	Half Bridge Output 1	Throttle Servo
C19	INJ_D3A_POS	INJ_D3A_POS	-
C20	INJ_D3B_POS	INJ_D3B_POS	-
C21	INJ_D4A_POS	INJ_D4A_POS	-
C22	INJ_D4B_POS	INJ_D4B_POS	-
C23	INJ_LS1	Low Side Injector 1	Port Injection - Injector 1
C24	INJ_LS2	Low Side Injector 2	Port Injection - Injector 2
C25	AV5	Analogue Voltage Input 5	Throttle Position Main
C26	BAT_POS	Battery Positive	Battery Positive
C27	INJ_D3A_NEG	INJ_D3A_NEG	-
C28	INJ_D3B_NEG	INJ_D3B_NEG	-
C29	INJ_D4A_NEG	INJ_D4A_NEG	-
C30	INJ_D4B_NEG	INJ_D4B_NEG	-
C31	HB3	Half Bridge Output 3	HPFP
C32	HB4	Half Bridge Output 4	HPFP
C33	HB5	Half Bridge Output 5	Inlet Camshaft Control (VTC)
C34	HB6	Half Bridge Output 6	Alternator Control

► M142 PINOUT

M142 Connector D – 26 Way

D1	UDIG1	Universal Digital Input 1	Crankshaft Position
D2	UDIG2	Universal Digital Input 2	Inlet Camshaft Position (VTC)
D3	AT1	Analogue Temperature Input 1	Inlet Air Temperature (BAT)
D4	AT2	Analogue Temperature Input 2	-
D5	AT3	Analogue Temperature Input 3	-
D6	AT4	Analogue Temperature Input 4	-
D7	KNOCK1	Knock Input 1	Knock Sensor
D8	UDIG3	Universal Digital Input 3	AC Low/High Pressure Switch (Gen1)
D9	UDIG4	Universal Digital Input 4	-
D10	UDIG5	Universal Digital Input 5	-
D11	UDIG6	Universal Digital Input 6	-
D12	BAT_BAK	Battery Backup	-
D13	KNOCK2	Knock Input 2	Knock Sensor
D14	UDIG7	Universal Digital Input 7	Engine Run Switch (IGN)
D15	SEN_0V_A	Sensor 0V A	Sensor 0V A
D16	SEN_0V_B	Sensor 0V B	Sensor 0V B
D17	CAN_HI	CAN Bus 1 High	Mazda CAN
D18	CAN_LO	CAN Bus 1 Low	Mazda CAN
D19	SEN_6V3	Sensor 6.3V	-
D20	AV6	Analogue Voltage Input 6	Throttle Position Tracking
D21	AV7	Analogue Voltage Input 7	Coolant Temperature
D22	AV8	Analogue Voltage Input 8	-
D23	ETH_TX+	Ethernet Transmit+	WHITE/ORANGE
D24	ETH_TX-	Ethernet Transmit-	ORANGE
D25	ETH_RX+	Ethernet Receive+	WHITE/GREEN
D26	ETH_RX-	Ethernet Receive-	GREEN

► M142 PINOUT

M142 DTM-12S (SPARES)

Pin	Function
1	Spares Ground
2	Spares 0V C Supply
3	Spares CAN3 Low
4	Spares AV17
5	Spares AV16
6	Spares AV15
7	Spares AT3
8	Spares DIG2
9	Spares CAN3 High
10	Spares 5 Volt 'C' Supply
11	Spares HB8
12	Spares Switched 12vc Power (From FI Relay)

M142 DTM-8S (PORT INJECTION)

Pin	Function
1	Port Injector 1 (Low Side Injector 1)
2	Port Injector 2 (Low Side Injector 2)
3	Port Injector 3 (Low Side Injector 3)
4	Port Injector 4 (Low Side Injector 4)
5	Port Injector Power (From FI Relay)
6	Port Injector Power (From FI Relay)
7	Port Injector Power (From FI Relay)
8	Port Injector Power (From FI Relay)

M142 DTM-4S (Lambda To CAN)

Pin	Function
1	Ground
2	CAN3 Low
3	CAN3 High
4	Switched 12v Power (From FI Relay)