IDC5 Basic - learning CAR

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TEXA EDU

INDEX

Legend:

⚠️ **Warning**

ℹ️ *Information/Notes*

❓ ***Curiosity***

1. INTRODUCTION

The purpose of this manual is to provide the most advanced information and knowledge of TEXA Diagnostics Software aimed to perform self-diagnosis on vehicles. It is suitable for those staff (technicians, electricians and mechanics) who already know the basics of self-diagnosis and have the electromechanical basis of knowledge as this manual provides the most detailed guidance techniques for those advanced features, available with the New Generations Of electronic control units which are adopted on the most modern vehicles.

In the case of less experienced or not adequately trained on the self-diagnosis tools produced by TEXA, it is firstly recommended to attend a basic course such as the D1.2C "CAR Diagnostic and Configuration Techniques".

1.1 Electronic Control Unit; Operation

An Electronic Control Unit is basically a computer that is in charge of managing and verifying the operation of a system. To do this, it needs to obtain information through the SENSORS and change the operating parameters of the system through the ACTUATORS.

For operation, it is of course necessary a supply voltage and, in the case of complex electronic board architectures, a data exchange line with other control units (CAN network).

Physical Quantities	Sensor		ECU		Actuators	Physical event
Engine Temperature	NTC Engine Temperature	Analog / digital conversion of incoming signals	EEPROM Memory	Output Signals Managing	Management Electro-Injectors	Petrol quantity
Air mass flow Intake	HFM Air Mass Meter		CPU		Ignition coils	Combustion Sparks
Crankshaft Speed Rotation	Induction Engine Speed		CAN BUS DTC Memory		EGR Valve	Exhaust gas Recirculation

- Power Supply +   Diagnostic Tool

Figure 1

The ability of an ECU to monitor the operation of everything that is connected to, as well as its own operation, takes the Self-Diagnosis name.

For Self-Diagnosis it is the ability of the electronic control unit to control itself to detect any failures that are stored in a "faulty memory" section.

In order to read and clear the "Fault Memory", you need to use a diagnostic tool that has the function of displaying the detected errors but does not implement any particular fault search.

The latest generation of controllers have evolved software that can detect a wider range of errors, but the principle remains always the same as the self-diagnosis tool reads the detected DTCs that an ECU has detected on itself.

On the elements and devices of an electronic system the control units are able to perform two different types of analysis and control:

1. Electrical analysis and control (short circuit - open circuit - out of range);
2. Analysis and functional control (plausibility of information - self-adaptability).

As a practical example, consider the following cases:

1. Electrical Type Diagnosis: Produces signals that cause the display of "Engine Temperature Sensor" DTC caused by the break or short circuit of the NTC sensor (Negative Temperature Coefficient). The current DTC is identified by the control unit by an evaluation of the intensity of the current circulating in the sensor or rather that the value of the latter does not fall again within a predetermined range (interval).

2. Functional Diagnosis: It is produced by a particular evaluation of the control unit and not by a single direct physical cause. The result of a functional diagnosis is, for example, the "Auto Adaptive Parameters" error that comes through the sensor analysis of the lambda sensor, which affects the modification of the mix parameter parameters.

1.2 Ground and Power Supply

Although with some obvious limitations (if the power supply is completely missing, the control unit obviously does not work and is not able to communicate with the diagnostic tool), the control units generally control their power supply. This is to verify and ensure their regular operation (some units do not work below minimum thresholds) and to handle more appropriately a low power supply situation (inhibition strategies for some non-vital activations and reduced operation of some systems).

Figure 2

It may happen that, due to oxidation or improper fixation, not all of the ground point fits perfectly to the vehicle body, creating a partial contact that results in a smaller section of the conductor: this circumstance obviously make the electrons movement harder by creating friction between them generating heat that is affects by an increase in resistance and thus limiting the current flow to the connected circuits. The device/system being affected by a lower current flow will suffer an alteration of its operation. therefore, it can be stated that in some cases the only resistance check using the only ohm meter can mislead the technician, thus leading it to express a series of erroneous or not precise diagnostic evaluations. To make resistive control in dynamic form, using the voltmeter or better the oscilloscope, you have to get used to a simple reasoning.

A fundamental principle of electric matter says "every resistance causes a drop in tension ..".

Taking note of the above, we can probably assert that if there is resistance in an electric current circuit, in the same circuit there is also a voltage drop between the terminals.

1.3 Sensors

This name defines a device to provide useful information to the electronic control unit. The main purpose of the sensors is to transform physical quantities of various types (eg temperatures, pressures, depressions, rotations, displacements, etc ...) into electrical signals that will be processed by the control unit.

Figure 3

A practical example is the crankshaft:

In this case there is a specific magnetic induction sensor located in front of a toothed wheel (also known as the phonic wheel) which turns the rotation movement into an electric signal.

This signal is processed by the control unit to determine the speed of rotation of the crankshaft (revolutions) and to check if there are no ignition.
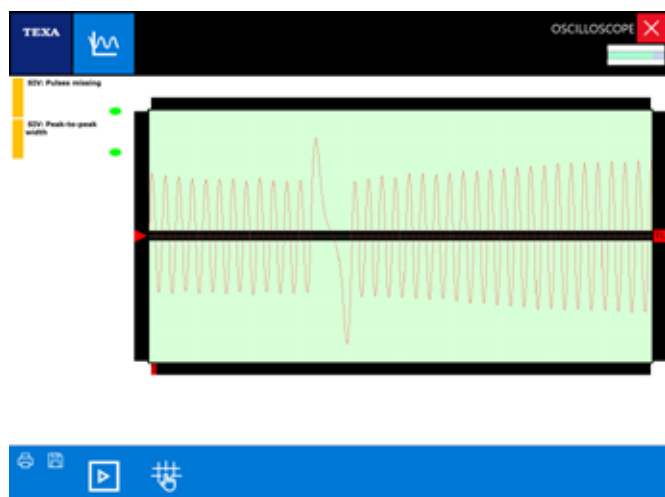
Figure 4: Crankshaft sensor oscilloscope acquisition via assisted "SIV" mode

1.4 Actuators

Unlike the sensor, which produces an input signal to the controller (information for the computer), the actuator instead is a device that is managed by the ECU which transforms an electrical signal In a physical event, by executing a command processed by the control unit.

Some examples of actuators are: the stepper motor that change the angular position of the throttle Throttle, the solenoid valves involved in the hydraulic or pneumatic circuits and the injectors.

In this case the control unit uses the information from the various sensors and commands the actuators according to a logic defined by a series of programs (mappings) stored and determined by the constructor.

One of the most important actuators in a motor is the injector: a solenoid valve controlled directly by the control unit to determine the amount of fuel to be fed into the cylinder through the injection times.
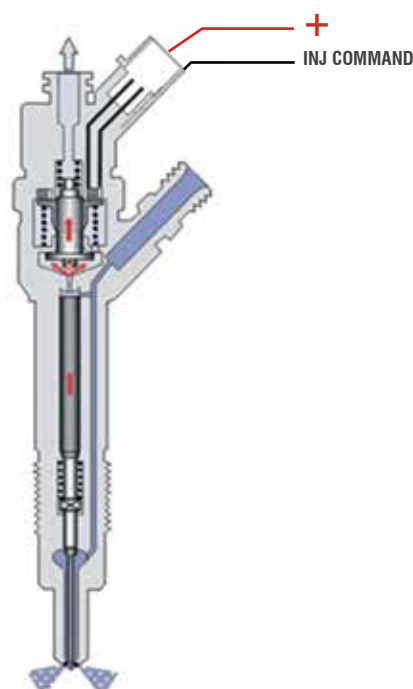
Figure 5: Injector's section

The injector is constantly powered to 12V (A); At the injection time, the control unit puts an injector terminal to ground, allowing pin lifting and fuel leakage for the pre-set injection time (B). At the end of the injection, the closing of the mass command generates an extraterrestrial (C) useful for oscilloscope diagnosis on the operation of the injector.
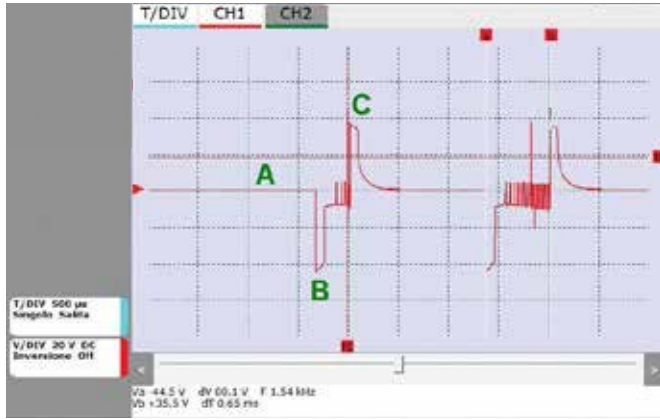
Figure 6: Oscilloscope acquisition of the opening signal of an injector: T DIV 500µs, V DIV 20V

Legend:
A. Rest Condition
B. Open the sprayer
C. Closure of the sprayer

1.5 CAN Bus: Characteristics and Advantages

CAN networks have been designed to reduce the complexity of traditional wiring by integrating a microcontroller / microprocessor-based control system that ensures flexibility configurability and improved information security as well as speed.
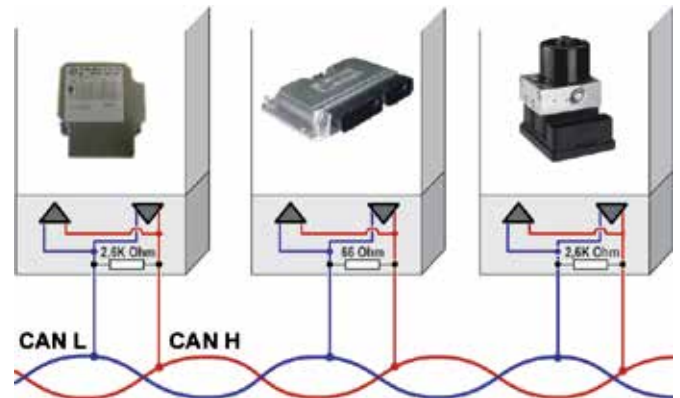
Figure 7: CAN Bus connection between ECU example

The on-board control ECUs can therefore act in an interactive way: think of the power cut of the engine when the traction control is operated by the ABS, or, in the event of an accident, the AirBag unit informs the engine control unit to turn off the electric pump to stop the fuel flow.

This interactivity suppose the exchange of information between the controllers that usually occurs through an interconnection network where computers communicate digital information using various protocols, most commonly the Controller Area Network or CAN BUS.

There are several CAN architecture solutions with two-wire communication networks with a different transmission speed. The SAE (Automotive Engineer Company) has classified the various transmission standards into three main categories, based on the transmission rates and the functions implemented:

- Bodywork network (A class) characterized by a low bit rates (up to 10 kb/s), few information and average response time: 100 ms;
- Intersystem multiplexing (B class) medium bit rate (10 to 125 kb/s), average information and average response time: 10 ms;
- Medium/High bit rate (C class) high-bit rate (125 kb/s at 1 Mbps), much information and average response time: 5 ms.

Then it happens that the search for a failure should not be stopped at a single control unit, but involves the diagnosis of several control units:

- Each control unit may carry out checks actions through the information it receives from the other control units;
- The use of the CAN protocol makes it possible to simplify the electrical systems of the vehicles, making them even more reliable;
- Only a few sensors are required;
- Optional components can be installed without twisting the electrical system of the motor vehicle.

Figure 8

The training: DIAGNOSIS OF CAN-Bus NETWORKS allows you to know the operation of the main data controllers of the Controller Area Network and how to diagnose their operation.
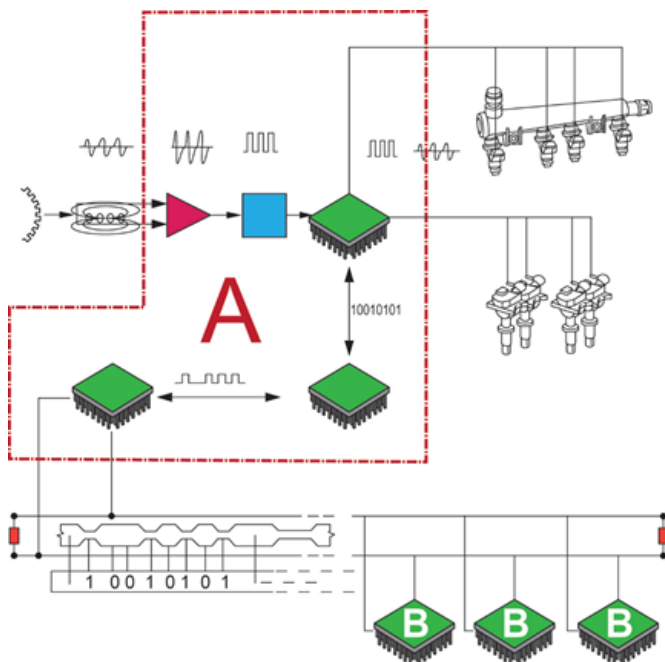
G9C

1.6 Self-Diagnosis Limit

It's important to emphasize and remember the limits of self-diagnosis resources. In particular, it must be borne in mind that the main job of an electronic control unit is manage the system where connected (engine control, braking management etc.) and, only later, it is to check and monitor the input signals And output for self-diagnosis functions.

For example, a crankshaft or camshaft sensor malfunction can lead to motor malfunction but not leaving any trace in self-diagnosis: this is because the sensor signal check for self-diagnosis is made at a lower frequency than the one used for the management direct injection.

This means that a signal interruption occurring between one check and the other does not lead to the engine failure or the ignition of the engine failure, even though it causes an engine malfunction.

It is therefore clear that a system's diagnosis should not stop at the simple DTC reading, but it must be thoroughly analyzed by checking the parameters that the diagnostic tool provides.

The ECU sometime is not able to define with very high accuracy which is the faulty device, providing incorrect, ambiguous or even misleading signals, even though the vehicle is not functioning properly.

This will cause the technician to replace the components listed in the Errors page of the tool without solving the cause of the fault that caused the problem. It is therefore useful to tale action only after careful reading of the engineering parameters and, in more complex cases, to carry out a road test with the on-board diagnostic (OBDLog and OBDMatrix) devices or with the "recording" function present In TEXA self-diagnosis software.

Engineering parameters are the values coming from sensors (engine temperature, pressure, throttle position, etc.) and those directly to actuators (injector control, advance, EGR, etc.).

With the engineering parameters, the technician is able to make a critical analysis of the data handled by the control unit, but to do this the technician must have a good knowledge of the operation and intervention strategies of the electronic system on which to take actions.

1.7 Self-Diagnosi on the road

Electronic systems inside the vehicles are drammatically increased in the last few years, it can obviously cause the appearance of sporadic or intermittent failures that occur only under certain driving conditions (at low temperatures, along an uphill, accelerator partial load, etc. Etc.) and that during a workshop diagnosis they are not correctly detected and therefore the vehicle is working properly.

In addition, some recent electronic systems (Start & Stop, Hybrid vehicles, assisted braking, etc.) can only be diagnosed on a vehicle road in motion.

This could reproduce the conditions during which the vehicle is malfunctioning, while the "On Board" diagnosis devices store the time sequence of all the signals handled by the control unit, including errors.

After collecting the data from the vehicle, it analyzes the detected values by connecting the "On Board" devices. Starts the stage of interpretation and investigation of the causes that generate the fault.

The new dynamic diagnosis solutions not only improve and innovate workshop equipment, but also design a new space on the market, creating new technologies, new systems and a new way of working.
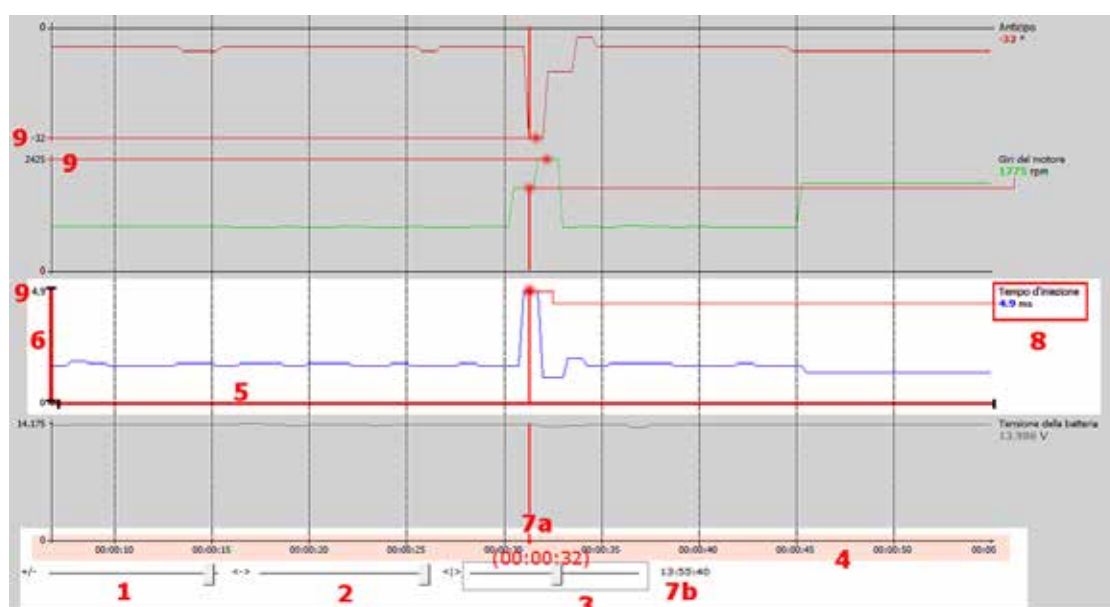
Figure 9: Example of graphic recording of parameters for a trip started at 13:55 and ended at 13:56 (1 'of the time

Legend:
1. Cursor to select the width of the chart display window (zoom)
2. Cursor to allow the time axis to move
3. Cursor to analyze the values of the various graphs at a precise time instant
4. Common Timeline to all graphs
5. Specific time axis of the single chart
6. Range of values assumed by the parameter analyzed (8) over the time interval considered.
7. Time Parameter Analysis Parameter
a) Relative: 00:00:32 after the start of the recording
b) Absolute: at 13:55:40
8. Parameter name analyzed and value of the same at time of analysis (7)
9. Maximum value assumed by parameter (8) in the analyzed time interval

The Training ADVANCED DIAGNOSIS AND RESEARCH ON ROAD allows you to improve your Knowledge about using the "Road Test" function of IDC4 plus and OBD Log and OBD Matrix data acquisition devices.

1.8 The Measurement Tools

According to what explained so far, it is clear that the diagnosis of a system should not stop at reading errors, but it must be thoroughly analyzed by checking the parameters with the diagnostic tool. However, in certain cases where malfunctions escape to the control of the ECU, it is imperative to use the oscilloscope to analyze the signals from the individual sensors and to check the controls implemented by the control unit towards the actuators.
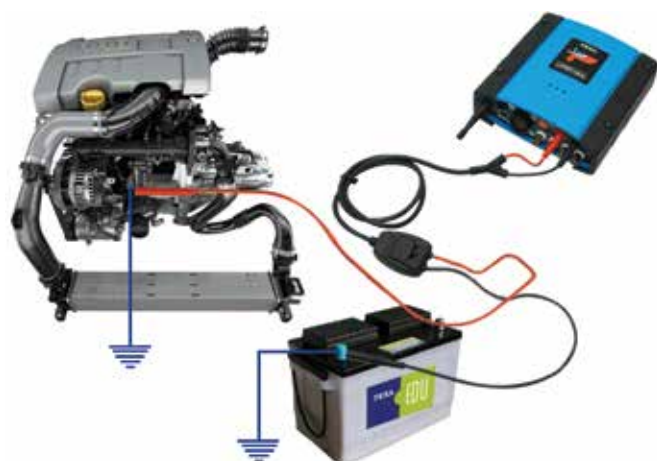
The pneumatic valve that manages the position geometry variable mechanism inside the turbo compressor, the EGR valve opening control and the signal from the air mass meter, just to give some examples, are managed by commands modulated in PWM (Pulse Width Modulation) and in order to be sure about their correct functionality you need to use an oscilloscope.

Figure 10

CH1 Freq: 12.6 Hz   D.Cycle: 50 %   Trigger Level: 2.40 V
CH1 Min: -1.941 V   Ave: +3.037 V   Max: +5.730 V
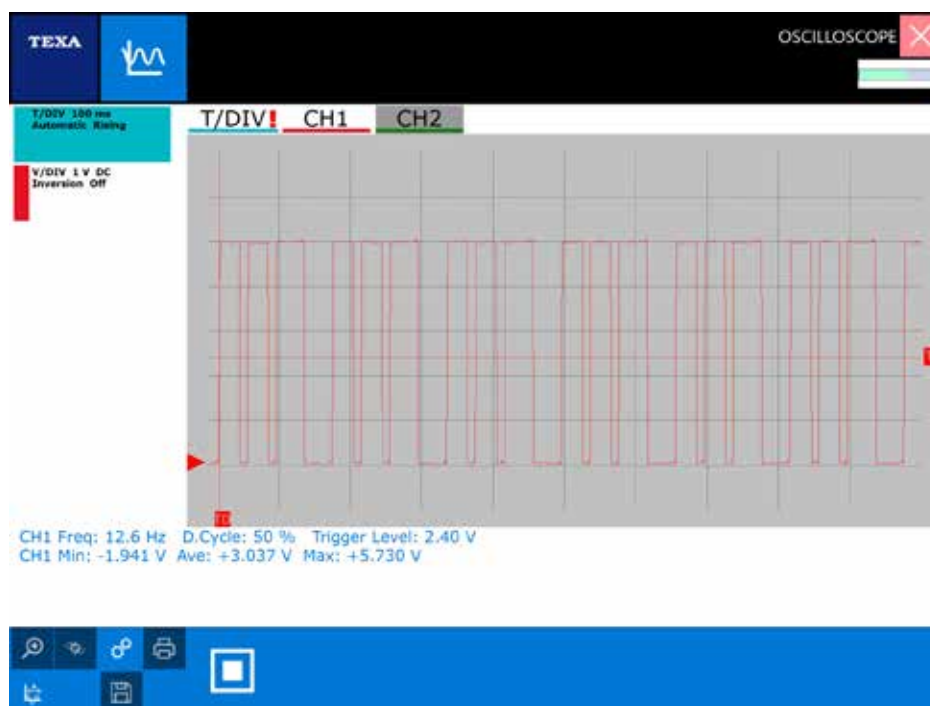
Figure 11: PWM Signal example

Another example may be an interruption on the signal of the throttle position sensor which create a malfunction on the output engine's power management from the ECU.

The ECU uses a fine control of the voltage parameter of the throttle valve potentiometer for operation, while Self-diagnosis and parameter display, checks the signal in a certain range of time.

Also for the evaluation of an efficient air mass flow we recommend the use of the oscilloscope, which allows a dynamic measurement of the engine running.
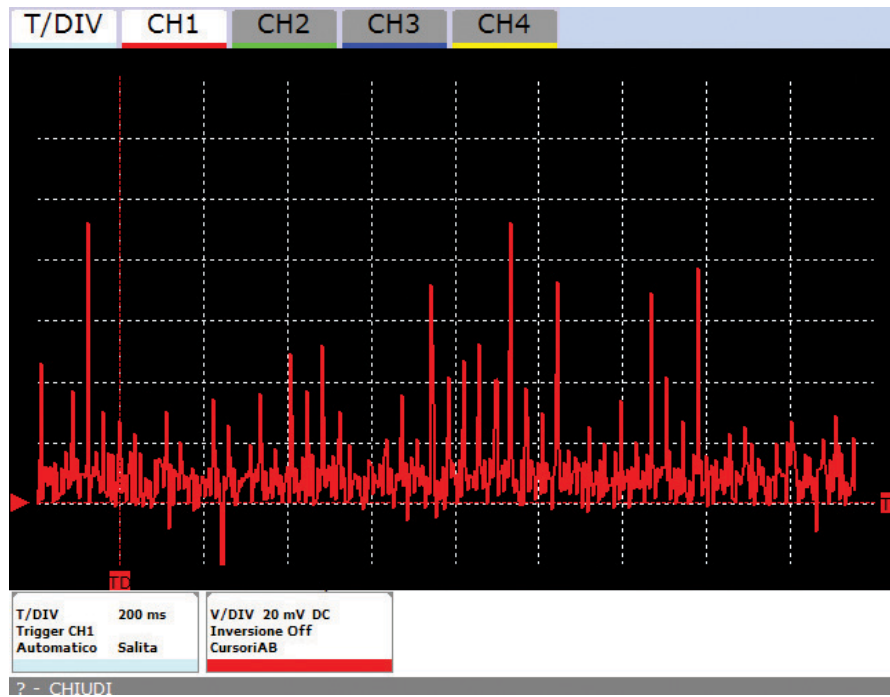
Figure 12: Example of a ground point analysis with electrical disturbances due to a bad connection

The Training: DIAGNOSIS TECHNICS USING THE OSCILLOSCOPE helps to develop TWINProbe & UNIProbe scopes skills capabilities, analog and digital signal reading modes, oscillogram reading for electrical troubleshooting and resolution.

1.9 The devices calibration using the Self-Diagnosis tool

The Diagnostic Tool is increasingly used to perform all the adjustment and calibration operations required to restore the system after an ordinary or extraordinary maintenance on the vehicle.
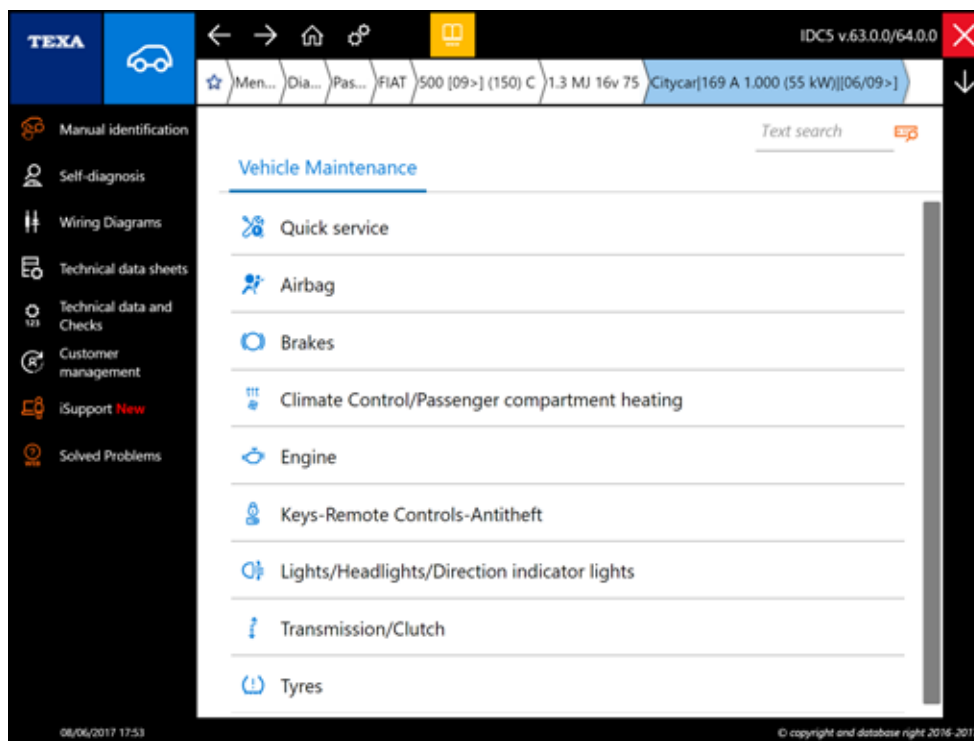
Figure 13: List of features for vehicle maintenance.

For example, the technician, using specific instrument features, can configure an airbag or air conditioning control unit, encode the remote control for the doors or program the immobilizer transponder for the engine, etc...
It can also perform any initialization in case when an electronic component is replaced or disassembled and repaired and then reinstalled, such as the EGR valve, a throttle valve potentiometer or an electronic steering gear for which the control unit must learn their specific positions, without forgetting the functions of clearing the lights and messages after replacing, for example, engine oil during maintenance work.

> **D3.4C** The courses on DIAGNOSIS, RESET AND CONFIGURATION TECHNIQUES allow you to know the most common diagnostic procedures, reset and configuration to be performed with the self-diagnosis tool after performing maintenance or repair of an electrical or mechanical component on the vehicle.

1.10 Diagnosis procedures and fault finding

As already mentioned, the self-diagnosis function performed by a vehicle's control unit does not always allow to accurately locate the source of the failure that has caused the vehicle malfunction.

If the control unit indicates a DTC related to a passive sensor "Cicuit open or circuit shorted to battery", it can not discriminate if the problem is the sensor itself, if there are interruptions on the wiring, oxidation in the pins or interruptions within the ECU.

In order not to fall into a false diagnosis it is best to follow a precise procedure to find out the correct nature of the failure:

1. Check the stored DTCs;
2. Create a logical group of parameters associated with the detected errors;
3. If necessary, check the actuator control by means of the "active diagnosis" function (in this way we check both the component operation and the goodness of the circuit connected to it);
4. Analysis of the electrical diagram to highlight the connections between different components, powers and masses;
5. The possible use of the oscilloscope to verify the congruity of the electrical signal generated by the sensor and also the circuit associated with it;
6. Verification of the continuity of electrical wiring.

2. TEXA SELF-DIAGNOSIS

TEXA self-diagnosis is composed with two devices:
- The display tool;
- The remote connection device (interface).

The first is where the diagnostic software is installed and where the user can view the information, while the second is the device that is physically connected to the vehicle to be diagnosed.
The two devices are connected to each other via a Bluetooth® wireless connection or via a common USB cable.
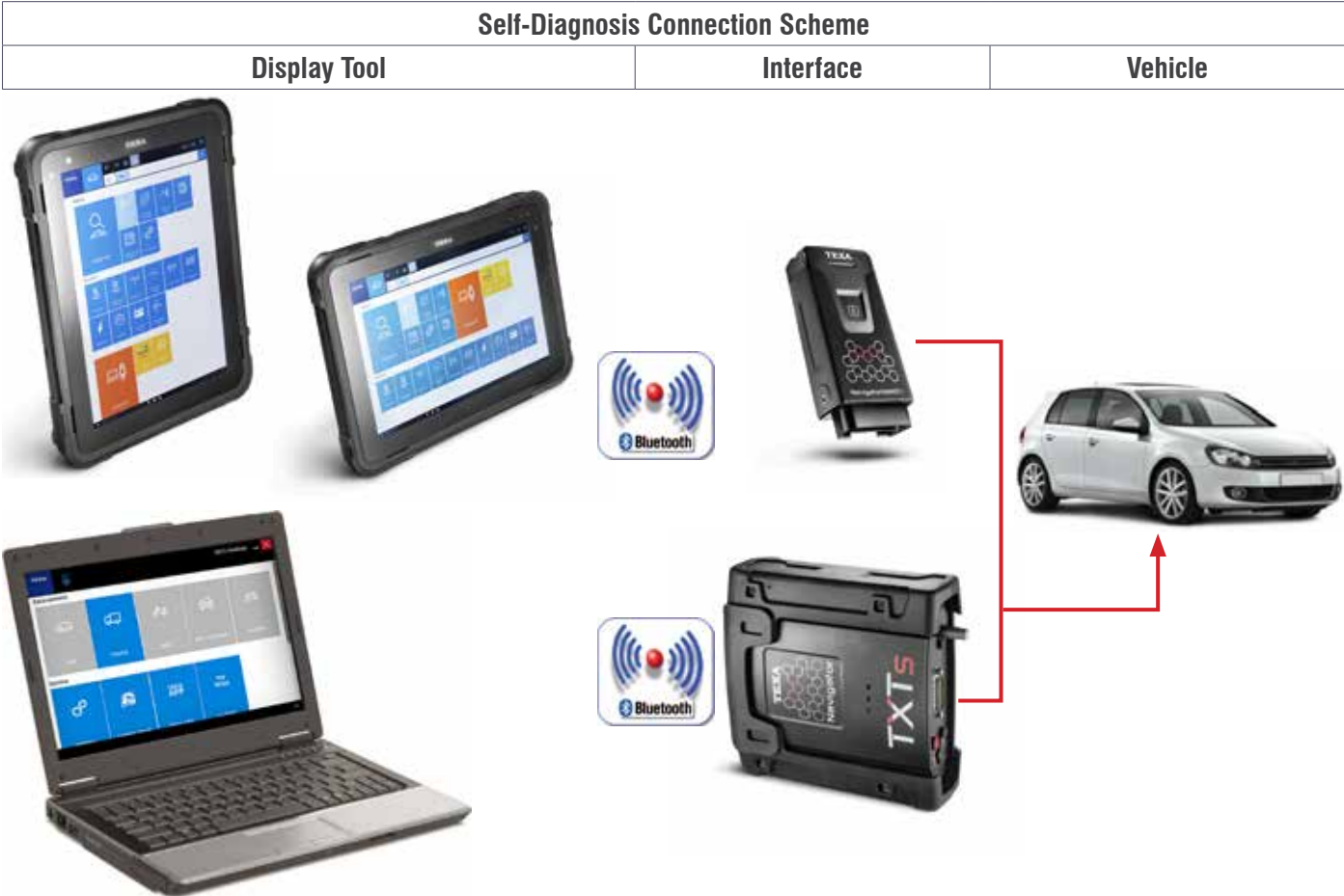
Self-Diagnosis Connection Scheme		
Display Tool	**Interface**	**Vehicle**

Figure 14

2.1 AXONE Nemo

The new AXONE Nemo Diagnostic Device is the TEXA home flagship among the diagnostic tools.

To realize AXONE Nemo, we started from our great experience as a trusted partner of tens of thousands of mechanical workshops, and we imagined what will be the evolution of their work over the next five years.

From this philosophy is born the first diagnostic device in the world "SMART", which is able to assure the technician a total flexibility to use thanks to its interchangeable modules, capable of rendering it suitable for multiple uses and situations.

Made according to military standards, it resists violent falls and is designed to cope with all the disadvantages of heavy work. Unique to the world, it has the extraordinary peculiarity to be not only waterproof but also floating: a patented international innovation by TEXA.

Other features include:
- ✓ ISO TS 16949 certification, the standard required for first-class automotive suppliers.
- ✓ Magnesium shell for ruggedness, rigidity and lightness.
- ✓ 12 inch ultra wide screen, robust thanks to Gorilla Glass specifications.
- ✓ Can be displayed in either vertical or horizontal mode.
- ✓ Magnetic hooks for additional modules capable of extending the potential and resources to keep it ready for the needs of checking and checking any car, even in the future.
- ✓ Conforms to military standards.
- ✓ Resolution of 216x1440 pixels.
- ✓ Quad Core Processor.
- ✓ Wi-Fi communication systems and Bluetooth® 4.0 Low Energy.

Figure 15

2.2 Personal Computer

For the maximum reliability and versatility, you can install self-diagnosis software on a very common PC with Windows ™ operating system.

Figure 16

The advantage of the PC solution is that it can integrate TEXA self-diagnosis software into your personal network of applications and access the new IT technologies by unlocking the software from the hardware.

2.3 Navigator TXTs

TXTs is the complete self-diagnosis interface that allows you to interact on all types of vehicles (cars, motorcycles, commercial vehicles, industrial vehicles, agricultural vehicles and marine propulsion engines).
Connects to all TEXA display interfaces with Bluetooth® technology and any commercial PC with TEXA operating software

Figure 17

With Bluetooth® wireless technology, you can work freely around the vehicle or comfortably seated inside.
With Navigator TXTs it is possible to perform multi-brand diagnosis of cars, motorcycles, commercial and industrial vehicles, buses, trailers, tractors, "Harvesting Equipments", etc.

