



Automotive Training Courses

IDC5 Off-High Way: Basic learning



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Legend:



Red: text trainer

Backhoe

It is the attachment that allows working the soil. It can be of two types: monoblock boom or two-piece boom.

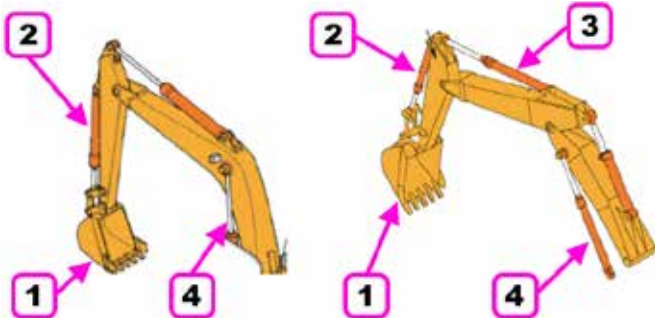


Figure 2: Monoblock boom and two-piece boom backhoe

Key legend:

- 1. Bucket
- 2. Stick or dipper arm
- 3. Positioning cylinder
- 4. Lifting cylinder

The two-piece boom model allows more freedom (though at higher costs and manufacturing complexity), but the choice of the backhoe depends on how the excavator will be used.

Undercarriage

The undercarriage is the lower part of the excavator that contains the mechanisms controlling the movement on the ground.

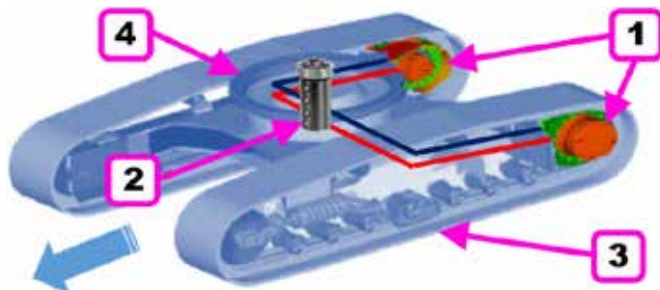


Figure 3: Tracked undercarriage

Key legend:

- 1. Travel motors
- 2. Central hydraulic coupling
- 3. Belts
- 4. Turntable

Generally, on wheeled excavators, travel is obtained by installing a hydraulic engine onto a transfer case; this way, the engine will turn the case, transmitting the rotation through the shaft(s) to the axles, causing the wheels to turn. The transfer cases may have two or four speeds.

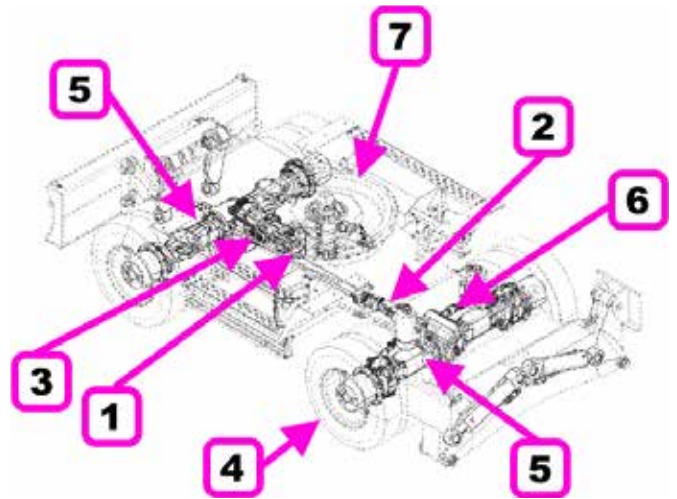


Figure 4: Wheeled undercarriage

Key legend:

- 1. Travel motor
- 2. Transmission shaft
- 3. Transfer case
- 4. Tyres
- 5. Axle
- 6. Steering cylinders
- 7. Turntable

Tower

The tower is the real machine body including the operator's cab, the engine and the hydraulic assemblies.

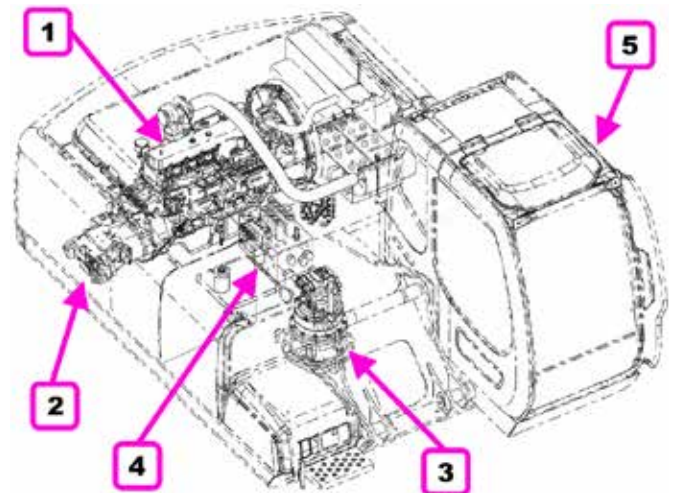


Figure 5: Tower

Key legend:

- 1. Engine
- 2. Hydraulic pump assembly
- 3. Rotation motor
- 4. Hydraulic coupler
- 5. Operator cab

2.1.2 Wheel loader

The wheel loader (also called bucket loader when equipped with the "bucket" attachment) is a type of vehicle that is appropriate for the transport of large quantities of material, according to the various cycle loading methods ("V-shape", "T-shape", "L-shape" and "I-shape") in short times. There may be various types and sizes, which all have in common the articulated chassis.



Figure 6: Wheel loader

They may use two types of transmission:

- Hydrokinetic transmission
- Hydrostatic transmission.

Hydrokinetic transmission

The hydrokinetic transmission allows amplifying the engine power. The output torque is multiplied thanks to a torque converter, installed between the engine and the transmission.

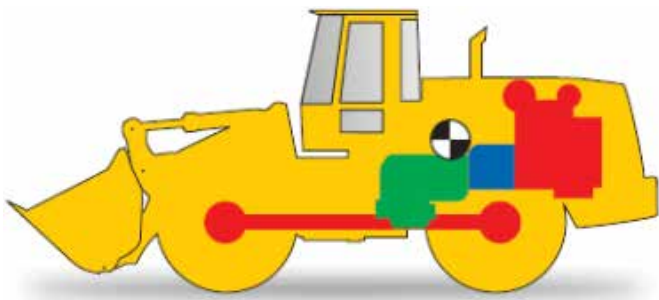


Figure 7: Hydrokinetic transmission

The advantages of this solution are:

- lower costs
- higher pull when stalled (in fact, torque peak occurs in stall condition) higher maximum speed small heat exchanger higher overall efficiency.

Hydrostatic transmission

The hydrostatic transmission is a travel system that connects a variable-displacement pump with a variable displacement hydraulic engine in a closed loop.

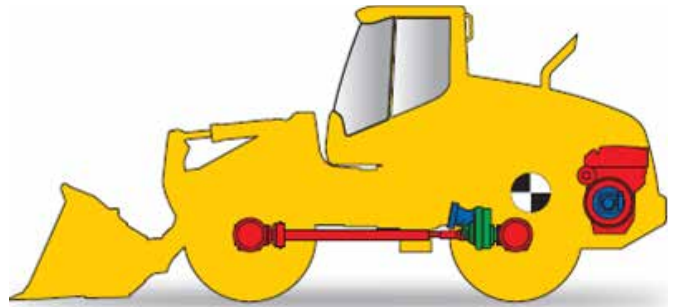


Figure 8: Hydrostatic transmission

This solution offers other advantages:

- less fuel consumption (the engine is constantly running in the lowest specific consumption field)
- less tyre wear (perfect motion control both when pulling and releasing)
- better vehicle drivability
- higher flexibility in positioning the system inside the vehicle (reduced mechanical constraints)

2.1.3 Bulldozer

It is a mechanical vehicle used to move large quantities of soil, sand, gravel or other material during construction or conversion work.

It is a widely used vehicle that can be found in a wide range of places such as construction sites, quarries, mines, heavy industry factories, military bases, farms, ...



Figure 9: Bulldozer

At the front, it is always equipped with a metal plate (called blade) that can reach very large dimensions, while at the rear, it can be equipped with a claw-like tool (called

ripper) that is used to till (break) soil surfaces and compact materials.

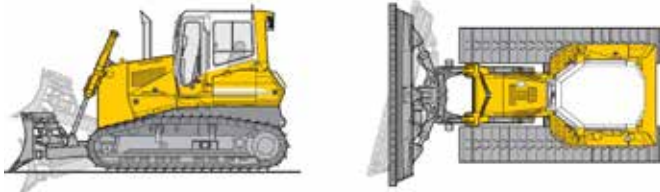


Figure 10: Blade with inside-mounted push frame

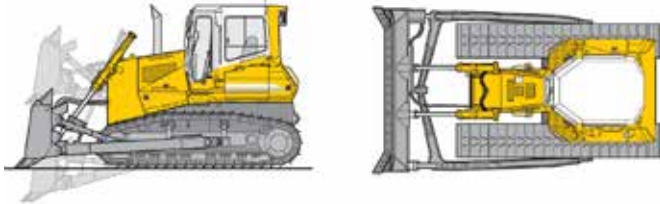


Figure 11: Blade with outside-mounted push frame

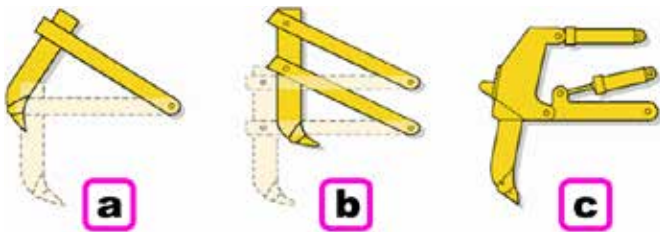


Figure 12: Rear tool configuration

Key legend:

- a. Single shank
- b. Fixed parallelogram, 1 or 3 shanks
- c. Adjustable parallelogram, 1 or 3 shanks

Based on the model and use, a bulldozer could be equipped with hydrokinetic or hydrostatic transmission, just as for the wheel loader.

2.1.4 Dumper

Dumpers are construction vehicles used to carry bulk materials quickly.

They may have an articulated or rigid chassis and must not be confused with normal construction and mining trucks.

The advantages of this type of vehicles are:

- Bulk material transportation in as little time as possible
- Possibility to reach the loader or the excavator in the working area
- High travel speed (up to 60 Km/h on the road)

Rigid dumpers

They are used to carry large material loads on relatively flat surfaces.

They are available in various sizes and may reach gigantic dimensions, used only in very large mines.



Figure 13: Rigid dumper

Based on their dimensions, they are equipped with two types of transmission.

Smaller dumpers have a powertrain structure similar to regular trucks.

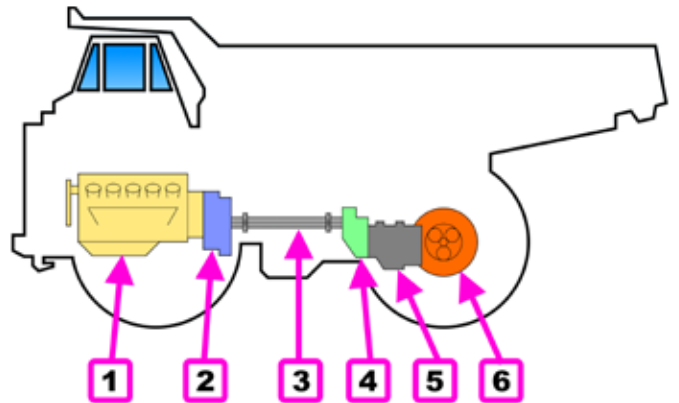


Figure 14: Small dumper's powertrain

Key legend:

- 1. Endothermic engine
- 2. Torque converter
- 3. Cardan shaft
- 4. Transfer case
- 5. Trans.
- 6. Engine axle

Vehicles of higher classes use an endothermic engine to activate a large electric alternator that supplies two electric motors positioned directly on the wheel hubs.

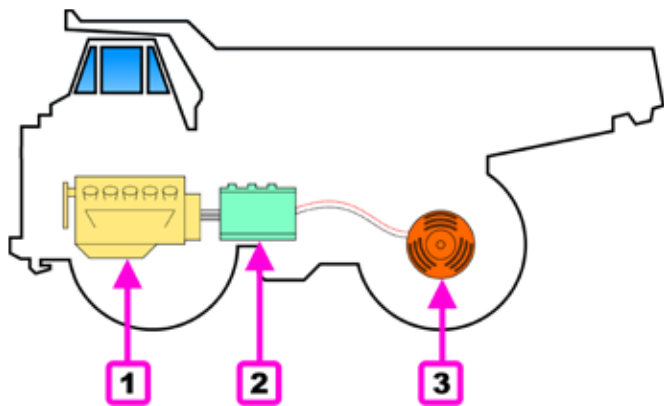


Figure 15: Large dumper's powertrain

Key legend:

- 1. Endothermic engine
- 2. Alternator
- 3. Electric motor

Articulated dumpers



Figure 16: Articulated dumper

Besides the features of rigid dumpers, articulated dumpers offer further advantages:

- Low centre of gravity that allows climbing high cross slopes (higher than 30%);
- Possibility to travel over rough surfaces with different slopes;
- Drive on all axes, 6x6.

The chassis is made up of a front part, where the driver's cab and the powertrain are installed, that is connected to the rear part through a central joint that allows longitudinal and transverse movement.



Figure 17: Articulated dump truck chassis structure

The drive transmission is always traditional.

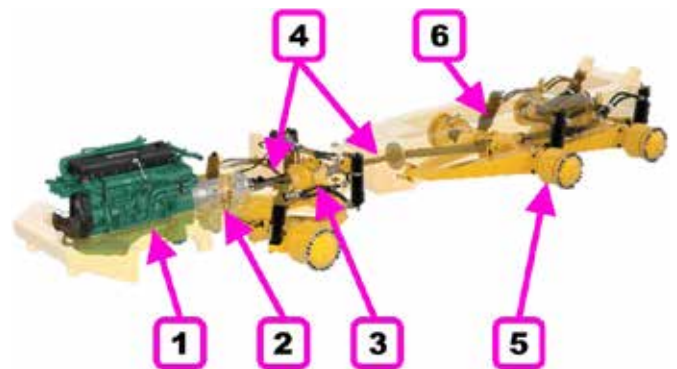


Figure 18: Powertrain

Key legend:

- 1. Engine
- 2. Transmission with torque converter
- 3. Transfer case
- 4. Cardan shaft
- 5. Axle
- 6. Suspensions

2.1.5 Construction trucks

Similar to dumpers, also construction trucks are used to transport bulk material, but they differ in that they are type approved for normal road use. Technically, they are regular trucks, specifically designed for heavy duty (higher number of axles, oversize structure, reinforced suspensions, ...).



Figure 19: Construction truck

2.1.6 Backhoe loader

The backhoe loader is a very common off-highway vehicle. It is used for excavation, construction and transportation of material in general.



Figure 20: Backhoe loader

It is an extremely widespread vehicle as it is equipped with two of the most used tools in the Off-Highway industry: the loader bucket and the hydraulic excavator. All in a wheeled vehicle, small-sized, particularly versatile and type approved to travel on roads open to traffic.

There are also "special" versions, equipped with tracks and/or articulated chassis (with a central joint as in the articulated dumpers).

2.1.7 Agricultural tractors

It is the agricultural vehicle par excellence. In combination with the various equipment (implements) that can be attached to the front, to the rear or towed, it can be used for a great variety of agricultural tasks.

Various types and models are available on the market, both wheeled and tracked, with powers and features that may be very different.



Figure 21: Trattore agricolo

They are designed and built to be used "in the fields", but they are usually approved for normal road use.

2.1.8 Harvesting and farming machinery

This category can include all the agricultural equipment used for some specific purpose.

For example, it includes:

- Combine harvesters
- Mixer Wagons
- Harvesting machines

They can be technically compared to tractors, though with special chassis and structures that guarantee the purpose they were designed for.



Figure 22: Combine harvester



Figure 23: Mixer Wagon



Figure 24: Mower

2.1.9 Crane trucks

Crane trucks are heavy duty vehicles that allow moving loads where no fixed lifting and moving structure is possible (or present). Various types and models are available according to operational needs and must not be confused with regular trucks on which a small hydraulic crane is installed (that is truck-mounted equipment).



Figure 25: Telescopic crane truck



Figure 26: Container crane truck

2.1.10 Skid-steer loader

The skid-steer loader is a relatively recent vehicle that was designed for specific operational needs. It is a smaller, more compact version of an excavator.



Figure 27: Skid-steer loader

In order to allow the equipment to move widely enough, the bucket's kinematic motion is moved at the rear of the vehicle. It is normally wheeled, but there are also tracked versions for specific purposes.

2.1.11 Telescopic Handlers

Another relatively recent off-highway vehicle category includes the telescopic handlers, that are used both in the agricultural and construction industry.

As for all the highly specialised vehicles, there are various types with different manufacturing features, based on the specific purpose the vehicle will be used for.



Figure 28: Fixed telescopic handler



Figure 29: Stationary telescopic handler

2.2 Electronic systems in off-highway vehicles

Over the past years, the electronic systems installed on off-highway vehicles have been developing quickly, improving the vehicle's functionality, safety and comfort.

Below there is a list, even though partial, of the electronic systems that can be found today on the vehicles and have a specific Self-diagnosis.

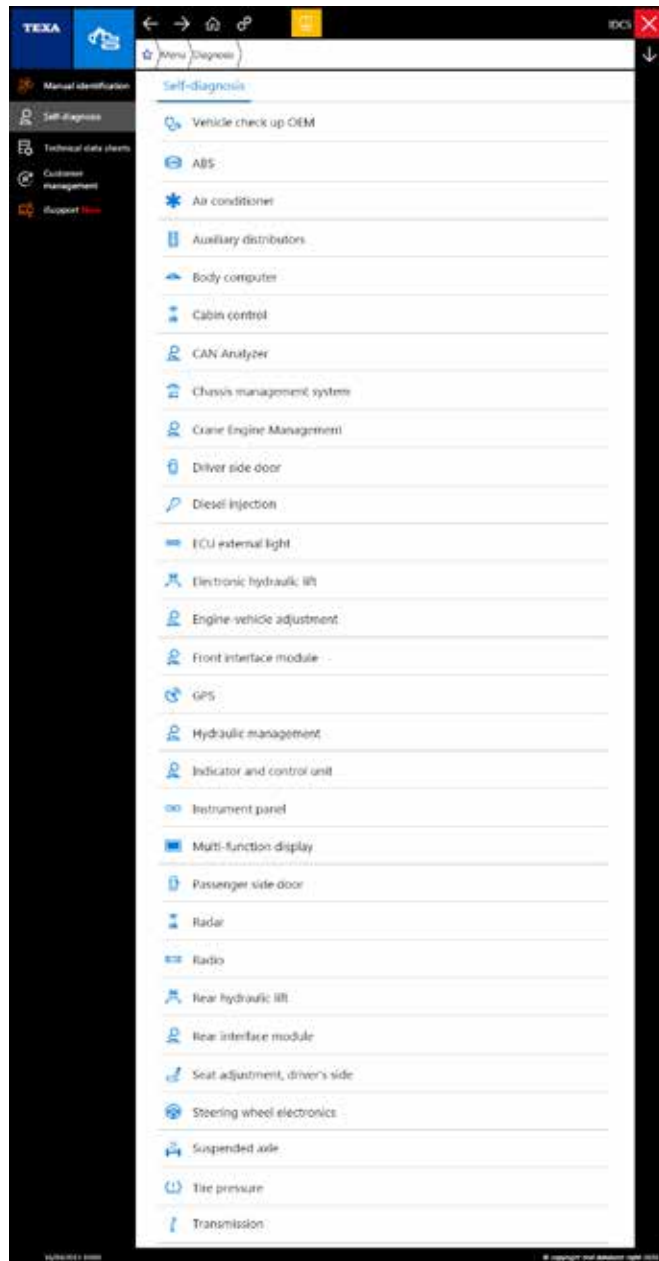


Figure 30: List of self-diagnostic systems

2.2.1 Electronic control

Over the last years, agricultural vehicles have been equipped with increasingly more sophisticated electronic control units. For example, from timing advance adjustment systems without self-diagnosis, we have moved on to increasingly more complex injection control units with high self-diagnostic ability, and this is just to mention the engine control.

A tractor's equipment may count several control units, such as:

- engine control;
- instrumentation;
- transmission;
- A/C;
- hydraulic assemblies;
- etc.

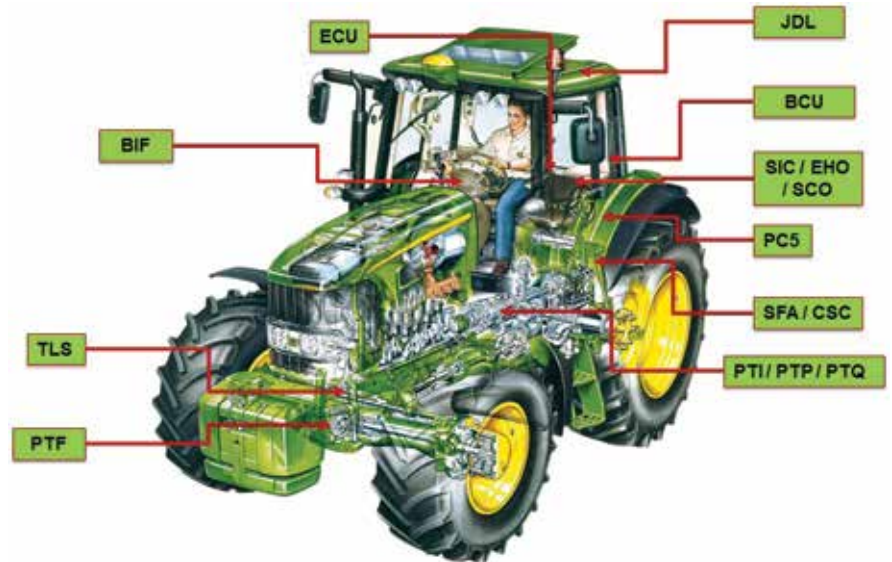


Figure 31: Tractor's electronic control units

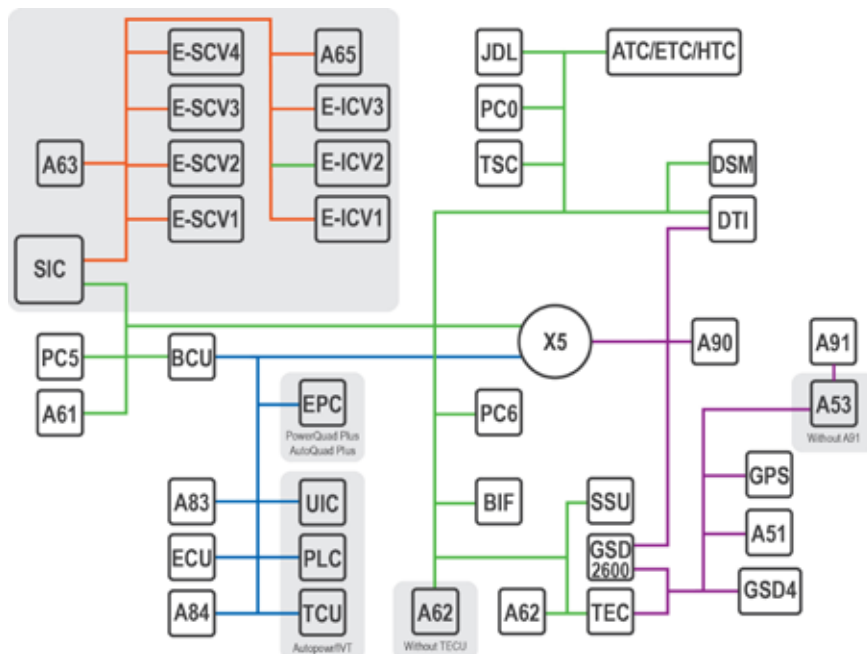


Figure 32: CAN structure of a modern vehicle

The on-board control units can also operate interactively. This interactivity implies an information exchange between control units that is usually performed through an interconnection network, through which the control units communicate information in a digital format using various protocols: the most widely used is the Controller Area Network or CAN-bus.

