Technical overview

of

PicoScope

by AK Training

This document has been developed and prepared by AK Training.

www.akautomotivetraining.co.uk

Contents

Foreword

This document has been developed by AK Training as a source of reference material for those attending technical courses with AK Training. It is intended to provide a technical overview of the main and most commonly used features and functions of the PC-based digital oscilloscope from Pico Technology.

The document begins with an introduction to the generic features and functions of an oscilloscope and associated technical terminology. It then explains in detail how to navigate the various menus of the PicoScope, select measurement functions, adjust and optimize settings and carry out test measurements. This should be useful in assisting technicians to get the best from PicoScope for carrying out fault-finding and diagnosis of modern vehicle electronic systems.

For more detailed information about how to use PicoScope, reference should always be made to the user's guide contained within the Help menu of the PicoScope software. The latest software updates should also be downloaded regularly from the Pico Technology website at www.picotech.com

A generic oscilloscope course is available from AK Training. The course show cases PicoScope and other test instruments. Courses are run at selective venues in the Buckingham, Milton Keynes and Northampton area or can be delivered on site at clients premises. For further information, contact AK Training.

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Oscilloscope features and functions

An Oscilloscope (scope for short) is a test instrument that displays the shape of electrical signals on a screen. Signals appear as a live graph showing voltage against time and a grid on the screen called a graticule shows divisions of voltage and time to enable test measurements to be made. Units of voltage per division are shown down the side of the scope screen whilst units of time per division are shown along the bottom. The graph is referred to as a scope trace or waveform and the scope repeatedly draws the trace across the screen from left to right.

The main advantage of using a scope compared to a digital multimeter is that it will display high frequency pulsating voltage signals and other rapidly changing voltages and signals. This is due to the frequency at which the scope measures the signal and converts it to a trace, and is referred to as sampling or sample rate. Digital multimeters by comparison have a much slower sample rate and can show only an average measurement of such signals. A scope can also display intermittent irregularities and glitches in a signal that a digital multimeter will not detect.

Oscilloscopes range from large stand-alone machines to small, compact hand held test instruments. Many scopes have a multiple channel facility that enables more than one scope trace to be displayed at the same time. A Scope may also be a PC-based software package providing a convenient test tool for mobile use.

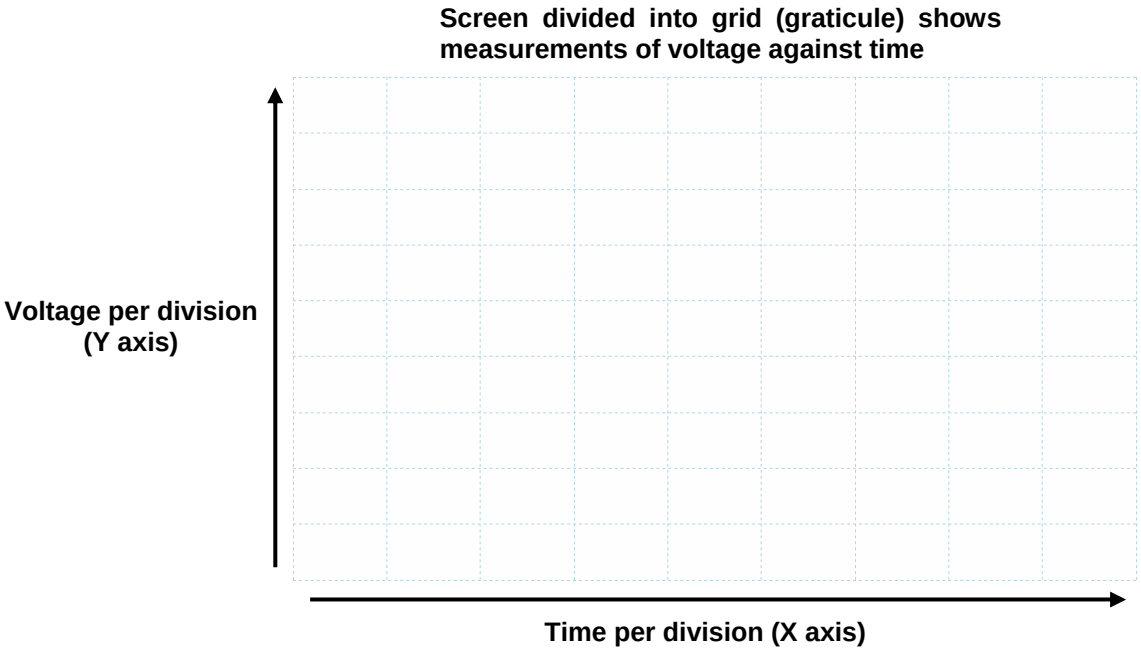
All oscilloscopes have the same basic functions of measuring voltage against time. They differ only in the way that the individual functions are selected and the layout of the controls and settings.

Oscilloscope basic controls and settings

The two most important controls that allow the user to adjust the settings of an oscilloscope are voltage per division and time per division. These controls can be compared to the measurement scales of a digital multi meter as they enable the scope user to adjust the scope settings to suit the particular test measurement.

Voltage per division
This is shown down the side of the screen. It is referred to as the 'Y' axis.

Time per division
This is shown along the bottom of the screen. It is referred to as the 'X' axis.



The position of the Y (voltage) axis and the X (time) axis on the screen can also be adjusted. If measuring an AC voltage for example, it may be useful to position 0 volts in the middle of the Y axis in order to be able to view voltage peaks occurring both above and below 0 volts. The layout of the scope controls differ between different makes of scope and so the user should become familiar with the controls beforehand.

Multiple scope channels
The multiple channel facility of an oscilloscope enables more than one waveform to be displayed at the same time. In this way, different signals can be compared to each other, for example a crankshaft sensor against a camshaft sensor. The voltage per division for each channel is adjusted individually whilst the time base per division is usually the same for all channels.

Units of measurement and terminology

The following definitions apply to units of measurement:

nano (symbol: n): This unit of measurement defines a billionth of something (eg a nanosecond = x 0.000 000 001 of one second).

micro (symbol: µ): This unit of measurement defines a millionth of something (eg a microsecond = x 0.000 001 of one second).

mili (symbol: m): This unit of measurement defines a thousandth of something (eg a milivolt = x 0.001 of one volt).

kilo (symbol: k): This unit of measurement defines a thousand of something (eg a kilovolt = x 1000 volts).

Mega (symbol: M): This unit if measurement defines a million of something (eg a megavolt = x 1 000 000 volts).

Giga (symbol: G): This unit of measurement defines a billion (or thousand million) of something (eg a gigavolt = x 1 000 000 000 volts).

Sample rate

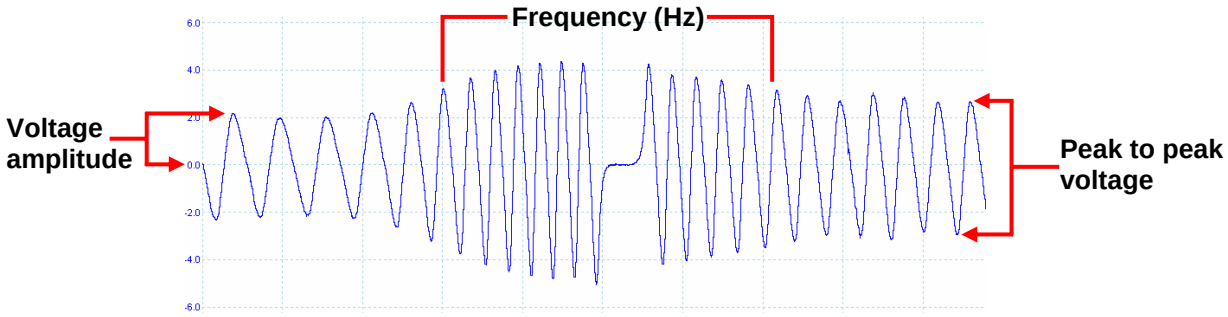
A Digital Storage Oscilloscope such as PicoScope plots the incoming voltage signal at regular intervals over a one second time period and digitally recreates the signal on the scope screen. Sample rate is the term used to define the number of plots per second captured by the oscilloscope. The faster the sample rate of the scope (ie the more frequently it plots the signal voltage per second), then the more detailed will be the trace that appears on the scope screen.

The sample rate is relative to the time per division setting. A low time per division setting for example will usually have a higher sample rate thereby enabling a more detailed trace to be displayed on the screen. The maximum sample rate of a scope is usually given in either Mega samples per second (MS/s) or Giga samples per second (GS/s).

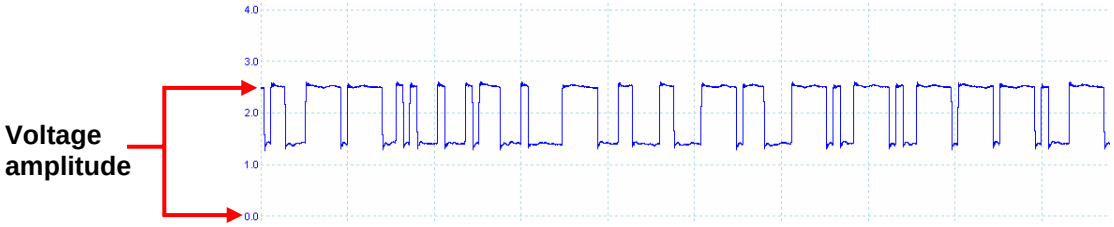
Waveform characteristics

The illustrations below show two basic types of waveform and explains the terms associated with those waveforms.

Sinusoidal waveform
Also often referred to as an AC (alternating current) signal, the waveform alternates either side of 0 volts or may simply rise and fall creating a regular sinusoidal shape (see below).



Square waveform
The signal switches between clearly defined voltage levels. A Hall effect sensor for example will create a square waveform signal by switching a voltage to ground. Other square wave signals are created digitally by an electronic control module (ECM). A typical digital square waveform is shown below.



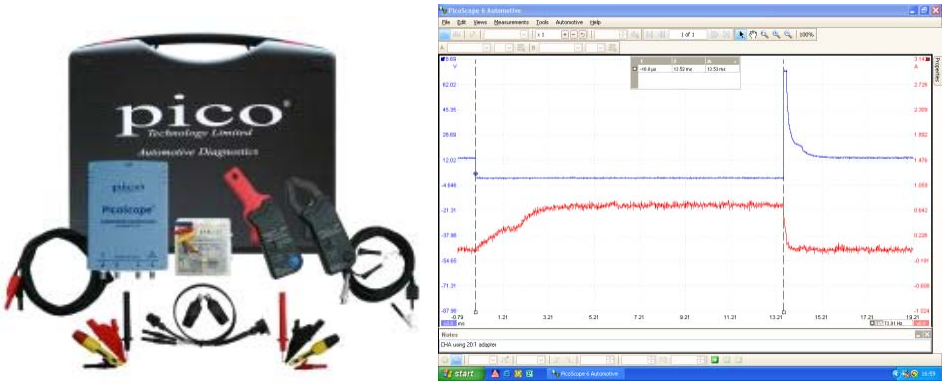
Voltage Amplitude
This is the maximum voltage generated from the zero volts line (Y axis) of the oscilloscope.

