

# **PC Oscilloscope Spectrum Analyzer Logic Analyzer**

## **DSO-50x12 Series**

### **User's Manual**

Revision I



CLOCK COMPUTER CORP.

<http://www.clock-link.com.tw>

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## Accessories Contents

- The DSO-50x12 Series Aluminum unit.
- Logic Analyzer Pod.
- Two pieces (DSO-50212) or Four pieces (DSO-50412).  
calibrated 300MHz Probe with (x1, x10). 10pF input Capacitance.
- Housing with twenty piece color wires and easy hook clips.
- USB 2.0 cable.
- Universal Power Supply with DC Adapter **12V/1A** (DSO-50212), **12V/2A** (DSO-50412). .
- DSO-50x12 Series User's Manual.
- Control Software CD.

## System Requirements

In order to use the DSO50x12, the following equipment is necessary:

- **Computer System:** Pentium PC system with at least one USB interface (USB 1.1 or 2.0 version).
- **Memory:** A minimum of 256 MB free RAM. 512 MB or 1GB is better.
- **Mass Storage:** At least one CD drives and hard disk drives.
- **Monitor:** Any monitor compatible with the above display adapter.
- **Operation System:** Windows 2000/XP/VISTA.

## Installing Hardware

- Connects USB cable to DSO.
- Setup USB driver from CD.
- Plug in power source from +12V DC Adapter.
- Waiting for control software turn on.

## Installing Software

- Insert the distribution CD into drive E: (here E: is CD driver).
- Enter file to run E:\DSO50x12\dso50x12.exe.
- Follow the on screen instructions.

## Feature

- Innovative cross triggering: logic analyzer channels can trigger the analog channels and vice versa.
- Long time pre-triggering up to 262143\*256 points, about -67M points.
- Fast data capture and screen update rates.
- Hot key function that is convenient to use.
- Deep 512K/2M sample data acquisition buffers on each channel (A1, A2, A3, A4, D0 ~ D11).
- Precision 200MHz Frequency counter, up to 7 digital resolution @ 512K memory for each analog channel.
- Advance Fast Fourier Transformations function to Bandwidth test.
- Support Pulse width and TV(NTSC525, PAL625) Triggering and count.
- Support high speed (up to 50MHz SCL clock) I<sup>2</sup>C , SPI Triggering.
- Support I<sup>2</sup>C, SPI, UART, more... serial bus timing encode.
- Convenient Timing state display for logic debug.

## Guide to Operations

When making measurements with the Digital Storage Oscilloscope / Logic Analyzer Cards, meaningful data can only be captured with some prior knowledge of the characteristics of the circuit under test.

Before initiating any capture cycles, the DSO must be configured using the control program. See the software section later in the manual for instructions on these procedures.

To connect the DSO to the test circuit, there are two standard BNC probes, one for each Analog input channel, and a series of mini-clips on the Logic Analyzer Pod for the Logic Input channels. The scope probes have removable hook clips on their ends and an attached alligator clip for the signal ground connection. The Logic Analyzer Pod has inputs for 12 channels, D0 channel is the external clock input, and 8 ground points.

For synchronous data captures, external clock sources can be connected to the D0 channel. At times, it may also be necessary to connect the test circuit to the computer system itself. This will eliminate more noise in the test application due to ground level differentials. This is especially true when dealing with high speed timing analysis. Use a heavy gauge wire to make a connection between the test circuit ground and the case of the computer. Each Analog channel probe has a calibration adjustment. It is important that this calibration be made at least twice a year. See Calibration for more information.

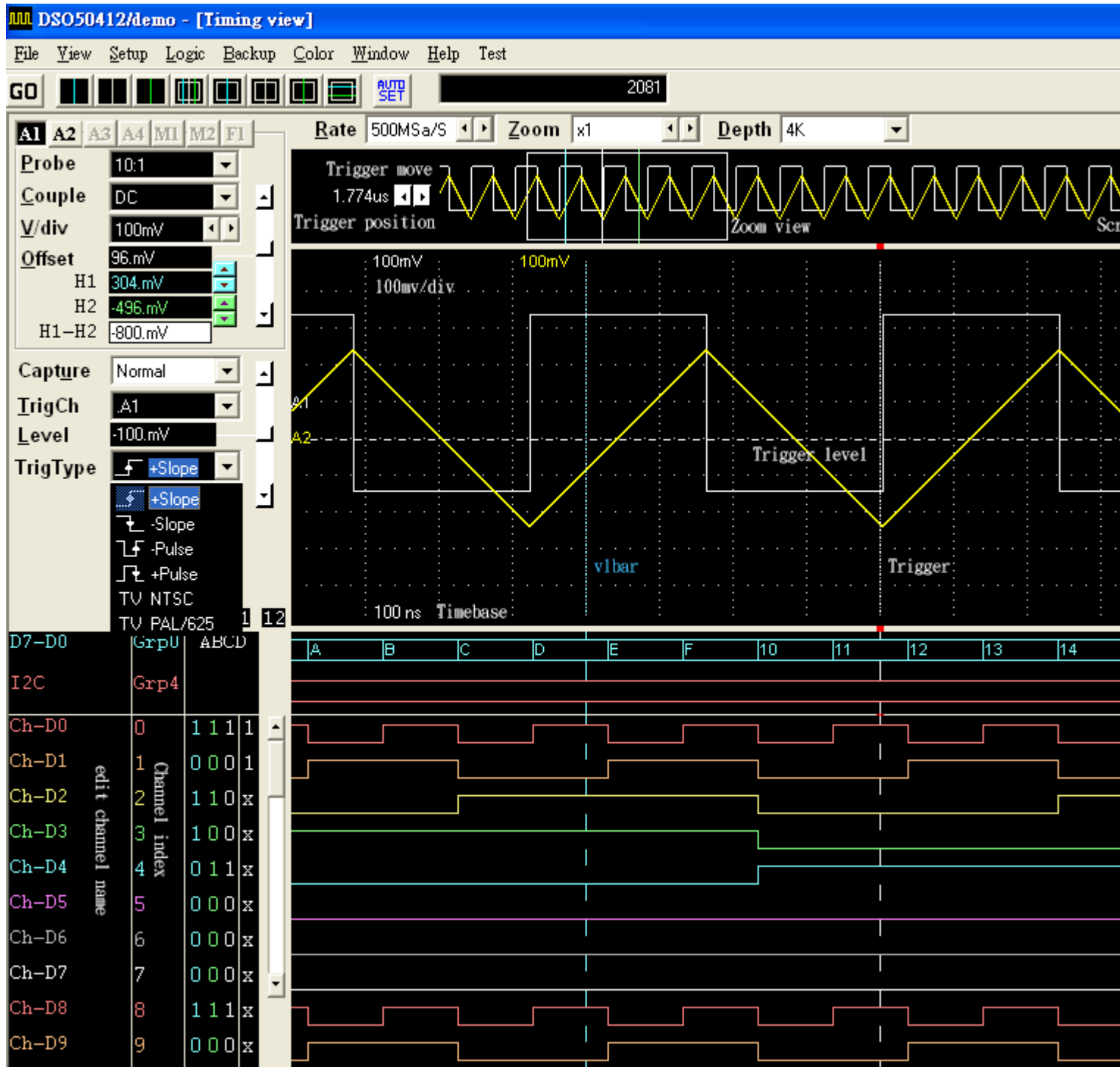
**When connecting the probes to any signal, make sure that the signal voltage is Within the limits of the DSO. check the technical information section for absolute maximum and recommended maximum input voltages for the probes.**

### Logic Analyzer Pod Markings:

**D0 ~ D11 Channel data inputs.**

**GND Signal ground connection.**

## Main Screen



## Horizontal Scroll Bar

This scroll bar is used in conjunction with a selected waveform or cursor. The Horizontal Scroll Bar will move a selected waveform or cursor left or right in the display area.

The Horizontal Scroll Bar works with Display, Analog input channels, Memory, Logic Analyzer channels, V1Bar, V2Bar, and Trigger Bar.

## Vertical Scroll Bar

This scroll bar is used in conjunction with a selected waveform or cursor.

The Vertical Scroll Bar will move a selected waveform or cursor up or down in the display area.

The Vertical Scroll Bar works with Display, Analog input channels, Memory, H1Bar, and H2Bar.

## Hardware Specifications

### DSO-50212 Hardware Specifications

| Model                  | DSO-50212  | Remark   |
|------------------------|--|--|
| Record Length          | 2MB / Ch   | Points   |
| Sampling Rate          | Ch.A1: 1Sa/s to 1Gsa/s<br>Ch.A2: 1Sa/s to 500MSa/s<br>D0 ~ D11: 1Sa/s to 500MSa/s  | Realtime: from 10Sa/s to 1Gsa/s.<br>Software catch: from 1Sa/s to 200Sa/s. |
| External clock         | 1KHz to 50MHz (max.)   | From Logic Channel D0  |
| Timebase Accuracy      | 50ppm  |  |
| <b>Analog Channel</b>  | Ch.A1, Ch.A2   | 8bit resolution  |
| Input Bandwidth        | ChA1: 200MHz (3db)<br>Ch.A2: 100MHz (0.5db), 125MHz (1db)  | @BNC connect (Probe 10:1)  |
| Input Impedance        | 1Mohm // 15pF  | @BNC connect (Probe 1:1)   |
| Max. input voltage     | 50v (100v Transient)   |  |
| Input Sensitivity      | 5mv/div to 2v/div  |  |
| Vertical Accuracy      | +/- 1.5%   |  |
| Trigger Sensitivity    | 0.2 div (250MHz)   |  |
| Trigger Level          | Adjustable 250 level   | 10 Vertical Divisions  |
| Trigger Type           | Slope +/-, Pulse width +/-, TV (NTSC / PAL),<br>Horizontal Synchronous Count Trigger.  | Pulse detect < 16ns(min.)  |
|                        |  |  |
| <b>Digital Channel</b> | D0 ~ D11 (12ch)  | Logic Pod  |
| Input Bandwidth        | 150MHz (max.)  |  |
| Input Impedance        | 100K ohm    2pF  |  |
| Input Sensitivity      | < 500mv  |  |
| Channel skew           | < 2ns  |  |
| Max. Input Voltage     | +/- 50v (100v Transient)   |  |
| Threshold Voltage      | -2v to +6v   | by 32mv step   |
| Trigger Qualify        | Parallel: 0, 1, X (don't care) settings for all<br>Digital channels<br>I <sup>2</sup> C: 0, 1, X (don't care) settings for 4 (bytes+<br>Ack) long<br>SPI: 0, 1, X (don't care) settings for 36bit long |  |
|                        |  |  |
| Operate                | Mouse  |  |
| Power Supply           | DC Adapter 12V/1A  |  |
| Power consumption      | USB +5V: <250mA+12V: <500mA  | Total: 7.2W  |
| PC Interface           | USB (Version 1.1/2.0)  |  |
| Net Weight             | 1.2 KGS  |  |
| Size (Dimension)       | 220mm x142mm x 40mm  | Aluminum Case  |
| Accessories            | Logic Analyzer pod, USB 2.0 cable.<br>Calibrated Probe 300MHz (1:1, 10:1) x 2 pcs.<br>User's Manual, Software CD.<br>Housing with Color wires & clips x 16 pcs.<br>DC Adapter 12V/1.0A.                |  |