Below there is an example image of CAN structure on a modern agricultural tractor (each coloured line is a specific CAN line, while every writing/code represents a control unit and/or an electronic component).

Lined area for notes or answers, consisting of 40 horizontal lines.

3. BASIC SELF-DIAGNOSTIC TECHNIQUES

For many years (decades) now vehicle repairers have been used to dealing with Self-Diagnosis. But what is the Self-Diagnosis?

“Is the ability of a control unit to evaluate the proper operation of all the components connected to it by monitoring the parameters and recording any problem in a specific memory area.”

In particular the control unit monitors:

- Power supplies
- Input signals (“←” sensors/network)
- Output signals (“→” actuators/network)

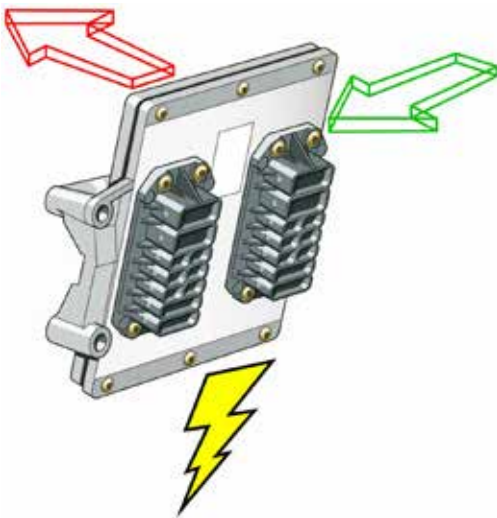


Figure 33: Power supplies, Input and Output

On these signals the control unit performs two different types of analysis:

- Electrical analysis and check (Short circuit - Open circuit - Out of range);
- Functional analysis and check (Information plausibility - Self-adaptability).

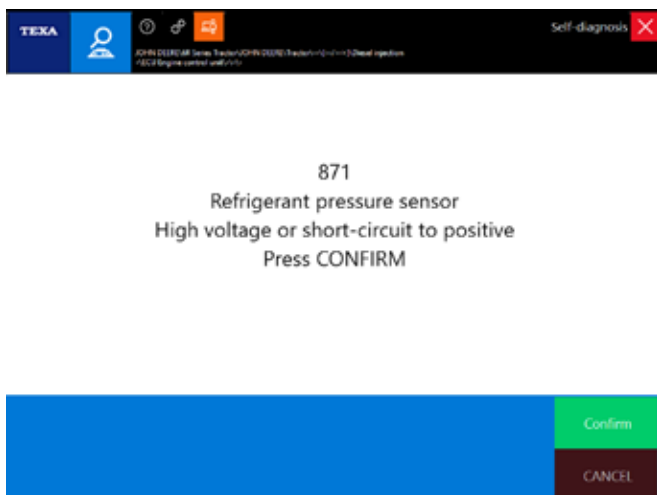


Figure 34: Electric trouble

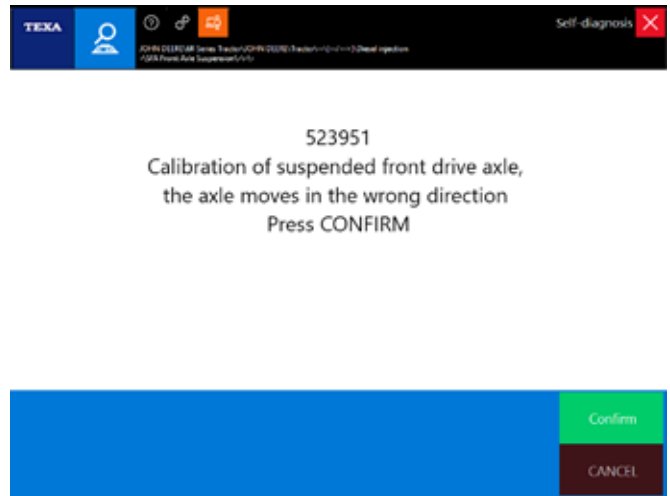


Figure 35: Functional trouble

The first type of check identifies electrical failures when the signal is out of range. The electrical check is an individual check done independently on each device.

The second type of check, on the other hand, analyses several signals simultaneously to verify if the signal of a component is within the preset range and to check the lack of plausibility (for example, in Image 35, the lift axle calibration procedure caused the axle to move, but the system detected that the movement was performed in the wrong direction).

3.1 SOME HISTORY

The first Self-Diagnostic systems only allowed viewing the error codes through a warning light (blink code). The number of blinks defined a specific code that had to be compared with a paper chart for the decoding and the explanation of the error.

No. of blinks	Error description
1-1	Primary analogue accelerator, voltage is too high
1-2	Primary analogue accelerator, Too low voltage
1-3	Secondary analogue accelerator, Too high voltage
1-4	Secondary analogue accelerator, voltage is too low
1-8	Coolant temperature sensor: Signal voltage is too high
1-9	Coolant temperature sensor: Insufficient signal voltage
2-1	Sensors' input voltage is too high
2-2	Sensors' input voltage is too low
3-9	Engine speed signal, incorrect
4-1	Start-up signal always active
4-2	High engine rpm
4-6	Start-up signal always active
5-5	CAN error
6-4	Manual accelerator calibration not succeeded
6-5	Incorrect manual accelerator position value
8-1	ECU internal error
8-2	ECU internal error
8-3	Fuel pump, short-circuit
8-4	Faulty fuel pump actuator
8-5	Fuel pump, short-circuit
9-1	Speed signal missing
9-2	Speed signal not plausible
9-3	ECU internal error

Table 1: Lucas injection control unit blink code on John Deere 6000 series (1992)

Further developments, along with the ability to calculate an increasingly larger number of electronic control units, brought the Self-diagnosis to continue evolving, allowing in time not only the possibility to view the errors stored (through an interface tool), but also to view the parameters, to check the components and to reprogram (when needed) the control unit itself.

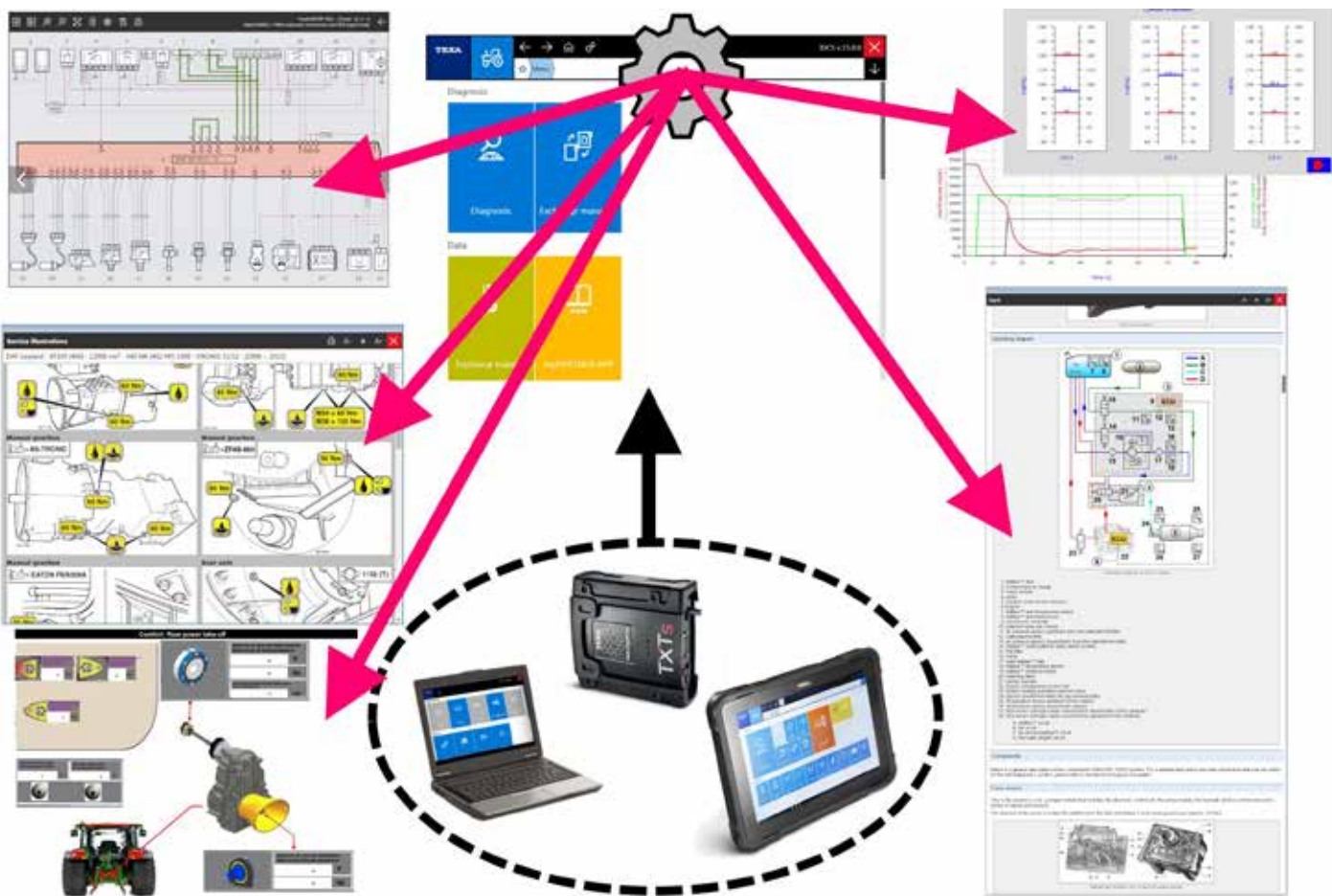


Figure 36: Modern self-diagnostic functions

The latest versions of Self-diagnosis allow cross-checking parameters and their correlation with the data from the control units of other systems.

It is worth remembering that, despite the undeniable advantages of an advanced diagnosis, the manual procedures are still widely used in the construction industry, namely for practical reasons.

In fact, off-highway vehicles are used out of the road for most of the time (if not for the whole time), and often in places that are not easily accessible.

As a consequence, the diagnosis and/or possibility to reprogram/recalibrate the equipment would have to be performed also "on the spot", directly by the operator, without needing dedicated tools.

For a detailed description of the manual procedures, please read chapter 4.3 Manual procedures on this manual.

3.2 TEXA self-diagnosis

TEXA's Self-diagnosis is achieved with two devices:

- The display tool
- The remote connection device or VCI (Vehicle Communication Interface).

The first one is where the diagnostic software is installed and where the user can read the information, while the second one is the device that is physically connected to the vehicle that must be diagnosed.

The two devices are connected to each other through a Bluetooth® type wireless connection or through a common USB cable.



Figure 37: Self-diagnosis connection diagram

Below there is a short overview on the TEXA tools and software developed for the world of construction vehicles.

3.2.1 AXONE Nemo

The new diagnostic device AXONE Nemo is TEXA's flagship product among the diagnostic tools.

To build AXONE Nemo, we started from our significant experience as a trusted partner of tens of thousands mechanical workshops and we tried to imagine what will be the evolution of their work within the next five years.

From this philosophy, the first SMART diagnostic tool in the world was created, a tool capable of guaranteeing technicians complete flexibility of use thanks to its interchangeable modules that allow it to adapt to multiple uses and situations.

Designed based on military standards, it resists to violent falls and can face all the inconveniences that are typical of heavy duty work. not only waterproofable to float Other

features are:

- ✓ ISO TS 16949 certification, the standard required for automotive first equipment suppliers.
- ✓ Body in magnesium to guarantee robustness, rigidity and lightness.
- ✓ Ultra-wide 12 inch screen, very robust thanks to the Gorilla Glass specifications.
- ✓ Viewable both vertically and horizontally.
- ✓ Magnetic hooks (an absolutely new feature for diagnostic tools) for the additional module capable of expanding the potentials and the resources, so that it is always ready for the check needs of any vehicle, even in the future.
- ✓ Compliant with military standards.
- ✓ 216x1440 pixel resolution.
- ✓ Quad Core processor.
- ✓ Wi-Fi and Bluetooth® 4.0 Low Energy communication systems.



Figure 38: AXONE Nemo

3.2.2 Personal Computer

For a maximum selection freedom, it is possible to install the self-diagnostic software on a common PC with a Windows™ operating system.



Figure 39: Personal Computer

The advantage of a PC solution is to integrate TEXA's self-Diagnostic software into your network of personal application and to be able to access the new IT technologies, freeing the software from the hardware.

3.2.3 Navigator TXTs

TXTs is a complete self-diagnostic interface that allows intervening on all types of vehicles (cars, motorcycles, light commercial vehicles, industrial vehicles, agricultural vehicles and marine engines). It connects to all of TEXA's display interfaces thanks to the Bluetooth® technology and to any commercial PC equipped with a TEXA operating system.



Figure 40: TXTs interface

Thanks to the Bluetooth® wireless technology it is possible to work freely around the vehicles or sitting inside it. With Navigator TXTs is possible to carry out the multi-brand diagnosis on cars, motorcycles, light commercial and industrial vehicles, buses, trailers, tractors, combine harvesters, ...

3.2.4 IDC5 self-diagnostic program

! The information given below is available in the self-diagnostic software at the time of the publication of this manual and therefore may not be updated. TEXA reserves the right to make any necessary changes or corrections necessary for the development of its software programs.

TEXA IDC5 (Info Data Centre 5) is the latest evolution of TEXA's diagnostic program, constantly developed and updated, which integrates not only the diagnostic and self-

diagnostic functions, but also all the diagrams and support documentation that modern vehicle repairers need.

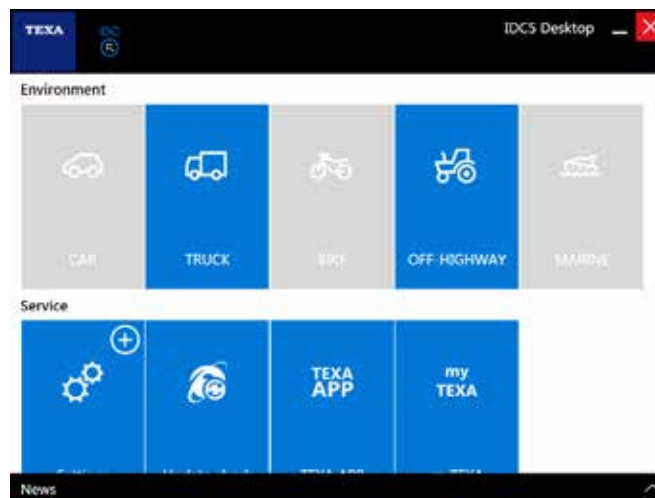


Figure 41: IDC5 Desktop

TEXA IDC5 is the operating environment that integrates the single-device functions with a multimedia support in the diagnostic software.

In fact, IDC5 makes technical data and detailed information available exactly when they are needed, and can be constantly updated via the Internet.

 *For a detailed description of each single function, refer to the OnLine technical documentation provided with the program.*

4. ADVANCED SELF-DIAGNOSTIC TECHNIQUES

The modern vehicle repairer is used to working with self-diagnostic tools. Reading an error, viewing a parameter and “testing” an activation are common operation for modern technicians in the automotive industry.

Even more: modern mechanics first read the error memory of a vehicle, then speak with the customer to understand the complained fault.

In this section the advanced functions of TEXA's self-diagnostic software that offer a better understanding of vehicle faults are analysed and explained.

4.1 Global system scan

The standardisation of the diagnostic protocols have brought enormous advantages and benefits for vehicle repairers, especially in the CAR environment, where the industrialisation processes are more driven compared to the world of industrial vehicles.

The construction vehicles too have experienced an evolution that is similar to the one occurred in trucks, i.e. having a large number of electronic systems, also by different suppliers, that may require specific diagnoses.



Figure 42: Electronic systems in Off-Highway vehicles

Often the “history” of the vehicle that must be diagnosed is not known. In these cases it is very useful to have a tool that can give, in a short amount of time, an overview of the information that the Self-diagnosis error memory can offer TEXA's knowledge and experience brought to the development of two different tools that allow a global scan of all systems installed in a vehicle.

- OEM vehicle check-up;
- TGS3 - System scan.

The first is a function that can be found in the official diagnoses of the most important makes. The second, on the other hand, is a TEXA proprietary technology that provides for the makes for which the first option is not available.

i *These scan systems are an innovation in the world of construction vehicles; therefore, they are present only in some makes and only in the most recent models, that are equipped with advanced, integrated electronic systems.*

4.1.1 OEM vehicle check-up

The OEM vehicle check-up "Total scan + error reading" function offers vehicle repairers the possibility to diagnose, on many models of the main makes, all the control units with only one operation, without having to examine each single system. Given the importance of the function (modern vehicle repairer must know the complete status of the vehicle in order to be able to formulate a correct diagnosis), it is the first option/selection available after the "Ordinary maintenance" quick controls.

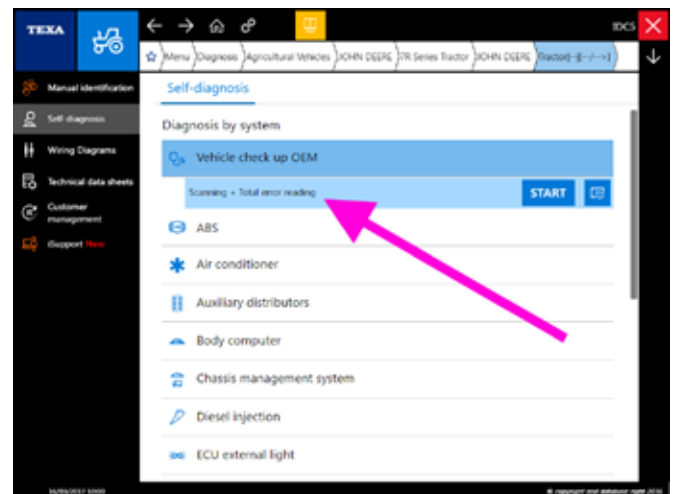


Figure 43: Vehicle check-up

It is an actual generic and general check-up of the vehicle's electronic systems and it specifically allows:

- Verifying the models of the control units in the vehicle's electronic system, even if they are not supported yet by the Self-diagnosis.
- More speed reading the error memory (from 3 to 20 times quicker).

- Checking the 'active' or 'stored' status of each single error in each control unit.
- Accessing, when available, the "error help" functions with the related repair procedures.
- Selecting and displaying only one specific group of control units (even only one at a time).
- Clearing the errors from the memory without having to physically reconnect the control unit at issue.

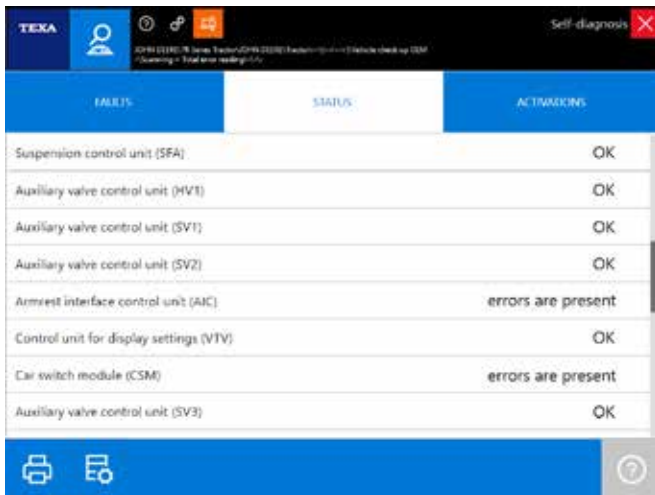


Figure 44: Vehicle check-up statuses page

This function is not available on all vehicles.

4.1.2 TGS3 System scan

The TGS3 (Total Global Scan 3) function is the third evolution of TEXA's consolidated system scan function and allows obtaining a list of the systems installed in the vehicle, selecting the systems desired and, by carrying out a scan, acquiring the status (presence of errors, ...) of the control unit.

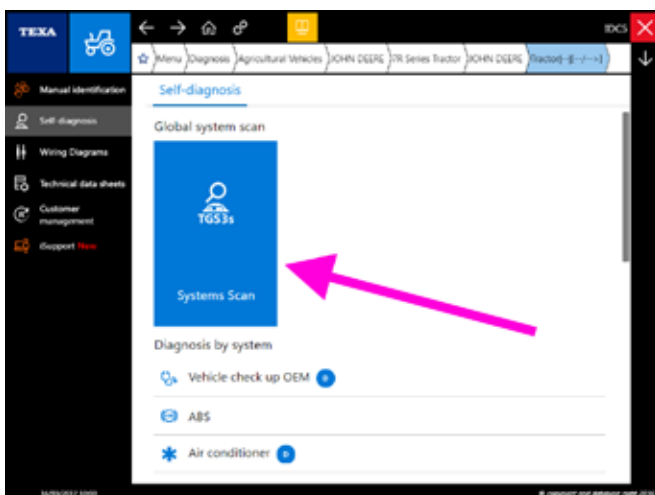


Figure 45: Total Global Scan 3 (TGS3)

Unlike the “OEM vehicle check-up” function, the TGS3 is a kind of automatism of the diagnosis that allows the user to access, from a single screen, only the electronic control units that are actually supported by TEXA's Self-diagnosis and the information given is only related to the presence or not of the control unit and if it has errors, without given more detailed information.

