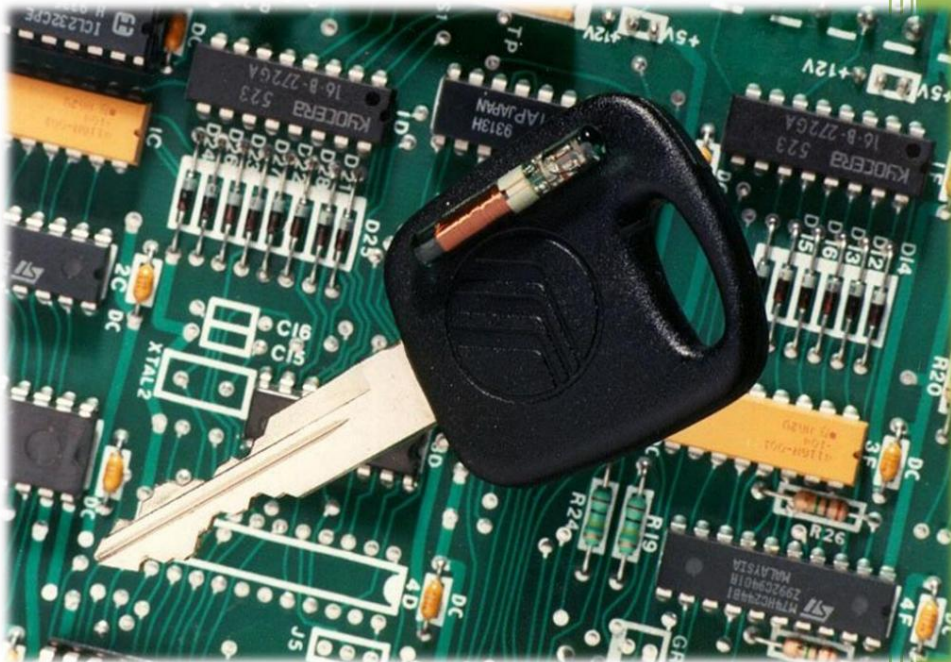


ECU REPROGRAMMING AND IMMOBILIZERS

OF DEPARTURE

2011

ECU REPAIR VOL 2



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Contents

INTRODUCTION	6
1. REPROGRAMMING THE INJECTION MODULE.....	6
STORAGE AND TRANSMISSION OF DATA	7
UNILATERAL COMMUNICATION	12
BILATERAL COMMUNICATION	13
READING AND WRITING IN A MEMORY	13
UNIVERSAL PROGRAMMER.....	15
ADAPTERS FOR MEMORY	17
BUILT-IN MEMORIES	20
READING MODE IN BOOT LOADER	22
THE ST10FXXX PROCESSOR	22
DIRECT READING AND PROGRAMMING	27
THE SERIAL PROGRAMMER	32
INDIRECT READING.....	35
2. REPROGRAMMING THE ENGINE OPERATING DATA.....	36
3 .THE DEPARTURE IMMOBILIZER SYSTEM	38
IMMOBILIZER ECU	38
ANTENNA.....	41
TRANSPOND.....	42
TYPES OF TRANSPONDER	43
ELECTRONIC INJECTION ECU	45
FIAT IMMOBILIZERS.....	46
GM IMMOBILIZERS	52
VW IMMOBILIZERS.....	56
FORD IMMOBILIZERS.....	60
REPROGRAMMING IMMOBILIZER DATA IN THE ECU.....	64
ECU DECODE	65
MAIN MEMORY	66
AUXILIARY MEMORY	67
PROGRAMS AND DATABASE FOR DECODING	69
IMMOKILLER	69

ECU IMMOBILIZER SYSTEM RESET	70
RESET FIAT.....	70
RESET VW	71
RESET GM	71
RESET FORD	72
IMMOBILIZER SYSTEM PASSWORD	72
FIAT PASSWORD	74
VW PASSWORD	77
GM PASSWORD	84
PASSWORD FORD.....	86
CHANGING THE ELECTRONIC INJECTION MODULE	87
COMMON DEFECTS IN THE IMMOBILIZER SYSTEM	93
CONCLUSION.....	95

ecu repair

INTRODUCTION

We will address in this volume two works that are of interest to many, automotive ecus reprogramming and starter immobilizers. With the scarcity of information on the market on the subject, it leads us to study and develop manuals that help technicians in maintenance and repair procedures.

1. REPROGRAMMING THE INJECTION MODULE

We found in the digital block of the electronic injection module , an extremely important component, memories.

It is in these components that the engine's operating parameters are stored, as well as confidential data, such as the immobilizer password.

We can then, through special tools, read this data, and even reprogram such data into the memories, which are already programmed at the factory.

For a better understanding, we will study a little about digital electronics, data storage and communication.



Figure 1

STORAGE AND TRANSMISSION OF DICE

current ECUs use a powerful digital communication and data storage system, so it is important that we address such digital systems.

The term digital is used in electronics to represent logic levels, 1 and 0.

Through these levels or digits, communications between machines, computers, TV and many other systems are made.

In our case, the communication between the ECUs and their internal components is also digital, called serial communication (fig2), it is the zeros and ones that do all the work.

many wonder how zeros and ones can read, write and count with just two digits. intriguing isn't it? This is possible through bits and bytes and formation codes.

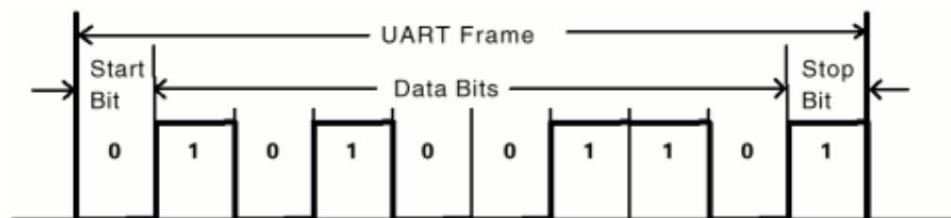


Figure 11a. UART Frame

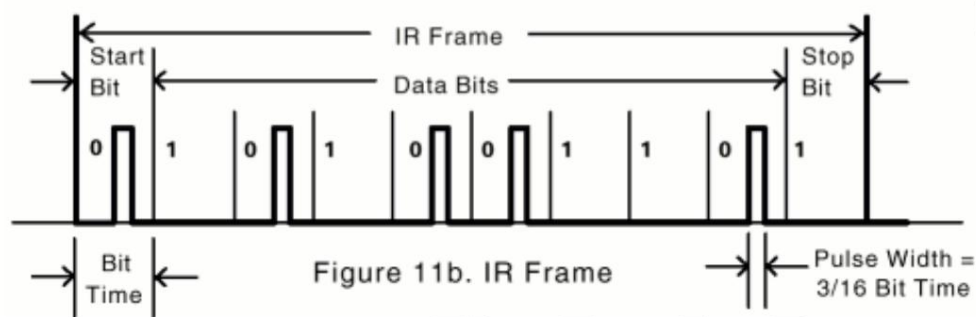


Figure 11b. IR Frame

Figure 2

The bit is nothing more than a digit, which can be 1 or 0, the sum of 8 of these bits, forms 1 byte, this byte (fig3), inside a special code, can form any number, letter or character.

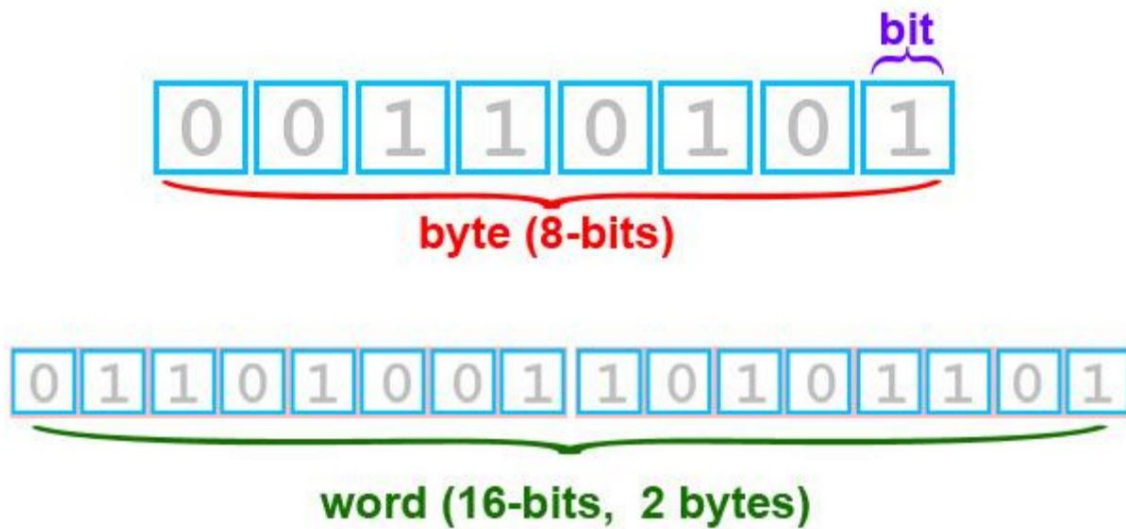


Figure 3

The most used code for encoding and decoding bytes is ASCII which in the original language means American standard code for information interchange (fig4), which in Portuguese means American standard code for information interchange.

Examples

00 00 0011 = 3

00 00 0111 = 7

0100 0001 = capital A

0110 0001 = lowercase a

Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
0	00	Null	32	20	Space	64	40	@	96	60	`
1	01	Start of heading	33	21	!	65	41	A	97	61	a
2	02	Start of text	34	22	"	66	42	B	98	62	b
3	03	End of text	35	23	#	67	43	C	99	63	c
4	04	End of transmit	36	24	\$	68	44	D	100	64	d
5	05	Enquiry	37	25	%	69	45	E	101	65	e
6	06	Acknowledge	38	26	&	70	46	F	102	66	f
7	07	Audible bell	39	27	'	71	47	G	103	67	g
8	08	Backspace	40	28	(	72	48	H	104	68	h
9	09	Horizontal tab	41	29	)	73	49	I	105	69	i
10	0A	Line feed	42	2A	*	74	4A	J	106	6A	j
11	0B	Vertical tab	43	2B	+	75	4B	K	107	6B	k
12	0C	Form feed	44	2C	,	76	4C	L	108	6C	l
13	0D	Carriage return	45	2D	-	77	4D	M	109	6D	m
14	0E	Shift out	46	2E	.	78	4E	N	110	6E	n
15	0F	Shift in	47	2F	/	79	4F	O	111	6F	o
16	10	Data link escape	48	30	0	80	50	P	112	70	p
17	11	Device control 1	49	31	1	81	51	Q	113	71	q
18	12	Device control 2	50	32	2	82	52	R	114	72	r
19	13	Device control 3	51	33	3	83	53	S	115	73	s
20	14	Device control 4	52	34	4	84	54	T	116	74	t
21	15	Neg. acknowledge	53	35	5	85	55	U	117	75	u
22	16	Synchronous idle	54	36	6	86	56	V	118	76	v
23	17	End trans. block	55	37	7	87	57	W	119	77	w
24	18	Cancel	56	38	8	88	58	X	120	78	x
25	19	End of medium	57	39	9	89	59	Y	121	79	y
26	1A	Substitution	58	3A	:	90	5A	Z	122	7A	z
27	1B	Escape	59	3B	;	91	5B	[	123	7B	{
28	1C	File separator	60	3C	<	92	5C	\	124	7C	|
29	1D	Group separator	61	3D	=	93	5D	]	125	7D	}
30	1E	Record separator	62	3E	>	94	5E	^	126	7E	~
31	1F	Unit separator	63	3F	?	95	5F	_	127	7F	□

Figure 4

With the examples we can conclude that the ascii code can write any letter, number or character.

It is not necessary for our learning, deep knowledge of the ascii code, because what we need is only to understand how sentences and numbers are written with only zeros and some.

Once the codes are understood, let's move on to data storage. This storage is done in memories, in a plastic way, the memory can be compared to a huge building with several windows, each window represents a bit, and the sum of eight windows forms a byte. Then imagine that each lit window represents the high logic level, or 1, and the ones that are off, the low logic level, or 0.

Each window of the building has an address, as in memories, this address is formed by pre-defined coordinates, for example, imagine that the building has 20 floors, and each floor has 32 windows, so compared to memory, each floor has 4 bytes of 8 bits each.

Now imagine that I ask you to tell me which number, letter or character has the second byte of the building, then you will look at the top floor of the building, and start counting the logical levels from the ninth window of the twentieth floor, then of writing down the sequence of the levels and comparing with the code asii you will have the answer.

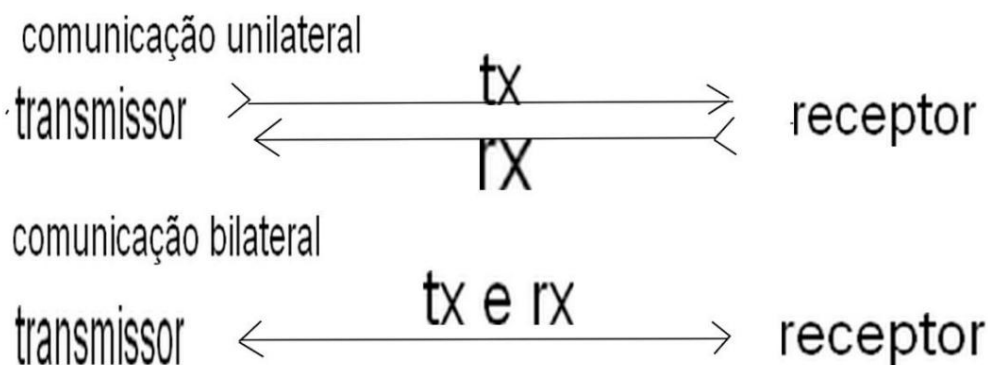
The same happens with the ECUs processor, when receiving a read instruction, the processor fetches the data at the address described in this instruction, the same happening for writing of Dice.

With the communication between the ECUs and its internal components it is not very different, the data are transmitted and received in serial form, that is to say one by one.

The physical lines, which make this communication, can have two definitions, which are:

UNILATERAL COMMUNICATION

It is common to find this type of communication in the internal circuits of the ECUs, because with unilateral communication, two transmission lines are needed, the data sending line, which has the abbreviation TX, and the receiving line, with the abbreviation RX.



The data are sent by TX and received by RX, it has the advantage of the possibility of simultaneous communication, it is not necessary for the TX line to be disabled to send the RX line, thus increasing the processing speed.

As a disadvantage we can mention the need for two physical lines, copper tracks, wires, connectors and etc.

These two lines are interconnected to all microcontrolled cis (integrated circuits), that is, cis that has the ability to process logical information.

The main processor then manages all communication, and each instruction has its destination programmed, for example:

Imagine that in a room of a doctor's office, five people are waiting, each person has a name, and of course, so when the doctor calls one of the five, the distinction is made by name, we understand then that they all heard the call, but only the person corresponding to the name called spoke, and carried out the orders given by the doctor.

The same happens in serial communication, everyone receives the message, but only the correspondent interacts with it.

BILATERAL COMMUNICATION

Bilateral communication is the most used in external communications between ECUs, as it enables the cost of the project, requiring only a physical line of data.

The vehicle diagnostic line is an example of a two-way communication line.

Communication happens in the same way as unilateral, but when the line is being occupied to transmit data, or is being occupied by TX, RX will have to wait for the end of the message to use the line.

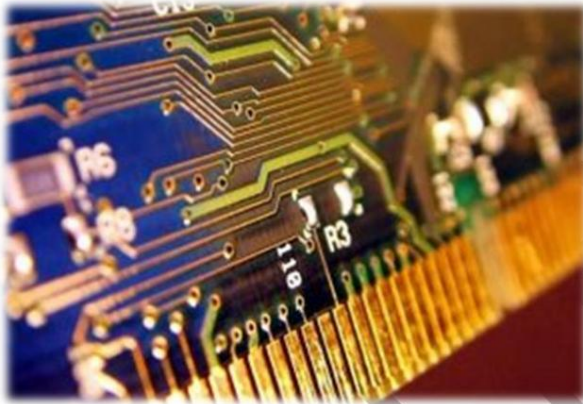
READ AND WRITE IN A MEMORY

Our next step is to understand how we can read and write to a memory.

