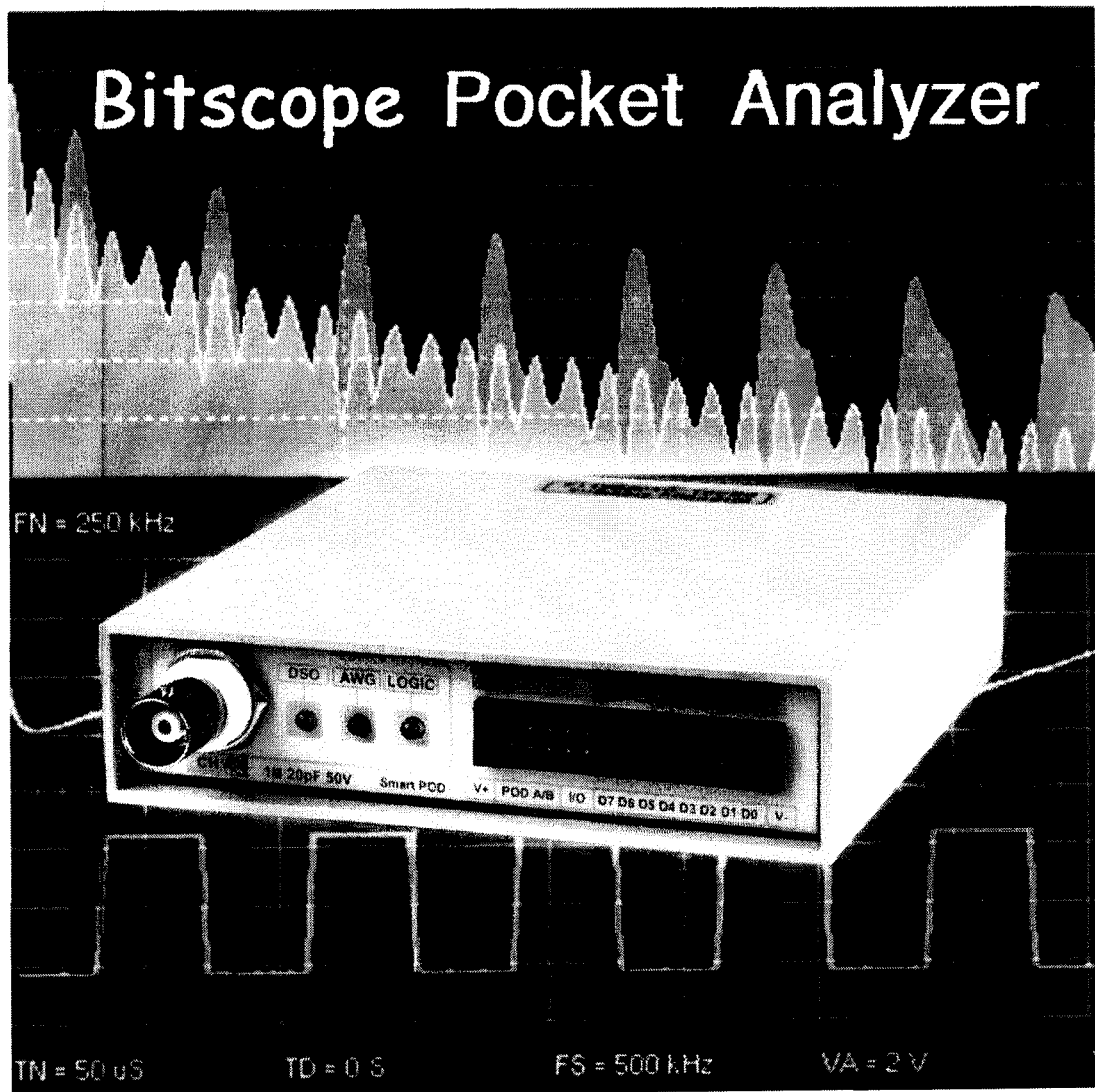


BitScope 50 Pocket Analyzer



www.bitscope.com

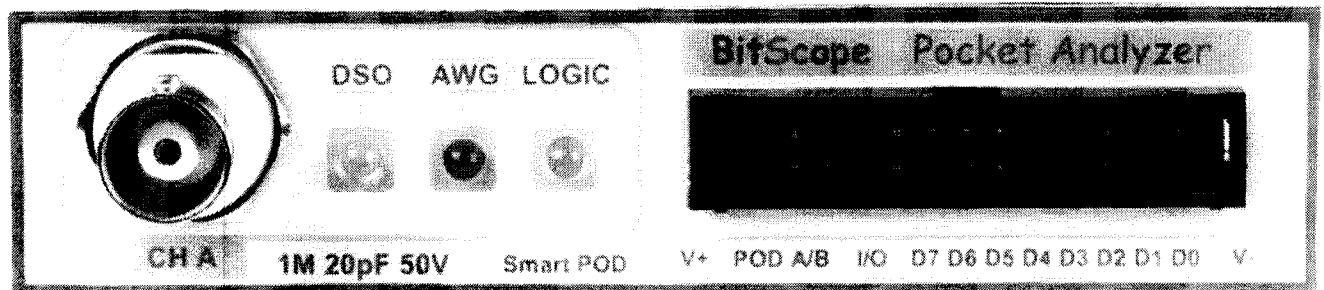
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Phone: +61 2 9436 2955 Fax: +61 2 9436 3764
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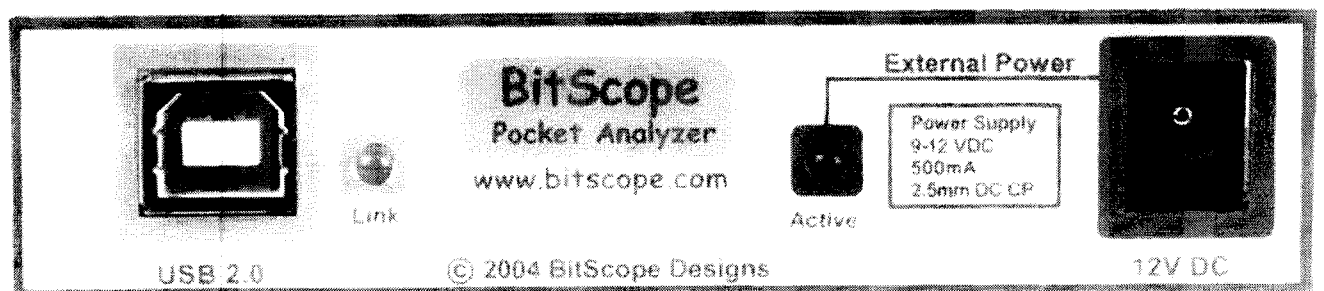
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BitScope Pocket Analyzer



Front Panel



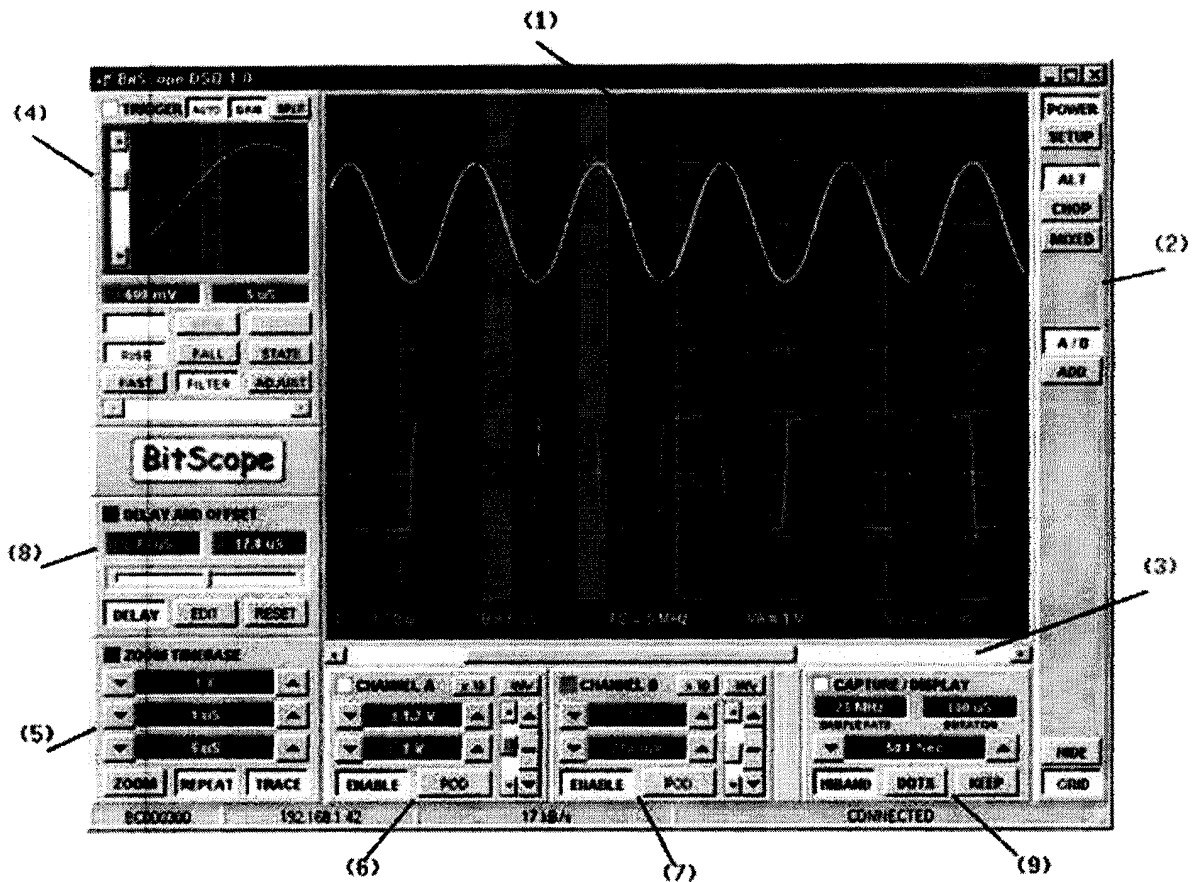
Rear Panel

BitScope BS50 Pocket Analyzer - Product Overview

Congratulations on purchasing the BS50 Pocket Analyzer! This portable USB powered instrument is designed to provide a wide range of test and measurement functions essential in the modern Electronics lab. The following list of features should help you understand your BitScope and find ways to get the most out of this versatile Scope.