Peak to peak voltage
Peak to peak voltage is the difference in voltage between the minimum and maximum voltages occurring in the waveform.

Frequency
This is the number of times per second that a signal occurs or is generated. Frequency is measured in hertz and is abbreviated with the letters Hz.

Introduction to PicoScope

The PC based Automotive Diagnostics oscilloscope kit from Pico Technology is available in both dual and four channel versions and comes complete with a range of useful accessories in its own hard plastic carry case. Other accessories are also available as optional extras direct from Pico Technology. The Pico Scope is user-friendly and has an integrated library of easily accessible example scope traces with accompanying help files to assist the user when carrying out test measurements. Regular free software updates are also available for download from the Pico Technology website at www.picotech.com



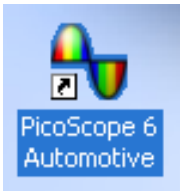
PC based automotive diagnostics kit from Pico Technology

The different channels of the PicoScope are colour coded as follows:

Channel A: Blue
Channel B: Red
Channel C: Green
Channel D: Brown

When the PicoScope software is installed, a short cut icon automatically appears on the PC desktop (see below).

PicoScope desktop shortcut icon



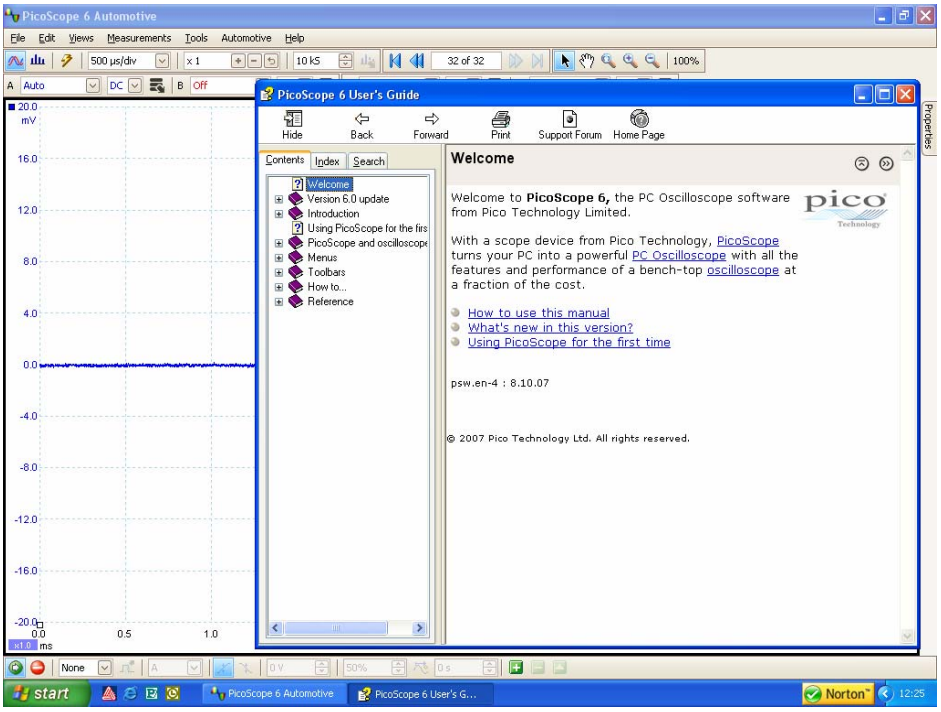
To use PicoScope, first ensure that the scope interface box is correctly connected to the PC via the USB lead (included in the kit). Double click with the left mouse button on the PicoScope shortcut icon and wait a few moments for PicoScope software to open.

Introduction to PicoScope

User's guide

The PicoScope User's Guide can be opened from the start up screen by clicking the left mouse button on the Help tab at the top of the screen. A drop down menu then appears.

Select User's Guide at the top of the list on the drop down menu and the User's Guide Welcome screen appears.

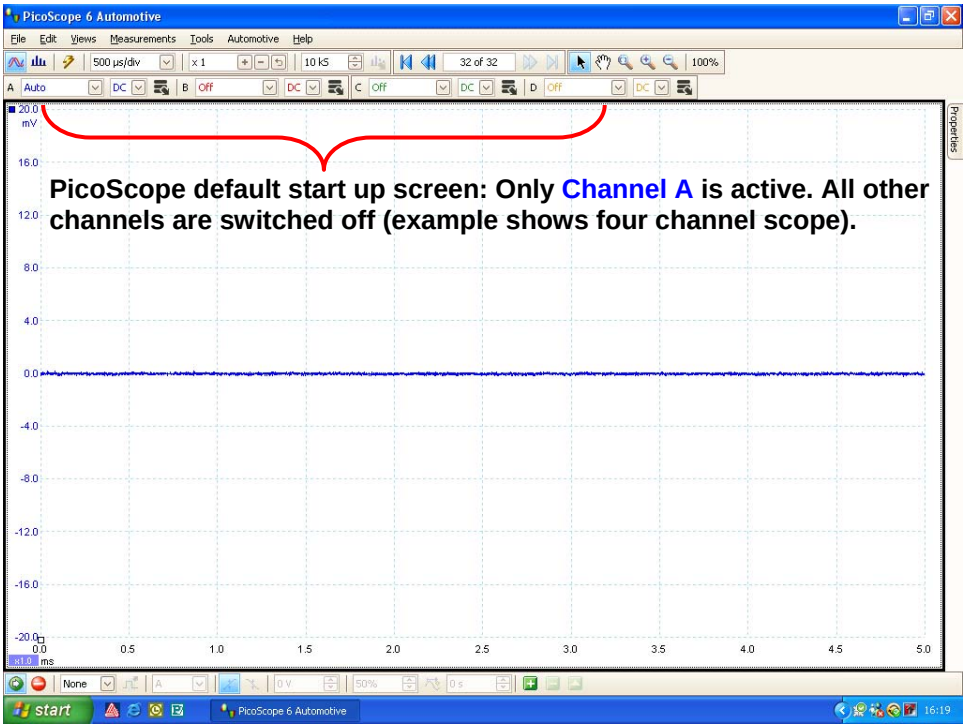


From the User's Guide Welcome screen, help topics can be selected from the left hand column using either the contents, index or search tabs at the top of the column. The following pages will explain the main navigational features and functions of the PicoScope. The User's Guide provides further and more detailed information.

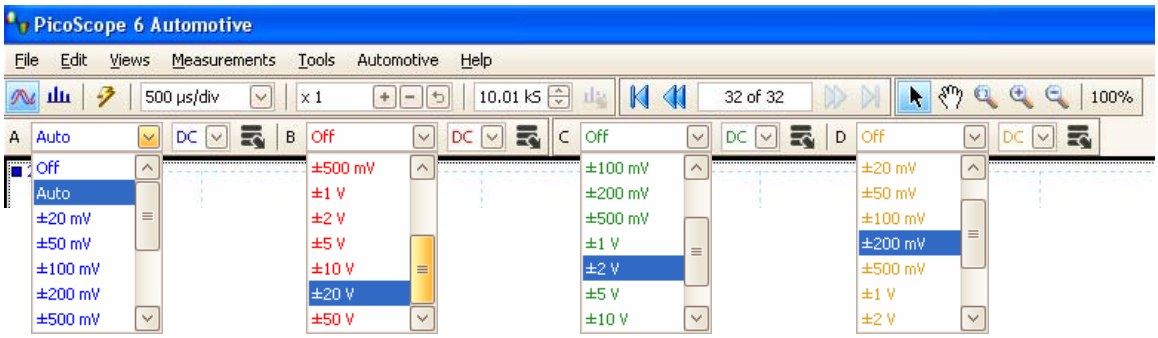
PicoScope familiarization

Basic controls and settings

When PicoScope opens, a default start up screen appears. Custom start up screens can also be set up and saved by the user. On the default start up screen, Channel A only is active whilst all the other channels are switched off (see screen shot below).

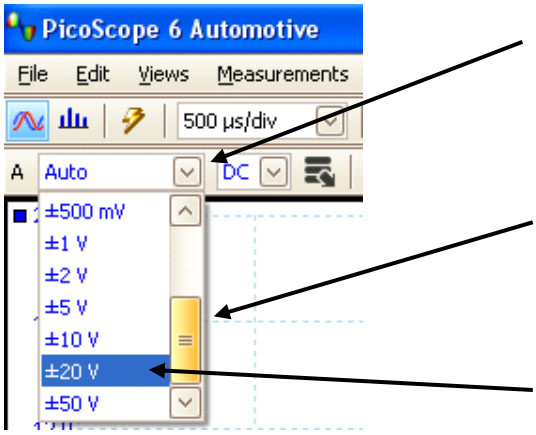


Voltage and time base adjustments for the PicoScope are carried out via a series of drop down menus. One unique feature of the PicoScope is that voltage adjustment options are selected as voltage scales instead of the more usual oscilloscope feature of adjusting the voltage per division on the scope screen. This feature of PicoScope is the same as adjusting the voltage scale of a digital multi meter. The screen shot below shows the available drop down menus for selecting basic voltage measurement scales.



PicoScope familiarization

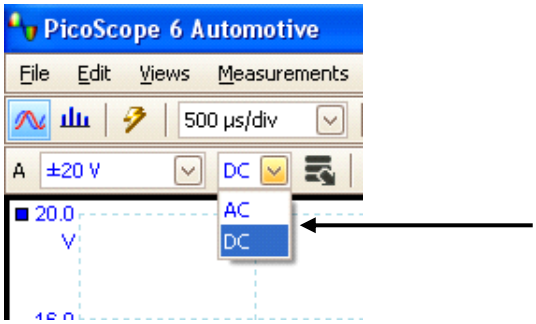
The default voltage scale setting for Channel A is Auto. If Channel A is connected to a circuit, PicoScope automatically selects an appropriate scale to enable a test reading to be obtained. This is the same as an auto ranging function of a digital multimeter. Auto can also be selected for each of the other channels as well.



Voltage scale drop down menus
To open a drop down menu, click the left mouse button on the arrow next to the channel to be changed.

