

User Manual

BOSA™-02 **BOSA™-04**

70 MS/s Fully Isolated USB
Automotive Oscilloscope

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BENEV®

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Used symbols


Symbol	Meaning
	Action related to software performance
	Action related to hardware performance
 NOTE:	Supplementary information
 CAUTION:	Important information
 WARNING:	Information with exceptional importance


Safety


 **NOTE:** Read this manual before using BOSA-02 and BOSA-04 oscilloscopes.


 **WARNING:** When performing any checks with an engine running in an enclosed space such as garage or workshop, always ensure a good ventilation! Never inhale the exhaust gases from the vehicle! They contain carbon monoxide, a colorless, odorless, extremely toxic gas, whose inhalation can lead to unconsciousness or death!


 **WARNING:** High voltage ignition systems! The ignition systems in modern vehicle, especially such as DIS – Wasted Spark and DI – Coil-On-Plug, can generate voltages high enough to stop your heart! Be extremely careful when working with this systems!

 **CAUTION:** Always set the parking brake securely and block the drive wheels before performing any checks or repairs on the vehicle.

 **CAUTION:** When working with the oscilloscope, always use only accessories and tools that meet the quality and safety standards requirements!

 **CAUTION:** Do not expose the oscilloscope to impacts or input voltages beyond the limits specified in the documentation! Use this instrument only for its intended purposes and strictly observe the operating instructions!

 **CAUTION:** When working with the oscilloscope, keep all leads and cables away from moving parts and hot surfaces!

 **CAUTION:** Use personal protective equipment!

Warranty

Benev Science & Technology Ltd. warrants that this product will be free from defects in materials and workmanship for a period of two (2) years from the date of shipment. If any such product proves defective during this warranty period, *Benev Science & Technology Ltd.*, at its option, will repair the defective product without charge for parts and labor, or will replace it.

It is customer's responsibility to notify us in the event of a defect occurring within the warranty period, as well as packing preparation and payment of the transportation costs to the our office. *Benev Science & Technology Ltd.* bears the transportation costs of delivering the repaired or replaced product back to the customer.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. *Benev Science & Technology Ltd.* shall not be obligated to furnish service under this warranty in the following cases:

- The product has been disassembled, modified, or repaired by persons who have not been explicitly authorized for this by *Benev Science & Technology Ltd.* and in the event of damage or replacement of warranty stickers.
- The product has been under impacts beyond the limits specified in its documentation or has been used in conjunction with defective products or such that are not in compliance with the quality and safety standards.
- In the case of natural disaster, such as fire, earthquake, flood, etc.

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1. Overview

BOSA is a modern digital oscilloscope for measurements of analog input signals and is specially developed for the purposes of automotive diagnostics. It is made in two modifications, 2-channel (BOSA-02) and 4-channel one (BOSA-04). With its innovative and compact design, full galvanic isolation and high reliability, convenient USB interface, built-in special engine tester functions for analysis of ignition systems in the internal combustion engines, as well as with its modern Windows based GUI software, BOSA is an indispensable assistant in everyday work of all automotive service professionals. BOSA is a versatile tool and is not related to a particular automotive brand or vehicle model. It is designed with excellent test capabilities for all types of ignition systems and sensors used in modern cars. The instrument also can be used by a wide range of technicians who need to measure and visualize electrical signals.

1.1 Basic features

Features
2-channel or 4-channel modifications
70 MS/s max sampling rate
Fully galvanically isolated USB interface
Short circuit protection between oscilloscope's inputs
Standard DSO modes of operation
Full set of engine ignition diagnostic modes
Trigger system completely implemented in hardware
Windows based software application StudioBOSA
Multilingual interface and documentation
Compact and robust aluminum enclosure

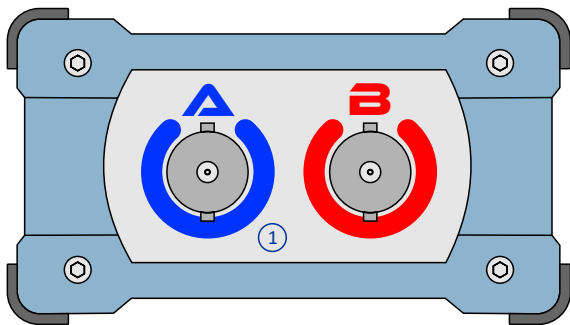
1.2 Applications

- Automotive diagnostics
- Internal combustion engine ignition diagnostics
- General measurements and analysis of electrical signals

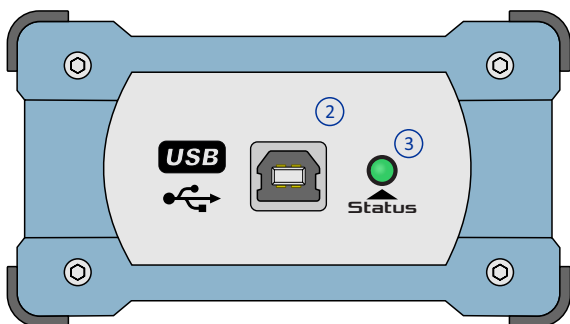
2. BOSA-02 и BOSA-04

2.1 Device overview

BOSA-02 Front panel

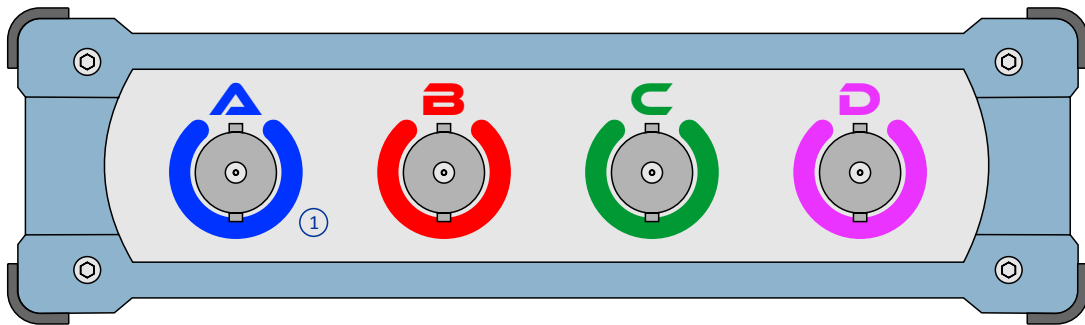


BOSA-02 Rear panel

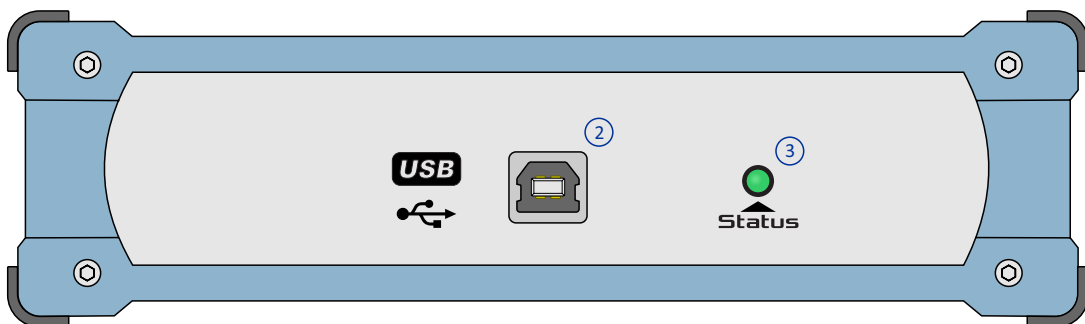


1. Analog inputs (BNC)
2. USB connector
3. Status LED

BOSA-04 Front panel



BOSA-04 Rear panel



1. Analog inputs (BNC)
2. USB connector
3. Status LED

2.2 Technical specifications

Specification	BOSA-02	BOSA-04
Number of channels	2	4
Resolution	12-bit	
Bandwidth (-3 dB)	1 MHz	
Input ranges	± 0.1 V; ± 0.2 V; ± 0.5 V; ± 1 V; ± 2 V; ± 5 V; ± 10 V; ± 20 V	
Max real-time sampling rate (RTS)	2 MS/s (1 or 2 channels)	2 MS/s (1 or 2 channels) 1 MS/s (3 or 4 channels)
Max equivalent-time sampling rate (ETS) ⁽¹⁾	72 MS/s (1 or 2 channels)	72 MS/s (1 or 2 channels) 36 MS/s (3 or 4 channels)
Max stream sampling rate	100 kS/s (1 channel) 50 kS/s (2 channels)	100 kS/s (1 channel) 50 kS/s (2 channels) 20 kS/s (3 or 4 channels)
Time ranges	1 μ s \div 2 s	
Time ranges (Stream mode)	1 s \div 100 s	
Time ranges (Slow Variable mode)	0.5 min \div 100 min	
Trigger (hardware)	Auto, Single ⁽²⁾ , Free; Rising / Falling edge	
Pretrigger ⁽²⁾	0 \div 100 %	
Trigger delay ⁽³⁾	1 μ s \div 1 min (1 μ s step)	
Input type	BNC	
Input impedance	1 M Ω \sim 20 pF	
Input coupling	AC / DC (software controled)	
Full galvanic isolation	Yes	
Input protection	\pm 350 Vpp, AC / DC	
Short-circuit protection between inputs	Yes	
Platform	Windows; USB 2.0, 3.0 or 3.1	
StudioBOSA	Yes	
Ignition tester functions	Yes	
Cylinders display patern	Parade, Raster, Overlay, Single	
Languages	English, Български	
Operating temperature range	-20 \div 50°C	
Humidity (relative)	10 \div 80 % (non-condensing)	
Dimensions	110 x 70 x 45 mm	110 x 150 x 45 mm
Weight	200 g	425 g