To read and write to a memory we need an electronic tool called a universal programmer. With this programmer we can read the data contained in a memory and

save this data on the computer, that is, save this file. we can also write data that are stored or saved in the computer in a memory, changing then its original programming.

There are several needs for this reprogramming, such as updating the ecu program, updating this teleloading call. They are also necessary in cases of disabling the starter immobilizer. to disable the immobilizer function.



UNIVERSAL PROGRAMMER



Figure 5

The memory programmers (fig5) have the function of reading and saving the contents of a memory and also of writing a new content when necessary. cables for a loop connection, no need to remove the memory.

The program is responsible for all contact with the user, in this program we can find a screen called buffer

(fig6), where the data read or to be written to memory is loaded. These data are converted from binary to hexadecimal, where a huge reduction in the size of the data representation is achieved, with hexadecimal notation we can represent any binary number, and with that, any letter, number or character.

Hexadecimal notation is used for its practicality of representation, with fewer digits than other notations,

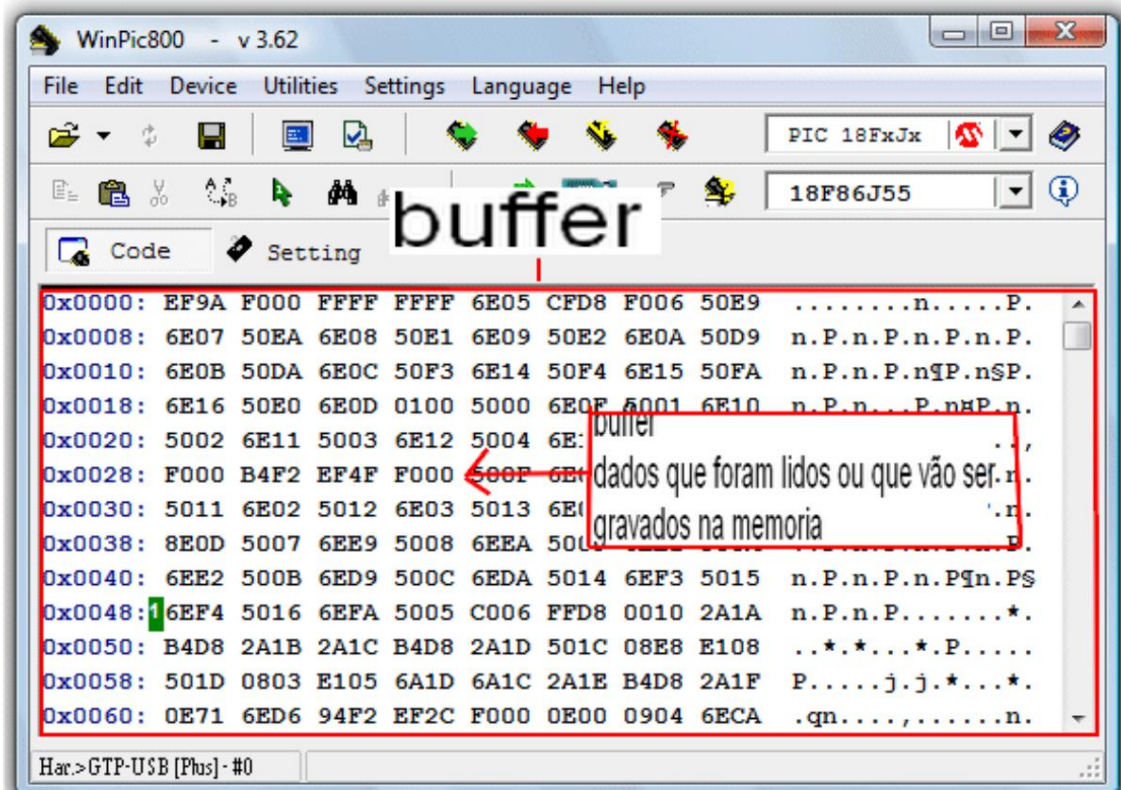


Figure 6

As the name implies, universal programmers are designed to serve all types of memory out there.

In our case, we will only use a small part of these resources, as the automotive ecus and immobilizers are equipped with DIP, PLCC, TSOP AND SOIC enclosures, and there are also special resources, which many universal programmers do not have, the programming of built-in memories. on the processors.



ADAPTERS FOR MEMORIES

Many memories need an adapter to fit the universal programmers socket, because their component socket has a unique format for use, this format is usually the DIP



With that, an adapter is necessary for each type of memory, providing the conversion of dip for the respective enclosures.

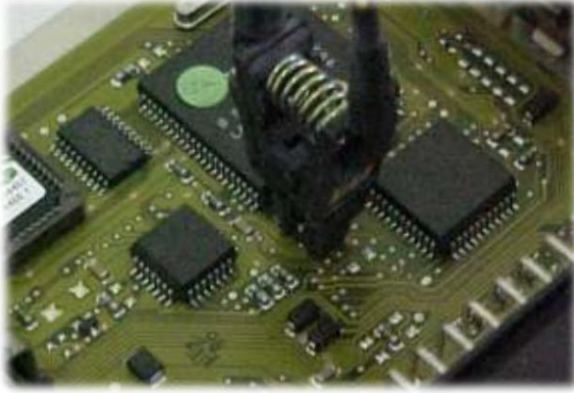
Adapters used in automotive ECUs are:

DIP FOR SOIC

Two adapters are used, a socket and a clamp (fig7).



Figure 7



DIP ADAPTER FOR PLCC

This adapter will depend on the number of memory pins (fig8).

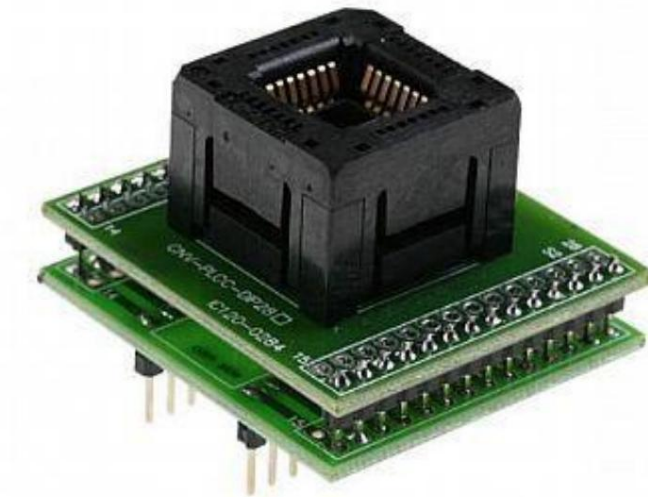


Figure 8

DIP ADAPTER FOR PSOP

In most cases, the adapted one is used as shown in the figure (fig9):



Figure 9

BUILT-IN MEMORIES

The memories built into the processors have a different programming mode from the conventional ones, as they can be programmed in solderable sockets, which are of little practicality, as it is necessary to desolder the processor from its board, a new solder in the adapter socket, where it will be read or changed your data, and again, the reverse process to the one described when returning the processor to your board.

The most used process is circuit programming which has the acronym in English ICP (in circuit programmer).

This process consists of soldering the wires necessary for programming to the IC board itself (fig10), without the exhaustive removal of the processor.

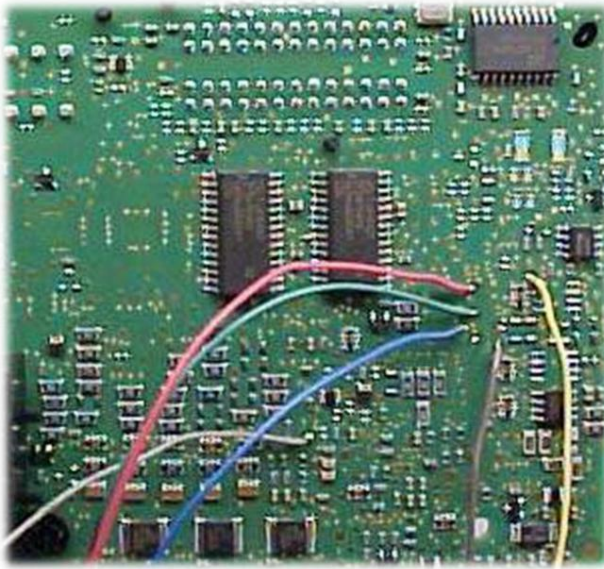
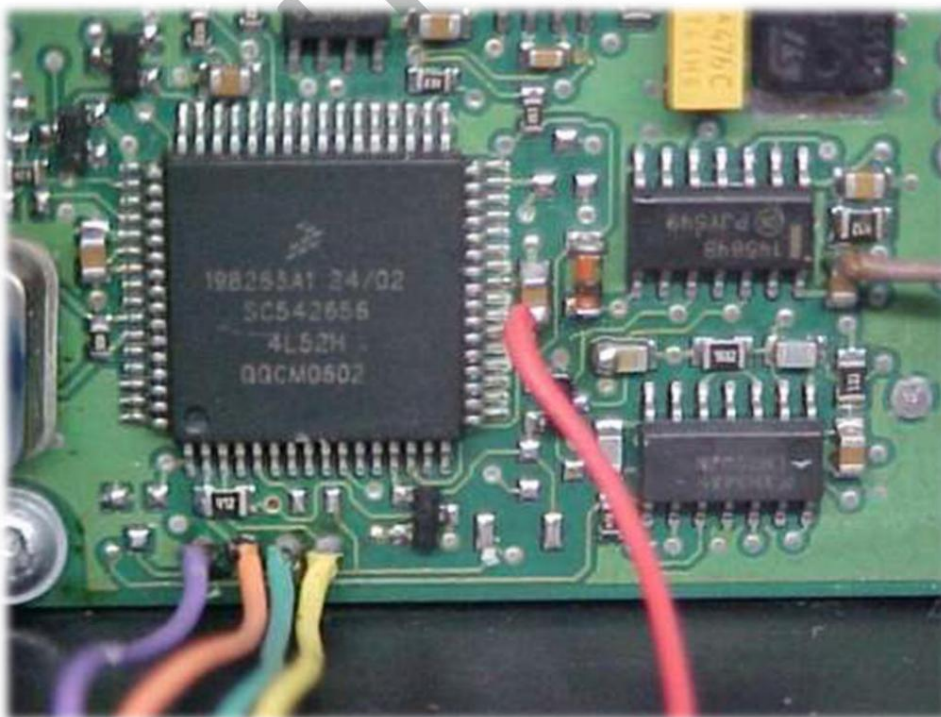


Figure 10

In general, it is necessary to have a specific programmer for programming built-in memories, which in most cases has a high cost, as such devices have software and an interface directed to each processor, which can be called as well as a development tool.



READING MODE IN BOOT LOADER

The read mode in boot mode, or boot loader, which comes from the English initialization.

Through this initialization mode, we can use the specific program to load or read the processor's built-in memory.

This mode aims to save on programming processes, since more expensive tools are not needed, thus attracting the interest of electronics manufacturing companies.

The activation mode of this mode is done physically, through connections with resistors, in the specific ports.

Usually the activation port is raised to 5vdc, voltage that denotes level 1 or high level in the ECU's internal circuitry.

When we take this port to level 0 or low level, the boot loader process starts.

THE ST10FXXX PROCESSOR

The st semiconductors processor (fig11), the st10fxx, was widely used in automotive ecus from the year 2004. This processor is widely used in embedded processes, such as ecus, toys, process automation in general and etc.

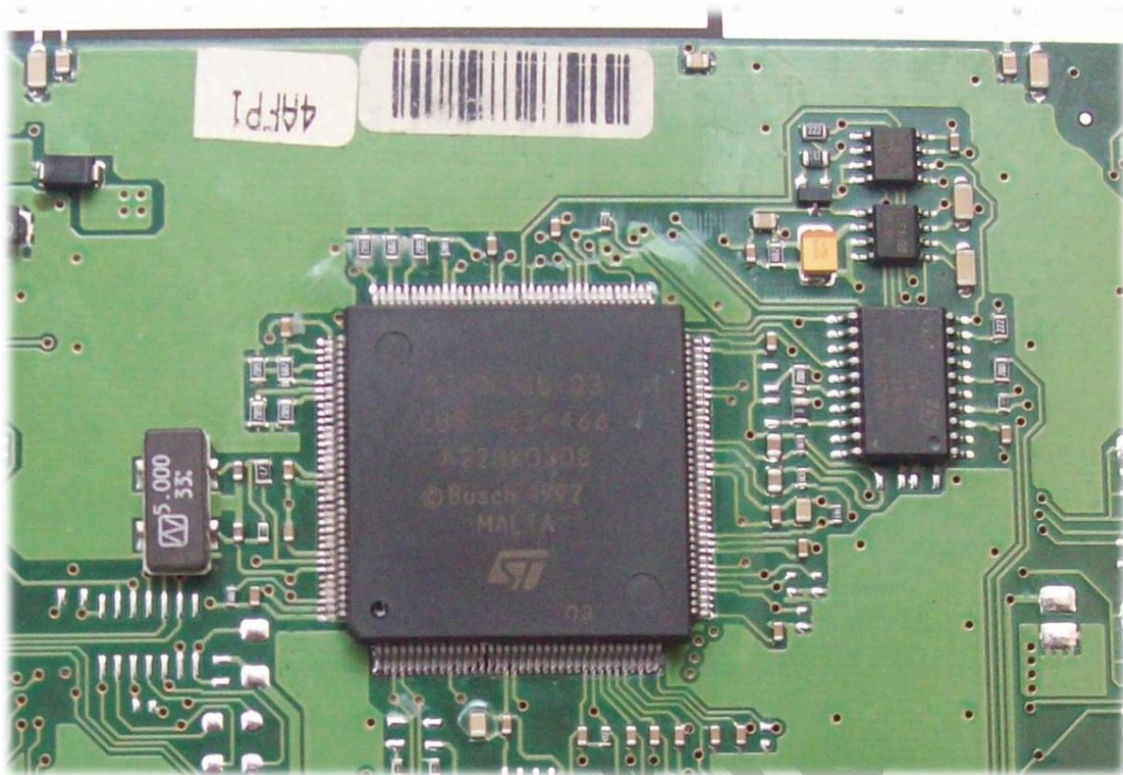


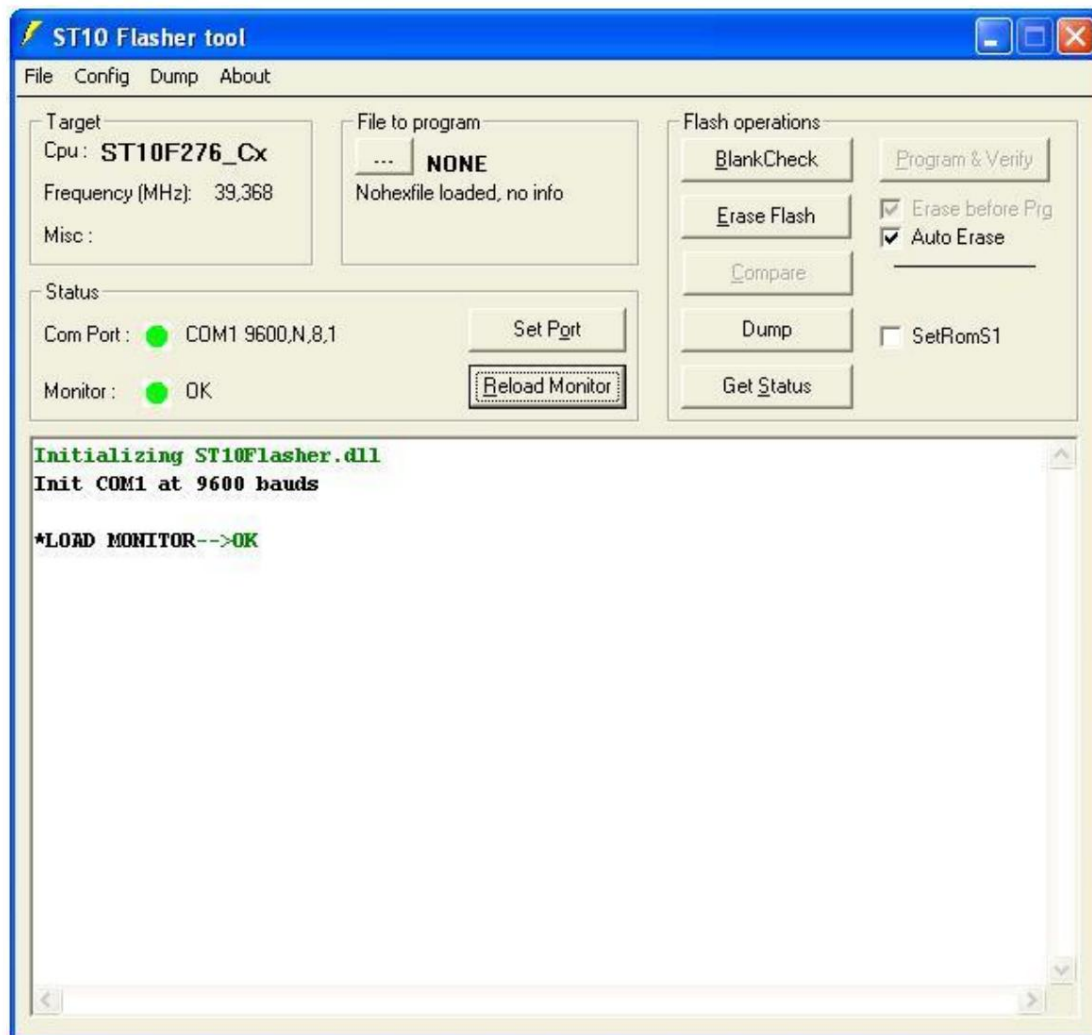
Figure 11



No need for development tools and special programmers for programming the memory built into these processors, as it uses a very practical boot loader system, as described above.

