Logic Analyzer
Software Manual

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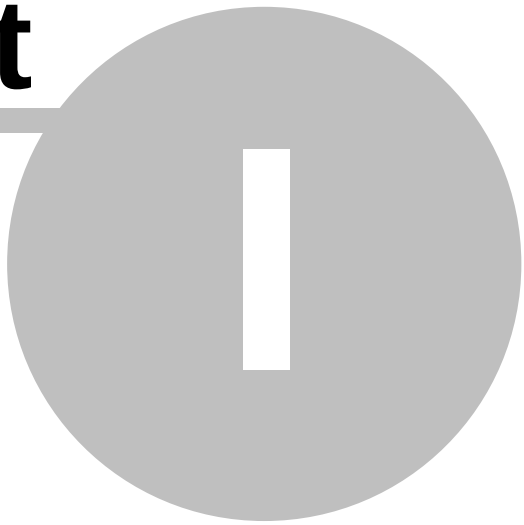

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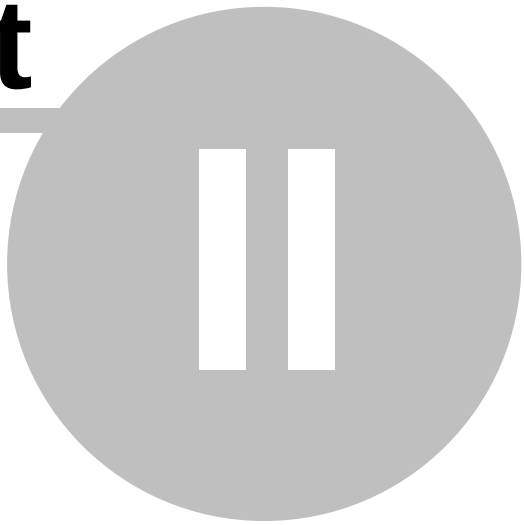
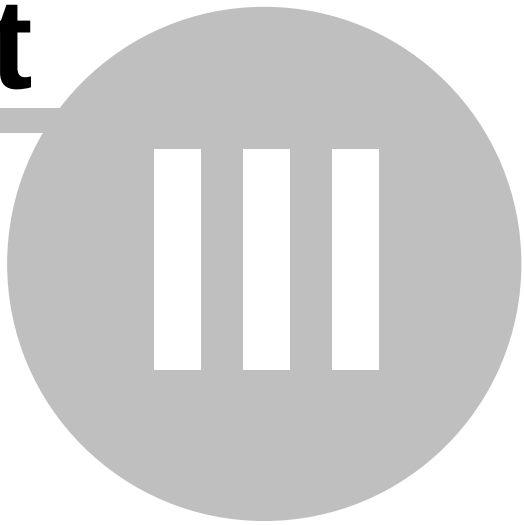


2 Installing software

1. Insert the distribution disk into CD drive.
2. Run Windows.
3. Run windows explorer.
4. Double click on Setup.exe file.
5. Follow the on screen instructions.

Note: You must have administrator privileges to install the software in WinXP\NT\2000\Vista.

Part



3 Installing Hardware

3.1 Installing Hardware

Installing IO-3200

Installing LA-5000 W/USB adapter

Installing LA-5000 to Parallel port

Installing LA-2124 Parallel port based Logic Analyzer

3.2 Installing IO-3200 series USB 2.0 Logic Analyzer/Pattern Generator

Please follow these instructions for installing the IO-3200.

1. Please install the software before installing the Instrument.
2. Locate an available USB port.
3. Connect the included USB cable to USB port.
4. Connect the other end of the USB cable to the IO-3200.

Note: When windows asks for the driver disk insert CD with driver or direct windows to the location of Link Instruments USB driver LINKIO32.INF file.

3.3 Installing LA-2124 Parallel port based Logic Analyzer

Please follow these instructions for installing the LA-2124 Logic Analyzer.

1. Locate an available parallel port.
2. Connect the included DB-25 cable to parallel port.
3. Connect the other end of the DB-25 cable to the LA-2124.
4. Plug the LA2124 power supply into the an AC outlet.
5. Plug the LA2124 power supply into the LA2124.
6. Connect the wires to the Logic Analyzer. See Connecting wires.
7. Make sure the parallel printer port is set to bi-directional mode. This is done in the bios configuration program of your computer.
8. After checking all connections, turn on the computer and peripherals. You are now ready to install the software.

3.4 Installing LA-5000 Parallel port mode

Please follow these instructions for installing the LA-5000 Logic Analyzer in parallel port mode.

1. Locate an available parallel port.
2. Connect the included DB-25 cable to parallel port.
3. Connect the other end of the DB-25 cable to LA.
4. Plug the power supply into the an AC outlet.

5. Plug the power supply into the LA.
6. Connect the pods and wires to the Logic Analyzer. See Installing Pods and Connecting wires.
7. After checking all connections, turn on the computer and peripherals. You are now ready to install the software.

3.5 Installing LA-50000 W/USB 2.0 adapter

Please follow these instructions for installing the LA-5000 Logic Analyzer USB adapter.

1. Locate an available USB port.
2. Connect the included USB cable to USB port.
3. Connect the other end of the USB cable to the LA.
4. Plug the power supply into the an AC outlet.
5. Plug the power supply into the LA.
6. Connect the pods and wires to the Logic Analyzer. See Installing Pods and Connecting wires.
7. After checking all connections, turn on the computer and peripherals. You are now ready to install the software.

Note: When windows asks for the driver disk insert CD with driver or direct windows to the location of Link Instruments USB driver LINKUSB5.INF (Win98/ME) or LINKUSB5_2K.INF (Win2000/XP) file.

3.6 Connecting pods to LA4xxx or LA5000 series

LA-4240-32k
LA-4540-128k
LA-5240
LA-5540

These analyzers have 1 row (Labeled "Board 1") of connectors for 5 pods.
The connectors are labeled 1A, 2A, 3A, 4A and 5A. Connect Pod 1(Ch 0..7), Pod 2(Ch 8..15), Pod 3(Ch 16..23), Pod4(Ch24..31), and pod 5(Ch32..39) to those connectors.

LA-4280-32k
LA-4580-128k
LA-5280
LA-5580

These analyzers have 2 rows (Labeled "Board 1" and "Board 2") of connectors for 10 pods.

"Board 2" is for channels 40..79
he connectors are labeled 1B, 2B, 3B, 4B and 5B. Connect Pod 1(Ch 0..7), Pod 2(Ch 8..15), Pod 3(Ch 16..23), Pod4(Ch24..31), and pod 5(Ch32..39) to those connectors.

"Board 1" is for channels 0..39
he connectors are labeled 1A, 2A, 3A, 4A and 5A. Connect Pod 1(Ch 0..7), Pod 2(Ch 8..15), Pod 3(Ch 16..23), Pod4(Ch24..31), and pod 5(Ch32..39) to those connectors.

LA-45160-128k
LA-55160

This analyzer has 4 rows (Labeled "Board 1", "Board 2", "Board 3" and "Board 4") of connectors for 20 pods.

"Board 4" is for channels 120..159
The connectors are labeled 1D, 2D, 3D, 4D and 5D. Connect Pod 1(Ch 0..7), Pod 2(Ch 8..15), Pod 3(Ch 16..23), Pod4(Ch24..31), and pod 5(Ch32..39) to those connectors.

"Board 3" is for channels 80..119
The connectors are labeled 1C, 2C, 3C, 4C and 5C. Connect Pod 1(Ch 0..7), Pod 2(Ch 8..15), Pod 3(Ch 16..23), Pod4(Ch24..31), and pod 5(Ch32..39) to those connectors.

"Board 2" is for channels 40..79
The connectors are labeled 1B, 2B, 3B, 4B and 5B. Connect Pod 1(Ch 0..7), Pod 2(Ch 8..15), Pod 3(Ch 16..23), Pod4(Ch24..31), and pod 5(Ch32..39) to those connectors.

"Board 1" is for channels 0..39
The connectors are labeled 1A, 2A, 3A, 4A and 5A. Connect Pod 1(Ch 0..7), Pod 2(Ch 8..15), Pod 3(Ch 16..23), Pod4(Ch24..31), and pod 5(Ch32..39) to those connectors.

Note:
Any of the input channels can be used as "Trigger-in"

See also: Connecting wires.

