



Automotive Training Courses
TRAINEE manual

IDC5 TRUCK - BASIC LEARNING



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Legend:



Warning



Information/Notes

2. ELECTRONIC SYSTEMS ON INDUSTRIAL VEHICLES

Over the past years, the electronic systems installed on an industrial vehicle have been developing quickly, improving the vehicle's functionality, safety and comfort.

The purpose of this section is to inform on this new environment, through a general overview of the electronic systems and technologies in it, so to help understand in depth the diagnostic methods that are available with TEXA solutions.

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

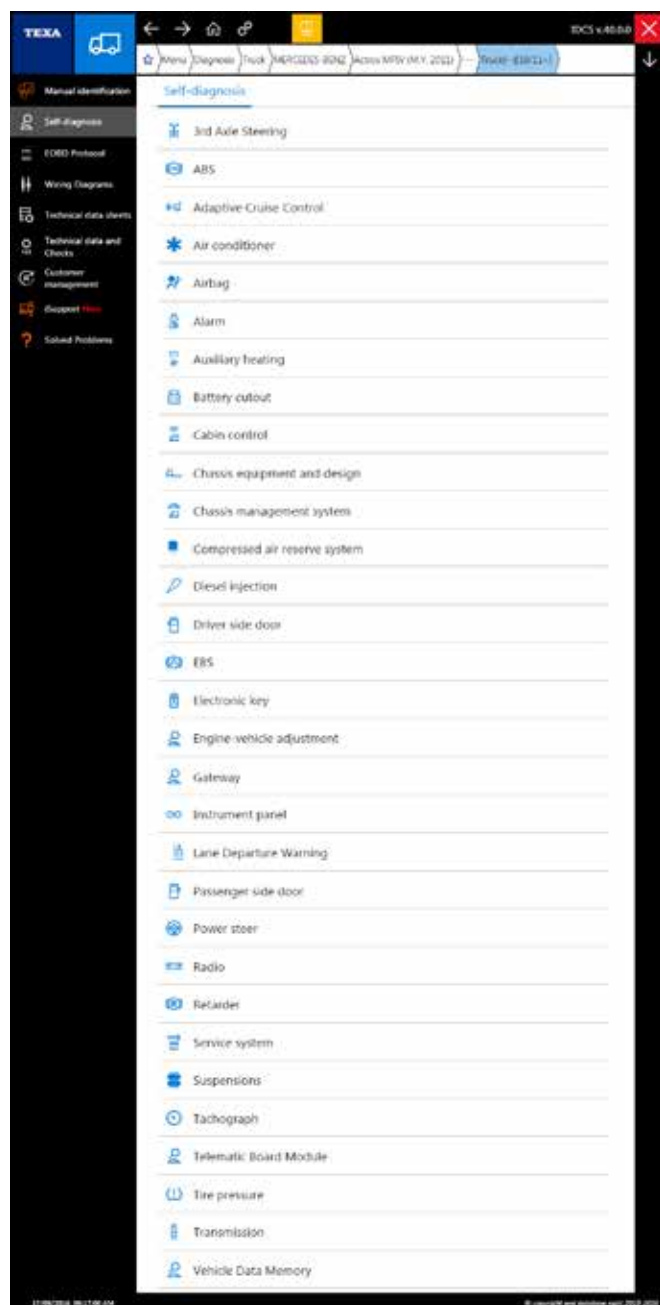


Figure 1: List of self-diagnostic systems

2.1 ENGINE MANAGEMENT

The anti-pollution regulations are more restrictive, the need to optimise consumptions and to increase the engine's performances has brought all manufacturers to evolve the injection systems by introducing the electronic control on the process.

Therefore the injection systems are made up by a series of sensors that define that status of the system at any time and by a series of actuators that carry out the control unit's commands.

The objective is to optimise the injection timing and duration.

Legend:

1. Accelerator pedal sensor
2. Primary rpm sensor
3. Secondary rpm sensor
4. Manifold pressure sensor
5. Water temperature sensor
6. Speed sensor
7. Cruise control unit
8. Multi-stage speed limiter switch
9. Multi-stage rpm limiter switch
10. Cruise control/speed limiter switch
11. Intermediate speed adjustment switch
12. Brake pedal switch
13. Engine brake switch
14. Clutch pedal switch
15. Open door switch
16. Start switch
17. Needle movement sensor
18. Input signals
19. Control unit power relay
20. Communication outputs
21. Vehicle CAN connection
22. PWM signal input
23. Diagnostic interface
24. Diagnostic warning light
25. Speed limiter warning light
26. Actuators
27. Additional control outputs
28. Manifold by-pass solenoid valve
29. EGR solenoid valve
30. Turbo pressure adjustment actuator
31. Advance timing actuator
32. Flow rate actuator
33. ELAB solenoid valve
34. Injection pump
35. Movement and temperature sensor

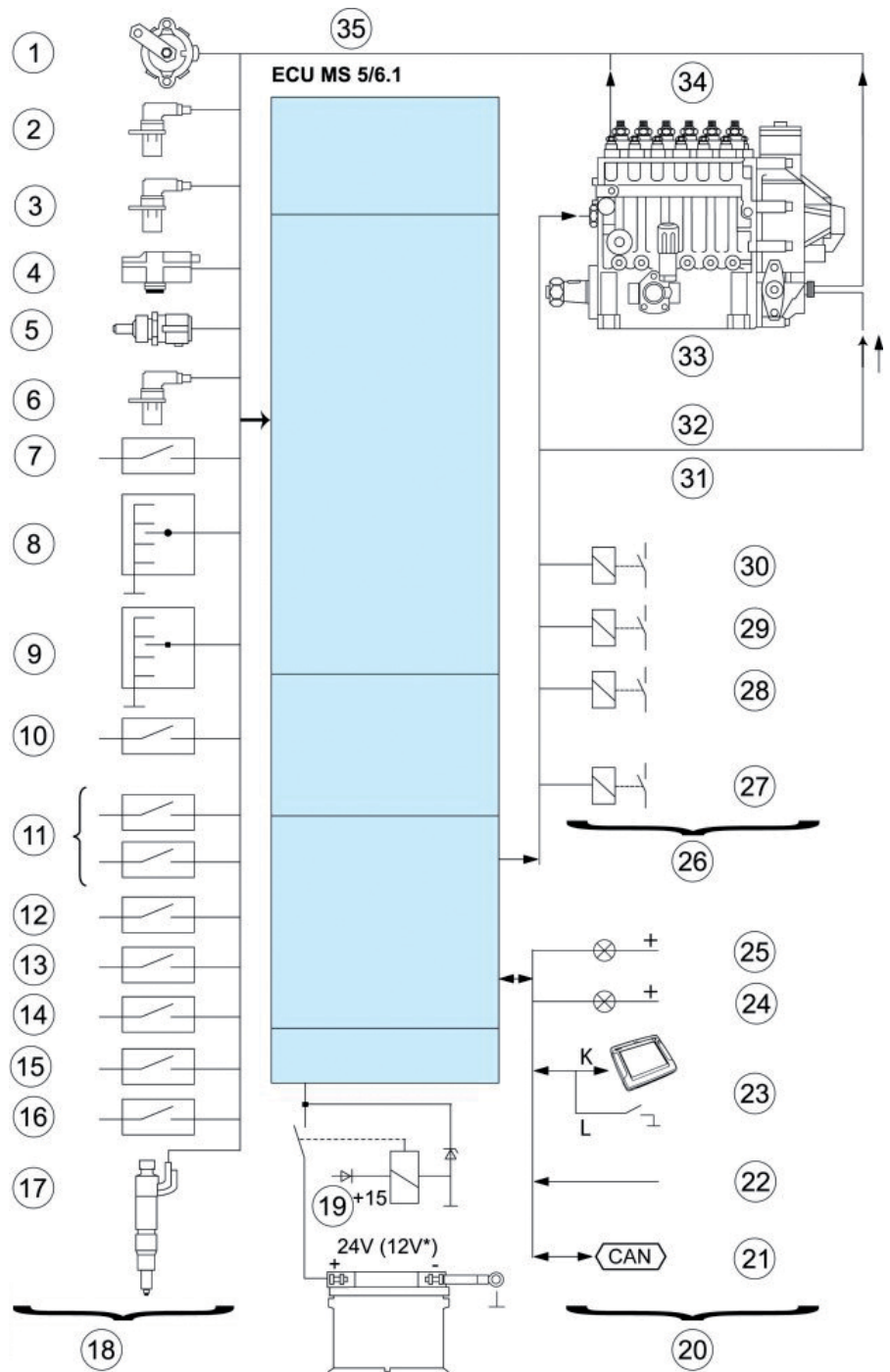


Figure 2: Example of an EDC injection system.

The systems used mainly belong to the following families:

- EDC type systems;
- PDE type systems;
- PLD type systems;
- Common rail systems.

2.1.1 EDC systems

The EDC systems use an in-line or rotary high-pressure injection pump that activates mechanical type injectors. Here are some examples of systems that can be checked using TEXA self-diagnostic resources:

- 1.systems with an in-line pump (M7, MS5, MS6.1, ITC);
- 2.systems with a rotary pump (MS6.4, EPIC, MSA, VP30/VP44, EDC 15V).

These systems are used on heavy duty vehicles (the first ones) and on average-light commercial vehicles (the second ones). The electronic management of the injection pump allows: the instant calculation of the amount of fuel, of the related injection advance timing, the direct control of the conditions of use and the response, in real time, to the variations of the input sizes.

They can have a blink-code diagnosis and a serial diagnosis, sometimes limited to the mere fault reading. as for example in the Bosch M7 system used for the Iveco 380 and 470 engine types.

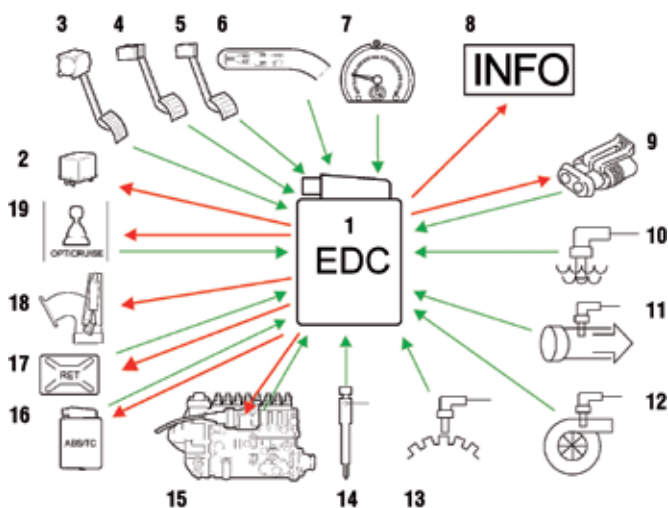


Figure 3: EDC injection system

However, where the second level diagnosis is available, you can use the available resources to perform deeper checks.

PARAMETERS		FAILS	STATUS	ECU INFO	ACTIVATIONS
Coolant temperature:	53 °C				
Fuel temperature:	15 °C				
Fuel pressure:	2.86 bar				
Oil pressure:	4.80 bar				
IGT throttle:	0 %				
Engine rpm:	905 rpm				
Auxiliary rev sensor:	906 rpm				
Needle travel sensor:	21.3 *				

Figure 4: MS6.1 injection parameters page

2.1.2 Pump injector system

In place of a single central pump feeding the series of injectors, this system (Image 5) uses a single unit made of a pump and an injector which serves each cylinder individually. The pump injector is fitted directly above the cylinder combustion chamber; the pumping element is controlled by the engine's camshaft through balancers. The fuel passes through a circuit built into the cylinder head. The system, managed by the specific control unit, allows injection pressures up to

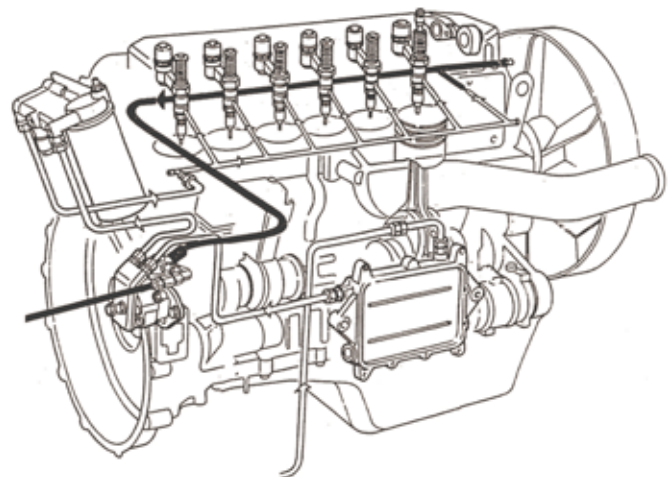


Figure 5: Pump injector system

2000 bar with optimal dosages, allowing, this way, the reduction of the consumptions and pollutant emissions. The first manufacturer to equip its engines with this system was Caterpillar in 1988, followed by Volvo on the FH12 model,

by Scania in the series "4" models and by Iveco with the Cursor engine.

Legend:

1. Solenoid valve: it is controlled by the control unit and adjusts the fuel delivery
2. Pumping element: it is activated at each engine cycle by a camshaft balancer
3. Atomiser: it injects the fuel under pressure, which opens it, into the combustion chamber finely pulverised

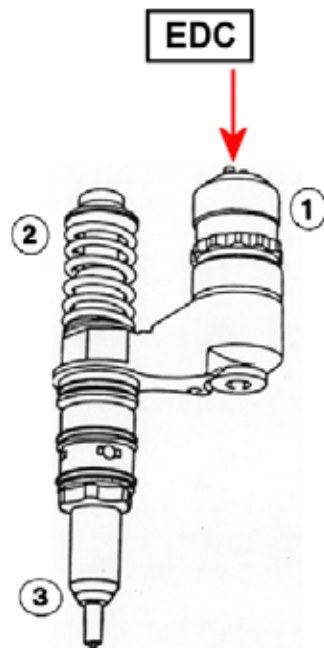


Figure 6: Pump injector

During the diagnosis of these systems the various manufacturers have introduced some diagnostic procedures which are useful to check the mechanical faults of the various devices.

Therefore you can find:

- compression test;
- cylinder balance test;
- cylinder shut-off test;
- cylinder performance test; etc.



A variant to the Injector-Pump system is the HPI system used by Scania.

2.1.3 PLD system

The PLD injection system (pump-pipe-atomiser) consists essentially in unitary units, inserted into the engine block (Image 7) or into particular supports, controlled by a specific camshaft.

They are connected, through short length pipes, to the injector needles of the respective cylinders. The same length of the pipes allows high injection pressures, up to 1800 - 2000 bar.

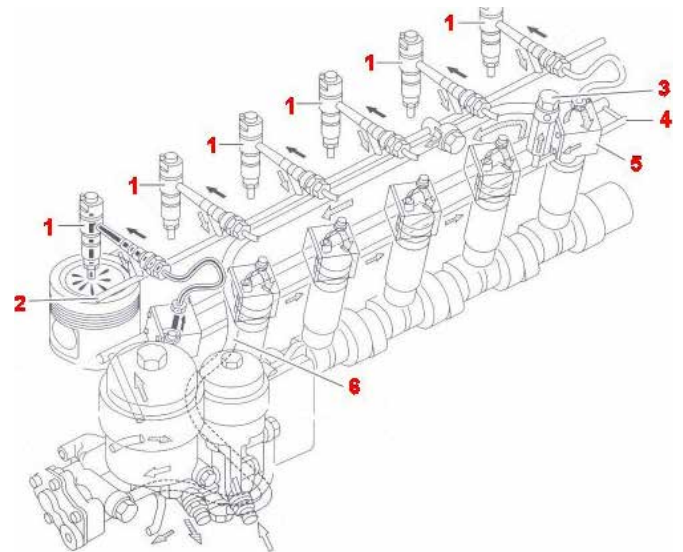


Figure 7: PLD system

This system is available on the following models: Mercedes-Benz (MR/PLD), Euro 3 models by DAF (UPEC) and Magnum (E-TECH) by Renault Trucks.

Legend:

1. Pumping element
2. Solenoid valve
3. Injection pipe
4. Injector holder with injector

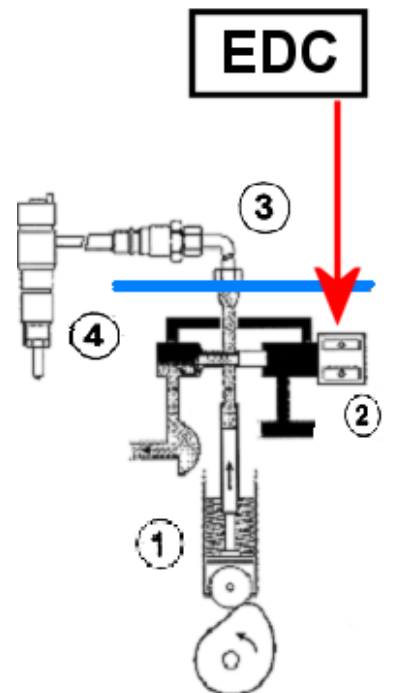


Figure 8: Submersible pump



A variant to the UPEC system used by DAF is the DMCI injection available on the most recently manufactured vehicles such as XF-105. In this case, in addition to the electronically controlled unitary pumps, there are also some electro-injectors. Therefore, the duration of the injection is managed by the pumps and injectors simultaneously, while the injection phase is determined by the injectors only.

2.1.4 Common rail system

The particularity of this system is that the generation of pressure and the injection control are completely separate and managed electronically.

In fact, the common rail was born as an electronic system and not as an evolution of a mechanical system.

This allows very high injection pressures (up to 1600 bar) and a management flexibility that has never been obtained before. The injection pressure does not depend on the engine's rotational speed and is managed, flexibly between approximately 300 and 1600 bar, by a solenoid valve in the high-pressure circuit (pressure regulator) or in the low-pressure circuit (flow rate regulator) controlled through a PWM signal, generated by the engine control unit. The electronic control allows the generation of multiple injections (pre-injection, pilot injection and post-injection for managing the catalyst), guaranteeing optimal performances, a reduction of the consumptions and pollutant emissions.

It has been used for many years in the light commercial vehicles, while they started to be used on heavy duty vehicles starting from the Euro VI generation (except MAN which introduced it starting from the Euro IV regulation).

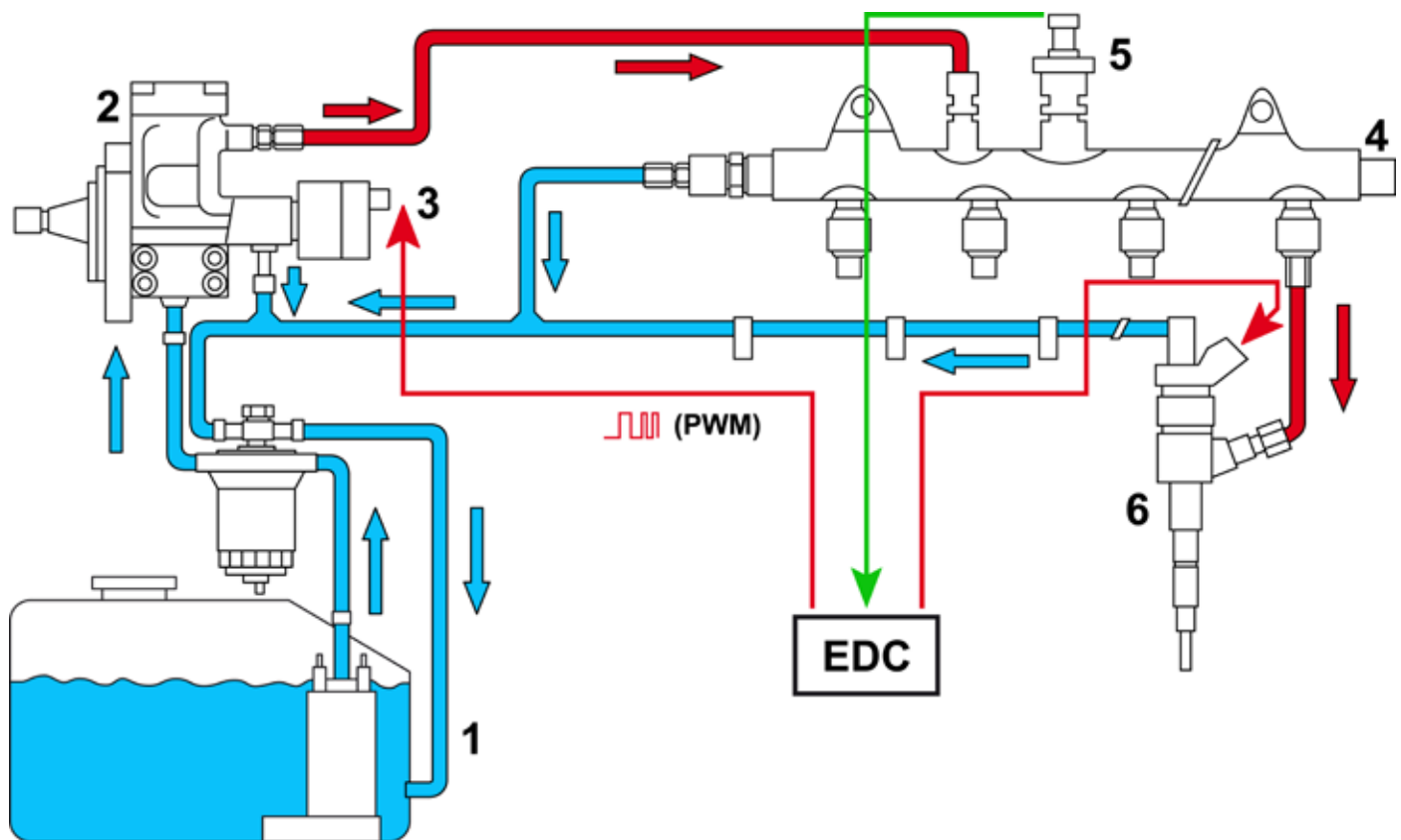


Figure 9: Common rail system

Legend:

- | | | |
|--------------------------|-----------------------|---------------------|
| 1. Electric priming pump | 3. Pressure regulator | 5. Pressure sensor |
| 2. High-pressure pump | 4. Rail | 6. Electro-injector |

2.2 ABS ANTI-LOCK BRAKE SYSTEM

Braking a moving vehicle and its consequent deceleration and stop distance especially depend on the coefficient of grip between the road surface and the surface of the tyre. To optimize braking and stability in critical weather conditions, an electronic braking system management has been introduced on industrial type vehicles also, where these requirements are particularly needed given the loads that these vehicles transport.

The ABS electronic management is used to avoid the wheels from locking.

Legend:

1. ABS control unit
2. Duplex valve
3. ABS solenoid valve
4. Relay valve
5. Wheel speed sensor
6. ASR solenoid valve
7. Brake pressure sensor inside the related valves
8. Trailer semi-couplers
9. Trailer control distributor for ABS ("Triple valve")

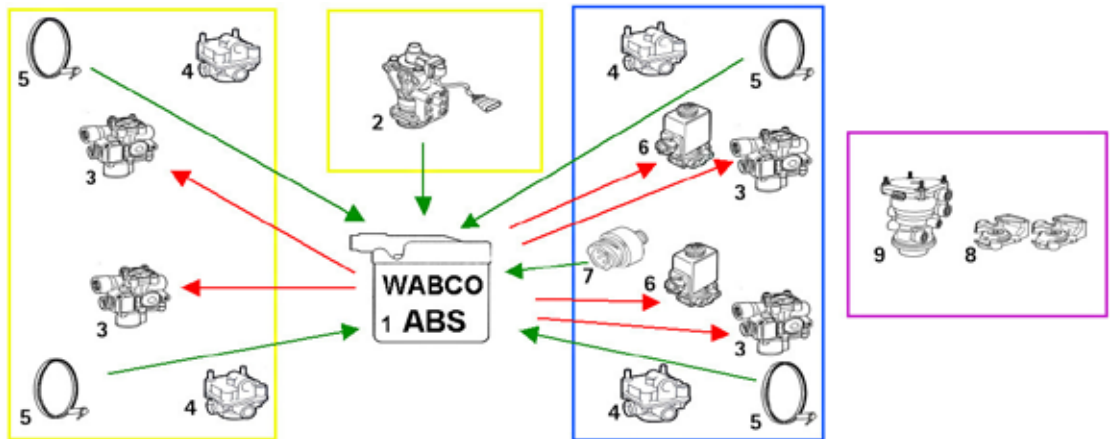


Figure 10: Wabco ABS



The electronic management takes control only if the braking conditions require it. Therefore normal vehicle braking is completely managed in a mechanical-pneumatic way, that is the braking control force are defined by the driver.

2.2.1 ASR (Anti-Slip Regulation) or TC (Traction Control) function

The function of the ASR / TC is to prevent the drive wheels (axle) from slipping while accelerating or steering, in order to avoid useless stresses on the mechanical parts, loss of driving force and grip. The system takes control during acceleration and on road surfaces with poor grip, improving stability on bends also and reducing excessive wear (it is installed on request).

2.2.2 EBL (Electronic Brakes Limiter) function

The comparison between the speed of the drive/axle wheels and of the front axle wheels allows the control unit to define the slipping level of the axle itself, the vehicle's speed and deceleration.

This way the control unit can calculate the minimum deceleration needed in order to slow down the vehicle, in the shortest time possible, avoiding the wheels from locking.

2.2.4 RSC (Roll Stability Control) function

This function represents a simplification of the ESP system applied to braking systems with ABS management. The possibility to electronically adjust the braking on each wheel (except the ones on which the ASR intervenes) does not allow the management of the vehicle's drift while it does allow avoiding rolling and therefore overturning.

This adjustment take place: reducing the torque, activating the brakes on the drive axle (by commanding the ASR solenoid valves) and eventually transferring an intervention command to the trailer control unit.

2.3 EBS (ELECTRONIC BRAKE SYSTEM)

The EBS is a completely electronic braking system.

It integrates the EPB, ABS, EBL, ASR/TC and ESP systems with the possibility to interact with the other electronic systems available in the vehicle (EDC, Suspension system, Retarder and Automatic Transmission).

! Vehicle braking is no longer defined based on the command pressure that comes from the Brake Distributor, but is regulated electronically based on the brake pedal's travel.

The EBS control unit also sends the deceleration request to the trailer control unit that, if it is an EBS system, calculates the braking pressure independently from the pneumatic command.

The aim of the EBS system is:

- to optimise the features of the braking system;
- to improve safety;
- to reduce vehicle management costs (global control of the brake lining wear).

The electronics allows managing the braking using the Brake Force Support devices and reducing the wear of the brake linings.

Legend:

1. EBS control unit
2. Duplex valve
3. Front axle proportional relay valve
4. ABS solenoid valve
5. Axle electro-pneumatic modulator
6. Trailer control servo-distributor
7. Brake wear sensor
8. Wheel speed sensor
9. Trailer semi-couplers
10. Brake pressure sensor inside the related valves

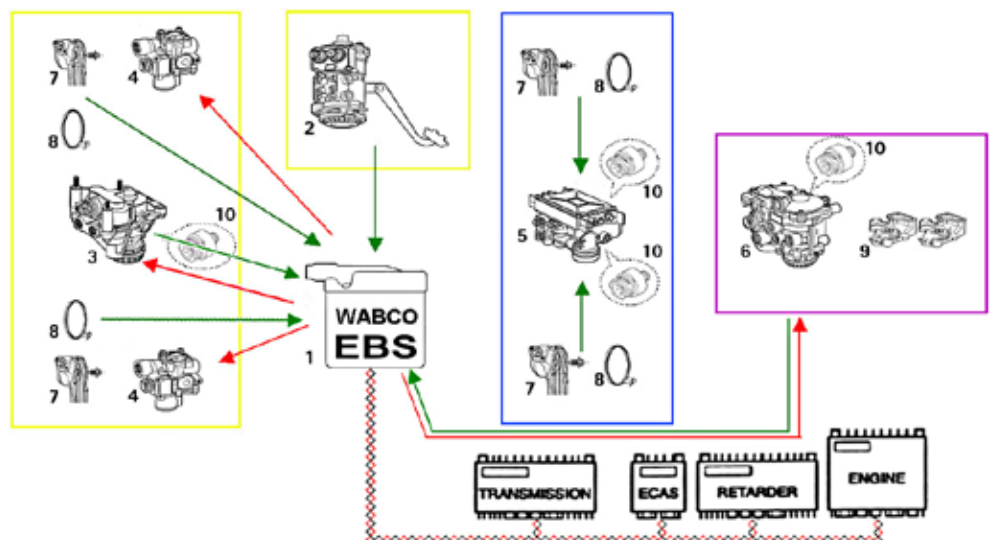


Figure 11: Wabco EBS logical diagram

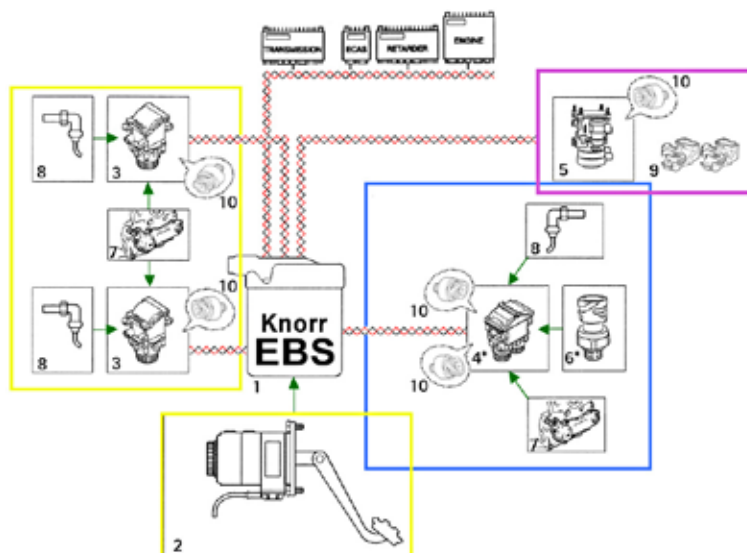


Figure 12: Wabco EBS logical diagram

Legend:

1. EBS control unit
2. Duplex valve
3. Single-control module
4. Double-control module (version 2.2)*; in versions 2.0 and 2.1 a single module is used for each wheel
5. Trailer control module
6. Load sensor
7. Brake wear sensor
8. Wheel speed sensor
9. Front trailer semi-couplers
10. Brake pressure sensor inside the related valves



⚠ Obviously according to the regulations there is also a circuit, called redundant, that activates when the electronic system is deactivated.

Since all the components are managed electronically, self-diagnostic system will also be more complete and will allow the control of the pressures, of the speeds, of the wear other than the possible settings that the Self-diagnostic tool allows performing.

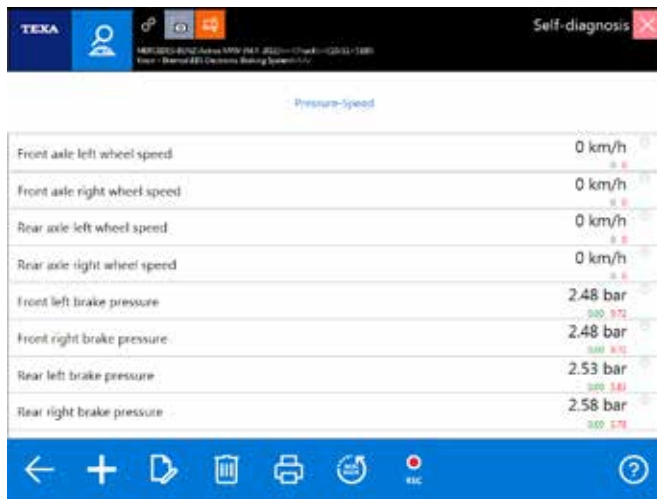


Figure 13: EBS pressure control

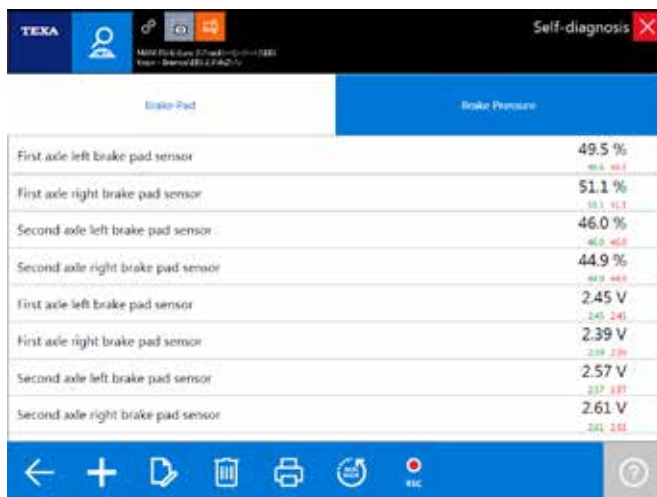


Figure 14: : EBS brake wear control

2.4 BRAKING SYSTEMS IN TRAILERS

As for trucks, even trailers/semi-trailers are equipped with ABS or EBS electronically controlled braking systems. Such systems can have both a first level diagnosis, reading and error clearing, and a deeper second level serial diagnosis. For these systems the same conditions indicated for the tractor ABS and EBS systems are valid.