In addition to its practicality, the program used for the boot loader process is free, and can be downloaded from the manufacturer.

Below the screen of the st10 flasher program



The use of the st10 flasher program and the activation of the boots, it is simple, just open the ecu, solder the resistors as described in the boots manual and ecu model (fig12), connect the interface via the diagnostics line k, open the st10 program flasher and follow the program's instructions.

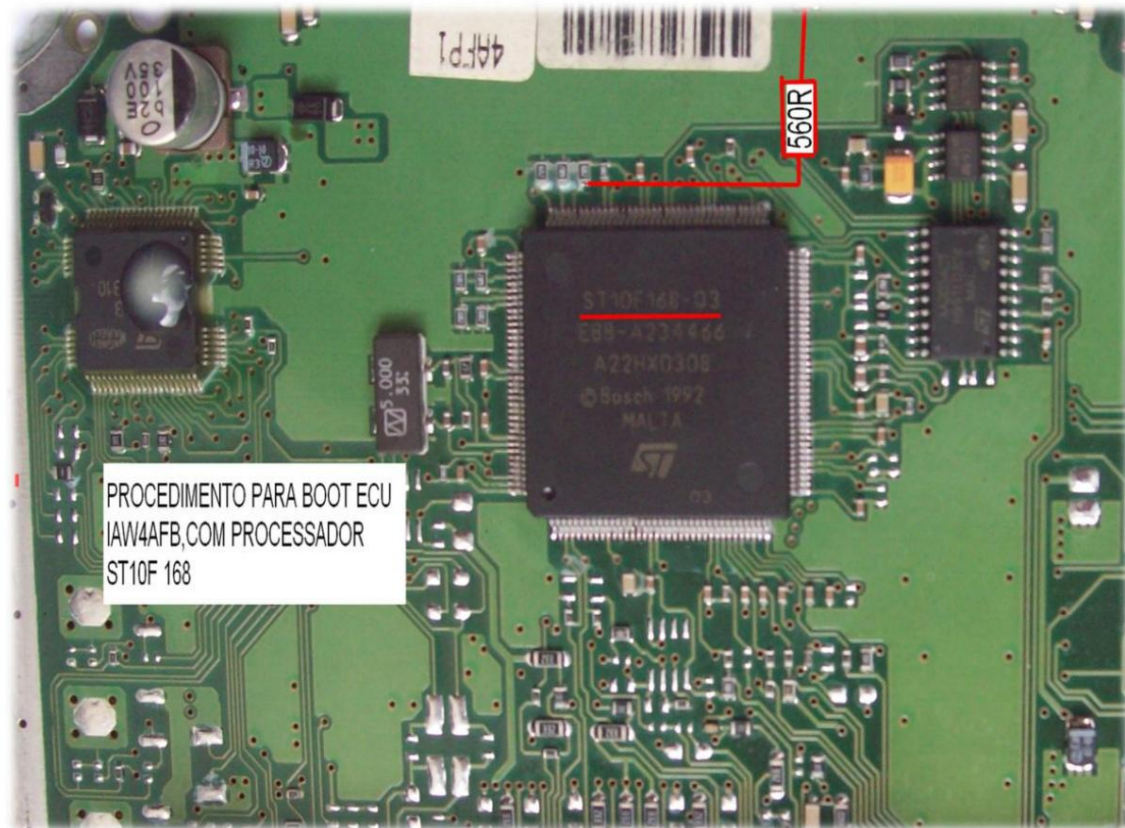
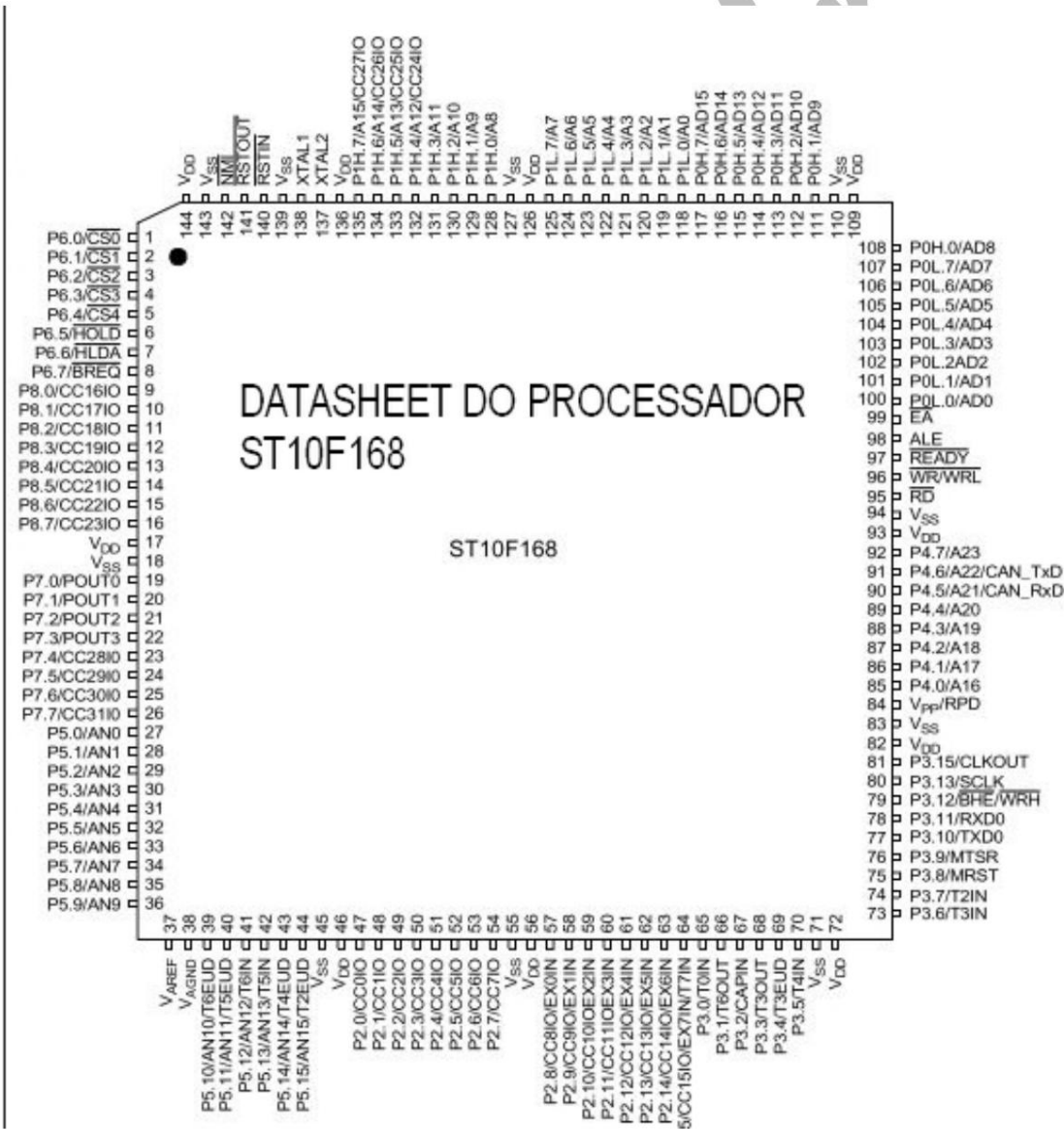
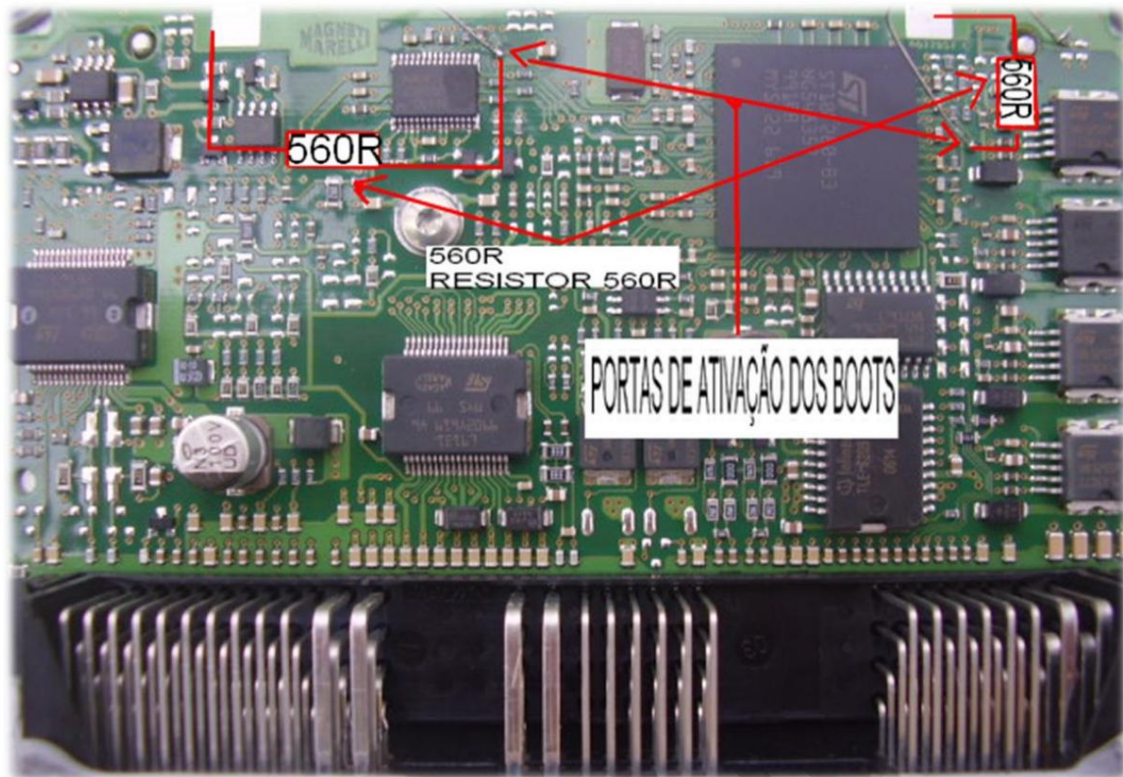


Figure 12

There are cases in which a single resistor is required to activate the boot mode process, as in the IAW 4AFB ecus, which uses the ST10F168 processor (fig12).





We can read the data contained in the ECU's memories in two ways. shapes, which are:

DIRECT READING AND PROGRAMMING

In this mode, there is no need to remove memory or boots. With a special tool called a serial programmer and sent through the vehicle's diagnostic line, a read request to the ecu processor, if the communication is successful, the processor sends the data from memory to the computer, via the diagnostics line and the serial programmer.

The same happens with programming, but in reverse order, the programmer asks the processor to write, or

that is, save the data that are on the computer, in memory ecu internal.

It is important to note that not all systems use this feature, as this feature is the specialty of some systems in particular.

This feature is common in hybrid type ECUs (fig13), hybrid ECUs, as the name implies, are ECUs that use encapsulated components together with non-encapsulated components, only covered with a protective gel. .

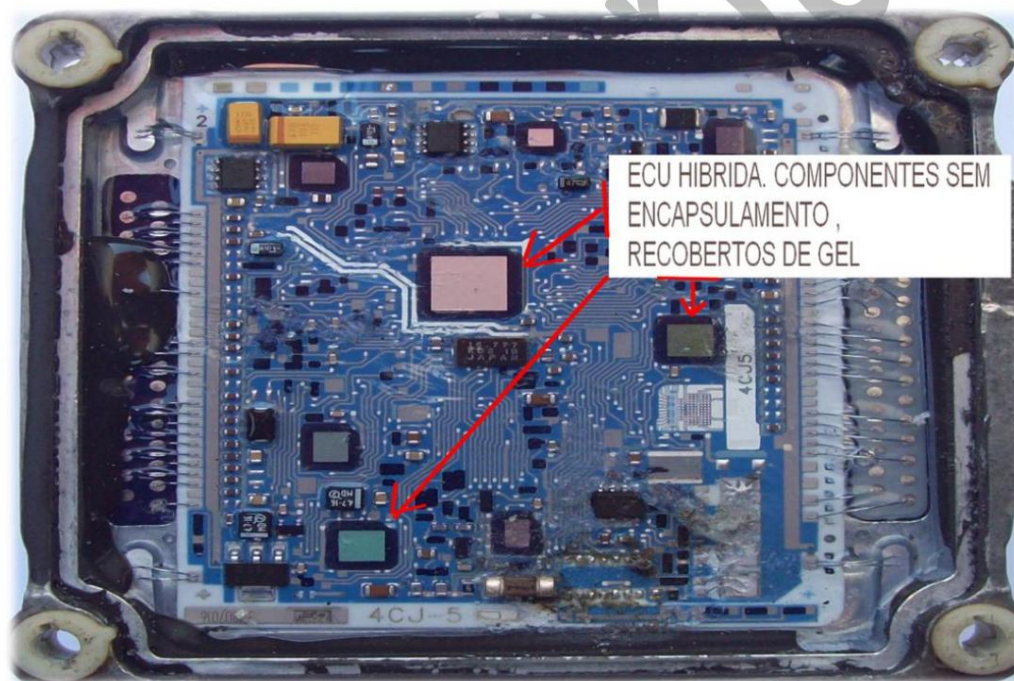


Figure 13

Some examples of hybrid ECUs:

Hitachi ECU (fig14), applied to Fiat brava hgt and marea vehicles with 1.8 16-valve engine. It is not possible to reprogram the operating data memory of this ecu.



Figure 14

Immobilizer data is stored in a memory internal of type soic 93c46 .



Figure 15

To reprogram this memory, it is necessary to drill the ecu housing (fig15).



Hybrid Bosch Ecu, this ecu equips the Fiat palio 1.0 16v and 1.3 16v, marea 2.4 and abarth 2.4 style vehicles (fig16).

We can reprogram both engine and immobilizer data through the serial programmer.

