SSC-A531 user manual Version 2.0

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These symbols appear on the product

Warning - risk of danger exists if the connections to these connectors is not made in accordance with the safety instructions. Refer to the section on Important Safety Information before using it.

Frame terminal. Electrically connects to unit case

Please read the safety information below before setting up your Screenscope. They apply to Screenscope model SSC_A531.

Equipment

Use the screenscope only with the power adaptor supplied.

It is the users responsibility to supply an approved monitor compliant with safety standards. Ensure it does not have physical damage and is in good working order. Only use with a mains connected monitor.

Intended use and maximum input voltage range

The Screenscope is designed for measurement category I (CAT I) indoor electronics use only. Do not use Screenscope with measurement categories II, III or IV.

Screenscope is designed to measure voltages in the range ±45 V maximum.

Do not use the Screenscope to probe mains voltages.

Probe ground lead connection precaution

Care must be taken to ensure the ground of the input, is not connected to a voltage other than ground. If there is any doubt, use a multimeter to check before connecting.

Failure to use the equipment according to the safety instructions may result in damage to the equipment, or personal injury to yourself or others.

CE compliance

Screenscope SSC-A531 is compliant to EMC directive EN61326-1: 2006 Class A emissions and immunity.

Warranty

Screenscope is covered by 12 month warranty against faulty materials and workmanship.

Copyright

Copyright © Diamond Systems Pty. Ltd. 2009

Diamond Systems Pty Ltd reserves the right to make changes to this manual and the products it describes at any time without notice.

Disclaimer

The information in this manual is intended to give the user an understanding of the product, and how it is used only. We make no warranty as to the completeness and total accuracy of the information or to the products suitability for any particular purpose.

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Introduction

Screen Scope A531 is a stand alone 55 MHz real time oscilloscope that gives you the benefits of a large colour display along with an easy to use Graphic User Interface (GUI). Controls are *one click* or *wheel scroll* away just like operating buttons and knobs on the front panel of a conventional instrument. But even easier, you can just grab waveforms and markers with the mouse and move them directly on the screen, then fine tune with the wheel once you release the object.

Screenscope is a responsive general purpose instrument. Ready in seconds after switch on makes it accessible for those quick looks often needed in repair or service, while its extensive range of measurements, math functions and the ability to save waveforms and screen shots to standard file types lends itself to production testing, R&D and schools.

Features

- 55MHz Bandwidth real time capture
- 2 x 8 bit, 1 x 1 bit channel input
- Display 1024 x 768 with large trace area
- excellent with wide screen monitors
- click, drag, scroll mouse GUI operation
- FFT , XY mode and Math functions
- Unique chart record/logger mode on slow timebases - log up to 100 continuous screen runs to a single file
- large DC offset volts relative to signal range
- Auto measure includes Vppk, Vmag, Vrms, Vave, Period, Frequency FFT peak Mag and freq.
- Manual measurement markers with readouts
- 240 MSPS, low phase noise clock source
- up to 450 traces per sec per channel
- 4k trace length
- sinx/x interpolation
- Trigger source: Ch1, Ch2, Ch3
- Trigger positive or negative edge or pulse width
- Trigger point can be up to 1 million samples before capture
- Trigger out
- 4 non volotile memory traces can be loaded from Channel, Math, FFT or USB
- USB host

- Save waveforms in text, csv or Screenscope native
- Save entire display exactly as it appears as bmp file
- Simple upload of new scope revision
- Control states saved and re-established on power up for continuity of operation

Your screenscope package includes:

Screenscope main unit

Two X1/X10 probes

12V DC power adaptor

user manual

You need to supply:

Monitor

The Screenscope video output is standard 1024 x 768 60Hz which will work on most CRT or LCD monitors. Higher resolution wide screen 17 and 19 inch LCD monitors will produce a good result with Screenscope's 1024 x 768 output.

Mouse

Screenscope is designed to work with a USB 2 button wheel mouse. It will work with other types but only 2 button wheel functionality is enabled. The mouse can be a wired or wireless type.

USB memory

A USB memory is only required if you want to save waveforms, or for uploading new system to the Screenscope. It is not required for normal operation.

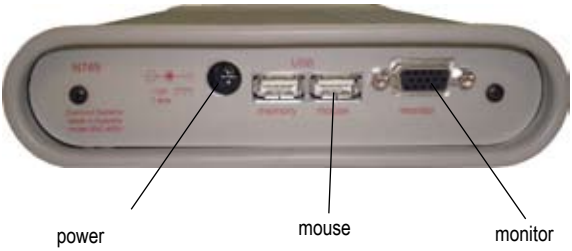
Plug monitor cable into the VGA output. Secure into place with the thumb screws without overtightening them.

There are two USB sockets on the rear of the unit, one for the mouse and the other for the USB memory. They will only work in their respective sockets.

Plug your mouse into the socket labeled “mouse”

Next, plug the 12V power lead from the power adaptor into the unit. The receptor is recessed about 9mm inside the unit to provide a more robust mount. Press the plug firmly into place.

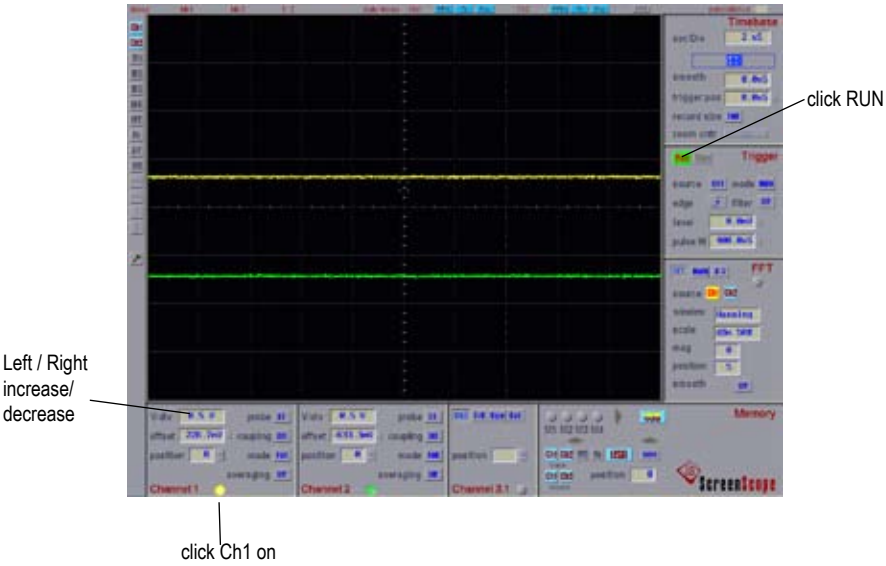
Now mount the power adaptor into a power point and switch the power point on.



Switch the monitor and then Switch Screenscope on by pressing the front panel On/Off button once.

The LED indicator should illuminate RED. About 7 seconds later you should have the Graphical User Interface display up.

Move the mouse and check that its operation is normal. The cross hair cursor should move around the screen smoothly.



Click on the indicated buttons until you get an active trace for channel 1. Left and right clicks in the V/div variable area will increase/reduce the attenuation for that channel.

Connect a probe to Ch1 input and check that it is working as you expect.

Operating Screenscope's controls

To operate a control on a conventional instrument, it is generally of the form: *reach for the button and press*, or *reach for the knob and turn*. Screenscope has a similar feel only its *move mouse then click*, or *scroll,* without the need for multi step menus.

Even easier, you can just grab and drag traces and markers in the measurement area. This feels most natural on a large display area such as Screenscope's waveform window. You can adjust Channel V offset, memory and Math positions, trigger level, trigger position and the manual measurement markers this way. Related numeric readouts will track the movements.

Tip on using wide screen monitor

If you are using a wide screen monitor, they commonly have advanced settings such as “graphics” , “text” “standard” and “movie”. Experiment to see which gives you the best result. Setting to “movie” gives best results on many monitors.