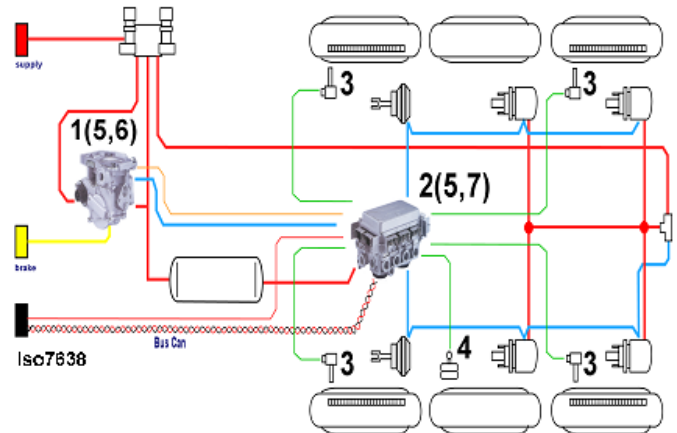


Figure 15: Trailer EBS logical diagram

Legend:

1. EBS relay valve
2. EBS trailer modulator
3. ABS sensor
4. Axle load sensor
5. Pressure sensor
6. Pressure switch
7. Redundancy valve

The EBS systems for trailers can manage additional functions such as:

- axle lifting systems;
- retarders;
- brake wear monitoring systems.

For these functions there are specific configuration procedures that allow managing the different settings.

2.5 AIR SUSPENSION SYSTEM

The air suspension system has significant advantages both in terms of safety and comfort compared to mechanical suspensions. For this reason, over time it has become the prevalent system on road vehicles.

The technical evolution finally brought to the development of the electronic management of the system itself that has spread and it is now present on all vehicles. The advantages of this system are:

- maintaining the same load and chassis position in any condition of use of the vehicle, through the variation of the pressure inside the air springs;
- increasing the passenger's comfort because the chassis fluctuations are reduced;
- increasing safety because the load on the vehicle while braking is correctly distributed and the vehicle maintains the steering manoeuvrability;
- the possibility to change the chassis level while manoeuvring and loading-unloading the kneeling function, available on buses, to help passenger boarding and exiting.

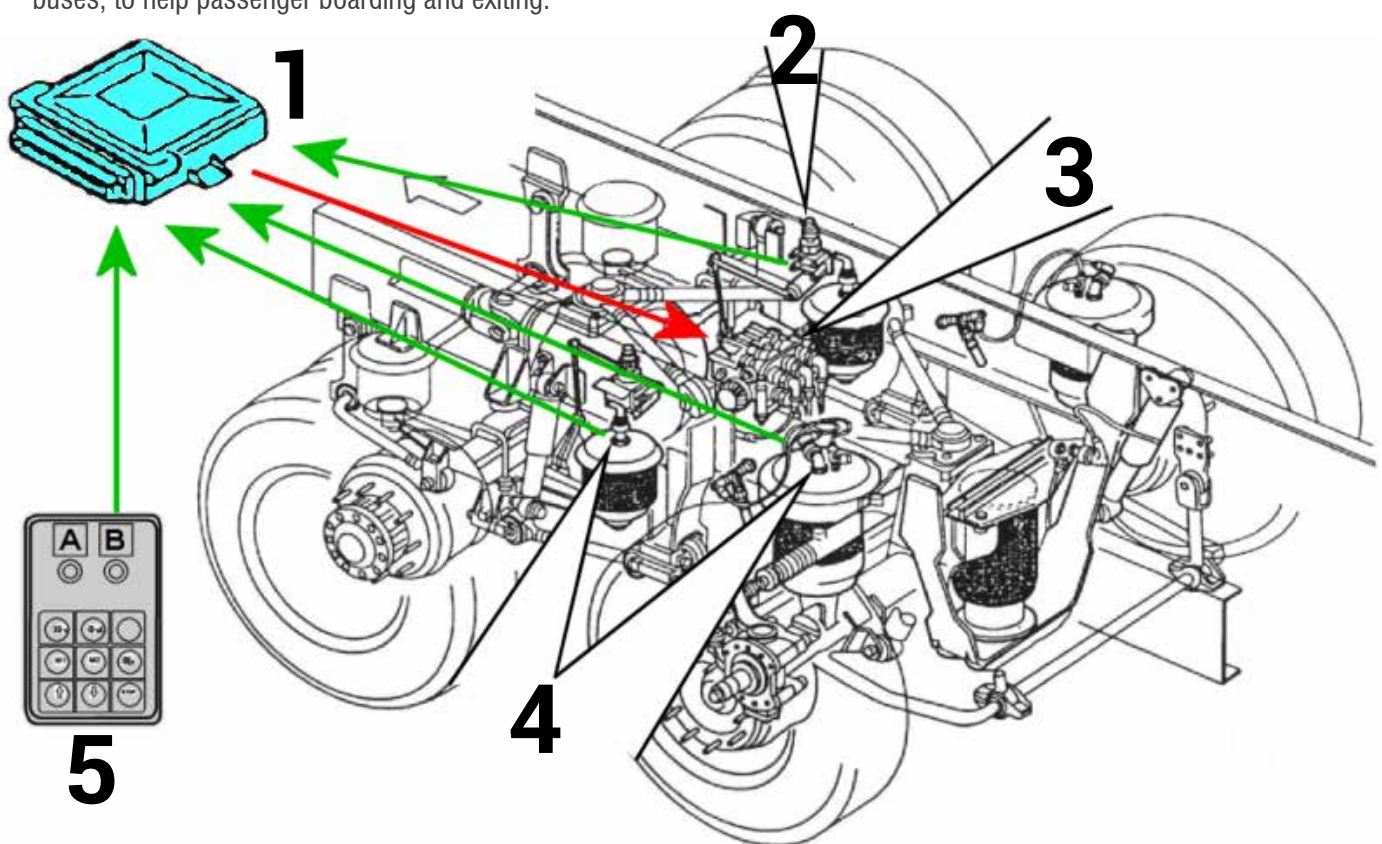


Figure 16: Suspension system logical diagram

Legend:

1. Control unit
2. Level sensors

3. Electro-distributor assembly
4. Pressure sensors

5. Remote control

The main function of the suspensions system is: to maintain the vehicle riding level.

The control unit works with the panel on.; however it also guarantees maintaining the level set when in standby mode.

The riding level can be changed manually, but at a speed above 30 km/h the level cannot be modified. The vehicle maintains the position taken and, if it differs from the normal level, the driver is warned of this by the warning light and by a buzzer.

2.5.1 Position of the components on the chassis

Legend:

- 1. Electro-pneumatic distributor assembly
- 2. Level sensor
- 3. Low-pressure switch

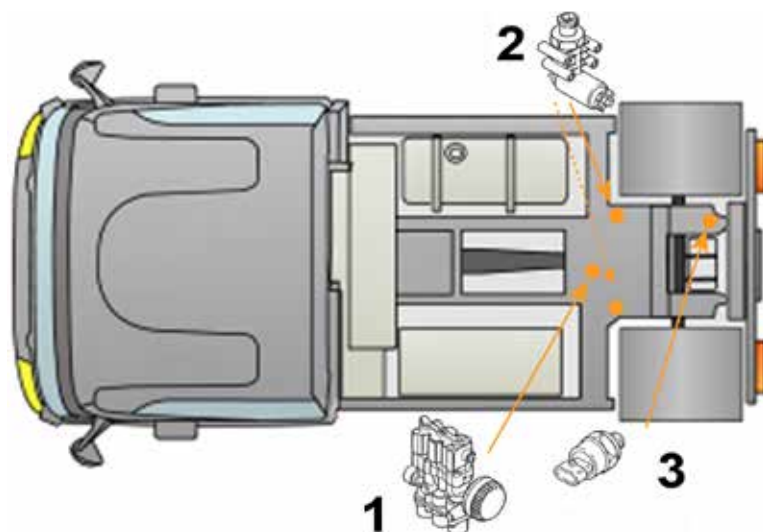
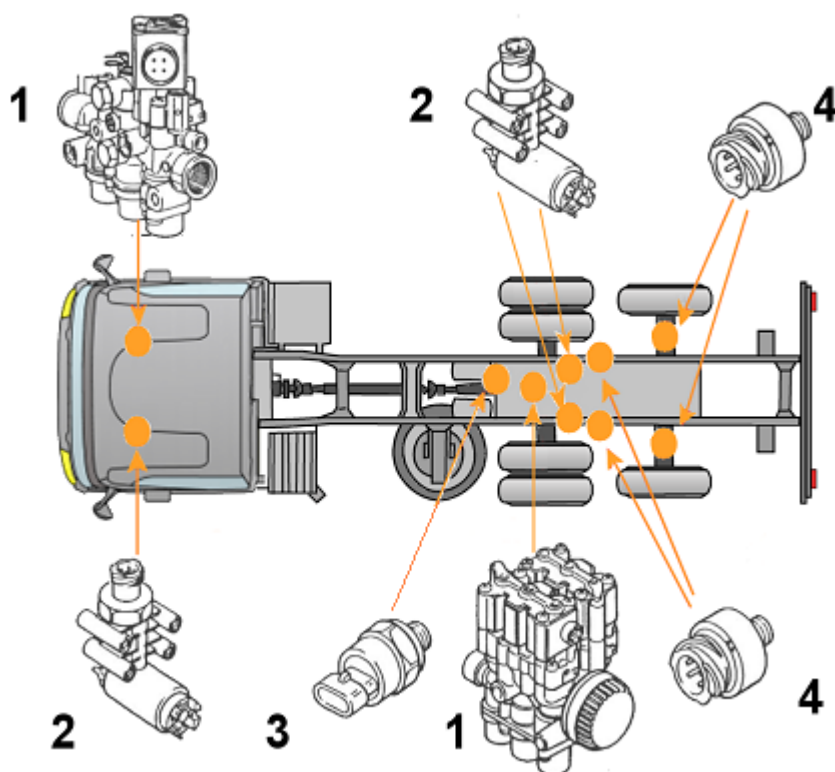


Figure 17: 4x2 P vehicle



Legend:

- 1. Electro-pneumatic distributor assembly
- 2. Level sensor
- 3. Low-pressure switch
- 4. Load sensor

Figure 18: 6x2 FP vehicle



"P" refers to a vehicle with air suspensions, only on the rear part, while "FP" refers to a vehicle with air suspensions, on both the front and rear part.

2.6 AUTOMATIC TRANSMISSIONS

The need to improve the gear shift management and the driving comfort has led many manufacturers to develop automatic or semi-automatic activation systems which enable gear engagement without any operation required by the driver or manually, however gear engagement does not occur mechanically.

There are two main automatic transmission families:

- Automatic transmissions
- Automated transmissions

Both fulfil the same function, but while the first has its own particular structure of components that allow managing gear shifts in a completely automatic way, the second is a normal manual transmission controlled and operated electronically through electro- pneumatic actuators.

2.6.1 Automatic transmissions

The automatic transmission is a particular type of transmission that allows automatic gear shifts, based on the driving conditions, without any intervention by the driver. It is designed to improve driving comfort and economy and is used mainly on buses (both for local and long distance transportation), but many applications are also found in commercial and special vehicles.

Some advantages of this solution are:

- Smooth and comfortable starts without jerks.
- Increased driving comfort.
- Automatic selection of the best gear ratio based on the driving conditions, leading to extended engine and powertrain life.
- Less brake wear thanks to the built-in hydraulic retarder.
- Optimised fuel consumption thanks to the selection of the best gear ratio.
- Increased driveability.
- No clutch wear.
- Reduced maintenance costs.

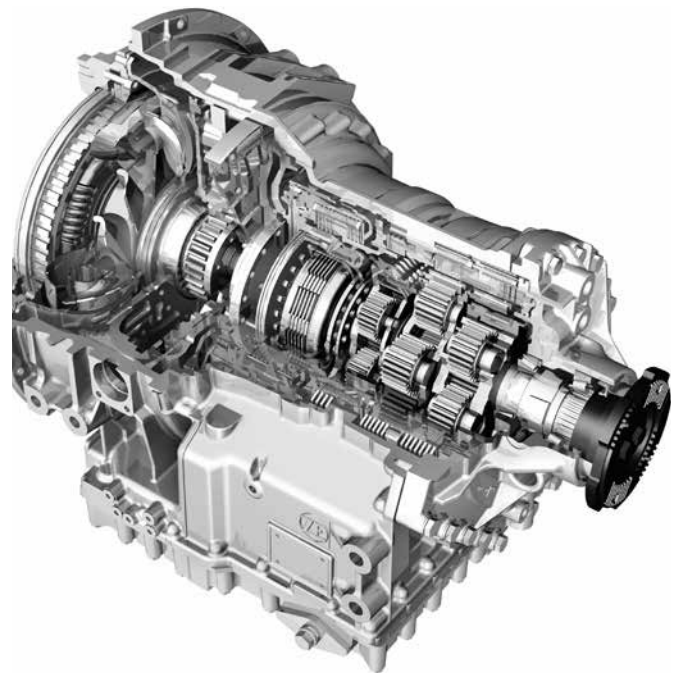


Figure 19: ZF Ecomat 4 automatic transmission

2.6.2 Automated transmissions

The particularity of these transmissions is determined by the fact that the structure is the same as in traditional transmissions, whereas the activation is electro-pneumatic, controlled by a specific electronic control unit.

The driver communicates, through a control lever, the gear selection to the control unit which verifies the other information received by the peripheral sensors and activates the solenoid valves of the gear shift actuator cylinders. A system of sensors signals to the control unit the positions of the rods and of the control shafts.

The advantages determined by this solution are:

- Reduced of strain on the transmission thanks to the automatic engagement of gears and to the electronic clutch management.
- Reduction of the vehicle's consumptions due to the data exchange between the EDC and the Transmission control unit.
- Simplicity in using the transmission.
- Possibility to correct the engagement thanks to the manual control that is always available.
- Reduction of the weights thanks to the absence of synchronisation of the main transmission assembly.



Figure 20: ZF AS-Tronic automatic transmission

Handwriting practice lines on the left side of the page.

Handwriting practice lines on the right side of the page.

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)

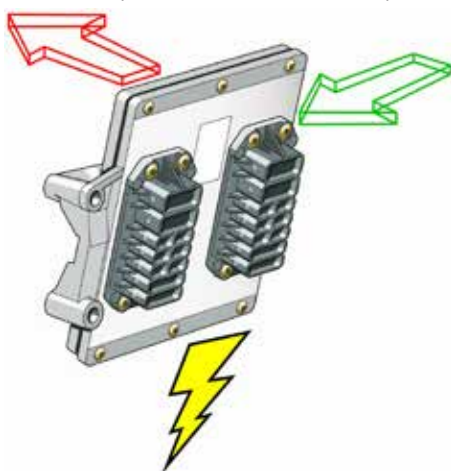


Figure 21: Power supplies, Input and Output

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)

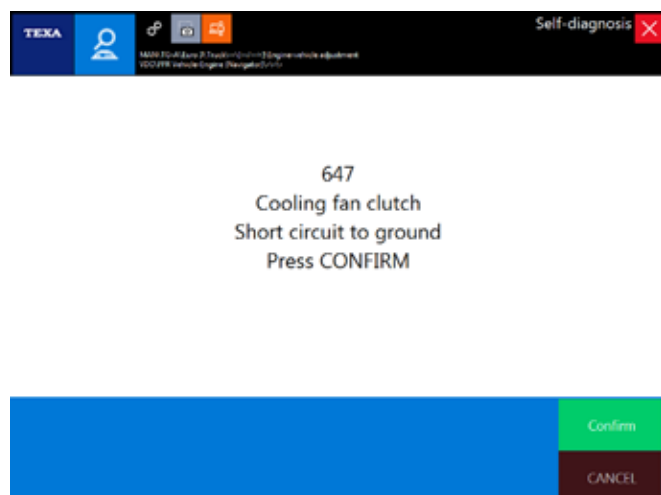


Figure 22: Electrical type error



Figure 23: Functional type error

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 23, the calibration procedure allowed the control unit to store the different chassis levels, but the relation between them is not plausible).

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	Faulty pedal transducer
2	Fuel temperature sensor
3	Boost air temperature sensor
4	Speed sensor
5	Boost pressure sensor
6	Transducer travel in the actuator
7	Coolant temperature sensor

8	Missing or irregular speed signal
9	Irregular idle position switch in the pedal transducer
10	Delivery actuator offset
11	Not used
12	Not used
13	Faulty control unit
14	Terminal W speed sensor
15	Faulty control unit

Table 1: MAN EDC M7 control unit (1986) blink codes

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.

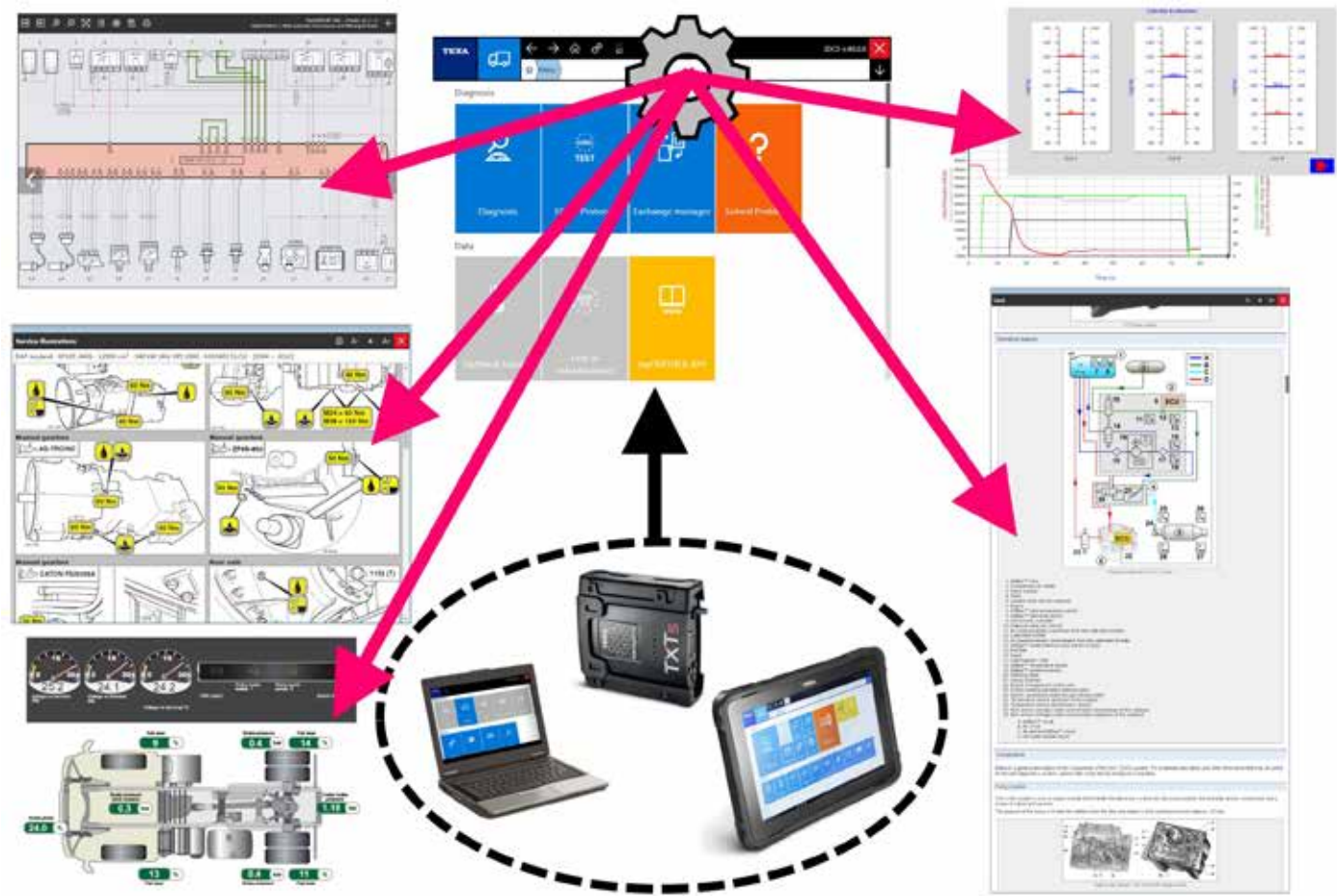


Figure 24: Modern self-diagnostic functions

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

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 25: Self-diagnosis connection diagram

Below there is a short overview on the TEXA tools and software developed for the world of Industrial 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. It is unique and has the extraordinary feature to be not only waterproof, but able to float: an

innovation patented by TEXA on an international level.

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 26: Axone Nemo

3.2.1 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 27: 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.

3.2.2 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 28: 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, ...

3.2.3 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.

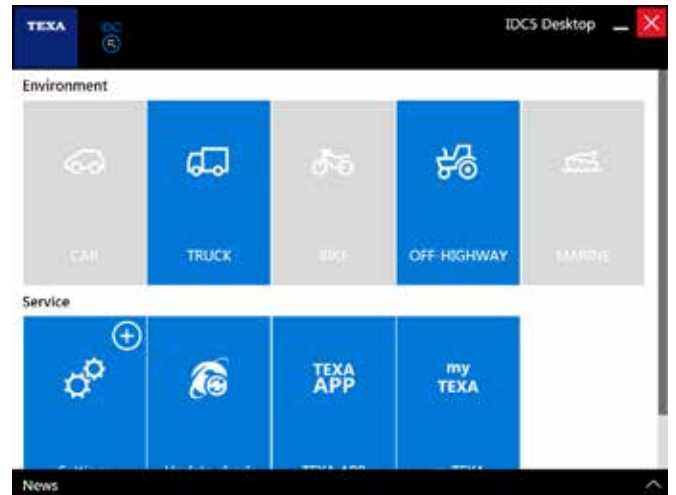



Figure 29: IDC5 Desktop

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 information 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 Ordinary maintenance

Up to yesterday the only self-diagnostic logic was to connect to a control unit to view the stored errors and to repair accordingly. But this is only one of the possibilities.

Often the repairs needed in a workshop are "simple"; sometimes it is sufficient to reset a parameter, recode, test a single component, ...

This is the reason why TEXA developed a series of functions that can be accessed quickly.

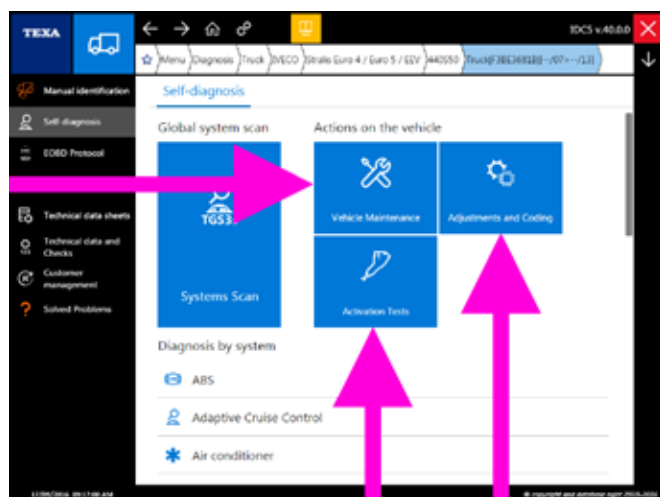


Figure 30: Ordinary maintenance functions

In fact, after selecting the vehicle that has to be diagnosed, there are three large buttons that offer the possibility to quickly access a series of functions without having to connect to the an electronic control unit first.

Icona	Nome	Descrizione
	Vehicle maintenance	It allows you to access the Activations or Adjustments functions for the specific component selected
	Adjustments and codings	It allows you to access the Adjustments function for the specific component selected.
	Device check	It allows you to access the Activations function for the specific component selected.

Table 2: Ordinary maintenance functions

Each single function allows you to quickly access the Activations and/or Adjustments without having to connect to the specific control unit that manages the function requested.

i Within this quick selection menu there are all the functions available for the selected vehicle, regardless of the actual version of the vehicle being diagnosed. Therefore, Activations and/or Adjustments that cannot be activated for the diagnosed vehicle may be displayed (for ex. a vehicle may have been produced, throughout its life, with different types of diesel injection control units, such as EDC MS6.1, EDC 7, EDC 7C32, ... In this menu you will find all the functions of all the control units possible, but only the functions of the control unit actually installed in the vehicle can be activated).

! ATTENTION: The attempt to activate a function that is not supported will cause the display of an error message.

4.1.1 Vehicle maintenance

The "Vehicle maintenance" menu contains all the Activations and/or Adjustments most commonly used in a workshop, such as, for example, the reset of the maintenance warning lights, the replacement of the dryer filters, the calibration of the suspensions and of the clutch, the replacement of the brake pads, the regeneration of the particulate filters, the specific resets for the replacement of a component, ...

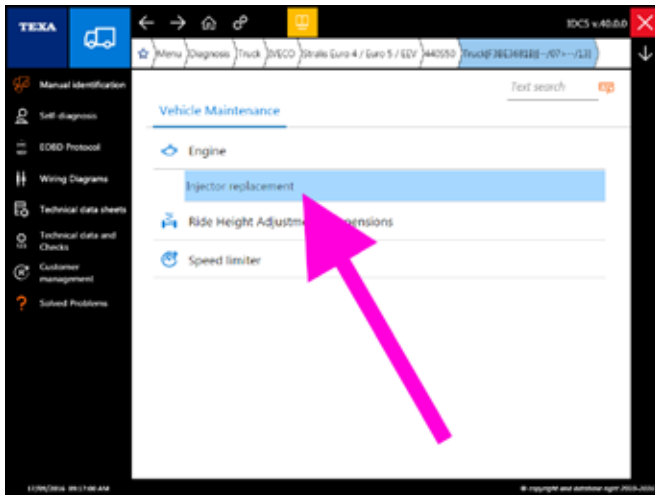
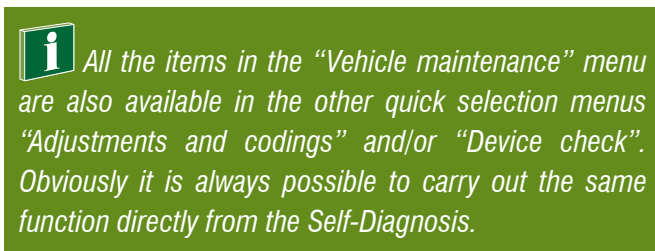


Figure 31: Vehicle maintenance: Injector replacement

For example (Image 31) if you have to recode an injector that has just been replaced, you can select the "Injector replacement" function directly from the "Vehicle maintenance" menu



4.1.2 Adjustments and codings

The "Adjustments and codings" menu contains all the Adjustments allowed for the vehicle being diagnosed, but that are not considered as common operations.

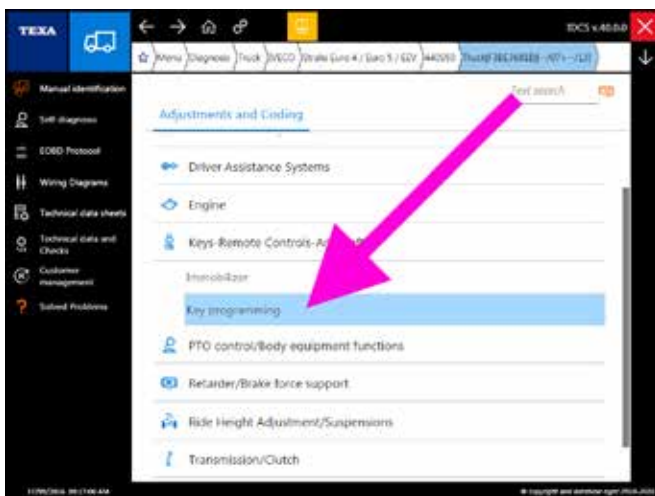
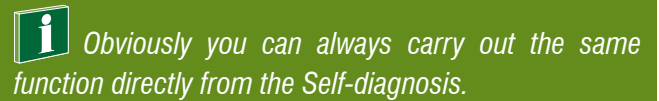


Figure 32: Adjustments and codings: Key programming

Therefore, if you have to program a new key, you can access this function directly from the "Adjustments and codings" quick menu (Image 32).



4.1.3 Device check

As already seen for the other quick selection menus, the "Device check" menu contains all the Activations allowed on the vehicle being diagnosed.

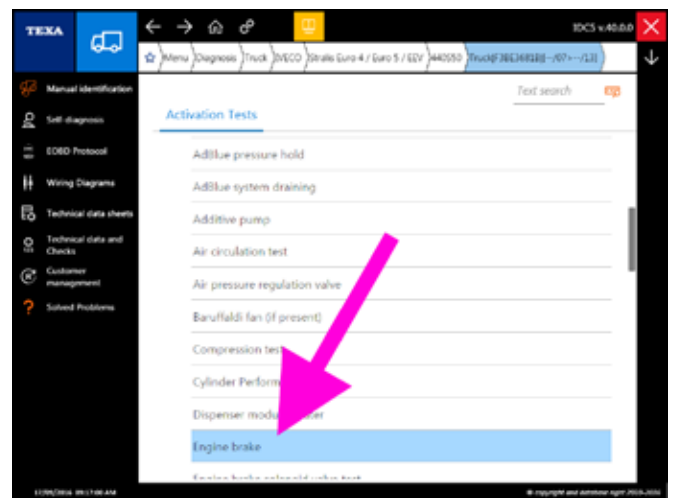


Figure 33: Device check: Engine brake

To test the engine brake solenoid valve's operation, for example, you can choose the function directly from the quick selection menu "Device check" (Image 33).



4.2 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.

In fact, one of the peculiarities of the world of industrial vehicles is to have a very large number of electronic systems and often, different brand control units coexist on the same vehicle with the need for customised diagnoses.



Figure 34: Electronic systems in industrial 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 in the world of industrial vehicles 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.

4.2.1 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.

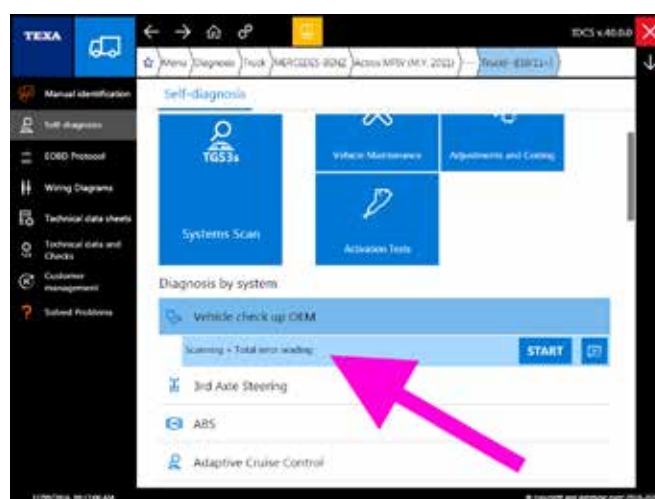


Figure 35: Vehicle check-up

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.