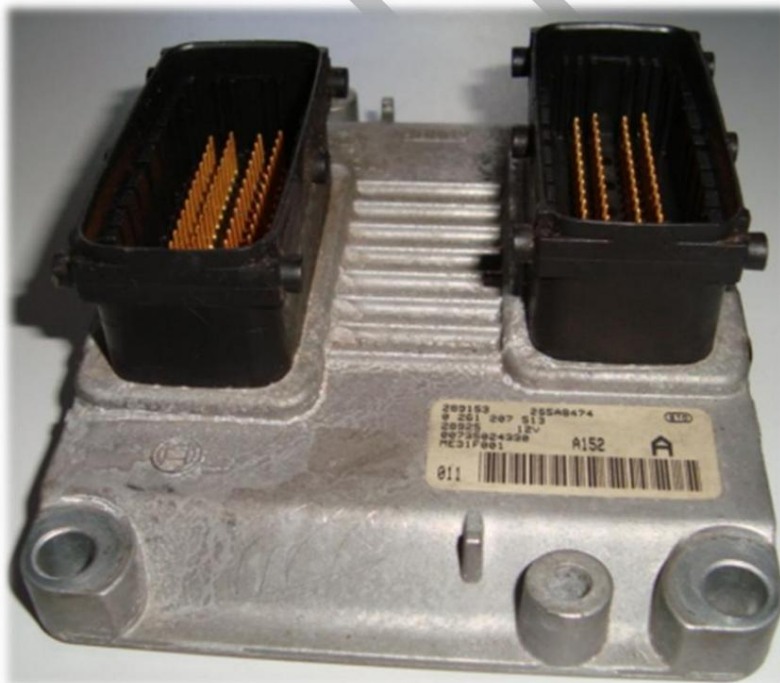


Figure 16

Bosch Ecu applied to the Astra Gm vehicle, we can reprogram with the help of the serial program, the engine and immobilizer data (fig17).

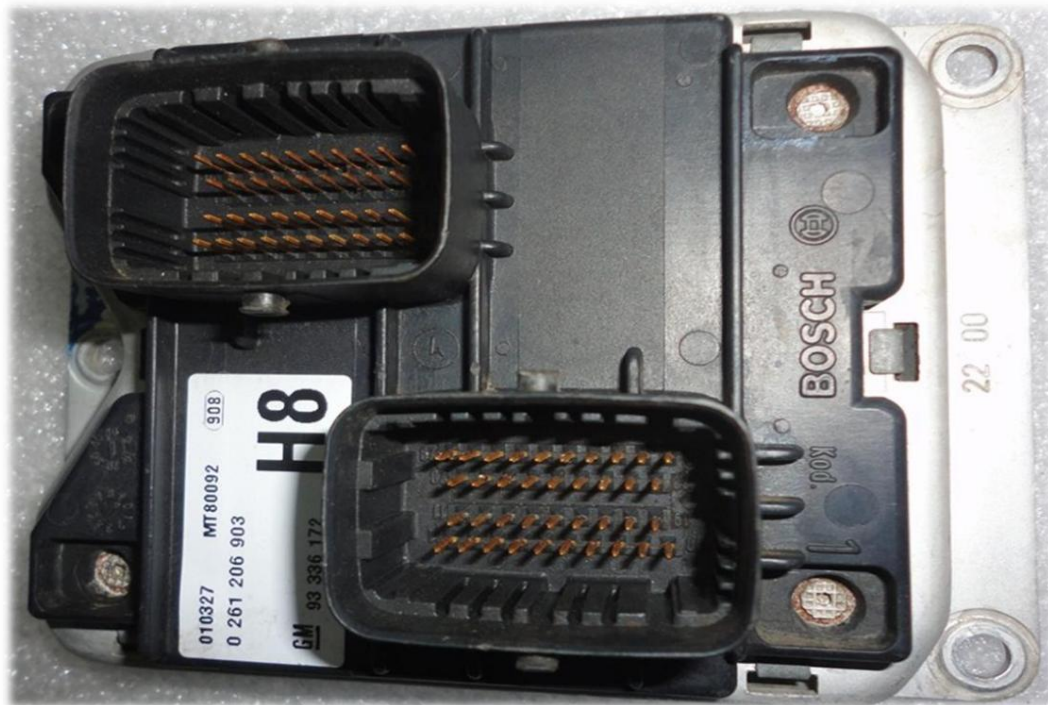


Figure 17

ecu delco hibrida(fig18), this model of ecu equips celta ohc, corsa meriva and zafira vehicles from GM, we can read the immobilizer data, but not change them, we can also reprogram the engine data through the serial programmer.



Figure 18

THE SERIAL PROGRAMMER

As the name implies, a serial programmer is an electronic tool that sends and receives data serially, that is, bit by bit. In your program or software, the programmer has

all requests used for communication and further reading and written in the ecu memory.

One of the most used serial programmers in the world is EOBD2 , because its versatility and low cost make its use viable. It has an easy-to-use program with multilingual resources.

Another programmer widely used around the world is KWP 2000, takes its name from the universal automotive communication protocol KWP2000.



In the figure below we can see the screen of the EOBD2 program.

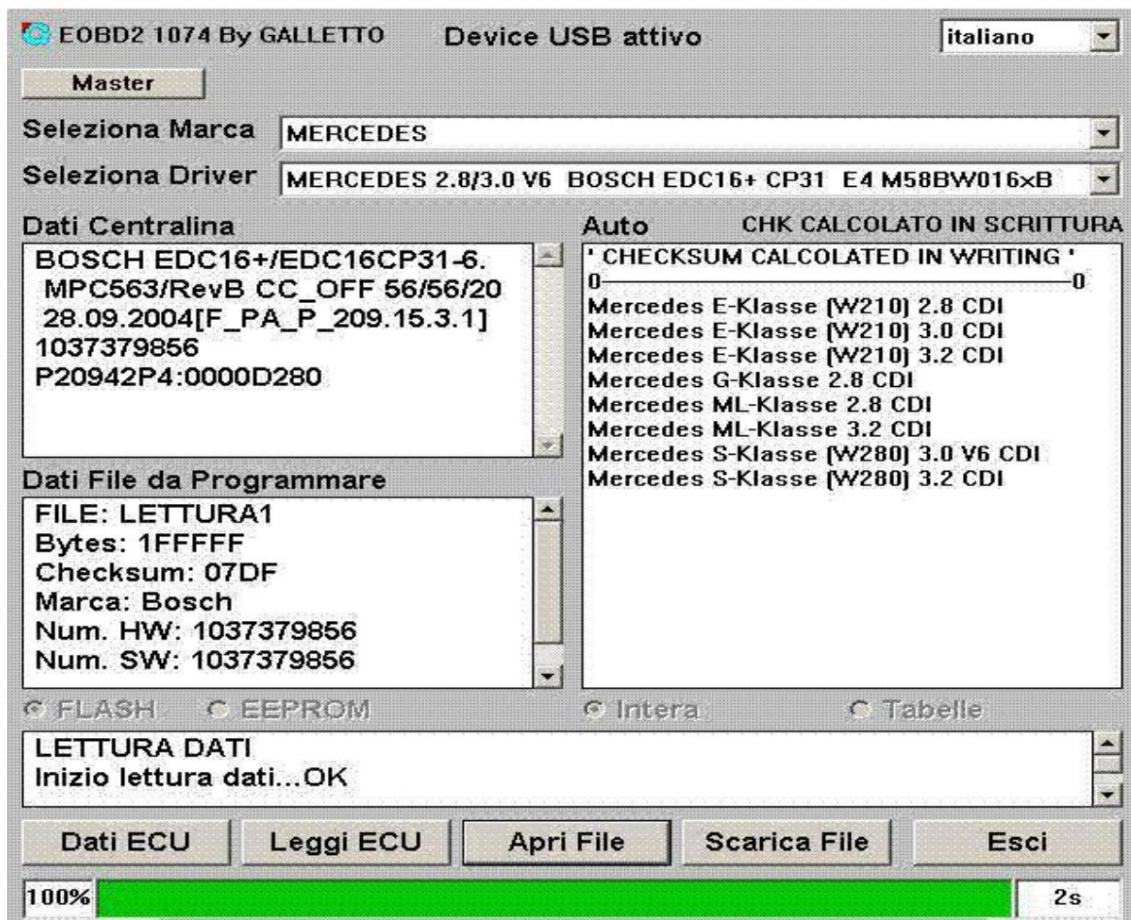


Figure 19

The electronic interface of these programmers is very simple and small in size, but with great electronic resources (fig20).



Figure 20

INDIRECT READING

Indirect reading and writing of memory data in ECUs automotive and done through the universal programmers and boot modes, as described above.

This is the mode in which there is a need to remove memory for programming.

There are many ECUs that use this mode for programming (fig21)

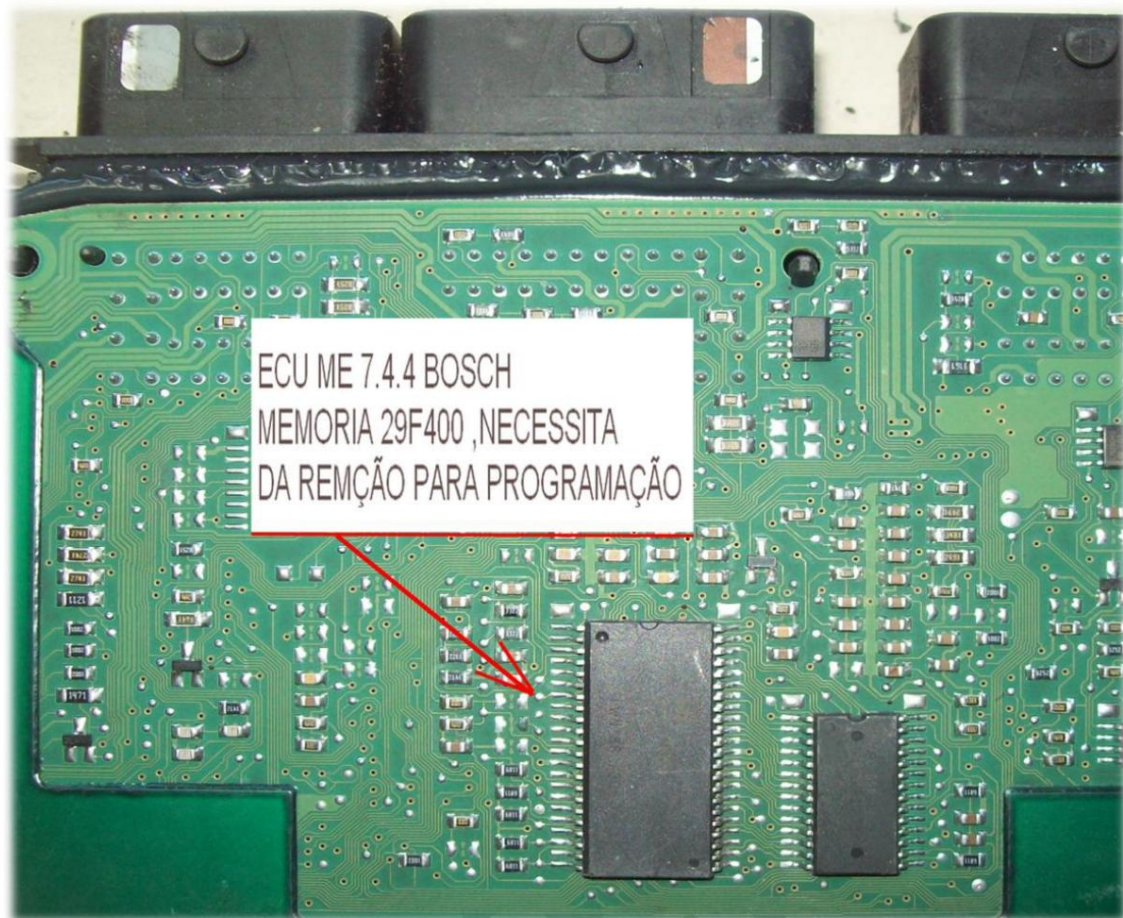


Figure 21

2. REPROGRAMMING OF DATA OF ENGINE OPERATION

The vehicle's engine operating and calibration data are stored in the ECU's internal memories, often there is a need for reprogramming to update the ECU's software or improve its consumption and performance.

Most of the time this data is stored in large memory sizes of 256 kb, 512 kb or greater.

There are programs for editing these data on the market, in order to offer improvements in consumption and performance.

An example of these programs is ECM 2001.

The ECM2001 is also widely used in chiptuning, which consists of increasing in some cases, up to 100 hp of engine power, by altering the original files.

Such programs act directly on the binary code of the original programming, mainly changing the ignition point and injection time, thus increasing the power of the motor.

In the figure below the screen of the ECM2001 program.



3.THE DEPARTURE IMMOBILIZER SYSTEM



The starter immobilizer consists of an electronic passive security and anti-theft system in today's vehicles.

system operation consists of reading data

confidential contained in a transponder, an electronic central sends through an antenna, a magnetic signal that reads the data contained in the transponder and compares them with the data of its internal memory, being the correct data the departure of the vehicle and released, if not, blocked.

In case of breakdown or loss of keys, an emergency start is possible. The procedure will be described for each system and assembler in the following chapters.

The main components of the immobilizer system are:

IMMOBILIZER ECU



The control module of the immobilizer system is programmed to send an electrical signal that energizes the antenna coil, creating a magnetic field that surrounds the transponder, thus reading its data, and later comparing this data with its internal memory, programmed with the same data. of the transponder.

If the data is correct, the immobilizer ecu sends a release message to the electronic injection ecu. Otherwise, the immobilizer ecu will send an error message, and the system will go into emergency, in some systems there is a warning lamp about the condition of the immobilizer.

The immobilizer module can be a separate ECU or incorporated into the instrument panel or also in the body control module (fig22).

Example of immobilizer built into the instrument panel.



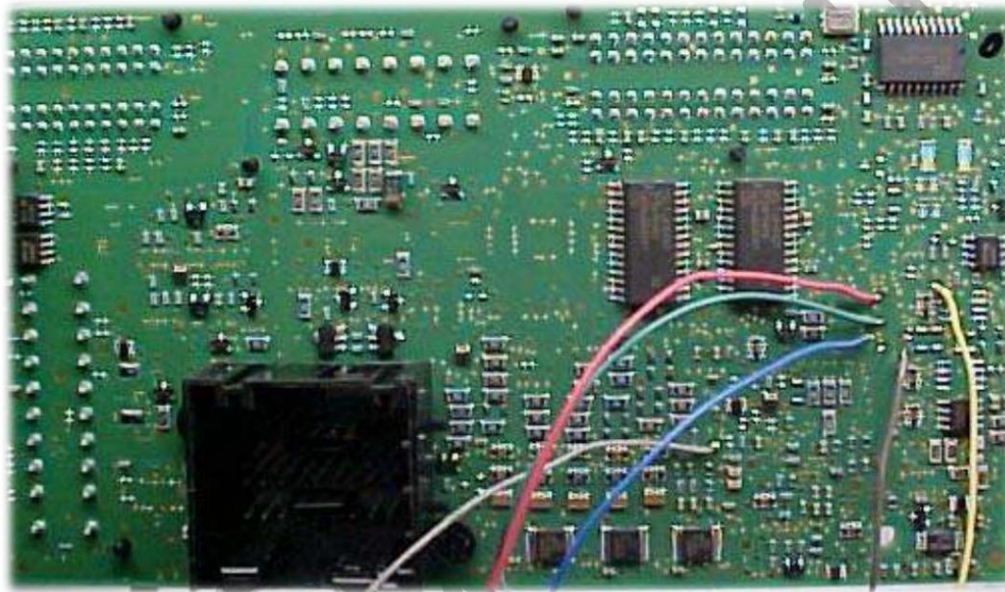
Figure 22



Example of immobilizer incorporated into the bodywork control module (fig23).



Figure 23



ANTENNA



The antenna consists of a coil, which has the function of sending and receiving data from the transponder. This coil is strategically installed in the ignition contact, where upon receiving electrical impulses, it produces a magnetic field that interacts directly with the transponder.

