

# CarScope i-Tester

## User's manual

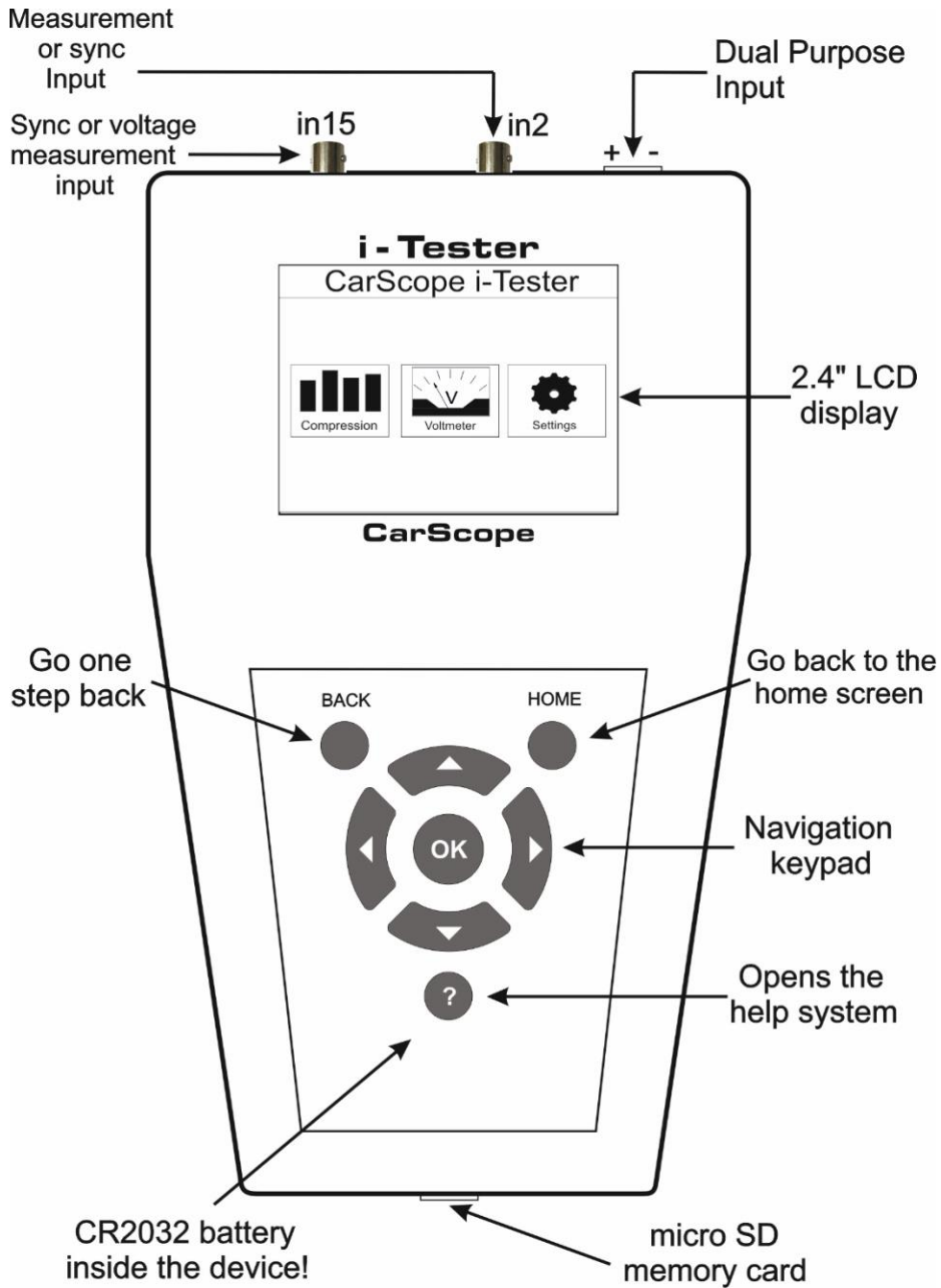
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**Important note:** Because of lithium-ion battery shipping restrictions, we do not include CR2032 lithium-ion battery inside in the post packages! When you receive the tester, you have to buy a Li-Ion battery type CR2032 yourself and put it into battery holder socket inside the CarScope i-Tester. To do so, you should unscrew and remove four screws to open the bottom cover. We apologize for the inconvenience!