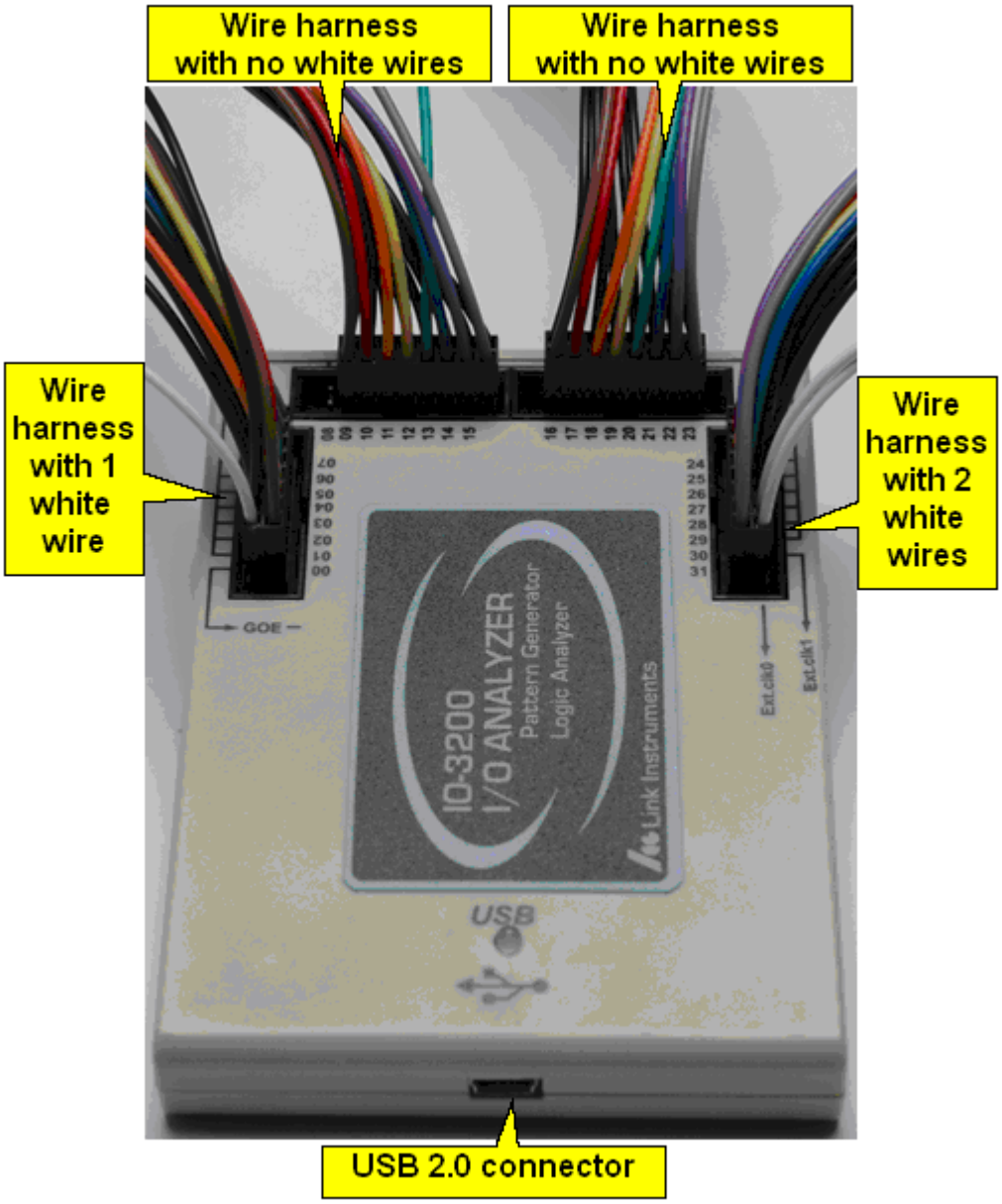
3.7 Connecting wires to the Logic Analyzer

IO-3200 series

These analyzers have 4 connectors.

Connector 1:	00, 01, 02, 03, 04, 05, 06, 07	Channels 0..7
	GOE-	Global Output Enable
	GND	Ground Connections
Connector 2:	08, 09, 10, 11, 12, 13, 14, 15	Channels 8..15
	GND	Ground Connections
Connector 3:	16, 17, 18, 19, 20, 21, 22, 23	Channels 16..23
	GND	Ground Connections
Connector 4:	24, 25, 26, 27, 28, 29, 30, 31	Channels 24..31
	Ext. clk0	External Clock 0
	Ext. clk1	External Clock 1 or Trigger Out (software selectable)
	GND	Ground Connections

Each IO-3200 series unit ships with 4 wire harnesses designed to plug into these connectors. Each harness has 8 colored wires for the channel connections. The black wires are for ground and the white wires are for external clock and output disable.



LA-4240-32k
LA-4540-128k
LA-4280-32k
LA-4580-128k
LA-45160-128k
LA-5240
LA-5280
LA-5540
LA-5580
LA-55160

Each pod has 8 channels and 3 ground connections. Each of the grounds is tied together. Push wires onto the posts. Make sure that the wire is actually on the post. It is possible to jam

the wire between the post and the plastic case and not make a connection.

The BNC on the back on the Logic Analyzer is a trigger out signal. This pin goes low when you hit Go and then goes to logic High when the instrument triggers.

LA-2124-128K

The LA-2124-128K has 40 pins. They are organized as follows:

Top row:

0..15 Channels 0..15

CLK External clock input

Trig External trigger out. This pin goes low when you hit Go and then goes to logic High when the instrument triggers.

GND Ground connection

Bottom row:

16..23 Channels 16..23

NC Not connected

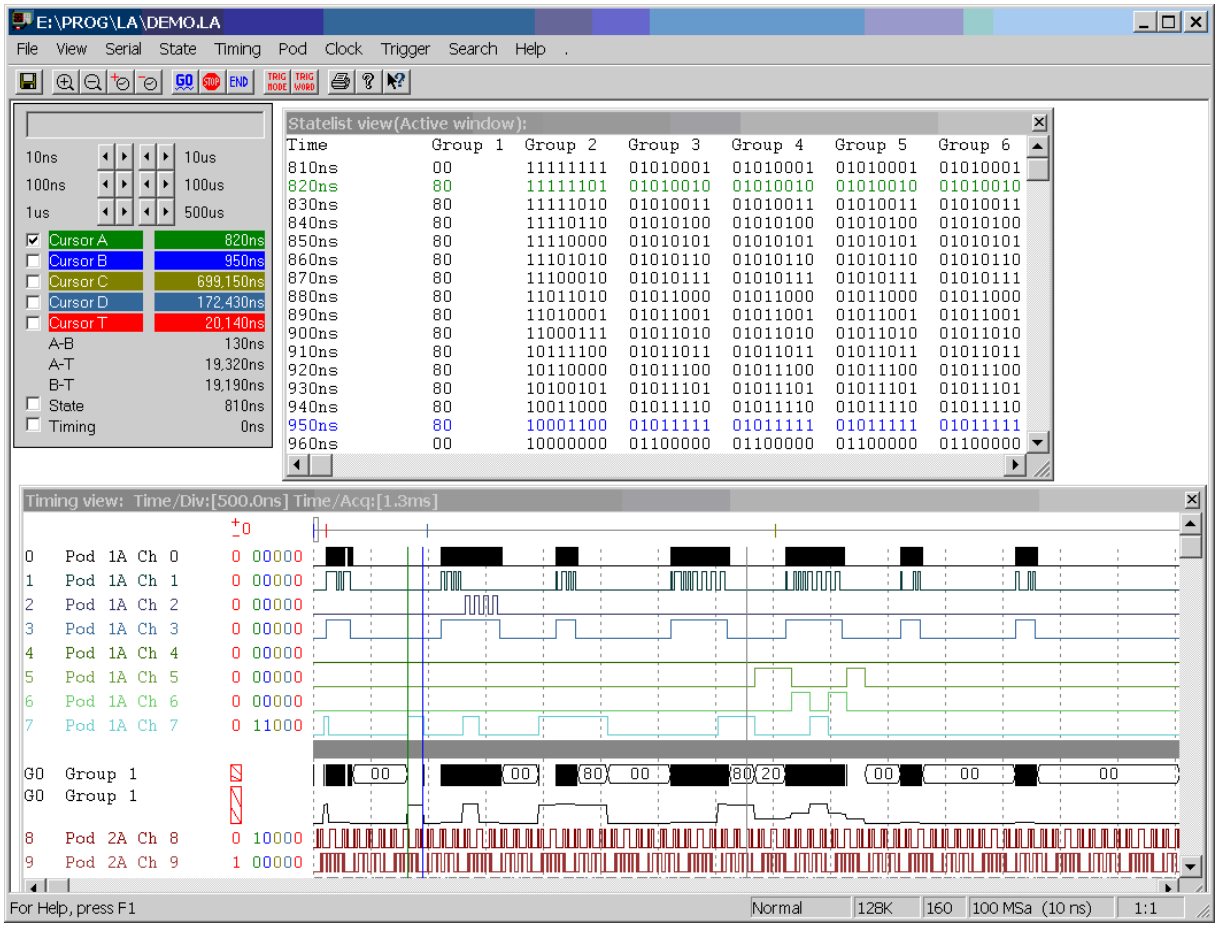
GND Ground connection

Part

4 How to

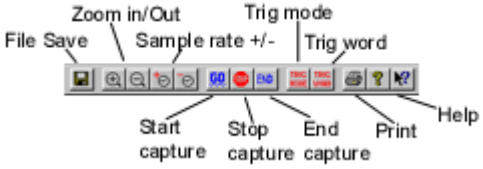
4.1 How to: Getting familiar with the software

Main screen



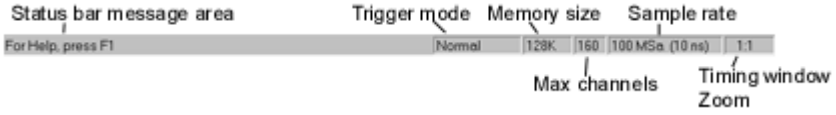
Menu bar

Tool bar



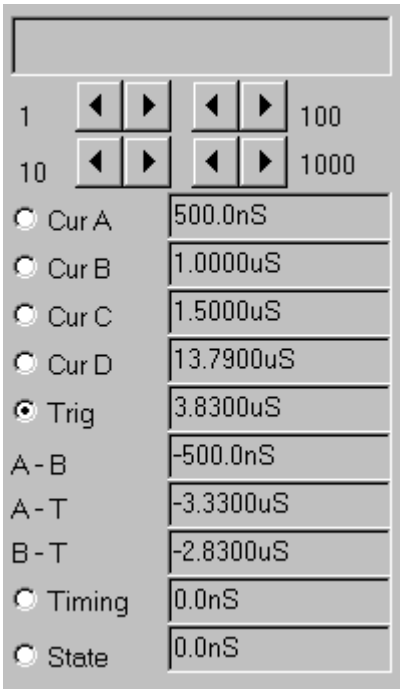
For more info see: Trigger mode, Trigger word, Trigger menu, Memory, Clock menu, zoom and toolbar.