TRANSPOND



The transponder is a receiving and transmitting unit, which operates with the energy of the field created by the ECU, as it does not have

battery or cell, through the antenna. contain a memory where confidential vehicle data is stored.

TYPES OF TRANSPONDER



TEXAS - This is one of two TEXAS transponder chip models. This transponder chip can be found in Chrysler, Dodge, Infiniti, Jeep, Lexus, Mazda and Toyota car keys.



TEXAS 2 - This is the other TEXAS transponder chip model. This transponder chip can be found in Ford, Lincoln and Mercury car keys.



PHILLIPS - This is the PHILLIPS automotive transponder chip. This transponder chip can be found in BMW, Cadillac Catera and Mercedes car keys.



MEGAMOS - This is the MEGAMOS automotive transponder chip. This transponder chip can be found in Acura, Buick, Honda, Jaguar, Porsche and Cadillac Seville car keys.



PHILLIPS CRYPTO GM - This transponder is used in most GM vehicles, its structure is composed of two blocks, the first one we can call it ID which is the chip identification. The second block is encrypted and the data is transferred from the vehicle to the transponder.



PHILLIPS CRYPTO VW - This transponder is used in some VW and Seat vehicles, such as the Polo Classic, Inca, Van and its structure is composed of two blocks, the first one we can call it ID which is identification of the chip, the second block is encrypted and the data is transferred from the vehicle to the transponder



CLONING - This transponder, also called Universal, is used for cloning and receives Philips protocols, Megamos, Motorola and Temic

ELECTRONIC INJECTION ECU

The injection ECU is responsible for releasing or not starting the engine, depending on the response of the immobilizer ECU. Like the immobilizer ECU, the injection ECU also has a memory where confidential data is stored.

The immobilizer systems divided by national automakers



FIAT IMMOBILIZERS

In Fiat brand vehicles there are two generations of immobilizer systems which are:



Figure 24

FIAT CODE PHASE I (fig24): It consists of 1 (one) master key and 2 (two) slave keys. In this system, the master key (red) encrypts the slave keys (blue). With the tracker it is not possible to encrypt the keys.

FIAT CODE PHASE II (fig25): In this phase the master key has been eliminated. Keys with transponders can only be coded using a diagnostic device.

indendificação do sistema code 2
existe um 2 gravado logo no
encontro da lamina com o punho



Figure 25

The immobilizer error fault light is on the control panel. instruments , it is yellow and has the symbol of a key . To Turn on the ignition key, the code light turns on for 0.8 seconds and turns off. If it stays on or flashing, it means FIAT CODE problems. At that moment, if the engine is started, it starts, but then dies, because the CODE system cuts the fuel pump, the ignition coil and the injection valves.

The vehicle comes from the factory with two blue keys , although Up to 8 keys can be encoded.

In FIAT, the immobilizer control unit is located under the steering column trim or incorporated into the instrument panel or body control module. If replacement is necessary, it can be exchanged.

individually for CODE PHASE I in cases of box type ecu, or be exchanged together with the injection center for CODE PHASE II as they form a matched pair.

VEHICLES INVOLVED

- PALIO
- SIENA
- STYLE
- MAREA
- BRAVA
- ONE FIRE
- DOUBLE
-

COMPOSITION OF THE IMMOBILIZER SYSTEM:

- Ignition key with transponder.
- Master key (for FIAT CODE PHASE I vehicles).
- Immobilizer Central (CODE).
- Electronic control unit, ecu.
- Anomaly light

IGNITION KEY CODING WITH TRANPONDER :

There are two procedures for encoding keys:

- 1) In this procedure, the system is CODE PHASE I and therefore has a master key:

- This system only accepts encryption if we have at least 2 keys to program and a maximum of 8 .

- Place the master key in the ignition and turn it until the lights on the dashboard come on.

- Note that the CODE LAMP on the panel lights up for 0.8 seconds and then goes out. At that moment remove the master key and in less than 10 seconds take the key to be programmed in the ignition and turn the key.

• Observe again that the CODE LAMP lights up for 0.8 seconds and then goes out. At that moment, remove the already encoded key less than 10 seconds place another key to be programmed in the ignition and turn the key.

• Notice again that the CODE LIGHT lights up for 0.8 seconds and then goes out. At this moment .

remove the 2 keys already coded and in less than 10 seconds place the MASTER key in the ignition and turn the key. • CODE LAMP will light for 0.8 second and then turn off. • The 2-key encryption is ready. The procedure is the same for more keys.

2) The following procedure is for the FIAT CODE PHASE .

• This system does not have a master key, but a diagnostic device can be used. However, it is necessary to have the key code that comes stamped on a card called "CODE CARD" and this code is 5 digits (electronic code).

• This system only accepts encryption if we have at least 2 keys to program and a maximum of 8.

• No need to delete existing keys , before doing new schedule. But if you want, you can erase them using a tracker.

• The diagnostic device must be enabled to enter, as the key coding on the CAN is via the VENICE system.

• Already with the device, follow the procedures provided by the equipment itself.

ELECTRONIC INJECTION MODULE (ECU)

To program the new OR RESET module, simply turn on the ignition key and the FIAT CODE control unit will program it.

Therefore, it is important to know if the injection center is really damaged at the time of its replacement, as it only accepts a single programming.

To prevent the new control unit from being programmed, enough
disconnect the FIAT CODE control unit connector.

FIAT CODE CENTER

The immobilizer unit can be replaced individually.

If its replacement is necessary, use the master key to program the
central code (same procedure for encoding keys).

From then on, the new FIAT CODE control
unit will already be synchronized with the keys and the injection control unit.

EMERGENCY DEPARTURE

This procedure is used for FIAT CODE PHASE I and PHASE
II

It is important to point out that this operating strategy only serves to
crash the code system. For example: the key with transponder has been
lost and you want to operate the vehicle with a common key (without
transponder).

Every time the vehicle is turned off, it must be
the whole procedure again.

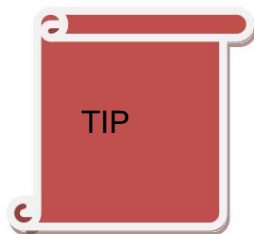
ÿ Switch on the ignition without starting it.

ÿ Step on the accelerator all the way down and hold it down.

ÿ Note that the injection lamp will flash twice and
delete.

ÿ At that moment release the accelerator pedal and start counting how
many times it lights up. When the number corresponding to the first digit
of the key code (electronic code) flashes, step on the accelerator again
all the way.

- Note that the injection light will come on and again if delete.
- Take your foot off the accelerator and start counting again how many times the injection light comes on. When the number corresponding to the second digit of the key code flashes, step on the accelerator again.
- Repeat this procedure for the remaining code numbers of the key.
- When you finish the last number , step on the accelerator again and notice that the injection light flashes about 2 times and it goes off.
- At this point the code has been accepted.
- Without turning the key back, start the engine.



We often come across an electrical failure in Fiat vehicles, and then we need to know precisely if the failure is part of the immobilizer system or if it is being caused by a failure in some isolated component of the electronic injection, or even the injection ecu.

The emergency start can help us in this diagnosis, the first step is to step on the accelerator pedal and wait, if the anomaly light does not flash, we have a great chance of having a problem of lack of electrical supply in the injection ecu, or even even if it burns. if we manage to insert the correct secret code, the start will be released, and then the immobilizer system will be disabled. injection.

GM IMMOBILIZERS



Figure 26

GM's immobilization system is called IMMOBILIZER, and was introduced in Brazil in August 1996 with the VECTRA B (fig26).

The immobilizer irregularity warning light is the same as the electronic injection. When turning on the ignition key, if it is flashing it means immobilizer problem. If she is lit , normal operation.

The vehicle comes from the factory with two keys, however it can be coded up to 5 keys.

This encoding can only be done with the help of a tracking device.
 , therefore not having a master key.

GM has two types of immobilizers:

1°) In the first model that equips VECTRA B ; OMEGA 4.1 L and 2.2 L; CORSA 98 to 2001; TIGRA 97 to 99 , can be placed

new or used command centers by simply doing the synchronization of the same with the help of a tracker

2°) In the second model that equips CELTA 2000 to 2001 ; ZAFIRA 200 to 2001 and ASTRA 98 to 2001, used switches must be erased before receiving new programming

VEHICLES INVOLVED

- VECTRA B
- OMEGA 4.1
- OMEGA 2.2
- CORSA MPFI after 96 (optional)
- NEW ASTRA
- TIGRA
- OMEGA NEW
- MOUNTAIN
- AGILE
- PRISM
- MERIVA •
- ZAFIRA

COMPOSITION OF THE IMMOBILIZER SYSTEM:

- Ignition key with transponder.
- Immobilizer control unit incorporated with the coil/antenna.
- Electronic control unit.
- Anomaly lamp.

IGNITION KEY CODING WITH TRANPONDER :

To encode the ignition key, you must have the INFO CARD handy. It is a card that comes with the vehicle which contains the immobilizer code, key code and radio , code and chassis number.

With the immobilizer password in hand, enter a
in-vehicle diagnostic device , enter immobilizer function

and following the steps determined by the device, encode the keys. It is important to remember that, when coding the new key, the old key must also be coded, otherwise it will not make the car work.

In the new OMEGA the key only accepts one programming, not possible to reprogram them.

If the customer does not have the INFO CARD, a request can be made to the vehicle manufacturer through a dealership, or with electronic resources. It is good to remember that the first GM vehicles with an immobilizer came with the key transponder just plugged in and that it was common to lose the transponder in case the key was dropped. Today the newest models come with the transponder glued on.

ELECTRONIC INJECTION MODULE (ECU)

The injection module can be replaced with a new or used one. However, it is necessary to do the coding and for that it is necessary the help of a tracking device.

Enter the immobilizer function and in possession of the key code, follow the procedures provided by the diagnostic device.

If the control unit recognizes any anomaly in the immobilizer, a fault will be registered that can be seen either by a tracker or by making a jumper between pins A and B or 5 and 6 (in the case of VECTR B) of the existing diagnostic connector in the vehicle.

In the case of ASTRA , ZAFIRA and CELTA it is only possible to see the NOVO fails with a tracker

Faults can be:

Code 143 - communication error between the immobilizer control unit and the ECU

Code 144 – unrecognized key code

Code 145- unrecognized key code

IMMOBILIZER CENTER

The immobilizer control unit is combined with the coil/antenna and can be replaced. The new or reset immobilizer control unit is virgin and accepts a single code entry. However this code can be any number.

Record preferably the old code that comes marked from the INFO, the key because that way it will be easier to memorize the CARD then .First record the immobilizer control unit and , only then the injection control unit.

In the second generation of the immobilizer, such as the ASTRA NOVO ZAFIRA and CELTA, the new code must be the same as the previous one, as the injection unit has already been coded with this code.

The CORSA FAMILY immobilizer harness is the same for cars with or without this safety device, as in these models the immobilizer is optional. If the vehicle comes without the factory immobilizer , A jumper will be made between pins 6 and 7 of the immobilizer central harness so that the control unit can receive the speed sensor signal. In the absence of this information, the fault light comes on and the vehicle starts to stall during deceleration.

EMERGENCY DEPARTURE

on the GM line , only the OMEGA NOVO has an emergency start in case of immobilizer failure. To make it work, follow the procedure:

- ÿ Turn the ignition key on without starting it for a period of two (2) hours.
- ÿ When the flashing alarm malfunction lamp goes out, start the engine.

This lamp is located on the on-board computer switch.

VW IMMOBILIZERS

VW's immobilization system is called IMMOBILIZER(fig27), and was introduced in Brazil in 1998.



Figure 27

The immobilizer fault light is yellow and has the symbol of a key. However not every VW vehicle has this lamp. For example, the imported ones.

When turning on the ignition key, if it stays on or flashing, it means immobilizer problems. At that moment, if the vehicle is started, it starts and then dies.

The vehicle comes from the factory with two keys, however it can be coded up to 8 keys.

This encoding can only be done with the help of a tracking device.

, therefore not having a master key.

On VW, the immobilizer control unit is coded ,
therefore needing to synchronize the keys and the injection command center.:

VEHICLES INVOLVED

- GOAL (all) •
- SAVEIRO
- PARATI
- KOMBI
- SANTANA
- GOLF (NATIONAL AND IMPORTED)

COMPOSITION OF THE IMMOBILIZER SYSTEM:

- Ignition key with transponder.
- Immobilizer control unit • Coil/antenna.
- Electronic control unit.
- Anomaly lamp.(not all)

IGNITION KEY CODING WITH TRANPONDER :

To encode the ignition key you must have the immobilizer code.

With the immobilizer password in hand, enter the immobilizer function.
diagnostic device in the vehicle and ,
following the steps determined by the device, encode the keys. It is important to
remember that, when making the

encryption of the new encrypted , the old one should be too otherwise key , it won't make the car run.

This programming can only be done with the help of a tracker.

If the customer does not have the code, a request can be made to the vehicle manufacturer through a dealership, or through electronic resources.

It is important to note that if the switch is subjected to a magnetic field. For example being close to a speaker.

It can be decoded. Before encrypting the key through a tracker, perform the following

procedure:

Disconnect the battery for (one) hour. Then turn on the ignition key without starting, wait for 45 minutes with the vehicle keys at idle, it is because the synchronization was successful.

ELECTRONIC INJECTION MODULE (ECU)

The injection module can be replaced with a new or used one. However, it is necessary to do the coding and for that it is necessary the help of a tracking device.

Enter the immobilizer function, choose the ADAPTA ECU function and with the key code, follow the procedure provided by the

If the command center recognizes any anomaly in the immobilizer, a fault will be recorded that can be seen by a tracker

IMMOBILIZER CENTER

The immobilizer unit on most vw vehicles is mounted behind the steering column trim and is replaceable.

The new immobilizer unit is already encoded. Then encode the keys and only then encode the injection unit. Some vw vehicles have the immobilizer ecu

incorporated into the instrument panel, as is the case of golf, Passat, bora and jetta.

EMERGENCY DEPARTURE

On the VW line, only the IMPORTED GOLF has an emergency start in case of immobilizer failure. To make it work, follow the procedure:

- Turn the ignition key on without starting • Turn the hour knob to the right and simultaneously press the trip odometer reset button.
- The odometer will read "0000" and the first digit will start blink.
- Keep pressing the odometer reset button until the number corresponding to the first digit of the secret code appears. Confirm by turning the hour knob to the right.
- The second digit will start flashing. Then follow the same procedure as described above.
- After entering the 4 (four) numbers, turn the hour adjustment knob to the right again and press the trip odometer reset knob.
- Run the engine. • The engine must remain running and the malfunction light will remain on.

NOTE: Whenever you turn off the ignition key, the same procedure mentioned above must be done, so that the vehicle starts working.

FORD IMMOBILIZERS

The FORD immobilization system is called PATS (Passive Anti-Theft System), and can be divided into three systems:



PATS I : Introduced in 1997 and has 1 (one) master key and 2 (two) slave keys. In this system, the master key (red) encodes the slave keys (black). With the tracker it is not possible to encrypt the keys. Just take readings, view fault codes, test actuators and erase keys.

PATS II: Introduced in 1999 , does not have a master key. Keys with transponders can only be coded using a diagnostic device.

PATS CAN: equips vehicles after 2005, and keys can only be encoded with the help of a scanner.

Immobilizer Error Fault LED is mounted next to the clock and is colored red, or has a design of a padlock in the center of the instrument panel. When turning on the ignition key, the LED lights up for 3 (three) seconds and goes out. If it stays on or flashes, it means immobilizer problems. At that moment, if the engine is started, it will not

turns, as the start inhibitor relay cuts off the starter motor. if a "break" is given , it won't work either , as the immobilizer system also cuts off the fuel pump, ignition coil and injection valves.

The vehicle comes standard with two black keys, but up to 15 keys (for PATS 1) and 8 (for PATS 2 and can) can be encoded.