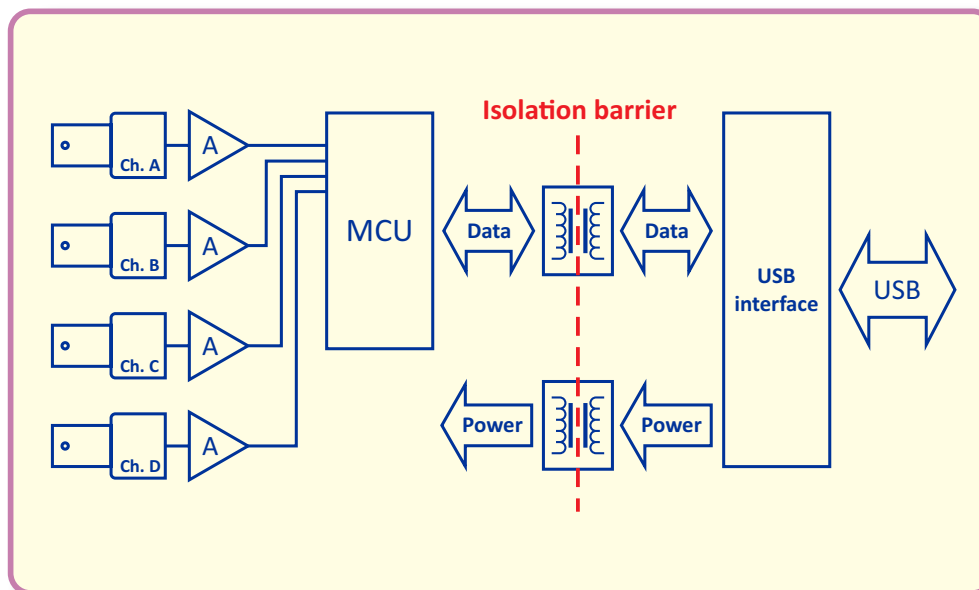
⁽¹⁾ ETS is available only in time ranges from 1 μ s to 100 μ s.

⁽²⁾ Available only in time ranges from 200 μ s to 2 s.

⁽³⁾ Not implemented in StudioBOSA.

2.3 Galvanic isolation

BOSA-02 and BOSA-04 are designed to operate in an industrial environment with increased electromagnetic pollution. In addition, when testing the secondary ignition circuits in petrol engines, it is possible to penetrate high-frequency interference through the USB interface to the computer, which can create additional difficulties in the measurement process. In order to avoid such problems and to increase the level of security for the high voltage ignition testing, the internal architecture of BOSA-02 and BOSA-04 has been developed with a full galvanic isolation (both on data lines and power buses) of the USB interface and computer on the one hand and oscilloscope's analog inputs on the other. The principal isolation scheme is shown below.



BOSA's galvanic isolation scheme.

The table below shows the list of standards that the isolation components meet.

U.S.	Canada	Germany/Europe	International
UL 1577	Component Acceptance Notice #5	DIN EN60747-5-2 DIN V VDE V 0884-10	IEC 747-5 IEC 60950-1: 2001

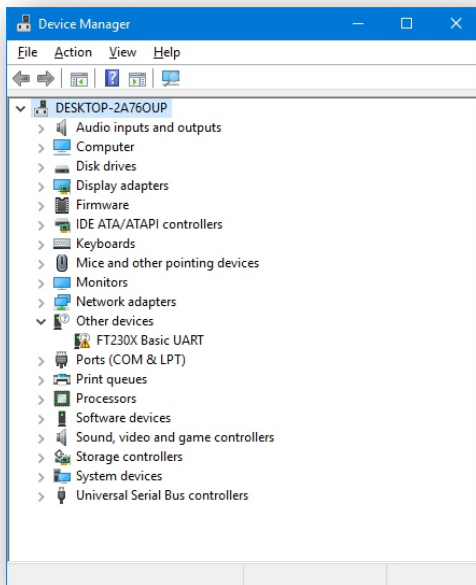
! **NOTE:** Additionally, BOSA-02 and BOSA-04 have a built-in short circuit protection between oscilloscope's inputs.

2.4 Driver installation

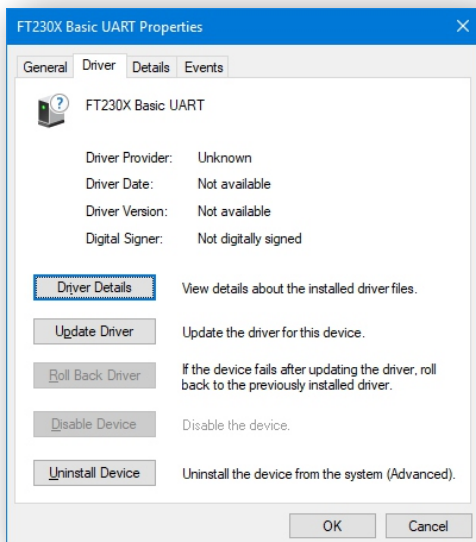
For proper operation, the BOSA-02 and BOSA-04 need the USB driver pack to be installed. You can download drivers from the tech info section on the product's page:

<https://benev.biz/en/bosa-automotive-oscilloscopes.html>

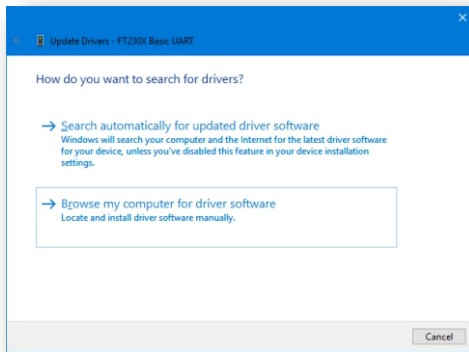
The example below demonstrates driver installation procedure on Windows 10. For other operating system versions the installation follows similar steps but you need to use a proper driver pack.



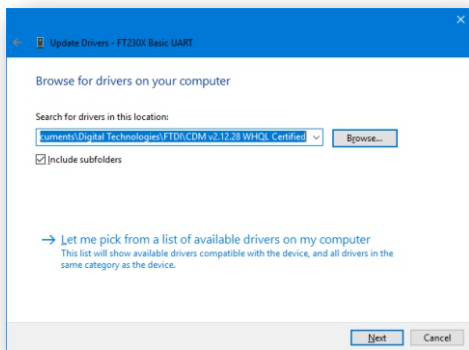
Step 1. Connect BOSA-02 or BOSA-04 to the PC. When device is connected for the first time, Windows automatically installs some driver by default, but this is not the correct one. In the Device Manager the device is displayed with a yellow warning mark, as is shown on the left.



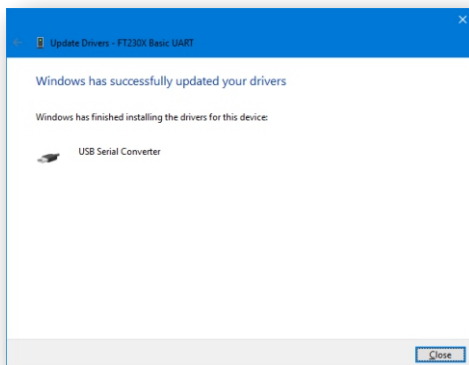
Step 2. In the Device Manager right click on the device and choose Properties from the drop-down menu. In the Driver tab click Update Driver button.