### 1. Introduction and appearance

CarScope i-Tester is a portable engine test tool and essentially a specialised type of engine analyser. It is a complex, multi-function tool, which can help diagnose the engine and finding engine problems. The i-Tester can be used with both 12V petrol and diesel powered vehicles. Currently, CarScope i-Tester's main function is relative compression testing but several automated diagnostic tests are upcoming with future firmware updates! Oscilloscope knowledge skills are not needed. You can skip the training and set-up time of an ordinary oscilloscope and get directly to a quick, precise engine analysis.



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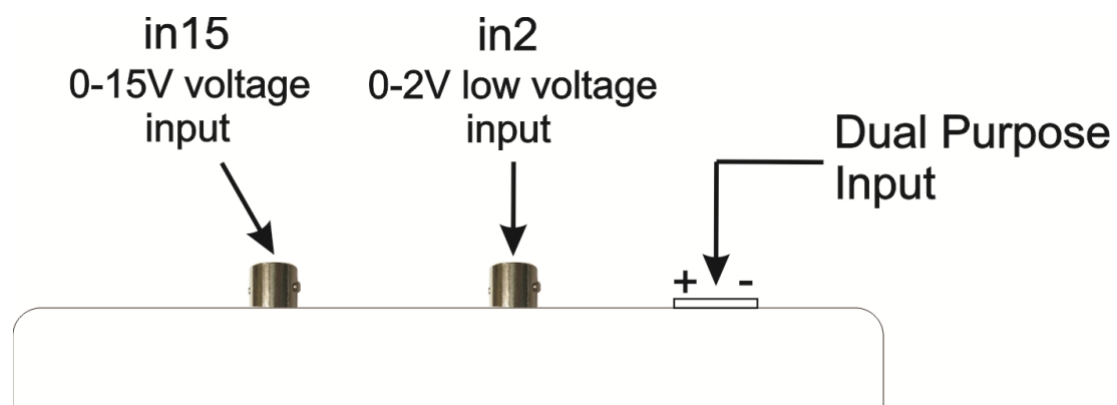
## 2. Features

- 2.4" TFT LCD 320x240;
- no external power adapter needed;
- 3 Channel — 3 measurement channels provide the ability to use a variety of voltage and current probes at the same time;
- Protection against reverse polarity connection;
- The Relative Compression mode helps you quickly find a low compression cylinder;
- Relative compression test function and automatic waveform analysis;
- Ultra fast boot time;
- Simple to use and connect, easy to use keyboard;
- Internal Micro SD card to save and review measurements;
- Works on 4 stroke, diesel and petrol engines;
- Works on 3, 4, 5, 6, 8, 10, 12-cylinder cars;
- Works on DIS, conventional and Coil-on-Plug ignition systems;
- Only 12V electrical systems supported;
- Excellent industrial design.

