ENDEAVOUR TOOLS TECH SUPPORT

D.TANCHEV / J.TOMLINSON 2022©   v2.2

Australian

DITEX ET0090 I-TESTER Companion

Contents

ET0090 I-TESTER introduction

The ET0090 I-tester can graph a comparative relative compression test on any electrically start-able non rotary engine from 3 to 12 cylinders. It does this by analyzing the peak-to-peak voltage direct via DC test leads, or current input with an optional Amps clamp.
In addition, the test can be synchronized to any cylinder via an optional inductive pickup, capacitive pick up, or additional amps clamp. Therefore, if the firing order of the engine is known a faulty cylinder can be easily determined.
For the optional accessories list click here.

Caution	The tool cannot perform effectively if a battery or starter fault is present.

Return to Contents

ET0090 Unit overview

Description

The unit has a green dual purpose primary input socket marked with **- & +**   This is the primary
point for making a relative test via voltage and for using the unit as a multi meter.
The top housing also has two BNC input marked IN 2, IN15
The lower housing contains the micro-SD card.

Controls
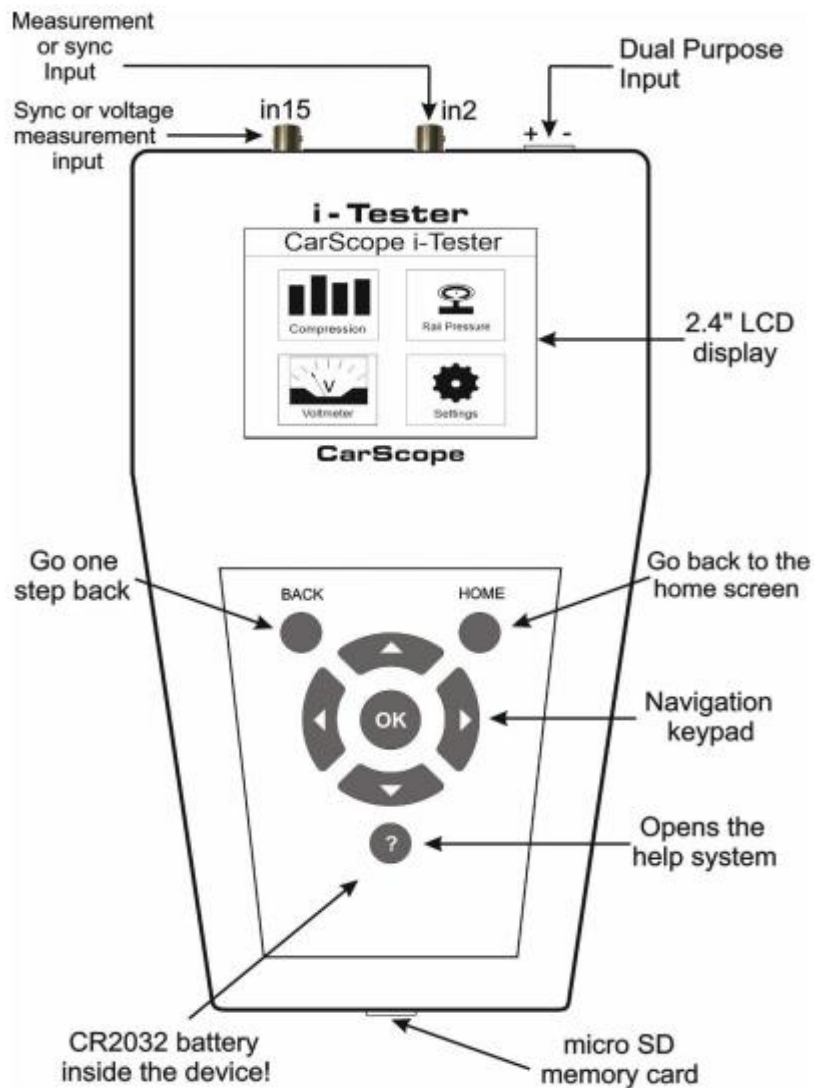
Table 1

Caution	All input sockets share a common ground with the dual-purpose input!

Inputs
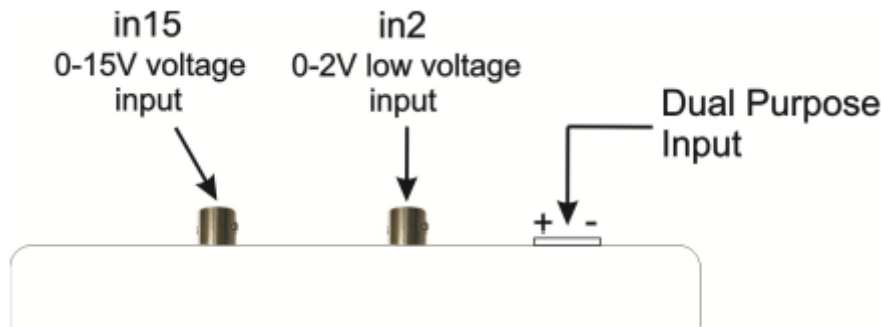
Dual purpose input

Main power supply terminal block connector with an additional function.
Primary input to power the unit and to measure the relative compression by DC Voltage method.

BNC socket in15

Rated from 0 to 15V voltage input with a BNC connector. Used for:
 - External synchronization from Inductive pick-up;
 - External synchronization from any gasoline solenoid injector, to get voltage signal;
 - In Common Rail pressure test mode for signal from the high-pressure sensor.

BNC socket in2

Rated from 0 to 2V low voltage input with a BNC connector. Used for:
- measuring the relative compression with 500, 600A or 1000A current clamps;
- As a synchronization input when using 10A or 20A current clamps;
- As a synchronization input from gasoline high impedance (saturated) injectors with an inductive pick-up clamp.

Return to

Connecting to a vehicle

How to connect - testing via voltage

Connect the supplied leads to the battery supply and ground posts.

How to connect – testing via amps

The optional ET0102-03 CARSCOPE AC / DC CURRENT CLAMP 600A can be used clamped on either the main negative cable or supply cable on the battery.

How to connect – optional amps clamp

The optional ET0102-02 CARSCOPE AC / DC CURRENT CLAMP 10 MA - 60A can be used on an injector harness to provide a synchronized input on Input15 or Input2 socket on the tool.

How to connect – optional ignition pickup

A signal can be used from a secondary ignition source with the ET0102-01 CARSCOPE #1 CYLINDER PICK UP CLAMP on Input15 or Input2 socket on the tool to synchronize a reading.

Return to Contents

How does it work?

The tool analyses an oscilloscope waveform, then uses a formula to calculate a reading expressed as a percentage.

Let's review an oscilloscope reading.
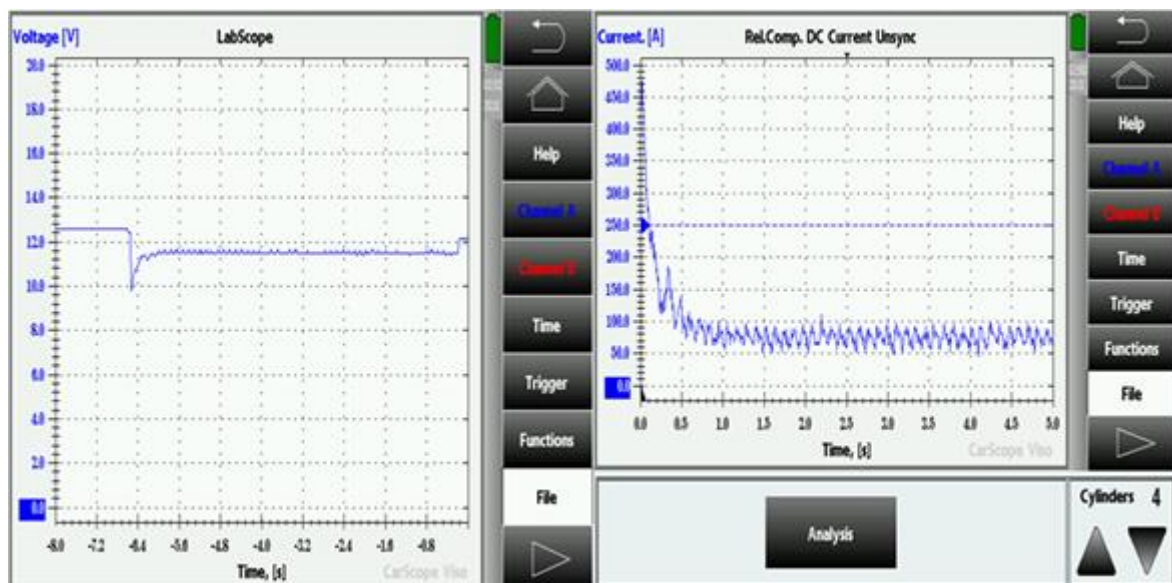
The left slide shows a sample of **voltage** captured from a 12v system. At time A showing approximately 1.2 seconds of the system at rest, followed by the starter cranking for approximately 6.2 seconds then 0.2 seconds at rest.