In FORD, the immobilizer control unit can be incorporated in the coil/antenna or incorporated in the ECU or in the instrument panel as in the case of the pats can.

VEHICLES INVOLVED

- FORD KA
- FIESTA
- MONDEO
- TAURUS
- F250
- ESCORT
- ECOSPORT

COMPOSITION OF THE IMMOBILIZER SYSTEM:

- Ignition key with transponder.
- Master key (for PATS I vehicles)
- Immobilizer control unit (incorporated into the coil/antenna) or Immobilizer control unit (built into the ECU, or panel)
- Electronic control unit.
- Start inhibitor relay
- Anomaly LED

IGNITION KEY CODING WITH TRANPONDER :

There are two procedures for encoding keys:

1) In this procedure, the system is PATS I and therefore has a master key:

• This system only accepts encryption if we have at least 2 keys to program and a maximum of 15 .

• Delete existing keys , before re-programming.

It is only possible to erase them with the help of a diagnostic device.

• Place the master key in the ignition and turn it until the lights on the dashboard come on.

• Note that the PATS LED on the watch lights up for 3 seconds and then turn off. At that moment, in less , remove the master key and than 10 seconds, place the key to be programmed in the ignition and turn the key.

• Observe again that the PATS LED lights up for 3 seconds and then goes out. At that moment, remove the already encoded key and in less than 10 seconds place the new key to be programmed in the ignition and turn the key.

• Notice again that the PATS LED lights up for 3 seconds and then goes out. At this moment . remove the 2 keys already coded and in less than 10 seconds place the MASTER key in the ignition and turn the key. • The PATS LED will light for 3 seconds and then turn off. • The 2-key encryption is ready. The procedure is the same for more keys.

OBS : To delete the keys you will need a password that will be obtained as follows .

MPI serial number (in case of RASTHER) Ex. : 598632 where the :

No. 1 = 5

No. 2 = 9

No. 3 = 8

No. 4 = 6

No. 5 = 3

No. 6 = 2

The password is the numbers placed as follows:

No.3 No.5 No.2 No.6 No.4 No.1 ie 839265

2) The following procedure is for PATS II This system does not have a master key, however one of the black keys can be used as the master key. :

• This system only accepts encoding if we have at least 2 keys to program and a maximum of 8.

• No need to delete existing keys , before doing new schedule. But if you want, you can erase them using a diagnostic device.

• This example procedure will assume that we have an encoded key and we want to encrypt another one. Let's call the encoded key key 1 and the key to be encoded key

two

• Put the key 1 in the ignition and turn it until the lights on the dashboard light up.

• Note that the PATS LED on the watch lights up for 2 seconds and then turn off. At this time less than 10 , remove key 1 and then seconds, place the key 2 to be programmed in the ignition and turn the key.

• Observe again that the PATS LED lights up for 2 seconds and then goes out. At that moment, remove key 2 already and 10 seconds later key 1 back in the ignition and turn the key.

• The PATS LED will light up for 2 seconds and then turn off. • The 2-key encryption is ready. The procedure is the same for more keys.

ÿPATS CAN

It is necessary to use a scanner to program the keys. The procedure is very simple, but a little time consuming, as the immobilizer system requires a time of 10 minutes for encoding, and if the procedure is wrong, it doubles the requested time. procedure and all described by the scanner.

ELECTRONIC INJECTION MODULE (ECU)

The injection module can be replaced with a new or used one. However, it is necessary to do the coding and for that it is necessary the help of a tracking device.

Enter immobilizer function , choose the ADAPTA ECU function and in possession of the code provided by the equipment company, follow the procedures provided by the diagnostic device.

If the command center recognizes any anomaly in the immobilizer, a fault will be recorded that can be seen by a tracker

IMMOBILIZER CENTER

The immobilizer control unit can be incorporated into the control unit ECU, panel or built-in coil/antenna.

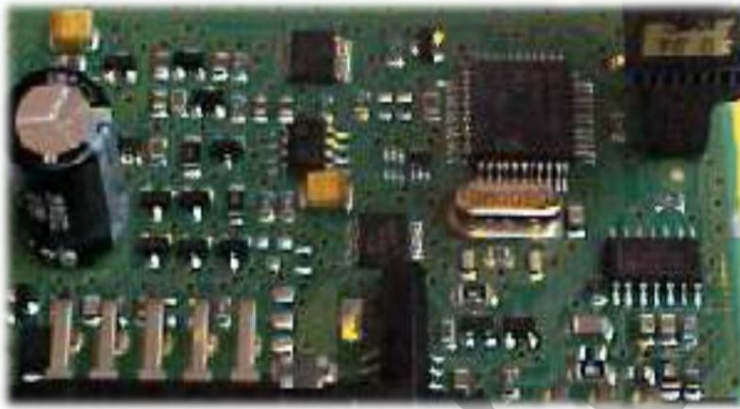
EMERGENCY DEPARTURE

There is no emergency start on the FORD line.

REPROGRAMMING OF DATA OF IMMOBILIZER IN ECU

We can reprogram the starter immobilizer data contained in the ECU memories, whether this is the main memory, which is the largest, where the vehicle operating data is also located, or secondary memory, which is smaller and exclusive to the immobilizer.

In the figure below, an example of reprogramming with the soic clamp (most used).



ECU DECODE

The decoding of the ECU consists of disabling its internal immobilizer system, so that it works without the need for the other components of the immobilizer system.

This disabling is done through the reprogramming of the memories where the immobilizer data are, these memories can be of the main or auxiliary type.

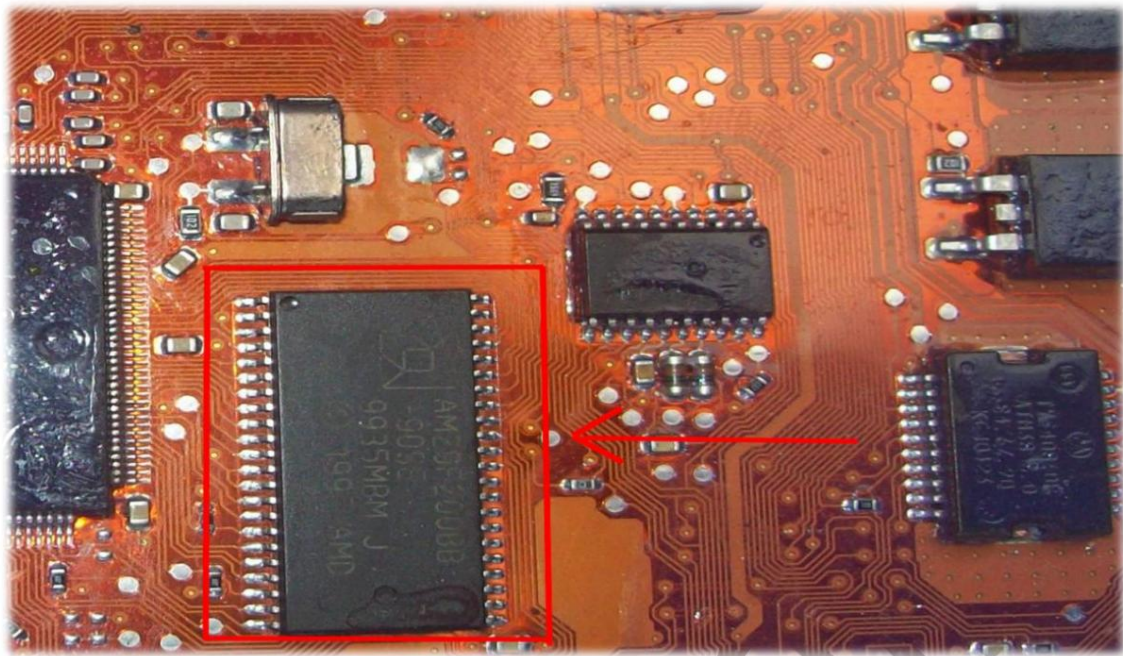
MAIN MEMORY

In some ecu the immobilizer data are stored together with the engine operating data, being possible to disable it, just by exchanging the original file for a modified file, in order to disable the system.

Some examples of ecus that have immobilizer data together to those of the engine.



Ecu Sirius 32 by simiens



AUXILIARY MEMORY

Auxiliary memories are exclusively for storing immobilizer and km data.

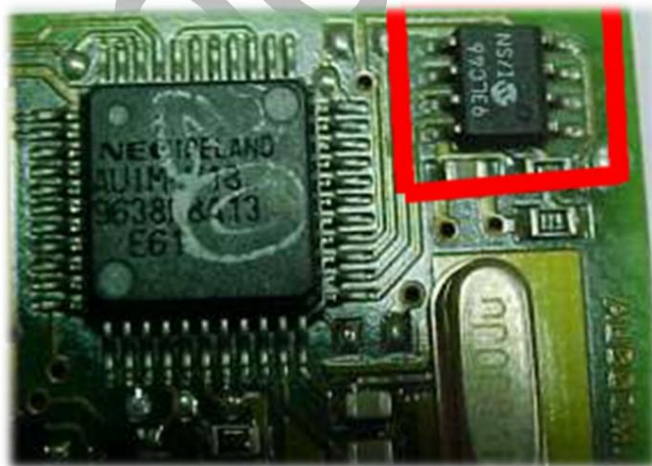
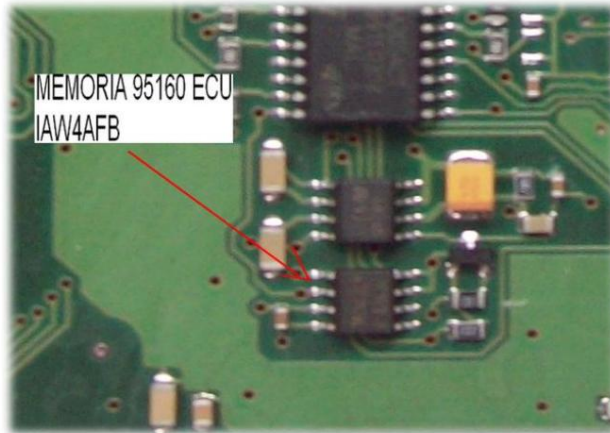
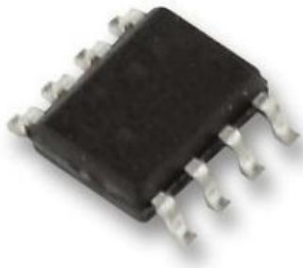
Generally, they have small data storage capacities and small size.

, memories with 8-pin involucro soic are generally used, the most used are:

95040 and family

24c02 and family

93c46 and family



Datasheets for these memories can be found on the website:

<http://www.datasheetcatalog.com/>

PROGRAMS AND DATABASE FOR DECODING

There are several programs on the market used for decoding and ecus resets.

It consists of loading the original file in the decoding program, where this program will identify the data to be changed in the original file, eliminating or resetting immobilizer system.

When creating a new decoded file, the technician can save this file, forming a valuable database for future use.

IMMOKILLER

Immokiller (fig28) is a program widely used by technicians in ECU repairs, as it has several features for decoding, resetting and reading immobilizer passwords.

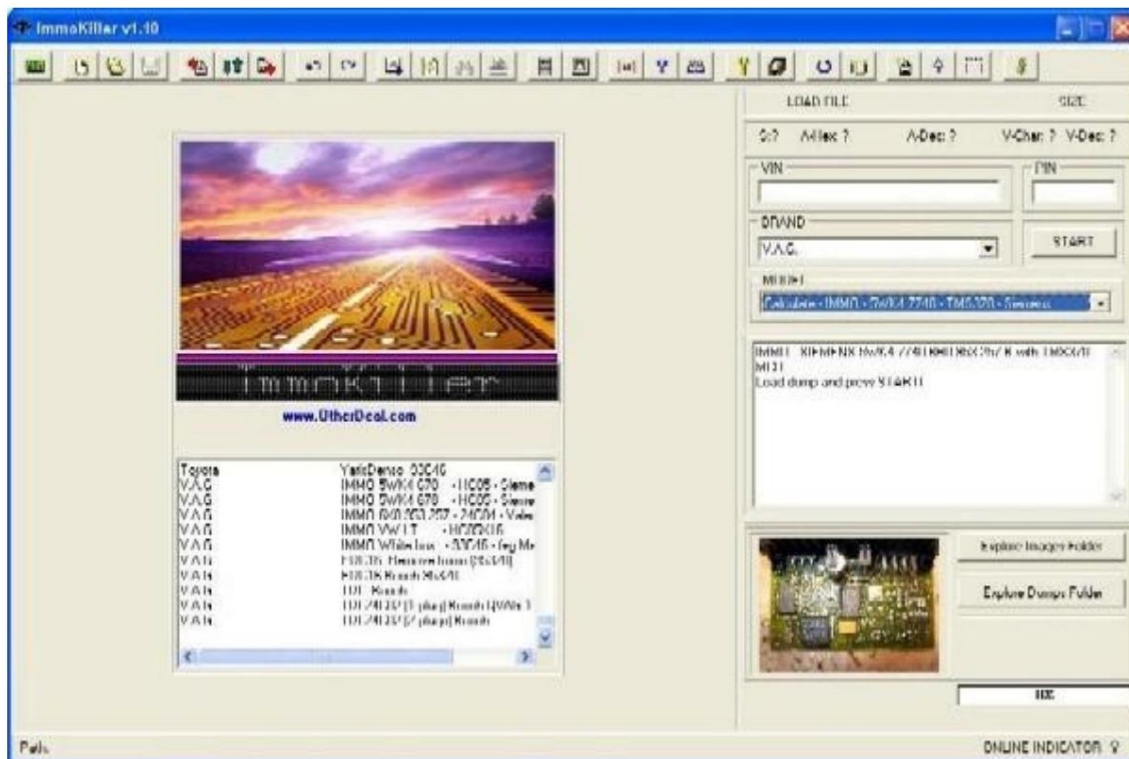


Figure 28

RESET OF THE IMMOBILIZER SYSTEM OF ECU

Resetting the ecu immobilizer system consists of a reprogramming in the ECU's internal memories, in order to renew its original recording ability, leaving the piece in new state.

There are several differences between the systems, described below:

FIAT RESET

It has the practicality of not needing to use tools for recording in the vehicle, just installing the ECU, when the ignition is turned on, the ECU of the injection combines with the ECU of the immobilizer, giving it its code and initializing it. .



RESET VW

In VW vehicles it is not necessary to reset the injection ecus used to enable the immobilizer system. the immobilizer system is integrated into the ecu when programming via a diagnostic tool (scanner).

RESET GM

ECUs for Gm vehicles are considered the most labor intensive in question of resetting the injection ecu .because your reset is all

done through the diagnostic tool. The internal password of the ecu is required, that is, the password of the immobilizer in which it is found.



NEVER PERFORM THE RESET PROCEDURE ON ECU DOS
CELTIC OHC VEHICLES, BECAUSE THE RESET OF THIS SYSTEM WITH
GENERIC SCANNER, THAT IS, THE DIFFERENT TO TECH 2
ORIGINAL GM, LOCKED ECU OPERATING SYSTEM.

RESET FORD

There is no reset in injection ecus on vehicles of this brand.

IMMOBILIZER SYSTEM PASSWORD

The immobilizer system has a password to access the system. In emergency cases, the password is required to start the engine without the transponder. In some systems it is also necessary to release the system for programming of new keys.

We have two ways to obtain the immobilizer system password, the first and most conventional and requesting the vehicle owner for the card that accompanies the vehicle's user manual.

vehicle, it is therefore recommended that you pay special attention to the card, as it contains the confidential immobilizer password.

This is often kept in a secret place, in which the owner, at the time of sale, forgets to pass it on to the new owner.

With the loss or lack of the card, the current owner can request the concession of the brand, a new card. Each brand has a price and a delivery time.

Another way to obtain the password is through electronic resources, which we will discuss now. through serial and universal programmers and programs designed to obtain passwords.