What’s next

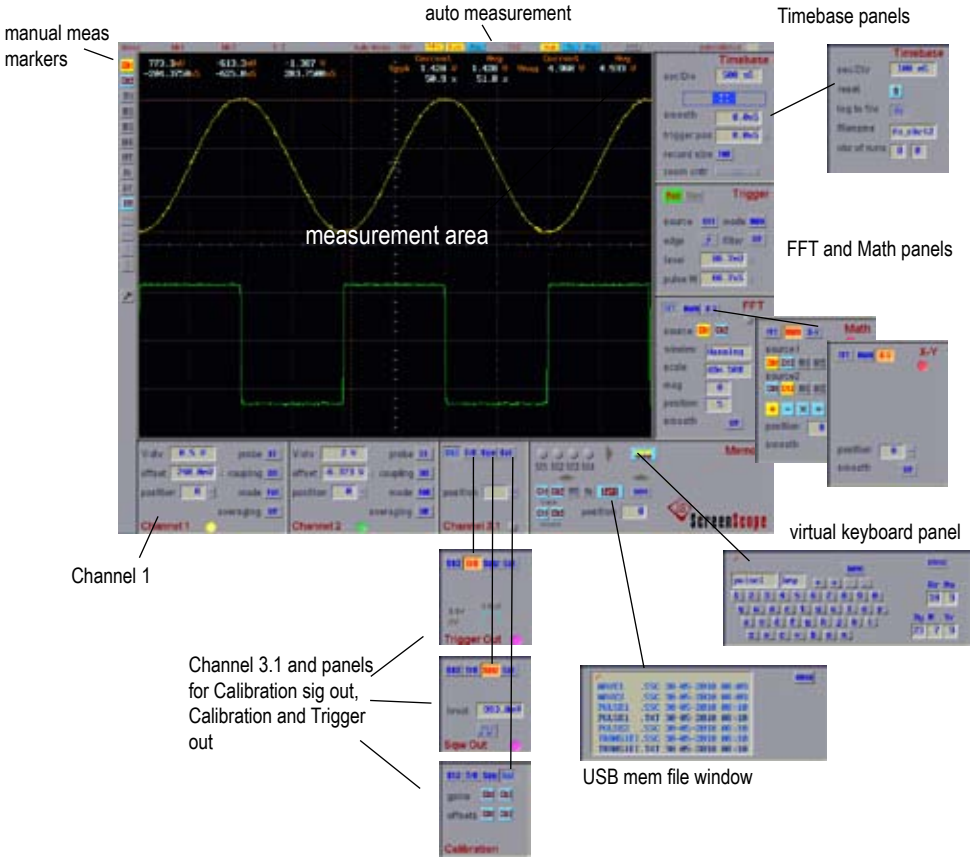
The next section gives an overview of the full GUI showing the various control and function panels and their locations.

Following that is the section on control panels starting with a description of common control types that you will see in many panels.

The control panel descriptions detail how they are used and any other information to help you get the best from your Screenscope.

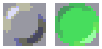
Screenscope's controls are grouped into functional panels, called **control panels**, which contain all the controls to do with a particular function. For example **Channel 1** control panel contains controls for the vertical axis display for that channel. Other control panels include; **Channel 2**, **Timebase**,**Trigger**, **FFT** etc.

Some panels share the same position and are swapped out either by pressing the option button or automatically when required. An exploded view of all panels available is shown below.



Shown here are common control types which appear in many panels. They are used to perform common functions such as on/off, option select etc. The labels may be different for a particular function, but there operation will be the same.

There are also some unique control types which are described in the sections on panel where they are used.



Round Buttons

Switch traces on/off. Used for Ch1, Ch2, Ch3, FFT, Math, M1..4
Off - raised, grey
On - depressed, colour of the trace it controls

Labelled buttons

Control buttons for selection of operating options in panels. Where the non default position alters operation, or readout in a significant way, the option button is highlighted red on orange. Otherwise, for multiple choice selection as in the triggers source button for example, all choices are the same.

Source buttons

Used in panels such as FFT for example, to select the source for the FFT.

Grey - source is not available, eg if Ch1 is Off, it is not avail able for FFT.
Lt Blue - if source is available but not selected.
Yellow - if source is selected for use in the function.

Variable Box

Displays value of setting for the control. ***Left/Right Click, scroll*** to adjust.

For some variables that have large ranges, you can also perform a ***left click and hold*** while inside box then ***move mouse left/right*** to adjust.

Zero button

This button, next to some variable boxes, sets the variable to zero, except for the trigger pulse width which is set to its minimum value.

Quick Position button

Appears next to the position variable box for most traces. Clicking this button provides a quick way to set the vertical position to center in the top half, bottom half, or mid screen. See description for **position** control in Channel 1,2 for more.

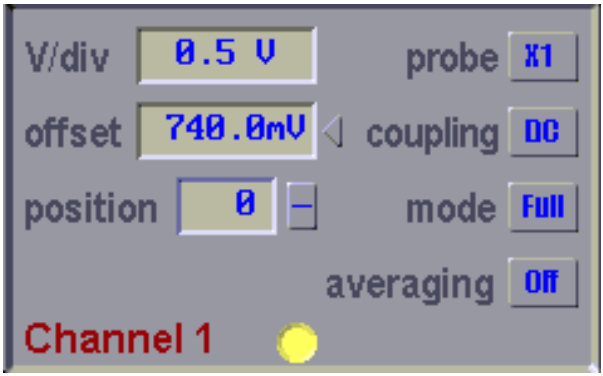
In the measurement area you can left click and drag waveforms, manual measurement markers and the trigger level cursor. After dragging, when the object is release, it will still be in the mouse focus and you can use the wheel to further fine tune its position to and fro. Click on an unoccupied area of the screen if you want to break the focus with the object so that it is not inadvertently moved again.

The table below summarizes the objects that can be moved this way.

Object	**Drag Y**	**Drag X**
Channel 1,2	offset Volts	Trigger position
Channel 3	offset position	-
Math	offset position	-
memories M1..4	vertical position	-
Measurement Markers		
Mk1,2 Vertical	-	Marker X context reading
Mk1,2 Horizontal	Marker Y context reading	-
Trigger cursor T	Trigger level	-

Channels 1 and 2 can be dragged in both X and Y directions, but only in one direction after grabbing. The direction is set by the first move direction after grab. There is a bias in initial preferred drag direction depending on whether you are clicking on a vertical edge or on a horizontal part of the waveform. This makes it less sensitive to assigning the wrong direction making it easier to grab and move.

Click on a vertical edge to drag in the Y direction, and a horizontal flat section to drag in the X direction to take advantage of the bias.



V/div Channel attenuator Volts/Division
Ranges available depends on mode:
mode Full ranges = 5, 2, 1, 0.5, 0.2 , 0.1 , 50m , 20m
mode Half ranges = 10, 5, 2, 1, 0.5, 0.2 , 0.1, 50m

offset Input offset voltage is added to input voltage before the amplifiers. Use this to view the extremes of a waveform that is larger than the display can accommodate. Input offset range is +/- 30V for attenuation ranges 10..0.5V/div and +3.3V..-2V for 0.2V..20mV/div.

Note: Viewing large clipped waveforms with fast rise/fall times at timebases 0.5uS and faster may display some ringing at the clipped edges.

position Position is different from offset above in that it is simply a repositioning of where the waveform is displayed on the screen, whereas the offset is in effect a vertical panning to view different portions of the waveform.

Use the wheel or click hold and drag method to adjust the variable box directly, or you can use the Quick Position button to set the trace in the top, mid or bottom half of the measurement display area.

This feature is useful as often the trace is repositioned just to put it in its own place on the screen apart from the other channels especially when the “Half” mode is used.

mode Screenscope's grid area has 800 horizontal pixels and 600 vertical lines. This is much more than most stand alone scopes with a smaller screen. Also when viewing 2 channels its common to view each at less than 4 div magnitude so that they have their own space.

Setting mode to **Half** allows the full 8 bit range of the scope to occupy just 4 vertical divisions effectively doubling the resolution of the displayed waveform. The Quick Position button can then be used to quickly reposition the trace on the screen.

Large input signals which clip would normally reach the top and bottom of the display grid, but in **Half** mode clipping will produce a flat top or bottom to the signal while it is within the grid area. To highlight the fact that it is clipped, Screenscope displays the colour of the flat clipped sections in red in this mode.

Changing between **Full** and **Half** modes is seamless. V/div and the waveform size will remain the same, all that you will notice is that the waveform will look finer in **Half** mode.

If you are viewing a waveform with magnitude greater than 4 div on **Full** and then change to **Half** it will clip to 4 div.

probe Options are **X1** or **X10** Set this to reflect the probe setting.
This allows readouts and measurements to display correct values.

coupling Options are **DC** or **AC**

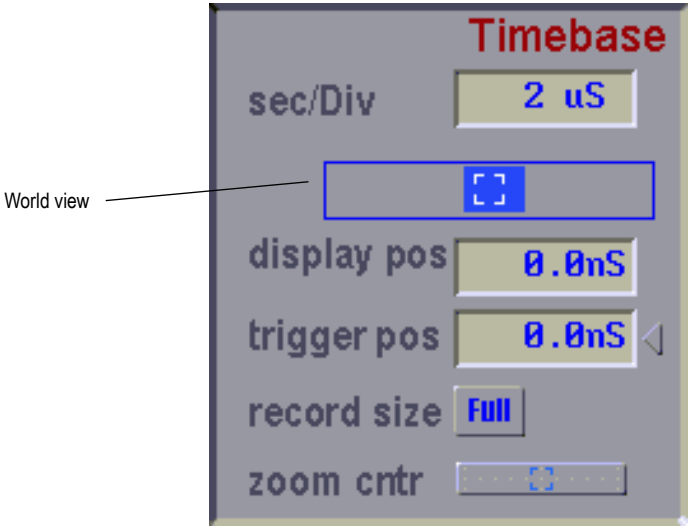
averaging Averaging displays the average of the previous 16 values for each horizontal location.