The right slide is displaying the starter motor current draw in **amps** as a timed 5.0 second sample. As this is a triggered sample, the graph has started with the initial current draw spike on the extreme left to overcome the friction of the stationary engine that has resulted in the data being captured. The following peaks and troughs represent the current draw in amps required for the initial acceleration up to approximately 1.0 second into the sample then the

stabilized rotation of a 4-cylinder engine in displayed in the remaining 4.0 seconds of the display. Each peak displayed as current draw represents the effort of the starter to overcome each individual cylinder compression pressure.

Caution	This tested result will be different on repeated tests, as the starter pinion will engage the crankshaft in a different position each time!

Relative compression test – Voltage – Unsynchronized

These slides show the same engine, with an un- synchronized test repeated a few moments later.

Note the highest recorded value has shifted from position #C to position #B

Note: Due to being a relative test, the highest performing cylinder will always display as a 100% even though this has no relation to absolute compression test readings or engine serviceability. The other cylinders are relative to the highest performing cylinder.
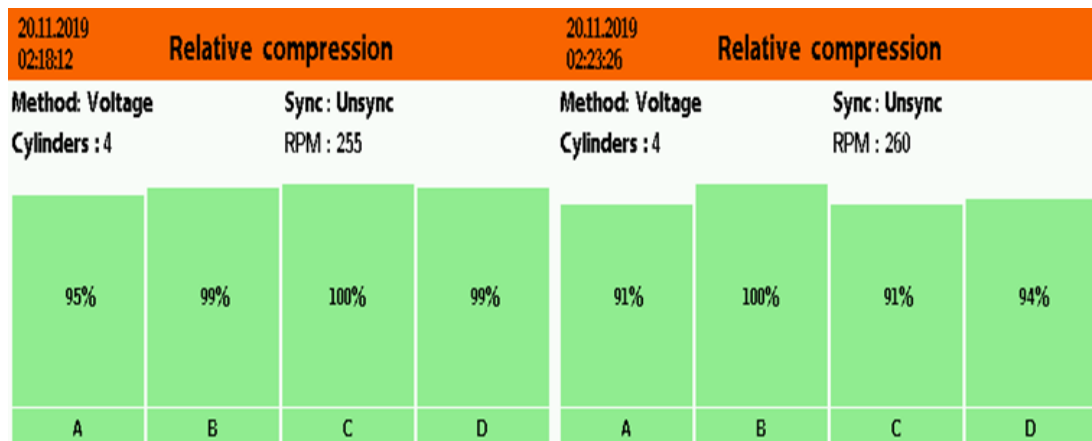
Relative compression test – Amps – Unsynchronized – No compression on one cylinder

The left slide show un-synchronized test, the right displays the background sample analyzed by the tool. This engine has nil compression on cyl #4. Without synchronization, this only serves to confirm a general fault.
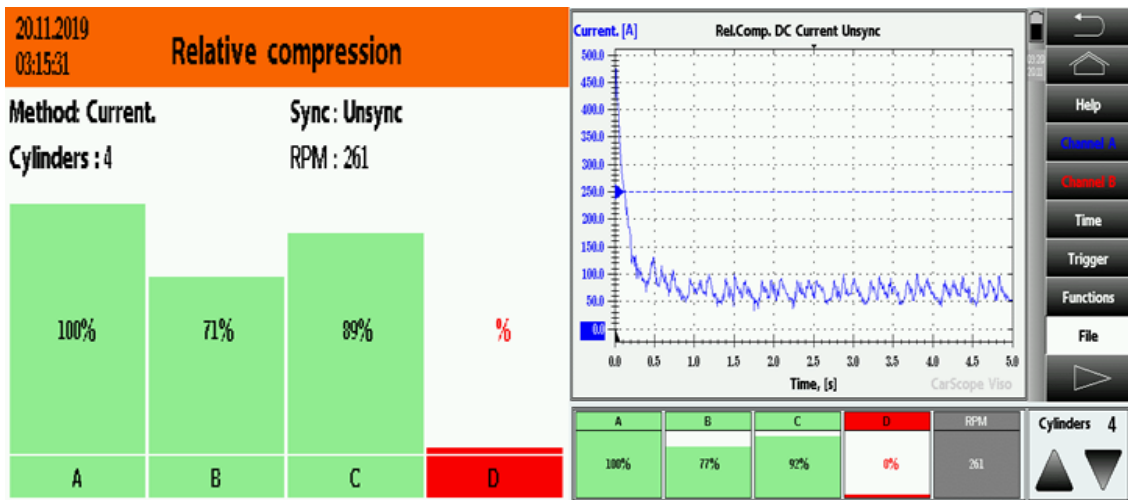
Relative compression test – Amps – Crankshaft to starter relationship

The same test repeated a few moments later, same fault: cylinder #4 nil compression. Note that the starter – crankshaft relationship has changed from the last test.
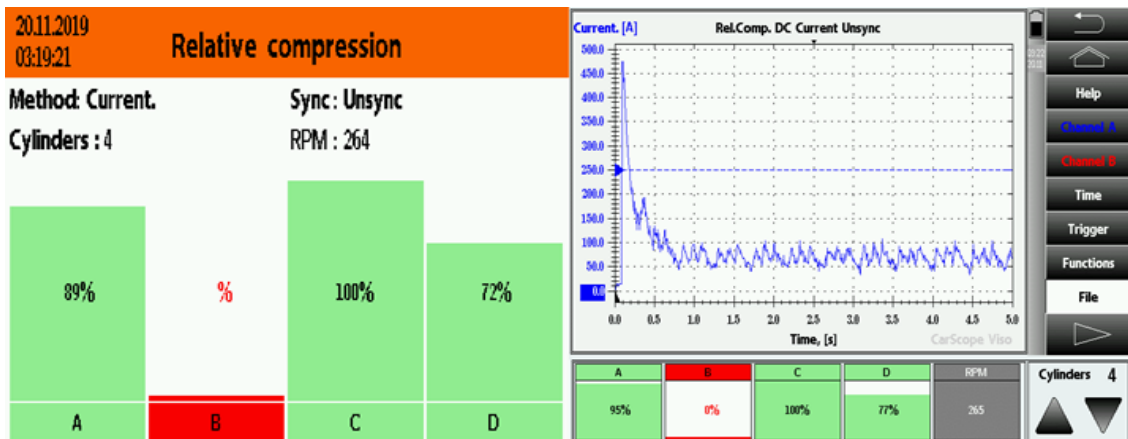
Relative compression test – Voltage – synchronized - No compression on one cylinder

