

## Errors that users may get when working with USB Autoscope

### Contents

|  |          |
|--|----------|
| <b>1. Common errors</b> .....  | <b>3</b> |
| 1.1 How to issue a notification to the developers concerning the error you encountered.....              | 3        |
| 1.2 Data transfer error, the device is stopped.....  | 4        |
| 1.3 Any device is not found.....   | 4        |
| 1.4 Device is connected to the USB Full-SPEED (12 Mbps) HUB.....   | 5        |
| USB HI-SPEED (480 Mbps) HUB is required!.....  | 5        |
| 1.5 Device configuration error.....  | 5        |
| 1.6 Input voltage error.....   | 6        |
| 1.7 The script gives an error message.....   | 6        |
| <b>2. Errors that users get when working with a CSS script</b> .....                                     | <b>7</b> |
| 2.1 Try selecting a different part of the oscillogram from idling.....                                   | 7        |
| 2.2 Unstable synchro spark signal.....   | 7        |
| Found insufficient number of synchronization pulses (sparks).....  | 7        |
| 2.3 Found insufficient number of teeth.....  | 8        |
| 2.4 Not detected falling engine speed.....   | 8        |
| Calibration of crankshaft reluctor is not carried out.....   | 8        |
| 2.5 Crankshaft sensor synchronization error or synchronization transducer error.....                     | 8        |
| 2.6 Incorrect parameter...Try to set a parameter... ..   | 8        |
| 2.7 An outdated version of Windows is installed on your computer.....                                    | 8        |
| 2.8 Is Adobe Flash Player ActiveX installed on your computer?.....                                       | 8        |
| 2.9 An unexpected error occurred. Recall the "Analysis - Execute script" menu.....                       | 8        |
| 2.10 An unexpected error occurred. Please, send the waveform file to developers via the menu.....        | 8        |
| <b>3. Errors that users may get when working with the Px script</b> .....                                | <b>9</b> |
| 3.1 Channel number is invalid.....   | 9        |
| Synchronization transducer channel number entered incorrectly.....                                       | 9        |
| Pressure transducer channel matches with sync transducer channel.....                                    | 9        |
| 3.2 The pressure transducer or it's connection is defective.....   | 9        |
| or the transducer type is incorrectly specified.....   | 9        |
| 3.3 The pressure transducer signal is not detected.....  | 9        |
| 3.4 The synchronization signal is not detected.....  | 9        |
| 3.5 Connect the synchronization transducer to the high-voltage wire of the cylinder is being tested..... | 10       |
| 3.6 Not enough data to analyze.....  | 10       |
| Insufficient snap throttle.....  | 10       |
| Snap throttle not detected.....  | 10       |
| No data suitable for checking valve timing found in the recording.....                                   | 10       |
| Idle data not found.....   | 10       |
| The waveform recording is too short for analysis.....  | 10       |
| 3.7 Wide open throttle not detected.....   | 10       |
| Bad (Insufficient) filling of the cylinder.....  | 10       |
| The throttle was not fully opened.....   | 10       |
| 3.8 The cylinder is losing compression.....  | 12       |

## Errors that users may get when working with USB Autoscope

|  |           |
|--|-----------|
| For a full report, please repeat the test after repair or perform the test in the other cylinders of the engine .....  | 12        |
| 3.9 Was unable to verify valve timing; please repeat the test or check manually .....  | 12        |
| 3.10 "Cylinder leakage" parameter interpretation .....   | 12        |
| 3.11 Is Adobe Flash Player ActiveX installed on your computer? .....   | 13        |
| 3.12 An unexpected error occurred. Recall the "Analysis - Execute script" menu.....  | 14        |
| 3.13 An unexpected error occurred. To eliminate it, please, send the waveform file to developers via the menu .....  | 14        |
| <b>4. Errors that users may get when working with the EIPower script.....</b>  | <b>15</b> |
| 4.1 Voltage channel is incorrect .....   | 15        |
| 4.2 Battery Voltage Not Detected .....   | 15        |
| 4.3 Current channel is incorrect.....  | 15        |
| 4.4 Starter current not detected .....   | 15        |
| 4.5 No charging current .....  | 15        |
| 4.6 Very high current. Check current clamp range .....   | 16        |
| 4.7 Change orientation of the current clamp.....   | 16        |
| 4.8 It is recommended to charge the battery .....  | 16        |
| The battery needs to be charged.....   | 16        |
| 4.9 Battery is defective - replacement is recommended .....  | 16        |
| 4.10 Download and install the USB Oscilloscope software update. ....   | 17        |
| New version of the EIPower script is available. ....   | 17        |
| Your version of EIPower script is outdated .....   | 17        |
| 4.11 The calculation of the relative compression can only be performed on the server. ....   | 17        |
| Connect to the server <a href="https://waveform-analyzer.com/">https://waveform-analyzer.com/</a> .....  | 17        |
| 4.12 Area suitable for compression measurement not detected.....   | 17        |
| 4.13 Area suitable for compression measurement too short .....   | 17        |
| 4.14 Compression measurement results are unstable. ....  | 18        |
| Try the test again or measure the compression with other methods .....   | 18        |
| 4.15 Incorrect number of engine cylinders .....  | 18        |
| 4.16 Required conditions for compression measurement not met.....  | 18        |
| 4.17 No connection to server <a href="https://waveform-analyzer.com/home">https://waveform-analyzer.com/home</a> . Please check your Internet connection. .... | 18        |
| Signal analysis will be performed offline. The results may be incomplete or inaccurate! .....  | 18        |
| 4.18 An unexpected error occurred; try again later .....   | 19        |
| 4.19 Interpretation of the "Number of measurement cycles" parameter .....  | 19        |
| 4.20 How the letter marking of cylinders correlates with their numbering.....  | 19        |

## 1. Common errors

### 1.1 How to issue a notification to the developers concerning the error you encountered

If you encounter any difficulty while working with the USB Autoscope or with its scripts, this does not necessarily mean that you should inform the developers about it. There is a high probability that a similar situation has already been discussed on the technical forum [forum.injectorservice.com.ua](http://forum.injectorservice.com.ua), and in order to solve the problem that you have come across, the solution may very well be found by simply reading the relevant topic. This will give developers more time to further develop the product. If you cannot find any information, open up a new topic and ask the question.