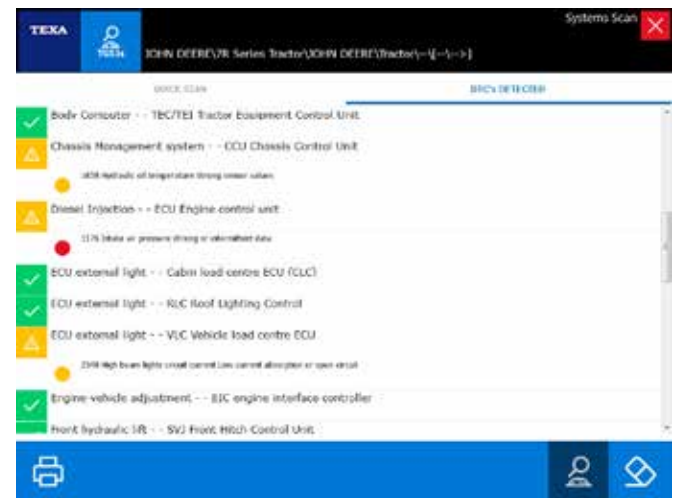
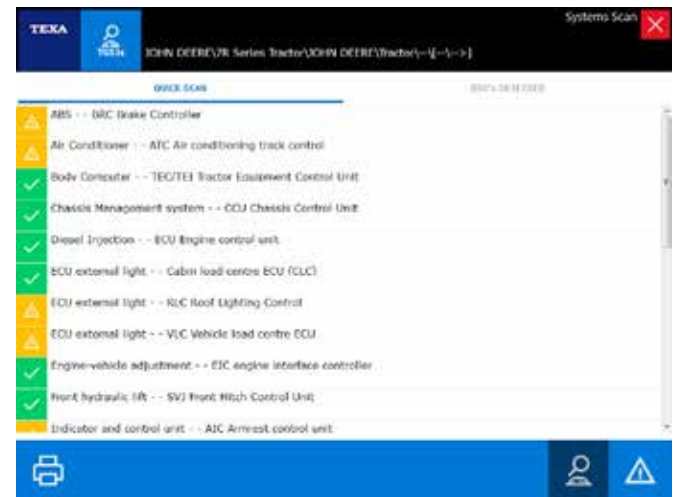


Figure 46: Scan with TGS3

4.2 Diagnostic protocols

There are many types of diagnostic protocols, but what is a protocol?

In Self-Diagnosis (and in IT technology), a communication protocol is a standardised set of rules and methods, defined to allow communication and the exchange of information between one or more devices.

In other words, it is possible to refer to a protocol as the language of an electronic control unit. It is easy to understand that two control units, to be able to communicate with each other, must share the same protocol (that is the same language).

4.2.1 Manufacturer/supplier protocol

Generally the vehicle manufacturer does not develop all the mechanical and electronic technology that is present on the vehicle, but relies on specific suppliers that can build the product based on the customer's particular needs or can supply a standard product that the vehicle manufacturer adapts to its vehicles.

In this regard, several examples may be made: the agricultural vehicle manufacturers are not engine manufacturers.

They purchase the engine (with its own diagnostic protocol) from an external supplier.

Another example: the AS-Tronic transmission, produced by the German manufacturer ZF Friedrichshafen, is used by many truck manufacturers.

Even the new AdBlue™ systems are normally built by an external manufacturer (Bosch over all) and are adapted to the vehicle by each manufacturer.

For many of these systems, the component's original manufacturer has already developed a dedicated diagnosis, but the customer (the vehicle manufacturer) often has its own diagnostic logic that generally does not match the component manufacturer's philosophy.

For this reason in TEXA's Self-Diagnosis there is the possibility to diagnose a system with both logics.

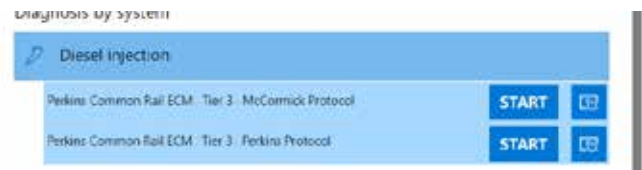


Figure 47: Manufacturer/supplier protocol engine self-diagnosis

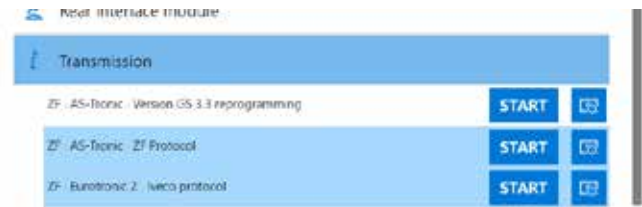


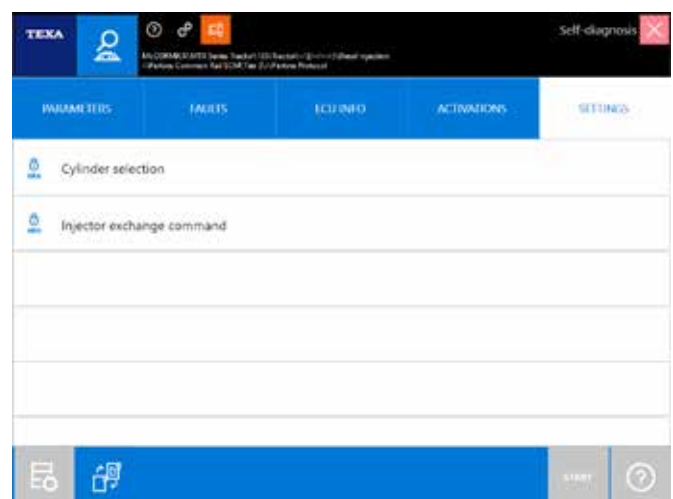
Figure 48: S-Tronic transmission self-diagnosis with Iveco or ZF logic

Images 47 and 48 show the possibility to select two diagnostic logics for the same type of system.

i Remember that the ZF AS-Tronic transmission is renamed, for commercial reasons only, in Eurotronic2 for Iveco and TipMatic or TipTronic for MAN, but it is always the same type of transmission.

Generally, the Self-diagnosis can be carried out with both protocols, without any limitation when selecting the one or the other.

The difference between the two protocols can be attributed to the presence or not of a few parameters, to slight differences between the error codings, but especially to a large difference in the adjustments that are available.



i The double diagnosis is only available for the systems in which both manufacturers have two distinct diagnoses.

This diagnostic method is particularly useful when the vehicle is not available (for ex. the vehicle is at the place of work and the driver is able communicate the error codes by phone).

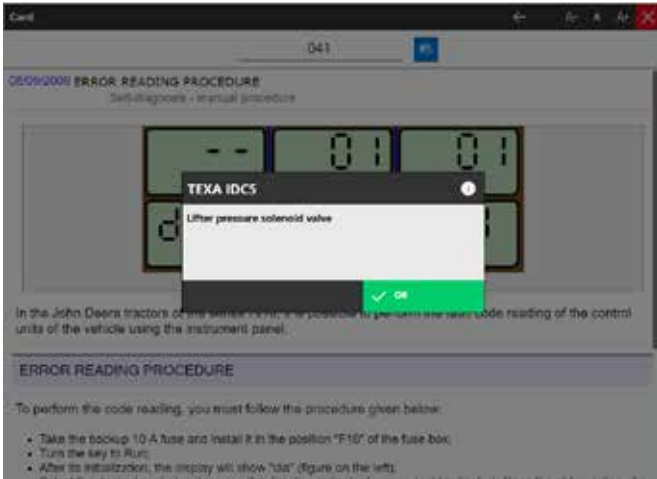


Figure 51: Error reading from the instrument panel

4.3.2 Manual calibration and adjustment procedures

Performing a large number of calibrations and adjustments on the accessories and devices installed in the vehicle is a similar possibility, but even more useful.

i The possibility to perform calibrations/adjustments in manual mode (without the Self-diagnostic tool) is an essential feature for construction vehicles.

The IDC5 diagnostic software offers a series of technical information (bulletins) including the instructions and operations to perform in order to complete the calibrations/adjustments in manual mode (Images 52 and 53).

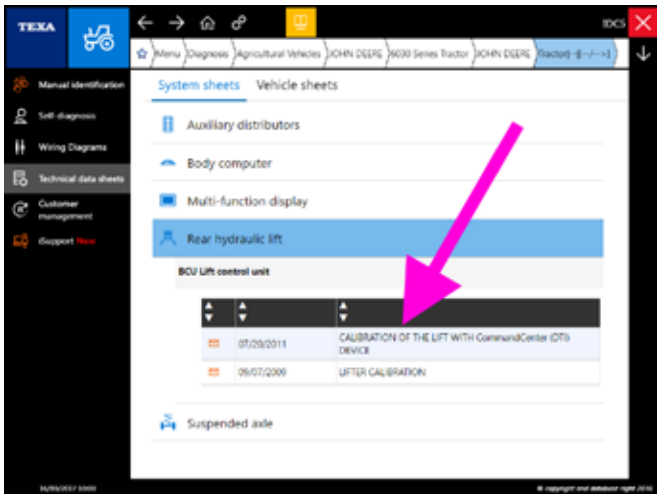


Figure 52: Manual calibration selection



Figure 53: Manual calibration procedure

i For further information on sheets and bulletins, please read section 5.2 Technical bulletins and sheets of this manual.

Series of horizontal lines for notes or additional information.

4.4 Advanced parameter reading and management

An important self-diagnostic function is the Parameters reading. It is from this page that you can view the values of the various sensors and of the actuators in the system being diagnosed.

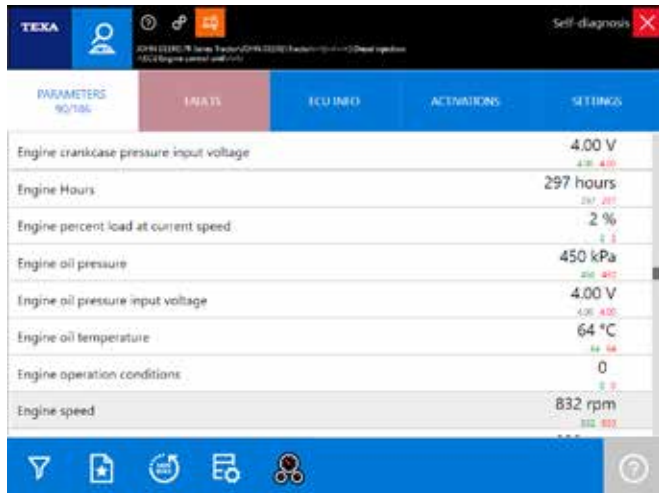


Figure 54: Parameters page

Often not all the functions available in the Parameters page are known. Below there are the possibilities offered by TEXA's Self-diagnosis.

4.4.1 Parameter help section

Some parameters are easy to read and understand but others it may be hard to understand what they indicate and if the values are plausible.

A small symbol "?" beside the parameter indicates that a help section regarding its meaning is available.

Press the button "Help" to get the information on the parameter and, when available, on the values it may have.

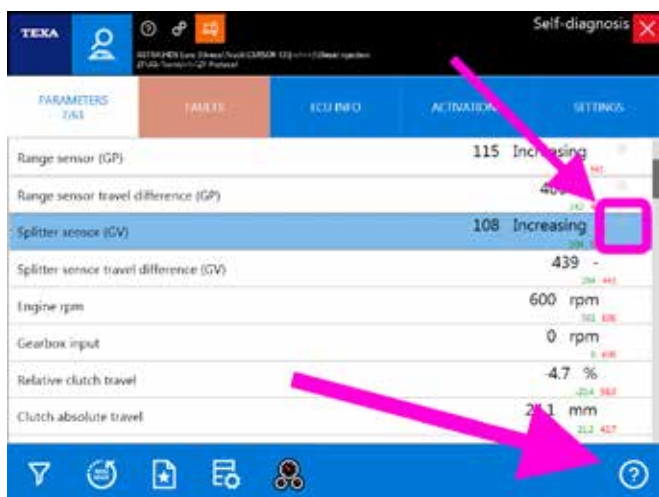


Figure 55: Parameter help button

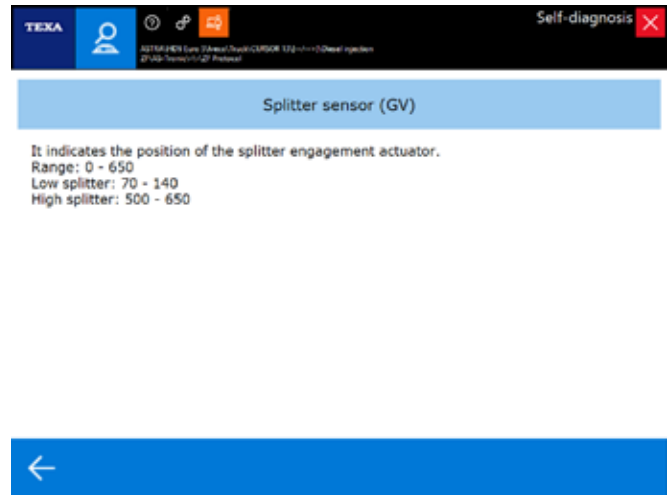


Figure 56: Parameter help section

Click on the "←" back arrow" to return to the parameters page.

4.4.2 Parameter selection

The latest generation electronic control units have dozens of parameters that can be analysed, sometimes hundreds! The parameters page of TEXA's Self-diagnosis shows all the parameters that are available for the system selected, but both the number and the order of the display are never the optimal ones for the diagnosis/repair being carried out. Therefore the possibility to view only some parameters is essential, to display only the ones that are strictly necessary for the repair/check that must be carried out.

The button "⌵" allows selecting the parameters of interest only.

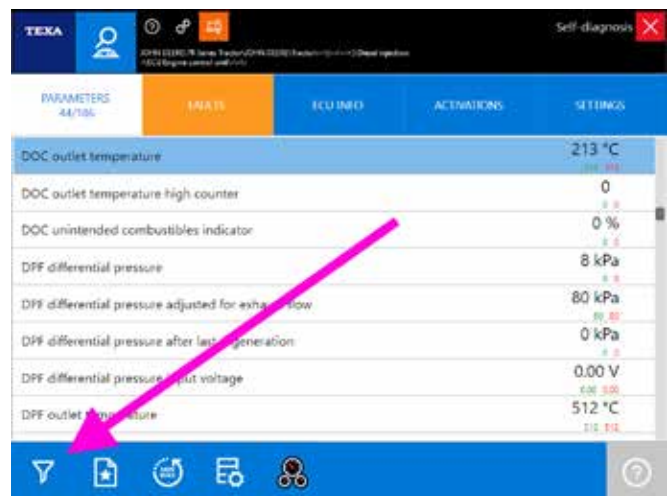


Figure 57: Parameter filter button

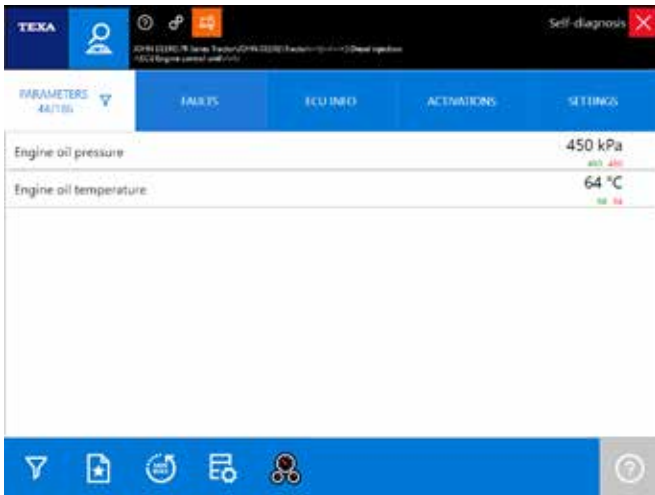


Figure 58: Filtered parameters

4.4.3 Favourite parameters

As mentioned above, the latest generation electronic control units have dozens of parameters that can be analysed and, as just shown, the display can be limited to the mere values of interest. However there is a better solution. In fact, IDC5 allows creating, displaying and managing groups of parameters called "favourites".

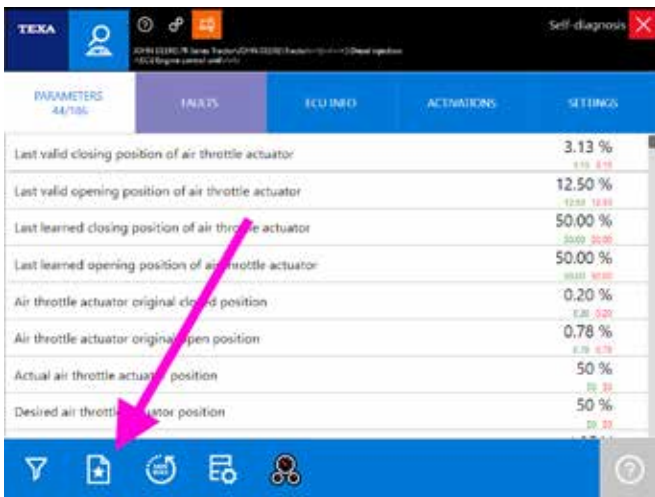


Figure 59: Favourite parameter button

The button for the favourites “b” allows creating and displaying the logical groups of parameters that are displayed as self-diagnostic pages.

i The favourite groups are not connected to a single vehicle but to the system being diagnosed. If you create a favourite group for the EDC 7UC31 system, this will be available for all the diesel injections of this model, even if used by other manufacturers.

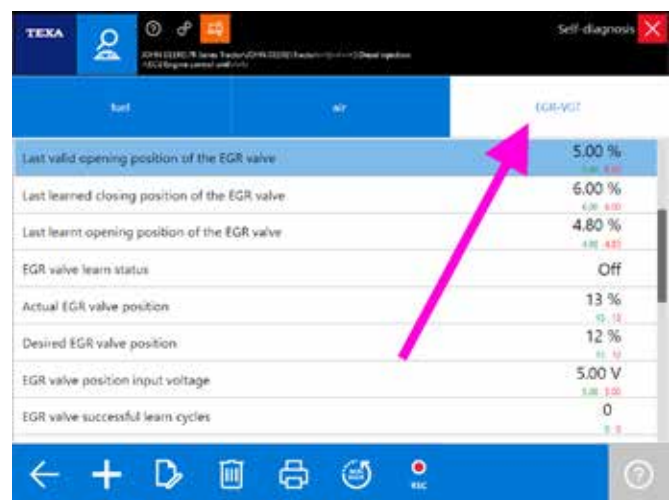
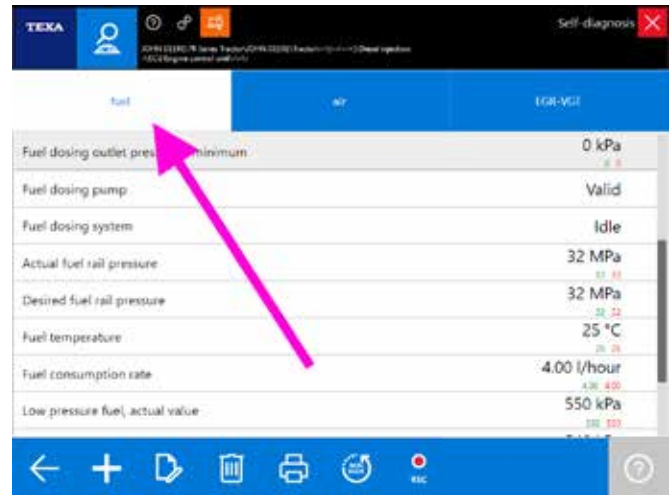


Figure 60: Favourite parameter groups

A new page is associated with each group of favourites created and it can be selected by simply clicking on the corresponding label (Image 60).

It is possible to create and name a new group with the desired parameters by clicking on the button “+” and selecting the parameters of interest (check mark “✓”).

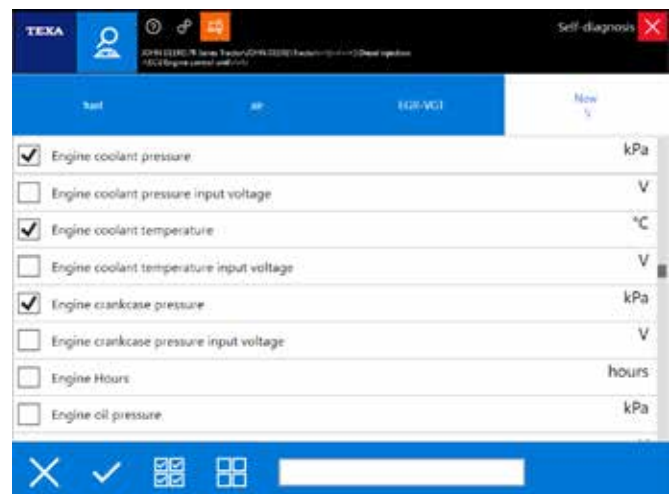



Figure 61: Parameter selection

 For a detailed description of each single function, refer to the OnLine technical documentation provided with the program.

4.4.4 Graphical display

When displaying the parameters page, the software shows by default the instant value.

At times it may be handy to have the possibility to display the values in a graphical form based on time, that is to display its trend.

This mode can be activated by simply double clicking on the parameter that must be displayed in a graphical form.

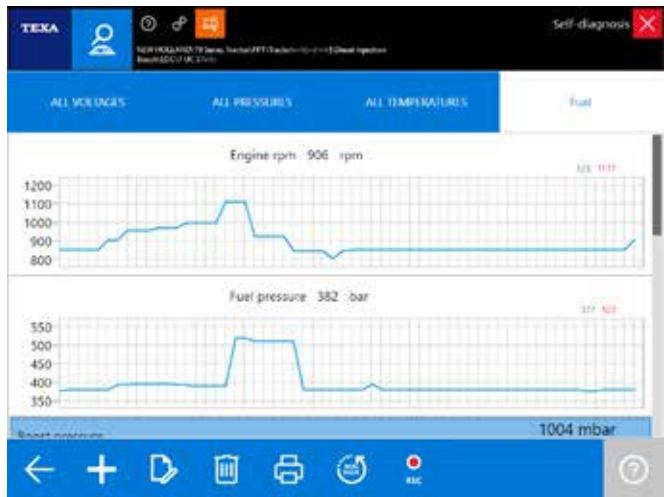


Figure 62: Graphical view of the parameters

The convenience of the graphical display is to be able to "keep an eye" not only on the numerical value, but on the behaviour of several values within a certain period of time. Image 62 shows some parameters related to the fuel system. You can notice that as the engine speed increases, the fuel injection pressure increases at the same pace.