Status bar



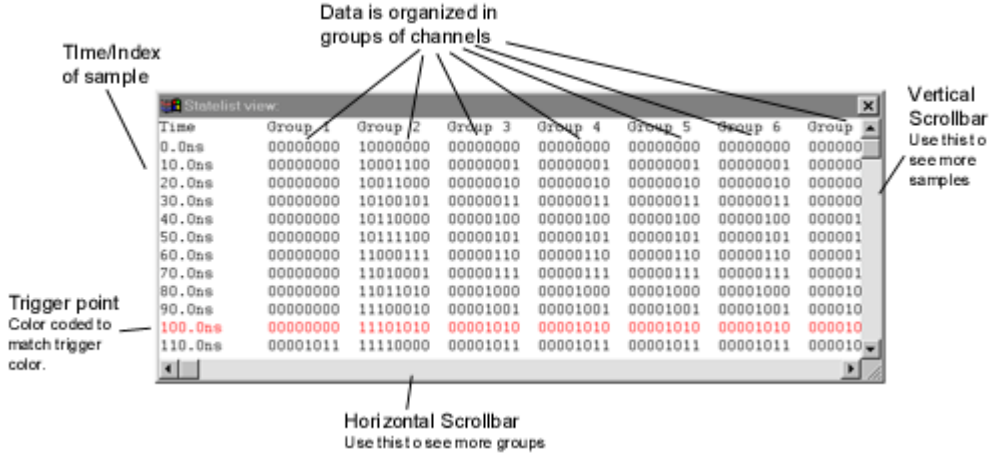
For more info see: Trigger mode, Memory, Clock menu and zoom.

Control window



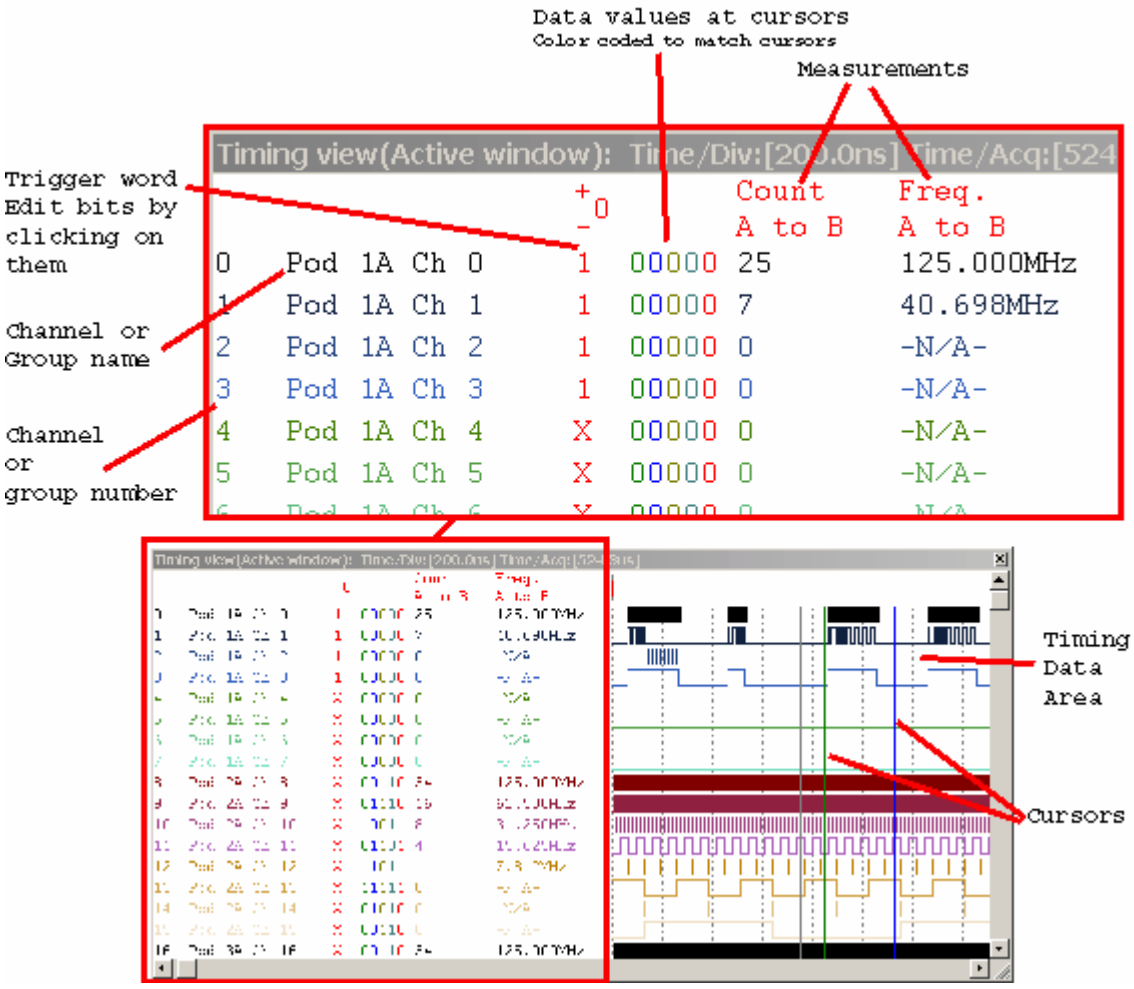
This window displays the positions of the various cursors. It also shows where the timing and statelist windows are scrolled to. Trigger status is displayed at the top.

Statelist window



Data is displayed in statelist format.
For more info see: Statelist, Setting up Statelist window, Setting up channel groups and Statelist verses Timing windows

Timing window



For more info see: Timing window, Setting up Timing window, Setting up channel names and colors and Statelist verses Timing windows

4.2 How to: Your first capture

1. Threshold Voltage

The Threshold voltage setting determines the difference between a Logic "1" and a Logic "0". Signals below the Threshold Voltage are considered a logical "0" (low) and signals above it are "1" (high).

2. Trigger word

The Logic Analyzer can be configured to acquire data when a certain bit pattern occurs. This bit pattern is called a trigger word.

The trigger word is a group of bits that are made of 0, 1 and X (don't care) values. Each of these values represent one of the LA channels.

Example:

If the trigger word = "XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXX1". The Logic Analyzer will trigger when channel 0 goes to logic high.

If the trigger word = "XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXX01". The Logic Analyzer will trigger when channel 0 is high and channel 1 is low at the same time.

The trigger word must be set appropriately for the LA to capture.

3. Clock rate

The clock rate defines when the instrument will sample.

If you are using an internal clock the rate should be set to a value 4 or more times faster than your signal source.

Note:

1. Slow clock rates can lead to long recording times since Acquisition time = Clock rate * buffer length. Some combinations will aquire data for days on a single capture. This is great if you want to aquire that much data, but generally you don't want to wait that long for the screen to update.

2. When using an external clock make sure that the signal has at least as many pulses as the buffer length. If it doesn't the buffer will never be filled, the capture won't finish and the instrument won't transfer the data to the PC.

4. Trigger position

The LA has a continuously variable trigger position (this is also called pre/post trigger). This defines how much of the buffer is allocated to data that happens before the trigger event and how much is for data that happens after.

5. Physical connections

Connect the LA to your signal sources

6. Trigger mode

The trigger mode can be set to Single, Normal or Auto.

7. Start the process

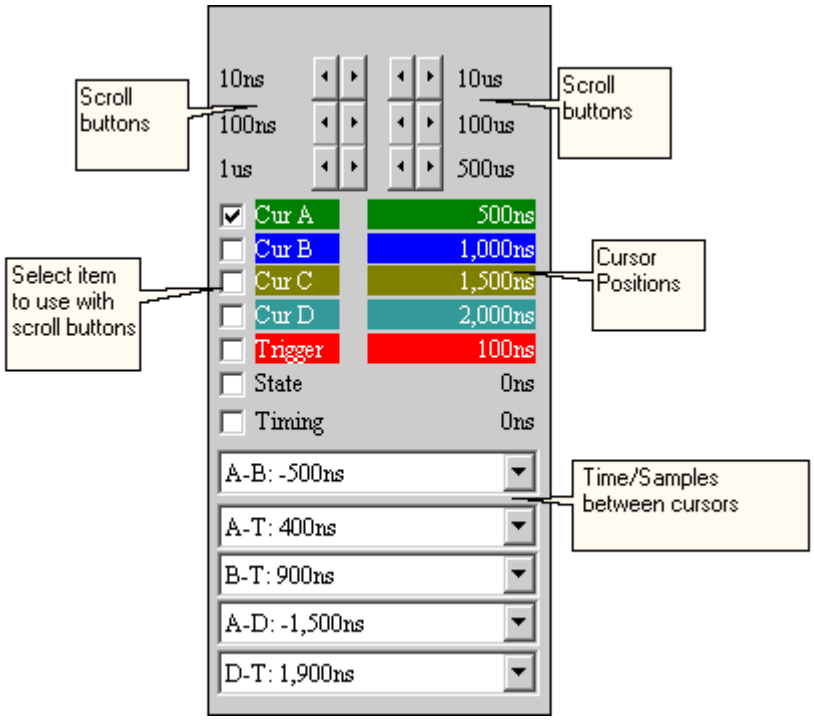
Hit the Go button

8. When the LA has triggered and filled the buffer the data will be displayed on the screen.

4.3 How to: Using cursors

Cursors are used to mark points of interest in the data, to measure time between events and to define pre/post trigger position.

Cursor window



Cursors A, B, C and D are used for measurements. The Trigger position cursor is used to define how much data is captured before and after the trigger event. It is also called pre/post trigger positon.

Moving a cursor:

1. In the control window you can select a cursor by clicking on the check box to the left of the cursors name and then using the arrow buttons in the cursor window to move it. The six sets of arrow buttons will move the selected cursor by the amount listed next to the arrows.
2. You can also "grab" the cursor by left clicking on it in the Timing or Statelist window and then move it by "dragging" it to a new location.
3. The Timing and Statelist menus have selections that allow you to bring the cursors onto their views.
4. You can also right click on the timing window and bring up the zoom dialog box. This dialog box will let you move cursors to the point that you right clicked or to the current view.

Viewing cursor position and time between cursors:

1. The cursor position is graphically depicted in the Timing or Statelist windows.
2. Cursor position is also displayed numerically in the cursor window . To change between Time and Sample number go to the view/Samples or time menu.

See also: Hot keys.

4.4 How to: Statelist verses Timing windows

Timing window:

Displays data as horizontal waveforms or as horizontal numeric streams. Each line typically represents a single channel, but a group of channels can also be displayed. Spacer lines can be inserted to separate the channels for easier visual differentiation.

The timing window setup is done by right clicking the channel names on the left edge or by going to the "Timing->Timing setup..." menu.