- **BitScope is tough.** The BS50 is housed in a solid aluminum powder-coated extruded case with a 1.6mm wall. The front and back panels are aluminum plate with LEXAN decals. As well as providing full electrical shielding, this configuration makes the instrument extremely rugged.
- **Integrated USB 2.0** connects to any PC or Notebook. A Data LED monitors the USB connection. BS50 runs from USB or detects a 9VDC supply and uses less than 3 watts.
- **BS50 is a true Mixed Signal Scope (MSO)** able to capture analog and digital data simultaneously. Triggering in MSO mode is available from any digital or analog source (Cross Triggering). Since most electronics now incorporate analog and digital components, the ability to see both signal types at the same time is essential.
- **32K Capture Buffer.** This deep memory allows you to capture and analyze long time periods in one shot mode or enhance the signal resolution in DSO modes. BS50 always captures your signals at maximum resolution and transfers compressed data as required to the PC. This allows real time or static zooms of up to X50 to see fine detail in your signals. The memory is dynamically allocated to analog or digital capture as required.
- **Standard 1M/20pF AC/DC BNC inputs** with 50 ohm option. The BS50 input may be software switched to a 50 ohm termination for coax connections. Alternatively, use the 50 ohm termination to directly measure current loop inputs.
- **Versatile POD connector** with separate Analog inputs, Logic inputs, power supplies and serial I/O. This unique feature allows BitScope to work with special purpose PODS or you can prewire a test socket into your design.
- **Built in Arbitrary Waveform Generator.** This feature lets you generate continuous, pulsed or triggered waveforms of up to 32K @ 10MS/s. The DAC has a level control of 256 steps to about 6Vp-p and may be offset +/- 2.5V. This AWG is software switched to CHA BNC as well as being permanently available on the POD connector.
- **Frequency measurement.** The BS50 can measure frequencies up to 50MHz from any of its 3 analog input channels.
- **BitScope Scripting Language.** Like all BitScope Products, BS50 uses this versatile protocol to build Virtual Instruments from a PC interface. With interface libraries like our BitLink Interface, BS50 can double up as a custom Data Acquisition Engine.
- **DSO 1.2 Software** provides a powerful Scope Interface for both Windows and Linux Operating Systems. This application covers Analog Scope, DSO, MSO, Spectrum Analyzer and Waveform Generator in a single integrated Virtual Instrument.
- **Open design.** BitScope comes with Schematic Diagrams so you can see how it works. Our web site www.bitscope.com has a large archive of technical information about the BitScope architecture and how to program it. We encourage third party developers to write BitScope applications to enhance its utility.

DSO Starting guide



The screenshot above shows the layout of the DSO. The main features of the software are:

- 1 Scope Display: waveforms, logic traces, spectrum plots and more are drawn here.
- 2 Mode Buttons: these buttons select the major DSO operating and display types.
- 3 Waveform Offset: used to scroll the waveform or logic trace left and right.
- 4 Trigger Control: controls the trigger setup and displays trigger waveform and data.
- 5 Zoom Timebase: primary and zoom timebase control and timebase expansion control.
- 6 Channel A: controls input source, range, vertical position and scaling.
- 7 Channel B: controls input source, range, vertical position and scaling.
- 8 Delay and Offset: sets post-trigger delay and reports the waveform offset.
- 9 Capture Display: capture sample rate, duration, frame rate and display modes.

When DSO first starts up it displays a lissajou figure in the main display and two buttons:

POWER: click to "switch on the DSO".

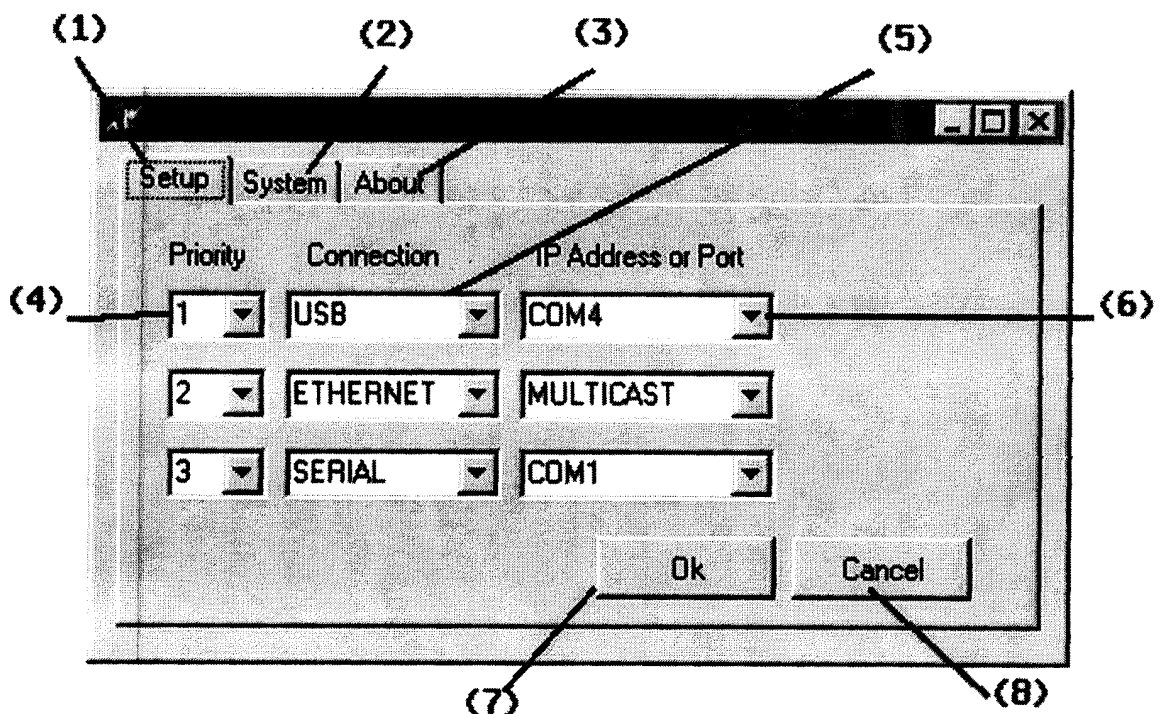
SETUP: click to open the setup dialog.

DSO supports RS-232 serial, USB and 10BaseT Ethernet links to BitScope and the setup dialog is where you tell the DSO which one to use.

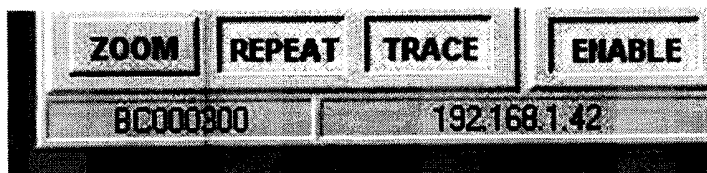
There are built-in defaults which attempt to connect on serial port COM1 and the default Ethernet adaptor (if your PC has one) but you should probably run setup anyway just to check before powering on the DSO.

DSO is a test instrument which means most settings are accessed directly on screen or via pop-ups rather than via nested menus or dialog boxes.

One exception is the SETUP dialog:



- | | |
|-------------------------------|---|
| 1 Setup Page: | selects the BitScope connection preferences. |
| 2 System Page: | configures system defaults for the DSO (not active in 1.0). |
| 3 About Page: | a little information about the DSO and its authors. |
| 4 Connection Priority: | establishes the priority of this connection. |
| 5 Protocol Type: | selects SERIAL, USB or ETHERNET connection methods. |
| 6 Address or Port: | selects serial or USB port or IP connection address. |
| 7 Accept Change: | accepts changes and saves them to the probe file. |
| 8 Cancel Change: | close the setup dialog without making any changes. |



When the connection is made, it is indicated at the lower left corner of the DSO as this example shows.

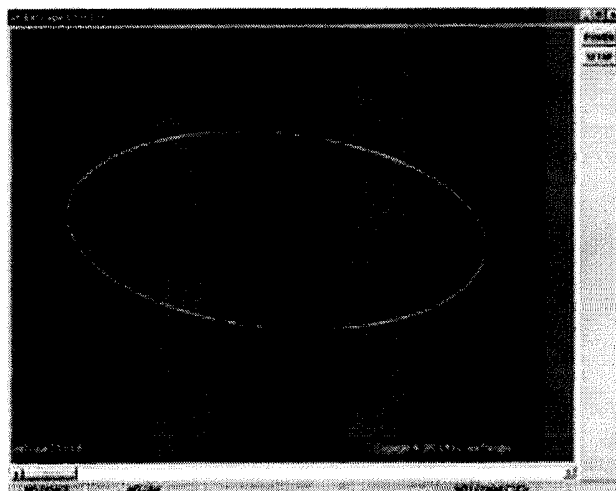
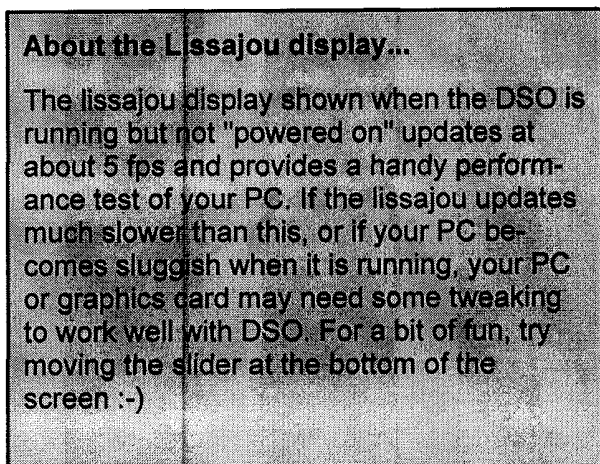
Here a BS300N has been found at IP address 192.168.1.42.

The setup lists three configurable connection methods. The DSO attempts connects to your BitScope using one of these methods. To do this, it searches the list in decending priority order until it finds the connected BitScope.

Note that UDP/IP protocol is used to connect with Network BitScopes.

If a USB or Serial BitScope was found it would report the COM port to which it is connected.

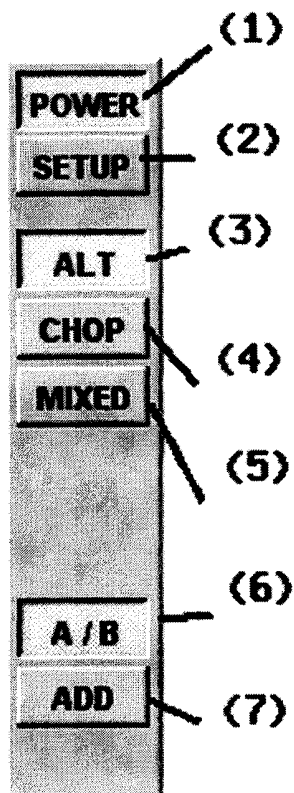
If no BitScope is found it defaults to a BS220 and "DEMO MODE" which simply means the DSO is running but is not connected to anything.



If you run BitScope DSO 1.0 on your PC when connected to the Internet and select the BitScope called SYDNEY, the DSO will connect to a BS300N in our Sydney R&D center which we have put on the Internet. The screenshot above shows what you'll see when the DSO connects with SYDNEY.

It's easy to try this on your own PC (Windows 98 to XP or Linux):

1. Download the Bitscope DSO, available [here](#).
2. Unpack the zip (or tgz for Linux) archive.
3. Open the dso folder and run the DSO application (no installation required).
4. Click the SETUP button to open the setup dialog (see below).
5. Choose 1 ETHERNET SYDNEY as the first option and click Ok.
6. Click the POWER button and wait a few seconds for the DSO to connect.



DSO Modes and Menus

The vertical bar down the right side of the DSO is where the major mode and menu buttons are located.

The set of buttons that appear depend on the type of BitScope you're connected to and the major mode currently selected. For example, when connected to a BS220S the available buttons in ALT mode are:

POWER: turns the DSO "on" and "off".

SETUP: selects the BitScope connection preferences.

ALT Mode: selects ALT capture dual channel mode.

CHOP Mode: selects CHOP capture dual channel mode.

