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Introduction to Coding & Programming

Model: All

Production: All

OBJECTIVES

After completion of this module you will be able to:

- Distinguish between Coding & Programming
- Understand the importance of Coding & Programming
- Understand where data is stored in a Control Module

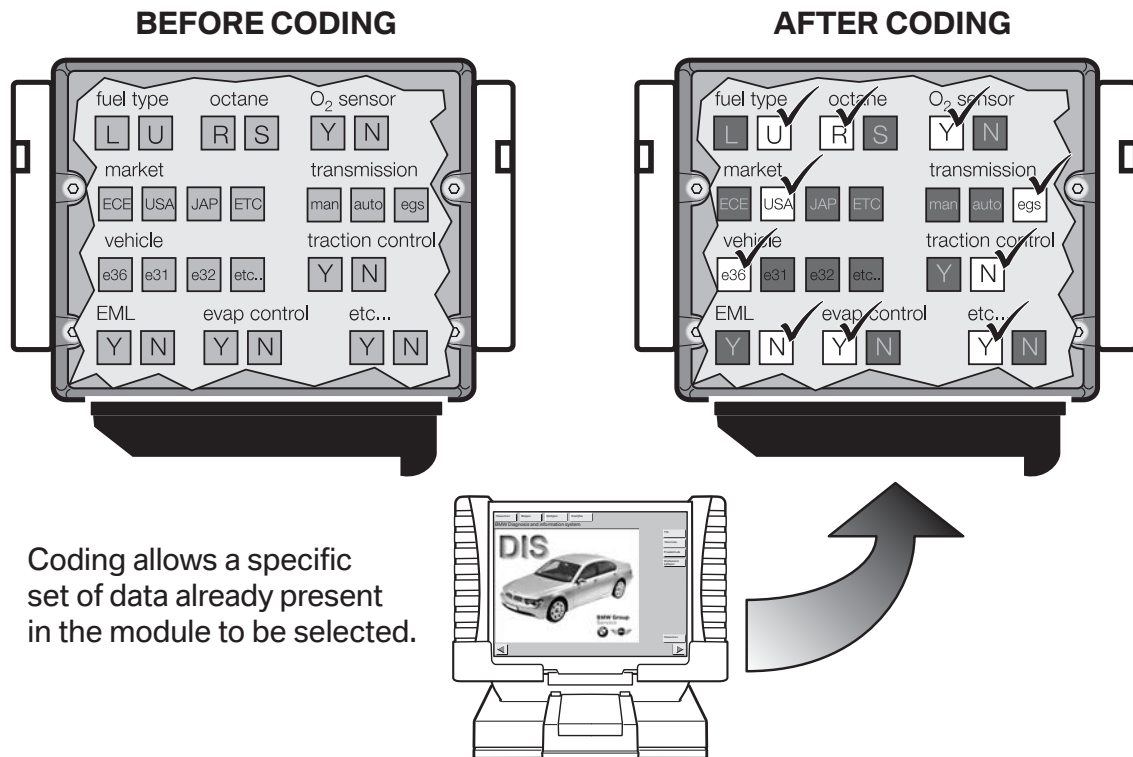
What is Coding?

It is a process utilized by BMW, which groups system specific operating requirements (Data) together and then assigns a label/code to each of these groups of data. The various groups of data are all pre-loaded into system specific “codable” control modules, along with a basic set of operating instructions (Program).

Types of operating requirements:

- Nominal values of device input signals (0.25V to 2.5V, 5W - 25W, ...)
- Type of device input signal (PWM, square wave, analog ...)
- Operational parameters (device activation/deactivation time, ...)
- Market specific operations (O2 Sensors, Fuel Type, Emission Control, ...)
- Country Specific Regulations (U.S., Canada, Japan, UK, ECE, ...)
- Powertrain Configurations (Manual, Auto, TLEV, ULEV, SULEV, Diesel, ...)

The procedure of assigning one specifically labeled group of data to the operating program of a specific control module/component is referred to as “coding”.



A “codable” control module has a basic operating program already installed along with several specific variations of operating data. The coding process allows a specific set of operating data to be assigned to the basic operating program of that module/component, with respect to its specific application.