There may sometimes be situations the way out of which cannot be found using the forum. In this case, you should write an email to [support@injectorservice.com.ua](mailto:support@injectorservice.com.ua). But it should be noted that in this case only those emails will be considered in which the features of the operation of the device and its software are discussed. Emails asking about vehicle repairs will not be considered, since the forum works for this purpose.

Normally, in order to get helpful answers, one must correctly formulate the question. Consider the recommendations that will help you to properly prepare your message for publication.

1. In the message title, always specify the information you know about the car. The following order of information is preferable:

- Vehicle make, model, body type, year of manufacture,
- Engine displacement,
- Engine layout and number of cylinders,
- The number of engine valves,
- Engine power output,
- Engine family,
- Transmission,
- A short description of the situation or problem.

For example, "*Honda Odyssey RL1 2001 3.5 V6 24v 213hp J35A1 AT - Effect of VTEC Valve Operation on Px Script Results*".

2. To the technical description of your question, example or remark - immediately attach the original, corresponding waveform files. Please note that this does not mean a screenshot of your computer, but the original waveform file in \*.mwf format. By going to the "File => Save As" menu in the USB Oscilloscope window you can save your waveform as a .mwf file. It is recommended to use a descriptive name of the file when saving.

Additionally, screenshots can also be helpful, especially if you mark the areas to pay attention to, using a graphics editor or similar.

3. If possible, supplement the message with reliable supporting information. In the process of preparing it, try to foresee what questions might arise later when reading it, and supplement the message with this information. Make sure the message is complete and contains all relevant information before you send it.

4. Do the following: After recording signals and starting their analysis using the script, the configuration window is displayed on the screen. Using it, the script asks the user for additional information about the tested vehicle, such as "Engine type", "Firing order", "Synchronization cylinder number" and more. It is very important that these parameters are configured correctly - only then can you expect to obtain reliable analysis results.

The data that was entered in the script configuration window should be saved with the waveform file. To do this, you should answer "Yes" when closing the waveform file a dialog box with the question "Save the changes made?" is displayed. If the configuration settings were saved, and the waveform file is reopened and the script is run, an automatically configured configuration window will be displayed on the screen, and it will be enough just to click the "OK" button. This is very convenient when publishing waveform files on the forum, when sending them by e-mail, as well as when saving waveform examples to your archive.

## 1.2 Data transfer error, the device is stopped

In some cases communication failures may occur between the USB Autoscope and the host computer. If this happens, the message "*Data transfer error, the device is stopped*" may be displayed on the screen and data transfer is interrupted. Most often this happens due to too high levels of electrostatic interference from the ignition system of the vehicle under test. In this case, a disconnection occurs when the data packets sent over the USB bus are distorted to the point that the computer cannot recognize them.

The reason for this may be too close location of the device (or its cables) to the ignition system, or malfunction of high-voltage wires, ignition coils or other components of the ignition system. Also, the level of radiated electrostatic interference increases greatly if the car is equipped with spark plugs without built-in noise suppression resistors or high-voltage wires with low electrical resistance.

An unreliable connection between the device and host computer can also be caused by a too long or poorly shielded USB cable.

We strongly recommend using the following USB cable:

Model: Cablexpert USB2.0 AM-BM 1.8 m

Article: CCF-USB2-AMBM-TR6

Length: 1.8m

In cases where additional high-voltage equipment (high-voltage extension cable, high-voltage spark gap tester) is used during the test, you should always carefully check the quality of the electrical connections in the high-voltage circuit and at the places of connection to the vehicle ground. If a high-voltage spark gap tester is used, **make sure that it is equipped with an interference suppression resistor built into the tester.**

Communication via the USB bus can also be disrupted due to a lack of performance of the computer, when it does not have time to receive the entire data stream that the device sends to it. The reason for this can be not only low-performance computer hardware components, but also execution of computer's central processor other tasks (for example, performing an anti-virus scan of the system).

In order to make sure that the device is working properly in such situations, it is recommended to perform a similar test on another car with a different USB cable and a different computer. If the connection is still interrupted, you should contact the manufacturer. Self-repair of the device is not recommended and will void the warranty.

## 1.3 Any device is not found

If the message "*One of the USB devices connected to this computer is not working properly and Windows cannot recognize it*" appears on the screen immediately after connecting the device to a computer, it means that the USB connection is disrupted. The reason for this may be a hardware failure of the following elements:

- USB cable;
- USB port of the computer to which the USB cable is connected;
- USB connector of the device.

In order to find out what exactly is the cause of the malfunction, first of all replace the USB cable. If replacing the cable does not solve this problem, then you should connect the device to another USB port on the same computer (if any).

If the message "*...Any device is not found...*" is still displayed on the screen, then you should check it by connecting it to the USB port of another computer; Before doing this, do not forget to preinstall on this computer the software package with drivers, which can be downloaded from the page <https://injectorservice.com.ua/downloads.php>

If the above-mentioned measures do not solve the problem, you should contact the manufacturer. Self-repair of the device is not recommended and will void the warranty.