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## 3. Inputs and connectors

**Warning:** All inputs have a common ground respective to the power supply ground at the Dual-purpose input!



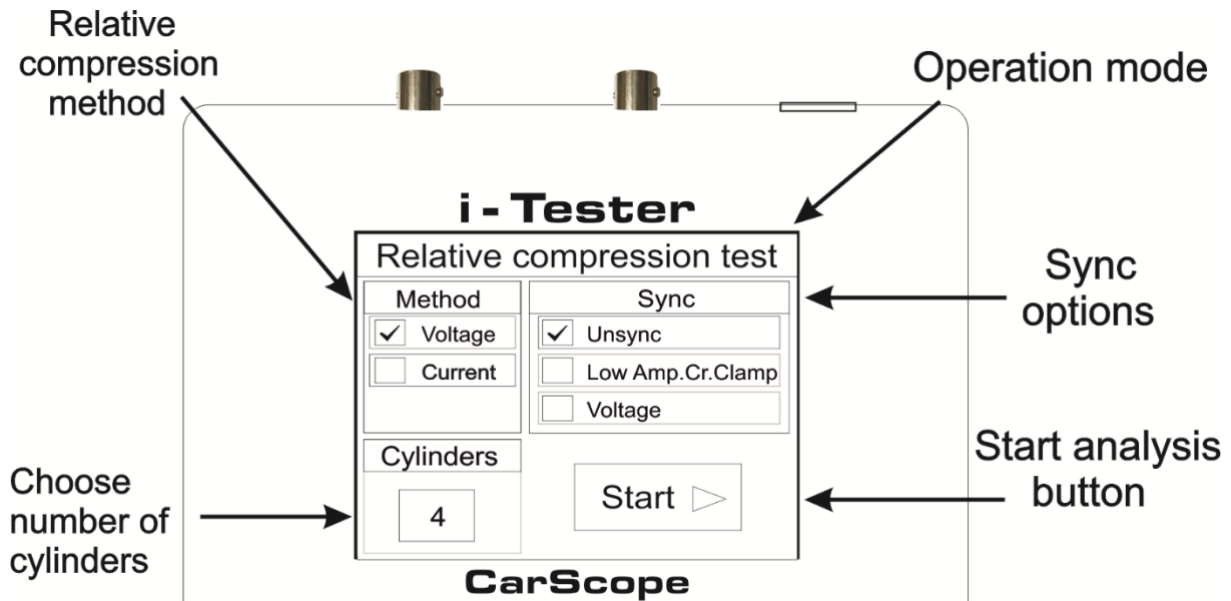
CarScope iTester has 3 measurement inputs:

1. **Dual purpose input:** power supply terminal block connector with an additional function.
  - This input is used always when we want to measure the relative compression by DC Voltage method. If you don't want cylinder synchronisation, you don't have to use any other inputs.
2. **"in15"** – from 0 to 15V voltage input with a BNC connector.
  - Used for an external synchronisation from:
    - an Inductive pick-up;
    - any petrol solenoid injector, to get voltage signal.
3. **"in2"** – 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 petrol high impedance (saturated) injectors with an inductive pick-up clamp.

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#### 4. Mode "Relative Compression"



##### 4.1. Description and advantages

###### **Description**

This test is only a comparison between cylinders so we can use this method to "see" if we have a cylinder (s) with low compression by comparing one cylinder to the next. Hence the term "relative".

Relative compression is the fastest, simplest way to find a low compression cylinder. This test has previously been available only on large and expensive diagnostic systems, requiring a laptop and an oscilloscope. Now it is easier than ever — with the new CarScope i-Tester that combines both functions - relative compression test and automatic waveform analysis. So, the final results are displayed in an easy to understand format.

You do not have to check each individual cylinder, all cylinders can be tested in one go. CarScope i-Tester works on 3, 4, 5, 6, 8, 10, 12-cylinder cars, 4 stroke, diesel and petrol engines, DIS, conventional and Coil-on-Plug systems, and 12V electrical systems.

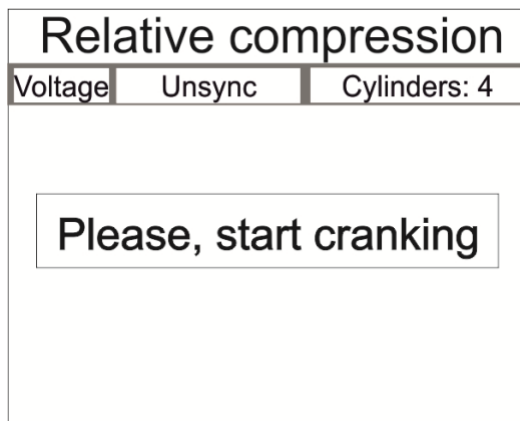
Note: This test cannot be performed on rotary (Wankel) engines!