Statelist window:

Displays data as a vertical stream of data. The data is organized as a group of channels and is displayed in a numeric format. The groups are initially defined as groups of 8 channels. You can edit and define groups in the group define dialog box.

Each of the columns can setup to display data in Hex, ASCII, Decimal or as translation table. Setup is done by clicking on "State->Statelist setup..."

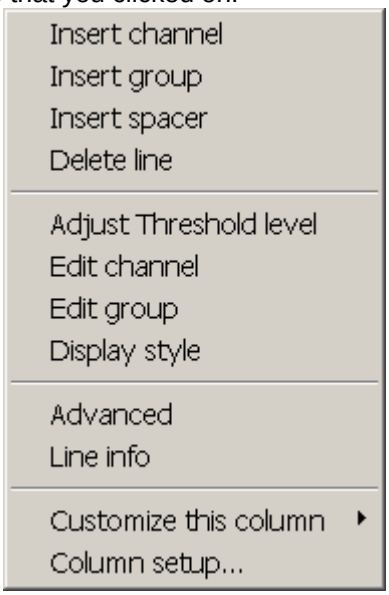
4.5 How to: Setting up the Timing window

The timing window is organized as a series of lines. Each line represents a single channel or a group of channels. Each line can be drawn in a different size/base.

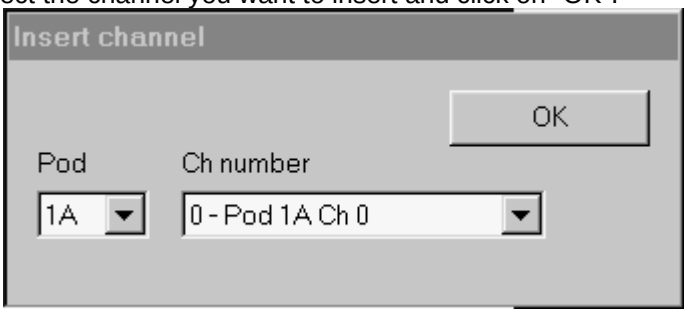
Lines can be inserted, deleted or changed by:
1) Right clicking on the channel name area and using the simple menu (see below).
2) By clicking on the "Timing->Timing setup" menu option. This is the more powerful method.

Adding a channel to the timing window:

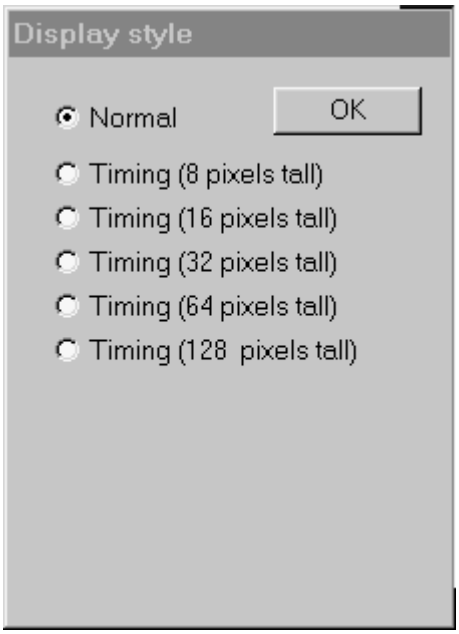
1. Right click on the channel name area of the timing window. The channel will be inserted on the line that you clicked on.



2. Click on "Insert channel".
3. Select the channel you want to insert and click on "OK".



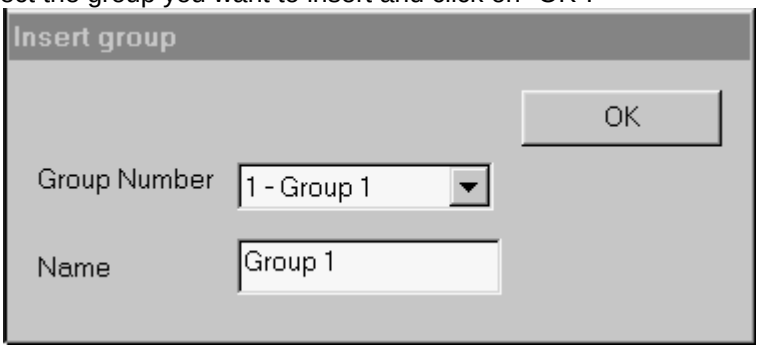
4. Select display style and click on "OK".



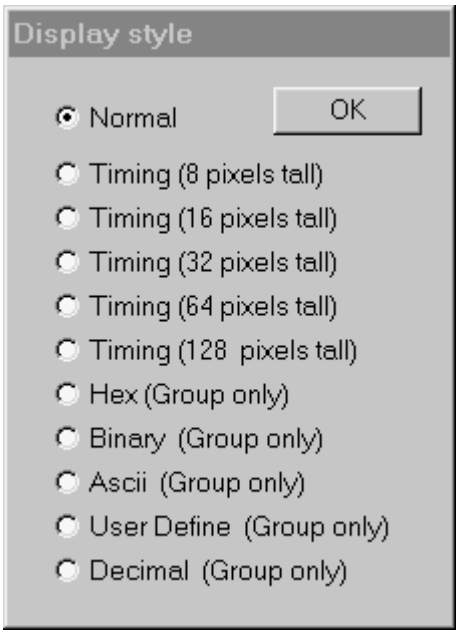
Adding a group to the timing window:

1. Right click on the channel name area of the timing window. The group will be inserted on the line that you clicked on.

2. Click on the "Insert group" button.
3. Select the group you want to insert and click on "OK".

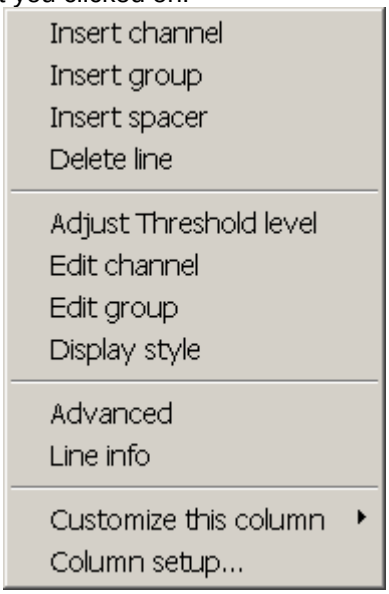


4. Select display style and click on "OK".



Deleting a channel or group from the timing window:

1. Right click on the channel name area of the timing window. The line that will be deleted is the line that you clicked on.

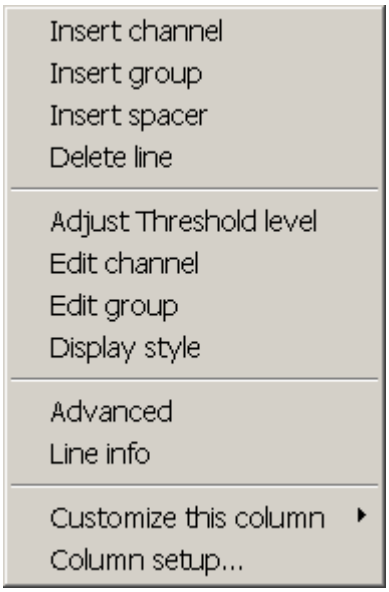


2. Click on the "Delete line" button.

Inserting a spacer in the timing window:

Spacers are used to separate timing display lines to make it easier to organize your data. The spacers are the same color as the grid.

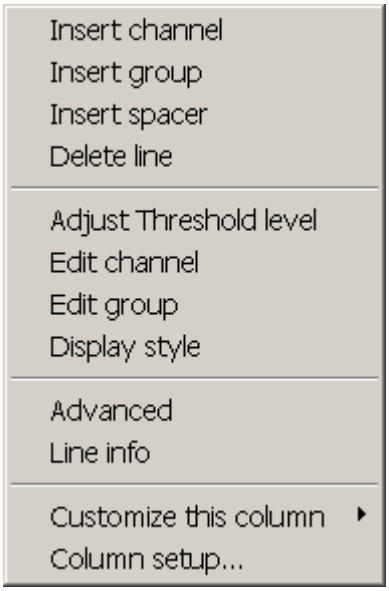
1. Right click on the channel name area of the timing window. The spacer will be inserted on the line that you clicked on.



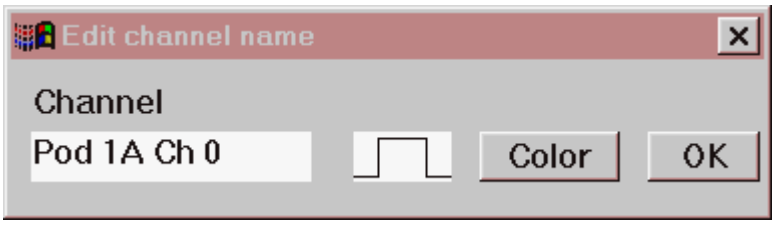
2. Click on the "Insert spacer" button.

Editing a channel name or color:

1. Right click on the channel name area of the timing window. The channel that will be changed is the line that you clicked on.
2. Click on the "Edit channel" button.



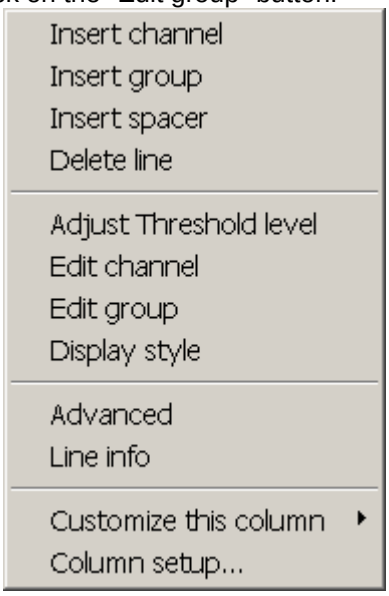
3. Click on "Edit channel".



4. You can edit the channel name or click on the "Color" button to edit the color.

Editing a group:

1. Right click on the channel name area of the timing window. The group that will be changed is the group that you clicked on.
2. Click on the "Edit group" button.