## **1.4 Device is connected to the USB Full-SPEED (12 Mbps) HUB**

### **USB HI-SPEED (480 Mbps) HUB is required!**

USB Autoscope IV is connected to a computer via a USB port, which must operate in a mode not lower than USB 2.0. If you connect it to a USB port operating in USB 1.1 mode, the USB Oscilloscope program will display this warning and the device will not start.

This message notifies the user that the USB port to which the device is connected is operating in USB 1.1 mode. But these ports are not used on modern computers. This almost certainly means that the USB port to which the device is connected is in hardware a USB 2.0 port, but in software it operates in USB 1.1 mode. Most often this happens due to the fact that the motherboard and / or USB port drivers are not installed on the computer, or specialized drivers are not installed at all. Sometimes the reason for this may be not optimal BIOS settings of the computer. Very rarely, but possible, the cause could be a malfunction of the computer hardware.

## **1.5 Device configuration error**

Such an error can occur when the device is sent a command to turn on, that is, when the device is started by the user using the "Device Start" or "Modes" menu. Most often it happens due to the unsatisfactory quality of the power supply to the device (the USB port of the computer does not provide sufficient current to power the device).

The specification of a standard USB port of a computer assumes that it must provide a device connected to it with a power supply of 5 V at a current consumption of no more than 500 mA. The current consumption of the USB Autoscope IV from the USB port does not exceed 300 mA, which is noticeably less than the permissible limit. However, there are situations when the power supply of the USB port is lower than 5V, and the message "Device configuration error" is displayed on the screen. There may be several reasons for this.

Firstly, it can be a poor quality or too long an USB cable. Try a replacement cable before anything else.

Another reason for the lack of sufficient power to the device can be too conservative power settings for the USB ports of the computer. This is primarily true for portable computers (laptops and tablets), since manufacturers of such equipment are trying to improve battery life, and in particular by reducing power consumption. We only need to verify and if possible adjust power supply restrictions for the USB ports. In some cases the USB port power settings are available in the motherboard BIOS. In this case, to solve the problem, it will be enough to simply reconfigure

them. Some computers with USB port power limitations does not make the information available, however.

If the USB ports power settings are unavailable or hidden, then the problem can be solved by connecting the device to the USB port of the computer via an active USB HUB. In this case, the device will be powered from the hub's power supply and not from the USB port of the computer.

It should be noted that when working with some laptop models, USB power limitations depend on the battery state of charge. The problem seems more common if the laptop battery charge was below 50%.

If the error considered here is not resolved either by reconfiguring the power settings, or by using an active USB HUB, or even by connecting to other computers, and the appearance of this error is of a systemic nature, you should contact the manufacturer.

### **1.6 Input voltage error**

The different inputs of the USB Autoscope IV are designed for different input voltages. The first 4 connectors located on the front panel of the device are analog inputs №1...4. They have 2 input voltage ranges:  $\pm 6$  V and  $\pm 30$  V. The  $\pm 6$ V input is designed to measure the signal from the transducers supplied with the device; the  $\pm 30$ V input is designed to measure signals of low-voltage automotive sensors, as well as for measuring voltages in the vehicle's power circuits.

The 5th and 6th connectors are analog inputs №5 and №6. Other input voltage ranges are provided for them:  $\pm 60$  V and  $\pm 300$  V. These inputs are designed to measure signals from inductive rotational speed sensors, such as a crankshaft, camshaft, vehicle speed sensor, shaft speed sensors in a gearbox, wheel speed sensors, a diesel fuel pump shaft, a turbocharger, as well as for measuring signals from other sensors that generate an increased voltage. Also, these inputs are designed to measure voltage waveform of control signals for ignition coils, fuel injectors, and other electronically controlled actuators.

Connectors 7, 8 and 9 on the front panel of the device are designed to connect capacitive and inductive high-voltage probes for testing ignition systems.

If the voltage of the measured signal exceeds the range set for this input, then part of the signal will not be measured, and this information will be lost. In this case, the USB Oscilloscope software provides a visual and audible alarm system for exceeding the input voltage range. If it is triggered, the user must independently assess the importance of the lost information and decide whether it is acceptable for him. If this is unacceptable (or you cannot make such an assessment), then you should change the input voltage range to a more extended one (if available), or use another analog input of the device for which wider input voltage ranges are available. In the first case, in the USB Oscilloscope program window, it will be enough to switch the "Input range" parameter in the settings panel of the corresponding channel (for example, instead of "6 V x1" select the value "30 V x1"). In the second case, you will first need to reconnect the measuring cable to another analog input in hardware (for example, instead of analog input №1, connect the cable connector to analog input №5), after that, in the USB Oscilloscope program window in the settings panel of the corresponding channel, correctly set the value of such parameters as "Used input" and "Input range", after that, if necessary, select the optimal values of the "Vertical V/div value" and "Vertical offset" parameters.

### **1.7 The script gives an error message**

During the recording of signals for the script, as well as during their analysis, various errors may occur. For such cases, the CSS script has a built-in error control system. If an error is found, it reports it in text form. In addition, the script may suggest ways to fix it. In order to receive error

messages as rarely as possible, try to strictly adhere to the recommended order of test execution and enter the data correctly in the script configuration window.

## **2. Errors that users get when working with a CSS script**

### **2.1 Try selecting a different part of the oscillogram from idling**

The CSS script displays this message when the user has turned on the recording of signals before starting the engine, while according to the instructions, the recording should be started while the engine under test is idling.