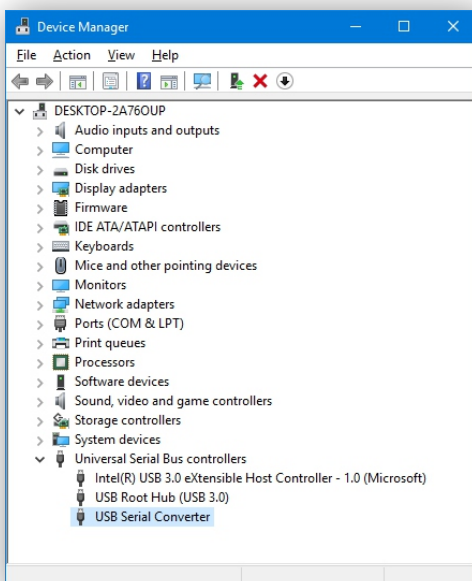
Step 3. In the next window choose Browse my computer for driver software.



Step 4. Click the Browse button and navigate to folder containing driver pack.




Step 5. Wait just a moment for the driver to be installed successfully.




After successful driver installation, device is displayed in the Device Manager, under the USB controllers node, as an properly working USB Serial Converter.

3. StudioBOSA

StudioBOSA is a specially designed software application for convenient and efficient work with BOSA-02 and BOSA-04 oscilloscopes. With its modern and intuitive interface automatically adjusting to the user selected mode of operation, with the presence of special engine tester functions and analysis capabilities, this application is a powerful tool for every professional in the field of modern automotive diagnostics. You can download the application from the tech info section on the product's page: <https://benev.biz/en/bosa-automotive-oscilloscopes.html>

 NOTE: For proper communication of StudioBOSA with BOSA oscilloscope, USB drivers should be installed. For more information on how to install the driver pack, please see previous section.

 NOTE: StudioBOSA recognizes the modification of the BOSA oscilloscope plugged into the computer and automatically adjusts its operating parameters.


3.1 System requirements

Requirements	
Operating system	Windows XP*, Vista, 7, 8, 8.1, 10; 32-bit / 64-bit
CPU	1 GHz or better; 32-bit / 64-bit
RAM	1 GB or more
Display	1024 x 768 or higher
Hard disc free space	50 MB or more
USB	2.0, 3.0 or 3.1 single port
Adobe Acrobat Reader	Version 9.0 or higher

* Windows XP requires .NET Framework 2.0 or higher to be installed.

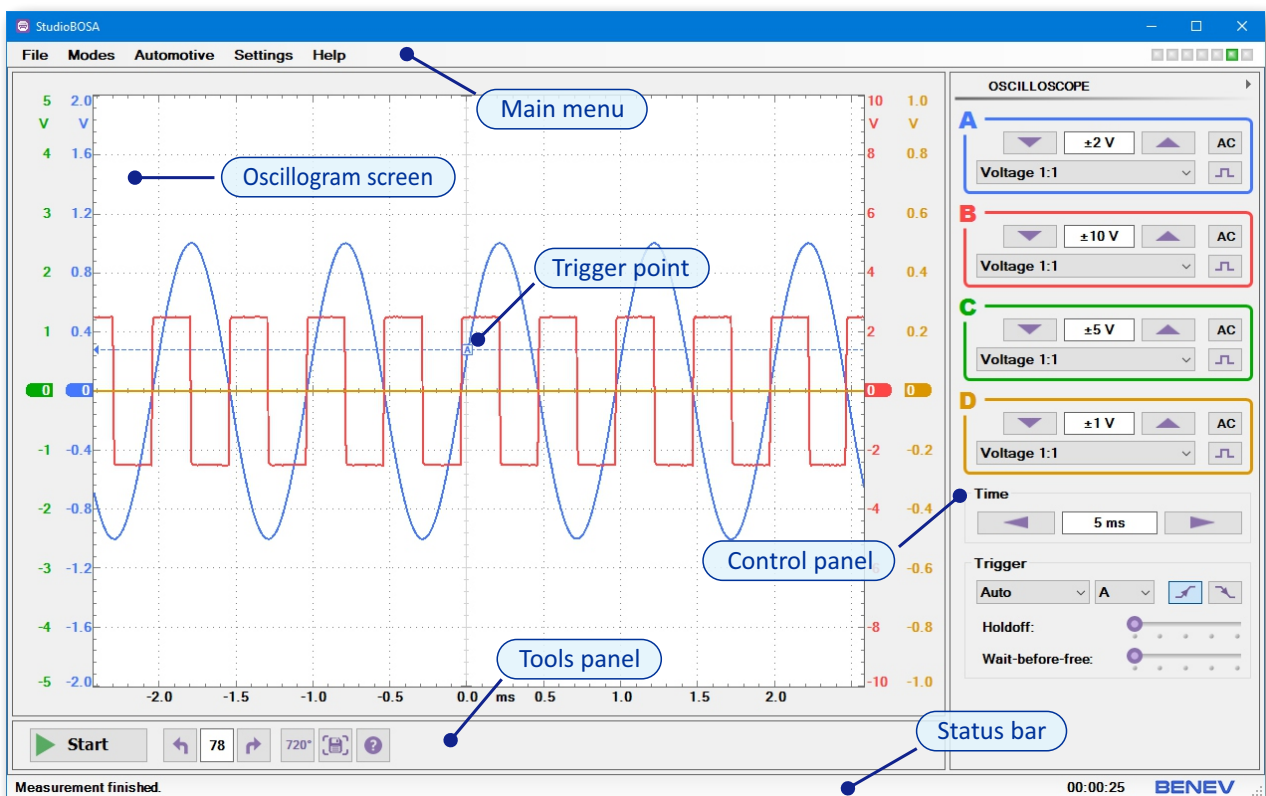
3.2 Application installation

StudioBOSA is an application with easy maintenance and virtually does not need a special installation at all. Just unpack the StudioBOSA.zip file somewhere on your system, for example, in the C:\Program Files\StudioBOSA and put a shortcut to the application's .exe file on your Desktop or Start menu. That's all.


 **NOTE:** Do not change the structure and content of the unpacked zip archive.

3.3 Main screen


StudioBOSA's main screen is shown below.



StudioBOSA main screen.

 **NOTE:** Content and functionality of StudioBOSA's panels change depending on the user selected mode of operation.

3.4 StudioBOSA basic features


 **CAUTION:** When working with the oscilloscope, always use only accessories and tools that meet the quality and safety standards requirements!


StudioBOSA offers built-in capabilities aiming the completion of specific tasks in the field of automotive diagnostics and allowing for quick and easy adjustment of all measurement parameters. The main modes of operation are:

- *Oscilloscope* – includes all universal lab scope functionality with full trigger control.
- *Stream* – shows the measured signal as a continuous data stream.
- *Slow Variable* – designed for very slow in time signals with periods in the range of 1 minute to hours.
- *Multimeter* – this mode allows to use the oscilloscope as a multichannel digital multimeter.
- *Sparkscope* – this is a specialized oscilloscope mode for quick and easy overview of the vehicle's ignition system operation as a whole.
 - *Distributor* – designed to check the ignition process in the secondary ignition system with mechanical distributor.
 - *DIS (Wasted Spark)* – designed for the case of ignition system with single coil on two sparks.
 - *DI (Coil-On-Plug)* – designed for the case of ignition system with single coil on single spark.

StudioBOSA allows for:

- Voltage measurement of electrical signals. Example - signals from various sensors in the vehicle.
 - Voltage measurement in the range of ± 200 V or ± 400 V by using 10:1 or 20:1 attenuators plugged in the oscilloscope's inputs. Example – primary ignition voltage.
 - Current measurement. Example – primary ignition current measurements using current clamps.
 - Secondary ignition voltage measurement using high-voltage 10000:1 capacitive pick-up clamps.
 - Cylinder's pressure and compression measurement.
 - Pulsations of the exhaust gases in the exhaust system measurement.
 - Changes of the gas pressure in the inlet manifold measurement etc.

 **NOTE:** StudioBOSA has a build-in Demo mode of operation for quick overview of application capabilities. To activate this mode, from the Main menu select *Settings* → *Demo Mode*.

 **NOTE:** StudioBOSA has a mode sensitive build-in Help system which allows in a quick and easy way to get the basic information of current working mode functionality and operational procedures. To see the Help box, from the Main menu select *Help* → *StudioBOSA Help*, or click on Help button in the Tools panel or press F1 key.

3.5 Universal modes of operation

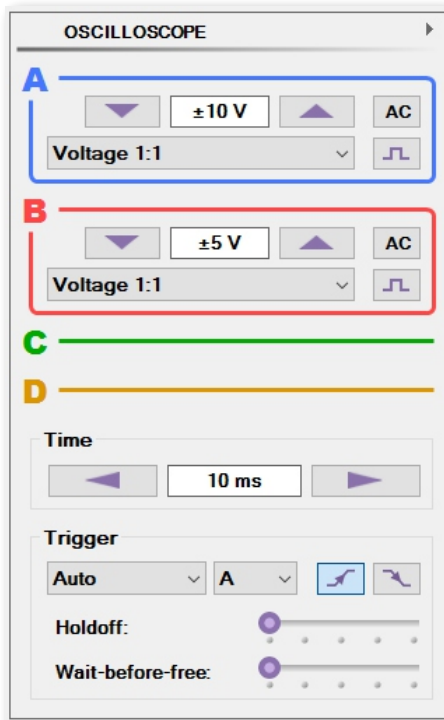
3.5.1 Oscilloscope



To activate this mode, from the Main menu click *Modes* → *Oscilloscope*. This mode offers all the basic universal lab scope functionality.