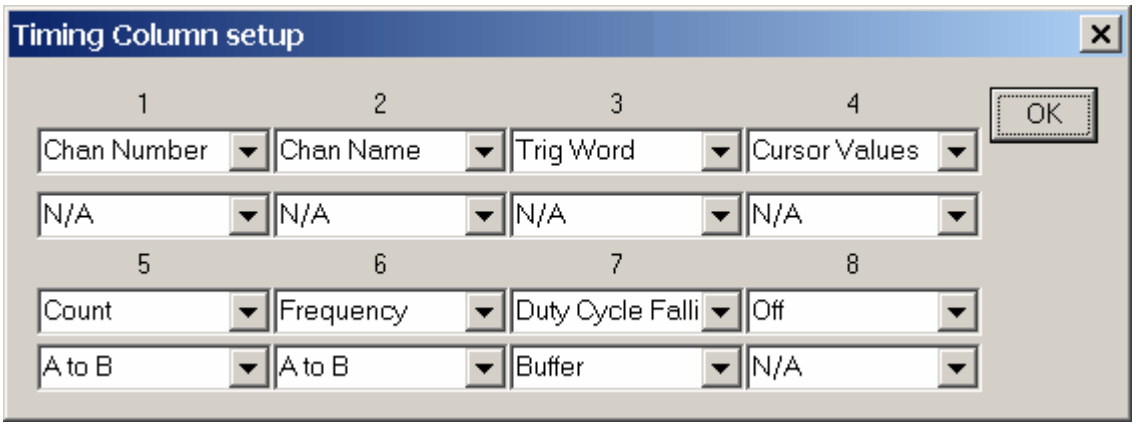
Changing channel order:

1. Left click on a channel name.
2. While holding the mouse button down you can drag the channel to a new position and change the order.

Selecting what columns to display :

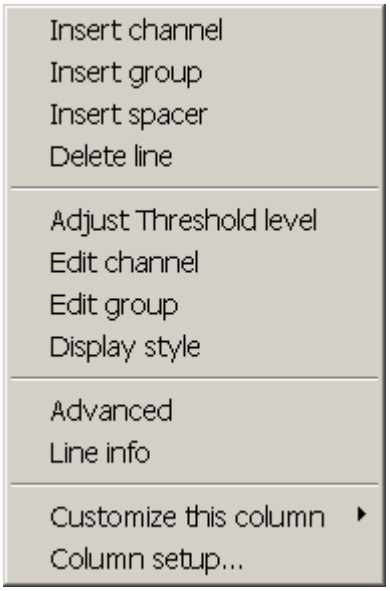
The left side of the Timing window can have up to 8 columns of information. They include the following:
Channel/group numbers
Channel/group names
Trigger bits
Values of data at each cursor (they are color coded to match the cursors).
Various measurements (LA-5000 series only)

1. Use the column setup window to turn configure the columns and the ranges of data that they work with.



Advanced editing:

1. Right click on the channel name area of the timing window. The group that will be changed is the group that you clicked on.
2. Click on the "Advanced" button.

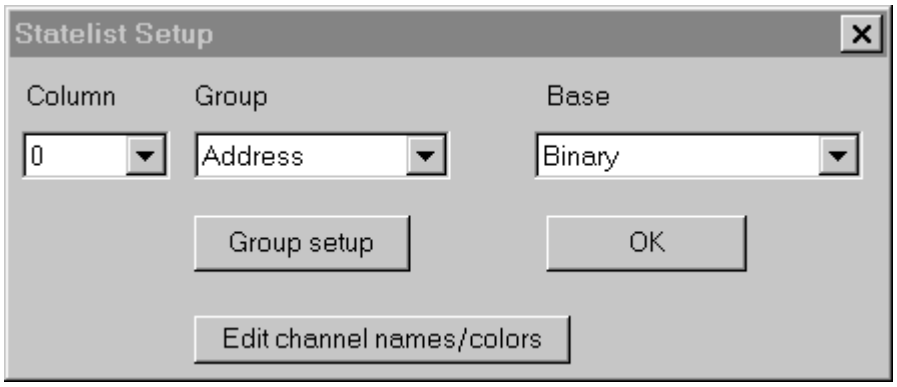


3. Use the Timing setup window.

See also: Timing window, How to: Group define, Column setup

4.6 How to: Setting up Statelist window

The statelist window is organized in columns. Each column represents a group of channels. Each column can be displayed in a different base (HEX, ASCII, Decimal or Translation table).



Setting up the statelist display.
1. Select column to edit.
2. Select which group to display in that column. Groups can repeat in multiple columns and can be in different bases.
3. Set Base of column.

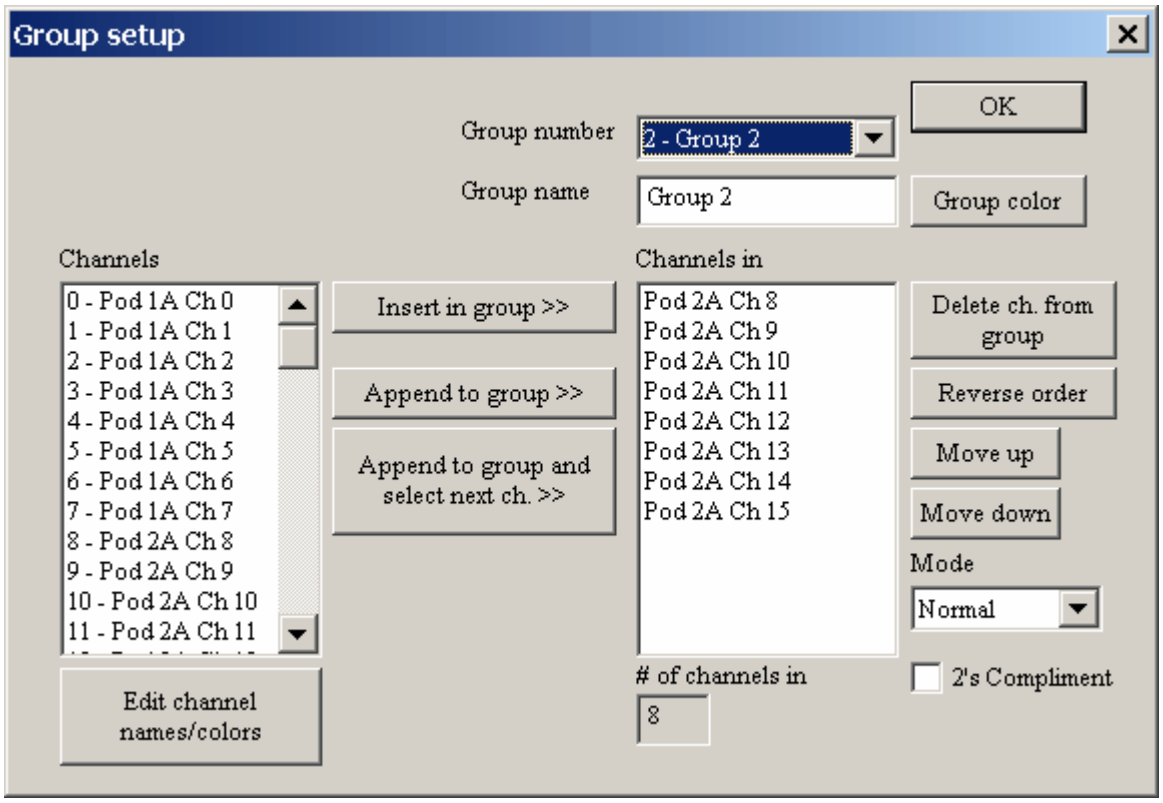
Note:
Use Group setup to define/edit the actual channel groups

See also: Statelist window , Edit channel names, Group define (how to) and group define.

4.7 How to: Setting up channel groups

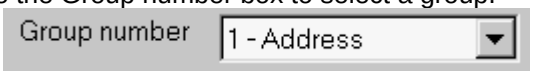
A set of channels can be defined as a "Group". This group is normally displayed in the statelist window, but can also be displayed in the timing window.

The group define window is available in the Statelist pulldown menu.



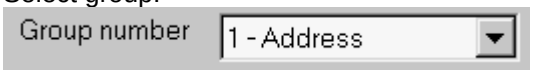
Selecting a group:

1. Use the Group number box to select a group.



Editing a group name:

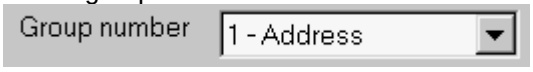
1. Select group.



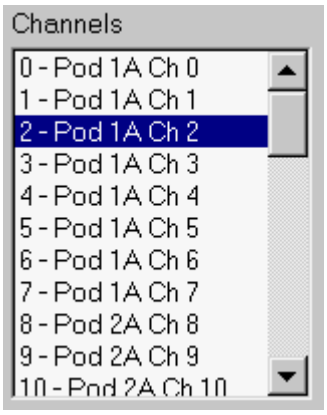
2. Edit name (14 character maximum).

Adding a channel to a group:

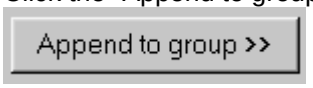
1. Select group.



2. Select channel you want to add from the "channels" window.



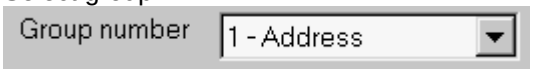
3. Click the "Append to group >>" button.



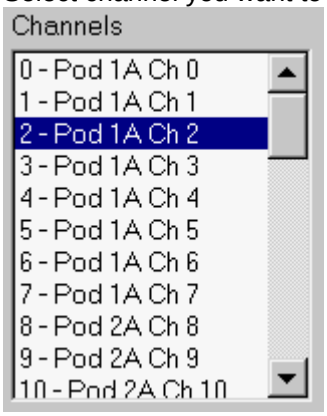
4. "Pod 1A Ch 2" will be added to the end of the group.

Inserting a channel in a group:

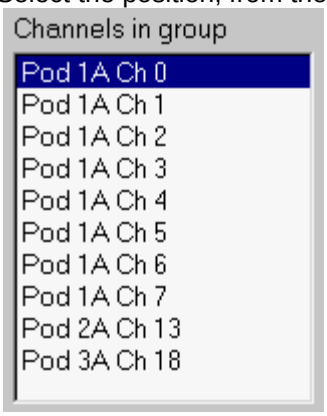
1. Select group.