4.4.5 Current value, minimum and maximum value

Three values are displayed for each item in the parameters page. The one written with big numbers is the parameter's instant value, whereas the two smaller numbers are the maximum and minimum value reached during the self-diagnostic session (a sort of reminder of the maximum and minimum value reached by the parameter during the diagnosis).

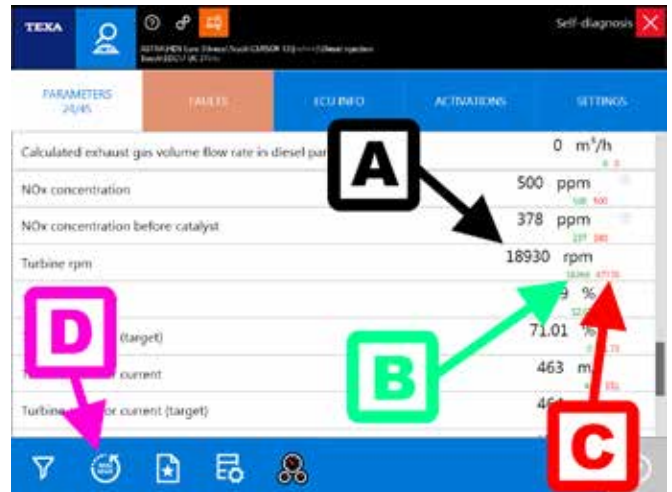



Figure 63: Current, minimum and maximum value of the parameters

Key legend:

- A. Current value
- B. Minimum value
- C. Maximum value
- D. Reset

In Image 63 you can see that the turbine speed is currently 18930 rpm (value A), but during the self-diagnosis the turbine registered a maximum peak of 47770 rpm and a minimum of 18260 rpm (respectively values C and B).

You can reset the maximum and minimum values at any time using the button “”.

4.4.6 Target value

Reading a parameter value is very important. Often it is possible to understand the status of the component from the value it gives: if an intake air temperature sensor indicates a value of 95 °C and the vehicle “is cold”, surely the sensor (or its electrical wiring) is not reliable. Likewise, a suspension level sensor that indicates a decreasing value when the chassis is lifted, can help us understand that the sensor was installed the wrong way.

In the past, the mechanic's experience along with a greater simplicity of the engines, allowed understanding, simply analysing the numerical value, if a component was working properly. In fact, a good mechanic knew that in a certain condition the engine had to respond a certain way (for ex. the mechanic knew that that particular model had to have a fuel pressure of approximately x bar at 2000 rpm). Nowadays this is impossible!

Reading that at a certain speed, the fuel's injection pressure sets, for example, at 930 bar, is not of much help. The technical development, along with the narrowness of the

emission values required for the approval, make these values differ a lot based on the conditions of use. The same engine used Norway during the winter or in the Arab Emirates during the summer, needs different amounts of fuel and air! (rarefaction of the air, operating temperature, atmospheric pressure, ...).

The self-diagnoses of the most recent control units help us. It is increasingly often to find two parameters for a specific component:

- Real value
- Target value

The first one is the value read by the sensor, the second one is the value that is calculated by the electronic control unit instant by instant and that it tries to reach.

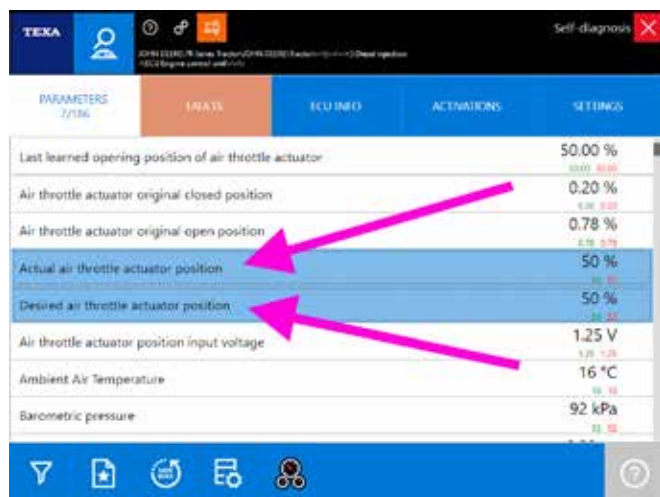


Figure 64: Actual and target value

4.4.7 Physical and logical values

Many electronic control units allow displaying a parameter in its two possible forms:

- Physical value (raw value);
- Logical value (decoded value).

The first one is the display of the signal's value, analysed in relation to its electrical components: voltage (Volt), frequency (Hertz), resistance (Ohm), etc ...

The second one is the interpretation of the signal's contents processed by the control unit: pressure expressed in bar, temperature in °C, ...

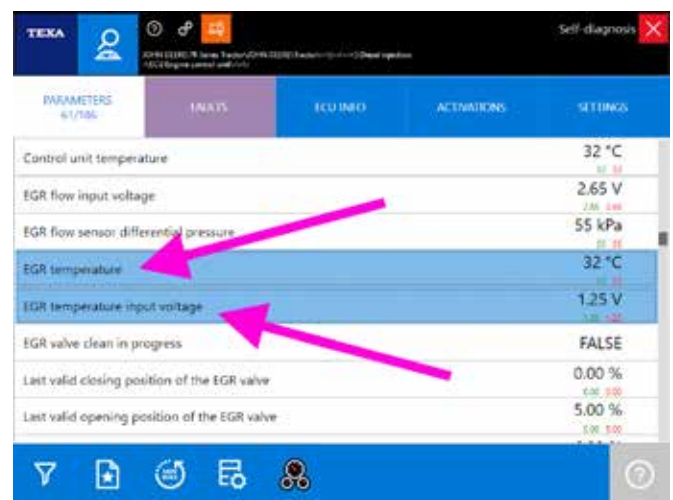


Figure 65: Parameters expressed with physical and logical values

4.4.8 Updating speed

The updating speed of a parameter depends on two main factors:

- 1.The electronic control unit's communication speed
- 2.The number of parameters displayed

For the first case nothing can be done.


The communication speed only depends on the type of hardware used by the manufacturer of the control unit (if for a specific parameter the control unit is programmed to send the new value every 0.5 seconds, the value will be updated on-screen every 0.5 seconds).

For the second case, instead, it is possible to try to reduce the number of parameters selected to obtain a quicker display.

i The word "target" can be replaced by various synonyms depending on the logic/naming used by the manufacturer. The words "nominal", "expected", "calculated value", ... are therefore equivalent to "target". The same way, in place of "actual" you may find a synonym ("real", "current", ...) or just the parameter's name.

4.5 Advanced parameter display: dashboard

Other than displaying the parameters in a chart or in a graphical form as shown above, there is a new exclusive function called **Dashboard** which offers the possibility to display the vehicle's engineering parameters, associated with intuitive and captivating graphics, that reproduce the dashboard of an industrial vehicle, the mechanical components and the system's operating logic.

To activate this advanced display mode, simply click on the icon .

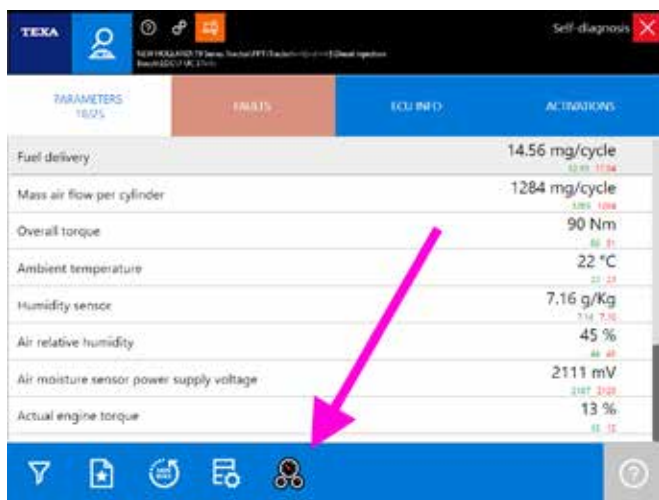


Figure 66: Modalità Dashboard

The image below (Image 67) shows the engine's air boost and intake system with the indication of only the parameters related to this part of the diesel injection system. It is also possible to infer from the image the air flow and the components involved in the operation.

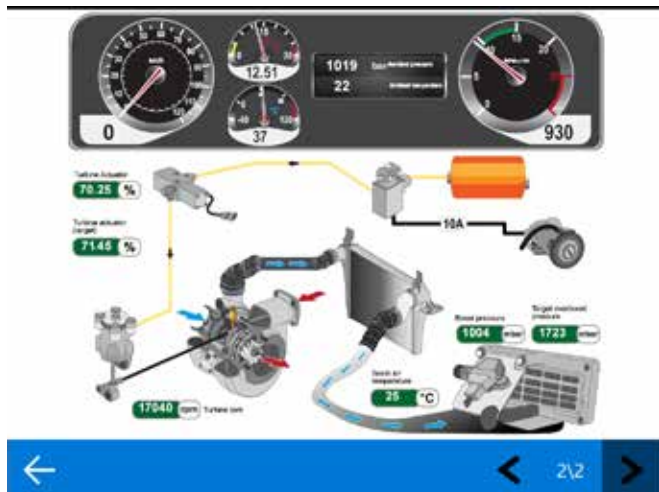


Figure 67: Boost and air intake system dashboard

4.6 Fault memory

The error page of the Self-diagnosis allows viewing the control unit's error memory.

It is the first screen that appears when connecting to Self-diagnosis and if the writing "Errors" is flashing, it indicates that there are faults stored.

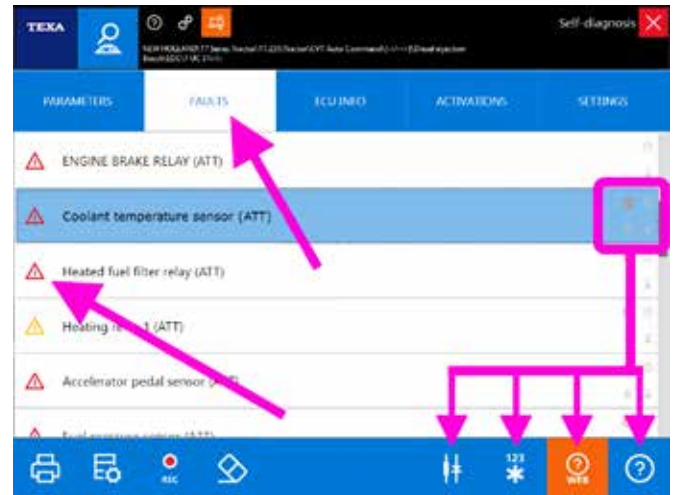


Figure 68: Error page

It is the main source of information on the present and past status of the vehicle and allows modern vehicle repairers to acquire further useful information.

The triangle icon beside the error description indicates the status of the error itself, whereas the availability of additional information can be inferred from the presence of some symbols on the right of the error that enable the related control button (Image 68).





Icon	Name	Description
	Error help section	Explanation of the error with the possibility to troubleshoot
	Freeze Frame	Parameters that were operative when the error occurred.
	Component location	Component location in the wiring diagram.
	Solved problems search	Search for the solution to the fault through TEKA's customer database.

Table 2: Information associated with the errors

Below there is an overview of the various information that can be acquired from the errors page.

4.6.1 Status of the errors

The errors can have 3 different statuses, each of them recognisable by an icon beside the error description:




Icon	Name	Description
	Active error (ATT)	It refers to a fault detected by the control unit and active at the time of the diagnosis.
	Stored error (MEM)	It refers to a fault that was detected in the past but not active at the time of the diagnosis.
	Historical error (STO)	This particular status appears only after a stored error has been cleared. It indicates that the error will no longer be present the next time the Self-diagnosis is accessed.

Table 3: Status of the errors

Stored errors

While the active or historical errors do not need additional explanations, a particular note must be made for the stored faults.

In fact, an error can have a stored status for 3 distinct reasons:

1. It is an error that occurred time ago, the fault was repaired but the fault memory was not cleared. The system keeps the error stored only as a past reference.
2. Some types of errors cannot be deleted by law (for ex. the errors regarding the exceedance of pollutant emissions on Tier4 or higher vehicles). If the fault is repaired, this error remains stored so law enforcement officers can check the "history".
3. The vehicle has a fault, but this latter only appears in particular conditions of use. In this case the error switches to the active status (ATT) only when the conditions are met.

It is easy to understand that point 3 is the most interesting for vehicle repairers. There is a whole series of cases of faults that may occur only in particular conditions of use of the vehicle.

A clarifying example would be about the transmission, related to the transmission output rpm sensor, when the problem is referred not to the sensor itself (faulty sensor) or its electrical wiring (short circuit or cable interruption) but to the phonic wheel or the air gap (sensor distance

from the phonic wheel).

Well, the error with the vehicle stopped (workshop condition) will always be in the stored status (MEM) as the control unit can verify the quality of the signal generated by the sensor/phonic wheel pairing only when the vehicle is moving (i.e. when the transmission output shaft starts rotating).

4.6.2 Details and error code

By double clicking on the description of an error, details of the error itself will be displayed. The level of detail depends on the electronic control unit's programming and may include a specification of the error or the manufacturer's original error code.

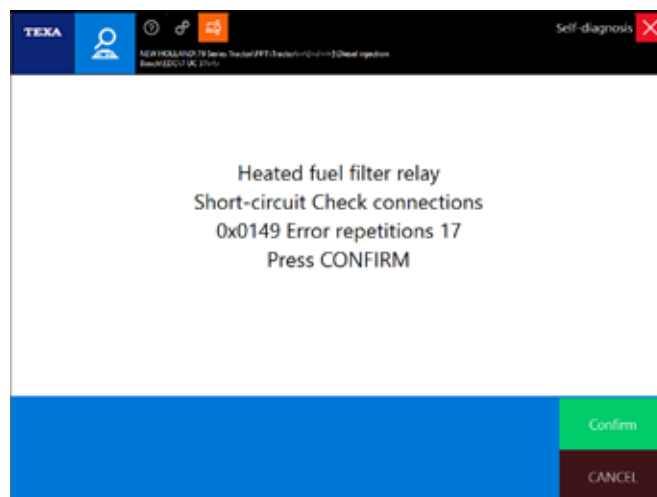



Figure 69: Dettaglio errore

 *The indicated error codes are ALWAYS the ones from the manufacturer of the vehicle and/or system being diagnosed. TEXA NEVER uses proprietary codings.*

4.6.3 Error help section

Each fault message, when possible, is supplied with an "Error help section" that includes a series of information and explanations regarding the error itself. When available, by selecting the error, the button results as enabled.

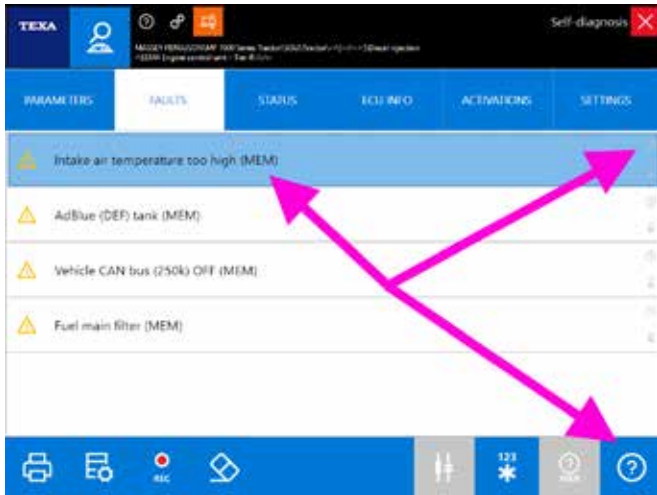


Figure 70: Error with the help function

The contents of the help section can give some information that is useful to understand the meaning of the error message and, eventually, a first series checks to carry out.

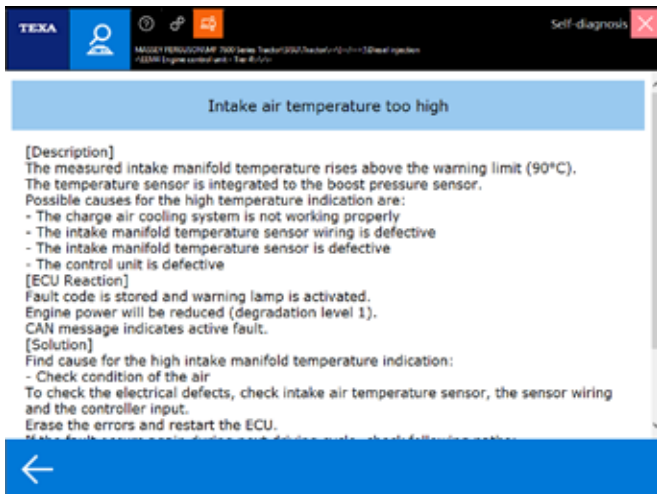


Figure 71: Error help section

Click on the "← back arrow" to return to the errors page.

4.6.4 Freeze frame

The continuous technological development also leads to new functions and possibilities in the Self- diagnosis field; a relatively recent function offered by TEXA's tools is the one called Freeze frame.

This new possibility allows displaying a series of parameters and data that indicate the conditions of use of the vehicle when a fault occurs.

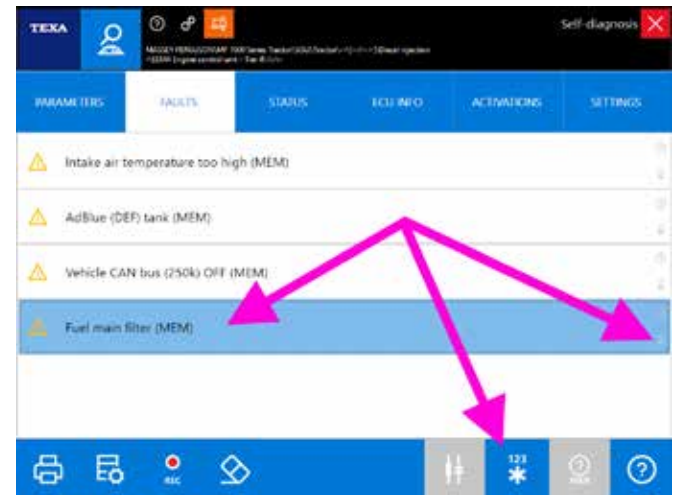


Figure 72: Freeze frame button

When available, by clicking on the button "123", a screen with the data stored at the time the fault occurred will be displayed.

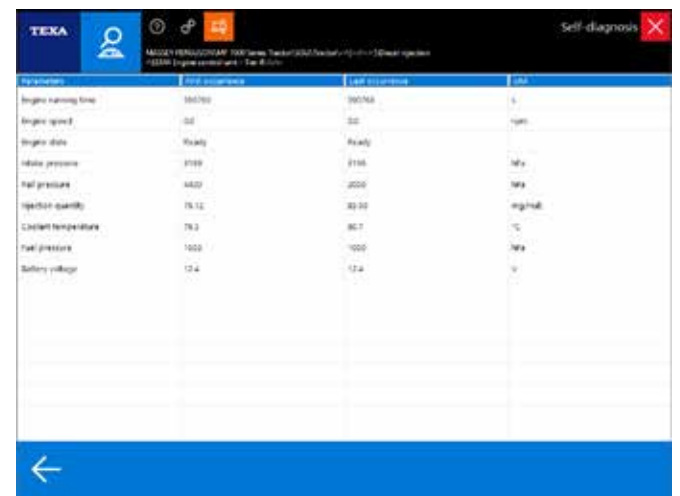



Figure 73: Freeze frame contents

The level of detail of the information in the Freeze frame depends on the manufacturer and can vary a lot based on the type of system diagnosed.

 TEXA did not develop this technology, but the control unit provides this support. Consequently not all the control units allow this function, but only the latest generation ones.

4.6.5 Component location

Many errors that may be in the control unit are referred to specific components (faulty pressure sensor, temperature probe disconnected, solenoid valve or actuator short circuited, ...).

When you are already familiar with the vehicle or with the system that must be diagnosed, you often already know the position and the type of connection of the faulty component. In many other cases though, it is useful to know "what you are talking about".

In fact, different manufacturers often use different names to identify the same component (for ex. the solenoid valve block that manages the passage of compressed air towards the driver's cab air suspensions can be called "Solenoid valve assembly" or "Electro-pneumatic assembly" based on the vehicle manufacturer).

Therefore, for the systems for which a wiring diagram is available and for the errors related to a specific component, the "# Component location button" will display in the wiring diagram the associated device.

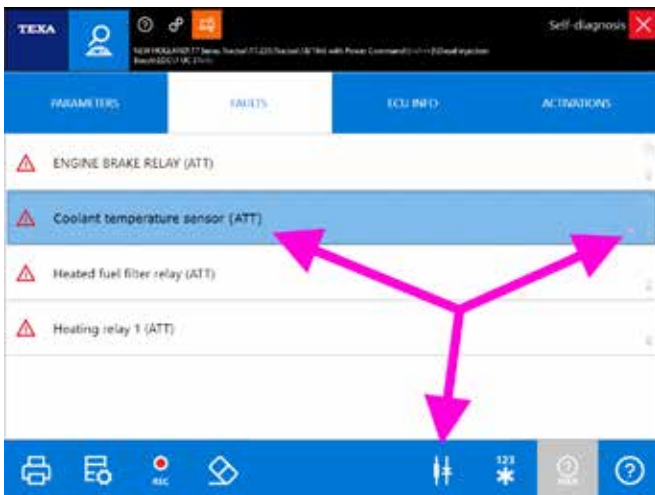


Figure 74: Component location button

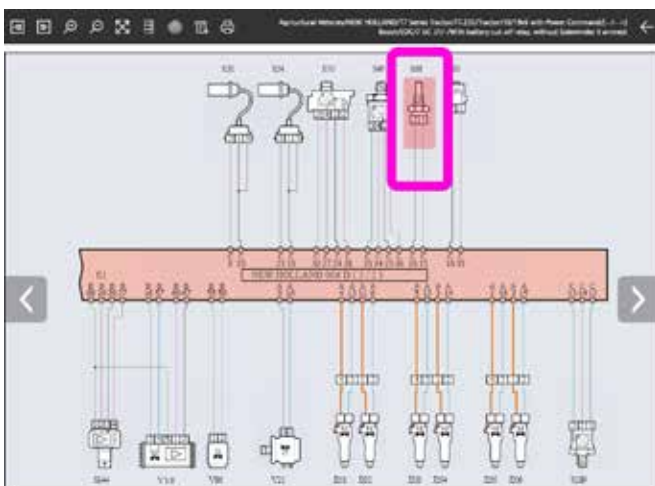


Figure 75: Location electrical wiring

i For a detailed description of the functions related to consulting the diagrams, refer to the OnLine technical documentation provided with the program or to chapter 5.1 Wiring diagrams of this manual.