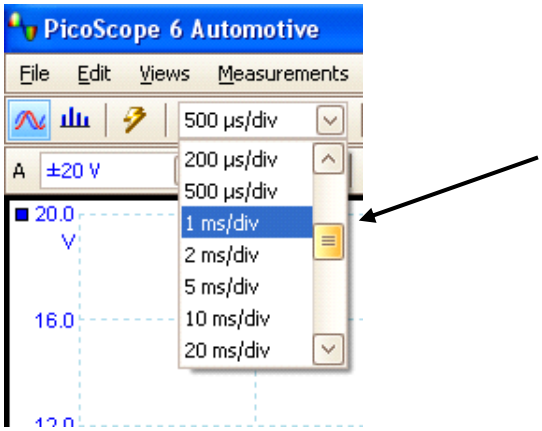
A scroll bar down the right hand side of the drop down menu enables the user to move up and down the list.

Hovering the mouse over an item on the menu will cause the item to be highlighted in blue. To select an item, click the left mouse button on the desired option (example shows Channel A).



Individual channels of the PicoScope can be switched on and off as required.

AC and DC measurements
A drop down menu is also available for each channel to enable the user to select AC or DC measurements. Selecting the required option from the menu is carried out in the same way as selecting a voltage scale.



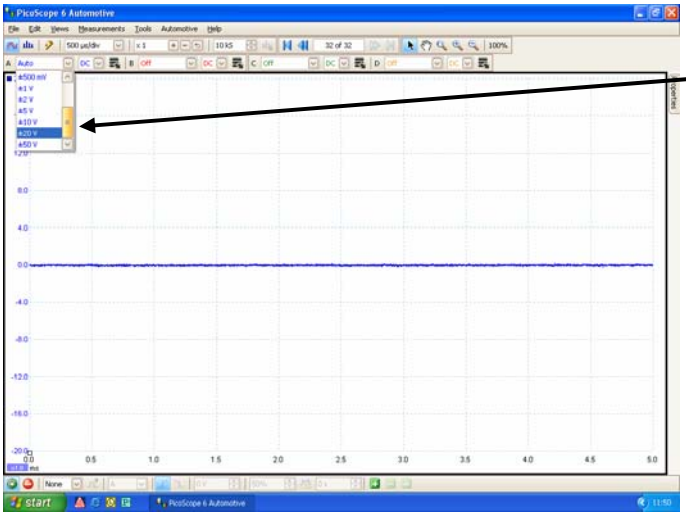
Time per division
A further drop down menu enables the user to select an appropriate time scale per division. Often referred to simply as the time base, the time base per division is displayed along the bottom of the screen. Ten divisions are available.

Note that the time base adjustment affects all of the active scope channels at once and it is not possible to adjust the time base for individual channels.

PicoScope familiarization

Setting up basic measurements

The example screen shots below show how to set up Channel A of a 4 channel PicoScope for measuring voltage on a vehicle with 12 volt electrical system. Select the desired voltage scale from the drop down menu. Scales are shown as +/- to enable AC wave forms to be displayed.



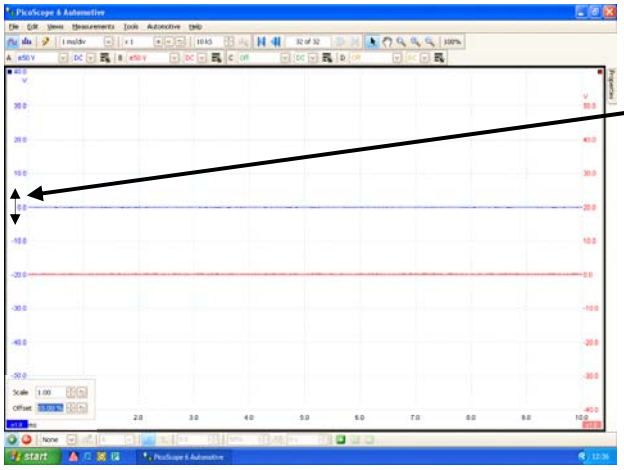
To take measurements on a 12 volt system, the +/- 20 volt scale needs to be selected.

Time base adjustment is not too important at this stage. A typical starting point of 1ms/div (1 mili second per division) is usually adequate but the time base can be adjusted later if necessary.

The maximum permissible voltage input per channel is 50 volts. Higher voltages require the use of special adapters in the Pico Scope kit. These will be described later on.

Adjusting position of Y axis

When the desired channels, voltage and time base have been selected, the Y axis may need to be adjusted on the scope screen. This can be done in one of two ways as follows:



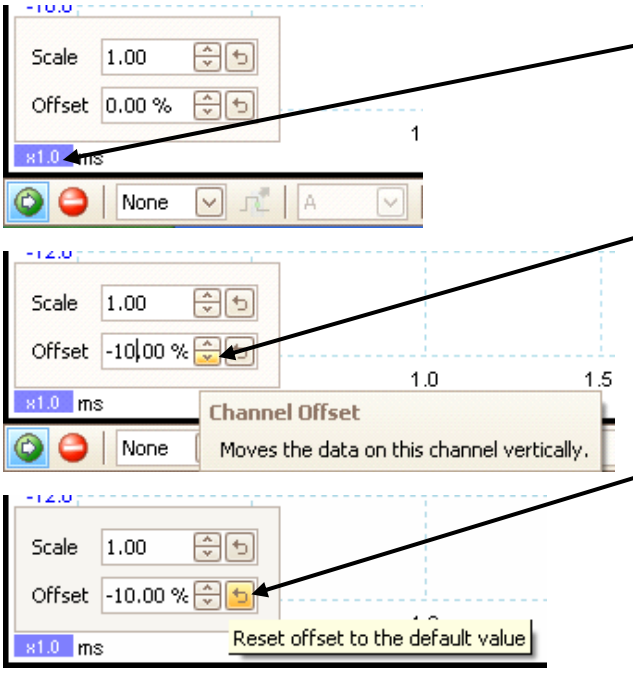
Move the mouse pointer to the side of the scope screen and hover the pointer over the voltage units for the channel to be adjusted. The mouse pointer changes to a double ended arrow.

Press and hold down the left mouse button and drag the Y axis up or down to the desired position on the scope screen. Repeat this procedure for each channel that is to be adjusted.

PicoScope familiarization

Adjusting position of Y axis (continued)

Alternatively, the position of the Y axis can be adjusted using the Channel Offset menu at the bottom corner of the screen (see screen shots below).



To open the relevant Channel Offset menu, click the left mouse button on the x1.0 box at the bottom corner of the screen.

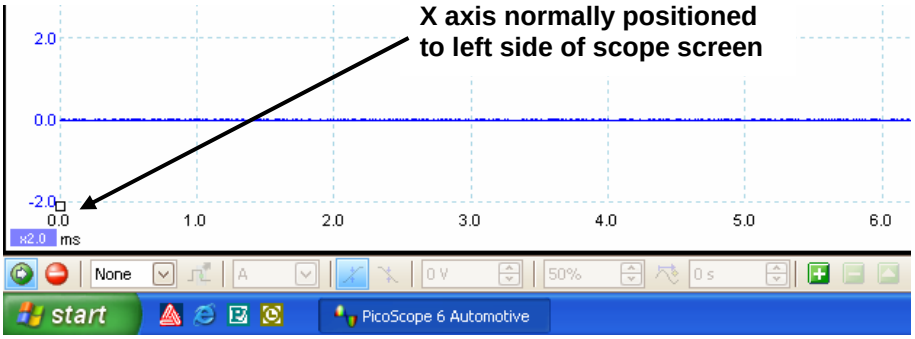
Use the up or down arrow button in the Channel Offset menu to move the position of the Y axis up or down.

To reset the Y axis offset to the default value, click the left button of the mouse on the reset button in the Channel Offset menu.

A separate Channel Offset menu is available for each scope channel. The menu x1.0 boxes are colour coded to the relevant channel. The example above shows Channel A.

Adjusting position of X axis

The X axis is normally positioned to the extreme left side of the scope screen (see screen shot below).

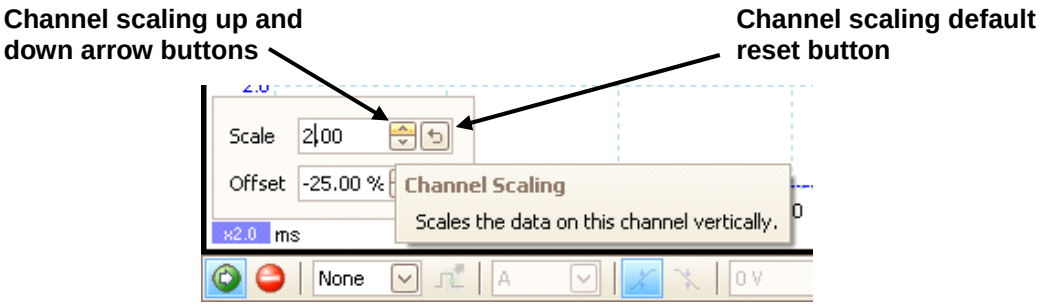


Adjustment of the X axis is carried out in conjunction with use of the pre-trigger function and will be explained in more detail later on.

PicoScope familiarization

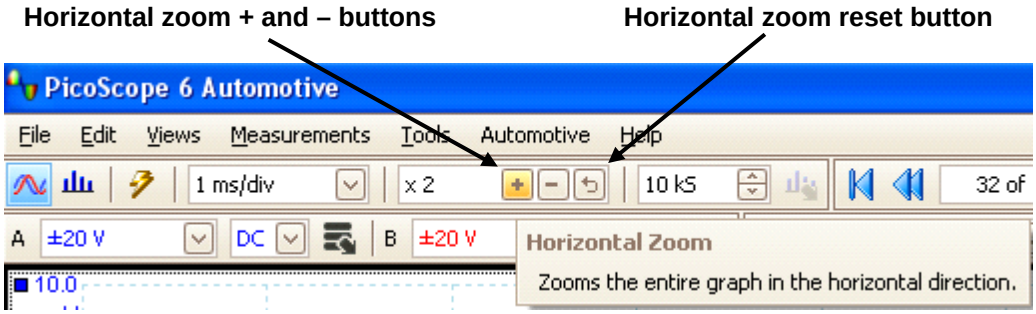
Channel scaling

Channel scaling multiplies the voltage scale vertically. In this way, waveforms can be viewed in more detail on the scope screen by effectively 'zooming in' on a particular part of the waveform. Channel scaling is achieved by opening the Channel offset menu and clicking on the relevant up or down arrows as required. A scaling of 2 for example doubles the height of the scale. The scale can be reset to the default setting by clicking the left mouse button on the return arrow (see screen shot below).



Horizontal zoom

A horizontal zoom feature of PicoScope enables the time base setting to be multiplied. This is achieved by clicking the left mouse button on the plus + or minus – buttons in the box next to the time per division drop down menu. This will either increase or decrease the horizontal zoom as required. The horizontal zoom can be reset to the default setting by clicking the left mouse button on the return arrow (see picture below).