## DSO-50412 Hardware Specifications

| Model                  | DSO-50412   | Remark   |
|------------------------|---|--|
| Record Length          | 2MB / Ch  | Points   |
| Sampling Rate          | Ch.A1, Ch.A3: 1Sa/s to 1Gsa/s<br>Ch.A2, Ch.A4: 1Sa/s to 500MSa/s<br>D0 ~ D11:1Sa/s to 500MSa/s  | Realtime: from 10Sa/s to 1Gsa/s.<br>Software catch: from 1Sa/s to 200Sa/s.<br>not support for Ch.A3 Ch.A4. |
| External clock         | 1 KHz to 50MHz (max.)   | From Logic Channel D0  |
| Timebase Accuracy      | 50ppm   |  |
| <b>Analog Channel</b>  | Ch.A1, Ch.A2, Ch.A3, Ch.A4  | 8bit resolution  |
| Input Bandwidth        | Ch.A1, Ch.A3: 200MHz (3db)<br>Ch.A2, Ch.A4:100MHz (0.5db), 125MHz (1db)   | @BNC connect (Probe 10:1)  |
| Input Impedance        | 1Mohm // 15pF   | @BNC connect (Probe 1:1)   |
| Max. input voltage     | 50v (100v Transient)  |  |
| Input Sensitivity      | 5mv/div to 2v/div   |  |
| Vertical Accuracy      | +/- 1.5 % 50v   |  |
| Trigger Sensitivity    | 0.2div (250MHz)   |  |
| Trigger Level          | Adjustable 250 level  | 10 Vertical Divisions  |
| Trigger Type           | Slope +/-, Pulse width +/-, TV (NTSC / PAL),<br>Horizontal Synchronous Count Trigger.   | Pulse detect < 16ns(min.)  |
|                        |   |  |
| <b>Digital Channel</b> | D0 ~ D11 (12ch)   | Logic Pod  |
| Input Bandwidth        | 150MHz (max.)   |  |
| Input Impedance        | 100K ohm    2pF   |  |
| Input Sensitivity      | < 500mv   |  |
| Channel skew           | < 2ns   |  |
| Max. Input Voltage     | +/- 50v (100v Transient)  |  |
| Threshold Voltage      | -2v to +6v  | by 32mv step   |
| Trigger Qualify        | Parallel: 0, 1, X (don't care) settings for all Digital channels.<br>I <sup>2</sup> C: 0, 1, X (don't care) settings for 4 (bytes+ Ack) long.<br>SPI: 0, 1, X (don't care) settings for 36bit long. |  |
|                        |   |  |
| Operate                | Mouse   |  |
| Power Supply           | DC Adapter 12V/2A   |  |
| Power consumption      | USB +5V: <350mA+12V: <900mA   | Total: 12W   |
| PC Interface           | USB (Version 1.1/2.0)   |  |
| Net Weight             | 1.8 KGS   |  |
| Size (Dimension)       | 225mm x 132mm x 60mm  | Aluminum Case  |
| Accessories            | Logic Analyzer pod, USB 2.0 cable.<br>Calibrated Probe 300MHz (1:1, 10:1) x 4 pcs.<br>User's Manual, Software CD.<br>Housing with Color wires & clips x 16 pcs.<br>DC Adapter 12V/2.0A.             |  |

## Hot Keys Function

|                    |   |
|--------------------|---|
| "G"/"g"            | GO/Stop   |
| "P"/"p"            | <u>P</u> robe   |
| "C"/"c"            | <u>C</u> ouple  |
| "V"/"v"            | <u>V</u> /div ("V" for up, "v" for down)                    |
| "O"/"o"            | <u>O</u> ffset ("O" for up, "o" for down)                   |
| "U"/"u"            | Cap <u>u</u> re   |
| "T"/"t"            | <u>T</u> rig Ch (Trigger Channel, "T" for up, "t" for down) |
| "R"/"r"            | <u>R</u> ate ("R" for up, "r" for down)                     |
| "L"/"l"            | Trigger <u>L</u> evel ("L" for up, "l" for down)            |
| "Z"/"z"            | <u>Z</u> oom ("Z" for up, "z" for down)                     |
| "D"/"d"            | <u>D</u> epth ("D" for up, "d" for down)                    |
| "Space"            | to switch A1, A2, A3, A4, M1, M2, F1 Channel                |
| "Print screen"     | Copy screen image to clip board.                            |
| <b>Control key</b> |   |
| Ctrl + "G"         | Turn On/Off Grid display.                                   |
| Ctrl + "H"         | Turn On/Off H bar display.                                  |
| Ctrl + "D"         | Turn On/Off Dots connect.                                   |
| Ctrl + "Z"         | Turn On/Off Zoom view.                                      |
| Ctrl + "P"         | Perform persist.  |
| Ctrl + "R"         | Refresh screen.   |



## Tool Bar

**GO** The Go command tells the DSO to start acquiring data when the trigger conditions are satisfied.

Pressed means Start capture, un-pressed means stop capture.

Moves one or more cursors to the display area. These commands are also available by clicking on the toolbar.



Centers waveform display area around V1Bar.



Centers waveform display area around V2Bar.



Centers waveform display area around the Trigger Bar.



Moves Trigger Bar, V1Bar and V2Bar onto the waveform display area.



Moves V1Bar onto the waveform display area.



Moves Trigger Bar onto the waveform display area.



Moves V2Bar onto the waveform display area.



Moves H1Bar and H2Bar onto the waveform display area.




Automatic setup parameters for Trigger Channel.




Perform force stop for long time capture, available 5KS/s to 10S/s sampling Rate.

## File Menu

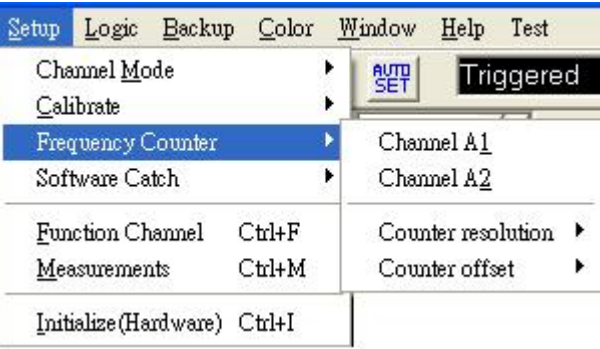
|  |  |
|--|--|
|  |  |
| <b>Load data</b>   | This option loads a data file (.dso), with a setting file (.ini) together.   |
| <b>Load data option</b>  | This option select of A1, A2, A3, A4 or D0 ~ D11 channel to be load.   |
| <b>Save setting</b>  | This option saves the current settings to a setting file (.ini).   |
| <b>Save data</b>   | This option saves a data file (.dso), every time saves all (A1, A2, A3, A4, D0-D11) data depend on Depth setting.      |
| <b>Transfer data to Excel</b>  | This option will convert data to Microsoft Excel by Decimal, Hexdecimal, Ascii or unit(v).                             |
| <b>Load setting</b>  | This option loads a previously Setting file (.ini).  |
| <b>Load Default Setting</b>  | Reset all parameters to factory defaults.  |
| <b>Auto. Load Setting</b>  | Turns on or turns off the Autoload option. When this option is on, all settings will be loaded when start the program. |
| <b>Print Screen</b>  | This option allows you to print Screen (Hard copy).  |
| <b>Print FFT</b>   | This option allows you to print FFT form.  |
| <b>Print Timing View</b>   | This option allows you to print Main Screen Form.  |
| <b>Exit</b>  | Use this command to end your session. You can also use the Close command on the application Control menu.              |

## View Menu

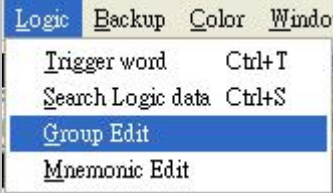
|  |  |
|--|--|
|  |  |
| <b>Status Bar</b>  | Show or hide Status Bar.   |
| <b>Channel display</b>   | <p>When display is checked, the channel will be displayed on the screen. When display is not checked, the channel will not be displayed on the screen. Turning Display off for a channel will speed up the display. However the data is still acquired from that channel unless transfer is turned off.</p> <p>A channel's display can also be set with the buttons on the left edge of the screen. If the channel is on the button will be highlighted. You can also turn on/off transfer of the data for a channel.</p> <p>Note: This command applies to both analog and digital channels.</p>                         |
| <b>Channel Height</b>  | Adjust height of logic channel (D0 ~ D11).   |
| <b>Time and Samples</b>  | For Timing display, display Time like as 123.456ms, or display how many samples.   |
| <b>Grid</b>  | Show or hide grid on analog display.   |
| <b>Dots connect</b>  | <p><b>Dots connect off</b></p> <p>None checking this option will display only the data points of the analog waveform. Logic data is unaffected by this option. This is the second fastest display option.</p> <p>Note that Lines will always be shown when in Sin (X) / X or Filter Interpolation modes.</p> <p><b>Dots connect on</b></p> <p>Checking this option will display the lines connecting the data points and the data points of the analog waveform.</p> <p>Logic data is unaffected by this option. This is the slowest display option.</p> <p>Note: The lines and dots can be set to different colors.</p> |
| <b>Zoom view</b>   | Compress and display the entire memory on the up screen.   |
| <b>Persistence</b>   | Turns on or turns off Persistence Mode. In this mode, with each acquisition of data, all previous waveform data remains on the display area. This mode is useful for finding waveform anomalies that occur infrequently. Persistence Mode is also useful for evaluating signal   |

|                        |  |
|------------------------|--|
|                        | <p>jitter. Scroll, zoom, change display width, or any update of the screen will erase all of the old data and will initiate a new Persistence Mode capture.</p> <p>To turn Persistence On, select Persistence from the View Menu. To turn Persistence Off, select Persistence again from the View Menu.</p> <p><b>Note:</b> scroll, zoom, change display width, or any update of the screen will erase all of the old data.</p> <p>See also: View menu, Toolbar, clear button.</p> |
| <b>Zoom align from</b> | Set cursor Bar (V1, V2, Trigger, Screen (left or center) ) for zoom operate reference.   |

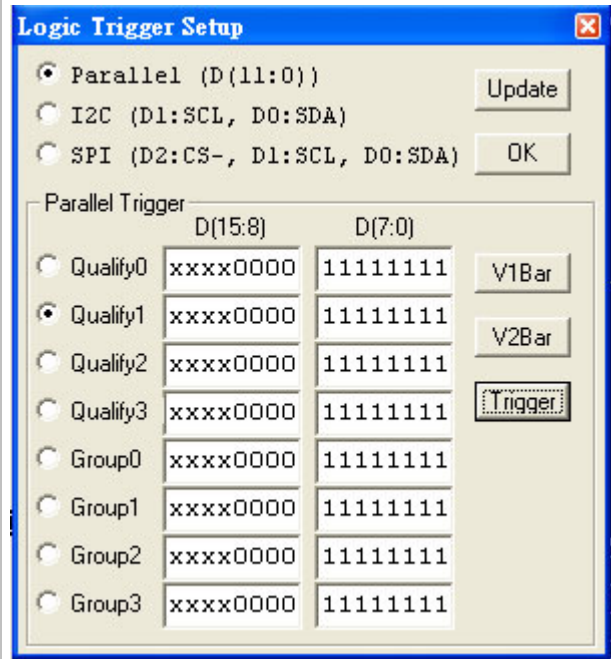
## Setup Menu

|  |   |
|--|---|
|  |   |
| <b>Channel mode</b>  | <p>To select 1 Ch (1Gsa/s sampling) or 2 Ch (500Msa/s) mode in DSO-50212.</p> <p>To select 2 Ch (1Gsa/s sampling) or 4 Ch (500Msa/s) mode in DSO-50412.</p>   |
| <b>Calibration</b>   | <ol style="list-style-type: none"> <li>1. Connect the scope probe Ground Connection to the BNC GND.</li> <li>2. Hold the probe's tip against the calibration point on the BNC center Hole.</li> <li>3. A Square wave signal should appear on the screen.</li> <li>4. Adjust the probe calibration until a true square wave is shown on the screen, noting the corners of the waveform which should be sharp and square, not rounded over or peaky.</li> </ol> |
| <b>Frequency counter</b>   | Precision 7 digital resolution frequency counter for A1, A2, A3, A4 channel.  |
| <b>Software catch</b>  | To capture data rate lower 500Sa/s be used, no Triggering.  |
| <b>Function Channel</b>  | To perform Channel +, -, *, /.  |
| <b>Measurements</b>  | Setup Measure Item.   |
| <b>Initialize (Hardware)</b>   | This function allows you to restart DSO.  |