The same engine, cyl #4 nil compression. In this test, we have added a synchronized signal from cyl#1 taken from the ignition coil. With a firing order of 1-3-4-2, we can easily confirm a compression issue in cyl #4
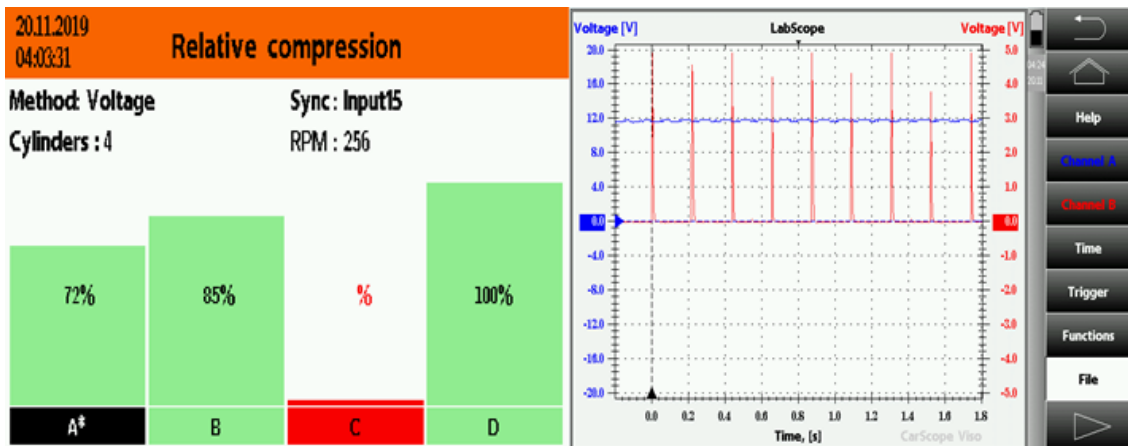
Return to Contents

Relative Compression tests – Unsynchronized

DC Voltage Unsync

DC Voltage method – No synchronization (Unsync)
This method is used to verify that all cylinders have equal compression. Results from this test does not allow exact cylinder number identification, because there is no cylinder synchronization signal.
The principle of this test is based on tracking the battery voltage changes during cranking to determine the compression values of all cylinders.
Table 2

Caution	Before performing this test, you must disable the fuel system to prevent the engine from starting. This can be done by removing the fuel pump fuse, relay or unplugging the fuel pump itself.

Test steps:
1. Connect the CarScope iTester power cable black crocodile clip to the battery negative (-)
 terminal and the red crocodile clip to the battery positive (+) terminal.
2. Select the number of cylinders of the engine you are testing, using the ▲ and▼ keypad
 buttons.
3. Select the Start button using ◄ and ► keypad buttons.
4. Press the OK keypad button to start the test.
5. Follow the instructions shown on the CarScope iTester display.
 Note: You may cancel the test process at any time by pressing the Back or Home button.
6. After the test process completed the results will be shown on the CarScope iTester
 display.

Relative Compression			
Current	Unsync		Cylinders: 4
A	B	C	D
89%	64%	100%	94%
Save to file			RPM:216

Return to Contents

DC Current Unsync

DC Current method - No synchronization (Unsync)

This is the most commonly used method for relative compression measurement. A current clamp is needed for this test

It is used to verify that all cylinders have equal compression. Results from this test does not allow exact cylinder number identification, because there is no cylinder synchronization signal. The principle of this test is based on tracking the starter motor current changes during cranking to determine the compression values of all cylinders.

Caution	Before performing this test, you must disable the fuel system to prevent the engine from starting. This can be done by removing the fuel pump fuse, relay or unplugging the fuel pump itself.

Test steps:
1. Connect the CarScope iTester power cable black crocodile clip to the battery negative (-)
 terminal and the red crocodile clip to the battery positive (+) terminal.
2. Connect the CA-600 AC/DC current clamp to the iTester "in2" BNC connector.
Be careful, the clamp arrow (points to the battery positive +) matches the current direction!
In case of wrong current clamp connection, you will not able to perform this test at all!
The current probe must be clamped on the wire that connects the battery to the starter.
Note: CA-600A probe is supplied with a 4 mm banana plug type connectors so it cannot be plugged directly to a CarScope iTester. A banana plug to BNC adapter must be used for this purpose.
3. Select the number of cylinders of the engine you are testing, using the ▲ and▼ keypad
 buttons.
4. Select the Start button using ◄ and ► keypad buttons.
5. Press the OK keypad button to start the test.
6. Follow the instructions shown on the CarScope iTester display.
Note: You can cancel the test process at any time by pressing the Back or Home keypad buttons.
7. After the test process completed the results will be shown on the CarScope i-Tester display.

Relative Compression			
Current	Unsync		Cylinders: 4
A	B	C	D
89%	64%	100%	94%
Save to file		RPM:216	

Return to [Contents](#)

Relative Compression tests – Synchronized

Cylinder synchronization and accessories needed for synchronization
Cylinder synchronization
By connecting up a second probe to either the ignition system or an injector, you can follow the firing order/injection sequence and know which one it is. This is not the only way to do this type of cylinder identification but it does work as a way to start with.
Additional accessories needed to capture an external synchronization signal (trigger pickup)
- Main signal cable with a BNC connector to a 4mm red banana plug (included in the basic set)
- Inductive pick-up (optional, it is not in the basic set)
- High sensitive, high frequency current clamp. We recommend current clamps which transformation ratio is at least 1-2V at 10A and frequency response 500Hz minimum.
Current clamps designed for the 50-60Hz mains supply will not do the work! (optional, not in the basic set)

Accessories needed for synchronization
⬚ A main signal cable with a BNC connector to a 4mm red banana plug (included in the basic set).

With the main cable, you can get synchronization from:
- Primary ignition;
- Gasoline injectors;

- Diesel injectors.

⬜ An Inductive pick-up (optional, it is not in the basic set)

There are various inductive probes for sale, but to achieve a stable synchronization with the i-Tester, we will clarify here the minimum parameter values:

- The output signal of the Inductive pick-up should have an amplitude of at least 120mV (0.12V) when connected to the "in2" input;
- The output signal of the Inductive pick-up should have an amplitude of at least 1.5V when connected to the "in15" input;
- Pulse width (pulse duration) of the Inductive pick-up signal should be at least 1mS.

With this probe, you can get synchronization from:
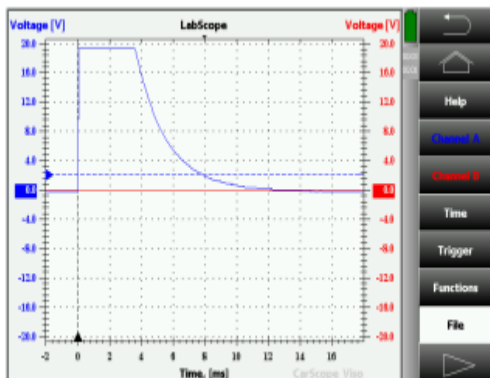
Signal - Primary ignition - signal from primary ignition "coil-on-plug"
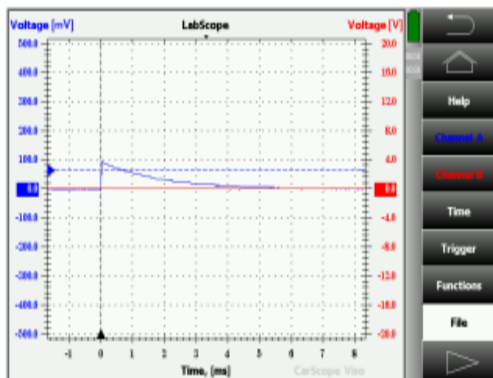
Signal - Secondary ignition;

- Gasoline high impedance injector (saturated) - signal from a high impedance (saturated) gasoline injector.
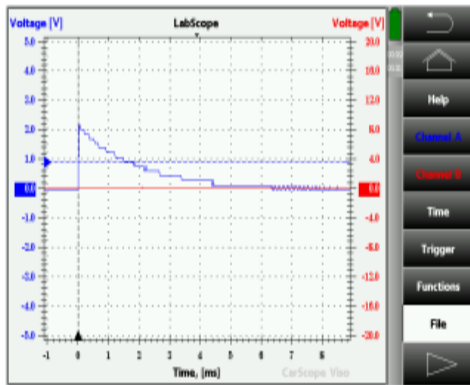
Signal - Diesel injectors - signal from a diesel Common Rail electromagnetic injector

A high sensitive, high frequency current clamp. We recommend current clamps which transformation ratio is at least 1-2V at 10A and frequency response 500Hz minimum. Current clamps designed for the 50-60Hz mains supply will not do the work! (optional, not in the basic set).