NOTE: StudioBOSA is starting always in Oscilloscope mode.



Control panel in Oscilloscope mode.



In the *Trigger* section you can set the trigger event parameters, including:

- Select the trigger type:
 - *Auto* - the measurement always takes place regardless of whether a trigger event has occurred or not. If this event doesn't occur, the program automatically switches to free trigger mode and starts the measurement immediately.
 - *Free* - the measurement takes place without waiting for a trigger event. It is suitable for initial overview of an unknown signal and allows for correct determination of the trigger point.
 - *Single (waiting)* - the measurement is performed only once after trigger event occurrence. It is suitable for non-periodic, one-time signals such as single pulses or transient processes.



NOTE: Single (waiting) trigger mode is available only in time ranges from 200 μ s to 2 s.

- Select the trigger channel.
- Select the trigger edge - rising or falling.



To activate or deactivate a given channel, click on its letter in the Control panel. When channel is active, a color field with additional controls opens.



In the color field you can:


- Select the input measurement range.
- Select the type of measurement:
 - Voltage 1:1
 - Voltage 10:1
 - Voltage 20:1
 - Current ± 20 A (1 mV / 10 mA)
 - Current ± 60 A (1 mV / 100 mA)
 - Current ± 600 A (1 mV / A)
- Select AC/DC input coupling.
- Invert the signal (software only).




In the *Time* section you can select the time range of the current measurement.

- Select the holdoff value - this is the time interval after a trigger event occurrence, during which a new trigger event is forbidden. It is only after this interval that the application again begins to wait for a new trigger event and starts next measurement. This setting is important in the observation of the signals with several fundamental frequencies in their spectrum. Typical example are the rectangular digital signal packets.


- Select Wait-before-free time - this is the time interval, during which the application is still in auto trigger mode for a missing trigger event before the measurement switches to free trigger mode.


 **NOTE:** You can open or close the Control panel by clicking on the small arrow button in the upper right corner of the screen or using F9 shortcut key.

 To set the trigger level and pretrigger value (i.e. what portion of the signal is visible before the trigger event):

- Click on the trigger point and hold the mouse button down to move it to the required position on the oscillogram screen.

- Click on the time axis under Oscillogram screen, hold the mouse button down and move to the left or right to set the prettrigger value.

 **NOTE:** Pretrigger is available only in time ranges from 200 μ s to 2 s.

 To move the given channel's waveform up or down on the screen, click on the vertical axis of the channel, hold the mouse button down and move up or down the graphics.




Tools panel in Oscilloscope mode.

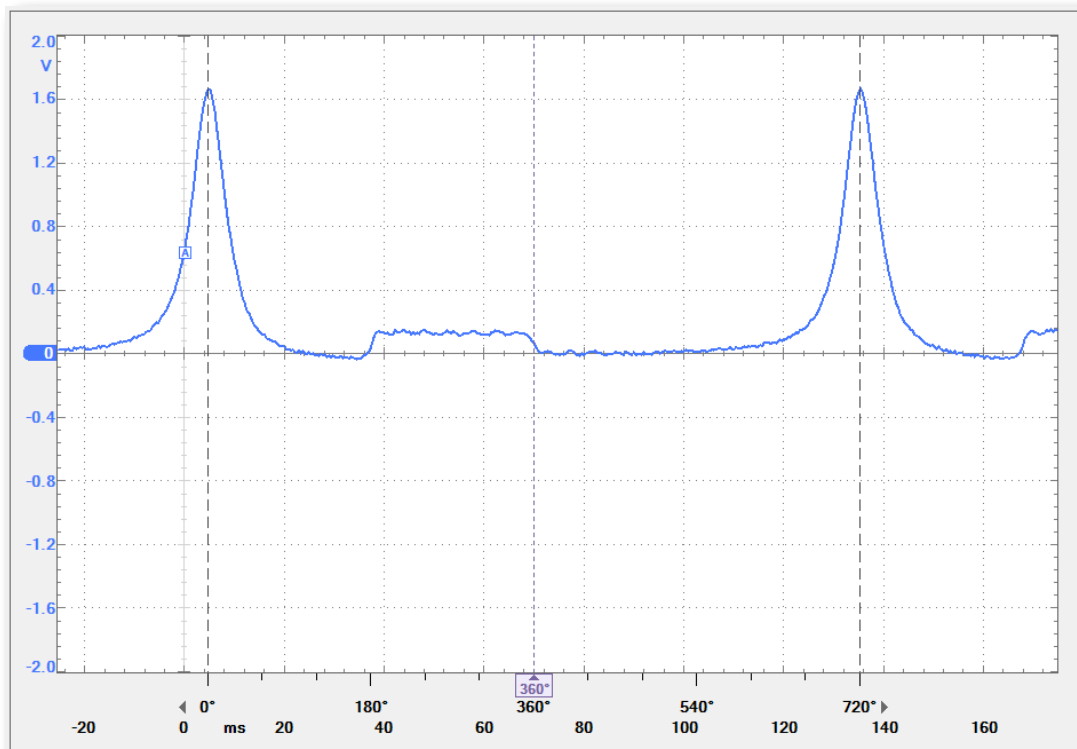


In the *Tools panel* you can:

- Start or stop the current measurement by clicking on the Start/Stop button.
- Make an observation of the last 100 oscillograms of the current measurement.
- Activate 720° phase markers.
- Save the application's screen as an image.
- Launch the application help.

 **NOTE:** Also, you can save the application's screen as an image using Main menu *File* → *Save Screen...* or Ctrl+G keyboard shortcut. To launch the application help use *Help* → *StudioBOSA Help* or F1 shortcut.

 **NOTE:** Status and duration of the current measurement are shown in the Status bar.



Graphics panel in Oscilloscope mode. Trigger point and 720° rotation phase markers shown.


720° phase markers are specially designed to help in phase determination of the processes related to the crankshaft rotation cycles.

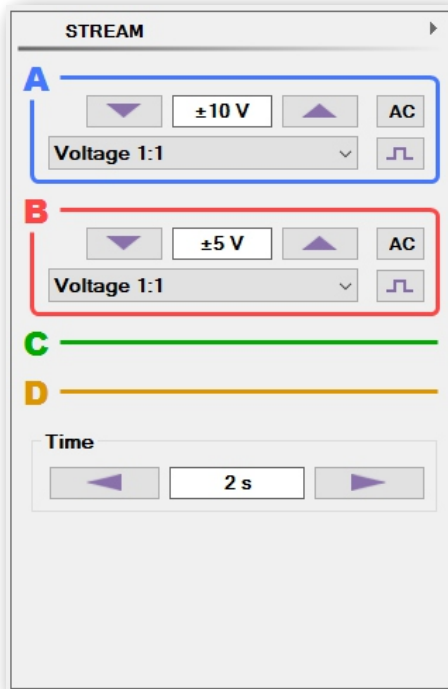


To use a 720° phase markers:


- Click on the 720° button in the Tools panel or press F2 to activate markers if they are not visible.
- Click and drag the left and right arrows in order to set the 0° and 720° points on the oscillogram.
- Click and drag the marker box to see the phase position of given point on the oscillogram.

3.5.2 Stream

 To activate this mode, from the Main menu click *Modes* → *Stream*. This mode shows current measurements as a continuous data stream on the screen. It is suitable for signals with periods from 1 s to 1 min.



Control panel in Stream mode.

 To activate or deactivate a given channel, click on its letter in the Control panel. When channel is active, a color field with additional controls opens.

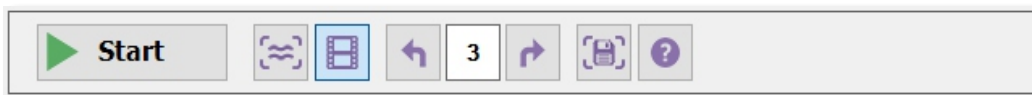


In the color field you can:

- Select the input measurement range.
 - Voltage 1:1
 - Voltage 10:1
 - Voltage 20:1
 - Current ±20 A (1 mV / 10 mA)
 - Current ±60 A (1 mV / 100 mA)
 - Current ±600 A (1 mV / A)
- Select AC/DC input coupling.
- Invert the signal (software only).



In the *Time* section you can select the time range of the current measurement.



Tools panel in Stream mode.