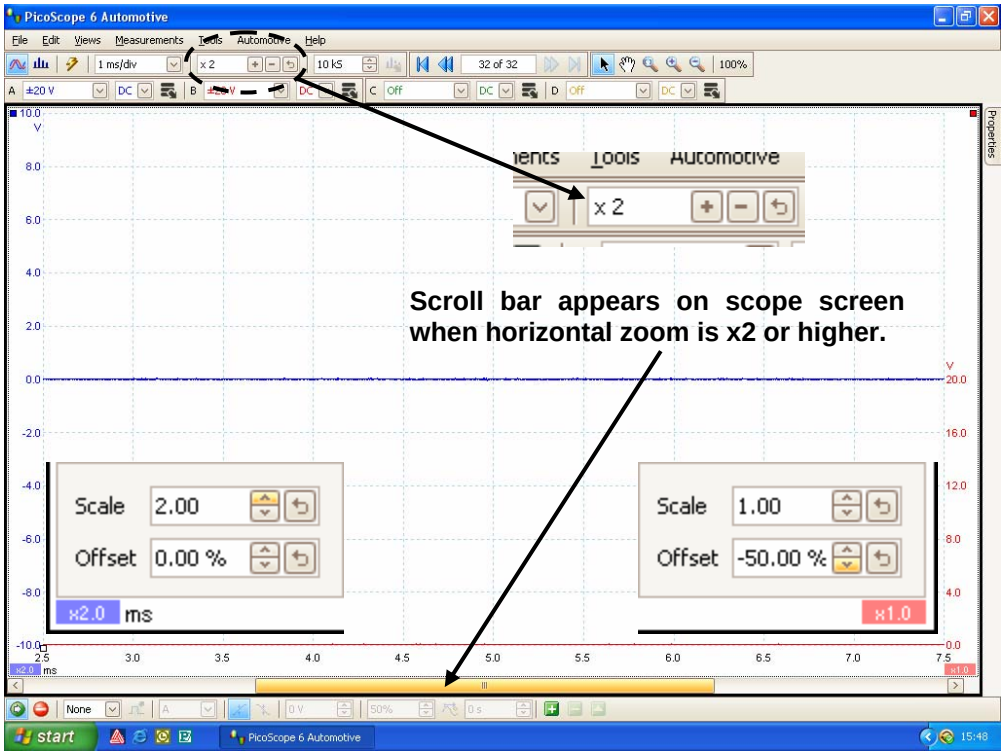
PicoScope familiarization

Example set up

In the following example scope set up, Channel A and Channel B have been switched on together.

Channel A is set up as follows:
+/- 20 V scale selected
Channel offset 0.00%
Channel scaling x2.0

Channel B is set up as follows:
+/- 20V scale selected
Channel offset -50.00%
Channel scaling x1.0



Channel A offset of 0.00% means that the Y axis of Channel A is positioned in the centre of the scope screen. Multiplying the channel scaling x2.0 means that 10 volts either side of the Y axis is visible on the scope screen.

Channel B offset of -50.00% means that the Y axis of Channel B is positioned at the bottom of the scope screen. The channel scaling remains at x1.00 which means that 20 Volts above the Y axis only is visible on the scope screen.

A time base of 1ms (1 mili second) per division has been selected with a horizontal zoom of x2. When the horizontal zoom function is x2 or higher, a scroll bar appears at the bottom of the scope screen. This enables the user to scroll backwards and forwards along the scope waveform.

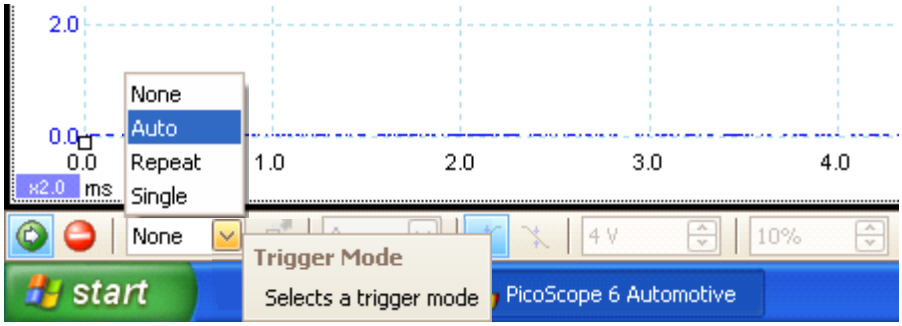
Oscilloscope trigger

Trigger function

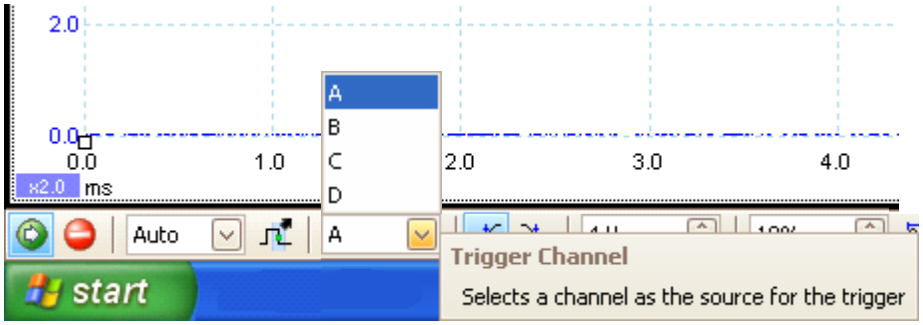
A scope repeatedly draws the waveform across the screen from left to right at a frequency determined by the time per division setting. If the signal is of a similar frequency to the scope, then the waveform will appear as a stable image on the screen. However, very often, the scope frequency and signal frequency do not coincide and the waveform appears to wander across the screen thereby making measurement difficult. To counter this, the scope can be set to start drawing the waveform when a pre-defined threshold voltage level is reached and this is known as triggering. Triggering the scope enables a stable image to be displayed on the screen making it easier to view and analyse specific details of the waveform.

PicoScope trigger

To trigger the PicoScope, open the Trigger Mode menu by clicking the left mouse button on the arrow next to the trigger menu box at the bottom of the scope screen (see picture below). Several trigger modes are available for PicoScope. The most commonly used is the Auto trigger. Select the trigger mode from the menu by clicking the left mouse button on the desired option.



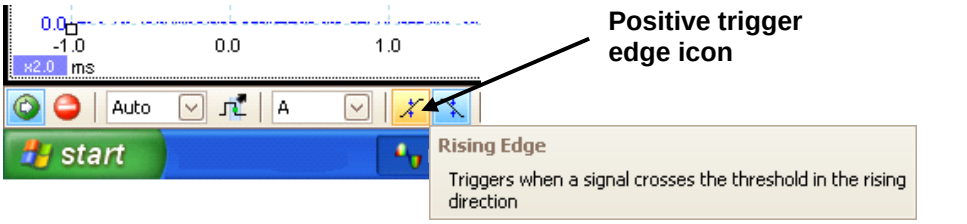
A trigger can be assigned to either channel of the scope as required by clicking the left mouse button on the Trigger Channel menu next to the Trigger Mode menu at the bottom of the screen (see picture below).

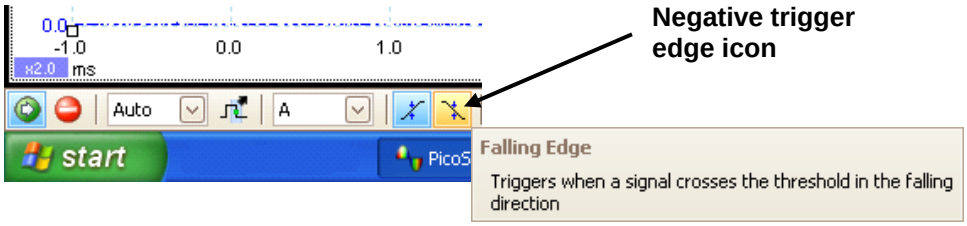


PicoScope trigger

Rising and falling edge trigger

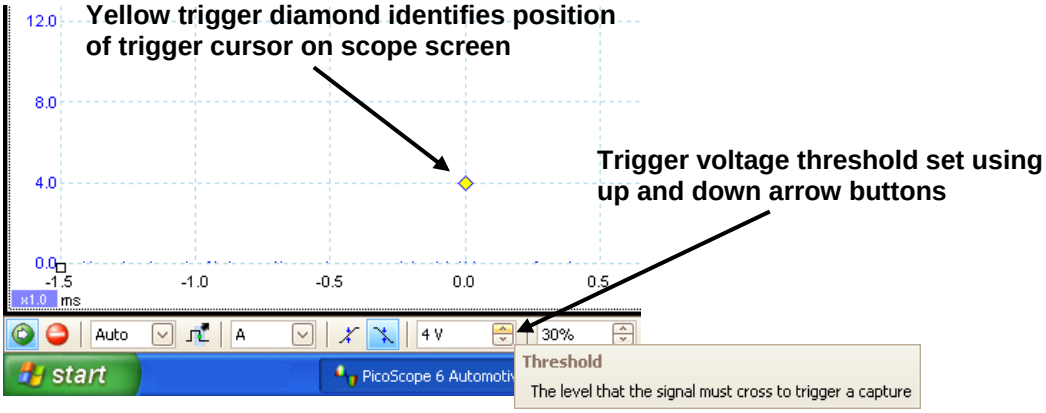
When the trigger mode has been activated, the trigger can then be set to occur so that the scope starts to draw the waveform when either a rising or a falling voltage occurs. When a rising voltage trigger edge is selected, the scope is positively triggered and when a falling voltage trigger edge is selected, the scope is negatively triggered. The trigger edge can be selected by clicking the left mouse button on the required trigger edge icon at the bottom of the scope screen (see pictures below).





Trigger threshold

A trigger cursor in the shape of a small yellow diamond appears on the scope screen to identify the position of the trigger. The threshold voltage level of the trigger can be set using the up and down arrows in the trigger Threshold menu. In the example below, a trigger threshold voltage of 4 volts has been selected.