With current clamps, you can get synchronization from:
- Primary ignition;
- Gasoline injectors;
- Diesel injectors.

10:1 attenuator when capturing signal from the Primary ignition

Return to Contents

Gasoline engines			
Test method	**Sync input**	**Sync probes**	**Synchronization from**
DC Voltage	In15	Inductive pick-up and Coil-on-Plug Extension Lead	Secondary ignition "coil-on-plug"
	In15	Inductive pick-up	Classic secondary ignition system
	In15, In2	Inductive pick-up	Primary ignition (current)
	In2	10/20A High sensitive, high frequency current clamp	Primary ignition (current)
	In15	Main signal cable and a voltage attenuator 20:1 ***	Primary ignition (voltage)
	In15	Main signal cable	Solenoid injector (voltage)
	In15	Main signal cable and a voltage attenuator 10:1 **	Piezo injector (voltage)
	In2	10/20A High sensitive, high frequency current clamp	Injector (current) - solenoid or piezo
	In2	Inductive pick-up *	Injector (current) - solenoid or piezo
DC Current	In15	Inductive pick-up and Coil-on-Plug Extension Lead	Secondary ignition "coil-on-plug"
	In15	Inductive pick-up	Classic secondary ignition system
	In15	Inductive pick-up	Primary ignition (current)
	In15	Main signal cable and a voltage attenuator 20:1 ***	Primary ignition (voltage)
	In15	Main signal cable	Solenoid injector (voltage)
	In15	Main signal cable and a voltage attenuator 10:1 **	Piezo injector (voltage)

Diesel engines			
Test method	**Sync input**	**Sync probes**	**Synchronization from**
DC Voltage	In15	Inductive pick-up	Injector (current) - solenoid or piezo
	In2	10/20A High sensitive, high frequency current clamp	Injector (current) - solenoid or piezo
	In15	Main signal cable	Solenoid injector (voltage)
	In15	Main signal cable and a voltage attenuator 10:1 **	Piezo injector (voltage)
DC Current	In15	Inductive pick-up	Injector (current) - solenoid or piezo
	In15	Main signal cable	Solenoid injector (voltage)
	In15	Main signal cable and a voltage attenuator 10:1 **	Piezo injector (voltage)

Caution	WARNING - HIGH VOLTAGE * If the induced voltage is greater than 120mV ** Warning: High voltage up to 140V!!! *** Warning: High voltage up to 400V!!!

Return to

DC Voltage Sync in2

DC Voltage method - Sync from "in2"
This method is used to verify that all cylinders have equal compression. Results from this test allow exact cylinder identification.
The principle of this test is based on tracking the battery voltage changes during cranking to determine the compression values of all cylinders.
Important note:
Before performing this test, you must disable the fuel system to prevent the engine from starting. This can be done by removing the fuel pump fuse, relay or unplugging the fuel pump itself.
Test steps:
1. Connect the CarScope i-Tester power cable black crocodile clip to the battery negative (-) terminal and the red crocodile clip to the battery positive (+) terminal.
2. Getting a synchronization signal
GASOLINE engines:
- Use a high sensitive, high frequency current clamp:
Injector sync: Connect the current clamp to the "In2" input! Clamp one of the injector's wires with a 10-20A current clamp to get a synchronization signal. Injector current is usually about 1-2A. If you use the CA-60 current clamp, set it to 20A!
Primary ignition sync: Connect the current clamp to the "In2" input! Clamp one of the wires of the primary ignition coil with a 10-20A current clamp to get a synchronization signal. Primary current is usually about 7-9A.
Be careful, the clamp arrow matches the current direction! Incorrect connection will cause a lack of synchronization signal!
- Use an Inductive pick-up
Injector sync: Connect the Inductive pick-up to the "In2" input! Clamp one of the injector's wires to get a synchronization signal. Inductive pick-up output signal will be about 100mV.
Primary ignition sync: Connect the inductive pick-up to the "In2" input! Clamp one of the wires of the primary ignition coil to get a synchronization signal.
Be careful, the inductive pick-up arrow matches the current direction! Incorrect connection will cause a lack of synchronization signal!
DIESEL engines:
- Use a high sensitive, high frequency current clamp:

Relative Compression			
Voltage	Ext.Voltage		Cylinders: 4
A*	B	C	D
89%	64%	100%	94%
Save to file		RPM:216	

Note: Cylinder recognized as a synchronization cylinder is always A and it's marked with "*".
By knowing the injection sequence / firing order of the engine and the cylinder number used

for synchronization, you can identify the cylinder numbers and their percentages.
Example: (please see the picture above for reference)
Cylinders: 4
Firing order: 1-3-4-2
Sync. Cylinder: 3
A* - 3: 89%
B - 4: 64%
C - 2: 100%
D - 1: 94%

Return to

DC Voltage Sync in15

DC Voltage method – Sync from "in15"
This method is used to verify that all cylinders have equal compression. Results from this test allow cylinder identification.
The principle of this test is based on tracking the battery voltage changes during cranking to determine the compression values of all cylinders.
Important note:

Caution	Before performing this test, you must disable the fuel system to prevent the engine from starting. This can be done by removing the fuel pump fuse, relay or unplugging the fuel pump itself.

Test steps:
1. Connect the CarScope i-Tester power cable black crocodile clip to the battery negative (-) terminal and the red crocodile clip to the battery positive (+) terminal.
2. Getting a synchronization signal
GASOLINE engines - we recommend 2 main triggering methods:
- Use an inductive pick-up:
Connect the inductive pick-up to the "In15" input and clamp it on any cylinder's high-tension wire. If the vehicle uses the "coil-on-plug" ignition system, use a "Coil on Plug Extension Lead" and clamp the Inductive pick-up on it.
Be careful, the inductive pick-up arrow matches the current direction. Incorrect connection will cause a lack of synchronization signal!
- Use the main signal cable with a BNC connector to a 4mm red banana plug to get an injector voltage signal:
Capture voltage signal from one of the injector's wires and supply it to the "In15" input.
- Use the main signal cable with a BNC connector to a 4mm red banana plug and 10:1 attenuator to get a Primary ignition voltage signal:
Capture voltage signal from one of the primary ignition coil wires and supply it to the "In15" input.
DIESEL Common Rail engines:
- Use an inductive pick-up:
Connect the inductive pick-up to the "In15" input and clamp it to one of the injector's wires to get a synchronization signal. Fuel system must be disabled by disconnecting the rail pressure valve and connecting another valve to the vehicle's electrics to simulate its presence!

If you don't do this, you will not get an injector signal!
- Use the main signal cable with a BNC connector to a 4mm red banana plug to get an injector voltage signal:
Capture voltage signal from one of the injector's wires and supply it to the "In15" input.
3. Select the number of cylinders of the engine you are testing, using the ▲ and▼ keypad buttons.
4. Select the Start button using ◄ and ► keypad buttons.
5. Press the OK keypad button to start the test.
6. Follow the instructions shown on the CarScope i-Tester display.
Note: You may cancel the test process at any time by pressing the Back or Home keypad buttons.
7. After the test process completed the results will be shown on the CarScope i-Tester display.