# Logic Menu



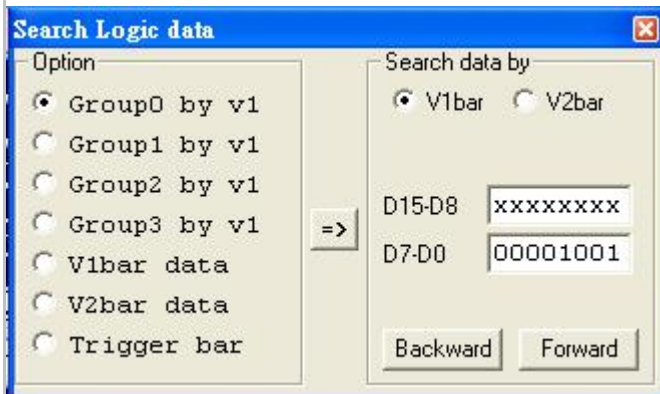
## Trigger word



Set Trigger word for digital channel 11 ~ 0 or Group 0 ~ 3.

The Trigger word backup four Qualify data and four Group data for quickly set digital trigger. conveniently setup from V bars.

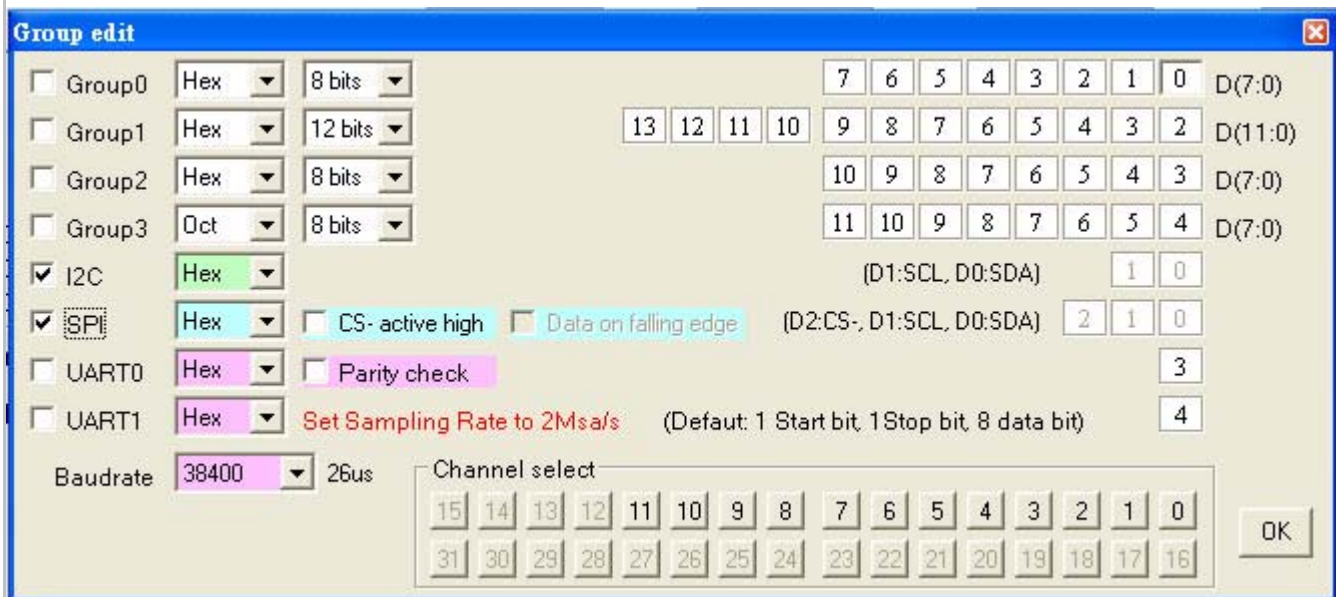
## Search data



The 'Search Logic data' dialog box has a title bar with a close button. It contains two main sections. The left section, titled 'Option', has a list of radio buttons: 'Group0 by v1', 'Group1 by v1', 'Group2 by v1', 'Group3 by v1', 'V1bar data', 'V2bar data', and 'Trigger bar'. A right-pointing arrow button is located between the 'Option' and 'Search data by' sections. The right section, titled 'Search data by', has two radio buttons: 'V1bar' (selected) and 'V2bar'. Below these are two text input fields: 'D15-D8' containing 'xxxxxxxx' and 'D7-D0' containing '00001001'. At the bottom are two buttons: 'Backward' and 'Forward'.

Sorting through all your data is easier with our search feature ! You can specify a search pattern, including Don't Care bits, in any shown numeric bases. Then just click on the forward or backwards search to find what you are looking for !

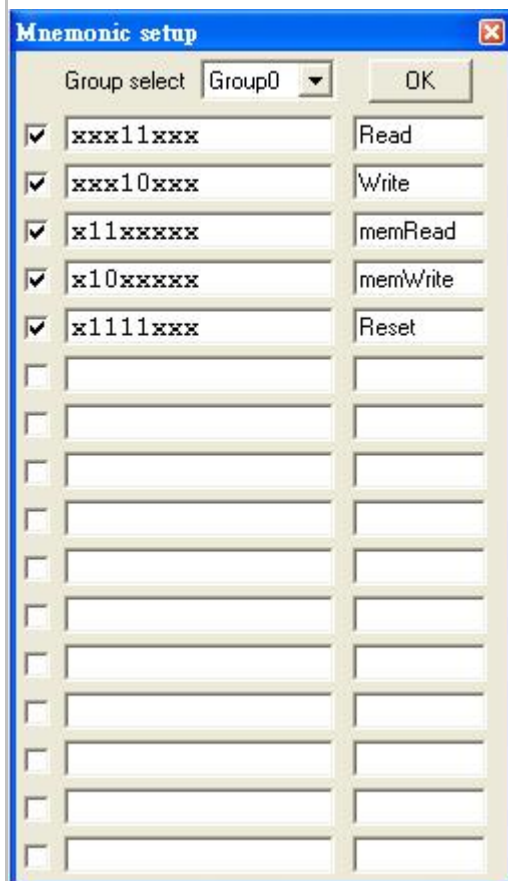
## Group edit



The 'Group edit' dialog box has a title bar with a close button. It contains several sections. On the left, there are checkboxes for 'Group0', 'Group1', 'Group2', 'Group3', 'I2C', 'SPI', 'UART0', and 'UART1'. Each checkbox is followed by a dropdown menu for the data format (Hex, Oct, etc.) and a dropdown for the number of bits (8 bits, 12 bits, etc.). Below these are checkboxes for 'CS- active high' and 'Data on falling edge'. At the bottom left, there is a 'Baudrate' dropdown set to '38400' and a '26us' label. To the right of these are two large grids of buttons for channel selection. The first grid is for 'D(7:0)' and the second is for 'D(11:0)'. Below these are two more grids for 'D(7:0)' and 'D(7:0)'. At the bottom right, there is an 'OK' button.

Edit channel 11 ~ 0 for Group Channel, every Group Channel supports 16 Ch Max. Could be display in Hex, decimal, binary, Oct, or Ascii code.

## Mnemonic edit



The image shows a 'Mnemonic setup' dialog box. It has a title bar with a close button. Below the title bar, there is a 'Group select' dropdown menu currently set to 'Group0' and an 'OK' button. The main area of the dialog is a table with 15 rows. Each row has a checkbox on the left, a text input field in the middle, and a text input field on the right. The first five rows have their checkboxes checked and contain mnemonic codes and their corresponding actions. The remaining ten rows have their checkboxes unchecked and are empty.

| Checkbox                            | Mnemonic Code | Action   |
|-------------------------------------|---------------|----------|
| <input checked="" type="checkbox"/> | xxx11xxx      | Read     |
| <input checked="" type="checkbox"/> | xxx10xxx      | Write    |
| <input checked="" type="checkbox"/> | x11xxxxxx     | memRead  |
| <input checked="" type="checkbox"/> | x10xxxxxx     | memWrite |
| <input checked="" type="checkbox"/> | x1111xxx      | Reset    |
| <input type="checkbox"/>            |               |          |
| <input type="checkbox"/>            |               |          |
| <input type="checkbox"/>            |               |          |
| <input type="checkbox"/>            |               |          |
| <input type="checkbox"/>            |               |          |
| <input type="checkbox"/>            |               |          |
| <input type="checkbox"/>            |               |          |
| <input type="checkbox"/>            |               |          |
| <input type="checkbox"/>            |               |          |
| <input type="checkbox"/>            |               |          |
| <input type="checkbox"/>            |               |          |

As figure Edit Mnemonic code for Groups.

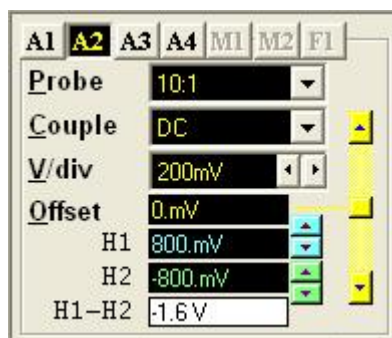
## Backup



### Backup Analog Channel to M1, M2 channel:

|               |                                   |
|---------------|-----------------------------------|
| Copy A1 to M1 | Store channel A1 to M1( memory 1) |
| Copy A1 to M2 | Store channel A1 to M2( memory 2) |
| Copy A2 to M1 | Store channel A1 to M1( memory 1) |
| Copy A2 to M2 | Store channel A1 to M2( memory 2) |

## Channel Box



A different channel can be selected by hitting the "A1, A2, A3, A4, M1, M2, F1" Channel select button.



## Probe

This controls the attenuation level for the probe inputs. This should be set to match the probe itself, either 1x, 10x, 100x or 1000x. When working with signal amplitudes within 200V, either the 1X or the 10X setting can be used. However, if the signal amplitude is outside of 200V, use the 100X setting. Note that using the 10X setting with both the probe and the scope even for signals within 200V will provide better frequency response through the system due to smaller voltage swings through to the digitizer..

Voltage range Probe and probe settings:

5mv/div to 2v/div @probe 1:1

50mv/div to 20v/div @probe 10:1

500mv/div to 200v/div @probe 100:1

5v/div to 2000v/div @probe 1000:1

## Coupling

The three selections available are AC, DC, and GND couple. In the AC setting, the signal for the selected channel is coupled capacitively, effectively blocking the DC components of the input signal and filtering out frequencies below 10 Hz. The input impedance is  $1\text{MW} \parallel 5\text{pF}$ .