###### **Advantages**

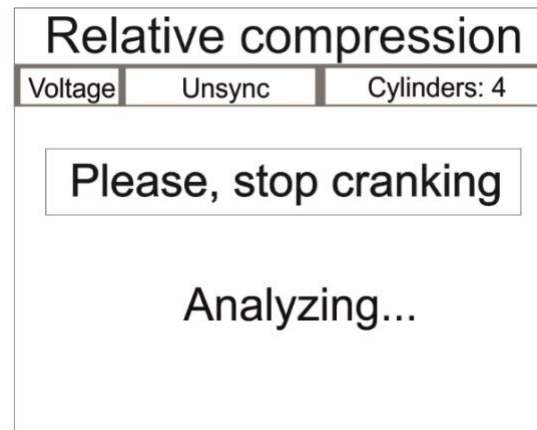
- Non-invasive test;
- Test completes within seconds;
- You do not need a pressure transducer to run the relative compression test;

- No mechanical work needed. No removal of spark plugs, glow plugs, or injectors, thus preventing accidental damage to the customer's engine components. All you have to do is to disable the fuel system to prevent the engine from starting;
- Disabling fuel system is always better because you are not flooding your cylinders;
- No oscilloscope needed;
- Reduced skill level required and thus achieve rapid testing;
- No waveform analysis skills needed;
- Test based on scientifically grounded theory;
- Test proven in the practice for many years;
- Useful tool in the parking lot type situation instead of dragging a scope/laptop around;
- No current clamp needed, in case the DC voltage method is used.

When you select and press the Start button, you will be prompted to start cranking:



Keep cranking the engine until the following appear:



The above is valid for all tests below!

## 4.2. Application

Reasons to perform a relative compression test using i-Tester.

Compression test has to be performed when the engine symptoms are as follows:

- engine misfiring;
- rough idle;
- loss of power over time;
- unexplained loss of power;
- smoke from the exhaust;
- puffing noise in induction or exhaust.

Checking the engine health in cases as follows:

- In case of buying a used car;
- Before ECU remapping to evaluate engine status;
- Periodic prevention check;
- In cases where it is very hard to gain access to the spark plugs in order to perform a traditional compression test.

### 4.3. "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 synchronisation signal.

The principle of this test is based on tracking 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 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 is completed the results will be shown on the CarScope iTester display.

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

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#### 4.4. "DC Current Unsync"

##### **DC Current method - No synchronization (Unsync)**

*This is the most commonly used method for relative compression measurement. No additional cables and accessories are needed!*

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.

##### **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 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 is 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

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#### 4.5. Cylinder synchronization and accessories needed for synchronization

##### **Cylinder synchronisation**

By hooking up a second probe to either the ignition 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 synchronisation signal (trigger pickup)  
 - a main signal cable with a BNC connector to a 4mm red banana plug (included in the basic set)

- an inductive pick-up (optional, it is not in the basic set)

- a high sensitive, high frequency current clamp. We recommend current clamps with transformation ratio at least 1-2V at 10A and frequency response 500Hz minimum. Current clamps designed for 50-60Hz mains supply will not work! (optional, it is 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 synchronisation from:

- Primary ignition;
  - Petrol injectors;
  - Diesel injectors.
- An Inductive pick-up (optional, it is not in the basic set)

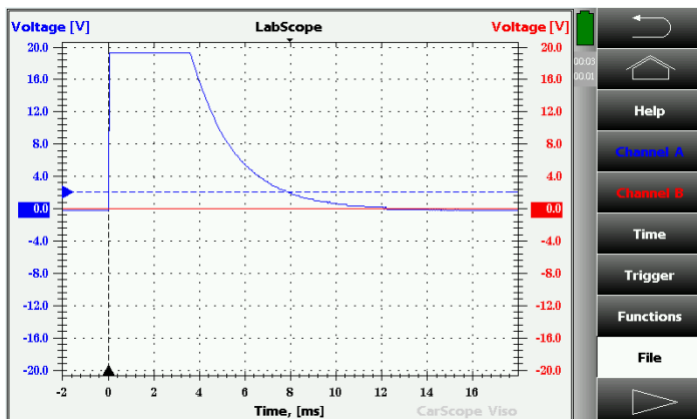


There are various inductive probes for sale, but to achieve a stable synchronization with the iTester, we will clarify here the minimum parameter values:

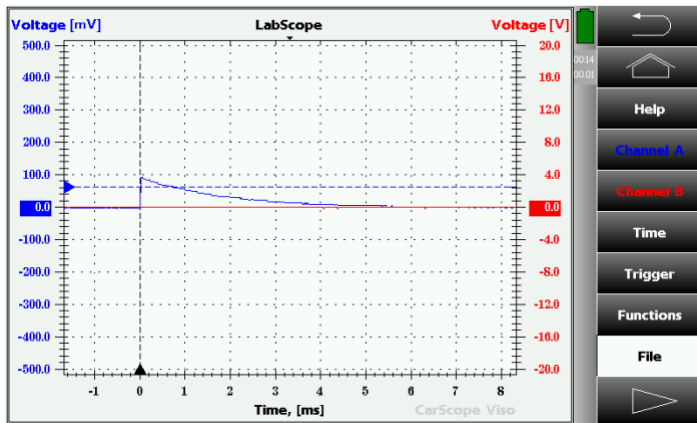
- The output signal of the Inductive pick-up should have an amplitude of at least 120mV (0.12V) when connected to the "in2" input;
- The output signal of the Inductive pick-up should have an amplitude of at least 1.5V when connected to the "in15" input;
- Pulse width (pulse duration) of the Inductive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

With this probe, you can get synchronization from:

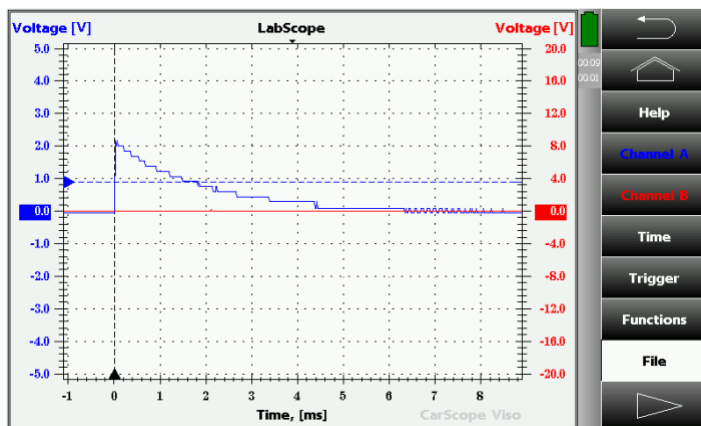
- Primary ignition - signal from primary ignition "coil-on-plug"



- Secondary ignition;
- Gasoline high impedance injector (saturated) - signal from a high impedance (saturated) gasoline injector.



- 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, it is not in the basic set).



With current clamps, you can get synchronization from:

- Primary ignition;
- Petrol injectors;
- Diesel injectors.

- 10:1 attenuator when capturing signal from the Primary ignition



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#### 4.6. Synchronization methods – gasoline and diesel engines

<b>Gasoline engines</b>			
<b>Test method</b>	<b>Sync input</b>	<b>Sync probes</b>	<b>Synchronization from</b>
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 10:1	Primary ignition (voltage)
	In15	Main signal cable	Injector (voltage)
	In2	10/20A High sensitive, high frequency current clamp	Injector (current)
	In2	Inductive pick-up	Injector (current) *
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 10:1	Primary ignition (voltage)
	In15	Main signal cable	Injector (voltage)

\* If the induced voltage is greater than 120mV

<b>Diesel engines</b>			
<b>Test method</b>	<b>Sync input</b>	<b>Sync probes</b>	<b>Synchronization from</b>
DC Voltage	In15	Inductive pick-up	Injector (current)
	In2	10/20A High sensitive, high frequency current clamp	Injector (current)
	In15	Main signal cable	Injector (voltage)
DC Current	In15	Inductive pick-up	Injector (current)
	In15	Main signal cable	Injector (voltage)

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## 4.7. "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 iTester 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

PETROL 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:

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 20A. If you use the CA-60 current clamp, set it to 20A!

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 button.