MIXED Mode: selects MIXED analog/logic capture mode.

Dual Channel Display: selects dual channel display mode.

Channel ADD Display: selects dual channel summed mode.

POWER and SETUP are always present. The buttons below these are the major mode selectors. In this case the choice is ALT, CHOP and MIXED. Below these are the display types which in the case of ALT are A/B and ADD. Other display types include X/Y, MIXED and LOGIC displays, FFT and spectrum displays and more.

Which Mode should I use?

ALT MODE

This mode allows the most flexibility in viewing high speed signals. Data is captured at maximum sample rate and processed before display. High frequency components will be shown as a light color band behind the main trace. If a stable trigger is present, both channels may be seen. Single channel real time captures may be expanded up to 50 times without loss of signal detail.

CHOP MODE

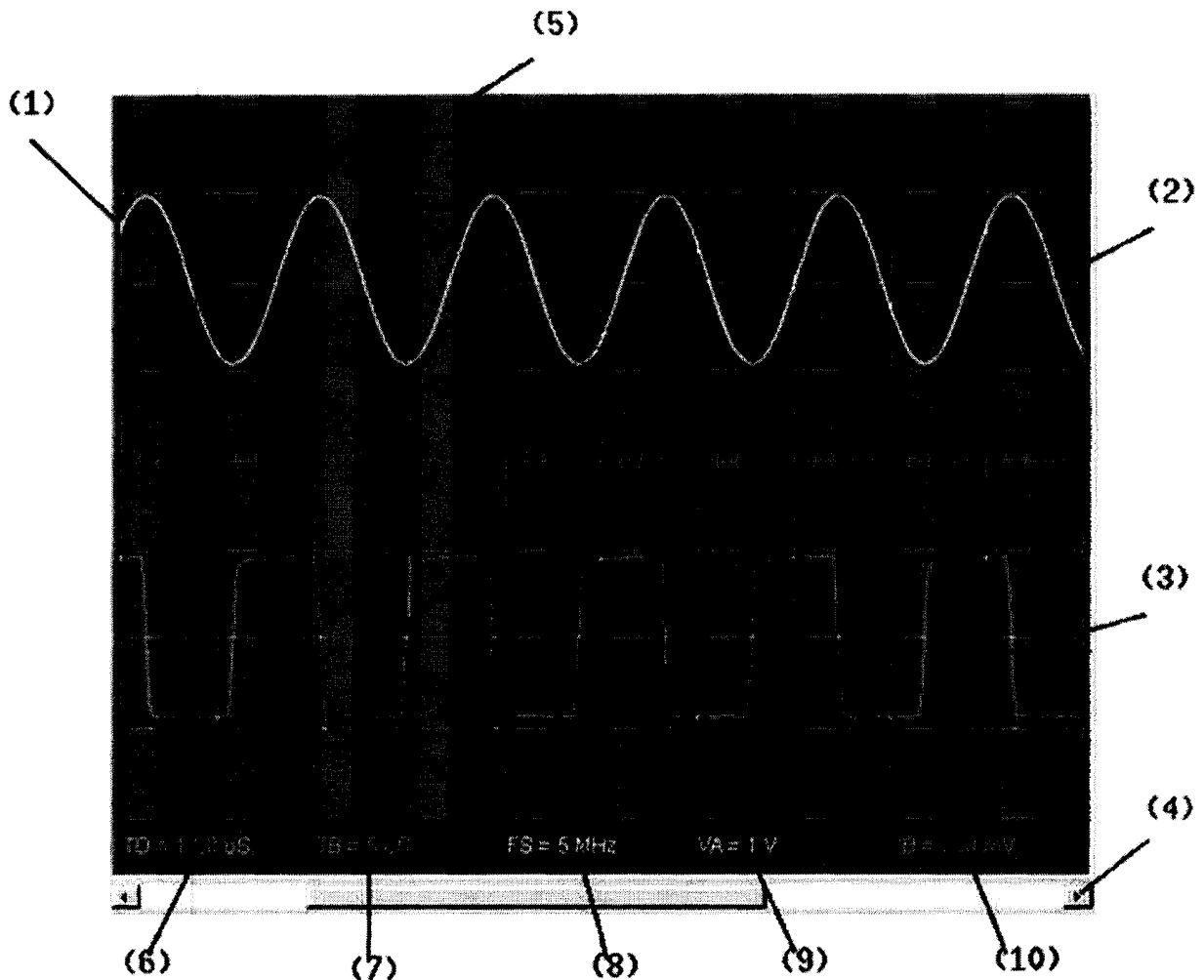
Only available for lower timebase ranges. In this mode both channels are simultaneously sampled – making it suitable for audio range signals up to about 50KHz. X/Y plots are available in this mode. Typically 4 samples are averaged for each data point giving an ENB of about 9.5 bits.

MIXED MODE

Mixed mode combines a Logic Analyzer type capture with a real time analog channel – time aligned. Displayed data may be either/both Analog or Digital. Typically this mode is used when trying to see the interaction between the digital and analog world. A good example would be an SPI DAC attached to a microcontroller. The activity on the SPI pins should produce an analog output – and all these signals may be seen in MIXED MODE.

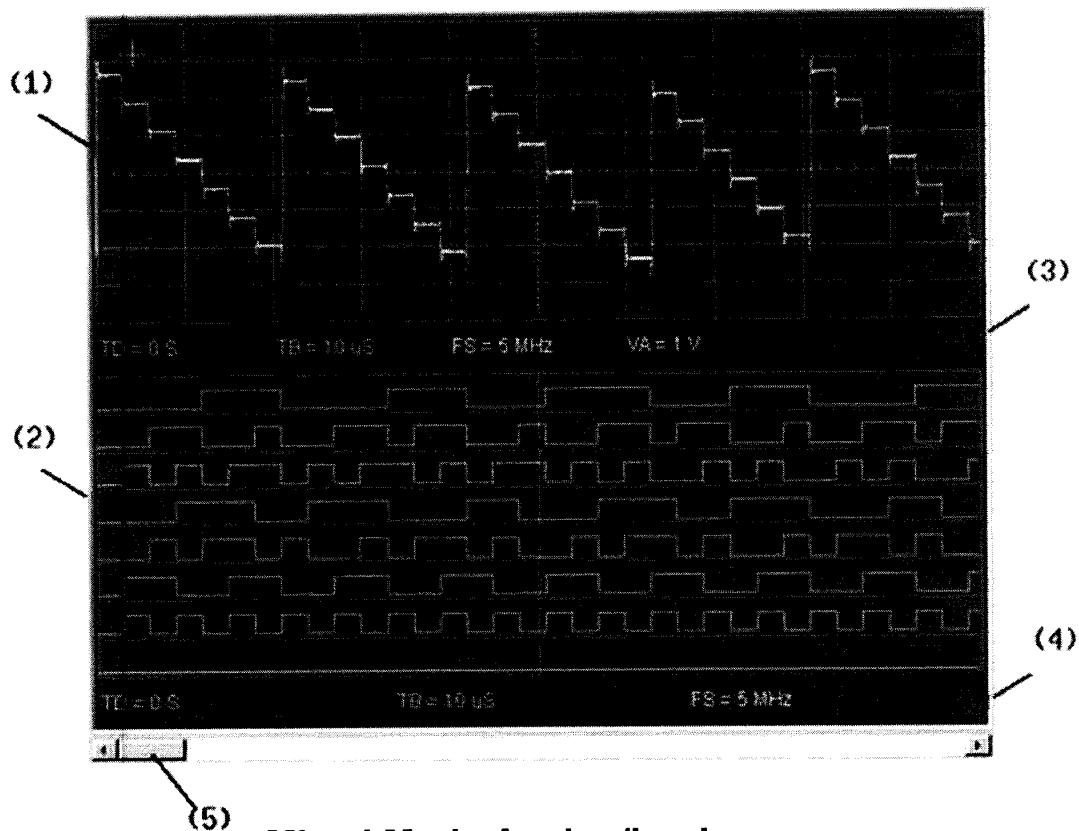
DISPLAY MODES

The DSO display reconfigures automatically depending which operating mode and display type is selected via the mode buttons. Two of the most important displays are explained here.



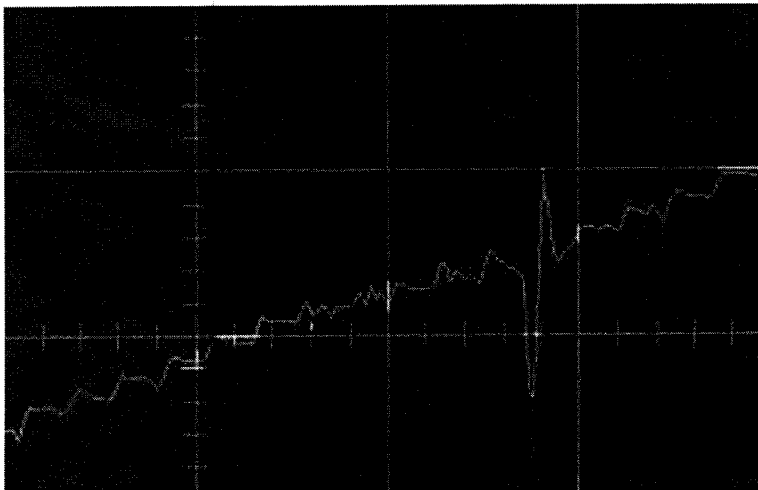
Dual Trace Analog Display

1. Display Graticule: all waveforms are displayed on the 8 x 10 graticule.
2. Channel A Trace: Channel A trace drawn in yellow.
3. Channel B Trace: Channel B trace drawn in green.
4. Waveform Offset: used to scroll both waveforms left and right.
5. Zoom Band: indicates where the zoom timebase will operate (when enabled).
6. Trigger Delay: time of the left edge of the display referenced to the trigger.
7. Timebase: the prevailing timebase setting (time per division).
8. Sample Rate: display sample rate (note this may be different to the capture rate).
9. V/Div Channel A: vertical scaling channel A (volts per division).
10. V/Div Channel B: vertical scaling channel B (volts per division).