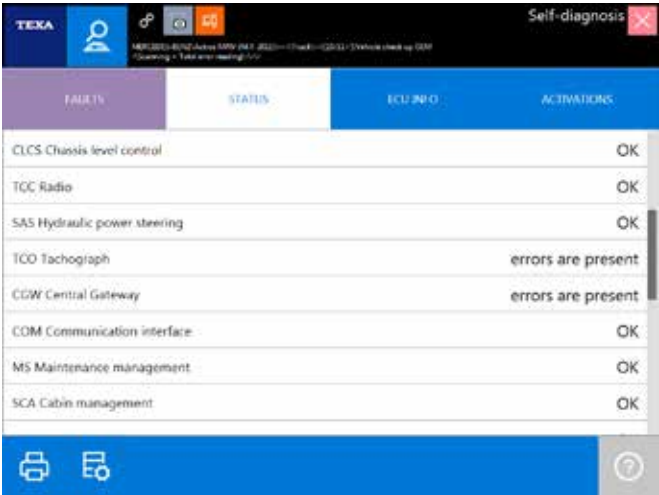


Figure 36: Vehicle check-up statuses page



The same function is also provided for the EBS braking systems of Trailers/Semi-trailers. For this category of vehicles, the function is called **EBS check-up** "Total scan + error reading" and offers the same operational improvements.

4.2.2 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.

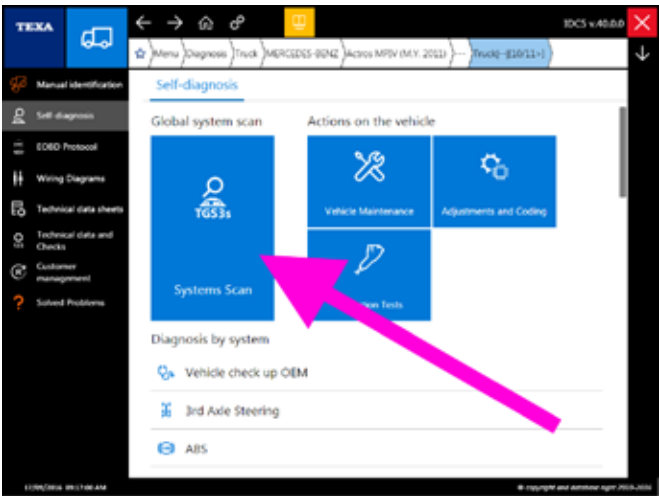


Figure 37: Total Global Scan 3 (TGS3)

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.

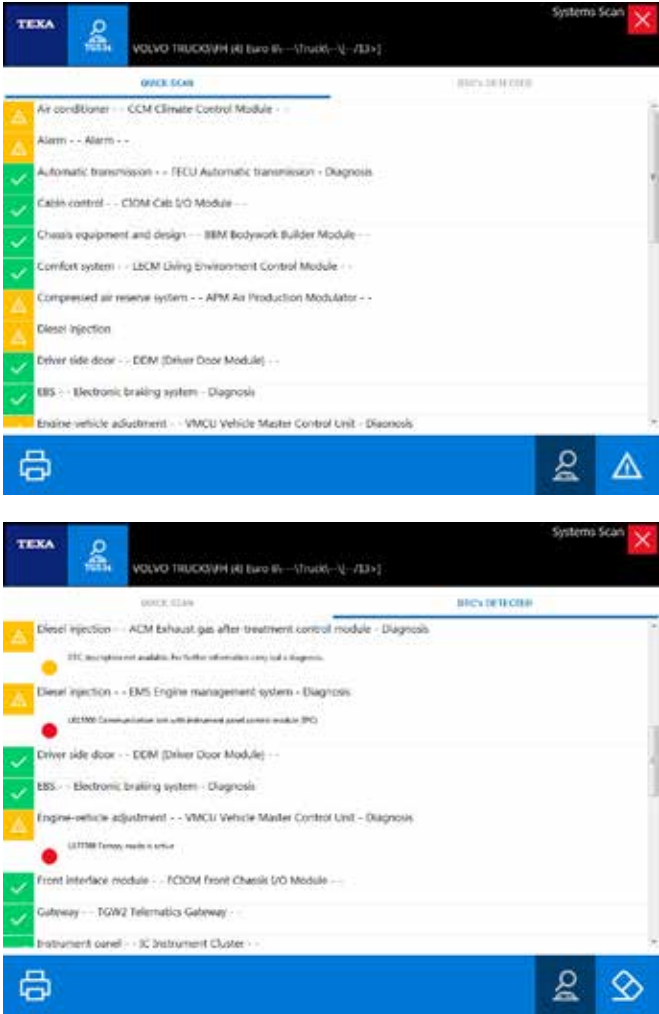


Figure 38: Scan with TGS3

4.3 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).

4.3.1 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.

Several examples are possible: the AS-Tronic transmission made by the German producer ZF Friedrichshafen is used by many truck manufacturers, such as Iveco, Daf, Man; the electronically controlled suspension from Wabco and Knorr (called, respectively, ECAS and ECS) are used by virtually all the manufacturers of industrial vehicles. The same applies to the electronic braking systems (EBS) built by the same 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 39: S-Tronic transmission self-diagnosis with Iveco or ZF logic



Figure 40: AS-Tronic transmission self-diagnosis with MAN or ZF logic



Figure 41: Electronic air dryer self-diagnosis with Scania or Wabco logic

Images 39, 40 and 41 show the possibility to select two diagnostic logics for the same type of system.



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.



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

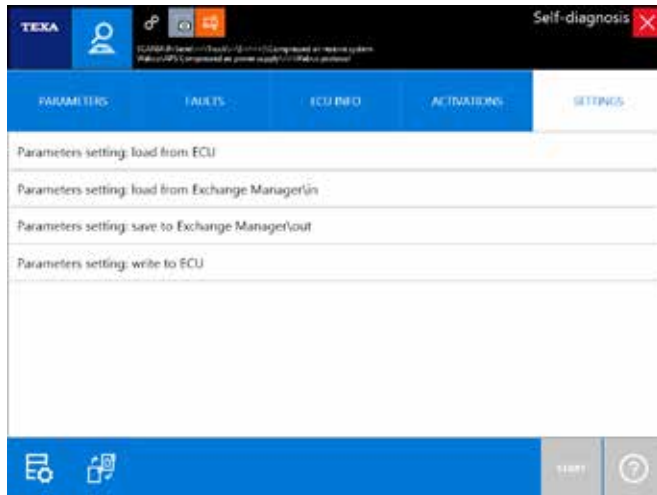


Figure 42: Adjustments page for the electronic air dryer self-diagnosis with Scania or Wabco protocol

In fact, the diagnoses with the system manufacturer's protocol are generally more generic, but allow greater configuration freedom. In the example in Image 42 notice the difference of the adjustments available in the APS dryer diagnosis using the Scania protocol rather than the Wabco protocol.

Notice above all that the possibility to manage the transfer of the configuration between control units is only available with the Wabco protocol.

4.3.2 Standard diagnostic protocols

There is a series of international authorities that are involved in standardising the various aspects of the communication among electronic control units.

A diagnostic protocol is not "a single thing", but a set of multiple rules and methods (physical level, logical level, type of hardware on which the protocol runs, how the information must be coded, ...).

We can simplify the idea by thinking of the communication between two human beings. To exchange information two people must share different aspects:

- same type of transmission hardware (e-mail, standard mail, voice, ...)
- same communication language (Italian, English, "Eskimo", ...)
- knowledge of the subject of discussion
- ...

The SAE American authority has, in time, released various protocols specifications for the world of self-diagnosis. The two most important ones are the J1708/J1587 and the

most recent J1939.

Both of them are specific for the "automotive" world, but have some slightly different application fields.

SAE J1708/J1587 protocol

The hardware (J1708) use a two-wire RS485 type connection, capable of managing connections up to 40 meters with a speed of 9.600 bit/s. The language (J1587) defines a series of standard rules and codes for all the types of systems and errors possible.

In a very simplified way, we can say that the diagnostic protocol SAE J1708/J1587 always communicates a series of two codes, the MID code and another code that can be called PID, PPID, SID or PSID.

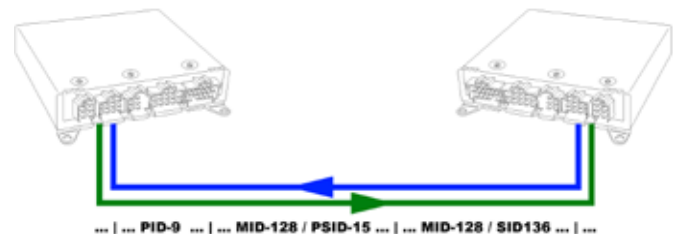


Figure 43: Communication on the SAE J1708/J1587 protocol

The MID code identifies the type of system, while the PID/SID/PPID/PSID codes indicate the values of the parameters or of the components that were diagnosed.



The MID, PID and SID codes are standard for all the manufacturers of industrial vehicles, whereas the PPID and PSID codes are specific and can be customised by each manufacturer.

Type	Value	Description
MID	128	Control unit/engine system
	133	Control unit/1st trailer axle system
	136	Control unit/tractor brake system
	144	Control unit/cruise control system
	169	Control unit/trailer 3 tyre pressure monitoring system
	230	Control unit/6th axle load management system
PID	9	Axle lifting status
	32	Splitter unit position
	100	Engine oil pressure
	190	Engine speed
SID/MID	1/128	Cylinder 1 injector
	136/128	Cylinder 8 exhaust gas flap temperature
	17/136	ASR switch
	49/166	Wheel temperature 16
PPID	25	Percentage of rear left axle 1 lining remaining
	307	VGT position
	334	Brake pedal position
	1694	Position of the piston in the clutch cylinder
PSID/MID	15/128	Oxygen sensor 3
	1/136	Left axle 2 load sensor
	1/144	Retarder activation switch
	140/164	Thruster module software not compatible

Table 3: Extract of Volvo MID, PID, PPID, SID and PSID codes

This type of protocol has been used since 1985 and the various manufacturers have used different types of diagnostic connectors. Up to 1995 each one used

proprietary connectors, while from 1996 to 2001 the OEMs have only used a single 6-pin "Deutsch" type connector; from 2001 they switched to a everyone go to a 9-pin "Deutsch" connector.



This type of diagnostic protocol is widely used by all the North American manufacturers and Volvo.



Figure 44: Volvo proprietary and American standard connectors

SAE J1939 protocol

It is a high level communication language, specific for industrial vehicles, that defines the rules and the structures of the messages sent over a communication line.

Therefore it does not define the type of communication hardware and it is not specific for the diagnosis, but it is a generic protocol type, valid both for exchanging information among electronic devices (control units, but not only), and also valid for diagnostic message and managing the diagnostic messages. Generally, it is implemented on a standard CAN communication line (such as ISO 11992), but it is possible to find it applied to other communication standards also. The protocol defines the data structure of the messages and codes their parameters.

Name	Identif.	Speed	Byte	Bit	Name	Res.	Range
EEC2	0C F0 03 00 PGN = 61443	50 ms	1	8, 7	- -	2 bit	0 - 1
				6, 5	Road speed limit	2 bit	0 - 1
				4, 3	Acc. pedal kickdown switch	2 bit	0 - 1
				1, 2	Acc. Pedal idle switch	2 bit	0 - 1
			2	1-8	Acc. Pedal position	0,4 %	0 - 100%
		
		
			8	- -	- -	- -	- -

Table 4: SAE J1939 message structure example

The SAE regulation recommends using a 9-pin "Deutsch" connector (solution used by American manufacturers), but it is not the only solution used (OBD connector in Europe).



Figure 45: EOBD and American standard connectors

4.4 ERROR READING FROM THE INSTRUMENT PANEL

The modern driver dashboards are actual computers, with various functions and a good processing capacity. Most manufacturer of industrial vehicles use this calculation power also to offer a diagnosis directly from the instrument panel's display.

The basic logic is the same as the old blink code system, but you no longer have to keep in mind count the number and type of flashes, but a number that indicate the fault code is displayed on-screen (some manufacturers provide a text description also).

TEXA's self-diagnostic tools can also support this type of diagnosis with some specific selections, where the error code reading procedure is shown and there is the possibility to enter the code read on the display to get a description.

i The display procedures vary based on the truck's make and model and they can also be found in the user and maintenance manual.

Based on the selected vehicle, it is possible to find this type of diagnosis in TEXA's software in two categories: either as a specific selection of the system, called "Manual procedure" (Image 46), or in a specific category called "Error reading from the instrument panel" (Image 47).



Figure 46: Manual procedure

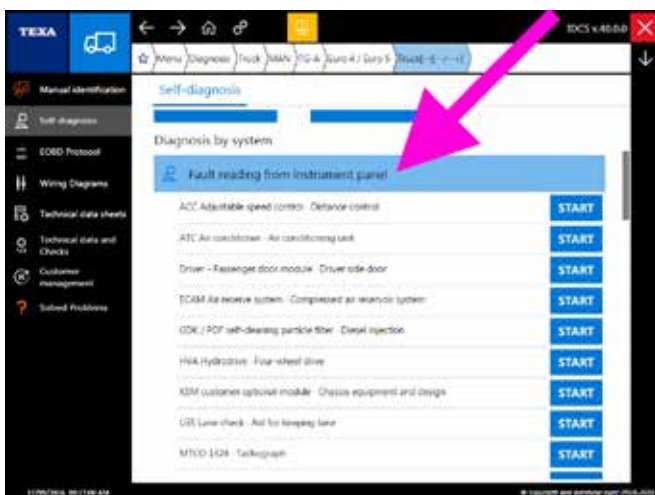


Figure 47: "Error reading from the instrument panel" category

i In general, the "Error reading from the instrument panel" category (Image 47) gathers the systems that display the error codes on the driver's display, whereas the manual procedures in the single systems (Image 46) are dedicated to the systems that still use the old blink code.

This diagnostic methods is particularly useful when the vehicle is not available (for ex. the truck is on the side of the road and the driver is able communicate the error codes by phone).



Figure 48: Error reading from the instrument panel

4.5 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 49: 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.

4.5.1 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.

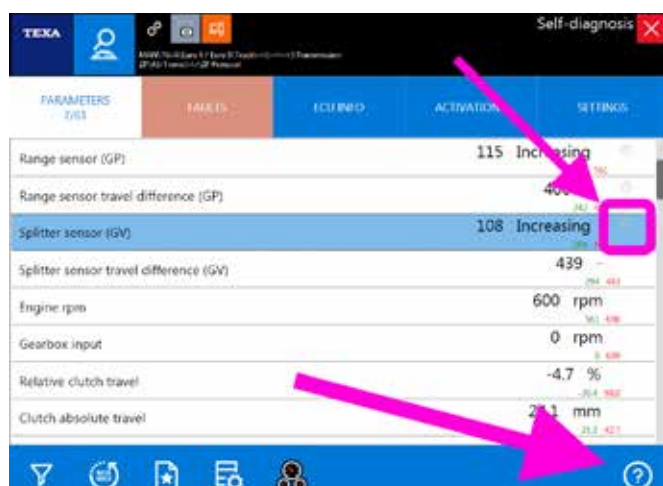


Figure 50: Parameter help button

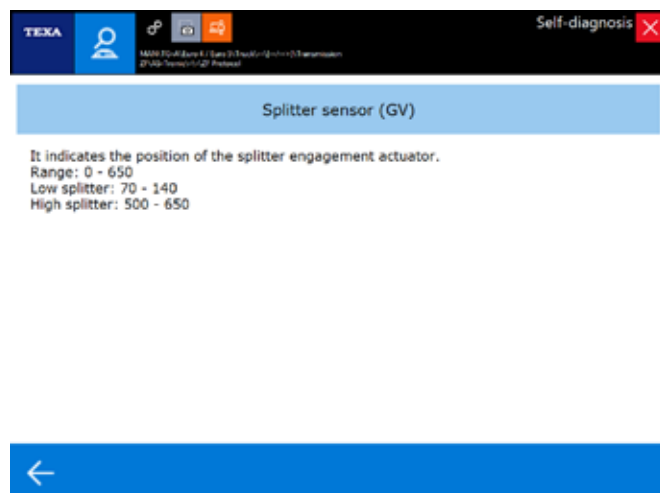


Figure 51: Parameter help section

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

4.5.2 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.

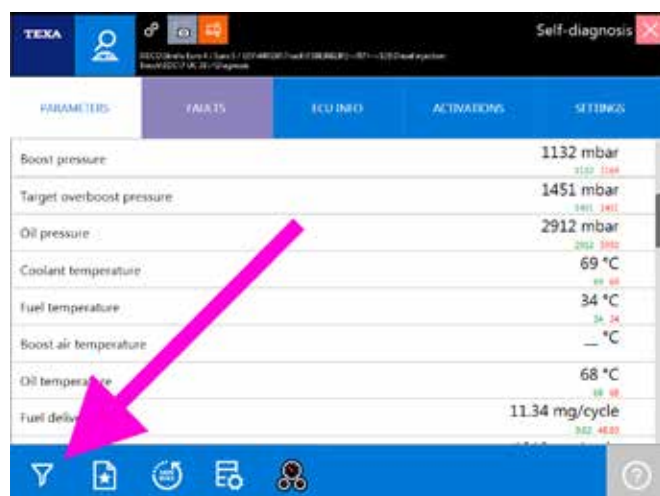


Figure 52: Parameter filter button

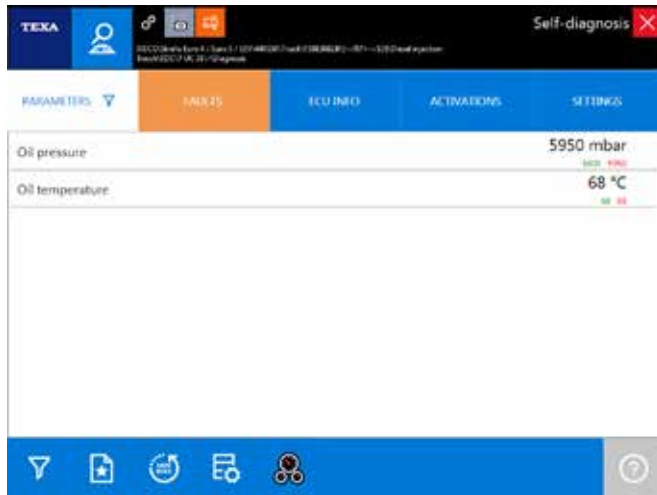


Figure 53: Filtered parameters

4.5.3 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".

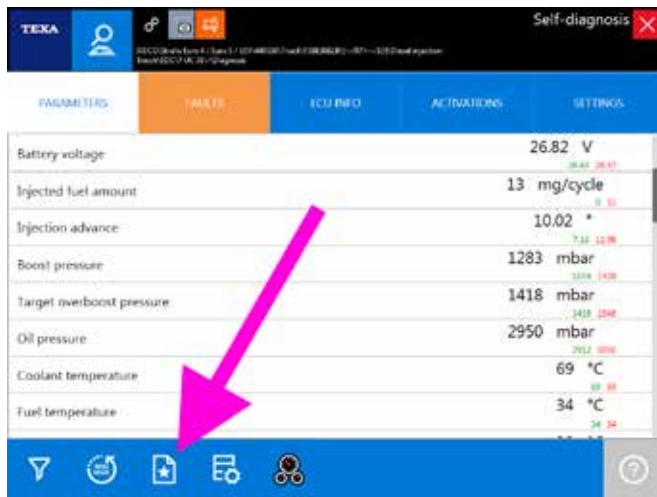


Figure 54: Favourite parameter button

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



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.

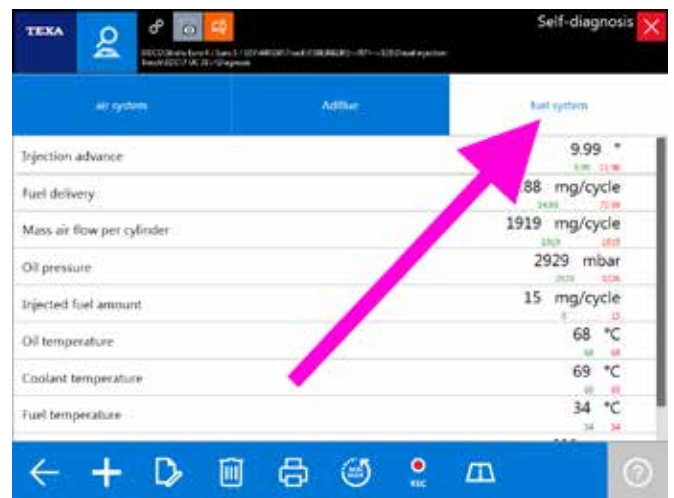
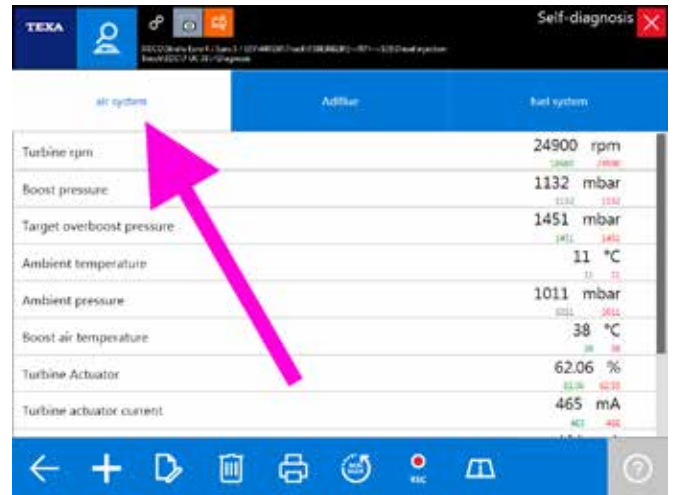


Figure 55: Favourite parameter groups

A new page is associated with each group of favourites created and it can be selected by simply clicking on the corresponding label (Image 55).

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 "✓").

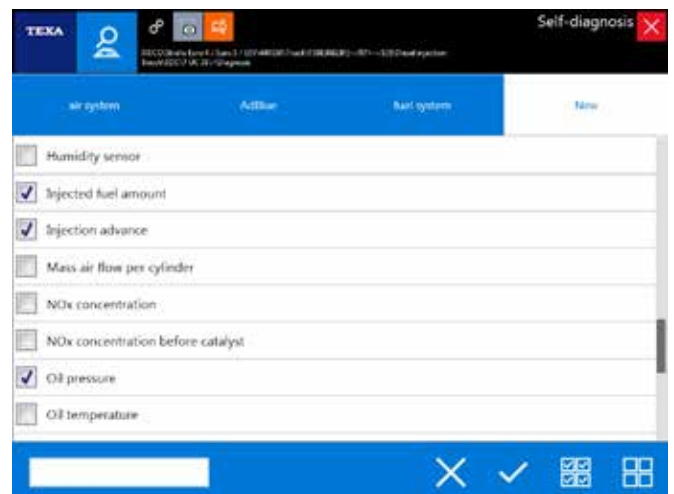



Figure 56: Parameter selection

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

4.5.4 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.

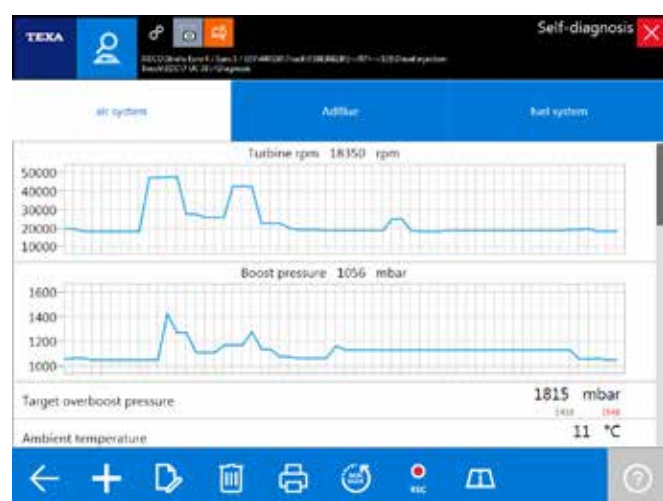


Figure 57: Graphical view of the parameters

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 57 shows some parameters related to air intake. You can notice that as the turbine speed increases, the boost pressure increases at the same pace.

4.5.5 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).

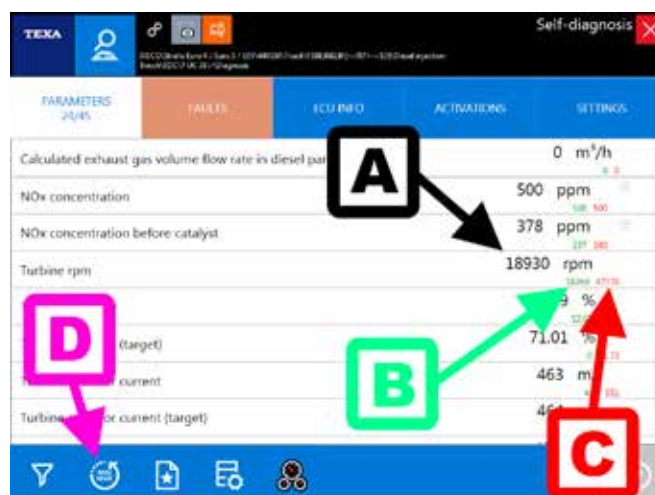


Figure 58: Current, minimum and maximum value of the parameters

Legend:

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

In Image 58 you can see that the engine 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 "🔄".

4.5.6 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:

- Actual 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.

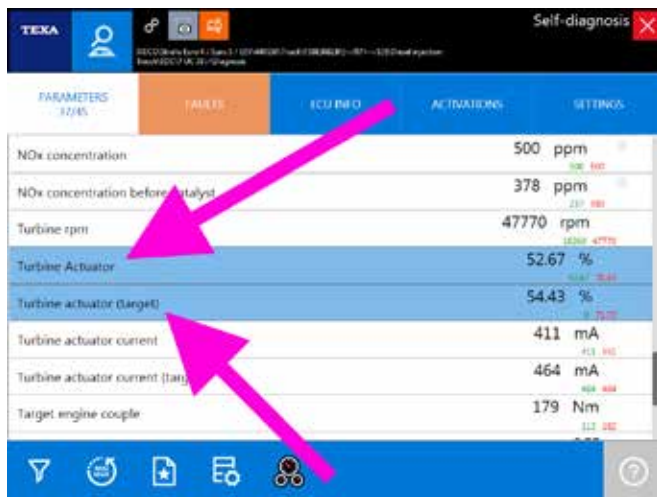


Figure 59: Actual and target value



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.

4.5.7 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, ...

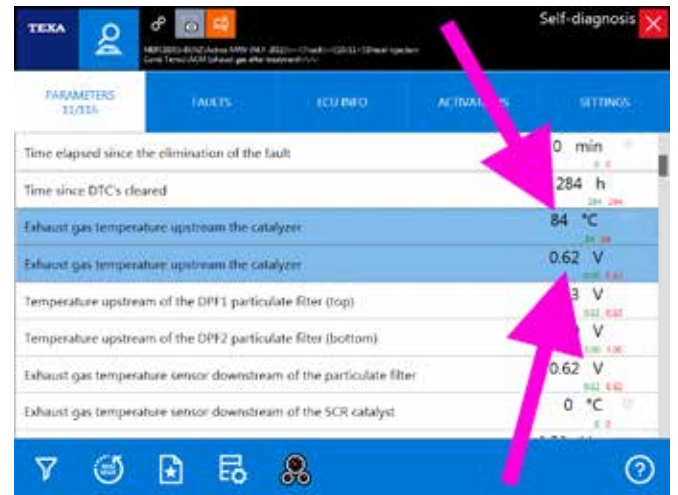


Figure 60: Parameters expressed with physical and logical values

4.5.8 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.

4.6 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

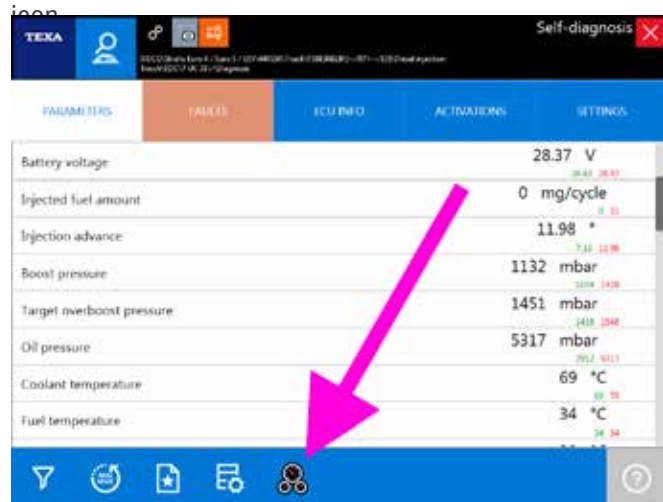


Figure 61: Dashboard mode

The image below (Image 62) 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 62: Boost and air intake system dashboard

4.7 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.

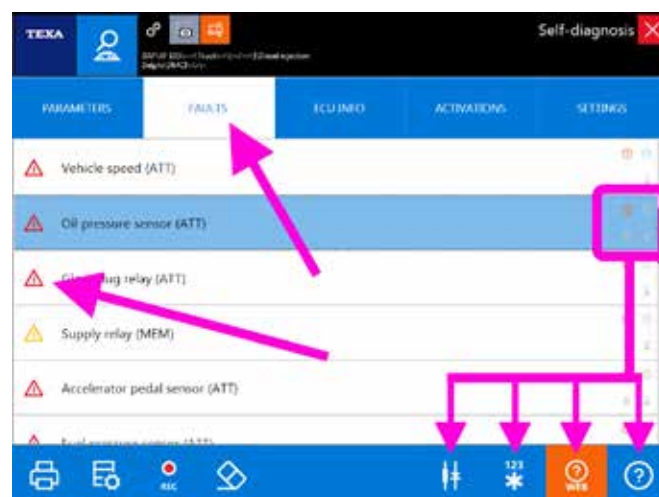


Figure 63: Error page

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 63).

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 TEXA's customer database.

Table 5: Information associated with the errors

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

4.7.1 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 6: 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 Euro4 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.

It is possible to give an illustrative example on an ABS and/or EBS braking system with regards to the wheel speed sensors, but when the problem is not related to the sensor itself (problem with the coil or magnet) or to its electrical wiring (short circuit or cable cut-off), but when the problem

is due to the phonic wheel or to the air gap (space between the sensor and 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 generating by the sensor/phonic wheel pairing only when the wheels are moving above a certain speed threshold.

4.7.2 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.

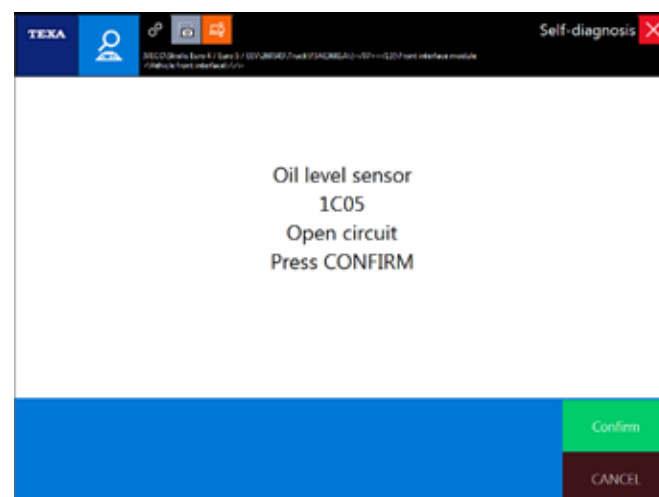



Figure 64: Error details



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

4.7.3 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.

