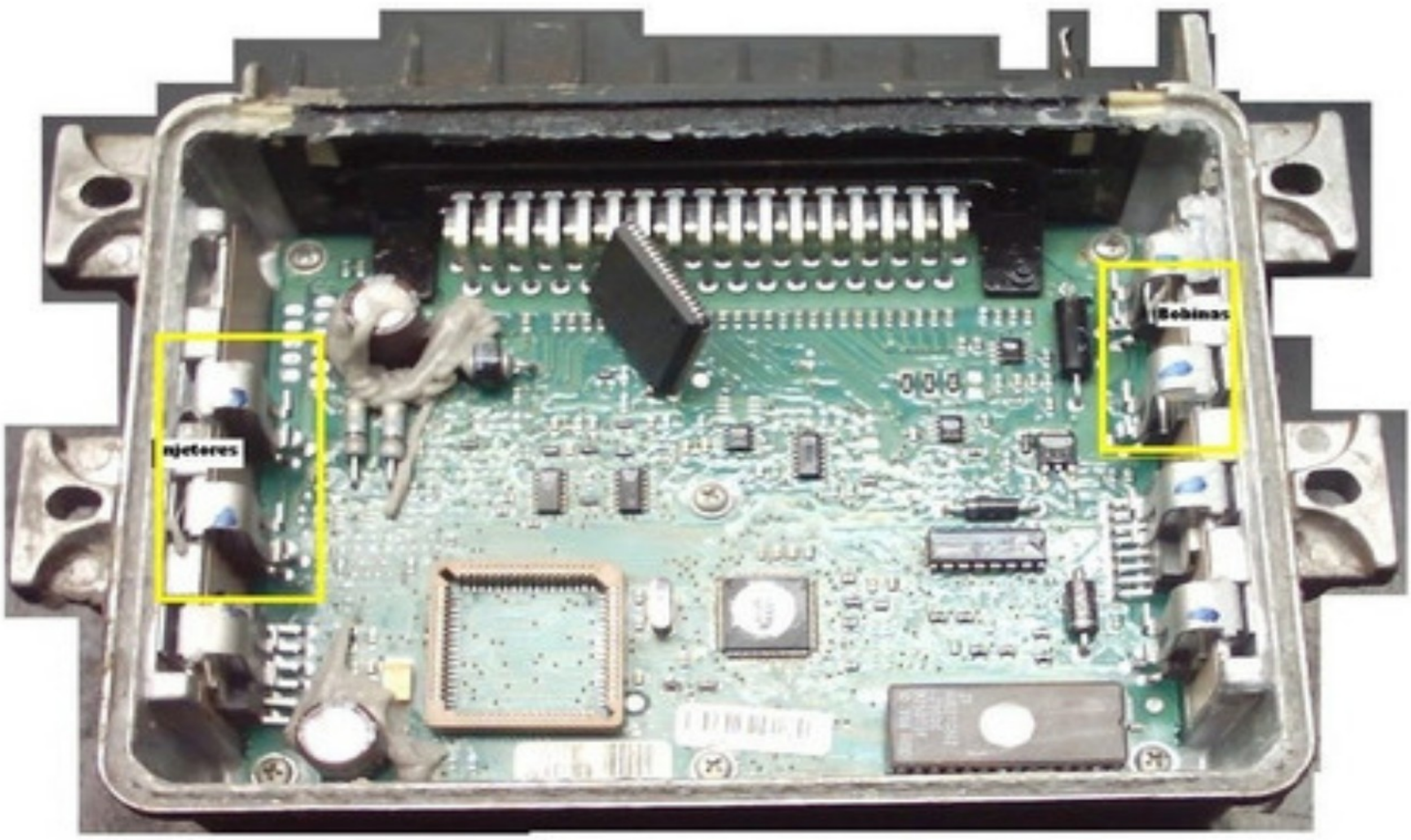
Ecu Repair course study guide



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PRESENTATION

The management and command system for operating a vehicle today is fully automated to achieve better performance, lower fuel consumption and greater comfort for the driver.

This is possible thanks to the technologies of the embedded electronics, used in the execution of this work routine.

We will see how these work routines are defined and how to find possible defects.

Let's get to know the various electronic components and how they act on the electronic device.

Component testing and replacement, welding techniques and rework on printed circuit boards.

The methods presented are based on the ISO9001 and QS9000 standards for automotive quality, training professionals able to perform services with quality assurance.

SUPPORT MATERIAL FOR STUDENTS AND REPAIR PROFESSIONALS IN ECU MODULES!

OBJECTIVE OF THE SYSTEM

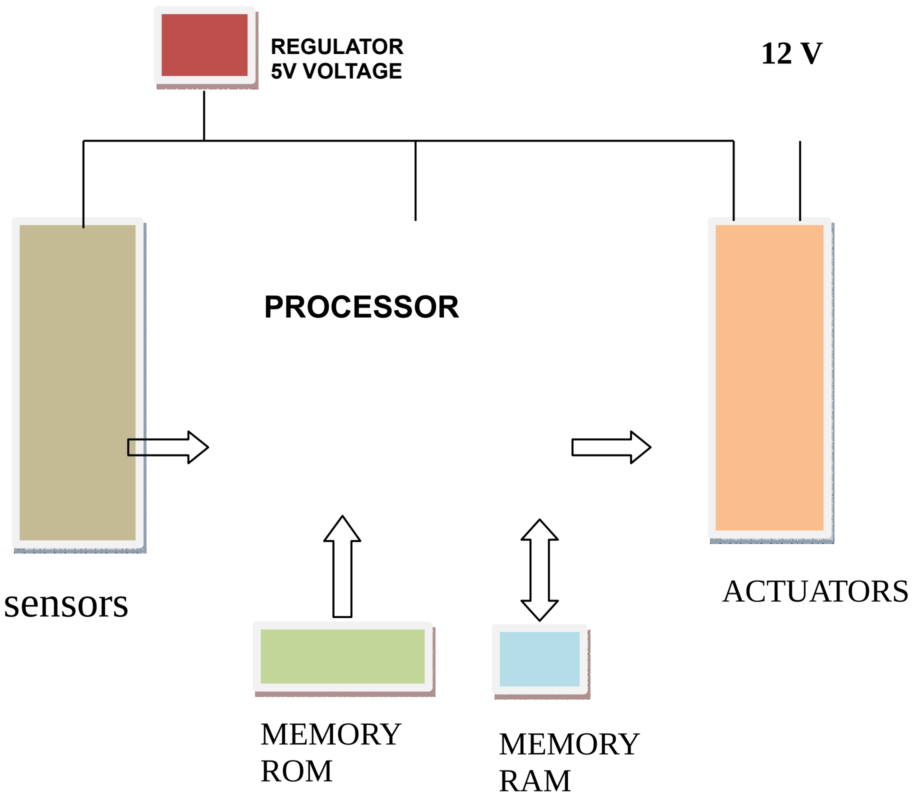
As we know, the main function of an electronic control module (ECU), it is to receive and process the input signals as a reference to perform the fuel injection and emit the appropriate spark for explosion in the cylinder, obeying the stoichiometric ratio. It also performs secondary functions such as: Fan activation, slow ax control, emission control etc.

With the current technological level, this Hardware has become very reliable considering the strict work regimes.

The electronic circuits have been designed with maximum security against interference-resistant to high temperatures and long periods of work.

Despite all safety procedures, failure to production of sparks or fuel injection or even secondary functions. Our job will be to analyze the source of the failure at the Hardware level and fix it.

The operation of the **Electronic Control Unit ECU**, is shown in the diagram below:



SYSTEM CLASSIFICATION

The electronic injection system is constantly evolving as all current technology.

We are going to introduce the main commercial systems found in the domestic and imported vehicles.

Systems are classified in several ways. These differences are present in natural evolution and by different manufacturers such as Bosch - FIC - Magneti Marelli - Siemens - Delphi - Mitsubishi - Hitashi etc.

In practice we find the following systems:

A - ANALOGUE COMMAND CENTER

Ex. Bosch Le-Jetronic

B – 8 bits DIGITAL ELECTRONIC CONTROL PANEL

Ex.

IAW 1AVB

IAW 1G7

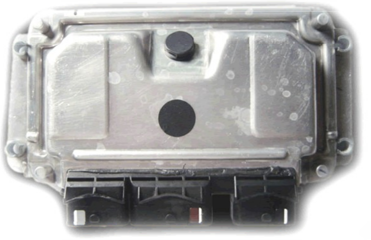
Bosch 1.5.4

Ford FIC

C – 16 Bits DIGITAL ELECTRONIC CONTROL COMMAND

Ex.

IAW 4AF



Bosch ME 7.5.10

Renault

Delphi Multec

Today we already find vehicles equipped with **ECU** with information processing capacity of **32 and 64 bits.**

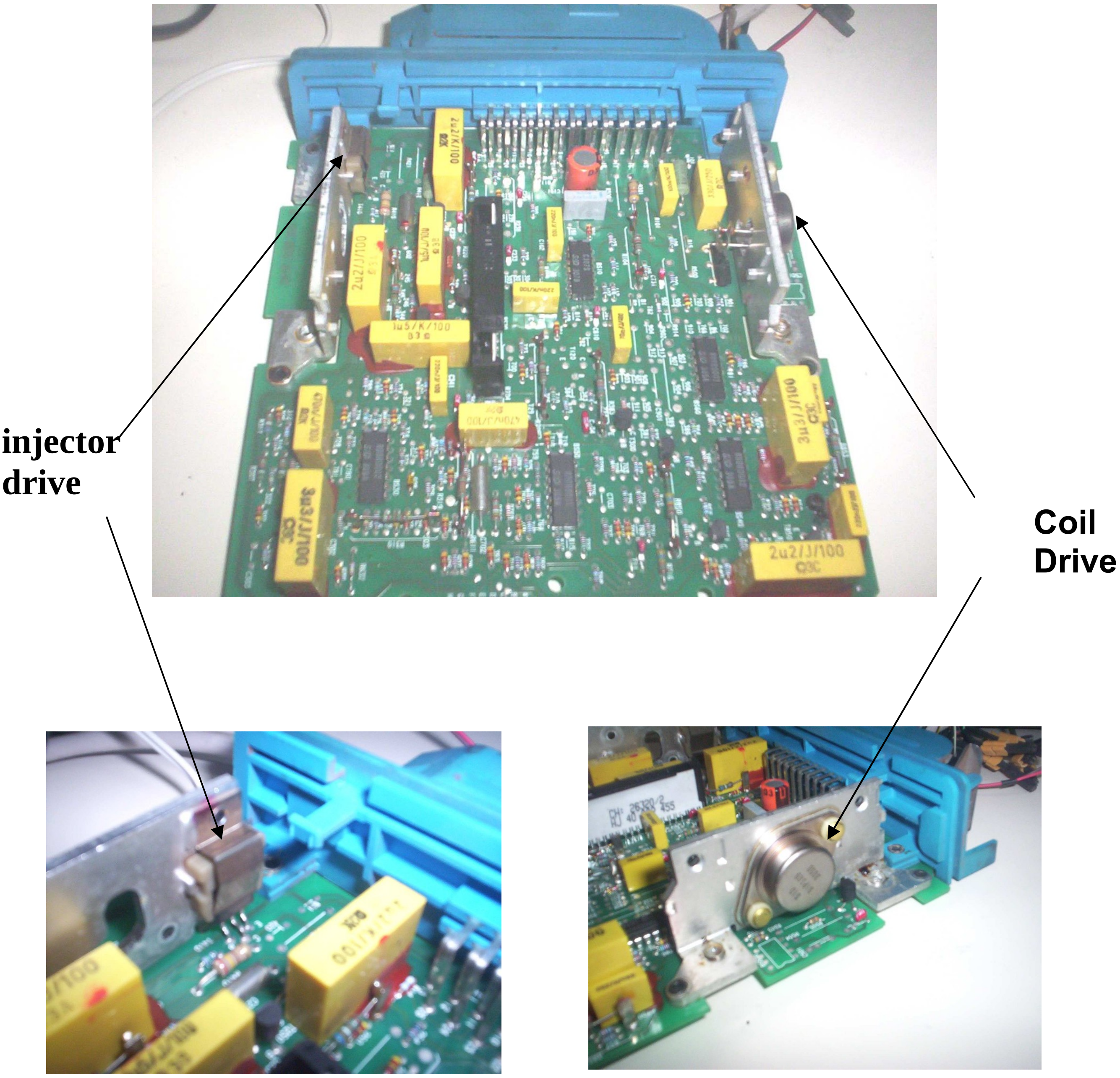
The electronic control centers, have different conceptions, according to the internal design of each Manufacturer.

Internal Assembly of the Control Center

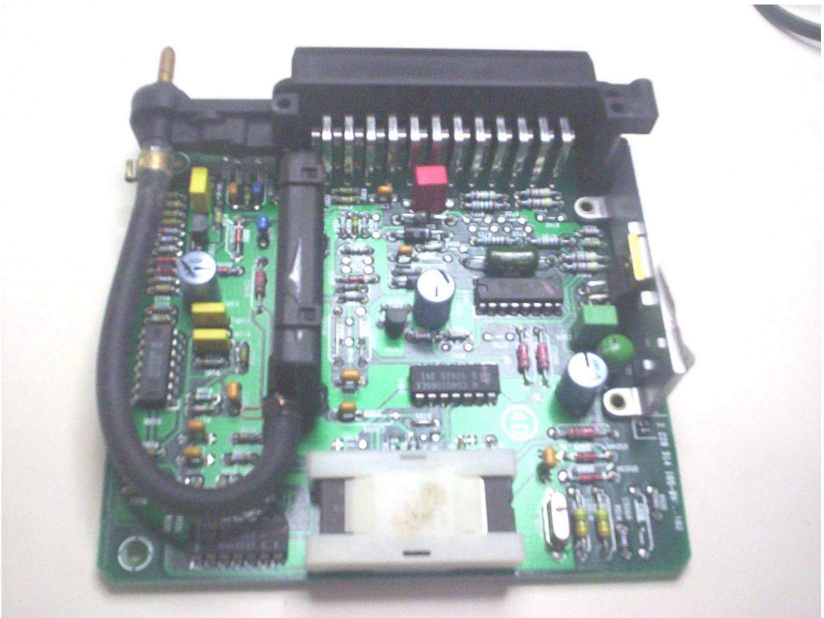
ANALOG CENTER

Bosch Le Jetronic

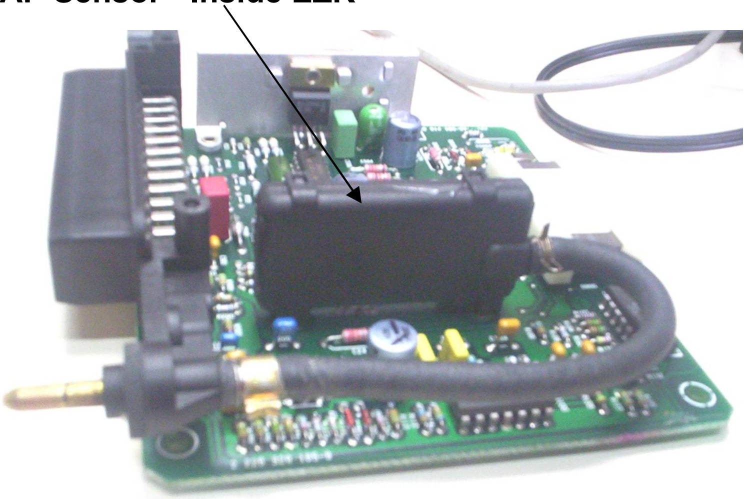
Common Defects
Cold solder in several points of the exchange (mainly in the Drives of the Coil, Injectors and Temperature Sensor).