Averaging is useful for viewing noisy repetitive signals. For un-synchronised or a non repetitive signal, averaging will not produce a meaningful display. Turn averaging off, adjust the triggering for a stable display, then enable averaging.

on/off Round button ***grey*** for off, channel ***trace colour*** when on.
colours are:

Channel 1	Yellow
Channel 2	Green
Channel 3.1	Purple

sec/Div Timebase ranges from 3.3nS/div down to 1 hour/div. The ranges down to 50mS/div are part of the conventional capture display mode and ranges 100mS and slower switch over to the chart record mode. See **Timebase Chart Recorder Mode** below.



World view The world view is a representation of the horizontal sizes and positions of the capture record buffer, display area, zoom center position, and trigger position. The controls below the world view relate directly to these.

The world view is central to the operation of the horizontal aspect of Screenscope, so it is worth spending some time to familiarise yourself with it.

There are four graphic elements in the world view:

outer blue line box	represents the capture record size.
inner solid blue box	represents the portion displayed in the grid area as a trace.
4 white corners	represents Trigger position
4 blue corners	represents zoom center position

In the above graphic, the Trigger cursor and zoom center position marker are in the same location so only the white is visible. These mirror the actual Trigger cursor and zoom center marker in the grid area which are of the same style and colour.

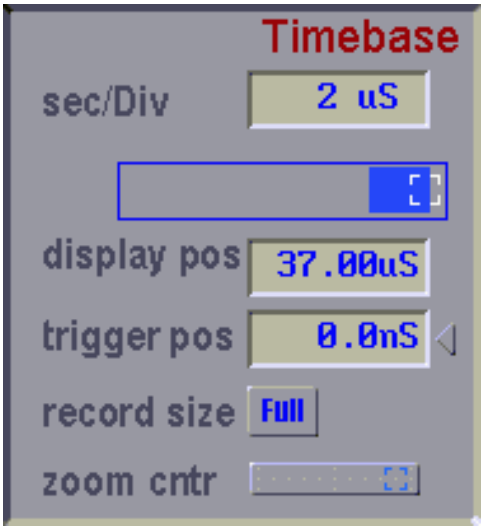
zoom cntr This control , sets the zoom center to the 1st division, center or 9th division in the grid waveform display area. Click this button to change the zoom center position.

The zoom center is the point on the waveform that appears to stay fixed when changing timebase ranges up or down while capture is running. This is the point of interest. Waveforms either side of this point expand or contract with faster or slower timebases.

The data captured in the buffer is also positioned so that the point of interest is at the start, middle or end of the buffer. This means that if the zoom position is set to the 1st position for example, then the point of interest will be at the start of the record data. If the trace is stopped, then you can pan right horizontally to the end of the record, to view the waveform as captured after the point of interest.

Conversely, if the zoom position is set to the 9th division, then that point will be near the end in the capture record. Stopping the trace you can pan left to view nearly a full buffer of waveform before the point of interest.

The zoom position control is a quick and easy way to position your point of interest on the screen.



eg. showing zoom position at 9th div and correspondingly data is captured so that the point of interest is near the end of capture record.

trigger pos Note that the point of interest described above is not the trigger position. Trigger position is the distance in time from the trigger point to the point of interest (zoom centre).

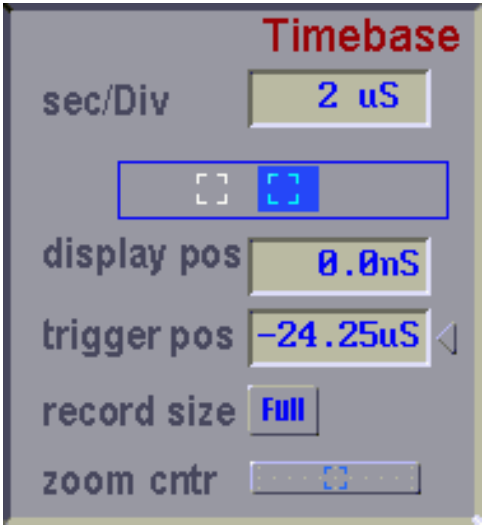
The Trigger position and zoom center are indeed in the same location when the Trigger position is set to 0, any other value however, will see the trigger cursor separating from the zoom position marker, both in the world view and in the measurement grid area.

Negative values mean the trigger is to the left, in advance of the zoom center. Positive values mean the trigger event is after the zoom center.

trigger before capture The trigger point can be set up to -4.361mS before capture. At the faster time base settings this allows viewing a point of interest well after the trigger, providing a “delayed” timebase without any reduction in resolution.

In the panel below, trigger position is at -24.25uS. On a 2uS/div range this means trigger position is not in the measurement area, it is to the left of it. This is indicated in the world view where the white trigger cursor is before the solid blue display area representation.

However, the trigger cursor is still inside the capture record area. This means the trigger point is being captured and you can stop the capture and pan back to the trigger point if desired.



Here the trig position is advanced further to -66.00 us. The world view now shows the cursor outside the capture record which means the trigger event is now not captured so you could no longer stop and pan to it.

Moving the trigger point further will display it with an arrow as shown below to indicate that the cursor is off scale. The trigger position can continue to be moved until the value reaches its limit. This is indicated by the readout being displayed in red.

Example **Using trigger position to measure jitter on a 10KHz square wave:**

View the wave on a timebase setting that gives you at least 1 full cycle before the point of interest.

First have a look at the jitter at the trigger point. With the Trig position at zero, zoom in to the highest timebase and check the jitter of the waveform at the trigger cursor and zoom out again.

Click and drag the wave left. The Trig cursor (white) will move with the waveform and the Trig position variable will show an increasing negative time.

The zoom center marker (blue) will remain in its initial position.

Continue drag until the next waveform cycle edge is approximately lined up with the zoom center marker.

Zoom in again. If the wave is not exactly on the point of interest, it may move off screen; just grab and refine its position any time and continue zoom in.

At the highest timebase settings, you may now see more jitter on the waveform since this point is 1 period after the trigger point.

To see jitter after 2 cycles, zoom out and move the wave another period, then zoom in again etc.

trigger after capture

The latest that a Trigger can be set for, is when acquisition stops immediately when the trigger event occurs. The capture record will contain samples prior to and including trigger but none after. There is no equivalent to the pre-trigger case where the trigger point can be well outside (before) the capture record.

While the trig position can be adjusted to position it at the end of the capture buffer, its easier to leave it at zero and use the zoom position control. Set it at the 9th div for example, and you'll get the capture buffer with the trig event near the end.

record size

The capture buffer record size is larger than the display size, so when the scope is running, only a portion of each buffer load is used for display, the rest is discarded. On slower timebases, especially 1mS/div and slower, the time taken to capture a full buffer starts to become significant and the capture rate will suffer.

Setting this control to Auto, will reduce the captured buffer size at slower timebases, to give faster display rates.

If using single shot, you may want record size on **Full** to get the maximum buffer load that can then be viewed by panning the stopped waveform.

display pos

The display position control is provided to allow panning on a stopped waveform.

To capture enough data so that panning is possible, make sure the record size is set to "full" for the capture first.

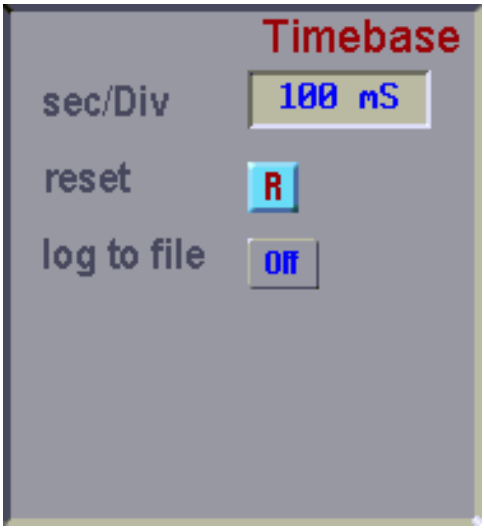
To pan on a stopped waveform, use the wheel of the mouse in the display pos variable readout box. You will see that the solid blue box in the world representation will move to indicate which part of the capture buffer is being displayed. The readout will indicate how far it is from the center position.

For timebase settings of 100mS/div or slower, the timebase switches to **chart recorder mode**. This mode displays each input sample immediately to give a trace that is drawn across the screen at the time base rate.

This has the benefit that even on very slow timebases, you can always see what is happening without having to wait for a full capture buffer before display.

Chart mode can also log the results to USB. You can save up to 999 screen runs as a continuous record.