In the *Tools panel* you can:

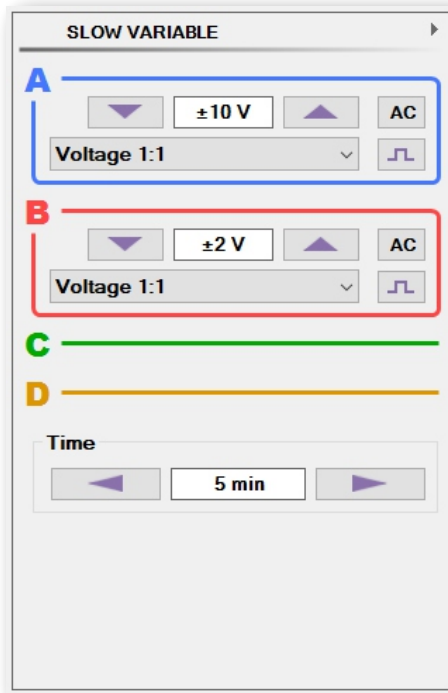
- Start or stop the current measurement by clicking on the Start/Stop button.
- Choose how to see individual measurements, as a single screens or as a continuous data stream.
 - Make an observation of the last 100 oscillograms of the current measurement.
 - Save the application's screen as an image.
 - Launch the application help.



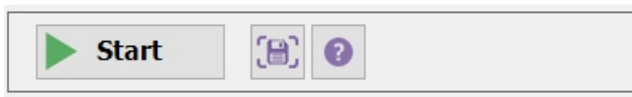
NOTE: Status and duration of the current measurement are shown in the Status bar.

3.5.3 Slow Variable

 To activate this mode, from the Main menu click *Modes* → *Slow Variable*. This mode shows current measurements as a continuous data stream on the screen. It is suitable for slow in time signals with periods from 1 min to hour or more.



Control panel in Slow Variable mode.





Tools panel in Slow Variable mode.


 In the *Tools panel* you can:

- Start or stop the current measurement by clicking on the Start/Stop button.
- Save the application's screen as an image.
- Launch the application help.


 **NOTE:** Status and duration of the current measurement are shown in the Status bar.

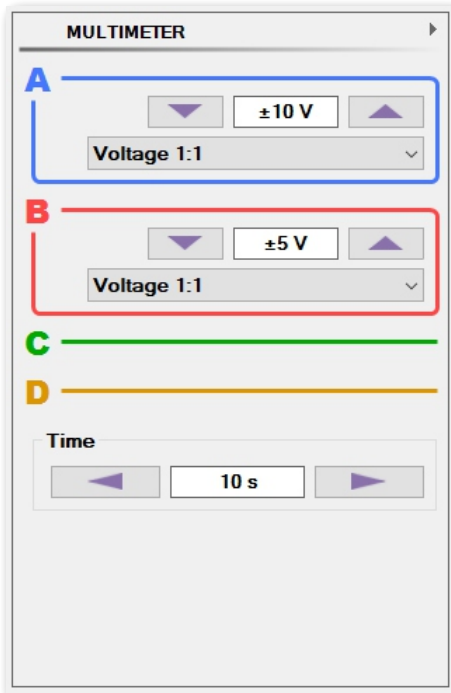
 To activate or deactivate a given channel, click on its letter in the Control panel. When channel is active, a color field with additional controls opens.


-  In the color field you can:
- Select the input measurement range.
 - Select the type of measurement:
 - Voltage 1:1
 - Voltage 10:1
 - Voltage 20:1
 - Current ±20 A (1 mV / 10 mA)
 - Current ±60 A (1 mV / 100 mA)
 - Current ±600 A (1 mV / A)
 - Select AC/DC input coupling.
 - Invert the signal (software only).

 In the *Time* section you can select the time range of the current measurement.

3.5.4 Multimeter

 To activate this mode, from the Main menu click *Modes* → *Multimeter*. This mode shows current measurements as a discrete values in digital form. It allows BOSA oscilloscopes to be used as a multichannel digital multimeter.



 To activate or deactivate a given channel, click on its letter in the Control panel. When channel is active, a color field with additional controls opens.



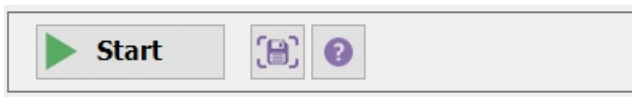
In the color field you can:

- Select the input measurement range.
- Select the type of measurement:
 - Voltage 1:1
 - Voltage 10:1
 - Voltage 20:1
 - Current ±20 A (1 mV / 10 mA)
 - Current ±60 A (1 mV / 100 mA)
 - Current ±600 A (1 mV / A)



In the *Time* section you can select the time range of the current measurement. Note that the refresh rate for digital values and data stream changes accordingly.

Control panel in Multimeter mode.



Tools panel in Multimeter mode.

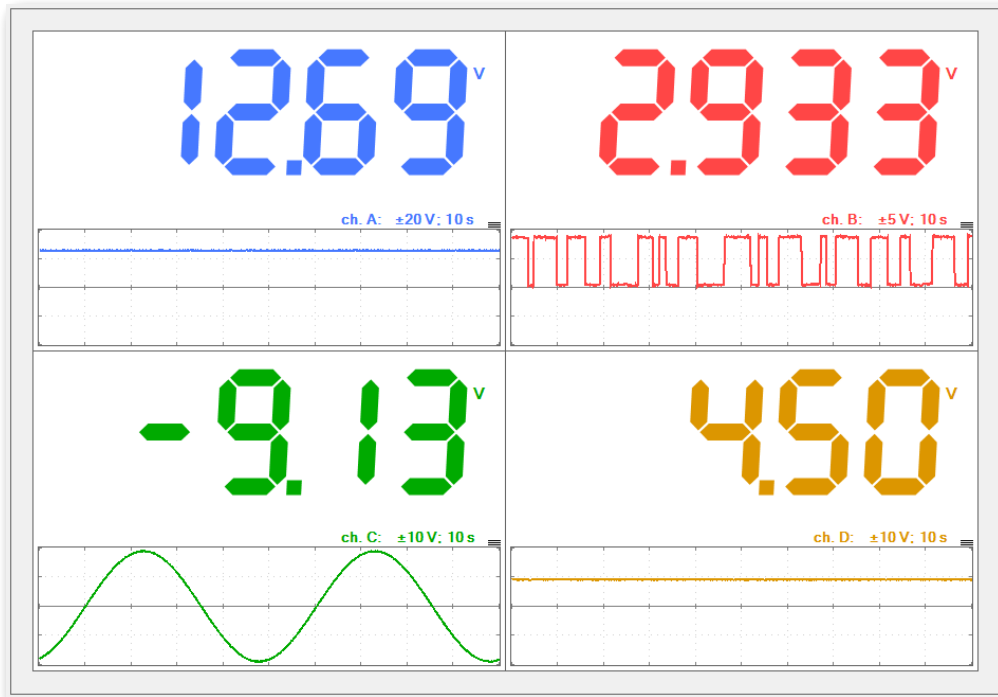


In the *Tools panel* you can:

- Start or stop the current measurement by clicking on the Start/Stop button.
- Save the application's screen as an image.
- Launch the application help.



NOTE: Status and duration of the current measurement are shown in the Status bar.



Graphics panel in Multimeter mode.



By left clicking and dragging up and down the small marker on the top right corner of the channel's oscillogram section you can resize the graphics for more comfortable view of the data stream.

3.6 Ignition diagnostic modes

3.6.1 Sparkscope



To activate this mode, from the Main menu click *Automotive* → *Sparkscope*. This is an universal oscilloscope for quick and easy overview of the periodic signals and specially of those, containing narrow spikes (needles) in their spectrum, such as ignition diagrams (primary or secondary) in petrol engines, injector signal (voltage or current) and so.



NOTE: This mode is not suitable for observation of pure lab signal as sinusoid, rectangular, triangular and so. For measurements on such kind of waveforms, please use the Oscilloscope mode (see section 3.5.1).



CAUTION: Secondary high-voltage ignition circuit! You must use only high-voltage capacitive pick-up clamps! Using standard oscilloscope leads and probes will cause a serious damage of the instrument!



Ignition system with mechanical distributor:

Connect high-voltage capacitive pick-up clamp to the common cable between the ignition coil and distributor (as close as possible to the coil) and plug it to channel A on the oscilloscope. Connect ground wire to the vehicle's chassis ground. Start the engine and let it idle.