2.4 Navigator NANO S

Navigator NANO S is the ultimate generation TEXA vehicle interface that allows you to perform all diagnostic tasks on cars, light commercial vehicles, motorcycles, scooters, quads and watercraft.
A small, lightweight, ergonomic interface designed to work smoothly and automatically with the next-generation TEXA display interfaces such as AXONE Nemo and AXONE 4 Mini.

Figure 18

3. IDC5 INFO DATA CENTER 5

> ⚠️ **The information below is available in the self-diagnosed software at the time of publication of this manual and may therefore not be up-to-date.**
> **TEXA reserves the right to make any corrections and changes it deems necessary during the development of its software.**

IDC5 (Info Data Center 5) is the new evolution of the TEXA Diagnostics Program, constantly updated and developed, integrating not only diagnosis and self-diagnosis capabilities, but the entire schema database and support documentation that the modern workshops and technicians needs.

Figure 19

3.1 IDC5 Self-Diagnosis software

TEXA IDC5 is the operating environment that combines the capabilities of the individual tools to a media support perfectly integrated in the diagnostic software.
In fact, IDC5 provides technical data and detailed information at the same time as it is needed and is constantly updated via Internet.
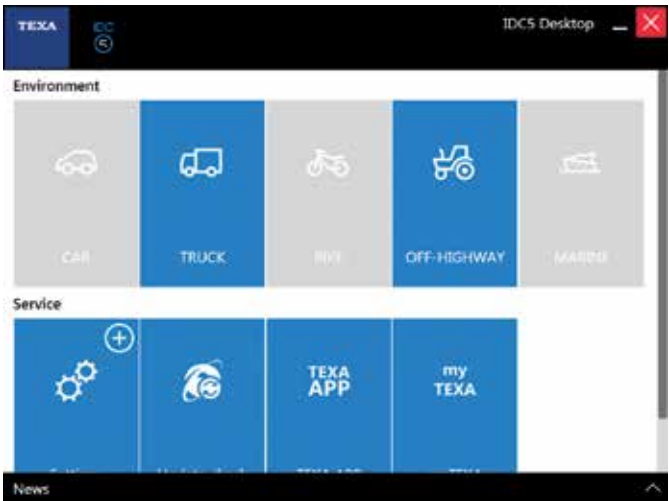
Figure 20: IDC5 Desktop

The self-diagnosis features have been structured and subdivided to facilitate the reading and handling of car maintenance operations under examination. The information provided by the self-diagnosis is divided into six different working environments:

Errors Page	Parameters Page	Status Page
Info ECU Page	Activations Page	Settings Page

Figure 21

3.2 Vehicle selection

This function allows you to select the vehicle on which you want to operate and access the diagnostic functions.

The Selection is made by choosing from the suggested items in the drop-down menus of the fields:

- Category;
- Brand;
- Model;
- Engine Code;
- Vehicle Code.

These fields are the selection levels.

In order to switch from one selection level to the next, you must have completed the selection level you are in.

The selection is complete when an item has been selected for each of the proposed field. When the selection is complete, the software has a specific menu for the selected vehicle. This menu provides evidence that you can run on the vehicle. The Vehicle Selection screen is the first time the software is displayed at startup.

Alternatively, you can start it from the Home screen.

Proceed as follows

1. Press
2. Select the category
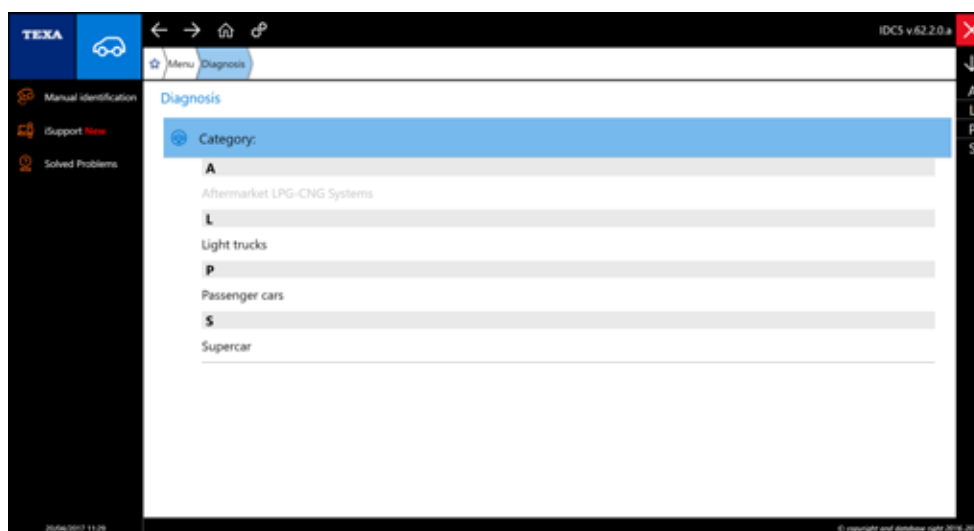
Figure 22: Category Selection

3. Select the Manufacturer

Brands, models and engines are arranged in alphanumeric order;
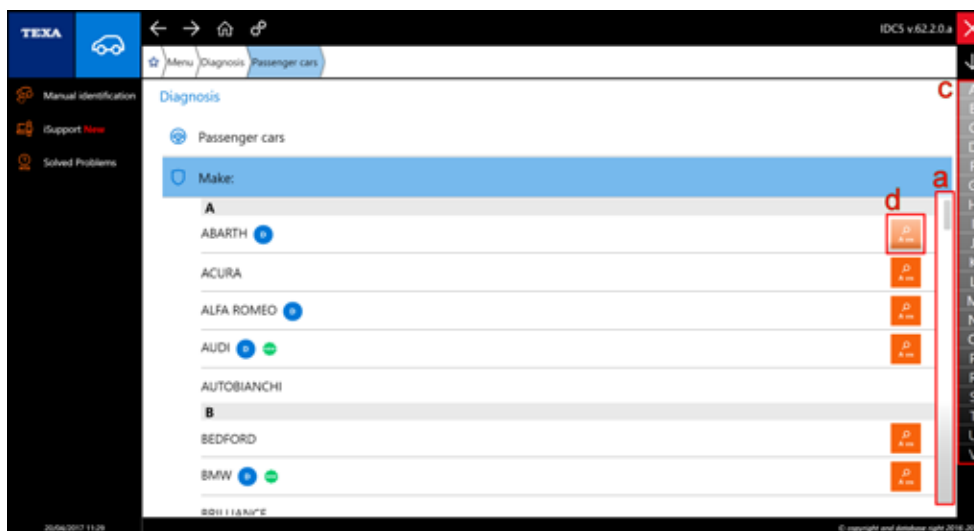

Figure 23: Manufacturer Selection

To quickly access items in a selection level, you can:

    a)Use the vertical scrollbar;

    b)   Push directly on your keyboard the letter corresponding to the beginning of the desired brand / model / engine;

    c)   Press on the letter corresponding to the beginning of the desired brand / model / motor on the list on the right side of the screen;

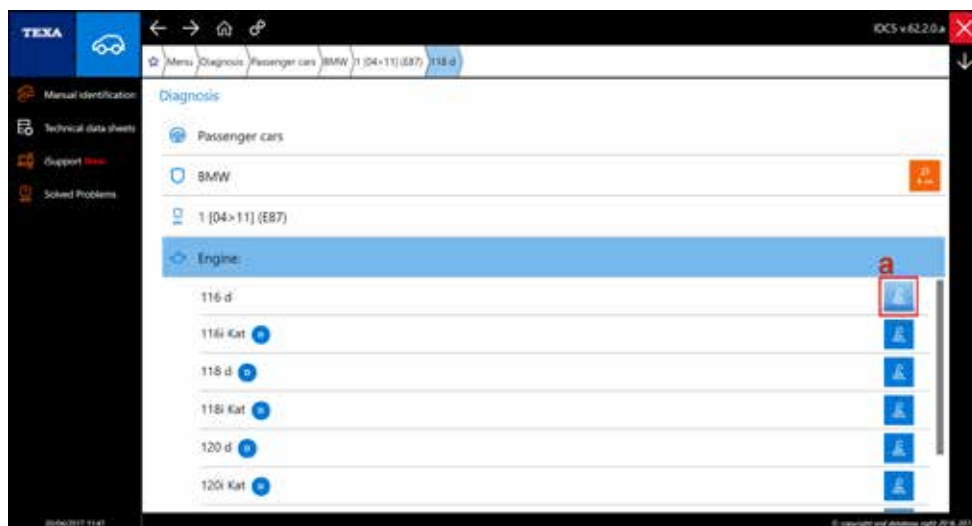   d)   From the Brand selection level, you can also start Scan VIN 2.0.

4.Select the Model

Figure 24: Engine Code Selection

5.Select the Engine Code:

    a)In the engine code list, the TG3s function launcher is on the right.

6. Select the Vehicle Code:
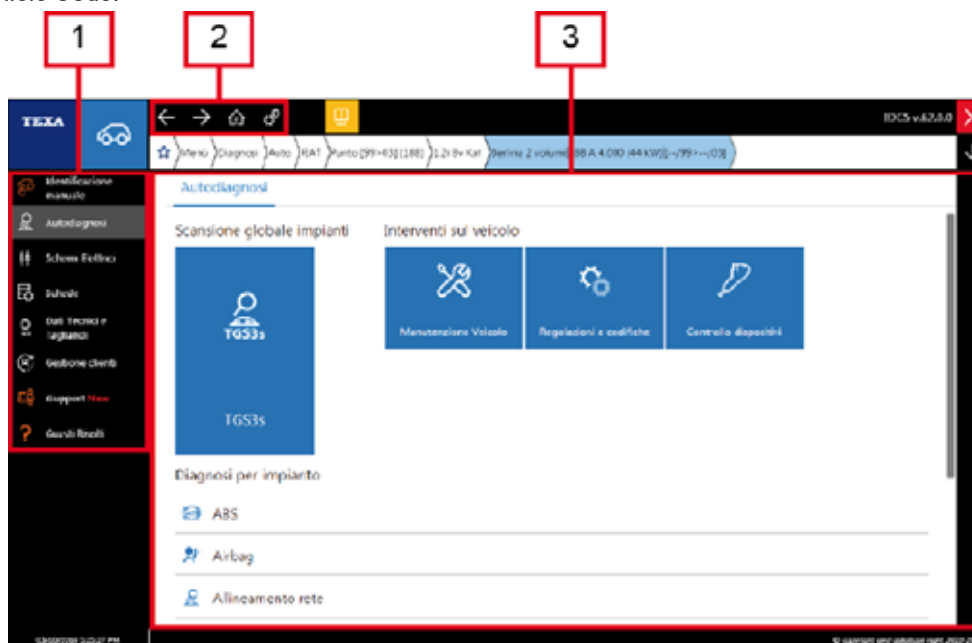
Figure 25: Vehicle Selected Menu

The screen of the selected vehicle is divided into three sections:

    1. Side Menu;

    2. Summary Bar;

    3. Diagnosis Preparation.

> ℹ *The functions on this screen depend on the selection made.*

3.2.1 Manual Vehicle Identification

It is a task of the use to properly identify the model and system version that we want to diagnose, starting from the vehicle documentation (circulation card, user manual, and driving instructions ...).

Vehicles that are to be diagnosed are often known, but sometimes "uncommon" means that they are often "seen for the first time". For this reason, TEXA has increased its vehicle search capabilities by means of a special function called Manual Identification.
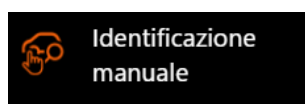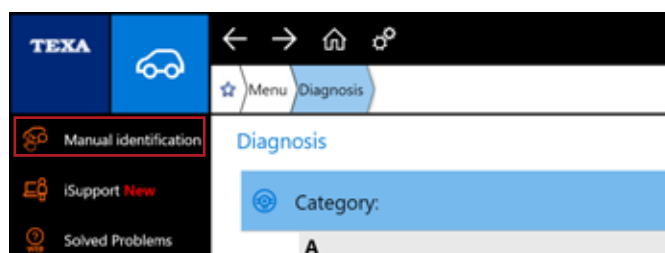

Figure 26

Figure 27: Vehicle Manual Identification

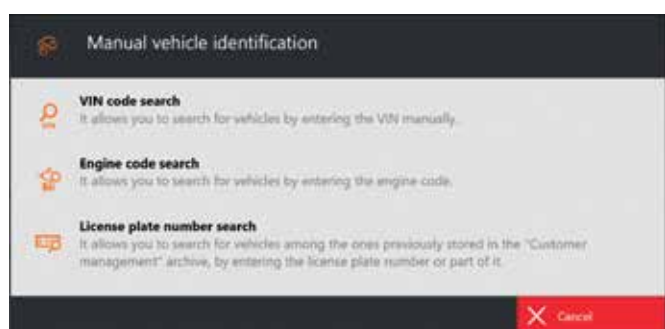The function allows for a search based on 3 different variables:
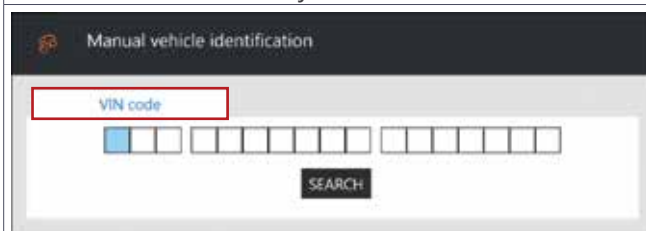

Figure 28

1. Insert the chassis number manually and proceed to identify the vehicle
2. Select by inserting the motor code on the traffic book
3. Registration Number Vehicle "Vehicle Search", on the other hand, allows you to search only for the specific vehicle if it has been already registered in your customer management database
ℹ *The "Search" by engine code allows to find the all vehicles which are equipped by the same engine.*

Table 1

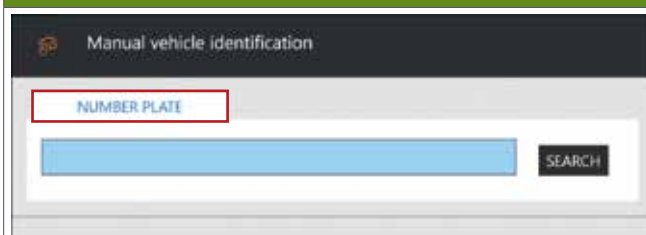### 3.2.2 Automatic Vehicle Identification

In order to make easier the correct selection of the vehicle from the "Brand" selection level of IDC5, you can start the SCAN VIN 2.0 function that automatically retrieves the VIN stored in the control units.

When using this feature, always make sure that the instrument panel is switched ON

Figure 29

3.3 The TGS &TGS3 functions

The TGS3 (Total Global Scan 3) function is the third evolution of the well-established TEXA system scanning capabilities and allows you to get a list of systems on the vehicle, select the systems you want and, by scanning, get the status (presence Errors, etc.) of the control unit.

The TGS3s function, on the other hand, allows the scanning of all electronic (supported by IDC5) of the vehicle's ECU with the ability to instantly see all the DTCs present and their descriptions and, above all, erase the errors with one action.
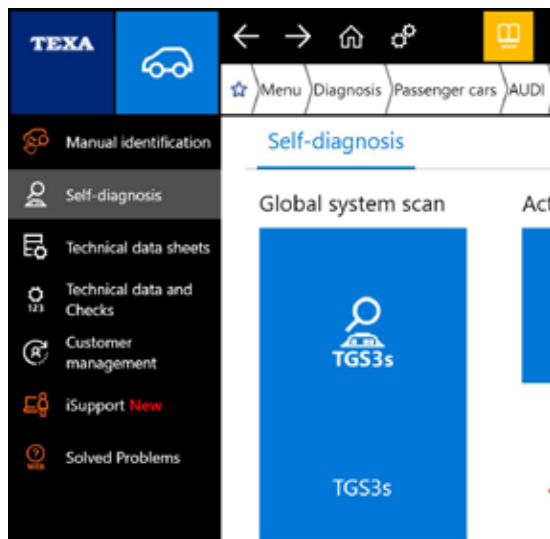

Figure 30

After you done the vehicle selection which needs to be checked, it is possible to access and perform the TGS3 function.

After a few seconds (the time is determined by the amount of control units present) you can see a report that shows a list of the systems present, the control units with one or more DTCs, the code and description of the DTCs found for each individual control unit.

At the end of the operation, the user can also print out the scan report to be delivered to the customer with all detected DTCs.
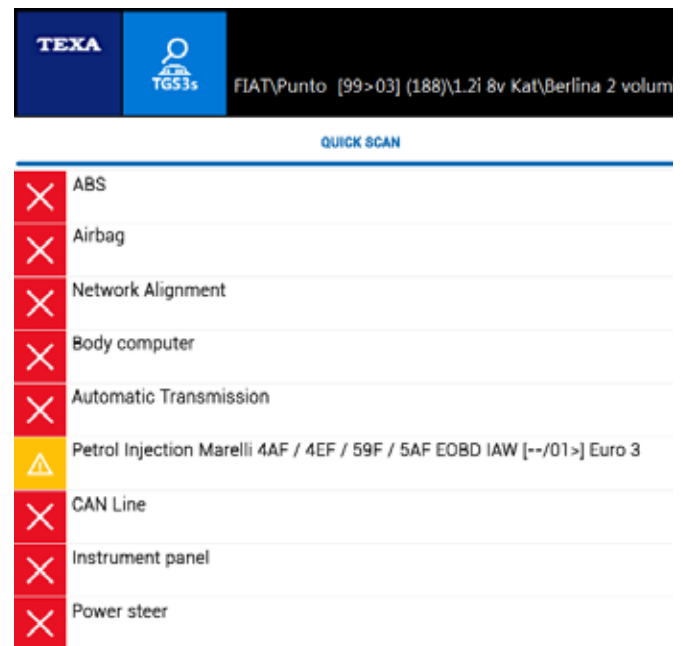

Figure 31

Through the "Faults Page" you can see the complete list of DTCs stored in each control unit. From this page, you can also perform a global erasure of the all DTCs stored.
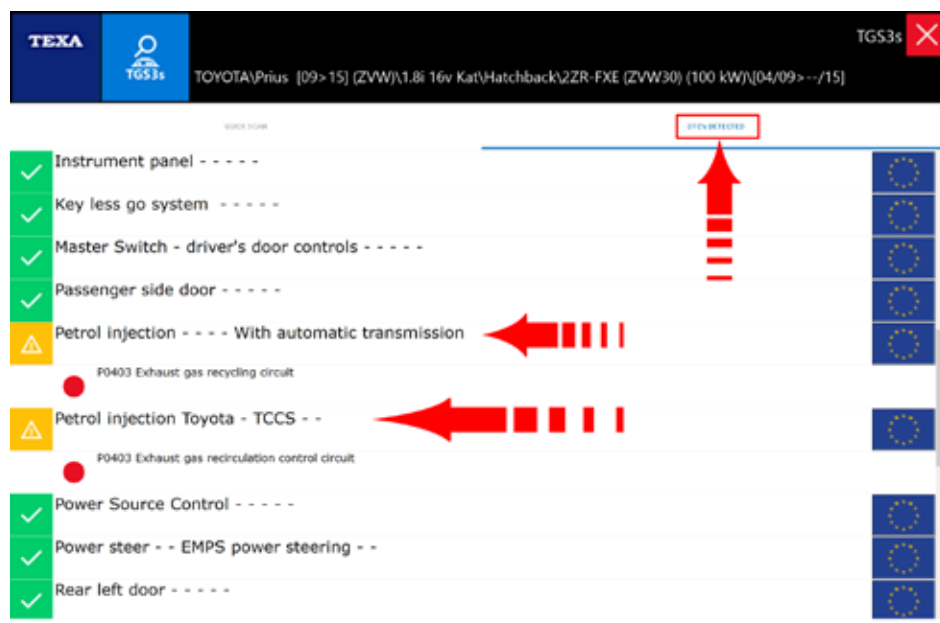

Figure 32

3.4 ⚠ Faults Page

Each diagnosis should begin with the acquisition and identification of errors stored in the electronic control unit of the vehicle.

> ℹ *In IDC5 the flashing "Tab" is informing the user that the ECU has one or more DTCs stored..*
>
> **FAULTS**
>
> Figure 33

The DTCs displayed by the self-diagnosis can be divided into 3 types:

- ⚠ **ATT (Active)**: This type of DTC it is currently present into the system, detected and saved by the ECU;
- ⚠ **MEM (Stored)**: The DTC has been detected by the ECU but currently it is not present, however the DTC is still stored in the ECU DTCs memory;
- ⚠ **STO (Historic)**: The DTC is not currently present in the ECU DTCs memory, it is stored by the Diagnostic Tool. (This kind of DTCs will be automatically erased at the end of the Diagnosis Process).

> ℹ *Stored DTCs*
>
> *While active or historical errors do not require additional explanation, a special note should be done for the stored failures.*
>
> *In fact, an error can assume the stored state for 3 distinct reasons:*
>
> 1. *It is a failure that occurred long ago, so the failure was repaired, but the ECU memory was not deleted. The system keeps the error stored only as a past reference.*
> 2. *Some types of errors can not be canceled for legal reasons (eg issue regarding the emission of pollutants from Euro4 or higher vehicles). If the failure has been solved, this error may remain in the memory to make law enforcement control of the "historian" possible. Cancellation in this case only comes after a series of trips (from 1 to 3 trips) where the control unit recognizes the failure of the failure.*
> 3. *The vehicle has a failure, but this only occurs in special conditions of use. In this case the error switches to the active state (ATT) only when the*

> *conditions are met, for example only when the vehicle is in motion and the engine is hot.*
>
> *It is easy to understand that the 3rd case is the most interesting one for the technicians.*
> *In fact, there is a whole series of failures that can occur only in particular conditions of use of the vehicle.*
> *An example of an ABS and / or EBS braking system can be made with regard to speed sensors on wheels, but not when the problem is related to the sensor itself (coil or magnet problem), or to its electrical wiring (Short circuit or interruption of the cable), but when the problem is due to the gear wheel or the "air gap" (distance of the sensor from the wheel).*
> *In fact, the vehicle fault condition (workshop condition) will always be in the stored state (MEM), as the control unit can check the signal quality of the sensor wheels only when the wheels are moving beyond a certain Speed threshold.*
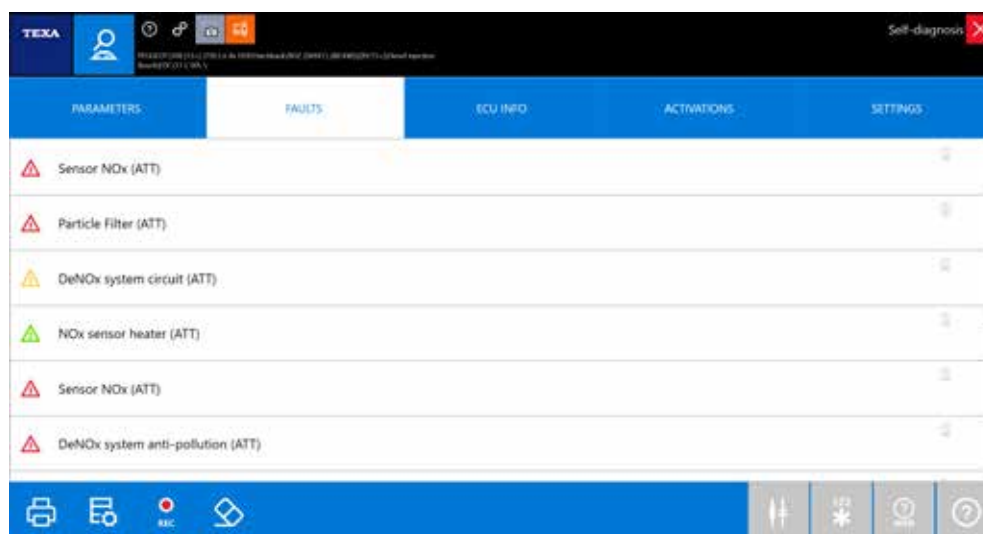
Figure 34: Fault Page

> ℹ️ *The meanings of the above abbreviations must be considered only as a general rule; In fact, there may be exceptions. For example, in some electronic systems, DTCs storage is not classified between the ATT and MEM status.*

By selecting a specific error, you can get information about the displayed error.
Clicking twice on the error will give you more detailed information about the recorded error.
Erasing errors is done by clicking on the "FAULT CANCEL" icon.

> ℹ️ *It may happen that although it has been erased, a fault does not disappear from the memory of the control unit. In this case, in addition to checking the correct selection of the vehicle, it may be necessary to run a road-driving cycle so that the error disappears.*
> *This is the case with the P1000 error that often appears on Ford cars.*
> *"P1000 Incomplete Diagnostic Board System (OBD) Predisposition"*
> *See also EOBD Error technical sheet on Renault.*

3.4.1 DTC Detail and Code

By double-clicking on the description of a DTC, you will see a detail of the fault itself. The level of detail depends on the programming of the electronic control unit and may include an error specification and the manufacturer's original error code.
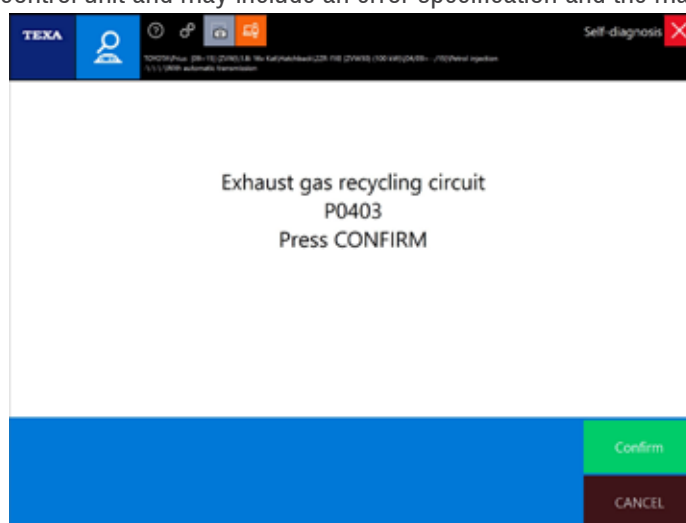

Figure 35

3.4.2 Fault Page, further Information

The triangle as icon next to the description of the DTC indicates the state of the error itself, while the availability of additional information may be inferred from the presence of some symbols to the right of the error that enable their command buttons (Figure 36).
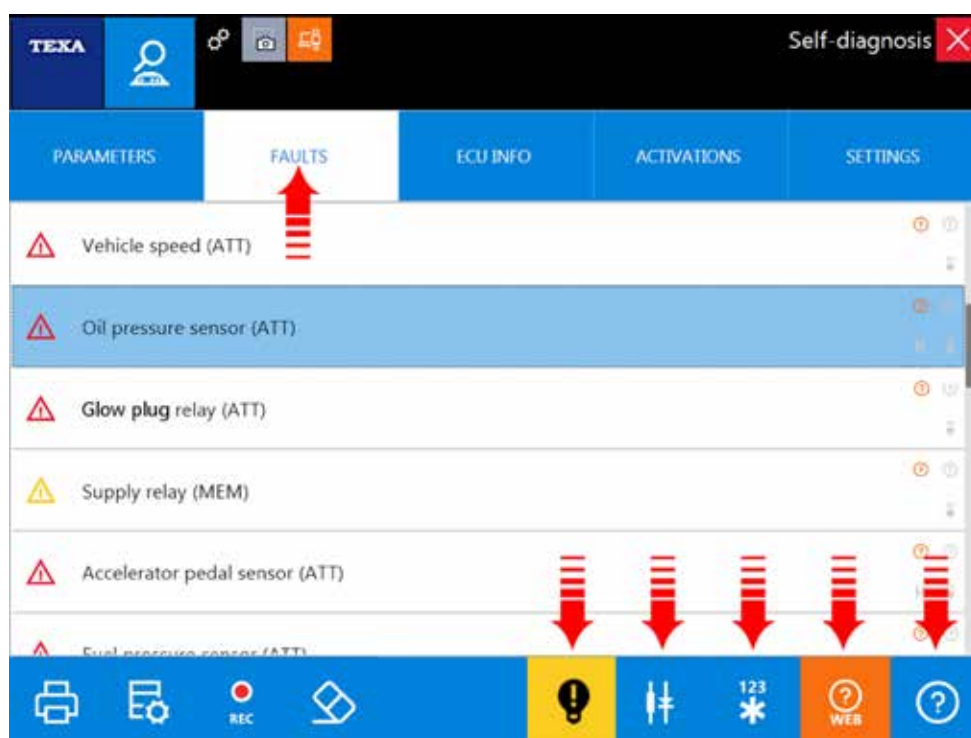

Figure 36

ICON	NAME	DESCRIPTION
	Help DTC	Spiegazione dell'errore con possibilità di trovare un troubleshooting.
	Freeze Frame	Operation Parameters saved when the fault occurred.
	Component Location	Component location on Schematics
	Fault Solved Database	Fault Finding through the TEXA workshops customers database.

Table 2

3.4.3 DTCs Help

Each fault message, when possible, is accompanied by a "Help" error that includes a series of information and explanations of the DTC itself. When available, by selecting the error, the button is enabled.

The help content can give us a series of useful information to better understand the meaning of the error message and, possibly, a first set of checks to be performed.

3.4.5 Component Location on TEXA Schematics

Many DTCs that can be found in the control unit are related to specific components (fault pressure sensor, temperature probe shut off, solenoid valve or short-acting actuator, etc.).

When you already know the vehicle or system to be diagnosed, the location and type of connection of the failed component are already known. But in many other cases, it is useful to know what "is talking" and where it is.

In fact, manufacturers often use different denominations to identify the same component (eg the block of engines that handle the air passage in the air conditioning system can be called the "Flap Motor" or "Stepper motor" depending on the manufacturer of the vehicle).

Therefore, for those installations where an electrical diagram is available and for those errors associated with a specific component, the "Component Location" button will display the associated device on the circuit diagram.
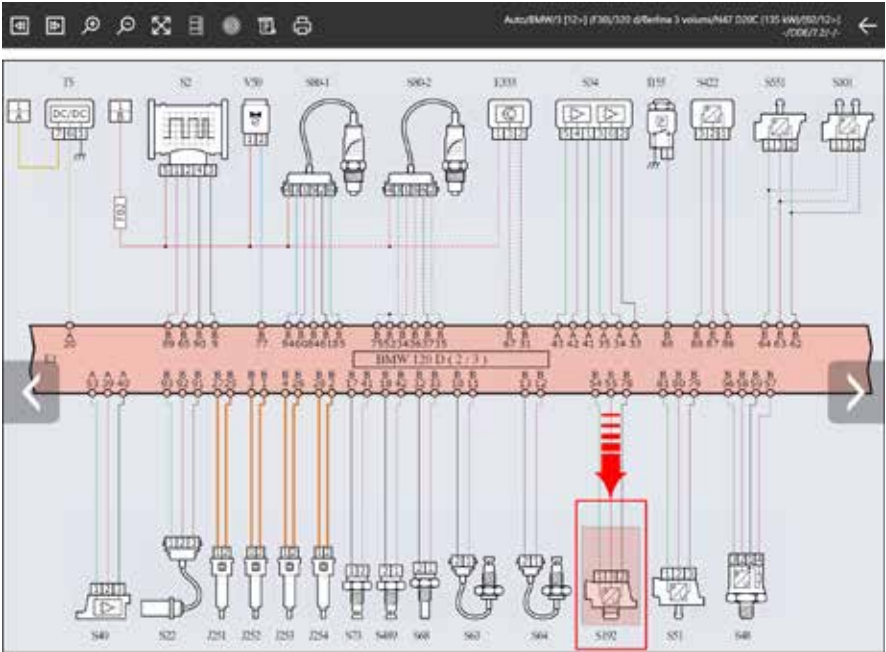

Figure 37

3.5 Parameters Page

Another important feature of the self-diagnosis is to display the system parameters, such as sensors and actuators, ensuring that the car-repairer understands whether the test component is working properly.

The TEXA diagnosis allows you to read the parameters through the dedicated function.

The displayed parameters are proposed almost in real time with a delay due to the speed of the serial line and the calculation power of the control unit.

We always remind you that the control units have the priority to be the system manage and, just as secondary activity communicating these information to the diagnostic tool.

The parameters reading depends on the type of electronic control unit being tested; Older power supplies have a longer data upgrade delay.

The user can activate or deactivate the initial parameters by selecting the most interesting ones for the diagnosis that is being performed up to a maximum of 8 at the same time. It is recommended to verify that the update of the various parameters corresponds to the actual change in the working condition of the observed device.
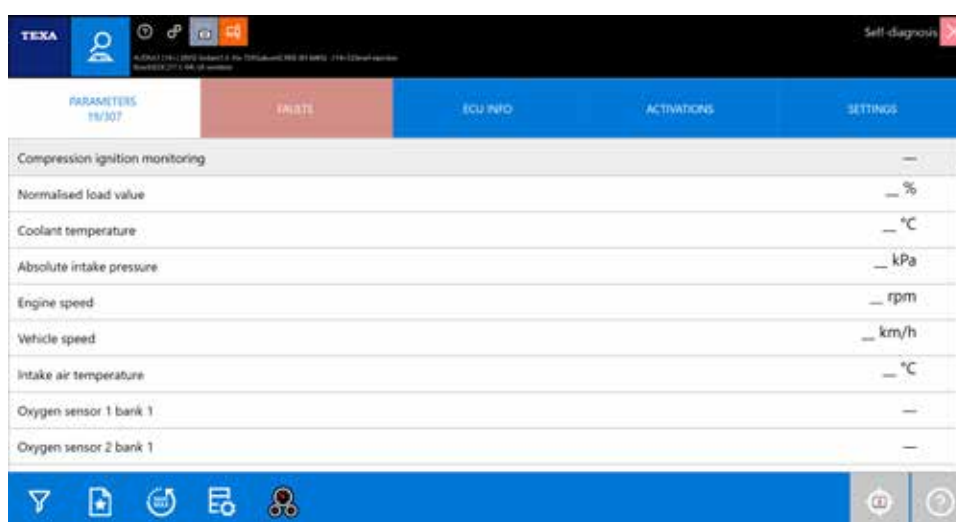

Figure 38: Values are stuck because of missing communication with the ECU

3.5.1 Logical Group, Parameters

Creating a logic parameter group means displaying a number of parameters through the diagnostic tool which helps to make sure about the goodness operation of a system.
For the logical group to have meaning:
- The operator must know the system he wants to check;
- The All parameters selected must be relating to the component or part of the system to be controlled;
- You must not select too many parameters at the same time to not slow down the refresh of the selected data (Refresh); these should not be too many (the ideal number is 4 at a time).