In this case, it is not necessary to repeat the test. It is enough to select a portion of the signals before starting the script, which then will start from the section corresponding to the engine idling. In this case, the script will analyze only the selected area. To do this, call the menu "Display => Switch to oscillograms view" - you will see the signals recorded at the very beginning of the test. And since the engine was not working at that moment, you will see horizontal lines instead of the expected signals. Now, for better clarity, set the value of the parameter "Horizontal Scale" equal to "1: 400" or "1: 500".

Using the horizontal scroll arrow, find the recording area where the crankshaft sensor pulses appear - this is the moment when the engine is started. Move a few more seconds later to the area where the pulse repetition rate of the crankshaft sensor becomes constant - this is the engine idling. From this point, you should begin to select a portion of the signals. To do this, move the mouse pointer to the waveform display area, press the left mouse button and without releasing it, move the pointer to the extreme right edge of the screen - after that, the window will start to scroll. Keep the left mouse button pressed until you see the recording area on the screen where the signals disappear. Now release the left mouse button and start signal analysis again.

### **2.2 Unstable synchro spark signal**

#### **Found insufficient number of synchronization pulses (sparks)**

These CSS script messages indicate that synchronization pulses with the ignition timing in cylinder #1 are insufficient in amplitude and action should be taken to improve the quality of the synchronization signal.

If we are talking about a gasoline engine, then usually the cause of this error is a faulty high-voltage cable of the cylinder #1. In this case, move the synchronization probe from the high-voltage wire of the cylinder #1 to the high-voltage wire of any other cylinder; when doing this please do not forget to specify the "Synchronization cylinder number" parameter correctly at the moment when you start the script.

If we are talking about a diesel engine with electronically controlled fuel injectors, then, most likely, you made a mistake with the choice of the wire on which the small current transducer should be installed. This usually happens when the transducer is connected from the side of the engine control unit, and a wire that goes to several injectors at once is in the grip of the clamp by mistake. In order to prevent such errors, it is recommended to install the transducer near the electrical connector of the diesel fuel injector, keeping in mind that by gripping the clamp, grasp only one of the wires coming to the injector connector.

### **2.3 Found insufficient number of teeth**

This CSS script message indicates a problem with the engine speed signal. In such a situation, you should make sure that you are not mistaken with the choice of the wire from which you record the crankshaft sensor signal, and the reliability of the electrical connections.

### **2.4 Not detected falling engine speed**

#### **Calibration of crankshaft reluctor is not carried out**

These messages indicate that the CSS test execution method was violated during signal recording. Record the signals again, strictly adhering to the recommendations of the standard method.

### **2.5 Crankshaft sensor synchronization error or synchronization transducer error**

This error occurs if the "Firing order" or "Synchro on cylinder" parameters were incorrectly set in the CSS script configuration window. Re-run signal analysis and adjust the configuration window correctly.

### **2.6 Incorrect parameter...Try to set a parameter...**

This message is displayed when the CSS script encounters incorrect data entered into the configuration window. Restart signal analysis and correctly configure the parameter indicated in the message in the configuration window.

### **2.7 An outdated version of Windows is installed on your computer**

This message is displayed by CSS script if the version of Windows installed on your computer is lower than Windows 7. In this case, some of the functionality of the CSS script will be unavailable.

### **2.8 Is Adobe Flash Player ActiveX installed on your computer?**

The «Phase» tab of the CSS script display the signal's color scale; the "Valve timing" tab of the Px script displays an animation of the valve timing. This functionality is displayed using Adobe Flash Player ActiveX. If this ActiveX component is not installed on your Windows, the script will display a corresponding message.

It should be noted that from 31.12.2020 Adobe stopped supporting Flash Player, and from 12.01.2021 it began to block the launch of Flash Player content in current versions of operating systems. In this regard, the display of the color scale of the CSS script and the animation of the valve timing of the Px script are now also disabled. A solution to this problem has not yet been found.

### **2.9 An unexpected error occurred. Recall the "Analysis - Execute script" menu**

In this case, simply rerun the signal analysis.

### **2.10 An unexpected error occurred. Please, send the waveform file to developers via the menu**

This message is displayed if the script was unable to determine the cause of the error. Problematic waveform files allow the developer to improve script algorithms and prepare new versions of them.

### **3. Errors that users may get when working with the Px script**

#### **3.1 Channel number is invalid.**

**Synchronization transducer channel number entered incorrectly.**

**Pressure transducer channel matches with sync transducer channel**

These messages are displayed when the Px script encounters incorrect data entered into the configuration window. Restart signal analysis and correctly configure the parameter indicated in the message in the configuration window.

#### **3.2 The pressure transducer or it's connection is defective**

**or the transducer type is incorrectly specified**

There may be several reasons for this error:

- in the line "Type of the pressure sensor:" of the Px script configuration window, the name of your pressure transducer is incorrect, sometimes users confuse the names of the transducers "Px" and "Px35"; in this case, the script cannot correctly recognize the pressure transducer signal, and displays this error message;
- together with the pressure transducer, a non-conforming pneumatic extension adapter was used;
- there is a foreign object at the pneumatic channel of the pressure transducer

#### **3.3 The pressure transducer signal is not detected**

When you receive this message, make sure the following requirements are met:

- pressure transducer cable is connected to the input # 3 of USB Autoscope IV;
- the pressure transducer is installed in place of the spark plug of the tested cylinder;
- the black crocodile of the USB Autoscope IV power cable is connected to the ground of the vehicle body;
- the red crocodile of the USB Autoscope IV power cable is connected to the "+" terminal of the vehicle battery under test;
- "12V" indicator on the front panel of USB Autoscope IV is on;
- in the line "Type of pressure transducer" of the Px script configuration window the name of your pressure transducer is incorrect.