Relative Compression			
Current	Low Amp. Clamp		Cylinders: 4
A*	B	C	D
89%	64%	100%	94%
Save to file			RPM:216

Note: Cylinder recognized as a synchronization cylinder is always A and it's marked with "*".
By knowing the injection sequence / firing order of the engine and the cylinder number used for synchronization, you can identify the cylinder numbers and their percentages.
Example:
(see the picture above for a reference)
Cylinders: 4
Firing order: 1-3-4-2
Sync. cylinder: 3
A* - 3 : 89%
B - 4 : 64%
C - 2 : 100%
D - 1 : 94%

Return to Contents

DC Current Sync in15

DC Current method with sync from "in15"
This method is used to verify that all cylinders have equal compression. Results from this test allow exact cylinder identification.
Test is based on tracking the starter motor current changes during cranking to determine the compression values of all cylinders.
Important note:
Before performing this test, you must disable the fuel system to prevent the engine from

starting. This can be done by removing the fuel pump fuse, relay or disconnecting the fuel pump itself.

Test steps:

1. Connect the CarScope i-Tester power cable black crocodile clip to the battery negative (-) terminal and the red crocodile clip, to the battery positive (+) terminal.

2. Connect the CA-600 AC/DC current clamp to the i-Tester "In 2" BNC connector and clamp it on the wire that connects the battery to the starter motor.

Be careful, the clamp arrow (points to the battery positive +) matches the current direction! In case of wrong current clamp connection, you will not able to perform this test at all!

Note: CA-600A probe is supplied with a 4 mm banana plug type connectors so it cannot be plugged directly to the CarScope i-Tester. A banana plug to BNC adapter must be used for this purpose.

3. Getting a synchronization signal

GASOLINE engines:

- Use an inductive pick-up for Secondary ignition signal:

Connect the inductive pick-up to the "In15" input and clamp it on any cylinder's high-tension wire. If the vehicle uses the "coil-on-plug" ignition system, use a "Coil on Pug Extension Lead" and clamp the Inductive pick-up on it.

Be careful, the inductive pick-up arrow matches the current direction. Incorrect connection will cause a lack of synchronization signal!

- Use an inductive pick-up for Primary ignition signal:

Connect the inductive pick-up to the "In15" input and clamp it on one of the primary ignition coil wires.

Be careful, the inductive pick-up arrow matches the current direction. Incorrect connection will cause a lack of synchronization signal!

- Use the main signal cable with a BNC connector to a 4mm red banana plug to get an injector voltage signal:

Capture voltage signal from one of the injector's wires and supply it to the "In15" input.

Relative Compression			
Current	Ext. Voltage		Cylinders: 4
A*	B	C	D
89%	64%	100%	94%
	Save to file		RPM:216

Note: Cylinder recognized as a synchronization cylinder is always A and it is marked with "*".

By knowing the injection sequence (firing order) of the engine being tested and the cylinder number that you are using for synchronization, you will be able to identify exact cylinder numbers and their percentages.

Example:

(Please see the picture above for reference)
Cylinders: 4
Firing order: 1-3-4-2
Sync. cylinder: 3
A* - 3: 89%
B - 4: 64%
C - 2: 100%
D - 1: 94%

Return to

Troubleshooting – relative compression test

Waveform Analysis ERROR code 001 - Very low average amplitude. (Peak to peak)

Possible causes:
- Poor (unstable) cable connections.
  - In case you are using the DC Voltage method for this test:
- CarScope i-Tester power cable is not properly connected.
- Please ensure the CarScope i-Tester power cable is connected properly (stable) to the
- vehicle battery.
  - In case you are using the DC Current method for this test:
- CarScope i-Tester "in2" input is not connected properly.
  - Please ensure the CarScope i-Tester "in2" input is connected properly to the current clamp / inductive pick-up and ensure the clamp arrow matches the current direction.
- Too short engine cranking time.
  - Please repeat the test with cranking time according to instructions on the CarScope i-Tester display during the test.
- Bad electrical connection or damaged starter motor.
  - Please check the electrical connections and the starter motor status.
  - Damaged or discharged battery.
- Please check the battery status.

Waveform Analysis ERROR code 002 - Insufficient stable cylinder cycles captured.

This error is displayed in case there are not enough stable cylinder cycles captured.
- This error is most likely due to:
  - Too short engine cranking time.
- Please repeat the test with cranking time according to instructions on CarScope i-Tester display during the test.
- Bad electrical connection or damaged starter motor.
  - Please check the electrical connections and the starter motor status.
- Damaged or discharged battery.
  - Please check the battery status.
- Entered number of cylinders, does not correspond to the tested engine.
  - Please check the correct number of cylinders.
- Cranking RPM's too low or too high.
  - Please ensure the cranking RPM's are in the range from 150 to 400 RPM.

Waveform Analysis ERROR code 003 – Cranking RPM's are too low.

This error is most likely due to:
- Bad electrical connection or damaged starter motor.
    - Please check the electrical connections and the starter motor status.
- Damaged or discharged battery.
    - Please check the battery status.
- Entered number of cylinders, does not correspond to the tested engine.
    - Please check the correct number of cylinders.
- In case of a missing compression in every even or every odd cylinder, for example:
    - 1st Cyl no compression, 2nd Cyl is with compression, 3td Cyl no compression, 4th Cyl is with compression…
    - 1st Cyl is with compression, 2nd Cyl no compression, 3td Cyl is with compression, 4th Cyl no compression…
- In this special case the analysis cannot be performed.

Return to

Waveform Analysis WARNING code 01 – Higher number of cylinders with relative low pressure than those with relative high pressure.

This warning message is displayed in case the cylinders with relative low pressure are more than those with relative high pressure.
This warning is most likely due to:
- Exhaust valves on one or more cylinders are permanently closed.
    - Please use another cylinder compression test method to confirm or ignore.
- Bad electrical connection or damaged starter motor.
    - Please check the electrical connections and the starter motor status.
- Damaged or discharged battery.
    - Please check the battery status.
- Entered number of cylinders, does not correspond to the tested engine.
    - Please check the correct number of cylinders.

Waveform Analysis WARNING code 02 - Synchronization signal used for cylinder ID is missing or out of range.

This warning is most likely due to:
- Improper cylinder synchronization signal polarity.
    - In case you are using the main signal cable with a BNC connector to a 4mm red banana plug, please ensure the signal is with positive polarity towards ground;
- In case you are using a Low amperage current clamp for cylinder synchronization signal, please ensure the Current clamp is connected with right direction to the "in2" input and ensure the clamp arrow matches the current direction;
    - In case you are using an Inductive pick-up for cylinder synchronization signal, please ensure the Inductive pick-up is connected with right direction to the "in15" input and ensure the arrow matches the current direction.
- Low amplitude of the cylinder synchronization signal.
    - In case you are using the "in15" input, please ensure the signal has an amplitude of at least 1.5V;

- In case you are using the "in2" input, please ensure the signal has an amplitude of at least 0.12V (120mV).
- Entered number of cylinders, does not correspond to the tested engine.
    - Please check the correct number of cylinders.
- Too short cylinder synchronization signal.
    - Please ensure the pulse time of cylinder synchronization signal is more than 1mSec (0.001 sec).

Waveform Analysis **WARNING code 03** - Synchronization signal used for cylinder ID is unstable.

This warning message is displayed in case the synchronization signal used for cylinder identification is not stable.
This warning is most likely due to:
- Unstable amplitude of the cylinder synchronization signal.
    - In case you are using the "in15" input, please ensure the signal has an amplitude of at least 1.5V;
- In case you are using the "in2" input, please ensure the signal has an amplitude of at least 0.12V (120mV).
- Entered number of cylinders, does not correspond to the tested engine.
    - Please check the correct number of cylinders.
- Some pulses of the cylinder synchronization signal are too short.
    - Please ensure the pulses of cylinder synchronization signal are longer than 1mS (0.001 sec).