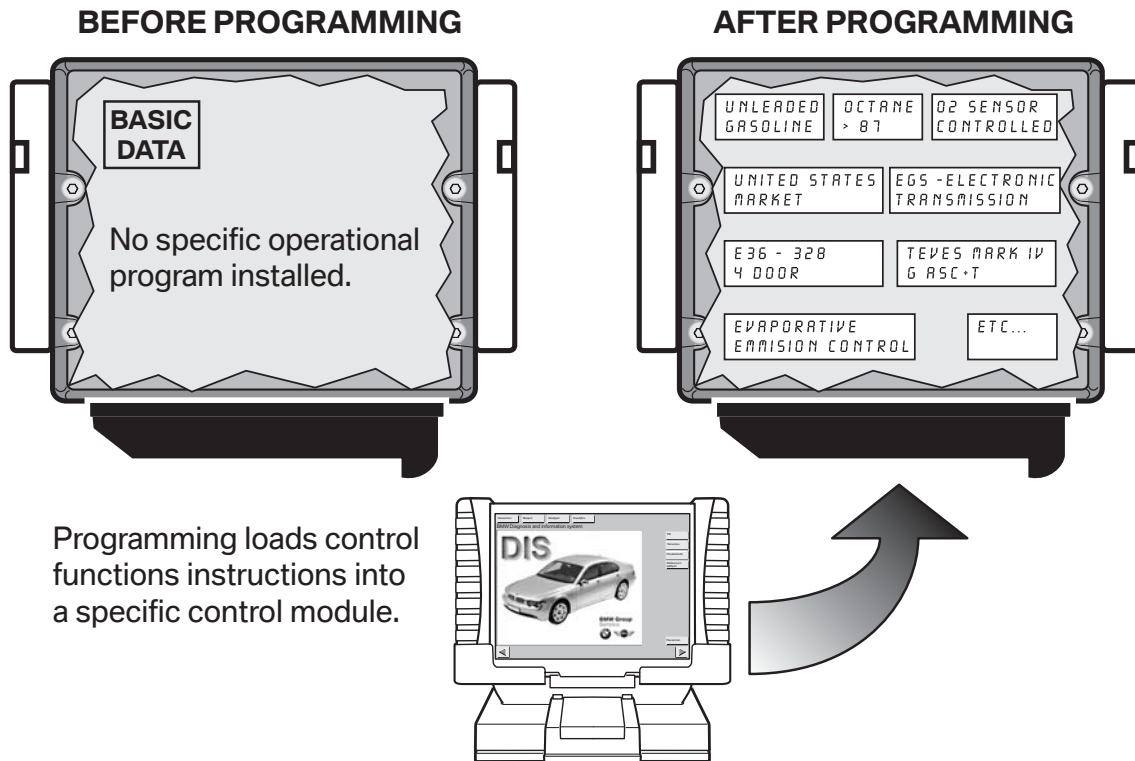
Coding can be performed for some systems/components:

- By installing a specific plug (coding plug) into a device/component
- By entering a 4 digit alpha-numeric code (variant code) via the programming selection on DISplus/GT1/SSS
- Selecting customer specific system operational settings from a list of available features (VKM)
- Automatically by selecting a specific coding process available via ZCS Coding or CIP using the DISplus/GT1/SSS

Note: Codable control modules/components are system specific, which means that not all control modules are codable.

What is Programming?

It is a process utilized by BMW to load application/system specific operating instructions



(Program) into a module/component which already has the systems operating requirements (Data) installed, plus it can be used as a means of updating data and operating instructions previously installed in a control module.

Basic programmable control modules have a pre-defined set of operating data already installed which allows the module to be fairly generic until a specific operational program is installed.

Programming of system control modules is performed using a DISplus/GT1/SSS.

Note: Programmable control modules are system specific and not all control modules are programmable using workshop equipment like the DISplus,GT1 or SSS. The ability to program a module is limited to the number of times it has already been programmed and the hardware version of the control module itself.

What is the Purpose of Coding and Programming?