4.6.6 Troubleshooting

A new fault has often already been analysed and solved by other mechanics in the world.

TEXA has been in the Self-diagnosis industry since 1992, but the difference is made especially the experience of our customers!

TEXA has collected its own experience and the experience of its customers within two databases (always available through an active Internet connection) to verify how other technicians have faced and solved the same problem.

The button "? WEB" allows consulting these two databases.

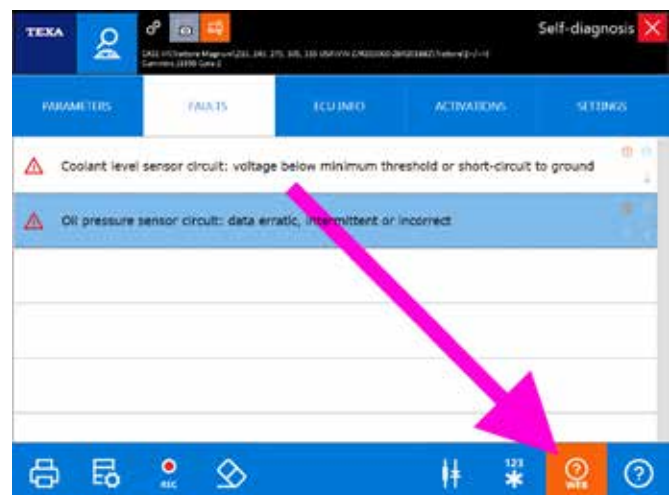


Figure 76: Solved fault search button

i For a detailed description of this function, refer to the OnLine technical documentation provided with the program or to chapter 5.3 Solved problems and Troubleshooting of this manual.

4.7 Recording of the diagnosis and test drives

At times a fault may appear only in certain operation conditions: for example the vehicle "loses power when uphill" or "when it is put under heavy stress" or "the fault warning light turns on only when the engine is warm",

...
 This type of problem generally stores a series of errors in the control unit that rarely result as active during the diagnosis in the workshop.

For sure, in some cases, a careful analysis of the errors and of the details associated with them, may help understand the nature of the problem; in many conditions though, this is not sufficient.

In fact, the vehicle repairer needs to be able to analyse the operational parameters during the actual conditions of use of the vehicle. Ideally, the technician should be able to sit beside the driver and analyse the parameters "live". Unfortunately this solution is not always feasible.

TEXA offers two operative methods for these cases:

- Recording of the diagnostic session
- Test drives

4.7.1 Recording of the diagnostic session

With all of TEXA's self-diagnostic tools the diagnostic session recording functions can be used; it allows recording the parameters and errors that may occur during a test drive. This data can be viewed and analysed in a second moment and printed to generate reports of the test drive that was carried out.

i In order to carry out the recording, you must be connected to Self-diagnosis.

Therefore, it is possible to connect to the self-diagnosis of the system that must be checked, select the set of parameters that has to be analysed and start the recording.

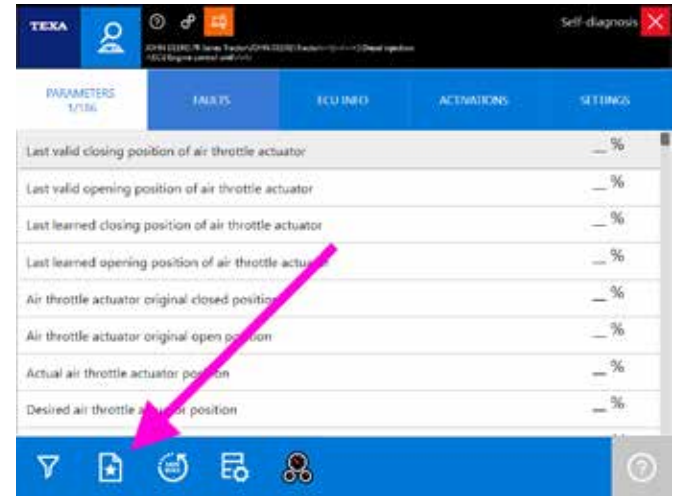


Figure 77: Parameter selection button

i For further information on the parameter selection function, refer to section 4.4.3 Parameters of this manual.

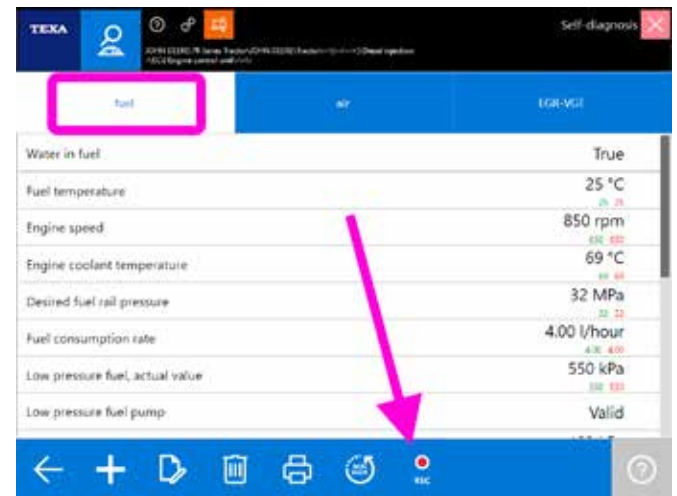


Figure 78: Diagnosis recording command

! The data recording and its following display are strictly related to the customer management database. In fact it is possible to view again the data stored only if the test is stored inside the customer database.

i For a detailed description of the Customer management functions, refer to the OnLine technical documentation provided with the program or to chapter 6.5 Customer management of this manual.


By clicking on the icon , the recordings of a diagnostic test is started. First, the total duration of the recording must be set (from 1 to 30 minutes).



Figure 79: Recording duration setting

During the recording of the test, the time remaining will be shown and at the end you will be able to store the session by clicking on the save button.



Figure 80: Recording in progress message



Figure 81: Recording complete message

When exiting the Self-diagnosis, the Customer management module page will be displayed, which allows associating the recording with a specific customer within the customer database or to create a new one.

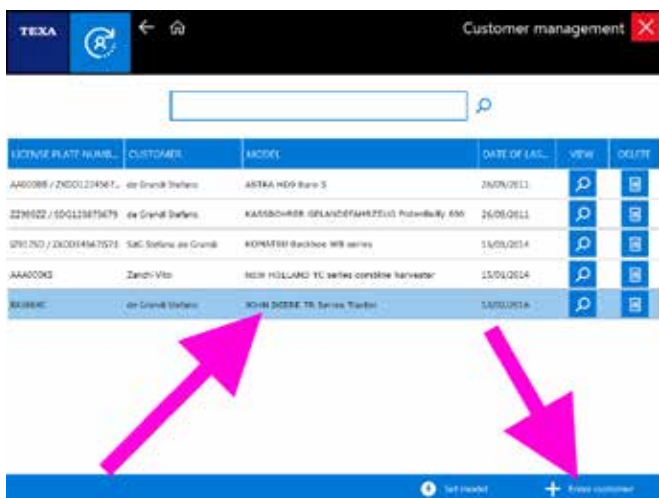



Figure 82: Association of the recording with a customer

Attention: not all the parameters available in the electronic control unit are stored, but only the ones selected and visible on-screen.

Display of the test recorded

The recordings can be viewed again through the Customer database. Select the test to display (the complete history of the tests carried out on the vehicle is present) and select the display command “”.

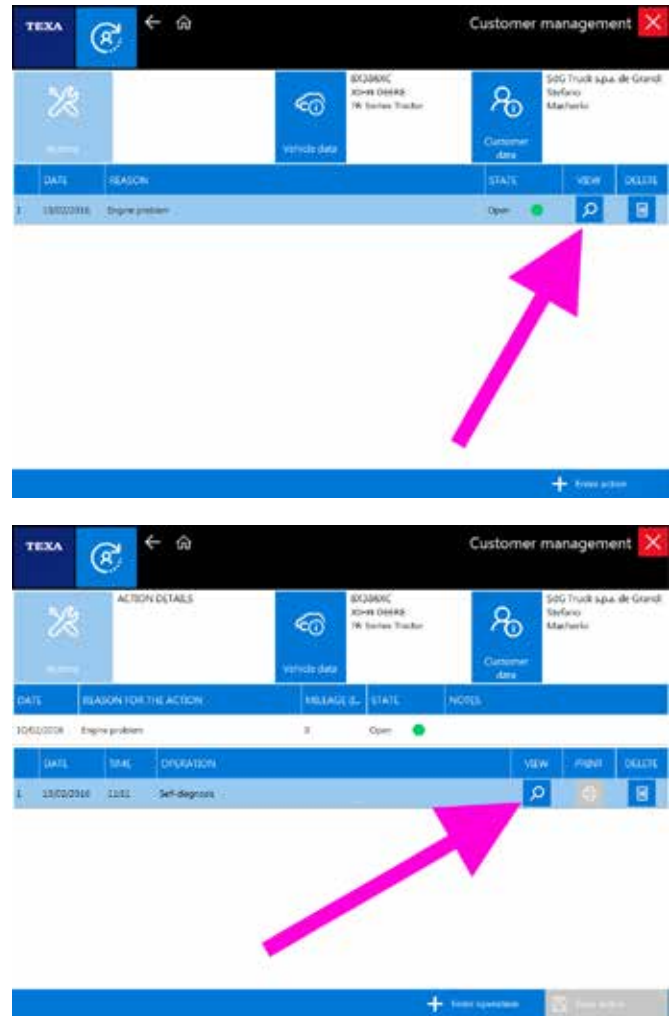


Figure 83: Customer database test record

It is now possible to view the trend of the values of the test carried out "📄" in a simple on-screen diagram that can also be printed if necessary.

Act on the page's buttons or click inside the diagram to view the values instant by instant.

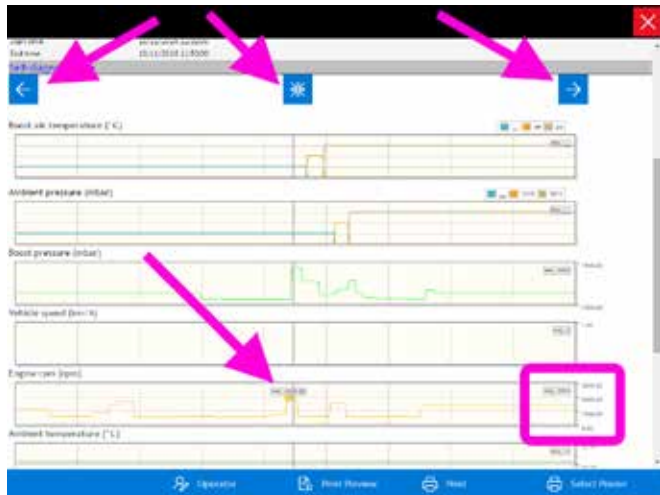


Figure 84: Display of the test data

In the example in Image 84, you can see the indicator positioned on the second 44.00 which indicates the instant values of the parameters recorded.

i For a detailed description of the Customer management functions, refer to the OnLine technical documentation provided with the program or to chapter 6.5 Customer management of this manual.

4.7.2 Test drives

The second method to record "live" the behaviour of a vehicle is the function called test drive.

Available only with latest generation tools (TXTs), this function requires connecting the diagnostic tool and leaving it on-board in order to carry out the test drive (even several hours long) without the presence of an operator, recovering it at the end of the test and downloading/analysing the data recorded.

Therefore, it is possible to connect to the self-diagnosis of the system that must be checked, select the set of parameters that has to be analysed and start the recording.

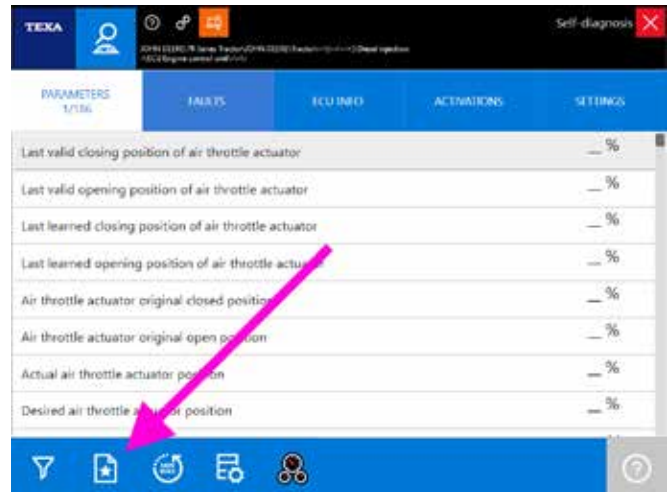


Figure 85: Parameter selection button

i For further information on the parameter selection function, refer to section 4.4.3 Parameters of this manual.

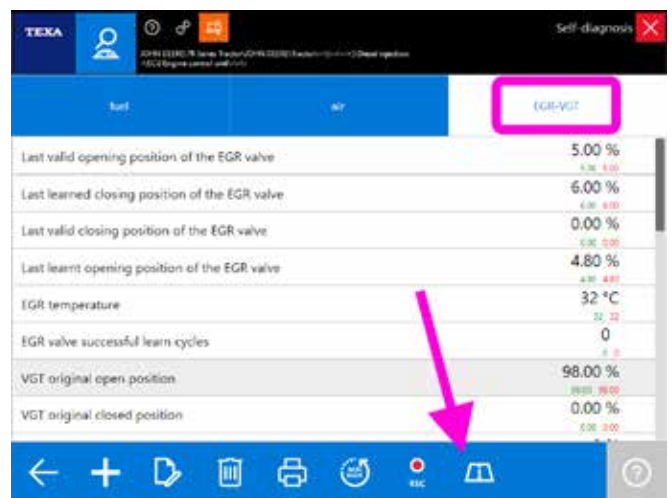



Figure 86: Command for carrying out the Test drive

The recording is started by clicking on the icon . The TXTs device goes into recording mode and the operator can leave it in the vehicle and close the Selfdiagnosis program.

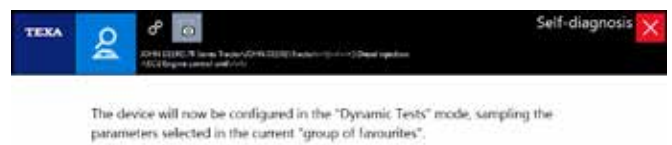


Figure 87: Test drive mode confirmation message

When the vehicle returns to the workshop, simply reconnect to diagnosis to start the stored data recovery process.

4.8 Component activation, resulting tests and diagrams

Surely reading errors and displaying parameters are two extremely important functions for the modern diagnostic systems in electronic control units, by TEXA's Self-diagnosis does not offer only these possibilities.

A very important part are the Activations of the components which allow the possibility to test the operation of the devices driven by the control unit (actuators) by temporarily activating them.

This allows verifying the efficiency of both the actuator and the control unit's electrical control line. In some systems the duration of test can be set by the operator, whereas in others the duration is set by the control unit's manufacturer. Many of the new electronic control units allow carrying out a series of preset tests to verify a component's operation. For example, all the manufacturers of SCR systems (AdBlue™) offer a test that sprays a certain amount of additive to verify the efficiency of the circuit and the dosing phase. The latest generation engine control units offer a test to check the turbine, the sealing of the chambers in the cylinders, ...

Generally, at the end of a test, if the result is positive or negative is indicated, but some tests also generate one or more diagrams that can help understand the system's operation more in detail.

Let's see in detail the test possibilities offered by the Self-diagnosis.

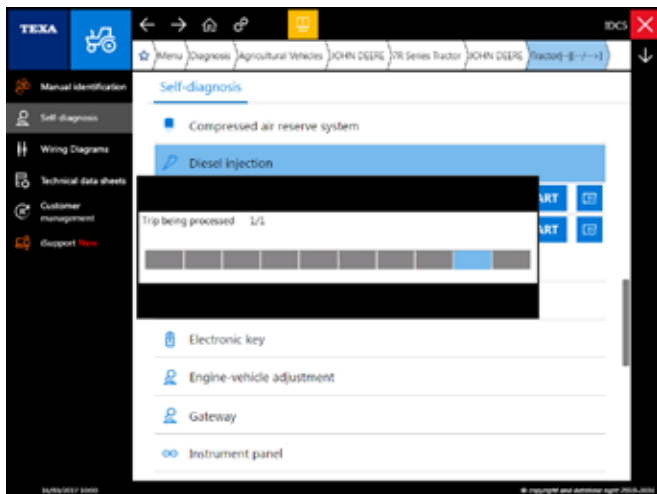


Figure 88: Trip data recovery

Therefore, you will be able to analyse the data immediately or consult it in a second moment from the customer management module, in a similar way to the one illustrated in the previous chapter.



Figure 89: Trip data display

It is useful to notice (Image 89) how this mode also displays the moment in which the error occurred (indicated by the icon “⚠”).

The data recording and its following display are strictly related to the customer management database. In fact it is possible to view again the data stored only if the test is stored inside the customer database.

For a detailed description of the Customer management and Test drive functions, refer to the OnLine technical documentation provided with the program or to chapter 6.5 Customer management of this manual.

4.8.1 Types of diagrams

As mentioned above, the latest generation electronic control units allow performing even complex tests that, sometimes, do not only provide a result such as "component working" or "component not working", but generate a series of diagrams that help understand in detail the component's operation and where the problem may be.

First of all, let's see the type of diagram that can be produced by the various tests available for the vehicle repairer.

Bar diagrams

Bar diagrams are the easiest to interpret. A graduated column that indicates the value reached during the test is shown.

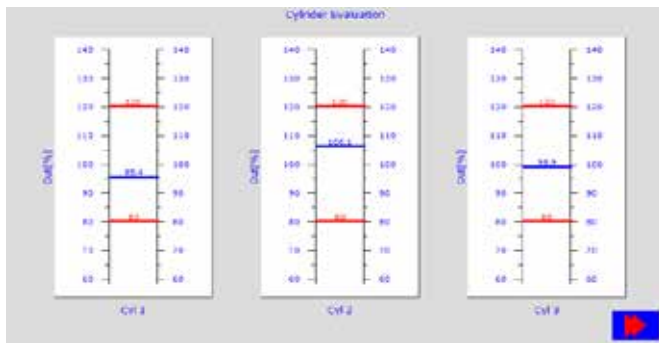


Figure 90: Bar diagrams

In Image 90 both the value reached during the test (blue line), and the limit values (red lines) within which the test is considered passed, are displayed.

i Not all the tests have reference values. Sometimes only the reached value is indicated and knowledge regarding the system or consulting specific technical bulletins (see chapter 5.2.2 Technical bulletins) helps understanding if the test was successful and if it indicates a problem in the component that was tested.

Line charts

Another type of diagram that can be obtained is the classic line chart, that compares the results of the test with a certain unit measurement (normally time).

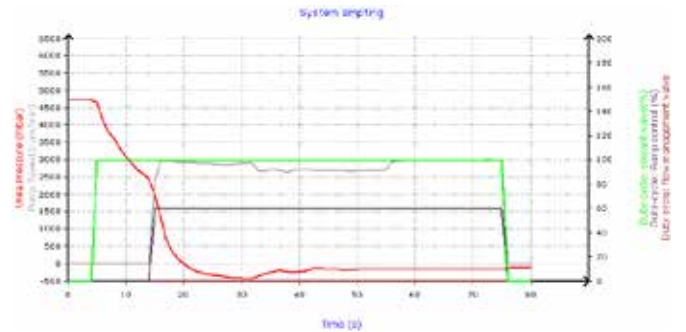


Figure 91: Line chart

The diagram in Image 91 shows the system emptying function of a SCR Bosch Denoxtronic2 system (Iveco in this case). On the abscissa (x-axis, horizontal) there is the time, while on the ordinate (y-axis, vertical) the red line shows the additive pressure trend based on the command from the solenoid valves (green, pink and brown lines) and on the pump's speed (grey line).

i Even in this case, knowledge regarding the operation of the system tested is essential in order to understand the diagram completely.

Line charts with references

Some types of line chart scan also have minimum/maximum reference values.

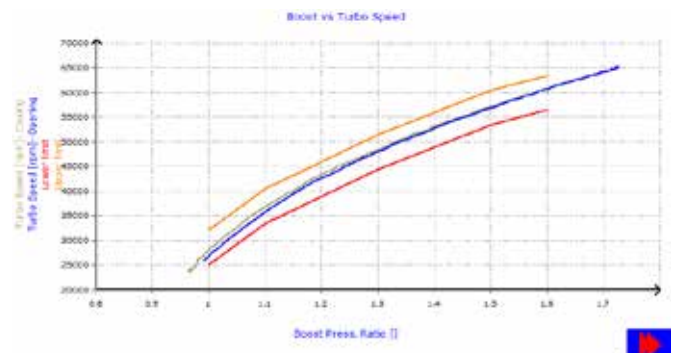


Figure 92: Line charts with references

Image 92 shows the result of a VGT turbine test. The red and orange lines indicate the reference limit values; if the blue line is on the inside, the test was successful.

4.8.2 Activations

As we have already anticipated, the Activations are one of the Self-diagnosis functions and allow understanding the operation of a component and of its electrical line.