2. Select channel you want to add from the "channels" window. .



3. Select the position, from the "Channels in group" window, you want the channel inserted into.

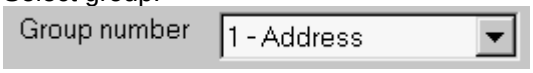


4. Click the "insert in group >>" button.

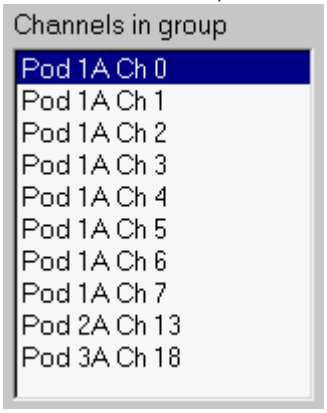
5. "Pod 1A Ch 2" will be added to the group before "Pod1A ch 0"

Deleting a channel from a group:

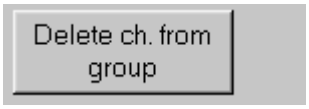
1. Select group.



2. Select the channel, from the "Channels in group" window, you want to delete.



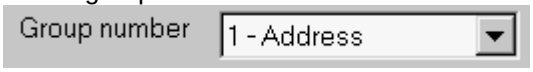
3. Click the "Delete ch. from group" button.



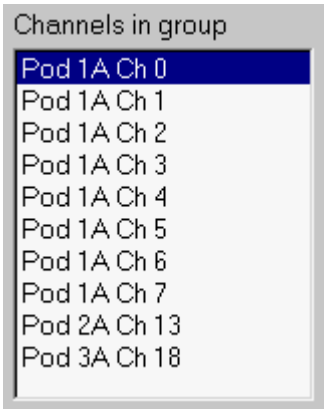
4. "Pod 1A Ch 0" will be deleted from the group.

Changing channel order in a group:

1. Select group.



2. Select the channel from the "Channels in group" window.



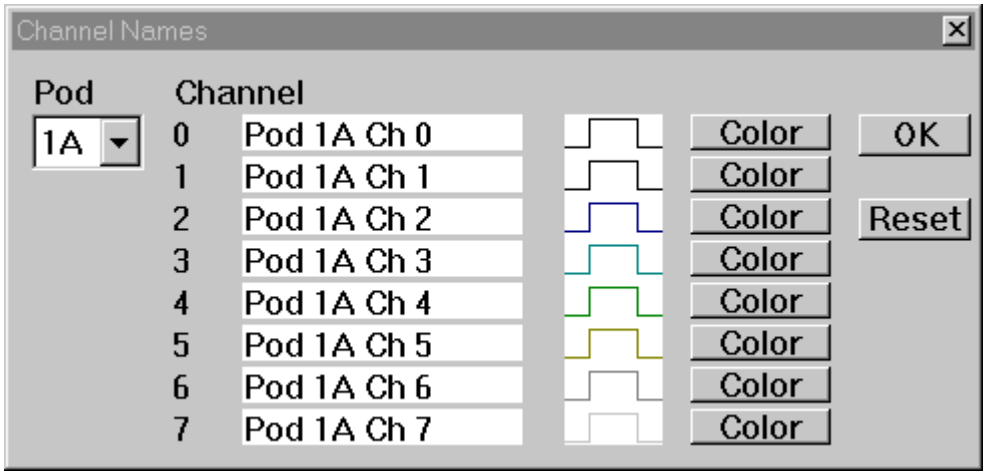
3. Click the "Move down" or "Move up" buttons to change the channels position.

4.8 How to: Setting channel names and colors

Channel names and colors be changed with the "Edit channel names and colors dialog box". This option is available in the following places:

1. Timing->edit names and colors menu.

2. Statelist->edit names and colors menu.
3. Right clicking on the channel names in the Timing window.



The channels are organized in groups of 8. Each group is called a pod.

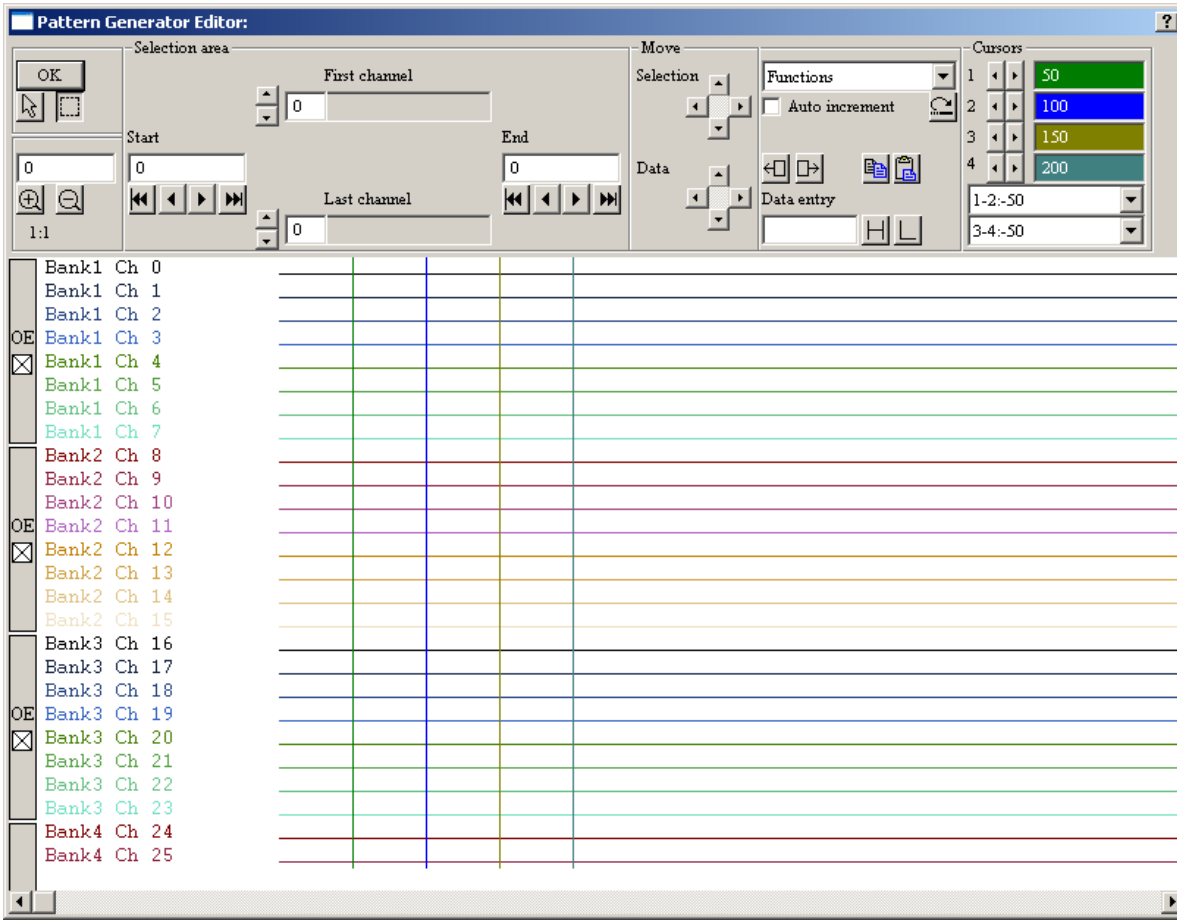
Using the channel names/colors dialog box

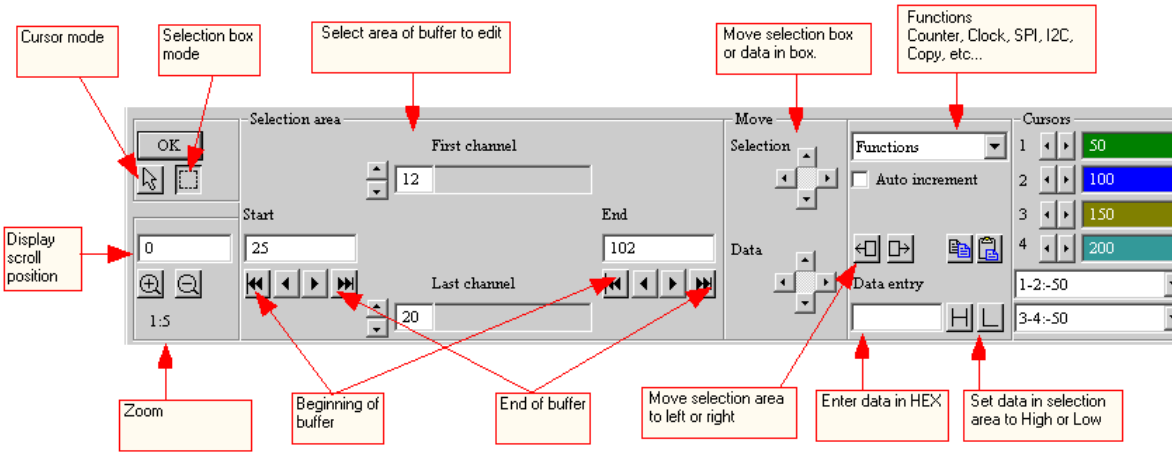
1. Select the appropriate pod for the channel that you want to edit.
2. Edit the channel name or hit the "color" button to bring up a color selection screen.

See also: Cursor colors, Grid color, Background color and group color.

4.9 How to: Setting up the Pattern Generator

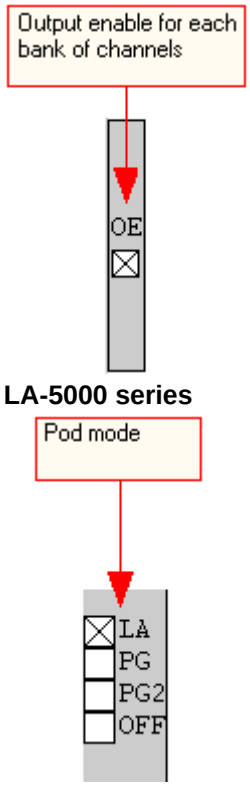
Open the pattern editor by going to the "Pod" menu and selecting "Edit Pattern Generator data".