As a global manufacturer, BMW must design a large variety of control modules to meet numerous vehicle requirements pertaining to issues such as:

- Country Specific Regulations (U.S., Canada, Japan, UK, ECE, ...)
- Vehicle Equipment Level (Phone, Navigation, HiFi, IHKA, IHKR, ...)
- Vehicle Powertrain Configurations (Manual, Auto, TLEV, ULEV, SULEV, Diesel, ...)
- System Specific Operating Requirements (Nominal values, type of input signal, ...)

By using Coding and/or Programming, the large variety of control modules needed can be reduced to a smaller number of model specific hardware variations.

Codable control modules contain:

- A common operating program
- A large number/variety of specific operating data groups

In order to use this type of control module it must first be CODED to ensure that the operating data specific to that vehicle/model application is used by the operating program of the control module.

Programmable control modules contain:

- The required/specific operational data
- No operating program

In order to use this type of control module it must first be PROGRAMMED to ensure that the operating program specific to the vehicle/model application is used.

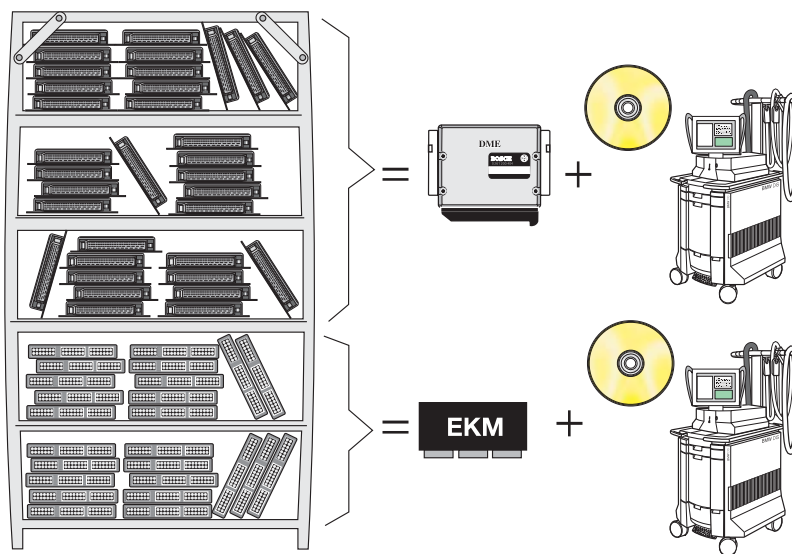
Prior to the availability of Coding and Programming in the workshop this task could only be performed at the factory.

Initially the factory installed Control Module(s) with a common operating program or data into vehicles and as these vehicles reached various points in the assembly process the control modules were updated with the required operating data or program specific to the application for that particular vehicle. Since replacement parts always need to be available, parts inventory needed to contain all variations of preprogrammed control modules installed in all varieties of vehicles that were manufactured. This was not a big problem in the early years, when the variety/quantity of models was smaller.

As the number of control modules and the complexity of the various systems installed into vehicles increased, the number of modules that needed to be stored in parts inventory began to increase as well. Eventually this led to the stocking of hundreds of different control modules that were either pre-programmed or pre-coded for a specific application and model, but only differed slightly in the way they were coded or programmed.

Pre-programmed and pre-coded control modules always needed to be available in the event a control module failed once the vehicle left the factory floor, since this was the only place programming & coding procedures could be performed. In order for repairs to be made quickly, dealers were required to maintain a stock of several varieties of control modules, since technicians could only remove the failed module and installed a new pre-programmed or pre-coded module into the vehicle.

As a result of having to maintain a very large inventory of pre-programmed and pre-coded control modules in parts inventory, it was decided to make coding and eventually programming available in BMW workshops.



The following advantages have occurred since programming and coding can be performed in the workshop:

- Fewer control module hardware versions are needed (only need basic control modules)
- Lower parts and inventory costs
- Able to update software in a control module without having to replace the module (Re-Code/ Re-Program to address service Measures)
- Ability to add special equipment features to existing control modules (DWA, Day Time Running Lights, ...)
- Customization of vehicle operation (Conversions, VKM, A/C, ...)

The means by which coding or programming information is provided to a control module varies and is determined by the vehicle, model year and type of module(s) installed.

