

Metatron[®]

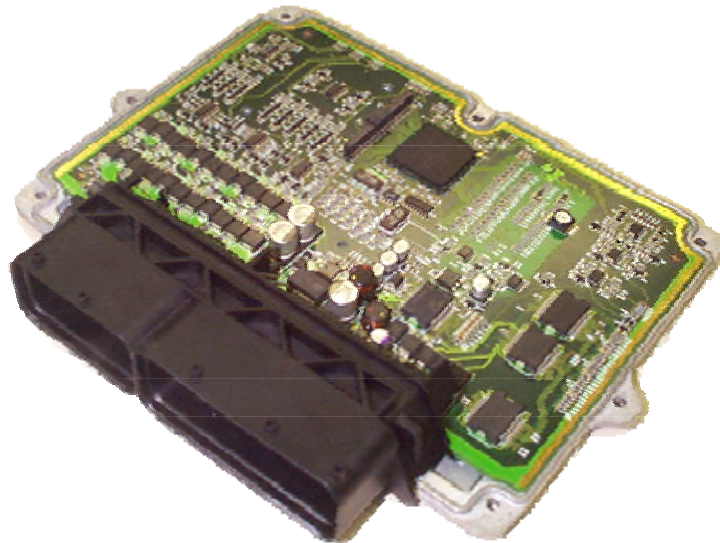
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METAFUEL 3

PRODUCT SPECIFICATION



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1. PRODUCT DESCRIPTION

1.1 General Information

The ECU Metafuel 3 (MF3) is an engine control unit dedicated mainly to CNG (compressed natural gas) fuelled turbocharged engines with a maximum of six cylinders to be used for commercial/industrial vehicles (LD and HD).

A brief summary of general characteristics is given below.

1.1.1 ECU main hardware features

- Injectors management with “Peak & Hold” driving for engines up to six cylinders and up to two injectors for cylinder (max peak current = 6A, max hold current = 2A)
- Ignition management with direct control of “pencil coil” type for engines up to six cylinders (max collector current = 9A)
- Waste gate management for turbocharger control
- Electronic throttle (ETC) direct control
- Pre and post catalyst Lambda probes (on-off type) and heaters management
- The ECU is suitable for 24 volt applications and compliant to ECE R110 and R10 regulation
- High speed CAN (up to 500 Kbit/s)
- Accelerator pedal management:
 - Analogue signals coming from double trace potentiometer
 - PWM signals
- Main engine information repetition (PWM signals) for dashboard
- K line for DATASET download and interface with the diagnostic tool (KW2000 protocol)

1.1.2 Main strategies and SW features

- “Torque based” control architecture with ETC device
- Management of the following vehicle architectures:
 - “One Box” (the ECU is responsible for engine control and vehicle functions)
 - “Two Boxes” (the ECU is responsible for engine control only)
- “Speed Density” strategy (no AFM required)
- Boost pressure control
- Closed loop A/F control by means of pre and post catalyst lambda probes
- Torque and engine speed limitation strategies
- Diagnostic strategies according to OBD-HD regulations
- Full self diagnostic with storage of error codes, engine parameters, etc. in non-volatile memory
- CAN messages management according to standard SAE J1939
- KW2000 protocol for communication and diagnostic

- In “One Box” architecture the main vehicle functions (Speed Limiter, Cruise Control, PTO, ecc.) are supported both for trucks and buses applications

1.1.3 External interfaces

1.1.3.1 Analogue inputs

The ECU is provided with 1 differential analogue input and 20 single ended analogue inputs, all of them have 0÷5 V input voltage range, gain = 1 and bandwidth of 72 Hz.

6 of the 21 analogue inputs can be configured to supply and interface an external NTC or PTC temperature sensor.

Moreover there are 2 channels dedicated for battery voltage measurement, 1 channel for 0÷12 volt signal measurement and 2 channels for On/Off lambda sensors..

1.1.3.2 Digital inputs

The ECU is provided with 19 digital input channels, 2 with pull-down, 6 with pull-up and 11 are HW configurable.

1.1.3.3 Frequency/PWM inputs:

There are 2 channels dedicated to variable reluctance sensors, that can be configured also for hall effect sensors, and 5 channels for frequency/PWM signals.

1.1.3.4 Power outputs:

6 half bridge channels for injectors driving are available. The maximum RMS current for each channel is 2,5 A and the maximum peak current is 6 A, but current capability depends on ECU total power dissipation issues, and therefore on installation site maximum operating temperature.

