



# ELAN DIGITAL SYSTEMS LTD.

LITTLE PARK FARM ROAD,  
SEGENSWORTH WEST,  
FAREHAM,  
HANTS. PO15 5SJ.

TEL: (44) (0)1489 579799

FAX: (44) (0)1489 577516

e-mail: [sales@elandigitalsystems.com](mailto:sales@elandigitalsystems.com)

website: <http://www.elandigitalsystems.com>

## USBscope50 USERS GUIDE

ES370



**Important Notice: Please refer to Safety Data 4.4.1, before using this instrument**

All Trademarks are duly acknowledged.

The USBscope50 is Patent Pending.

### REVISION HISTORY

ISSUE	PAGES	DATE	NOTES
1	30	04.07.2005	FIRST ISSUE
2	30	08.07.2005	Various additional info & spec amendments
3	31	15.07.2005	Add support for Win98 & DBCS Language's in 2K/XP
4	31	20.07.2005	Various additional info & amendments
5	39	27.09.2005	General update. Explain trigger modes, Math, FFTs etc
6	43	06.10.2005	Add clipboard feature and MIS mode
7	44	11.01.2006	Add offset null feature
8	34	22.04.2009	User Guide for New Java Software
9	34	08.07.2009	Clarified Absolute Maximum voltage detail

# CONTENTS

<b>1 OVERVIEW.....</b>	<b>5</b>
<b>2 ABOUT THE USBSCOPE50.....</b>	<b>6</b>
<b>2.1 General.....</b>	<b>6</b>
<b>2.2 USBscope50 Architecture.....</b>	<b>7</b>
<b>2.3 Using More Than One USBscope50.....</b>	<b>8</b>
2.3.1 Stacked Mode.....	8
2.3.1.1 Assembling The Stack.....	8
2.3.1.2 Disassembling The Stack.....	10
2.3.1.3 USB Connections For Stacked Configurations.....	11
2.3.1.4 Software For Stacked Configurations.....	11
2.3.1.5 Stacking Do's And Don'ts.....	12
2.3.2 Non-Stacked (MIS) Mode.....	13
2.3.2.1 USB Connections For Non-Stacked Configurations.....	13
2.3.2.2 Software For Non-Stacked Configurations.....	14
<b>2.4 Input Ranges.....</b>	<b>15</b>
2.4.1 Offset Nulling.....	16
<b>2.5 Probe Compensation.....</b>	<b>16</b>
<b>2.6 Acquisition Modes.....</b>	<b>20</b>
2.6.1 Single Shot.....	20
2.6.2 Random Interleaved Sampling.....	21
<b>2.7 Trigger Modes.....</b>	<b>22</b>
2.7.1 USBscope50 continuous run in Free Mode.....	23
2.7.2 Normal Triggering.....	23
<b>2.8 Trigger Position.....</b>	<b>23</b>
<b>2.9 Trigger Threshold.....</b>	<b>24</b>
<b>2.10 Data manipulation.....</b>	<b>24</b>
2.10.1 Save Graph.....	24
2.10.2 Export Graph Data.....	24
2.10.2.1 Example Data File.....	25
<b>2.11 Import Graph Data.....</b>	<b>26</b>
<b>2.12 Software Development Kit (SDK) for USBscope50.....</b>	<b>27</b>
<b>3 SOFTWARE INSTALLATION.....</b>	<b>28</b>
<b>3.1 Windows XP and Vista.....</b>	<b>28</b>

<b>3.2 Linux Ubuntu.....</b>	<b>29</b>
<b>3.3 Troubleshooting.....</b>	<b>30</b>
<b>4 HARDWARE SPECIFICATION.....</b>	<b>31</b>
<b>4.1 Power Requirements.....</b>	<b>31</b>
<b>4.2 Mechanical.....</b>	<b>31</b>
<b>4.3 Environmental.....</b>	<b>31</b>
<b>4.4 Performance.....</b>	<b>32</b>
4.4.1 Safety Data and Maximum Ratings.....	32
4.4.2 Static Performance.....	33
4.4.3 Dynamic Performance.....	34
4.4.4 Miscellaneous.....	34
4.4.5 Software.....	34

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## **Listed Products**

The models covered by this installation guide are intended only for installation in computers for use in business or home.

## 1 OVERVIEW

The USBscope50 is an isolated digital storage oscilloscope that has the following features:

- Single channel scope with BNC input and USB PC interface
- Each USBscope50 can be stacked to increase channel count (each requires its own USB connection)<sup>1</sup>
- 300V Cat II isolation between BNC ground and USB ground<sup>2</sup>  
*This means that there is no DC path through the USBscope50 from your scope ground clip to the PC's ground*
- 50MSample/sec single shot sample rate
- 1GSample/sec equivalent sample rate<sup>3</sup>
- Timebase from 4ns/div to 4s/div in 1,2,4 steps
- 75MHz 3dB analogue bandwidth<sup>4</sup>
- 3000 sample points, 8-bits per sample
- Pre and post triggering
- AC and DC coupling
- Input sensitivities with x1 probe are 30mV/div, 300mV/div, 3V/div and with x10 probe are 300mV/div, 3V/div, 30V/div; Input ranges provided by the software from 2mV/Div to 10V/Div in 1,2,5 steps
- 1Meg input impedance, 16pF
- Channel offset control
- Hardware triggering with >, <, +, – modes
- Refresh or Roll modes for display, depending on timebase
- Host powered from USB (200mA typ)
- Stacked configurations of 2,3 and 4 channels are supported
- Stacked configurations allow any channel to be trigger channel
- Stacked configurations have tight phase locking between channels
- Probe compensation output, 3V 1KHz
- Power/activity LED

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<sup>1</sup> A stacking connector pair is required

<sup>2</sup> In stacked configurations the channels share a common ground at the BNC terminals

<sup>3</sup> Suitable to measure repetitive signals that are not phase locked with the internal acquisition clock

<sup>4</sup> Hardware trigger bandwidth is approximately 60MHz

## 2 ABOUT THE USBscope50

### 2.1 General

The USBscope50 uses a 50MSample/sec 8-bit A-to-D converter. The A-to-D and front-end circuits that process the input waveform, and the digital stages that acquire and store the waveform are all powered from the USB host interface via an isolated supply. This means that there is no galvanic connection between the BNC ground (or BNC centre terminal), and the USB interface. When you measure a circuit and connect the scope ground clip to a voltage that is not at the same ground potential as the host computer, no current can flow and the host computer is therefore not forced to be at the same potential as the circuit under test. This clearly has major safety advantages. The USBscope50 has been designed so that up to 300V CAT II<sup>5</sup>, or 500V CAT I can exist between the scope ground clip and the host computer ground.

Each USBscope50 can be used as an independent single channel scope but to enhance flexibility several USBscope50s can be stacked together to make a combined 2,3 or 4-channel device. In this case, each scope is synchronised with the others so that the compound device acts like a single multi-channel instrument. Each USBscope50 still needs its own USB connection and the combined device shares a common ground between all the BNC connectors i.e. the channels are isolated from the USB but not from each other.