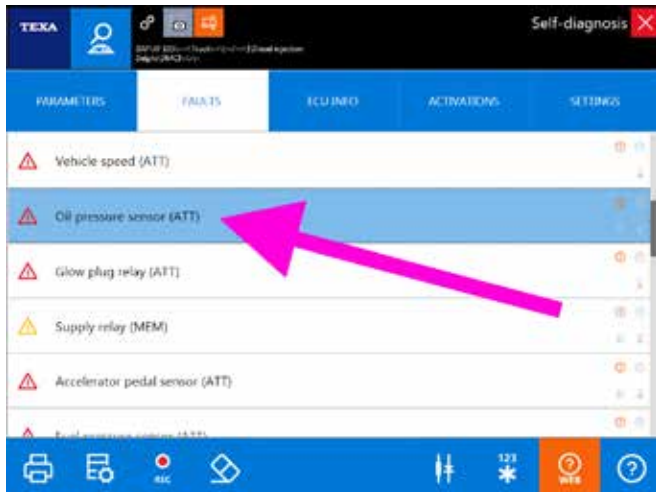


Figure 65: Error with the help function

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 66: Error help section

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

4.7.4 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.

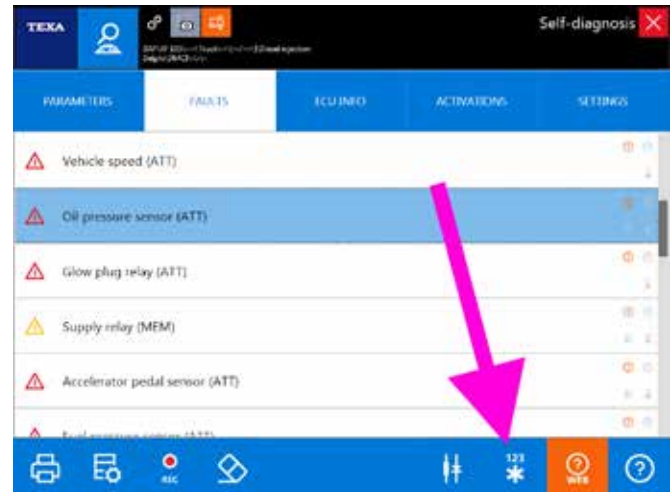


Figure 67: Freeze frame button

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

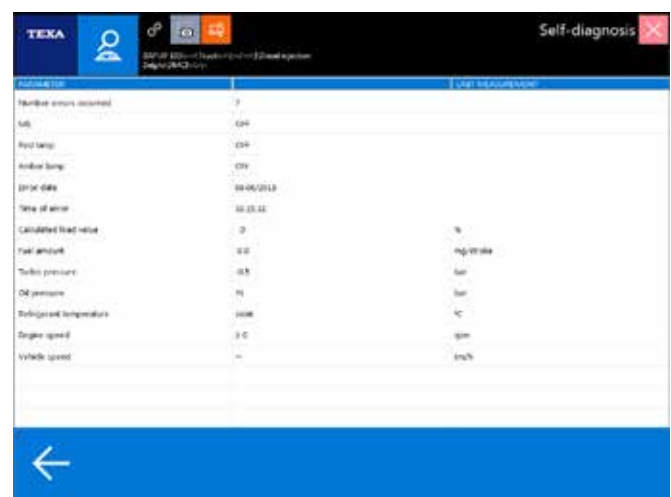


Figure 68: Freeze frame contents

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 non all the control units allow this function, but only the latest generation ones.

4.7.5 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, often different manufacturers use different names to identify the same component (for ex. the solenoid valve block that manages the passage of compressed air towards the air suspensions may be called "Solenoid valve assembly" or "Electro- pneumatic assembly" based on the vehicle manufacturer; or, in the EBS braking systems, "Axle modulator" rather than "Rear air electro-distributor assembly" to indicate the module for the solenoid valves which supplies air to the engine axle's brakes).

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.

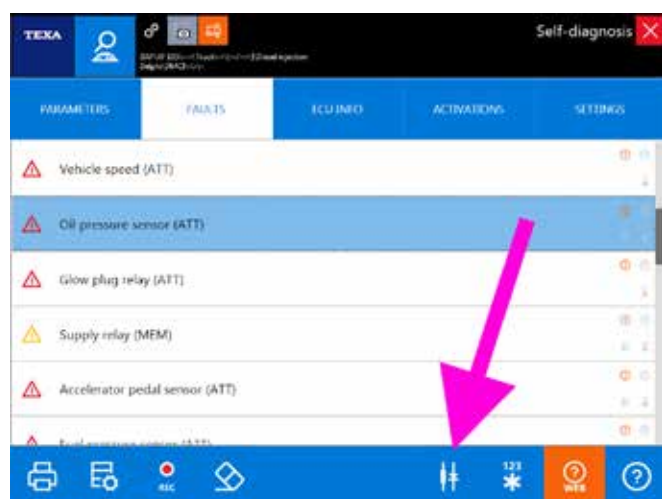


Figure 69: Component location button

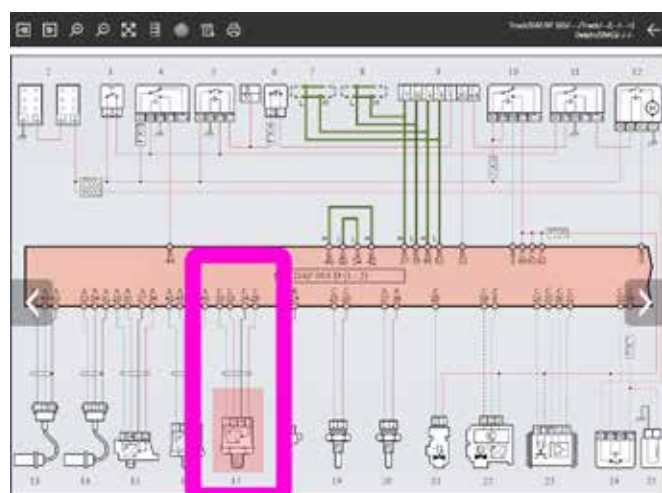


Figure 70: Location wiring diagram



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.

4.7.6 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 "Solved fault search" allows consulting these two databases.

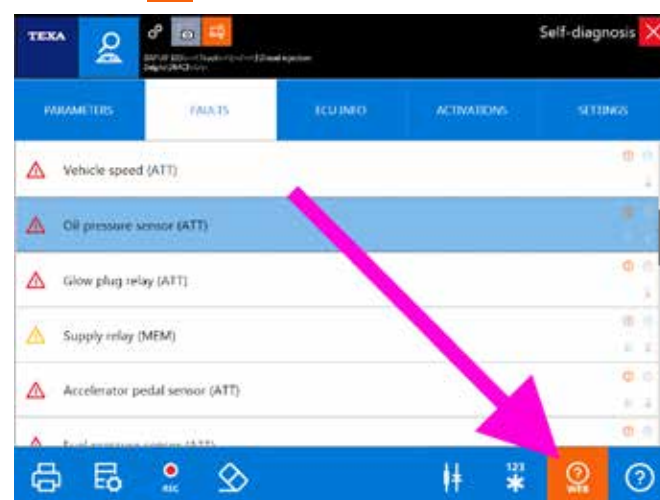


Figure 71: Solved fault search button



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

4.8 RECORDING OF THE DIAGNOSIS AND TEST DRIVES

At times a fault may appear only in certain vehicle operation conditions: for example the truck “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

4.8.1 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 72: Parameter selection button

i For further information on the parameter selection function, go to section 4.5.3 Parameters of this manual.

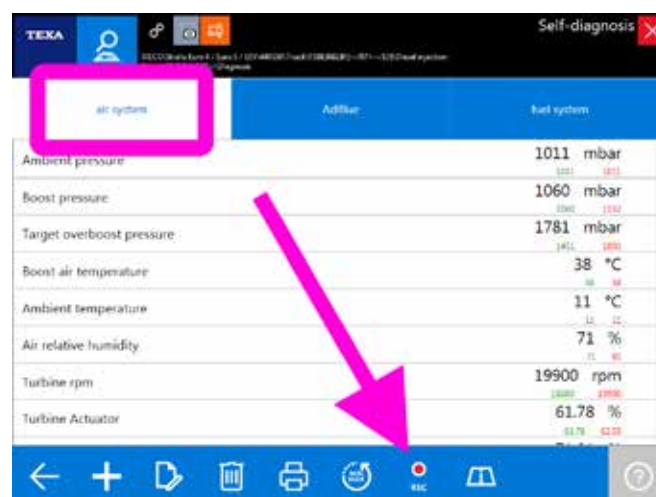


Figure 73: Diagnosis recording command

! 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 6.6 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 74: 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 75: Recording in progress message



Figure 76: 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.

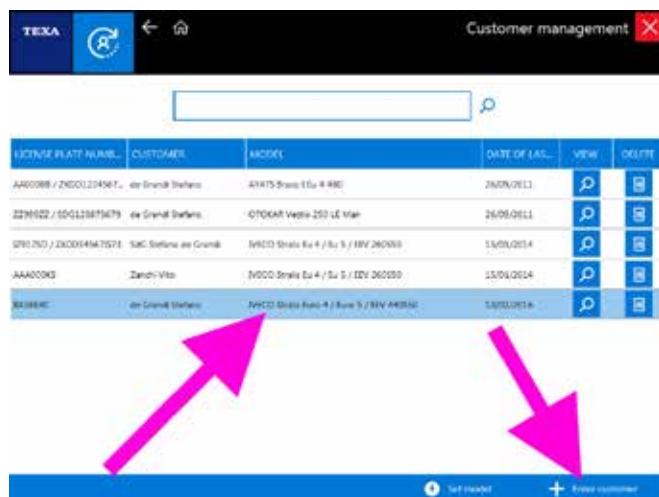


Figure 77: Association of the recording with a customer

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 "🔍".

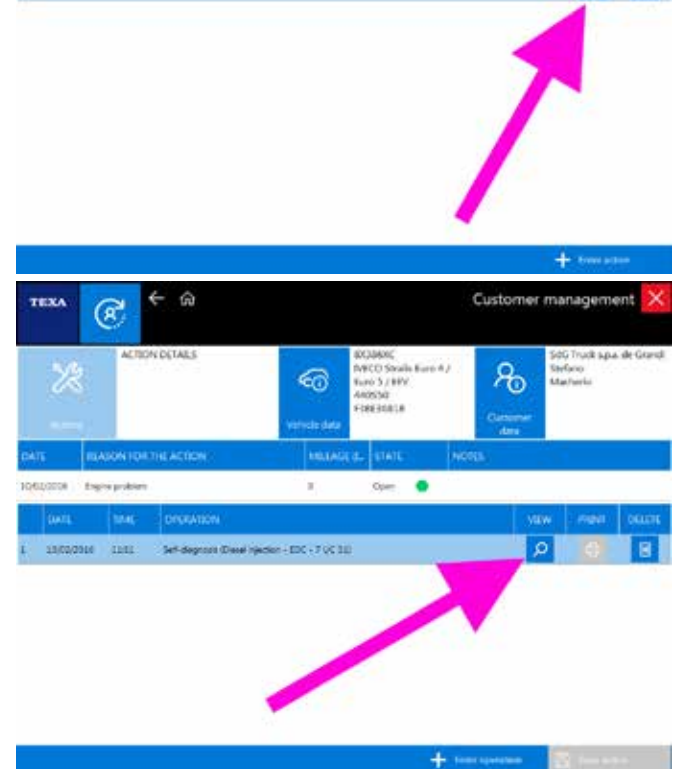


Figure 78: Customer database test record

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.

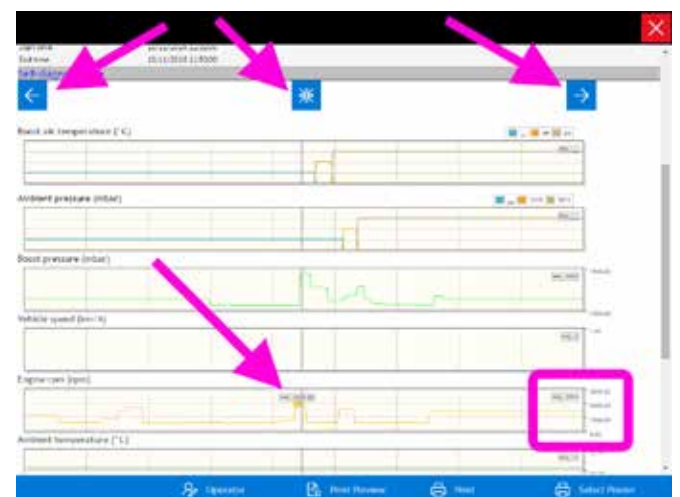



Figure 79: Display of the test data

In the example in Image 79, you can see the indicator positioned on the second 44.00 which indicates the instant values of the parameters recorded.

 For a detailed description of the Customer management functions, refer to the OnLine technical documentation provided with the program or to chapter 6.6 Customer management of this manual.

4.8.2 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.

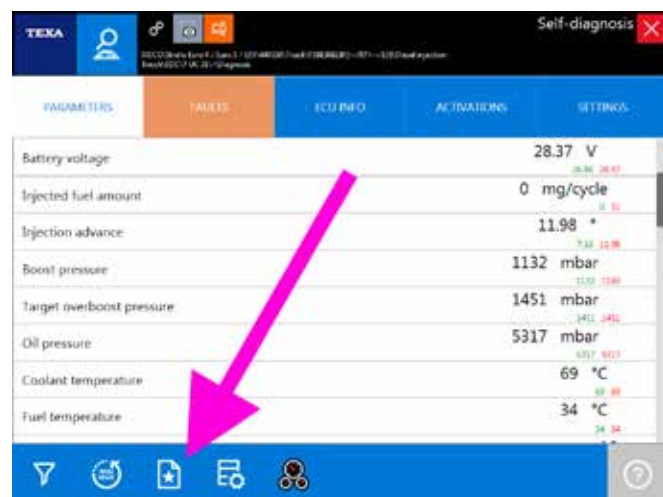


Figure 80: Parameter selection button

 For further information on the parameter selection function, go to section 4.5.3 Parameters of this manual.

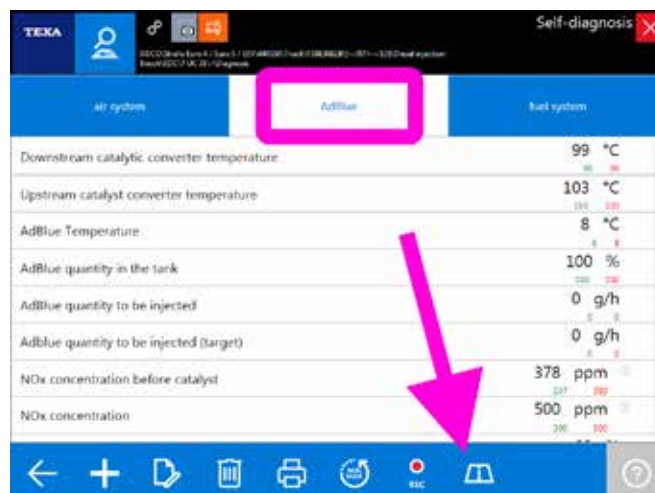


Figure 81: Command for carrying out the Test drive


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 Self-diagnosis program.



Figure 82: Test drive mode confirmation message

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

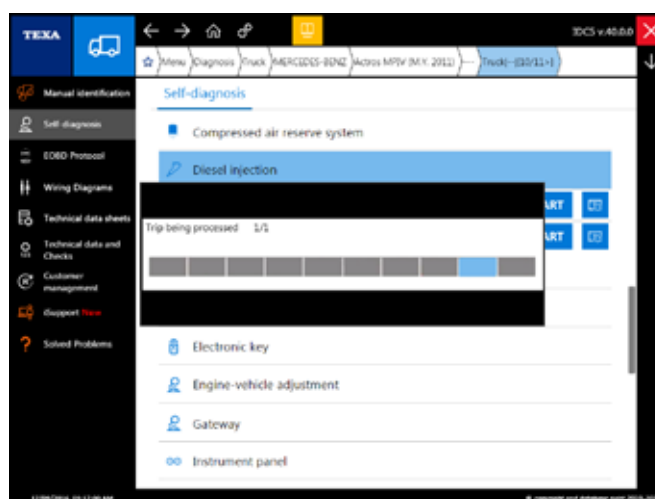


Figure 83: Trip data recovery

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 84: Trip data display

It is useful to notice (Image 84) 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 6.6 Customer management of this manual.

4.9 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.

4.9.1 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.

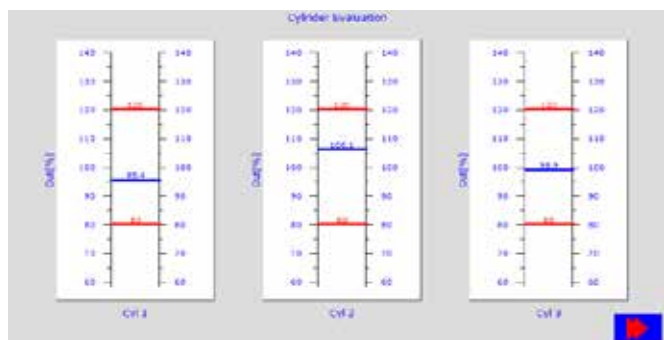


Figure 85: Bar diagrams

In Image 85 both the value reached during the test (blue line), and the limit values (red lines) within which the test is considered passed, are displayed.

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).

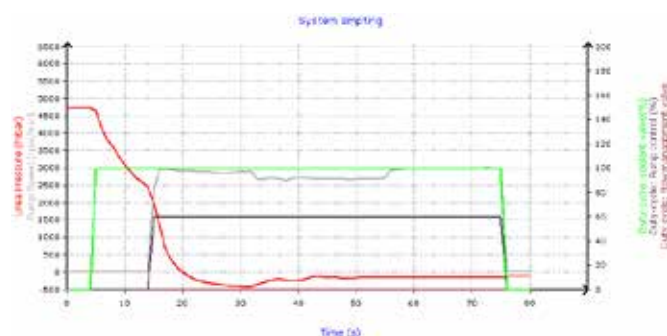


Figure 86: Line chart

The diagram in Image 86 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).

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.

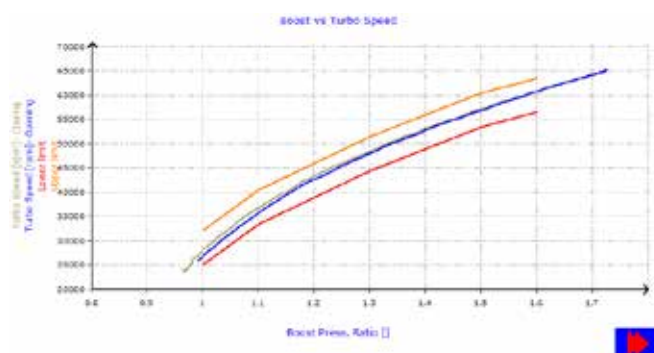


Figure 87: Line charts with references

Image 87 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.

4.9.2 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.

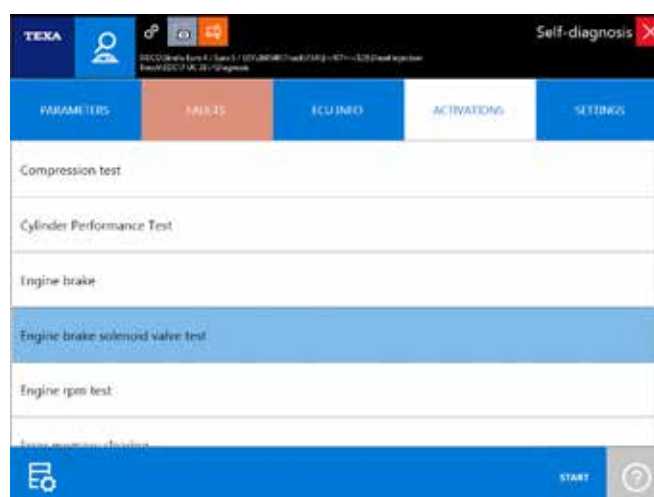


Figure 88: Activations page

Basically there are two types of check:

- Signal electrical check (component activation/deactivation)
- 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.

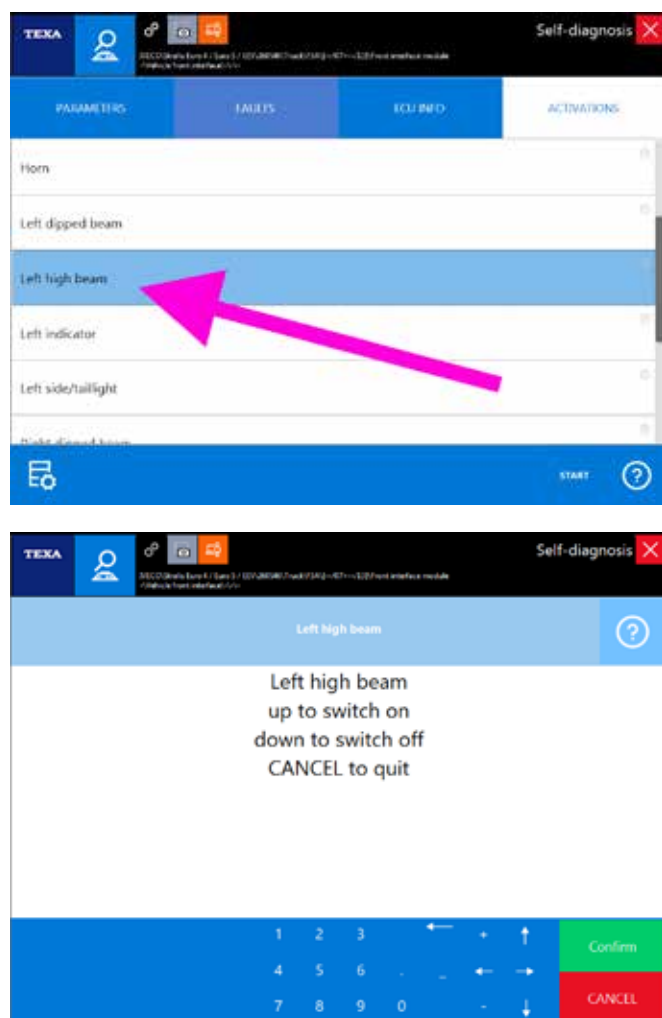


Figure 89: Activation: external lights

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

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

ECAS lifting/lowering

Another activation that allows a purely electrical check is the possibility to vary the chassis height from the diagnosis of the electronic suspensions.

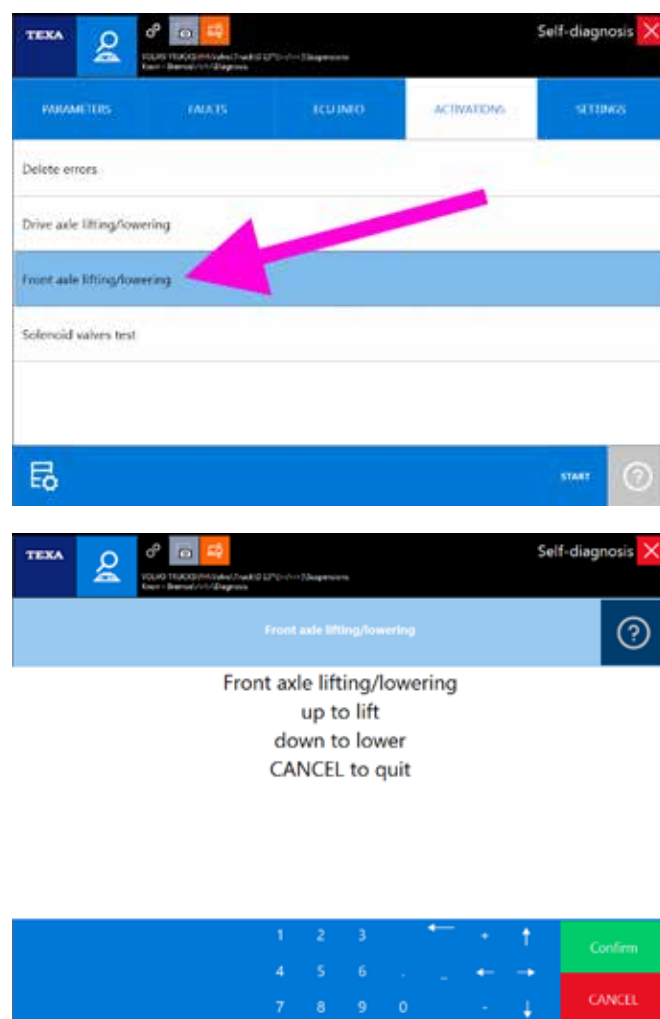


Figure 90: Activation: chassis lifting/lowering

By acting on the Self-diagnosis buttons you can vary the chassis height with respect to the type of activation selected (front axle, only one side, ...).

Iveco VGT

Other type of activation include the execution of a complex test for a dynamic component check. An example is the VGT turbine check on Cursor engines from the FPT group.

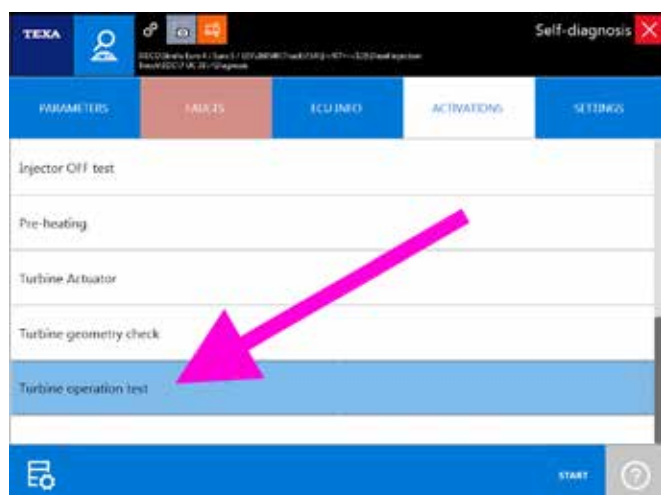
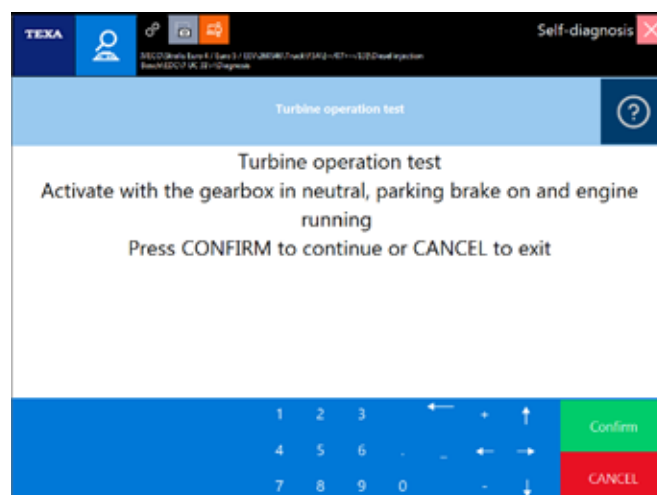


Figure 91: Activation: Turbine operation test



The test is completely automatic and requires accelerating the engine and the simultaneous command from the turbine's geometry actuator.

The values will be displayed on-screen during the test. Once complete some diagrams that help understand the proper execution of the test will be displayed.

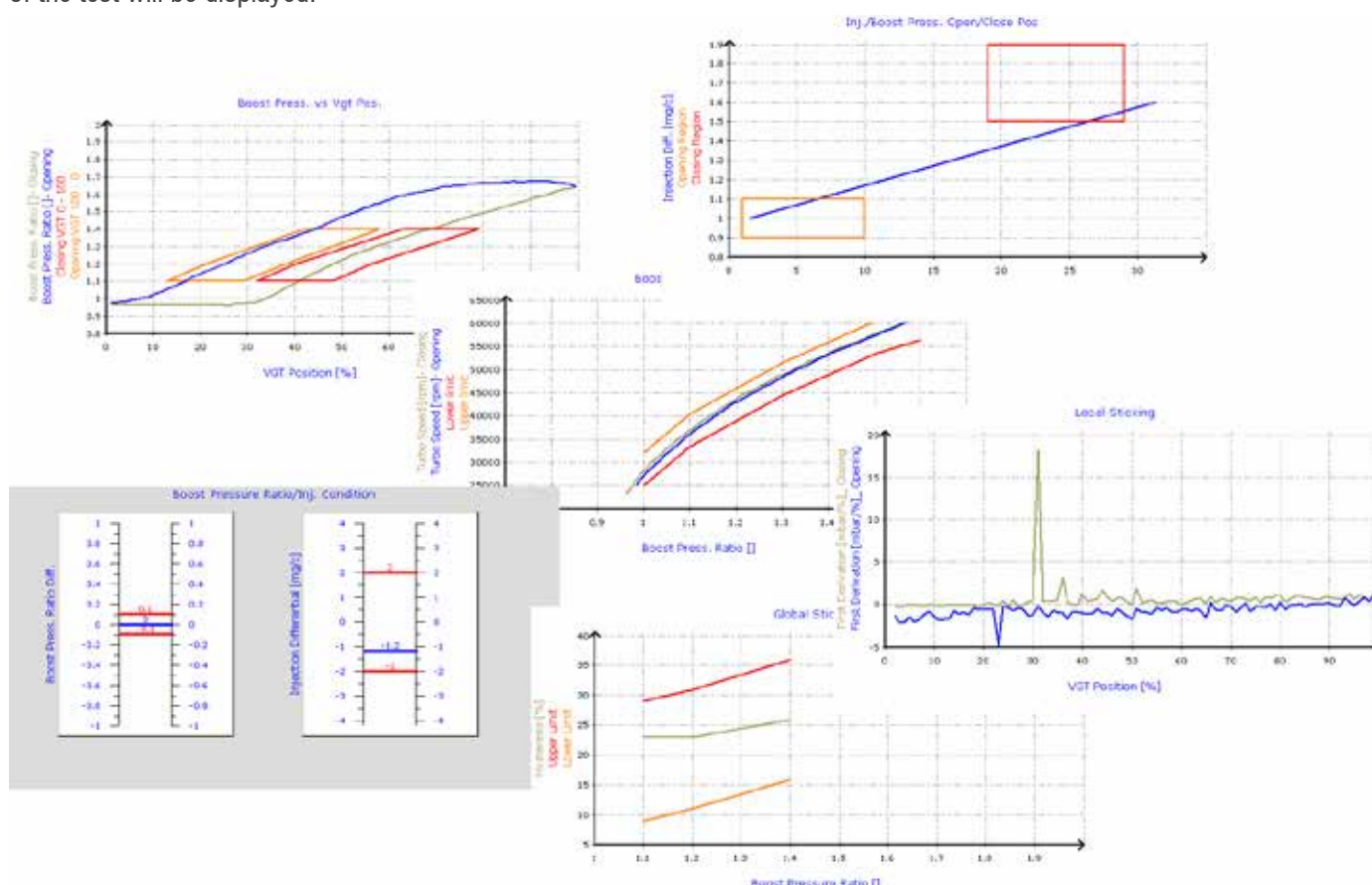


Figure 92: Turbine operation test diagrams

For the correct interpretation of the test, you must have knowledge regarding the system that was diagnosed. Otherwise you can find information in the specific technical bulletins (see section 5.2.2 Technical bulletins of this manual).

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.



Figure 93: 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 93).



Figure 94: 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.

Iveco, 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™;
- the tightness of the pipes;
- that the cleaning and emptying phase is completed correctly.



Figure 95: "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.