Central EZK



MAP Sensor - Inside EZK

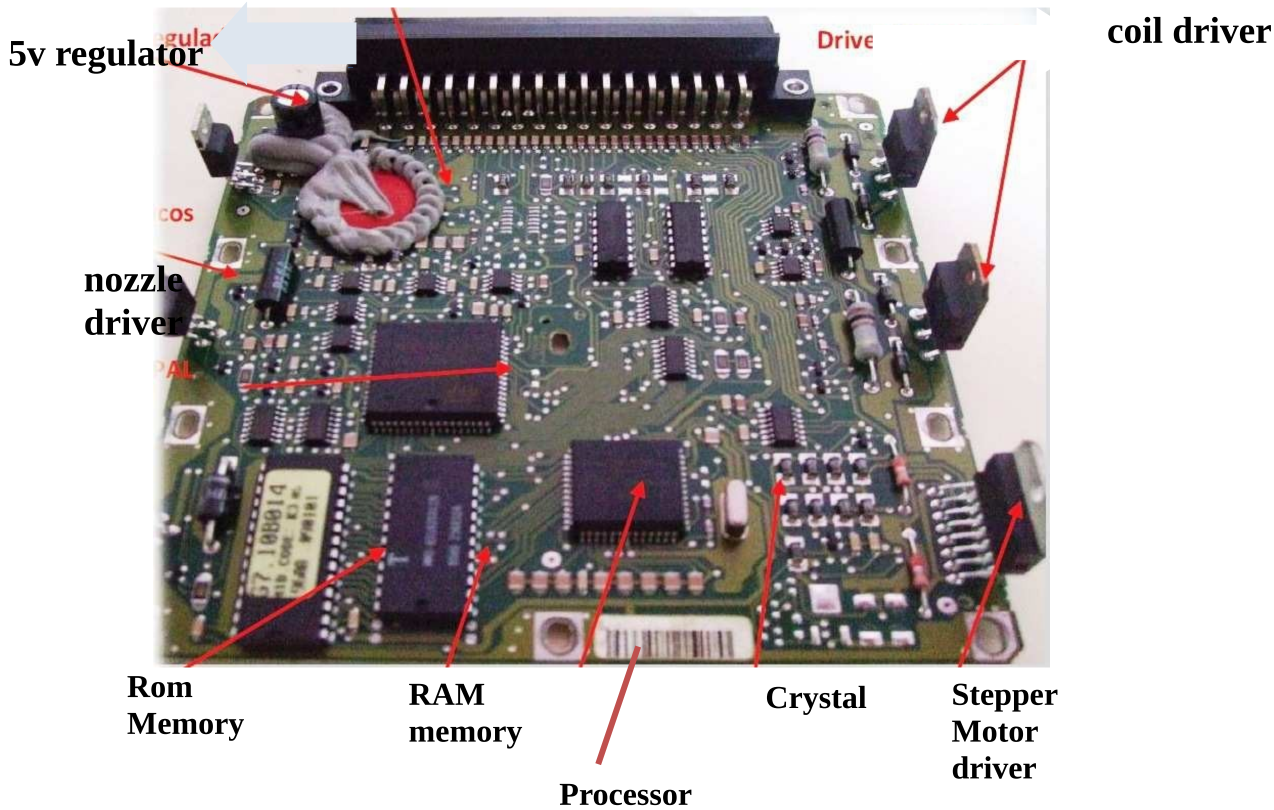


DIGITAL CENTRAL

Internal assembly of the 8 bits digital control panel

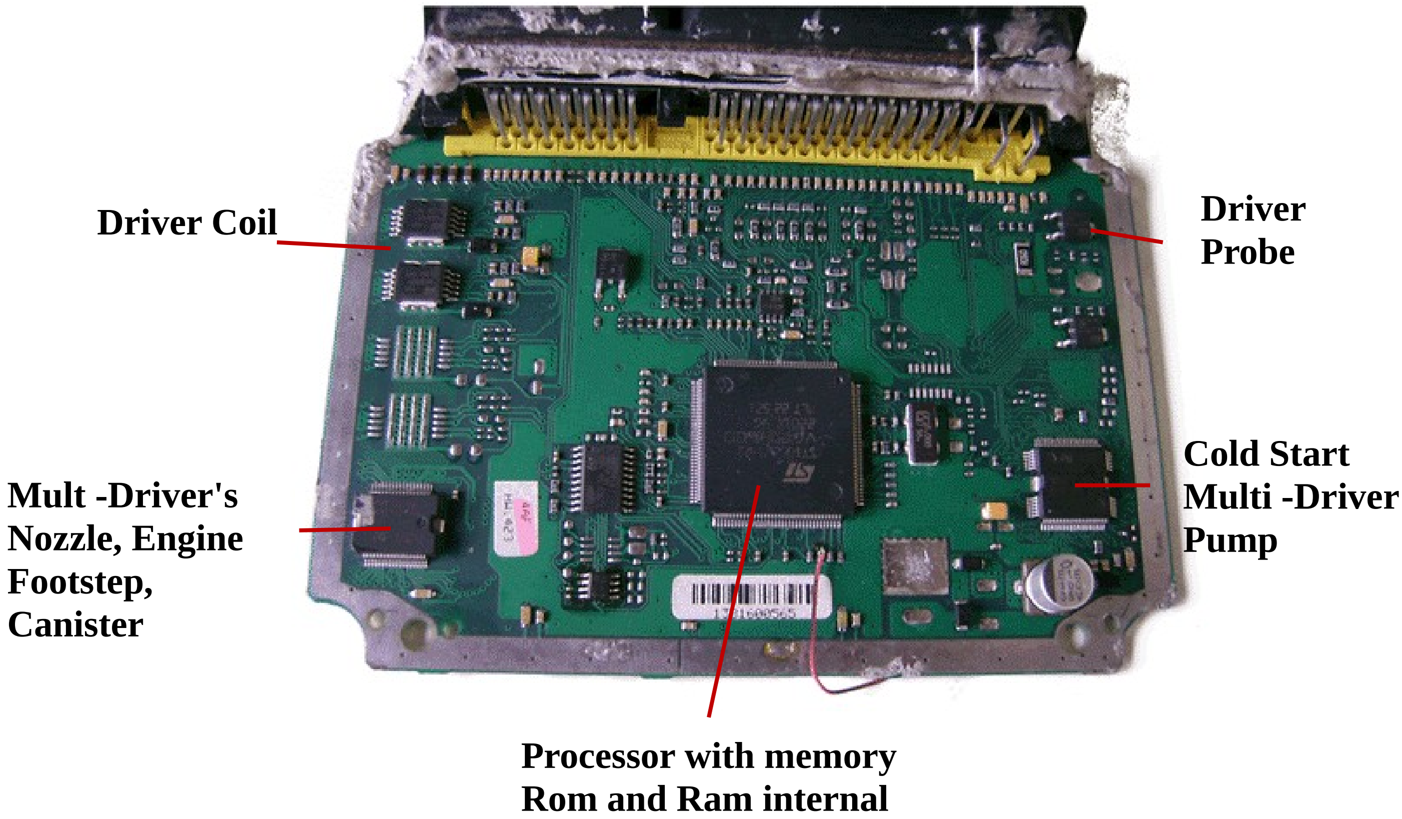
In this example we illustrate an 8 bits digital exchange. In these exchanges we can highlight the nozzle drivers, coil driver and Ram and Rom memories.

The design configurations and specific components change from manufacturer to manufacturer, but we can understand how the signals are processed internally in the Hardware.



Internal assembly of the 16 bits digital control center

In this example, we show a more advanced 16 bits switch. Note that in this case the nozzle drivers are combined with other drivers and components within a single chip. As well as coil drivers with other drivers. These chips are called Mult-Drivers. The Ram and Rom memories are inside the processor.


Driver Coil
Driver Probe
Mult -Driver's Nozzle, Engine Footstep, Canister
Cold Start Multi -Driver Pump
Processor with memory Rom and Ram internal

DATASHEET

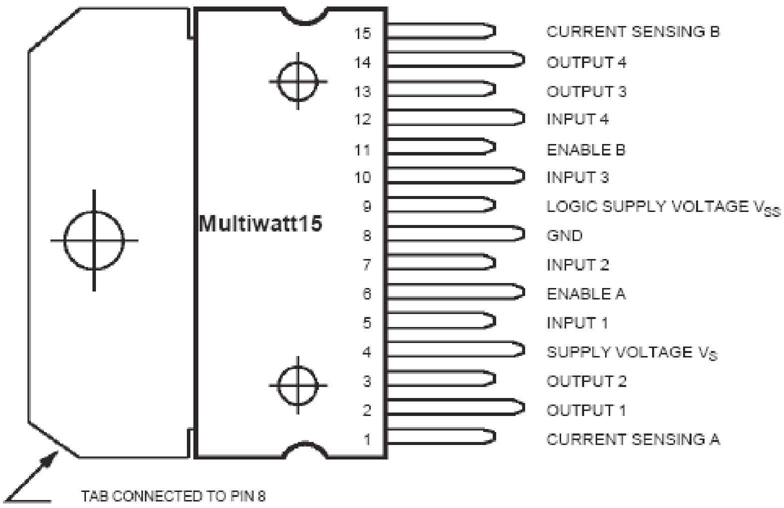
The datasheet is the description of the electronic component, it contains all technical specifications, such as:

•Function of each pin;
•Work tension;
•Maximum voltage;
•Maximum current;
•Block diagram (Internal electrical schematic of the component)

Example Below is part of the datasheet for the L 298 N component, which controls the stepper motor of IAWG6 / G7 systems.

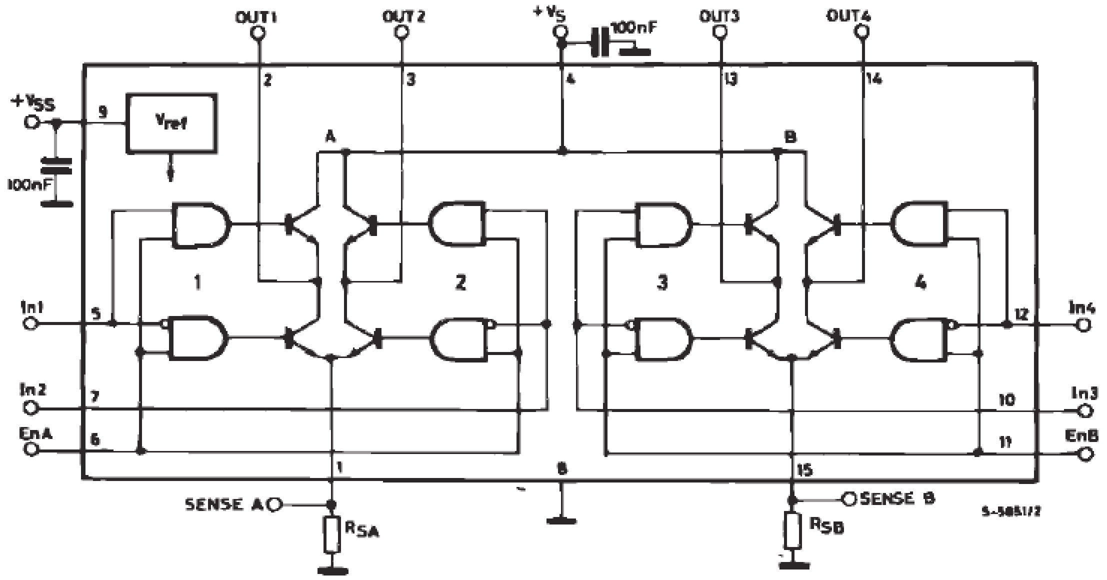
We can find the Datasheet of the components on any search engine by typing the code of the same.

L 298 N - Stepper Motor;



Pin Description
1 Monitors the current of Coil A
2 – 3 Controls coil A (pin 2 and 20 of the control panel)
4 Vs
5 – 7 Command input for coil A
6 – 11 Enables the activation of coil A or B
8 Grounding
9 Component power
10 – 12 Command input for coil B
13 – 14 Controls coil B (pin 21 and 3 of the control panel)

Block Diagram of L 298 N



TEST EQUIPMENT

Mult-Test or Multimeter

There are many equipments, simple and sophisticated to perform analysis of components and electronic circuits. For this training we will use only common equipment.

- To measure the voltage and resistance of components in a system, it is recommended to use a high impedance multimeter (10 KW / Volt minimum), which includes a voltage scale of 0 - 20 V and a scale of Ohm low (0 - 200) and high (0 - 20 K).

- There are analog (1) and digital (2) multimeters within a wide range of prices and specifications. Since the instrument will be used in the harsh workshop environment, the purchase of a shockproof one will be a good investment, which will justify the extra expense.

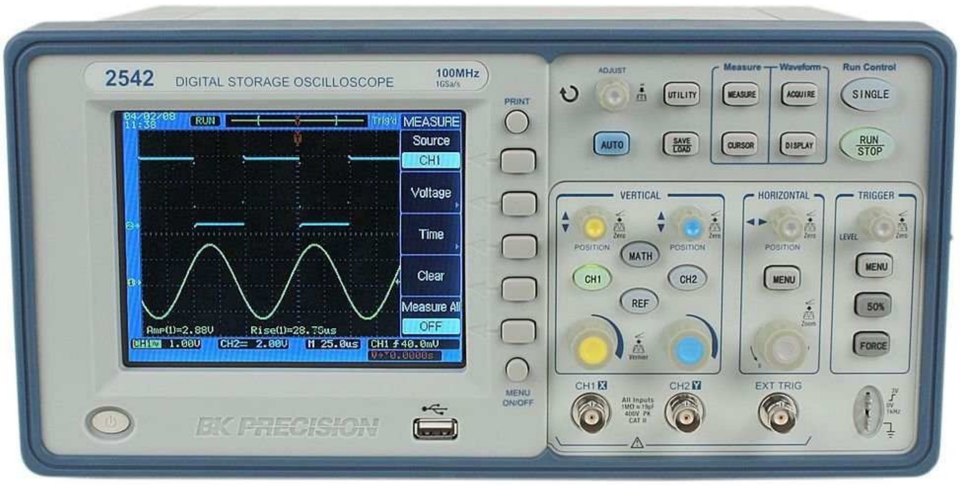
- In addition to the normal scales in volts, Ws and milliamps, certain characteristics such as, for example, the ability to read Capacitances (uF) frequencies (Hz) and operating cycles (%) will also be useful.

1

2

OSCILLOSCOPE

Indispensable equipment for testing in electronic centrals.



The **oscilloscope** helps us to find the problem quickly and easily. Often the problem has not registered an error code **(DTC)** in the corresponding **ECU**, the DTC, which can be read with a code reader. Generally, a DTC is recorded when there is a broken cable or a cable is **short-circuited** to a positive or negative source. But when a detector or mechanism has stopped working at some intermediate position, there is no error recorded. In this case, like when you need to find the reason that caused an error to be recorded - the automotive oscilloscope is your most important instrument required.

With the increase in sensors, actuators and wiring diagrams in modern automobiles, the oscilloscope is an instrument that diagnoses irregularities faster and easier.

Let's see the waveforms found in the different points of the **ECU** Let's study the meaning of each one.

For configuration and setup (setup) of the Oscilloscope we recommend

consult the AutoLeap Oscilloscope Handout .

3.1 CENTRAL SIMULATOR

The ECU Electronic Control Unit, in order to function and thus allow the tests and diagnostics, needs several signals at the input, provided by the sensors, as well as **12v power** at other several points (**line 15 and line 30)**.

To create this situation that allows the ECU to work on the workbench, there is the equipment that simulates all the existing signals in the Automobile.

ANALYZE WAVE FORMS

Each oscilloscope waveform contains one or more of the following parameters:

- **Amplitude - voltage (V)**

The signal voltage at a given time Frequency -

- **Cycles per second (Hz)**

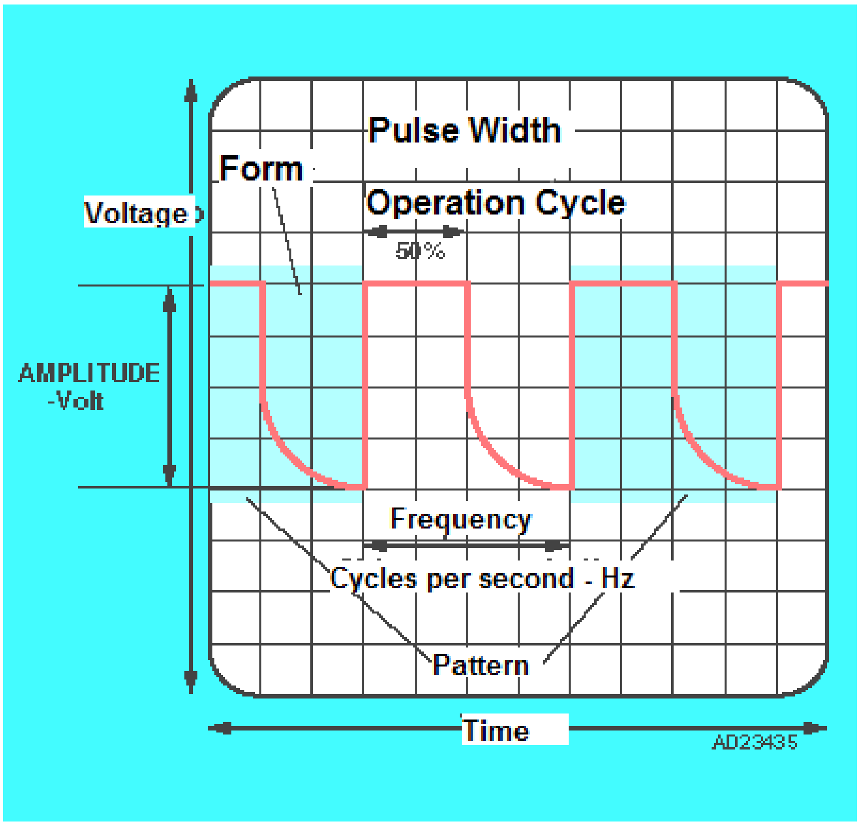
The time between signal points

- **Pulse width - duty cycle (%)**

The period during which the signal is on - expressed as a percentage (%) over the total

- **Shape - peaks, curves, serrations, etc. The global "image" of the signal**

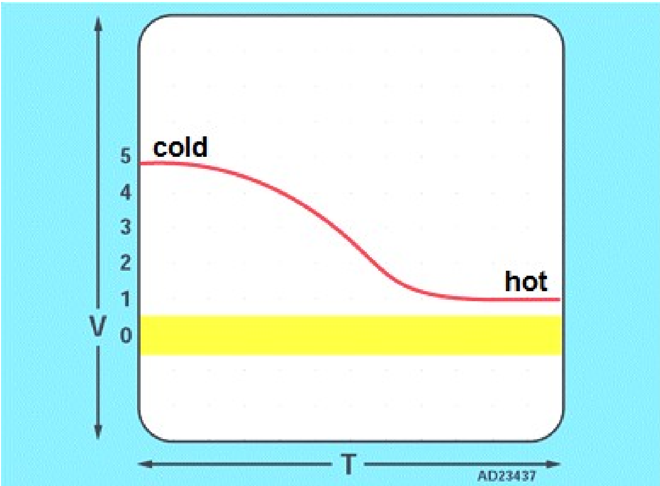
Waveform parameters - 1



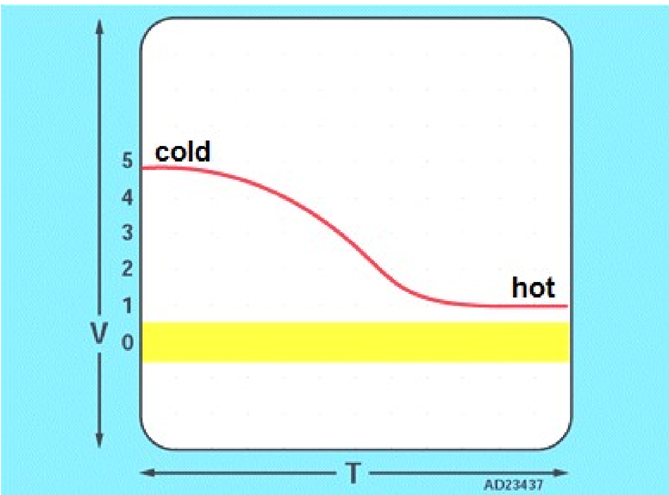
- **Pattern** - repeated shapes. The repetition pattern of the overall shape of the signal.
- **The oscilloscope** shows all these parameters on a single screen and the comparison of the wave forms presented in the **ECU Module** to be tested with those illustrated here allows to evaluate the status of each circuit and its components. The line of an anomalous circuit or component is usually very different from the line of one under satisfactory conditions, which facilitates the identification of malfunctions.
- The five parameters listed above can be categorized as follows form:

4.1.1 Analog DC Voltage Signals

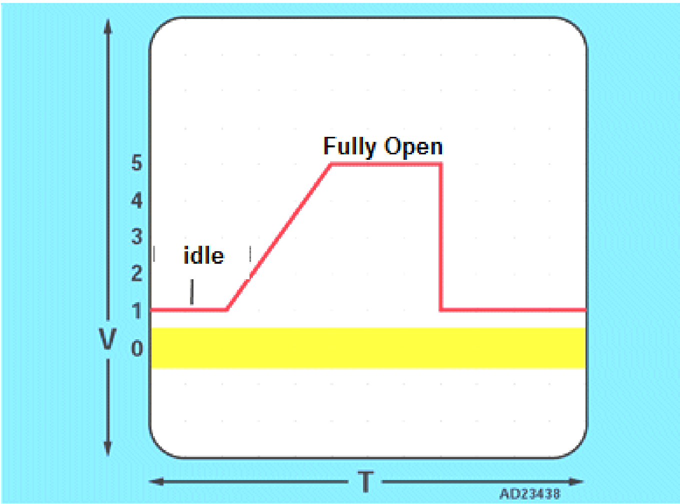
Coolant temperature sensor - 2



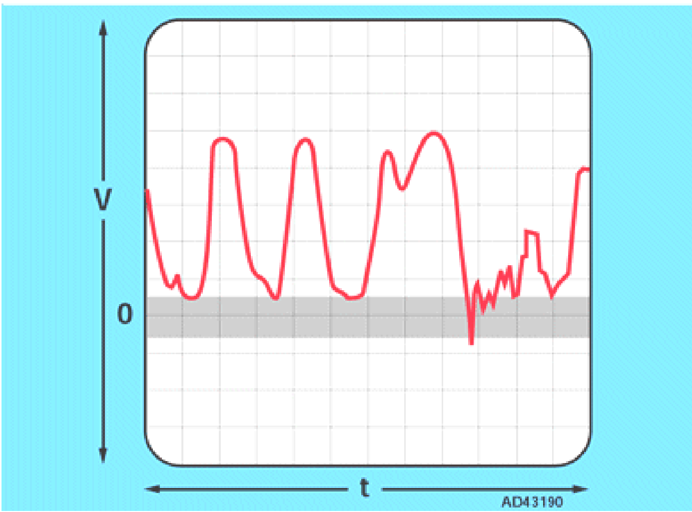
Intake air temperature sensor - 3



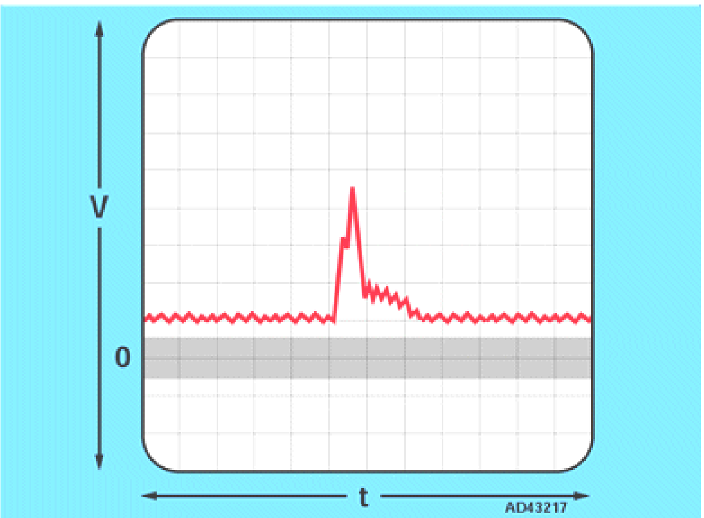
Throttle throttle position sensor - 4



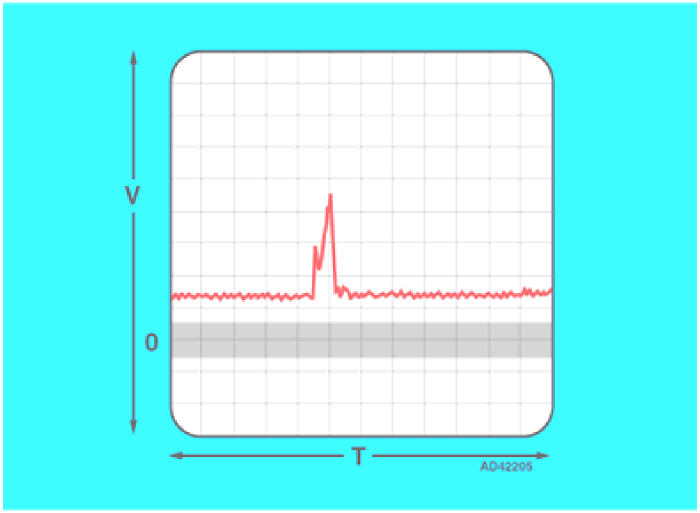
Oxygen sensor - 5



Airflow volume sensor - 6

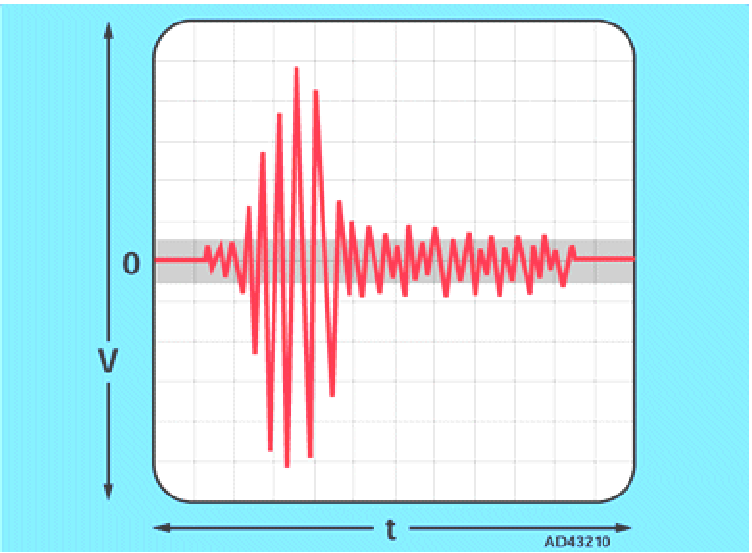


Air flow measurement sensor - 7

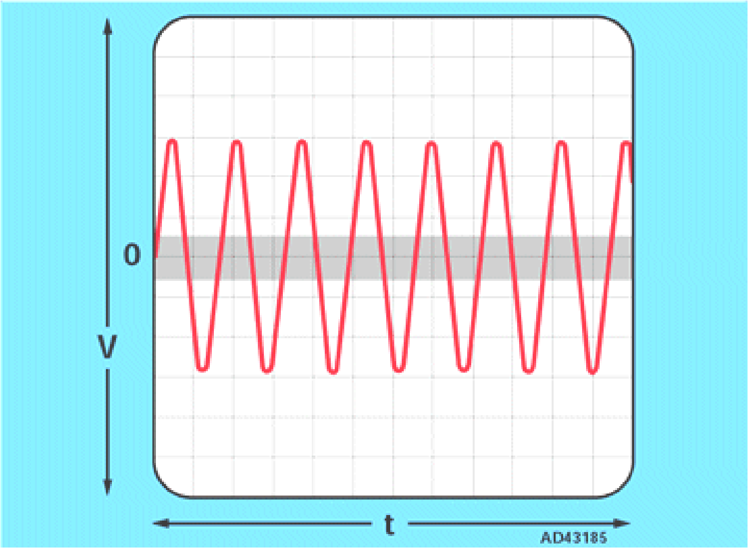


AC voltage signals

Knock sensor - 8

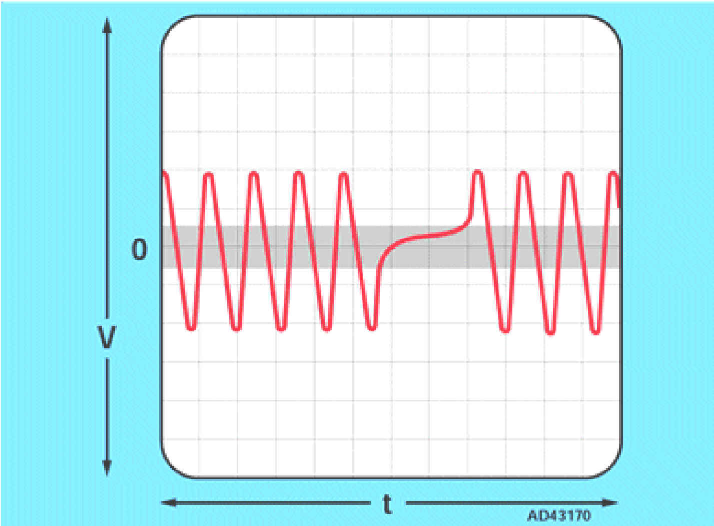


Motor speed sensor - inductive type - 9

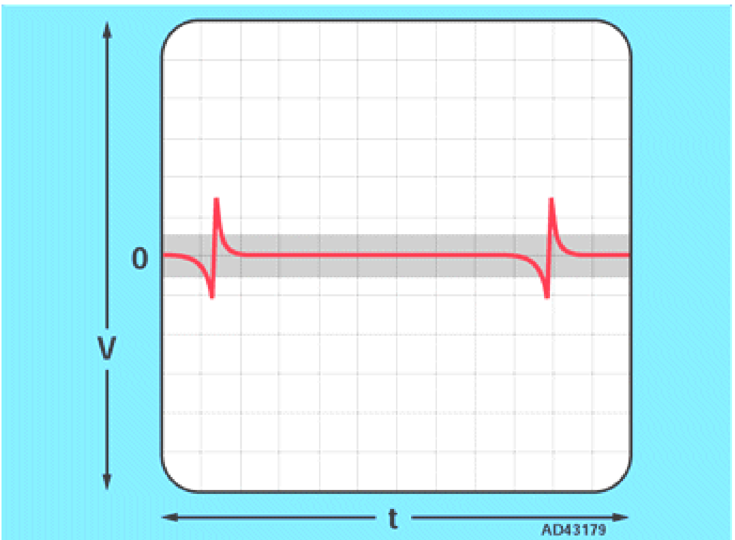


Frequency modulated signals

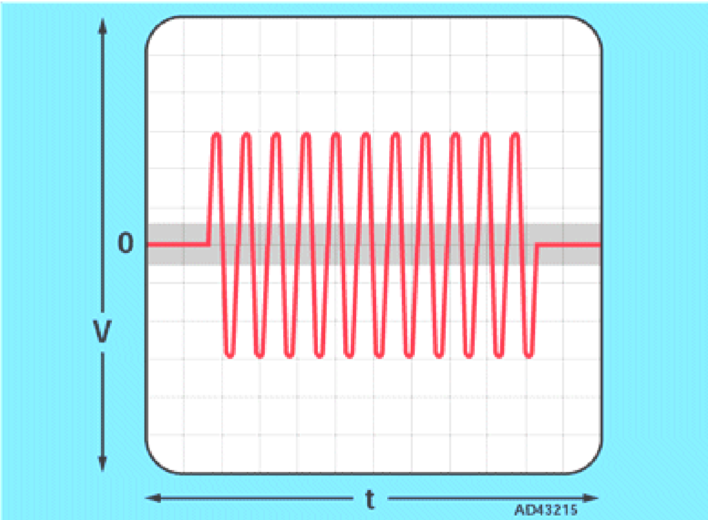
Rotation Sensor - Inductive Type - 10



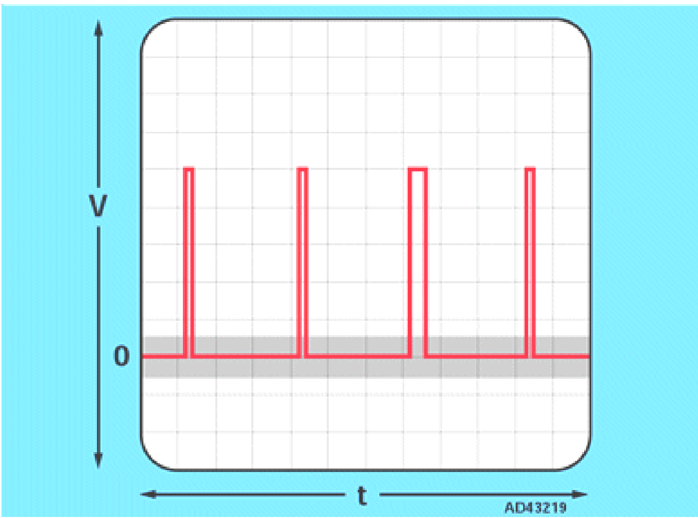
Phase sensor - inductive type -11



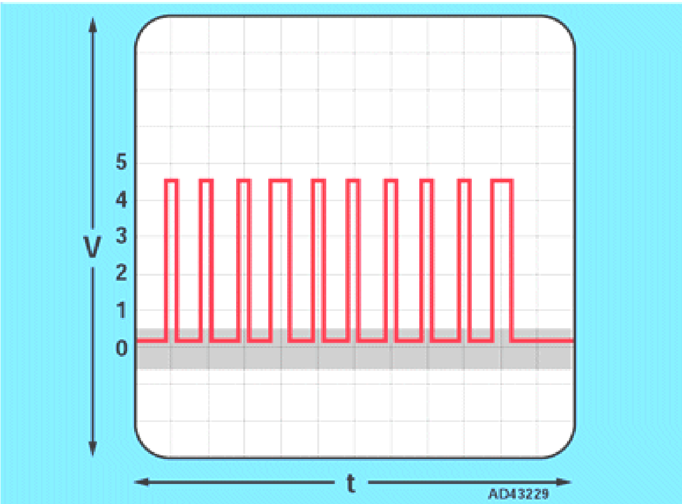
Vehicle speed sensor - inductive type - 12



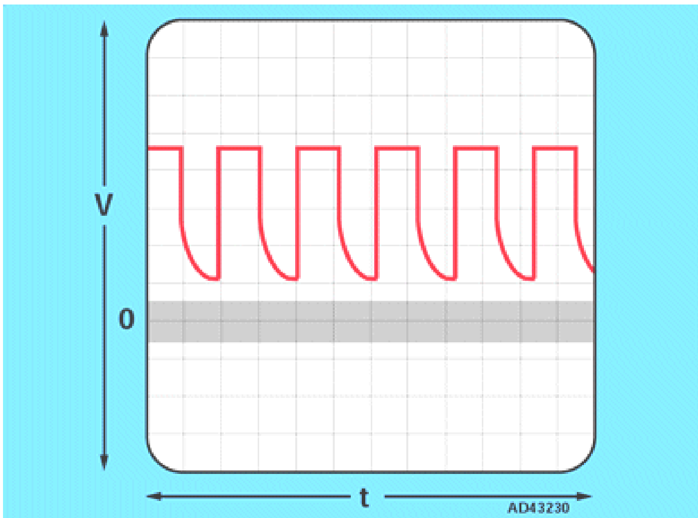
Rotation and position Hall effect sensors - 13