2 channels are dedicated to electronic controlled throttle or idle by-pass actuator device, the maximum RMS current for each channel is 1 A and the maximum peak current is 7 A.

At last there are 6 channels for ignition driving, maximum current is 9 A (internally limited).

1.1.3.5 Digital outputs open collector low/medium power

Open collector digital outputs are divided in two groups:

- 8 channels low power: 0.5A RMS, 1 A peak
- 8 channels low/medium power: 1 A RMS, 3 A Peak

There is a limitation concerning the total current that can be supplied by digital output drivers, therefore loads distribution must be performed by HW designers.

1.1.3.6 Frequency/PWM outputs open collector low/medium power:

Open collector frequency/PWM outputs are divided in three groups:

- 4 channels low power: 0.5A RMS, 1 A peak
- 3 channels low/medium power: 1 A RMS, 3 A Peak
- 2 channels medium power: 2 A RMS, 6 A Peak

Also in this case there is a limitation concerning the total current that can be supplied by frequency/PWM output drivers, therefore loads distribution must be performed by HW designers.

1.1.3.7 Communication lines:

The ECU is provided with 2 CAN high speed standard 2.0B lines and 1 ISO 9141 KW2000 compatible line (K line).

1.1.4 Microprocessor and memory

- Microprocessor: 32 bit
- Memory:
 - FLASH: 1 Mbyte
 - RAM : 32 Kbyte
 - E2PROM : 2 Kbyte
- Expansion module (available only for development kit) with 512 Kbyte RAM
- Supervisor microprocessor : MOTOROLA 8 bit MC68HC908GR8

1.2 Possibilities of application

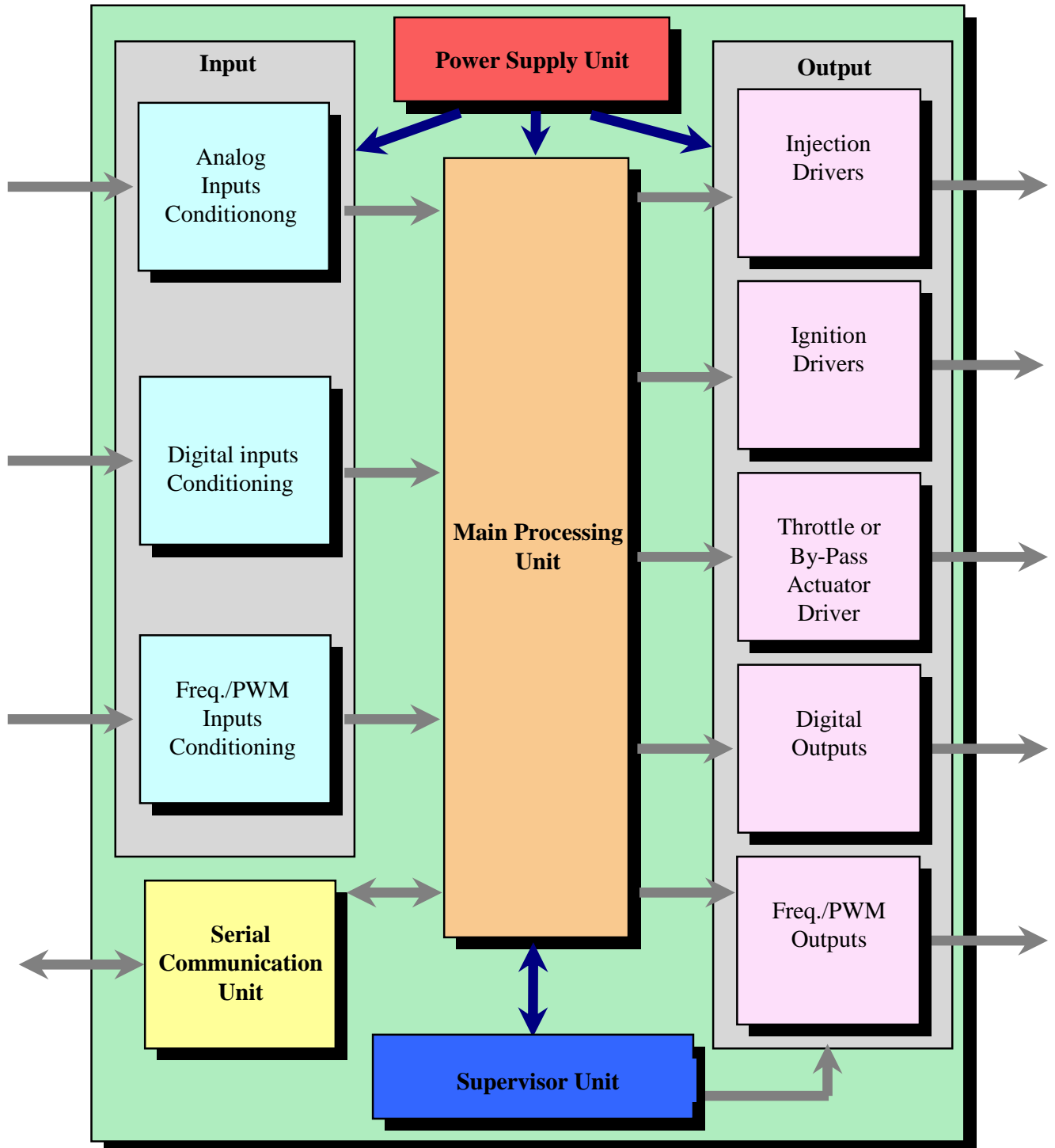
The ECU can be used as engine control unit on monofuel vehicles (gas or petrol) or bifuel vehicles (gas and petrol) up to a maximum of 6 cylinders.

