

# MF4M

## Engine Control Unit



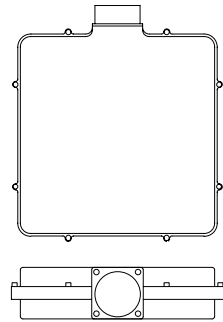
### Description

The MF4M ECU is a versatile engine control unit designed for universal installation on 1, 2, 3, 4, 5, 6 and 8 cylinder engines. This ECU is user configurable for most common crank signal patterns with a single tooth on the cam.

All ignition, injection and sensor electronics are integrated in a single box, with no need for additional external devices or power stage electronics.

The system uses a set of user definable engine maps and constants which are used to control the actuators based upon specific sensor inputs. All the lookup maps use linear interpolation between user definable breakpoints.

The ECU uses a single 32 bit microprocessor. All analogue to digital conversion is 10 bit resolution. The system firmware is stored in flash EEPROM and the calibrations stored in EEPROM ensuring that the unit is "sealed for life".



### Technical Data

#### Mechanical characteristics

Overall dimensions (approx.) ..... 158x147x41 mm  
Weight (approx.) ..... 0.5 kg  
Container ..... machined aluminium  
Connector ..... 6020 22 55 pin  
Operating temperature range ..... -30 to +70 °C  
Power supply ..... 8 to 16 V

#### Analogue inputs

Voltage  
No. .... 6  
range ..... 0 to 5 V  
typical uses ..... throttle position  
..... air pressure  
..... barometric pressure  
..... fuel pressure  
..... oil pressure  
..... gear position

Temperature  
No. .... 3  
type ..... NTC  
typical uses ..... coolant  
..... fuel  
..... air

Internal temperature NTC ..... 1  
Injector power supply sensing ..... 1  
Thermocouple  
No. .... 1  
type ..... K type

Lambda  
No. .... 1  
type ..... ON/OFF

#### Digital inputs

Speed pick-ups  
..... crankshaft, magnetic  
..... camshaft, magnetic or Hall Effect  
..... wheel speed, magnetic or Hall Effect  
MFIO (Multi-Function I/O) ..... 5  
Knock ..... 1

#### Outputs

Injector Drivers  
No. .... 8  
type ..... ON/OFF  
max. current ..... 3 A  
clamp ..... 60 V

Ignition drivers  
No. .... 4  
type ..... inductive  
max. charge current ..... 12 A

MFIO drivers  
No. .... 5  
type ..... ON/OFF  
max. current ..... 3 A

#### Communications

CAN line ..... 1  
Serial RS232 line ..... 1

#### Applications Software

Fully configurable 1,2,3,4,5,6,8 cylinder  
normally aspirated or pressure charged

### Ordering information

Part No.	Description	Order Code
MF4M	Engine Control Unit	83814076000

For further details please contact

MM Competition Systems Ltd  
Unit 3, Old Station Business Park,  
Compton, Berkshire,  
RG20 6NE  
England

Tel: +44 (0)8707 444666  
Fax: +44 (0)8707 444888  
www.mmcompsys.com  
mail@mmcompsys.com

## Features

- Sequential or semi-sequential fuel injection for 1,2,3,4,5, 6 and 8 cylinder applications
- Variable phase fuel injection
- Double bank fuel injection for up to 4 cylinder applications
- Integral inductive drivers for plug top or wasted spark distributorless ignition coils.
- Multi function input / output drivers
- Turbo wastegate, anti-lag control
- CAN communications suitable for Magneti Marelli data acquisition
- Gear change algorithm
- Launch control

---

## Fuel Control

For normally aspirated engines, the MF4M uses engine speed and throttle position as primary inputs to determine fuel injection quantity. Pressure charged engines use engine speed, throttle position and inlet air pressure as primary inputs.

The injection quantity may be corrected for:

- Manifold air pressure (or air box pressure)
- Throttle position (pressure charged variant)
- Barometric air pressure
- Fuel pressure
- Air temperature
- Coolant temperature
- Fuel temperature
- Lambda - either ON/OFF
- Battery voltage
- Individual cylinder
- Number of crankshaft revolutions from engine start

## Fuelling system notes

For up to four cylinder applications it is possible to split the quantity of fuel injected between two injector banks allowing an improved compromise between engine torque and throttle response. For V-engines, it is possible to correct the injection quantity for each bank of the engine.

Sequential fuel injection is applied to all injectors ensuring optimum torque and fuel consumption at all times.

The start of each injection pulse may be optimised to a particular point in the cylinder 4-stroke cycle; the optimised point may vary with engine speed and be different for each bank of injectors.

Both positive and negative throttle transient add or subtract fuel quantity to modify the injection time appropriately. These are corrected by engine speed, throttle position and coolant temperature. Closed throttle fuel cut off may be used.

Fuel consumption is continually calculated and available on the CAN data stream allowing accurate fuelling strategy / consumption prediction.

---

## Multi-function Input / Output Drivers

The multi function auxiliary input / output drivers are fully configurable by the user, for activation during any defined input or output condition.

---

## Rev Limiters

The in built rev limiter can be set at different levels depending upon gear position for ignition, injection or both. The rev limiter is modified by a switch input for pit lane speed.

---

## Turbo Waste-gate Driver

A Pulse Width Modulated signal is used to control one or two turbo waste-gate valves. This signal is controlled as a function of engine speed and inlet manifold air pressure.

The system also provides a PWM signal control for a contra pressure valve to work in conjunction with the waste gate valve.

---

## Anti Lag

For turbo vehicles, the system provides post combustion control for closed throttle turbo anti lag. It is also possible to operate an exhaust air valve.

---

## Ignition Control

Normally aspirated engines use engine speed and throttle position as primary inputs to determine spark advance, whilst pressure charged engines use engine speed, throttle position and inlet air pressure as primary inputs.

The spark advance may be corrected for

- Barometric pressure
- Air temperature
- Coolant temperature
- Individual cylinder
- Cockpit mounted trimmer
- Ignition coil dwell uses battery voltage and ambient temperature to determine charge time.

---

## Gear Change Algorithm

The system provides correction to fuel quantity, spark advance and ignition coil activation during a detected gear change. Gear change indicator lamps may be illuminated at and above engine speed thresholds.

---

## Launch Control

For turbo vehicles, the system provides post combustion control and driver selectable engine rev limiter.

---

## Knock Control

Knock detection with adaptive ignition timing control is provided. Magneti Marelli can offer to define and trim this strategy.

---

## Other Functions

The ECU provides a fuel pump relay output, rev counter and a configurable alarm lamp output.

On board logging of certain engine parameters enables engine builders to easily assess engine life.

---

## CAN Communication

A user definable data stream of engine parameters is continuously transmitted via CAN, which interfaces directly with the Magneti Marelli data acquisition product range.

The MF4M can directly set the display options and alarm conditions that control a Magneti Marelli dashboard.

---

## System Calibration

Calibrations for fuel quantity, fuel injection phasing, fuel injection bank split, spark advance and waste-gate duty cycle can be interactively implemented via a computer (PC) keyboard. Alternatively, the corrections may be stored in real time to the ECU as each individual map point is derived, using a potentiometer bank linked to a PC.

The calibrations can be modified with an editor program which uses a combination of graphical and text displays, allowing tuning of all system features. The calibrations can be downloaded to the MF4M EEPROM.