The Programming Tool for the Automotive Sector

1.1 ECM Nomenclature

ME17.3.0 → Petrol
- MED17.4
- MEVD17.2.3
- ME17.8.5
- MEV17.2

EDC16C34 → Common Rail
- EDC16C35
- EDC16C31
- EDC16C39
- EDC16C1

6F3 → Fiat

6O3 → Opel

9GV → Volkswagen

Diesel *Piezoelettric* → **EDC16CP34**
- EDC16CP31
- EDC17CP04
- EDC17CP46

Multijet → **MJ8DF**

Injector Pump → **EDC16U1**
- EDC16U34
- EDC16U31

DME8
BMW Petrol

DDE8
BMW Diesel

For example: **MD1CS006**

MD 1 C S 006

MD Motronic Diesel	**1** Generation (1,2,3,4,...)	**C** CommonRail	**S** Solenoid injector	**xxx** Consecutive numbering
MG Motronic Gasoline	**P** Piezo Injector			

Bosch MD1CS001TC298TP & SPC5777
Bosch MD1CP002SPC5777
Bosch MG1CS003SPC5777
Bosch MG1CS024TC298TP
Bosch MG1CS201TC298TP

1.2 Automotive Engine Control Module (ECM) Architecture

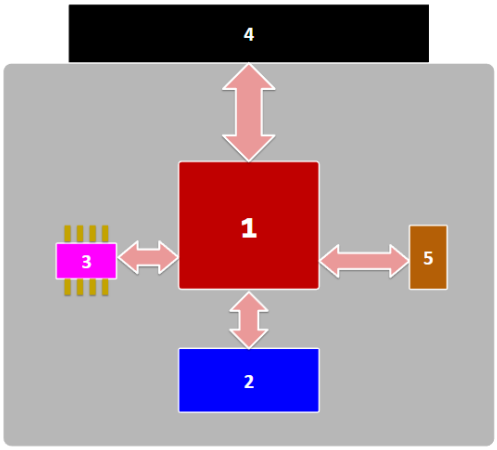
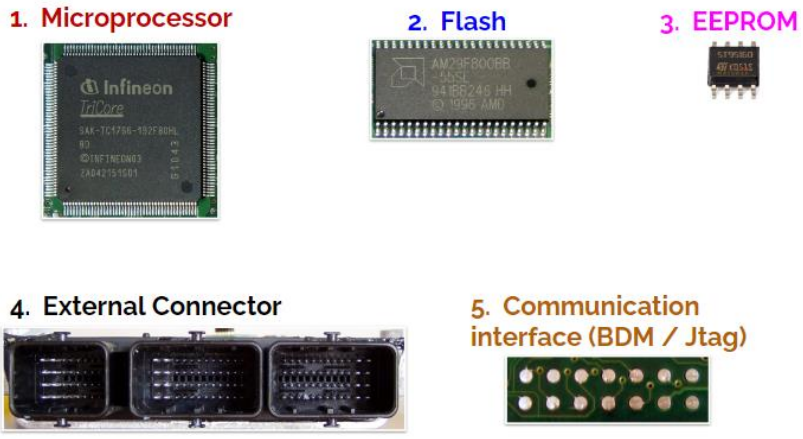
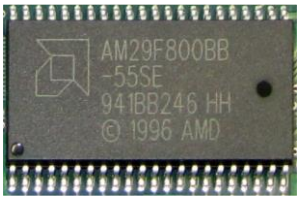
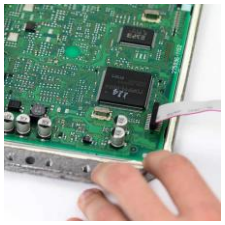
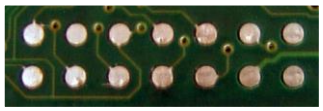


Figure 1.3 ECU's Architecture



	Component	Functionality
1	Microprocessor 	Performs calculations («thinks» only in numbers) Contains the Operating System (Firmware) It sometimes has enough memory to hold ALL data (Micro + Flash + EEPROM) Communicates with the outside (Sensors, actuators, diagnostic testers…)

2	**Flash** 	Engine management data memory Contains the original file: updated Micro functions updated management maps It may not exist if the ORI file is stored in the Micro
3	**EEPROM** 	Vehicle data memory Safety VIN (chassis code) Key codes Immobiliser Trouble Codes (DTC) (opt.) Configuration Supported tire radius Kilometers (opt.) Injector coding (opt. for diesel)
4	**Connectors** 	External connectors Analog inputs (sensors) Outputs (actuator signals) Communication and diagnosis: L Line (in extinction) K Line J1850 CAN bus
5	**Communication interface** 	Used in the ECU manufacturer's factory to program the Operating System It can be: BDM in the case of a Motorola Micro

	 	J-TAG in the case of an ST or Infineon Micro Infineon Trcore Port

Microprocessor

A microprocessor in an ECM is responsible for controlling and regulating various functions in a vehicle's engine. The ECM is essentially the brain of the engine, and the microprocessor is the central processing unit (CPU) that runs the ECM's software and controls its operations.

The microprocessor receives input from various sensors throughout the engine, such as the oxygen sensor, throttle position sensor, and engine temperature sensor. Based on this input, the microprocessor makes decisions on how to adjust various components in the engine, such as the fuel injectors, ignition timing, and idle speed.