In the DC setting, all signal frequency components of the signal for the selected channel, are allowed to pass through. The input impedance is  $1\text{MW} \parallel 5\text{pF}$ .

In the GND setting, both the input and the A/D converter are connected to ground. Again, the input impedance is  $1\text{MW} \parallel 5\text{pF}$ . Use for setting the Ground reference point on the display or if calibrating the DSO board.

## **Volts/Division**

V/div controls the vertical sensitivity factor in Volts/division for the selected analog channel.

Each V/div step follows in a 1-2-5 sequence.

To get the best representation of the input signal, set V/div such that the maximum amplitude swing is displayed on the screen.

This will match the signal amplitude to use most of the digitizer's range, allowing the most bits to be used.

Volts/division can be set via the V/div Combo to Settings.

Volts/division Probe can be set to

5mV, 10mV, 20mV, 50mV, 100mV, 200mV, 500mV, 1V, 2V (1:1)

50mV, 100mV, 200mV, 500mV, 1V, 2V, 5V, 10V, 20V (10:1)

500mV, 1V, 2V, 5V, 10V, 20V, 50V, 100V, 200V (100:1)

5V, 10V, 20V, 50V, 100V, 200V, 500V, 1000V, 2000V (1000:1)

## **Offset**

This parameter offsets the input signal in relation to the digitizer. This changes the usable input voltage range. The input voltage range is the offset +/- 5 divisions.

Thus if you moved the offset to 1.00V with 1V /division the usable range would be 6.00V to -4.00V. Data outside the input range is clipped and stored as either the max or min input value. The offset references the 0.00V point (GND) for the input channel.

The ground point is marked on the screen by the Ground Point Tick Marks to the right of the Analog Display. To change the offset in this dialog box, move the elevator button in the scroll bar. The offset can also be changed by grabbing and moving the appropriate Ground Point Tick Mark in the analog display area.

Trigger Box

TrigCh

A1

TrigType

+Pulse

Level

-320.mV

Width

> 40 ns

100 ns

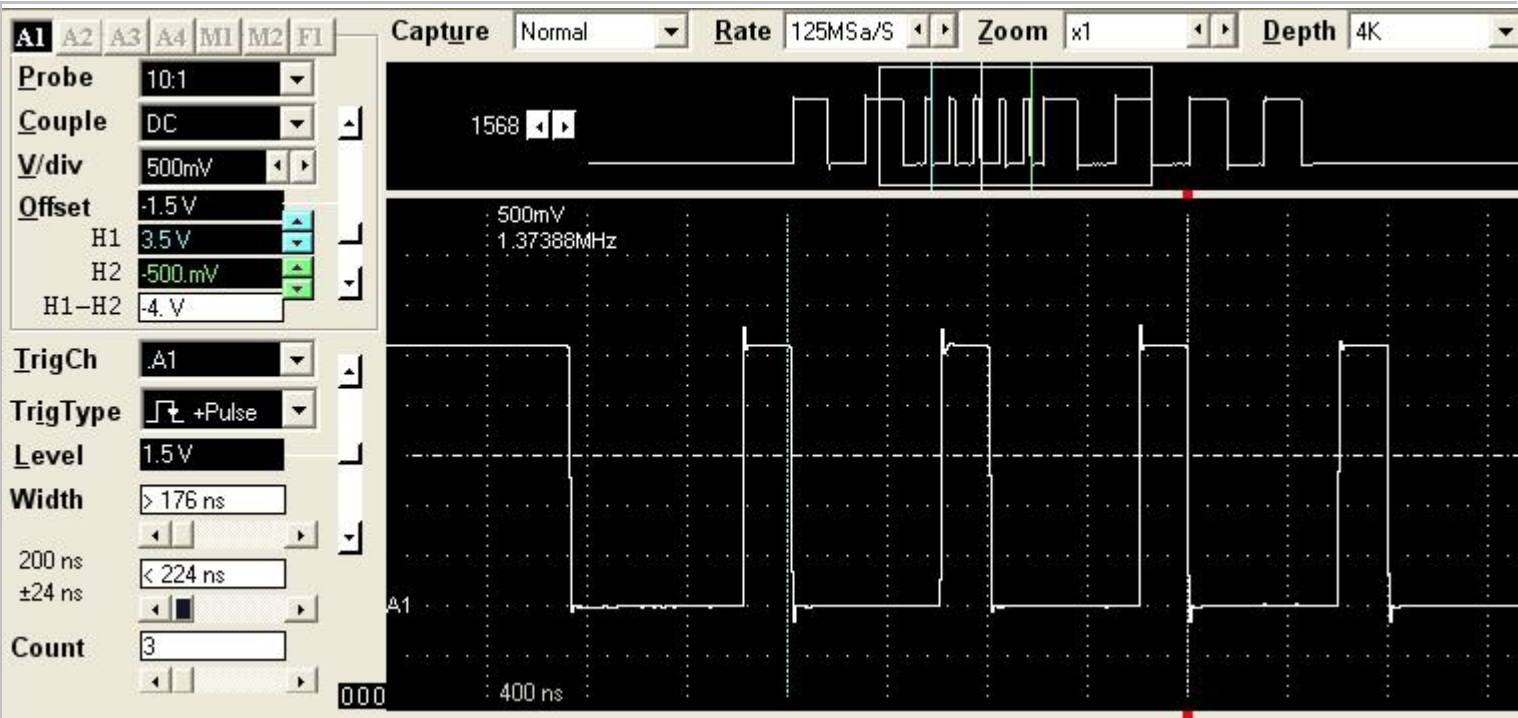
< 160 ns

±60 ns

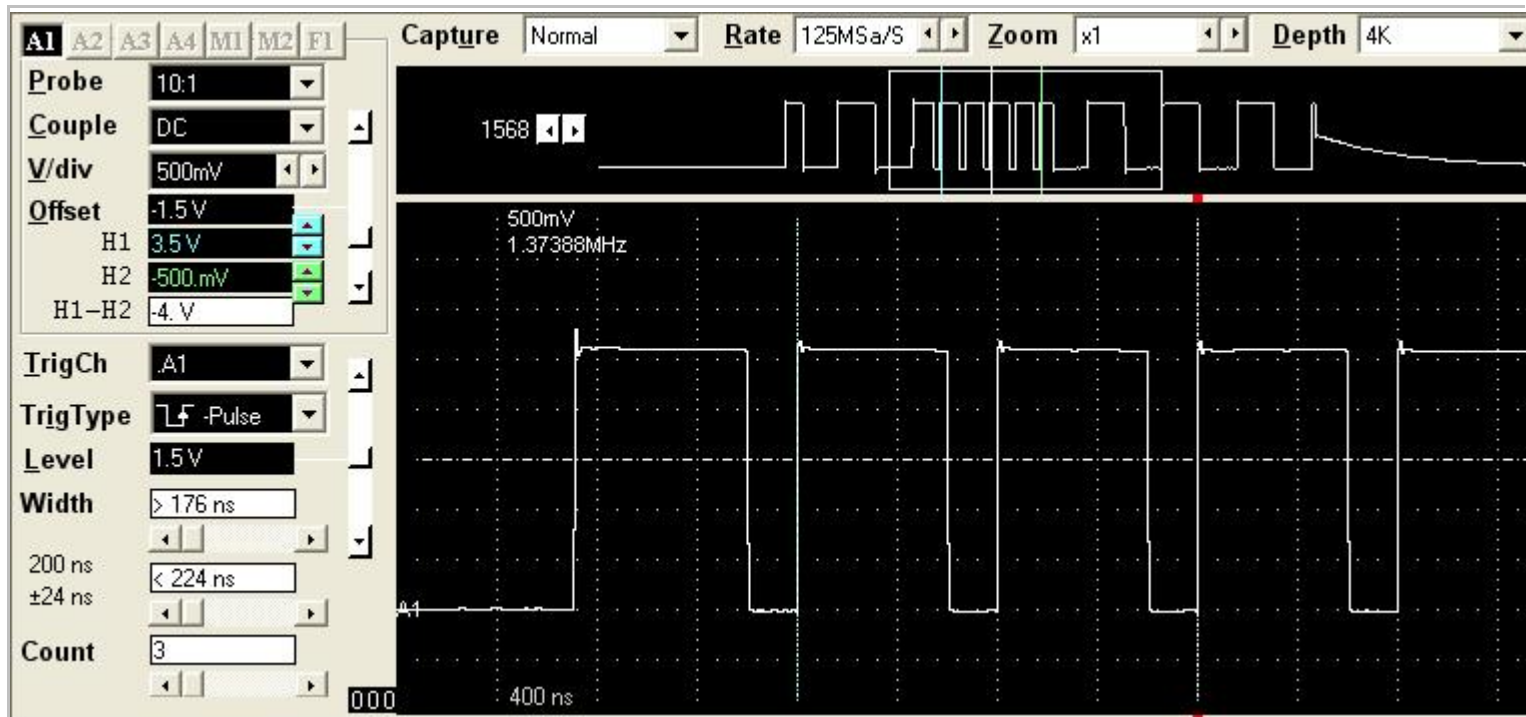
Count

3

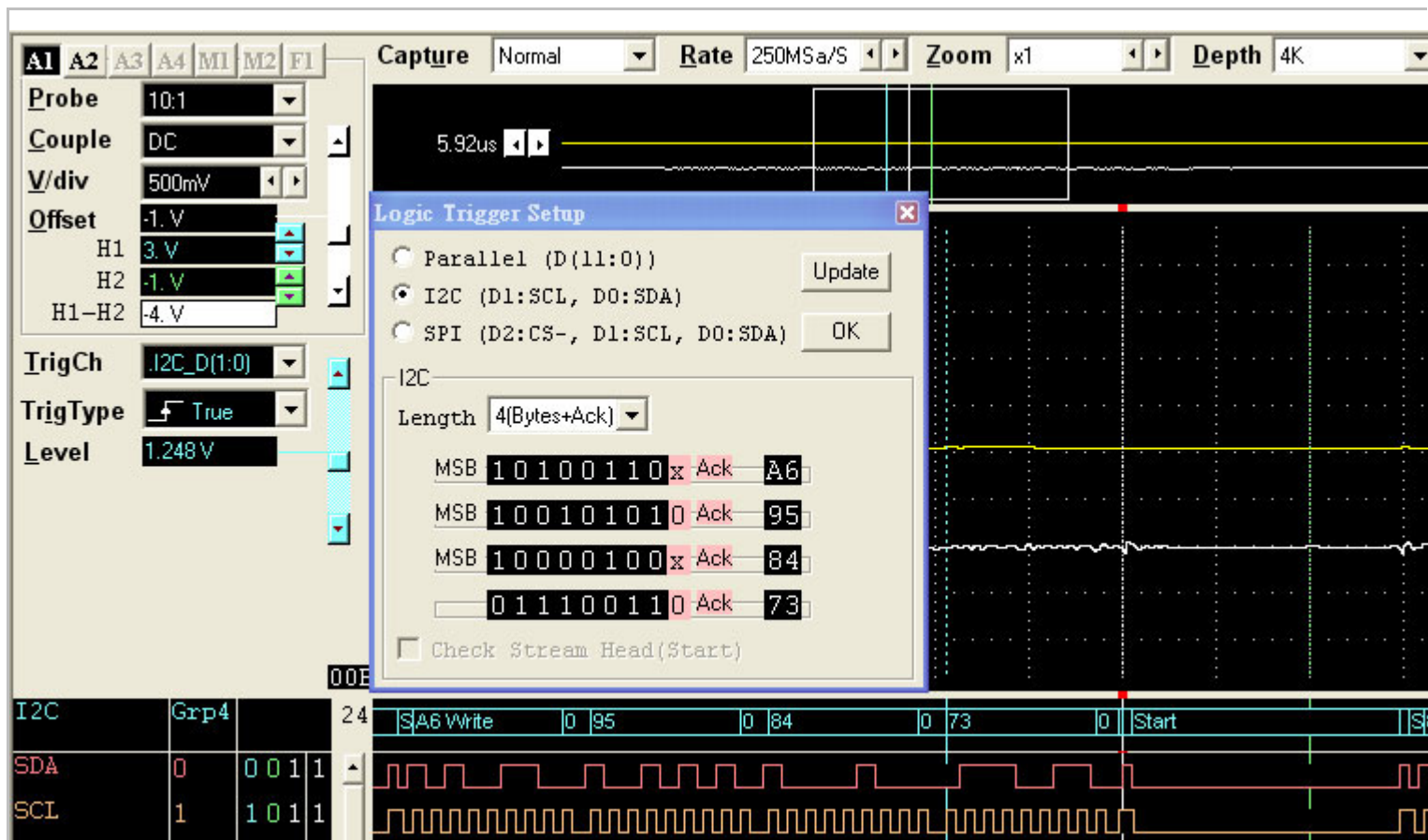
|                     |   |
|---------------------|---|
| TrigCh              | To select A1, A2, A3, A4 or Logic pod for Trigger source.                                     |
| TrigType            | To select +Slope, -Slope, +Pulse width, -Pulse width, NTSC/525 or PAL/625 for Analog channel. |
| Level               | To adjust Trigger Level for A1, A2, A3, A4 or Threshold for Logic Channel.                    |
| Width (Pulse width) | To adjust pulse width for A1, A2, A3, A4 Analog Channel trigger.                              |
| Count               | To adjust pulse count for A1, A2, A3, A4 Analog Channel trigger.                              |