The timebase panel changes automatically to the chart record mode, when it is set below 50mS/div. In this mode **display position** and **Trigger position**, **record size** and **zoom position** no longer have any meaning and are removed from display.



Trigger source, level, edge and mode can be selected as for normal timebase mode, except that pulse width trigger is not available. See section on **Trigger**.

The operation of the Trigger **RUN** , **STOP** and mode selection, changes depending on whether **log to file** is enabled.

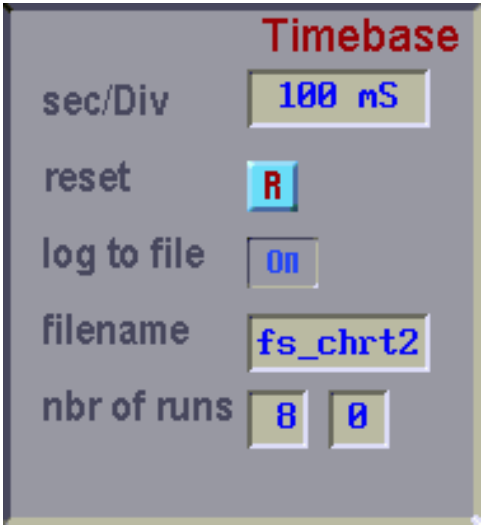
log to file

When **Off** the scope the **RUN**, **STOP** and mode operate the same way as for normal timebase modes.

When **On** a filename window appears as well as variable boxes for the number of runs required to be logged and another next to it showing number of the current run. Where "**run**" is one complete trace.

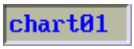
The operation of the Trigger "mode" control is changed in **log to file** mode to prevent Auto and Triggered modes from being able to re-start any capture sequences that might overwrite saved log file data captured by a previous sequence.

It is changed so that whatever the trigger mode is set to, capture will always stop, and the **STOP** button is set at the end of the final run. However, if trigger mode is set to **Auto**, then pressing **RUN** will immediately start a new run without waiting for a trigger event. If mode is set to Triggered or Single, then pressing **RUN** will re-arm the trigger, but a run won't start until a valid trigger event is detected.



The **On** button will illuminate (yellow) when the data is being written to USB memory at the end of each run. If it is staying illuminated, it may mean that the timebase is too fast for the memory stick and there may be gaps in the recorded data.

filename



To enter a filename for the chart mode recording, click in the filename variable box. If there is a mounted USB memory plugged in, the memory panel will display the virtual keyboard with which you can enter the name. The extension is fixed to ".log"

See "file formats" for a description of the format the data is saved in.

If a filename is not specified the variable box will display <flnm> in red when it attempts to write the data to the USB memory. No data will be written.

nbr of runs

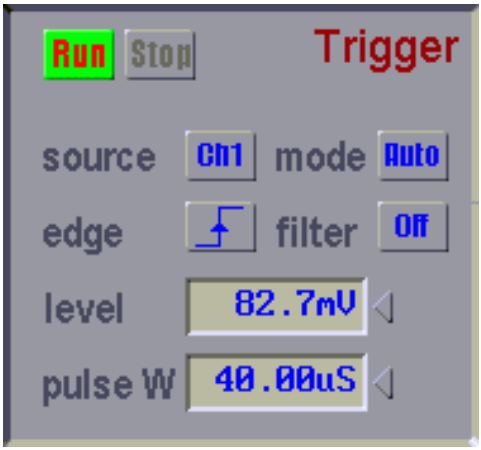
The first variable box is where you set the total number of runs you want to record. Mouse scroll or left/right buttons to set this value.

The second counts down from the set value to 0 for every screen run. The scope is then set to **STOP**

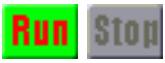
reset

You can hit reset at any time to restore the current state to its pre trigger point. The screen is cleared and the trigger is armed. **RUN**, **STOP** is not changed.

The trigger control panel is where you set the trigger source and conditions. The scopes **RUN** and **STOP** controls are also in this panel.



run stop Separate buttons are provided for **RUN** and **STOP**



When the scope is running, **RUN** is illuminated green and **STOP** is grey.
When the scope is stopped, **RUN** is grey and **STOP** is illuminated red.

These are manual controls and can be clicked at any time. The scope will also set to **STOP** in single shot mode, or at the end of a chart logging run.

source Trigger source select button rotates through 3 choices; channel 1, 2 or 3.

If channel 3 is selected, then trigger level has no meaning since this is a 1 bit input. It has a logic threshold of 1.65V.

mode

Trigger mode button rotates through **Auto**, **Triggered** and **Single shot**.

Auto will wait for a time for a valid trigger event. If a triggers occurs before the time expires, a triggered waveform will be displayed. If not the scope runs a capture cycle anyway and a free rolling waveform is displayed.

Triggered is similar to **auto**, except there is no time out on waiting for a trigger. Waveform updates will freeze if trigger events stop.

Single is similar to **triggered**, except the scope is set to **STOP** after a single trigger event and the waveform is displayed on screen.

level

If the source is channel 1 or 2 set the voltage threshold for the trigger event in the level variable box. Setting is in volts. It is limited to the range that fits inside the measurement window for the current V/div vertical channel setting.

You can use mouse right/left click or scroll in the box area, or grab and drag the white trigger cursor vertically in the measurement grid area. Click the triangular marker to set the level to zero.

filter

The trigger filter is applied before the input signal is passed to the trigger circuit. Selection of a setting other than **Off** may cause the trigger cursor and the trigger point on the waveform to be offset because of delays introduced by the filter.

Low Pass Filter Use this if the signal has high frequency noise causing excessive jitter. This is especially useful when averaging waveforms for more accuracy. For best results, the Low Pass Filter should not be used for viewing high frequencies or signals with fast edges since for example, the filter will slow dow a fast rise time making it harder for the trigger circuit to pick up a clean trigger point..

dv/dt This differentiates the signal before passing to the trigger circuit. This allows triggering on edges with fast rise times ignoring low frequencies. The trigger level setting now corresponds to a trigger threshold gradient and magnitude rather than voltage level.

Set near 0v for most sensitive where it will trigger on slower rise/fall edges. Raise it higher to discriminate for faster rise/fall times. Note the trigger cursor will

not correspond to an actual point on the waveform in the vertical direction.

The dv/dt depends on the signal magnitude as well as rise time, so it may trigger equally on a larger slower edge as a smaller faster one.

edge The edge select button rotates though 4 options: rising edge, falling edge, negative pulse and positive pulse.

Trigger on rising edge.

Trigger on falling edge

Trigger on positive going pulse

Trigger on negative going pulse

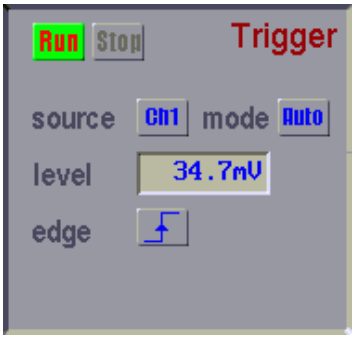
When pulse is selected, The pulse W variable box displays the width setting

The pulse width will start timing from the leading edge of the pulse, negative or positive. When the time equals the set time, the scope will trigger.

Pulse width range is 66.67nS to 4.369mS in 66.67nS increments. Click the

Trigger panel in chart mode

In slow timebase chart mode, some options are not available in the trigger panel and is displayed without them.

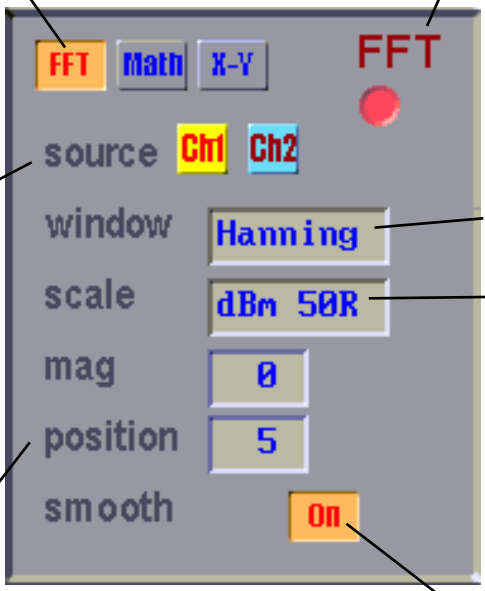


When enabled, the FFT is displayed at the base of the grid area. The vertical axis is a logarithmic scale at 20dB/div. Horizontal frequency scale will depend on sampling rate. For timebases 500nS and higher sampling rate is the maximum 240MSPS, while for low timebases the sampling rate is progressively reduced.

Use the manual measurements to readout frequencies and magnitudes from the FFT display, or you can use the FFT button in the Auto measurement area to display the magnitude and frequency of the highest peak. See Measurement section.

Press **FFT** button to show the FFT control panel. It will be illuminated if FFT is ON.