Optical Rotation and Position Sensors - 14

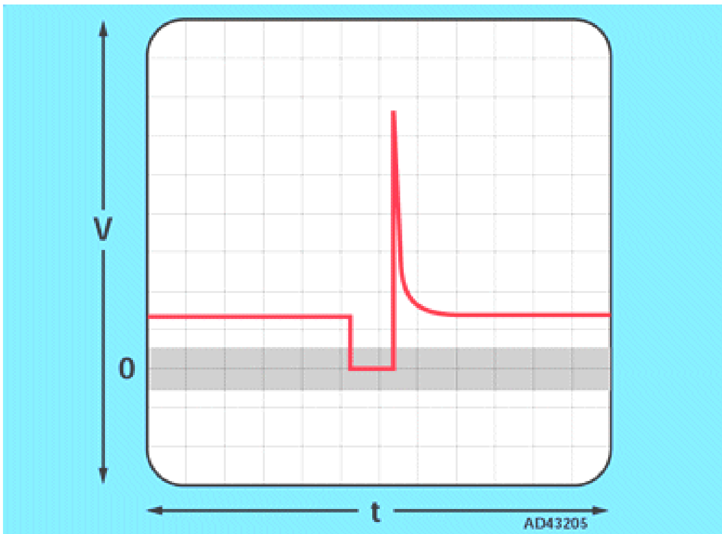


Absolute pressure sensor in the manifold - digital type - 15

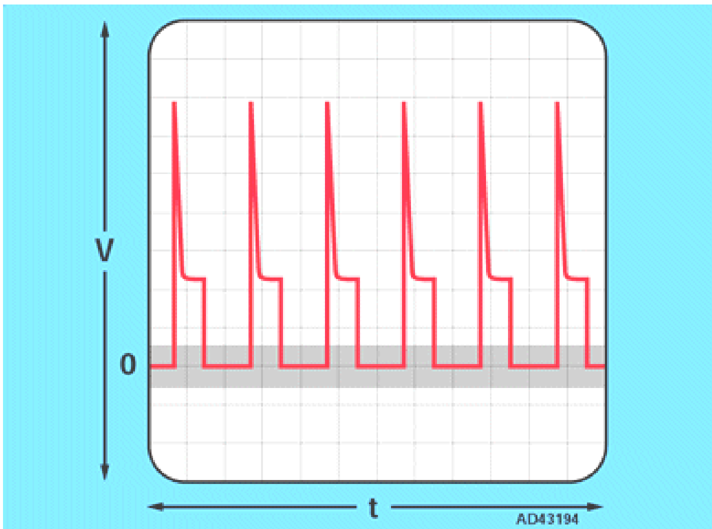


Modulated pulse width signals

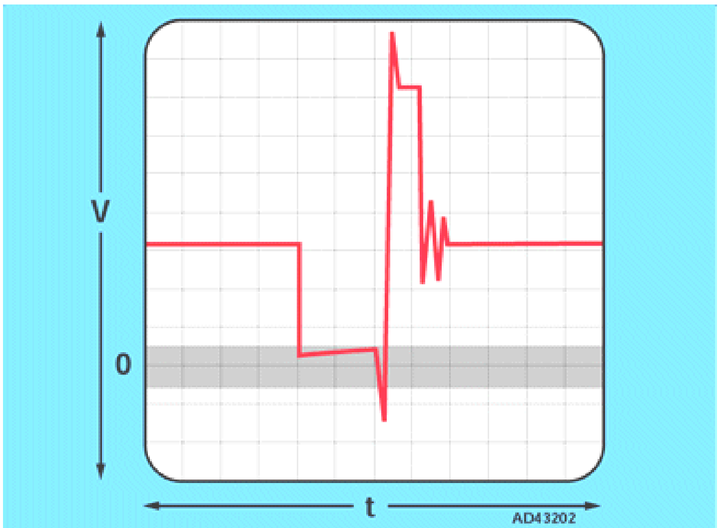
Injectors - 16



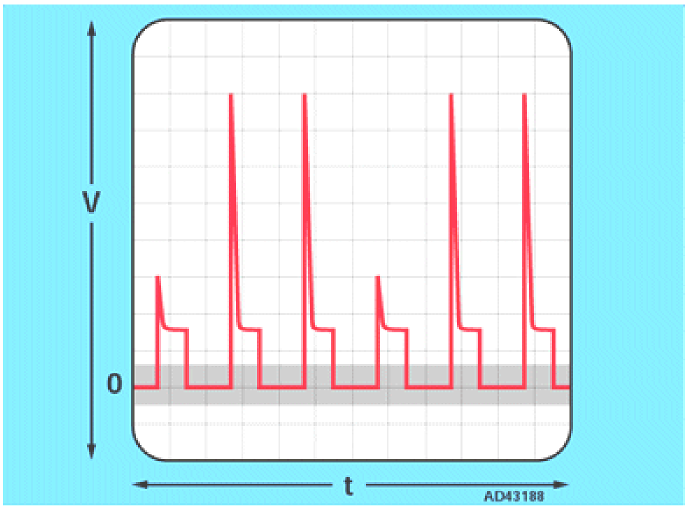
Idling air control devices - 17



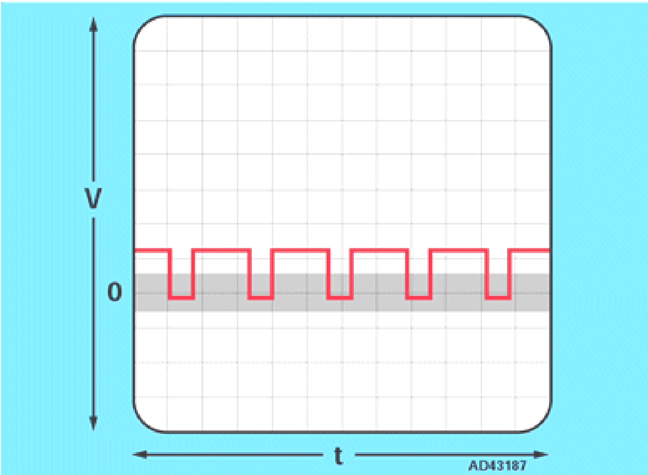
Primary ignition coil circuits - 18



Purge valve for fuel vapor emissions - 19



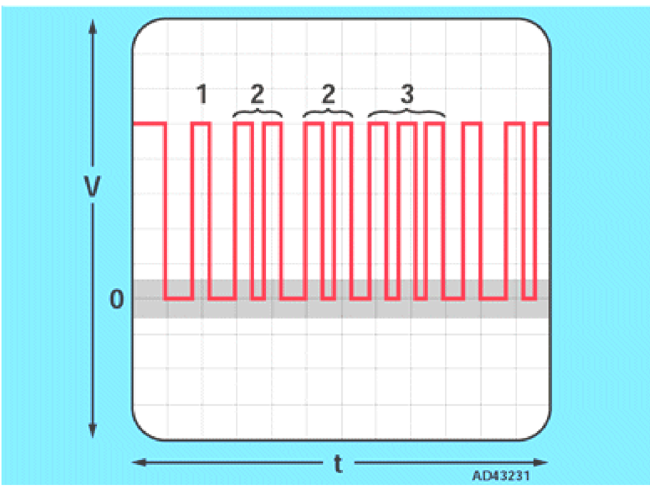
Exhaust gas recirculation valves – 20



Serial data signals

- Serial data signals are generated by the engine control module (ECU) (21).
- Observing the pulse width, pattern and frequency, short pulses can be counted in groups and interpreted as a fault code (in this case 1223).
- The amplitude and shape remain constant and the pattern is repeated until the code of malfunction to be cleared.

Data communication waveform - fault code - 21



INTERPRETING WAVE FORMS

Typical waveforms - 22 and 23

- Oscilloscope waveform patterns can vary immensely and depend on many factors. So, whenever the waveform appears to you to be incorrect when compared to the **"typical"** waveform that appears in the pin data table to be analyzed, consider the following points before making a diagnosis or replacing components.

Voltage

- Typical waveforms indicate the approximate position of the waveform relative to the **"zero grid"**, but this can vary depending on the system being tested and can be positioned anywhere within the "**range"zero** "approximate.
- The overall amplitude or height of the pattern (**the voltage)** depends on the operating voltage of the circuit.
- In the case of direct current (**DC)** circuits, this depends on the voltage that is switched; for example, the voltage of the idle speed control device is constant and does not change with the engine speed.
- In the case of alternating current (**AC**) circuits, this will depend on the speed of the signal generator; for example, the output voltage of an inductive RPM sensor (**CKP**) increases with the speed of the motor.
- Therefore, if the **oscilloscope** pattern is too high (or the top is missing), increase the voltage scale to obtain the desired display. If the pattern is too low, reduce the voltage scale.
- Some circuits with solenoids may exhibit spikes when the circuit is turned off. This voltage is generated by the component and can normally be ignored.

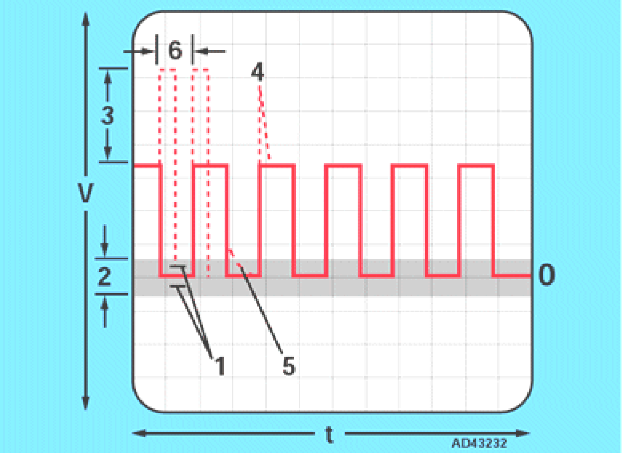
Some circuits that have a typical **square-type** wave may experience a voltage drop at the end of the switching period. This is typical of some systems and can usually be ignored, as it is not an indicator in itself malfunction.

Frequency

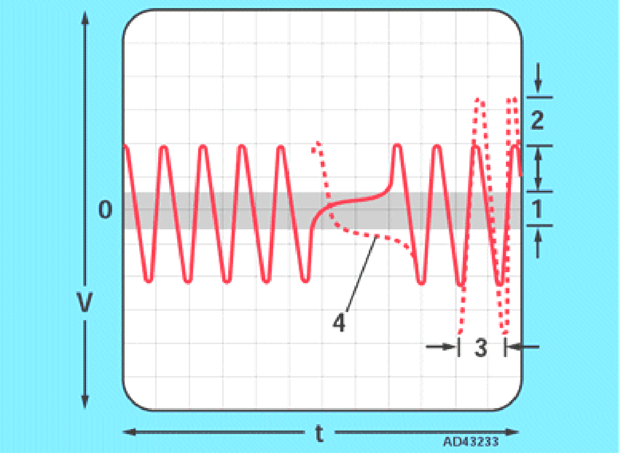
The total width of the pattern (**the frequency**) depends on the operating speed of the circuit.

- The typical waveforms illustrated are obtained with the oscilloscope's timescale adjusted to allow detailed observation. In direct current (**DC**) circuits, the time scale will depend on the speed at which the circuit is switched;
- In the case of alternating current (**AC**) circuits, the time scale depends on the speed of the signal generator; for example, the frequency of an inductive speed sensor increases with the motor speed.
- If the **oscilloscope** pattern is too compressed, decrease the time scale to obtain the desired view. If the pattern is too expanded, increase the time scale.
- An inverted pattern indicates that the system to be tested has its component connected with the polarity opposite to the typical waveform shown and can normally be ignored, as it is not a malfunction indicator by itself.

Digital Waveform - 22

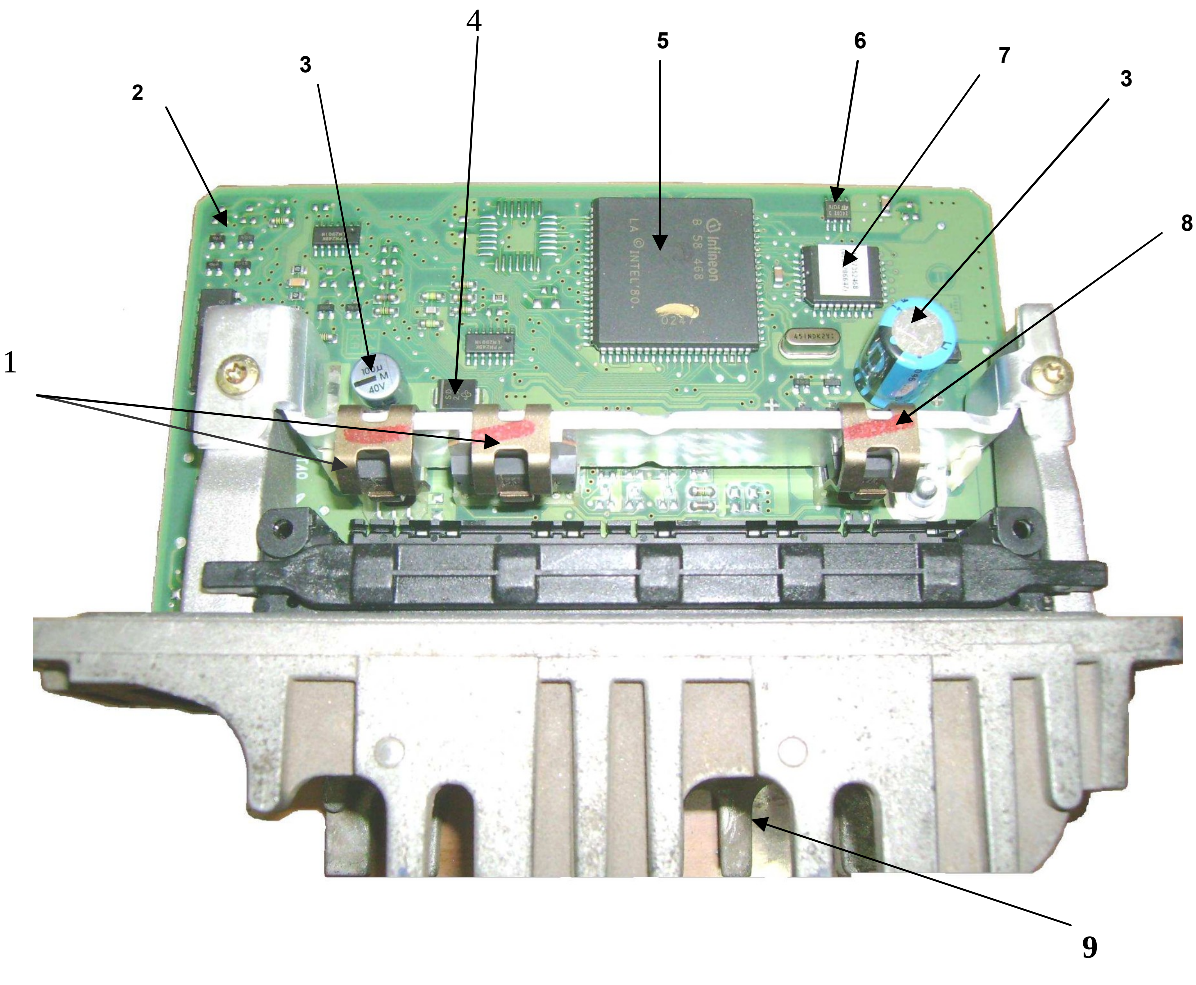


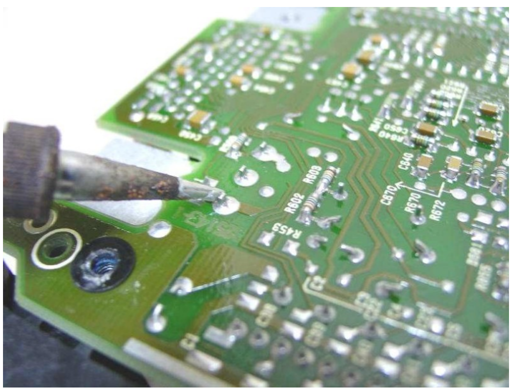
Analog waveform - 23



TESTING OF COMPONENTS

As we have already seen, the first analysis is the detailed visual inspection of the conditions of the printed circuit board, connectors, component positioning, components with overheating characteristics, etc. In case of removing any component, do not forget to write down or photograph the original position of the component. In the sequence we will see the components to be tested:





The vast majority of defects found in Control Centers (**ECU**), is the "cold solder" or interrupted conductive track.

Cause - Several factors can cause bad contact in terminal welds or breakage of tracks: **1-Time action 2-Oxidation 3-External short circuit 4-Over load, due to lack of grounding of external components.**

It is made - Lack of grounding of some sensors, actuators not operating, Central does not work.
Solution - First check the cause. Redo the weld or rebuild the track with capped wire.

The components shown in the photo above, have their physical appearances (**encapsulation**), very different in the different models of **ECUs**, according to the manufacturer but the internal characteristics of operation are the same. We can check each type of component and its characteristics, with the help of the Datasheet of the manufacturer of the component under test.

1 - Drivers

Components such as Transistors and FETs, used to amplify and transform processed digital signals into power signals for triggering the injector nozzle, coil, solenoids, etc. Check the internal characteristics in the Datasheet. The Coil Driver is generally shorted when the Coil is damaged. The Driver consists of an individual Power Transistor in Integrated Circuit with several internal components, Mult-Driver.

2 - Transistors

Low power transistors used for switching and communication of processed digital signals.

3 - Electrolytic capacitor

Used to filter the input voltage before the voltage regulator and after the voltage regulator. It consists of two dielectrics and an acidic substance internally, which can leak over time, causing corrosion and short circuits in the board.

4 - Zener diode or rectifier

The rectifier diode allows the passage of the electric current only in a sense. The zener diode protects the system against over voltage.

5 - Processor

As with a Desk Top Computer, it is the heart of the ECU. Contains a internal software with the system's work routine. To check its operation, consult the Datasheet to find the power terminals + 5v, Earth, and with the help of the oscilloscope, check the Clock signal.

EEprom

Serial Eprom package SOIC08 contains information like code immobilizer, engine, Airbag etc. It can be reprogrammed via Scanner.

Eprom

It can be found in DIP, PLCC, PSOP or internally in the processor in Hybrid ECUs. Contains information about the engine's operating parameters: advance, injection time, temperature etc. Programming can only be done by changing the Chip or using special equipment.

Voltage Regulator

Adjusts the 5v working voltage of the ECU.

Connector

Connects the ECU to supply voltage, earth, sensors and actuators. It presents defects of bad contact, oxidation.

5.1.1 - TEST OF RESISTORS:

Electric resistors are electronic components, whose purpose is to offer opposition to the passage of electric current through its material. This opposition is called "Electrical Resistance".

Electrical resistance

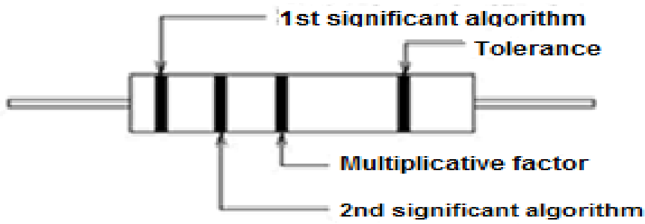
Unit	Oh M Ω
kilo Ohm	k Ω = 10^3
Mega Ohm	M Ω = 10 6

Resistors can be Fixed or Variable.

Fixed: They are resistors whose electrical resistance cannot be changed (they have two terminals)

Variables: They are those whose electrical resistance can be changed through an axis or course (**Rheostat, Potentiometer**).

Resistors are identified by a color code, where each color and its position in the resistor body represents a value or a factor multiplicative.

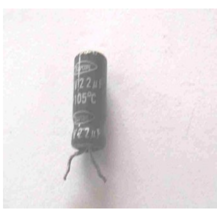


Color	1st	2nd	Multiplicative Factor	Tolerance
black	0	0	X1	- - -
Brown	1	1	X10	1%
Red	2	2	X100	2,00%
Orange	3	3	X1,000	- -
Yellow	4	4	X10,000	- -
Green	5	5	X100,000	- -
Blue	6	6	X1,000,000	- -
Violet	7	7	- - -	- -
Grey	8	8	- - -	- -
White	9	9	- - -	- -
Golden	-	-	X0.01	5%
Silver	-	-	X0.1	10%
No color	-	-	- - -	20%

SMD RESISTOR

SMD resistors are 1/3 the size of conventional resistors. They are soldered on the underside of the board by the side of the tracks, taking up much less space. They have the value marked on the body with **3 numbers, the 3rd digit being the number of zeros.** Ex: 102 means 1,000 Ω = 1K Ω.TESTING OF ELECTRYLIC CAPACITORS

Symbols that represent electrolytic capacitors:

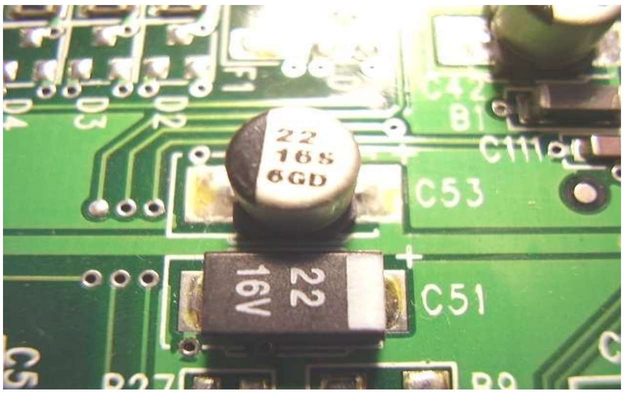


Real look

These capacitors are used specifically in filtering power supplies, low frequency oscillating circuits, low signal coupling frequency and time circuit (**timer**).