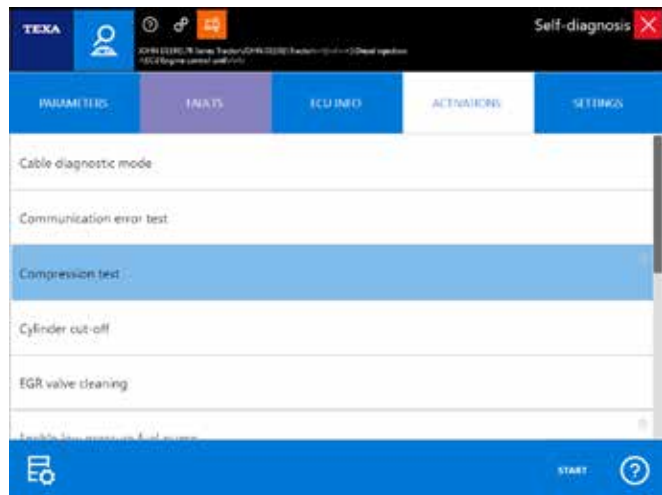


Figure 93: Activations page

Basically there are two types of check:

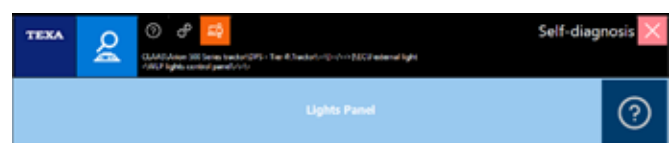
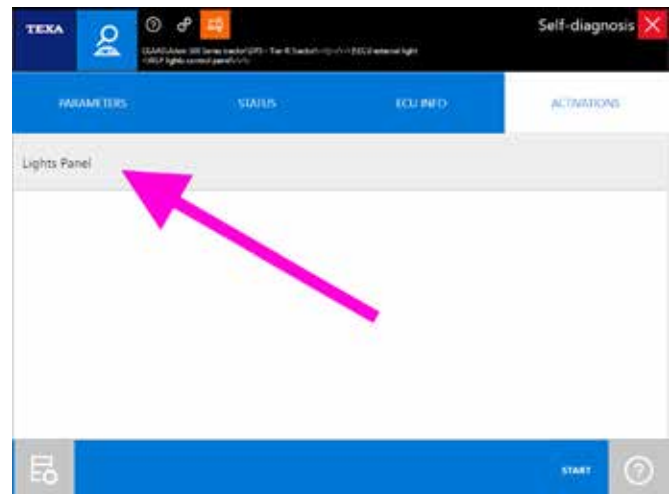
- a. Signal electrical check (component activation/deactivation)
- b. Dynamic check (execution of a complex test)

The first one is just an electrical activation, where the mechanic must verify if the activation was successful by "looking at" or "listening to" the component. The second one is an actual test, made available by the manufacturer, that verifies the efficiency of a subsystem in a more complex way. This second type of test only gives as result regarding the success of its execution or it can generate a diagram from which it is possible to understand the proper operation of the component tested.

Below there are some examples of possible activations.

External lights

As stated previously, some activations are purely electrical; the activation of the external lights is a check of this type. The component is activated by performing the Self-Diagnosis and it is possible to check if the light bulb turns on.



LEFT/RIGHT arrow to select
Arrow UP/DOWN to enable/disable, CONFIRM or CANCEL to quit
1) Night View
ON

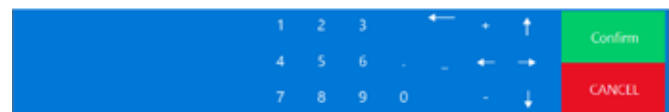


Figure 94: Activation: external lights

A malfunction (the light does not turn on) may be caused by:

- Burnt out light bulb
- Electrical wiring fault
- Faulty control unit.

AdBlue metering

The anti-pollution systems based on the SCR technology (AdBlue™ systems), always require a specific test that allows checking the additive circuit efficiency and the metering phase, by verifying that the injected amount of AdBlue™ matches the amount calculated by the electronic control unit.

ATTENTION: this test sprays a certain amount of AdBlue™. Adopt all the necessary precautions in order to avoid damages to both the environment and the operator.

The test requires disconnecting the injection nozzle and placing it in a graduated measuring container to check the exact amount of sprayed additive.



Figure 95: Graduated measuring container



The test can generate a diagram or only give numerical values and is considered successful if the amount of AdBlue™ collected in the graduated measuring container corresponds the amount indicated by the tool at the end of the test (Image 96).

Figure 96: Graduated measuring container at the end of the test

UDST AdBlue

For the AdBlue™ systems, many manufacturers offer several tests to check the system's status.

The CNH group, in its vehicles equipped with a Bosch Denoxtronic2 system, provides a particular test called UDST (Urea Dosing System Test) that allows verifying the system's overall operation without having to remove any component.

The test specifically verifies:

- the possibility to put the additive under pressure;
- the capacity to inject the AdBlue™;
- that the cleaning and emptying phase is completed correctly.



Figure 97: "Urea Dosing System Test (UDST)" diagram

Even in this case knowledge of the system that was diagnosed is required for a proper interpretation.

AdBlue pump

Besides the complex tests, even the SCR systems have some purely electrical activations.

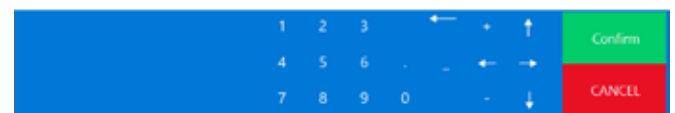
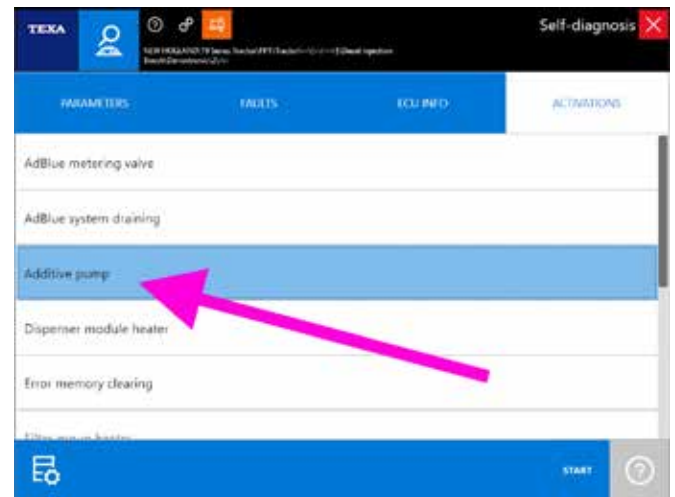


Figure 98: Activation: AdBlue pump

An example is the AdBlue pump activation. The check is successful if you hear the noise of the pump running.

Cylinder cutoff

In the diagnosis of the engine control units there is always a function to control the injectors. Based on the system version and the choice made by the manufacturer, this activation can have slightly different names (Cylinder deactivation, Injector deactivation test, Cylinder cut-off, ...) In any case this activation allows activating or deactivating each single injector while the engine is running.

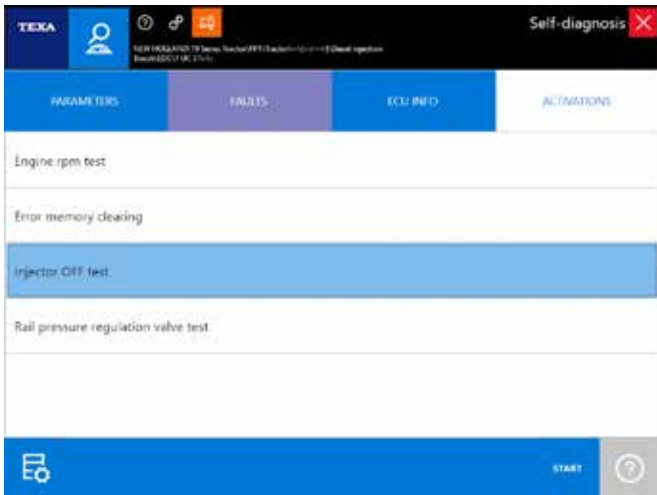


Figure 99: Activation: Cylinder deactivation

The engine sound changes when an injector is deactivated, it means that the electrical operation of that injector is correct.

Compression test

Another specific engine activation for the engine diagnosis (and almost always present in all control units), is the compression test, that is needed to check the sealing of the combustion chambers of each cylinder.

In this test the electronic engine control unit checks the deviations and the angular accelerations of the rodcrank unit and performs calculations to verify the correspondence of the operating parameters.

i This test is an analytical evaluation and does not reflect the actual efficiency of the engine. In fact, the engine control unit evaluates the efficiency of each single cylinder by comparing it with the others; if all cylinders were to have the same fault, the test's result would be positive, because there would be no difference between the cylinders.



Figure 100: Activation: Compression test

At the end of the test a message will indicate whether the test was successful or failed; and many manufacturers also provide a diagram with the values detected and the reference values for each cylinder (Image 100).

In case of a value out of range, we recommend checking the following components:

- the clearance and the adjustment of the valves;
- the timing;
- possible leaks in the cylinder head and in the injector housings;
- the sealing of the valves;
- the sealing of the piston rings.

High-pressure circuit test

The new Common Rail engine types need a series of specific tests.

One of these is the high-pressure test that is needed to verify the efficiency of the fuel system's high-pressure circuit.

The test consists in series of activations of the components in the Common Rail circuit (high-pressure pump, pressure regulator, sensors and sealing of the injectors) to verify the system's ability to generate and adjust the fuel's pressure throughout the different engine stages.

Even this type of test generally generates one or more diagrams from which you can deduce the correct behaviour of the high-pressure fuel system.

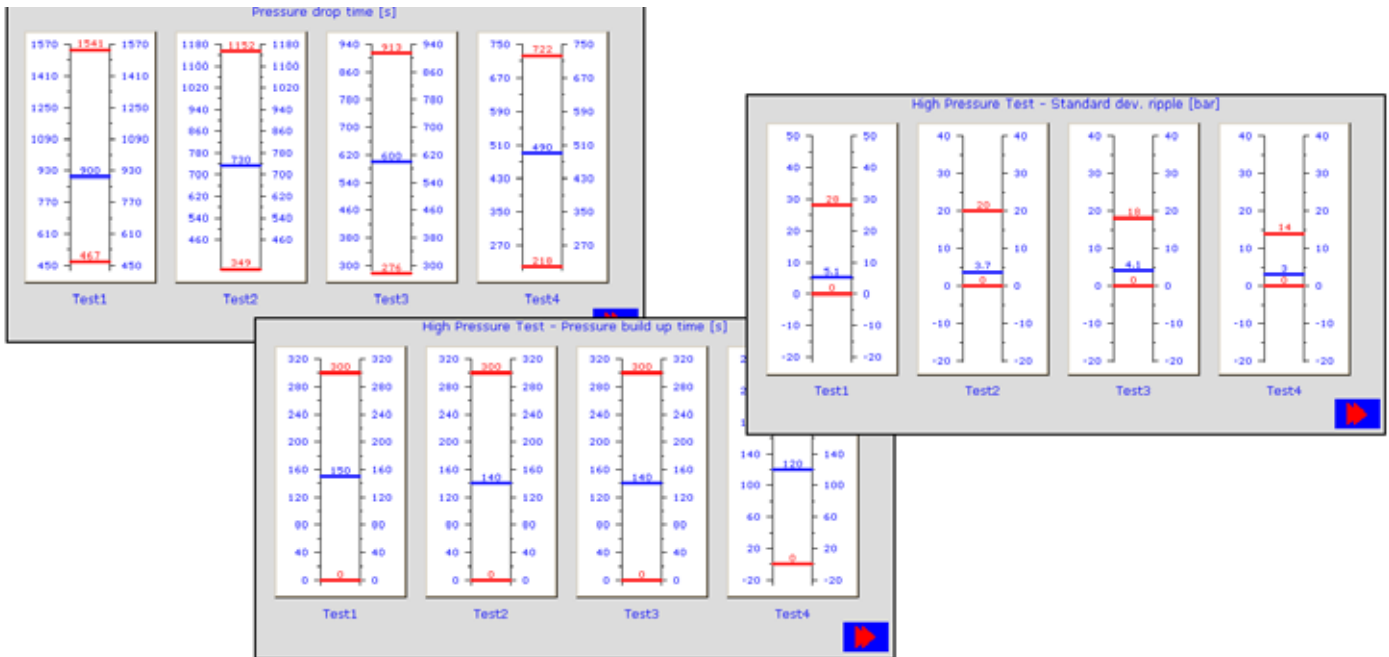


Figure 101: "High pressure test" diagram

4.9 ECU adjustments and programmings

The adjustments page of the self-diagnostic software allows performing a permanent adjustment (that is a programming) on some devices, through the functions provided by the control unit (ex.: idle speed adjustment, self-adaptive parameter reset, injector coding, etc.).

⚠ Carrying out adjustments on the devices is a delicate operation that must be done with the utmost care; for this reason in certain cases the software's use is limited by the need of an active Internet connection.

Carrying out adjustments on the devices is a delicate operation that must be done with the utmost care as it can change the system's behaviour or make the vehicle no longer compliant with the legal requirements. For this reason the user must accept some conditions and assume the liability of what is changed.

4.9.1 Web adjustments

TEXA, with IDC5, provided a software which allows completely diagnosing an electronic system. In fact, it is possible to perform the reading/clearing of the errors,

reading of the parameters and various activations and tests of the components installed in the vehicle.

Sometimes these operations are not sufficient to complete interventions that require a further step forward.

This is represented by the possibility to replace a component, change the parameters and configure a new control unit. With TEXA's software this possibility is available in various systems and these configurations have different levels of difficulty.

For this reason the user must accept some conditions and assume the liability of what is changed by using the provided software.

In particular there are two levels of protection:

- the first level is required to enable the "standard" adjustments (for example maintenance reset, electronic counter reset, input of the injector code when it is replaced, ...);
- the second level is to enable safety adjustments and the adjustments recommended by law, that is the programmings that, if are incorrect for any reason, may cause damages, dangerous situations or make the vehicle no longer compatible with the regulations in force.

The first level is enabled automatically, by accepting the electronic contract that appears the first time the user installs the software agreement the and each it is updated.



Figure 102: Contract conditions acceptance screen

For the second level, on the other hand, the diagnostic tool needs to have an active Internet connection when performing the adjustment. The Internet connection is needed because the vehicle information, the tool serial number, the date and time when the user performs the adjustment are stored on a server that allows TEXA to know which operations were performed on a specific vehicle at any time. This type of adjustment can be recognised by an icon located beside the adjustment you wish to perform.



Figure 103: Adjustments through Internet icon

4.9.2 Adjustments

As mentioned previously, the Self-diagnosis Adjustments page offers the programming possibilities for the electronic control units.

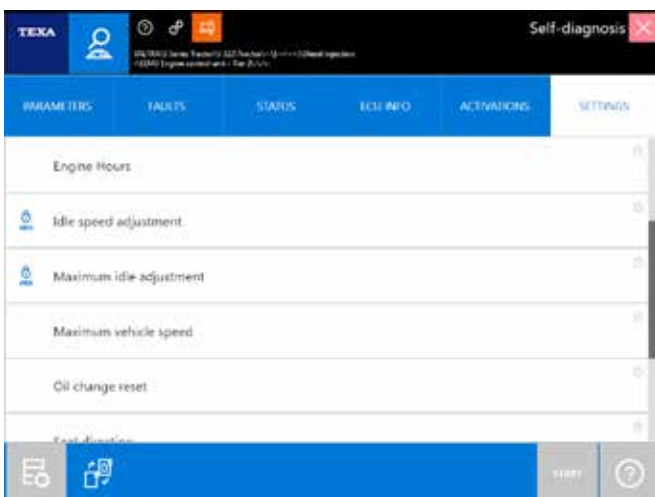


Figure 104: Adjustments page

Below there are some examples of possible adjustments.

Maintenance reset

A very easy but common adjustment procedure is the possibility to reset the expired maintenance warnings that may appear in the dashboard, such as the counter for the engine oil's operating hours.

i In older vehicles, the maintenance reset is manual, by operating specific controls on the dashboard. In these cases there is a technical bulletin that explains the procedure that must be carried out.

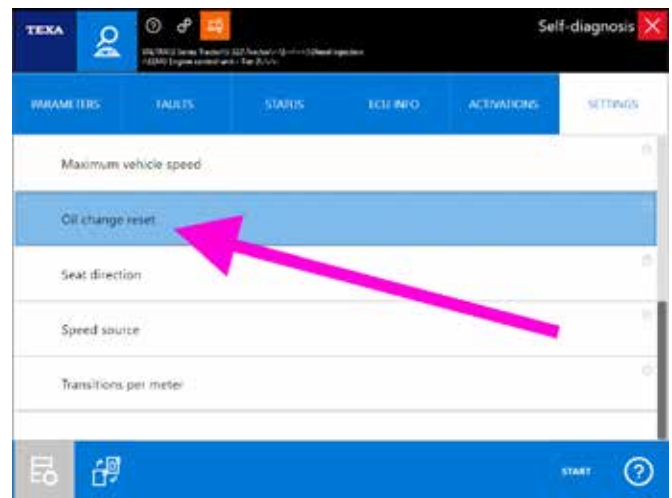


Figure 105: Adjustment: Oil reset

Generally, just connect to diagnosis with the control unit and perform the adjustment related to the maintenance you wish to reset (Image 105).

Component coding

The most modern systems more often need specific adjustments when a component is replaced. The increasingly strict anti-pollution regulations require that the components in an engine be extremely calibrated and small mechanical differences, due to the manufacturing processes, can greatly influence the performance of a latest generation engine.

For example it is possible to find specific adjustments for replacing various components, such as injectors, mass flow sensor, particulate filter pressure sensors, catalytic converter, rail pressure sensor, oxygen sensor, ...

Therefore it is possible to find the specific adjustments within the Self-Diagnosis when replacing a component.

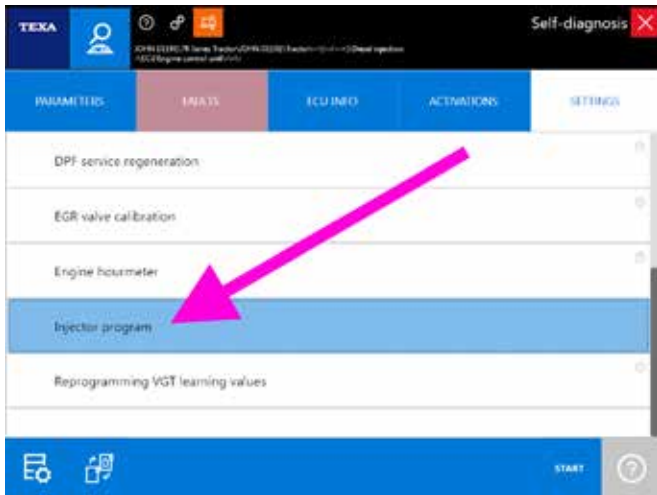


Figure 106: Injector replacement

Particulate filter

The anti-pollution systems that use a particulate filter (FAP, DPF, DPR, ...) need specific adjustments to be properly maintained.

There are specific adjustments for the regeneration while drive, the one when the vehicle is stopped, resets and codings for replacing the filter itself or its components (differential pressure sensor, ...).

TEXA's diagnosis offers all the functions needed for a proper management of the particulate filters of the main makes.

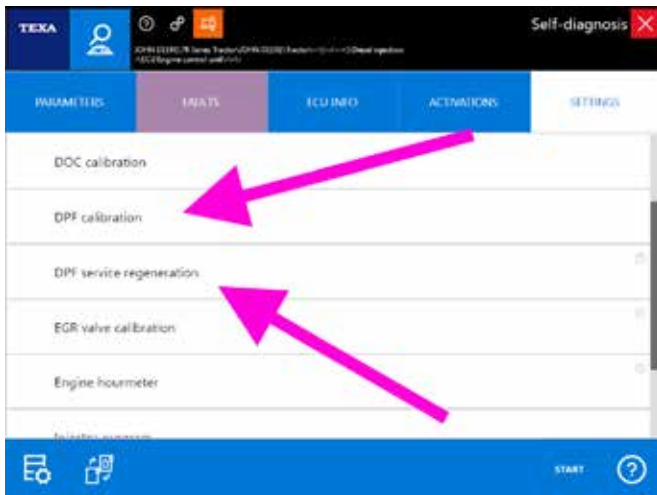


Figure 107: Adjustments for particulate filters

When necessary, additional information that illustrates the various operating procedures and the adjustments needed in order to manage the particulate filters correctly, is available and can be accessed from the technical documentation section.



Figure 108: Particulate filter bulletin

Attachments and equipment calibration

In the Off-Highway world, special importance is given to the calibration procedures for the attachments and devices connected to the vehicle.

Based on the manufacturer's logic, these calibrations may be performed with manual procedures and/or using the Self-diagnostic tool.

In both cases, the IDC5 diagnostic software supports both modes, with specific adjustments or technical documents.

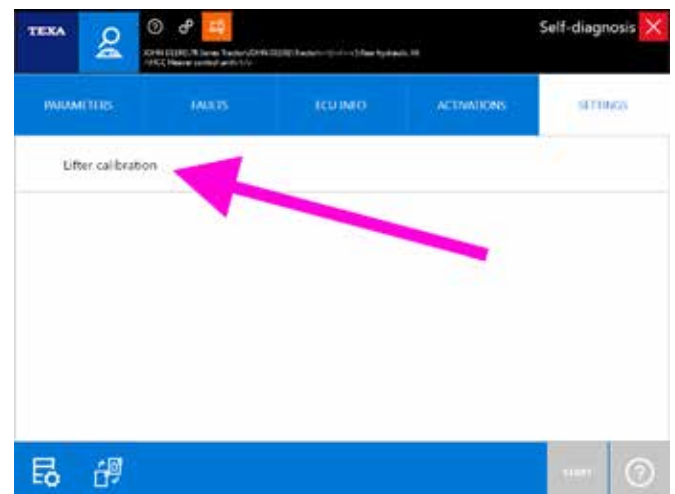


Figure 109: Self-diagnostic calibration

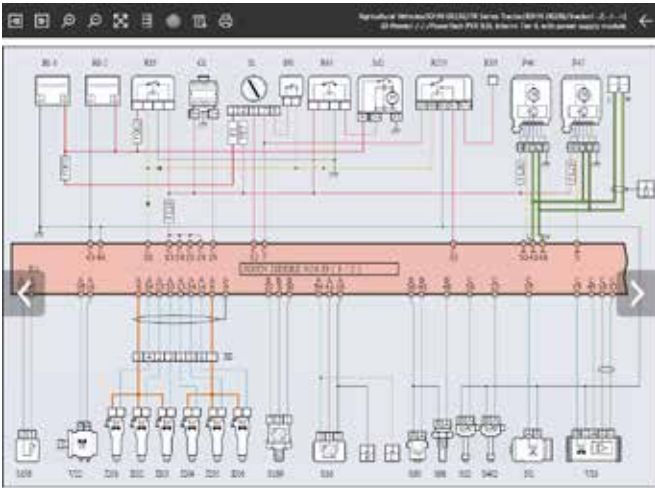


Figure 114: Wiring diagram, page 1

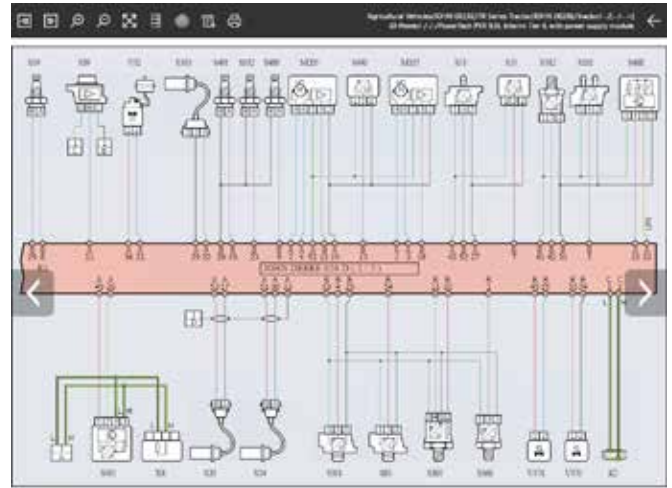


Figure 115: Wiring diagram, page 2


i For an easier understanding of the system's diagram, the representation is standardised for all the different manufacturers based on a single logic.