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<sup>5</sup> The CAT rating refers to how large a transient over-voltage may be when connected to the circuit in question. The USBscope50 is designed to handle a certain transient over-voltage between the BNC and the USB host i.e. across the internal isolation circuits. The CAT II UL rating defines a more severe environment than CAT I and hence larger transients are possible. This is why the isolation rating for CAT II is lower than the rating for CAT I. For further information on CAT ratings please refer to [www.fluke.com](http://www.fluke.com)

## 2.2 USBscope50 Architecture

The figure below shows a simplified diagram of the USBscope50.

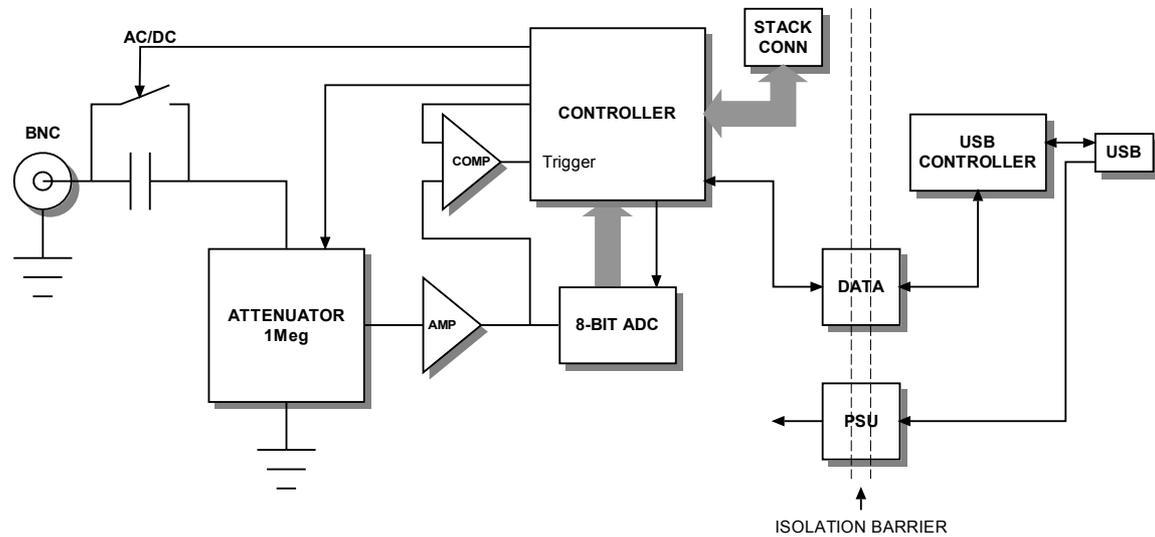


Figure 2.2-1 USBscope50 Architecture Diagram

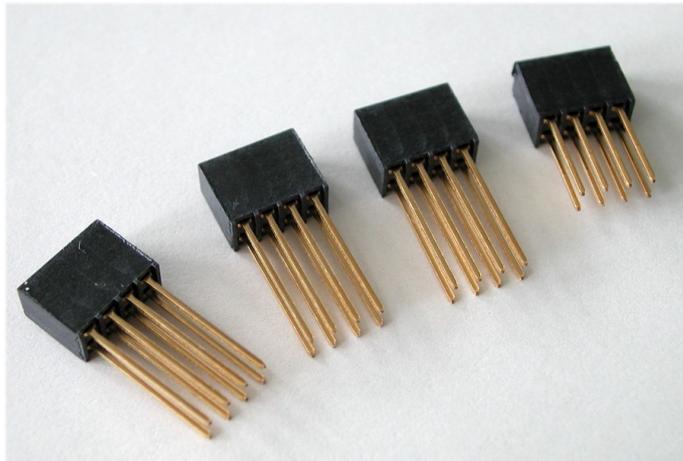
## **2.3 Using More Than One USBscope50**

### **2.3.1 Stacked Mode**

A unique feature of the USBscope50 architecture is that up to 4 devices<sup>6</sup> can be stacked to make a multi-channel instrument.

In order to use a stacked configuration, you will need to use the connectors supplied with the USBscope50 unit.

You should have a pair of connectors supplied with each unit, one long one and one short one, similar to these:



#### **2.3.1.1 Assembling The Stack**

To stack the USBscope50 devices, first be sure that none of them are connected to a USB port.

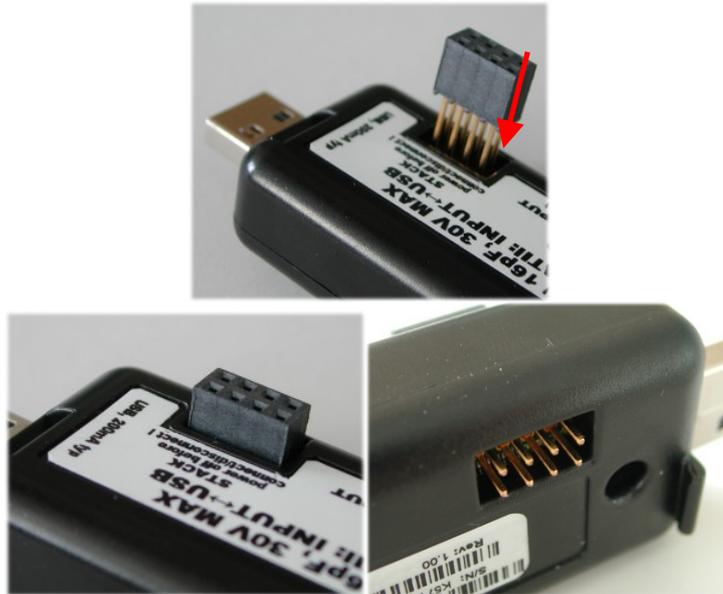
Before you begin, put the short lead connectors to one side...you'll only need one of these.

Now, insert one of the long connectors from the top of one of the scopes (it doesn't really matter which one). Push the pins of the connector into the top of the stacking connector from the side where you can see the top of the black connector down inside the scope. Be careful when doing this, don't use too much force or you may damage the connector pins. Push the long connector all the way in until it seats down on the scope's internal connector. You should be

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<sup>6</sup> Don't stack more than 4, the software will reject this.

able to see the gold pins about 2-3mm beyond the bottom surface of the scope. The connectors have no pin orientation...they can go in 2 possible ways round...both are OK.



Repeat this for all except the last scope to be stacked.

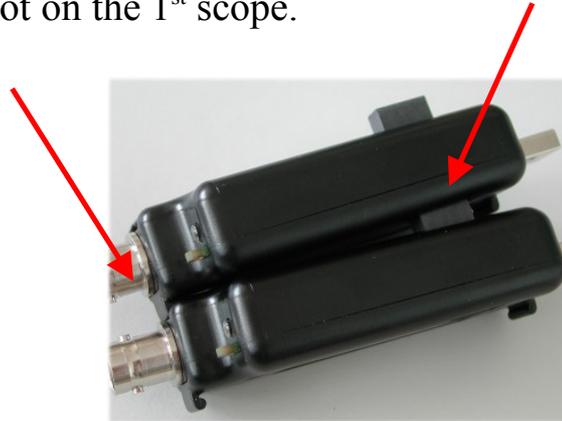
For the last scope in the stack, do the same as above but use the short length connector. This time, the pins are shorter so they stop well inside the scope's case. **This scope MUST be the bottom scope in the stack.** The reason for this is that if you use the long connector, the pins could be shorted out accidentally, or you may touch the pins when the scope is connected to a high voltage and you could get an electric shock! Similarly, if you plan to use only one scope, make sure there is no stack connector fitted or the shorter connector type is fitted.