There are two types of electrolytics: Those that have a metallic body

(similar to the common ones) and those with an epoxy body, similar to the diodes. Some have the characteristics indicated by a letter (working voltage) and a number (value in mF). Ex: 22/16 See below:



To do the tests of the electrolytic capacitors, it is first necessary to know their value in Microfarade in order to be able to position the selector switch in the correct scale

SCALE VALUES IN MICROFARADE

X1 OR X10 330 Mf at 10,000 mF

X 1K 0.05 Mf at 220 mF

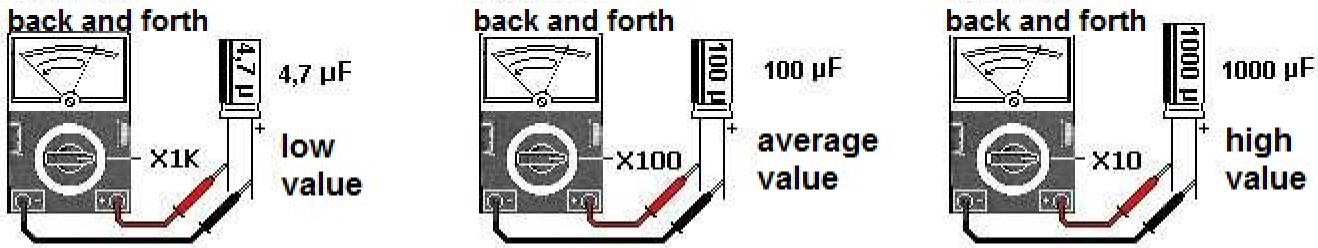
Also note that the electrolytic capacitor has polarity (+ and -) the working voltage value is also found in the capacitor.

In your tests it is not necessary to see its polarity or the working voltage, only the capacitance value to position the selector switch on the correct scale.

- Take a capacitor whose value is between 330mF to 10,000mF.

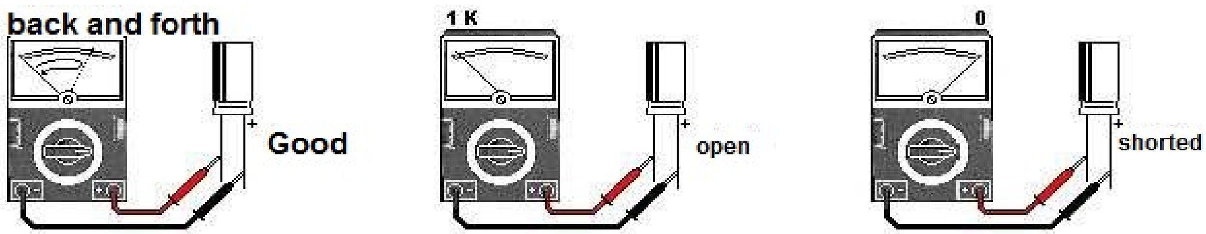
- Position the selector switch on the X10 scale.
- Place the test leads on the capacitor terminals and keep the multimeter test leads fixed to the capacitor terminals and note that the multimeter's pointer has shifted and returned to the resting point.
- Change the multimeter's test leads at the capacitor terminals, that is, invert the cables; black cable in place of red and red in place of black. Note that the pointer will move and return to the rest position. This occurs when the capacitor is fine.

  Start with the smallest scale (X1) and measure in both directions. Increase the scale until you find one that the pointer deflects and returns. The larger the capacitor, the smaller the required scale. This test is only for the charge and discharge of the capacitor. See below:



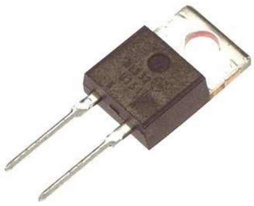
If the pointer does not deflect or deflect just a little, the capacitor is open or exhausted. If the pointer deflects and does not return, the capacitor is in short.

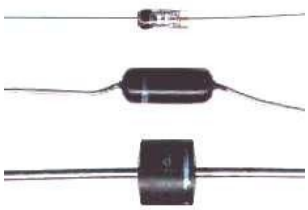
See below:



DIODES TEST

We find it in several common and SMD packages.





There are several types of Diode such as Rectifier, Zener, LED, Varicap etc. let's look at just two types most used in ECUs.

Rectifier Diode

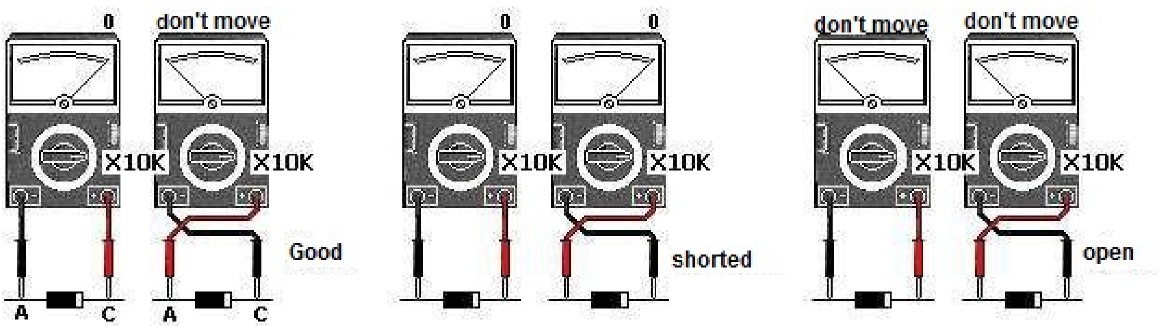
It has the characteristic of allowing the passage of electric current in a single sense.

Zener Diode

It has the characteristic of allowing the current to flow inversely, when it exceeds the zener value.

Rectifier Diode Test

Use the largest scale (**X10K or X1K**) and measure the diode in both directions. The pointer should only deflect in one direction. As the black tip is connected to the positive of the batteries, the pointer will touch the black on the anode. If the pointer deflects in both directions, the diode is in I enjoy . If the pointer does not deflect in any direction, the diode is open . See below:

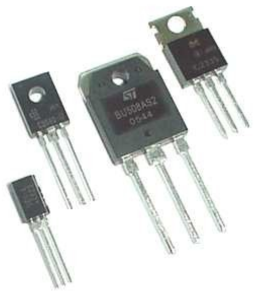


Zener Diode Test

The test for Zener Diode is the same for rectifier diode, if we improve the test we can use an adjustable voltage source and adjust for rupture voltage, the diode and check the reverse current, finding the zener voltage.

TRANSISTORS TEST

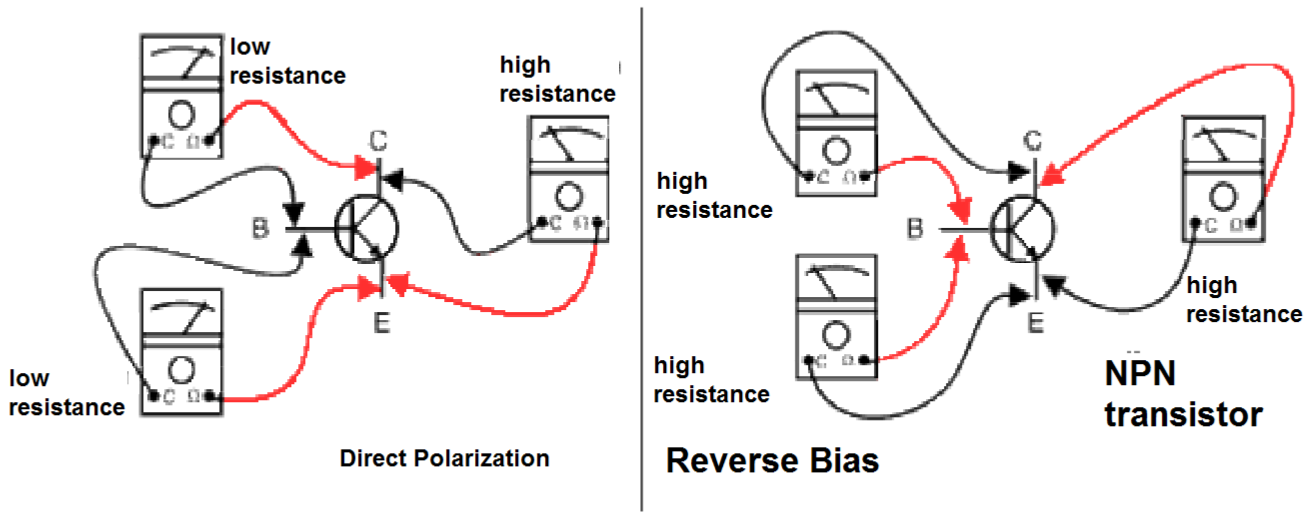
The Transistor has the function of amplifying electric currents and switching loads electrical. In the ECU, among other functions, it is mainly used as an output and switching nozzle driver, coil etc.

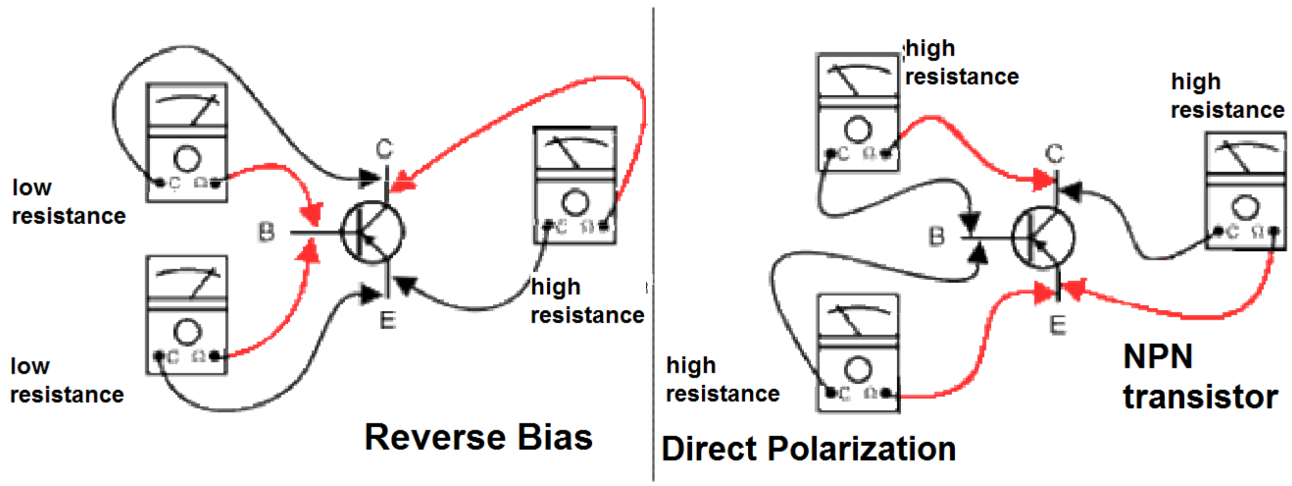


Test Bipolar Transistors (NPN, PNP)

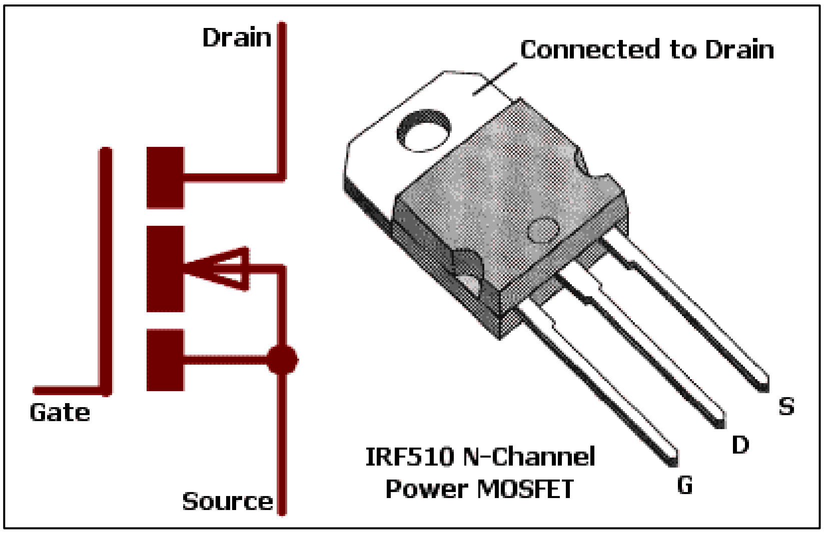
A transistor for testing purposes is no more than two diodes connected in opposition, the verification with the multimeter is performed according to the two PN junctions and NP.
The measurement is carried out in the same way as on a normal **PN diode.**

The test is carried out on all joints.





FET TRANSISTOR



A common defect in power transistors is a short one between collector and emitter, or Dource and Drain that can be detected by these tests. Remember that certain types, such as the Coil output, may have an internal diode between emitter and collector and also internal resistance between base and emitter. But the short mentioned is observed by the low resistance in both directions.

PROCESSOR TEST

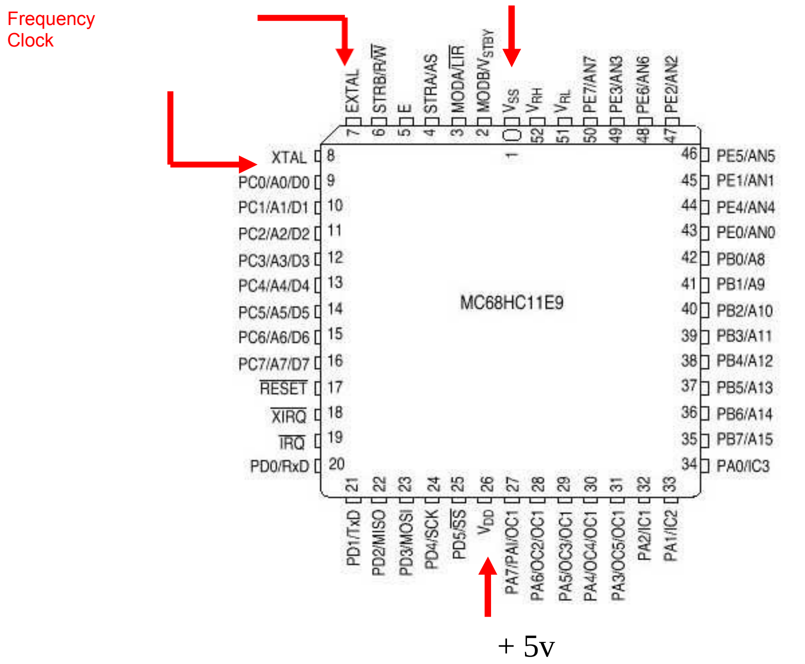
Processors are also different depending on the manufacturer and the ECU model. Major processor manufacturers are: Motorola, STMicroelectronics, NEC Electróncs, Texas Instruments, SGS Tomson.

The complete test of a Processor is performed with Hardware and advanced software. In this stage of Cuso we will carry out the basic test of the processor's operation in the circuit.

With the aid of the component's Datasheet, we will locate the terminals

Vss (land) V DD **(+ 5v)** and Clock. With the **12v** supply properly connected, we check with an oscilloscope or frequency meter, if the processor is generating the clock frequency - frequency of the Cristal.

EARTH



With the self-adaptive feature, the Processor performs the reading of the sensors and rewrites the parameters at a speed 4 times greater than the engine speed. When the sensor readings report values that are too high or too low at random, far outside the characteristic parameters, the processor registers an error and crashes its operation. For this ECU to return to normal operation, we have to reset this processor, loading new software into its memory.

This procedure happens with all types of Electronic Command, such as Electronic Panel, ABS Brake Central, Immobilizer etc.

Very common procedure in vehicle repair shops, is the exchange of the Vehicle Dashboard or Injection Module, for a component removed from another vehicle whose characteristics are different. For everything to work correctly, just copy the software from the Panel or Module Processor and write to the Processor of the new Module.

In the most recent Centrals, it is possible to do this work by interface **OBD2** via **diagnostic connector** or even through the Scanner. In other plants it is only possible to reprogram the Processor with the help of special programmers.

Below are some Processor programmers:

MC68HC (7) 11

Supported devices:
MC68HC11A8 (AB95T), MC68HC11A8 (C96N), MC68HC11A8 (D26E), MC68HC11E20 (3E22B), MC68HC11E9 (1B60R), MC68HC11E9 (D82R), MC68HC11E9 (E22B), MC68HC11HC (2D), MC68HC11E9 (E28B), MC68HC11F1 (E87J), MC68HC11K1 (2D58N), MC68HC11K4 (1E62H), MC68HC11K4 (OE75J), MC68HC11KA4 (1E59B), MC68HC11KS2 (0H95B), MC68HC11KS4 (0E57S), MC68HC11711 MC68HC711E9 (5C47M), MC68HC711EA9 (0D46J), MC68HC711K4 (K59D), MC68HC711PH8 (0H30R), MC68S711E9 (5C47M), XC68HC711KS8 (1H96 MC68HC11P2 (2E74J), XC68HC711P2 (1E53M).

MC68HC11PA8

Supported devices:
MC68HC11PA8, MC68HC11KA1, MC68HC11KA4, MC68HC11P2, MC68HC705B16 / 32, MC68HC705X16 / 32, MC68HC05B6 / 8/16/32

Supported devices:

MC68HC705B16, MC68HC705B32, MC68HC705X16,

TMS370
Supported devices: TMS370CX6X TMS370CX5X TMS370CX4X TMS370CX3X TMS370CX0X TMS375C006 TMS374C003A TMS374C013A

NEC uPD17011GF
Supported devices: uPD17011GF
Tested on: NEC D17011GF E91, E93, E95

Programmer ST10Fx
Supported devices: ST10F168, ST10F276, ST10F279, ST10F280

EPROM TEST

The models of eproms vary according to ecapsulations and sizes of memory capacity, according to the scheme and table below.

- They are rewritable
DIP (Large) -Use the eraser to erase Start with 27C...

EPROM

PLCC (Small)

“NORMAL” - Only record

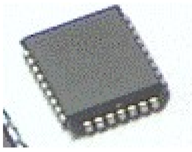
- Start with 27C ...

FLASH -They are rewritable

- Use the recorder to erase
- Start with 28F ...