Mixed Mode Analog/Logic

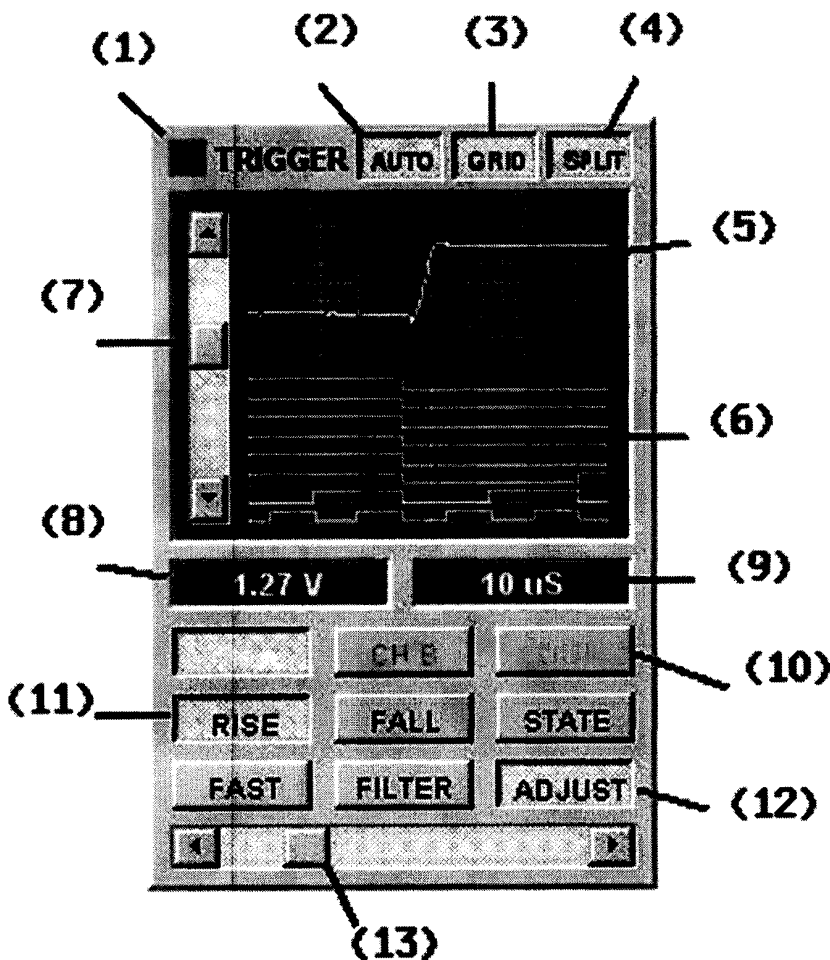
1. Analog Display: analog trace displayed on the 8 x 10 graticule.
2. Logic Display: 8 logic traces displayed concurrently with the analog trace.
3. Analog Info: same information set as the dual channel analog display.
4. Logic Info: a sub-set of information pertaining to the logic display.
5. Waveform Offset: used to scroll both analog/logic displays left and right.



HIBAND DISPLAY

In Analog Scope modes, the deep capture buffers of BitScope are used to present detailed images of analog waveforms at the best available sample rate. The high frequency components of the waveform at left are rendered to emulate a traditional CRT based scope. Even on a static screen, zooming in will reveal the hidden detail.

DSO TRIGGER



BitScope is a mixed mode device that can capture analog and logic signals simultaneously. Consequently you need a sophisticated trigger control to make full use of its capabilities. The trigger panel is where the DSO sets the trigger condition and displays the result.

1. **Trigger LED** lights RED when waiting for a trigger switching to the color of the trigger channel (yellow, green or blue) when the trigger fires.

2. **AUTO Trigger** enables automatic trigger which fires after a short delay if a trigger event is not otherwise seen. Useful in REPEAT mode when you're not sure what the signal is.

3. **GRID Enable** enables trigger graticule.

4. **SPLIT Enable** selects between analog or logic only trigger display or both (as pictured).

5. **Analog Display** shows the analog waveform with the trigger point aligned at the center of the display. The time width of the trigger window is usually 5 uS.

6. **Logic Display** shows the 8 logic signals time-aligned to the analog signal

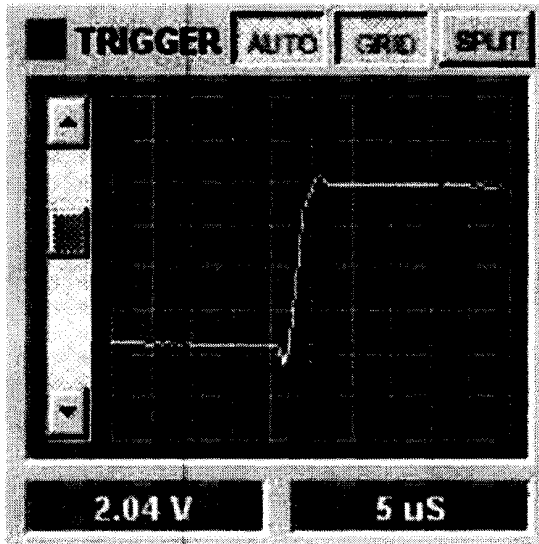
7. **Trigger Level** slider to adjust the analog trigger level.

The slider is replaced with a bitwise trigger condition control when triggering on the logic signals or when triggering on the digitally encoded analog data as shown below.

Some BitScopes (eg, BS220) do not have an analog level trigger. In this case the DSO configures the digital trigger when an analog channel is selected. The digital trigger is the same as a logic trigger - but it applies to the A/D encoded analog waveform instead of the logic bus.

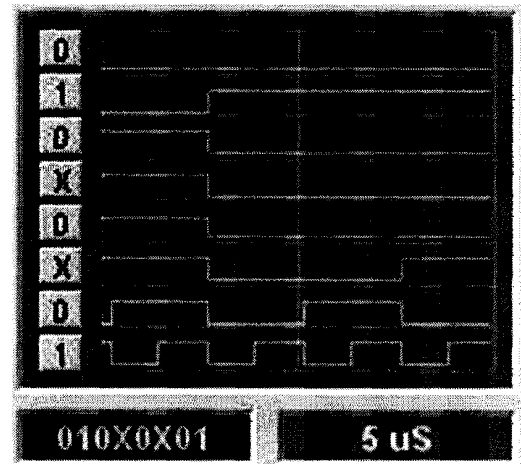
8. **Trigger Condition** displays the current analog trigger level in volts or the logic trigger condition. The example below shows the condition 010X0X0X with 5 uS trigger hold-off.

Remember that an X indicates that the state of this bit position is ignored by the trigger logic - that is it is a "DON'T CARE".



Analog Trigger Example

Arbitrary level is indicated in panel below main TRIG display.



Digital Trigger Example

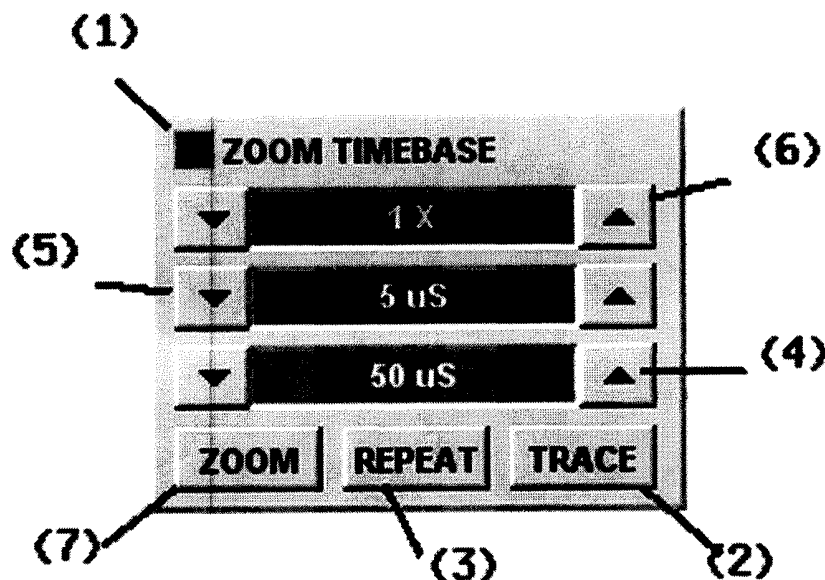
The Logic Bus state for trigger is in the panel below main display.

9. **Trigger Hold-Off** – the duration the trigger condition must remain true before the trigger will fire.
10. **Trigger Source** – three buttons to select which of the analog channel A or B, or the logic bus is to be the trigger source. The source channel is color coded (yellow, green and blue).
11. **Trigger Type** – three buttons to select the type of trigger to apply: RISING edge, FALLING edge or LEVEL trigger. In the case of a logic trigger, rising means a transition from "FALSE to TRUE" and vice versa. In the case of an analog trigger, LEVEL means a bit pattern applied to the digitally encoded analog signal.
12. **Trigger Filter** – three buttons to select the type of trigger filter to apply: FAST (ie, no filter), FILTER (a fixed 5 uS with no hold-off) or ADJUST (adjustable hold-off).

The trigger window is scaled such that the most negative voltage (at the A/D) is at the bottom and the most positive at the top. When you adjust the slider, a grey line in the trigger window changes to indicate the level at which the trigger will occur (which can be inverted with the RISE/FALL buttons). By default it's at 50% (zero volts). Note, the signal level this translates to depends on the input range chosen for the channel concerned - so changing this allows you to apply the trigger to different levels.

By choosing STATE (instead of RISE or FALL) you can also set arbitrary trigger "bands" to be applied to an analog signal. In this case you are effectively applying a logic trigger to the output of the A/D convertor - kind of an unusual concept for an analog trigger but still potentially very useful.

In general, because BitScope has a very precise trigger delay and offset control, as long as you can get a reliable trigger from the signal *somewhere*, you can see any part of a (repeating) waveform in as much detail as you like by applying appropriate delay, zoom, scaling and offset to the waveform to bring the region of interest in the *next* period into view.



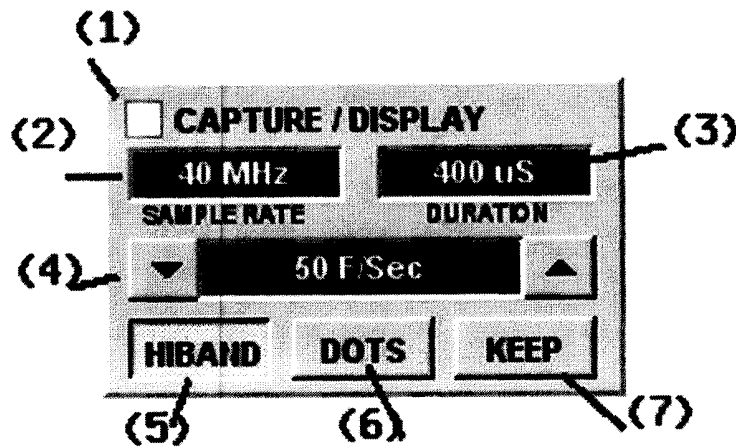
DSO TimeBase, Zoom, Time Scaling

The BitScope DSO a *dual timebase* digital oscilloscope and logic analyzer. It is also capable of time scaling, even on one-shot captures ! The Zoom Timebase control is where you set the timebase and timescale parameters and initiate one-shot capture or repeating display.

1. **Zoom Enable LED** lights up when the Zoom Timebase is active.
2. **TRACE button** initiates a one-shot capture.
3. **REPEAT button** initiates repeating display.
4. **MAIN Timebase** sets the main timebase value. Usually set in "time per division" units but in some modes (eg LOGIC or MIXED), it can set the time per sample.
5. **ZOOM Timebase** same as the main timebase control but applies to the zoom timebase. The zoom timebase may be faster or slower than the main timebase. When faster and not enabled, it controls the width of the zoom band in the main display. When enabled it controls the timebase of the main display.
6. **Time Scale Control** sets the timebase expansion factor. Applies to the active timebase. The active timebase is indicated by a highlight. When set other than x1 the timescale also highlights. If the ZOOM was active in the example above, it would result in a display timebase of 5 uS/Div. Selecting 2X would highlight the top panel and result in a display timebase of 2.5uS/Div.
7. **ZOOM Enable** selects between the main and zoom timebases. It is important to understand the difference between ZOOM timebase and timebase SCALING. The ZOOM timebase requires a separate data capture. It may be delayed compared to the main timebase, and it may capture at a different sample rate than the main timebase.