#### **3.4 The synchronization signal is not detected**

When you receive this message, make sure the following requirements are met:

- the high-voltage wire of the cylinder being tested must be connected to the spark gap;

If the ignition coils of the engine being tested are not equipped with high-voltage wires, then the high-voltage output of the ignition coil of the cylinder being tested must be connected to the spark gap using an additional high-voltage wire; the high-voltage terminals of the ignition coils of the remaining cylinders must be connected to the spark plugs of the corresponding cylinders (if necessary, use additional high-voltage wires);

- the synchronization probe is installed on the high-voltage wire of the tested cylinder;

- the black crocodile of the USB Autoscope IV power cable is connected to the ground of the vehicle body;
- the red crocodile of the USB Autoscope IV power cable is connected to the "+" terminal of the vehicle battery under test;
- "12V" indicator on the front panel of USB Autoscope IV is on;
- on the front panel of the USB Autoscope IV under the "In Synchro" connector, either a red or a green indicator is on (this indicates the presence of a signal from the synchronization probe).

### **3.5 Connect the synchronization transducer to the high-voltage wire of the cylinder is being tested**

When beginning technicians perform the Px test on any cylinder other than the first, they often mistakenly install the sync probe on the high-voltage wire of the cylinder #1, instead of installing it on the high-voltage wire of the cylinder under test. In this case, the Px script informs about the detection of this error in text form. Then you should make sure that the synchronization probe is fixed on the high-voltage wire of the cylinder, in the place of the spark plug of which the pressure transducer is installed.

### **3.6 Not enough data to analyze**

#### **Insufficient snap throttle**

#### **Snap throttle not detected**

#### **No data suitable for checking valve timing found in the recording**

#### **Idle data not found**

#### **The waveform recording is too short for analysis**

These messages indicate that the Px test procedure was not completely adhered to during signal recording. In this case, record the signals again, strictly adhering to the recommendations of the standard method.

### **3.7 Wide open throttle not detected**

#### **Bad (Insufficient) filling of the cylinder...**

#### **The throttle was not fully opened**

The standard practice for performing the Px test involves snap throttling. In this section, the maximum filling of the cylinder with a fresh air-fuel mixture is measured. The Px script displays the received data in the "Intake" tab. The diagram displayed in this tab allows you to assess the ability of the engine (more precisely, the cylinder being tested) to absorb fresh air when the throttle valve is fully open, and does not restrict air flow.

Why is it important? - Because the more air enters the cylinder, the more fuel will be injected, and the more power the engine will develop.

Now let's distract, take our minds off a little from the Px script and talk about measuring the maximum engine power. Dynamometers are used for this purpose. Such a stand allows you to measure the maximum power and torque developed on the wheels of the tested car. Moreover, they provide measured values not only as peak values, but also as graphs. Some of these stands

are able to subtract the power loss in the vehicle's transmission from the measured power at the wheels, and thus calculate and display the power and torque at the engine crankshaft.

Now let's get back to the Px script. Practical measurements have shown that the shape of the graph of the maximum cylinder filling with air, provided by the Px script, quite accurately coincides with the graph of the maximum engine torque, measured using a dynamometer. Thus, - the "Intake" tab shows what shape of the torque curve on the crankshaft of the engine under test could be expected, when the fuel supply system and the ignition system are working properly. By the form of this graph, it is possible to determine quite accurately whether a given engine develops even torque and at what RPM. At which RPM does the engine operate most efficiently. Also, at which RPM range is it best not to operate it. And by the vertical scale of this graph, one can judge the horsepower developed of any given engine.

However, when diagnosing some engines equipped with an electronic throttle valve, the standard Px test procedure may not provide good reliability of the intake manifold test results. The fact is that during a snap throttling, despite the fact that the accelerator pedal is fully pressed, the engine control unit may not open the throttle completely. Most often, this situation can be found on relatively new car models. As a consequence, the throttle will prevent the free flow of air, and the Px script will inform this in its report. But, the technician is interested in obtaining a graph of the maximum cylinder fill at full throttle.

In such cases, you can perform the Px test again, while slightly changing the method: you need to turn off the engine as it is done during the CSS test so that the throttle valve is fully open during RPM drop. As a result, the filling of the cylinder can be assessed not only in the section of a snap acceleration of the engine, but also during a drop in engine speed after a snap throttling. To do this, during a snap throttling, when the engine speed has reached its maximum, it is necessary to turn off the fuel supply, and continue to hold the accelerator pedal pressed until the engine stops.

What may happen during a snap throttle, despite the driver's command the engine control unit does not open the throttle completely, maybe only halfway. Therefore, the engine RPMs do not rise as quickly as if the throttle was fully open; but still rise, and eventually reach the maximum.

Now the control unit sees that RPMs are already the maximum allowable, and further reduces the degree of opening the throttle valve, maybe only allowing quarter throttle.

At this moment it is necessary to turn off the fuel supply. The pump will stop supplying fuel from the tank, and the pressure in the fuel rail will begin to drop sharply, as the injectors will continue to consume fuel from the rail.

Due to the decrease in fuel pressure, the mixture in the cylinders will suddenly become so poor that the ignitions of the mixture in the cylinders will stop. As soon as the ignition in the cylinders stops, the engine speed will immediately begin to decrease.

In this case, the engine control unit sees that the driver continues to hold the accelerator pedal fully pressed, still requiring the engine to reach maximum speed. However, for reasons not understood by the control unit, the RPM is falling. To prevent the RPM drop, it begins to increase the throttle opening, and pretty soon the throttle is fully open. But, despite all the efforts of the control unit, the speed will continue to fall until the engine stops.

What will be the result? An additional red fragment of the diagram will appear in the "Intake" tab. This fragment will show the maximum filling of the cylinder at full throttle, not during the increase in engine speed, but during its fall.