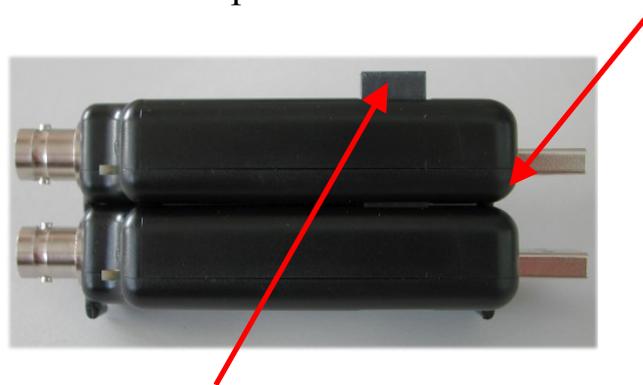
**This is a safety critical point so please note it carefully.**

Now you can assemble the stack.

Start with the bottom scope. Hold it in one hand, and put the next scope on top of the 1<sup>st</sup>, the same way around. Align the stacking connectors and when the stacking connectors are partly mated engage the front “P” shaped clip (BNC end) on the 2<sup>nd</sup> scope into the “P” shaped slot on the 1<sup>st</sup> scope.



Now, bring the back edge “P” clip (USB end) of the 2<sup>nd</sup> scope down until it clicks into the 1<sup>st</sup> scope’s slot. These two scopes are now mated.



Check that as you pushed the 2<sup>nd</sup> scope down, the stack connector has not been forced upward...if it has simply press it down until it seats correctly (see picture above for a guide as to the normal exposed connector depth after stacking). Repeat this for each remaining scope, adding each one on top of the previous one.

The scopes are now stacked.

### ***2.3.1.2 Disassembling The Stack***

Start with the top scope in the stack. Grasp the stack in one hand and with the other hand’s thumb and forefinger, pinch between the interface between the top two scopes, near the back “P” clip (USB

end). With moderate force, the top scope will pop up and come free. Remove the stacking connector from the free scope.

Repeat this for all scopes in the stack.

### ***2.3.1.3 USB Connections For Stacked Configurations***

**All stacked scopes need a USB connection.** A standard hub may be useful for multi-channel stacks to get enough USB ports.

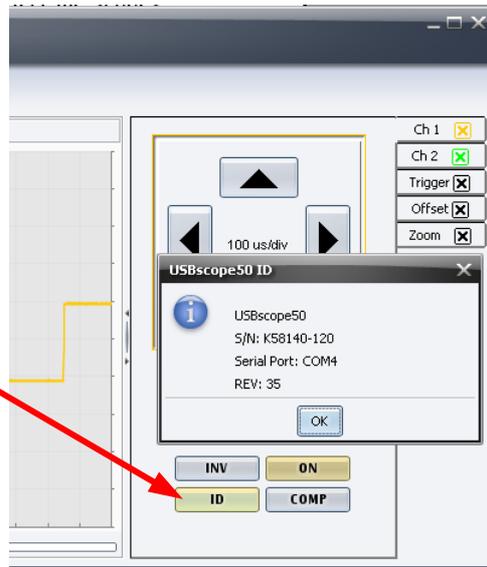
Each scope needs about 200mA. Plugging more than 2 scopes into a hub will mean that the hub may need to be powered externally. Please refer to the hub's documentation for more details about the power available per port.

### ***2.3.1.4 Software For Stacked Configurations***

When you run USBscope50, it will automatically detect the scopes connected via USB and will also check to see if the scopes are electrically connected together via the stack. It will then initialise all connected scopes, one at a time. This may take a few seconds. If you stack several scopes but forget to connect say one of the scopes to a USB port, the software will warn you and will not run.

The software will display a channel "tab" for each scope in use. The channel number allocated to each scope depends on its serial number, so the order you stacked them will almost certainly NOT be the same as the channel order allocated by software.

To find out which scope is Channel 1, use the CH1 tab and click the "id" button.



The LED on the scope will blink rapidly and message dialog with the device information will appear on the screen. Pressing ESC key will close this window.

Repeat this for each channel in the stack to identify them.

If you like, you can stop the software, and unplug all the scopes from their USB connections, and then re-stack them in their channel order.

### ***2.3.1.5 Stacking Do's And Don'ts***

- Do power off all scopes (remove USB lead) before connecting and disconnecting scopes from the stack
- Don't remove any scopes from the stack while the software is running
- Don't remove any scopes from the stack while any of them are powered
- Don't stack several scopes and leave one or more scopes unstacked...this configuration will ignore the unstacked scopes
- Don't short circuit any of the stack connector pins, or bend the pins or use excessive force trying to mate the connectors
- Don't probe or drive any of the stack connector signals
- Avoid touching the stack connector pins/signals during stacking

- Do make sure that each stack connector is properly seated in place before trying to stack another channel on top
- Don't allow water or dirt etc to enter the scope via the stack connector access hole
- Do remember that scopes in the stack are **NOT isolated from each other, they are only isolated from the USB ports. To re-iterate, stacked scopes have their BNC connector bodies connected together through the stack connector.**

### 2.3.2 Non-Stacked (MIS) Mode

It is also possible to use multiple USBscope50s as independent instruments. In this mode, the scopes are NOT connected together via the stacking interface<sup>7</sup>.

This configuration is also termed Multi-Independent-Scope mode or MIS mode.

In MIS mode, each scope can use its own timebase setting, and each scope input will remain electrically isolated from the others (unless you connect their BNC grounds together).

#### 2.3.2.1 USB Connections For Non-Stacked Configurations

**All scopes need a USB connection.** A standard hub may be useful for multi scope use to get enough USB ports.

Each scope needs about 200mA. Plugging more than 2 scopes into a hub will mean that the hub may need to be powered externally. Please refer to the hub's documentation for more details about the power available per port.

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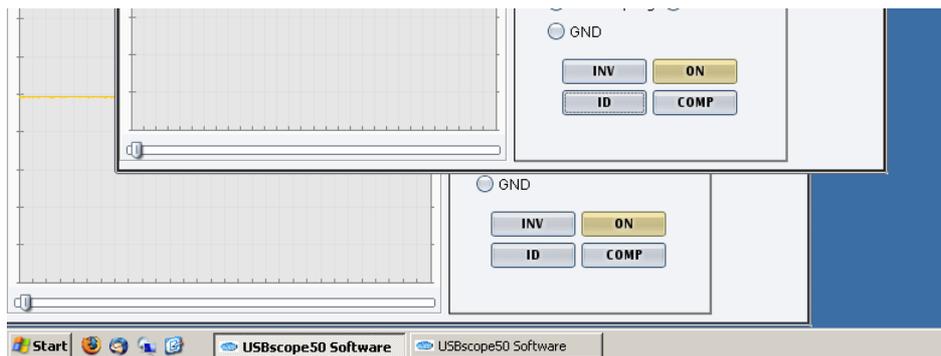
<sup>7</sup> They can of course still be snapped together, but remember NOT to fit any of the stacking connectors so that the scopes remain electrically independent of each other.