DIP	NORMAL PLCC	PLCC FLASH
27C128	27C512	28F512
27C256	27C010 OR 27C1001 *	228F010 OR 28F1001 *
27C512		
27C010 OR 27C1001 *		

*** 010 OR 1001 have the same parameters.**



Example of an Eprom **DIP** Example of an Eprom **PLCC**

Eproms are distinguished from each other by their respective data storage capabilities:

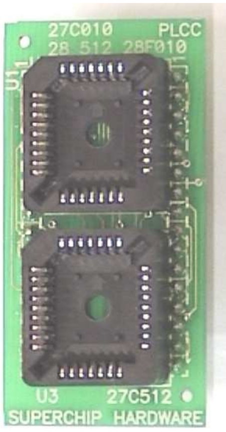
CLASSIFICATION	CAPACITY	FORMATS FOUND
27C128	16KB	DIP only
27C256	32KB	DIP only
27C512	64KB	Both DIP and PLCC Both DIP
27C1001 (27C010)	128KB	and PLCC

Eprom Test

The test is performed with the Eprom Reader and Recorder equipment.

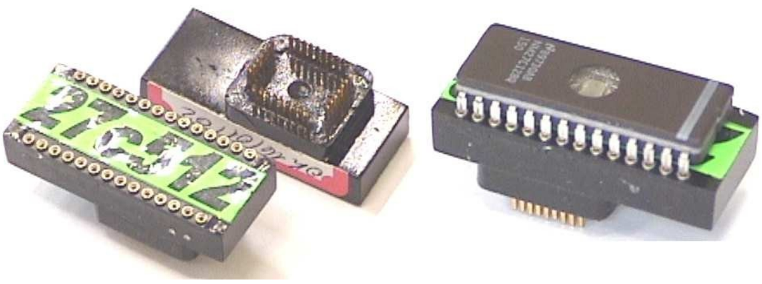
Adapters

This adapter socket is used to allow reading and writing PLCC type eproms on equipment whose socket is DIP. Observe carefully which socket the particular Eprom PLCC should be fitted in (27C010 or 27C512).



TEST SOCKET 27C512

This socket is used to test a file that originally belongs to a PLCC 27C512. In case the eprom is a 27C010, we have the possibility to do the tests on a PLCC Flash 28F010 eprom. However, we do not have this same device in the case of PLCC 27C512. In this case, we write the file to a 27C512 DIP and use the test adapter.

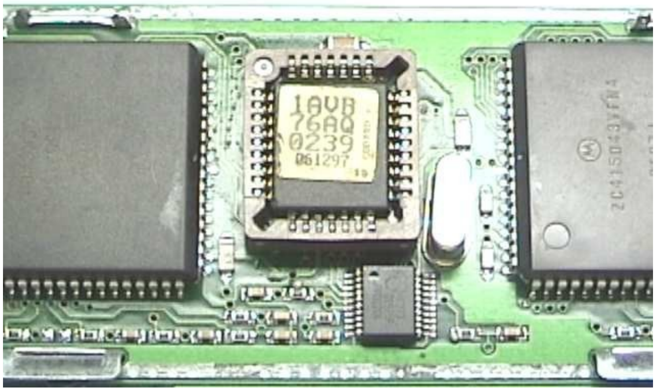


Example of a 27C512 test adapter

TYPES OF FIXATION

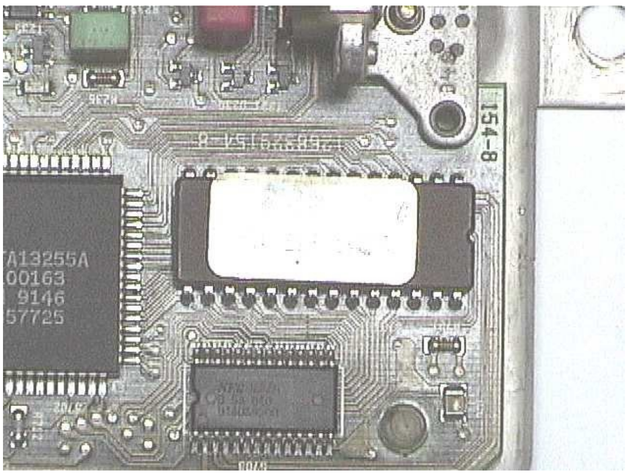
The eproms are fixed to the Central Electronic board in three different ways: socket, solder and mencal.

SOCKET: The eprom is fixed to the central board through a socket, varying only the type of socket, according to the type of eprom used, DIP or PLCC.



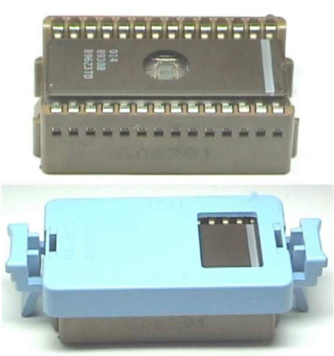
Example of socketed eprom.

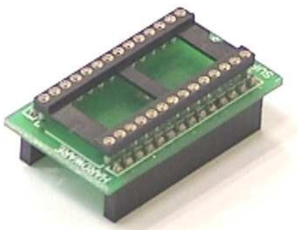
WELDING: The eprom is welded directly to the central plate, that is, it is fixed.

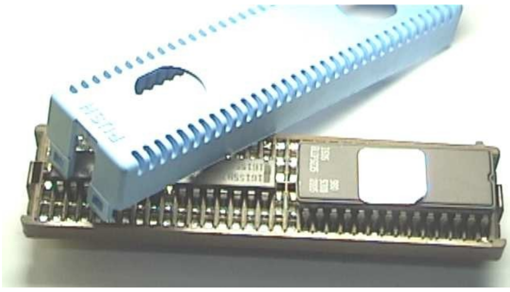


Example of welded eprom.

<u>MENCAL</u>: The eprom is fixed to the central board using a special socket, developed by the central manufacturer. These mencals are found in some Delco plants. There are two types of mencals: MENCAL BLUE, which are small (to assist in the exchange of this eprom, we developed the Delco Spacer), and the large mencals.





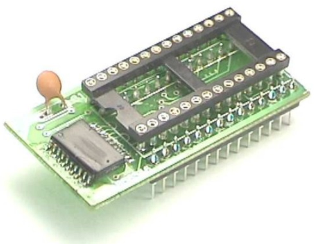


Mencal Blue example   Delco Spacer Example   Mencal example

Big

SOCKET FOR PLANTS BOSCH MP9.0

These plants are found in the Gol 1.0 8V until 1999 (from 2000 onwards it is already a PLCC) and in the 1.6 8V Kombi. In both cases, the replacement eprom will be DIP



27C512. This socket will be fixed between the central and the new eprom and will be fixed in the central.
Example of a socket for MP9.0 control panels

PROGRAMMING ENVIRONMENT

EPROM: It's a memory. It works like a computer diskette. It has a file stored inside it where the car's electronic and electronic information is located, as well as the information from the sensors, its routines and maps.

FILE: It is a set of data transformed into binary or hexadecimal numbers represented by letters and numbers.

BUFFER: It's the computer's memory. It is there that the file extracted from Eprom or the file remapped by the program is stored.

PROGRAM: It is the tool used to change (remap) a file which has been transformed into a graphic so that it can be viewed.

EPROM REPROGRAMMING

There is a lot of software to Edit and Reprogram the internal File of the

Eprom memory. In the next step of our Courses, we will learn how to use the most advanced Reprogramming tool to date. Let's learn how to reprogram with Software **ECM2001** from AlienTech.

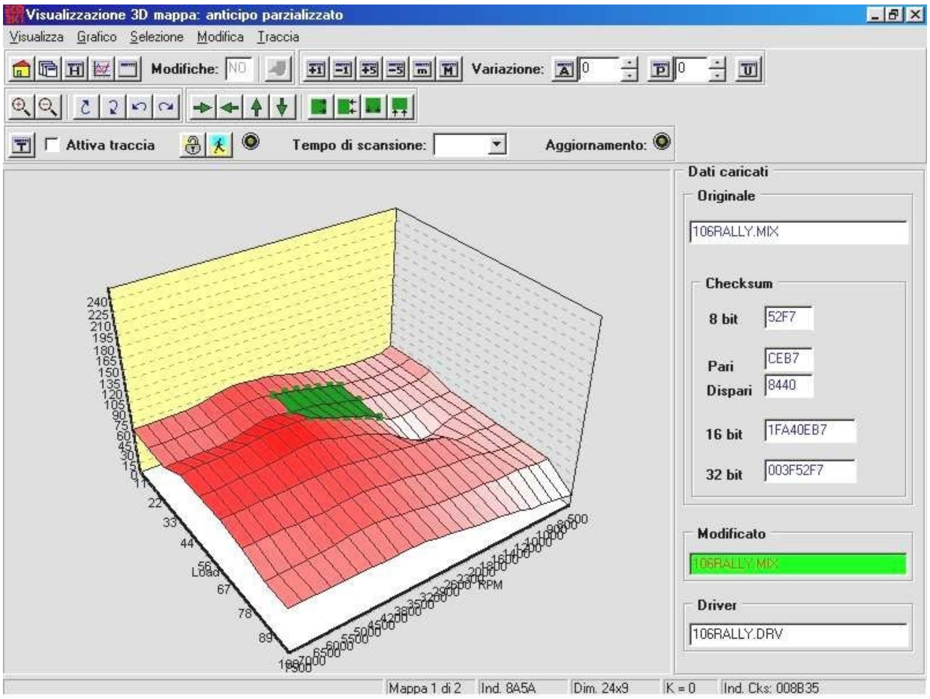
ECM 2001 is a new concept of remapping software for electronic injection. Enables modifications to the file contained in the EPROM memory with more precision and practicality, whether on engines Diesel or Gasoline , aspirated or turbo-compressors, quickly loading the maps available in the driver (injection, point, pressure, turbo ...).

Plots all the data contained in an eprom in graphical form, generating graphs in which the curves related to the mapping can be recognized and shows the exact location of the injection, advance, rotation limiter, lick probe etc. maps.

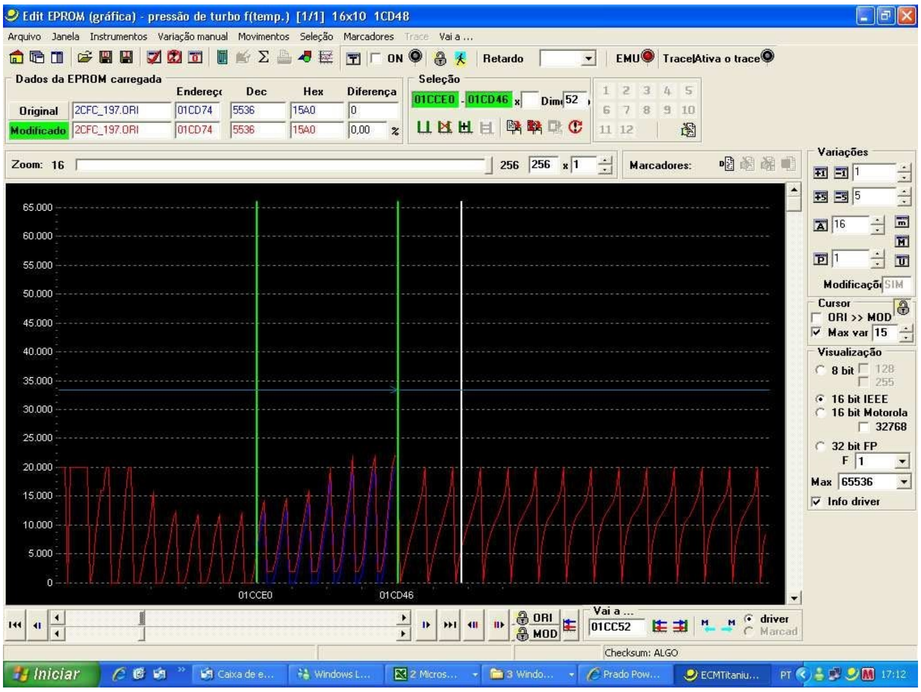
* It allows the visualization of maps of 8 bits, 8 bits / 128, 8 bits / 255, 16 bits IEEE, 16 bits IEEE / 32768,
16 bits Motorola and 16 bits Motorola / 32768;

Calculates and adjusts the cheksum automatically.

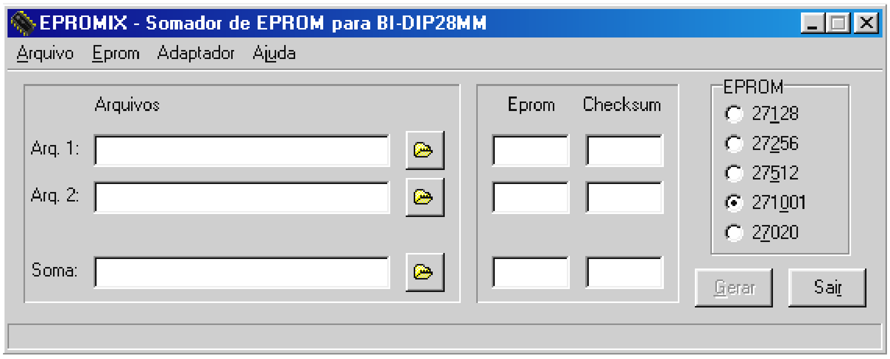
3D Graphic Editor



2D Graphic Editor



BI-FUELS



THE EPROMIX is a program for adding files. It generates a third file from the sum of two others. How does it work:

First: You must choose (select) the first file by clicking on the button that contains the drawing of a yellow folder referring to file one. When working as an original file and a remapped file, it is advisable that file number one (first file) be the original. In the case of two remaps, the order of the files is the same.

Second: You must repeat the same procedure as before, but now to choose file number 2.

Third: In the field called “Sum”, you will click on the button with a yellow folder drawn and choose where (in which directory) your new file (the third, coming from the sum of the first two) will be saved.

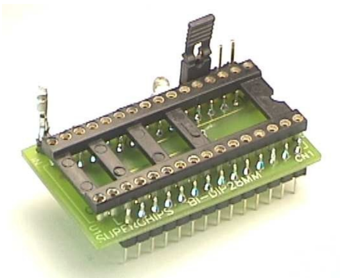
Bedroom: On the right side of the program window (**or in the “Eprom” menu**) you have the option to select which type of eprom will be used by the added file. That is, when the original eprom of the vehicle you are converting is a DIP 27C256, a DIP 27C512 or a PLCC 27C512, in this field, you will always select the eprom "271001" . When the vehicle's original eprom is a PLCC 27C010, in this field you will select the eprom "27020" .

Fifth: After the previous four procedures, you must generate the added file by clicking on the program button called “Generate”.

Note that the size of the generated file corresponds to the type of eprom you selected and that Cheksum is the sum of the Cheksum of the two first files.

Socket BI-MM28

This socket is used in vehicles that have **DIP 27C256 or DIP 27C512** as the original eprom. In the **EPROMIX program**, it must be selected in the kind of eprom a 271001 . In the socket there is a “jumper” that serves to select the type of original eprom of the vehicle. There is also a connector where you will connect a positive **12 volt supply** together with a common, on-off switch. This switch will switch between files, that is, while the switch is off and the bi-fuel socket is not being powered



positively (12 volts), the socket will trigger file number one. The moment the key is activated (on) and starts driving 12 volts to the socket, it will trigger file number two, without having to turn the vehicle off.

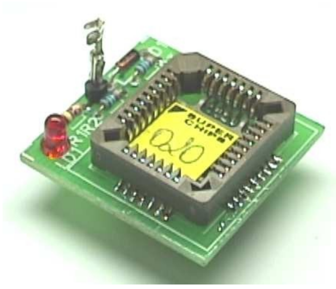
Example of a BI-MM28 socket

Socket BI-PLCC 010

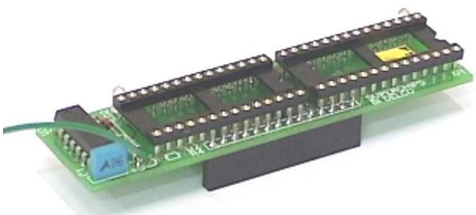
Its operating principle (**12 volt supply and on-off switch**) is the same as that of the BI-MM28, however this socket is only for the PLCC 27C512 eprom, so it does not have any jumper to select the type of eprom. In the **EPROMIX program**, it will also be selected as the type of eprom to be 271001 .

Socket BI-PLCC 020

Its working principle (12 volt power and on / off switch) is also the same as the previous sockets, but this socket is only for the eprom PLCC 27C010 and also does not have any “jumper” to select the type of eprom. However, in the EPROMIX program, the type of eprom will be selected as 27020 .



Example of a BI-PLCC socketBi-fuel socket for Delco control units Its operating principle (12 volt power and on / off switch) is also the same as the previous sockets, however this socket does not use the **EPROMIX program**. Its two files are recorded in different eproms, that is, the first file in one eprom and the second file in another eprom, both using the eproms corresponding to the vehicle's original.



Example of a Bi-Fuel socket for Delco control units.