In case of bifuel application, Metafuel 3 can be the only control unit and manage both gas and petrol systems.

Metafuel 3 can be installed, through proper HW configuration, on vehicles with 12V or 24V power supply system.

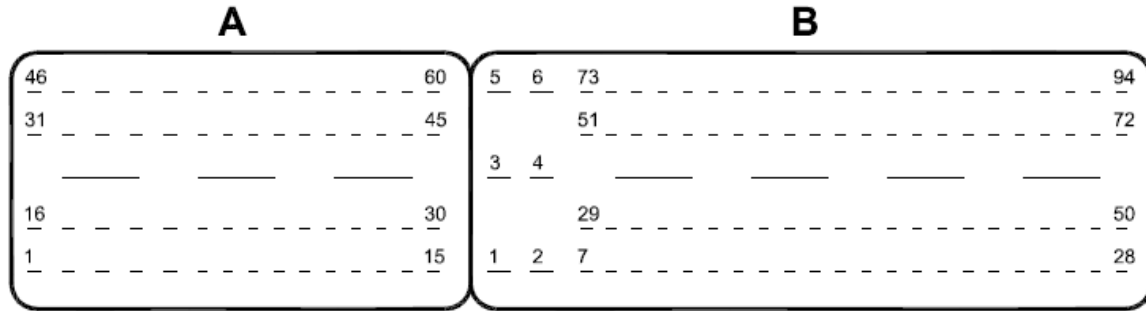
2. TECHNICAL CHARACTERISTICS

2.1 Block diagram of ECU architecture



2.2 Connector

The connector used is an AMP-TYCO 154 pins, item type P/N. 284617.



ECU Connector – Front view

2.3 Electrical, electromagnetic and environmental characteristics

Electrical, electromagnetic and environmental characteristics of the ECU are compliant with IVECO standard 18-2252. rev. of 21.09.2001.

The main characteristics are:

- 6÷16V power supply in vehicles with 12V battery voltage and 12÷32V in vehicles with 24V battery voltage
- Connector pins protected against permanent short circuit to battery voltage and battery ground (with the exception of power supply pins)
- The ECU is protected against vehicle battery polarity inversion by means of an appropriate external fuse provided in the wiring harness
- Installation site: engine compartment (or other sites with less stringent environmental characteristics)
- Assembling position: The ECU can be mounted in vertical position (along vehicle Z axis) with the connector towards high or longitudinal position. Any other mounting position is not recommended (see CRF document “MF3 installation Note rev. 2.0”).
- Operating temperature: $-30^{\circ}\text{C} \div +100^{\circ}\text{C}$
- Useful life: $+85^{\circ}\text{C}$ continuously for 20000 hours at 0.1m/s air flow rate
- Storage temperature: $-40^{\circ}\text{C} \div +120^{\circ}\text{C}$
- ECU water protection degree is IP9K
- Test conditions for mechanical vibrations are:
 - Sinusoidal vibrations, 8 hours along each axis, frequency from 5 to 50 Hz, peak to peak amplitude 5mm, acceleration 150m/s^2

3.2 Weight

The ECU weight is about 1050g.