### 2.3.2.2 Software For Non-Stacked Configurations

By default when you run USBscope50, it will automatically detect all the scopes connected via USB and will also check to see if the scopes are electrically connected together via the stack.

To run in Non-Stacked MIS mode, power USBscope50s via USB port and run the software. Make sure that software is not running in demo mode and that number of detected devices corresponds to number of powered devices. Then plug in the remaining USBscope50 devices and run the second instance of the Java application. Software will ignore the scopes that have already been initialized and are already used and will only attempt to communicate with the uninitialized USBscope50s.

For example, if you want to run 2 scopes in MIS mode plug in one USBscope50, and then run USBscope50 Software. Confirm that channel 1 is detected and running. Insert the second USBscope50 in the USB port and run another instance of the Java software by double clicking on the Desktop icon. As software remembers the position and the window size of last USBscope50 Software application, two instances of the Java software will overlap. Click and drag one window and the second application is revealed underneath. Note the two USBscope50 Software taskbar buttons in the windows taskbar.



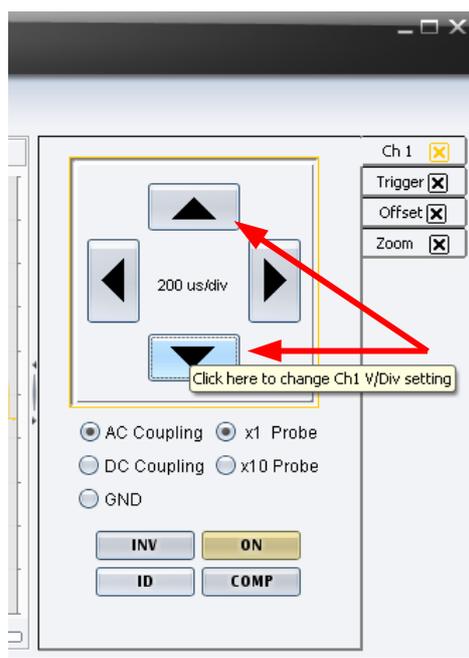
You can simply run multiple copies of the USBscope50 software, just remember not to power USBscope50 devices all at once.

When running in MIS mode, to easily identify which instance of software is for which scope you could change the software

appearance in Settings → Channel Colours and in Settings → Chart Settings.

## 2.4 Input Ranges

The USBscope50 supports 3 settings on its input attenuator. These are then adjusted in the software to expand the range which user can adjust by pressing the arrow keys.



The ranges at the BNC input depend on the type of scope probe used:

A “x1” probe causes no signal attenuation and will result in nominal full-scale input ranges. The bandwidth of x1 scope probes is generally quite low (10’s of MHz) and the circuit being measured will see a 1MegOhm load.

A “x10” probe causes a factor of ten signal attenuation. The bandwidth of x10 scope probes is generally high (100’s of MHz) and the circuit being measured will see a 10MegOhm load.

The USBscope50 also supports AC and DC coupling:

In AC coupling mode, the input signal is passed through a capacitor prior to attenuation. The input bandwidth is around 3.4Hz up to 75MHz.

In DC coupling mode, the capacitor is bypassed and the bandwidth is DC up to 75MHz.

### **2.4.1 Offset Nulling**

The input stages of the USBscope50 will naturally tend to cause a small DC offset error in any readings, and this will change from range to range and from scope to scope. In order to null this offset out, the software is able to subtract a DC level from all its readings and its plots, that will help to remove this error.

Select Settings → Offset Nulling and follow the instructions shown to null each voltage range and each channel. You will be asked to ground the probe tip. Note that grounding the probe tip as instructed is NOT the same as selecting GND coupling

USBscope50 adjustments values are then stored in OffsetNulling.config file in the same location where the software is installed.

Note that there is no difference from a hardware perspective whether you do this with the channel tab set to x1 or x10 coupling; they use the same ranges in the hardware. There may be a very small change in offset in the most sensitive scope input range as you change your probe itself between x1 and x10 mode, but the software assumes this change is negligible and only stores one null value regardless of the coupling selected.

## **2.5 Probe Compensation**

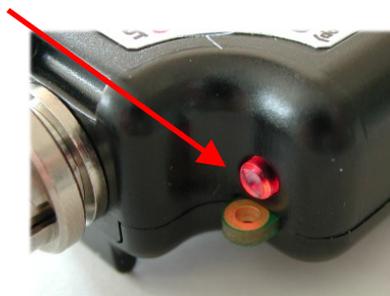
Before taking measurements with the USBscope50, the attached x10 scope probe must be compensated to ensure that it is matched to the scope input stage<sup>8</sup>.

This ensures that the probe+scope act together to keep the input frequency response as flat as possible. Using a scope probe that has not been adjusted to match the USBscope50 can lead to inaccurate readings for higher frequency signals.

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<sup>8</sup> This does not apply to x1 scope probes

The USBscope50 includes a probe compensation output<sup>9</sup>.



This must be turned on using the USBscope50 Software. In the channel tab you will find a button with COMP label. Click on COMP to turn ON / OFF probe compensation signal. When COMP button is coloured, you should see a probe compensation output. Once enabled, the compensation output is a 0 to 3V (approx) square wave with 50% duty cycle and 1KHz frequency.

The USBscope50 can work with scope probes that list an adjustment range that includes 16pF. It is best to use probes that have a range that puts the 16pF point near the middle of the range, for example the HP10071A type probe lists an adjustment range of 9-17pF and our tests show that whilst it is easy to compensate this probe against the USBscope50, the trimmer in the probe body is certainly quite close to the top end of its range. There are many probe choices on the market, and lots of them list ranges that span 16pF.<sup>10</sup>

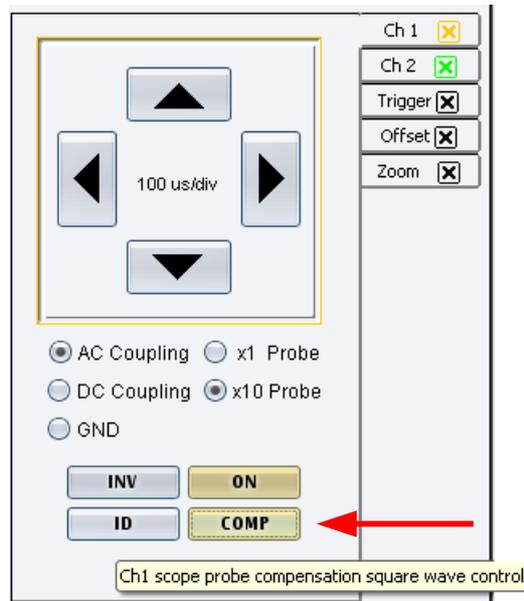
To compensate your probe follow these steps:

1. Connect your x10 probe to the USBscope50 software and run the USBscope50 software
2. Set the input range to 500mV/div, x10 probe, coupling to AC
3. Use the channel tab and click on the “COMP” button to turn on the compensation output

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<sup>9</sup> Later models have a dual pad compensation point that includes a GND pad

<sup>10</sup> Some very high frequency low capacitance probes may not be suitable for use with the USBscope50



4. Set the timebase to 100us/div
5. Now connect your probe tip to the compensation output on the scope. You should see a square wave something like this



or it may look more like this

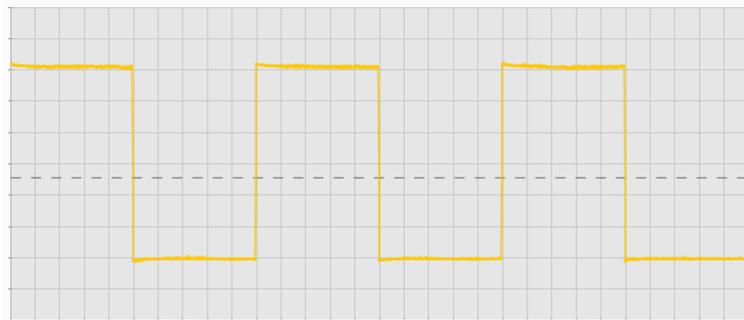


6. You may find you need to connect the ground clip to either the BNC ground or use the GND pad near the compensation output<sup>11</sup> to achieve a clean waveform with minimal mains “hum”

<sup>11</sup> Be careful not to short-circuit the GND pad to the COMP output with the ground clip. A momentary short circuit is not harmful but leaving a sustained short may damage the scope’s output

7. Now, slowly adjust the trimmer in the probe body until you achieve the best square wave shape that you can. By this we mean nice square corners and minimum over and under shoot near the edges. A small amount of over shoot is preferable to an adjustment with “curved” square wave corners: this would mean that the scope will attenuate high frequency signal components whereas a small amount of overshoot will mean that the scope will tend to slightly amplify high frequency signal components.

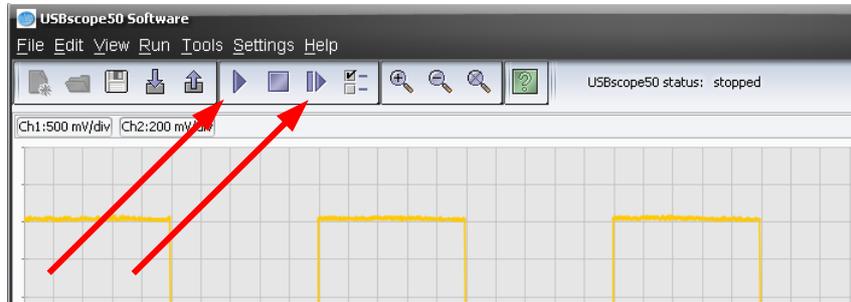
A typical trace, after compensation will look like this.



Some deviation from this is normal due to variations in probe performance. It is possible that on lower cost, lower bandwidth probes that you may see a larger amount of overshoot near the edges. This overshoot may be very narrow and seem to come and go...this is normal. Better quality scope probes have better transient response and so have smaller overshoot.

## 2.6 Acquisition Modes

The USBscope50 can acquire waveforms in two different ways. Single shot and continuous run mode.



### 2.6.1 Single Shot

In this mode, the ADC is clocked at up to 50MegaSamples/sec. Each sample is placed into the buffer and then the buffer is painted on the screen.

This mode is the one to use for non-repetitive signals i.e. single pulses, irregular bus events etc. It can also be used for repetitive waveforms.

For practical purposes the maximum frequency sine wave you can resolve is about 10MHz in this mode, giving just 5 sample points per cycle: expect to see a very “jagged” and “triangular” looking waveform when observing a 10MHz input! Drop the input frequency down to say 1MHz and you will see a nice smooth waveform.

In single shot mode the timebase can be set from 200ns/div all the way up to 4s/div. The time to acquire the waveform gets noticeably slower when rates above 40ms/div are selected: the total acquisition time is approximately “30 x timebase” so at 4s/div, the display will update once every 120s, or 2 minutes !

As with all digital storage scopes, be careful not to view a high frequency waveform on too low a timebase. You may see a waveform that looks correct but drifts or fluctuates over time, and that has the wrong frequency...this is called aliasing and is quite

normal. To avoid this effect, always pick the fastest single shot timebase consistent with being able to view the waveform in question.

### 2.6.2 Random Interleaved Sampling

This mode is a little more complex and is suited only to observing certain types of waveform.

The USBscope50 includes special circuitry that allows it to trigger off the input waveform and also to be able to measure the time between the trigger instant and the first ADC sample that is taken. In this way, several single shot acquisitions are taken and the data points for each “sweep” are ordered based on the relative time as measured. For this to work of course, the relationship between the trigger instant and the waveform must remain constant i.e. a repetitive waveform is required like a continuous sine wave or square wave for example. It also needs the scope to be in trigger mode, not a free running mode...the software automatically switches to this mode on entering RIS mode.

The software automatically sweeps the input several times before updating the display. Because each sweep happens at a random time with respect to the input waveform, the relative times measured for each sweep are also random. **So it can take a few seconds for the “picture” of the waveform to update fully.** While this acquisition process is happening, you may see some waveform displays that are not related to the actual input waveform...this is because the random nature of the sweeps means that the software may not have completely built up the picture of the signal, leaving some data from previous sweeps on the screen. This is normal. Wait a while and the waveform will update completely.

Another side-effect of the RIS mode is that because the relative sweep time measurement is “quantized” i.e. the time value is rounded up or down to place it into one of 20 possible values, or “bins”, a fast changing input signal can show small anomalies<sup>12</sup> on

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<sup>12</sup> This may show up as small spikes that come and go, particularly near to fast changing edges. In essence the data for a particular sweep is forced to a particular place on the time axis and these data points may therefore appear to be in slightly the “wrong” place in time...showing as an error in voltage

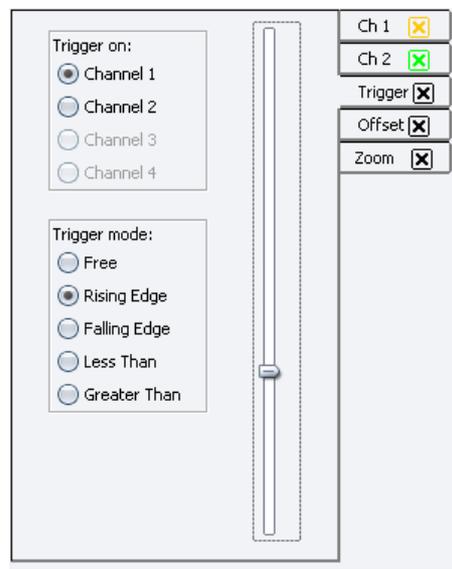
the screen as a result...the software forces the sweep data into one or other of the bins even though the data may have been at one end of the “bin” or the other.