3.5.2 ⬛ Favourite Group

This function allows you to view and manage the favorite parameter groups created through the Parameters function. Favorites are organized on pages such as diagnosis functions.
Each new favorite group will be displayed with a new page, which can be selected simply by pressing the relevant label.
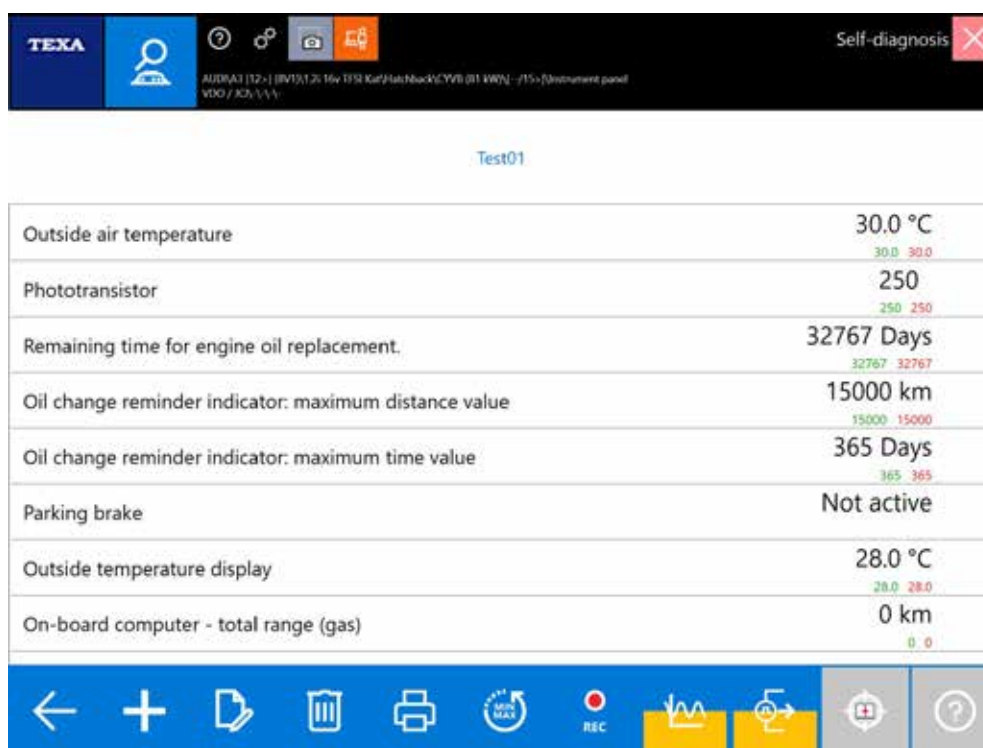Proceed as follows:

Press ⬛

Figure 39:

ICON	NAME	DESCRIPTION
	Create a Group	Allows to create a new Favourite Parameters Group
	Edit a Group	Allows you to edit the Favorite Parameters Group by adding or deleting some of them
	Delete a Group	Allows to delete a Favourite Parameters Group
	Printing	Allows to print a report where the parameters value are saved
	Reset Min Max	Allows to reset the max and min values of the displayed parameters
	Recording	Allows to record the parameters value of the selected favourite ones. The Record is saved in the Customer Management Database.
	On the raod test/ Dinamic Test	Allows to configure the Self- Diagnosis Tool for the recording function of the parameters and the DTCs detected by the ECUs with vehicle on the road.
	Vehicle Sheet	Allows to access to the Technical Sheets related to the most difficult components of the vehicle (i.e. Common Rail Injectors, Digital Air Mass meter, ecc).
	Information	Allows to see an Help screen related to the selected parameter

Table 3

1) Group creation
   Proceed as follows

a) Press [+]

b) Select the desired parameters
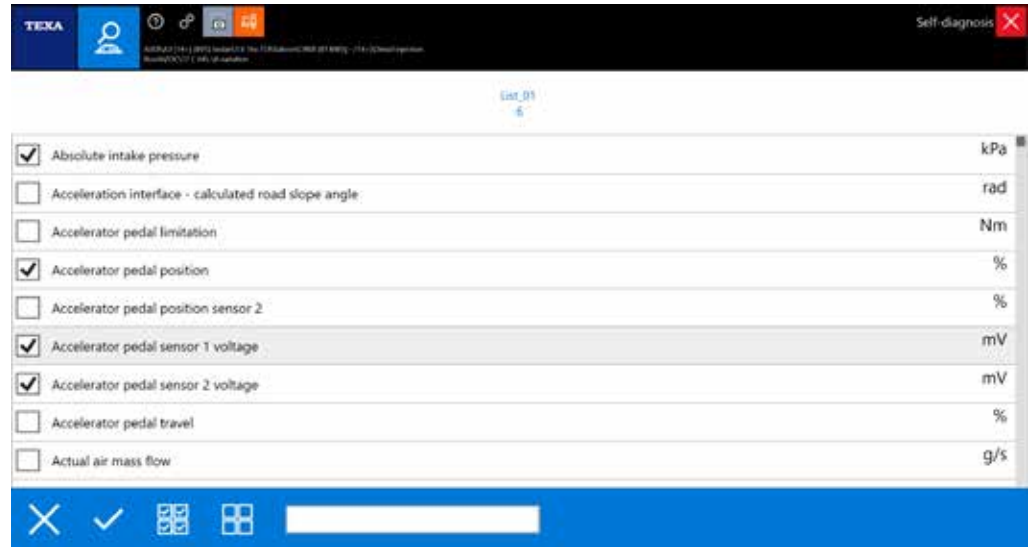
Figure 40

c) Please write the name of the group in the specific space
d) Press [v] the Group is done

3.5.3 Graphic Display

When the parameter page is displayed, the default software proposes the display of the instantaneous value.
Sometimes it may be practical to have the ability to visualize the values in graphical form according to time, that is to see the trend. This mode can be activated simply by double-clicking on the parameter you want to display graphically.

Figure 41: Graphic Parameter Display

The convenience of this graphic display is to be able to be monitoring not only the numeric value, but the behavior of multiple values over a certain period of time.
The image in Figure 41 shows some parameters related to air suction. It can be noticed that as the increase in the number of turns increases the mass of aspirated air.

3.5.4 Actual value and Minimum and Maximum

There are three values for each item on the parameter page. The big one is the instantaneous value of the parameter, while the two smaller numbers are the maximum and minimum values reached during the self-diagnosis session (a kind of reminder of the maximum and minus values reached by the parameter during the diagnosis).

Legend:
A. Current Value
B. Minimum value
C. Maximum value
D. Reset MIN / MAX values
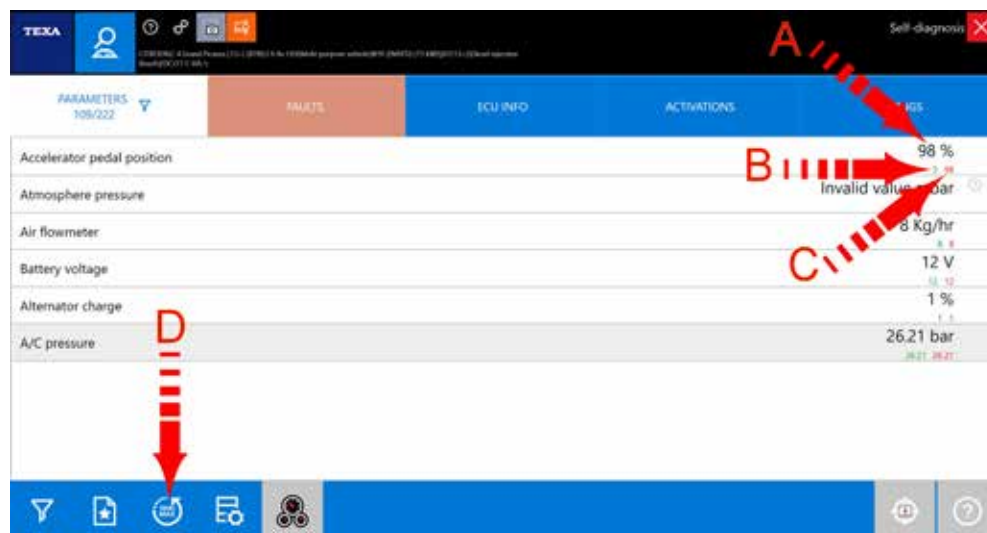
Figure 42

In Figure 44, the accelerator pedal value is currently 98% (A), but in the self-diagnosis session the Turbocharger also recorded a minimum of 3% and a maximum of 98% (B and C).
You can reset maximum and minimum values at any time using the " 🔄 " (D) button.

3.5.5 Logical and Physical Values

Many electronic control units allow the display of a parameter in its two possible shapes:
  • Physical value (rough value);
  • Logical value (decoded value).

The first is the display of the signal value, analyzed in relation to its electrical components: voltage
(Volt), frequency (Hertz), resistance (Ohm), etc ...
The second is the interpretation of the information content of the signal processed by the control unit: pressure expressed in bar, in ° C, sec, etc

Figure 43: Example of Accelerator pedal position parameter seen in the two modes

3.5.6 Parameter Value Update Speed

The update speed of a parameter depends on two fundamental factors:
1) Communication speed of the electronic control unit;
2) The number of parameters displayed.

For the first case nothing can be done.
The communication speed depends only on the type of hardware used by the manufacturer of the electronic control unit (if the control unit is programmed to send the new value every 0.5 seconds for a particular parameter, the value will be updated every 0.5 sec.).
For the second case, however, you can try to reduce the number of selected parameters to get a quicker view.

3.5.7 DASHBOARD Parameter Display

In addition to displaying graphical parameters as shown above, there is a new exclusive feature called Dashboard that gives you the ability to view vehicle engine parameters associated with an intuitive and captivating graphics that reproduces a dashboard of a vehicle Industrial, mechanical components and the operating logic of the plant.
For activating this specific mode, please press on   .
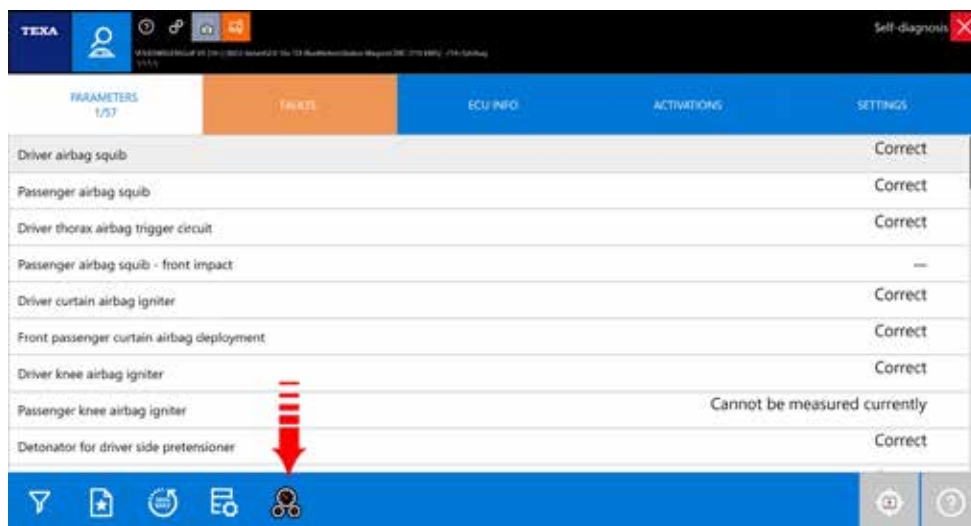

Figure 44: Dashboard mode ON button

The figure below shows the airbag system, indicating the main system parameters.
It is also possible to deduce from the image the position of the components involved in the operation.

Figure 45

3.6 Status Page

Normally, the information from the sensors is an ANALOG signal, such as the
cranckshaft sensor that provides information about the speed of the crankshaft to the electronic control unit, or as in the case of temperature sensors providing information to the electronic control unit Water temperature, air etc. Through a variable voltage continuously in a precise range of values.

Electronic control units also need other information that can be calculated according to the position of actuators, switches, relays, system configurations etc.

This information is precisely given by another type of sensors applied to the vehicle that provide the digital signal controller with information such as: OPEN / CLOSE; ON / OFF; ON OFF.

These types of information are "state" information in which the component is located. The TEXA diagnosis allows states to be read through a dedicated function: the STATUS page.
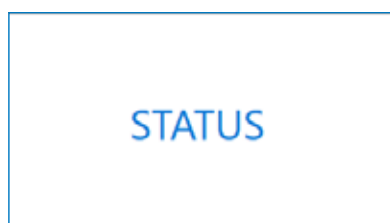

Figure 46

In addition to provide an easy and immediate check of some components such as the clutch switch rather than the trunk opening button, this feature allows access to sometimes essential information.

Sometime, some air bag systems in order to encode the new control unit, it is necessary to read on the relevant page of what components the system consists of, or think of the precious "camshaft / engine synchronization" information that can be read on some Cars (PSA Group and Mercedes for example), which in case the car does not go in motion tells us if the problem is to be found in the lack of synchronism between the turn signal and phase and therefore not attributed to other causes.
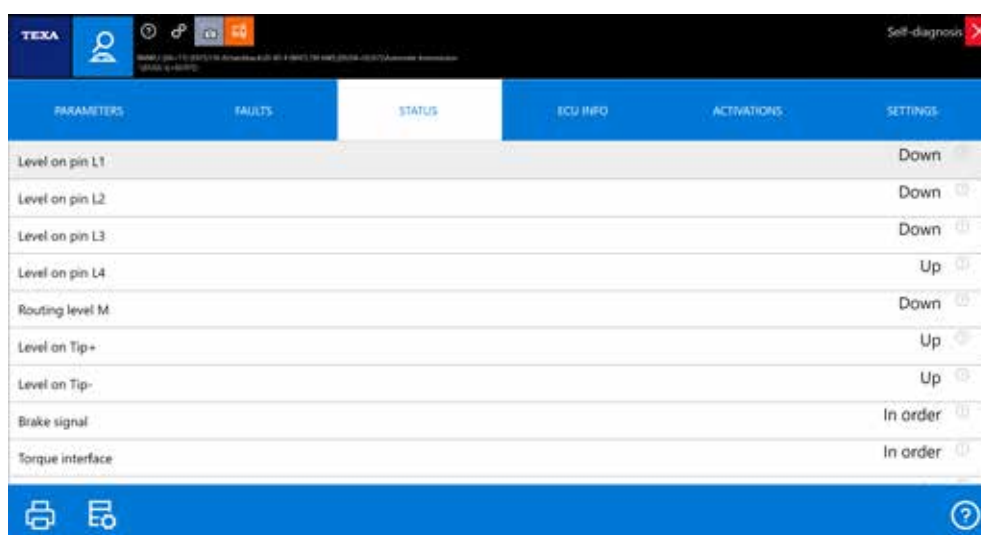
Figure 47: STATUS page of an Airbag ECU

> **i** With the "clutch switch" status it is possible to understand if the control unit receives the electrical signal of the component itself. By pressing and releasing the clutch pedal, the technician can detect the change from the PRESSED / NOT PRESSED condition by the diagnosis. This action will be interpreted by the control unit as the driver's intention to change gear and will accordingly apply the appropriate strategies such as, for example, the disengagement of the cruise control or fuel compensation.

3.7 Info ECU Page

With this function it is possible to identify what are the Manufacturer features of the tested control unit, both at the hardware level and at the software level.

Depending on the diagnostic system, you can get directions such as replacement code, date of production, and version of the software.

Figure 48

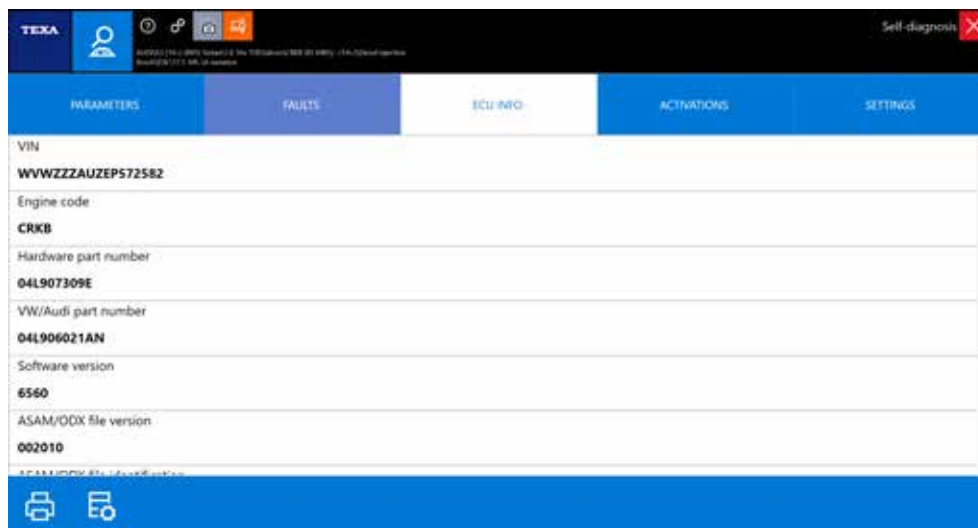In addition, this page contains useful information for programming or coding when replacing the old control unit with a new one.

3.8 Activations Page

The electronic control unit is a computer that, based on the information received from sensors and communication lines (Bus-CAN), monitors actuators by applying the operating strategy for plant management. These transactions are called ACTIVATIONS. ACTIVATIONS, in the self-diagnosis feature, give the possibility to control the various actuators connected to the specific electronic control unit directly from the diagnostic tools.

This type of test is performed by the controller itself based on a command given by the diagnostic tool.

So the component activation overcomes the normal running logic of the control unit.

From the activation page you can directly actuate spies, solenoid valves, injectors, etc ...

This function should be used primarily to test the operation of components whose control would otherwise result in a loss of time.

It can also be used to understand the many equal components the diagnosis refers to.

For example, if I have two solenoid valves that are the same, such as the EGR command and turbine geometry, and I do not know which of the two EGR commands, I can activate the component I'm interested in by detecting which one of them is activated.

In some cases, activations do not only have diagnostic capabilities but are required to perform maintenance procedures.

As is the case for example in some engine systems where it is possible to change the injection or ignition time or allow the brakes to bleed in some ABS systems.
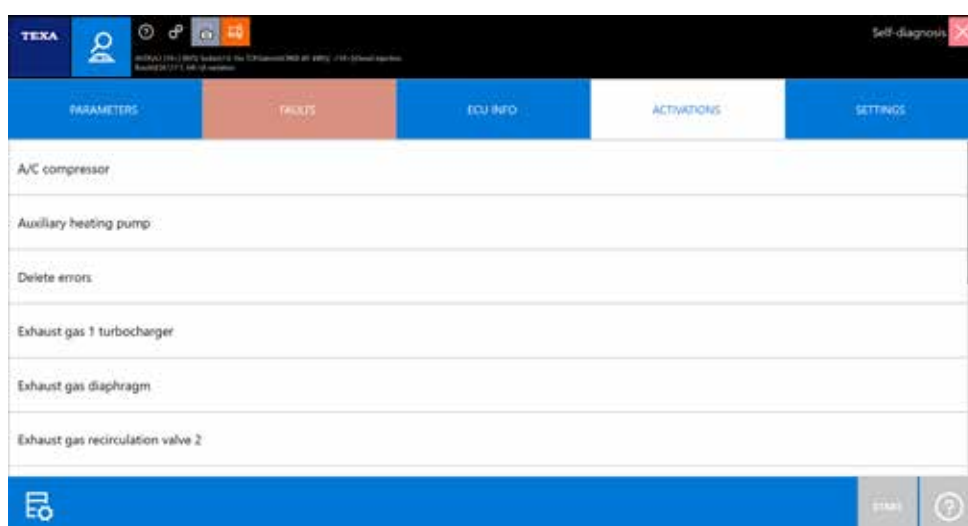

Figure 49

- The ACTIVATIONS function has differences that depend on the manufacturers, the model, and the electronic system.
- The amount of devices to be activated and the test execution mode depend strictly on how the controller software is designed and not by the capabilities of the diagnostic tool (see, for example, the difference between the Volkswagen group and other manufacturers).
- Some control units enable activation tests with the moving vehicle. This possibility of diagnosis could be very dangerous when it comes to diagnosing safety systems such as ABS or AIR BAG. In fact, the direct activation of a security system actuator will force the electronic control unit, causing improper behavior of the vehicle.
- Activating some components (such as ABS solenoid valves) may not have a pre-set activation time; In this case it will be up to the operator to disable the component after a few seconds to avoid overheating and possible failure.

3.9 Settings Page

Much of the last build ECUs, regardless of the type of system they control, have the option of being configured without operate directly on the hardware part. This is possible because they adopt a flash rewritable eeprom memory.

Using this technology, using external power connections to the control unit, it is often possible to quickly change the software settings programmed by the manufacturer; In fact, the reprogramming has the purpose of modifying the controller's behavior in the system management.

External programming, carried out with appropriate tools, is now widely used by all manufacturers of motor vehicles, motor vehicles and industrial vehicles.

This type of solution allows you to use a single type of control unit to handle different systems, the control unit is adapted to the various models in which it is used. The possibility of adapting the control unit to the various solutions required is called CONFIGURATION.
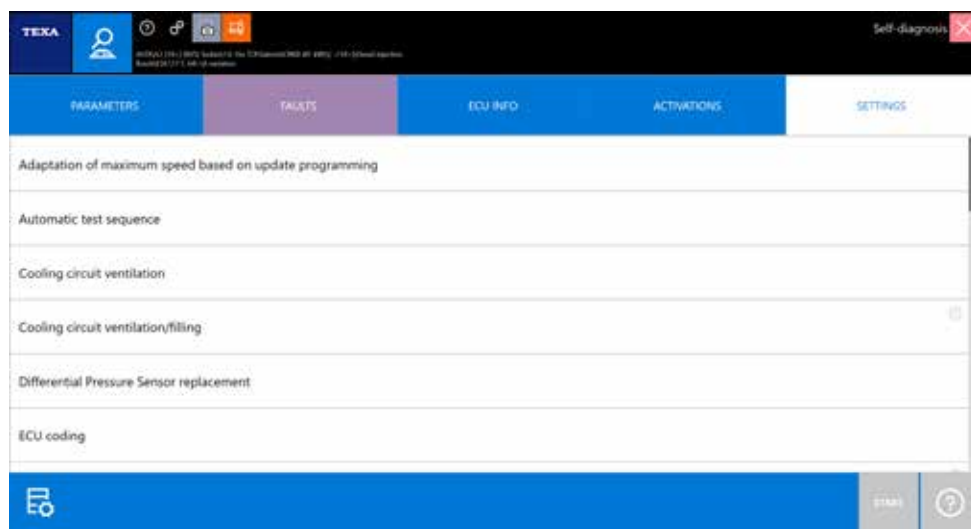

Figure 50

The "Settings" procedures are not only relate to the possibility of coding the control unit, but increasingly become indispensable for performing common maintenance operations such as replacing brake pads or clearing the expired maintenance notice.

With self-diagnosis tools, various types of encoding can be performed depending on the type of control unit, the manufacturer and the vehicle on which it is being adopted.

In the following chapters we will discuss some of the most common encoding procedures, analyze some differences between the various constructors, and explain how the coding procedures can be performed from the Settings page.

> **i** *From the chapter 6 below there will be examples of Settings according the electronic systems, how to use the page with a detailed explanation of the procedures to be performed.*

3.10 Vehicle maintenance functions

Until yesterday the only logic of self-diagnosis was to connect to a control unit to see stored errors and perform repairs accordingly. But this is just one of the possibilities.

It often happens that repair of a vehicle in a workshop is of a "simple" nature; Sometimes you only need to "reset" a parameter, perform a "recode", try a single component, etc ...

That's why TEXA has developed a series of fast-accessible quick-access functions.
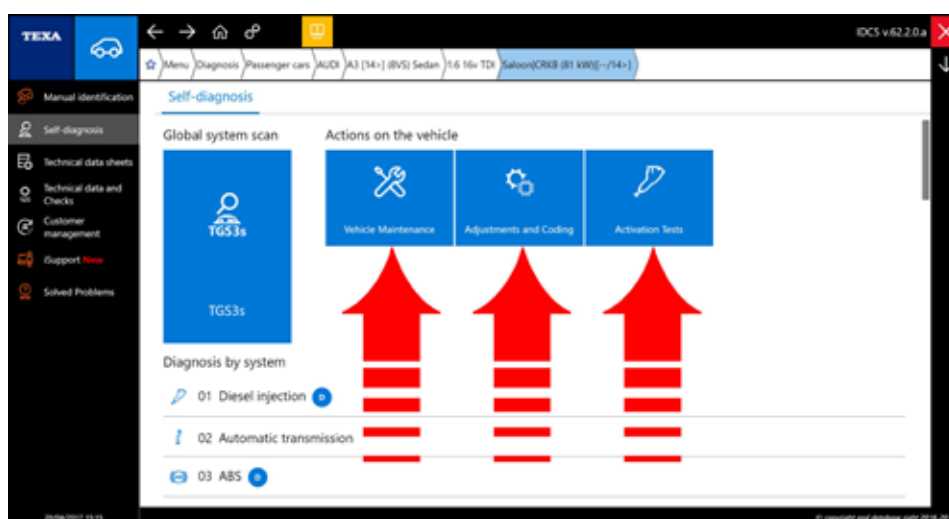

Figure 51: Vehicle maintenance features

In fact, after choosing the vehicle to be diagnosed, there are three big buttons that give you the ability to quickly access a variety of features without having to connect to the electronic control unit.

ICON	NAME	DESCRIPTION
	Vehicle Maintenance	Allows you to access the features Activation or Settings for the specific component selected.
	Settings and Encodings	Allows you to access the function Settings for the selected component.
	Devices Check	Allows you to access the function Activations for the selected specific component.

Table 4: Vehicle maintenance functions

Each single function allows quick access to activations and / or Settings without having to connect to the specific controller that manages the required function.

ℹ️ *Within these quick selection menus, there are all the features available for the selected vehicle, regardless of the type of outfit actually present on the vehicle in diagnosis.*

It is thus possible to display Activations and / or Non-Activating Adjustments for the Vehicle Diagnosed (eg a vehicle may have been manufactured during its lifetime with different types of diesel injection control unit such as EDC MS6.1, EDC 7, EDC 7C32, ... In this menu you will see all the features of all the available control units, but only the functionality of the unit actually installed on the vehicle will be enabled.

⚠️ **Attempting to activate an unsupported feature will result in an error message being displayed.**

3.10.1 ⚒ The Vehicle Maintenance menu

The "Vehicle Maintenance" menu contains all of the most common used Activation and / or Settings in the workshop, such as: reset maintenance light, replace dryer filters, suspension and clutch calibration, brake pad replacement, regeneration of brake pads Particle filters, specific resets for replacing a component, etc.
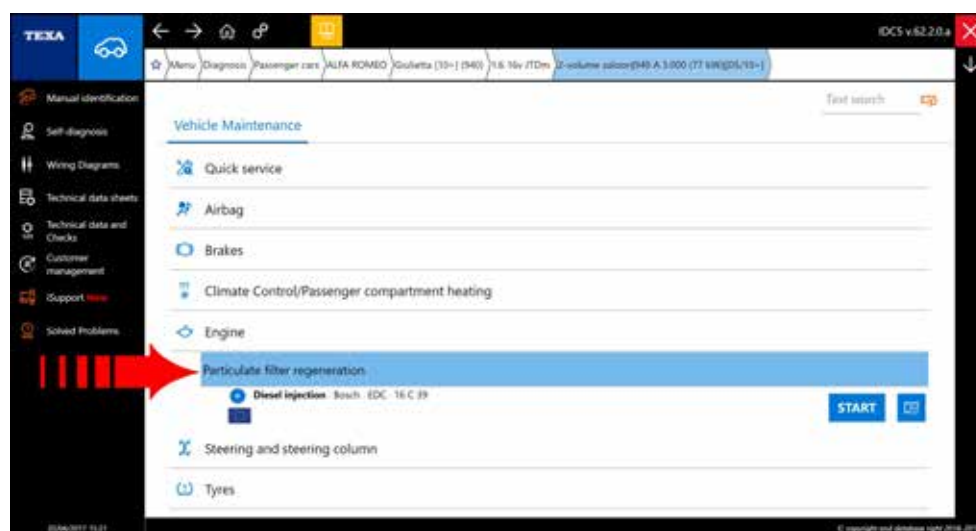

Figure 52: Example of particle filter regeneration

For example, in the previous figure, if you need to regenerate a particle filter that is clogged, you can choose the "Particulate Filter Regeneration" feature directly from the "Vehicle Maintenance" menu.

> ℹ️ *The All items in the "Vehicle Maintenance" menu are also available in the other quick selection menus "Controls and Codes" and / or "Device Controls". Obviously, it is always possible to perform the same function directly from Auto-diagnosis.*

3.10.2 🖊 The Device Check Menu

Like the other quick selection menus, the "Device Control" menu contains all the Activations enabled on the vehicle under diagnosis.
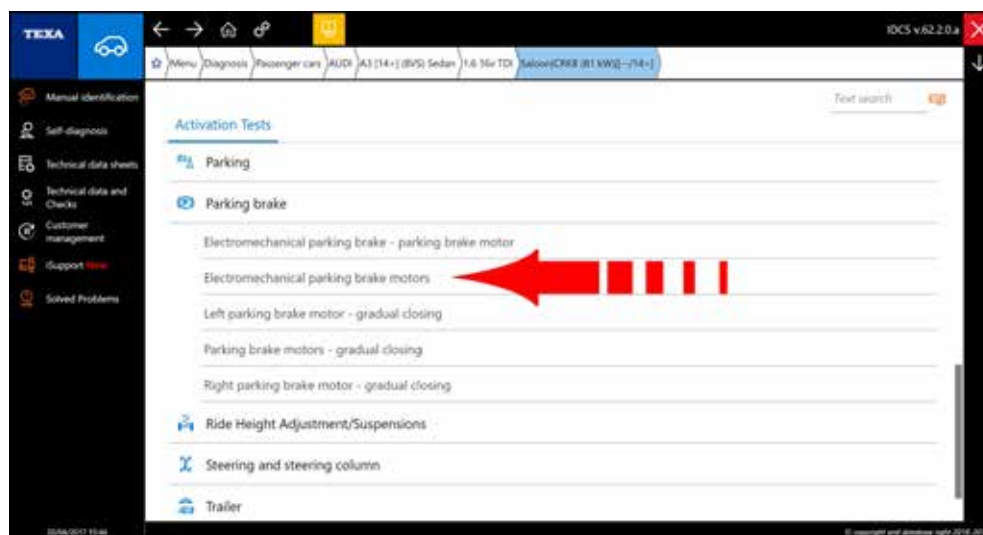

Figure 53: Electromechanical parking brake control

For example, to test the operation of the parking brake motors, you can select the function directly from the "Device Control" shortcut menu (Figure 53).

3.10.3 The Settings and Codes menu

The "Settings and Codes" menu contains all available settings on the vehicle under diagnosis but are not considered common operations.
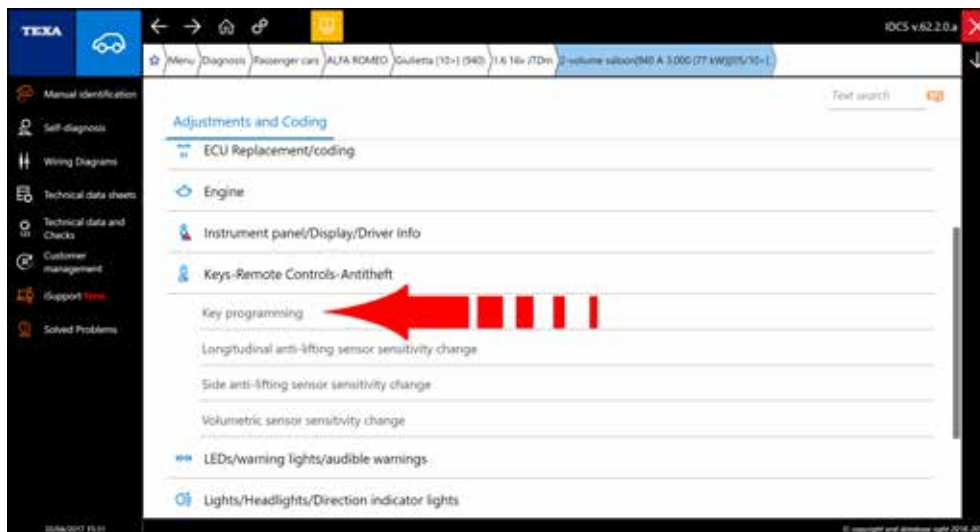

Figure 54: Select Key Programming in Alfa Romeo Giulietta Settings and Codes

So if you have to program a new key, you can directly access the function from the "Settings and Codes" quick menu (Figure 54).

> ℹ️ *Obviously, it is always possible to perform the same function directly from Self-Diagnosis.*

3.11 The IDC5 Technical Documentation

It's not just Self-Diagnosis that is needed for modern mechanics, but often the difference between self-diagnosis itself, and all the additional information that allows us to understand the functioning of a system and which provide us Control and verification data.

In fact, reading the "Turbo Faulty" or "Insufficient Fuel Pressure" errors just helps to recognize the area of the problem, but if you do not know the vehicle and the system you are checking, it is just a partial information.

"The Turbo charger is normal or with VGT mechanism?", "Is the fuel injection system has a common rail or pump injectors?"

Such doubts can be can be frowned upon by the technical documentation provided by TEXA to support the Diagnostics. Within the TEXA diagnosis environment, we can find various types of technical information:

- Wiring Diagrams, with relative components cards;
- Technical sheets and bulletins;
- System Description Sheet;
- Technical Data and Technical Maintenance Information.

3.11.1 Wiring Diagrams

Very important for the technicians are the schematics. In fact, many issues require wiring monitoring and / or testing of specific electrical signals on the cables.

Unfortunately, it is not possible to provide electrical diagrams for all self-diagnosis selections, as TEXA does not provide official documentation for manufacturers, but thanks to our technical research, we usually provide electrical diagrams for brands and the main installations.

Schematics can be viewed either just in free consultation mode and/or within self-diagnosis.

Selecting the "Schematics [||]" icon, it will display a screen with a list of all the available electrical diagrams for the selected vehicle, grouped by plant type.
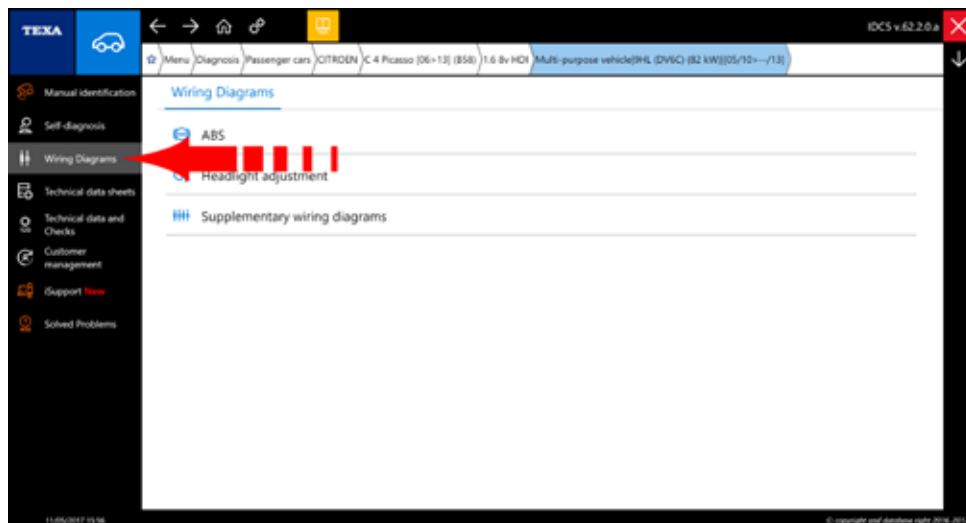

Figure 55

The wiring diagram can be displayed on multiple pages and there are a number of commands and specific features to the consultation of all information related to the schema itself.