Select pod mode:

IO-3200 series



Select area of buffer to edit

An area can be selected in the following ways:
1) Draw a selection box using your mouse.
2) Use the "selection area" controls at the top of the edit window.

Create data:

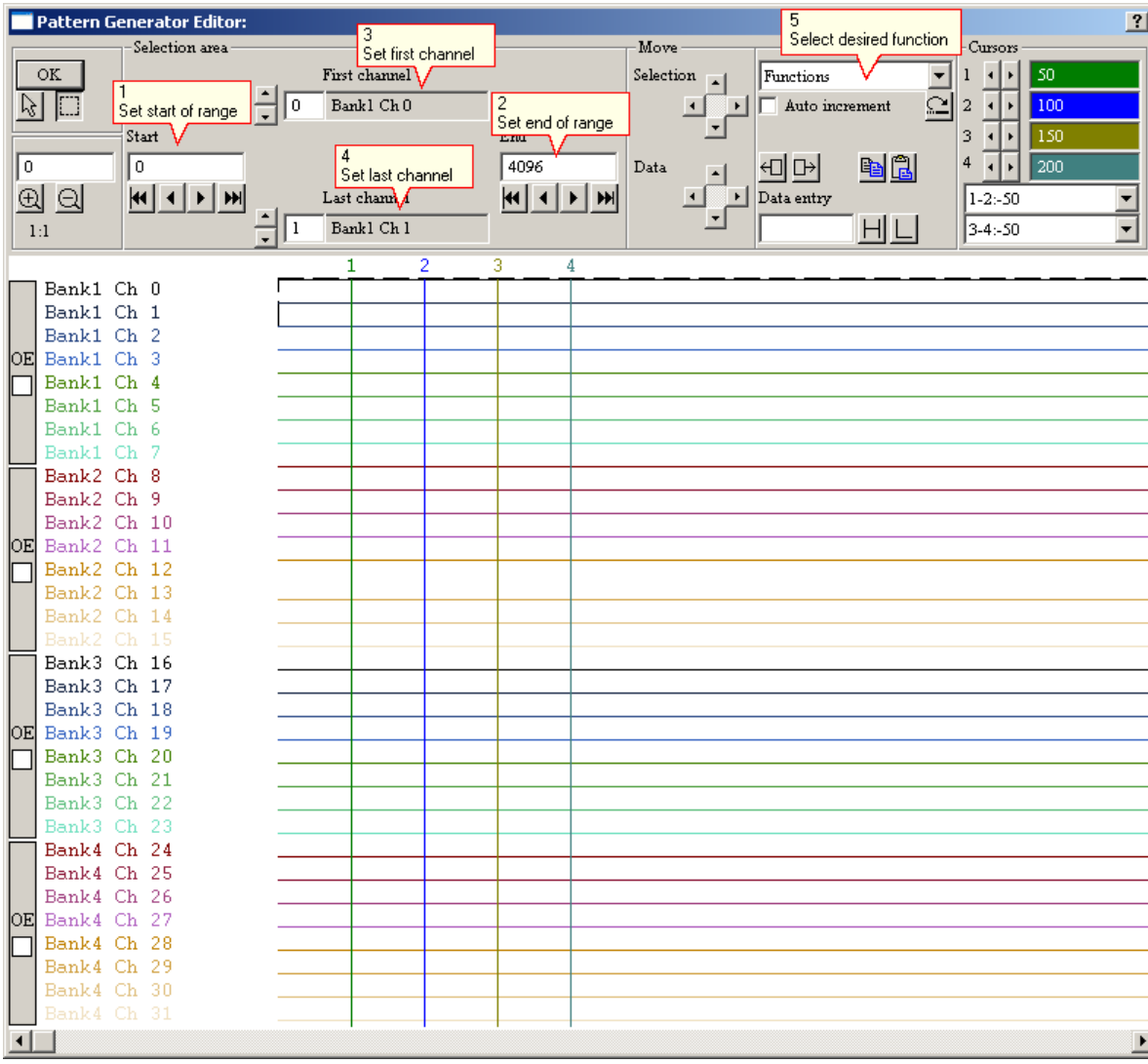
Data patterns can be generated in a number of ways:
1) By direct entry typing by using the "Data Entry" window.
2) By clicking on the "H" or "L" buttons to set the entire selection are to High or Low.
3) By using the function menu and using a number of data creation wizards.
4) By selecting "channel copy" from the function menu you can copy data the Logic Analyzer channels.
5) By loading data from a file.
6) By combining any or all of the above methods.

Outputing the data:

Exit this window, select the correct trigger mode and click the GO button.

4.10 How to: Creating a simple pattern in the Pattern Generator editor

Open the pattern editor by going to the "Pod" menu and selecting "Edit Pattern Generator data".



Before you create a pattern you need to select the data range to operate on.

A. Enter the start and end address in the selection area (see "1" and "2" above). You enter the numbers or use the arrows below the entry boxes to do this.

B. Enter the first and last channel in the selection area (see "3" and "4" above). Use the up and down arrows to select the channel.

C. Select the desired function (See "5" above). The functions include I2C wizard, SPI wizard, clock, counter, invert, expand, compress,etc...

D. Turn on Output enable:

Outputing the data:

Exit this window, select the correct trigger mode and click the GO button.

4.11 How to: Printed manual

A Adobe Acrobat (.PDF) version of the manual was installed at the same time and in the same directory as this software. You can view the .PDF file on screen or print it out.

It can be found at:
LA-3200 series: "Start->Programs->IO-3200->IO-3200 Logic Analyzer Manual"
LA-5000 series: "Start->Programs->LA-5000->LA-5000 Logic Analyzer Manual"
LA-4000 series: "Start->Programs->LA-4xxx->LA-4xxx Logic Analyzer Manual"
LA-2124: "Start->Programs->LA-2124->LA-2124 Logic Analyzer Manual"

Part V

5 Commands

5.1 File menu commands

The File menu offers the following commands:

Load	Opens an existing file (data or settings).
Save	Saves a file to a specified file name. Saves settings or data files.
Export	Export data to other programs.
Data Log	Automatically save data to file after each capture.
Data Log Settings	Settings for Data Log.
Auto save settings	If checked settings will be saved when you exit the program.
Quick save settings	Save settings to one of five predefined files.
Quick load settings	Load settings from one of five predefined files.
Delete Settings	Delete one of five predefined settings files.
Print	Prints data in Timing or Statelist format.
Print Preview	Displays the data on the screen as it would appear printed.
Print Setup	Selects a print mode, printer and printer connection.
Memory mode	Select memory/channel/speed mode.
Exit	Exit.

See also: File formats

5.1.1 File Open command

Use this command to open an existing file.

The following types of files are supported:

.LA	Data file
.INI	Settings file
.CSV	Comma Separated Value
.LXT	Translation table

Shortcuts

Toolbar: 

Keys: CTRL+O

5.1.2 File Save command

Use this command to save a data or settings file. The Save As dialog box is displayed so you can name your document.

File types are the following:

.LA	Data file Link Instruments file format for data and settings.
.INI	Settings file Link Instruments file format for settings only.
.CSV	Comma Separated Value Industry standard data file format. Use this to export data to excel, dbase and others
.PRN	MathCad file Industry standard data file format. Use this to export data to MathCad and others
.LXT	Translation table Link Instruments file format for translation tables.

See also: File/Export

5.1.3 File open dlg

The following options allow you to specify which file to open:

File Name

Type or select the file name you want to open.
This box lists files with the extension selected in the "List Files of Type" box.

List Files of Type

Select the type of file you want to open:

.LA files	Data files.
.CSV files	Data files.
.INI files	Settings files.

Drives

Select the drive in which the file that you want to open is stored.

Directories

Select the directory in which the file that you want to open is stored.

Network...

Choose this button to connect to a network location, assigning it a new drive letter.

5.1.4 File save dlg

The following options allow you to specify the name and location of the file you're about to save:

File Name

Type a new file name to save a document with a different name. A file name can contain up to eight characters and an extension of up to three characters. The extension you specify in the Save File As Type box is added to the file name.

Drives

Select the drive in which you want to store the document.

Directories

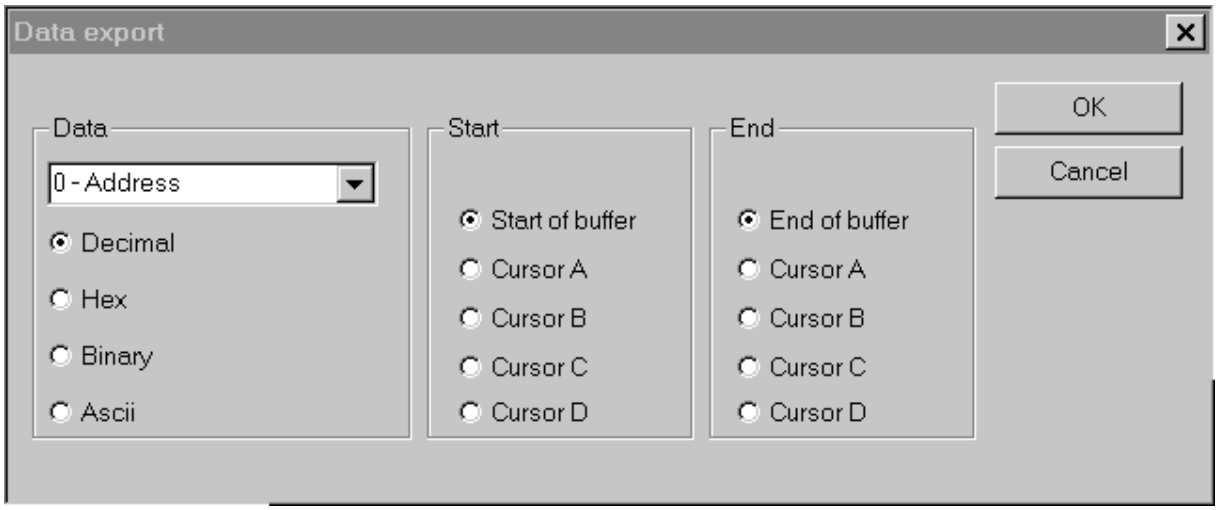
Select the directory in which you want to store the document.