The programs have the function of searching in the specific positions of the file read in the memory of the immobilizer or injection ecu. but many times these data can be encrypted, a system used since ancient times to protect data and messages. It consists of scrambling the data or messages so that, whoever receives it, has the same knowledge as who scrambled it, that is, they have the sequence and can then receive and understand the message, but whoever intercepts it, will not be successful when trying to read, as they will not know how to unscramble such a message, could not decrypt.

The already described immokiller has the function of decrypting some systems.

The immobilizer password can be entered in injection ecus, immobilizer ecus and instrument panels.

We will deal with the systems from the brands.

FIAT PASSWORD

In Fiat vehicles, the password can be obtained by reading the memories built into the ECU processors of the immobilizer system. through the 93c66 memory as described in fig. on iaw4sf models it can be obtained through the injection ecu.



Figure 29



Memory location on the board.



We can also get the password in panels, in the case of canopies year 2007 onwards and new one.



New uno printed circuit board.



In Fiat vehicles, the making of the transponder is done through the data obtained in the memories of both the panels, modules of bodywork control and immobilizer ecus.

There are programs that, through this data, generate the encoding for the transponder, as in the case of TM MAKER PRO(fig30)

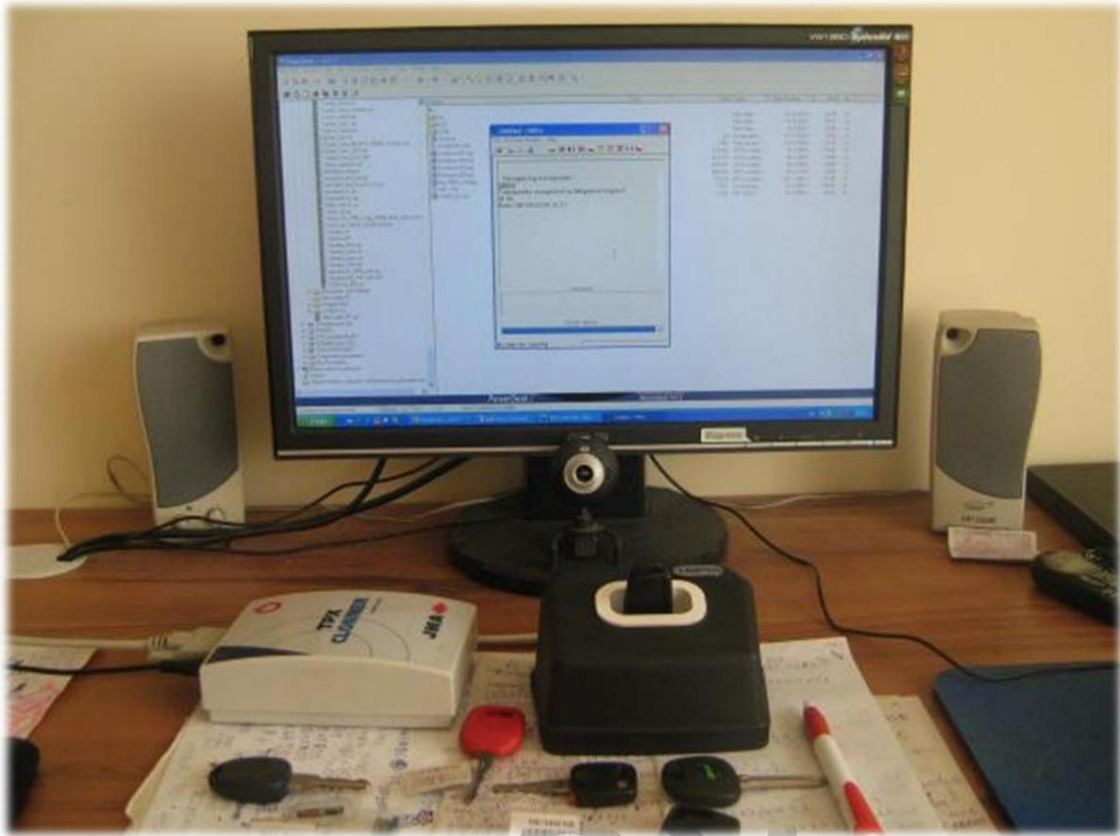


Figure 30

We can find a lot of information about immobilizer on the website of the manufacturer of this device:

<http://tmpro2.com/index.php/modulesdescription1>

VW PASSWORD

VW vehicle passwords can be obtained in several ways , as described below:

Classic ,golf and van vw pole: the password can be obtained by reading the memory built into the MOTOROLA **MC68HC05B16** PLCC52 processor. Requires a special programmer dedicated to this processor.



Reading the processor's internal memory via the socket.



Gol family, Fox, Santana, Saveiro and etc: in this family until the year from 2007 the password is in the memory 93c56 of the ecu of the immobilizer.can be read through the universal programmer or directly through serial programmers such as the vag tacho 2.5.in vehicles of this family after 2008 the password can be obtained from the injection ecu or dashboard.

Ecu Audi golf megamos, memory 93c46



Password reading via soic clamp.



Ecu IAW 4GV, from gol g5, the password is in memory 95320 as shown in figure 31.

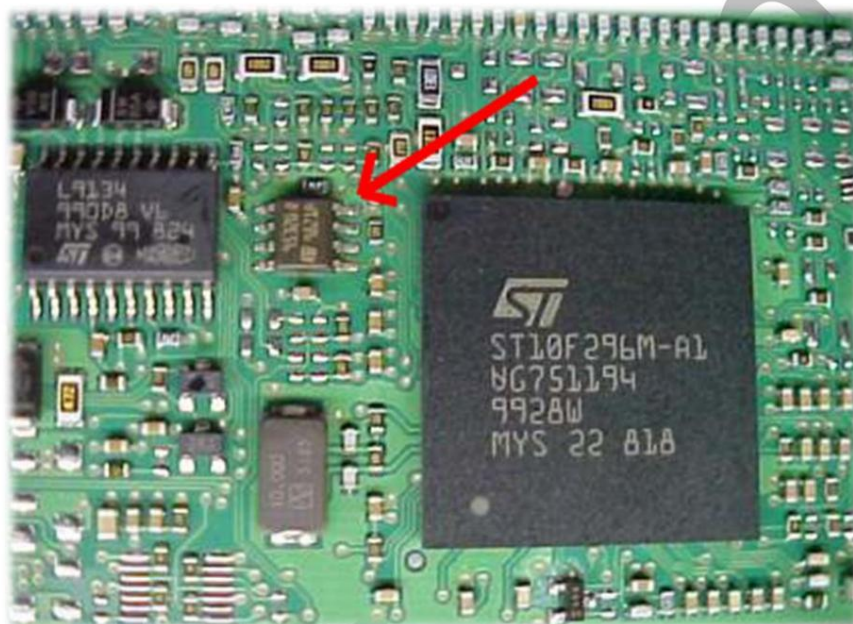


Figure 31

Golf v, polo, bora , Passat: with German technology, which uses the immobilizer module incorporated into the instrument panel these vehicles have a variety of systems, only golfv (golf5, no Brazil, the golf has two versions, but this model in Europe is already in the fifth version), it has 16 versions of panels, in most of them it is possible to obtain the password in the memories 24c02, 93c66 or

93c86 from instrument panel, with vag serial programmer
pot 2.5

Golf panel.



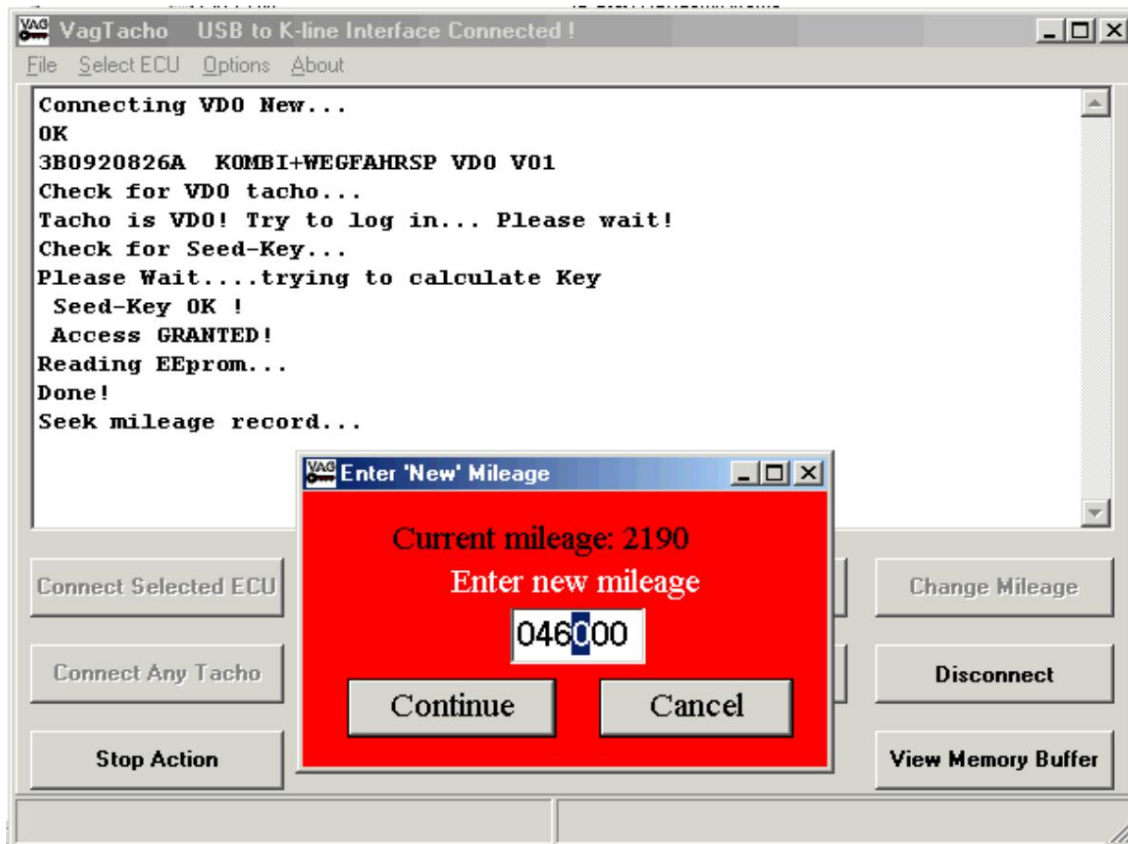
Memory location 24c02.



Reprogramming with the soic tweezers.



TACHO program screen 2.5.



we can also obtain the password quickly and practically, as it eliminates the need to remove and dismantle the panel.



GM PASSWORD

On GM vehicles, the password can be found in the memories of the injection ecus, immobilizer ecus, and some cases on the dashboards.

of instruments and body control ecus.the system

Gm immobilizer has two versions, called opel 1 and opel2, and we find an evolution of the opel 2, the opel2r.

On opel1 systems we can read the password through the memory built into the Motorola zc 430 754 processor (fig32)



Figure 32



Figure 33

In figure 33 we can see the socket used to wrap the processor for reading.

On the opel 2 system, the password is located in the internal memory of the tms 370 processor, which can be read through the specific programmer for this processor.

The opel2r system has the password located in the Motorola processor's built-in memory (fig34).

Immobilizer ECU label, where you can identify the version of the system.



ECU view without housing and antenna.



Figure 34

FORD PASSWORD

In Ford vehicles, a password is not used and does not have the emergency departure.

INJECTION MODULE REPLACEMENT ELECTRONICS

We are constantly faced with the need to change an ecu, there are many cases in which we need to test an ecu in good condition in a vehicle with suspected defect in the injection module. the injection ecu change will depend on its internal memory where the immobilizer information is contained.

In cases of ecus with memory built into the processor, as is the case of units with st10fxx processor, it is only necessary to transfer the total content of the main memory to the ecu that will be installed.

In cases such as the corsa 98's multec system, the programming required will be only the isolated block where the immobilizer data is, which are of few bytes, only 256 bytes inside the Motorola MC68HC11 processor (fig35).

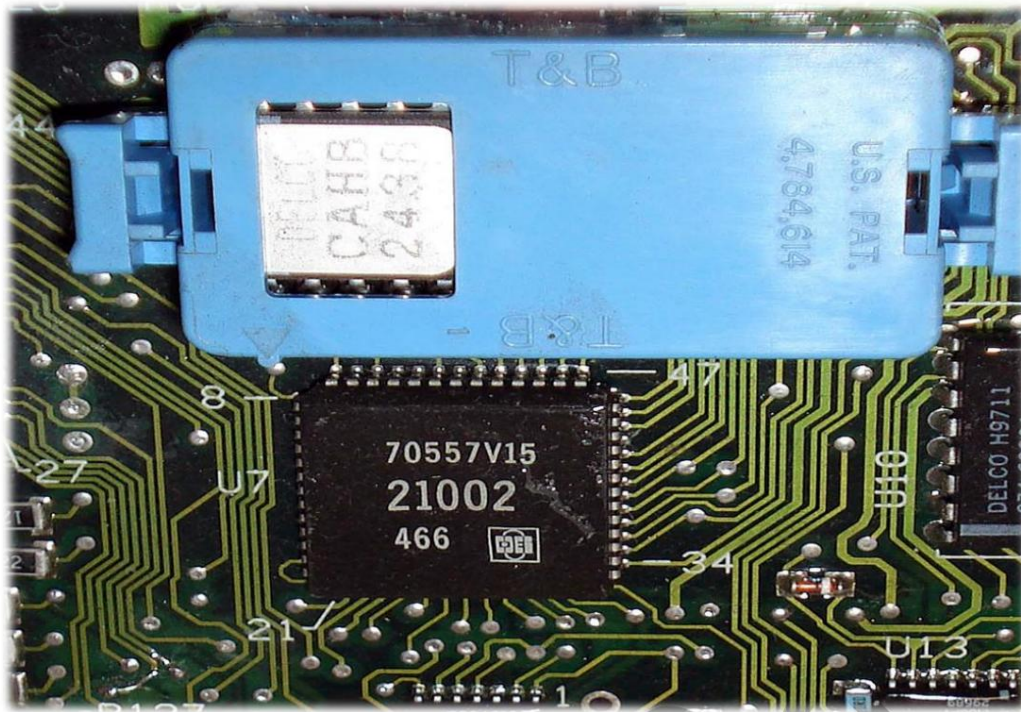


Figure 35

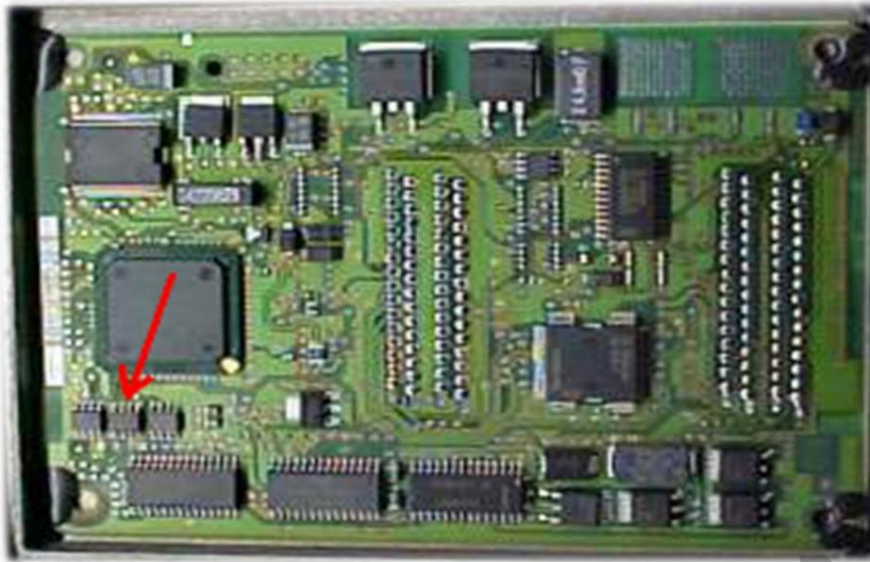
The vast majority of ECUs use auxiliary memory to store immobilizer data, usually memories with small storage capacity and reduced size.