FFT On/Off control



Select the source for the FFT. Channel 3 is not available since it is a 1 bit channel.

see below

see below

Position is a vertical trace position on the screen only, same as the position for the channel traces. Use mouse left, Right buttons or scroll to move.

Apply a smoothing function to successive FFT results. It can considerably reduce noise to highlight a weak signal.

window Various windows can be applied to the captured data before the FFT is calculated. Use Left and Right mouse clicks only in the window variable box the change your selection. Options are: Hanning, Hamming, Blackman, flattop and rectangular.

scale Since readouts are in dBm or dBV, the FFT must know how the signal is terminated.

Use dBV for an unterminated input, such as using the probe, dBm 50R for a 50 Ohm termination, dBm 75R for a 75 Ohm termination etc.

For terminated dBm readings, the user must supply the termination impedance externally.

mag reserved

The FFT calculation is performed by low level hardware to give fast throughputs without loading down the scope. The FFT size will be either 2048 points or 1024 points depending on the **record size** setting in the timebase panel. Full size will display the FFT across the width of the screen, and half will display across 6 horizontal divisions.

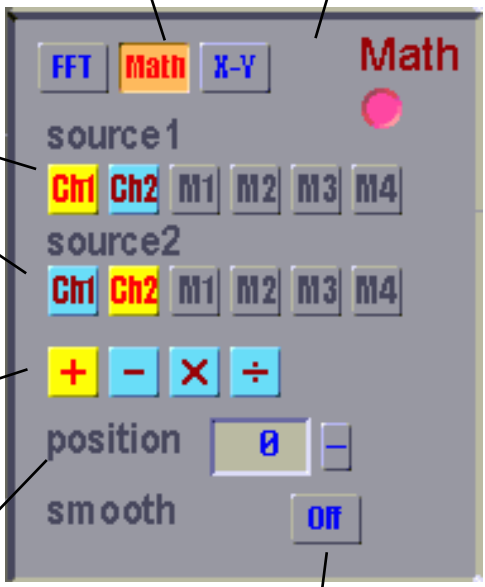
The math functions create a new trace from the combination of two source traces and displays it on the screen.

Sources can be Ch1, Ch2, M1..4. Function can be Add, Subtract, Multiply or

Press **Math** button to show the Maths control panel. It will be illuminated if Maths is ON.

Maths On/Off control

The two inputs to maths can be selected from any of the available buttons in the 2 rows. Available buttons are blue.
Grey means it isn't available because the channel or memory is not turned on.



Press the button for the function to perform on source 1 and 2. It will illuminate yellow and the trace will display the result.

Position is a trace position on the screen only. It is the same as the position for the channel traces. Position ranges 10 for top, 0 for center, -10 for bottom.
Use mouse left, Right buttons or scroll to move, or click the quick position button on the right.

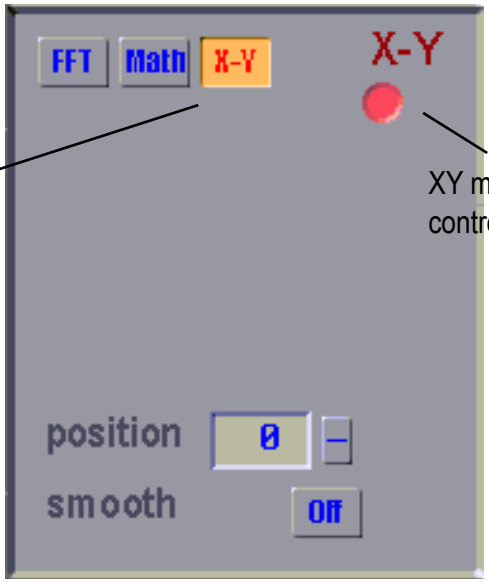
Averaging applies a smoothing function to successive math results.

X-Y mode plots channels 1 against channel 2, with channel 1 forming the horizontal axis and 2 the vertical. The X-Y mode can plot any traces that you can normally capture. Traces can be single shot or repetitive up to the highest timebase settings.

Rendering to screen is carried out by special hardware which uses dot joining for a display which is more complete and easier to interpret than if only displaying sample points.

Like a conventional oscilloscope, the X and Y positions of the X-Y trace are affected by the Voffset controls of the channels. In addition there is also the usual position control which can be used to place the trace independently in the vertical direction. This is useful when the normal channels are also displayed to allow separating the X-Y trace on the screen.

Press **X-Y** button to show the X-Y control panel. It will be illuminated if X-Y mode is ON.

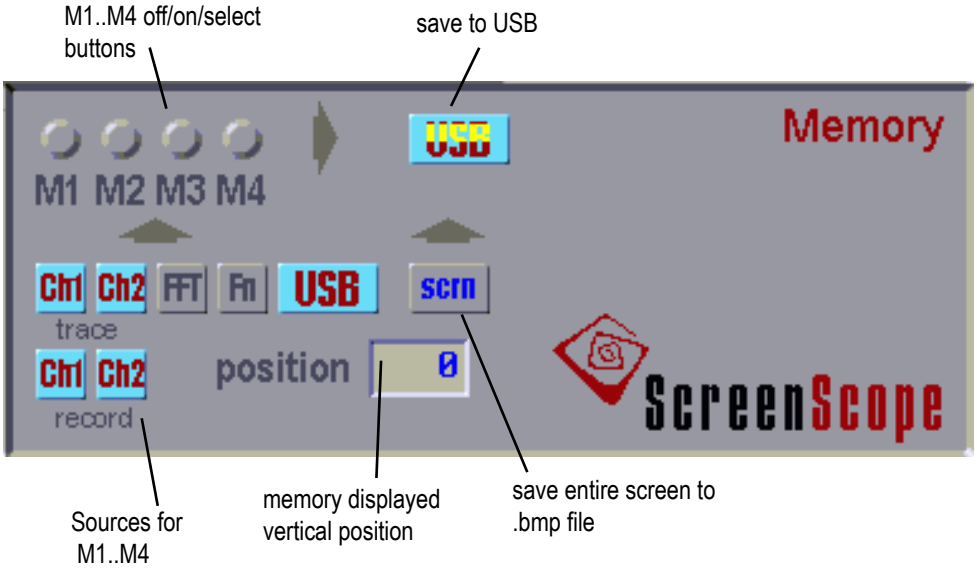


XY mode On/Off control

X-Y plots can appear more noisy because the noise on the signals from both channels appears on the plot. The smoothing filter can be used to minimise the appearance of this noise on some plots. Unlike the averaging filter of the channels, the smoothing filter is a single pole recursive filter which can be applied to single waveforms. Note that this filter is not suitable for all inputs. If the channels signals are changing too rapidly against on another, it may distort the result.

The Memory panel contains the USB memory interface and 4 trace waveform memories M1 to M4 and the screen shot button. Trace memories are saved in board non volatile memory and will not be lost on power down. They can also be copied to USB memory.

The arrows indicate the flow of data. M1..M4 are intermediaries, They can receive data from one of the sources Ch1,2,3, FFT, Fn, USB, or its current content can be saved to a file on USB.



M1..M4 off/on/select buttons

The local memory on/off buttons have 3 states:

Off - Button Up grey. Trace is off.
On - Button down blue. Trace is on.

Selected - Button down - Blue with yellow circle. Trace is on and it is the target for load from a source, or it is selected for save to USB memory.

If more than one Memory is on, clicking once on any one will transfer the yellow ring to it indicating it is selected. If it is clicked again, the trace is switched off.

M colours

The colours of the M1..M4 traces and on/off buttons are different shades of blue with M1 the darkest and M4 the lightest.

Sources The source button will be blue if it is available, grey if the source is off.

If a memory is on and selected, then a single click on an available local source, will load a memory from the from the source.

Trace memories also store a context for the saved waveform. This means you can later enable the manual measurement markers for a memory and obtain readings based on the settings used to capture the original waveform.

trace

There are two sets of source buttons for saving channels 1 and 2 to a trace memory..

The **trace** source buttons will copy the channel trace exactly as it appears on the screen to local memory.The stored memory is only the width of the screen and cannot be panned. but takes up less space if later saved to USB memory. Use this to save a trace with averaging enabled.

record

The channel **record** source buttons will copy the entire capture record to memory in its raw format. This can be saved to USB and later reloaded. It can also be panned using the horizontal position control to view the entire waveform.