RIS mode is not well suited to very slow input signals or signals that have jitter. This will lead to an uncertainty in the trigger instant and hence the sweep data will appear in the wrong “bins” and so the displayed waveform will not “lock” on the screen over time.

**Please note that in RIS mode it is not possible to observe the probe compensation output.** This is because it is precisely phase-locked to the ADC’s clock hence there is no way to take random sweeps to build up the picture...every sweep comes out in the same bin due to the phase lock. This is normal.

## 2.7 Trigger Modes

The USBscope50 can use two main types of triggering. These modes are used when the “Run” button or the “Trigger Single” button has been pressed causing the scope to enter the run state.



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i.e. a spike. This is normal.

## 2.7.1 USBscope50 continuous run in Free Mode

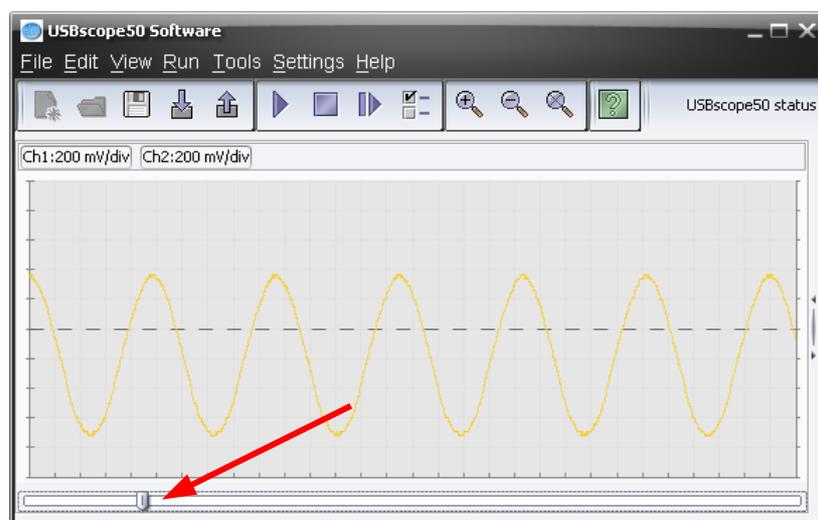
In this mode the acquisition begins just after the software has set up the scope. The scope will effectively free run, with no attempt to lock to the input waveform and displaying all the the graph as soon as data is available. Free mode is good for checking DC levels etc.

## 2.7.2 Normal Triggering

This includes Rising Edge, Falling Edge, More Than and Less Than trigger options. In this mode, the acquisition is primed, but will not start until the input waveform meets some criteria. This mode will cause the waveform on the screen to “lock” to an edge and so appear fixed in time. It is useful for observing regular waveforms or for doing a single triggered acquisition. If no suitable waveform is present, the scope will wait indefinitely with no display update in the meantime.

## 2.8 Trigger Position

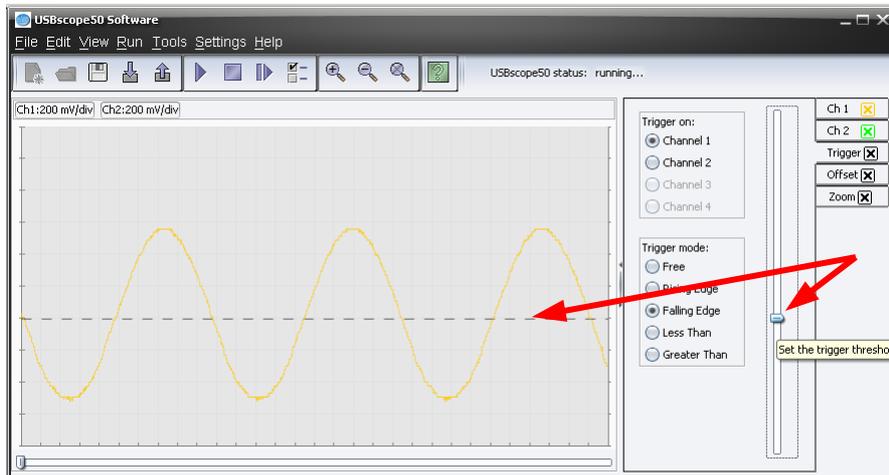
The total sample buffer is 3000 points long. The acquisition can be triggered in Norm mode from the input waveform. By adjusting the trigger position slider, you can make the trigger position in the buffer earlier or later in time. This is known as pre and post triggering.<sup>13</sup>



<sup>13</sup> By definition, RIS mode needs repetitive waveforms so pre or post trigger has no relevance.

## 2.9 Trigger Threshold

You can adjust the trigger voltage that is used for Norm Modes, either by moving the slider from the trigger tab. Select View → Trigger Options and trigger tab should appear on the right hand side of the USBscope50 Software application.



## 2.10 Data manipulation

### 2.10.1 Save Graph

With USBscope50 Java software you can save graph in one of the following formats: jpg, pnp or pdf. Please select menu option File → Save Graph.

### 2.10.2 Export Graph Data

USBscope50 Software displays 3000 data points on the graph. By Exporting Graph Data you can save all these points in a txt file. Select Edit → Export Graph Data and Save Channel Data Points Dialog will appear. You will be given option of saving all the present channel data starting from channel 1. Save dialog in the title should say what channel is being exported, Save Channel 1 or Save Channel 2 and also the file name will automatically begin with Ch1\_ or Ch2\_ etc. Just click cancel for channels you do not wish to export data points.

Remember to stop the acquisitions before saving the data otherwise the most recent data will be saved.

Data is saved in ASCII text format and will import directly to Open Office Spreadsheet, Excel, MathCAD.

### ***2.10.2.1 Example Data File***

There are 3000 sets of numbers. Document contains the header that defines the acquisition mode used.

```
//USBscope50 Software loaded this file with the 3000 graph points.  
//Use software option Edit -> Import to recreate the graph.
```

```
DATA ON CHANNEL : 2  
TIME BASE SETTING : 20 us/div  
V/DIV SETTING : 200 mV/div  
FILE PATH & NAME : C:\Ch1_.txt  
DATE/TIME STAMP : 24-04-2009 09:44:41
```

```
0.312  
0.324  
0.336  
0.324  
0.336  
0.324  
0.312  
0.336  
.  
.  
.  
-0.528  
-0.54  
-0.54  
-0.528  
-0.54  
-0.552  
-0.54  
-0.552
```