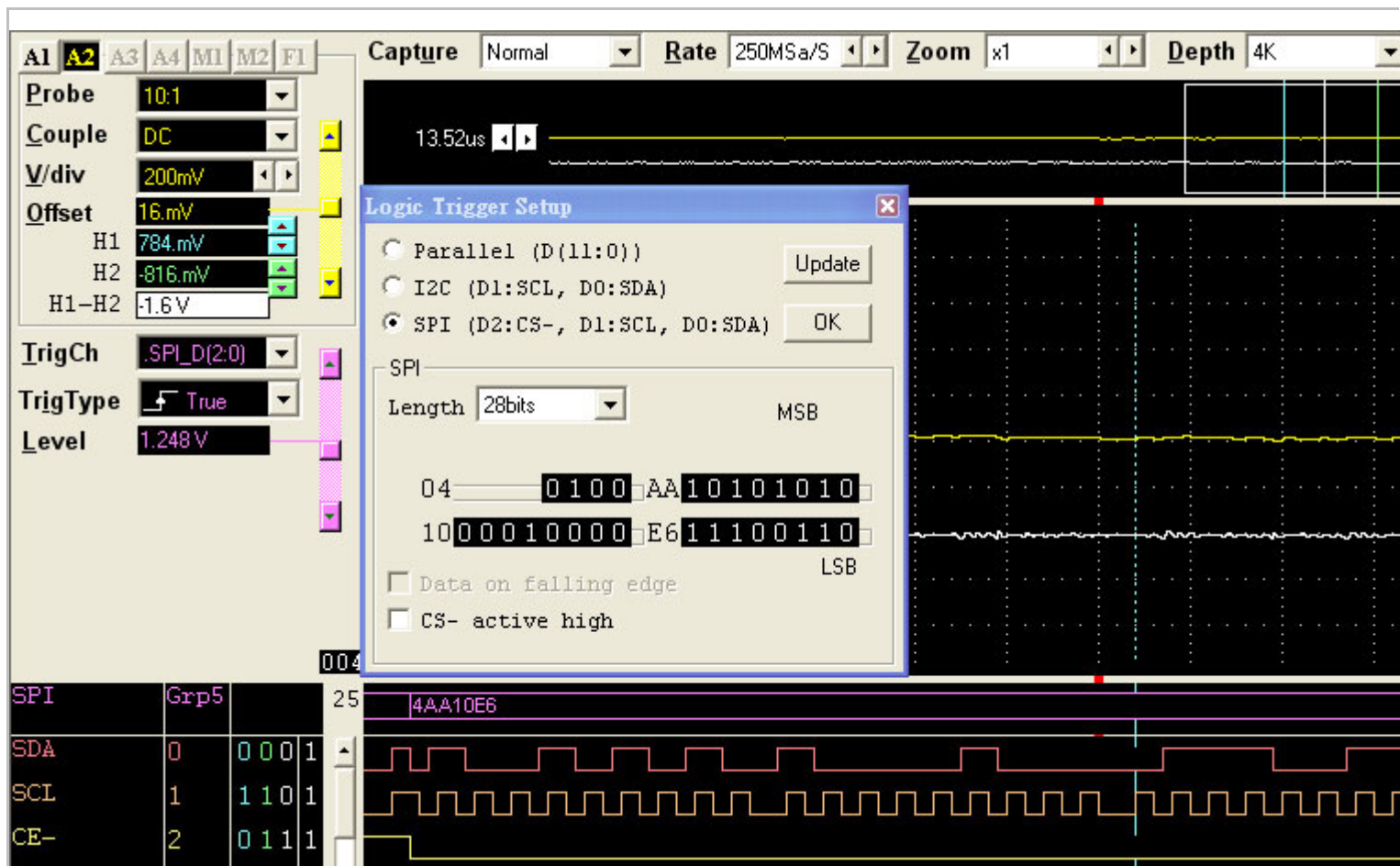
This figure shows 200ns +Pulse width Trigger at third count.



This figure shows 200ns -Pulse width Trigger at third count.

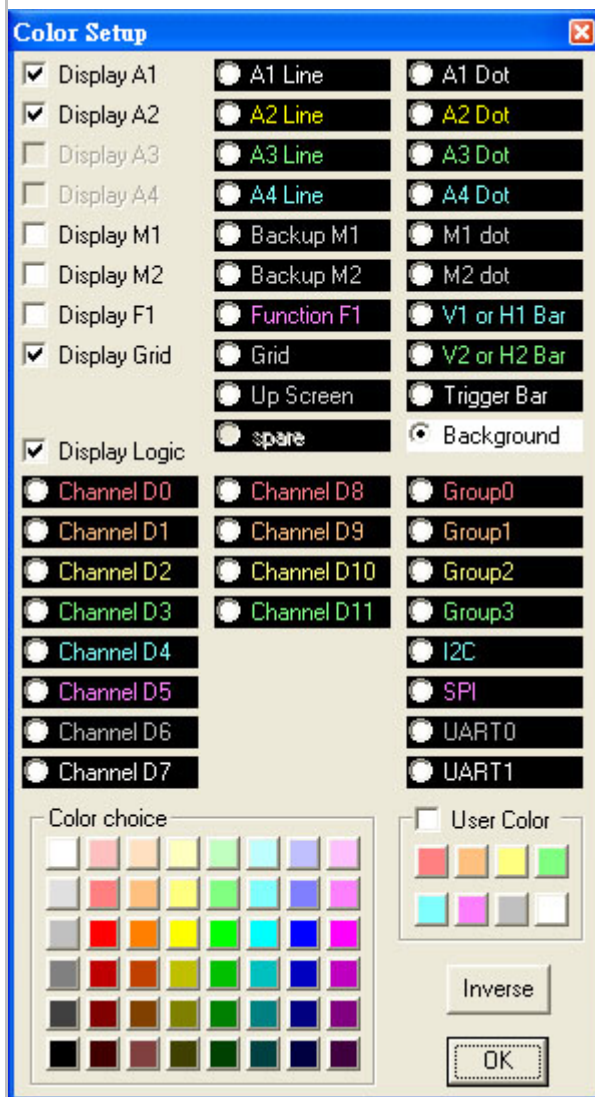


This figure shows 4 (bytes + Ack) I2C Trigger.



This figure shows 28 bits **SPI** Trigger.

## Color Setup



The Color Setup dialog box is a window with a blue title bar and a close button. It contains several sections for configuring colors. On the left, there are checkboxes for 'Display A1' through 'Display A4', 'Display M1' through 'Display M2', 'Display F1', 'Display Grid', and 'Display Logic'. The main area is divided into three columns of radio buttons. The first column includes 'A1 Line', 'A2 Line', 'A3 Line', 'A4 Line', 'Backup M1', 'Backup M2', 'Function F1', 'Grid', 'Up Screen', 'spare', 'Channel D0' through 'Channel D7'. The second column includes 'A1 Dot', 'A2 Dot', 'A3 Dot', 'A4 Dot', 'M1 dot', 'M2 dot', 'V1 or H1 Bar', 'V2 or H2 Bar', 'Trigger Bar', 'Background', 'Channel D8' through 'Channel D11', 'I2C', 'SPI', 'UART0', and 'UART1'. The third column includes 'Group0' through 'Group3'. At the bottom left is a 'Color choice' palette with a 6x6 grid of color swatches. At the bottom right is a 'User Color' section with a 2x4 grid of color swatches, an 'Inverse' button, and an 'OK' button.

| Display   | Line/Dot                          | Bar/Group                                   |
|---|-----------------------------------|---|
| <input checked="" type="checkbox"/> Display A1    | <input type="radio"/> A1 Line     | <input type="radio"/> A1 Dot                |
| <input checked="" type="checkbox"/> Display A2    | <input type="radio"/> A2 Line     | <input type="radio"/> A2 Dot                |
| <input type="checkbox"/> Display A3               | <input type="radio"/> A3 Line     | <input type="radio"/> A3 Dot                |
| <input type="checkbox"/> Display A4               | <input type="radio"/> A4 Line     | <input type="radio"/> A4 Dot                |
| <input type="checkbox"/> Display M1               | <input type="radio"/> Backup M1   | <input type="radio"/> M1 dot                |
| <input type="checkbox"/> Display M2               | <input type="radio"/> Backup M2   | <input type="radio"/> M2 dot                |
| <input type="checkbox"/> Display F1               | <input type="radio"/> Function F1 | <input type="radio"/> V1 or H1 Bar          |
| <input checked="" type="checkbox"/> Display Grid  | <input type="radio"/> Grid        | <input type="radio"/> V2 or H2 Bar          |
| <input checked="" type="checkbox"/> Display Logic | <input type="radio"/> Up Screen   | <input type="radio"/> Trigger Bar           |
|   | <input type="radio"/> spare       | <input checked="" type="radio"/> Background |
| <input type="radio"/> Channel D0                  | <input type="radio"/> Channel D8  | <input type="radio"/> Group0                |
| <input type="radio"/> Channel D1                  | <input type="radio"/> Channel D9  | <input type="radio"/> Group1                |
| <input type="radio"/> Channel D2                  | <input type="radio"/> Channel D10 | <input type="radio"/> Group2                |
| <input type="radio"/> Channel D3                  | <input type="radio"/> Channel D11 | <input type="radio"/> Group3                |
| <input type="radio"/> Channel D4                  |                                   | <input type="radio"/> I2C                   |
| <input type="radio"/> Channel D5                  |                                   | <input type="radio"/> SPI                   |
| <input type="radio"/> Channel D6                  |                                   | <input type="radio"/> UART0                 |
| <input type="radio"/> Channel D7                  |                                   | <input type="radio"/> UART1                 |

Color choice: [6x6 grid of color swatches]

User Color: [2x4 grid of color swatches]

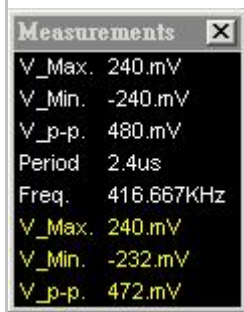
Inverse

OK

The color of each channel, Group, cursor line(V1, V2, Trigger bar, Screen, H1,H2)... can be set independently.