7. After the test process is completed the results will be shown on the CarScope iTester display.

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

Note: Cylinder recognised 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 synchronisation, 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%

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#### 4.8. "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 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 iTester power cable black crocodile clip to the battery negative (-) terminal and the red crocodile clip to the battery positive (+) terminal.

2. Getting a synchronisation signal

PETROL 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 synchronisation 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 iTester display.

Note: You may cancel the test process at any time by pressing the Back or Home keypad buttons.

7. After the test process is completed the results will be shown on the CarScope iTester 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 synchronisation 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 synchronisation, 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%

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## 4.9. "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 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 "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 be 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 iTester. A banana plug to BNC adapter must be used for this purpose.

3. Getting a synchronisation signal

PETROL 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 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 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.



- Use the main signal cable with a BNC connector to a 4mm red banana plug and 10:1 attenuator to get signal from the Primary ignition:

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 synchronisation 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.

4. Select the number of cylinders of the engine you are testing, using the ▲ and ▼ keypad buttons.

5. Select the Start button using ◀ and ▶ keypad buttons.

6. Press the OK keypad button to start the test.

7. Follow the instructions shown on the CarScope i-Tester display.

Note: You can cancel the test process at any time by pressing the Back or Home keypad buttons.

8. After the test process is completed, results will be shown on the CarScope i-Tester display.

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

Note: Cylinder recognised as a synchronisation 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 synchronisation, 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 - : 94%

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## 4.10. Errors during measurement

### ***Waveform Analysis Error code 001***

This error is displayed in case the captured waveform has a very low average amplitude, and the analysis cannot be performed.

This error is most likely due to:

1. Bad (unstable) cables connections.

1.1. In case you are using the DC Voltage method for this test:

CarScope iTester power cable is not properly connected.

Please ensure the CarScope iTester power cable is connected properly (stable) to the vehicle battery.

1.2. 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.

2. Too short engine cranking time.

Please repeat the test with cranking time according to instructions on the CarScope i-Tester display during the test.

3. Bad electrical connection or damaged starter motor.

Please check the electrical connections and the starter motor status.

4. Damaged or discharged battery.

Please check the battery status.

### ***Waveform Analysis Error code 002***

This error is displayed in case there are not enough stable cylinder cycles captured.

This error is most likely due to:

1. Too short engine cranking time.

Please repeat the test with cranking time according to instructions on CarScope i-Tester display during the test.

2. Bad electrical connection or damaged starter motor.

Please check the electrical connections and the starter motor status.

3. Damaged or discharged battery.

Please check the battery status.

4. Entered number of cylinders, does not correspond to the tested engine.

Please check the correct number of cylinders.

5. 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**

This error is displayed if cranking RPM's are too low.

This error is most likely due to:

1. Bad electrical connection or damaged starter motor.

Please check the electrical connections and the starter motor status.

2. Damaged or discharged battery.

Please check the battery status.

3. Entered number of cylinders, does not correspond to the tested engine.

Please check the correct number of cylinders.

4. In case of a missing compression in every even or every odd cylinder, for example:

4.1) 1st Cyl no compression, 2nd Cyl is with compression, 3rd Cyl no compression,  
4th Cyl is with compression...

4.2) 1st Cyl is with compression, 2nd Cyl no compression, 3rd Cyl is with compression,  
4th Cyl no compression...

In this special case the analysis cannot be performed.

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## 4.11. Warnings during measurement

**Waveform Analysis Warning code 01**

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:

1. Exhaust valves on one or more cylinders are permanently closed.

Please use another cylinder compression test method to confirm or ignore this doubt.

2. Bad electrical connection or damaged starter motor.

Please check the electrical connections and the starter motor status.

3. Damaged or discharged battery.

Please check the battery status.

4. Entered number of cylinders, does not correspond to the tested engine.

Please check the correct number of cylinders.

**Waveform Analysis Warning code 02**

This warning message is displayed in case the synchronisation signal used for cylinder identification is missing or not correct.