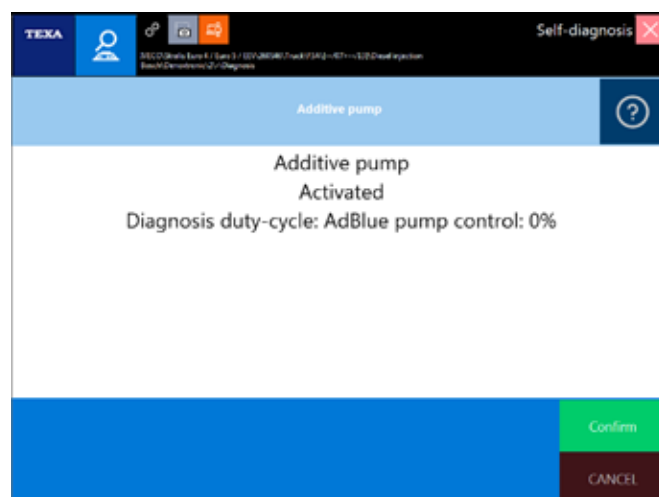
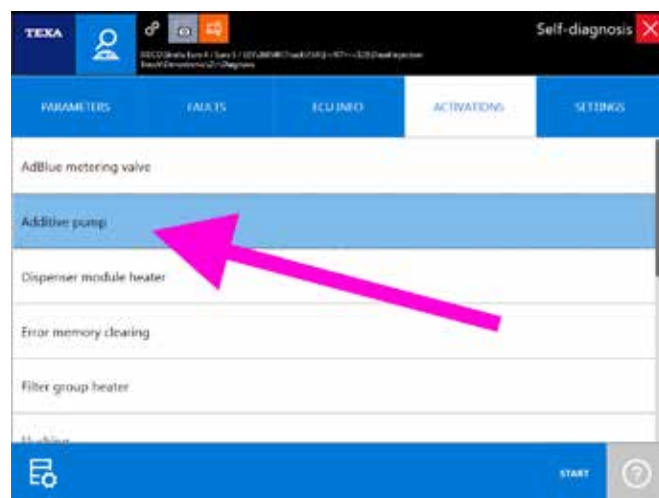


Figure 96: Activation: AdBlue pump

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

Cylinder deactivation

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.

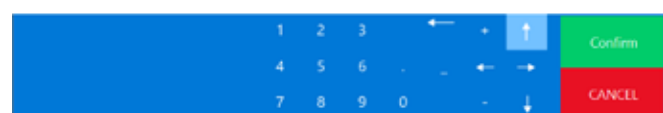
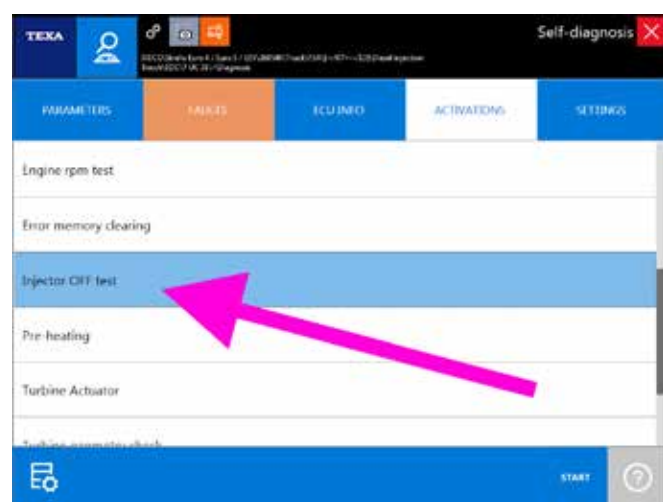


Figure 97: Activation: Cylinder deactivation

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 rod-crank 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.

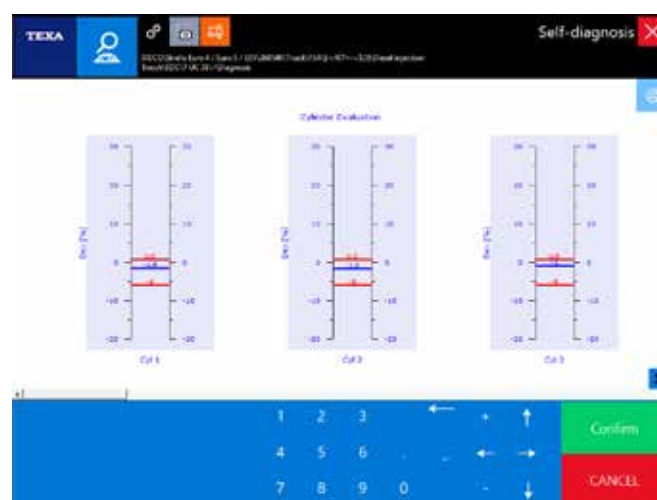


Figure 98: Activation: Compression test

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 98).

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.

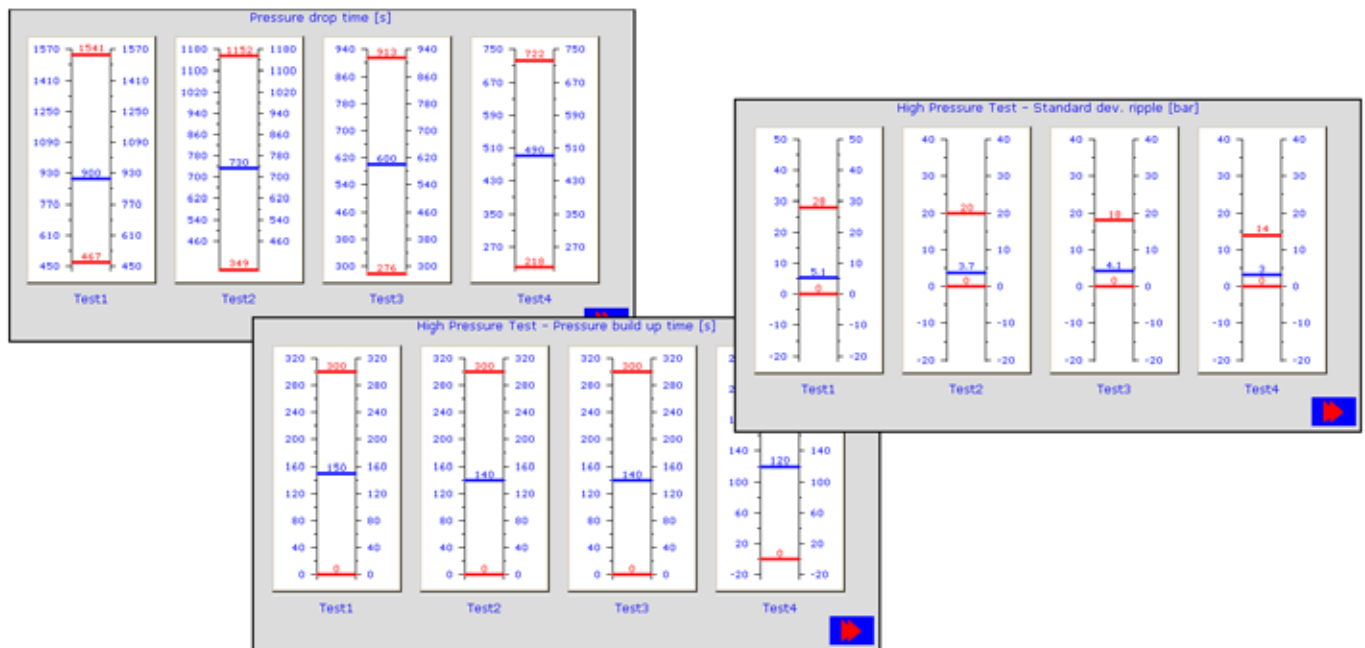


Figure 99: "High pressure test" diagram

Cummins VGT

In other cases the activations are needed in order to complete a repair procedure correctly. An example is the variable geometry turbine installed on the engines of the American manufacturer Cummins.

In fact, whenever the unit is removed and reinstalled, two electronic procedures must be followed in order to complete the component's assembly properly:

- VGT electronic actuator installation
- VGT electronic actuator calibration

The first must be used when the VGT is installed on the engine and it is needed to place the actuator's in a specific position. The second is needed to calibrate the VGT actuator and check if it work properly.

In this specific example, the mere electronic activation is not sufficient, therefore you must follow step by step the various phases provided in the manufacturer's official procedure.

In these cases a specific technical bulletin is available (Image 100) that explains in detail the operations that must be carried out.

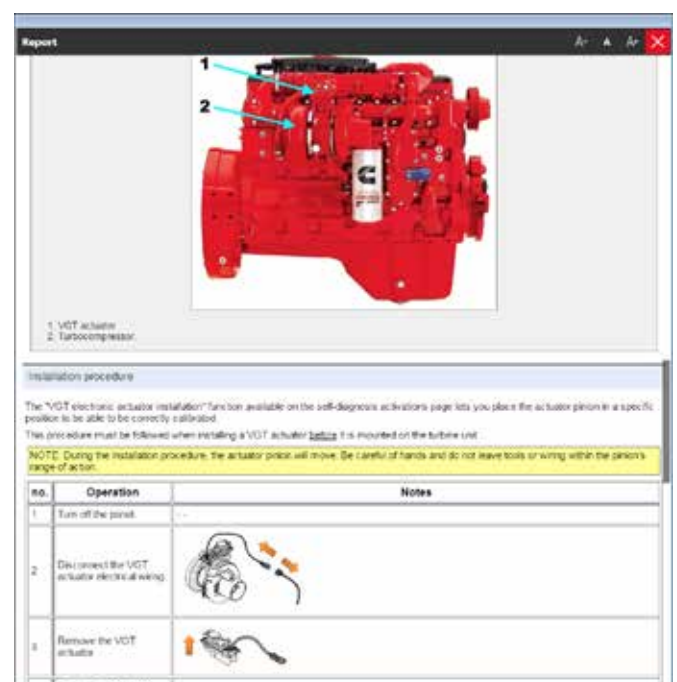


Figure 100: Cummins VGT bulletin

4.10 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 request of a "SPECIAL CODE".

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.

4.10.1 Special code and 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 101: Contract conditions acceptance screen

For the second level, instead, an unlock code, called Special Code, is required and the tool must be connected to the Internet.

The Special Code is requested after signing a contract, the acceptance of which allows unlocking the advanced functions, whereas the Internet connection is needed as the information related to the vehicle, the tool's serial number, the date and time at which the user performed the adjustment, are stored in a server that allows TEXA to know, at any time, which operations were carried out on a specific vehicle.

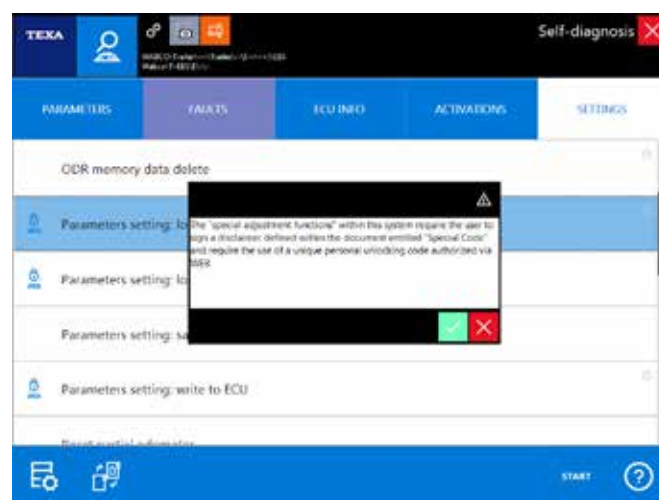


Figure 102: Warning message related to the Special Code

This type of adjustment can be recognised by an icon located beside the adjustment you wish to perform.



Special parameterizations

Figure 103: Adjustments through Internet icon

4.10.2 Adjustments

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

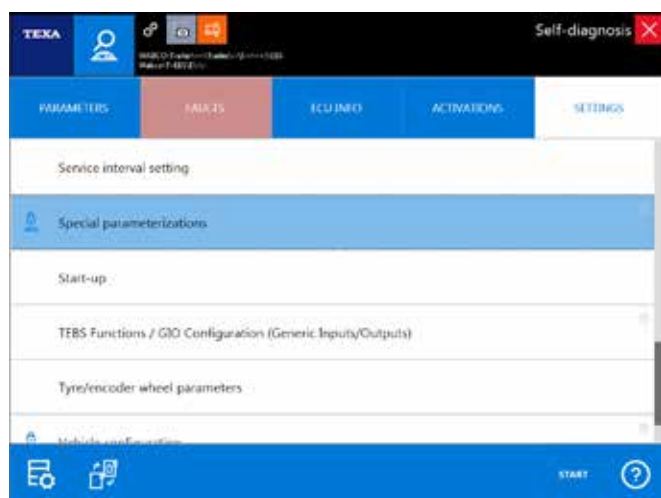


Figure 104: Adjustments page

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 appear in the driver's dashboard.

The new generations of industrial vehicles have a specific electronic control unit to manage this function.



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.

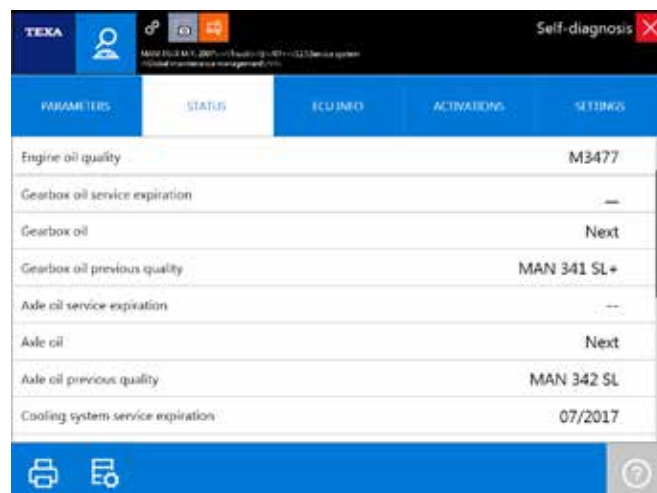


Figure 105: Adjustment: Maintenance reset

Generally, it is sufficient to connect to diagnosis with the control unit and perform the adjustment related to the maintenance that must be reset (Image 105) or use the quick controls as explained in chapter 4.1 Ordinary maintenance.

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.

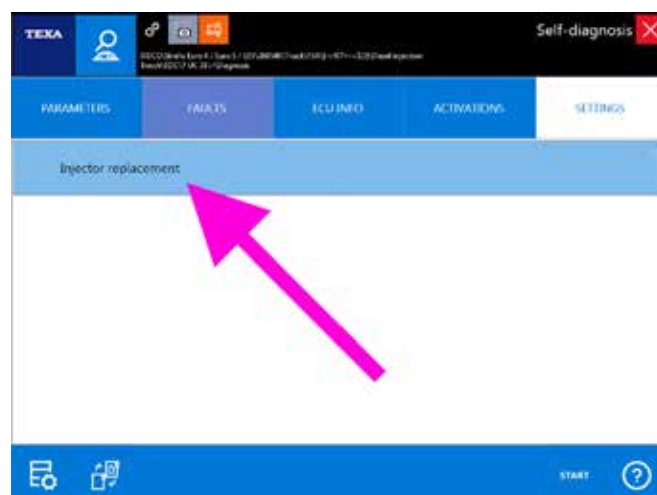


Figure 106: Adjustment: Injector replacement

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.

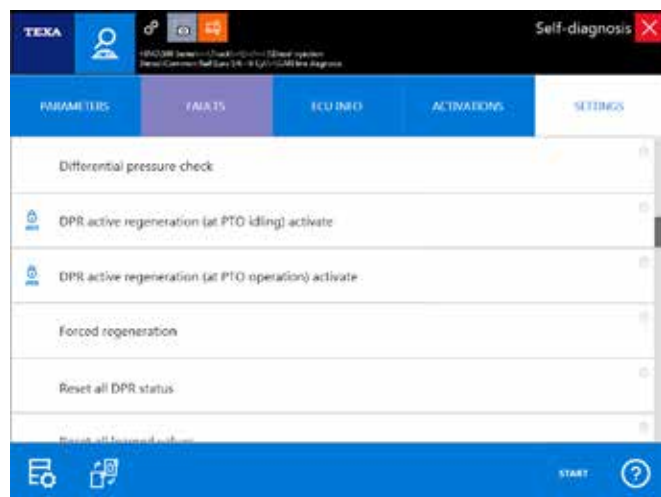


Figure 107: Adjustments for particulate filters

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

Control unit replacement

Replacing an electronic control unit is one of the most "felt" adjustments for the end-user. When available, this procedure is located in the adjustments page.

TEXA offers this possibility for many types of systems:

- AdBlue control units of DAF, MAN, Scania, Iveco, ...;
- EBS trailer control units of Wabco, Knorr-Bremse, Haldex;
- Body computer of Iveco, MAN, ...;
- ABS/EBS braking system control units;
- PLC system control units;
- ...

i The list of control units for which the replacement can be managed depends on the vehicle model and the choices made by each manufacturer. In fact, these "policies" can change without prior notice.

It is impossible to define a replacement procedure valid for all vehicles, as the logic may vary from manufacturer to manufacturer and based on the type of control unit that must be replaced.

A detailed description with examples of single cases can be found in section 4.11 Control unit replacement procedures of this manual.

PTO programmings

The programmings of the power take-off (PTO) functions can be managed by many electronic control units (transmission control unit, engine control unit, body computer, ...). Therefore you must carry out the single adjustments for each control unit.

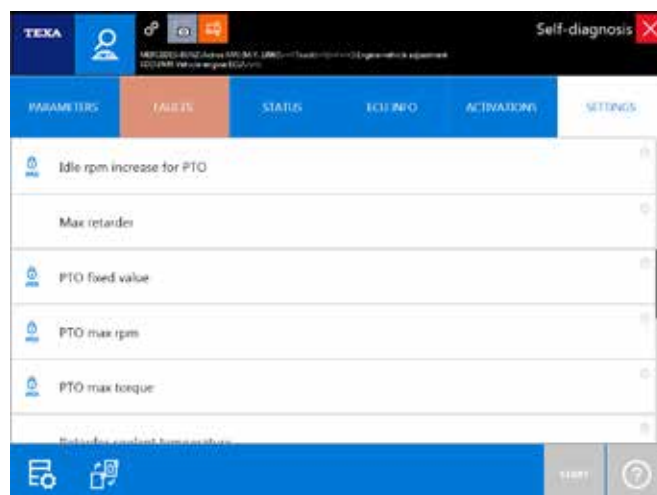


Figure 109: Adjustment: PTO programmings

In other cases, such as in Image 109, there may be a specific control unit that collects all PTO adjustments.

Suspension calibration

In electronically controlled suspension systems, it is possible to calibrate the vehicle's chassis level. It is also true that a vehicle should always be calibrated as recommended by the manufacturer, but it is at the end-user's discretion to change this value (always within the range programmed in the control unit).

Depending on the manufacturer, the system type and the diagnostic protocol used, there may be several adjustments for calibrating the chassis level.

Adjustment	Description
1 level calibration	The calibration requires moving of the normal chassis level placing calibres between the chassis and calibrating the value of the sensors. The upper and lower levels may be entered as numerical values or automatically by control unit.
3 level calibration	This calibration requires moving the chassis in all three levels (normal, upper and lower), placing calibres between the chassis and the vehicle and calibrating the value of the sensors.
Calibration	This method, instead, only requires entering the numerical values (no need to move the chassis).

Table 7: Types of electronic suspension adjustments

In all the above cases, you must know the calibration values used by the manufacturer. When available, they can be recovered from a specific technical bulletin.

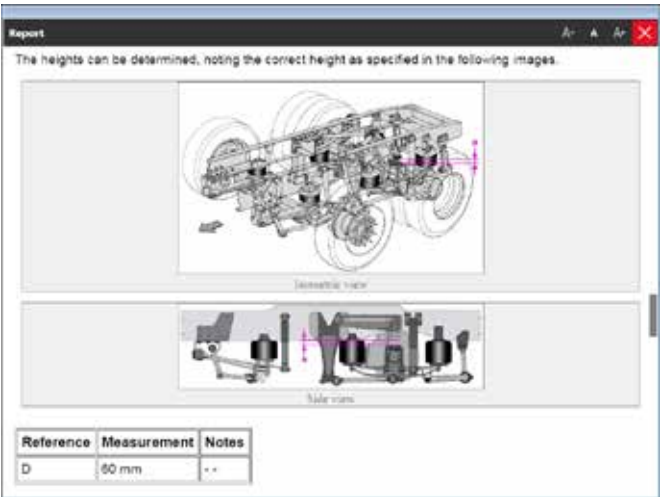


Figure 110: Chassis height technical bulletin

Clutch initialisation

When a clutch disc is removed (either if to be replaced due to wear or for an ordinary repair operation) you must generally re- initialise the component so the control unit can learn the slipping point and the maximum travel.

Thanks to TEXA's self-diagnostic adjustments even this type of function can be performed.

The procedure varies from make to make, but you simply have to follow the instructions given by the diagnostic tool to complete the initialisation easily (generally you have to press and release the clutch pedal following a logic and times programmed in the control unit).

Transmission calibration

Similarly to what we indicated above for the clutch, even repairing the internal parts of a transmission requires a specific adjustment afterwards.


Even in this case the diagnostic tool offers the appropriate controls.

In Image 111 you can see the diagram generated by the adjustment “Transmission calibration” of a Volvo I-Shift transmission.



Figure 111: Adjustment: Transmission calibration

Adjustment: Transmission calibration

 In the trailer/semi-trailer category, the names of the trailer manufacturers are not given but the name of the system's manufacturer is.

The evolution of modern trailers/semi-trailers brought to the development of control units that are capable not only of managing the braking (EBS system) but also a series of

additional functions, such as:

- Stability control
- Axle lifting systems
- Load balancing management
- Brake wear monitoring systems
- Chassis height management
- Tyre pressure management
- Immobiliser
- Generic optional equipment management
- ...

For all these functions there are specific configuration procedures that allow managing the different programmings..

Attention, the advanced programmings of trailers/semi-trailers allow a complete reconfiguration of the EBS control unit, with the risk of making the vehicle no longer compliant with the legal requirements. We recommend following the specific training course before performing the above mentioned adjustments.

Legend:

1. Trailer EBS control unit
2. EBS relay valve
3. Pneumatic connection
4. Pneumatic connection
5. Electrical connection
6. Chassis height management valve
7. Air tanks
8. Speed sensor
9. Combined brake
10. Axle lifting valve

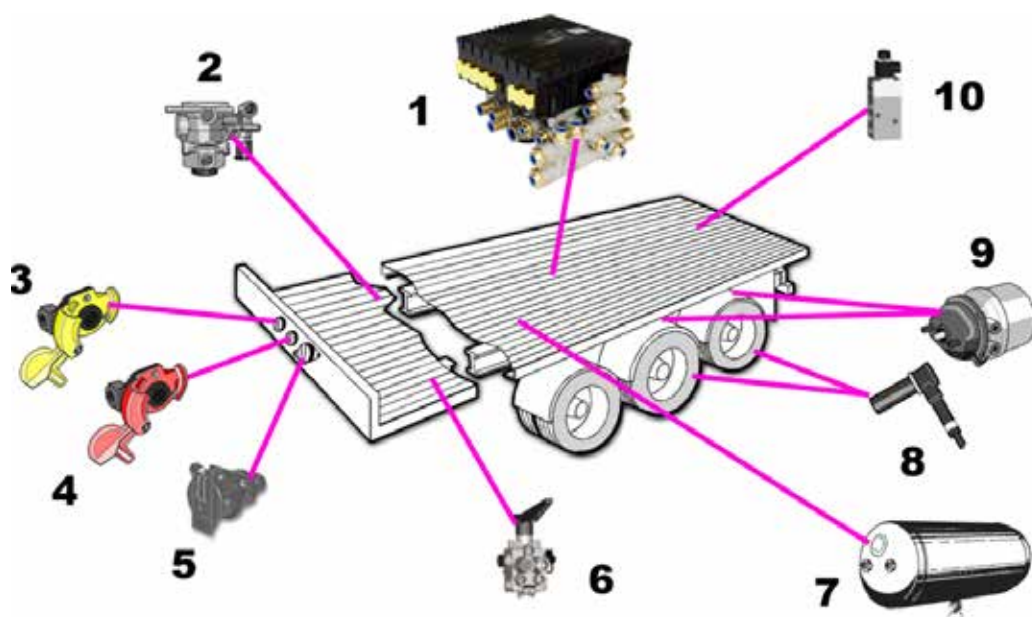


Figure 112: Semi-trailer components

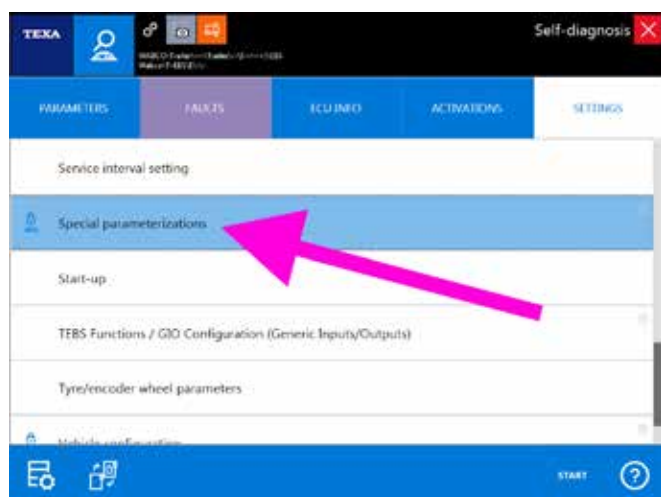


Figure 113: Special trailer parameterisations

Below there is a short and partial extract of the possible adjustments.

Function	Options
Vehicle type	Drawbar trailer, Semi-trailer, Central-axle trailer, trailer
Number of axles	1, 2, 3, 4, 5
ABS	2S/2M, 4S/2M, 4S/2M + 1M, 4S/3M
Axle definition	Axle c-d, Axle e-f, Third modulator, Lift axle 1 and 2
Configuration of the lift axle valves	Lift axle 1, 2
Suspension	Mechanical suspensions , Air suspensions
RSS	RSS not available, deactivated, single or twin tyres
RSS parameters	Steering axle incidence Vehicle subject to overturning
Fault warning light operation	The warning light turns off after 2 s, The warning light turns off at 7 km/h
ISO11992 CAN messages	EBS 23 standard EBS 23 group bit EBS 22 no output on total axle load RGE 22 no output on single axle loads Supports 12V CAN bus
Standard functions	Speed switch 1 (ISS1) Speed switch 2 (ISS2) Lift axle control 1 (LAC1) Lift axle control 2 (LAC2) External axle e-f load sensor (ALS2)(1) Traction Help (TH) Lift axle forced lowering (FL) Maximum wear value (LWI) GIO5 telematic system/diagnosis Trailer extension control/road finisher brake (FB)
Subsystems	IVTM (IVTM) Remote control (RCU) SmartBoard (SB) Telematic System (TS) ELEX (ELEX)
Special functions	Traction Help with residual pressure hold (TH+) OptiTurn/OptiLoad plus (MH+) External axle c-d load sensor (ALS1) External nominal pressure sensor (DPS) Active ABS signal (ABS-O) Speed signal (V-S) Power supply 1 (24 V-01) Steering axle lock (SAC) Configurable digital function (FKD-1) Bounce control (release function) (TR-SW) Brake release function (BR-SW) Configurable function 1 (FCF-1)
Automatic lift axle control	Lift axle 1 Lift axle 2 Axle lowering with ignition off Tag axle residual pressure control

Table 8: Partial extract of special trailer parameterisations

4.11 CONTROL UNIT REPLACEMENT PROCEDURE

From many years the electronic control units have become the dominant part of an electrical system (in fact now called electronic system). These units have a large intrinsic reliability (anti-short circuit protection, ability to analyse the power supply, possibility to prevent mechanical faults by cross-checking the various parameters, ...) but they may still break and have to be replaced.

It is important to know and understand the types of programs and data that these control units may contain.

4.11.1 Types of programming and memory areas

The electronic control units can have two types of programming:

- Basic programming (also called "firmware" or "application")
- User programming (also called "parameter setting" or "wiring")

The first one contains all the data needed so the system can work properly (for ex. in an automated transmission there is the data regarding the coupling with the engine, the torque reduction strategies during gear shifts, the clutch slipping times, ...) and must not be changed. The second one contains the vehicle's specific data (for ex. VIN, identification codes, PTO programming, calibration values, ...) that can be changed during maintenance operations. The two types of programming are stored in the control unit in two separate memory areas with different protections and features.



The first electronic control units had the user programming stored in an EEPROM type chip (therefore rewriteable x times) while the basic programming was on a ROM or PROM (eventually even EPROM) chip which require being replaced in order to be modified.

Not all the control units have two programmings; some only have the basic program (old versions of ABS, EDC, ...).



Generally the basic programming can be carried out by HIGHLY QUALIFIED EXPERT PERSONNEL ONLY and only with special enabled tools (supplied by the manufacturer).

4.11.2 Control unit replacement logics

Based on the type of electronic control unit and on its programming, there can be four replacements methods:

1. Replacement without any additional operation.
2. Replacement with manual reprogramming.
3. Replacement with user parameter transfer.
4. Replacement with basic parameter transfer.



All the control unit replacements MUST be carried out with the BATTERIES DISCONNECTED.

1 - Replacement without any additional operation

Some types of electronic control units only have the basic programming and do not need to be configured by the user. Therefore, they are available pre-programmed as spare parts and do not require any operation; you purchase the spare part specifying the vehicle and system's identification data (control unit code, VIN, engine number, ...), remove the old control unit and replace it.

The ABS control units, the external light management modules (FFC and RFC of Iveco, LLC of Volvo, ...), the airbag, the A/C systems, the display and instrument panel control units and many more belong to this category.



The examples indicated above are merely illustrative and may vary based on the choices made by each single vehicle manufacturer.

2 - Replacement with manual reprogramming

Some control units have both the basic and the user programming, but the latter cannot be transferred from the old control unit to the new one.



The missing availability of the user programming transfer function is not a limit of TEXA but a feature of the system itself as not even the official tools have this possibility.

In this case you must purchase the spare part already with the basic programming (specifying the vehicle's identification data such as the VIN, the engine number, ...) and carry out the appropriate adjustments to set the user parameters thanks to TEXA's Self-diagnosis functions. An example of this family of control units is the Wabco ECAS BUS electronic suspension system.



Figure 114: Wabco ECAS BUS control unit

Purchase the specific spare part for the vehicle, replace the old control unit, but you must carry out the calibration of the levels from the Self-Diagnosis.

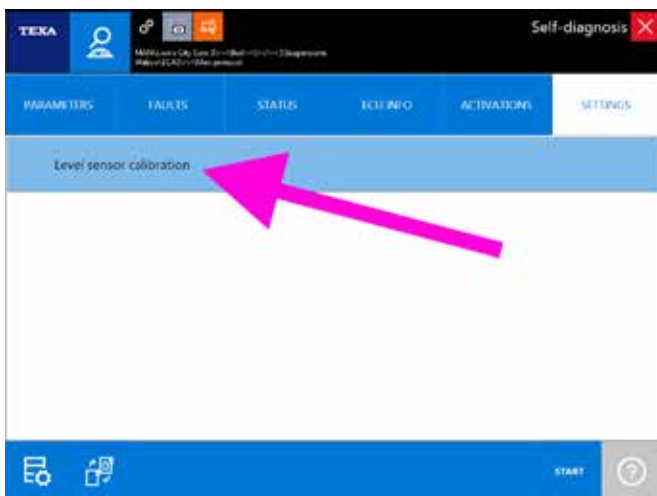


Figure 115: Adjustments page of a Wabco ECAS BUS system

3 - Replacement with user parameter transfer

Even this type of electronic control unit has both the basic and the user programming.

The replacement procedure requires purchasing the spare part that already has the basic programming in it (specifying the vehicle's identification data such as the VIN, the engine number, ...) and thanks to TEXA's Self-diagnosis functions it is possible to transfer the user programming from the old control unit to the new one.

An example of this type of logic is Knorr EBS braking system, used by many trailer manufacturers.

The controls for downloading the old control unit's programming and loading it into the new one are in the adjustments page.