Timebase SCALING operates on either the main or zoom captured data and applies different scale factors to the captured data *without* changing the sample rate or requiring a new data capture.

Scaling operates as far as possible *without* interpolating the data. Instead it uses the very high resolution data already captured by BitScope to render the waveform at full resolution but in a different timescale.



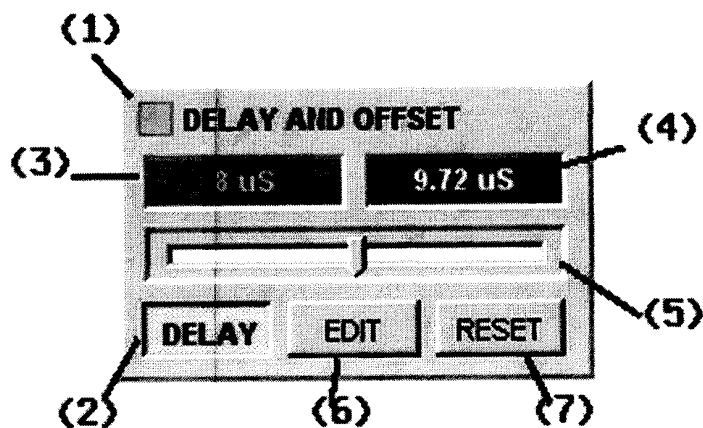
DSO CAPTURE

By default, BitScope captures at the highest sample rate it can to maximize capture resolution.

However, depending on the time-base settings the display sample rate may be lower. This is how the DSO can support non-interpolating time scaling, enhanced resolution and high bandwidth displays

The CAPTURE and DISPLAY control is where these things are set up.

1. **Capture LED** lights up whenever the DSO is communicating with the BitScope. As such it provides a good indicator as to whether there is a problem communicating with your BitScope.
2. **Capture Sample Rate** shows the sample rate used by BitScope during the most recent data capture. If you look on the display you will probably find the reported sample rate is lower than this. If so, time scaling, enhanced resolution and high bandwidth display modes are available.
3. **Capture Duration** shows the total duration of the capture data in BitScope's capture buffers. It is usually at least twice as long as the display "time width" at the current timebase.
4. **Frame Rate** specifies the maximum repeating capture frame rate. The actual frame rate may be lower than this depending on the type of BitScope, the speed of the link and whether high resolution or high bandwidth displays are enabled. As guide, RS-232 scopes are unlikely to be more than 7 fps but USB and Network BitScopes can exceed 40 fps in some circumstances.
5. **Enhancement Mode** specifies whether to display the data "as is" or in enhanced resolution or high bandwidth modes. For example, the waveform shown here has both high resolution and high bandwidth modes enabled. It shows a square wave in the presence of a higher frequency tone burst and a lot of noise. Without these display modes, aliasing effects would distort the displayed waveform beyond recognition.
6. **Dot Display Mode** when displaying some types of data (eg, X/Y phase plots) it is sometimes better to show the data using individual dots instead of lines or filled regions. This is even more important in accumulating displays.
7. **Keep/Decay Mode** selects waveform keep or phosphor decay display modes. While often unnecessary (due to capabilities of high resolution mode) these modes are still very useful for accumulating statistical information or when detecting patterns in the data (eg, eye patterns, phase plots etc).



DSO Delay and Offset

When the zoom timebase is active an arbitrary post-trigger delay may be applied.

Using the same trigger condition this delay allows you to see a signal "in overview" and zoom in to some tiny part of it in detail.

For example, you could view an entire video frame in the main timebase and zoom in on the 112'th video line in the zoom timebase using delay.

1. **Enable LED** lights when delay is enabled.

2. **Delay Enable** click to enable the delay.

When in main timebase is selected this causes the delay band to be shown on the display. When in zoom timebase is selected it applies the specified post trigger before capture starts.

3. **Delay Value** shows the prevailing post-trigger delay. The minimum possible delay depends on your BitScope. It is typically 8 uS. If you need to use shorted delays than this, use timebase scaling together with the waveform offset control (located under the main display).

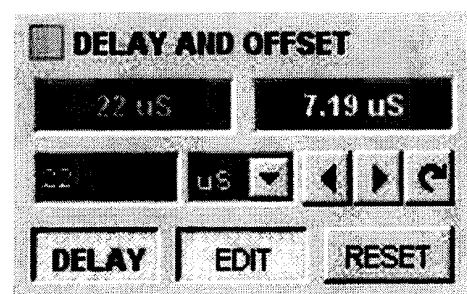
4. **Offset Value** shows the prevailing offset applied to the captured waveform. Delay plus offset is the total time between the trigger and the left edge of the display (in zoom timebase). The offset is adjusted using the slider under the main display.

5. **Delay Shuttle** adjusts the delay value. This is a "shuttle control" (ie, it changes delay at a speed proportional to position).

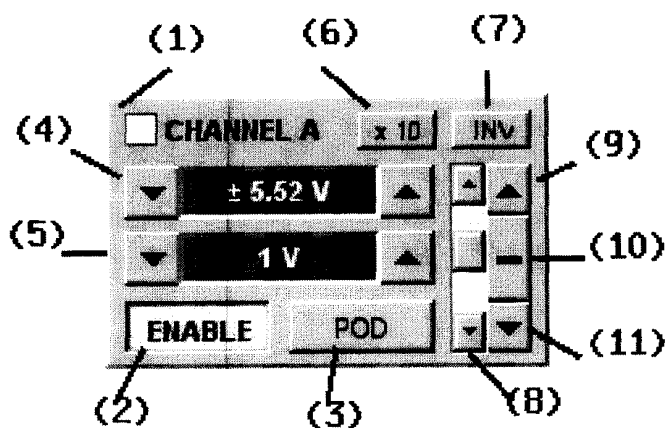
This is convenient when viewing a repeating delayed waveform in the zoom timebase as you can scroll the waveform "past your eyes" until a feature of interest comes into view. In the main timebase it adjusts the delay band position on the display.

6. **Delay Editor** allows a precise delay value to be entered. In some cases you know precisely the delay you require, or the delay is not easily set using the shuttle control. In this case click the EDIT button to open the delay editor (pictured right) and enter an exact value (in uS, mS or S units).

7. **Delay Reset** resets the delay to it's minimum value.



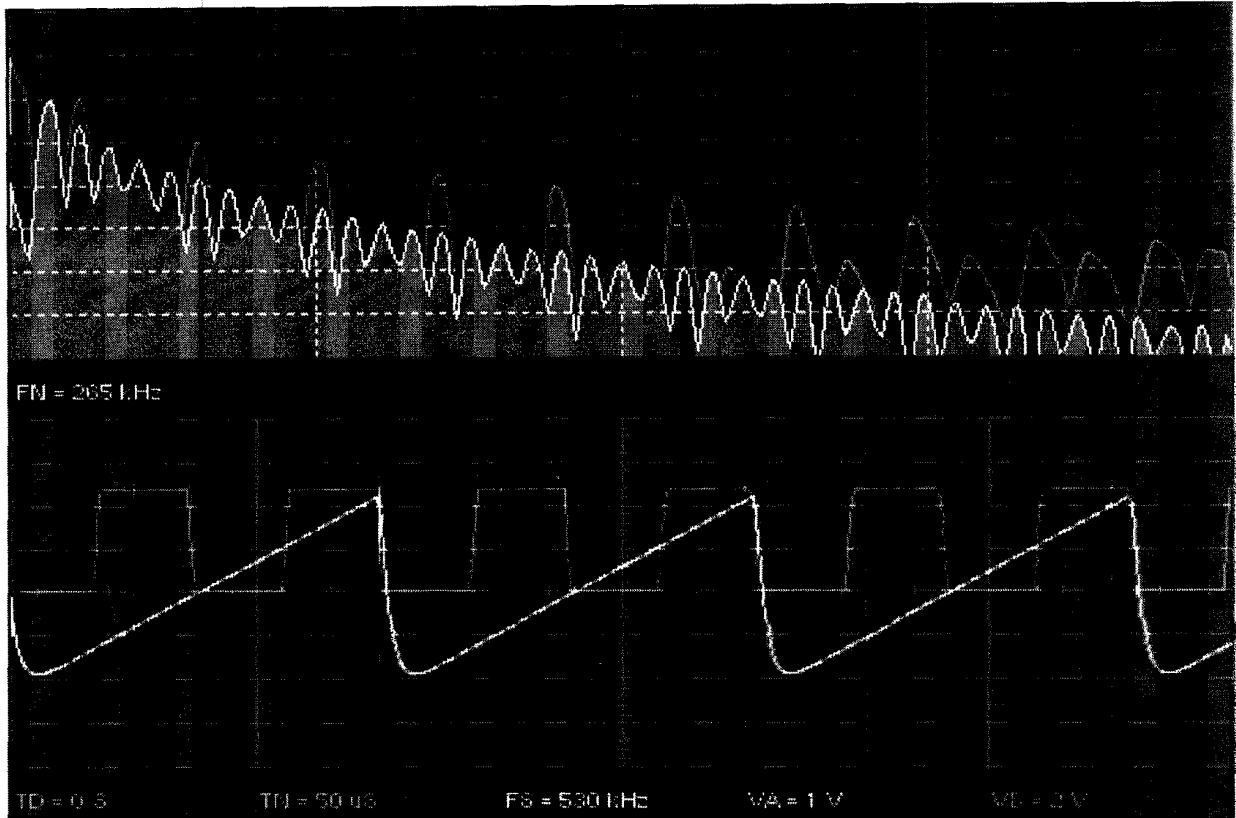
Post-Trigger Delay Editor



DSO Input Channel Control

Each analog input in BitScope is controlled via its channel control. The number of controls that appear when the DSO starts up depends on the type of BitScope to which the DSO is connected. For BS300, there should be 2 controls with a POD switch.

1. **Enable LED** lights dimly in the color of the channel when the channel is enabled. Light up brightly when a capture on the channel occurs.
2. **Channel Enable** enables the channel for capture and display.
3. **Source Select** selects the channel input source. Typically this selects between the BNC probe and POD analog inputs.
4. **Range Select** selects the analog input range to be used for capture. Normally you select the smallest range that can accommodate the range of voltages you expect to see at the input (so as to maximize the A/D resolution of the capture). Do not confuse this with the vertical scaling!
5. **Vertical Scaling** selects the volts per division at which to display the waveform on the display.
To see the currently selected input range displayed using the full vertical height of the display, click on the vertical scaling value. It will fade and the volts per division change to the value necessary to scale the entire input range to the full display height. This mode is very useful when looking for the optimum range to use; just choose the range that shows the biggest waveform without clipping. Click the scaling value again to flip back to your selected vertical scaling.
6. **Probe x10 Scaling** if you have a x10 probe connected on the BNC input, click this button to rescale the display for the voltages appearing at the probe tip (instead of at the BNC input). In the case of a BS300, this increases the maximum measurable voltage from $\pm 5.52\text{V}$ to $\pm 55.2\text{V}$.
7. **Waveform Invert** click this button to invert the waveform. This is particularly useful to see the voltage difference between the input channels using the ADD display (just invert one of the channels).
8. **Vertical Position** slider to adjust the vertical position of the waveform on the display.
9. **Position Up** move the waveform up by one division.
10. **Position Zero** locate the waveform to the middle of the display.
11. **Position Down** move the waveform down by one division.