## Measurements



Automatic measurements on input waveforms can be performed. These include frequency, period, rise time, fall time, min, max, area, ....

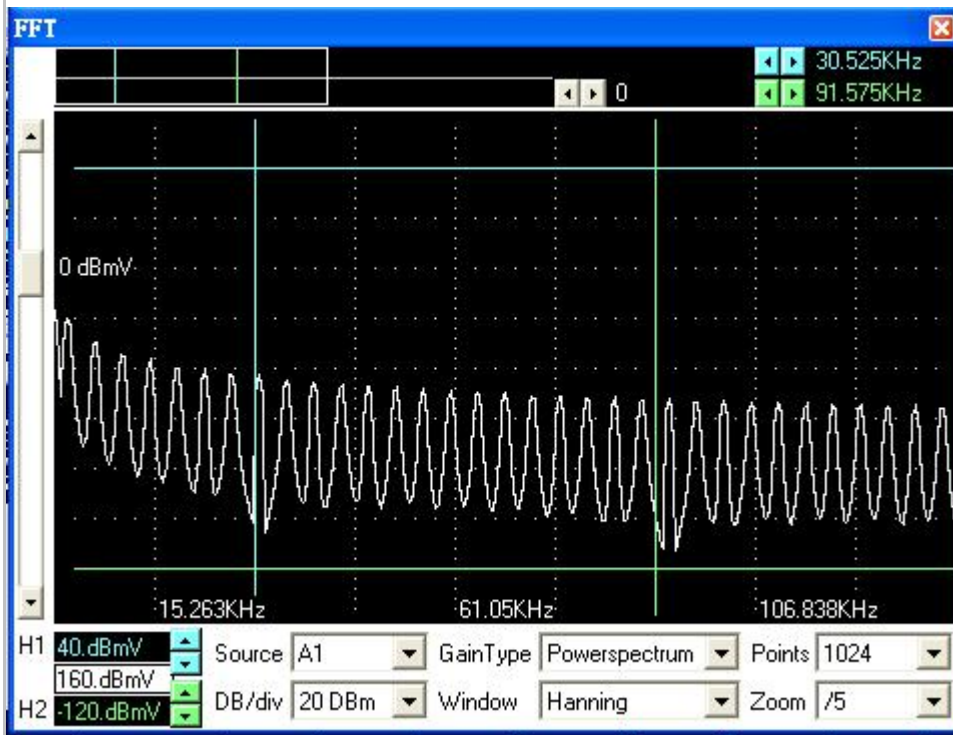
Pulse parameter measurements are performed as specified by ANSI/IEEE std 181-1977 IEEE Standard on Pulse Measurement and Analysis by Objective Techniques.

Up to 10 signal parameters can be measured, tested, and displayed simultaneously. To setup A measurement, select the [Measurements \(Setup menu\)](#) and choose one of the tests to setup (1 to 11).

## Parameter Measurements

|                               |  |
|-------------------------------|--|
| <b>Area</b>                   | Sum of all voltages * sample time.   |
| <b>V1Bar (time)</b>           | V1Bar (time) position of V1Bar in time.  |
| <b>V2Bar (time)</b>           | V2Bar (time) position of V2Bar in time.  |
| <b>Trigger (time)</b>         | Trigger position of trigger Bar in time.   |
| <b>V1-V2 (time)</b>           | Time difference between V1Bar and V2Bar.   |
| <b>V1-trigger (time)</b>      | Time difference between V1Bar and Trigger.   |
| <b>V2-trigger (time)</b>      | Time difference between V2Bar and Trigger.   |
| <b>H1-H2 (voltage)</b>        | Voltage difference between H1Bar and H2Bar.  |
| <b>V_max.</b>                 | Maximum voltage.   |
| <b>V_min.</b>                 | Minimum voltage.   |
| <b>V_p-p.</b>                 | The difference between maximum and minimum voltages.   |
| <b>V_avg.</b>                 | Average of minimum and maximum voltages.   |
| <b>rms SQRT</b>               | $( (1/ \# \text{ samples}) * ( \text{sum} ( \text{each voltage} ) * ( \text{each voltage} ) ) )$                             |
| <b>rms (AC) SQRT</b>          | $( (1/ \# \text{ samples}) * ( \text{sum} ( \text{each voltage} - \text{mean} ) * ( \text{each voltage} - \text{mean} ) ) )$ |
| <b>Period</b>                 | Average time for a full cycle for all full cycles in range.  |
| <b>Risetime(10..90)</b>       | Average time for a rising transition between the 10% to the 90% points.  |
| <b>Risetime(20..80)</b>       | Average time for a rising transition between the 20% to the 80% points.  |
| <b>Falltime(10..90)</b>       | Average time for a falling transition between the 10% to the 90% points.   |
| <b>Falltime(20..80)</b>       | Average time for a falling transition between the 20% to the 80% points.   |
| <b>Pulse width (positive)</b> | Average width of positive pulses measured at 50% level.  |
| <b>Pulse width (negative)</b> | Average width of negative pulses measured at 50% level.  |
| <b>Frequency</b>              | Average frequency of waveform.   |

## FFT



The FFT window allows control and display of FFT's.

The following controls are available:

Window Select the FFT window type: (Triangular, Hanning, Hamming, Blackman-Harris, Rectangular, Wetch and Parzen).

Sample points Select how many points the FFT will sample, points can't exceed memory depth. Horizontal zoom Select horizontal zoom ratio.

The FFT routines will process the selected channel starting at V1Bar and continue until "Sample Points" number of points has been reached. If V1Bar is not within the buffer, start of buffer will be used.

Further information on FFT's can be found in the following sources:

Embedded Systems Programming magazine Volume 3, Number 5, May. 1990

Embedded Systems Programming magazine Volume 7, Number 9, Sept. 1994

Embedded Systems Programming magazine Volume 7, Number 10, Oct. 1994

Embedded Systems Programming magazine Volume 8, Number 1, Jan. 1995

Embedded Systems Programming magazine Volume 8, Number 2, Feb. 1995

Embedded Systems Programming magazine Volume 8, Number 5, May. 1995

Circuit Cellar Ink, The Computer Applications Journal Issue 52 Nov. 1994

Circuit Cellar Ink, The Computer Applications Journal Issue 61 Aug. 1995

Dr. Dobb's Journal Issue 227 Feb. 1995



## State List

| State display |                |                            |            |
|---------------|----------------|----------------------------|------------|
| Mnemonic      | [Key function] | ↑ ↓ Home End Page ↑ Page ↓ |            |
| Position      | D15-D0         | Group2                     | Group3     |
| 40            | 1428           | 00010100                   |            |
| 41            | 1429           | 00010100                   |            |
| 42            | 152A           | 00010101                   |            |
| 43            | 152B           | 00010101                   |            |
| 44            | 162C           | 00010110                   |            |
| 45            | 162D           | 00010110                   |            |
| 46            | 172E           | 00010111                   |            |
| 47            | 172F           | 00010111                   |            |
| 48            | 1830           | 00011000                   |            |
| 49            | 1831           | 00011000                   |            |
| 50            | 1932           | 00011001                   | !          |
| 51            | 1933           | 00011001                   | !          |
| 52            | 1A34           | 00011010                   | A          |
| 53            | 1A35           | 00011010                   | Q          |
| 54            | 1B36           | 00011011                   | a          |
| 55            | 1B37           | 00011011                   | q          |
| 56            | 1C38           | 00011100                   |            |
| 57            | 1C39           | 00011100                   |            |
| 58            | 1D3A           | 00011101                   |            |
| 59            | 1D3B           | 00011101                   |            |
| 60            | 1E3C           | 00011110                   |            |
| 61            | 1E3D           | 00011110                   |            |
| 62            | 1F3E           | 00011111                   | Reset      |
| 63            | 1F3F           | 00011111                   | Reset      |
| 64            | 2040           | 00100000                   | Write      |
| 65            | 2041           | 00100000                   | Write      |
| 66            | 2142           | 00100001                   | Read "     |
| 67            | 2143           | 00100001                   | Read 2     |
| 68            | 2244           | 00100010                   | memRead B  |
| 69            | 2245           | 00100010                   | memRead R  |
| 70            | 2346           | 00100011                   | memWrite b |
| 71            | 2347           | 00100011                   | memWrite r |
| 72            | 2448           | 00100100                   |            |
| 73            | 2449           | 00100100                   |            |
| 74            | 254A           | 00100101                   |            |
| 75            | 254B           | 00100101                   |            |
| 76            | 264C           | 00100110                   |            |
|               |                | 00100110                   |            |

Channels can be organized into groups and be displayed on screen in ASCII, binary, decimal, hex-decimal, and user defined mnemonics.

Channels can be displayed in any sequence. Time between V1bar, V2bar, and Trigger is displayed.

## USB driver install

### Windows 2000 USB driver install

When USB2.0 control interface be connected to computer, screen will display as following:



Click Next to continue



Click Next to continue



Click Next to continue



Edit or browse path to ...\\USB20driver\\win2000\_XP\\gene.inf  
(here F: is CD location, dso25216 may be dso29xxA/B)  
Press OK

## Upgrade Device Driver Wizard

### Driver Files Search Results

The wizard has finished searching for driver files for your hardware device.



The wizard found a driver for the following device:



USB2.0 Device

Windows found a driver that is a closer match for this device than your current driver. To install the driver Windows found, click Next.



f:\dso25216\usb20driver\win2000\_xp\gene.inf

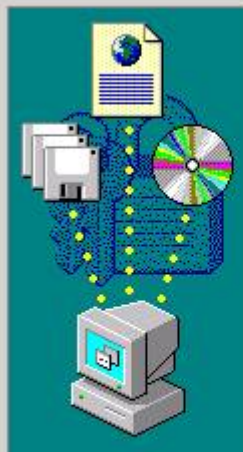
< Back

Next >

Cancel

Click Next to continue

## Digital Signature Not Found



The Microsoft digital signature affirms that software has been tested with Windows and that the software has not been altered since it was tested.

The software you are about to install does not contain a Microsoft digital signature. Therefore, there is no guarantee that this software works correctly with Windows.

Usb2.0 Controller 5

If you want to search for Microsoft digitally signed software, visit the Windows Update Web site at <http://windowsupdate.microsoft.com> to see if one is available.

Do you want to continue the installation?