> ℹ️ *For a detailed description of each feature, refer to the On Line technical documentation provided with the program.*
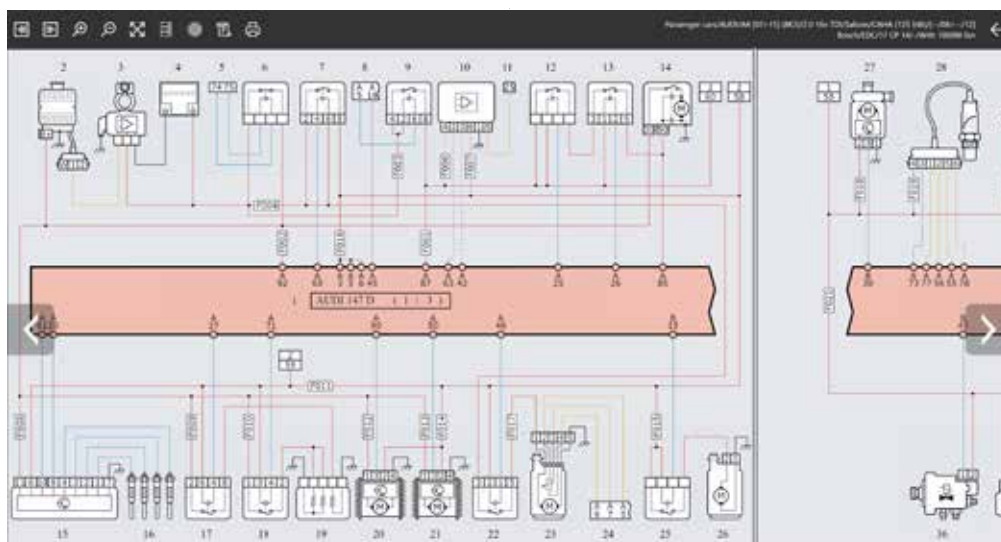
Figure 56: Audi A4 (8K2) Engine Wiring Diagram, pag. 1/3

> **i** *For an easier understanding of the layout of the system, the displaying is Standardized for everyone the Manufacturer according to a unique logic.*

ICON	NAME	DESCRIPTION
	Previous Page / Next	Allows you to move between different pages of the same wiring diagram (only for multi-page schematics).
	Zoom In/Out	Allows you to zoom in the desired wiring area.
	Full Screen	Allows you to return to Full Screen display of the wiring diagram.
	Device Legend	Allows you to view the list of components in the wiring diagram.

	Device Location	Permette di visualizzare l'ubicazione del componente desiderato.
	Schematics Legend	Allows you to see the color code used in the links.
	Print	Allows to Print the Wiring Diagram And the Legend

Table 5: Wiring Diagrams Buttons

Moving the pointer over the symbols of the Schematics, it shows a label identifying the component and indicating the location.
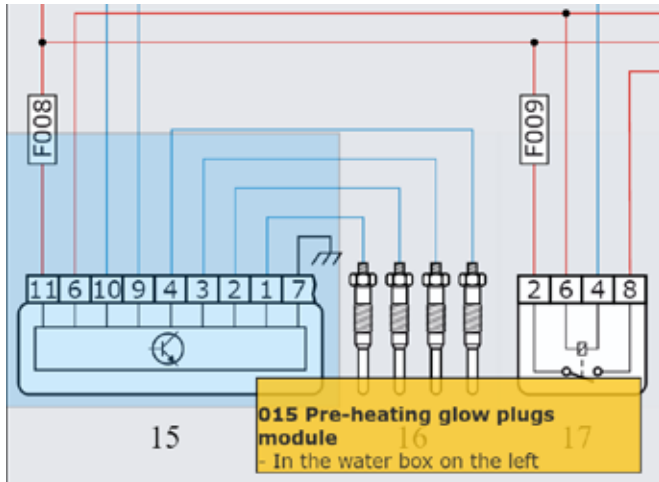

Figure 57: Identification of Glow Plugs control unit component with location description

Clicking on a device symbol, it displays the available function menu.

ICON	NAME	DESCRIPTION
	Technical Sheet	Displays a technical datasheet of the selected component.
	Image	View a device photo.
	Manual Mode	Allows you to execute the oscilloscope command interface.
	Connector	Shows a pinout image of the connector.

Table 6: Command and function of the wiring diagram component

ℹ️ *Not on the all Devices those information are available.*
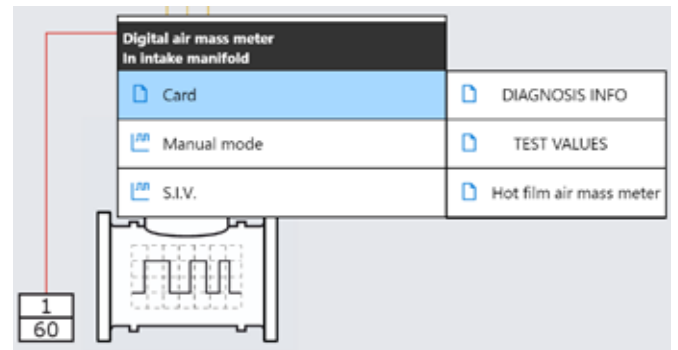
Figure 58: Sub-menu of the technical data sheets linked to the component

For example, a technical data sheet of a component can explain the operating principle, technical characteristics and control values, can provide operational aid on self-diagnosis, depending on the type of component; you can also find a multiple tabs for each specific topic.

The following figure shows the technical data sheet "Test values" of the electrical signal of a common rail injector, in which you can see the characteristic waveform that must have the electrical command.
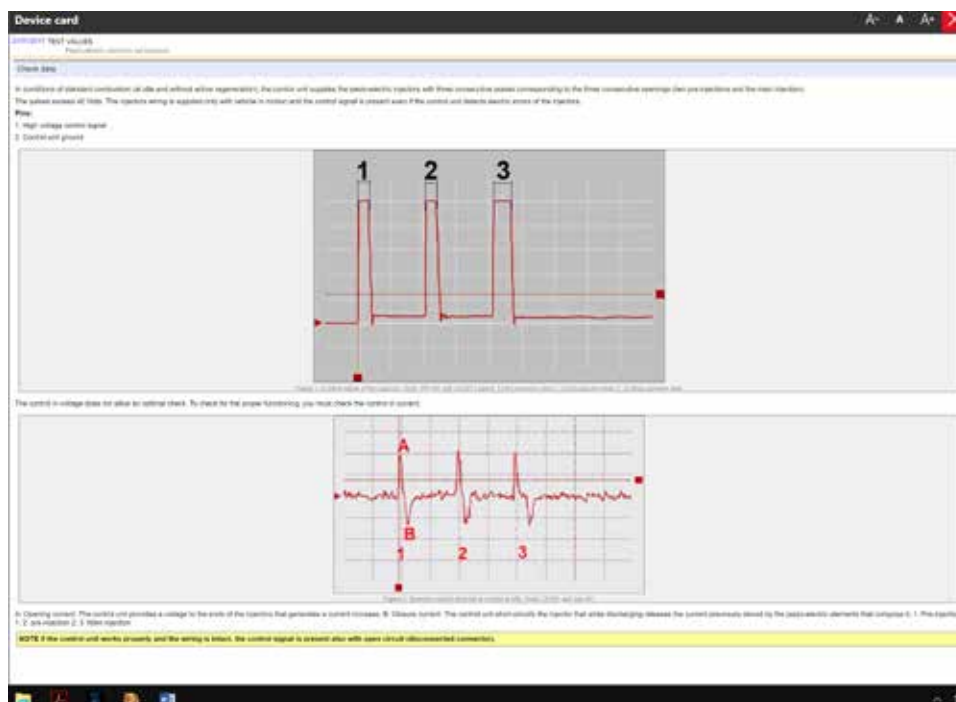
Figure 59

It is often necessary to be able to consult electrical diagrams during a self-diagnosis session.

On the various Screens there is a " ⊟ " button (Parameters page, Activation, Adjustments ...) that allows access to all the documentation that supports self-diagnosis.
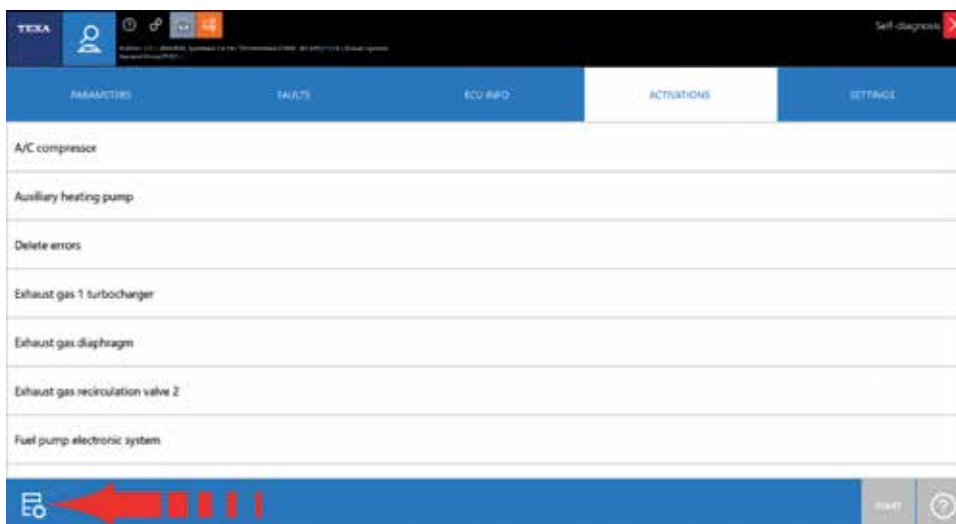
Figure 60: Location
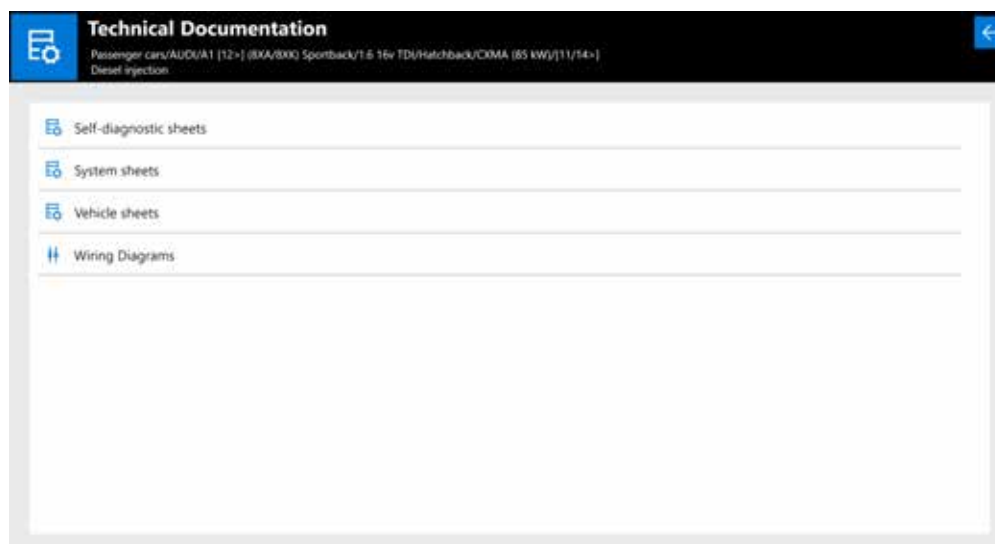
Figure 61

3.11.2 Bullettins and Technical Sheets

Nowadays, the technician of a multi-brand workshops has to face a great variety of systems from different manufacturers, each with their own peculiarities.

This, of course, is not always possible. The huge number of manufacturers and variants makes practically impossible the in-depth knowledge of each plant.

For this reason, TEXA provides a range of technical cards and information for diagnostic systems.

This information is available, sorted by system and / or vehicle, by clicking the " " button.
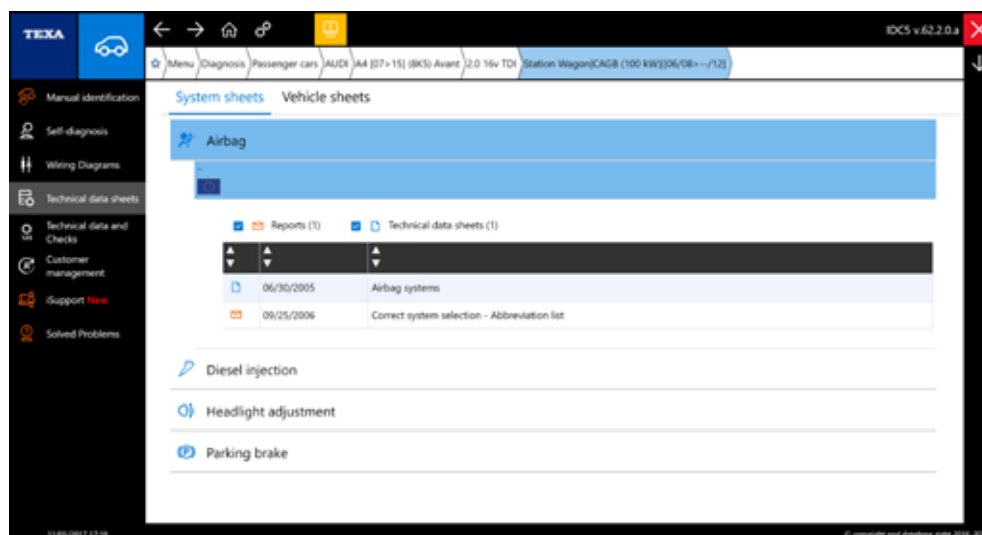
Figure 62: Technical Sheet and Bullettin

There are two types of technical information: Sheets and Bulletins.

ICON	NAME	DESCRIPTION
	Sheet	View a descriptive data sheet for the selected system.
	Bullettin	Displays a document that shows a specific problem and / or solution.

Table 7

Each of these two types can be found under two different categories:

- System charts;
- Vehicle cards.

The System charts contains information relating to a specific system, while the second contains valid information for the entire vehicle. Due to their nature of information and explanation of "practical" problems, technical bulletins are constantly updated and made available to the public (subject to a subscription). This way you stay constantly updated with the latest information available.

3.11.4 Smart Solved Problems (powered by Google©)

TEXA has been on the Self-Diagnosis market since 1992, and since then we have done a great deal of experience, but above all it is the experience of our customers to make a difference! For this reason, two specific databases have emerged over time, where both TEXA and our customer experience are collected.
Thanks to these databases, the mechanic are able to complete the repair quickly and with the correct procedure.
The access to these databases is possible either from the IDC5 operating environment and from the self-diagnosis ( ).
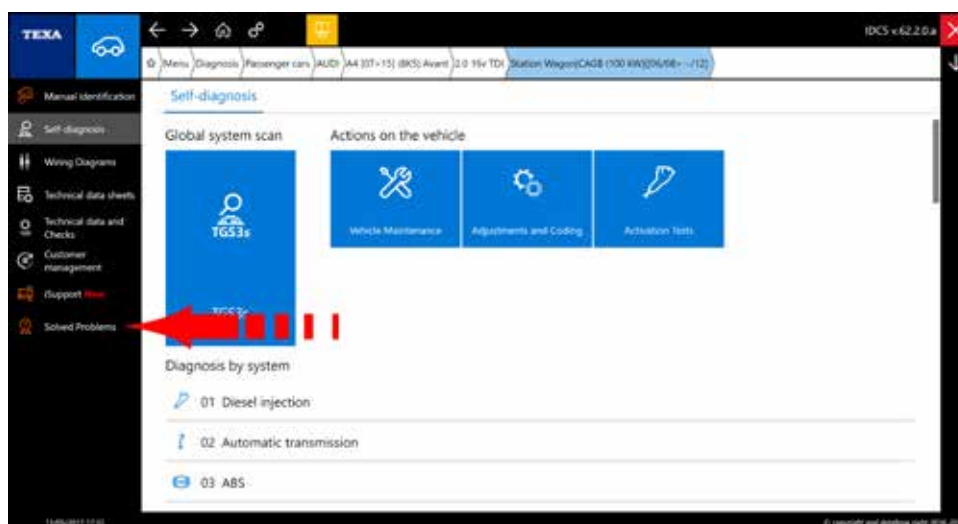
Figure 63: Access from IDC5

45>
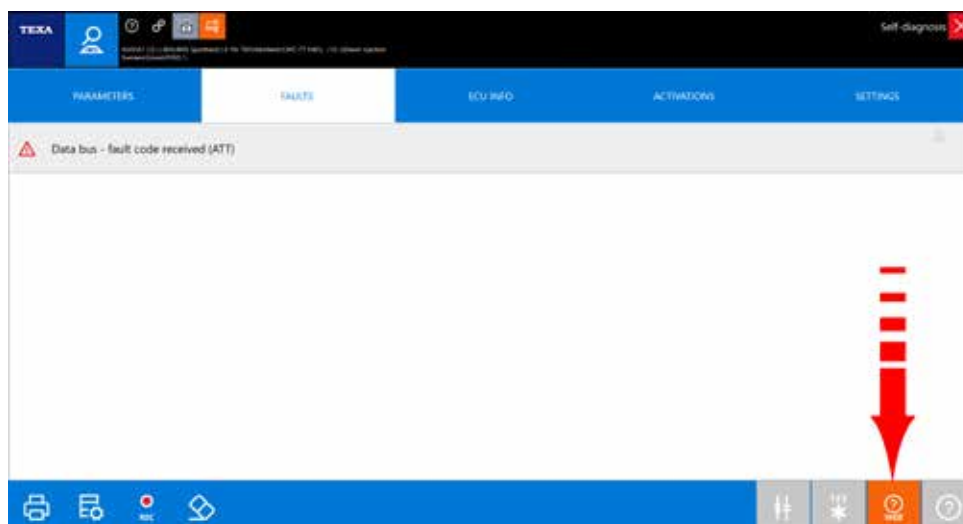
Figure 64: Access from the Self-Diagnosis environment

"Troubleshooting" is a database that contains the real experiences of TEXA customers. Thanks to this feature, the mechanic is able to complete the repair quickly and with a proper procedure, by quickly and easily accessing, through Google search, a TEXA database for troubleshooting already encountered by Mechanics from around the world and gathered by the international TEXA call centers.

The database is accessible both from the IDC5 operating environment and from self-diagnosis, and once the function is executed, a screen will appear that allows us to perform both "full-text" searches and more targeted searches, specifying the data of the Vehicle in diagnosis.

Figure 65: Troubleshooting for keyword description
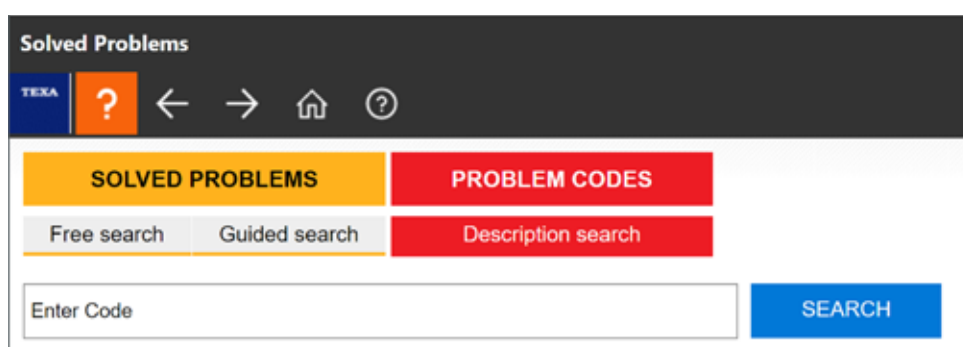
Figure 66: Troubleshooting for Trouble code DTC

⚠️ **For the use of these databases, the diagnostic tool must be connected to the Internet and subscribed to its subscription contract (if applicable).**

3.11.5 Technical Data and Maintenance

The modern mechanic, in order to complete the "state of art" repair, needs to access to a whole range of technical data and specific information about the vehicles diagnosis. The Technical Data and Maintenance feature gives access to the TEXA database from which to retrieve this information.
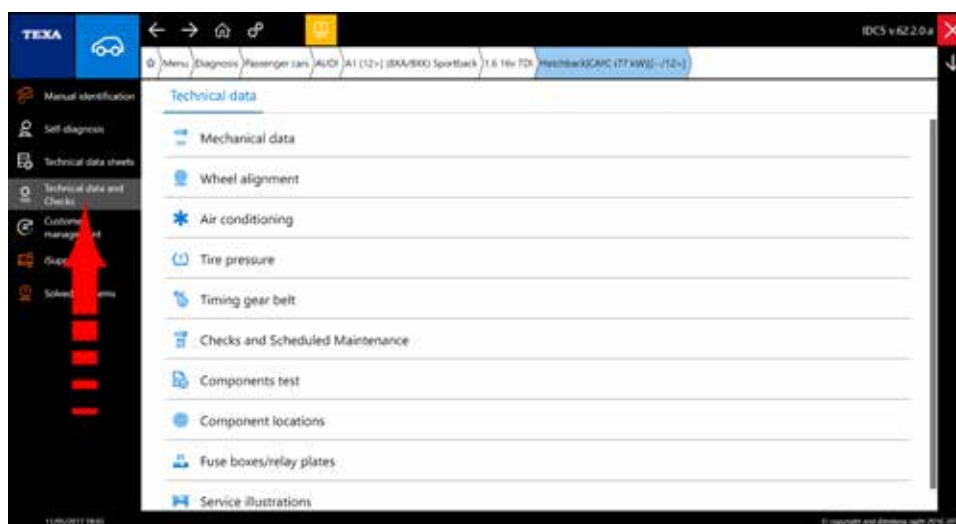
Figure 67: Technical Data and Maintenance

> ℹ️ *Depending on the type of selected vehicle or the reference market (Europe, Asia, America), the amount of information available may vary from lack of information, mechanical or maintenance data only to additional electrical diagrams. However, TEXA's database is constantly updated and expanded in every new released version.*

The names of the individual menu functions are self-explanatory and do not require any further explanation. We only include some categories as an example.

Mechanical Data
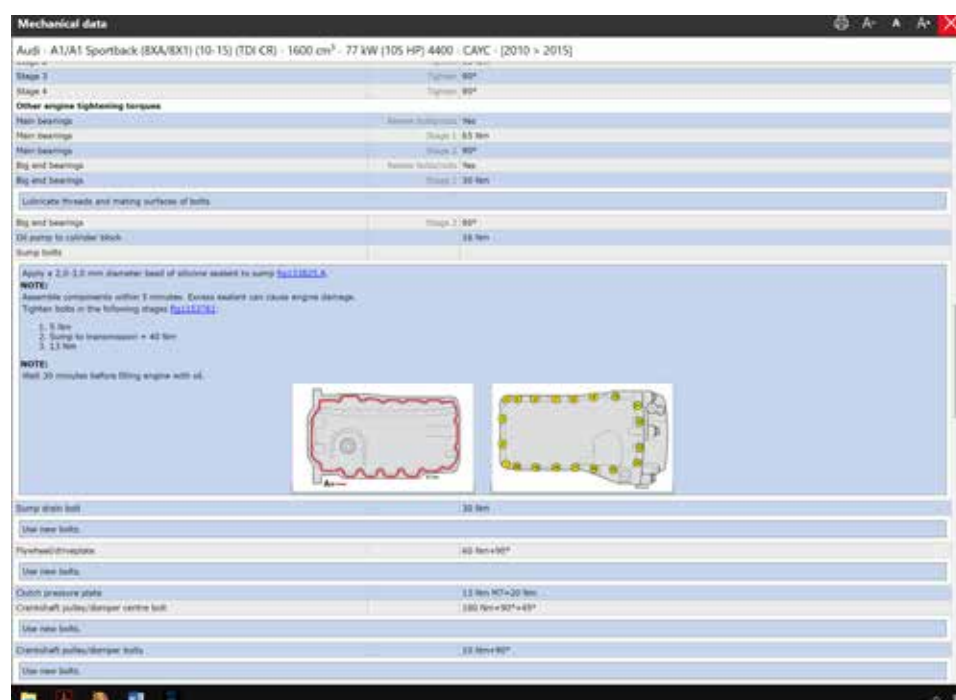
Figure 68

Figure 68 shows the Vehicle Mechanical Data Screen, divided by category. You can access engine data, nuts tightening pairs, used lubricating types and required quantities, and information for tuning the engine and other systems.

Maintenance and Scheduled Maintenance
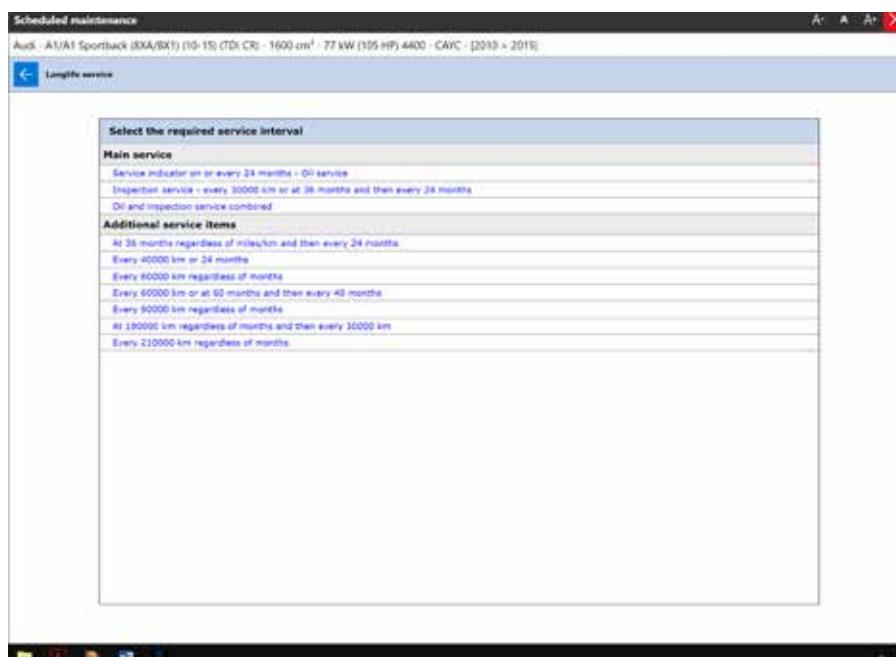
Figure 69

The "Figure 69" shows the list of scheduled maintenance for the selected vehicle.
By choosing a kilometer deadline, you access the technical data sheet of the machining and controls to be performed.

Service illustrations

The "Figure 70" shows Service Illustrations, a series of images useful to understand how to access certain operations (position of oil drain plugs by various mechanical groups, level indicators, belt diagrams, etc.).
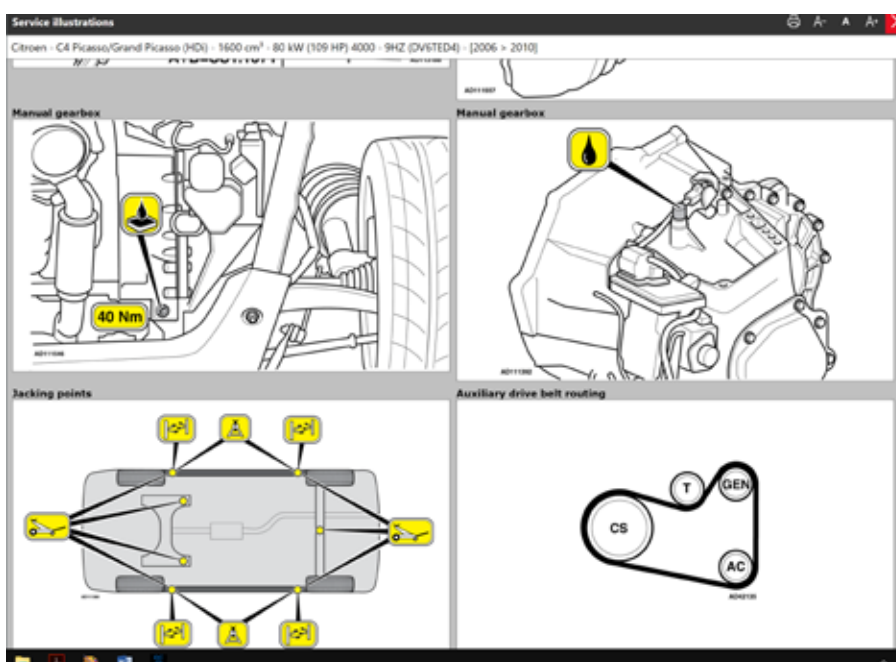
Figure 70

4. ENGINE POLLUTANTS CONTROL LEGISLATION AND EOBD SYSTEM

Pollution is a phenomenon that is not limited to the only emission of toxic gases from power plants, heavy industries and vehicles. Often, it also involves a series of very complex chemical reactions whose repercussions have not yet been clearly defined, despite the grueling discussions by experts from around the world. In Italy since 1993 (by virtue of the transposition of Community Directives commonly referred to as EURO I, II, etc.), for vehicles equipped with internal combustion engines, more and more restrictive emission limits have been introduced with the use of internal combustion engines, The aim of reducing the impact of the transport sector on the environment. The consequence of these provisions, in the attempt to still reach these limits today by only acting on the combustion-combustion system, is to equip vehicles with additional exhaust-killing devices. In September 2009, the Euro 5 standard went ahead of the expected timeframe (2010), which sets even more restrictive limits on NOx and particulate emissions.

| PETROL[1]	From:	CO (g/km)	THC (g/km)	NOx (g/km)	Particolulate (g/km)
EURO I *	01/07/1992	4.05	0.66	0.49	---
EURO II *	01/01/1996	3.28	0.34	0.25	---
EURO III	01/01/2000	2.30	0.20	0.15	---
EURO 4	01/01/2005	1.00	0.10	0.08	---
EURO 5	09/01/2009	1.00	0.10	0.06	0.005
EURO 6	09/01/2014	1.00	0.10	0.06	0,0045
DIESEL[2]	From:	CO (g/km)	THC (g/km)	NOx (g/km)	Particulate (g/km)
EURO I *	01/07/1992	2.88	0.20	0.78	0.14
EURO II *	01/01/1996	1.06	0.19	0.73	0.10
EURO III	01/01/2000	0.64	0.06	0.50	0.05
EURO 4	01/01/2005	0.50	0.05	0.25	0.025
EURO 5	09/01/2009	0,50	0.05	0.18	0.005
EURO 6	01/09/2014	0,50	0.05	0.08	0.0045

*Table 8: Passenger and commercial vehicles up to 1305 kg. * According to the new set of tests being applied from 2000...*

In fact, a first evolution step towards emission reduction has occurred with the adoption of increasingly innovative electronic fuel injection systems, catalytic converters and quality exhaust sensors.

These vehicle innovations have led to a reduction of approximately 70% of the main regulated emissions: **CO**, **HC**, **NOx**.

Guidelines for the development of engine technology identify different fields of intervention including:

- The development of high pressure GDI direct injection technology for both petrol and diesel engines;
- Recirculation of EGR exhaust gases;
- The choice of gaseous fuels that approximate the optimum conditions of homogenous combustion;
- Research on various types of fuels such as bio-fuels and oxygenated hydrocarbons such as methanol and ethanol;
- The development of on-board electronic diagnostics equipment for active and instantaneous monitoring of the optimum operating modes of the propulsion system;
- Aerodynamic research, the development of low rolling resistance tires and the reduction of weights by the use of new materials.

The next steps in the reduction of pollutants will be directed mainly at setting limits on CO_2 emissions, which is to reduce the consumption of cars. This will definitely lead to the production and marketing of alternative fuel vehicles, including hybrid vehicles. It should also be emphasized that the Euro 6 regulation foresees a significant reduction of NOx, about 68% less than the values in Euro 5.

[1]   The dates refer to new approved vehicles. For registered vehicles, they are postponed for one year.

[2]   The dates refer to new approved vehicles. For registered vehicles, they are postponed for one year.

- **September 1, 2014**: Starting from this date, "national authorities will refuse to grant EC or national type approval for new types of vehicles that do not comply with the Regulation and its implementing measures, in particular the Euro VI limit values."
- **September 1, 2015**: Starting from this date "national authorities will cease to hold valid certificates of conformity for new vehicles that do not comply with the Euro VI Regulation, by not allowing the registration of vehicles prior to the said legislation".

In 2015, the European Community adopted the first two legislative pieces (EU 2016/427, EU 2016/646) defining the implementation of the new pollutant emission measurement methods (RDE). Two other legislative packages are currently being studied to complete the project, which aims to establish a reality-based pollution control test for light motor vehicles and light commercial vehicles. The RDE test will begin gradually from 2017 and will apply to all cars since the beginning of 2021 and all light commercial vehicles from 2022. The new procedure integrates the current roadworthiness testing of road vehicles simulating more realistic conditions Engine operation.

4.1 Recognize the Euro Regulations

To understand what kind of homologation a car respects, you only need to consult the vehicle card, better known as a "booklet". The following information must be given here for each type of approval (Euro 1, Euro 2, Euro 3 etc.).

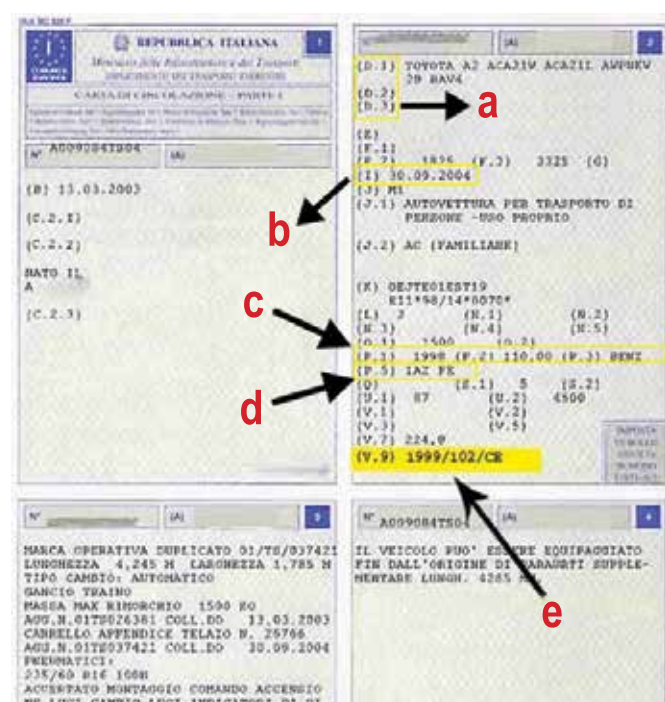| YEAR	1971	1975	1977	1979	1984	EURO 1: 1993	EURO 2: 1997	EURO3: 2000/2005	EURO IV: 2005/2010	EURO V: 2009/2013	EURO V: 2015
Law n°	70/220	74/290	77/102	78/665	83/351	91/441 91/542 fase I 93/59	94/12 91/542 fase II 96/1 96/44 96/69 98/77	98/69 98/77 1999/96 1999/102 2001/1 2001/27 2001/100 2002/80 2003/76	98/69 B 98/77 B 1999/96 B 1999/102 B 2001/1 B 2001/27 B 2001/100 B 2002/80 B 2003/76 B	2007/715 2008/692	

Table 9

Figure 71

The introduction of EURO 3 has brought about a significant leap in quality on reducing pollutants by spreading, for the first time, emission control directly on the motor vehicle in order to monitor the correct operation of the vehicle. The decisive reason for introducing such a control is the need to ensure that the car passes the approval phase while respecting the emission limits, but that it maintains its compliance throughout its lifetime. This control system must comply with the new protocol called EOBD (European on Board Diagnostic to distinguish it from the US OBD II protocol), which was initially introduced (year 2000) for petrol vehicles only and for diesel and power vehicles

The application deadline was postponed to 2003. Because of the technical difficulties of directly measuring the actual concentrations of pollutants such as CO, HC and NOx; These are determined by controlling the engine management and post-treatment of exhaust gases.