The spectrum analyzer is now part of the core DSO engine and its output is available in several displays (FREQ, BOTH and PHASE) in ALT and CHOP modes. The most comprehensive is BOTH:

As the example above shows, you can see both waveforms and spectra for both channels on screen simultaneously, updating live from analog inputs or you can scroll through a one-shot capture to view the spectrum at different points in the buffer.

If you wish to see just the magnitude spectrum select FREQ or if you want the phase spectrum as well select PHASE.

Being fully integrated, there are no complicated settings to adjust. The spectrum analyzer adapts automatically to the current DSO timebase, scale, volts/div and screen size to give you the optimum resolution power and/or phase spectrum for the waveforms currently on-screen.

Magnitude Scaling and Vertical Resolution

The vertical (magnitude) resolution of the spectrum analyzer is 10 dB per grid line with 0 dB at the top of the display. The spectrum is calibrated such that a DC waveform scaled to full display (via the channel's vertical scaling control) is 0 dB magnitude in the spectrum display. If you wish to shift the spectrum up to see low level details simply increase the vertical scaling for the channel concerned.

Spectrum Bandwidth and Frequency Resolution

The bandwidth and frequency resolution of the spectrum analyzer depends on the prevailing timebase settings and display sample rate (which depends on display size and DOTS mode).

The bandwidth (ie, Nyquist Frequency) is reported via the FN information variable (250 kHz in this example). The graticule has vertical divisions at DC, 25%, 50% and 75% of current Nyquist frequency for quick measurements but precise frequency and bandwidth measurement of spectrum features can also be performed using on-screen frequency cursors.

DSO Data Information Format

The DSO maintains a set of on-screen information variables (aka information data). These variables are shown immediately below the display to which they belong. The variables to be displayed depends on the display type and whether certain features such as cursors are enabled.

Variables are identified by a two character name and are typically colour coded on the display.

Information Variables

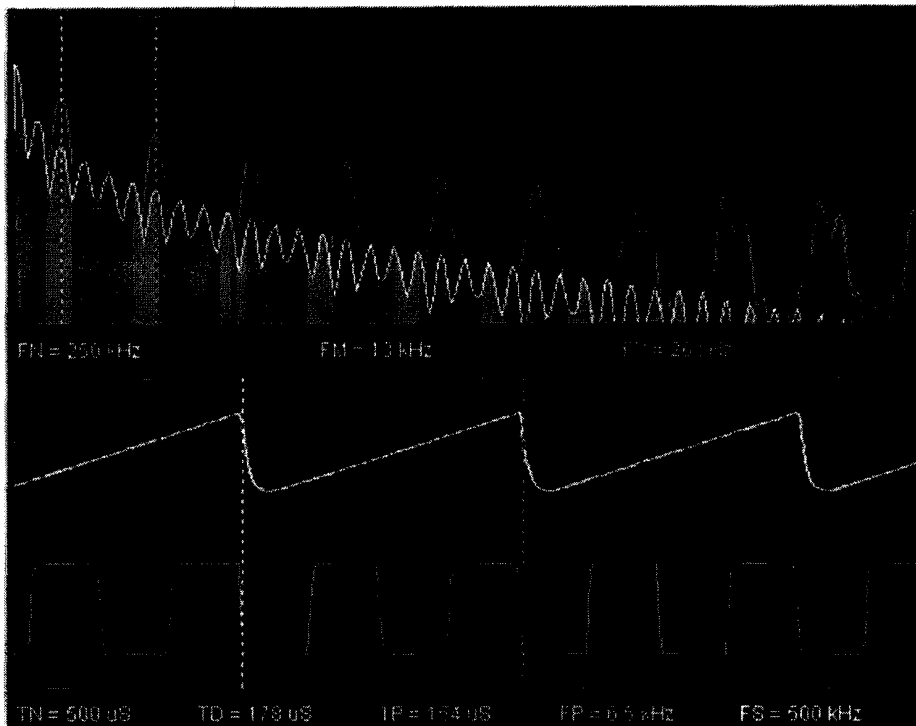
ID	NAME	DESCRIPTION
TN	Timebase	Time per division (Graticule Enabled) or time per display (Graticule Disabled).
FP	Frequency	The frequency implied by the cursor delimited time period (TP). <i>Appears in time displays only.</i>
FN	Bandwidth	Spectrum display bandwidth or Nyquist frequency (aka the highest displayed frequency).
FS	Sample Rate	Display sample rate (not the capture sample rate).
TD	Time Delay	Post-trigger time delay (if a delay has been enabled).
VA	Voltage Scale A	Volts per division (Graticule Enabled) or Volts per display (Graticule Disabled) for Channel A.
VB	Voltage Scale B	Volts per division (Graticule Enabled) or Volts per display (Graticule Disabled) for Channel B.
VC	Voltage Scale C	Volts per division (Graticule Enabled) or Volts per display (Graticule Disabled) for Channel C.
VD	Voltage Scale D	Volts per division (Graticule Enabled) or Volts per display (Graticule Disabled) for Channel D.
TP	Time Period	The time difference between the two time cursors.
FM	Frequency (Mark)	The value of the Mark frequency cursor. <i>Appears in frequency displays only.</i>
FP	Frequency (Point)	The difference (aka bandwidth) between the Point frequency cursor and the Mark frequency cursor. <i>Appears in frequency displays only.</i>

An important distinction between these variables and the DSO settings that control them is that the variables always report values appropriate for the waveform or spectrum data currently on-screen. This is in contrast to some DSO settings (eg, timebase) which may be changed to new values which do not correspond to the displayed waveforms until a new capture is performed.

The DSO supports TIME and FREQUENCY cursors for precise measurement of time periods, pulse width, delays, frequencies and bandwidths. Cursors are also useful to indicate fixed time and frequency points when switching to different modes, timebases or timescales. Cursors are enabled via the global CURS button which also enables the display of cursor variables so measurements can be made. In each display there are two cursors available:

- **POINT** the primary value cursor (RED).
- **MARK** the mark (or origin) cursor (LIME).

To move a cursor, simply click on it (with the left mouse button) and drag it to the position required. If both cursors are at the same location, the POINT cursor will be picked up first. Below is a screenshot showing both cursors on features of the SYDNEY Bitscope waveforms.



BitScope with Time and Frequency cursors enabled.

In this example the time cursors are positioned to report the waveform period on channel A (TP=154 uS) and the associated frequency (FP=6.5 kHz).

The frequency cursors are positioned on the first harmonic (fundamental) of the waveform on channel B (FM=13 kHz) and the third harmonic (39 kHz). The frequency difference between the first and third harmonics is 26 kHz (FP=26 kHz).

These measurements in both time and frequency domains are consistent (the waveform on channel B is precisely twice the frequency of that on channel A).

Some other statistics to note are the display sample rate (FS=500 kHz), the total spectrum bandwidth (FN=250 kHz) and the time span of the waveform display (TN=500 uS). Also, the left edge of the time display is 178 uS after the trigger point.

In normal usage, if you are interested to measure a single time or frequency value (referenced to 0 Hz or the trigger point respectively) simply move the Point Cursor (RED) to the position you wish to measure. If you want to measure the **difference** between two times or frequencies move the Point Cursor to the right point (first) and the Mark Cursor (LIME) to the left point (second).

Once located to a point in time or a frequency, each cursor will remain there regardless of the timebase, time scale or DSO operating mode. This can be very useful if (for example) you locate to a particular position in a logic sequence (in LOGIC mode) and switch to the scope (ALT or CHOP mode) to see the analog signal in fine detail.

USB SETUP NOTES

- (1) Is the installed driver version 1.0.2134.0 or later (check the COM port driver settings to find out). Note that the latest version of this driver is available here: <http://www.ftdichip.com/Files/R9052151.zip>
- (2) Does USB adaptor appear in Win XP as a new COM port when the BitScope is connected to the the PC ?
- (3) Is the BitScope DSO software configured to use this COM port as its first preference ? For details see:
<http://www.bitscope.com/software/dso/guide/?p=setup>

Note: please copy the DSO software folder to your hard disk before running Dso.exe (ie, do not try to run it directly from the CD-ROM). Also check that the file Dso.prb is not write protected (opening it with NotePad and saving it again usually fixes this).
- (4) Does the BitScope DSO software report BC000301 in the lower left corner of the application when you click the POWER button. If not what does it report ?
- (5) Does the DSO software work with the BitScope if you configure the software for SERIAL and connect the BitScope via a serial interface instead ? ie, when you don't use the USB adaptor at all.
- (6) Have you tried using it via USB with a different PC and/or a different USB cable (ie, one that you know works with other USB devices) ?

Some Windows XP installations have a preinstalled USB driver which is out of date. The OS already thinks it has the necessary driver but in fact it is assigning the *wrong* driver to the USB adaptor. First up make sure you have the right driver. You can download and install the FTDI USB drivers here:

<http://www.ftdichip.com/FTWinDriver.htm>

choosing the "enhanced BM series support" version.

Windows XP (Home or Pro) should report:

Found New Hardware

USB Serial Port

in a pop-up box on the lower right of the display when you connect the USB/BitScope to your PC. Shortly afterward the "Found New Hardware Wizard" should appear (a dialog box) asking you to install the driver.

Right click "My Computer" and select "Properties".

Select the "Hardware" tab choose "Device Manager".

Open the "Ports (COM & LPT)" entry and confirm that a line with "USB Serial Port" appears there.

Right click this and choose "Properties", select the "Driver" tab and click the "Reinstall Driver" button.

This should open the "Hardware Update Wizard" which should allow you to install the driver (by choosing the "Advanced" option and browsing to the folder in which you unpacked the FTDI driver you downloaded).

DSO Installation Notes

USAGE (Windows version)

- [1] Unzip DSO.zip in a convenient folder.
- [2] Connect your BitScope to the PC.
- [3] Run DSO.exe (no installation necessary).
- [4] Click SETUP (optional, see below) to specify how to connect.
- [5] Click POWER to start the DSO application running.

If you're using our USB adaptor you will need to download and install the FTDI USB drivers:

<http://www.ftdichip.com/FTWinDriver.htm>
or .. \USB\ directory on CD.

USAGE (Linux/X11 version)

- [1] Extract DSO.tgz in a convenient directory.
- [2] Install libborqt-6.9-qt2.3.so library (see below).
- [3] Connect your BitScope to the PC.
- [4] Run DSO (no installation/configuration necessary).
- [5] Click SETUP (optional, see below) to specify how to connect.
- [6] Click POWER button to start the DSO.

This application runs under the X Window system and requires the QT library libborqt-6.9-qt2.3.so. If you don't have this library it is available as an RPM, DEB or TGZ archive:

<http://kylixlibs.sourceforge.net/down.html>

The library installs in its own directory in /usr/lib, so it will not interfere with anything else already installed that uses your Linux distribution's own version of the Qt library (if installed).