We can then remove this memory and replace it with the part that we are going to use, thus facilitating the exchange of the ecu.

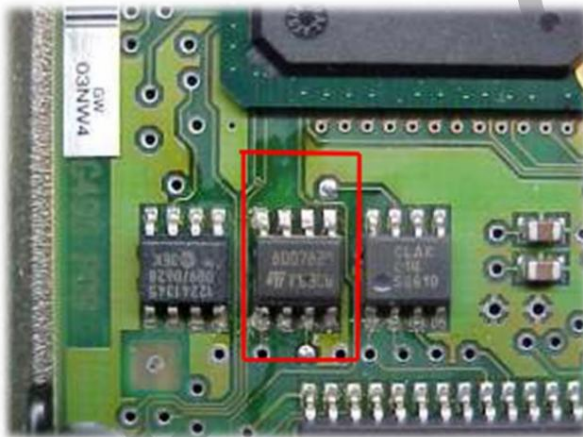
We can also change the memory programming through the universal programmer.

Some examples:

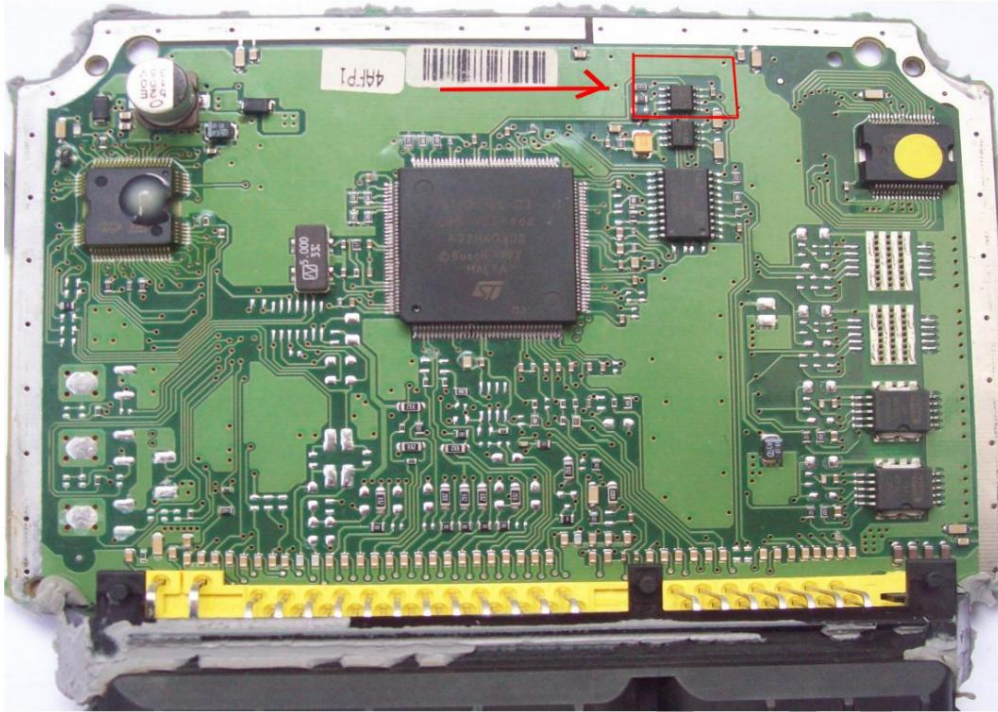
Ecu hsfi delphi, fiat and GM



Location of soic memory in HSFI ecu.



Ecu family Fiat IAW49FB



Ecu marea system Bosch M 2.10.4(fig36)

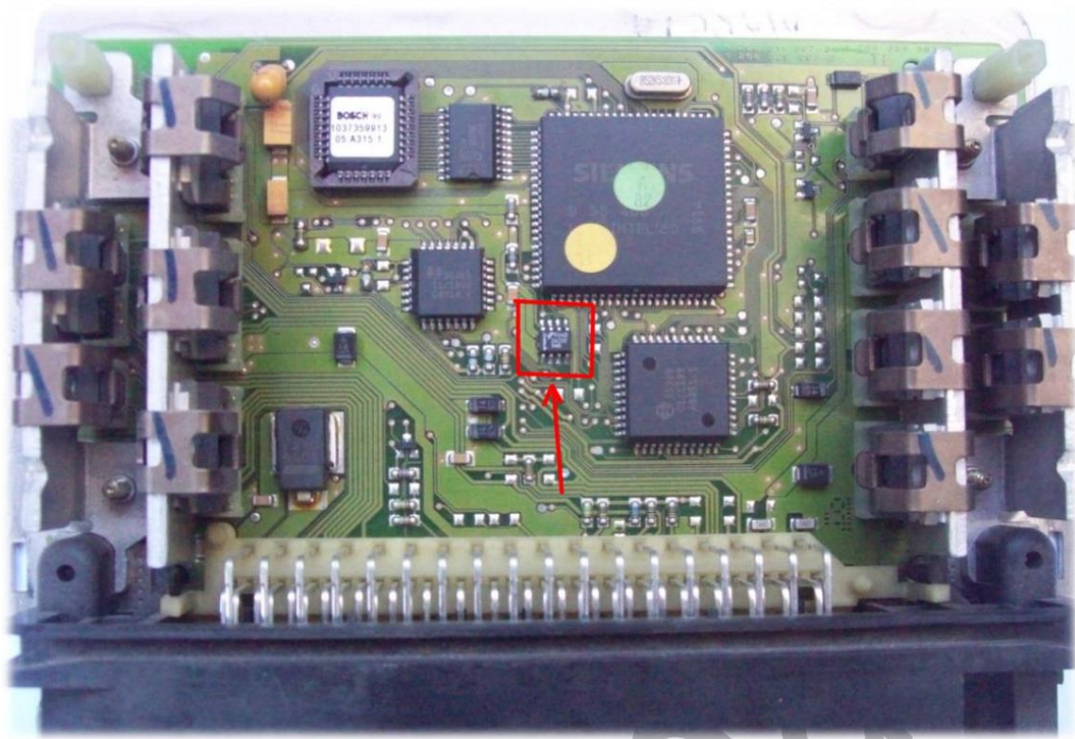


Figure 36

Ecu Ford system ECC V PATS 2 memory 25020(fig37)

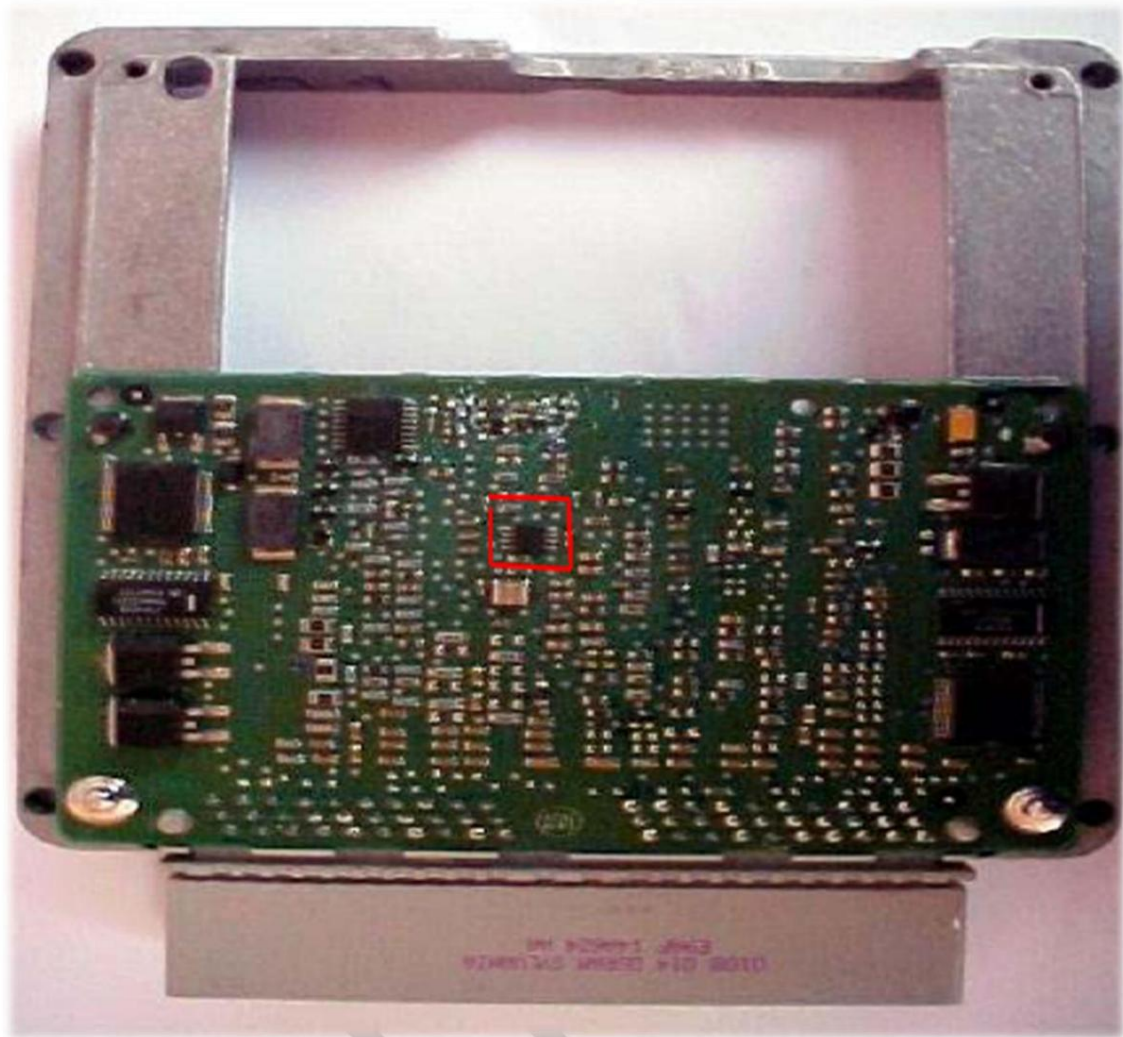
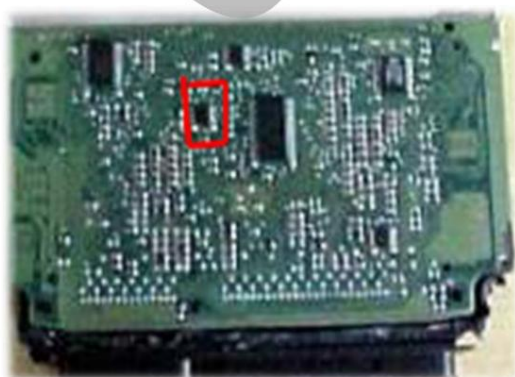
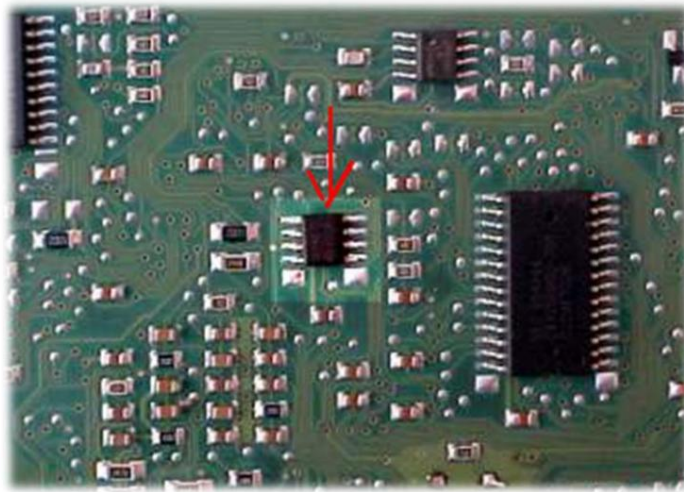


Figure 37

Ecu vw M 7.5.10 memory 95040





COMMON SYSTEM DEFECTS

IMMOBILIZER

Like any electronic system, the starter immobilizer is also prone to failures, among them, the most common are:

TRANSPONDER FAILURE

The most common failure happens with the transponder, because it is a small component, it suffers many with the impact of the keys where they are housed. The transponder can deprogram if or break, for the diagnosis it is necessary to use a scanner to read the failure, which will remain recorded in the fault memory of the immobilizer's ECU in the event of a breakdown. We can also submit the transponder to a test in specific transponder identification devices, and if this device does not detect the transponder, its failure is attested, otherwise, the failure it could be in the antenna or in the immobilizer ecu.

ANTENNA FAILURE

The system antenna is also the cause of many failures, because if the magnetic field does not reach the transponder, it cannot be read. In a practical way, the antenna works as a coil, so if its winding is short-circuited or open-circuited, it cannot work. In figure 38 we can see the test of the antenna with the multimeter.

The measured value should be around 10 OHMS.

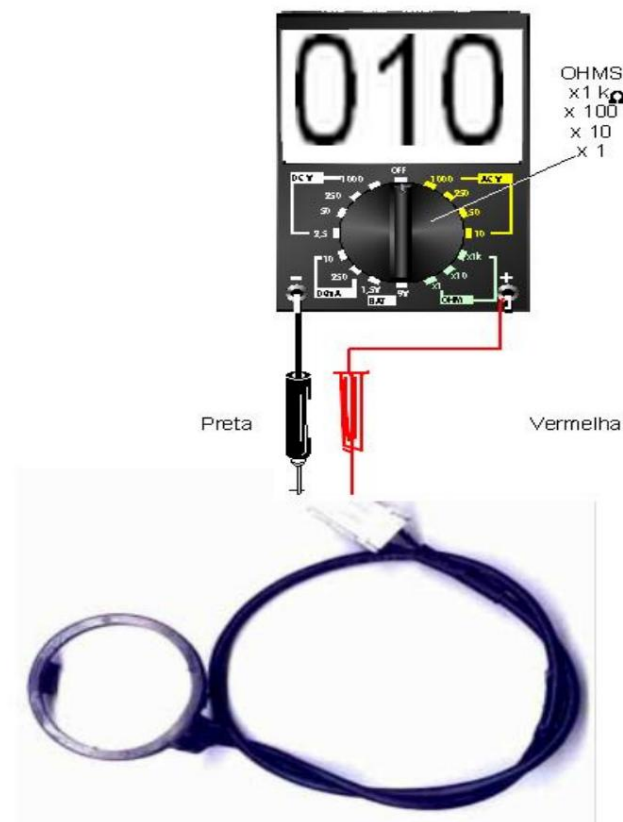


Figure 38

FAILURE IN ELECTRICAL CIRCUITS

ECU electrical wiring failures are very common, as many are installed in places unprotected from moisture. This moisture causes the ECU connectors to oxidize, leading to the failure of the ECU.

system.wiring interruptions for various reasons, such as installation of accessories may cause serious damage.

IMMOBILIZER ECU FAILURE

It is also common to detect failures in the immobilizer ecus, in these cases a diagnosis is needed a little more judicious.

The first step is to measure the polarization (power supply) of the ecu with the help of the electrical schematic of the system, multimeter or test lamp of low electrical current.

After verifying the correct polarization, and its electrical circuit, we will start to change the ecu.



**DO NOT USE ELECTRICAL HIGH POWER TEST LAMPS
,FOR THIS TYPE OF TEST, CAN INSERT A CURRENT
ELECTRIC TO OTHER CIRCUITS INTERCONNECTED TO THE ECU OF
IMMOBILIZER, CAUSING POSSIBLE OVERLOAD.
PREFERENCE TO TEST PEN THAT USE LEDS. THIS NOTICE
SERVES FOR TESTING ALSO OF OTHER ECUs.**

CONCLUSION

As we conclude the second part of our training, we hope that this manual will be of great value to those who are interested in it.

Follow the next news on the site:

<http://www.suporteaoficina.com.br/>

thank you all.

Cassio Bittencourt

30 years old, electronics technician, works for 15 years in the automotive area, during this period he took programming courses in delphi, visual basic, microprocessors, digital serial ports. in the city of Belo Horizonte, Minas Gerais, Brazil. USB and electronics