This offers new features and advantages over previous self-diagnosis systems:

1. Diagnostic Connector is unified for all 16-way models;
2. DTC codes are unified for all manufacturers - the same kind of failure assumes the same error code for any car brand;
3. The same generic diagnostic tool (SCAN TOOL) can be used to detect the error codes of all vehicles approved according to EOBD;
4. The range of diagnostic errors has been expanded and new tests have been introduced - catalyst diagnosis, diagnosis of the petrol system, misfire failure diagnosis, Lambda probes diagnosis;
5. The error codes do not provide generic indications about the component or circuit as above, but also specify the type of failure that has occurred (interruption, short circuit, signal compatibility, etc.), allowing a faster and more accurate diagnosis ;
6. The display of operating conditions when the failure occurred (freeze frame)

To achieve this goal, the OBD diagnosis involves controlling the system on 8 different areas:

1. Catalyst (loss of HC conversion efficiency);
2. Lambda Sensors;
3. Misfire Diagnosis (Overcoming Emissions, Catalyst

Damage);

4. Circuit check of the gas vapor washing system;
5. EGR (Checking the exhaust gas recirculation circuit);
6. Secondary air system;
7. Fuel system (correct operation of the fuel supply circuit);
8. Transmission.

> **ℹ** It should be always remembered that the self-diagnosis resources of the OBD system are limited to the verification of emission control systems and should not therefore be confused with the specific diagnostic systems for the electronic system present in each car.

> **ℹ** In addition to the pollutant emission control of vehicles, international legislation has also imposed constraints on fuel composition: diesel is imposed by the limit of 51 for the number of cetane, the sulfur content of 350 ppm up to 2005 and 50 ppm After 2005; For gasoline imposes the sulfur limit of 150 ppm since 2000 and 50 from 2005. Since 2005 we also recommend the use of sulfur-free fuels (<10 ppm) which has become mandatory since 2009.

4.2 European Law for the on Board Diagnosis (EOBD)

Directive 98/69 EC and Directive 2002/80 EC relating to amendments to Directive 70/220 / EEC on measures to be taken against air pollution by emissions from motor vehicles shall apply to:

- *exhaust gas emissions at normal ambient temperature and low ambient temperature, evaporative emissions, gas emissions from the base, durability of the pollution control devices and on-board diagnostic systems (OBDs) of ignition-ignition engines controlled;*
- *emissions from exhaust, durability of pollution control devices and on-board diagnostic systems (OBDs) of spark ignition engines of category M1 (cars with at least 4 wheels and less than 8 seats for the transport of persons) and N1 (Vehicles with at least 4 wheels intended for the carriage of things with a total mass of less than 3,5 t). '*

'Vehicles of M1 and N1 category equipped with a powered ignition engine shall be equipped with an on-board diagnostic on-board diagnostic (OBD) system as from 1 January 2000; With effect from 1 January 2003 for new types and from 1 January 2004 for all types of vehicles of category M1 fitted with a spark ignition engine, with the exception of: vehicles intended to carry more than six passenger including, - vehicles the maximum mass of which exceeds 2 500 kg.

Finally, "new types of vehicles of category N1, class I equipped with a spark ignition engine must be equipped with an on-board diagnostic system (OBD) for emission control from 1 January 2005" 'New types of vehicles of category N1, class II and III' shall be shifted to 1 January 2006.

During the approval of a new vehicle, the manufacturer, who has full freedom to choose the operating systems of the system, must provide the following information:

- *In the case the vehicles is equipped with powered ignition engines, the percentage of irregular ignitions on the total number of ignition which may cause an emission level exceeding the limits;*
- *In the case the vehicles is equipped with powered ignition engines, the percentage of irregular ignition on the total number of ignition which could cause overheating, irreversible damage, of the exhaust catalysts or of the exhaust catalyst;*

- *Detailed written information describing in full the functional features of the OBD system, including a list of all the main parts of the vehicle emission control system, ie sensors, actuators and components controlled by the OBD system;*
- *A description of the malfunction indicator (MI) used by the OBD system to signal a fault to the driver of the vehicle;*
- *The manufacturer must describe the measures taken to avoid tampering with or modifying the emission control computer.*

The following tests shall be submitted for the approval of the vehicle:
- *Type I (checking average exhaust emissions after a cold start);*
- *Type II (carbon monoxide emission at the minimum speed);*
- *Type III (gas emission from the Engine Block Base);*
- *Type IV (evaporative emissions);*
- *Type V (Duration of anti-pollution control devices);*
- *Type VI (verification of average carbon monoxide / hydrocarbon emissions by low temperature exhaust after a cold start);*
- *OBD tests.*

Vehicles equipped with a spark ignition engine shall be subjected to the following tests:
- *Type I (average exhaust emissions check after a cold start);*
- *Type V (duration of anti-pollution control devices);*
- *OBD tests, where appropriate. "*

4.3 Malfunction Indicator Light (MIL)

"The OBD system must include a malfunction indicator lamp (MIL) easily detected by the driver of the vehicle. MIL must not be used for purposes other than emergency start-up or reduced efficiency and must be visible in all normal light conditions.

When in operation, a symbol conforming to ISO 2575 must be displayed. A vehicle must be fitted with no more than one general MIL for emission issues. Other light sources with different specific functions are allowed. The use of red is not allowed for the indicator light of the ILO.

No systems are required that require on average more than ten driving cycles to activate the MIL. The MIL must also come into operation whenever the engine is in the normal operating mode, the emission limits are exceeded or the OBD system is unable to meet the specified basic control requirements.

The MIL must provide a distinct signal, such as intermittent light, whenever an irregular ignition of the motor occurs which could cause a catalyst failure. The MIL must be activated when the vehicle injection is activated before the engine starts and will shut off after the engine starts if no malfunction has been detected. "

Figure 72: MIL light ON

4.4 Trouble Code Storing

"*The OBD system must record the code or codes indicating the state of the emission control system. Different codes must be used to identify properly functioning emission control systems and those requiring a further use of the vehicle to be fully evaluated. If the MIL is switched on at the same time, a fault code identifying the type of malfunction should be stored.*

After MIL has been activated, the value of the distance traveled by the vehicle must be available through the serial port of the standardized connector for data transmission (this requirement applies only to vehicles equipped with an electronic device transmitting data on the controller to the controller Provided that the ISO standards are completed within a time-limit compatible with the application of the technology. It shall apply to all vehicles put into circulation from 1 January 2005). '

4.5 Scan Tool

The law states: "*After detecting the first malfunction of a component or system, the current engine conditions must be stored in the controller as frozen information.*"
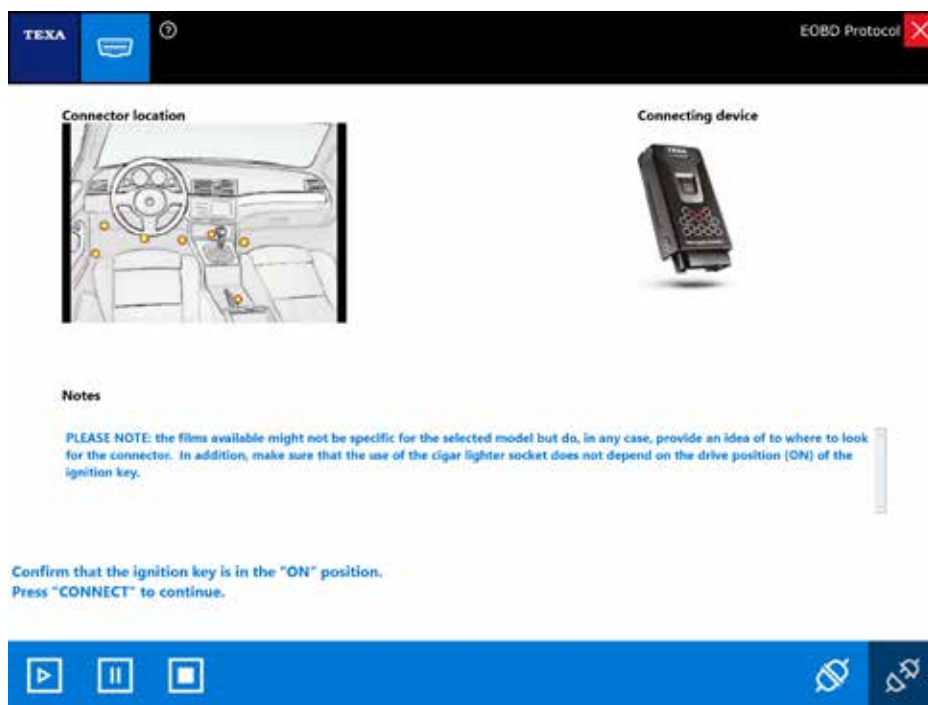
Additionally, car manufacturers must allow a generic diagnostic tool to access to the diagnosis of the control units involved in engine management, which is named Scan Tools.

The Scan Tools must be able to read the conditions of the engine stored during normal operation and after storing an error (frozen parameters).

These must include:

- The distance in Km traveled with the MIL light on;
- The calculated load value;
- Engine speed;
- The fuel system regulation value (if available);
- The state of the fuel control system;
- The advance of the injection;
- The air temperature;
- Air flow;
- Pressure in the intake manifold;
- Fuel pressure (if available);
- Vehicle speed (if available);
- The coolant temperature;
- Intake manifold pressure (if available);
- Closed or open loop ("closed loop" or "open loop") (if available);
- The output value of the throttle position sensor;
- The secondary air state and the fault code that caused the data to be stored.

55>

It must also be available for the systems and the devices checked, the indication "Pass / Fail" of the latest test results.
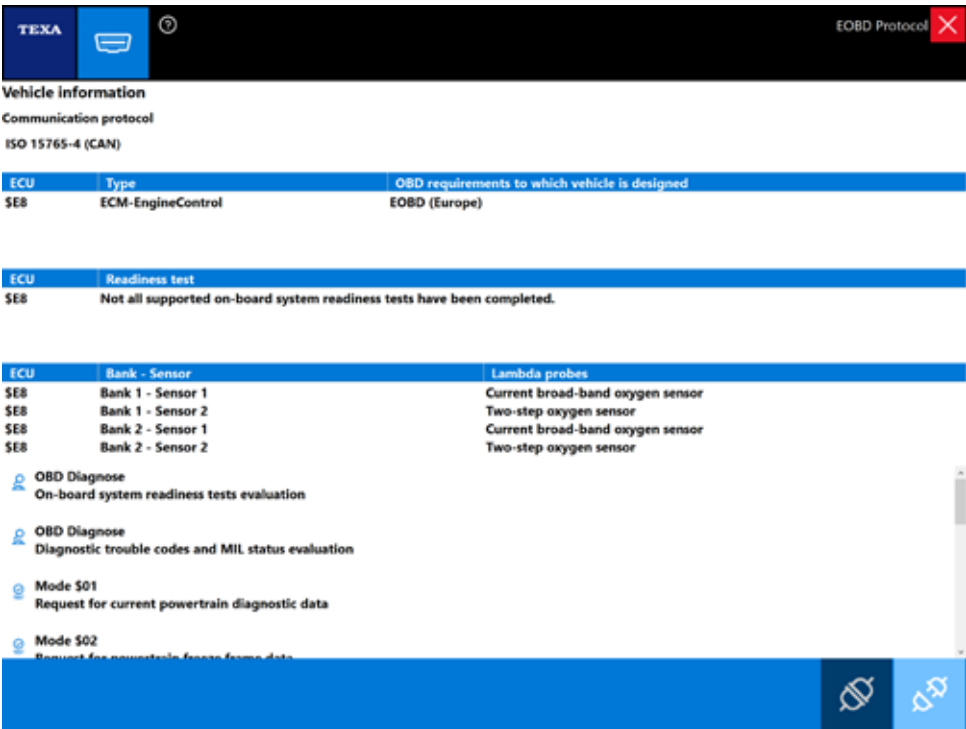

Figure 74: Start page viewing of the new OBD Scan Tools TEXA

4.6 The Trouble Code

The rule states that failures are stored through error codes, which are alphanumeric and individually identify a failure.
The EOBD and OBD II error codes consist of 5 characters: a letter followed by 4 numbers such as P0101.
The **first character** is a letter and identifies the system that generated the code and can be:

- B) Body;
- C) Chassis;
- P) Engine;
- U) CAN Bus;

The **second digit** is a number and identifies the type of code:

Code	Generic code defined by the EOBD/OBDII protocol, it is the same for every Manufacturer	Specific Manufacturer Code
P0xxx	X	
P1xxx		X
P2xxx	X	
P30xx-P33xx		X
P34xx-P39xx	X	

Table 10

The **third digit** (in the case of errors marked with the letter P) identifies the specific system or subsystem where the problem is localized:

1. Air or fuel dosage;
2. Air or fuel dosage (only malfunctions of injectors);
3. Injection or ignition system;
4. Auxiliary emission control systems;
5. Speed and minimum speed control;
6. Output and computer circuits;
7. Transmission.

The **fourth and fifth digits** identify the system section that caused the failure.
Of course, for these digits there is no reference table because the number of components in each system or subsystem depends on the manufacturer.

Figure 75: Trouble code relief with the EOBD Scan Tool TEXA program

Figure 76: MIL light of Volkswagen New Beetle

4.7 Available Test

Icon	Name	Description	Chapter
	OBD Diagnosis	Assessment of board system readiness tests	OBD Diagnosis - Assessment of board system readiness tests
	OBD Diagnosis	Evaluation of Trouble Code and Light Statu MIL (*).	OBD Diagnosis: Evaluation Trouble Code and MIL light Status
	Mode $01	Current Powertrain Engine Diagnostics Data	Mode $01
	Mode $02	Freeze Frame related to the Powertrain System	Mode $02
	Mode $03	Emissions Trouble Code for the Powertrain System	Mode $03
	Mode $04	Emissions Clearing diagnosis information	Mode $04
	Mode $05	Lambda Sensors Test Result	Mode $05
	Mode $06	Results of the on-board test for systems NOT constantly monitored	Mode $06
	Mode $07	Results of the on-board test for systems constantly monitored	Mode $07
	Mode $08	On Board System Check, Device Test	Mode $08
	Mode $09	Request Vehicle Information	Mode $09

Table 11

4.7.1 OBD Diagnosis - Assessment of board system readiness tests

This Test gives us information on the systems fitted in the vehicles and the status of their operation:

- Response message in hexadecimal (readiness code).
- Bit train representing the supported services (0 if the service is not supported and 1 if the service is supported).
- Bit train representing completed services (0 if service is completed or not applicable and 1 if service is not completed).
- Control unit address.
- Overall result from the assessment of the readiness test.
- Extended description of the readiness test.
- Readiness status test.

Figure 77

4.7.2 OBD Diagnosis: Evaluation Trouble Code and MIL light Status

Faults are stored on this page only if they have a negative impact on emissions.

If the MIL light is on and there are no errors in this page, you must query MODE $ 07 for the complete list of stored errors.

Figure 78

4.7.3 Mode $01 - Current Powertrain Engine Diagnostics Data

This function allows us to display the current parameters and states made available by the system.
The instrument asks the control units to know which parameters and states are available for reading.
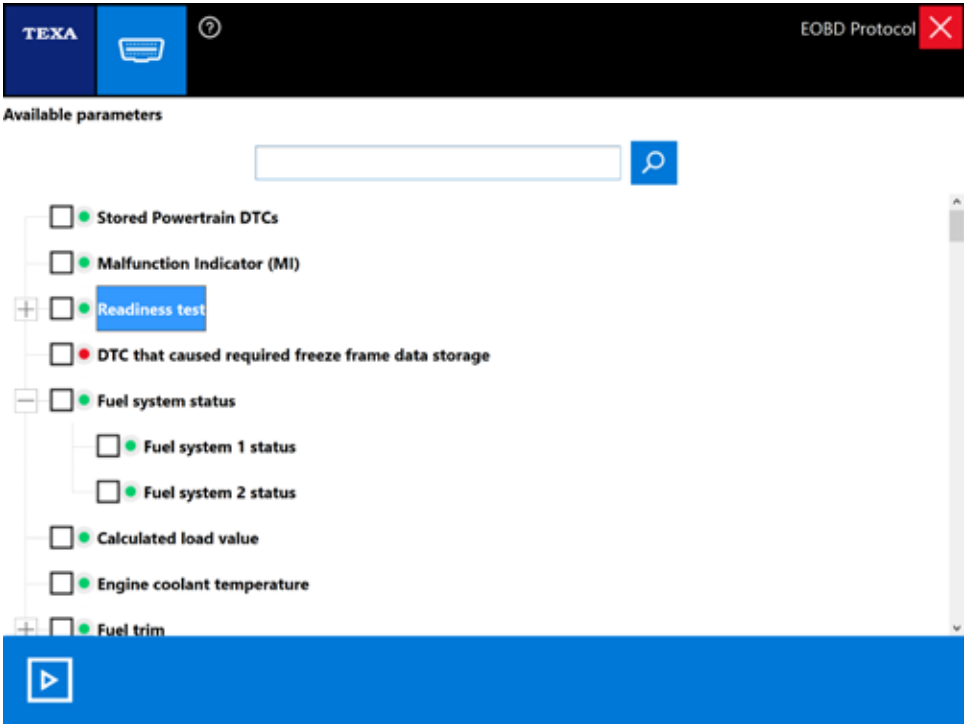After selecting the parameters that you want to display, press the PLAY button .

Figure 79: EOBD Scann Tool: Mode $01

i *This Table is applicable for the All following descrbed Mode (Mode $02 … Mode $09).*

Description	ECU	Value
Fuel system 1 status	$E8	----
Fuel system 2 status	$E8	----
Calculated load value	$E8	0.0 %
Engine coolant temperature	$E8	21 °C
Short term fuel trim - Bank n.1	$E8	0.0 %
Long term fuel trim - Bank n.1	$E8	-7.0 %
Short term fuel trim - Bank n.2	$E8	0.0 %
Long term fuel trim - Bank n.2	$E8	-6.3 %
Engine rpm	$E8	0 rpm
Intake air temperature	$E8	34 °C
Air flow rate from Mass Air Flow sensor	$E8	0.97 g/s

Figure 80: Parameters Evaluation Mode $01

4.7.4 Mode $02 - Freeze Frame related to the Powertrain System

This menu allows access to the freezing parameters and states available in the control units.

A parameter or state is defined as "frozen" when it is acquired at the time of the error and is maintained over time. The instrument asks the control units to know which parameters / states are available for reading.

After selecting the parameters that you want to display, press the PLAY button ▶ .

4.7.5 Mode $03 - Emissions Trouble Code for the Powertrain System

This menu allows you to obtain DTC (Diagnostic Trouble Code) errors stored by the control unit.

If the DTCs listed are standard (not dependent on the manufacturer), the corresponding description is also displayed.

> ℹ️ *The Trouble Codes not EOBD can be viewed but they couldn't be translated.*

Figure 81: DTC Mode $03 Trouble Codes List

To activate the continuous reading of the values, check the box "Repeat the reading of values cyclically".

4.7.6 Mode $04 - Emissions Clearing diagnosis information

This menu if is on "ACTIVE mode": it allows to clear errors stored by the EOBD system. The vehicle control units respond to this service with ignition key ON and engine off.
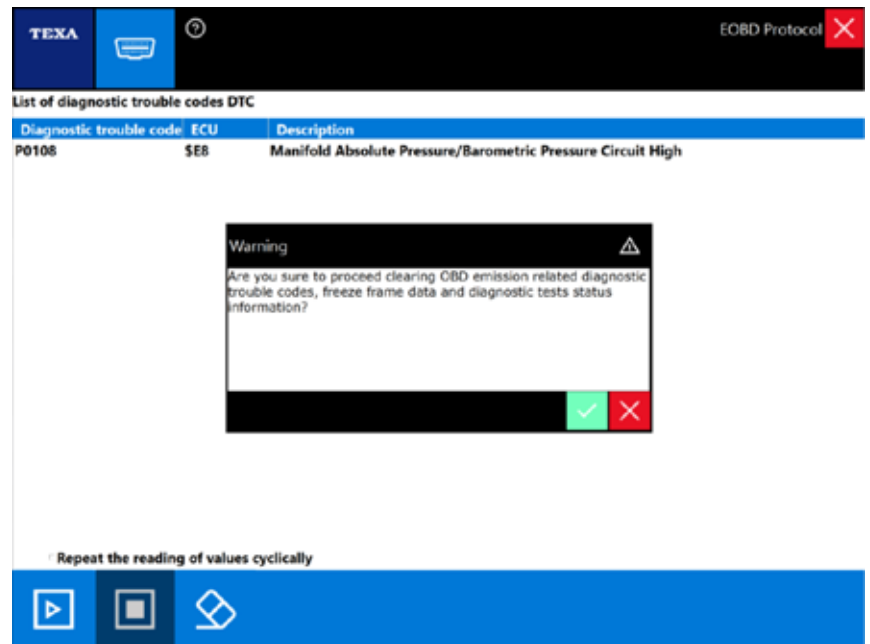

Figure 82: Mode $04, Clearing DTCs

> ℹ️ *RESET Button allows to erase also the DTCs not displayed in this page.*

> ℹ️ *The Trouble Codes NOT EOBD can be viewed but they couldn't be translated.*

4.7.7 Mode $05 - Lambda Sensors Test Result

This function if is on "ACTIVE mode": it allows you to see the results of the LAMBDA test probes.

4.7.8 Mode $06 - Results of the on-board test for systems NOT constantly monitored

This function if is on "ACTIVE mode": it allows to display in addition to the results of the LAMBDA test probes, as well as the results of the on-board control tests for components or systems that are not monitored on a continuous basis Such as EGR valve, Evaporation system, etc.
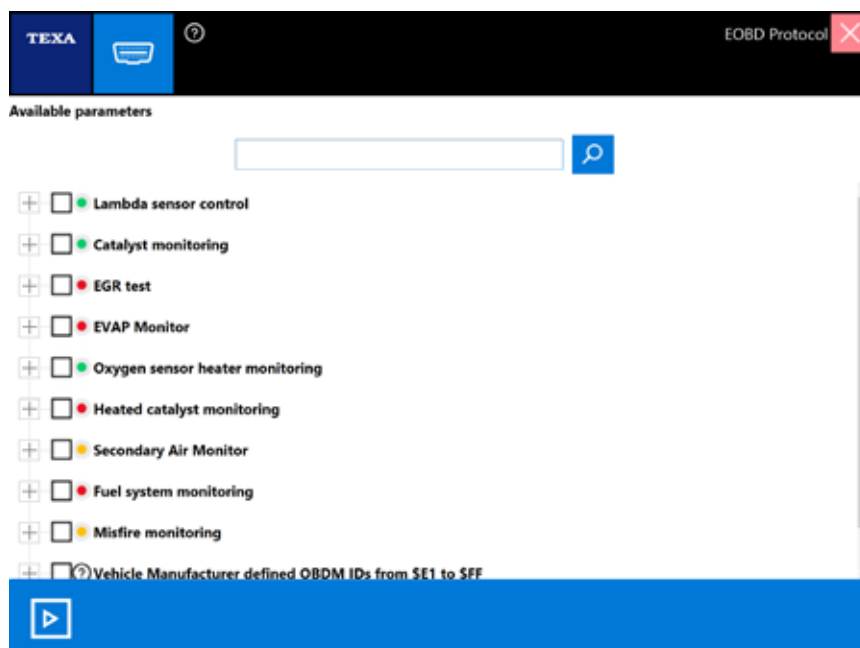
Figure 83: Mode $06, Selecting Parameters

Figure 84: Mode $06, Parameters evaluation

4.7.9 Mode $07 - Results of the on-board test for systems constantly monitored

Displays the DTCs that have not yet triggered the MIL light ON.

Figure 85: Mode $07, DTCs List

4.7.10 Mode $08 - On Board System Check, Device Test

It allows you to run TESTs to control the operation of a given component.
It can be compared to the "ACTIVATIONS" page of conventional self-diagnosis.
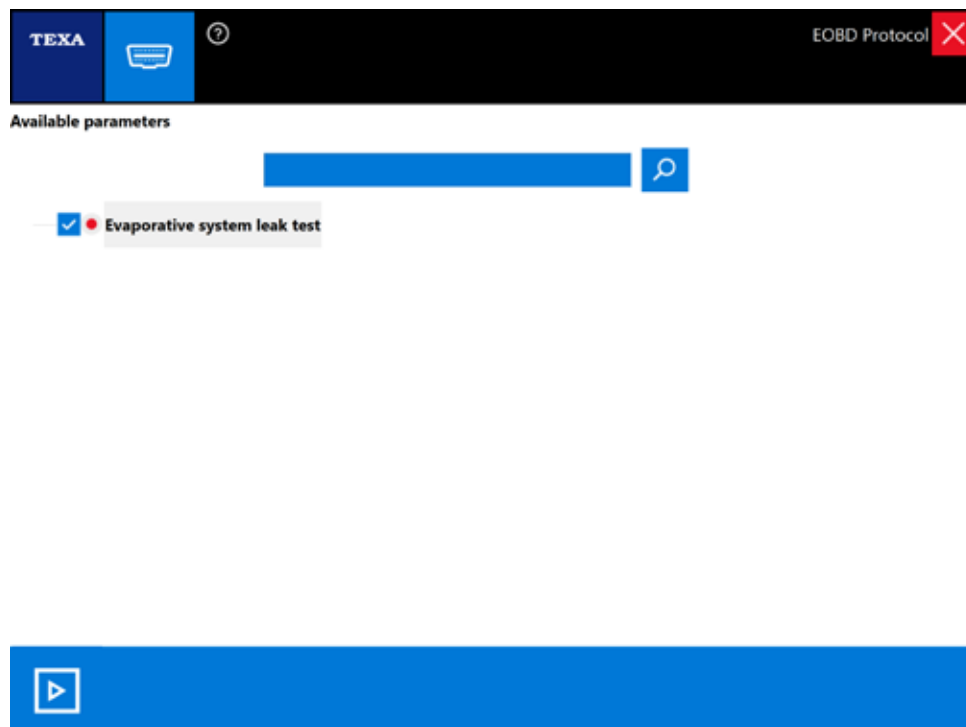

Figure 86: Mode $08

ℹ️ *This Service è ACTIVE according to the Manufacturer choice.*

4.7.11 Modo $09 - Request Vehicle Information

This function if is on "ACTIVE mode": it allows you to view vehicle specific information such as Vehicle Identification Number (VIN) number, CALID (calibration identification number, Software version installed on the control unit), etc.
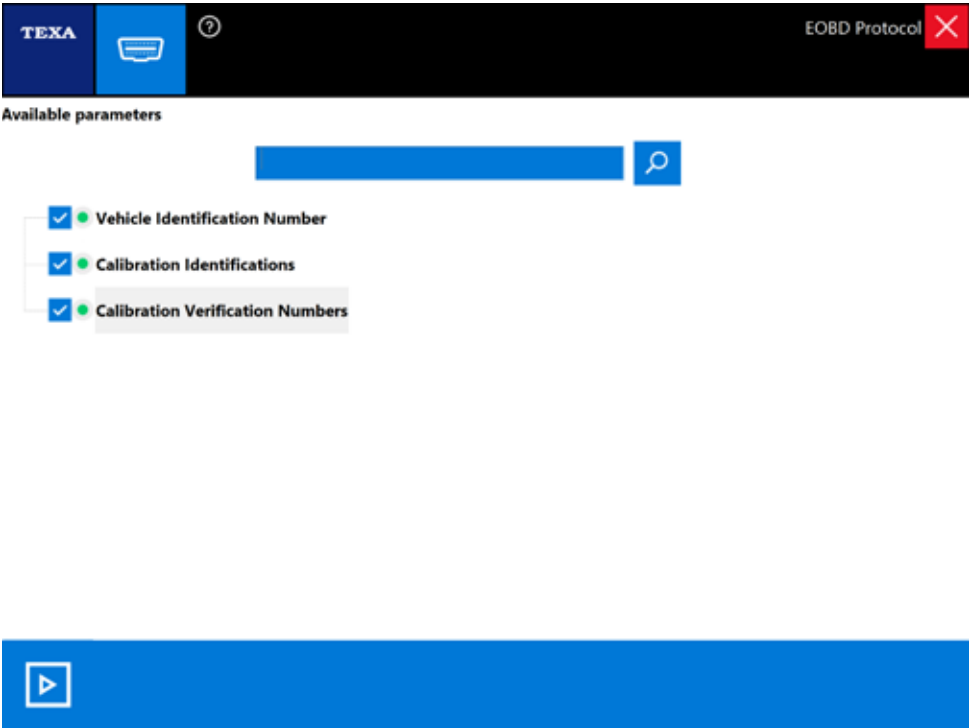
Figure 87: Mode $09, Available Parameters

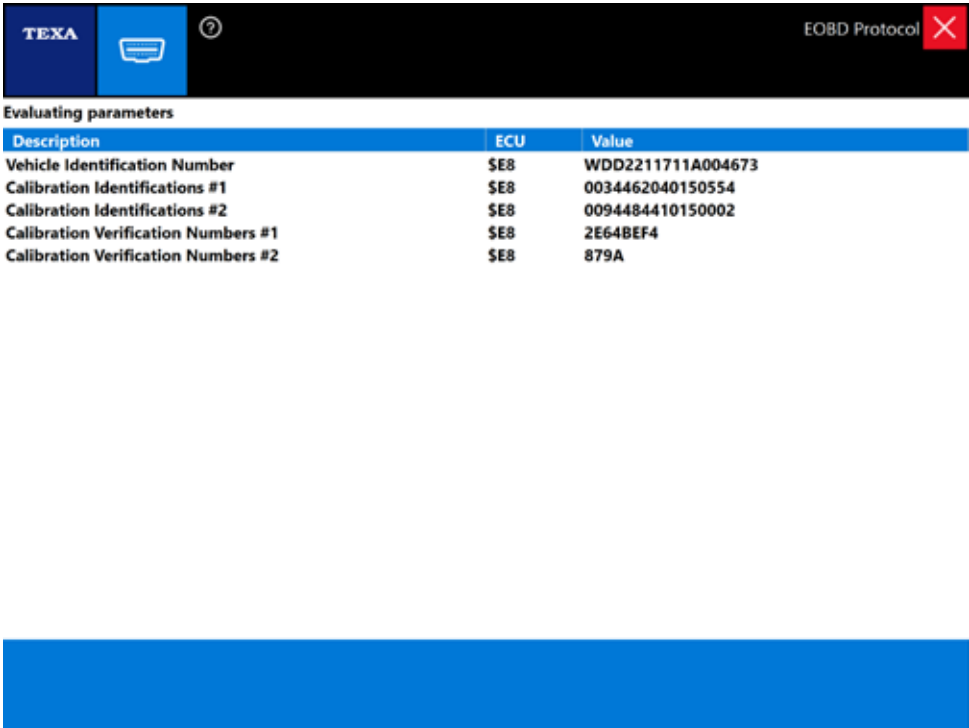| Description	ECU	Value
Vehicle Identification Number	$E8	WDD2211711A004673
Calibration Identifications #1	$E8	0034462040150554
Calibration Identifications #2	$E8	0094484410150002
Calibration Verification Numbers #1	$E8	2E64BEF4
Calibration Verification Numbers #2	$E8	879A

Figure 88: Mode $09, Parameters Evaluation

5. DIAGNOSIS PROCEDURES – STUDY CASES

5.1 Toyota Yaris: poor engine power[3]

Figure 89

Vehicle: Toyota Yaris gasoline 1.3 model NCP 10 (engine version 2NZ-FE), A / T gearbox.
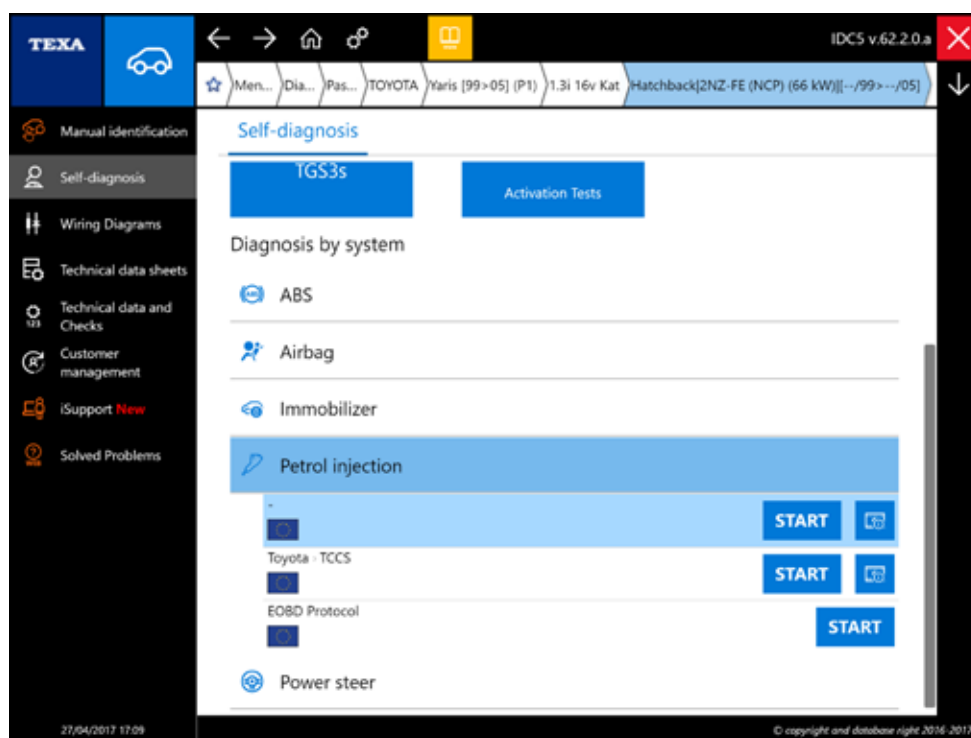**Customer's complaint:** the engine lacks power and often has hesitations.

Figure 90: Self-Diagnosis, Model selecting

5.1.1 Fault Finding Precedure

Preliminary Checks: Check if any lights on the vehicle are lit up without any special problems.
The symptoms are described by the customer. There is a lack of power in acceleration and irregular engine operation. Through the self-diagnosis you enter the diagnosis with the petrol injection control unit by finding the active error: **"OCV Circuit (bank 1) (ATT)"**
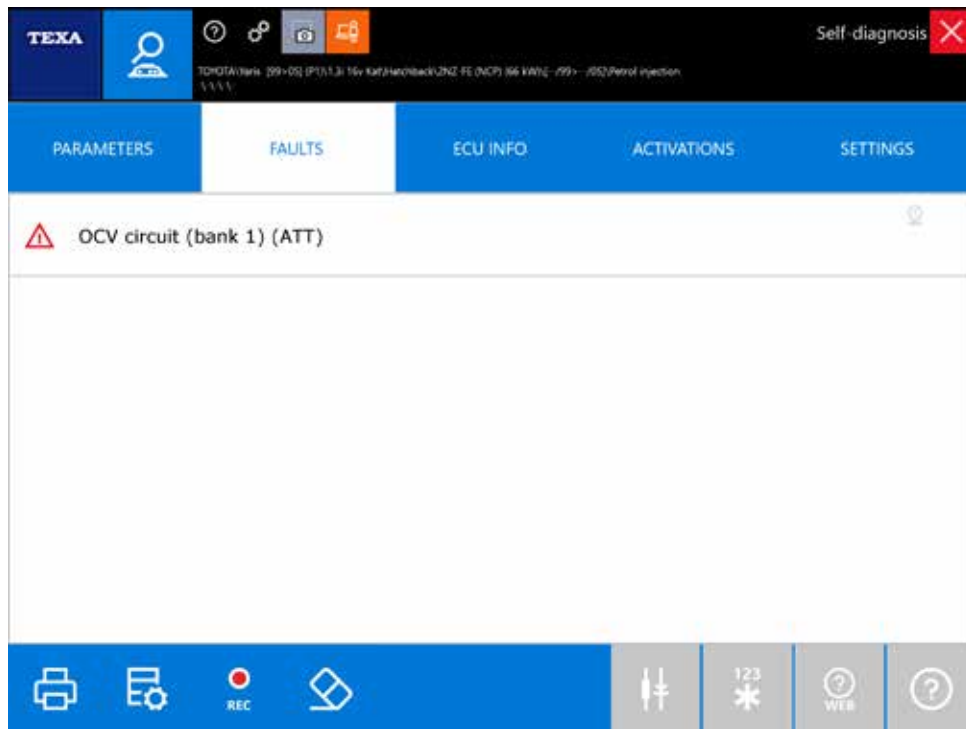

Figure 91: Example of stored DTC in Engine ECU

The fault search is started and the VVT timing system OCV valve is removed.