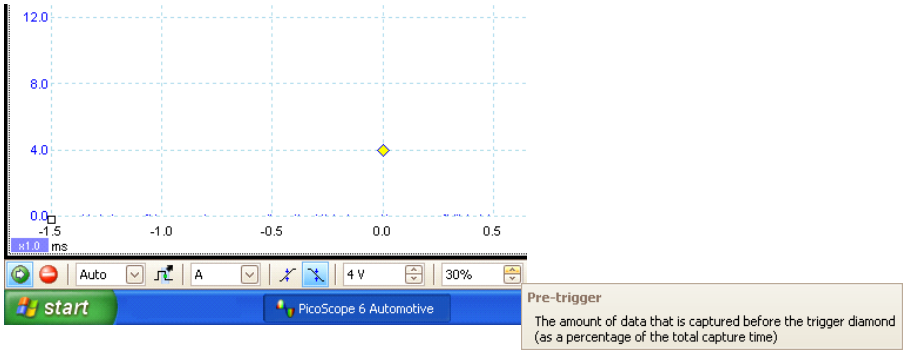


For the trigger to be effective, its threshold voltage must be positioned within the voltage range of the waveform being measured.

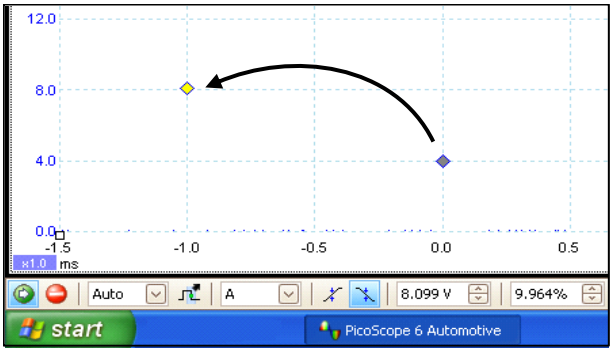
PicoScope trigger

Pre-trigger (X axis adjustment)
The pre-trigger defines the position of the X axis on the scope screen and determines the amount of data captured on the scope screen before and after the trigger diamond. It is a % value of the total capture time of the scope screen and can be set using the up and down arrows of the Pre-trigger menu. Each division on the PicoScope screen is 10% of the total screen width and the reference position of the trigger diamond is always 0.00%.

In the example below, a pre-trigger of 30% has been set. This means that three divisions of capture time are available on the scope screen before the trigger diamond and seven divisions are available after the trigger diamond.



A quick method of adjusting the trigger threshold voltage and pre-trigger is to use the left mouse button to drag the trigger diamond to the desired position on the scope screen.

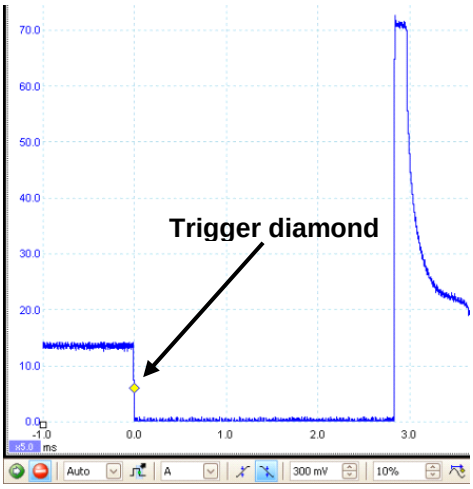


Hovering the mouse cursor over the trigger diamond enlarges the trigger diamond slightly. By clicking and holding down the left mouse button on the trigger diamond, it can then be dragged anywhere on the screen. Release the left mouse button when the trigger diamond is at the desired position. Note that the values for the trigger threshold and pre-trigger are also adjusted automatically to show the new trigger settings.

PicoScope trigger

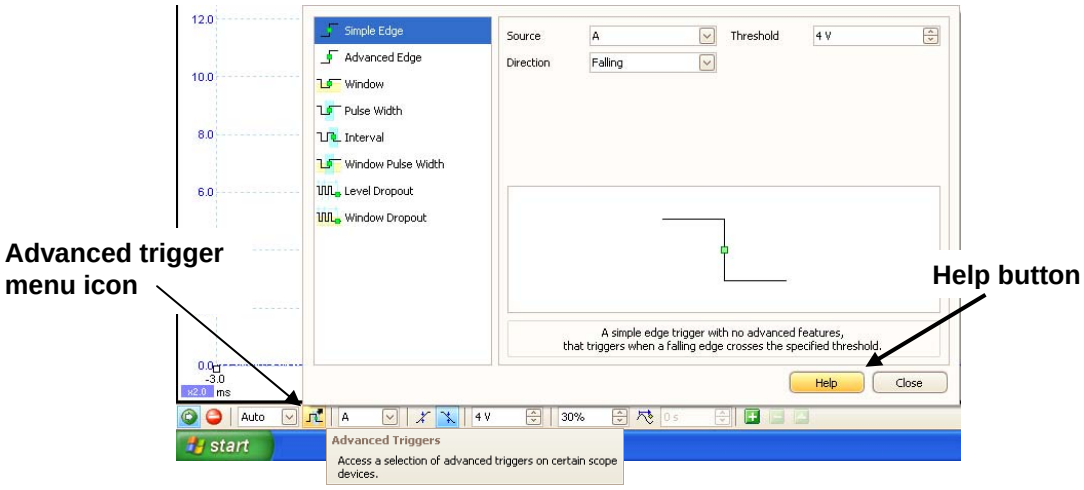
Example trigger set up

The picture below shows an example trigger set up for Channel A. The auto trigger has been selected for a falling edge (negative trigger). The trigger threshold voltage is shown as 300mV with a pre-trigger offset (X axis adjustment) of 10%.



Advanced trigger functions

A selection of advanced trigger functions became available with the introduction PicoScope software version 6 and are accessable via a separate menu (see picture below).

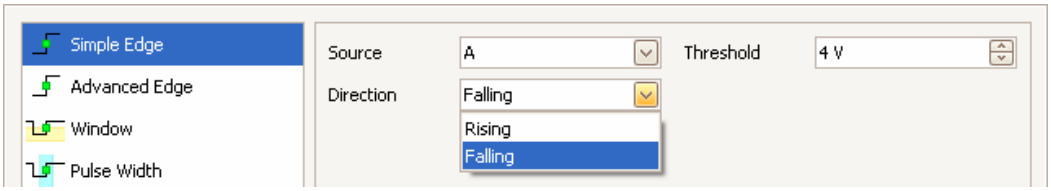


Advanced triggers enable the user to set specific trigger parameters. Several features of the advanced trigger functions will be briefly explained on the next page. For more detailed information about advanced trigger functions, click the Help button at the bottom right of the Advanced Triggers menu on the scope screen.

PicoScope trigger

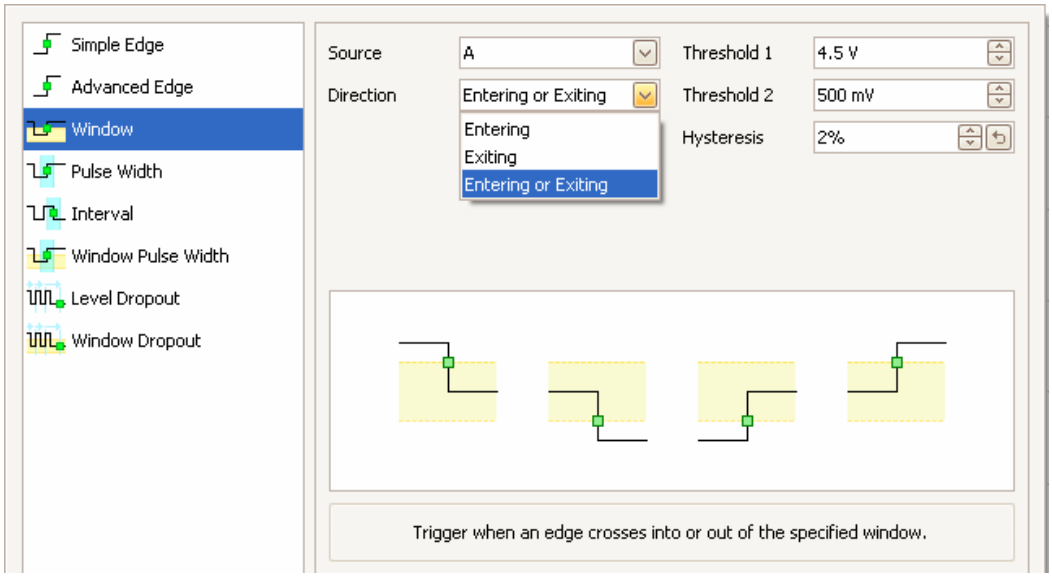
Comparison of simple edge and advanced edge trigger

The simple edge trigger is a basic trigger type with no advanced features. It is triggered when either a rising or falling edge crosses a specified threshold voltage. In earlier versions of PicoScope software, this was the only trigger function available.



The advanced trigger functions of PicoScope 6 enable the user to select and adjust various settings that will trigger the scope when the waveform characteristics fall either within or outside of specified parameters. The options available depend upon the trigger type selected.

In the example below, a window advanced trigger enables the scope to be triggered when the waveform characteristics enter or exit a specified threshold voltage range (window).

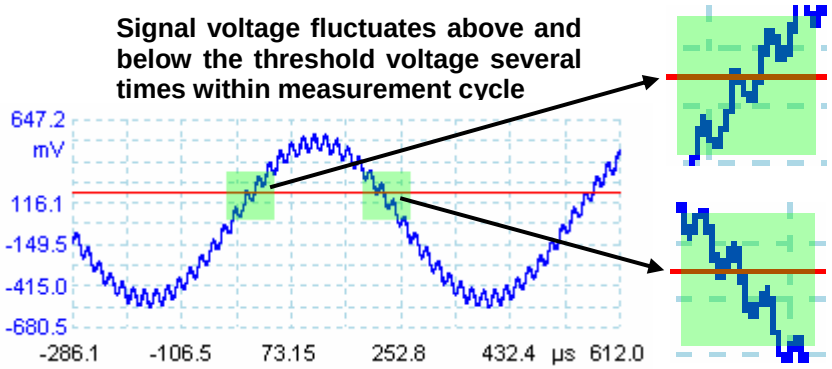


Other advanced trigger types enable more accurate triggering of the scope for pulse width and frequency-based signals. This includes setting the scope to trigger when the width of a pulse exceeds or goes into or out of a specified range. The scope can also be set to trigger when a specified threshold voltage is detected or occurs for a specific length of time.

PicoScope trigger

Hysteresis

A feature common to all of the PicoScope (version 6) advanced trigger types is the Hysteresis. The basic function of the Hysteresis feature is to reduce false triggering of the scope. This can occur for example where electrical noise is present on the signal or the signal voltage fluctuates above and below the trigger threshold several times within a measurement cycle, thereby making it more difficult for the scope to trigger reliably (see picture below).