Icon	Name	Description
	Previous/Next Page	It allows scrolling through the different pages of a single wiring diagram (only for multi-page diagrams).
	Zoom In / Out	It allows zooming in/out on the desired areas of the wiring diagram.
	Full screen	It allows returning to a full-screen display of the wiring diagram.
	Component legend	It allows viewing the list of the components in the wiring diagram.
	Device location	It allows viewing the position of the desired component.
	Diagram legend	It allows viewing the colour code used in the connections.
	Print	It allows printing the wiring diagram and the legends.

Table 4: Wiring diagram menu controls

5.1.2 Consultation from the Self-diagnosis

Consulting the wiring diagrams is often essential when performing the Self-diagnosis.

In the various screens there is a “” button (Parameters, Activations, Adjustments, ... pages) that allows accessing all the Self-diagnosis support documentation.

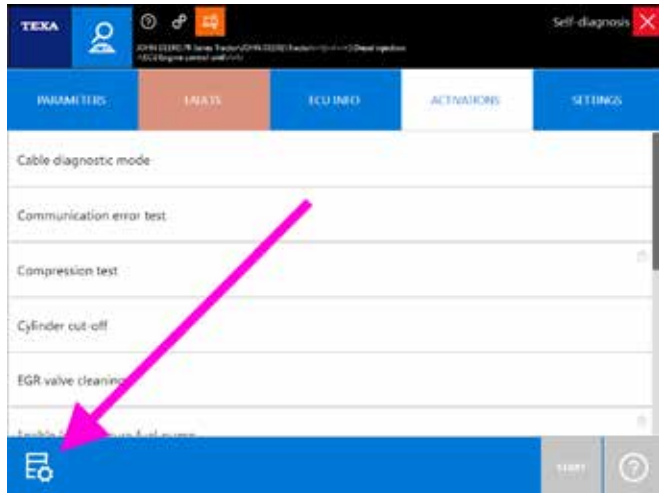




Figure 119: Access to the documentation from the Self-diagnosis

 The wiring diagrams can be accessed from the Errors page, as illustrated in chapter 4.6.5 Component location of this manual.

5.2 Technical bulletins and sheets

Nowadays, a multi-brand technician needs to know a large variety of systems of different manufacturers, each with its own peculiarities. Clearly this is not always possible. The large number of manufacturers and of variants makes it practically impossible to have an in-depth knowledge of each single system.

For this reason TEXA provides a series of technical sheets and information for the diagnosable systems. This information is available, divided by system and/or vehicle, by clicking the button “ Sheets”.

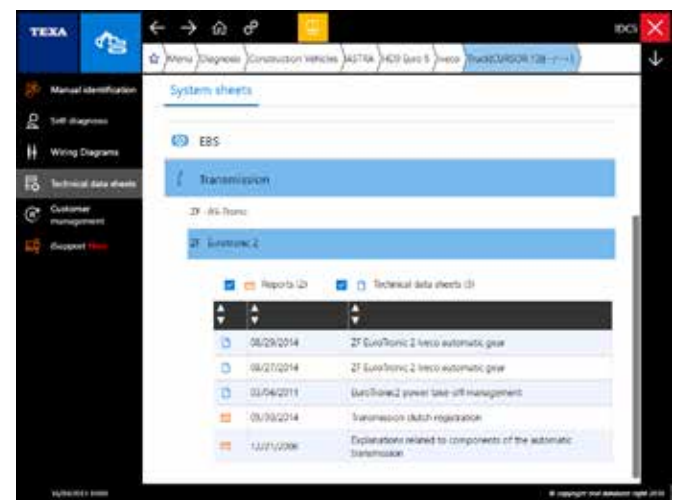


Figure 120: Technical bulletins and sheets

There are two types of technical information: the sheets and the bulletins.



Icon	Name	Description
	Technical sheet	It displays a technical sheet describing the system selected.
	Bulletin	It displays a brief document which illustrates a specific problem and/or solution.

Table 6: Technical bulletins and sheets

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

- System sheets;
- Vehicle sheets.

The first ones have information related to a specific system (as Image 120), whereas the second ones contain information that is valid for the whole vehicle.

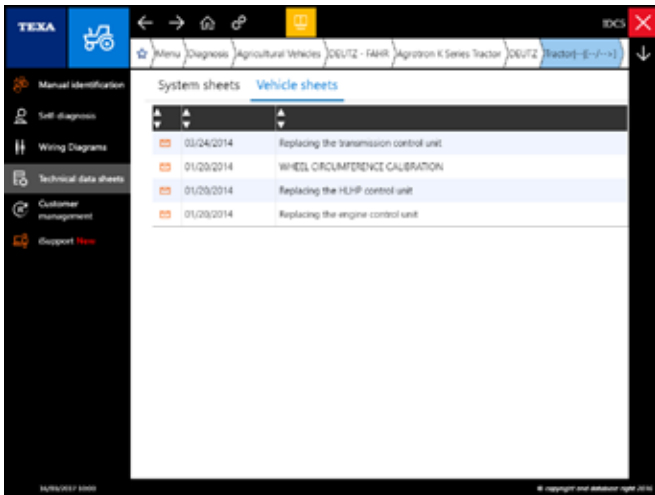



Figure 121: Vehicle technical sheets

5.2.1 Technical sheets

The technical sheets (recognisable by the icon ) explain in detail the operating principle of the system that must be diagnosed, also giving generic technical information general and specific solutions.

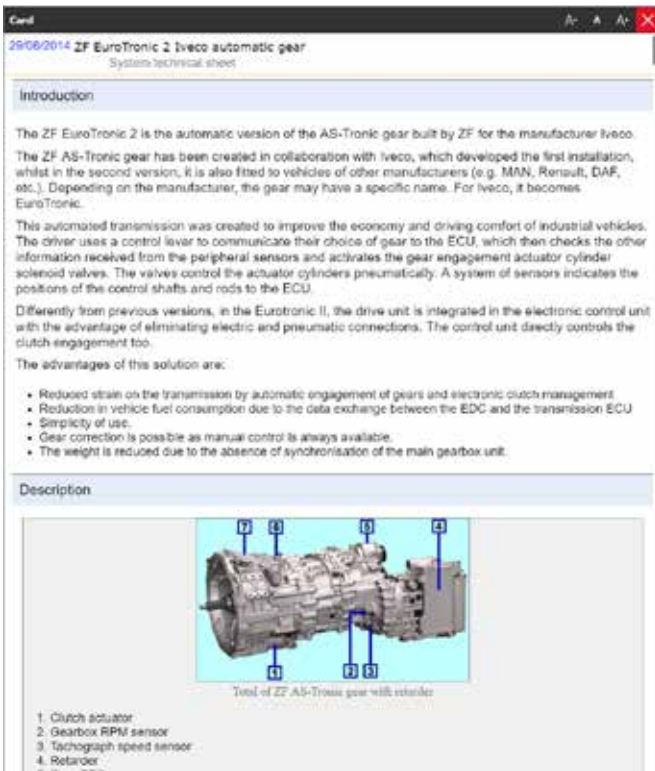


Figure 122: Technical sheet

Image 122 shows the technical sheet of a the Wabco tyre pressure management system; a relatively recent type of system, probably not well known. The sheet contains a general description with the explanation of why it is used; then there is a description of

the operating principle and of the components. This way vehicle repairers learn the basics and the operating details of a system that (in this case) they still do not know.

 **The technical sheets explain the system, not the Self-diagnosis.**

5.2.2 Technical bulletins




The technical bulletins (recognisable by the icon ) instead explain some operating details or give information on specific problems of that system and/or vehicle.



Figure 123: Technical bulletin

 **When carrying out a Self-diagnosis session, it is a good idea to consult the list of technical bulletins first, as it is always possible to find useful information on specific or particularly common problems.**

5.2.3 Consultation from the Self-diagnosis

It is very important to be able to consult the technical documentation even during a self-diagnostic session. As already seen for the wiring diagrams, the button “” in the various screens (Parameters, Activations, Adjustments, ... pages) allows accessing all the Self-diagnosis support information.

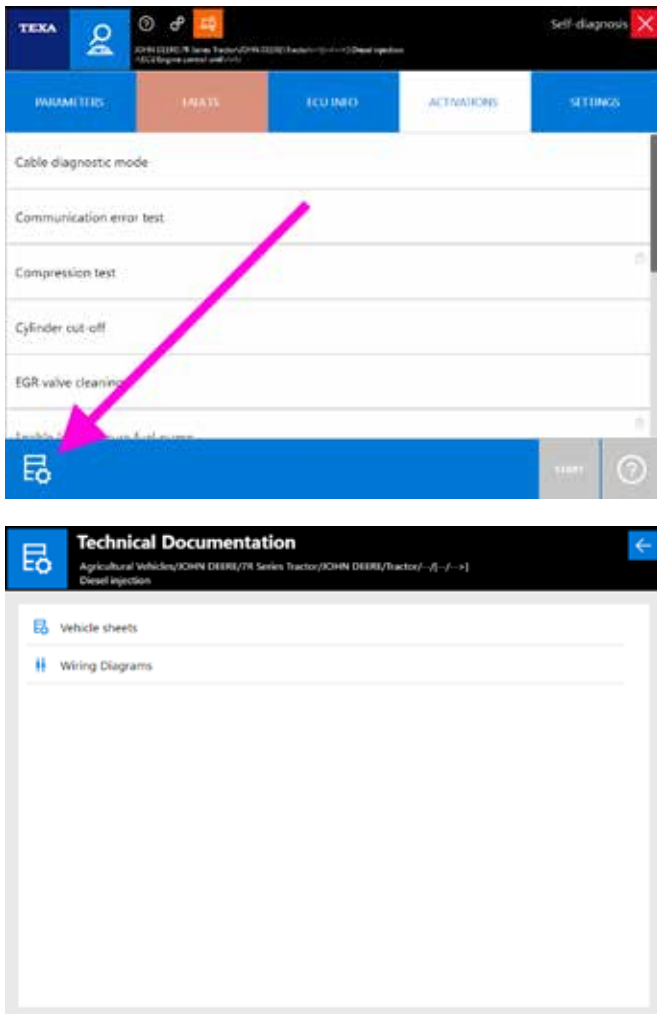


Figure 124: Access to the documentation from the Self-diagnosis



5.3 Solved problems and troubleshooting

TEXA has been in the Self-Diagnosis market since 1992, and from then it has gained a lot of experience, but it is especially the experience of its customers that makes the difference!

It is for this reason that two specific databases have been created throughout the years, in which the experience of both TEXA and its customers is collected.

1. Solved problems.
2. Troubleshooting.

Thanks to this data mechanics are able to complete repairs quickly and with the most correct procedure.

You can access to these databases from both the IDC5 operating environment () and directly from the Selfdiagnosis ()

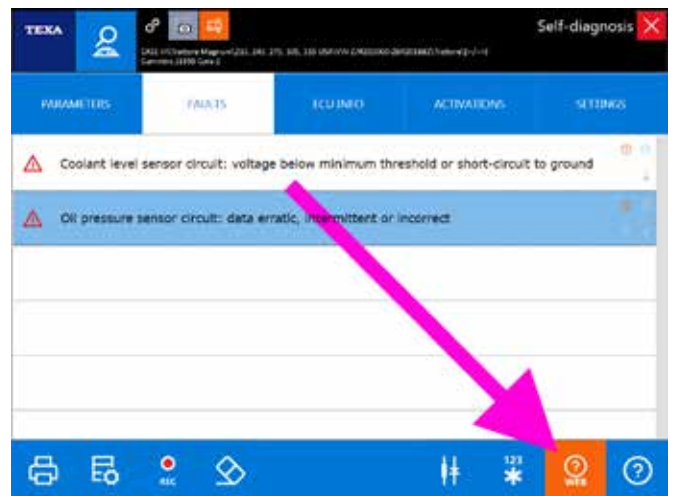
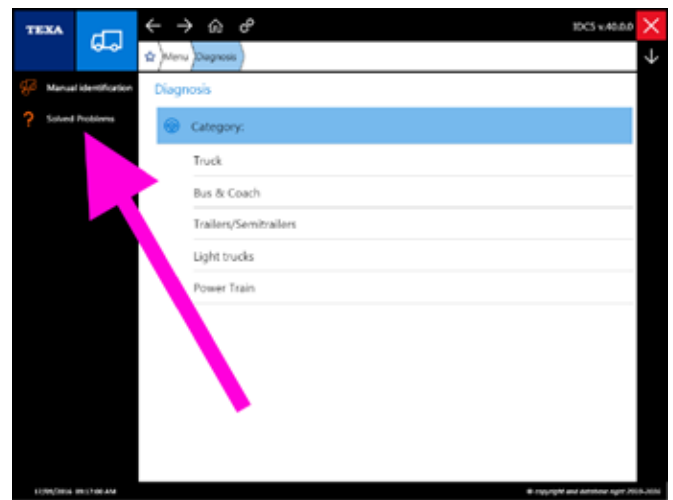


Figure 125: Access to Solved problems and troubleshooting

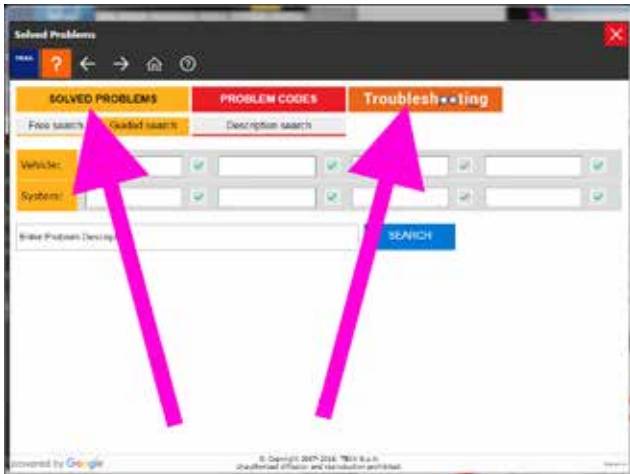



Figure 126: Solved problems and troubleshooting portal

! In order to use these databases the diagnostic tool must be connected to the Internet and the related subscription contract must be active (if required).

i For a detailed description of each single function, refer to the OnLine technical documentation provided with the program.

! In some markets this function may not be available.

5.3.1 Solved problems

"Solved problems  " is a database that contains real experiences from TEXA's customers. Thanks to this function mechanics are able to complete repairs quickly and with the correct procedure, being able to quickly and easily, using Google search, access a TEXA database to search for faults that have already been found by other mechanics worldwide and collected by TEXA's international call centres. The database can be accessed from both the IDC5 operating environment and from the Self-diagnosis (Image 125) and once the function is launched, a screen which allows carrying out both free "text" searches and more detailed searches appears with the specifications of the vehicle being diagnosed.

5.3.2 Troubleshooting

In a similar way to the Solved problem database, TEXA also offers access to a database called "Troubleshooting" in which you can find information, additional details and recommended repair procedures for a large variety of errors that may appear during Self-diagnosis.

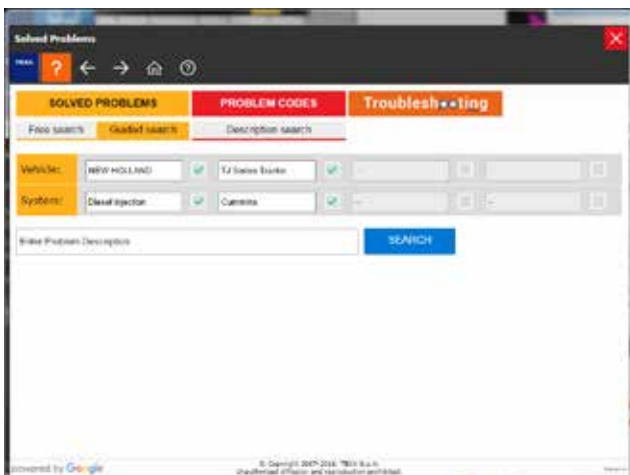


Figure 127: Solved problem search

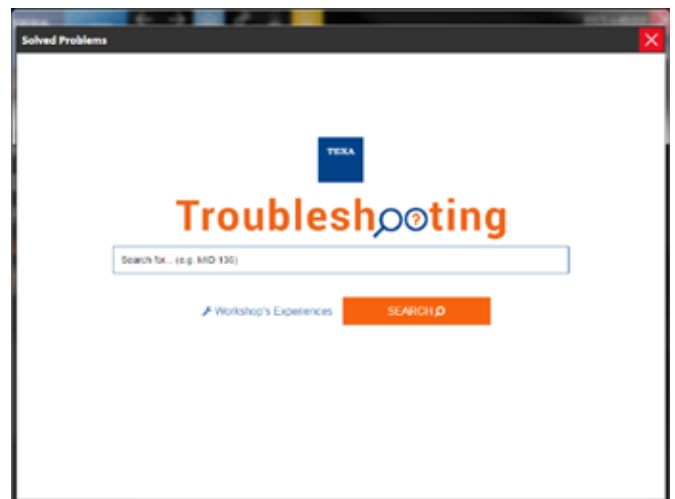


Figure 128: Troubleshooting search

6. COMPLEMENTARY SELF-DIAGNOSTIC FUNCTIONS

TEXA knows the world of vehicle repairers very well and is aware that the most important function is the SelfDiagnosis; but it also knows that it is not enough by itself. Not even the technical information and the specific diagrams for each system are enough.

It is for this reason that a series of other information and complementary functions are available, and perfectly integrated inside the diagnostic tools.

6.1 ECU INFO

When connected to diagnosis with a control unit, it is possible to get a some information by selecting "ECUinfo" sheet.

A screen with the control unit's diagnostic data will appear.



Figure 130: ECU info

Based on the vehicle and the type of the system, it is possible to find different types of information among which: control unit software, programming dates, component codes, serial numbers, ...).

Generally the data indicated is not essential for the repair itself, buy may be very useful if you are not familiar with the system or if you need additional information.

6.2 Vehicle search

The vehicles to diagnose are often already known, but sometimes there may be "uncommon" vehicles that are "seen for the first time".

It is the vehicle repair's duty to correctly identify the model and the version of the system that must be diagnosed, starting from a direct observation of the vehicle (plate with the mechanical data) and an analysis of the documentation on the vehicle (vehicle registration certificate, user manual, ...).

To make the correct identification easier, TEXA increased the vehicle search possibilities thanks to two specific functions:

1. Manual identification.
2. Automatic VIN identification (VIN scan).

6.2.1 Manual identification

The first function is called "Manual identification" "Identificazione manuale" and allows launching a search and a vehicle identification by manually entering some codes.

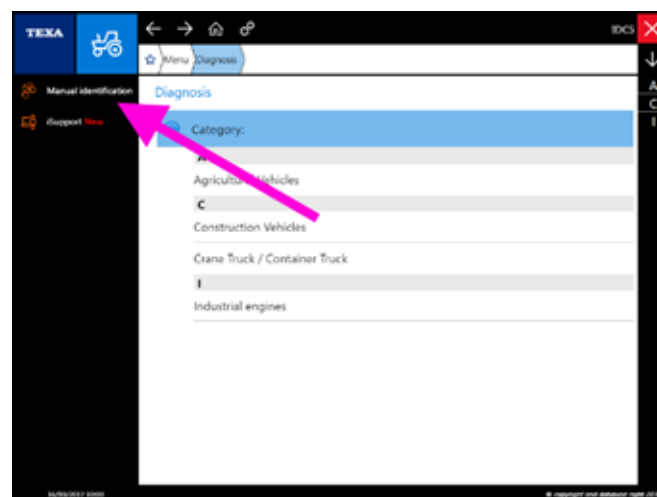


Figure 131: Manual identification

The function allows searching based on three different variables.

- Engine code
- VIN
- Vehicle license plate number

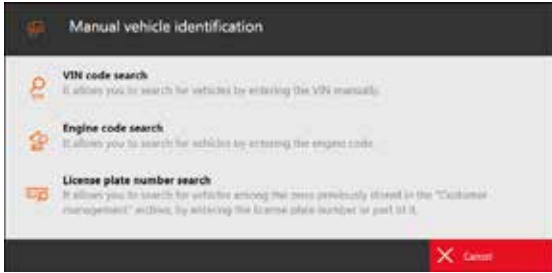


Figure 132: Vehicle search by code


The search by engine code allows finding all the vehicles that install that particular type of engine.
The search by VIN allows identifying the vehicle's model starting from its VIN.

i The search by VIN is possible only for manufacturers that use model differentiation rules through the VIN. For some models the identification may be partial or impossible due to the coding chosen by the manufacturer.

The search by license plate number, instead, allows searching for the vehicle only among the ones registered in the customer management database (see paragraph 6.6 Customer management).

6.2.2 Automatic VIN identification (VIN scan)

The second function allows an automatic vehicle search through the detection and automatic analysis of the VIN during the connection phase.

This possibility is not available for all makes, but only for the manufacturers that have a standardised VIN coding in the electronic control units. The availability of this function can be recognised by the icon “”.

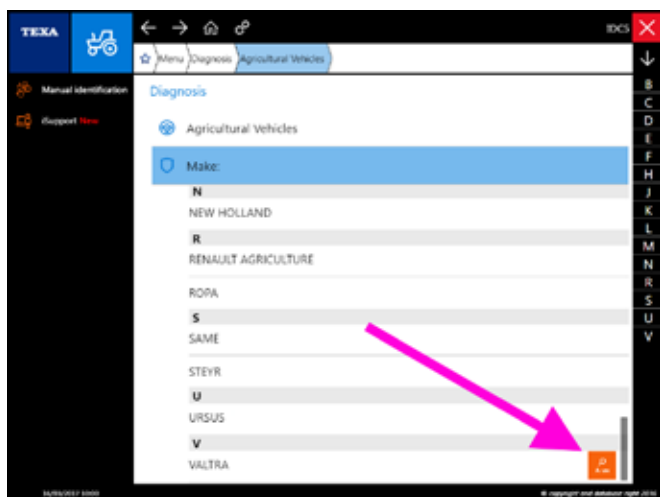


Figure 133: Automatic VIN identification

By activating this function (clicking on the orange icon) a scan will be carried out on the diagnostic data line to search for a valid VIN.