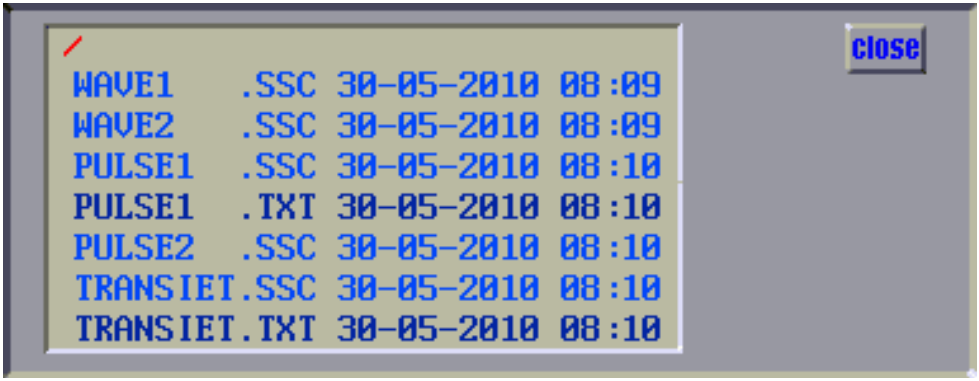
Note that when panning through a saved record, the current timebase should be set to be the same as that when the original waveform was captured.

FFT will copy the FFT traces as it appears to a trace memory, and **Fn** will copy the Maths result trace to local memory.

The USB buttons will be blue if there is a USB memory plugged in and it has been enumerated. Otherwise it will be grey and the source will not be available.

The lower USB button represents it as a source to local memory. Use it to load a waveform from USB memory to a local trace memory.

If a memory is on and selected, and the USB is available, it will show the USB file window below.



A single click on any native screenscope file (.ssc) in the file window will load the waveform into the selected memory.

To move down a directory, just click on it, to move up click in the top line which shows the current path.

save to USB To save a selected memory to USB, click on the upper USB button pointed to by the top arrow.

If the USB is available it will show the filename and Virtual keyboard panel.

Simply type in the filename you want. Use the arrow keys to move back and forward. Hitting the space key at any point will fill any remaining spaces in the file name with spaces.

The filename extension field is click only. Click to select the file format. It will rotate through:

.SCC	native screenscope format which can be reloaded direct to the M1..M4 local memories.
.TXT	X Y format file space separated fields
.CSV	X Y format comma separated fields.

Click save to save to USB. The save button will illuminate yellow while the USB memory is busy.

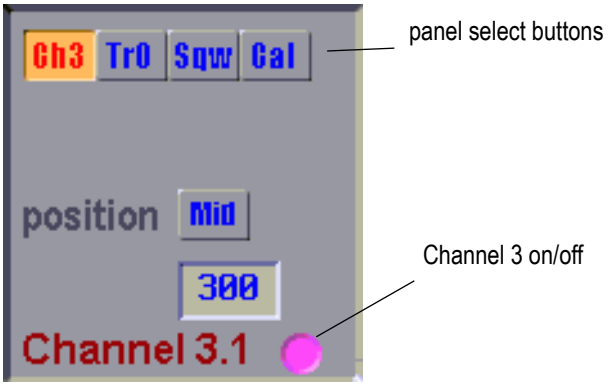
Press the **scrn** button to save a bmp file of the entire screen exactly as it appears. If a file name with a .bmp extension has not been defined, the keyboard panel will be displayed with the extension filled in. This is in fact the only way to enter the .bmp extension.

Use the keys to enter the file name you want. You can then continue with the save either by pressing the **save** key in this panel, or by closing the panel and again pressing the **scrn** key. FIle names are limited to 8 characters.

clock There is no real time clock in Screenscope. The time and date entry are provided here to allow time stamping of USB files saved. The clock will function while Screenscope is on, and will remember its last values, but will not run when screenscope is off.

The channel 3 panel is shared with other functions of the Ch3.1/Aux front panel BNC connector. The panel select buttons will highlight to yellow when the function is set on with its on/off button.

Select the panel you require by pressing the appropriate button along the top of this panel.



threshold Channel 3 is a 1 bit channel with a voltage threshold of 1.65V. It is suitable for use with a standard probe on the X1 setting, or a coaxial cable connection from a TTL or CMOS source.

When operated from a coaxial source, it may or may not need a termination. If there is evidence of multiple edges, when there should be just one, a terminator may be required especially on longer cables.

Ch3 trigger To select channel 3 as a trigger source, simple set the source in the trigger panel to channel 3.

When channel 3 is the trigger source, the screen will show the triggering edge as steady. Other edges on the channel 3 display however, will display 1 sample clock time jitter. This is normal and results from the fact that even very small jitter on asynchronous input may cause it to be sampled in one or other sample time if its changing at the sample edge time.

position This is a pixel offset position that allows placing the trace display at any vertical location. Channel 3 has no voltage offset adjustment. The same **Top**, **Mid**, **Bot** button is available as for channels 1 and 2, as well as the scrollable variable box.

on/off Turns the trace on/off. Button and trace are purple when on.

Press the Cal button to display the Calibration panel if it is not in view.

Screenscope can calibrate gains and voltage offsets of the two channels. The gains and offsets are done separately, since some user intervention is required to calibrate one or the other.

gains Offsets can be calibrated by itself, but gains should always be followed by offset calibration.

To calibrate gains, press the button for the channel gain you want to calibrate. The button will turn orange and a message will be displayed at the bottom of the grid area:

“connect Ch3 to Ch1 with short cable and click button again”

Connect the cable, and click again. The button will turn yellow and it will then proceed with gains calibration which will take a few minutes. The button will go back to blue when it is done.

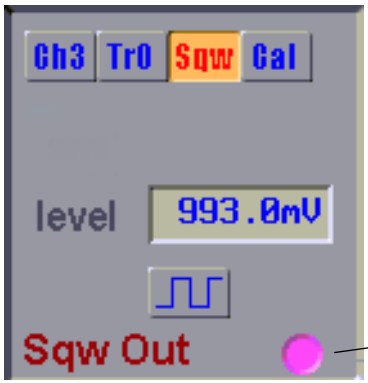
offsets To calibrate offsets, press the required channel button next to offsets. The button will turn orange and a message will be displayed at the bottom of the grid area:

“disconnect cable from the Ch then click button again”

Disconect any cable or probe from the channel then click the button again. The button will turn yellow and will then proceed with offsets calibration which will take a few minutes. The button will become unhighlighted when it is done.

Press the Sqw button to display the panel if it is not in view.

The Square wave output is a 1.22 Khz signal for scope and probe calibration but can be used for a user function.



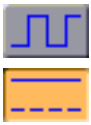
Click the round on/off button to enable the signal out. When the signal is off, the output is a high impedance.

Right clicking in the variable box will enable and increase the magnitude of the square wave output. Left click will reduce the magnitude. Voltages available are approx:

0.135, 0.88, 1.00, 2.30, 2.43, 3.18, 3.3

If this is left on a voltage, it will stay on even if the panel is swapped out and channel 3 turned on for example. In this situation it will display the waveform so long as its magnitude is greater than 1.65V, the channel 3 threshold.

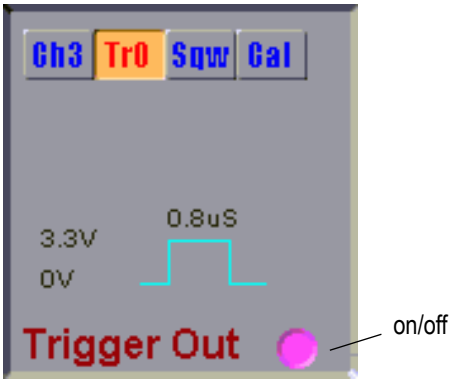
Note that the voltages will be 1% lower when displayed on the screen compared to the readout. This is because the low frequency output impedance is 10K. See the note next page about output impedance of this port.



This button sets the signal output to DC. Its purpose is to allow the level to be checked with a multimeter for factory calibration set.

Press the Sqw button to display the panel if it is not in view.

To enable Trigger out press the round on/off button.



The trigger out is a ~0.8uS, 3.3V pulse with source impedance of 50 Ohm. The rising edge occurs 127 ±3nS after a trigger event.

Note - Output impedance on Trig out and Square Wave Out

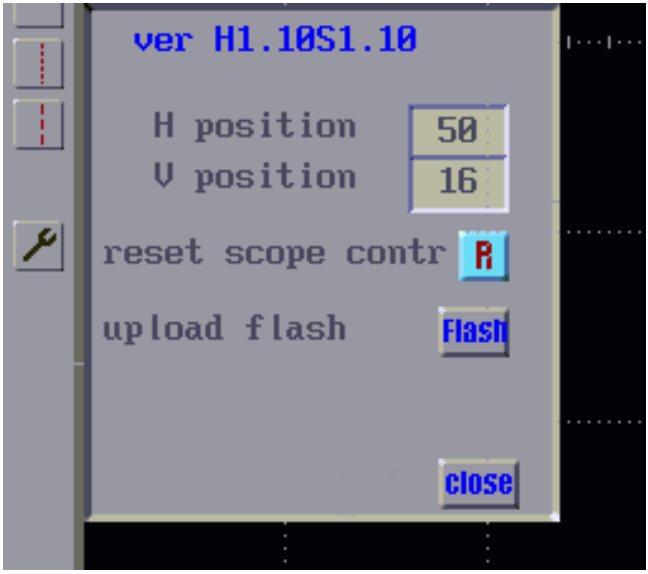
The output impedance of this port when used for Square Wave Output, or Trigger output, is 50 Ohm plus a series 0.1uF capacitor in parallel with a 10K resistor.