Return to Contents

COMMON RAIL PRESSURE TEST MODE

Caution	This function is available since firmware version TT0106B!

Description, advantages and application
This mode is used for fast verification of the condition of the diesel Common Rail high pressure system. Results allow direct/indirect identification of common problems in this
system – lack of pressure due to leaks, high-pressure pump failure, bad high-pressure sensor, no sensor power supply etc.
The principle of this test is based on checking the high-pressure sensor readings while the car is in various operation states: ignition on, cranking, idling and accelerating.
Checking the high-pressure sensor readings is the fastest, simplest way to find a problem in the Common Rail system.
Great advantage of this test is that it is very easy to perform – only one wire hooked to the high-pressure sensor output.

Test steps:
1. Connect the CarScope i-Tester power cable black crocodile clip to the battery negative (-) terminal and the red crocodile clip to the battery positive (+) terminal.
2. Connect a "BNC to 4mm red banana" cable to the "in15" input and insert a needle probe in the 4mm banana.

3. Back probe the output of the high-pressure sensor which usually is the center pin.
Note: On some Delphi and Siemens high-pressure sensors, output pin is not the center pin!
To find it, use a multimeter, back probe each sensor pin to find the ground, +5V and signal output pins! Do not disconnect the high-pressure sensor connector during back probing sensor pins!
4. Choose "Rail Pressure" from the home screen and select your preferable pressure measurement unit. MPa is default but you can change it by entering the Unit submenu and pick "bar" or "PSI".
5. Select "P threshold" if you need to change the pressure threshold when the engine starts. According to our research during development, the most versatile default value is 185MPa. If you are experiencing problems with your particular system, you can choose between 180 and 200MPa. Pressing returns the default value - 185MPa.
6. Select the vehicle's fuel system type: Bosch, Delphi, Siemens, Denso using the ▲and▼ keypad buttons.
Note: To find fuel system type, see the technical documentation of your car or labels on the high-pressure pump, high-pressure sensor, injectors etc.
7. Select the high-pressure sensor pressure range, using the ▲and▼ keypad buttons
8. Switch the ignition ON and wait for sensor test to complete. You do not need to press the "OK" button in this step!
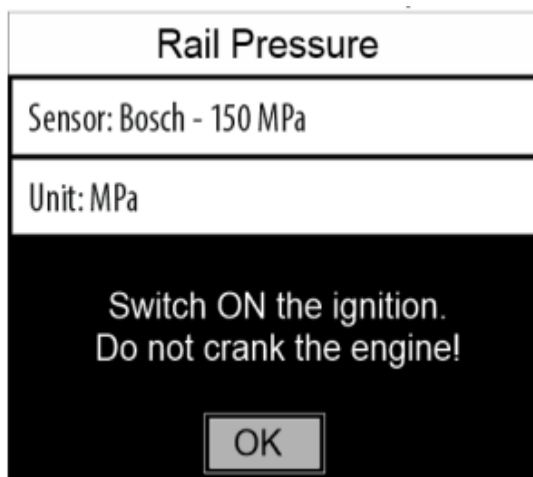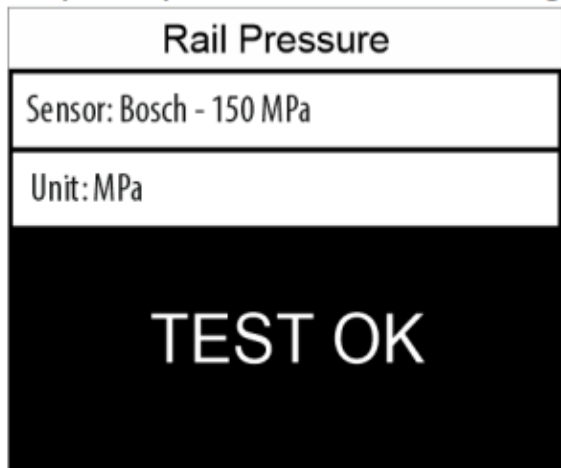
Rail Pressure	Note: If you select wrong pressure range, displayed pressure will not be the actual rail pressure! For most engines, when the engine is idling pressure is about 25-30MPa!
Sensor: Bosch - 150 MPa	
Unit: MPa	
Switch ON the ignition. Do not crank the engine! OK	Note: If no response within 5-10 seconds, please check the electrical contact between the high-pressure sensor and the needle probe!

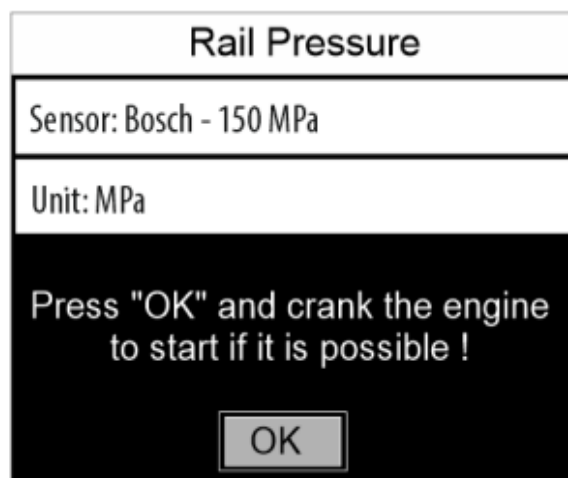| Caution	If you receive an error or warning message, see the list of warnings/errors below for more details

9. You will see the "TEST OK" message for just a second if everything is ok and then you will

be prompted to start cranking the engine. See point 10.

Rail Pressure

Sensor: Bosch - 150 MPa

Unit: MPa

TEST OK

10. Press the "OK" button and start cranking the engine.

Rail Pressure

Sensor: Bosch - 150 MPa

Unit: MPa

Press "OK" and crank the engine
to start if it is possible !

OK

11. You will get this screen with warning "Not cranking/No pressure/Failure" which is normal. Warning should disappear when the pressure rises.

Rail Pressure

Sensor: Bosch - 150 MPa

Unit: MPa

State: Not cranking/No pressure/Failure

P = 1.7 MPa
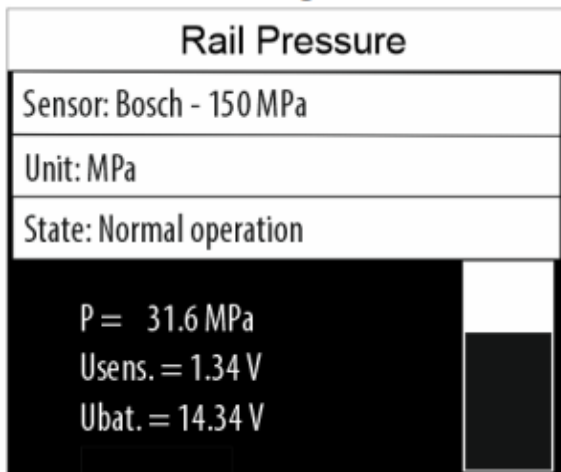Usens. = 0.55 V
Ubat. = 12.60 V
Sout: OFF
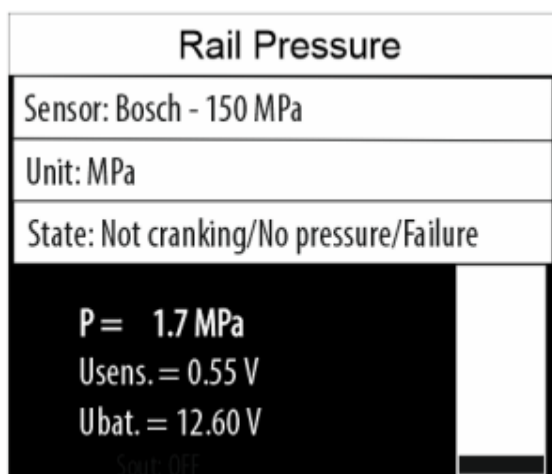
Note: You may receive errors/warnings in this step, which will guide you to find the issue with the system. See the list of warnings/errors below for more details.