This warning is most likely due to:

1. 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 synchronisation 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 synchronisation signal, please ensure the Inductive pick-up is connected with right direction to the "in15" input and ensure the arrow matches the current direction.
2. Low amplitude of the cylinder synchronisation 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).
3. Entered number of cylinders, does not correspond to the tested engine.  
Please check the correct number of cylinders.
4. Too short cylinder synchronisation signal.  
Please ensure the pulse time of cylinder synchronisation signal is more than 1mSec (0.001 sec).

#### ***Waveform Analysis Warning code 03***

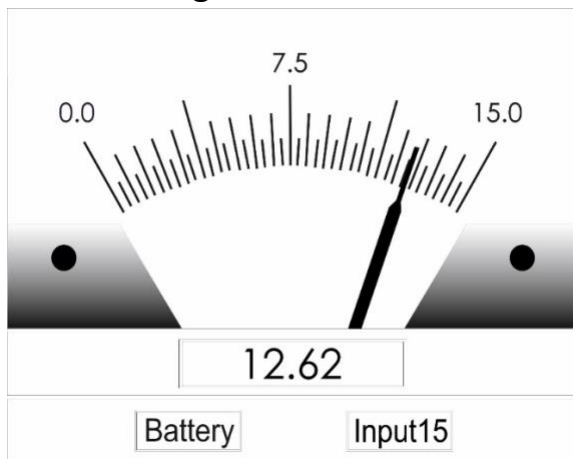
This warning message is displayed in case the synchronisation signal used for cylinder identification is not stable.

This warning is most likely due to:

1. Unstable amplitude of the cylinder synchronisation 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).
2. Entered number of cylinders, does not correspond to the tested engine.  
Please check the correct number of cylinders.
3. Some pulses of the cylinder synchronisation signal are too short.  
Please ensure the pulses of cylinder synchronisation signal are longer than 1mS (0.001 sec).

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## 5. Mode “Digital Voltmeter”



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).

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## 6. Settings

In this menu you can change the device language, set date & time, update the device firmware and see details about the device.

Settings
Language
Date & Time
Firmware Update
About device

[TOP](#)

## 7. Technical specifications

### 7.1. General Specifications

Functional on the following Engine Types:

Number of Cylinders	3, 4, 5, 6, 8, 10, 12
Engine Stroke	4 stroke
Fuel Types	Gasoline, Diesel
Ignition Systems	Conventional, DIS, Coil-on-Plug
Electrical System Voltage	12V

Power Supply	10V to 18V, 4 W typical
Relative Compression	0 to -100% contribution

**Display**

Type	TFT LCD Module
Size	2.4" diagonal
Resolution	320 x 240 pixels
Backlight	4chip white LED in Parallel
High Brightness	150 cd/m <sup>2</sup>

<b>Real time clock battery</b>	CR2032, 210 mA/h save time for up three years without external supply
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*Important note: Because of lithium-ion battery shipping restrictions, we do not include a CR2032 lithium-ion battery inside post packages. When you receive the tester, you have to buy a Li-Ion battery type CR2032 yourself and put it into battery holder socket inside the CarScope i-Tester. To do so, you should unscrew and remove four screws to open the bottom cover. We apologize for the inconvenience!*

<b>Included Memory Card</b>	4 GB micro SDHC
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[TOP](#)**7.2. Inputs****Dual purpose input**

//Power supply connector with an additional function//

Main purpose	Power Supply
Additional purpose	Supply voltage measurement
Frequency Response, -3 dB	DC to > 200 KHz
Coupling	DC
Input range	0 mV to 15 V
Input Overload Protection	± 200V DC+AC peak
Input Impedance	50 kOhm    20 pF
Vertical Resolution	12 bit (4096 levels)
DC Voltage Measurement Accuracy	± 5 mV Max Error

**IN15**

Frequency Response, -3 dB	DC to > 200 KHz
Coupling	DC
Input range	0 mV to 15 V
Input Overload Protection	±200V DC+AC peak
Input Impedance	50 kOhm    20 pF
Vertical Resolution	12 bit (4096 levels)
DC Voltage Measurement Accuracy	± 5 mV Max Error