## 2.11 Import Graph Data

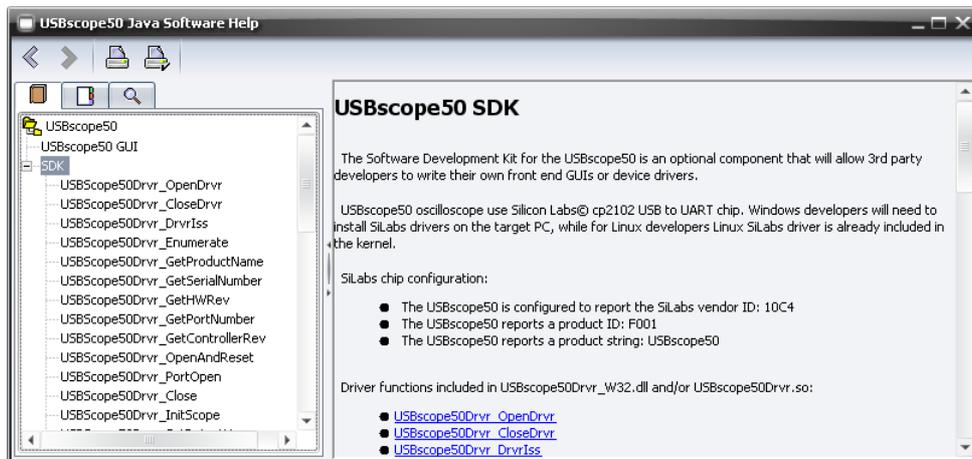
Any text file with the header of exported file and 3000 points can be imported on the graph. Select Edit → Import Graph Data and these data points will appear on the channel set in the file header DATA On CHANNEL. When you select a text file to import, software will scan through it and will warn you if any of the header settings are missing, and also will point out the line number where error encountered.

All lines beginning with “//” in the text file will be ignored by software. Use this if you wish to write comments or not include certain data points on the graph.



## 2.12 Software Development Kit (SDK) for USBscope50

While running the USBscope50 Java application try selecting Help option from the software menu or pressing F1 key. You should get some additional help pages on how to use the software and also detailed information on SDK for USBscope50. Sources of the Software, as well as driver sources are made available for you to download from our website. This information should aid you if you wish to write your own GUI or device driver.



## 3 SOFTWARE INSTALLATION

### 3.1 Windows XP and Vista<sup>14</sup>

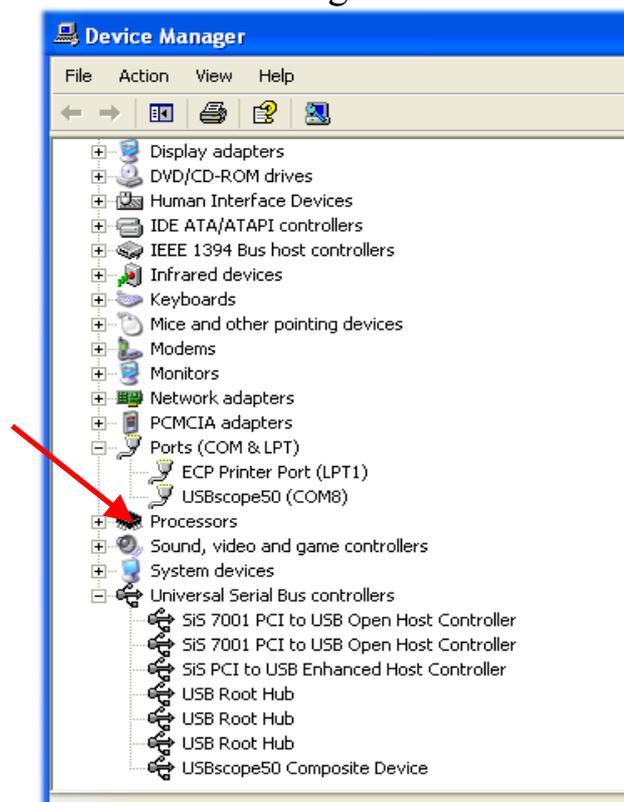
#### Before plugging in the hardware:

Use the supplied install CD and run the setup program. This will copy all the required files and drivers to your PC.

#### After running the setup program:

Insert the USBscope50 into a free USB socket, or into a USB hub port. A USB extension cable can be used if needed.

During installation hardware device is detected: “USBscope50”.<sup>15</sup>  
After installation the device manager will look like this<sup>16</sup>:



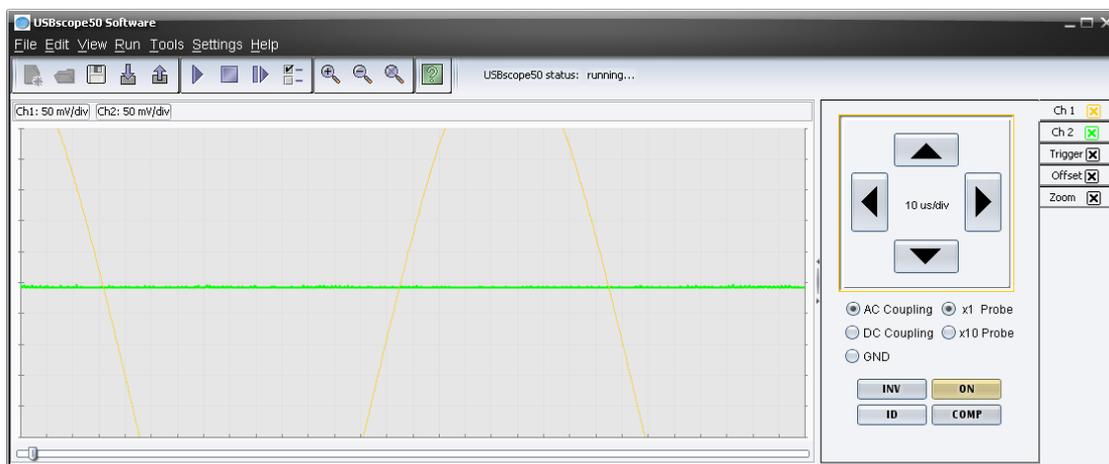
<sup>14</sup> Include Language variants using the DBCS character mappings e.g. Chinese, Japanese, Korean etc

<sup>15</sup> **If Windows prompts to search the Internet for a driver, select “Not this time”, and when it warns about Unsigned Drivers you MUST click on “Continue Anyway”**

<sup>16</sup> The COM port number will be platform specific, this is just an example

Once the hardware has installed, there is no need to make any settings for the allocated COM port...the software takes care of all this at run time<sup>17</sup>.

Start the USBscope50 software and you will see the following display:



To find out what the various buttons and knobs do, simply hover over them for a brief explanation.

### 3.2 Linux Ubuntu

Elan USB Test & Measurement equipment consists of 4 different USB devices USBscope50, USBwave12, USBcount50 and USBpulse100. These devices all use SiLabs driver, cp2101.c, which is included in the kernel. When you plug Elan USB device if driver is loaded the red led on the device will come on. If LED is off, it is most likely because these 4 lines are missing from the cp2101.c file:

```
{ USB_DEVICE(0x10C4, 0xF001) }, /* Elan Digital Systems USBscope50
{ USB_DEVICE(0x10C4, 0xF002) }, /* Elan Digital Systems USBwave12
{ USB_DEVICE(0x10C4, 0xF003) }, /* Elan Digital Systems USBpulse100
{ USB_DEVICE(0x10C4, 0xF004) }, /* Elan Digital Systems USBcount50
```

<sup>17</sup> You may be prompted to alter the COM port number...please follow the on-screen instructions.