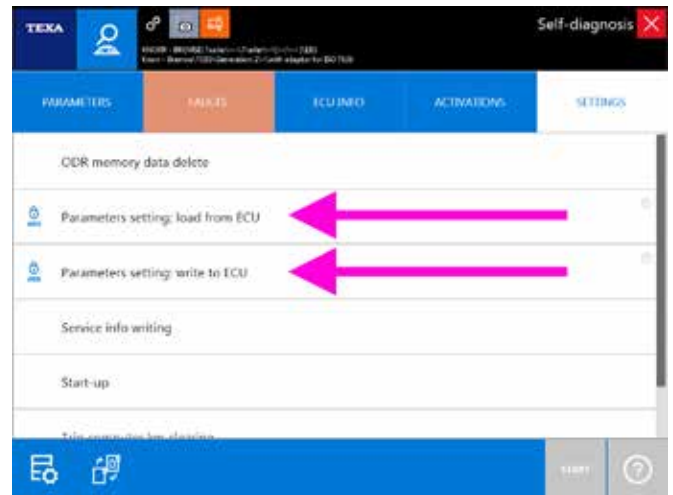


Figure 116: Adjustments page of a Wabco EBS system

4 - Replacement with basic parameter transfer.

As mentioned previously, the basic programming of the engineering parameters can be carried out by HIGHLY QUALIFIED EXPERT PERSONNEL ONLY and only with special enabled tools (supplied by the manufacturer).

There are some cases though, in which this type of programming is possible even using TEXA's self-diagnostic tools. An example may be the replacement of the actuator unit in a ZF AS-Tronic transmission.



Figure 117: AS-Tronic actuator unit

There are two specific selections for this system in the Self-diagnosis:



Figure 118: ZF AS-Tronic transmission selections

- ZF / AS-Tronic / - / - / ZF protocol
- ZF / AS-Tronic / - / - / Version GS 3.3 reprogramming

The first is for the normal diagnosis and the management of the parameter setting (user programming), whereas the second is a specific selection for the basic reprogramming (firmware) ONLY.

The replacement method is structured in three phases: first, with the old unit still installed, connect with the normal diagnosis (ZF / AS-Tronic / - / - / ZF protocol) and save a copy of the user parameterisation.



Figure 119: ZF protocol diagnosis selection

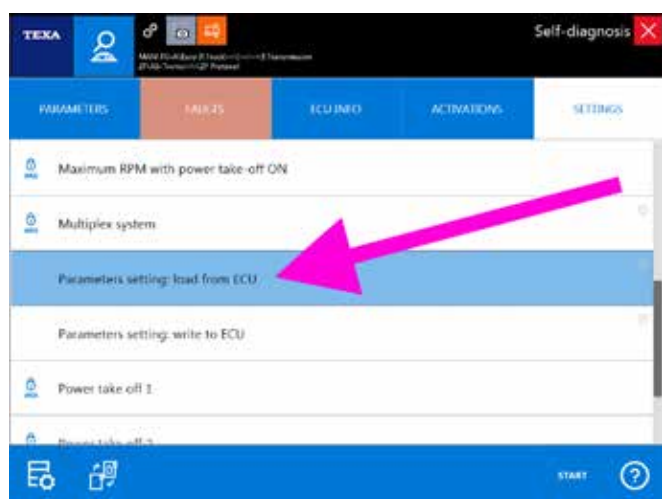


Figure 120: ZF protocol diagnosis adjustments page

i For an explanation regarding the "Parameters setting ..." controls, refer to section 4.11.3 Parameters setting: Operating procedures of this manual.

Then replace the actuator unit (including the control unit) and connect to Self-Diagnosis using the second selection (ZF / AS- Tronic / - / - / Version GS 3.3 reprogramming) and load the basic programming file from the adjustments page.



Figure 121: Basic reprogramming diagnosis selection

! Attention: pay the utmost attention to the version of the actuator unit installed on the vehicle. Version GS3 is not compatible with GS3.3 and needs a specific Self-diagnosis selection.

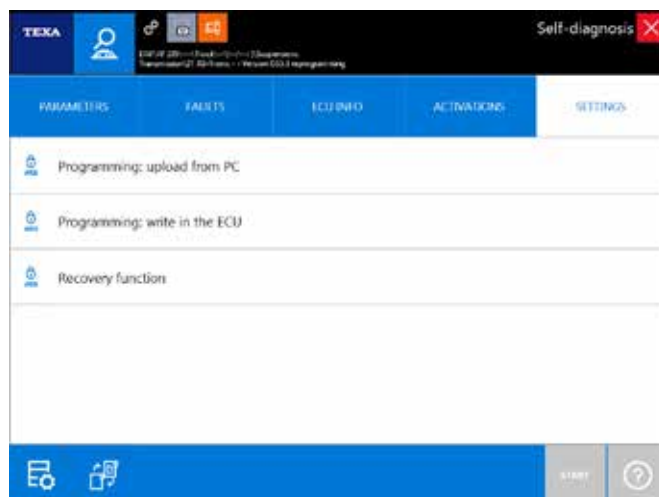


Figure 122: Basic reprogramming diagnosis adjustments page

! It is impossible to recover the basic programming that is already in the control unit, but you must already have the file. with the engineering data. TEXA supplies a sample of programming files only as a support and "first aid". Refer to the "readme.txt" file in the ZF folder of the Exchange Manager for further information.

i The missing availability to recover the basic programming is not a limit of TEXA but a feature of the system itself as not even the official tools have this possibility.


After load the basic file, you must connect a second time using the normal diagnosis (ZF / AS-Tronic / - / - / ZF protocol) and download into the electronic control unit's memory the user programming file stored previously (if the old electronic cannot be diagnosed, you can reconfigure the user programming starting from scratch by selecting the adjustments that are available in the Self-Diagnosis).

4.11.3 Parameters setting: Operating procedures

Below there is a description of the operations that must be carried out in order to manage the "Parameters setting" adjustments properly.

There are generally 2 functions in the Adjustments page:

- Parameters setting: load from ECU
- Parameters setting: write in the ECU

 Particularly old self-diagnostic systems may have four "Parameters setting" adjustments instead of two, as, in the past, storing the programming file in a PC was an optional operation.

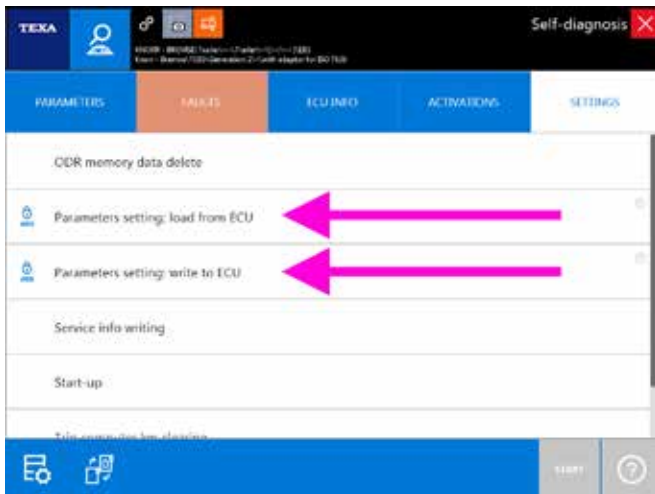




Figure 123: Parameters setting adjustment

 The icon  beside the adjustment's name indicates that the function is "protected" and it can be unlocked only with an active Internet connection (for further information, refer to paragraph 4.10.1 Special code and Web adjustments of this manual).

The first adjustment (load from ECU) reads the programming from the control unit and saves a copy of it on the diagnostic tool; the second one (write in the ECU) allows loading a configuration file and writing it into the control unit.

Programming transfer

To transfer the programming from an old control unit to a new one, proceed as follows:


- Connect to diagnosis with the old control unit.
- Go to the parameters page and select "**Parameters setting: load from ECU**".
- This way the programming of the old control unit will be read and stored in a file in a specific folder in the computer (or in a memory card).
- Disconnect the diagnosis.
- Install and connect the new control unit.
- Connect to diagnosis with the new control unit.


- Go to the parameters page and select "**Parameters setting: write in the ECU**".
- A screen in which you can select the programming file is displayed.



Figure 124: Programming file selection

- By clicking on OK, the file will be loaded and the programming of the old control unit will be transferred into the new electronic control unit.

 The procedure indicated above only refers to the programming transfer. Some types of systems (for example EBS) need, after the transfer, specific additional configuration operations that must be carried out with the appropriate Self-diagnosis functions.

 A special note must be reserved for Mercedes Benz industrial vehicles equipped with a ZDS "Central data memory" control unit. On those vehicles the control units can be replaced (except the diesel injection control unit) without carrying out the procedures indicated above, but simply performing the appropriate adjustments. For further operational details, refer to the vehicle bulletin available in the Self-Diagnosis.

4.11.4 Programming files and folders

As seen in the previous chapter, the adjustment "Parameters setting: load from ECU" stores a file in specific folders in the computer (or in a memory card for the self-diagnostic tool) which will be used to program a new electronic control unit.

The folder in which these files are stored are created during the installation of TEXA's self-diagnostic software and can be accessed through the "Exchange Manager" tool.

By selecting the "TRUCK Texa S.p.A. Exchange Manager" icon on the desktop (or choosing the specific function inside IDC5), you can access various folders/subfolders that are

used for different purposes by the self-diagnostic program. Considering the logic when replacing the control units, the folder to consider is the one called "in".

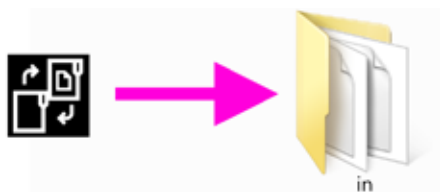


Figure 125: Icon and folder

You can also access the Exchange manager folder through the button "in" in the self-Diagnosis adjustments page.

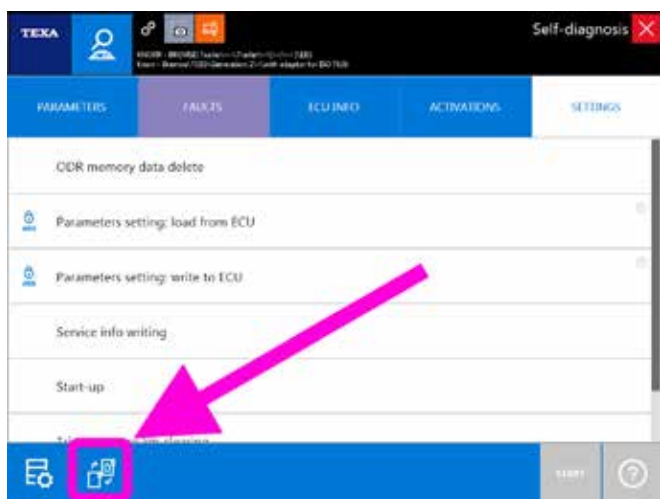


Figure 126: Exchange Manager access button

i For a more detailed description of "Exchange Manager" refer to the OnLine technical documentation provided with the program or to chapter 6.5 Exchange Manager of this manual.

In this folder you can find a list of subfolders divided by make (of the manufacturer or of the supplier) and by type of system.

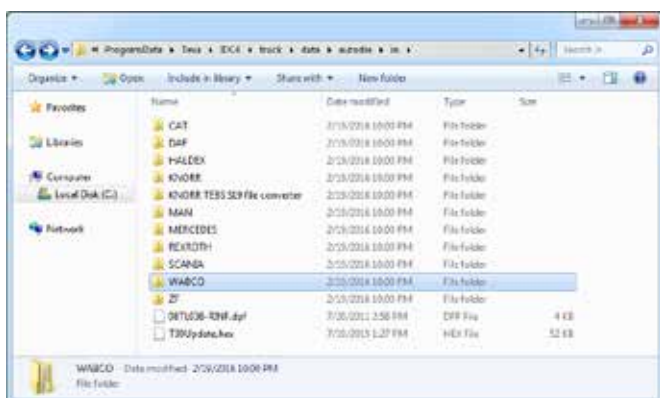


Figure 127: Contents of the "in" folder

The image below (Image 128) shows the contents of the folder for the programming files of the Wabco EBS modulators for trailers/semi-trailers "in \ WABCO\ TEBS".

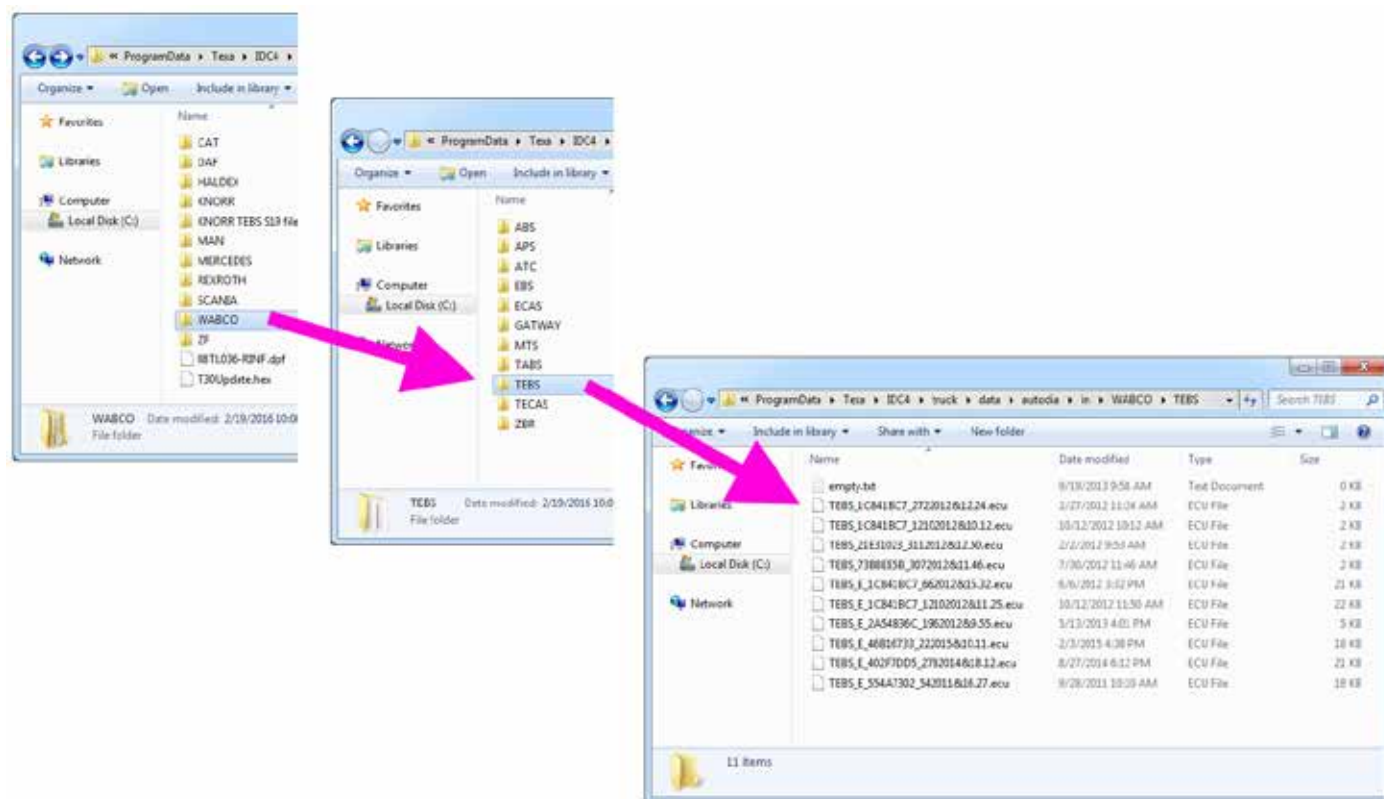


Figure 128: Contents of the folder "in \ WABCO \ TEBS"



The programming files are named within this model: "SystemName"_"CustomerCode"_"YearMonthDay&Hour.Minutes of storage". (ex.: EB+_016FDA7_2272011&10.21.dpf, TEBS_E_1C841BC7_662012&15.32.ecu).

5. TECHNICAL DOCUMENTATION FOR THE SELF-DIAGNOSIS

Not only the Self-diagnosis is necessary for modern mechanics that work on industrial vehicles, but, often, what makes the difference is the support to the Self-diagnosis, that is all the additional information that allows understanding the operation of a system and provides data for checking and verifying.

In fact, reading the errors “Turbo fault ” or “Low fuel pressure” helps isolate the area of the problem, but if you do not have know the vehicle or the system you are diagnosing, they offer only partial information.

“Is the turbocharger fixed or with a variable geometry?”, “Is the injection system Common Rail or with pump-injectors?”: these type of doubts can be solved thanks to the technical documentation provided by TEXA in support to the Self-diagnosis.

Within TEXA's diagnostic environment you can find many types of technical information:

- Wiring diagrams with the related component sheets
- Technical bulletins and sheets
- System description sheets
- Technical data and services


5.1 WIRING DIAGRAMS

The wiring diagrams are very important for vehicle repairers. In fact, many problems require checking the wiring and/or the specific electrical signals over the cables.

Unfortunately it is impossible to provide a diagram for all the self-diagnostic selections, since TEXA cannot access the official documentation of the manufacturers; but thanks to its technical researches it can generally provide the wiring diagrams for the main makes and systems.

You can access the wiring diagrams both in free consultation mode and within the Self-diagnosis.

5.1.1 Free consultation

By selecting the icon “Wiring diagrams ” a screen with a list of all the diagrams available for the selected vehicle will be displayed grouped by system type.

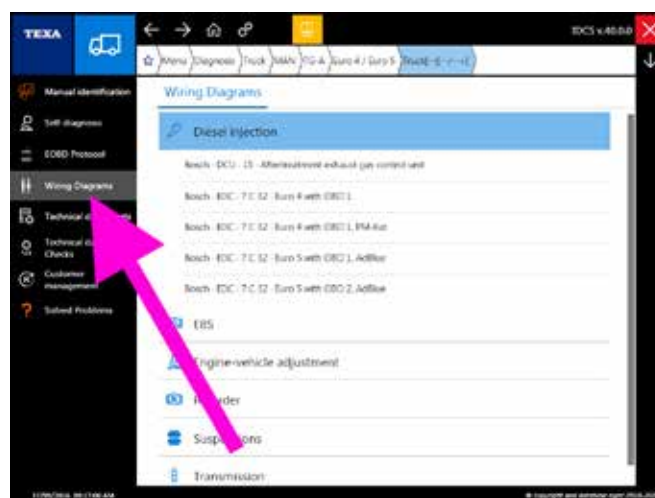


Figure 129: Wiring diagram menu

The wiring diagram can be displayed on more than one page and a series of controls and specific functions are available for consultation to gather all the information connected to the diagram itself.



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

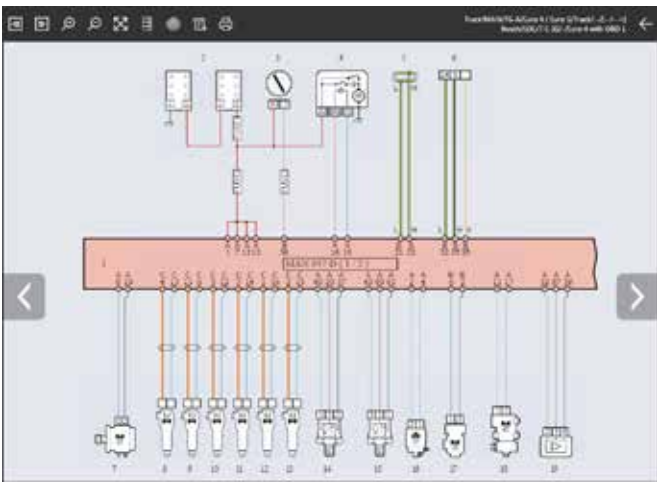


Figure 130: Wiring diagram, page 1

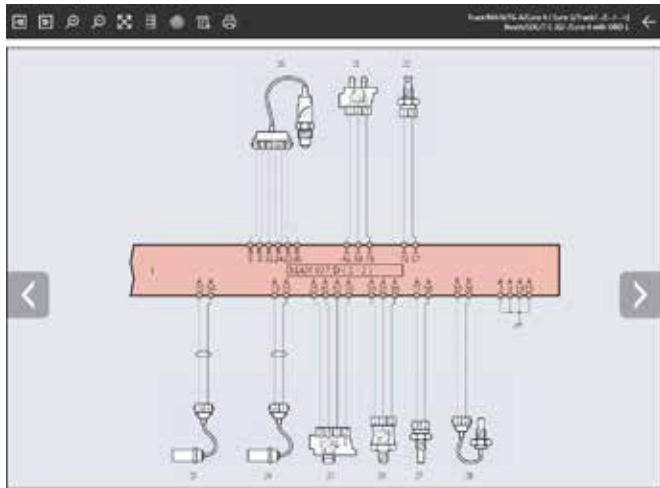


Figure 131: Wiring diagram, page 2

 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 9: Wiring diagram menu controls

By moving your cursor on the symbols in the wiring diagram a label appears identifying the corresponding component and indicating its position.

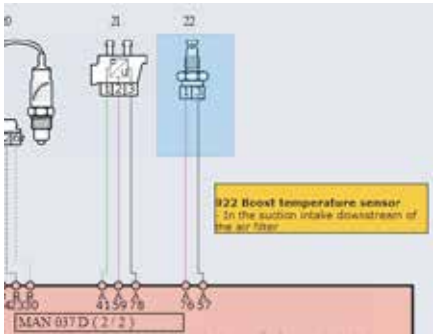


Figure 132: Wiring diagram, component identification

By clicking on the symbol of a component, a menu indicating the functions available is displayed.





Icona	Nome	Descrizione
	Technical sheet	It allows viewing a technical sheet for the selected component.
	Image	It displays a photo of the device
	Manual mode	It allows starting the oscilloscope's control interface.
	Connector	It shows an image with the connector's pin-out.

Table 10: Functions and controls on the wiring diagram component

 Not all controls are available for all the components.

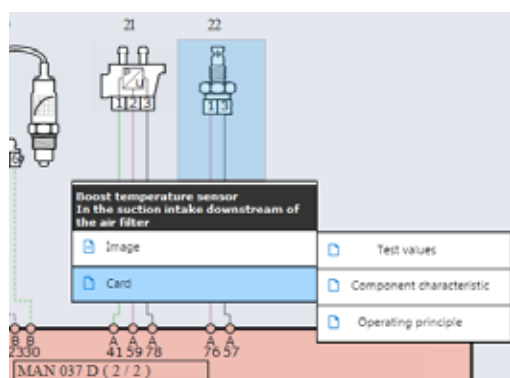


Figure 133: Component technical sheets

For example the technical sheets of a component can explain the operating principle, the technical features and the control values, the self-diagnostic operating support, ... and, based on the type of component, it is possible to find several sheets, each for a specific topic. Image 134 below shows the technical data sheet "Test values" for a boost air temperature sensor and you can see the connector's shape and pins, the ohmic reference values at different temperatures in a graphic and tabular form.

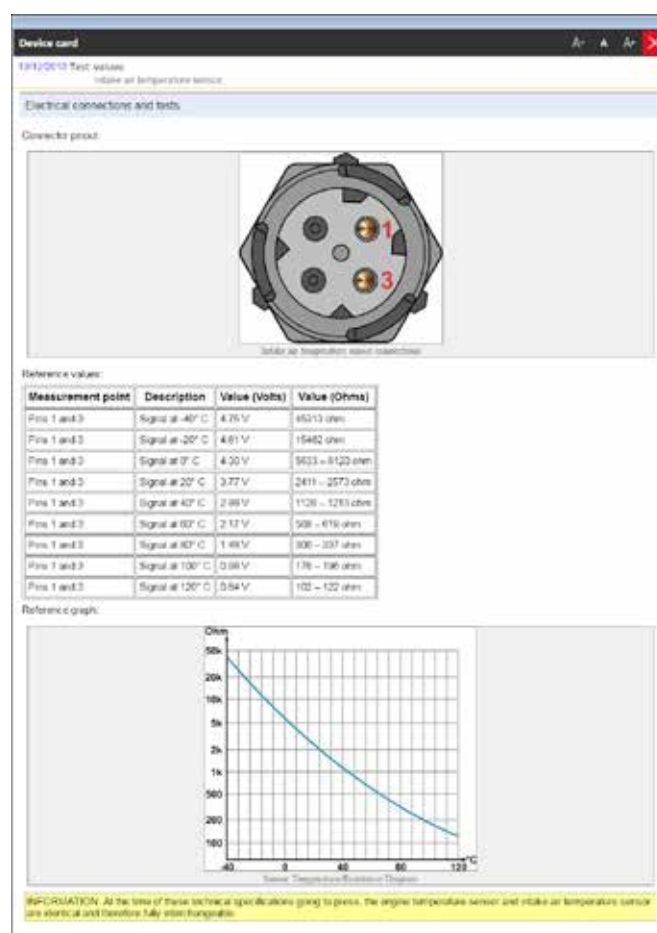




Figure 134: Electrical component technical sheet

 There are other types of electrical diagrams provided by TEXA; they normally are generic and less complete, but in any case useful. Refer to section 5.4.3 Additional wiring diagrams of this manual.

5.1.2 Consultation from the Self-diagnosis

It is often essential to be able to consult the wiring diagrams during a self-diagnostic session. In the different screens there is a button  (Parameters, Activations, Adjustments, ... page) which allows accessing all the Self-diagnosis support documentation.

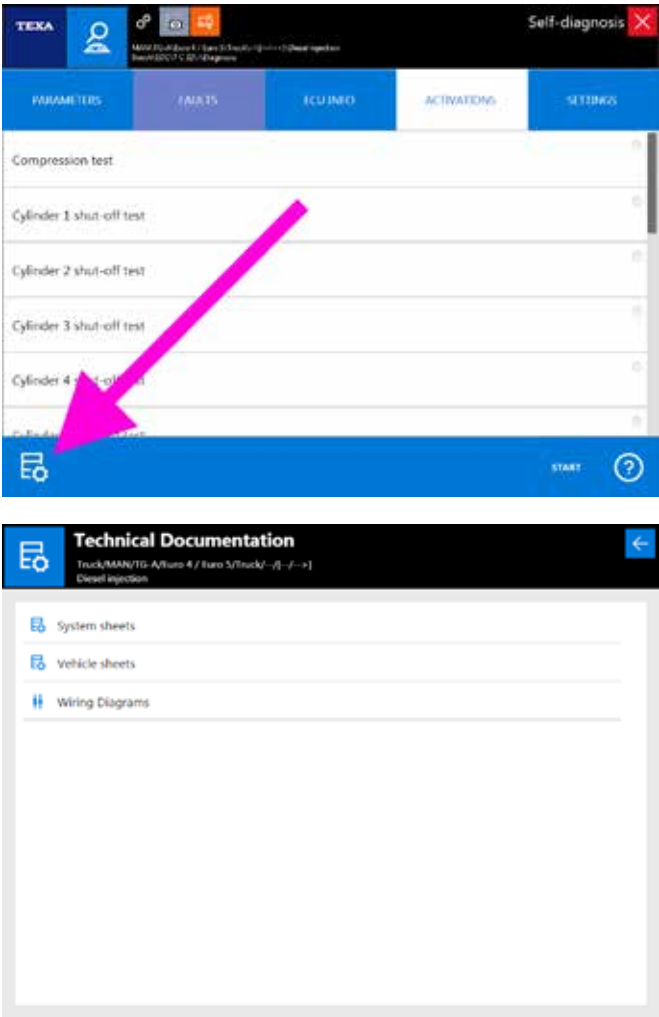




Figure 135: Access to the documentation from the Self-diagnosis

 The wiring diagrams can be accessed from the Errors page, as illustrated in chapter 4.7.5 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 TECA 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".

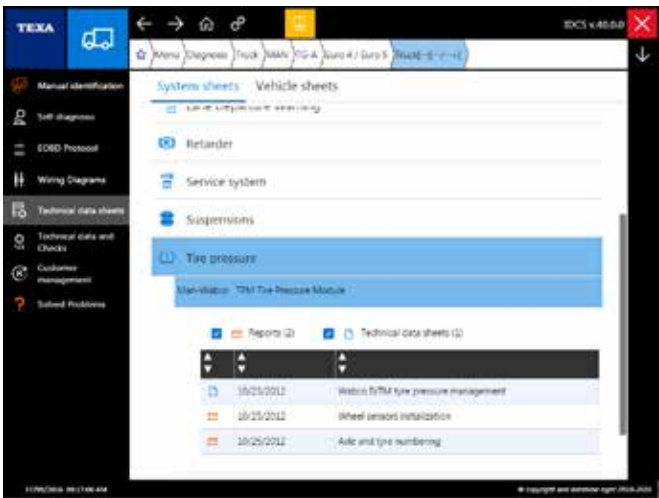


Figure 136: Technical bulletins and sheets

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 11: 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 136), whereas the second ones contain information that is valid for the whole vehicle.

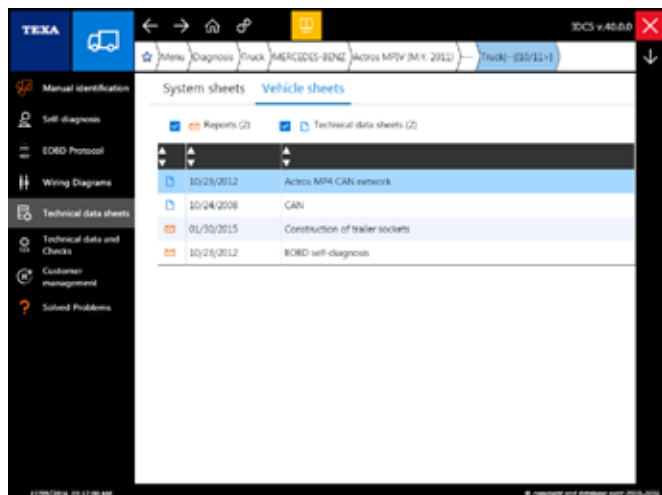


Figure 137: Vehicle technical sheets

In Image 137 a vehicle sheet for the Mercedes Actros MP4 models is highlighted. The sheet describes in detail the 25 communication lines in this vehicle model: information that does not refer to a single system but is valid for all the systems.

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.

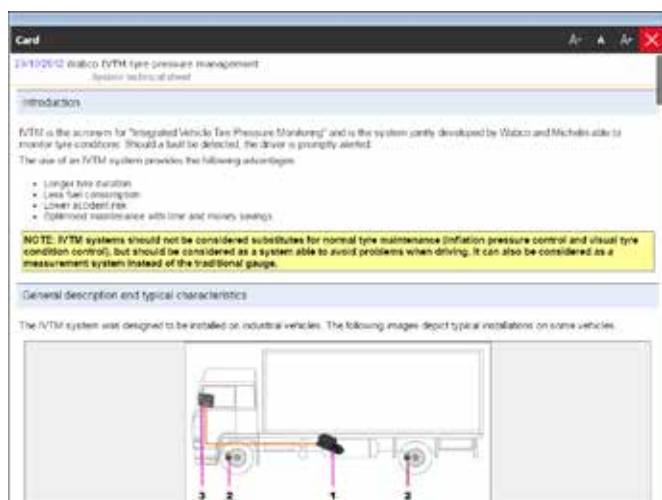


Figure 138: Technical sheet

Image 138 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.

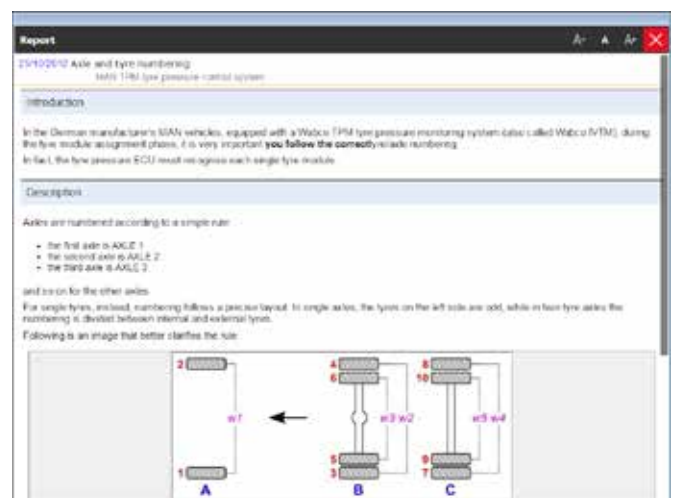


Figure 139: Technical bulletin


Image 139 shows a technical bulletin for a MAN TG-series vehicle equipped with an Wabco ITVM tyre pressure management system.