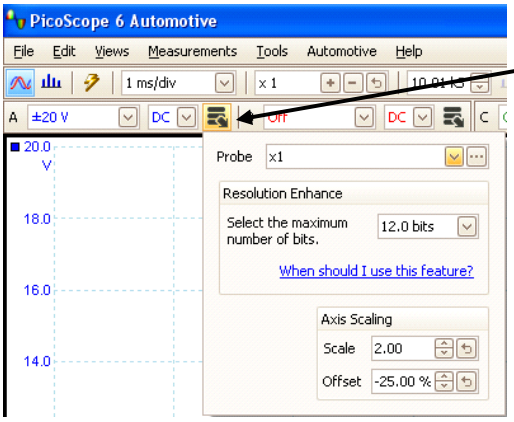
When the Hysteresis is enabled, a second trigger threshold voltage is used in addition to the main scope trigger threshold. The trigger fires only when the signal crosses the two thresholds in the correct order. The pictures below show a zoomed in view of the part of the signal that crosses the threshold voltage. The original threshold is the lower red line. The upper red line is the additional threshold used by the Hysteresis trigger.

In the left hand picture, the fluctuating signal voltage is following an upward trend and crosses the threshold at points 1 and 2. This does not fire the trigger. The trigger fires only when the signal voltage crosses the Hysteresis threshold at point 3.

When the signal voltage follows a downward trend as in the right hand picture, the fluctuations in the signal cross the Hysteresis threshold at point 4 and the original threshold at point 5. The signal voltage has now crossed the two thresholds in the wrong order and so the trigger is not fired.

Advanced channel options

Advanced options are available for each individual channel of the PicoScope. These are accessible by clicking the left mouse button on the Channel Options icon for the relevant channel at the top of the scope screen (see picture below).



Advanced channel options icon

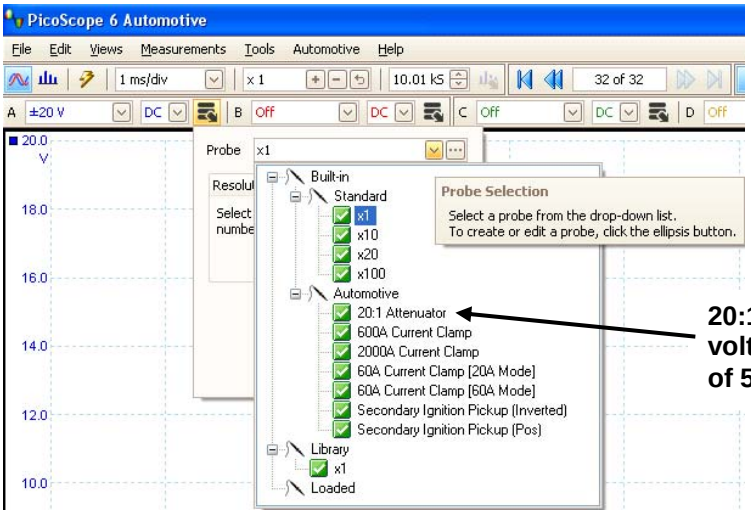
The three main options available in the advanced channel menu are as follows:

- Probe
- Resolution enhance
- Axis scaling

Axis (channel) scaling has already been described and refers to the position and scaling of the Y axis on the scope screen.

Probe

The probe menu enables the user to select the type of measuring device input to the PicoScope. This is important if, for example a current clamp is to be used, or when measuring voltages that exceed the maximum permissible level of 50 Volts per channel (see picture below).



20:1 Attenuator probe required for voltage measurements in excess of 50 volts

If measuring voltages that exceed 50 volts for any one channel, an attenuator probe will need to be selected from the advanced channel options menu for each channel on which the measured voltage is likely to exceed 50 volts.

Advanced channel options

Attenuators

The attenuator is a small adapter included in the PicoScope kit. It is connected between the BNC connector on the scope interface box and the test lead BNC connector. Its function is to scale down the voltage input to the PicoScope interface. The waveform is then recreated by the PicoScope software on the scope screen. The picture below shows two attenuators in use, one each connected to channels A and B respectively. Channel C is being used to measure current and the 60 amps clamp has been connected to this channel.

Resolution enhance

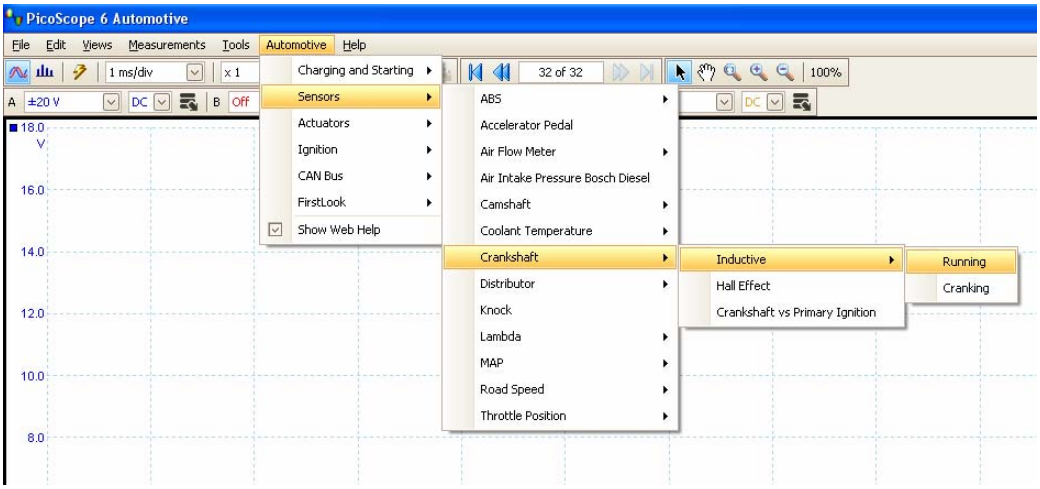
The oscilloscope measures the voltage signal in a circuit by taking instantaneous readings at a very high frequency known as the sample rate using a device called an analogue to digital converter. Sample rate is usually quoted in samples per second. Each sample consists of a number of binary bits (zeros or ones) These samples are then used by the software to recreate the signal as a waveform on the oscilloscope screen, like "join the dots".

The Pico Automotive scopes are all 12 bit, with a true voltage accuracy of around 1%. The resolution enhance feature of PicoScope enables the user to simulate different bit resolutions using advanced software calculations. This can give a better accuracy, but at the expense of other parameters.

PicoScope hardware utilizes a 12 bit analogue to digital converter which is more than adequate for measuring automotive electrical signals (including high frequency signals such as CAN bus) to a DC accuracy of about 1%.

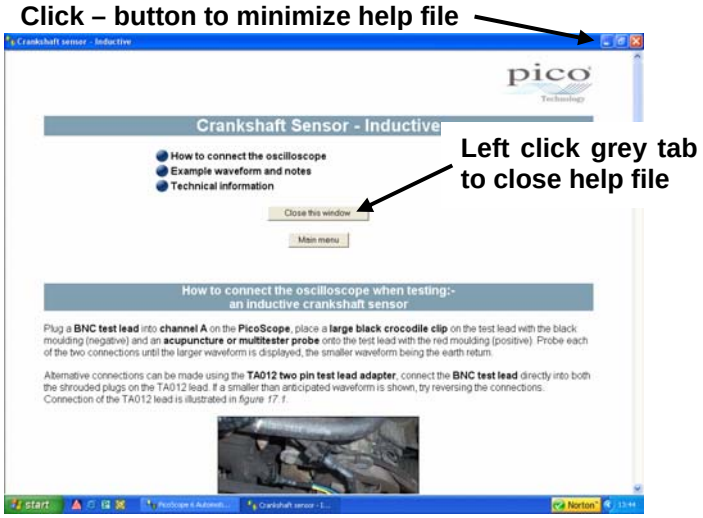
Automotive menu

The Pico scope automotive diagnostic kit has an integrated menu of example scope trace waveforms and help files relating to a wide range of systems and components. This menu includes sensors, actuators, charging and starting systems diagnosis as well as engine management, ABS and CAN bus. To access these help files, left click on the Automotive menu at the top of the scope screen and follow the drop down sub menus to the desired system or component as shown in the example screen shot below.



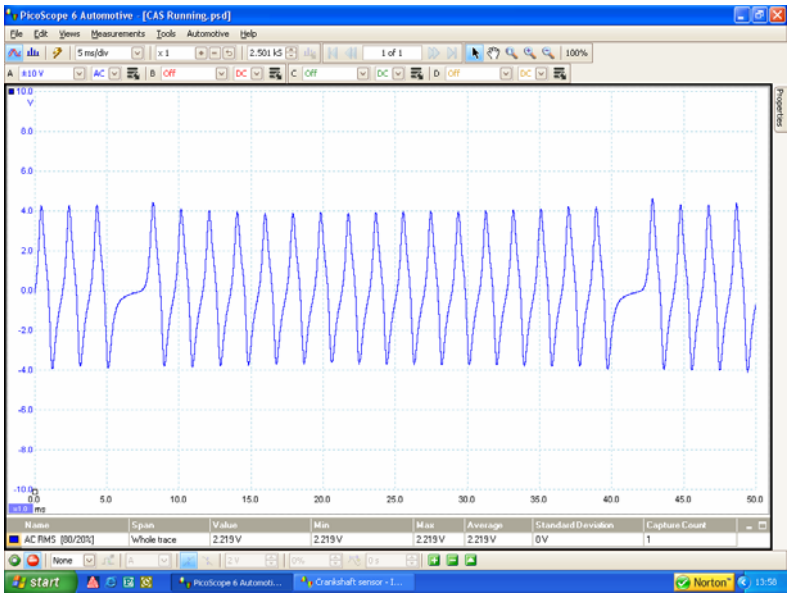
When an item is selected from the Automotive menu, a help file appears (see below). The help file explains how to connect the Pico scope using the correct test leads and any necessary additional adapters included in the Pico scope kit. It also contains an example scope trace for the respective component and useful technical information relating to the component or system function.

When the user is finished with the help file, the file can be closed by clicking the left mouse button on the grey 'Close this window' button. Alternatively, it can be left open but minimized so that it remains available for further reference by clicking the left mouse button on the - button at the top right hand corner of the screen (see opposite).



Automotive menu

The scope trace below shows and example waveform from the PicoScope Automotive menu.



Note that the Automotive menu is intended as a guide only and is not an exhaustive list as vehicle technology continues to develop at a very rapid pace. Also, the waveforms contained in the help files represent an example of a typical signal from the respective component type and may not be an exact match of the actual signal obtained on the vehicle.