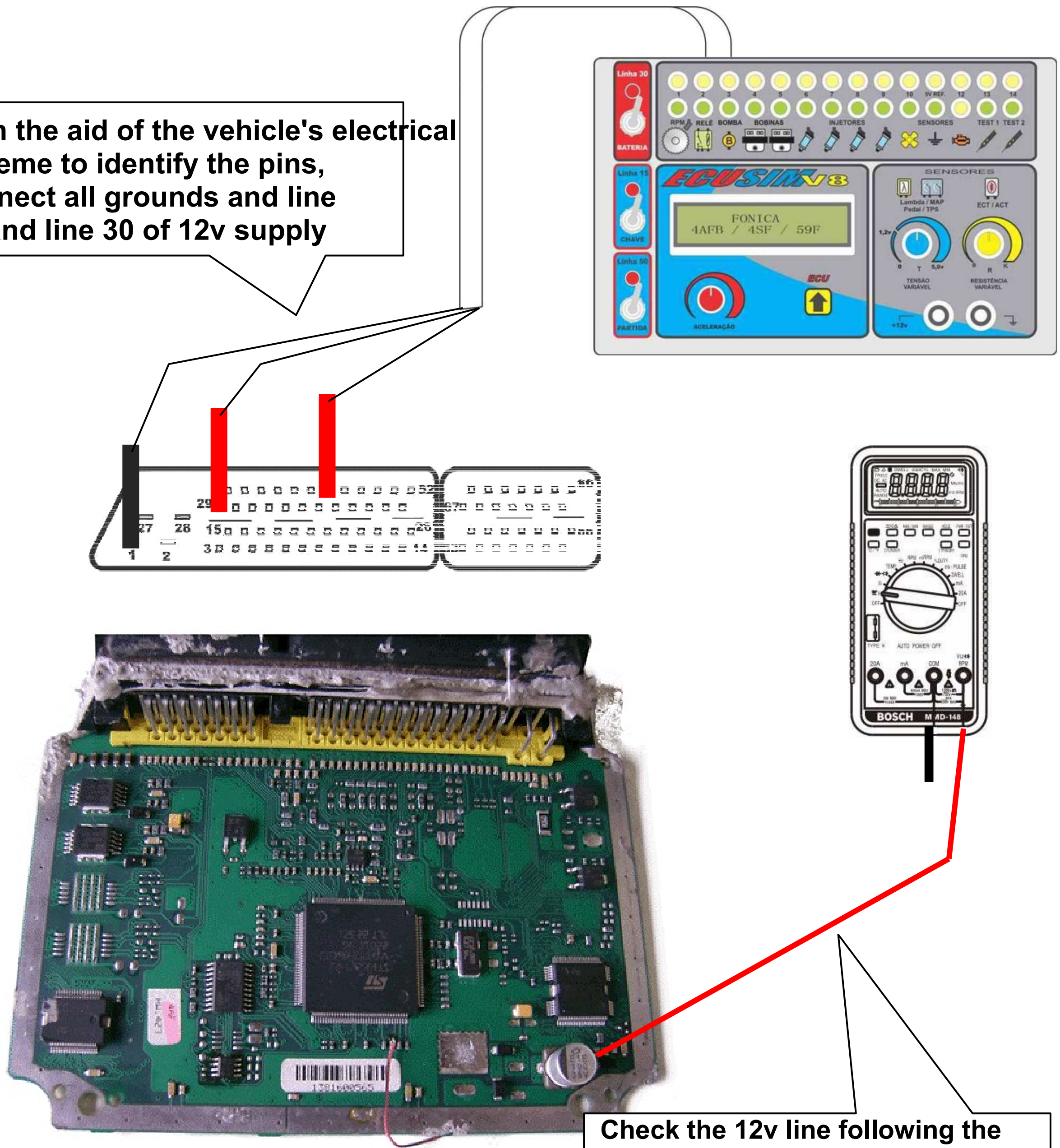
Original Vehicle Eprom	Bi- Socket Fuel	Eprom to be used	Software Screen
DIP 27C256	BI DIP MM28	DIP 27C1001	271 0 01
DIP 27C512	BI DIP MM28	DIP 27C1001	271 0 01
PLCC 27C512	BI PLCC 010	PLCC 27C010	271 0 01
PLCC 27C010	BI PLCC 020	PLCC 27C020	two 7 020
PLCC 28F512	BI PLCC 010	PLCC 28F010	271 0 01
PLCC 28F010	BI PLCC 020	PLCC 28F020	two 7 020
Central Delco (Mencal BLUE)	BI DELCO	Two equal to original	- - - - - - - -

BANCADA CENTRAL TEST

POWER TEST 12v and 5v

Test **12v** input and **5v** voltage regulator.
We must connect the simulator to the **ECU.** Using the universal cable of the simulator, we can connect the corresponding pins only to the sector of the Central that we want to test at the moment.

With the aid of the vehicle's electrical scheme to identify the pins, connect all grounds and line 15 and line 30 of 12v supply



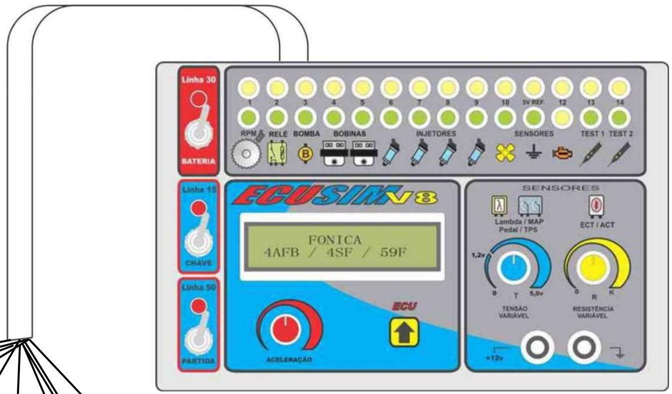
Check the 12v line following the connector path until it reaches the input of the
1 - Zener diode shorted by battery inversion or over voltage.
2 - Broken trails
3 - Voltage regulator shorted.

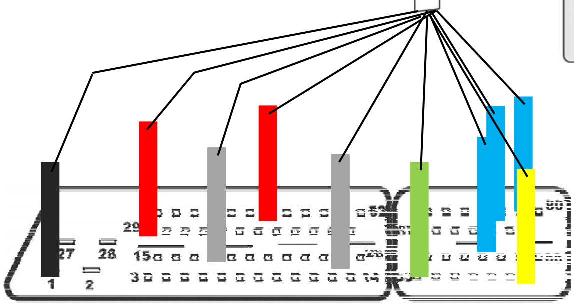
Regulator.
With the help of the Datasheet, identify the 5v output pin, and check this voltage. All chips are powered by 5v. Identify this pin, and check this voltage on all chips.

FULL ECU TEST

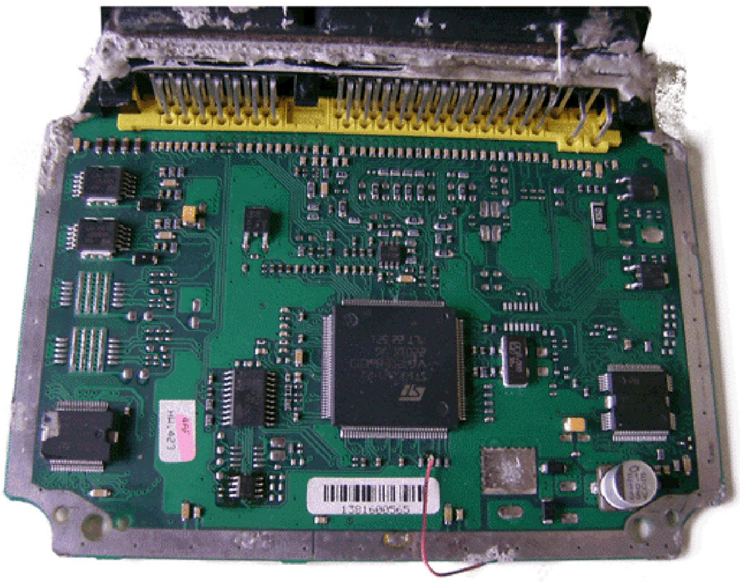
By connecting all the input and output pins, we can carry out a complete test of the ECU.

With the aid of the vehicle's electrical scheme to identify the pins, we connected the simulator to the ECU.





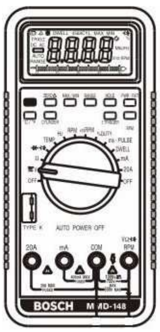
1 - Select the Rotation signal 2 - Connect line 30 (Battery)
3 - Connect line 15 (switch)

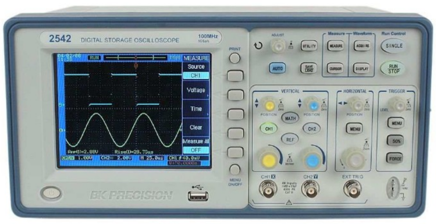


<u>ECU WORKING:</u>
Injection light comes on Pump light turns on and off. Turn on Ignition. Pump indicator light comes on again; Coil indicator light flashes Nozzle indicator light flashes.

For Immobilized Centrals, perform the reset or connect an antenna with key and Immobilizer Central.

We can connect Scanner and others
Reset equipment, encode keys etc. Directly in the ECU or through the Simulator



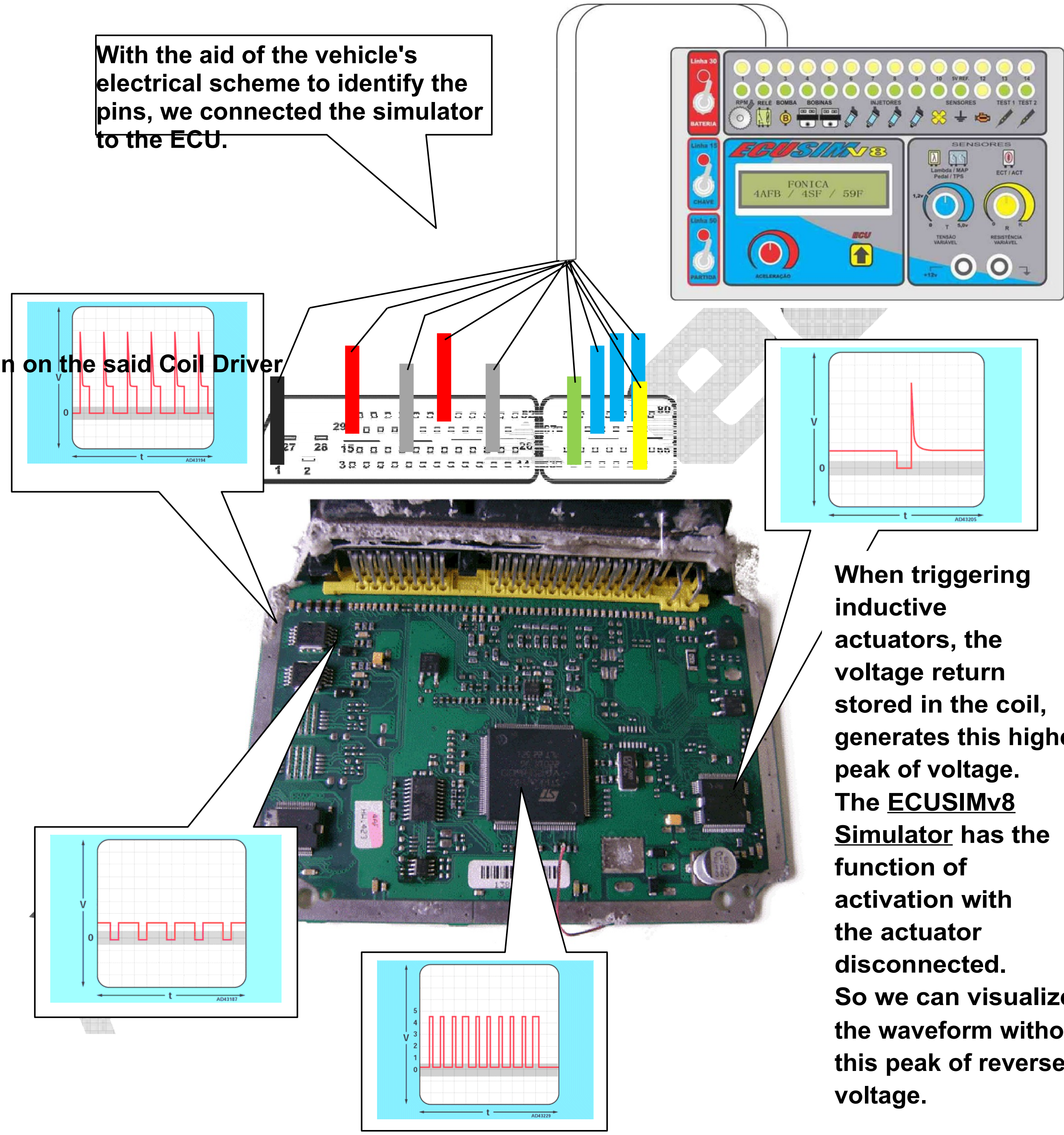


With Multimeter and Oscilloscope equipment, perform all tests.

Connecting all input and output pins we can perform a complete test of the ECU, considering an ECU in good working order we will have these readings.

With the aid of the vehicle's electrical scheme to identify the pins, we connected the simulator to the ECU.

Sign on the said Coil Driver

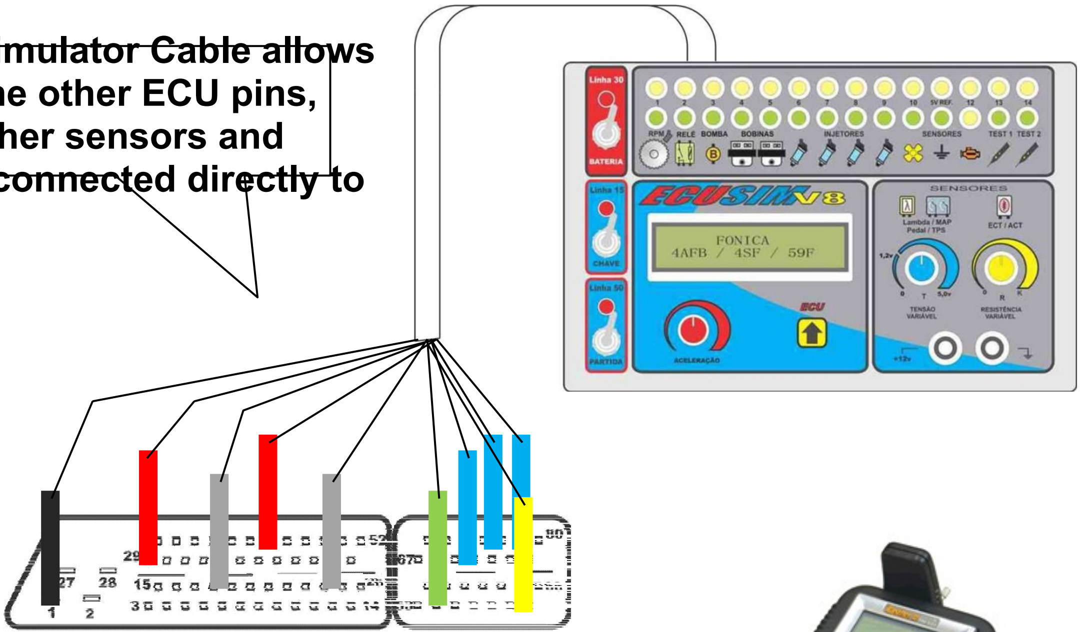


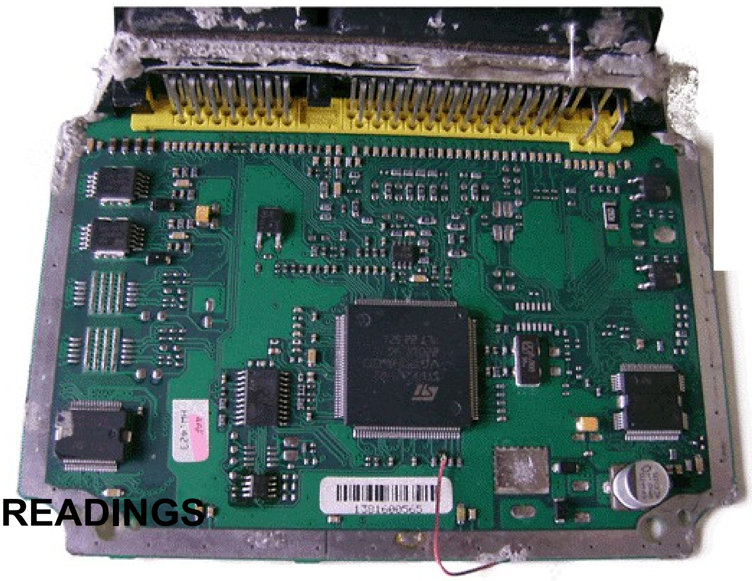
When triggering inductive actuators, the voltage return stored in the coil, generates this highest peak of voltage. The ECUSIMv8 Simulator has the function of activation with the actuator disconnected. So we can visualize the waveform without this peak of reverse voltage.

Signal coming from the Processor at the Coil Driver input.
The Nozzle Driver should also have a similar signal.

Data Signal

The Universal Simulator Cable allows free access to the other ECU pins, thus allowing other sensors and actuators to be connected directly to the ECU.





SCANNER READINGS

With the Scanner we can analyze the signal processing of the sensors carried out by the ECU.
1 - Connect the Scanner directly to the ECU through the pin of the K communication line or through the Simulator.

2 - Enter Scanner Readings

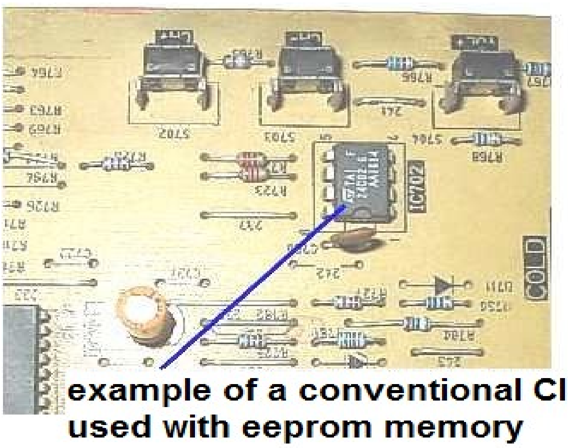
3 - Vary the Simulator sensors and check the readings on the Scanner

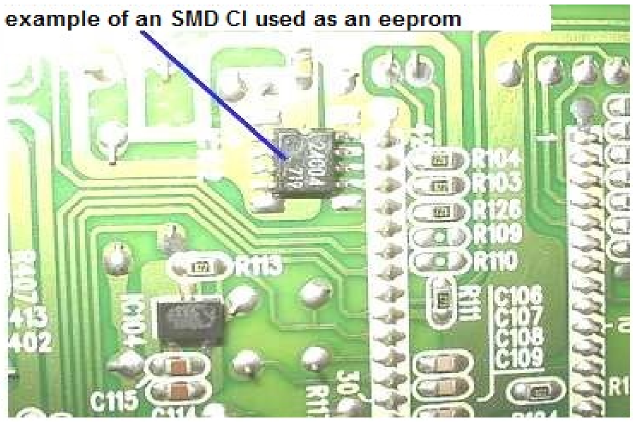
With this procedure we check which function the ECU is not processing correctly.