5.1.2 System Description

The VVT system controls the correct timing of the intake valves according to the different driving conditions.
The petrol injection control unit controls the OCV (Oil Control Valve) solenoid valve through a duty-cycle signal that changes the oil pressure inside the VVT controller, which in turn changes its position between the camshaft and the crankshaft.
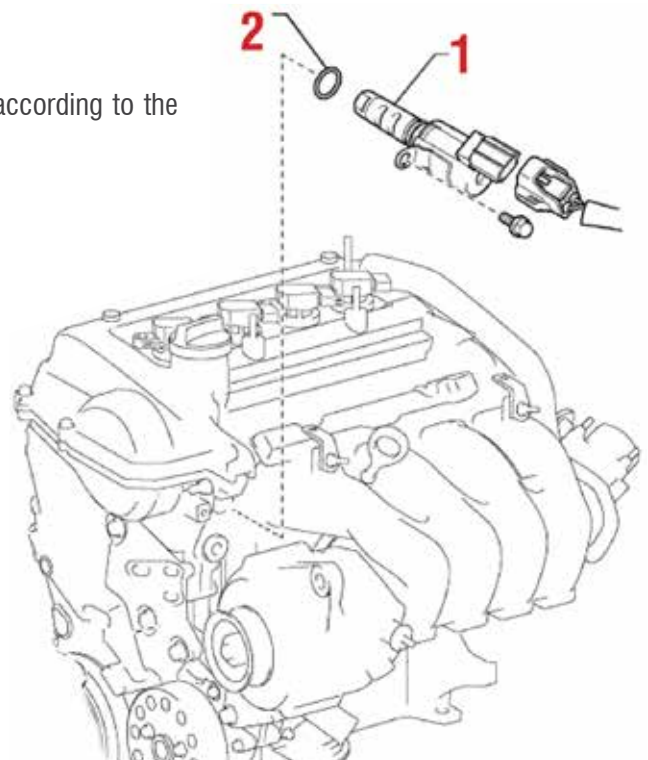
Legend:
1) OCV solenoid Valve
2) O-ring seal

Figure 92: OCV Solenoid Valve location

Legend:
1) Oil Control Valve
2) ECM

Figure 93: Electrical Connections OCV Valve

5.1.3 Fault Resolution

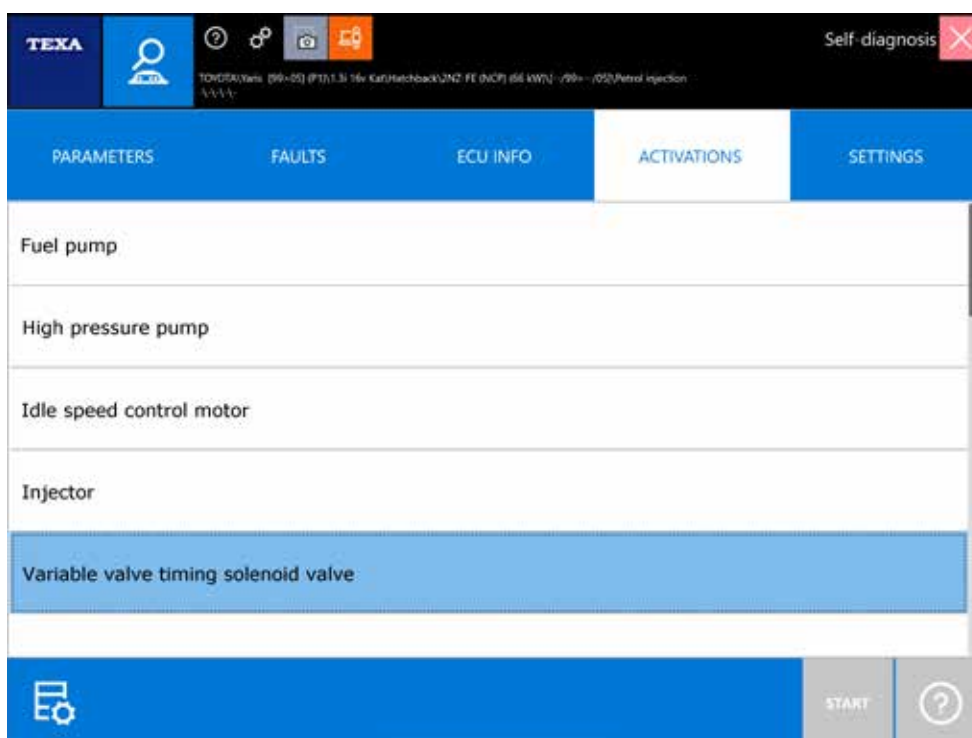The panel lights up and the valve is activated. No noise changes are noticeable.

Figure 94: Variable valve timing solenoid valve

We can check the signal that controls the valve using the UNIPROBE oscilloscope; the result should be similar to the one shown in the figure.
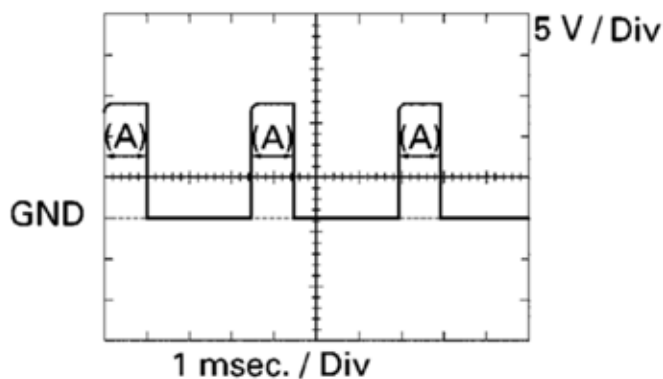

Figure 95: Example of the OCV Solenoid valve signal

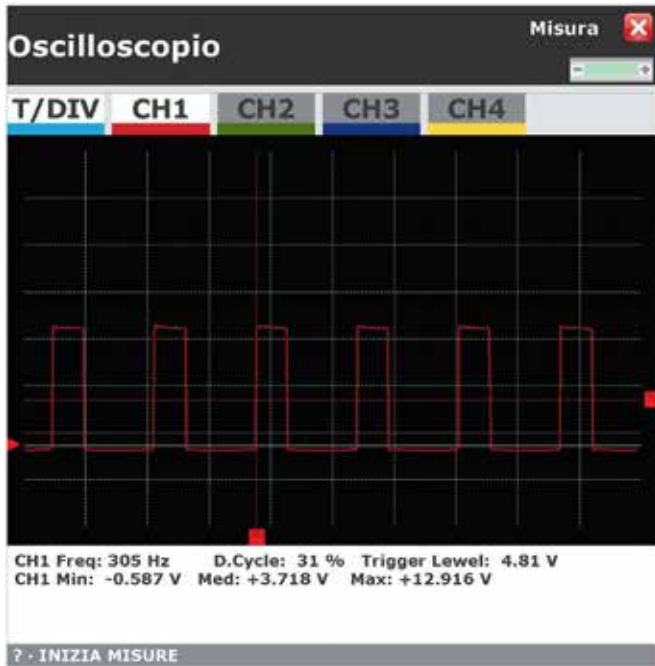*Figure 96: Oscilloscope settings on the OCV Solenoid Valve*

Figure 97: OCV Solenoid Valve command signal. T/DIV: 2 ms, V/DIV: 5V. Duty-Cycle del 31%.

The obtained signal appears to be correct and then you are sure the control unit correctly managing the valve. It therefore suggests that the problem is of a mechanical nature.

To control the operation of the internal actuator, the valve is removed and is then fed directly by the battery with two cables. If it is working properly, you must move the internal actuator.

Figure 98: OCV valve disassembled and connected directly to the power supply 12 V

The actuator, although directly powered, does not move. It shows that the valve is definitely broken and it will need to be replaced. There is no need for adaptations and / or encodings through self-diagnosis to restore the operation.

5.2 Fiat Panda: Power Steering Malfunction

Figure 99

Vehicle: Fiat Panda 1.3 Multijet, registered: 14/02/2006, engine type: 188 A 8000, 51 kw.

Customer's complaint: The car has an EPS warning light (electric power steering) ON, steering is occasionally hard during the use and the City function is inactive.

5.2.1 System Description

The Power Steering (EPS) is a steering arm, which is intended to ease the steering wheel's effort, especially in low-speed steering, without making the running command too light normal.

Figure 100

The electronic unit processes the signals received by the sensors and drives the electric motor, delivering the appropriate current to obtain the desired torque. It also manages communication on CAN network and performs a continuous self-diagnosis of the system to ensure its proper operation. On CAN network manages communication with diagnostic tools. The values for the speed of the vehicle, the alternator, the City / Normal / Sport mode and the type of setting are read on the CAN line. The position and torque signals from the sensor represent the basic values with which the microprocessor processes the output data in terms of current delivered to the servomotor. The control

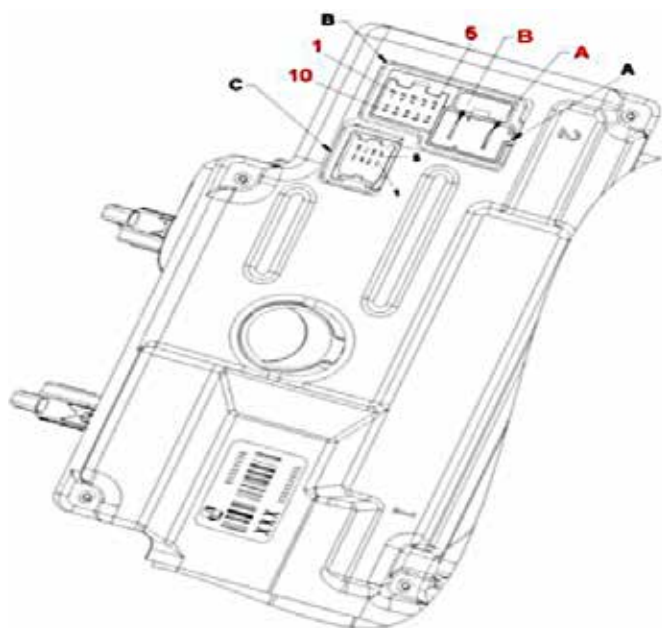unit for the control of the guide is fixed to the body of the electrode itself.

Figure 101: EPS ECU

Legend:
Connector A:
A – Battery +
B – Battery -
Connector B:
1. Ignition
2. CAN HI
3. CAN LO
4. N.C.
5. N.C.
6. N.C
7. CAN HI
8. CAN LO
9. N.C.
10. N.C.
Connector C:
1. ESP ECU Connection
2. Position Sensor 1 (P1)
3. Power Supply Key +5V
4. Torque Sensor 2 (T2)
5. N.C.
6. Torque Sensor 2 (P2)
7. Ground
8. Torque Sensor 1 (T1)
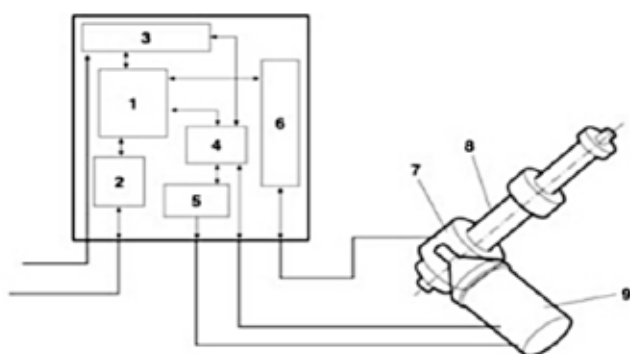
Figure 102: Electric Circuit of the System

Legend:
1. Microprocessor
2. CAN Interface
3. Power Supply Cicuit
4. Electric Motor management Circui(EBMD)
5. Power Electronc module (FET)
6. Analogic Signals Interface
7. Torque&Position Sensors
8. Servomechanism
9. Electric Motor (torque sensor included)

Servo assistance is ensured by a three-phase, synchronous electric motor with a permanent magnet rotor, which transfers the torque generated directly to a coaxial wheel and integral to the platform. The absorbed current ranges from 1 A up to 80 A in the maximum delivered torque condition.

5.2.2 Fault Finding Procedure

It starts scanning the NGE Electric Power Steering Control Unit (Electric Power Node).
The Fault Page displays the error:
  • Motor steering column torque/position sensor (State: Current).
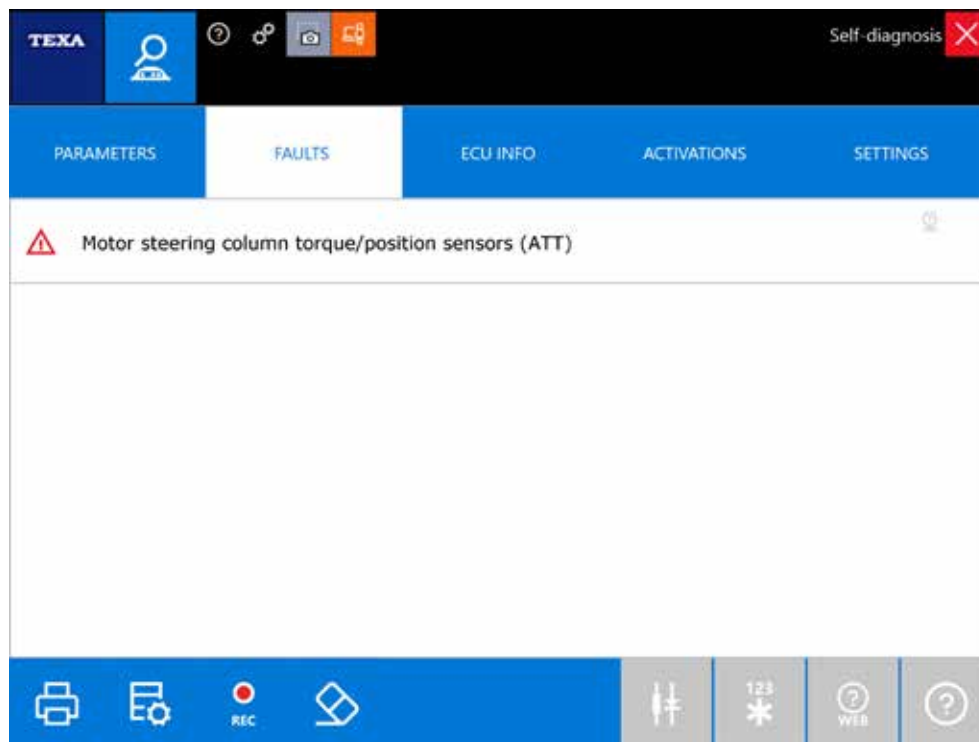

Figure 103: Faults page of Self-Diagnosis

Depending on how many DTCs we found in the ECU memory, we are going to read the parameter page where we can see the following parameters:
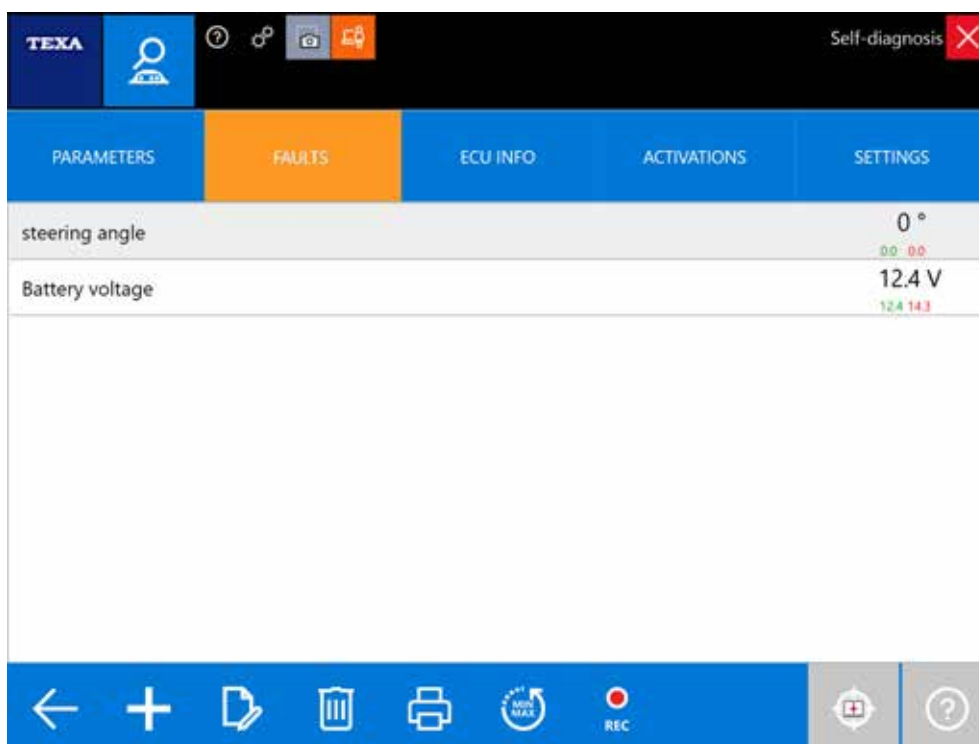

Figure 104: Available Parameters reading in the EPC ECU

From the analysis of the "steering angle" parameter it is clear that, when the steering wheel is moved, the control unit detects the variation of the steering angle.

You then proceed by diagnosing using other instruments: the oscilloscope and the multimeter.

The first check is the control with the multimeter, power supply and ground at the torque / position sensor, on pin 3 and 7 of connector C and detect the presence of 5 volts.

After defining the power supply is good, the next steep is to make sure about the signal verification through the oscilloscope on the sensor pin:

- Pin 2 Connector C position signal 1
- Pin 6 Connector C position signal 2
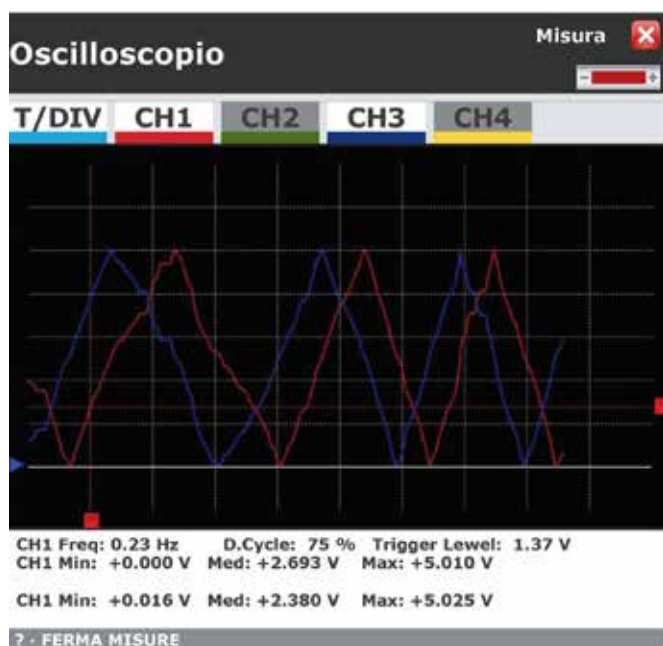
Figure 105: Position sensor, signals. T/DIV: 2s, V/DIV:1 V

From the analysis of the two position signals, the position sensor works perfectly.

We check the torque sensor signal:

- Pin 4 Connector C torque signal 2
- Pin 8 Connector C torque signal 1

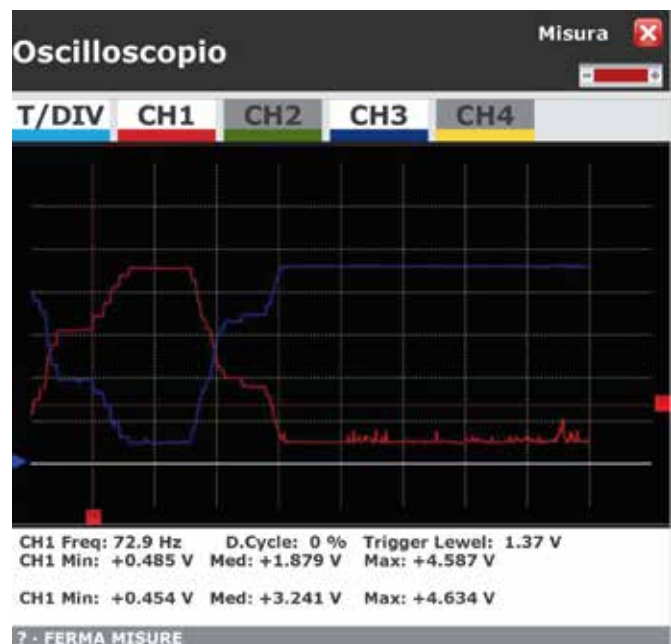*Figure 106: Torque sensor signals. T/DIV: 1s, V/DIV: 1V*

From the analysis of the two pair signals, there is a significant disturbance on the torque sensor.

Depending on the fault in self-diagnosis and the test performed with the oscilloscope, it can be hypothesized with certainty that the problem lies in the Pair / Position sensor.
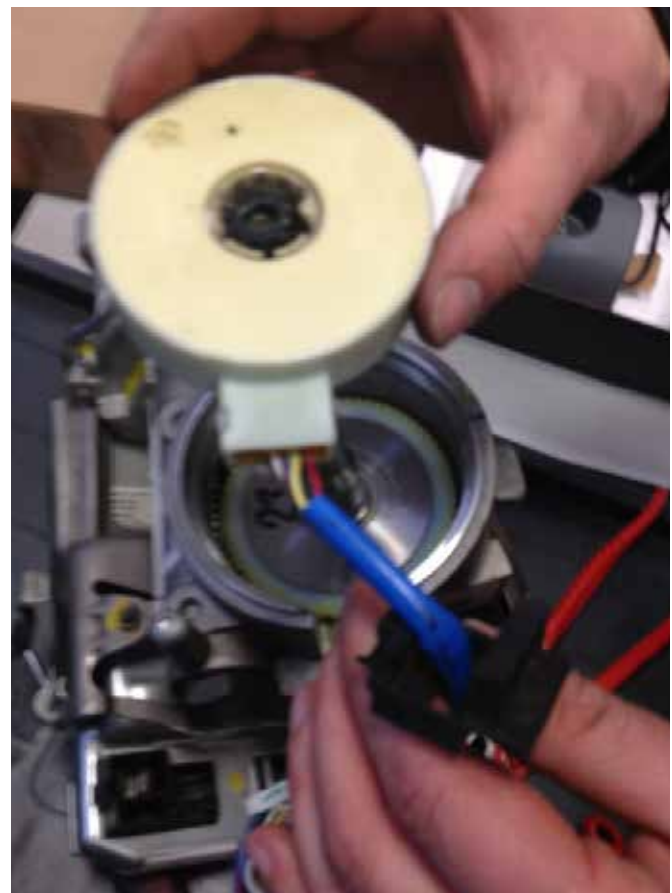

Figure 107: Torque Sensor in the EPS assembly

Figure 108: Angle Steering sensor. Point "0" detail useful for the centre setting of the sensor.

5.2.3 Fault Resolution

Since the torque sensor is not supplied by Fiat as a single replacement, it is necessary to replace the entire EPS group. This spare part is available on the market both as original and commercial revised spare parts.

It is well known that in the After Market are available individual torque sensors, but, in agreement with the motherboard, we do not recommend replacing the single component without certifying its proper installation. Any mounting defects could cause an abnormal operation of the EPS by affecting the safety of the vehicle.

The replacement procedure is quite simple, starting with the disassembly of the steering column, taking care to position the right wheels and to mark the position of the steering wheel.

Figure 109: Disassembling procedure of the EPS assembly

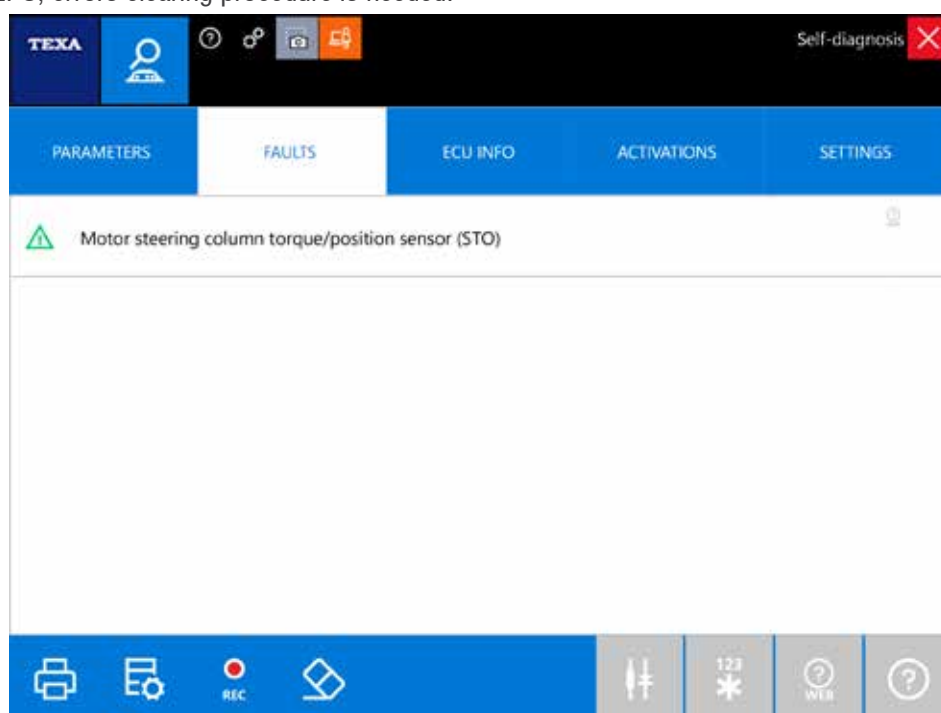After installing the EPS, errors clearing procedure is needed.

Figure 110: DTC clearing

After the DTC clearing procedure, it is required to switch to Setting page in order to perform the calibration of the sensor.
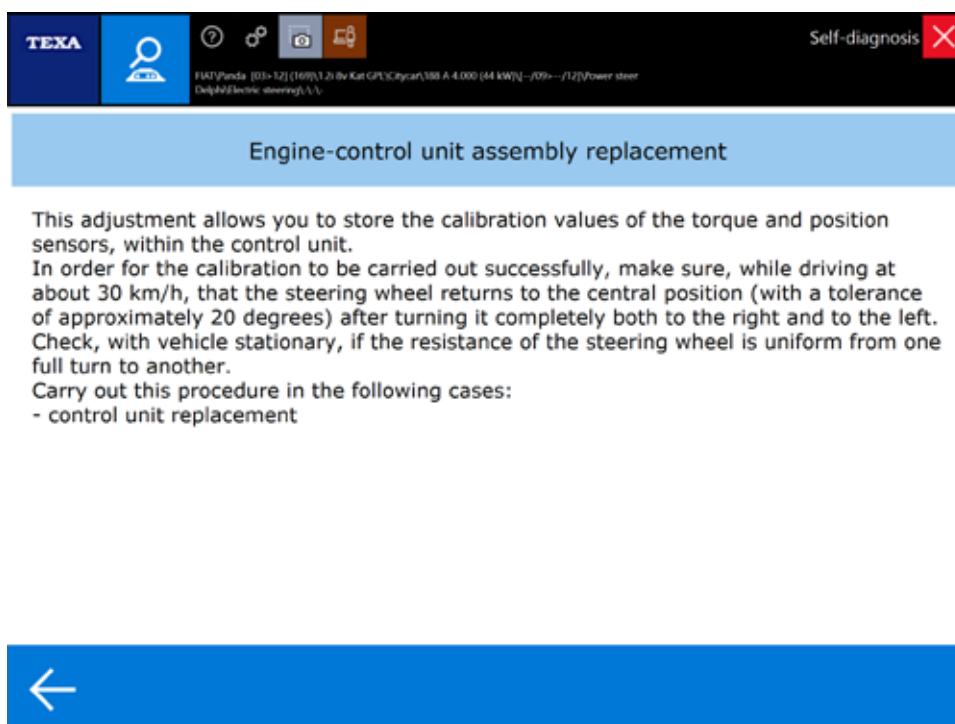
Figure 111: Calibration mode EPS assemby

ℹ️ *ENGINE-CONTROL UNIT ASSEMBLY REPLACEMENT:*

With this setting, the calibration values of the position and torque sensors will be stored in the control unit.

In order for the calibration to be successful, at about 30 km / h, the steering wheel should return to the center position (with a 20 degree steering wheel tolerance) after having brought it to the right and left limit point.

Then, with the vehicle stationary, the uniformity of the steering heaviness from one limit point to the other must be checked.

Do this in case of an ECU Replacement

Figure 112: Settings available for the device replacement

Figure 113: For proper setting, the vehicle must be stationary, steering wheel and straight wheels, no load applied to the steering wheel

Figure 114: Self-Diagnosis, Setting Info

Figure 115

6. ENGINE: RESET AND CONFIGURATION

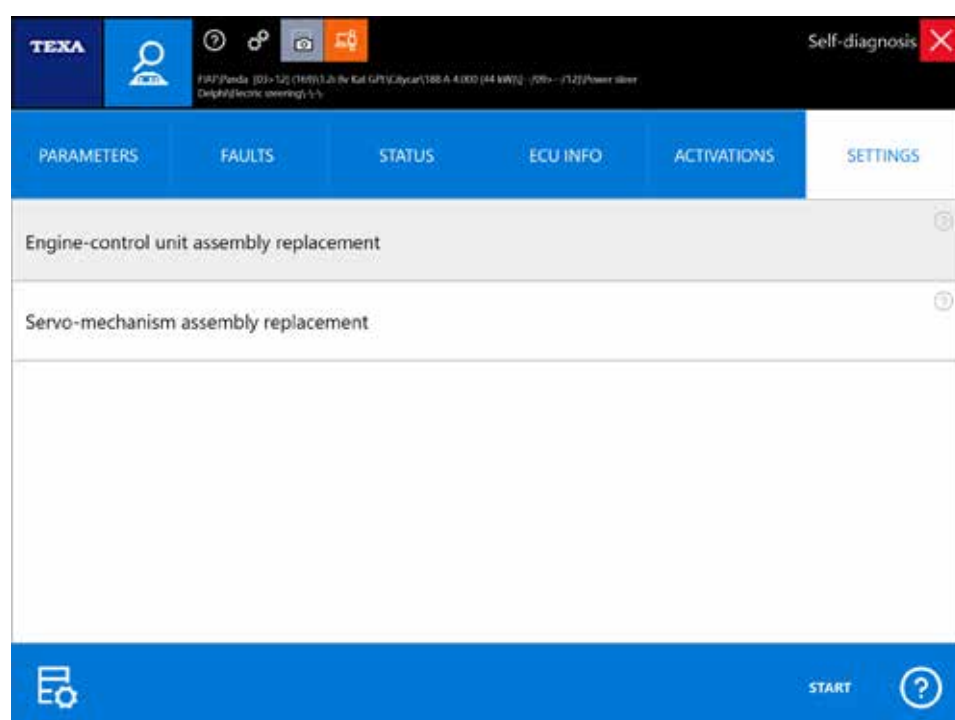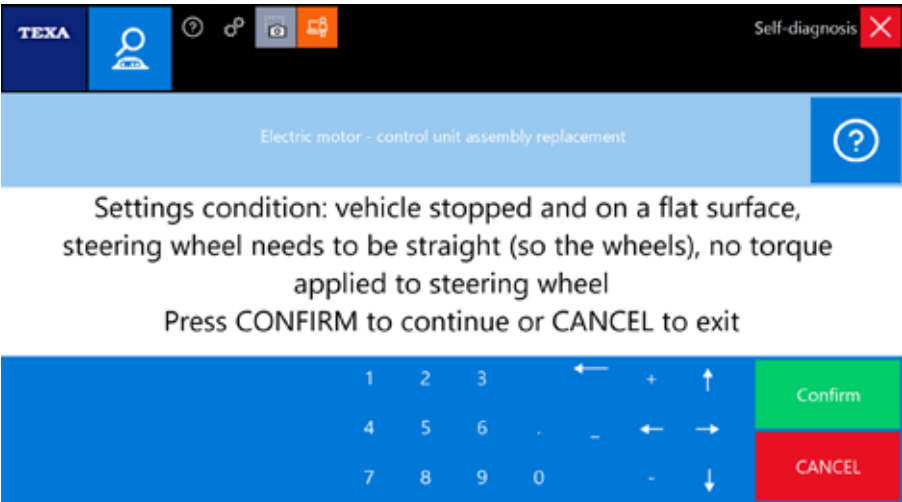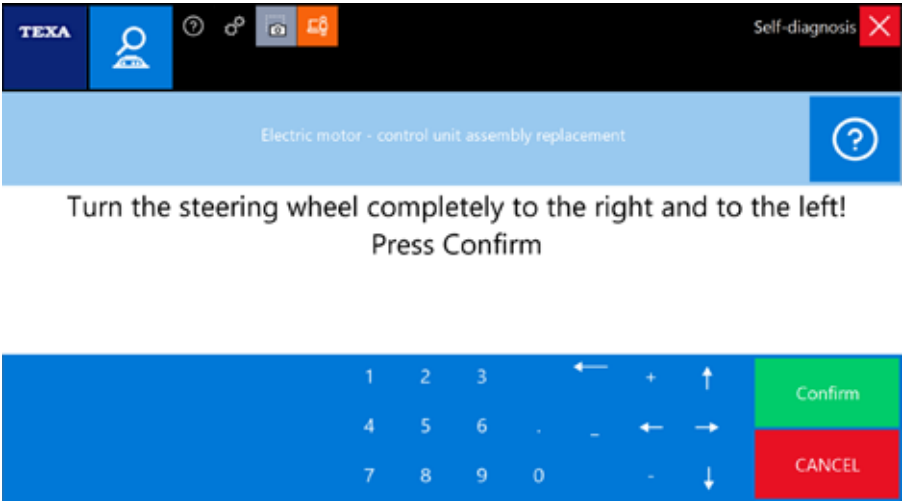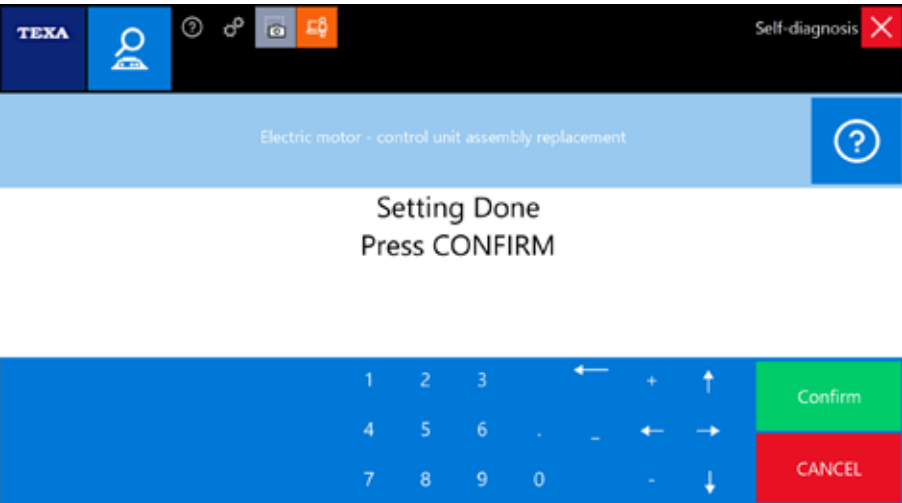## 6.1 DPF: Fiat Croma 1.9 Mj 16v (2007) – DPF Rigeneration and Oil Service

6.1.1 General

The DPF diesel particulate filter system, is mainly used in the cars manufacturers that do not adopt the PSA engine, the main difference from the FAP system is by not using any cerium oxide additive for the filter regeneration.