Note: You may cancel the test process at any time by pressing the "BACK" or "HOME" buttons.

You can see the actual pressure as well as sensor and battery voltages during cranking. If the engine cannot start, you could directly/indirectly find the reason for that.

12. After the engine start and if everything is ok, the screen will change:

Rail Pressure

Sensor: Bosch - 150 MPa	
Unit: MPa	
State: Normal operation	

P =   31.6 MPa
Usens. = 1.34 V
Ubat. = 14.34 V

Common rail test mode - Warnings during test

Ignition on or sensor failure

If Ignition is ON and you start a sensor test this warning will appear.

Rail Pressure

Sensor: Bosch - 150 MPa
Unit: MPa
Ignition is On or sensor failure

Switch OFF the ignition.

OK
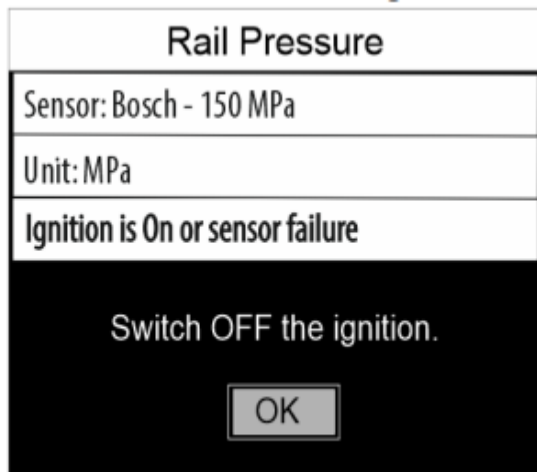
Note: On some cars when you switch OFF the ignition it takes up to 1 minute for the sensor voltage to drop down to zero! You may have to wait until that happens and repeat the test!

Solution: Switch the ignition OFF, (wait) and repeat the test.

Not cranking / No pressure / Failure

This warning is normal and will appear every time after pressing "OK" and before cranking the engine. Other possible reason could be if you are cranking the engine but there is no fuel pressure in the system due to a failure - fuel leaks, bad high-pressure pump and etc.

Insufficient pressure for start

This warning message appears if the engine is cranking but cannot exceed the selected "P threshold" value. You could lower this value and repeat the test again. Default is 185 MPa but you can vary between 180MPa and 200MPa.
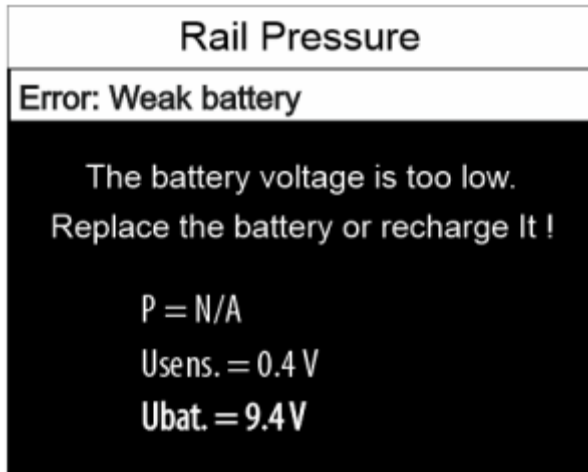

Note: Pressing returns the default value - 185MPa

## Common rail test mode – Errors during test

Error – Weak battery

If the car battery voltage is below 10.5V when you start the test, this error message will appear:

Rail Pressure

Error: Weak battery

The battery voltage is too low.
Replace the battery or recharge It !

$P = N/A$
$U_{sens.} = 0.4\,V$
$U_{bat.} = 9.4\,V$

Solution: Recharge or replace the battery!

Error - Ignition off or sensor failure

If Ignition is OFF but the sensor voltage is over 0.1V, this error will appear. It means that something it is wrong with the sensor itself because in this state sensor voltage should be 0V.

Rail Pressure

Error: Ignition off or Sensor failure

The sensor voltage is too low.
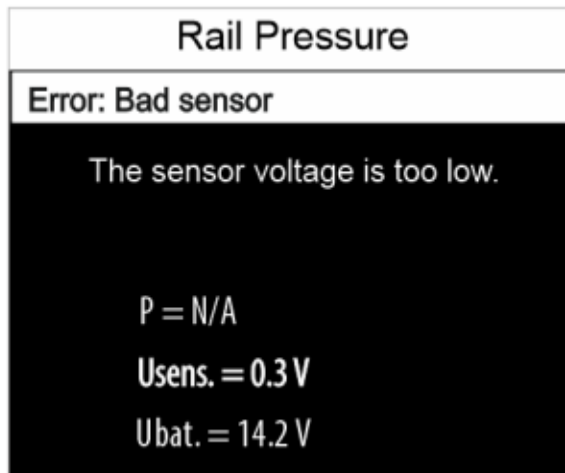
$P = N/A$
$U_{sens.} = 0.3\,V$
$U_{bat.} = 14.2\,V$
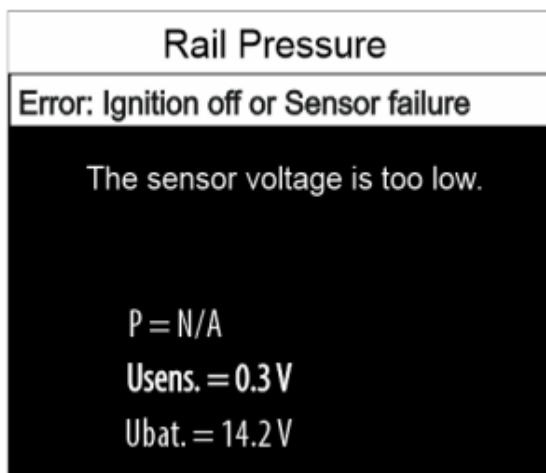
Note: On some cars it may take up to 1 minute after the last ignition on/engine start for this voltage to drop down to zero!

Solution:
- Wait some time and try again;
- If the same error appears, check the vehicle electrical wiring;
- Replace the high-pressure sensor.

Error - Bad sensor

If Ignition is ON but the sensor voltage is too low, this error message will appear.

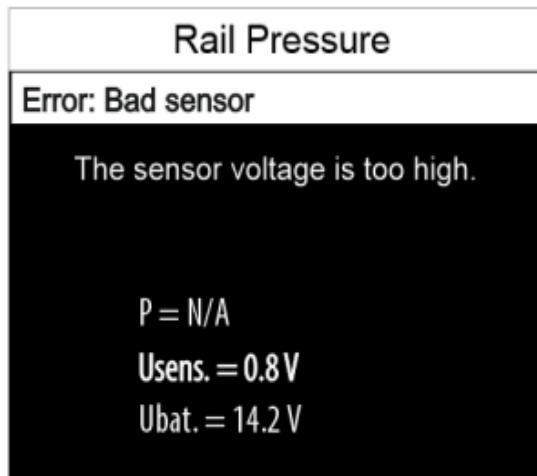| Rail Pressure	Note: Bosch, Delphi and Siemens sensors have around 0.5V at their output at zero pressure!
Error: Bad sensor	
The sensor voltage is too low. P = N/A Usens. = 0.3 V Ubat. = 14.2 V	Denso sensors have about 1V at zero pressure!

Solution:
- Check the sensor supply voltage – it should be around 5V.
- Check the sensor connection to ground and the vehicle electrical wiring!
- If none of the above-mentioned helps, replace the high-pressure sensor!

Error – Bad sensor

If Ignition is ON but the sensor voltage is too high, this error message will appear.

Rail Pressure	Note: Bosch, Delphi and Siemens sensors have around 0.5V at their output at zero pressure!
Error: Bad sensor	
The sensor voltage is too high. P = N/A Usens. = 0.8 V Ubat. = 14.2 V	Denso sensors have about 1V at zero pressure!