Rework on SMD plates

SMD PLATE Rework

SMD (**"superficial monting device"**) components or surface mount components have dominated electronic equipment in recent years. This is due to its small size compared to conventional components. See below the comparison between the two types of components used in the same function in two different devices:

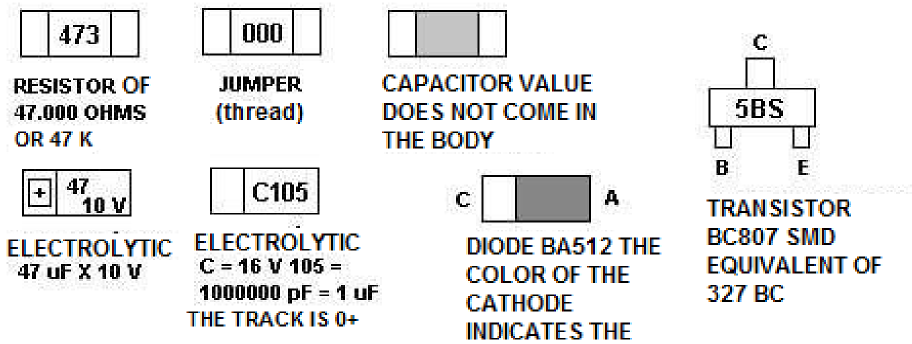




Types of SMD components

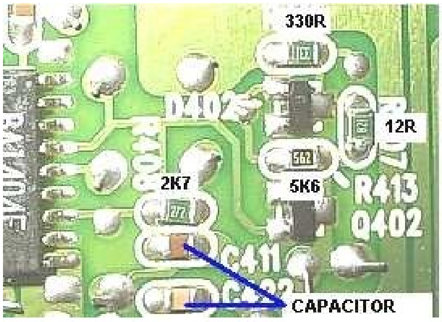
Most **SMD components** are made of silicon (**transistors, diodes, ICs**) and soldered on the side of the tracks, taking up much less space on a printed circuit board. Thanks to these components it was possible to invent the cell phone, notebooks, handheld computers, etc. Below is an example of some types of

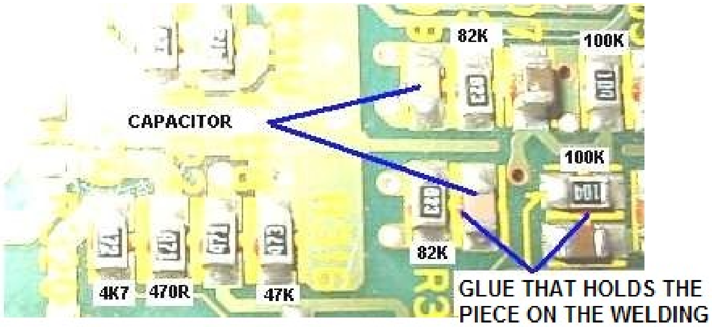
SMD components:



SMD resistors, capacitors and jumpers

The resistors are 1/3 the size of conventional resistors. They are soldered on the underside of the board by the side of the tracks, taking up much less space. They have the value marked on the body with 3 numbers, the 3rd digit being the number of zeros. Ex: 102 means 1,000 Ω = 1 K. The jumpers (wires) come with the indication 000 on the body and the capacitors do not come with the indicated values. We can only know through a capacimeter. See below:

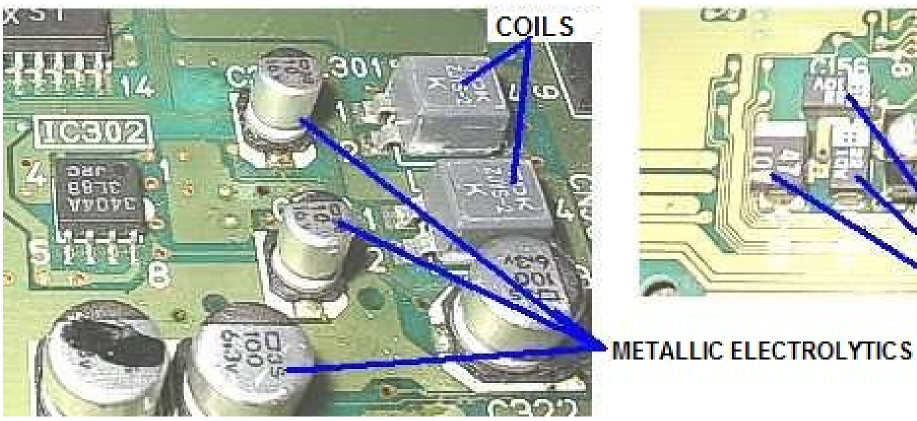


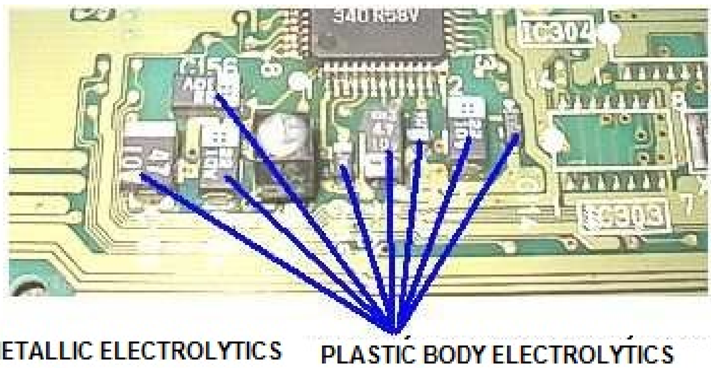


Electrolytics and SMD coils

The coils have an epoxy encapsulation similar to that of transistors and diodes. There are two types of electrolytics: Those with a metallic body (**similar to the common ones**) and those with an epoxy body, similar to diodes. Some have the characteristics indicated by a letter (working voltage) and a number (pF value).

Ex: A225 = 2,200,000 pF = 2.2 μ F x 10 V (letter "A"). See below:





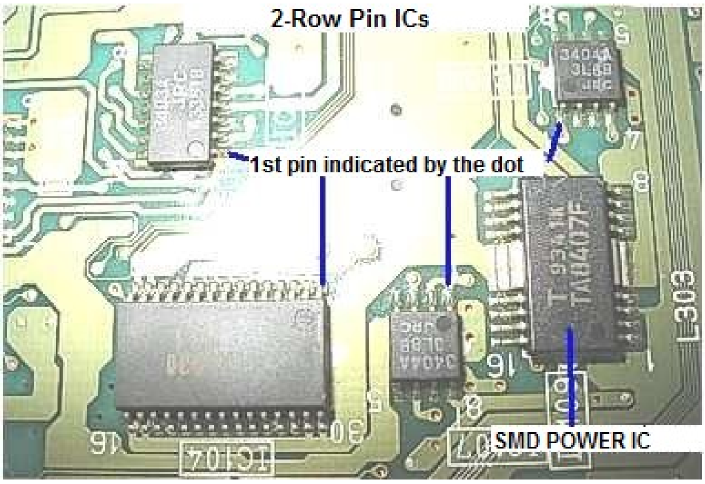
SMD Semiconductors

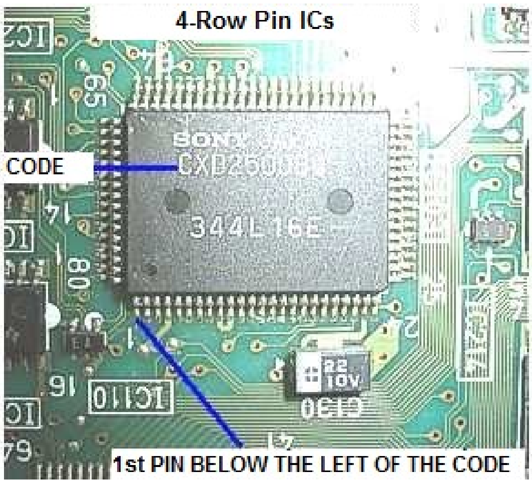
Semiconductors comprise the **transistors, diodes and ICs** placed and soldered alongside the tracks.

The transistors can come with **3 or 4 terminals**, however the position of these terminals varies according to the code. Such code is marked on the body by a letter, number or sequence of them, but it does not correspond to the indication of the same. For example. the BC808 transistor comes with a 5BS indication on the body.

In the diodes the color of the cathode indicates its code, and some of them have the encapsulation of 3 terminals equal to a transistor.

ICs have **2 or 4** rows of terminals. When there are 2 rows, the count starts with the pin marked by a dot or to the right of a "**half moon**". When they have 4 rows, the 1st pin is below the left of the code. The remaining pins are counted counterclockwise. Below are some examples of SMD semiconductors:





7.1 SMD components rework station

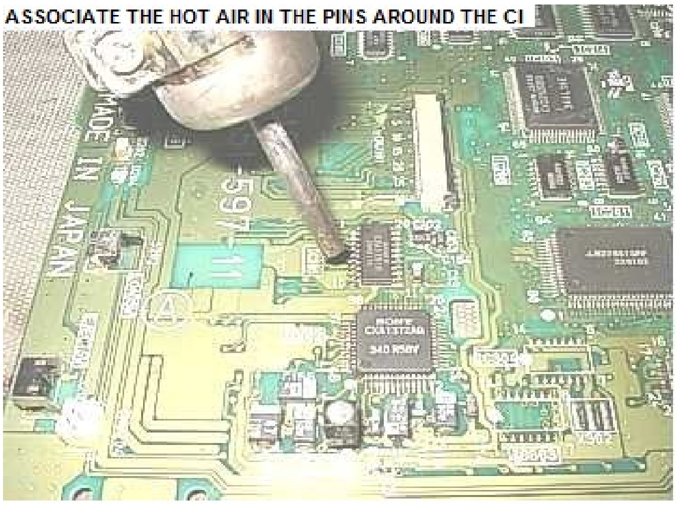
This is an excellent tool for removing and soldering SMD components from printed circuit boards.

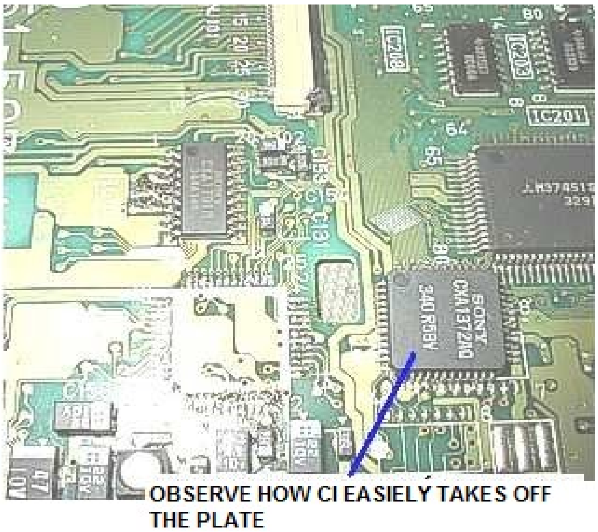
SMD desoldering

Turn on the blower and place an average amount of air and the temperature between 300º and 380º appropriate to the **CI** and the printed circuit where the operation is carried out.

Phenolite sheets are more sensitive to heat than fiberglass sheets. Therefore, for phenolite, care must be taken (lower temperatures and desoldering as quickly as possible) to avoid damaging the plate.

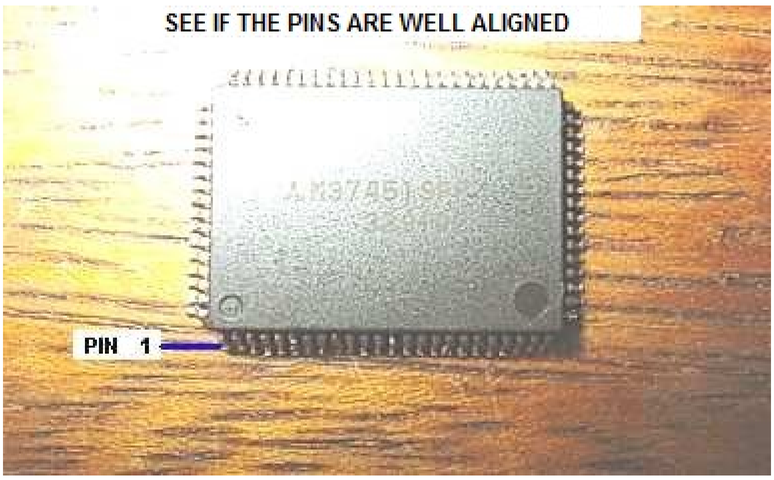
Then blow the air around the **CI** until it is completely released from the plate. Then just clean with a brush and **isopropyl alcohol.**





SMD CI welding

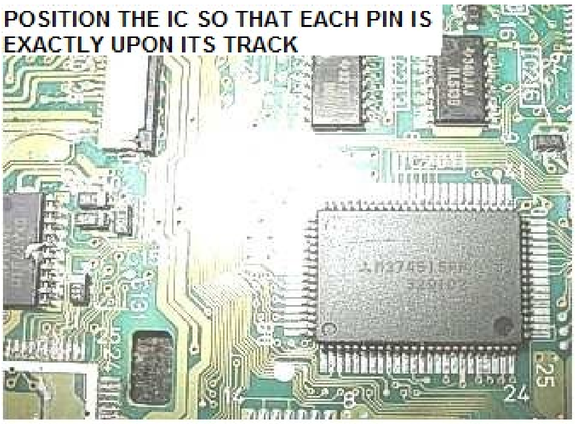
First of all, we observe if the CI to be placed is with the terminals perfectly aligned. A slightly bent pin will make the operation very difficult. Use a magnifying glass to assist you in this task. Please note below:

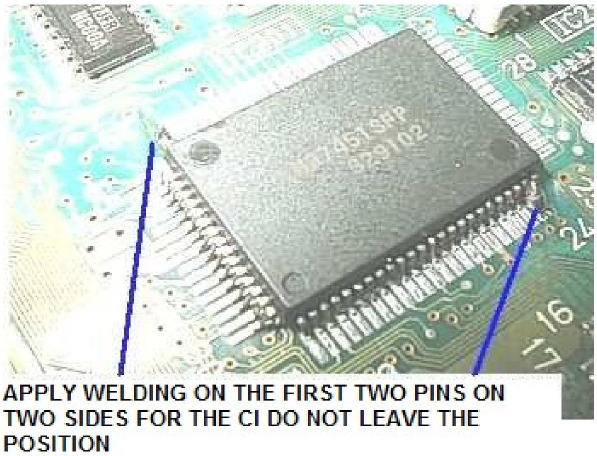


SMD welding - Step 1

Place the CI on the board taking care to position it so that each pin is exactly on its corresponding track. If necessary, use a increase.

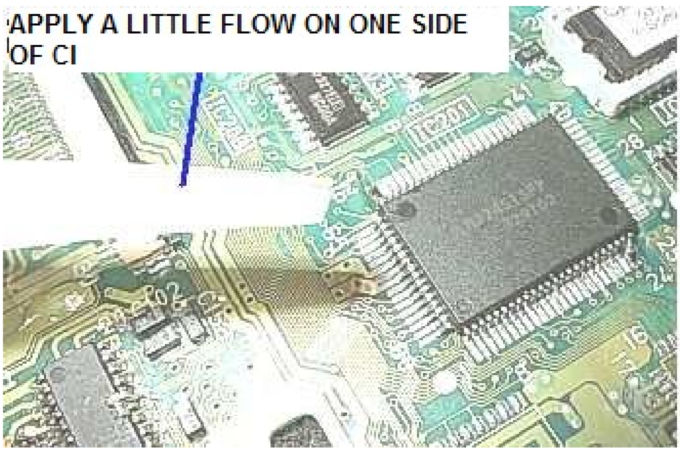
Then keep a finger on the CI and apply solder to the first two pins on two opposite sides so that it does not move out of position during welding. Watch bellow:





SMD welding - Step 2

Put some **solder flux** on the IC pins. Melt common solder in one corner of the **CI** until it forms a solder ball. The welding should be done in a row of the **CI** at a time. Look:



SMD welding - Step 3

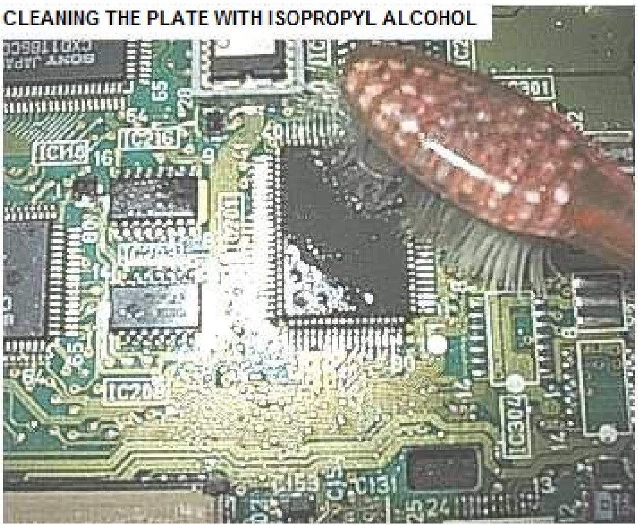
Stand the plate upright and carefully run the tip of the iron through the pins from top to bottom, dragging the solder down. Add more flow if necessary.When the solder reaches the bottom, place the plate horizontally again, apply a little more flow and pull the solder out of the pins. If it is too difficult, remove the excess solder with a solder suction. Repeat this operation on each row of pins on the **CI**. See below:

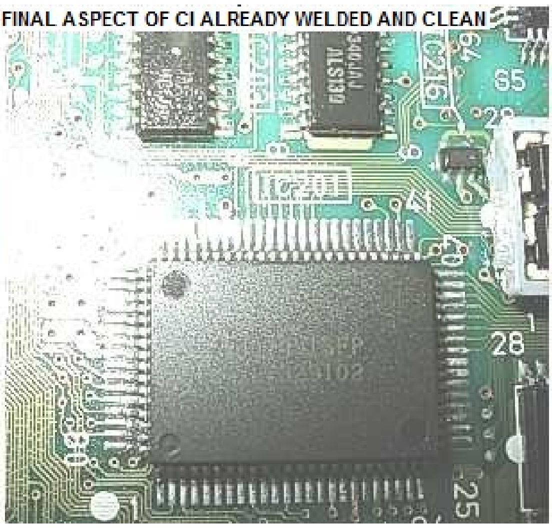

PUT THE PLATE STANDING AND GO THROUGH THE IRON TIP CAREFULLY THROUGH THE PINS. WATCH HOW THE WELDING IS GOING DOWN. PUT MORE FLOW IF NECESSARY.


SEE HOW THE WELD ARRIVED IN THE LAST PINS AND IF THE WELD ARRIVED CORRECTLY ALL THE PREVIOUS

SMD welding - Step 4

After welding, preferably check with a magnifying glass that two or more pins are not shorted. If this has occurred, apply more flux and remove excess solder. Finally, clean the plate around the IC with isopropyl alcohol. See below how the CI was after the process:


CLEANING THE PLATE WITH ISOPROPYL ALCOHOL


FINAL ASPECT OF CI ALREADY WELDED AND CLEAN