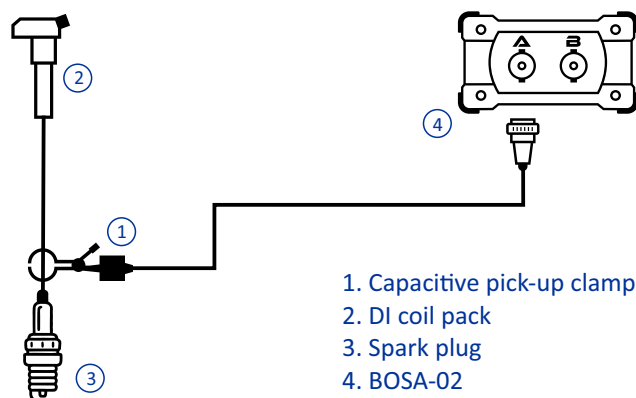


DIS – Wasted Spark or DI – Coil-On-Plug ignition:

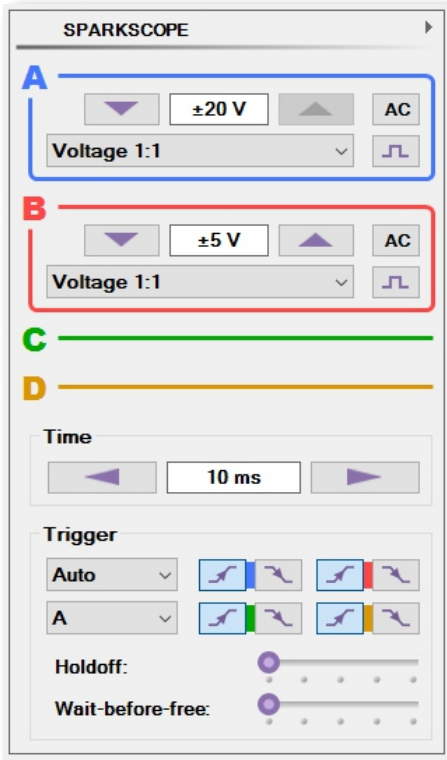
Connect high-voltage capacitive pick-up clamps to the secondary ignition cables (as close as possible to the spark plugs) and plug them to the oscilloscope's input channels. Connect ground wires to the common point on the vehicle's chassis ground. Start the engine and let it idle.



NOTE: For secondary ignition system observation this mode should be used with high-voltage 10000:1 capacitive pick-up clamps.



An example connection of BOSA-02 for observation of the ignition in Sparkscope mode for a DI – Coil-On-Plug system (the diagram demonstrates the use of an extension cable between spark plug and the coil).



Control panel in Sparkscope mode.



To activate or deactivate a given channel, click on its letter in the Control panel. When channel is active, a color field with additional controls opens.



In the color field you can:

- Select the input measurement range.
 - Voltage 1:1
 - Voltage 10:1
 - Voltage 20:1
 - Current ± 20 A (1 mV / 10 mA)
 - Current ± 60 A (1 mV / 100 mA)
 - Current ± 600 A (1 mV / A)
 - Voltage 10000:1 (capacitive)
- Select AC/DC input coupling.
- Invert the signal (software only).



In the *Time* section you can select the time range of the current measurement.



In the *Trigger* section you can set the trigger event parameters, including:

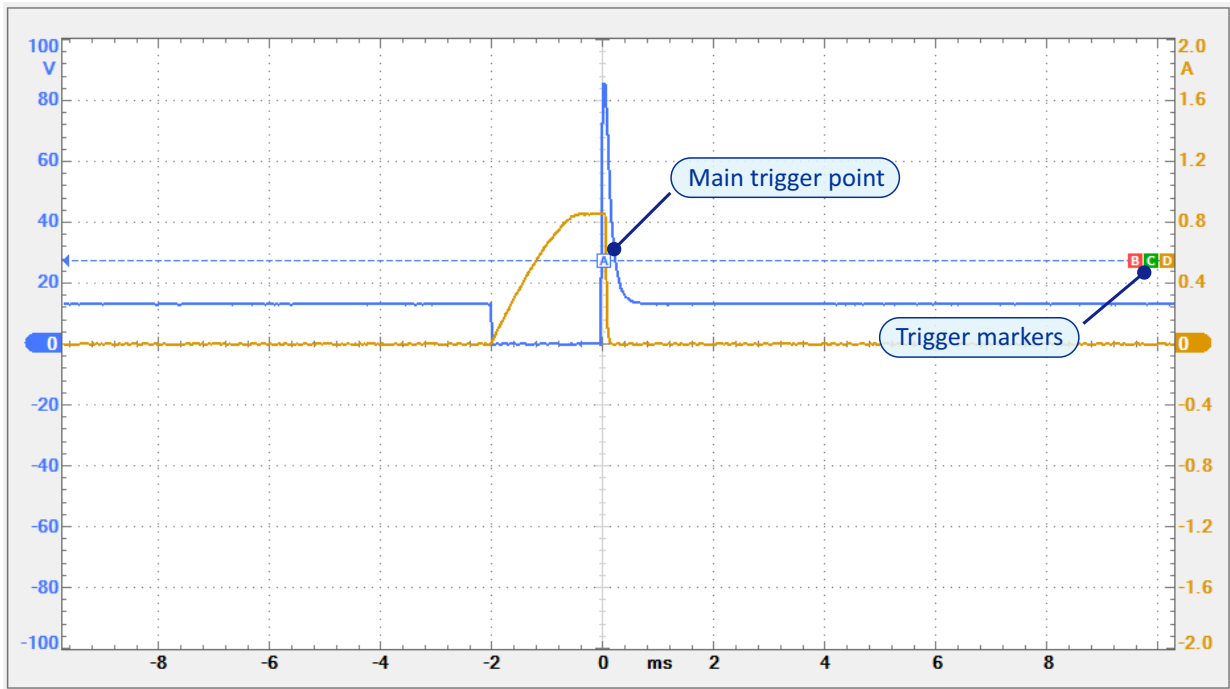
- Select the trigger type:
 - *Auto* - the measurement always takes place regardless of whether a trigger event has occurred or not. If this event doesn't occur, the program automatically switches to free trigger mode and starts the measurement immediately.
 - *Free* - the measurement takes place without waiting for a trigger event. It is suitable for initial overview of an unknown signal and allows for correct determination of the trigger point.
 - *Single (waiting)* - the measurement is performed only once after trigger event occurrence. It is suitable for non-periodic, one-time signals such as single pulses or transient processes.
- Select the trigger channel.
- Select the trigger edge - rising or falling, independently on each channel.
- Select the holdoff value (see explanation in 3.5.1).
- Select Wait-before-free time (see explanation in 3.5.1).



NOTE: You can open or close the Control panel by clicking on the small arrow button in the upper right corner of the screen.



In the *Oscillogram screen* you can set the main trigger level and pretrigger value on the current trigger channel (main trigger point) and independently, trigger levels for the other channels. Controlling trigger edge and level in such a way on each channel is helpful in long time ranges of observation (hundreds of milliseconds) of signals with high frequency spikes in their spectrum, for example, firing lines in ignition waveforms.



Main trigger point and trigger markers for each channel.



Click on main trigger marker and drag it to set the trigger level and pretrigger value on current trigger channel. Alternatively, click on the time axis under Oscillogram screen, hold the mouse button down and move to the left or right to set the pretrigger value.



Click on one of the other trigger markers in the right side of the screen and move it up or down to set the trigger level for the given channel independently. Please, notice when marker is moved in such a way it become unstacked and its color fill mode is changing from solid to frame.



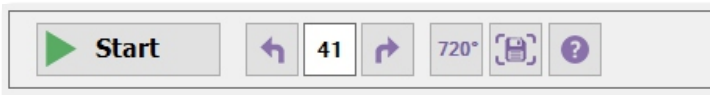
NOTE: Double click on main trigger marker to stack together all trigger markers and move them using only main trigger marker. In this case the trigger level is determined by the main trigger marker position.



NOTE: The colors and letters of the trigger markers change accordingly to the choice of trigger channel.



To move the given channel's waveform up or down on the screen, click on the vertical axis of the channel, hold the mouse button down and move up or down the graphics.



Tools panel in Sparkscope mode.



In the *Tools panel* you can:

- Start or stop the current measurement by clicking on the Start/Stop button.
- Make an observation of the last 100 oscillograms of the current measurement.
- Activate 720° phase markers.
- Save the application's screen as an image.
- Launch the application help.



NOTE: See in section 3.5.1 for more information about how to use 720° phase markers.



NOTE: Status and duration of the current measurement are shown in the Status bar.

3.6.2 Classic ignition with mechanical distributor



To activate this mode, from the Main menu click *Automotive* → *Distributor*. This mode measures ignition in the secondary circuit of systems with mechanical distributor.



CAUTION: Secondary high-voltage ignition circuit! You must use only high-voltage capacitive pick-up clamps! Using standard oscilloscope leads and probes will cause a serious damage of the instrument!