The analysis of this VIN will bring to the automatic identification of the vehicle and engine type used.

i The search by VIN is possible only for manufacturers that use model differentiation rules through the VIN. For some models the identification may be partial or impossible due to the coding chosen by the manufacturer.

6.3 Quick access bar

To quickly access the list of the vehicles that were diagnosed last (or to access the list of stored selections), you can use the upper quick access bar.



Figure 134: Quick access bar

The last 20 selections made are shown. To insert a selection into the category stored (favourite vehicles), click on the star “★” after completing a selection.

6.4 Exchange manager

The Self-diagnosis support files (such as the programming files for the control unit) are stored in a specific folder in the Windows™ operating system.

This folder is called “Exchange Manager” and can be accessed through the icon located on the PC's desktop (“OFF-HIGHWAY TEXA S.p.A Exchange Manager”) or by selecting the specific function from inside IDC5.

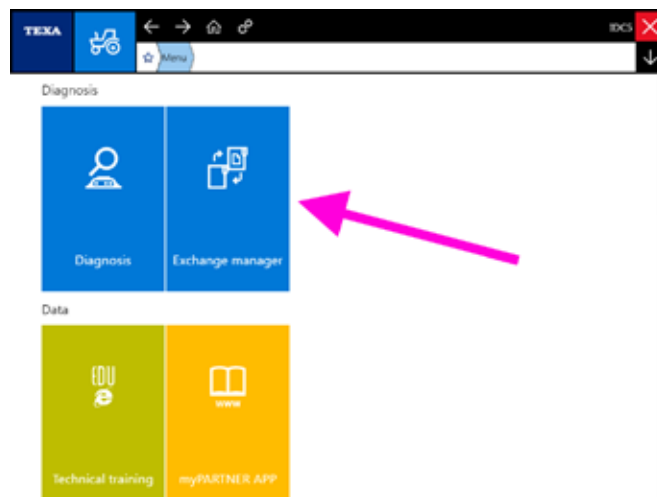


Figure 135: Exchange Manager Self-diagnosis

Since it is a function that is normally used during the control unit replacement procedures, the Exchange Manager folder can be accessed from the Self-diagnosis adjustments page also.

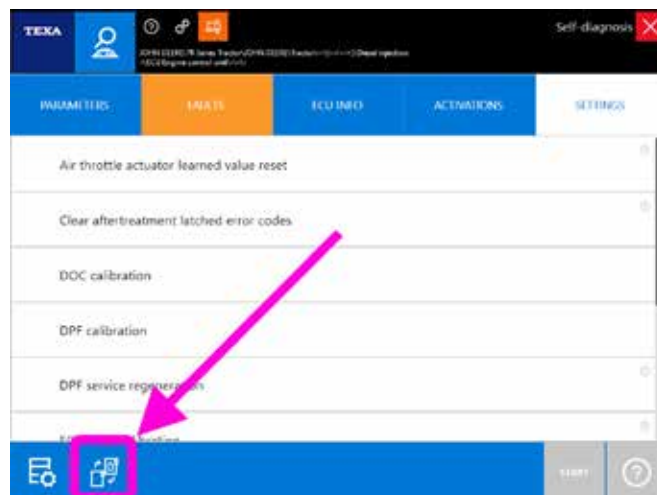


Figure 136: Exchange Manager access button

All the controls allows viewing one of the operating system's windows from which you can access some support files/folders.

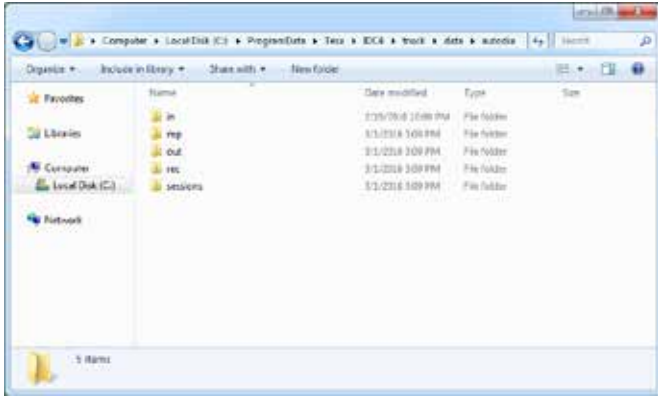



Figure 137: Exchange Manager folder

Some of these folders are reserved for specific IDC5 functions and cannot be used; others contain support tools and files for the user.

Folder name	Description
in	It contains the files with the electronic control unit programmings that are loaded in IDC5 with the adjustment "Parameters settings: load from ECU".
out	It contains all the files produced by particular self-diagnostic functions that generate reports (consultable documents). For ex.: - IVECO EDC trip recording (engine operating data). - ...
rec	System folder used by the self-diagnostic software for particular functions.
sessions	System folder used by the self-diagnostic software for particular functions.

Table 7: Exchange Manager folders

 There may be other folders and/or files, not included in the chart above, that are used by IDC5 for its normal operation.

6.5 Customer management

Inside the self-diagnostic software there is a program that allows managing an archive (database) of the customers and related vehicles, including the operations carried out on them. The management provides both a recall to the reports that are generated at the end of the related tests and the possibility to enter new customers/vehicles.

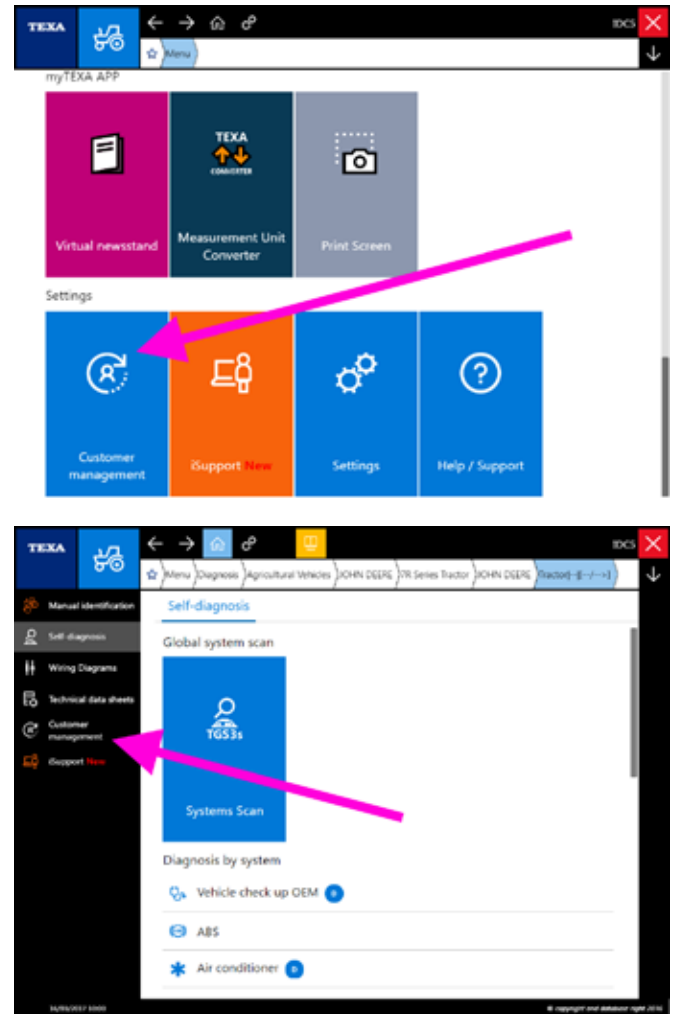




Figure 138: Customer management


It is possible to start the program in stand-alone mode by clicking on the icon “ Customer Management” available in several parts of the Self-diagnosis software (Image 138), but it can also be launched automatically at the end of some functions (for ex. the recording of a diagnostic session, the analysis of the exhaust gases, ...). Once the program is started, it is possible to access the customer database's operating environment from which all the customer management operations can be carried out.

LICENZ/PLATT-NUMMER	CUSTOMER	MODEL	DATE OF LAS...	VIEW	DELETE
AA0008 / ZKD01224561...	de Grand Stefano	ASTRA HD9 Rapo S	26/09/2011		
220622 / 10G123879679	de Grand Stefano	KASASCHERRE (ISLANDFAHRZEUG) Potentiality 650	26/09/2011		
076170 / ZK0014M7575	SAC Stefano de Grand	KONNATHI Backhoe 300 series	15/01/2014		
AA0008	Zanchi Vito	NEW HOLLAND TC series combine harvester	15/01/2014		
83084C	de Grand Stefano	JOHN DEERE TR Series Tractor	15/01/2014		

Figure 139: Customer management environment

 **The customer management module is a complete database management program with many commands and specific functions that are not the subject of this course. For a detailed description of each function, refer to the OnLine technical documentation provided with the program.**

6.6 iSupport

TEXA develops its own software programs and workshop tools always trying to reach maximum quality and customer satisfaction. Sometimes though not all the indications can be understood right away (unknown system errors, unknown vehicles on which you do not know how to operate, malfunctions, ...). For this reason there is a specific portal that allows direct and continuous communication with TEXA's technical personnel and retailers. This function is available in the first page of the self-diagnostic software and is called  **iSupport** (Image 140).

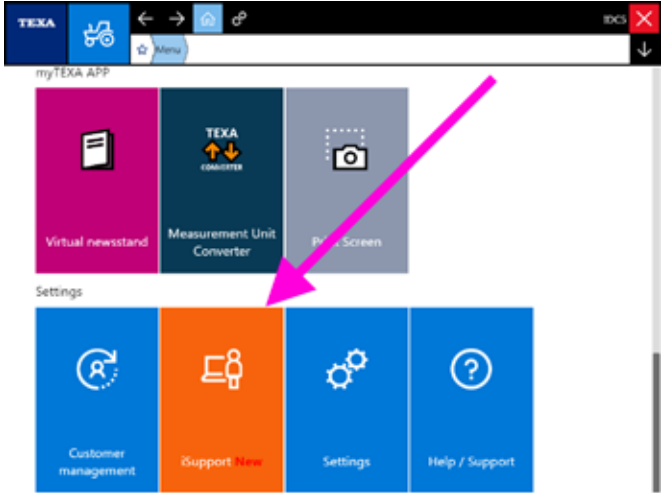


Figure 140: iSupport

This service allows:

- receiving technical support directly from the software;
- signalling faults that may occur during normal diagnostic operations on the vehicle;
- sending a request for a diagnostic development to TEXA's technical personnel if specific selections or functions regarding particular vehicles are not found within the software.

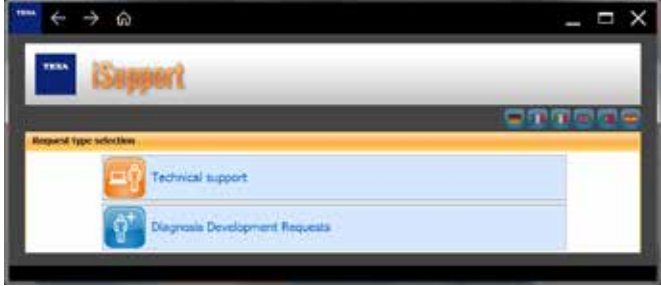


Figure 141: iSupport portal

 **In some markets this function may not be available.**

You can access iSupport directly from the Self-diagnosis.

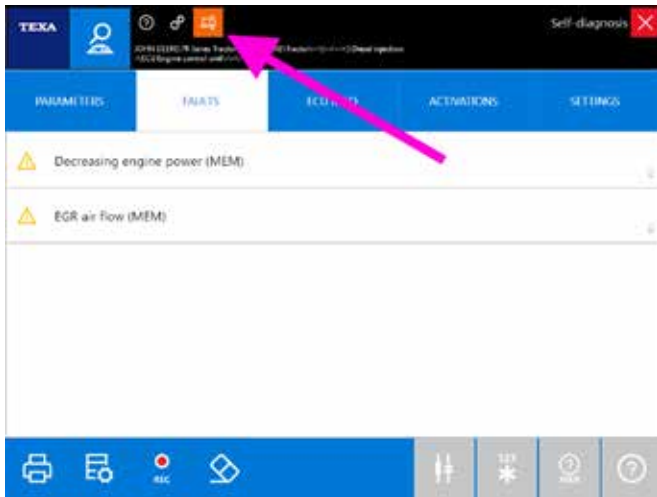
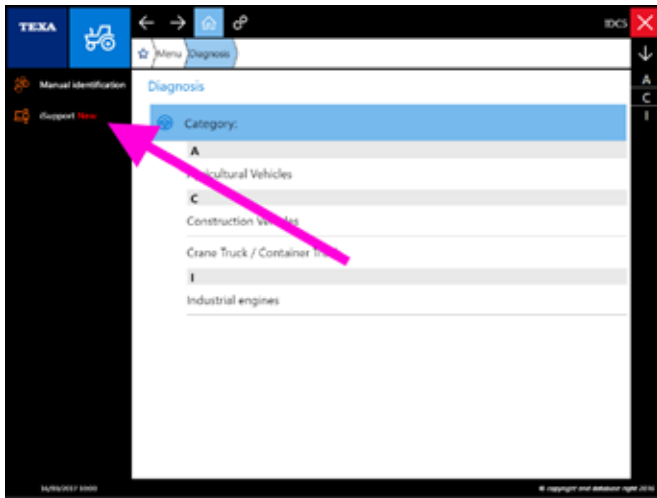



Figure 142: Access to iSupport from the Self-diagnosis

6.6.1 Fault notification

For some specific markets the possibility to store and then to send TEXA a file containing the operations carried out by the user during diagnosis is active, if the operations themselves are not successful or generate malfunctions. This way, if the user detects a fault, the TEXA technicians are warned and can work to find a solution for the future versions. To activate this mode, press the big button “” in the upper part of the Self-diagnosis screen.

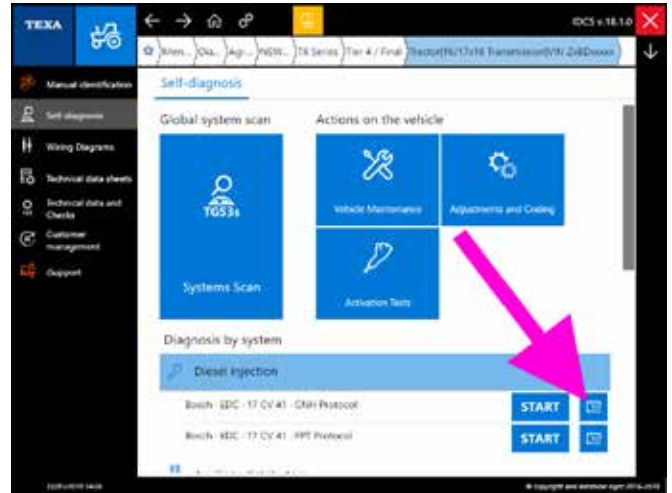


Figure 143: Fault notification button

In the example above, you can see that the values of the parameters are surely not plausible. By activating the function, you must follow the instructions that appear on screen (the diagnosis will be restarted) and it is **MANDATORY** to carry out the operations that cause the fault.

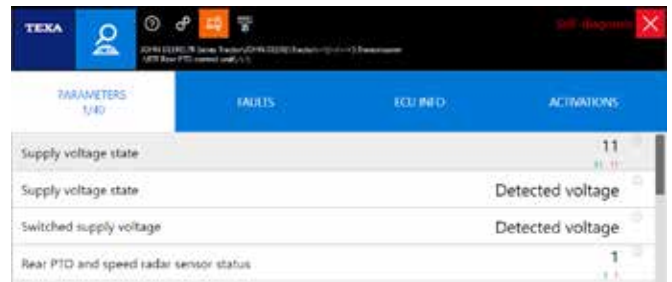




Figure 144: Active fault notification

 You can notice that the main writing turns red to warn that you are in the Fault notification mode.

When closing the Self-diagnosis, the IDC5 software automatically generates a report and prepares to send via iSupport “” all the information needed by TEXA's technical support service.

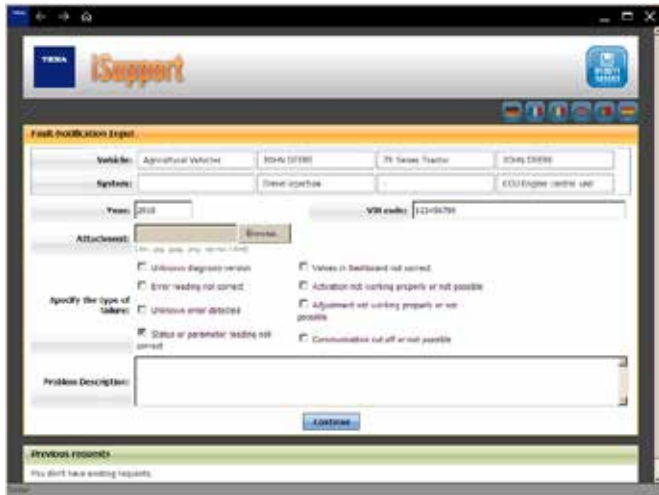



Figure 145: iSupport fault notification

The information is sent to TEXA's laboratories through an Internet connection. If there is no connection, the file is stored in the Customer management archive so it can be later sent to TEXA.

6.7 Diagnostic socket location

A multi-brand technician may have to repair vehicles never seen before and in these cases even finding where to connect the self-diagnostic tool may be a time losing problem.

TEXA knows this and for this reason, when possible, it indicates the exact location of the diagnostic socket.

By clicking on the button “” (Image 146) a screen indicating the various information on the diagnostic cable and on the position of the connection socket will be displayed along with a short video (Image 147).

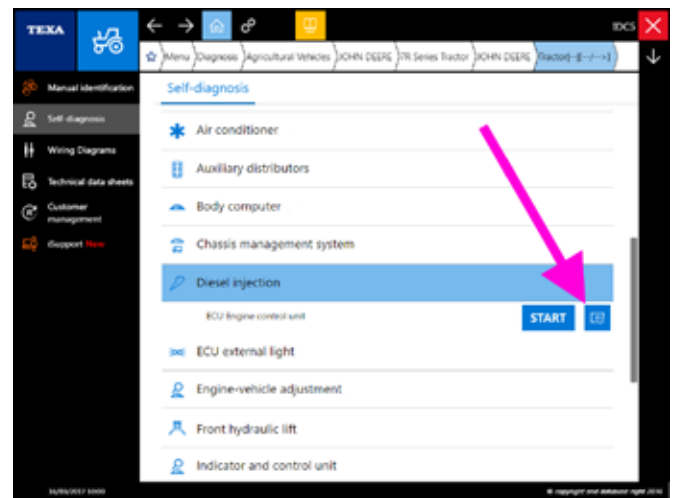


Figure 146: Connection with information on cable and socket position

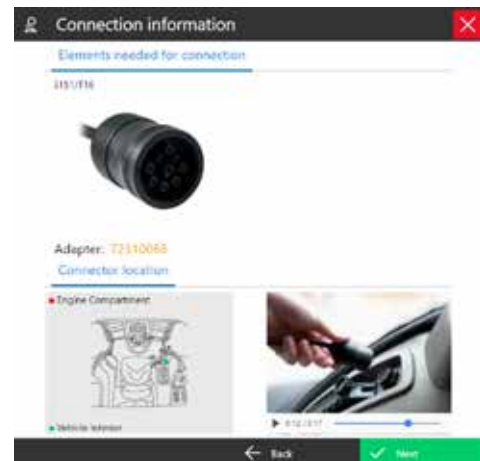


Figure 147: Information and videos on the connection

The same screen (Image 147) allows selecting other connection cables and shows information regarding the connection itself (need for additional adapters, additional power supply, ...).

6.9 Predefined diagnostic cable

Starting from Off-Highway version 18, you can set a predefined cable, that is set a type of cable (among the ones that can be selected) that will be used as first choice when carrying out a diagnosis.

This selection is made when installing IDC5, but this setting can be changed at any time from the connection cable's selection window.

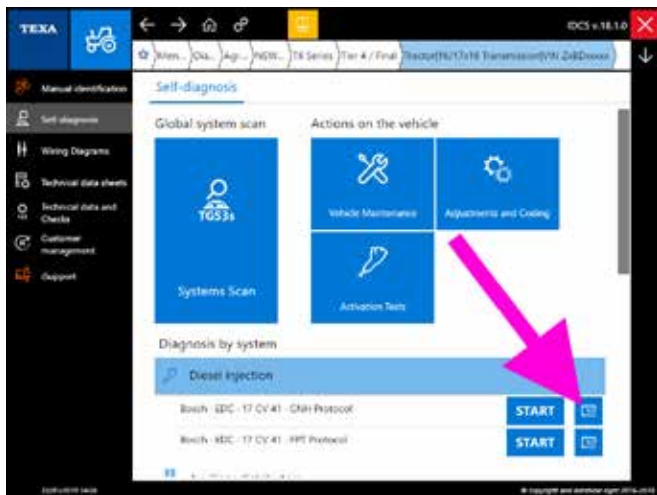


Figure 151: Connection cable selection

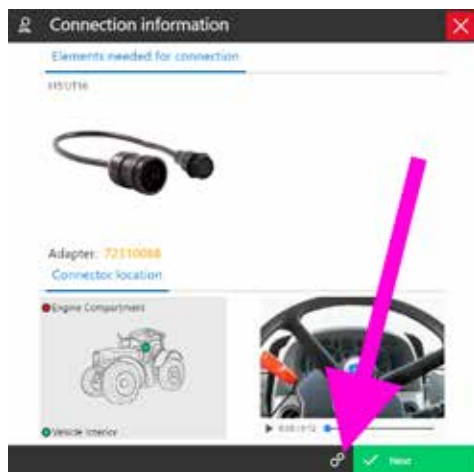


Figure 152: Connection cable selection window

From the connection cable selection window, click on the settings icon (Image 152).

The predefined diagnostic cable selection window will be displayed (image 153) in which you can selection among the ones suggested.



Figure 153: Predefined diagnostic cable



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To check out the extensive coverage of TEXA products, go to: www.texa.com/coverage

To check on IDC5 compatibility and minimum system requirements, go to: www.texa.com/system

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cod. 8200288
02/2019 - Inglese - V.0.1



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