6.1.2 System Description

The system consists of two main components:
- Oxidizing catalyst;
- Particulate Filter.

It is centrally located on the underbody (in Euro 4 versions). With the version of the DPF system, transposed with the new Euro 5 regulations, will be shifted into the engine compartment instead of the pre-catalytic converter.
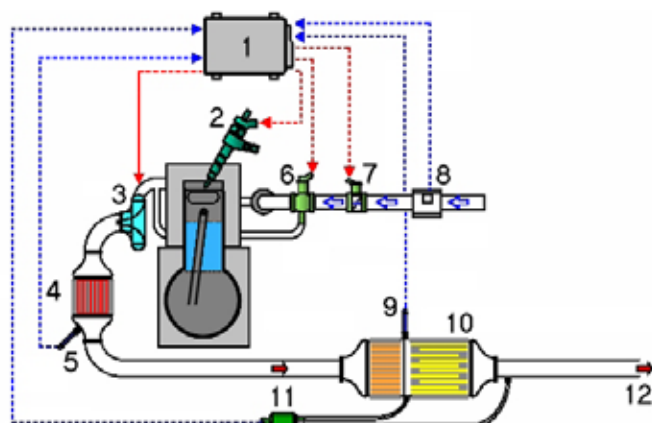The figure shows the principle of the DPF system:

Figure 116

Legend:
1. ECU engine
2. Injector (MultiJet)
3. Turbocharger
4. Pre catalyst
5. Temperature sensor (TOP)
6. EGR valve
7. Motorized butterfly
8. Air flow meter
9. Temperature sensor (BOTTOM)
10. DPF particulate filter
11. Differential Pressure Sensor
12. Exaust

6.1.3 System Operation

The DPF system bases its operation on MultiJet technology to raise the exhaust gas temperature.
In fact, thanks to a post injection, made possible by this system, no additive is needed, which in addition to being a chemical dangerous to human health, is also expensive. On the other hand, precisely because of the many post-injection at regeneration request, part of the injected diesel fuel drains the oil cup by diluting and contaminating engine oil.

> ℹ️ *The engine oil contamination (dilution) is directly connected to the number of failed or missing regenerations, and therefore the driver's driving style. A massive number of "city" driving style cycles will increase the chance of getting a DPF completely clogged. Consequently, the oil change will also be very small.*

During the normal vehicle operation, exhausted gases, due to combustion, pass through the porous walls of the filter, trapping and retaining the particulate in solid form inside, allowing the gas part to be ejected from the discharge.
The engine control unit, by means of a differential pressure sensor, measures the upstream pressure and downstream of the filter and obtains a counterweight, which is important to calculate the "degree of particulate filter clogging" (expressed as a percentage) visible in diagnosis.
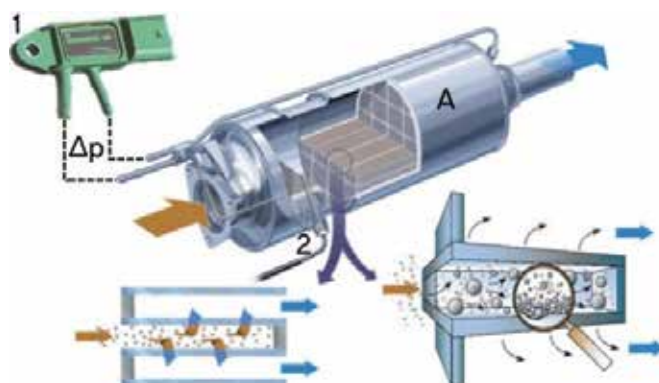

Figure 117

Legend
1) Pressure Differential Sensor
A) Temperature Sensor
B) DPF Filter

When the clogging value exceeds the threshold value mapped in the engine control unit and the temperature sensor measures a sufficient value for regeneration, the ECM proceeds to implement the various strategies necessary to regenerate the filter and burn the PM.

The filter regeneration can be of 2 types:

1. Spontaneous: The process is handled autonomously by the engine control unit during the normal road operations, with a series of actions in order to increase the exhaust gas temperature to burn particulate trapped in the filter (see paragraph "Spontaneous Regeneration");

2. Forced: The process is activated during a maintenance operation, then started not by the engine control unit, but by an operator using the TEXA diagnostic tool (see paragraph "Forced Regeneration").

6.1.4 Minimum Requirements and Strategies for Regeneration

When the ECM detects that the filter clogged degree has exceeded the set threshold value, it is verifying that the minimum conditions are met to implement and manage the strategies required for good regeneration.

These conditions are:

- Engine running at a temperature > 75 ° C;
- Vehicle speeds exceeding 40 km/h for at least 15 consecutive minutes.

Figure 118

> **i** *Only once you check the minimum conditions, the ECM can implement the various strategies to raise the exhaust gas temperature. These conditions must remain for the duration of regeneration.*

To achieve regeneration of the filter, the ECM must bring the exhaust gases at the DPF input to a temperature greater than 580 ° C, with an O2 content of more than 5%

- **EGR Clousure:** During each regeneration, the engine control unit may decide to implement two different control and control strategies on the EGR solenoid valve

Figure 119: EGR Valve

   o EGR closed: when it is necessary to keep the exhaust gas temperature high.

   o EGR slightly open: in this case recycled gases make the air / fuel mixture greener (less oxygen), consequently the exhaust gases are warmer, allowing the post injections to be reduced.

- **Turbocharger Pressure Adjustment:** The engine management in order to maintain the engine torque stable, will be modifying the Turbo pressure through variable geometry mechanism.

Figure 120: Turbocharger

- **Injection:** The engine control unit, by means of a very delayed injector command, called post injecting, allows to introduce into the non-burning diesel fuel cylinder but which will be expelled together with the exhaust gases, only burning in the particulate filter due to high temperatures at Its interior.

Figure 121: High Pressure Fuel System

ℹ️ *At constant engine speed and constant engine load, post injection would result in an increase in engine torque. Therefore, in order to maintain constant the driving conditions, engine management proceeds as follows:*
- *Reduces fuel flow during main injection (MAIN);*
- *Adjusts the overrun pressure.*

ℹ️ *The "Spontaneous Regeneration"process, therefore the strategies just described, are managed in a completely independent way by the ECM, averaging every 800/1000 km, but can also reach 400 km intervals for the use of particularly heavy vehicles.*
The regeneration process lasts between 8 and 15 minutes, depending on the type of car and the clogging level of the filter.
In any case, the distance between a regeneration and the next depends on the operating conditions and use of the vehicle.
If the driver's driving conditions do not allow regeneration, the ECM, by means of advices on the instrument panel, persuade the driver to maintain the driving that will allow the driver to achieve the useful conditions for the filter to regenerate (40 km / h for at least 15 minutes).

⚠️ **Once spontaneous regeneration has begun, driving conditions must be maintained for as long as necessary for cleaning, as a result of the process interruption (eg when it stops at a traffic light or drops below 40 Km / h regeneration is interrupted).**
In this case obviously, the filter regeneration cycle can not be completed, continuinag (and getting worse) to clog the filter and "polluting" the engine oil.

ℹ️ *The oil replacement interval exits the programmed maintenance plan and becomes flexible (15000 km - 50000 km). The driver is alerted about the oil change need by flashing the "oil light", with a message of replacing it within the next 1000km.*
Self-Diagnosis will be indicating the clogging percentage of the filter is defined as "Particulate filter clogging degree".

6.1.5 Managing of the Malfunction lights

The DPF light (depending on the set, can be replaced by a message on the central display of the instrument panel) is handled by the ECM based on the broken regeneration counter. When this counter reaches 5, the DPF indicator lights up to alert the driver that the DPF system is loaded beyond the threshold and therefore requires a road cycle that will allow a regeneration.

Figure 122: DPF light

Although there is still no recovery strategy in this condition to limit the vehicle performance and no error codes stored in the ECM, if the driver continued to fail to meet regenerative drive conditions, the filter would continue to load.

ℹ️ *As long as the regeneration process is not completed, the DPF light will remain ON.*

Until the vehicle is used without performing the regeneration till the end, the filter is charged until a second clogging threshold is reached, the ECM will command the MIL indicator to turn on, indicating that the system absolutely needs a regeneration.
In this case, the P1206 error will be recorded in the ECM along with a recovery strategy that provides a slight performance limitation to safeguard the engine.

Figure 123: MIL light

ℹ️ *To limit performance, the control unit inhibits the turbine operation.*
In this mode, the system continues, if in condition, to handle the possibility of spontaneous regeneration.

If the driver, despite the reports, does not allow a useful regeneration cycle to accumulate particulates beyond the last particulate pollution alarm threshold, the P2002 code is also recorded in the error memory.

At this point, the recovery strategy will be activated limiting the performance of the engine aimed to avoid the damage of the engine system.

> ⚠️ **When the P2002 code is registered in the control unit, the engine and exhaust system are at risk. At this storage threshold, regeneration is no longer managed by the ECM. From now on, only a forced regeneration of the filter will be possible through the diagnostic tool.**

> ℹ️ *Before starting the forced regeneration process, it is recommended to check that the oil level is between min and max. During the procedure DO NOT place the vehicle on potentially flammable surfaces (eg grass, plastic, etc.).*

Malfunction Lights	Meaning
DPF light ON	Indicates to the driver that the system needs regeneration and it is necessary to maintain a driving cycle that allows the system to regenerate (V> 40 km / h for at least 15 minutes).
Engine malfunction light (MIL) - Malfunction indicator ON and the DTC P1206 will be stored (I ° level) in the engine control unit memory	Informs the customer that the system requires forced regeneration, triggered by a diagnostic tool due to the clogged DPF filter. Under these conditions, the engine control unit implements a "recovery" security strategy, with a slight engine performance limitation.
Engine failure light (MIL) ON and the DTC P2002 will be stored (2nd level) in the engine control unit memory.	Informing the customer that the system requires forced regeneration, triggered by a diagnostic tool because of the filter is overly clogged and will likely need to be replaced. Under these conditions, the engine control unit implements a "recovery" strategy, implementing a heavy performance limitation to avoid damaging the engine.

Table 12

6.1.6 DPF Filter, Forced Rigeneration Process

Being a process that brings the engine under heavy mechanical stresses, forced regeneration should only be used when the MIL light is on and errors P1206 and P2002 are recorded.

Before starting forced regeneration, make sure that:

- Engine oil level between minimum and maximum (a level too close to the maximum could indicate a diluted oil with diesel fuel that might not provide good lubrication);
- Vehicle outside the workshop and exterior cleaning of the exhaust pipe;
- Removing the gas extraction grip from the vehicle's exhaust pipe;
- Car on a non-asphalted yard;
- The cooling temperature is above 90 ° C;
- The fuel tank should be at least 1/4 full.

> **ℹ** *Because of the heat released during the regeneration operation, it is advisable to start the procedure in a ventilated place. Do not operate on accelerator, clutch and brake pedals during the forced regeneration procedure. Their use will interrupt the procedure.*

Legend:
1) Start engine and wait for tH2O> 90 ° c
2) Command for forced regeneration
3) 3500 rpm engine speed - Electric Steam on (for about 5 minutes)
4) Regeneration Result

Figure 124: Operation sequence for forced regeneration

6.1.7 Diagnosis

Parameter	UM	Description
Differential Pressure Sensor	Bar	Lists the differential pressure between the input and output of the DPF Filter
Degree of particulate filter clogging	%	Lists the value, expressed as a percentage (%) calculated by the ECM, of the particulate mass, trapped in the filter.
Pre-catalyst temperature	°C	Lists the exhaust gas temperature detected by the output sensor on the pre catalyst.
DPF filter Temperature	°C	Lists the exhaust gas temperature detected by the sensor at the particulate filter inlet.
Average of the last 5 regenerations	km	Lists the distance the vehicle has traveled between one DPF regeneration and the other.
Average of the last 5 regenerations	sec	Lists the time the vehicle has traveled between one DPF regeneration and the other
Average of the last 5 regenerations	°C	Lists the average temperature of the last 5 DPF regeneration
Kilometers from last regeneration (Km)	km	Lists the kilometers traveled since the last regeneration (spontaneous or forced) performed. This value is set to 0 Km at the end of each successfully completed regeneration (or after performing the "Replacement of the particulate filter" regulation). If the engine control unit is replaced, this parameter assumes the same value as the "Last ECU Odometer Parameters" parameter.
Replacing the particulate filter	km	Lists the Km value that has been reached since the last part of the particulate filter was replaced. With the "Particle Filter Replacement" procedure, this parameter is set to 0 Km.

Table 13

> **ℹ** *If the engine control unit is replaced, the parameter is updated with the same value as the "Last ECU Odometer Replacement" parameter.*

Status	Description	Available Status
Diesel Particulate Filter	Lists the current DPF status	Regeneration not ended
		Fault
		Not clogged
		DPF OK
		DPF Clogged

Table 14

Setting	Description	When do it
Engine Oil Replacement (only for vehicles with DPF)	The engine oil replacement interval no longer depends on the scheduled maintenance of the vehicle, but on the number of regeneration cycles made by the DPF filter and the distance in km. By performing this setting, the blinking engine oil lamp is switched off and the counters used by the ECM are reset to calculate the end of the engine oil life	When the oil light flashes, it means that the Oil Life function has calculated that the oil quality has expired. In this case, after replacing the engine oil, you must perform this setting to reset the service and turn off the light
Diesel particulate filter replacement	This setting should be made only if the particle filter is effectively replaced. This setting resets all the parameters related to the DPF filter.	After Diesel Particulate Filter Replacement
Diesel Particualte Filter Regeneration	Regeneration of the particulate filter must be performed in the event of: • Engine failure (MIL) ON and the DTC P1206 stored (1st level) in the engine management control memory. This warning tells the customer that the DPF system requires forced regeneration, done by a diagnostic tool, because of the clogged DPF filter. Under these conditions, the engine management unit goes in the "recovery" strategy, with a cut of the engine performance. • Engine light MIL ON and the DTC P2002 (2nd level) is stored in the memory of the engine control unit. This warning tells the customer that the DPF system requires a forced regeneration attempt, implemented through the diagnostic tool, because of the excessively clogged DPF filter. It is likely a necessary replacement. Under these conditions, the engine management control unit has a "recovery" strategy, limiting heavily engine performance.	Diesel Particulate Regeration

Table 15

6.1.8 Service Oil (Oil Replacement)

Using the post injections strategy to allow the regeneration of the DPF filter, it causes the side effect of the dilution of the oil in the cup.

To ensure quality control there is no oil quality sensor as in other vehicles, but an ECM-based algorithm called Oil Life that bases its operation on 2 counters. One counts the kilometers traveled by the vehicle from 50.0000 km, while the second is the percentage of regenerations made from 100%.

The two counters are to climb and the first to zero causes the ignition and warning to change the engine oil through the "flashing of the oil warning light" on the instrument panel.

> **i** *If the oil light is flashing, it is important to change the oil within the next 1000 km to avoid an engine damage.*

ENGINE OIL AND MESSAGE & LIGHT RESET

IN GENERAL

When the engine oil flashes, it means that the OIL LIFE function has caused poor engine oil quality. After replacing it, it is always necessary to reset the service because the warning light stops flashing.

Through this reset, the 2 counters will be also reset for the oil quality counter.

Figure 125

WHEN DO IT

When the engine oil light flashes.

PROCEDURE EXECUTION

For the Service reset it is necessary use the TEXA Diagnostic Tool:

1. Select the vehicle:
2. Select the MENU – Vehicle Service → Quick Service;
3. Select the Oil Replacement setting (only for the vehicles with the DPF).

The TEXA diagnostic will be connecting automatically with the ECU in order to perform the selected function.
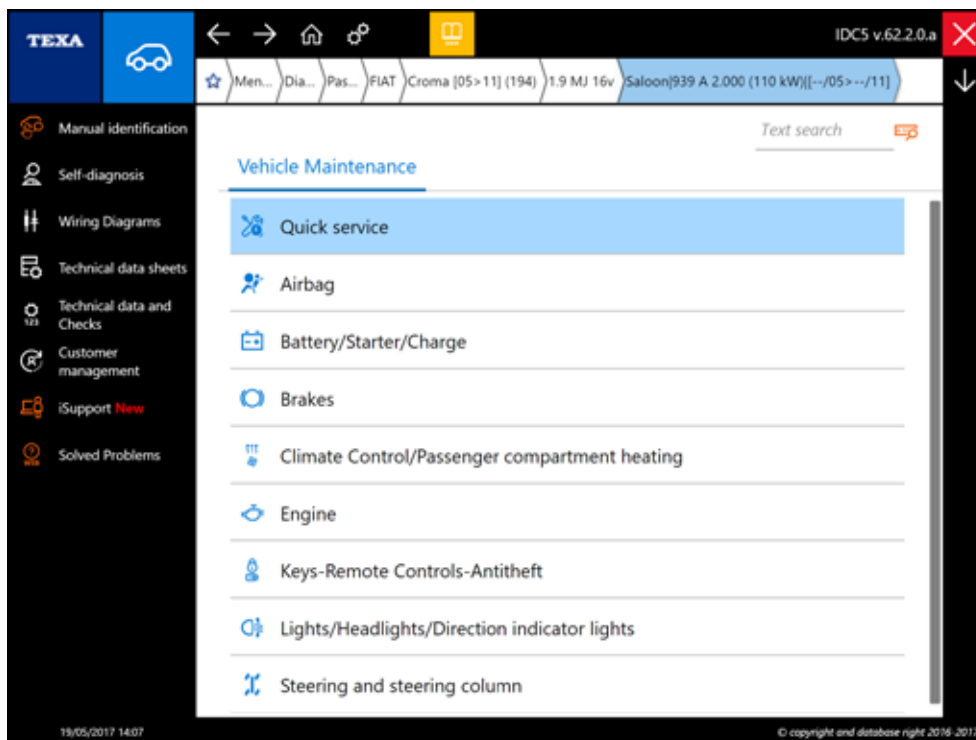
Figure 126

ℹ️ *After replacing or reprogramming the engine control unit, the engine oil must also be replaced as the engine control unit resets the two counters.*

ENGINE OIL REPLACEMENT AND MESSAGE/LIGHT RESET AFTER THE EXPIRED SERVICE

IN GENERAL

If replacement of the oil is due to the cut-off time, it is important to remember that the reset to be performed only with the diagnostic tool are 2.

In this case, the oil warning light will not flashing , but the "English wrench" icon will be displayed to indicate the need to perform the cutting.

Figure 127: A) indicatore di "tagliando scaduto"
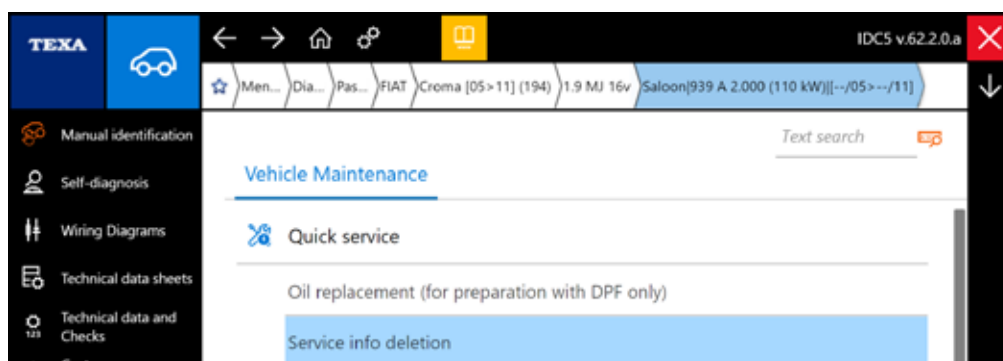
WHEN DO IT

When the Service is expired .

PROCEDURE EXECUTION

Figure 128: Service Reset from the Instrument Cluster ECU
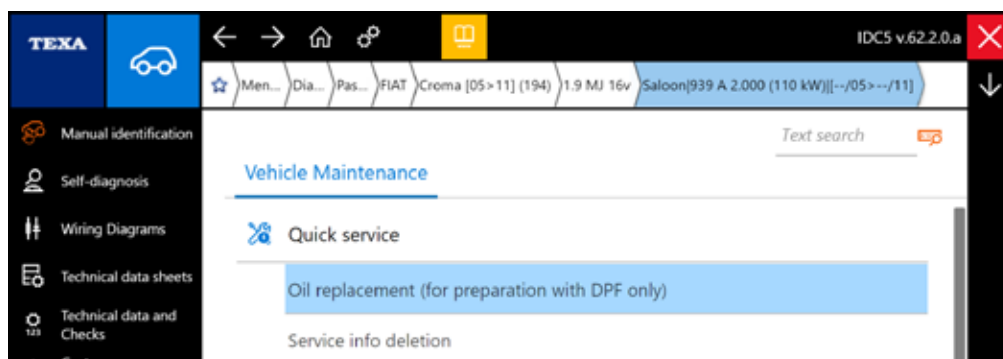
Figure 129: Reset Oil Service in the IPC

1. Select the vehicle:
2. Select the MENU – Vehicle Service → Quick Service;
3. Select: Reset service information
4. Select the Oil Replacement setting (for preparation with DPF only).

The TEXA diagnostic will be connecting automatically with the ECU in order to perform the selected function.

6.2 Additive Level Restoration (FAP) Ford Focus '05 e C-Max 1.6 e 2.0 Tdci

6.2.1 FAP System in general

The FAP is the particulate filter used by the Peugeot-Citroen-PSA group. Unlike the DPF system, the FAP requires an additive to operate, the "cerium". The "Cerium" works as a catalyst, ie a substance that accelerates a given reaction.

6.2.2 System Description

Vehicles equipped with FAP particulate filter are in the Euro IV category. The system consists of a filter (1) with a catalyst (4), a tank for the additive provided with a dosing pump (2) and a module for controlling the fuel additive (3).
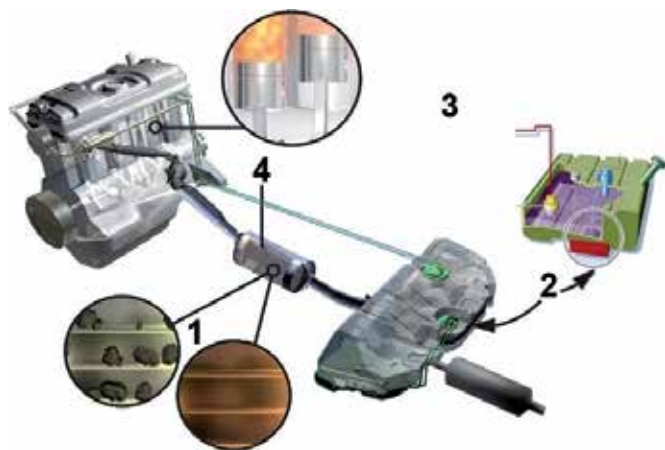
Figure 130: FAP System Description

Legend:
1) Filter
2) Tank and additive dosing pump
3) Additive Fuel Management Module
4) Catalyst;

The used additive is cerium oxide and is automatically mixed by the additive control module in the tank area with the fuel in order to obtain a correct blend; Is contained in an additional capacity of 1.8 liters secured behind the fuel tank.

Figure 131: Additive tank

Once the refueling (information received from the opening / closing of the oil stopper door and the increase in the differential fuel quantity detected in the tank of at least 5 liters), an amount of additive is injected into the main tank, this dose is determined From the control unit and sensors. The additive is calculated for a distance of 60,000 km after it has to be restored, however, when 0.3 liters of additive remain, the dispensing is suspended and the warning lamp lights up.
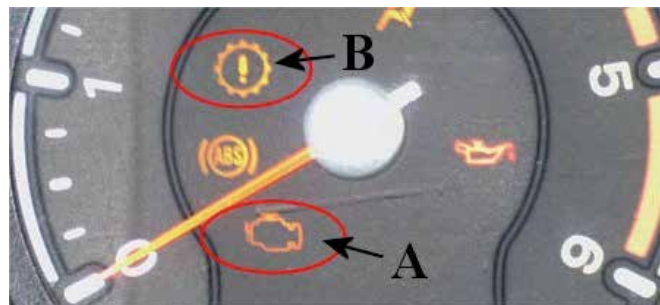

Figure 132: FAP related Lights

Legend:
A) MIL light
B) Engine Fault warning light

In the 1.6 TDCI engines, the FAP filter is an integral part of the catalytic converter, while in the 2.0 TDCI engines it is a separate component located downstream of the catalyst. Soot deposition in the filter would lead to clogging of the same, so it must be regenerated at intervals set by the engine management control, but after 120,000 km it has to be replaced. When FAP regeneration occurs, an exhaust fumes may occur. It's just water vapor and sulfur. The main components of the system are:

- Fuel additive pump: Take the additive to be sent to the injector. It is also composed of a piezo metric sensor

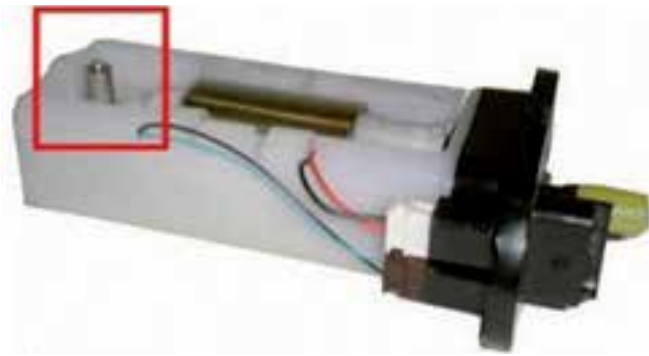that detects the level of the additive.

Figure 133: Additive Pump with level sensor

- Injector: Located in the fuel tank. Inject the additive into the diesel at the right time.

Figure 134: Additive Injector

- Fuel Tank cap switch: the ECU uses the signal in order to be aware when a diesel refueling is occurring.
The position with the door closed, corresponds to the open switch. After receiving this status, the control unit compares the current fuel level to the previous one. At the end of the comparison, it calculates the exact amount of additive to be injected into the fuel tank.
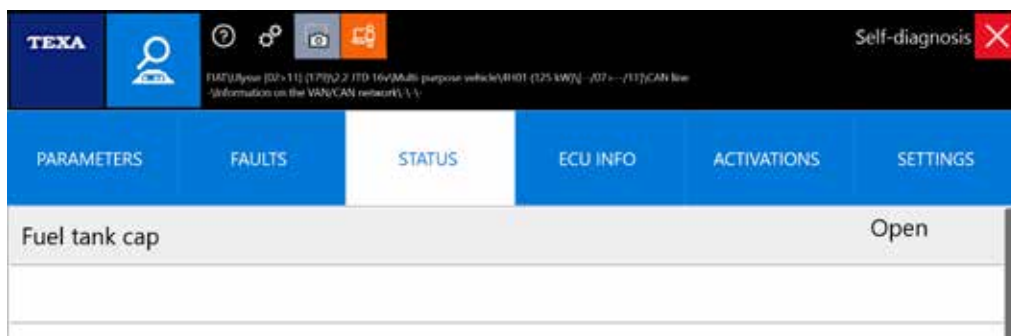
Figure 135: Fuel Tank cap indication Status

- Fuel additive module: placed under the right-hand rear seat, manages the injection times, the quantity, and any failures code to the fuel additive system, which are sent to the engine management unit.

Figure 136: Fuel Additive module

- FAP Filter Exhaust Gas Temperature Sensor: In the 1.6 TDCI engine the system expects one because the FAP filter is integrated into the catalyst, while in the TDCI 2.0 engine there are two, one for the FAP filter and one for the catalyst. The sensor consists of an NTC thermistor. The more the temperature increases and the more its resistance value decreases.
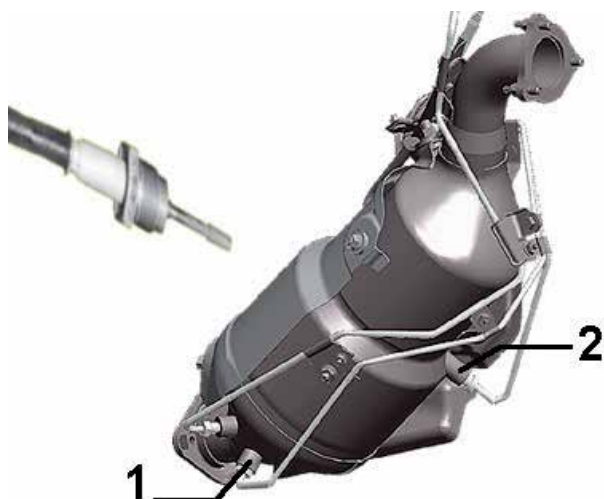
Figure 137: Location Exaust Temperature Sensors

Legend:
1) Downstream Filter Temperature sensor
2) Upstream Filter Temperature sensor

- FAP Filter Differential Pressure Sensor: Calculates the differential pressure of the exhaust gas flow before and after the filter, this signal is will be sent to the engine control unit.
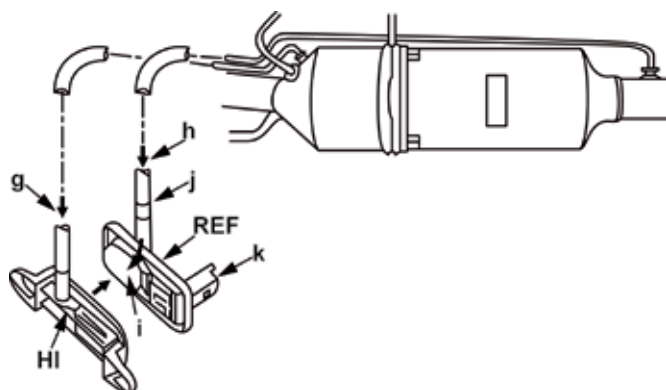

Figure 138: FAP Differential Pressure Sensor

Legend:
G) Filter Upstream Input information
H) Filter Entry downstream Information
J) White reference
K) Electrical connector
I) Membrane

After supplying the fuel additive tank (at scheduled maintenance intervals), the counter in the fuel additive management module must be reset. The Reset is possible by opening and closing the Fuel tank cap.

> ℹ️ *The counter cannot be reset via the fuel tank cap fswitch if the engine malfunction indicator lamp or MIL indicator is lit up due to the empty fuel tank. In this case, in order to complete the zero reset, errors must be cleared with the diagnostic tool.*

6.2.3 Refueling Procedure for Fuel Additive

> ⚠️ **WARNING: Make sure that the area of the workshop where you are going to operate is as clean as possible and free from dust. Dirt produced by clutch or brakes replacement may contaminate the fuel additive liquid. For this reason, the fuel additive kit should then be stored in a dry, dirt-free area. According to the nature of the additive, it is advisable to use adequate personal protective equipment (gloves and goggles).**

Figure 139: DPI for Additive Refueling

Before carry on, please make sure you are equipped with the following accessories:

- New additive tank;
- An empty container (to be used for "overflowing");
- A filling pipe tube with plug and plug;
- A pipe for the overfowing
- A container support device for "overflowing".

Figure 140: Additive container

> ℹ️ *Please check the Technical Bullettin: "FAP Tank Refueling" selecting a vehicle Ford Focus C-Max[03>10] > 1.6 TDCI > Monovolume > GPDA (66 kw) > [--/07>--/10]*

6.2.4 Manual Reset for the fuel additive warning light

> ℹ️ *Please check the Technical Bullettin: "Reset Diesel Additive warning message" selecting a vehicle Ford Focus C-Max[03>10] > 1.6 TDCI > Monovolume > GPDA (66 kw) > [--/07>--/10].*

6.2.5 Reset for the fuel additive warning light using the Diagnostic Tool

RESET LOW LEVEL ADDITIVE WARNING LIGHT
IN GENERAL When the additive level into the tank is too low, the DTC P1932 is stored and the message is: Additive Diesel, level too low.
WHEN DO IT When the Engine warning light is ON.
PROCEDURE EXECUTION Refuel the additive into the specific tank By the Diagnostic Tool go in the Setting menu Please, perform the setting: "Refill the Fuel Additive Tank" Figure 141: Refill the Fuel Additive Tank
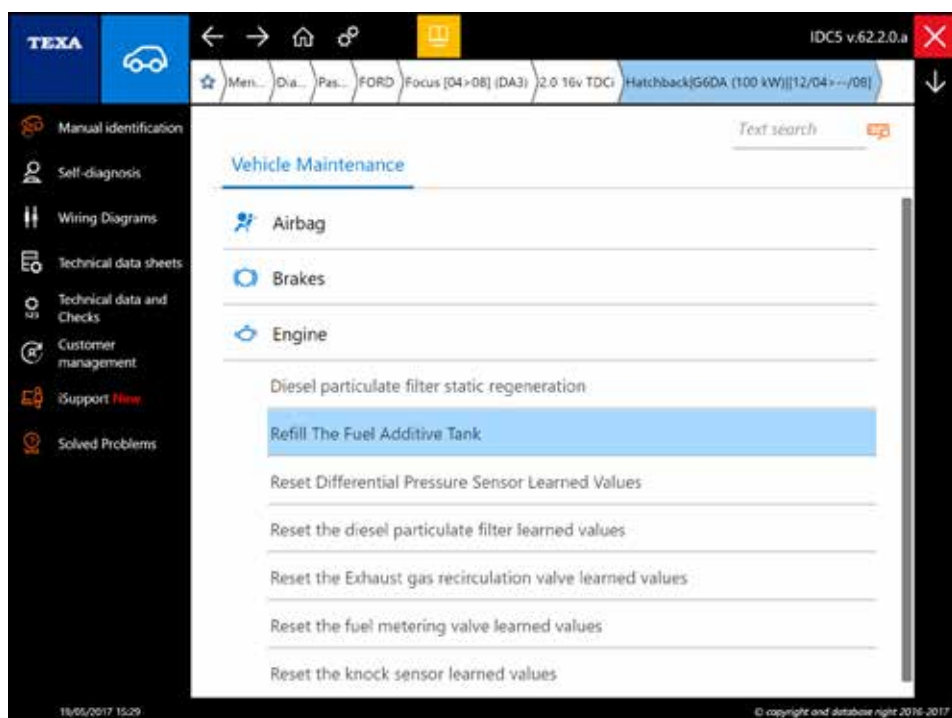
7. BRAKES: SETTINGS AND CODES

7.1 Electromechanical parking brake, VW Passat (3C2)

7.1.1 System features

Compared to the conventional handbrake, the electromechanical parking brake offers a numbers of additional functions such as:

- "intelligent parking brake" function (if the driver connects the belt, closes the door and starts the engine, the electromechanical parking brake will automatically deactivate during acceleration and startup);
- ascending dynamic assistant (Hill Holder);
- Dynamic emergency braking function (activating the braking system at any speed, greater than 7km / h, regardless of pressure on its pedal; maximum deceleration of 6 m / s2);
- Auto Hold function.