Please copy USBscope50Drv.r.so to /usr/lib making sure you have root privileges. Copy USBscope50\_Software.jar and lib folder in the same location. To run this Java Application you need Java Runtime Environment (JRE). USBscope50 Software is not bound to a JRE version, but we would advise customers to keep JRE up to date. Software was tested on JRE version 6. For more information and instruction on how to install JRE, please refer to Java Sun website [www.java.com](http://www.java.com).

Run USBscope50 Software from the terminal  
java -jar "path to/USBscope50Software.jar"

### **3.3 Troubleshooting**

- Check that the scope hardware installed properly. Use the device manager as shown above and check that there are no yellow exclamation marks on USBscope50 device. If there are, try deleting that device, then un-plug and re-plug the scope.
- Make sure that you do not press cancel or stop during any part of the hardware installation. If you did, use the device manager to delete any USBscope50 devices shown, the re-plug the device and try again
- If you are still having problems please use the Windows "PrtScr" button to make a screen capture of the application. Then paste this into a Word or Paint document and send it to tech support.

## 4 HARDWARE SPECIFICATION

All parameters typical @ 20°C unless otherwise stated

### 4.1 Power Requirements

Supply Voltage:	==	5.0V	±10% from host USB bus
Total Supply Current:		200mA	avg

### 4.2 Mechanical

Mass:	42g typ.
Case Material Data:	Polycarbonate (UL94V rated)
Size (typical in mm):	99.6 <sup>18</sup> x 30.6 x 17.5 <sup>19</sup>

### 4.3 Environmental

Humidity:	<80% non condensing
General Operating Temperature:	-10°C to +45°C Ambient
Specific Operating Temperature:	22°C ±3°C for rated accuracy
Full Warm Up Time:	10mins for rated accuracy
Storage Temperature:	-40°C to +80°C Ambient
Operating Location:	Indoor or under-cover use only
Operational Category:	Cat II
Pollution Degree:	2

<sup>18</sup> From BNC end to USB end

<sup>19</sup> Not including “P” clips on base

## 4.4 Performance

### 4.4.1 Safety Data and Maximum Ratings



#### Important Safety Precautions

Always observe these when using the USBscope50

*The USBscope50 contains no user serviceable parts inside. Do not open the plastic housing.*

*There may be lethal voltages inside the plastic housing. Do not use the instrument if the housing is damaged or is poorly fitting. In such a case do not connect anything to the USBscope50 to avoid a hazard. The USBscope50 will have to be repaired or replaced in such a situation.*

*Do not exceed the maximum ratings listed below.*

*Never use the instrument if it becomes damp for any reason. This includes situations where condensation has formed on the unit due to sudden temperature or humidity changes.*

*Never use test leads that are damaged or have insufficient or incomplete insulation.*

*Never allow any conductive part of any test lead to contact the host computer ground. Doing so will bypass the safety isolation in the USBscope50 and could cause a lethal hazard.*

*Remember that the isolation is between the BNC and the USB connectors. The BNC is, of course, at the same potential as the test lead ground clip to which it is connected. Be careful when measuring hazardous voltages not to touch the BNC connector ground for this reason<sup>20</sup>.*

*Only use the shorter length stack connector in the bottom scope of the stack, and if using a single scope, don't fit any stack connector at all. This is to avoid touching the contacts*

<sup>20</sup> This is true of almost all scopes, except that most scopes have no isolation to safety earth...in fact normal scopes connect the BNC ground **directly** to safety earth. If you were to connect a probe ground clip to an earth referenced potential you would short it out on a normal scope!

Isolation rating:	300V CAT II, 500V CAT I between BNC ground and USB ground
Transient isolation <sup>21</sup> :	BNC ground to USB ground +/-2.5KV
Isolation capacitance <sup>22</sup> :	1000pF typ between BNC ground and USB ground
Maximum Measured Voltage:	Between BNC center and BNC ground: +/-30V.
Absolute Maximum Input Voltage <sup>23</sup> :	Between BNC center and BNC ground: 148Vrms or 148Vdc.

#### 4.4.2 Static Performance

Input DC resistance:	1Meg Ohm $\pm$ 2%
Input capacitance:	16pF $\pm$ 10% at 1MHz
Range accuracy:	+/-0.3V range: $\pm$ 4%
	+/-3.0V range: $\pm$ 6%
	+/-30.0V range: $\pm$ 6%
Input coupling modes:	AC, DC, GND
ADC vertical resolution:	8bit
Channel offset error:	$\pm$ 2% of range
Channel offset control:	$\pm$ 100% of range, approx 7bit resolution
Buffer depth:	3000 points
Pre-triggering:	Up to 99% of buffer depth <sup>24</sup>
Post-triggering:	Up to 100% of buffer depth
Triggering:	Normal, rising edge, falling edge, greater, less
Trigger delay:	From 0 to 65535 sample periods
Trigger range:	$\pm$ 100% of range, approx 7bit resolution

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<sup>21</sup> This figure derives from the 300V CAT II isolation rating and defines the peak transient voltage that can be safely tolerated between the BNC ground and the USB ground.

<sup>22</sup> This capacitance causes the impedance across the isolation barrier will reduce with frequency. This is only significant if an AC component is impressed between the BNC ground and the USB ground that is referenced to the USB ground. At 50/60Hz this impedance is approximately 3MegOhms.

<sup>23</sup> This level will saturate the scope input, and is the maximum that can be applied without causing damage to the scope. It applies regardless of the input attenuator or coupling setting.

<sup>24</sup> Single shot mode only

### 4.4.3 Dynamic Performance

Maximum ADC single shot rate:	50MSPS
Maximum effective sample rate <sup>25</sup> :	1GSPS
Sample rates available:	4ns/div to 4s/div in 1,2,4 sequence
Sample rate accuracy:	0.02% typ
Stacked scope channel skew:	±2ns between any channel pair typ
Analogue 3dB bandwidth:	75MHz typ
AC coupling 3dB high pass freq:	3.4Hz typ
Analogue trigger 3dB bandwidth <sup>26</sup> :	60MHz typ
SFDR:	50dB typ

Compensation output: 0 to 3V nominal 1KHz square wave, absolute max source/sink current 1 mA

### 4.4.4 Miscellaneous

USB transfer rate:	USB 2.0 <sup>27</sup> Full Speed 12Mbits/sec
USB device ID:	10C4 F001

### 4.4.5 Software

USBscope50 support:	XP/Vista
Recommended system:	Pentium Class 600MHz or better, 16-Bit colour depth graphics or better with graphics acceleration, 800x600 min screen resolution, 256MBytes RAM

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<sup>25</sup> Using RIS mode

<sup>26</sup> The circuit involved with triggering causes the maximum input frequency that can trigger the scope to be lower than the scopes measurement channel bandwidth.

<sup>27</sup> Works in USB 1.1 or USB 2.0 hosts using the 12Mbits/sec full speed mode