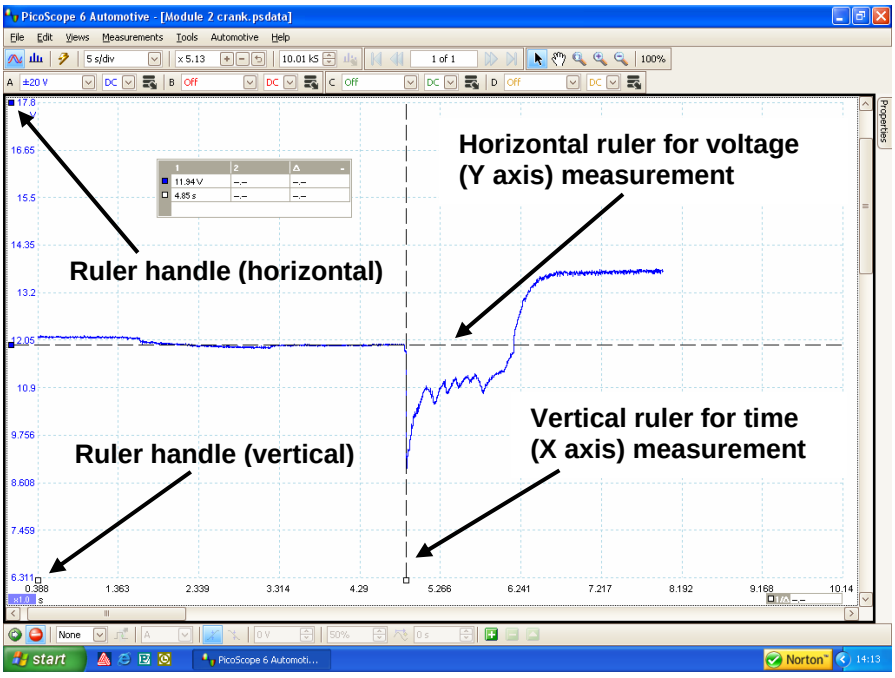
It is the responsibility of users to ensure that they have the necessary background knowledge, skills and experience to assess and evaluate the oscilloscope waveforms obtained.

Measurement rulers

Measurement rulers enable exact measurements of the voltage and time duration of a waveform to be made. Rulers can be either vertical (for evaluation of time difference), horizontal (for evaluation of voltage difference), or a combination of both for cross referencing voltage against time.

Using PicoScope (software version 6), it is possible to activate up to two horizontal rulers per channel for voltage (Y axis) measurement. Horizontal rulers are introduced by clicking and holding down the left mouse button on the small handle (square) at the top corner of the screen and then dragging the handle to the desired position on the screen. Note that the cursor handles are colour coded for the respective channel on the screen (blue for Channel A, red for Channel B etc).

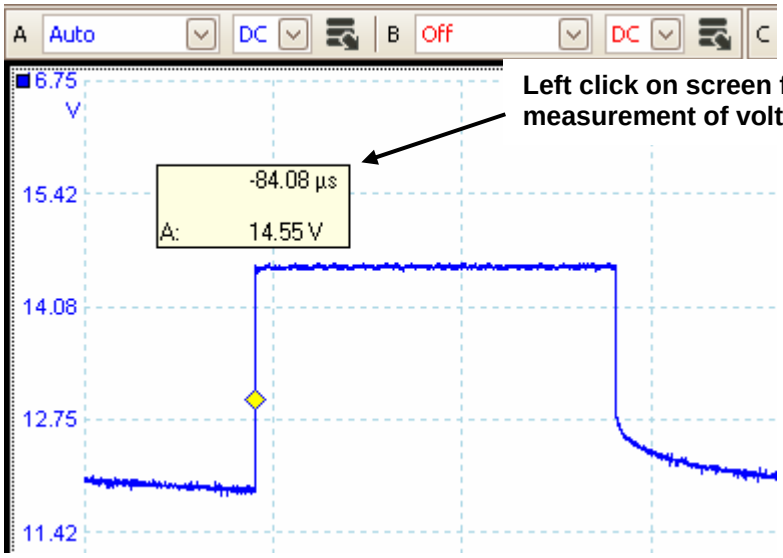
Two vertical rulers are also available for time (X axis) measurement. They are activated in the same way as for horizontal rulers; using the white colour coded handles in the bottom left corner of the scope screen, drag the ruler across the screen to the desired position. The example scope trace below shows how rulers can be used for evaluation of waveforms.



When rulers are active, a box appears on the scope screen showing voltage and time measurement values for each channel. To remove rulers, left click and drag them back to their rest positions at the corner of the screen.

Measurement rulers

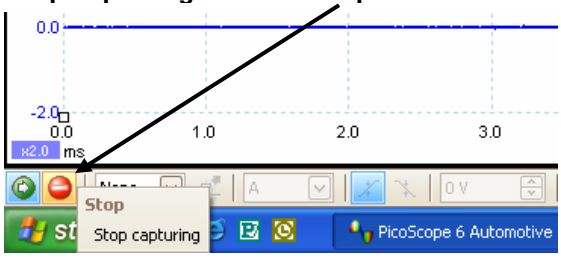
As a quick reference, an instantaneous measurement of voltage and time can be made by clicking the left mouse button at the desired position on the scope screen. A small box appears showing the voltage and time.



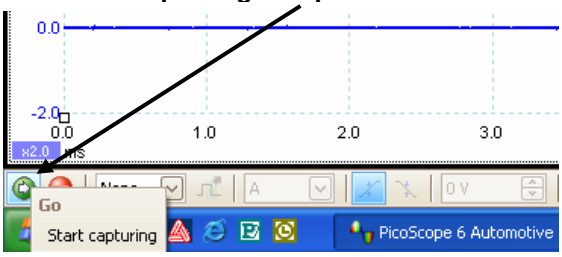
Stopping/starting PicoScope

It is possible to stop and start the scope by either clicking the left mouse button on the GO or STOP button at the bottom left hand side of the screen or by using the space bar on the PC keyboard.

Stop capturing: freezes scope screen

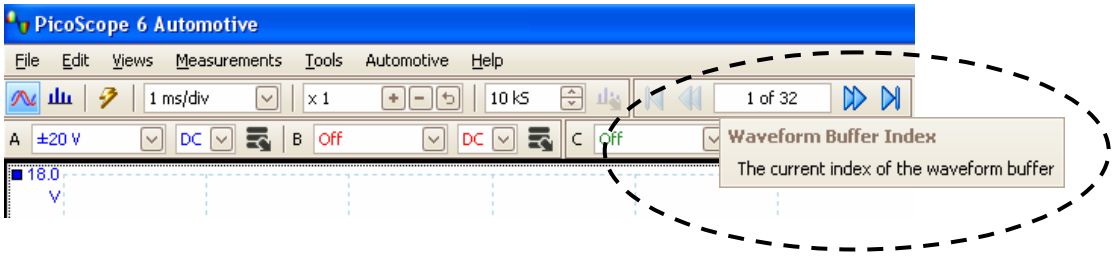


Start capturing: scope screen active

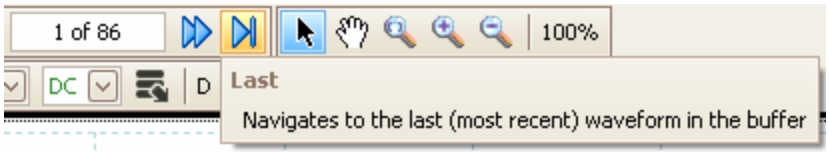


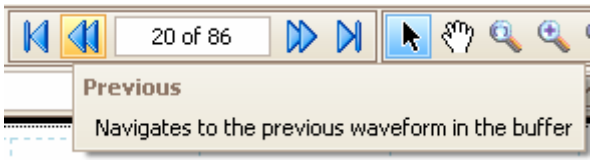
Waveform buffer index

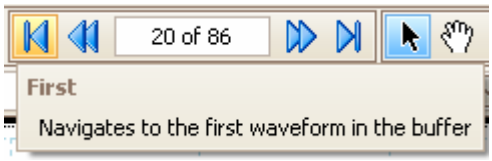
The buffer index enables PicoScope to capture and store a series of frames for a waveform. The buffer index automatically starts capturing data when the scope is activated.



By stopping the scope, it is possible to scroll through the individual frames one by one by clicking the left mouse button on the blue forward and backward arrow buttons either side of the buffer index window (see screen shots below).

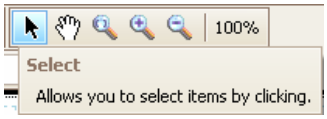


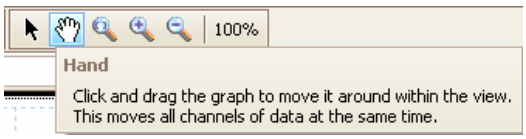


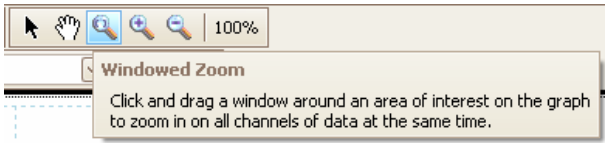


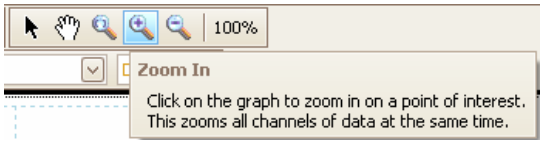
Zooming and scrolling tool bar

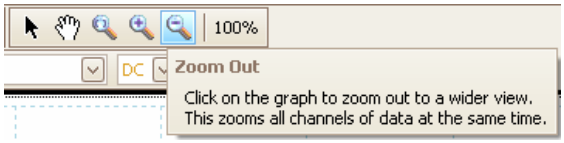
The zooming and scrolling tool bar is located at the top of the screen and has some useful features that enable the scope user to move around a scope view. Individual functions are activated by clicking the left mouse button on the respective tab on the tool bar. By hovering the mouse pointer over an icon, a drop down box appears with a brief explanation of the function (see screen shots below).







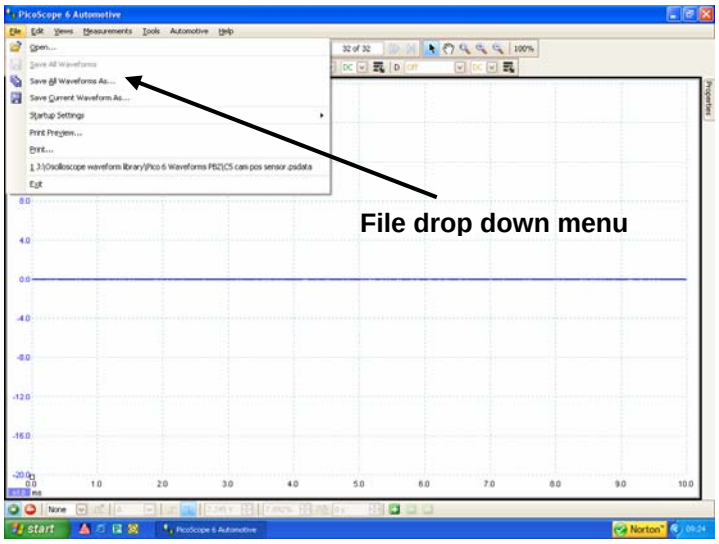




For further information about the zooming and scrolling tool bar, refer to the PicoScope 6 user's guide by clicking the left mouse button on the help tab at the top of the scope screen to see the Help drop down menu.