**IN2**

Frequency Response, -3 dB	DC to > 200 KHz
Coupling	DC
Input range	0 mV to 2 V
Input Overload Protection	± 100V DC+AC peak
Input Impedance	100 kOhm    18 pF
Vertical Resolution	12 bit (4096 levels)
DC Voltage Measurement Accuracy	± 3 mV Max Error

[TOP](#)**7.3. Accessory Information**

Standard Accessories (included with your i-Tester)

***Shielded Test Lead***

Length	1.8 meters
Connector at i-Tester	BNC
Bandwidth	0 to 1.0 MHz
Test lead capacitance	170 pF
Voltage to ground	200V
Maximum input voltage	200V
Maximum current	2A
Maximum cable resistance	100 mohm
Operating temperature range	0 - 40 °C

***Power supply cable***

Description	Red/Black car battery crocodile clips to 2 pin terminal block plug
Total length	1.0 meter
Connector at i-Tester	Pluggable Terminal Block 5.0mm, 2 POS
Red/Black cables	Silicone jacketed highly flexible 0.75 mm <sup>2</sup> (18 AWG)
Operating temperature range	-20 °C to +120 °C

**Optional Accessories (abbreviated specifications)*****Inductive Pickup***

The inductive pick-up probe is used for synchronisation from primary/secondary ignition or injectors (gasoline or diesel).

Maximum RPM	12,000 RPM @ 4 stroke / 4 cylinder
Accuracy	10% of reading
Current range	0 to 10 amperes
Connector at i-Tester	BNC
Cable	RG58, shielded
Cable length	1.5 meters (5 feet)
Suitable spark plug lead diameter	9 mm. maximum

**10:1 Attenuator adapter**

The 10:1 voltage attenuator is used for synchronisation from injectors (petrol or diesel) or primary ignition.

Attenuation	10:1
Bandwidth	0 to 1.0 MHz
Input impedance	10 M
Input capacitance	27 pF
Maximum input	200V

**AC/DC Current Probe CA-600A**

The 600-ampere current clamp is ideal for use with CarScope i-Tester for performing relative compression tests.

The current clamp can measure up to 600 A (AC or DC). In use there is no need to break into the circuit or disturb the isolation as the opening jaws simply clamp around the current carrying conductor. No electrical contact is required.

Current ranges	2 to 600 A dc or ac peak
Rate Output	0 to 600mV (AC and DC) for 0 to 600A
Output	Coil cable with 4 mm banana plug
Captured Conductor Size:	30 mm maximum
Accuracy	0 to 400A, $\pm(2\% \text{ reading} + 2A)$ 400A to 500A, $\pm(3\% \text{ reading} + 2A)$
Low battery indicator	Red LED lightning
Operating environment	0°C to +50°C, at <70 % R.H.
Storage environment	-20°C to +60°C, 0...80 % R.H.
Battery type	9V DC, 6F22
Battery life	100 hors typical
Dimensions	178mm (H) × 70mm (W) × 33mm (D)
Weight	300g

**AC/DC Current Probe CA-60A**

Current ranges	0.01 to 20 A dc or ac peak 0.2 to 60 A dc or ac peak
Output	Coil cable with 4 mm banana plug
Jaws Opening Capability	Max 9mm conductor
Accuracy	2% to 3.5% (range dependent)
Low battery indicator	Red LED lightning
Operating environment	0°C to +50°C, at <70 % R.H.
Storage environment	-20°C to +60°C, 0...80 % R.H.
Battery type	9V DC, 6F22
Battery life	100 hors typical
Size	195mm X 70mm X 33mm
Weight	250g



**Car Cigarette Lighter cable**

You can use this cable to power the device from the cigarette lighter. This allows you to sit inside the car while performing the relative compression test.

**WARNING:**

**ALL INPUTS HAVE A COMMON GROUND RESPECTIVE TO THE POWER SUPPLY GROUND AT THE DUAL PURPOSE INPUT! WHEN USING A POWER SUPPLY THAT IS NOT DOUBLE INSULATED, CONNECT COMMON TO PROTECTIVE GROUNDING!**

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