In detail it shows the way the Man-Wabco system numbers the wheels and the axles because during the configuration and assignment phase of the wheel modules it is very important to follow the correct numbering.




Figure 140: Technical bulletin

Sometimes (Image 140) the technical bulletins give information regarding specific problems, as on some Iveco vehicles equipped with a solenoid valve for the turbine's air supply. This component is directly powered by a fuse (and not by an electronic control unit) and a possible malfunction is not indicated by any warning light/error. The technical bulletin explains how to recognise the problem and solve it.

 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.

Technical bulletin update

Due to their nature of informing and explaining "practical" problems, the technical bulletins are constantly updated and made available publically (after signing a specific subscription). This way you are continuously updated with the latest information available.

The technical bulletins must be updated manually through the specific function “ Bulletin update” available in the first screen of the Self-diagnosis software (Image 141).

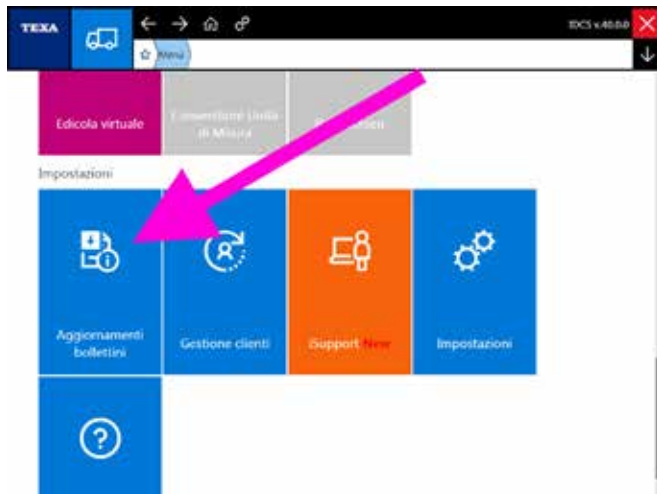


Figure 141: Bulletin update

 **The possibility to subscribe to the technical bulletins is for Italian only.**

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.

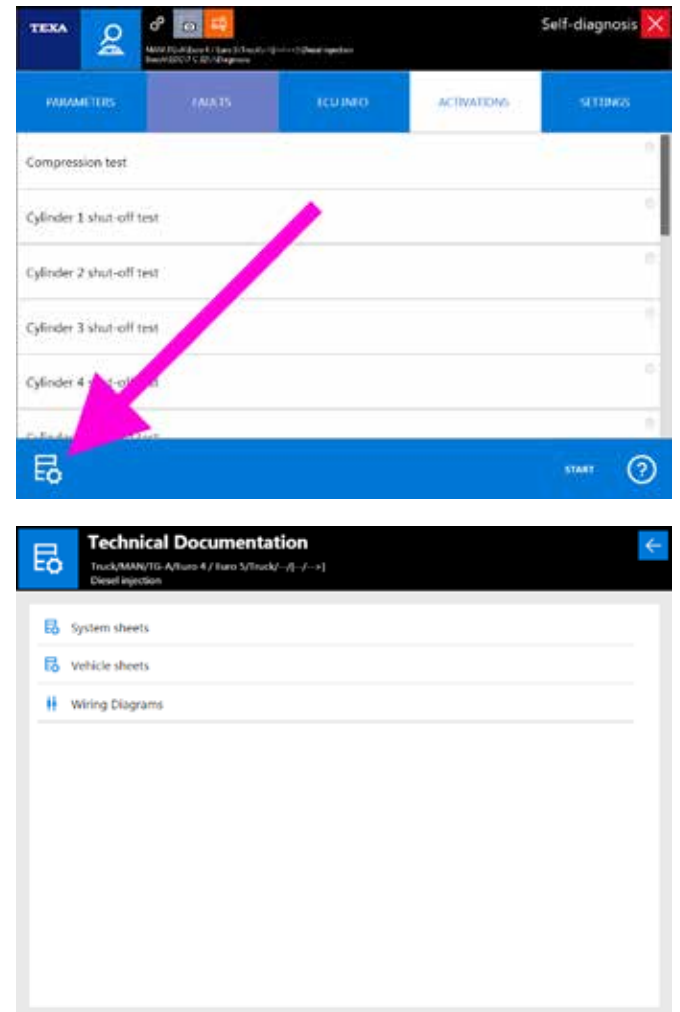


Figure 142: Access to the documentation from the Self-diagnosis

[illegible]

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 Self-diagnosis (🔍).

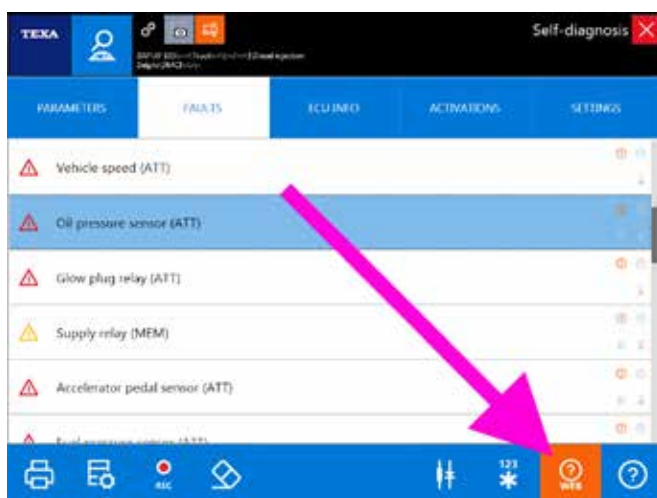
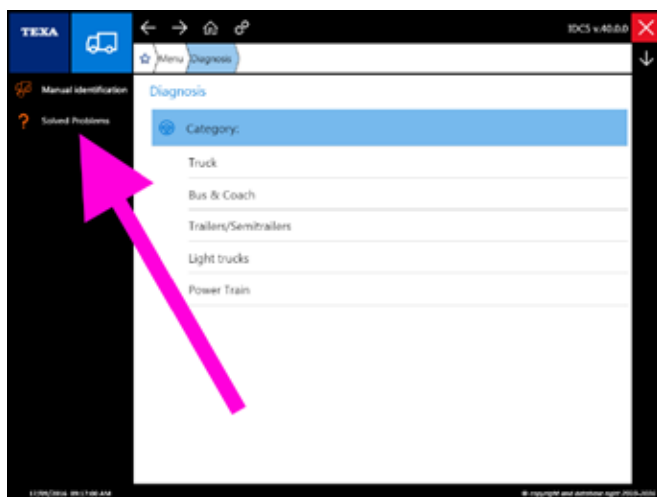


Figure 143: Access to Solved problems and troubleshooting

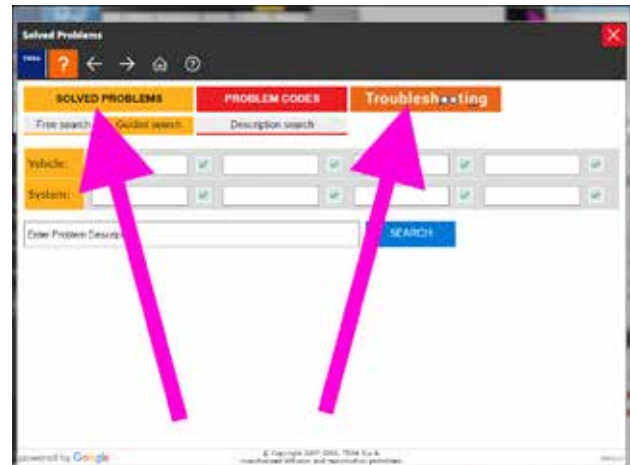


Figure 144: Solved problems and troubleshooting portal

! 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).

5.3.1 Solved problems

"Solved problems 🔍 - Google" 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 143) 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.

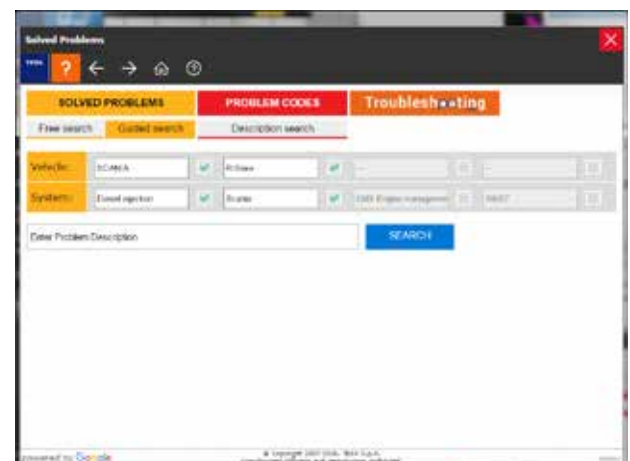


Figure 145: Solved problem search

Using Google technology allows optimising the search for desired information by entering search keys such as: vehicle model and type of system. In addition to this you can carry out a search starting from a free text directly input by the operator. If more fields are filled in, the software offers all the results obtained from the cross search of the key words input.

For example, by filling in the vehicle (ex.: Scania R-series) and system (ex: Diesel injection) fields, the software carries out a cross search giving as results all the items related to the problems on that specific vehicle (ex.: solutions related to problems in diesel injection system on Scania R-series).



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

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.

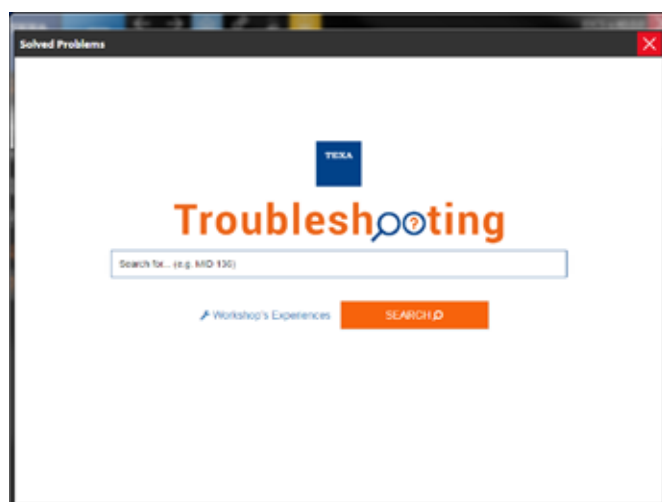


Figure 146: Troubleshooting search

By entering the error code or description, you will be given the repair procedure recommended by the manufacturer.



Figure 147: Recommended repair procedure

The two databases seem alike, but the first (Solved problems) collects the experience from customers and indicates how a specific customer solved the problem (therefore, for the same error you can find more than one solution, even in relation to the status of that specific vehicle).

The Troubleshooting database, instead, indicates the repair procedures recommended for a specific error, considered as a separate element and not in relation to other errors that may eventually be present.

Therefore it is up to the mechanic to consider the procedure in relation to the overall status of the vehicle (for example: the presence of many errors related to the power supply or to a low voltage may indicate a poor battery status and not wiring problems in the single component).

5.4 TECHNICAL DATA AND SERVICES

Modern mechanics, needs to be able to access to a wide range of technical data and information specific for the vehicle being diagnosed in order to complete the repair accordingly. The Technical data and services function (Image 148) gives access to TEXA's database in which you can find this information.

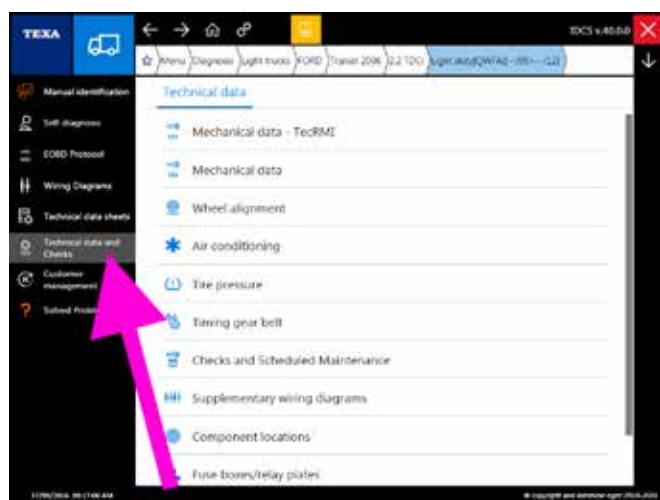


Figure 148: Technical data and services menu

5.4.1 Mechanical data



Figure 149: Mechanical data

Image 149 shows the screen of the vehicle's Mechanical data, divided into categories. You can access the engine data, the tightening torque for the nuts, the type of lubrications used and the amounts needed, information for a proper setup of the engine and other systems, ...

5.4.2 Scheduled maintenance and services

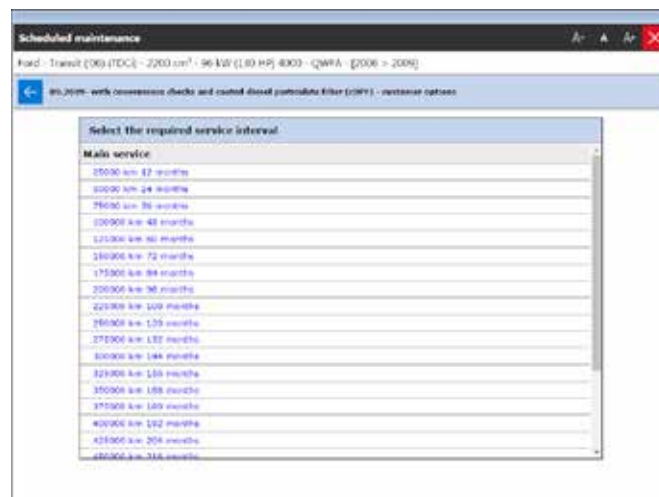


Figure 150: Scheduled maintenance and services

Image 150 shows a list of the scheduled maintenances and of the services required for the selected vehicle. Choosing a mileage expiration gives access to the technical sheet of the operations and checks that must be carried out.



Based on the vehicle selected of on the market of reference (Europe, Asia, America), the amount of information available may vary from the complete absence of information, to the mere presence of mechanical or maintenance data, up to the wiring diagram. However TEXA's database is constantly updated and expanded at each new version released.

The names of the single menu functions are self-explanatory and do not need any additional explanations. Below are examples of some categories.

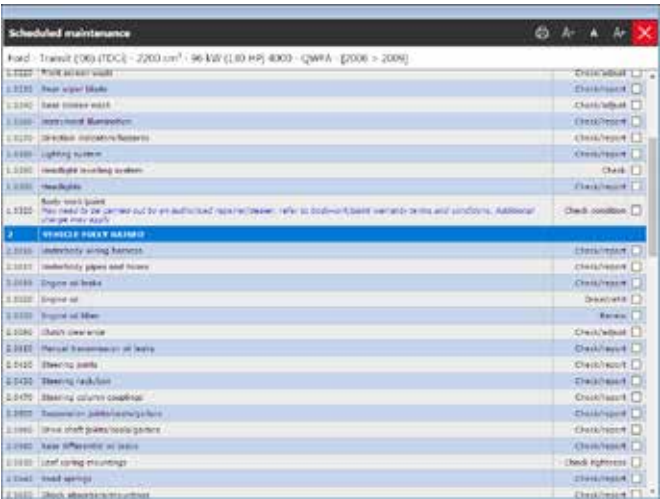


Figure 151: 90000 km schedule

5.4.3 Additional wiring diagrams



Figure 152: Additional wiring diagrams

Sometimes additional wiring diagrams (Image 152/Image 153) are available; they do not have the same level of detail as the ones by TEXA (see section 5.1 Wiring diagrams), but they are still useful for repairing the vehicle.

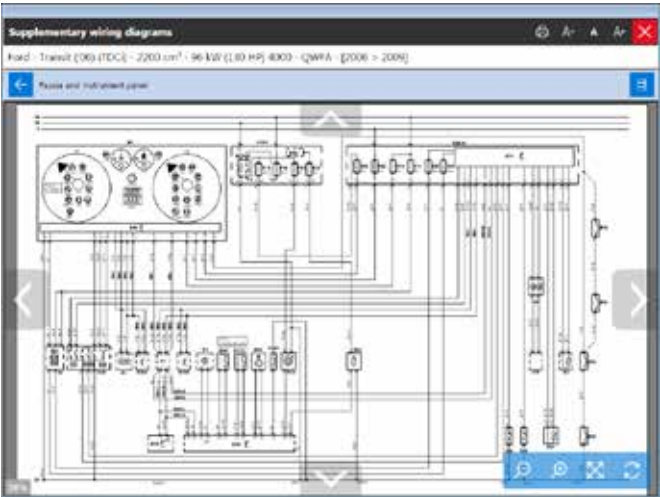


Figure 153: Example of an additional diagram

5.4.4 Service illustrations

In image 154 there are service illustrations, a series of images that are useful in order to understand how to access certain operations (Position of the oil drain caps for the various mechanical units, level indicators, belt diagram, ...)



Figure 154: Service illustrations

6. COMPLEMENTARY SELF-DIAGNOSTIC FUNCTIONS

TEXA knows the world of vehicle repairers very well and is aware that the most important function is the Self-Diagnosis; 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.

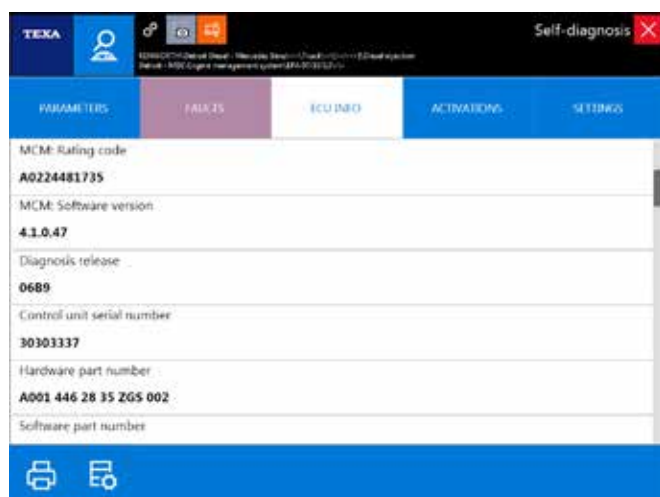


Figure 155: ECU info

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, but may be very useful if you are not familiar with the system or if you need additional information.

6.2 EOBD PROTOCOL

This function allows carrying out a diagnosis focused on EOBD parameters.

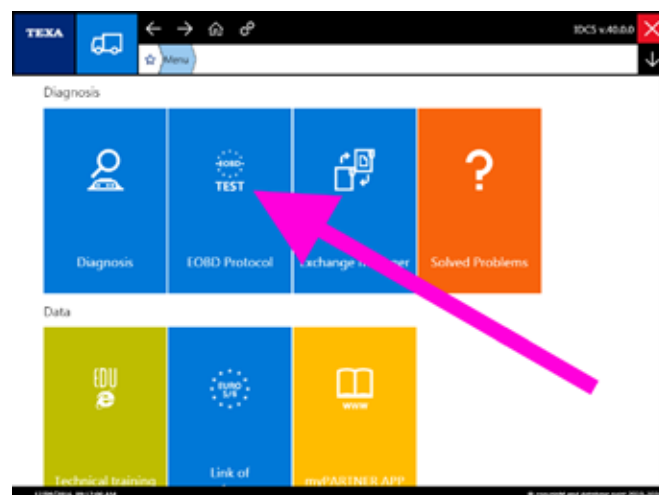


Figure 156: EOBD protocol

EOBD is an acronym that means "European On-Board Diagnostics" and it is a standard referred to the ability of a vehicle to self-diagnose and signal errors/faults.

The OBD standard was born on vehicles in the Eighties, and is completely standardised on this vehicle category (cars and light commercial vehicles). The main purpose is to allow the integration of different systems and simplify the diagnosis, thanks to the definition of a standard protocol for the representation and communication of fault codes, parameters, faults, ...



On industrial vehicles the OBD standard is still partial. In fact, the law forces manufacturers to have an OBD standard diagnostic socket only for the "emission relevant" systems. For all the other systems, the manufacturer is free to choose whether to implement the diagnosis via OBD or to maintain a specific proprietary one.

You can activate this mode both from the software's first page (Image 156) and from the Self-diagnosis page (Image 157).

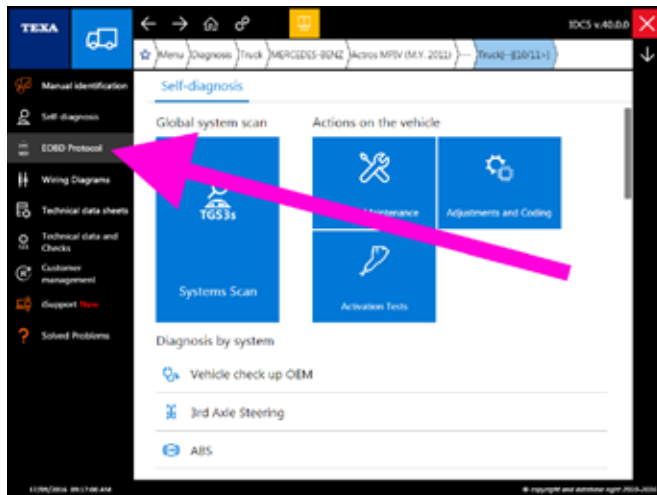


Figure 157: EOBD protocol Self-diagnosis

By launching the “EOBD Protocol” function the connection screen is displayed.



Figure 158: EOBD Protocol connection

Activating the connection through the “Connect” button, the connection over the CAN is established and a screen with the vehicle's information will appear. The screen is divided into several areas, each of them indicating specific information (Image 159).

Legend:

1. Communication protocol (ISO9141-2, ISO14230-4, SAE J1939, ...)
2. Control unit address
3. Type of control unit
4. Position of the sensors installed on the vehicle
5. OBD status (OBD I, OBD II, EOBD, EOBD and OBD II, ...)
6. Status of the readiness tests
7. Probe type
8. Service icons



Figure 159: EOBD Protocol

Attention: the diagnosis via EOBD Protocol is also possible on "Not OBD compliant" vehicles, but this vehicle may not support certain software functions or may not respond to polls and tests in a compliant way.

The part of the screen (area no. 8 in Image 159) shows the tests and polls carried out by the Protocol function (the tests and polls that can be selected depend on the services provided by the control unit of the vehicle being tested). Click on the icon corresponding to the desired service to activate it.













Icon	Name	Description	Notes
	OBD diagnosis	Evaluation of the on-board system readiness tests.	This service reads and evaluates the readiness tests. The reading is carried out through the diagnostic device using the request Mode\$01 PID\$01 (data byte B, C + D).
	OBD diagnosis	Evaluation of the fault codes and MIL status.	This service carries out the reading of the status of the MIL and of the number of DTCs (Diagnostic Trouble Codes). The service was carried out through the diagnostic device using the Mode\$01 PID\$01 (Data Byte A) request. The reading of any stored error code is carried out using the Mode\$03 request.
	Mode \$01	Current diagnostic data related to the powertrain.	This service allows accessing the current parameters and statuses available in the control units. A parameter or status is defined as current when it is acquired during the diagnosis. The device interrogates the control units to know which parameters/statuses are available to read.
	Mode \$02	Frozen parameters related to the powertrain.	This service allows accessing the frozen parameters and statuses available in the control units. A parameter or status is defined as frozen when it is acquired when the error occurs and maintained throughout time. The device interrogates the control units to know which parameters/statuses are available to read.
	Mode \$03	Powertrain fault codes related to the emissions.	This service allows obtaining the DTCs (Diagnostic Trouble Codes) stored by the control units. If the DTCs are standard (do not depend on the manufacturer) the corresponding description is also displayed.
	Mode \$04	Reset of the emission-relevant diagnostic information.	This service allows resetting all the diagnostic information in the control units. The vehicle's control units respond to this service when the ignition key is turned in the ON position and the engine is off.
	Mode \$05	Results of the control tests on the oxygen sensors.	This service allows viewing the results of the control tests on the oxygen sensors. Attention: it is not supported by the ISO 15765-4 (CAN) protocol. Use Mode \$06 with this type of standard.
	Mode \$06	Results of the on-board control tests for the non-continuously monitored systems.	This service allows viewing the results of the on-board control tests related to specific components/systems that are not continuously monitored, such as the catalyst or the evaporation system.
	Mode \$07	Results of the on-board control tests for the continuously monitored systems.	This service allows viewing the results of the on-board control tests for specific systems that are continuously monitored. This information is useful after repairing a vehicle to observe the operation of its systems after a single driving cycle. If the test fails during the driving cycle, the DTC associated with that test is indicated.
	Mode \$08	Check on an on-board system, test or component.	This function allows checking the operation of an on-board system, test or component.
	Mode \$09	Vehicle information.	This service allows viewing specific vehicle information, such as the Vehicle Identification Number (VIN) or the calibration IDs.

Table 12: EOBD Protocol, service icons

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

Example of the current parameters on a vehicle via an EOBd Protocol (Mode \$01) connection:

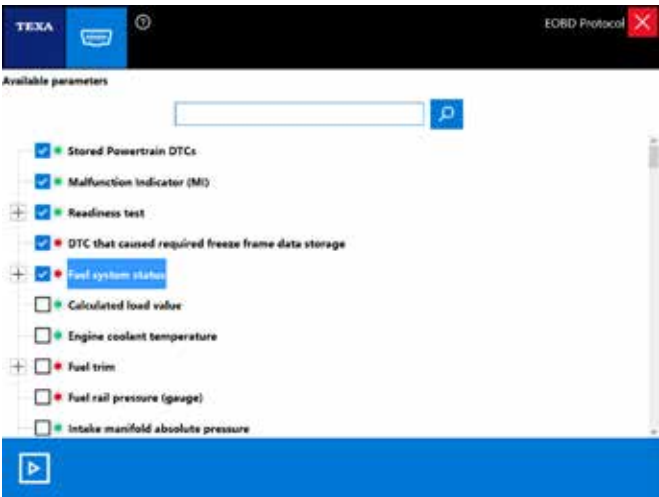


Figure 160: Mode \$01: parameter selection

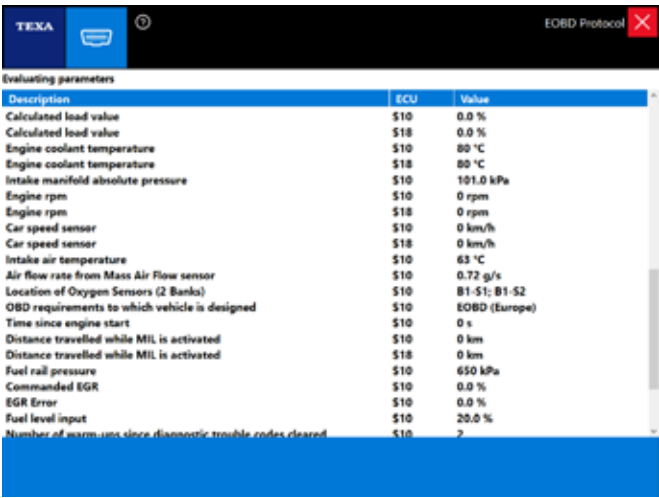


Figure 161: Mode \$01: parameter evaluation

6.3 VEHICLE SEARCH

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, TEHA increased the vehicle search possibilities thanks to two specific functions:

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

6.3.1 Manual identification

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

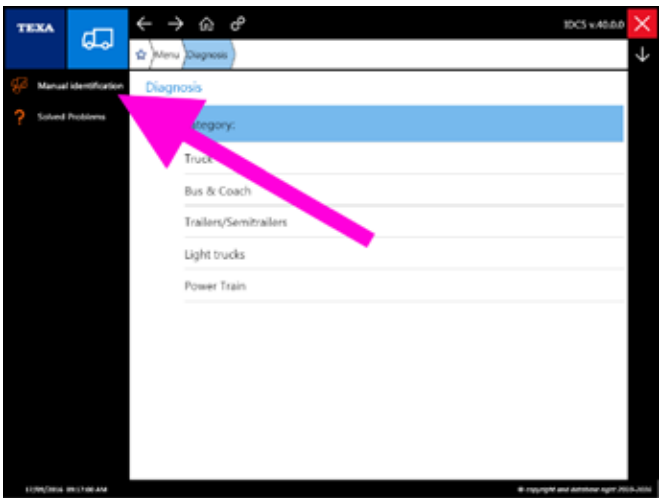


Figure 162: Manual identification

The function allows searching based on three different variables.

- Engine code
- VIN
- Vehicle license plate number



Figure 163: 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 La ricerca per codice VIN è possibile solo per quei costruttori che adottano delle regole di differenziazione dei modelli tramite codice telaio. Per alcuni modelli l'identificazione potrebbe essere parziale o impossibile a causa della codifica scelta dal costruttore.

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).

6.3.2 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 "A" .

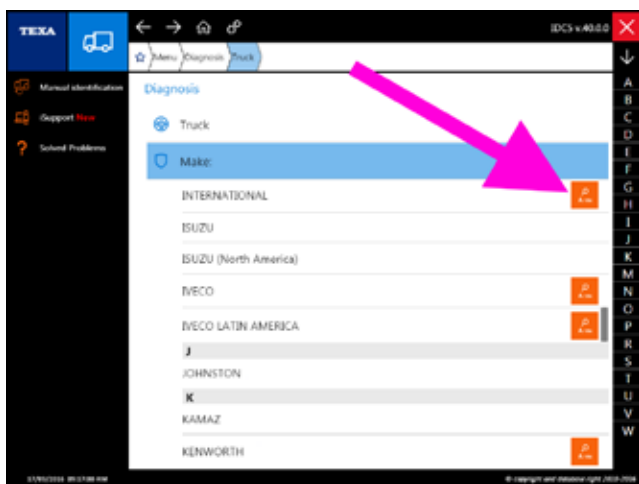


Figure 164: Automatic VIN identification

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.

6.4 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 165: 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.

6.5 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 ("TRUCK TEXA S.p.A. Exchange Manager") or by selecting the specific function from inside IDC5.

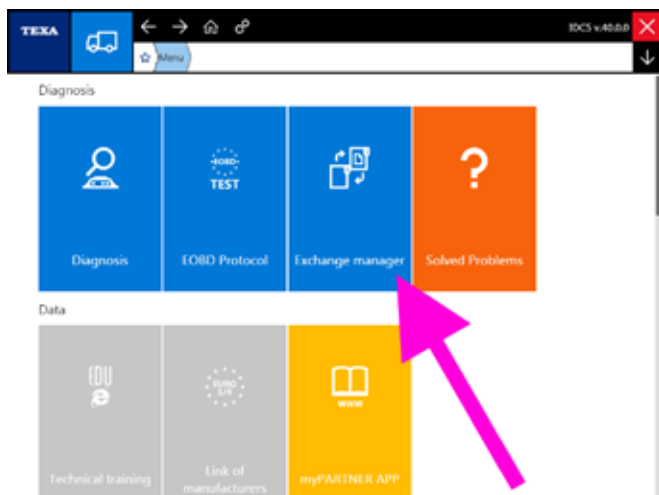


Figure 166: Exchange Manager Self-diagnosis

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.