The microprocessor also monitors the engine's performance and can detect and diagnose problems such as misfires, overheating, or other malfunctions. It may also communicate with other onboard computers and systems, such as the transmission control module, to coordinate the vehicle's overall performance.

In summary, the microprocessor in an ECM is responsible for regulating and controlling the various functions of a vehicle's engine, ensuring that it operates efficiently and effectively while meeting emissions and performance standards.

Types of Microprocessors in an Engine Control Module

There are several types of microprocessors that can be used in an Engine Control Module (ECM), depending on the specific requirements of the engine and the desired performance characteristics of the ECM. Some of the common microprocessors used in ECMs include:

- *8-bit microprocessors*: these are simple, low-cost microprocessors that can perform basic operations and are often used in entry-level or budget ECMs.

- *16-bit microprocessors*: These are more powerful than 8-bit microprocessors and can perform more complex operations, making them suitable for mid-range ECMs.

- *32-bit microprocessors*: These are the most powerful and sophisticated microprocessors used in ECMs. They offer high processing speed and can handle complex algorithms and control strategies required for high-performance engines.

The choice of the microprocessor for an ECM depends on several factors, including the engine's performance requirements, the complexity of the control algorithms, and the cost and availability of the microprocessor. In general, the more powerful microprocessors are, the more expensive they are, but they offer better performance and more advanced features, such as real-time data logging and advanced diagnostics.

Figure 1.3.1: Infineon C167

INFINEON C167

Flash: External (29F200 - 512KB / 29F400 - 1MB / 29F800 - 2MB)

EEPROM: External

Typology Boot: Bootloader

ECU: Bosch EDC15/ME7 - Continental SIDxxx

Figure 1.3.1 Renesas SH70XXX

RENESAS SH70xxx

Flash: Internal (1MB)

EEPROM: Internal/External

Typology Boot: JTAG

ECU: Denso – Valeo

Figure 1.3.2: Infineon ST10

INFINEON ST10

Flash: Internal (832KB)

EEPROM: External

Typology Boot: Bootloader

ECU: Bosch EDC15/ME7 - Marelli IAW

Figure 1.3.3: NEC 76F00XXXX

NEC 76F00xxxx

Flash: InternaL (736KB - 992KB)

EEPROM: External

Typology Boot: JTAG

ECU: Toyota Denso 896xx

Figure 1.3.4: Motorola MPC55XX

MOTOROLA MPC55xx

Flash: External (2MB) / Internal (512KB)

EEPROM: External (Can be virtualized)

Typology Boot: BDM

ECU: Bosch EDC15/ME7 - Continental SIDxxx

Figure 1.3.5: Nexus SPC5XX / MQC5XX

NEXUS SPC5xx/MPC5xxx

Flash: Internal (2/4/8 MB)

EEPROM: External

Typology Boot: Bootloader

ECU: Marelli 8/9 - Bosch MDG1 - Delphi CRD2 - Continental EMSxxxx

Figure 1.3.6: Infineon Tricore TC17XX

INFINEON TRICORE TC17xx

Flash: Internal (2/4MB)

EEPROM: Internal

Typology Boot: Bootloader

ECU: Bosch EDC17/ME17 - Continental SIDxxx - Delphi CRD2/CRD3 - Simos

Figure 1.3.7: Infineon Tricore TC2XX

INFINEON TRICORE TC2xx

Flash: Internal (8MB)

EEPROM: Internal

Typology Boot: Bootloader

ECU: Bosch MD1/MG1 - Delphi DCM7.1

Types of Memories

Flash

Flash memory is a type of non-volatile memory that is commonly used in ECMs. Non-volatile memory means that the information stored in the memory is retained even when power is turned off. This makes it an ideal storage medium for the ECM, which needs to retain important data and program code even when the engine is turned off.

In an ECM, the Flash memory is used to store the program code that runs on the microprocessor. This program code controls the various functions of the engine, such as fuel injection, ignition timing, and emissions control. The code is written in the Flash memory during the manufacturing process and can be updated or reprogrammed using specialized tools.

The Flash memory is preferred over other types of non-volatile memories, such as EEPROM or ROM, because it can be erased and reprogrammed multiple times. This makes it easier to update the program code as needed to improve engine performance, fix bugs, or meet new emissions or safety standards.

Overall, the Flash memory in an ECM plays a critical role in storing and executing the program code that controls the engine's operations, and it is an essential component of modern engine management systems.

The Flash memory can be **INTERNAL** or **EXTERNAL** to the Microprocessor.

EEPROM

Electrically Erasable Programmable Read-Only Memory (EEPROM) is a type of non-volatile memory that is commonly used in Engine Control Modules (ECMs). EEPROMs are used to store important calibration data and settings that are specific to each engine, such as fuel maps, ignition timing maps, and idle air control settings. These settings are programmed into the EEPROM during the manufacturing process, and they are used by the ECU to control the engine's performance and emissions.

One of the advantages of using EEPROMs is that they can be reprogrammed multiple times, which allows for the calibration data to be updated as needed. This is important because changes in the engine's components, such as the installation of aftermarket parts or modifications to the air intake or exhaust system, can affect the engine's performance and emissions.

In addition to calibration data, some ECUs also use EEPROMs to store other important information, such as trouble codes and diagnostic data. This information can be read by a technician using a diagnostic tool to help diagnose problems with the engine.

Overall, EEPROMs are an important component of modern ECUs, as they store critical calibration data and other important information that is necessary for the engine to operate effectively and efficiently.