Connect high-voltage capacitive pick-up clamp to the common wire between the ignition coil and distributor (as close as possible to the coil) and plug it into channel A on the oscilloscope. Connect ground wire to the vehicle's chassis ground. In order to have a correct RPM value and first cylinder synchronization, connect the inductive pick-up clamp to the high-voltage cable on the first cylinder (near the spark plug) and plug it into channel B on the oscilloscope. Start the engine and let it idle.



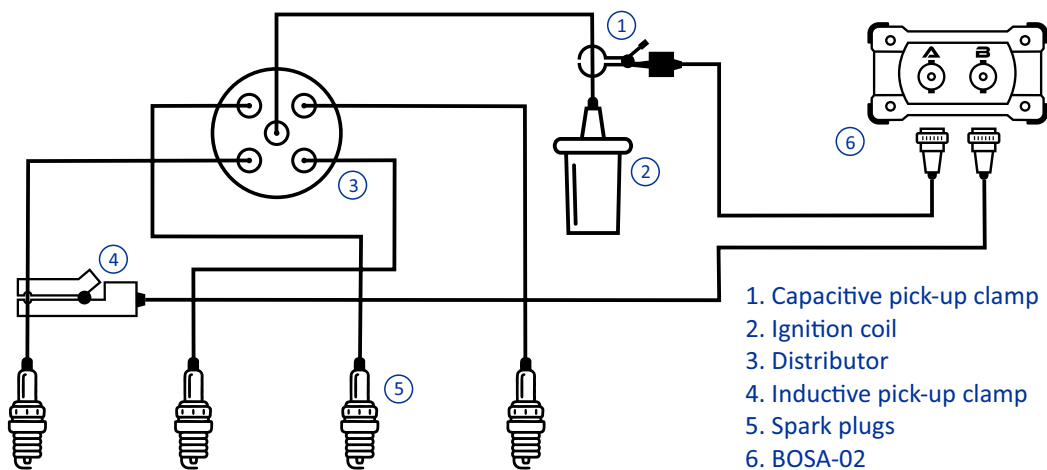
NOTE: This mode should be used with high-voltage 10000:1 capacitive pick-up clamps.

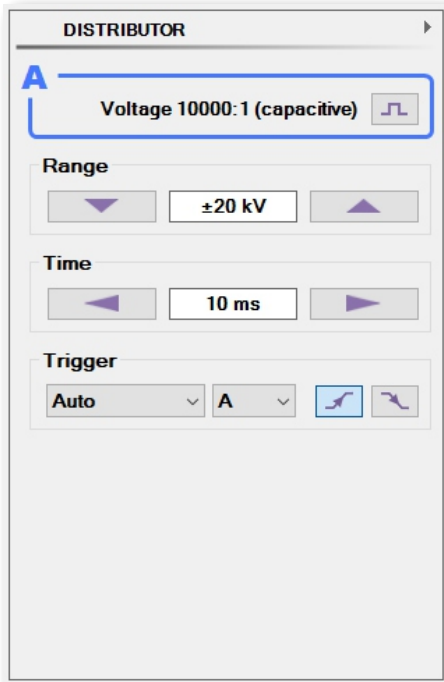


NOTE: You can use a standard high-voltage 10000:1 capacitive pick-up clamp to measure RPM instead of inductive one.




NOTE: This mode is designed to measure a 4-cylinder engine with a standard firing order of 1-3-4-2. When used with an engine with a different firing order or a different number of cylinders, the ignition pattern for a given cylinder and its number on the screen will not match with each other. In the case of different number of cylinders in the engine, the displayed RPM value will also be incorrect.








Control panel in Distributor mode.

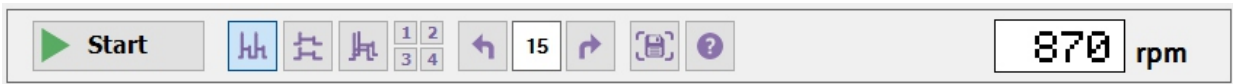
 In the color field in Control panel you can invert the signal (software only).

 In the *Range* section you can set input voltage range simultaneously for all channels.

 In the *Time* section you can select the time range of the current measurement.

 In the *Trigger* section you can set the trigger edge – rising or falling.


 **NOTE:** In this mode trigger is always automatic and is on channel A only.





Tools panel in Distributor mode.

 In the *Tools panel* you can:

- Start or stop the current measurement by clicking on the Start/Stop button.
- Choose the cylinders display pattern:
 - Parade. The individual cylinders are displayed side by side.
 - Raster. The individual cylinders are displayed one above the other.
 - Overlay. The individual cylinders are superimposed on one another.
 - Single. Only one cylinder is shown at a time.
- Make an observation of the last 100 oscillograms of the current measurement.
- Save the application's screen as an image.
- Launch the application help.
- See engine's RPM value.

 **NOTE:** If a correct first cylinder synchronization is present, the RMP value is shown in the right side of Tools panel.

 **NOTE:** If a correct first cylinder synchronization is present, the number "1" is shown in the upper left corner of the screen. Otherwise, the "?" symbol is displayed.

 **NOTE:** Status and duration of the current measurement are shown in the Status bar.

3.6.3 DIS – Wasted Spark ignition



To activate this mode, from the Main menu click *Automotive* → *DIS – Wasted Spark*. This mode measures ignition in the secondary circuit of systems with single coil on two plugs.



CAUTION: Secondary high-voltage ignition circuit! You must use only high-voltage capacitive pick-up clamps! Using standard oscilloscope leads and probes will cause a serious damage of the instrument!



BOSA-02: Connect two high-voltage capacitive pick-up clamps to the spark plug wires pair from a single ignition coil and plug them into oscilloscope inputs. Connect ground wires to the common point on the vehicle's chassis ground. Start the engine and let it idle.



BOSA-04: Connect four high-voltage capacitive pick-up clamps to the four spark plug wires from two ignition coils and plug them into oscilloscope inputs, respectively, the 1st cylinder - channel A, 2nd cylinder - channel B, 3rd cylinder - channel C, 4th cylinder - channel D. Connect ground wires to the common point on the vehicle's chassis ground. Start the engine and let it idle.



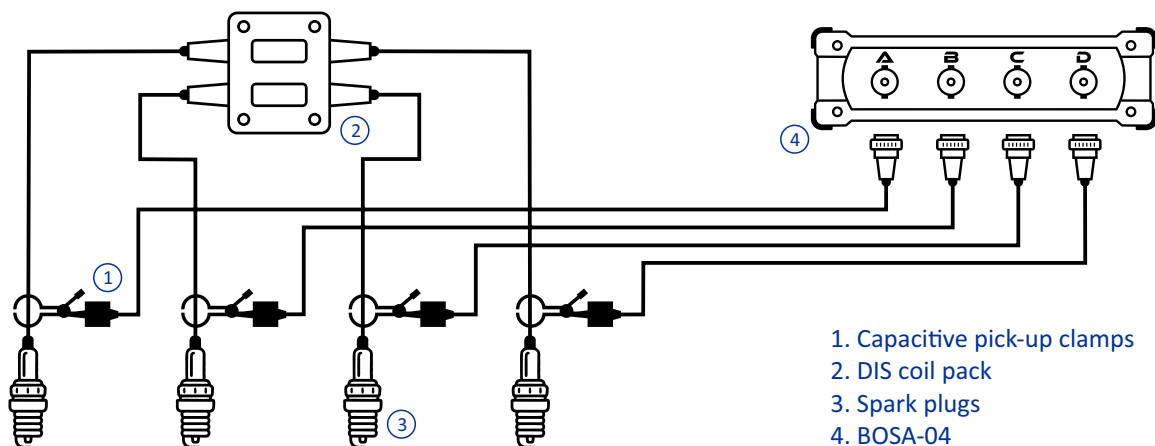
NOTE: This mode should be used with high-voltage 10000:1 capacitive pick-up clamps.



NOTE: In this mode, the signal from the cylinder connected to channel A is used to determine the RPM value.



NOTE: This mode is designed to measure a 4-cylinder engine with a standard firing order of 1-3-4-2 with a common ignition coil on cylinders 1-4 and 2-3 respectively. When used with an engine with a different firing order or a different number of cylinders, the ignition pattern for a given cylinder and its number on the screen will not match with each other. In the case of different number of cylinders in the engine, the displayed RPM value will also be incorrect.



3.6.4 DI – Coil-On-Plug ignition



To activate this mode, from the Main menu click *Automotive* → *DI – Spark-On-Plug*. This mode measures ignition in the secondary circuit of systems with single coil on single plug.



CAUTION: Secondary high-voltage ignition circuit! You must use only high-voltage capacitive pick-up clamps! Using standard oscilloscope leads and probes will cause a serious damage of the instrument!



NOTE: Very often in the modern vehicles the ignition coils are mounted directly on top of the spark plugs, either individually or in a common monolithic block. It is necessary to use a set of high-voltage extension cables for ignition diagnostics.