Solution:
- Wait for a while if there is some pressure left in the system to drop down;
- Check the sensor supply voltage – it should be around 5V;
- Check the sensor connection to ground and the vehicle electrical wiring!
- If none of the above mentioned helps, replace the high-pressure sensor!

Error - Weak battery

If during cranking the battery voltage drops below 9.5V, this error message will appear.

Rail Pressure

Error: Weak battery

The battery voltage is too low.
Replace the battery or recharge It !

$P = N/A$
$Usens. = 0.4\,V$
$Ubat. = 9.8\,V$

Note: It is possible that you have a bad starter motor, which consumes too much current when cranking the engine!

Solution: Recharge or replace the battery!

Error – Ignition off or sensor failure

If during cranking, sensor output voltage drops below a predefined value, this error will appear.

Rail Pressure

Error: Ignition off or Sensor failure

The sensor voltage is too low.

$P = N/A$
$Usens. = 0.3\,V$
$Ubat. = 14.2\,V$

Note: Bosch, Delphi and Siemens sensors have around 0.5V at their output at zero pressure!

Denso sensors have about 1V at zero pressure!

Solution:
- Check the ignition status - you should be in ignition ON state at this time;
- Check for sensor failure;
- Check the sensor supply and ground connections;
- Check vehicle electrical wiring.

Error – Sensor failure

If during cranking or engine running, sensor output voltage exceeds a predefined value, this error will appear.

| Rail Pressure |
| Error: Sensor failure |
| The sensor voltage is too high. |

$P = N/A$

$U_{sens.} = 4.8\,V$

$U_{bat.} = 14.2\,V$

Note: Bosch, Delphi and Siemens sensors have around 4.5V at their output at maximum pressure! Denso sensors have about 4V at maximum pressure!

Solution:
- Check for sensor failure;
- Check the sensor supply and ground connections;
- Check vehicle electrical wiring.

Error – Engine starting problem

If cranking lasts too long (more than 6 seconds) and the engine cannot start, this error message will appear.

| Rail Pressure |
| Sensor: Bosch - 150 MPa |
| Unit: MPa |
| Error: Engine starting problem |

$P = 24\,MPa$

$U_{sens.} = 1.0\,V$

$U_{bat.} = 10.7\,V$

Note: On some cars even if the engine is running, battery-charging circuit still does not operate. If this time exceeds those 6 seconds, this error will appear!

Solution:
- Check what is preventing the engine from starting;
- Check for fuel leaks that does not allow the engine to start;
- Check the battery charging circuit operation.

Return to Contents

VOLTMETER MODE
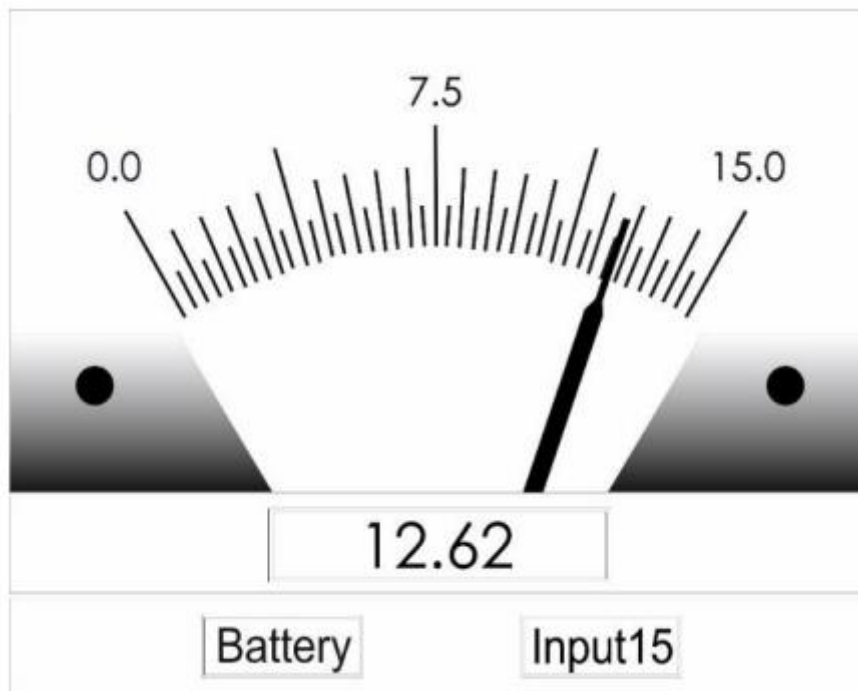
There are 2 possible configurations in this mode:
- Measure the car battery voltage with the power supply cable via the dual purpose input;
- If you use the in15 input, you can use the i-Tester as a standard voltmeter with a ground respective to the power supply ground (at the Dual purpose input).

UPDATING - Firmware update procedure

1. Download the firmware package to your computer.
2. Unzip the archive to your computer.
3. Turn i-Tester power off and unplug the micro-SD card from the device.
4. Plug i-Tester SD card to your computer (or USB card reader).
5. Copy the TTxxxxx.SUF file from your computer to i-Tester SD card in folder as follows:
SD card:/ITESTER/FWUPDATE/TTxxxxx.SUF
A warning message "Are you sure you want to copy this file without its properties" could appear once or several times. Just click "Yes" on each message and copying will continue. Texts on images below are exemplary and may be different on your computer!
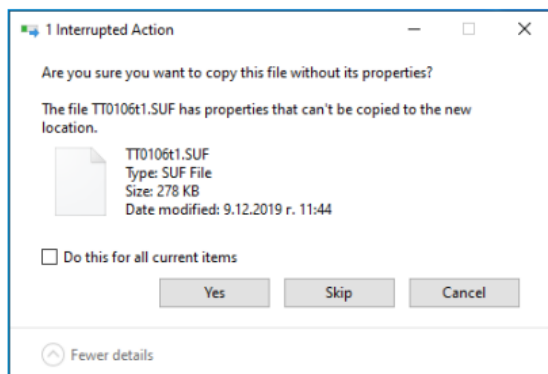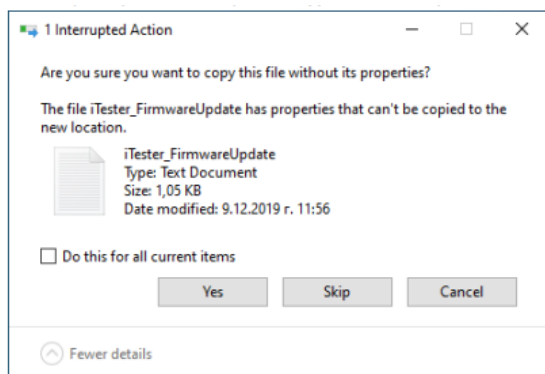
6. Copy the HELP folder from the archive to the SD card, replacing the folder with the same name in the following path:

SD card:/ITESTER/

Confirm replacement of all existing files in the micro-SD card HELP folder

7. Unplug i-Tester SD card from your computer and put it in i-Tester.

8. Turn i-Tester Power On

9. From the home screen choose "Settings" and select "Firmware update"

10. Select and confirm "TTxxxxx.SUF" file name.

11. Warning message will appear Do you want to continue? Select and confirm "YES".

12. A series of messages will appear on the screen that will inform you about firmware update process status. The whole process will take few seconds.

Return to

Optional accessories

Current clamps

ET0102-03 CARSCOPE AC / DC CURRENT CLAMP 600A

ET0102-02 CARSCOPE AC / DC CURRENT CLAMP 10 MA - 60A

Cylinder pickup

ET0102-01 CARSCOPE #1 CYLINDER PICK UP CLAMP

Return to

For further inquires, please contact Endeavour Tools on:

PH: 03 9753 3800 Email us at sales@endeavourtools.com.au