Yes

No

More Info

Click Yes to continue



Completing install

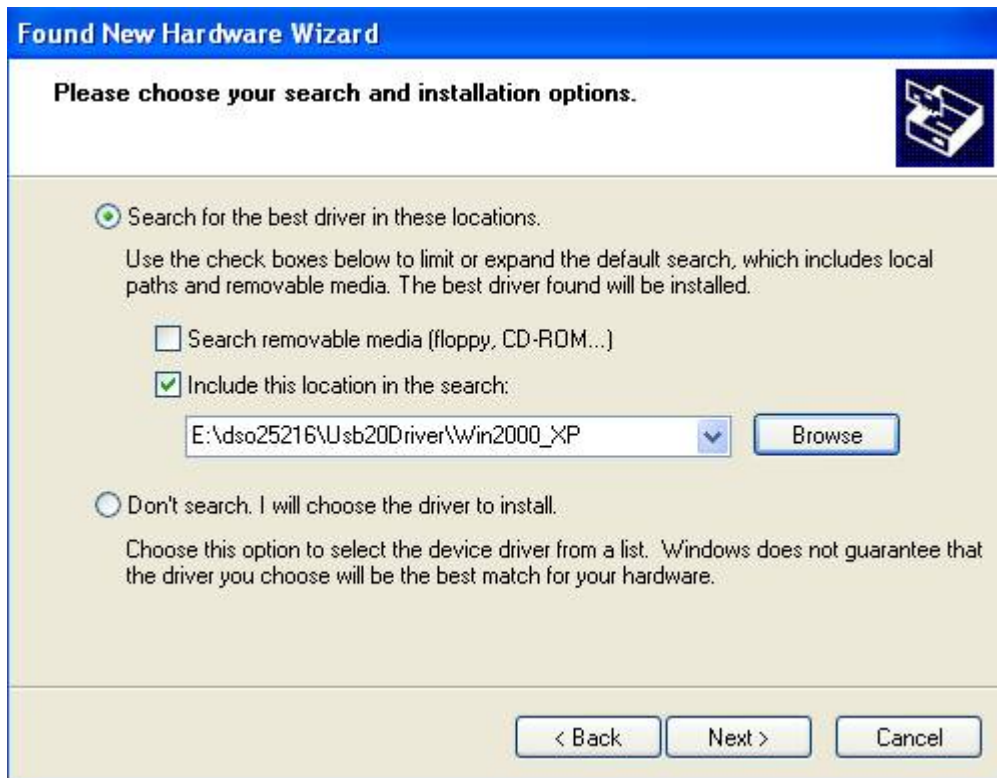
Windows XP USB driver install

When USB2.0 control interface be connected to computer, screen will display as following:



Click Next to continue





Edit or browse path to ...\\USB20driver\\win2000\_XP\\gene.inf

(here E: is CD location, dso25216 may be dso29xxA/B)

Click Next to continue



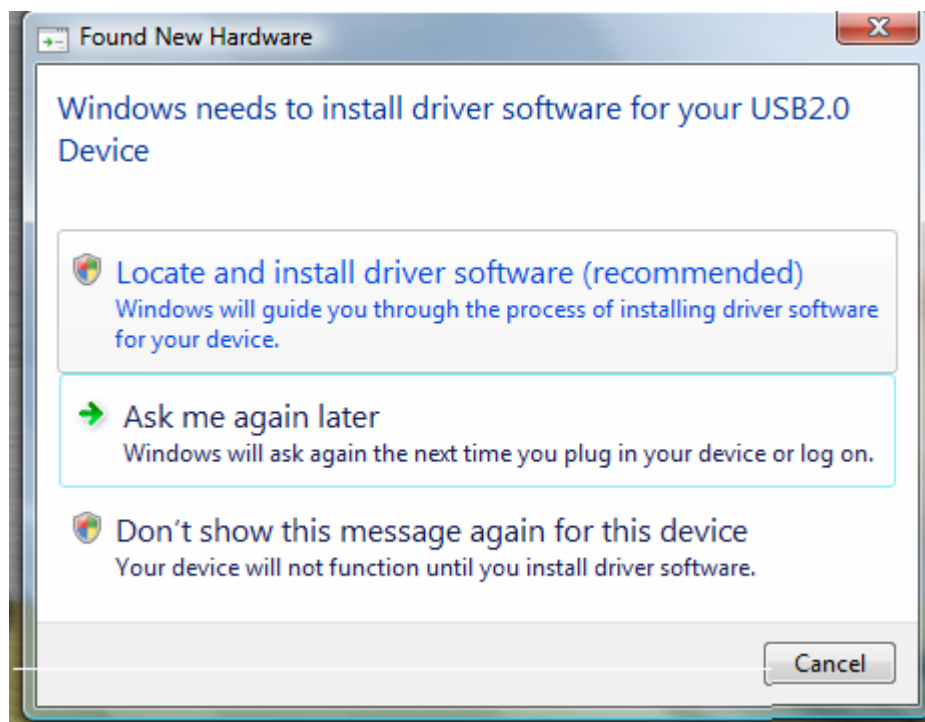
Press Continue Anyway



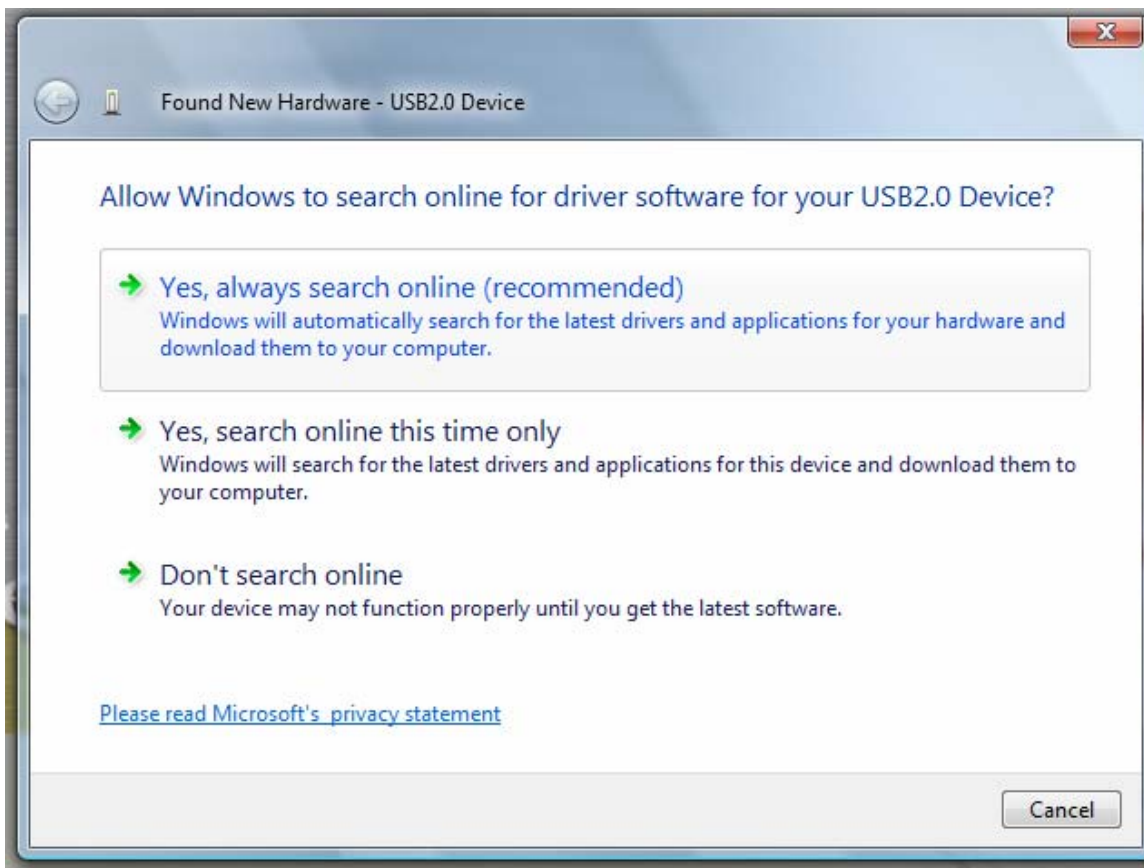
Completing install

### Windows Vista USB driver install

When USB2.0 control interface be connected to computer, screen will display as following:



Press **Locate and install driver software (recommended)** Continue Anyway



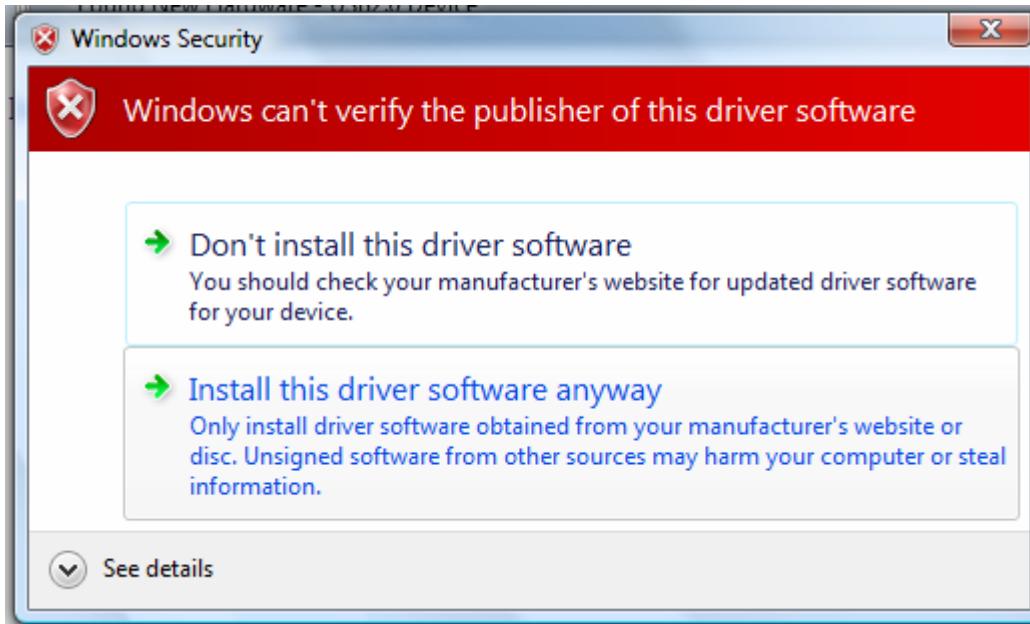
Press Continue Anyway



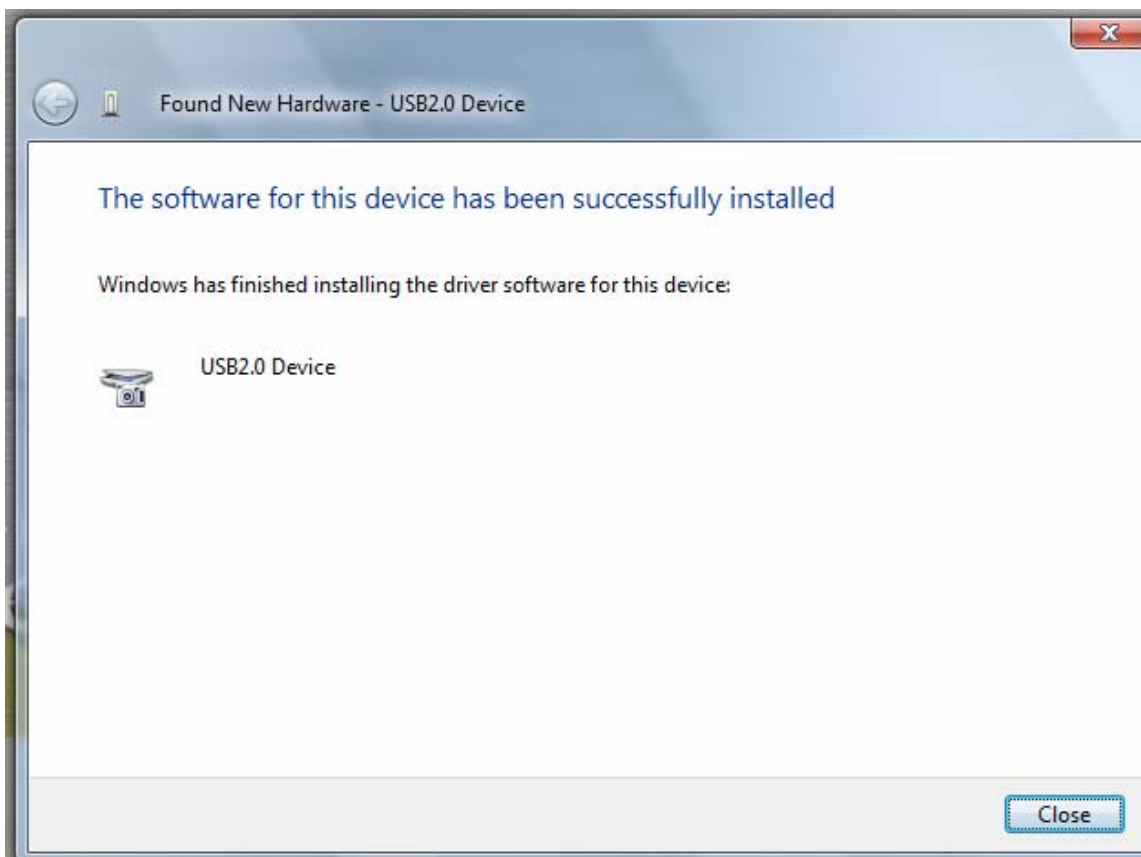


Press **Insert the disc that came with your USB2.0 Device**

Click Next to continue



Press **Install this driver software anyway** to Continue



Completing install

## Technical Support

Technical Support



CLOCK COMPUTER CORP.