BOSA-02: Connect two high-voltage capacitive pick-up clamps to the spark plug wires for any two cylinders and plug them into oscilloscope inputs. Connect ground wires to the common point on the vehicle's chassis ground. Start the engine and let it idle.



BOSA-04: Connect four high-voltage capacitive pick-up clamps to the four spark plug wires and plug them into oscilloscope inputs, respectively, the 1st cylinder - channel A, 2nd cylinder - channel B, 3rd cylinder - channel C, 4th cylinder - channel D. Connect ground wires to the common point on the vehicle's chassis ground. Start the engine and let it idle.



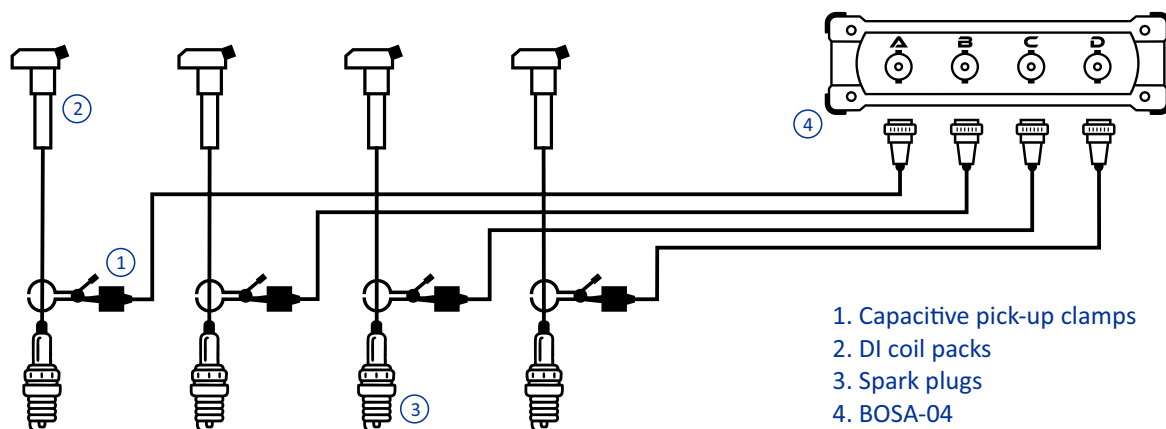
NOTE: This mode should be used with high-voltage 10000:1 capacitive pick-up clamps.

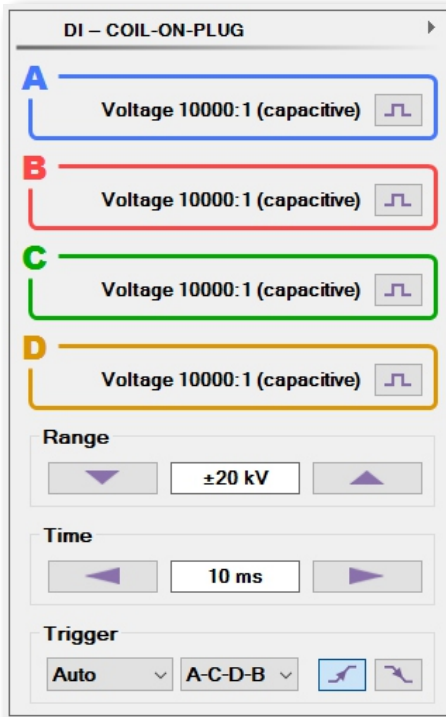


NOTE: In this mode, the signal from the cylinder connected to channel A is used to determine the RPM value.




NOTE: This mode is designed to measure a 4-cylinder engine with a standard firing order of 1-3-4-2. When used with an engine with a different firing order or a different number of cylinders, the ignition pattern for a given cylinder and its number on the screen will not match with each other. In the case of different number of cylinders in the engine, the displayed RPM value will also be incorrect.








Control panel in DI – Coil-On-Plug mode

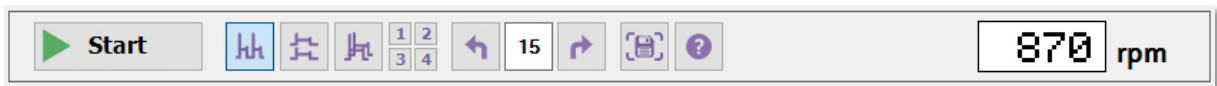
 In the color field in Control panel you can invert the signal (software only).

 In the *Range* section you can set input voltage range simultaneously for all channels.

 In the *Time* section you can select the time range of the current measurement.

 In the *Trigger* section you can set the trigger edge – rising or falling.

 **NOTE:** In this mode trigger is always automatic and suggests a 1-3-4-2 firing order.



Tools panel in DI – Coil-On-Plug mode.



In the *Tools panel* you can:

- Start or stop the current measurement by clicking on the Start/Stop button.
- Choose the cylinders display pattern:
 - Parade. The individual cylinders are displayed side by side.
 - Raster. The individual cylinders are displayed one above the other.
 - Overlay. The individual cylinders are superimposed on one another.
 - Single. Only one cylinder is shown at a time.
- Make an observation of the last 100 oscillograms of the current measurement.
- Save the application's screen as an image.
- Launch the application help.
- See engine's RPM value.



NOTE: Status and duration of the current measurement are shown in the Status bar.

3.7 Multilingual support

StudioBOSA is an application designed to support a wide range of automotive professionals in their everyday work experience and one of its important benefits is built-in multilingual support for graphical interface and documentation.



To change the current application language:

- From the Main menu click on [Settings](#) → [Language](#) select the language you prefer.
- In the popup dialog box, confirm your selection and StudioBOSA will automatically close and restart with the new language settings.



NOTE: When the application is starting for the first time on your computer, the default language is *English*.



NOTE: The application help file launches in the language version corresponding to the current application language.

3.8 Application preferences

StudioBOSA allows for customization through setting user's preferences .

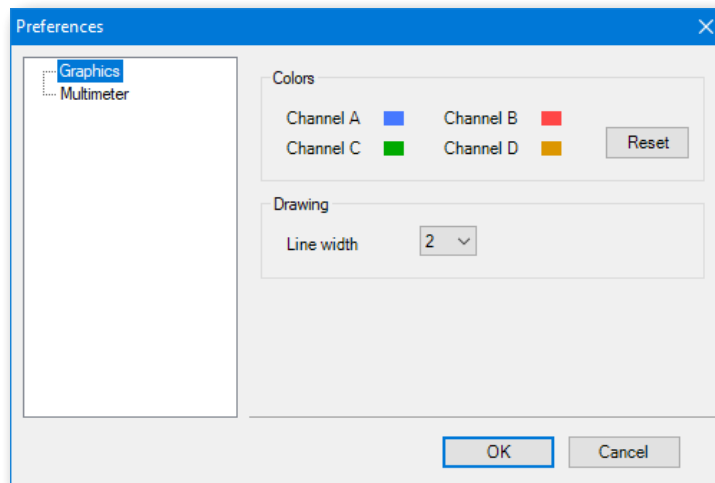


To launch the Preferences box, from the Main menu click on *Settings* → *Preferences...*

- In the *Graphics* page you can choose the color for every channel and set the drawing line width. Click on the Reset button if you want to set back colors to their default values.

- In the *Multimeter* page you can choose the color scheme (color or monochrome) and font style (7-segment or dot-matrix) for digital multimeter display.

When you are ready click OK button. The preferences will take place immediately. On the next launch StudioBOSA will start with the new settings.



Preferences dialog box.

Appendix A: Shortcut keys in StudioBOSA

Keys	Action
Space	Start/Stop measurement
A	Activate/deactivate channel A
B	Activate/deactivate channel B
C	Activate/deactivate channel C
D	Activate/deactivate channel D
Ctrl+A	Moves the keyboard input focus to channel A
Ctrl+B	Moves the keyboard input focus to channel B
Ctrl+C	Moves the keyboard input focus to channel C
Ctrl+D	Moves the keyboard input focus to channel D
Up arrow	Increases the input voltage range
Down arrow	Decreases the input voltage range
Right arrow	Increases the time range
Left arrow	Decreases the time range
Shift+Up arrow	Moves the trigger point up
Shift+Down arrow	Moves the trigger point down
Shift+Right arrow	Moves the trigger point right
Shift+Left arrow	Moves the trigger point left
Page Up	Shows the next screen
Page Down	Shows the previous screen
Home	Shows the first screen
End	Shows the last screen
H	Scrolls down the ignition screen modes
1	Shows ignition of the first cylinder only
2	Shows ignition of the second cylinder only
3	Shows ignition of the third cylinder only
4	Shows ignition of the fourth cylinder only

Keys	Action
F1	Application help
F2	Shows / hides 720° phase markers
F9	Shows / hides Control panel
Ctrl+G	Saves application screen as an image
Esc	Application exit

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