Now about the methods how to stop the fuel supply during a snap throttle.

1) The easiest way to do this is by simply turning off the ignition.

But this method does not work on all cars, since the control unit can immediately completely close the throttle, deciding that the ignition off signal is more important than the signal of the accelerator pedal fully pressed by the driver.

If the first method did not work, then you will have to repeat the test. But this time, it will be necessary to turn off the engine not by turning off the ignition key, but by turning off the fuel supply. To do this, turn off the petrol pump located in the fuel tank using the [Remote Power Off](#) fuse switch. Before starting the test, it must be connected to the place of the fuel pump and during the test - at the moment when you need to turn off the engine, you must press the button on the body of the remote switch.

You can do without a remote fuse switch. In this case, you will need the help of an assistant. At the moment when it is necessary to turn off the engine, the assistant must either pull out the fuse of the electric fuel pump from its socket, or disconnect the electrical connector located on the gas tank, thereby turning off the fuel pump.

### **3.8 The cylinder is losing compression**

#### **For a full report, please repeat the test after repair or perform the test in the other cylinders of the engine**

If the Px script detects a critical cylinder leak, it does not display an abbreviated version of the report. This is done in order not to mislead the user. The fact is that in such conditions only part of the cylinder parameters under test can be reliably measured and they are shown in the script report.

### **3.9 Was unable to verify valve timing; please repeat the test or check manually**

This message is displayed if the Px script failed to measure the valve timing despite the fact that the signals were recorded correctly. Examples of such waveform files should be sent to the developers. This will help to improve this function of the script.

### **3.10 "Cylinder leakage" parameter interpretation**

Even on a good condition car, gas leaks from the cylinder through the piston rings during the compression stroke. These gases are then removed through the crankcase ventilation system. But this is only a part of the gas losses. Another part is heat loss.

The fact is that in the process of rapid compression of a gas, not only its pressure increases, but also its temperature, and it grows very significantly. Due to this effect, for example, the fuel is ignited in the combustion chamber of a diesel engine. This means that the temperature of the compressed gas there reaches hundreds degrees Celsius. In gasoline engines, the temperature of the compressed gas reaches slightly lower values. This is because the compression degree is lower. However, even in the combustion chamber of a gasoline engine, the gas is heated to temperatures significantly higher than the surface temperature of engine parts. Therefore, heat is inevitably removed from the compressed gas to the walls of the combustion chamber. You can learn more about this effect by reading the description of such a physical phenomenon as "Adiabatic process". In short, it is the process of gas compression in a thermo-insulated container.

It is obvious that the combustion chamber of the engine is not a thermally insulated container. But, when designing new internal combustion engines, manufacturers pay much attention to the issue of reducing heat losses in the combustion chamber, because this parameter directly affects the final fuel economy of the engine. It should be noted here that with an increase in engine speed, the amount of heat loss decreases. This is because the duration of the contact time of the

heated gas with the walls of the combustion chamber is shortened. And in a shorter period of time, less heat has time to escape from the gas.

Why are we now talking about heat losses in the combustion chamber? Because the Px script measures them! It measures the quantitative gas losses, measures the heat losses of the gas, adds these values, and displays the resulting value as the "Cylinder leakage" parameter. Therefore, with rare exceptions, even modern gasoline engines show complex gas losses of at least ~ 15%. Most of these losses are precisely the heat losses caused by the cooling of the compressed gas by the surface of the combustion chamber.

As the engine parts wear out, gas leaks from the cylinder grow, and with them cylinder leakage also increase. A value of ~ 20% is still acceptable for a not new engine. With losses of ~ 25%, the cylinder is no longer able to work stably at idle speed, but still works at increased speeds. This happens because with an increase in engine speed, not only heat losses, but also quantitative ones, decrease. And this happens for the same reason: the duration of the exposure of increased pressure on the cylinder leaks is reduced. And in a shorter period of time, less gas has time to escape.

It should be noted that good values of the "Cylinder leakage" parameter do not guarantee a completely serviceable state of the combustion chamber seals. This parameter allows you to detect only those gas losses that occur at idle and above, because the Px script performs this measurement with the engine running (conventionally, at 1000 RPM). The parameter "Cylinder leakage" is not intended to detect a decrease in compression that occurs only when the engine is started. This situation arises when the engine is cranked with a starter, the engine oil has not yet had time to seal the compression rings, and the gas leaks from the cylinder are too large. But, as soon as the engine starts, the piston rings are sealed with oil, and gas leaks from the cylinder return to normal. Such a malfunction impairs the engine's ability to start, but after starting it no longer prevents it from working normally.

In order to check the compression in the cylinder at starting speed (conventionally, at a speed of 200 RPM) - before performing the Px test, take measures to block the engine start. To do this, turn off the fuel supply and / or ignition system. After that, turn on the signal recording, crank the engine with a starter within 5 ... 10 seconds, and turn off the recording - right there on the screen you will see the compression value in Bars in this cylinder. That is, this test is analogous to measuring compression using a classic compression meter.

But let's go back to the "Cylinder leakage" parameter. There are often cases when checking the pneumatic tightness of a cylinder using a pneumatic tester or measuring the compression in the cylinder at engine cranking speed with the starter shows a poor result, while the Px test performed in the same cylinder shows a normal value of complex gas losses. At the same time, the owner of this car has no complaints either to the starting characteristics of the engine, or to its operation both at idle and in motion, but there are complaints about the increased consumption of engine oil. This means that the gaps between the piston / rings / cylinder are already significantly increased, but when the engine is running, they are filled and sealed with engine oil sufficiently to compensate for leaks. This allows the engine to still start and run normally. In this case, to make a decision on the need to repair the engine, you should compare all the "Pros" and "Cons": the cost of additional costs to compensate for increased engine oil consumption, the need to check the oil level in the engine more often, considerations of an increased level of environmental pollution and the cost of the upcoming renovation.