Also, if you're using our USB adaptor you will need to download and install the FTDI USB drivers:

<http://ftdi-usb-sio.sourceforge.net/>

SETUP / CONFIGURATION

In most cases, no configuration is required. When DSO is "powered on" it searches configured serial and USB ports and your local network (if you have one) looking for a BitScope. By default, the following three locations are "probed" in the order shown:

SERIAL COM1 (/dev/ttyS0 in Linux)
NETWORK UDP (to any network BitScope via your local ethernet)
USB COM5 (/dev/ttyS5 in Linux)

After clicking the POWER button, DSO connects with the first BitScope it finds. You can tell if your BitScope has been found because the word "CONNECTED" appears in the status bar at the bottom of the DSO. If it does not appear the DSO could not find your BitScope.

The probe is managed via the "Dso.prb" file (in the same directory as the application). Read the contents of Dso.prb file for more details.

DSO - DISTRIBUTION ARCHIVE MANIFEST

Copyright (C) 2003 BitScope Designs. All Rights Reserved.

The files in this archive are:

Dso.exe	- DSO application executable
Dso.prb	- default DSO probe file
BUG.txt	- current bug list for the DSO
FIX.txt	- fixed bug list for the DSO
LICENSE.txt	- the DSO software license
README.txt	- *brief* install/user manual
SYDNEY.txt	- description of SYDNEY, a demo BS300N
MANIFEST.txt	- this file

BitScope Designs. October 14, 2003.

BitScope Expansion POD

On the front panel of BitScope is a 26 way logic POD connector. It provides an interface to the 8 logic inputs. It is here you connect BitScope's logic analyzer channels to the circuit under test. Normally you would use short test leads with Grabber clips on the end – 10 of these are included with the Pocket Analyzer. For slower signals you may use ribbon cable and wire a matching connector on your circuit (3). When the logic capture is in progress, the BLUE LED on the front panel will light. If an analog capture is in progress, the YELLOW LED will light.

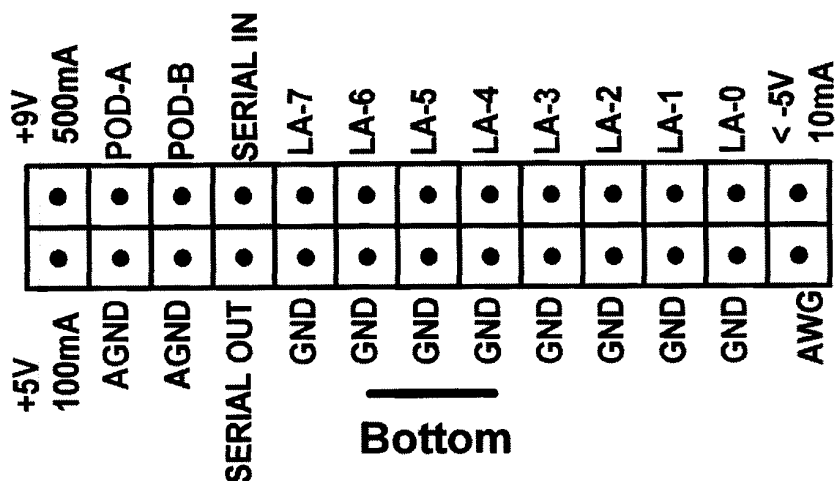
In addition to the logic inputs, the POD connector also provides access to BitScope's Dual Channel analog inputs, power and ground lines and 2 special I/O signals (1), as the schematic diagrams show. These additional signals give BitScope some unique hardware expansion capabilities. POD adapters may be connected to provide very specific functionality (2). This BitScope provides a permanent AWG connection on PIN 26. The AWG connection to BNC A is switched (GREEN LED).

If you are using the Pocket Analyzer as a USB BUS-POWERED device, most active POD attachments will not work. This BitScope will only request enough power from USB for its own operation.

Hints for using a Logic Analyzer

- Make sure you have a solid GND connection to the Logic circuit
- Grabber clips are OK for some components, but don't be afraid to solder tack some WireWrap wire to your signals and connect to these.
- Thru-hole resistors with one lead cut off make good Test Points. Solder the remaining leg to the circuit and grab this lead. The resistor body will stop the clip from sliding off.
- Clearly label your test points with meaningful signal names. This makes problem solving easier.
- Check signals first with the fastest sample rate possible to avoid sample aliases.
- Check all logic signals with the Analog Input (Mixed/DSO) to look for odd levels, glitches or ringing. This can save a lot of time as problems like this will not show up on LA inputs.
- Make sure you understand the trigger settings you are using. Make use of the Cross-Triggering feature of BitScope where possible. The correct trigger condition can solve a problem in minutes.
- Look at all your signals and make sure you can explain what you see on the scope.

- 1 The details of the 19K2 serial port available on the POD are provided at www.bitscope.com. To access this port you will need to use BitScope Scripting Language (BSL) or an interface library such as BitLink.
- 2 For example, a "Smart POD", powered by BitScope, could implement a Vibration Transducer interface and pre-amplifier coupled to the POD Analog inputs
- 3 Be aware that ribbon cable has significant capacitance and could interfere with the signals under test.



Pocket Analyzer POD

www.bitscope.com

Notes on using the BitScope Pocket Analyzer POD

BitScope POD is designed for use with low voltage electronics. DO NOT attempt to use this POD with any circuit above 12V. If in doubt, use a resistor of at least 1K as a probe to limit current into the logic inputs.

The BS-50 POD makes +9, +5 volts available for powering a prototype IF it is being externally powered. When used in USB BUS-POWERED mode neither voltage will be present. Be very careful if using these pins – digital logic can be damaged by the wrong voltage. The +5 output is diode protected to prevent current flowing into the BitScope circuit.

The Logic Channels are as marked along the top row of pins. The pins directly below them are digital GNDs. Make sure you have a solid Ground connection to your circuit under test.

BitScope is GND referenced to the USB port of the host PC. Take this into consideration before connecting any scope GND lead to live equipment! It is a good idea to establish a GROUND reference between BitScope and the circuit under test. For High Frequency signals, use a POD GND connection with a short wire as well to eliminate induced noise.

The SERIAL IN/OUT pins are +5 LOGIC signals. They are not RS-232 levels!. You can connect them directly to a +5V Microcontroller UART Port. Use BitScope Scripting Language to send and receive data to a Smart POD.

All Analog and Digital inputs are 100K impedance to GND and about 5pF. The Digital inputs are CMOS levels. An alternate Logic POD with Low Voltage logic inputs should be used for special applications.

The analog inputs may be increased X10 with a 900K series resistor. To compensate this would require a 0-6 pF trimmer in parallel with this resistor.

— Notes —

Product Information

Analog Inputs [1]	1 x BNC + 2 x POD
Logic Inputs	8 x POD
Analog Bandwidth [2]	100 MHz
Input Impedance	1M/20 pF (BNC), 100K/5 pF (POD)
Input Voltage Range (+/-)	513mV ~ 10.8V & 5.13V ~ 108V (with x10 probe)
Input Multiplier Gain [3]	x10 (BNC input only)
Analog Sensitivity	2mV ~ 40mV (x1)
Maximum Sensitivity [4]	500 uV (Time), 100uV (Freq), 20uV (Mean)
Fast Sample Rates	4, 5, 10, 13.5, 20, 25, 33, 40 MS/s
Mixed Mode Sample Rates [5]	2, 2.5, 5, 6.75, 10, 12.5, 16.5, 20 MS/s
Slow Sample Rates [6]	4 kHz ~ 1 MHz (slow) & <1 Hz (burst mode)
Channel Buffer Depth [5]	32 kS (analog or digital), 16 kS (mixed)
Resolution (Convertor)	TLC5540 8 bit convertor with 6.8 ~ 7.6 ENOB
Maximum Resolution [7]	11.5 ENOB
Glitch Capture	25 nS
BitScope Digital Trigger	8 bit combinatorial on logic or A/D output.
High Speed Analog Trigger	YES
Waveform Generator [8]	10 MS/s (switchable to BNC)
Pattern Generator	40 MS/s (switchable through Logic POD)
Analog Interface	1 x BNC and 2 x POD
Logic Interface [9]	1 x IDC 26 (inc. logic, analog, data and power)
Data Upload Speed (Max)	1 Mb/s
Standard PC Software	BitScope DSO
External Power Requirement [10]	9-12VDC 300 mA
Operating Temperature	0°C to 50°C
Storage Temperature	-20°C to +60°C
Size (WxHxD)	100x25x100 mm

[1] Analog capture from the BNC input is available on channel A only however both channels are available via the POD inputs.

[2] Input bandwidth refers to the analog input circuitry and compensated A/D convertor.

[3] User selectable analog input multiplier with x10 gain for use with low level signals.

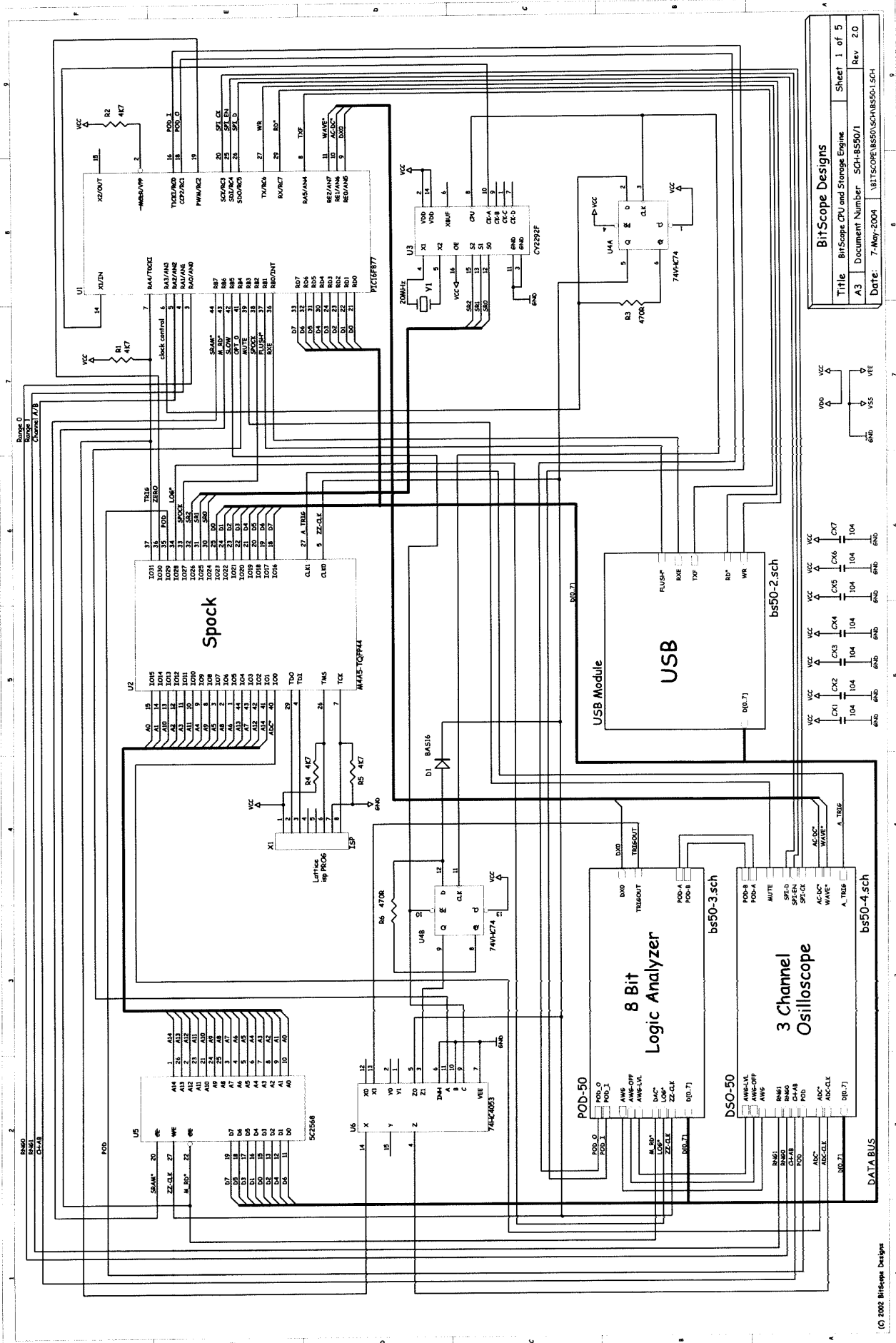
[4] Specifies minimum measurable peak-to-peak sinusoidal waveform voltage when both resolution enhancement and input multiplier are enabled, when viewed as a waveform (Time) or viewed as a spectrum (Freq), and the minimum measurable average DC voltage (Mean).