BMW currently uses the following methods to perform Coding or Programming:

- Coding Plug
- DME variant Coding
- Coding Code
- Central Coding Key (ZCS) or Vehicle Order (VO)
- EPROM Programming
- Flash Programming
- Vehicle and Key Memory (VKM)

Where is Data Stored in a Control Module?

The control modules used in our vehicles store data/information on one of the following:

- EPROM (**E**lectrically **P**rogrammable **R**ead **O**nly **M**emory)
- EEPROM (**E**lectrically **E**rasable **P**rogrammable **R**ead **O**nly **M**emory)

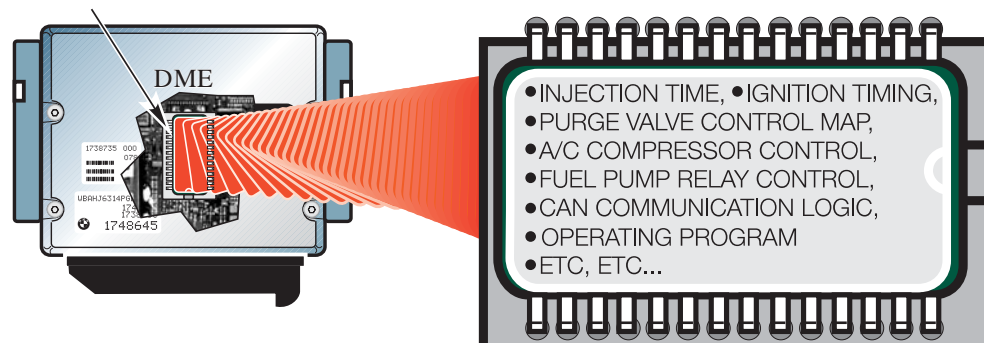
In essence these devices are similar to the harddrive of the PC (**P**ersonal **C**omputer) that many of us use daily to store the images and documents/files of information.

EPROM (Electrically Programmable Read Only Memory)

An EPROM is a computer memory chip that can be electrically programmed, however in order to erase data that is stored on the chip it must be removed from the device and exposed to UV lighting for a specific time period. An EPROM has what is commonly called a “window” on the top portion of the chip usually located underneath a protective label, it is this area that must be exposed to UV light of a certain intensity for a specific time period in order to erase the information stored on it.

Early engine control modules (DME 3.X) and transmission control modules were the first devices which allowed technicians to first remove the chip from the module, install a new “blank” EPROM and then program the module.

EPROM IN CONTROL MODULE



EEPROM (Electrically Programmable Read Only Memory)

An EEPROM is a computer memory chip that can be electrically programmed and electrically erased, thereby not requiring the chip to be removed from the module or exposed to light. In general this chip is not easily removable from the device it is installed into.

Since the entire process of programming and erasing is done electronically this device is commonly referred to as “Flash Programmable”.

During the programming process the following type of information may be loaded into the control module depending on the specific application or update that needs to be installed:

- Characteristic Maps (Ex. Ignition, Injection, Purge Control, DSC Regulation, ...)
- Control Constants/ Operational Data
- Operational Program
- Control Module Identification Information (Ex. Hardware Number, Program Number, Date of Modification, ...)

What is needed to Code and Program?

In order to code or program a vehicle or control in the workshop, specific equipment and special software is required such as a DISplus, GT1 and an SSS which must all be connected to a network and have the most current version of CIP (**C**oding, **I**ndividualization & **P**rogramming) installed. CIP is the software program that contains all the latest data and program information to allow control modules to be updated to the latest level to address customer concerns and implement service solutions.

With the release of CIP 15.0 and the implementation of Progman (see Progman section for additional information) the DISplus and GT1 will only be capable of performing vehicle diagnosis and activation/initiation of a Coding, Individualization or Programming task through the SSS. A special program management tool (Progman) will only allow the DISplus and GT1 to act as remote terminals to the SSS (regarding Coding, Individualization & Programming), which means that the SSS will be the single supplier of Coding, Individualization and Programming information to a vehicle and its respective control modules.

Review Questions

1. *What happens when a control module is coded?*

2. *What happens when a control module is programmed?*

3. *What advantage is there by allowing workshops/centers to code and/or program control modules?*

4. *What component(s) stores data in a control module?*