克拉克電腦股份有限公司

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## Software Updates

Software can be downloaded from our website

Web: [www.clock-link.com.tw](http://www.clock-link.com.tw)

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Email: [ufclockc@ms9.hinet.net](mailto:ufclockc@ms9.hinet.net)

## APPENDIX

### Fast Fourier Transformations

#### Understanding FFT's Application

##### Introduction to FFT

Detecting and measurement are the basic functions of signal processing. In some application, it is important to analyze the periodic components of sinusoidal signals. FFT can serve as a tool to dismember a signal into its periodic components for analysis purposes.

#### Typical FFT of Applications

- 1) Antenna's directional diagram is a function of Fourier's Transformation of transmitting current.
- 2) On the front and back focus planes of convex lens in an optical system, the amplitude distribution is a Fourier's Transformation.
- 3) In Probability, a power density spectrum is a Fourier's Transformation.
- 4) In Quantum Theory, the Momentum and Location of a particle are connected through Fourier' Transformation.
- 5) In Linear System, Fourier Transformation is the product of System Transmission Function times Input Signal Fourier Transformation.
- 6) The Noise Analysis of signal detecting can be obtained through Fourier Transformation. These are all different applications, but they share the same analytical path which is Fourier Transformation.

#### Fundamental Principles

The Fourier Transformation Formula:

$$F(x) = (1/M) \sum_{K=0}^{2M-1} T_k \{ \cos [2\pi K (x/M)] + i \sin [2\pi K (x/M)] \}$$

$T_k$  : The mapping data value for the Time Domain.

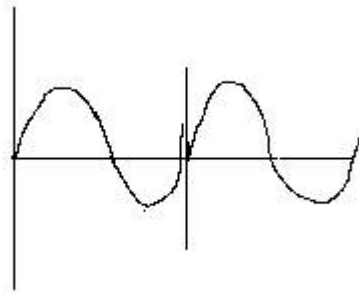
$F(x)$  : The mapping data value for the Frequency Domain.

$M$  : FFT data length.

$X$  : The mapping data value for the Frequency Domain.

$i$  : Imaginary number.

The result of the formula is a vector of complex number. To show this on the screen, we present the Frequency as horizontal coordinate, we make the leftmost position representing zero frequency that is the direct current component. Harris had pointed out that due to periodic characteristics of FFT, we could observe the phenomena of discontinuation at the binderies of a finite length sequence. Therefore when we select randomly a signal sample, we could see points of discontinuation as a result of periodic expansion. This would produce leakage of Frequency Spectrum across the whole frequency band. To suppress the amplitude of sample around the binderies, we must apply Weight Function to it.



discontinuation

The Vertical Axis on the screen is expressed in terms of Magnitude, Decibel (db) and Logarithm.

## Magnitude

$$M_n = \sqrt{R_n^2 + I_n^2}$$

## Decibel (db)

$$\begin{aligned} \text{dbm Ps} &= 10 \log (M_n^2 / M_{\text{ref}}^2) \\ &= 20 \log (M_n / M_{\text{ref}}) \end{aligned}$$

Here  $M_{\text{ref}}$  represents the reference value. It is define as 0 dbm or 0.316 V Peak-to-Peak Value or Effective Value 0.244V. It is define as 1.0 mW or it is defined as Resistance Value 50  $\Omega$ .

## Logarithm

In this mode, the display is expressed in decibel and the Measurement is expressed in Magnitude.

Generally speaking, the Spectrum Processing System is expressed in the following formula:

$$Y(k) = \sum_{n=0}^{N-1} A(n) * X(k-n)$$

This formula utilizes Weighting function that is also known as Window. For example, Hanning, Hamming, Blackman, Triangle and Rectangle. These are further explained as following:

Hanning: It is  $\cos \alpha (\theta)$  type window, expressed mathematically as following:

$$a(n) = 0.5 [ 1 - \cos ( 2 \pi n / N ) ]$$

Hamming: It is similar to Hanning. The only difference is the coefficients for cosine term.

$$a(n) = 0.54 - 0.46 \cos ( 2 \pi n / N ) , n = 0, 1, 2, \dots, N-1$$

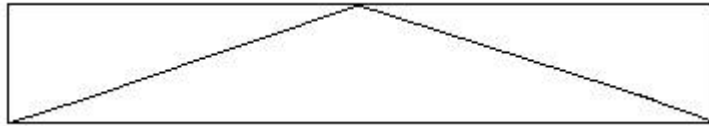
Blackman: It is the sum of a series of cosine terms. It is equal to Weighting function.

$$a(n) = \sum_{m=0}^M (-1)^m b(m) \cos ( 2 \pi n m / N ) , n = 0, 1, 2, \dots, N-1$$

Triangle: Triangle Weighting Function, It is define as following:

$$a(n) = \begin{cases} 2n/N & n=0,1,2,\dots, N/2 \\ a(N-n) & n=(N/2)+1,\dots, N-1 \end{cases}$$

Rectangle: Rectangle Weighting Function



window coefficients



FFT. of window  
Triangle Weighting Function

## The Characteristics of Weight Function

| Window    | Highest Side Lobe | 3db Bandwidth (bins) | 5db Bandwidth (bins) | Scallop Loss (db) |
|-----------|-------------------|----------------------|----------------------|-------------------|
| Hanning   | -35               | 1.54                 | 2.14                 | 1.26              |
| Hamming   | -43               | 1.30                 | 1.81                 | 1.78              |
| Blackman  | -61               | 1.56                 | 2.19                 | 1.27              |
| Triangle  | -27               | 1.28                 | 1.78                 | 1.82              |
| Rectangle | -13               | 0.89                 | 1.21                 | 3.92              |

## Functionality

The functionality of FFT can be achieved through the use of Utility. To use the Utility, We must set Channel/Math first, and then turn on FFT or Bw.sweep. We have to Bear that in mind that we could only analyze one channel at a time. After finish all the settings, we could see the screen showing FFT Channel. We describe the differences between FFT and Bw,sweep as follow:

## FFT

If we are using this mode, we are analyzing Channel A1 or Channel A2 in an Real Time Mode. To achieve the state of Synchronized Display. We are measuring time Domain while we are displaying Fourier Frequency Domain. In addition to that, we are able to analyze the stored signal easily. We only need to read the file on A1 Channel or A2 Channel, and then thrown on FFT. Whether we turn on Go or not is the difference in retrieving signals.

## Bw.Sweep

When turning on this mode, we are analyzing A1 Channel or A2 Channel through the Frequency Sweep Mode to achieve the State of Frequency Output. The user must apply additional frequency to the point of measurement. Also we have to increase the frequency from small to large gradually. The finer the increment of frequency, the better the obtained data will be. Attention must be made to clear the Frequency and record Sweep Frequency again every time when we turn on Go to retrieve signal.

When a user set the Mode, he can also set the FFT parameters. These are the required settings and they are explained as following:

## Source

From channel A1, A2, M1 or M2.

## Points

The points to be used are 256, 512, 1024, 2048, 4096, 8192, 16384 and 33678. The user could think of these points as the scope of period. It can be understood that the more points we are taking, the better the results will be except the speed of it would be sacrificed. This is because the more you analyze the more time it takes to get the job done. It is an user's responsibility to make a judgment as to how a compromise should be achieved.

## Window

The window is also known as (Weighting function), it includes Hanning (a fixed value, generally is peaking), Hamming, Blackman, Triangle and Rectangle. Please refer to the Fundamental Principle of this article. Due to periodic characteristics of FFT, we observe the discontinuation phenomena around the boundaries of the finite length sequence. We must use Window to suppress the amplitude of the sample around the boundaries.

## Gain Type

The Vertical Axis on the screen is expressed in terms of magnitude, Power Spectrum and Logarithm.

- 1. Magnitude:** The magnitude of the Polar Coordinates on the screen.
- 2. Logarithm:** in this mode, it display Power spectrum and the measurement is expressed as Magnitude.

**3. Power Spectrum:** By formula  $P_s = 20 \log (M_n/M_{ref})$ .  
Here  $M_{ref}$  represents the Reference Value of 0.316V.  
It is defined as 0 dbm.  
0.316V p-p or 0.244V Effective Value also known as 1.0mW and the Resistance of 50  $\Omega$ .

The Vertical Axis on the screen is expressed in terms of Magnitude, db or Logarithm. These are explained as following:

- DB/div:** It is active only when Gain Type is set to Power spectrum. It is the unit of the Vertical coordinate. It represents DBm.  
There are four different scales: 5, 10, 20, 50 DBm.
- DB/offset:** It is active only when Gain Type is set to Power spectrum. It can change the position of FFT to make it going up and down.

To obtain the measured data, using Ctrl and Alt keys plus Left or Right key to measure Frequency. To measure Magnitude, we can use Ctrl or Alt key plus Up or Down key. After that we can get the data displayed in the rectangle frame of FFT parameter.

#### **Notes:**

It is highly desirable to confirm the following items before doing analyzing:

- 1) If the measurement is for low frequency, we ought to make sure the frequency of the sample is not too large. Since the larger the frequency of the sample the large the Band Width. The sample frequency needs to be as twice as large as the frequency to be measured.
- 2) It is undersirable to use Logic Analyzer and FFT simultaneously.
- 3) It is desireable to have waveform on the Time Domain. The stronger the waveform the better the accuracy of the results.
- 4) To obtain the highest speed on FFT, we could turn all the channels off except for FFT.
- 5) The values of Depth can be 4K, 64K. When using 4K, we are using the real part and Imaginary part of the integer results of the Simulater Output for independent Probability Noise Signal. The MSE calculation results is obtained using 16 bits FFT processor with db less than 75 DB. If using db value greater than 75 DB, we are going to get too great an inaccuracy. When we are using 64K Depth, we are doing floating point calculation therefore the machine we use must have floating point math coprocessor.