Product Information

- [5] Unlike the larger BitScopes, BS50U uses shared memory data capture. When mixed mode (ie, analog + logic) is enabled, the sample rates and buffer depth are halved.
- [6] In addition to the fast sample rates, a wide range of "slow clock" and "burst clock" rates are supported (to below 1 Hz). Burst clocking also supports further increased bit resolution (ENOB).
- [7] Specifies the maximum effective number of bits (ENOB) achievable with resolution enhancement enabled.
- [8] The waveform generator is standard with BS50U. Note: unlike **BS310U**, concurrent waveform capture on BS50U is **not** possible when the generator is enabled.
- [9] Like all BitScopes the BS50U POD interface provides power, ground and control signals in addition to the logic and analog capture inputs. However this POD includes signal conditioning which means a separate cable and **Logic POD is not required**. Simply plug the logic and analog probes into the POD connector directly !
- [10] BS50U is USB bus powered. However if used with unpowered hubs or if using POD power for your own circuits our **UPP-02** Universal AC adaptor and US power **cable** may be purchased as options for use with this product.

Logic and Analog probe leads for use via the POD are included.

Analog oscilloscope and specialized logic **probes and leads** are sold separately.



9V DC - 12V DC

SOCKET

PI

7805

U7

D4

6S16

C35

104

C1

100uF/25V

D2

BA516

C37

104

D3

BA516

D5

SS14

VCC

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U9

IRF7314Q

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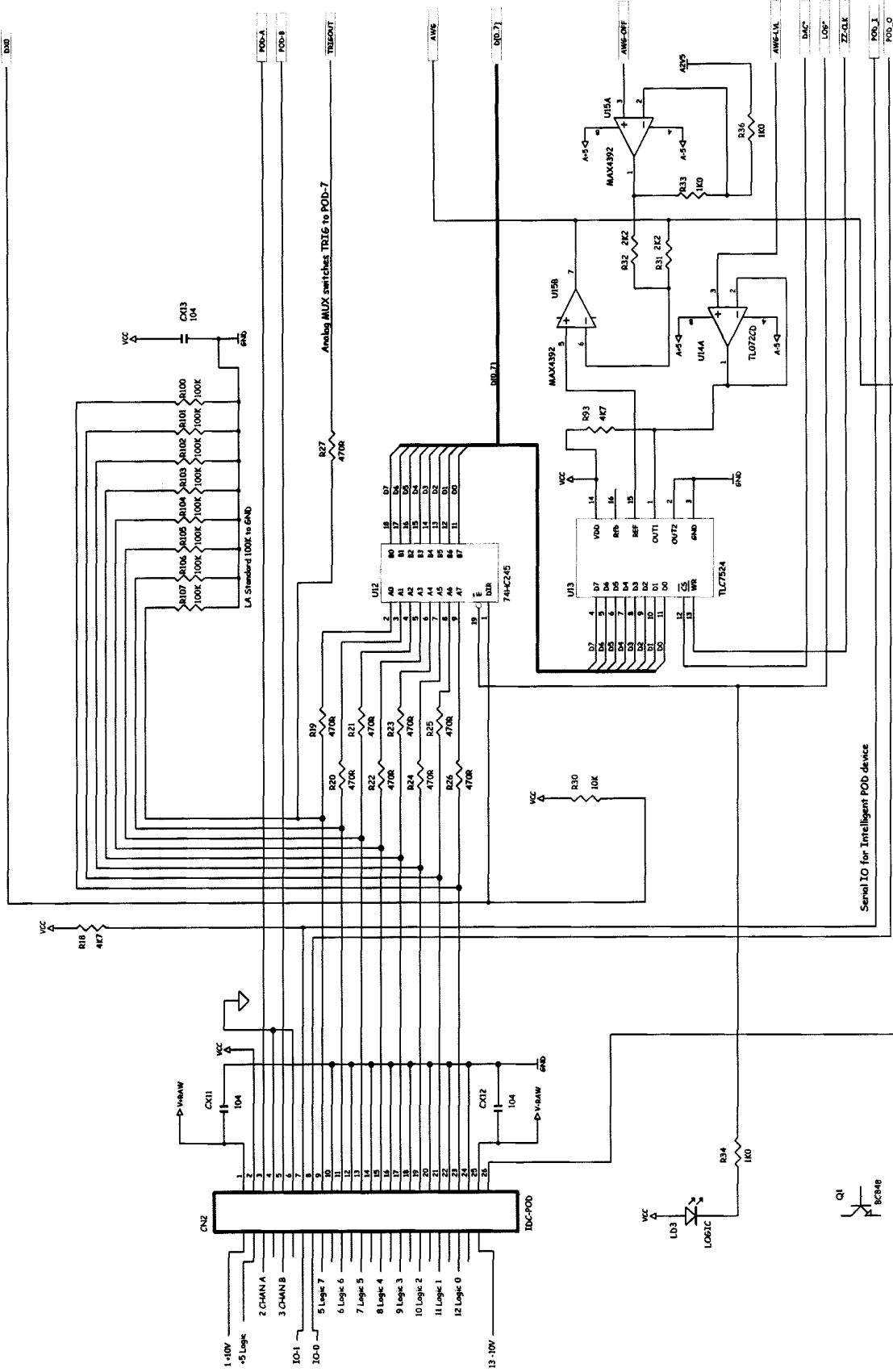
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Logic Pod



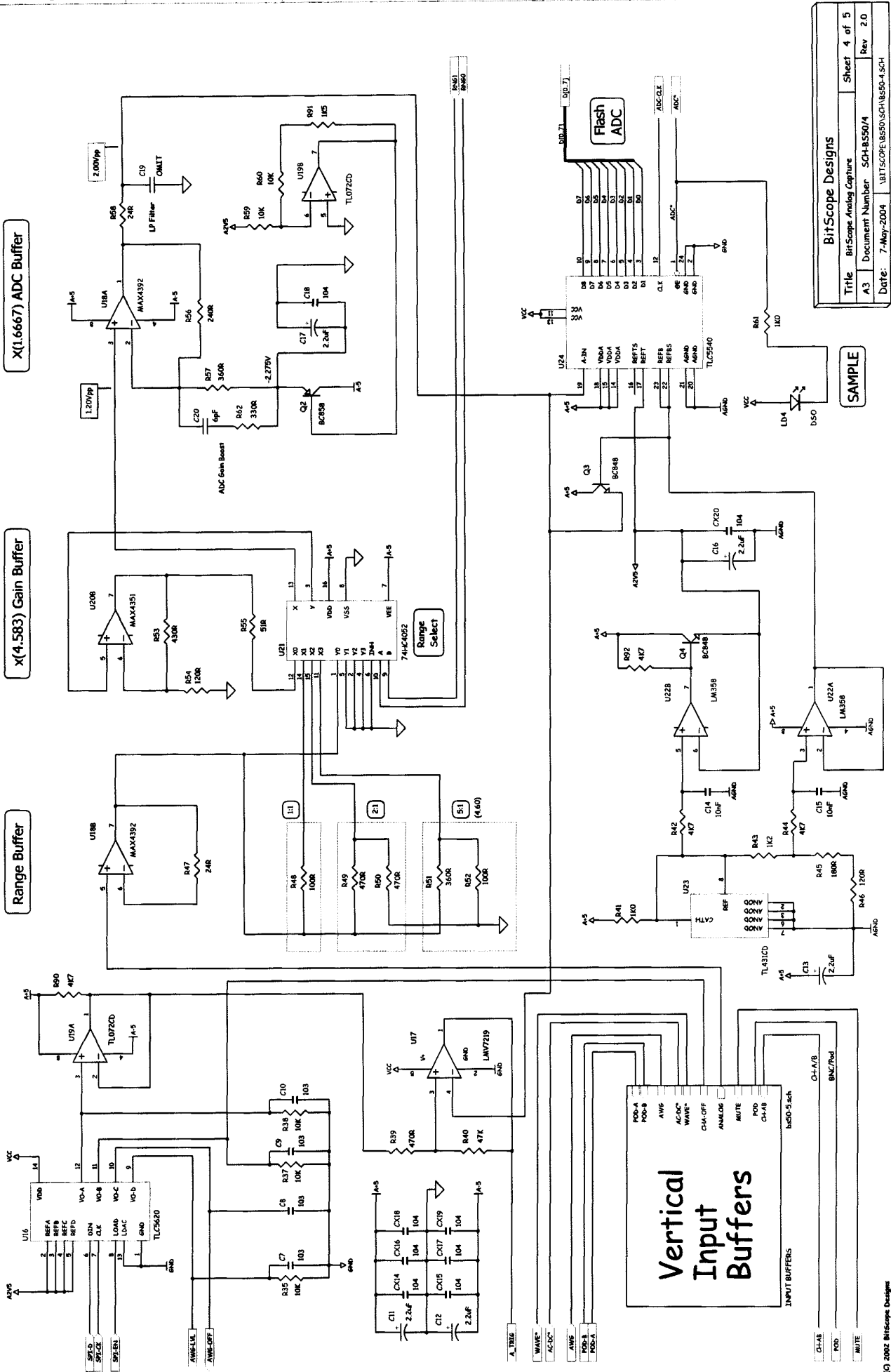
BitScope Designs

Title		BitScope Digital Capture		Sheet 3 of 5	
A3	Document Number	SCH-B550/3		Rev	2.0
Date:	7-May-2004	\\BITSCOPE\B550\5CH\B550-3.SCH			

Range Buffer

x(4.583) Gain Buffer

x(1.6667) ADC Buffer



BitScope Designs			
Title	BitScope Analog Capture	Sheet	4 of 5
A3	Document Number	SCH-B550/4	Rev 2.0
Date:	7-May-2004	UATSCOPE/B550/SCH-B550-4-SCH	

SAMPLE

Vertical Input Buffers