### **3.11 Is Adobe Flash Player ActiveX installed on your computer?**

The «Phase» tab of the CSS script display the signal's color scale; in the "Valve timing" tab of the Px script, an animation of the valve timing is displayed. This functionality is displayed using

Adobe Flash Player ActiveX. If the ActiveX component is not installed on your Windows, the script will display a corresponding message.

It should be noted that from 31.12.2020 Adobe stopped supporting Flash Player, and from 12.01.2021 it began to block the launch of Flash Player content in current versions of operating systems. In this regard, the display of the color scale of the CSS script and the animation of the valve timing of the Px script are now also disabled. A solution to this problem has not yet been found.

There is an alternative option show here:

<https://forum.injectorservice.com.ua/viewtopic.php?f=2&t=10618&start=30>

### **3.12 An unexpected error occurred. Recall the "Analysis - Execute script" menu**

In this case, simply rerun the signal analysis.

### **3.13 An unexpected error occurred. To eliminate it, please, send the waveform file to developers via the menu**

This message is displayed if the script was unable to determine the cause of the error. Examples of such waveform files allow the developers to improve script algorithms and prepare new versions of them.

## **4. Errors that users may get when working with the ElPower script**

### **4.1 Voltage channel is incorrect**

This message is displayed if the "Battery voltage channel" parameter was incorrectly set in the ElPower script configuration window. In this case, run the signal analysis again, and correctly enter the data in the script configuration window.

### **4.2 Battery Voltage Not Detected**

This message is displayed if the ElPower script has not found the waveform of the battery voltage in the channel specified by the user. This can happen for the following reasons:

- the input #1 of the device does not receive voltage from the "+" terminal of the vehicle battery;
- the black alligator clip of the device's supply cable is not connected to the "-" terminal of the vehicle battery, or the supply cable is not connected at all.

### **4.3 Current channel is incorrect**

This message is displayed if the "Battery current channel" parameter was incorrectly configured in the ElPower script configuration window. In this case, run the signal analysis again, and correctly enter the data in the script configuration window.

### **4.4 Starter current not detected**

This message is displayed if the ElPower script did not find the waveform of the starter current in a channel specified by the user. This situation may arise for the following reasons:

- current clamp is turned off;
- the input #4 of the device does not receive a signal from the current clamp;
- failure to pass through the jaws of the current clamp all the wires coming from the selected terminal of the vehicle battery, and the clamp does not measure the current consumed by the starter; in this case, you should take measures to correct this error by selecting the battery terminal for measuring the current where it will be more convenient to connect the current clamp, and then run the ElPower test again.

### **4.5 No charging current**

This message is displayed when the script did not detect the alternator current. Such a situation may arise if during the test the alternator did not really turn on, or if the user did not pass through the jaws of the current clamps all the wires emanating from the selected battery terminal.

Except in cases of a malfunction of the alternator or its circuit, it may not turn on if the engine did not start during the ElPower test after cranking or if the engine was turned off immediately after starting.

If, however, the user did not pass a wire through the jaws of the current clamp, through which the battery charging current flows, then the clamps will not measure this current. In this case, you should take measures to correct this error by selecting the battery terminal for current measurement, where it will be more convenient to connect the current clamps and repeat the ElPower test.

#### **4.6 Very high current. Check current clamp range**

The reason this message is displayed is almost always an incorrectly selected range of measured currents. This range is set using a switch on the clamp body, combined with the power switch. In this case, instead of the 100 A range, you should select the 600 A | 1000 A and run the ElPower test again.

#### **4.7 Change orientation of the current clamp**

This error notifies the user that at the moment the starter is engaged the direction of the current flowing through the power wire located inside clamp jaws did not match the marking on the body of the clamp.

The ElPower script automatically corrects this error. However, such a situation is undesirable, since at this moment magnetization reversal of the current clamp core occurs. The magnetization reversal leads to a significant change of the zero calibration of the current clamp, which was performed by the user before starting the measurements. The script automatically monitors and compensates for inaccuracies in zero calibrations. However, this algorithm can only work correctly if the test is performed according to the recommended ElPower methodology.

So, observing the polarity of the current clamp connection significantly reduces the magnetization reversal effect, which minimizes the zero calibration errors.

#### **4.8 It is recommended to charge the battery**

##### **The battery needs to be charged**

A low battery charge will impair its starting performance. Therefore, if the ElPower test is performed on a vehicle with a battery having a low charge, the results may be inaccurate. If a message appears on the screen about the need to charge the battery, you should take appropriate measures, and only then run the ElPower test again. This does not always mean the need to use a battery charger. Often, starting the engine and let it idle for 10 minutes is enough.

#### **4.9 Battery is defective - replacement is recommended**

If such message is received, first of all, the technician must double-check himself and make sure that in the script configuration window he has correctly specified the value of the parameters "Battery capacity" and "Standard of measurement", read from the battery case of the vehicle under test. (Example: 650 CCA) At the same time, the technician should not take into account other messages from the script about malfunctions in the vehicle starting and power supply systems, since reliable ElPower test results can be obtained only if the battery is not worn out or discharged.