7.1.2 Operating Principle
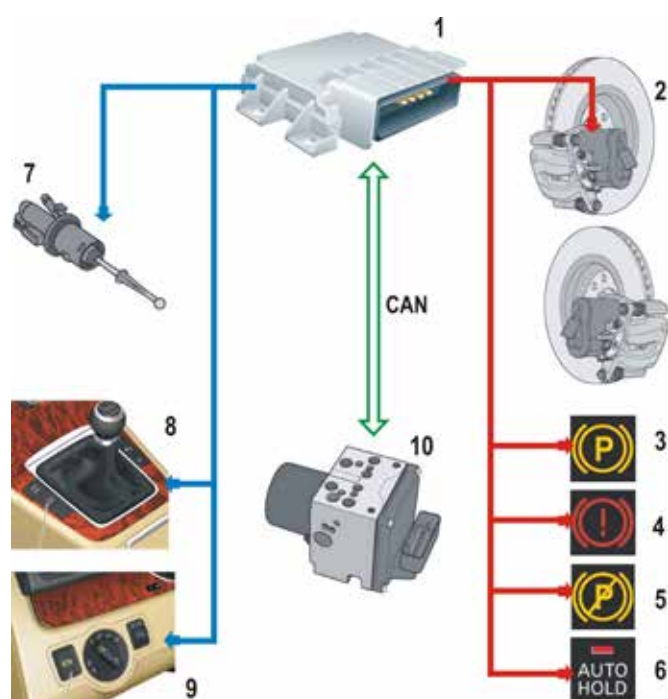
Figure 142

Legend:
1) Parking Brake ECU
2) Brake motors and calipers
3) Electromechanical parking brake light on
4) Brake light indicator
5) Electromechanical parking brake failure
6) Auto Hold function light
7) Clutch potentiometer

8) Auto Hold button
9) Electromechanical parking brake button
10) ECU of ABS / ESP systems
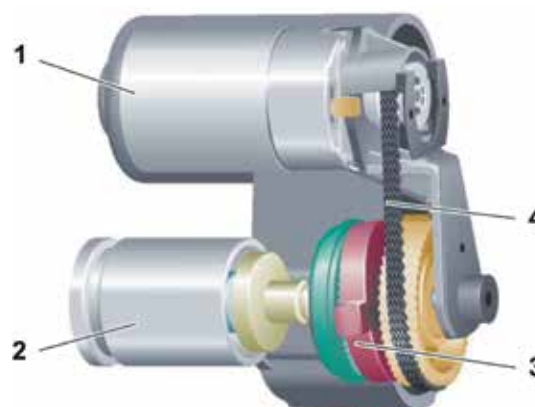
Figure 143

Legend:
1) Electric motor
2) Spindle pistons
3) Reduction gears
4) Reducing belts
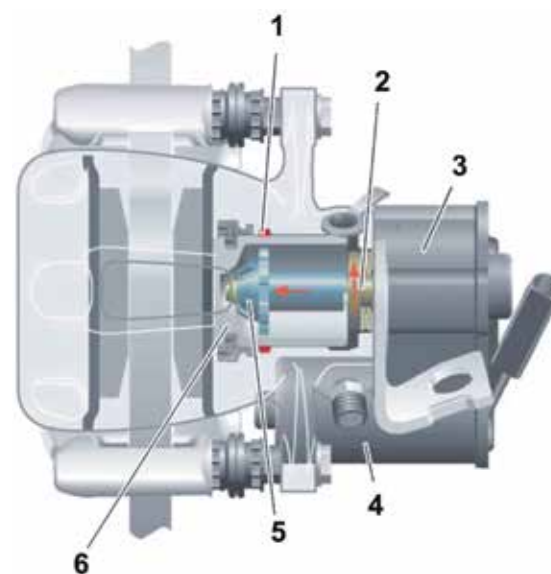
Figure 144

Legend:
1) Seeger Ring
2) Endless screw
3) Reduction gears
4) Electric motor
5) Pressure nut on the pad
6) Brake Piston

To close the parking brake, the control unit manages the two electric motor which, by means of a belt, transmits the spin to the pinion. The worm rotation, by means of a pressure nut placed inside the brake piston, transmits a thrust to the same piston, which consequently presses the pads against the brake disc. The indication of correct electric brake actuation is the measurement of the electric current absorbed by the electric motor.

7.1.3 Brake Pad Replacement Procedure

REPLACEMENT OF THE BRAKE PAD AND/OR DISCS POST
IN GENERAL In order to perform the specific procedure it is necessary use the TEXA Diagnostic too.
WHEN DO IT Whenever is required the replacement of the brake pad or the disc post.

PROCEDURE EXECUTION

1. Through the specific button placed in the dashboard, please deactivate the Electromechanical parking brake button.

Figure 145

2. Perform the Setting "Brake Pad Opening" on the maintenance page. By this setting, the electric motor returns to its idle position by releasing the disc pads.
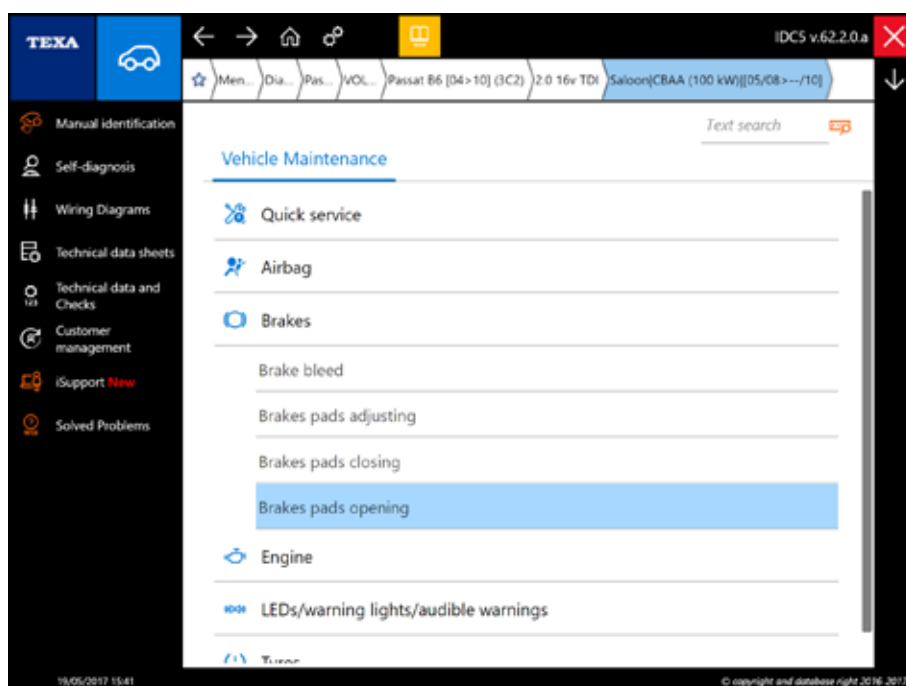
Figure 146: Opening Pad Procedure

3. After this procedure the following DTC will be stored:

⚠️ **BASIC REGISTRATION (ATT)**

4. Please carry on with the normal brake pad replacement procedure
5. Now, please perform the setting "**Brake Pads Closing**". Through this setting the electric motor adapts the pads to the brake disc.
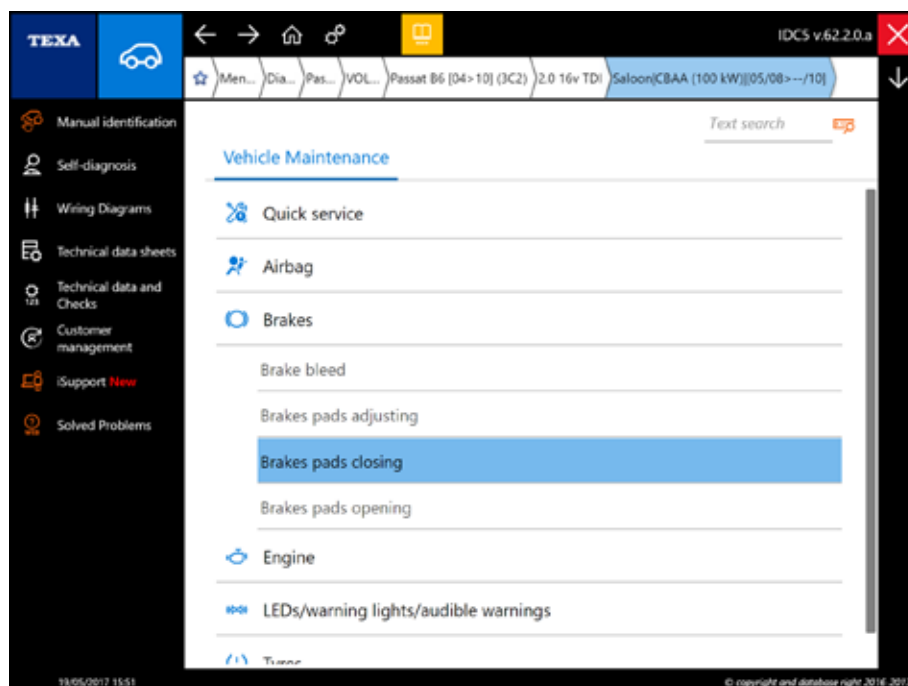
Figure 147: Brake Pads Closing

After this procedure the DTC "Basic Registration" which we saw before under the Current status, will be passing to the Stored status

⚠ **BASIC REGISTRATION (MEM)**

6. Please clear the DTC "Basic Registration".

7. Please, perform the setting "**Brake Pad Adjusting**". Through this option, the electric motor pushes and releases the brake disc pads three times to auto-adapt and memorize the new parking brake positions activated and deactivated.
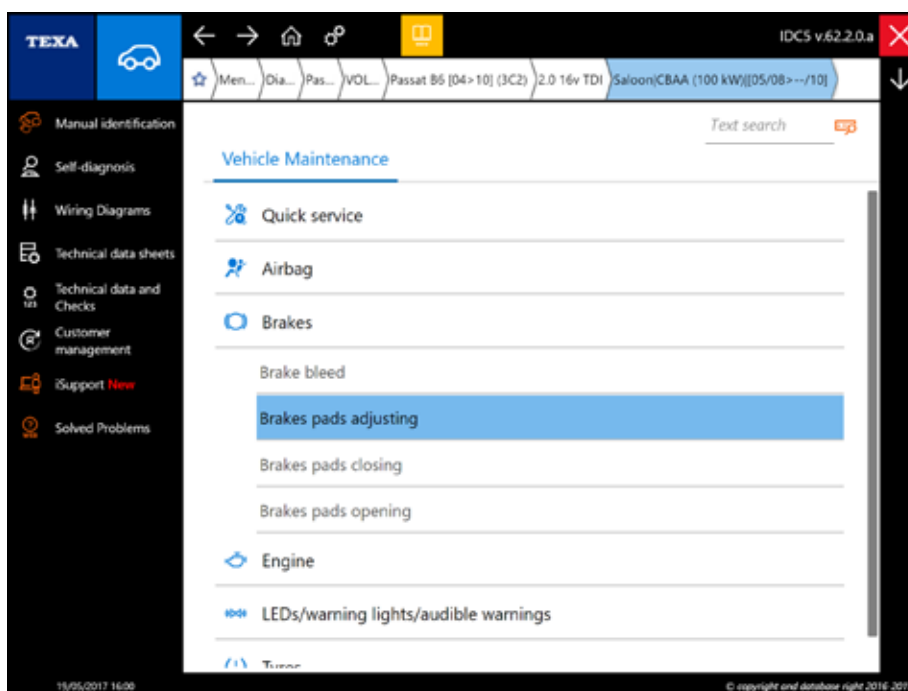

Figure 148: Brake Pads Adjusting

8. Press CONFIRM, Procedure complete.

8. TPMS – TYRE PRESSURE MONITORING SYSTEM

8.1 Renault Laguna II: Tyre pressure monitoring system (SSPP)

8.1.1 System Description

In general

Renault, starting with the "Laguna II" model, has started to fit in some of its car the tyre pressure monitoring system S.S.P.P.

The purpose of this system is to alert the driver in the event of fault detected on the tyre pressures due to insufficient inflation, slow pressure loss or inadequate tire pressure.

The information is shown to the driver by means of a display portion on the instrument panel that illuminates the wheel that has an abnormality and shows any information related to the system.

Operation

Each wheel is fitted with a sensor (each powered by an integrated battery). These sensors regularly measure the internal pressure of the tires and send this information together with a unique identification code useful to recognize the wheel, by radio frequency, to a receiver placed under the vehicle transmitting them by means of a link to the electronic module that detects any Leakage (puncture) or improper inflation and control the display.

> **i** *From the Clio III model, the evolution of the SSPP system allows the system to automatically detect the sensor and its position for the all four wheels. This evolution does not includes any storage of wheel pressure sensors.*
> *Vehicles equipped with this system are:*
> *- Clio III (New Clio)*
> *- Koleos*
> *- Megane III (New Megane)*

System Description

The Tire Pressure Control System consists of:

1. Four pressure sensors integrated into the valves (one per wheel). They sends a radio frequency signal;
2. An electronic controller;
3. A display where the information and alerts handled by the system will be showed

Figure 149: Renault SSPP System

Legend:
1) Pressure sensors
2) Electronic module
3) Display

Pressure sensors

These components, powered by a non-replaceable integrated battery, are installed inside the body valve body regularly measure the internal pressure of the 4 tires.

The pressure sensor consists of:

- A classical valve;
- A pressure sensor;
- By a radiofrequency sender (one per sensor);
- From a non-replaceable internal battery (it is therefore not possible to replace only the pressure sensor valve battery).

Figure 150: Tyre pressure sensor

Each sensor is marked by a colored ring that, if the valve is replaced, or one and more tires, it needs to be reassembled to the original position in order to avoid, in the event of fault, incorrect reporting:

- Blue = Left front
- Yellow = Right front
- Red = Left rear
- Black = Right rear

Figure 151: Tyre pressure sensor, details

> **ℹ** *To know the original position of the pressure sensors based on reference colors, you must check the label on the driver's door mast showing tire pressure and valve colors.*
> *If the tires are disassembled, by the fact the sensor is fitted, it means that the more attention must be paid in order to don't damage the sensor.*

Figure 152: Tyre pressure and location label

Tires

Renault vehicles equipped with SSPP system are also equipped with PAX tires. This system consists of:

- A special wheel rim;
- A particular structure of the tyre which includes
- An elastic insert housed in the center of the same rim that surrounds it.

Figure 153: Example of PAX device on Renault Wheel Rim

Malfunction managed by the SSPP system

The SSPP system notifies the driver in the following cases:

- Pressure warning less than 0.6 bar compared to the actual pressure;
- Inflating pressure warning "too high";
- Weird Pressure loss warning on a tire;
- Pressure difference warning between left and right side;
- Maximum speed warning exceeded with excessively deflated or perforated tires (with PAX system);
- Maximum travel distance warning with deflating tire (with "PAX" system).

Summer - Winter tire

In this system, you can save two different kind of tire set, one for the winter and one for the summer.

In this way, with every tire changing between summer and winter, it is not necessary to re-save the tire, but simply fit the new tire with its valve in the correct position, which can be viewed on the INFO page.

> **ℹ** *It is absolutely NECESSARY ONLY after the first change of summer / winter tire, learn the position of the valves using the diagnostic tool.*

After programming the second tire set, the controller will retain two sets of tires and, in case of change, simply select the type of tire immediately after they have been installed, by means of the "PNEUMATIC" setting.

8.1.2 System Diagnosis: Status

Figure 154: Status concerning the TPMS management within the UCH (central cockpit unit)

Status	Description	Possible Condition	
Rear Value (front) Left (right)	Lists the Sensor Operation Status	Inactive	The sensor is in "CHECK" mode and the pressure parameter stays stationary at 3,49 bar
		Normal	The sensor detects a normal pressure
		Forcing Trasmission	Sensor communication was forced by means of the exciter
		Pressure Varaition	The sensor detects a pressure loss
		Battery Flat	The sensor detects a battery flat

Table 16

8.1.3 System Diagnosis: Settings

Setting	Description	When do it
Tire pressure control unit	Allows you to enable or disable the system on the CAN network	
Nominal pressure configuration	It allows to change the nominal tire pressure for both axes, rear and front, both for high and low speeds 1.89 bar: low speed 2.68 bar: high speed	If necessary
Manual coding of the Wheels code	Starts the manual saving process the valve by writing the code	To do with: 1. Wheel Rotation 2. Replacing the wheel pressure sensor
Wheels code automatic saving	Start the Self-learning process of the 4 valve by forcing the communication of the valve	To do with: 1. Wheel rotation 2. Replacing the wheel pressure sensor
Automatic saving of 1 valve code	Starts the Self-learning of saving one valve code by forcing the communication of the valve	Valve Replacement
Change alarm threshold	It allows to increase the threshold value for the pressures considered under "fault"	If necessary
Tyre	It allows to select the tyre type (Summer or Winter)	Tires Replacement Summer/Winter

Table 17

WHEEL CODE AUTOMATIC SAVING

IN GENERAL

This procedure allows to match correctly the tyre and the pressure sensor.

WHEN DO IT

The "Wheels code automatic saving", must be done all the time when:

1. Wheels Swap.
2. Pressure sensor replacement.

PROCEDURE EXECUTION

Perform the setting "Wheels code automatic saving" and follow the instruction showed on the TEXA Diagnostic tool.
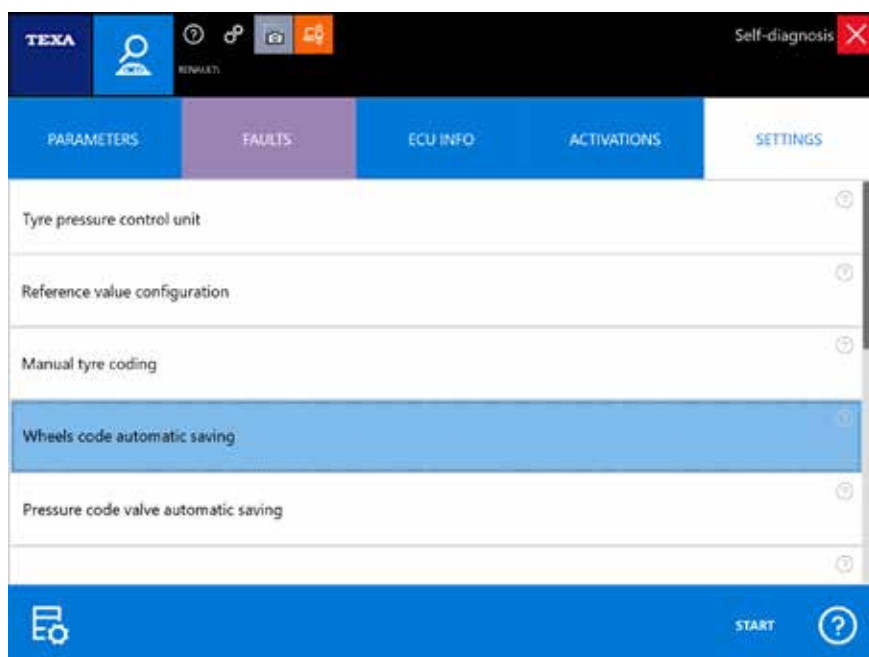

Figure 155: Wheels code automatic saving

Figure 156: The saving starts after deflate the tyre of 1 bar

9. BATTERY PROGRAMMING

9.1 BMW Battery Replacement and programming

BMW vehicles are equipped with AGM batteries (Absorbent Glass Material - Absorbent Glass Fiber Layer)

Figure 157: BMW Battery

This type of battery are different from the other traditional batteries because they do not "erode" the electrolyte during the charged phase. That is, hydrogen and oxygen, produced in normal battery operation, are not released into the environment, but are recombined in water with the reaction made possible thanks to the strong pressure inside the battery casing.

To prevent this pressure, in some conditions, may increase excessively, these batteries mount the safety valves for gas leakage. For this reason they are also called "VRLA" (Valve Regulated Lead Acid).

> **i** *Do not open the battery casing to prevent air intake that would cause a chemical process to be cancelled, making it unusable.*

BMW vehicles are equipped with a system that are able to be monitoring the battery charge status so that the system can balance the energy required, produced and stored in and out of the battery. For this purpose, the sensor "IBS" (Intelligent Battery Sensor) is installed on the battery negative pole.

This sensor has the function of detecting any battery charge faults or any abnormal "key off load" in order to determine the priority of the utilities needed to safeguard the charge.
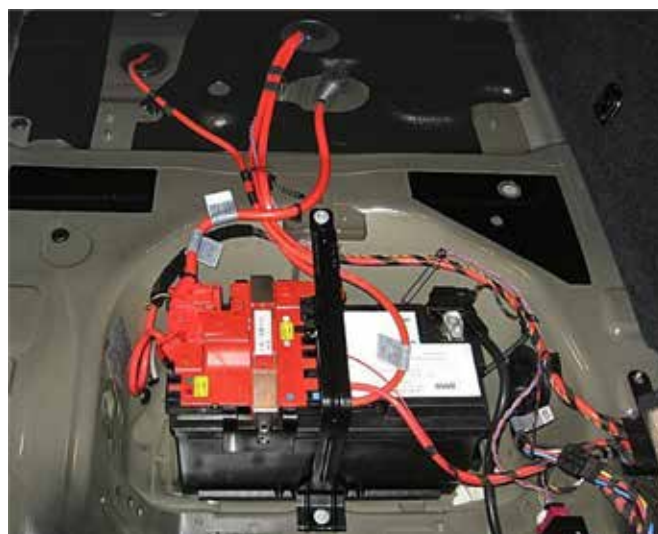
Figure 158: IBS Sensor installed on the ground battery wire

> **i** *The IBS is not always fitted, it depends of the vehicle trim level. If It fitted, it is very easy to see on the battery.*

BATTERY REPLACEMENT RECORDING: SAME CAPACITY

IN GENERAL

If the old 12V battery is replaced with a new one of the same capacity, this information has to be transferred to the CAS (Car Access System) control unit, which will reset the parameters programmed for the battery in order to perform a management of the energy car system.

WHEN DO IT

After the battery replacement with the same capacity.

PROCEDURE EXECUTION

After selected the vehicle, get communication with the ECU "Battery Adjustment", then perform the setting "Battery Replacement recording: same capacity". Please follow the instruction listed in the TEXA Diagnostic tool.
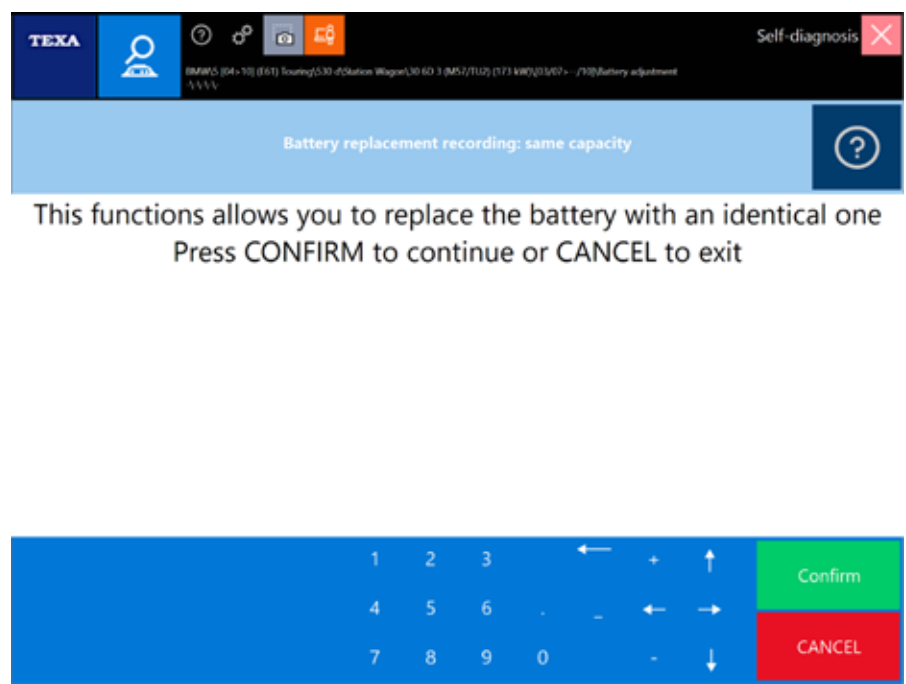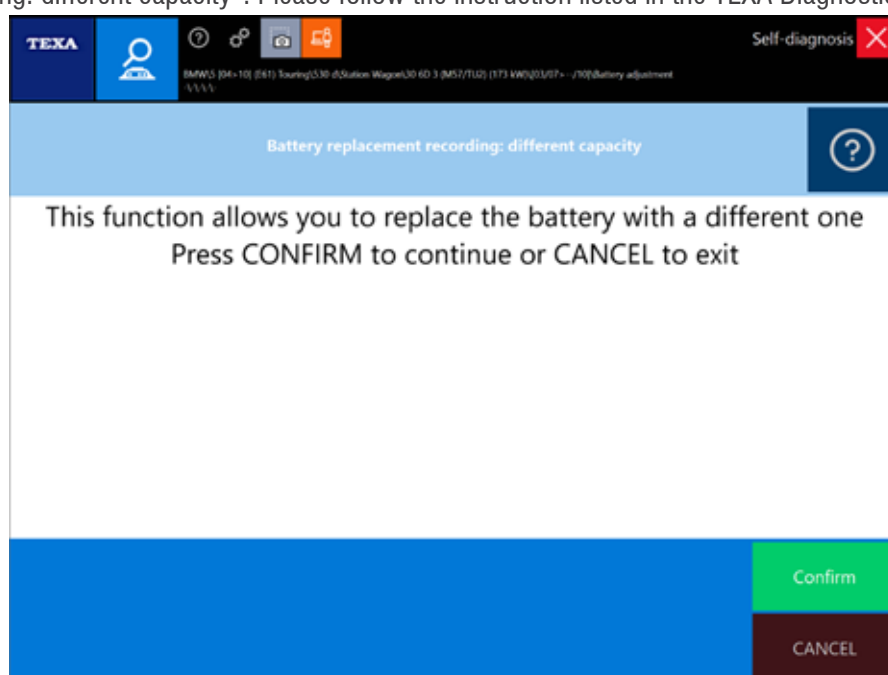

Figure 159: Setting for the Battery Replacement: same capacity
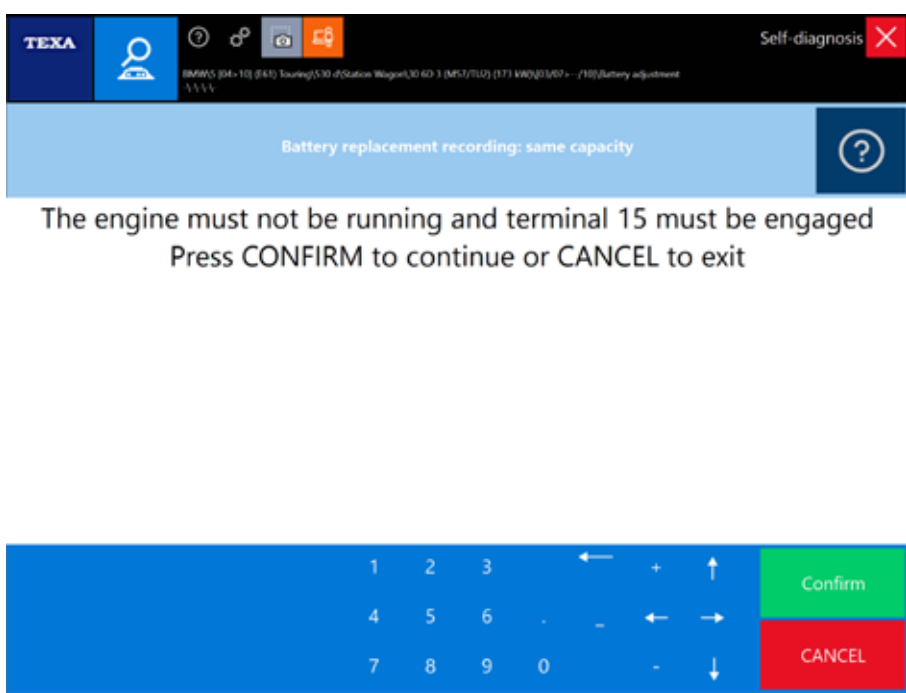
Figure 160: Only Ignition ON for carry out the procedure
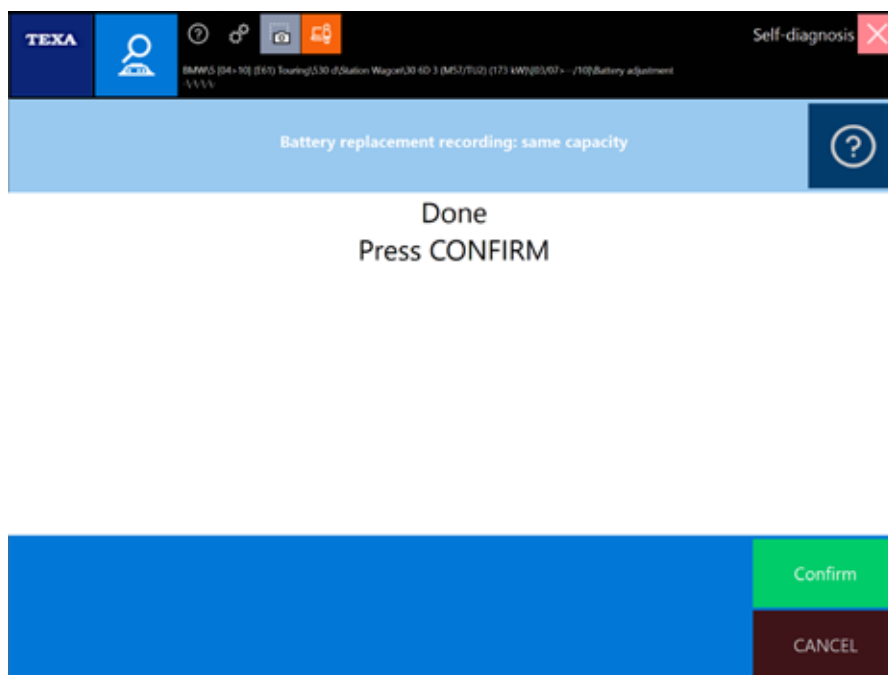
Figure 161

BATTERY REPLACEMENT RECORDING: DIFFERENT CAPACITY

IN GENERAL

If the old 12V battery is replaced with a new one but with different capacity, this information has to be transferred to the CAS (Car Access System) control unit, which will reset the parameters programmed for the battery in order to perform a management of the energy car system.

WHEN DO IT

After the battery replacement with one of different capacity.

PROCEDURE EXECUTION

After selected the vehicle, get communication with the ECU "Battery Adjustment", then perform the setting "Battery Replacement recording: different capacity". Please follow the instruction listed in the TEXA Diagnostic tool.

Figure 162: Different capacity Battery Replacement setting
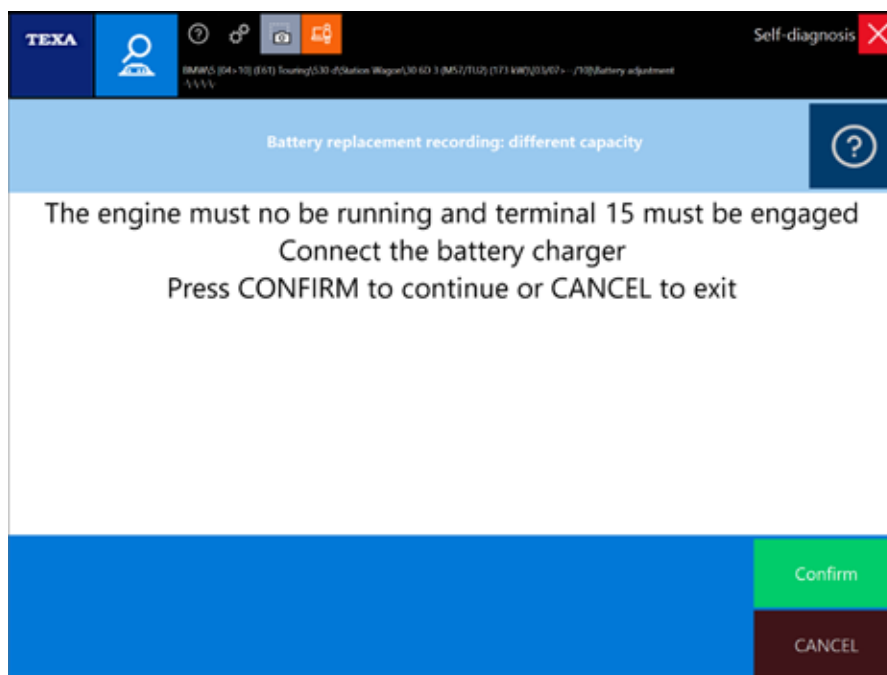
Figure 163: During this procedure it is important that the engine is OFF and a battery charger is connected to the vehicle battery
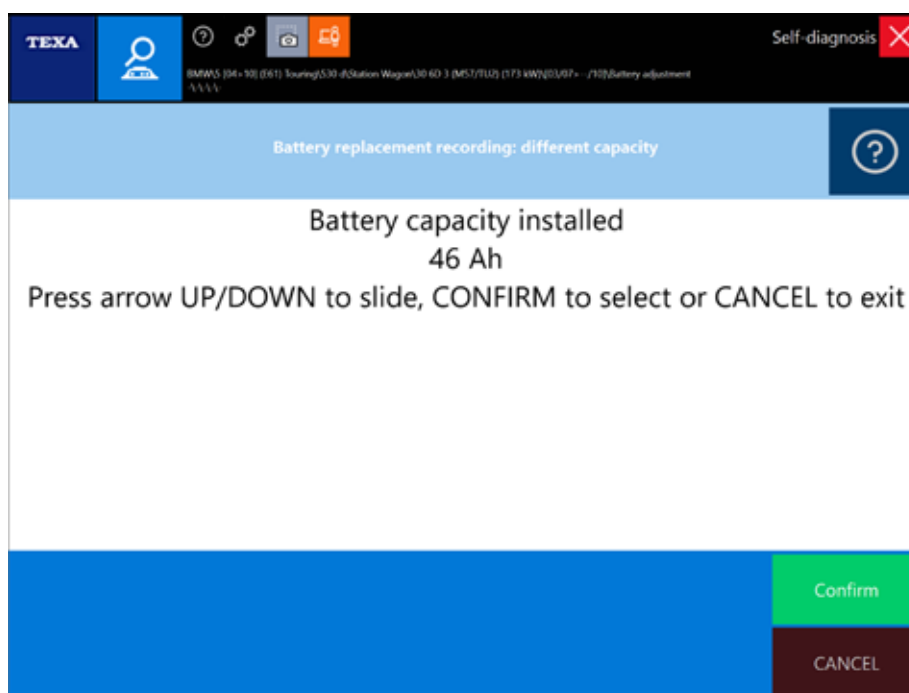
Figure 164: During the procedure will be asked which kind of capacity is the new battery fitted

ℹ️ *When will be added a new capacity it will be listed in the diagnostics only after disconnecting and connecting of the battery.*

ℹ️ *If you do not register the new battery and then do not reset the data that matches your old battery characteristics, the new battery charge and the related values may be abnormal for the CAS ECU, which has still stored the old battery data. This could generate battery error or charge errors, even if you have actually been replacing it.*

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