For square wave outputs, this will drive High impedances but will show decay on low impedances.

For trigger output, it will drive 50 Ohm load at a magnitude of 1.65V. unterminated loads will drive to 3.3V

Acquisition must be stopped to access the control panel. Press **Stop** to stop the scope if necessary.

The Control Panel button on the side bar pops the control panel into the measurement area. It contains functions not required for normal scope operation.



H position
V position

Adjust the video position as displayed on your monitor by positioning the cursor in the Horizontal or Vertical variable area then using the mouse buttons or wheel.

reset scope controls

Screenscope's control settings are regularly saved to flash so that the scope state can be restored on power up giving it a continuity of operation.

To reset the controls back to default, click the R button, then power cycle the scope. The controls can also be reset via the low level boot screen.

To upload new system firmware, insert a USB memory with the two system files:

ssc531c.bin
ssc531d.bin

then press the **flash** button. Uploading will take about 1 minute. Do not remove the USB key or power down while uploading is in progress. Power cycle the scope to reboot with the new system.

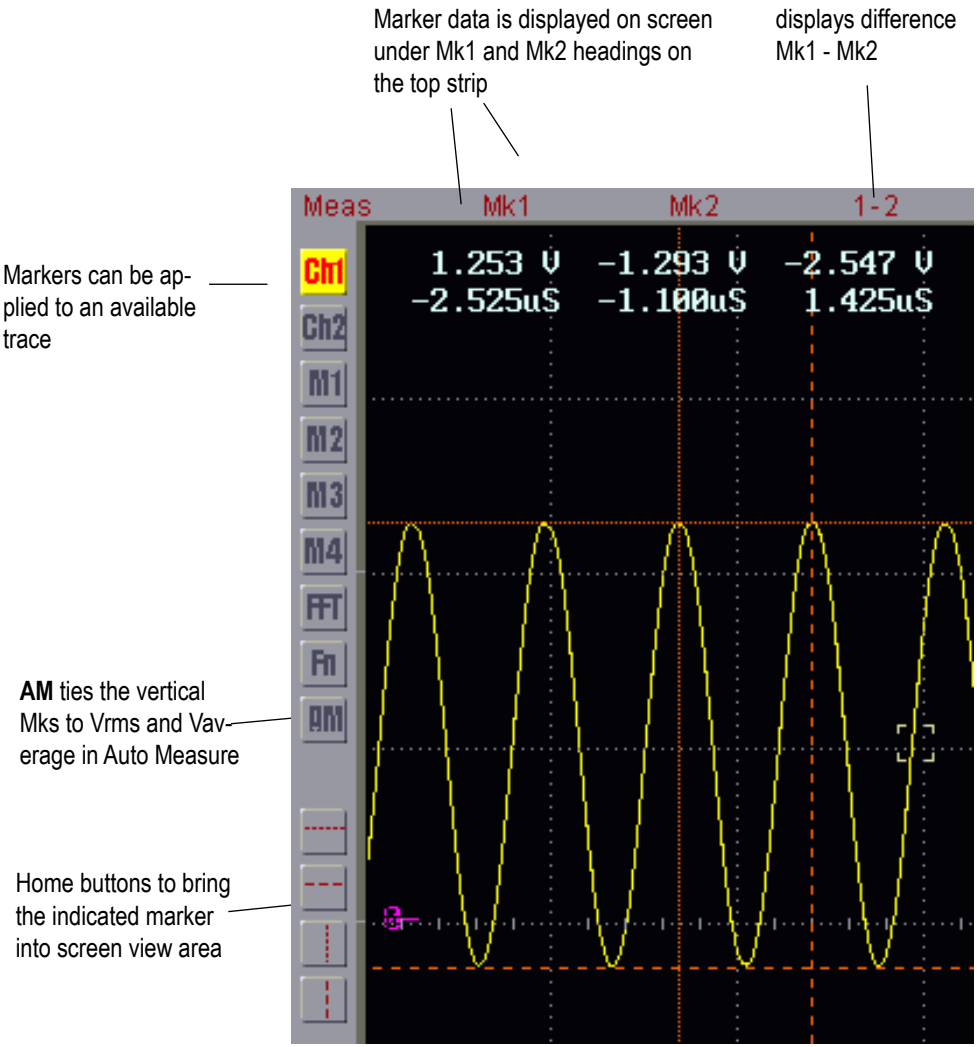
If the upload is interrupted, or there is some other reason that the files are corrupted, the scope will no longer boot into the system on power up. In this case you can use the low level flash loader to attempt a reload. In the absence of a system it will most likely come up automatically in this loader, but you can also direct it to it by continually left clicking the mouse while powering the unit up. This is similar to hitting 'delete' on a PC to enter the COMS configuration at power up.

The low level loader is permanently read only and cannot be corrupted by any ordinary means.

See the section on Low Level Flash Loader for information on its use.

For manual measurements two sets of vertical and horizontal markers are provided Mk1 and Mk2. Mk1 are identified by the short orange broken lines, Mk2 are longer broken lines.

These are moved by mouse click and grab on the screen. After release, a markers position can be further fine tuned with the mouse wheel. Click another object or on a blank area to end the wheel association with the maker if required.

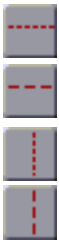


source

The Markers can be applied to measure any available trace according to the available status buttons on the left strip. If a trace is available it can be pressed and will become yellow. If taking over from another trace, its trace button colour will change to blue.

The markers will display the measured variables in the correct units for the type and scale of measurement. The markers also remember their positions for each source so changing from one to another, then back will not require repositioning.

The AM , links the vertical Markers to the Auto measure RMS and Average functions. This allows you to select the boundaries between which RMS and Average are calculated.

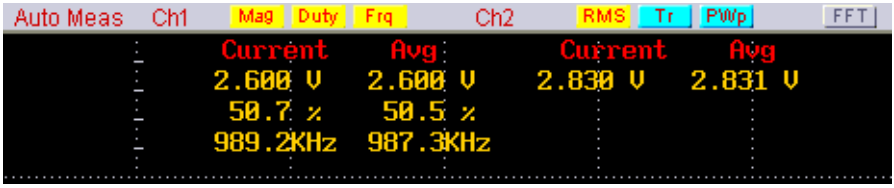


If a maker is set to a position on screen away from the center, and then you zoom in, either on the vertical or horizontal scale, the markers may exit the screen and may be some way off.

These buttons provide a quick way to call a marker into the measurement area. Just click the button identifying the maker and it will be placed near zero for horizontal, and near the zoom center for vertical markers.

Screenscope has 11 auto measurements available for channel 1 and channel 2 plus 1 for FFT.

The 11 measures for the channels 1 and 2 are condensed into 3 buttons so only 3 Auto Measures are available at the same time per channel.



Left clicking on a button will toggle it on/off. Right clicking will change the auto measure type that is performed by that button.

Ch button 1

right click to change button function

PPK

Volts Peak to Peak - measures between the extremes of a waveform.

Mag

Volts Magnitude - a histogram is taken of the waveform and magnitude is the measurement between the two most populous readings. For example a square wave with overshoot would return the value between the flat top and bottom and ignore the overshoots.

RMS

Volts Root Mean Square - calculated across the screen width, or by clicking on the “AM’ button in the Marker measure source buttons, the vertical markers can be used to select the horizontal section between which RMS is to be calculated.

Avr

Volts Average - Calculated across the screen width, or by clicking on the “AM’ button in the Marker measure source buttons, The vertical markers can be used to select the horizontal section between which average needs to be calculated.

Ch button 2

Rise time, defined as time taken to go from 10% to 90% Mag.

Fall time, defined as time taken to go from 90% to 10% Mag.

Calculates the Duty cycle of a zero crossing waveform. Displayed in xx.x % where the reading refers to the positive side.

Ch button 3

Calculates the frequency of any repetitive zero crossing waveform.