#### **4.10 Download and install the USB Oscilloscope software update.**

**New version of the ElPower script is available.**

##### **Your version of ElPower script is outdated**

These messages notify the user to update the software package on this computer, which can be downloaded from the page <https://injectorservice.com.ua/downloads.php>

#### **4.11 The calculation of the relative compression can only be performed on the server.**

**Connect to the server <https://waveform-analyzer.com/>**

The scripts of the USB Autoscope engine analyzer are constantly being developed and modified by the developer, as well as adding new functions. This improves the accuracy and level of information from the results obtained. But it also leads to an increase in the amount of mathematical calculations performed each time during signal analysis. This increases the amount of time it takes to complete the analysis. Therefore, earlier developers had to take into account the limited computing power and disk space of the user's computer and apply highly simplified algorithms in order to make the analysis fast.

Now, it was decided to move resource-intensive calculations to the server, new scripts will be executed not on the central processor of the user's computer, but by means of a remote server. The computing power of the server is much higher, due to which it became possible to significantly complicate the analysis algorithms. Thanks to this, it became possible, in particular, to write a rather complex algorithm for calculating the relative compression by the starter current in the cylinders of internal combustion engines. This function is a part of the ElPower script. Naturally, to calculate the relative compression, the user's computer must be connected to the Internet.

So, the calculation of the relative compression can only be performed on the server, and this requires an Internet connection. In addition, you will also need a server access key. To get it - you need to register on the website <https://waveform-analyzer.com/> where you will be provided with 3 copies of the access key. Copy any of them, and enter in the appropriate field of the window "Enter the access key to the server", which at the right time will be displayed on the screen by the USB Oscilloscope program. The other two keys allow you to connect your other computers to the server.

#### **4.12 Area suitable for compression measurement not detected**

Usually such message means that during the ElPower test no measures were taken to block the possibility of starting the engine (by disconnecting the fuel injector fuse or in another way).

The methodology that allows you to get the most complete results of the ElPower test can be found in the following video – <https://youtu.be/slh4xfagRVo?t=31>

#### **4.13 Area suitable for compression measurement too short**

This message means that the duration of cranking the engine during the test, was too short. Repeat the test following the recommendations of the methodology.

#### **4.14 Compression measurement results are unstable.**

##### **Try the test again or measure the compression with other methods**

The reason for this message is the poor quality of the recorded signal. Most often this is caused by the fact that during the cranking single flashes occurred in the engine cylinders, despite the measures taken to block the possibility of starting the engine. This happens due to glow ignition caused by leaks in the fuel supply system and at the same time by the presence of hot carbon deposits on the walls of the combustion chamber. In this case, it is enough just to let the combustion chambers cool down a little and repeat the test after a few minutes.

Some vehicles, by design, are very difficult to obtain reliable relative compression measurements from. So, if, as a result, you repeatedly receive the message "*Compression measurement results are unstable*", you will have to measure the compression by other methods, for example, using a conventional compression tester.

#### **4.15 Incorrect number of engine cylinders**

This error occurs if "Number of engine cylinders" or "Firing order" parameter was incorrectly set in the ElPower script configuration window. Restart signal analysis and configure the configuration window correctly.

#### **4.16 Required conditions for compression measurement not met**

To obtain reliable measurements of the relative compression, it is necessary that the condition of the battery and starter is satisfactory. The ElPower script automatically controls this and, when a critical malfunction is detected, hides the results obtained and indicates the reason for this. This is done in order not to mislead the diagnostician with false data.

The reasons for such a situation may be the detection of the following defects by the script:

- *Available battery current is insufficient for the starter's demand;*
- *The starter brushes are arcing.*

In this case, the measurement of the relative compression will become possible only after the elimination of the detected defects.

#### **4.17 No connection to server <https://waveform-analyzer.com/home>. Please check your Internet connection.**

##### **Signal analysis will be performed offline. The results may be incomplete or inaccurate!**

If there is no connection with the server, the user will receive this notification. In this case, a simplified analysis algorithm will be automatically launched, which is performed directly on the user's computer. It is able to calculate parameters for sections such as "Battery", "Glow plugs", "Starter" and "Alternator". The "Relative Compression" section will remain empty.

That is, when the connection to the server is in order, the signal analysis will be performed by the latest version of the algorithm on the server side. And when there is no connection, the analysis will be performed on the user's computer by a simplified algorithm, and the results obtained may be incomplete or inaccurate.

#### **4.18 An unexpected error occurred; try again later**

This message is provided in case the software crashes. In such a situation, try running the signal analysis again after a few minutes. If the problem doesn't go away, please report it to the developers.

#### **4.19 Interpretation of the "Number of measurement cycles" parameter**

The ElPower script takes into account only stable engine rotation cycles (one rotation cycle of a 4-stroke engine is equal to two full revolutions of the crankshaft). Thus, the measurement of the relative compression is performed based only on the fragment of the signal record where the engine rotated evenly. To ensure the optimal number of relative compression measurement cycles, it is recommended to engage the starter for 5 ... 10 seconds during the test.

#### **4.20 How the letter marking of cylinders correlates with their numbering**

The current version of the Relative Compression Measurement Algorithm (as of early 2021) does not identify the cylinders as it does not yet use the cylinder #1 synchronization signal. Therefore, the measured compression values are shown in the order in which the engine cylinders physically operate.

For example, for an engine with cylinder order of 1342, the ratio of compression values to cylinder numbers can be one of the following:

ABCD = 1342

or

ABCD = 2134

or

ABCD = 4213

or

ABCD = 3421

That is, you should always remember that, for example, a cylinder marked with the letter A is not the same as cylinder #1.

In future versions of the algorithm, it is planned to use the synchronization signal for cylinder #1 in the analysis. Based on this signal, as well as taking into account the value of "Firing order" parameter, the script will no longer mark the cylinders with letters, but with numbers that will coincide with the actual cylinder numbers of the tested engine.