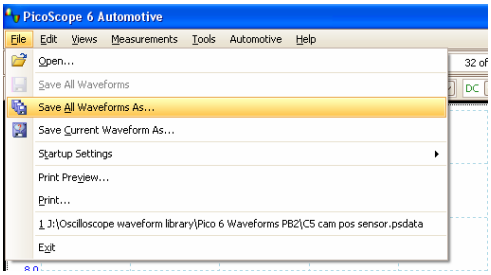
Saving PicoScope waveforms

PicoScope waveforms can be saved to a folder on the hard drive of the PC. To do this, click the left mouse button on the 'File' tab in the top left corner of the screen. A drop down menu then appears (see screen shot below).

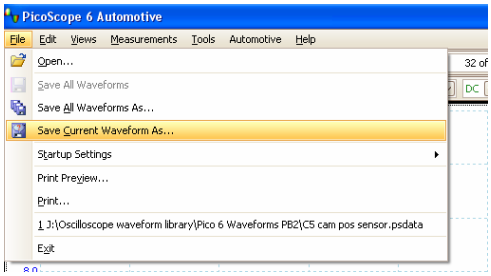


By clicking the left mouse button on the relevant option from the File drop down menu, it is possible to save either the entire waveform buffer index or alternatively the current waveform only.

Click Save All Waveforms as to save entire buffer menu



Click Save Current Waveform as to save a single waveform



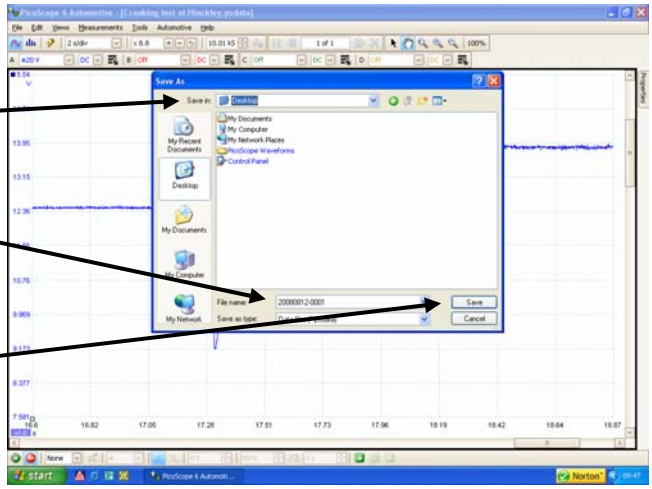
Saving PicoScope waveforms

A ‘Save As’ box now appears on the scope screen. In the ‘Save in’ drop down menu, select the destination on the hard drive of the PC where the PicoScope waveform is to be saved. Type in the name of the scope trace in the ‘File name’ text box and then click the grey ‘Save’ tab in the bottom right hand corner of the ‘Save As’ box. Waveforms are saved as file format .psd.

In the Save in drop down menu, select scope trace destination.

Type in the name of the scope trace in the File name box

Click Save tab to save the scope trace file on the PC

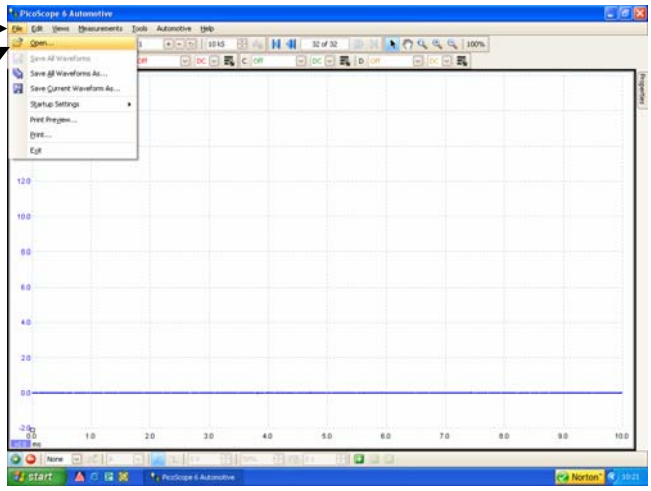


Opening a saved PicoScope waveform

To open a saved waveform, click the left mouse button on the File tab in the top left corner of the screen and select Open from the drop down menu (see screen shot below).

To open a saved waveform, click File

Click Open from the drop down menu



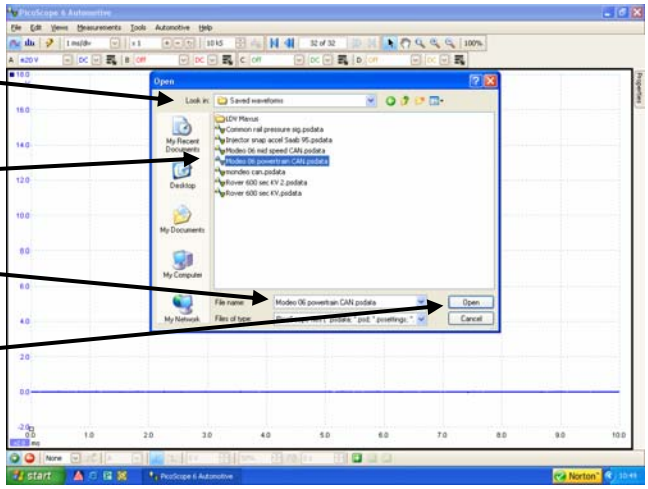
An ‘Open file’ box now appears on the screen. In the ‘Look in’ drop down menu, select the location or file on the PC hard drive where the scope trace has been saved. Click on the .psd file name of the required scope trace. It will then be highlighted in blue and the file name will appear in the ‘File name’ text box. Click on the ‘Open’ button in the bottom right corner of the ‘Open file’ box to open the saved waveform file.

Select location in Look in drop down menu

Left click to highlight the saved .psd file

Title of saved waveform file appears in File name text box

Click Open to open and view the saved waveform



Using PicoScope software version 6, it is not necessary to open the PicoScope program first or have the PicoScope interface connected the PC in order to open a saved waveform .psd file.

Assignment: PicoScope familiarization

The aim of this practice task is to become familiar with the basic operating features and settings of the PicoScope. By the end of the task, you will be familiar with the PicoScope and be able to correctly connect the scope to the vehicle to take accurate test measurements and adjust the scope settings to optimize viewing of a waveform.

Ask the course instructor for further assistance if you are unsure about any of the following practical activities.

1) Familiarize yourself with the following scope controls:

- Adjustment of voltage per division.
- Adjustment of time per division.
- Method of positioning X and Y axis on the scope screen.
- Method of triggering the scope for positive or negative slope.
- Method of adjusting the trigger level.
- Method of switching individual channels on and off (multi channel scope).

Practice adjusting the above settings once you are familiar with them.

2) Note the following features of the scope:

- Minimum voltage per division: _____
- Maximum voltage per division: _____
- Minimum time per division: _____
- Maximum time per division: _____

3) Adjust the scope time and voltage per division in such as way as to enable you to test the voltage level on the earth wire of a component. Note the voltage and time divisions that you selected.

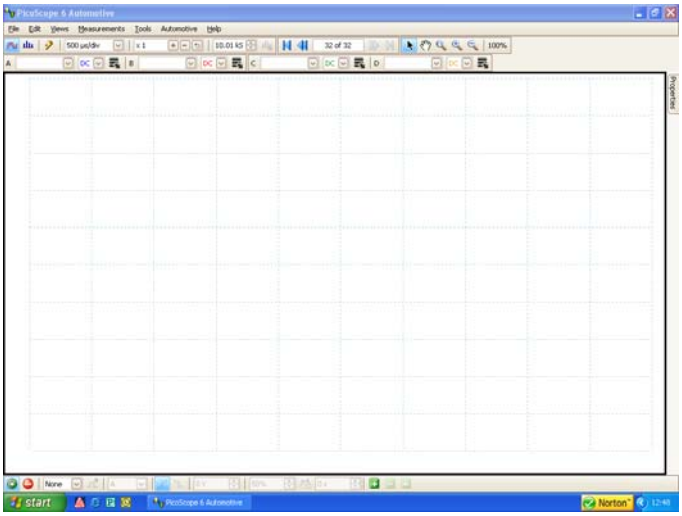
_____

_____

_____

Assignment: PicoScope familiarization

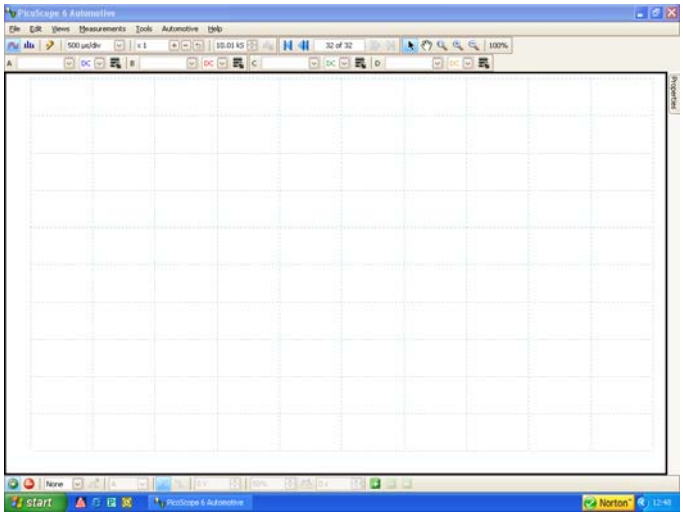
4) Adjust the Y axis of the scope and set the time and voltage divisions in such a way as to enable you to see a sinusoidal waveform with a peak to peak voltage of 40 volts. Draw a line on the graticule below to mark the position of the Y axis and note the time and voltage per divisions that you selected.



Voltage per division: _____

Time per division: _____

5) Using two channels of the oscilloscope, adjust the Y axis and the voltage and time divisions on channel A to measure a 5 volt negatively triggered square waveform, and on channel B to measure a sinusoidal waveform with a maximum voltage amplitude of 30 volts. The settings for each channel should not allow the two waveforms to overlap each other on the scope screen. Draw a line on the graticule below to mark the positions of the Y axis for each scope channel and note the voltage and time divisions selected for each channel.



Channel A

Voltage per division: _____

Time per division: _____

Channel B

Voltage per division: _____

Time per division: _____