Measures the time interval between positive edges of a periodic zero crossing waveform

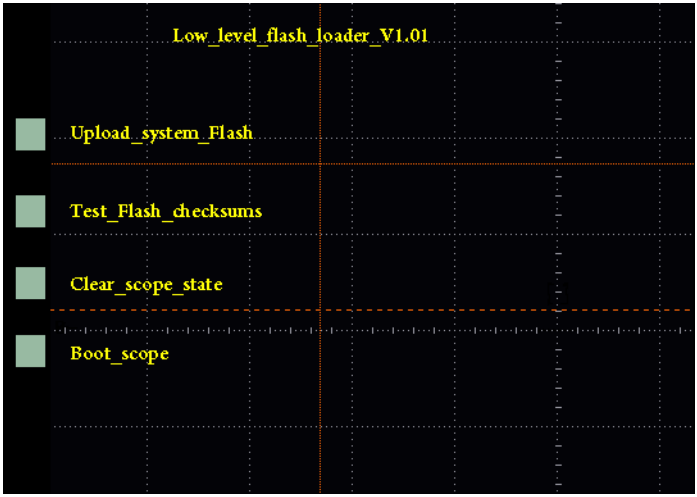
Measures time interval from positive edge to negative edge of a zero crossing pulse.

Measures time interval from negative edge to positive edge of a zero crossing pulse.

When the FFT auto measure is enabled, a reading of mag in dB and frequency is displayed next to the highest magnitude peak in the FFT trace.

The persistance control is above the TImebase panel. Simply click or wheel adjust this between 0 normal, and 9. maximum. Higher settings hold traces displayed for longer periods of time

The Low Level Flash Loader provides a convenient way to upload new system flash without having to boot the main scope. It is permanent and cannot be erased or upgraded and so provides a secure fall back position in case the main system is lost for any reason. For example if the power is interrupted while uploading flash via the system control panel.



To enter the loader, simply repeatedly click the left mouse button while powering up the unit. It should come up with this display within a few seconds.

There are 4 commands available. To execute any one, click in the grey square to the left of the command title.

Upload System Flash

To upload new system flash, the two system files should be on a USB memory inserted in the USB memory socket.

ssc531c.bin
ssc531d.bin

Note that in the loader, the USB key can be inserted only once. If it is removed and re-inserted it will not be recognized again. To re-mount the USB , power cycle the scope and re-enter the loader.

Click the grey button next to “Upload_systems_files” to start uploading the flash. If all is well it will display a message “loading ssc531c” and soon after “loading ssc531d”. It should take about 1 minute to complete.

If it can’t find files to upload it will display “no system files on USB”

Note that if only one file is present it will load that file. To ensure compatibility between the two file revisions, they should be loaded together from the same dates.

Test Flash Checksums

This function can be used any time before or after upload. It displays two sets of two numbers. The sets should be the same for valid data.

Use this after uploading new flash to check that the load was OK.

It is possible that if a source file was corrupted to start with, that the checksums will be OK but the scope will not boot into the main system. In this case check you source files and try again.

Reset Scope Controls

This is the same function as in the Control Panel. It is provided here also in case there has been a corruption in the scopes saved state that may be preventing the normal system from displaying video. In this case, test the flash checksums first, if they appear OK. then press this button and attempt a boot of the system.

Boot scope

Clicking this button will proceed with booting the main system. You can also just power cycle the scope.

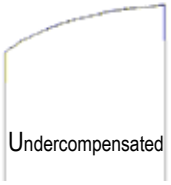
The probes have an adjustment trimmer which is used to match the probe to scope input capacitance for a flat frequency response.

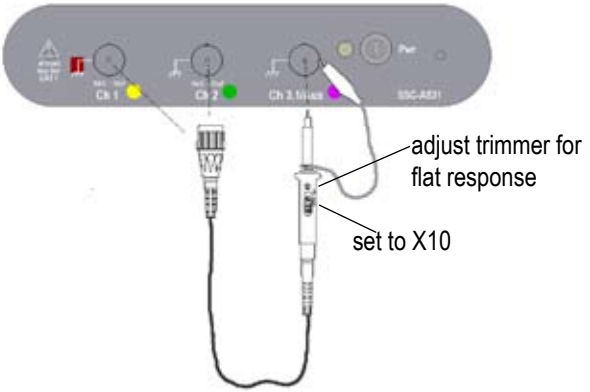
To compensate a probe:

Connect the probe to channel 1, and set it for X10

Set scope controls to :

Trigger panel	-		**RUN ,**
		Trigger source	**Ch1**
Channel panel	-	V/div	**50mV/div**
		coupling	**DC**
Sqw panel	-	level	**3.32V**
Timebase panel	**-**	sec/Div	**100uS**





Connect the probe ground clip to one of the BNC connector grounds and touch the probe tip to the Ch3/Aux BNC center. You should then see the calibration signal on the screen. Drag the signal to position the top of the waveform for good visibility. Drag the trigger level marker up to steady the capture if required. You can also set averaging to get a clearer waveform.

Adjust the trimmer for a flat top waveform. The probe is now correctly compensated.

Repeat for the other channel/probe.

Screenscope self calibrates using the **Cal** panel in the Channel 3 group.

Gains and Offsets are calibrated separatly for each channel. To calibrate gains a short BNC cable is required to loop the Ch3.1/Aux connector back to the channel you want to calibrate. This provides a reference signal output to the channel.

To calibrate offsets, the channel input should be disconnected, or a 50Ohm terminator can be mounted directly onto the input.

Since accuracy of the offset position depends on the channel gain, offsets should always be calibrated after gain calibration. The reverse is not required however. You can calibrate offsets by themselves. Calibration takes approx 10min per channel.

You should allow 20min from cold switch on to allow temperatures to stabilise before running calibration.

See section **Control Panels -> Calibration** for procedure.

Aquisition

aquisition mode	real time
sample rate	240 MSPS
Digitizers	8 bit channel 1 and 2 1 bit channel 3
aquisition rate	waveforms/sec max typical 1 channel 450 300 2 channels 250 200 per channel 3 channels 200 150 per channel Values for waveforms only without auto measures, FFT, or math Depends on timebase setting and density of rendered trace.
sample clock jitter	< 1 ps rms

Inputs

coupling channel 1, 2 channel 3	DC, AC DC
Maximum input voltage at input BNC	45V peak all inputs
Input impedance channels 1,2	1MΩ, 20pf

Vertical

number of channels	2 analog, 1 digital 1 bit
analog channel attenuator range	5V/div to20mV/div at BNC
vertical display resolution	75 lines/div
Channel 1,2 bandwidth	55 Mhz -3dB typical
AC coupled lower frequency limit	3.3Hz at BNC
DC gain accuracy	±2%
offset voltage position accuracy	±1%
averaging	16 point moving average

Horizontal

Timebase range	3.3nS/div...50mS/div standard aquisition 100mS to 1 hour/div chart record mode
interpolation	sinx/x
record length	Selectable Full 4096 samples, or min required for display
record sampling rate timebase >= 500nS/div timebase <= 1uS/div	 240 MSPS 240/(3 * timbease setting =1 for 1us, 2 for 2us, 5 for 5uS etc)

Trigger

types	edge psitive, negative pulse width positive,negative
pulse width range	66.7nS - 4.369mS
modes	free run, triggered, single shot
source	channels 1,2 or 3.
jitter	channels 1,2 < 200pS channel 3 500pS
trigger position range timebase >= 100mS/div timebase <= 50mS/div	 pre-trigger 10hr , post trigger 0 pre-trigger 3,600 samples post-trig 4.36mS, 4.1667nS resolution
trigger level range	± 3.5 div
trigger level accuracy	> 1%

FFT

Frequency range	2048 point. at record sampling rate
Output scale	20dB/div dB Vrms, dBm 50Ω, dBm 75Ω, dBm 100Ω, dBm 300Ω, dBm 600Ω.
Window	Hanning, Hamming, Blackman, Flattop,Rectangular.
Averaging	single pole recursive filter applied to FFT output.

Math

sources	channels 1,2 local memories M1 to M4
functions	plus, minus, times, divide.
operation	recalculated every aquisition

Auto measurements

sources	channel1 and 2, FFT
measurements	V peak to peak V magnitude V rms - fulls screen or between markers V average - fulls screen or between markers T rise T fall Duty Cycle - positive half/negative half % Frequence Period Pulse Width Positive Pulse Width Negaitve FFT magnitude and frequency
simultaneous	3 per channel, plus FFT

Marker measures

sources	channel1,2 FFT M1 to M4
number of markers	2 sets of vertical and horizontal
readouts	on screen
readout units	context of selected source actual or saved for memory.
readout resolution	1 pixel vertical or horizontal

Calibration

method	self calibration with loopback cable gains and offsets calibrated separatly
accuracy	± 1%
temperateure stabilisation time	30min before calibration

Peripherals

Monitor output	1024 x 768 256 colour
Mouse	Standard 2 button wheel USB mouse
Memory	USB 1.1

Power

input	12V DC positive center
consumption	5 watts typical. May vary depending on mouse and USB key

Power Adaptor

Output voltage	12V DC positive center 1 Amp
Mains supply variation	± 10%

Environmental

Temperature	operating 5 to 40 deg C storage -10 to 50 deg C
Humidity	95 % non condensing
Altitude	up to 2000m

Mechanical

size - main unit	widht 160 mm height 42 mm Length 227mm
weight - main unit	0.95 Kg