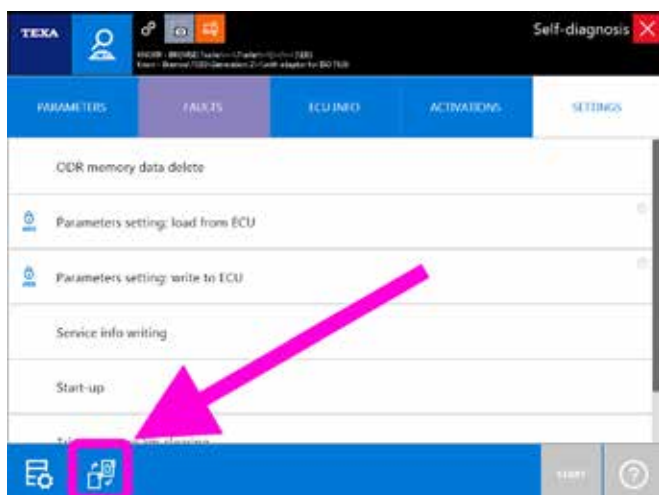


Figure 167: Exchange Manager access button

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

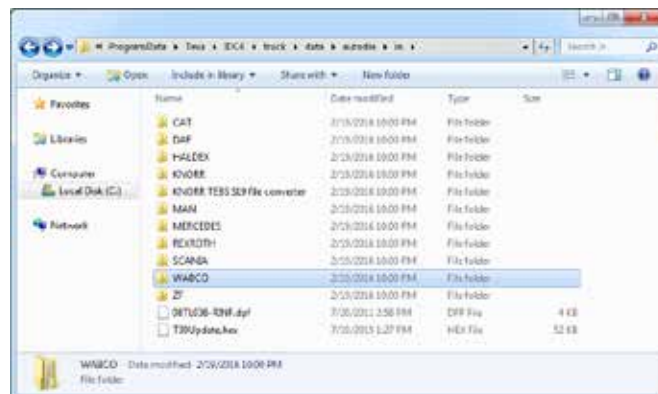


Figure 168: Exchange Manager folder

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 files containing the programmings of the control units that are loaded in IDC5 with the adjustment "Parameters setting: load from ECU" (see chapter 4.11 Procedures for replacing the control units).
in/KNORR TEBS S19 file converter	<p>The "KNORR TEBS S19 file converter" subfolder (inside the "in" folder) contains an application to convert the files from the manufacturer of the trailer/semitrailer of the Knorr EBS braking system ECU, with the extension "S19".</p> <p> See the specific technical bulletin for the user instructions.</p>
mp	System folder used by the self-diagnostic software for particular functions.
out	<p>It contains all the files produced by particular self-diagnostic functions that generate reports (consultable documents).</p> <p>For ex.:</p> <ul style="list-style-type: none"> - Wabco ODR (function that records the operating parameters of a trailer/semi-trailer). - IVECO EDC trip recording (engine operating data). - DAF ZF AsTronic transmission operation test reports - ...
out/WABCO ODR	<p>The "WABCO ODR" subfolder (inside the "out" folder) contains an application to use to consult the trip data that can be recorded with the most recent EBS central units for trailer/semi-trailers (Wabco EBS version E).</p> <p> See the specific technical bulletin for the user instructions.</p>
rec	System folder used by the self-diagnostic software for particular functions.
sessions	System folder used by the self-diagnostic software for particular functions.
*.xml	System files used by the self-diagnostic software for particular functions.
reg.xml_	System files used by the self-diagnostic software for particular functions.

Table 13: Exchange Manager folders

6.6 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.

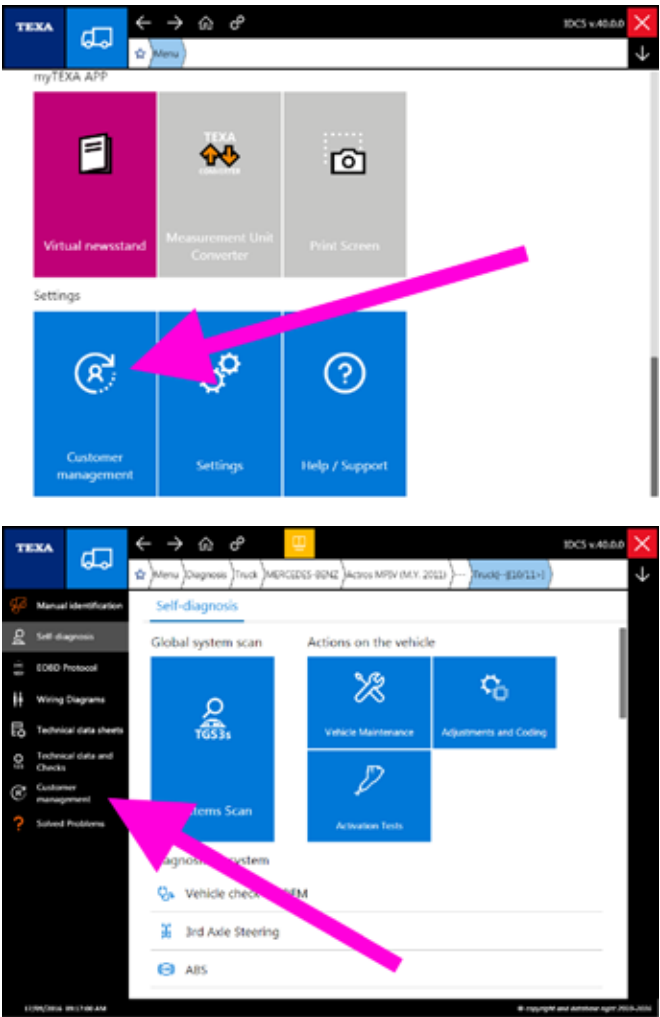



Figure 169: Customer management

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 169), 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.

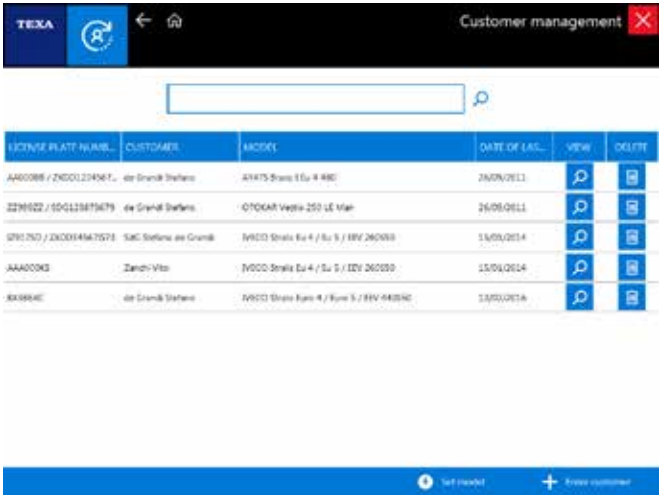



Figure 170: Customer management environment

 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.

6.7 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 171).

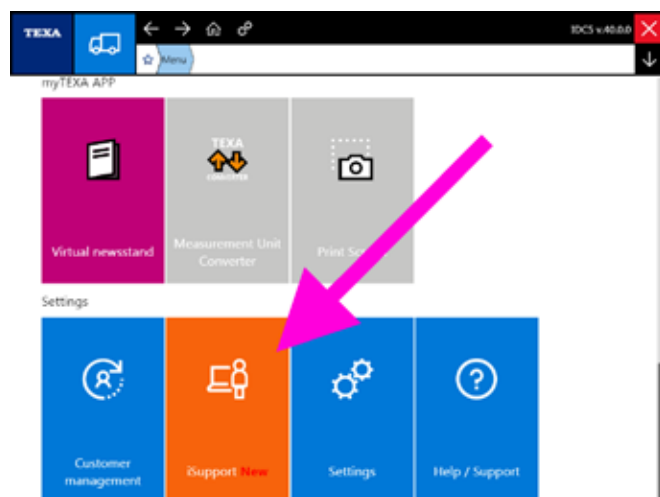


Figure 171: iSupport

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.

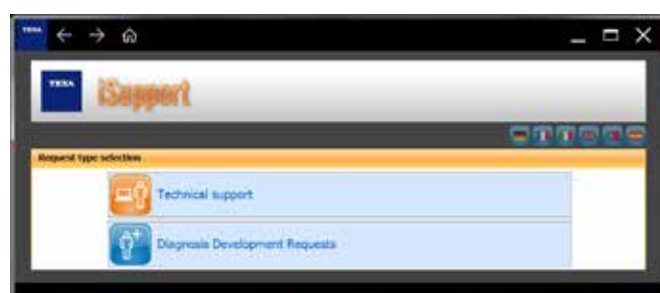


Figure 172: iSupport portal

 In some markets this function may not be available.

You can access iSupport directly from the Self-diagnosis.

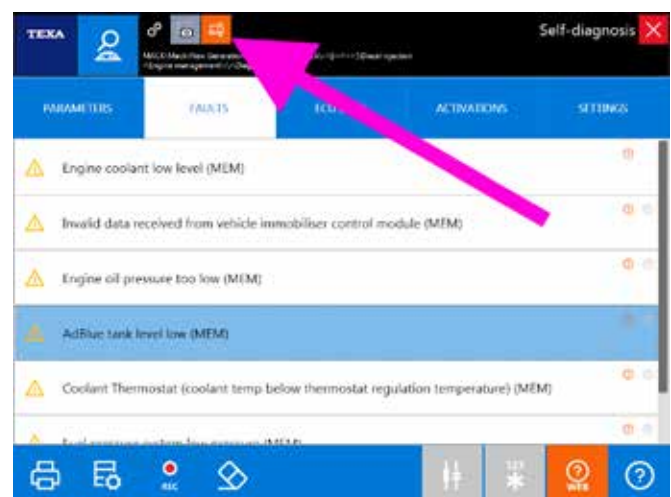
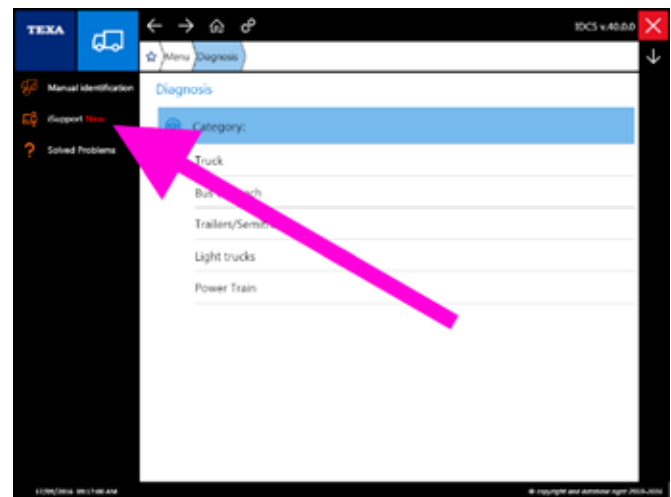


Figure 173: Access to iSupport from the Self-diagnosis

6.7.1 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 "iSupport" in the upper part of the Self-diagnosis screen.

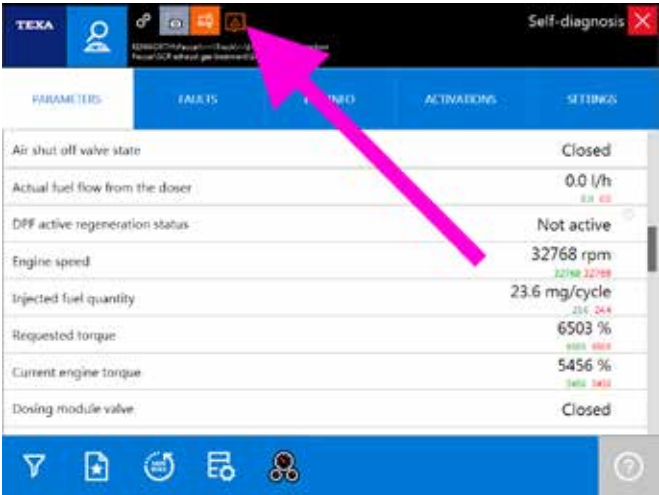


Figure 174: Fault notification button

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.

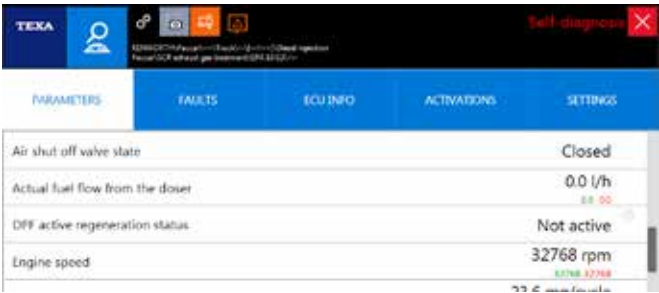



Figure 175: Active fault notification

 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.

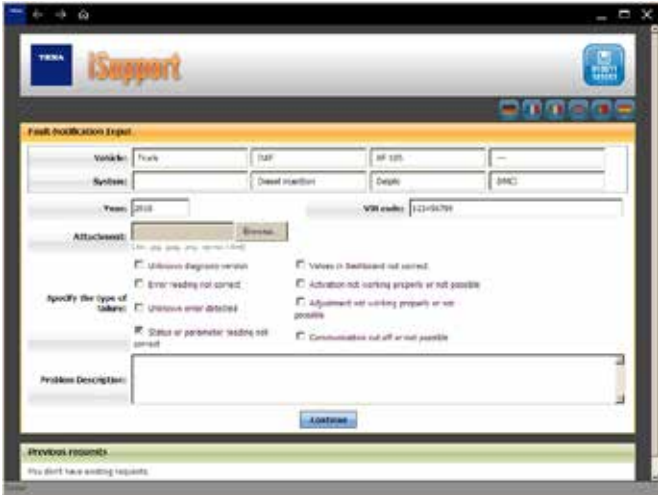


Figure 176: iSupport fault notification

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.

6.8 SCREENSHOT

It is often useful to have a snapshot of what appears on-screen.

With the button "📷 snapshot", always available in the upper part of the screen, you can save an image of the screen.

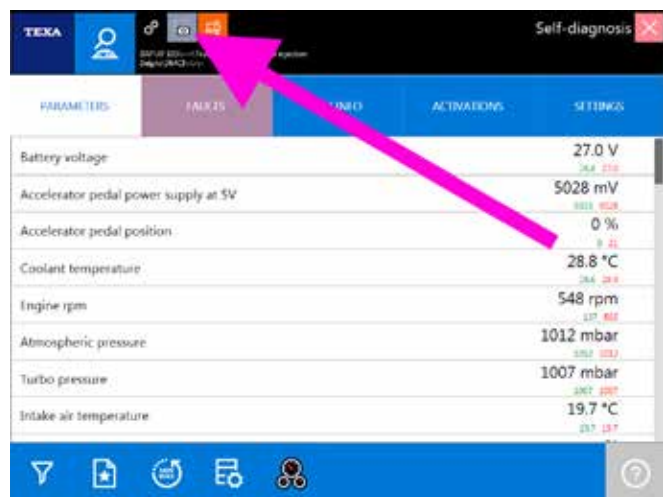


Figure 177: Screenshot button

The captured images are available in the Customer management archive.

6.9 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 178) 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 179).

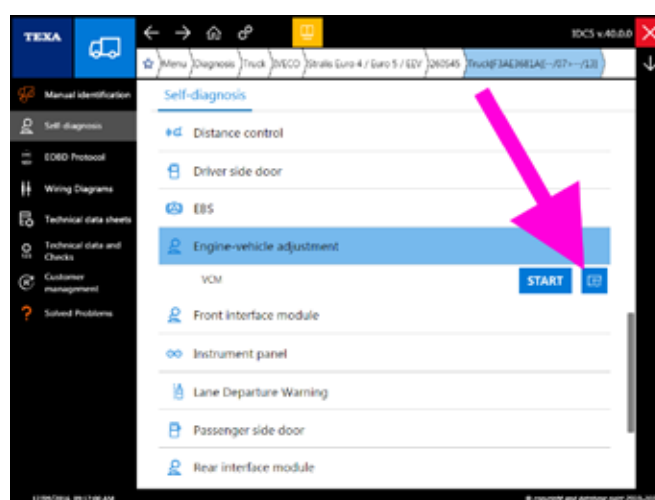


Figure 178: Connection with information on cable and socket position

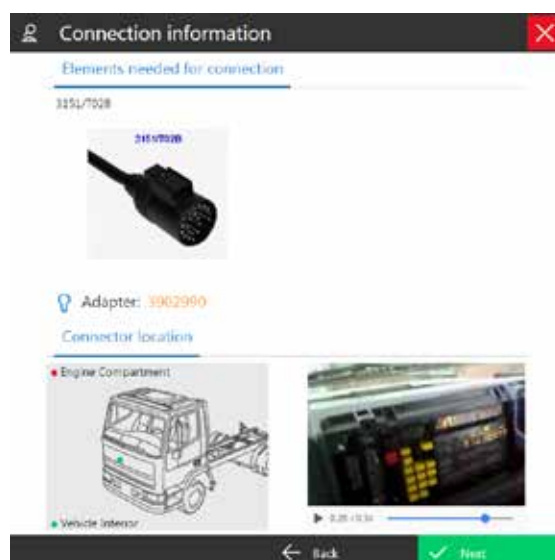


Figure 179: Information and videos on the connection

The same screen (Image 179) allows selecting other connection cables and shows information regarding the connection itself (need for additional adapters, additional power supply, ...)

6.10 UNITS OF MEASUREMENT

The IDC5 self-diagnostic program was developed to be compatible with all the international measurement systems (international, English, American, ... systems). When the software is installed, you must select the type of system you wish to use and generally you are no longer required to change it.

If you wish to view the values based on another standard, you can change it directly from the Self-diagnosis settings. Therefore select the button to change the settings of the Self-diagnosis "⚙️".

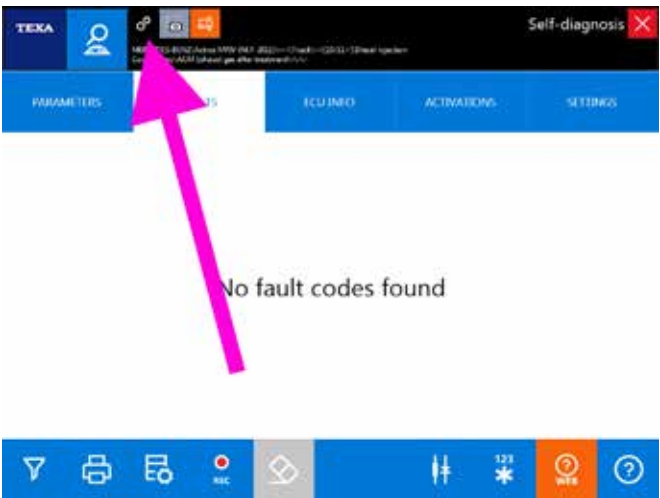


Figure 180: Self-diagnosis settings

A chart with the active settings will be displayed.

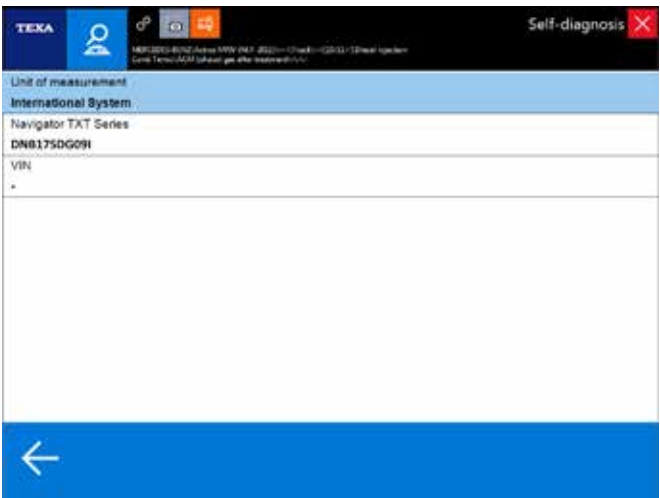


Figure 181: Unit of measurement settings

Click on the line with the units of measurement and in the following screen select the new standard to use.

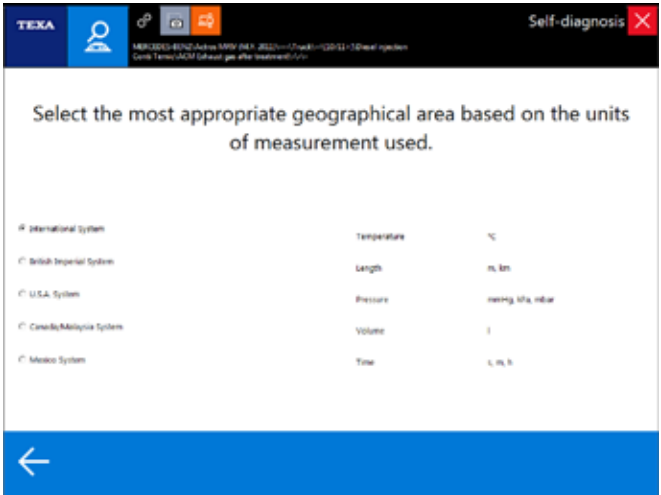


Figure 182: Unit of measurement selection

6.11 ONLINE PDF MANUAL

During its development, TEXA's self-diagnostic program has grown and the number of functions has increased exponentially with the release of each new version. Many of these functions are "vertical" and suitable for specific problems; others functions are instead valid in wider contexts.

For this reason the user manual for the self-diagnostic software is essential! There are so many functions that it is possible "to remember all of them!

Therefore The "🔑 Help / Support" function can always be accessed (from the first page of the self-diagnostic software), in order to view the OnLine manual in PDF format.

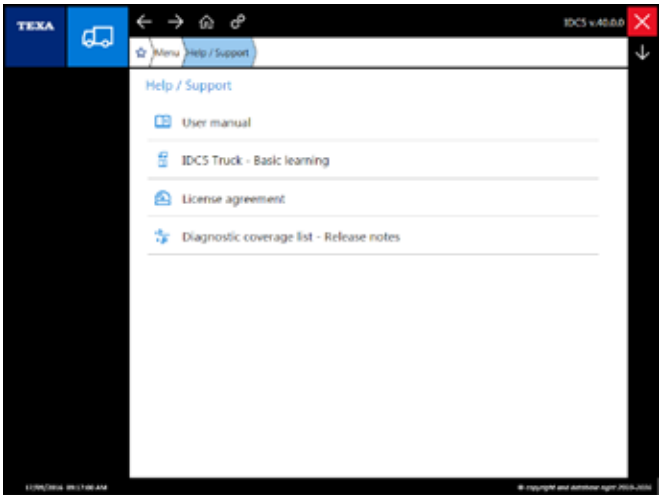


Figure 183: Documentation menu

In this menu there re the controls available in order to view:

- The user manual
- The diagnostic coverage
- The license agreement of TEXA's software programs
- IDC5 Truck – Basic learning (this manual in electronic format)

In particular, the "user manual" is a PDF file made up of approximately 700 pages and it explains in detail each single function/command of TEXA's self-diagnostic software.

7. DETAILED KNOWLEDGE AND TECHNICAL ANALYSIS OF THE SINGLE SYSTEMS

TEXA do not only manufacture advanced workshop equipment, does not only develop diagnostic software and management systems to optimize the job of mechanics; it does not only offer customer assistance services with call centres worldwide.

TEXA also offers  a complete training program for mechanic and specialists in the automotive industry. The availability of the training courses and the their calendar can be viewed in TEXA's website (www.texa.com) or through the “ Technical training” function available in the myTEXA APP menu (Image 184).

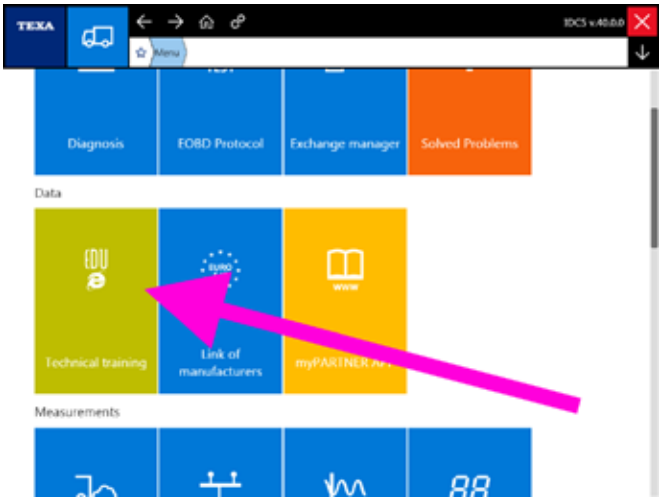


Figure 184: Technical training

The portal allows viewing the professional training courses developed by the TEXA Educational department.

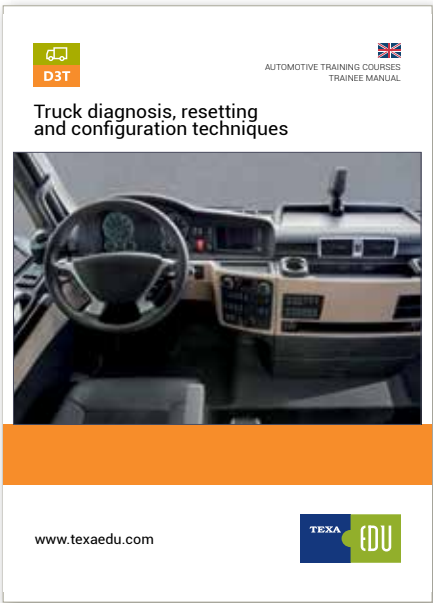
 Based on the market and on the TEXA reference branch, some courses may not be available.

Below there is a list of the available courses developed by TEXA for the world of industrial vehicles.

7.1 D3T TRUCK DIAGNOSTIC TECHNIQUES

The course "D3T Truck diagnostic techniques" aims at illustrating the self-diagnostic techniques for industrial vehicles.

You will be able to: interpret the results of the diagnostic tests on Iveco Tector and Cursor engine types; correctly replace components such as injectors, pumping units and electronic dryers; correctly complete traditional maintenance operations on the main Mercedes, Volvo and MAN transmission (clutch, servo-clutch or actuator replacement); replace the control unit in the ZF AsTronic transmission; reset the maintenance on Mercedes, MAN and Volvo vehicles.



7.2 G13 ENGINE MANAGEMENT 1st PART

The course "G13 Engine management 1st part" illustrates in detail the evolution of the injection systems for industrial vehicles, the operating principles of the EDC type injection systems, the PLD and Pump-injector systems as well as the diagnostic and repair methods.

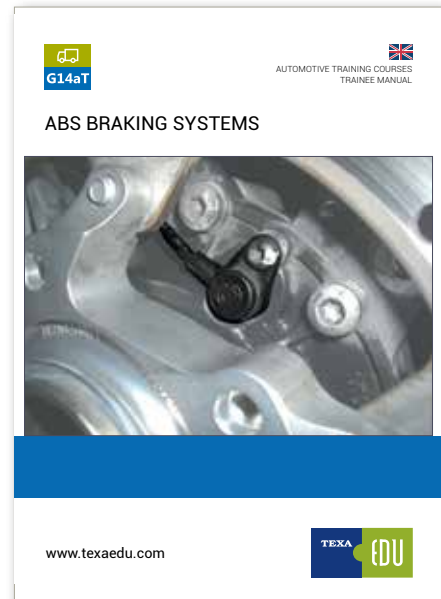
Features of the traditional injection systems, concepts of advance timing, flow rate and high pressure; EDC injection systems (with in-line pump). Analysis of the components, operating strategies and applications of the EDC MS5, EDC MS6.1, MS6.2 Pump-injector and PLD injection systems.



7.3 G14A ABS BRAKING SYSTEMS

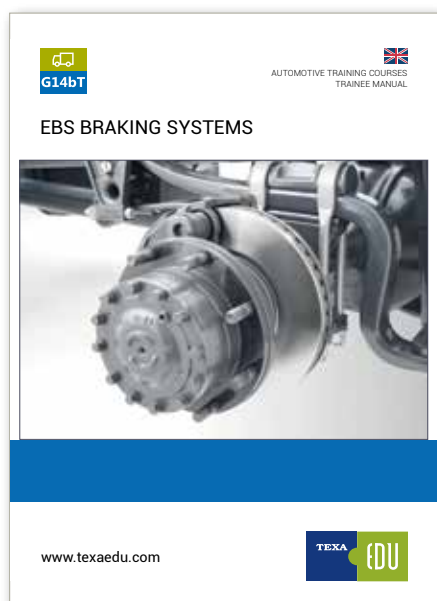
The aim of the course "G14a ABS braking systems" is to analyse in detail the different types of braking systems that are used on industrial vehicles.

Operating principles and diagnostic methods for solving possible faults. Introduction to the pneumatic part of the systems, analysis of the Wabco D and E ABS braking systems.



7.4 G14B EBS BRAKING SYSTEMS

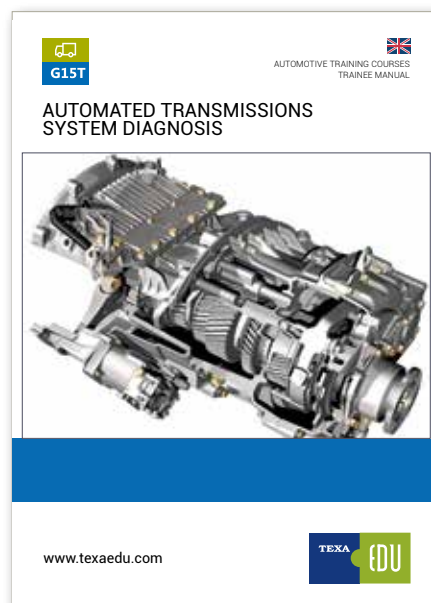
The “G14b EBS braking systems” course describes the operation of the Wabco and Knorr EBS braking systems. Analysis of the operating strategies and of the faults that can be detected using the Self-diagnosis, electrical checks on the various components, adjustments available using the IDC5 resources; recovery strategies. Differences between the Wabco EBS equipped on Mercedes Benz and Iveco vehicles. Analysis of the Knorr EBS installed on Scania vehicles.



7.5 G15 AUTOMATED TRANSMISSIONS

During the course "Automated transmissions" the operating principles of the F AS-Tronic, Mercedes EPS and Scania Opticruise transmissions are explained.

Analysis of the components, Iveco ZF AsTronic configuration and adjustment procedures. Analysis of the components, Man ZF AsTronic configuration and adjustment procedures.



7.6 G17 NETWORK SYSTEMS

In the course "G17 Network systems" the theory of the network communication systems is analysed along with the systems without network connections.

Analysis of the different transmission protocols in industrial vehicles. In-depth analyses of the Mercedes and Volvo network architectures.

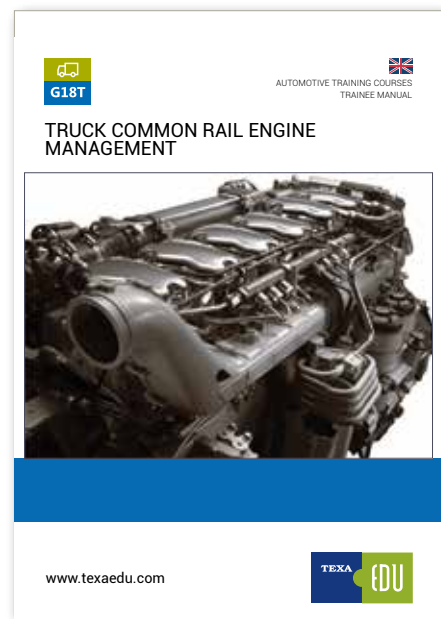
Analysis of the Iveco Stralis Multiples system. Interpretation of the errors, analysis of the digital signals using measurement tools.



7.7 G18 IVECO-MAN EDC7 COMMON RAIL ENGINE MANAGEMENT

The course "G18 Iveco-Man EDC7 Common Rail engine management" illustrates the operation of a Bosch 1st generation Common Rail engine control system (EDC15, EDC16, DCI). It also describes the Bosch 2nd generation Common Rail system (EDC7, EDC16) along with an overview of the 3rd generation Common Rail systems (EDC16, EDC17).

Basic elements of the 4th generation Common Rail systems (X-Pulse New Mercedes Actros).



To complete this course, the following specific technical analyses are available:

- S1T Iveco EDC7 Common Rail engine management
- S2T Man EDC7 Common Rail engine management
- S3T DMCI (DAF Multi-Controlled Injection) engine management

7.10 G21 ADBLUE™ / SELECTIVE CATALYTIC REDUCTION (SCR) SYSTEMS

The course "G12 AdBlue™ / Selective Catalytic Reduction (SCR) systems" illustrates the reasons that brought to the use of the SCR systems, the legal implications and the technological limits.

It describes the various types of systems on the market used by the different manufacturers, technically illustrating the operating principle with a comparison between the various families of products and a description of the components used. It gives indications to carry out the specific Self-diagnosis for each manufacturer with the explanation of the engineering parameters and of the single diagnostic tests.





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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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