Network...

Choose this button to connect to a network location, assigning it a new drive letter.

5.1.5 Export data

Use this to output data to other programs. You can export a Group of channels or all of the channels. You can output all of the data for those channels or just a portion of it.



How to use:

1) Data:
Select which data to output: Individual group or all channels.
Select base to output data in.

Note: If you select an I2C group the base options will be disabled and the data will be saved as I2C commands.

2) Start and End:
Select data address range that you want to export.

3) Click OK to save data.

See also: File formats.

5.1.6 Print dialog box

The following options allow you to specify how the document should be printed:

Printer
This is the active printer and printer connection. Choose the Setup option to change the printer and printer connection.

Setup
Displays a Print Setup dialog box, so you can select a printer and printer connection.

Copies
Specify the number of copies you want to print for the above page range.

Collate Copies
Prints copies in page number order, instead of separated multiple copies of each page.

Print Quality
Select the quality of the printing. Generally, lower quality printing takes less time to produce.

5.1.7 File Print command

Use this command to print a document. This command presents a Print dialog box, where you may specify the range of pages to be printed, the number of copies, the destination printer, and other printer setup options.

Use print setup to define printout style and print range.

Shortcuts

Toolbar:
Keys: CTRL+P

5.1.8 File Print Preview command

Use this command to display the active document as it would appear when printed. When you choose this command, the main window will be replaced with a print preview window in which one or two pages will be displayed in their printed format. The print preview toolbar offers you options to view either one or two pages at a time; move back and forth through the document; zoom in and out of pages; and initiate a print job.

5.1.9 Print Setup dialog box

The following options allow you to select the destination printer and its connection.

Printer

Select the printer you want to use. Choose the Default Printer; or choose the Specific Printer option and select one of the current installed printers shown in the box. You install printers and configure ports using the Windows Control Panel.

Orientation

Choose Portrait or Landscape.

Paper Size

Select the size of paper that the document is to be printed on.

Paper Source

Some printers offer multiple trays for different paper sources. Specify the tray here.

Options

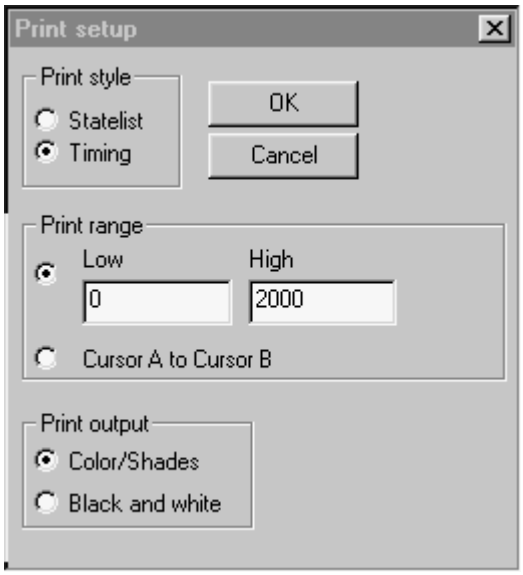
Displays a dialog box where you can make additional choices about printing, specific to the type of printer you have selected.

Network...

Choose this button to connect to a network location, assigning it a new drive letter.

5.1.10 File Print Setup command

1. Use this command select output style (statelist or timing), Data range and mode (color or B/W).



Print style:
Select statelist or timing.

Print range:

Low/High:	Specify data range to print. This range is in "Sample" units. See "Samples or Time" in View Menu.
Cursor A to Cursor B:	Print region between cursors A and B

Print output:
Colors are often not printed well on some black and white printers. Choosing Black and white will make the software use a black instead of trying to use color.

2. A second dialog box appears(Print Setup dialog box) when this one closes. This is where you specify the printer and its connection.

5.1.11 File Exit command

Use this command to end your session. You can also use the Close command on the application Control menu.

Shortcuts
Mouse: Double-click the application's Control menu button.

Keys: ALT+F4

5.2 View menu

The View menu offers the following commands:

Toolbar	Shows or hides the toolbar.

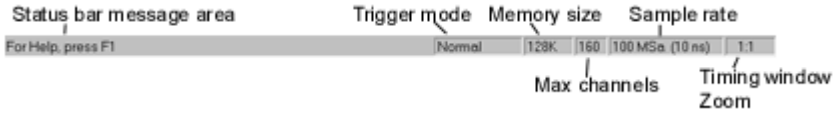
Status Bar	Shows or hides the status bar.
Colors	Set various display colors.
Edit channel names or colors...	Set channel names and colors.
Samples or Time	Set display mode of time. Display in units of time or samples.
Clear data buffer	Set all data points to logic "0".

5.2.1 Color menu

Set the color of various screen items such as cursors, text and background.

It is possible to set the colors of Timing display items and Statelist display items also.

5.2.2 View Status Bar Command



Use this command to display and hide the Status Bar, which describes the action to be executed by the selected menu item or depressed toolbar button, and keyboard latch state. A check mark appears next to the menu item when the Status Bar is displayed.

The status bar shows Trigger mode, Memory setting, number of channels, clock rate and Zoom.

See Status Bar for help on using the status bar.

5.2.3 View Toolbar command

Use this command to display and hide the Toolbar, which includes buttons for some of the most common commands, such as File Open. A check mark appears next to the menu item when the Toolbar is displayed.

See Toolbar for help on using the toolbar.

5.3 Pod Menu

Pod Mode setup	Select to configure the pods.
Edit pattern	Select this to edit pattern generator data.
Threshold voltage	Set threshold voltage. Signals above the threshold voltage are evaluated as a "1" and signals below are "0".

5.3.1 Pod mode

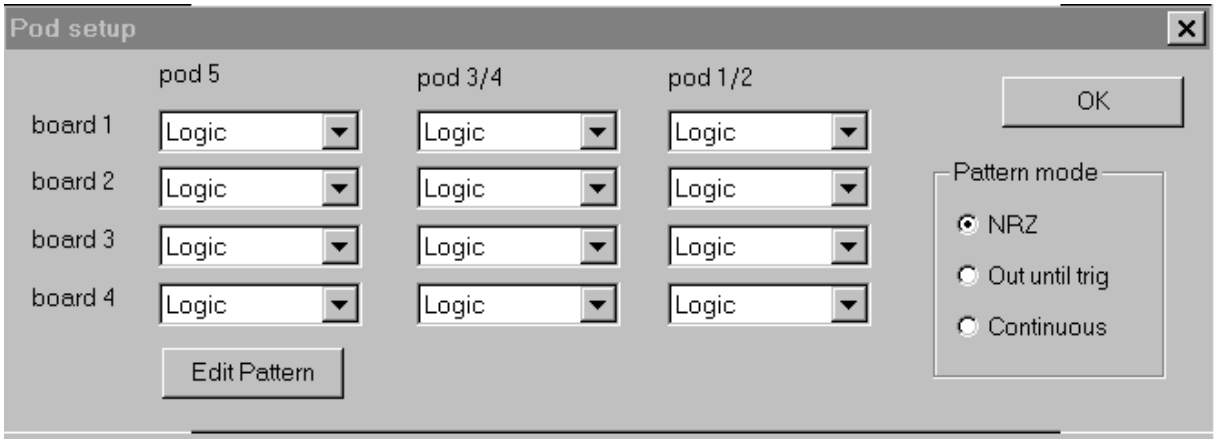
The Logic Analyzer can be converted into a combination Logic Analyzer/Pattern Generator or to a Pattern Generator only. This is done by connecting the optional Pattern Generator pods instead of the Logic pods and then configuring the software.

Data for the Pattern generator can come from 3 sources:
1) Patterns can be edited and defined in the Pattern Generator editor window.
2) It can be captured from the logic channels and copied to the pattern channels.
3) Data can also come from files. These files could be previously saved by this software or

generated by the user. Files are loaded in the File menu. They need to be in one of our supported file formats.

Pod mode:

Logic	Install Logic pods and acquire data.
Pattern Generator	Install Pattern Generator pods and output data.
Pattern Generator type II	Install Pattern Generator pods and output data. The "type II" pattern pods have adjustable output levels. Low (0) is always 0 V and High (1) can be set between 1.5 V and 4.5 V. Type II pods are not adjustable when used with the LA-4000 series Logic Analyzers.
Off	Turn off pod connector on instrument and stop inputting/outputting data from that pod.



Pattern mode:

NRZ	Output pattern once. Data is acquired simultaneously on Logic pods. After you hit the "GO" button a window will prompt you to output the pattern. If you are in "Single" mode the data will be output once. If you are in "Normal" or "Auto" mode the data will be output once for each capture. The output prompt window will pop up for each capture/output cycle.
Out until trig	Output until trigger condition met. Data is acquired simultaneously on Logic pods. Once the trigger condition is met the Pattern Generator will continue outputing for the rest of the buffer.
Continuous	Continuously output until stop hit. Data is not acquired simultaneously on Logic pods.

Pattern generator output is controlled a combination of "Pattern mode" and by "Trigger mode".

	Trigger mode "Single"	Trigger mode "Normal"
Pattern mode "NRZ"	Pattern will output once (After OK is clicked in dialog box). Click cancel to stop.	Pattern will output once for every click of OK in dialog box. Click cancel to stop.
Pattern mode "Out until trig"	Pattern will output continuously until the LA is triggered. When a trigger has been matched the pattern will finish the current buffer and than stop.	Similar to "Single" except it will keep repeating.
Pattern mode "Continuous"	LA channels are turned off. Output is continuous.	LA channels are turned off. Output is continuous.

How to:

1) Connect pattern pods and select the matching configuration on the table above.
   Note: The pods are organized into groups. Everypod in the group must be the same type.
   Each row of pods is organized in the following way: Pod 1 & 2, Pod 3 & 4 and Pod 5
2) Select pattern output mode.
3) Edit the pattern.

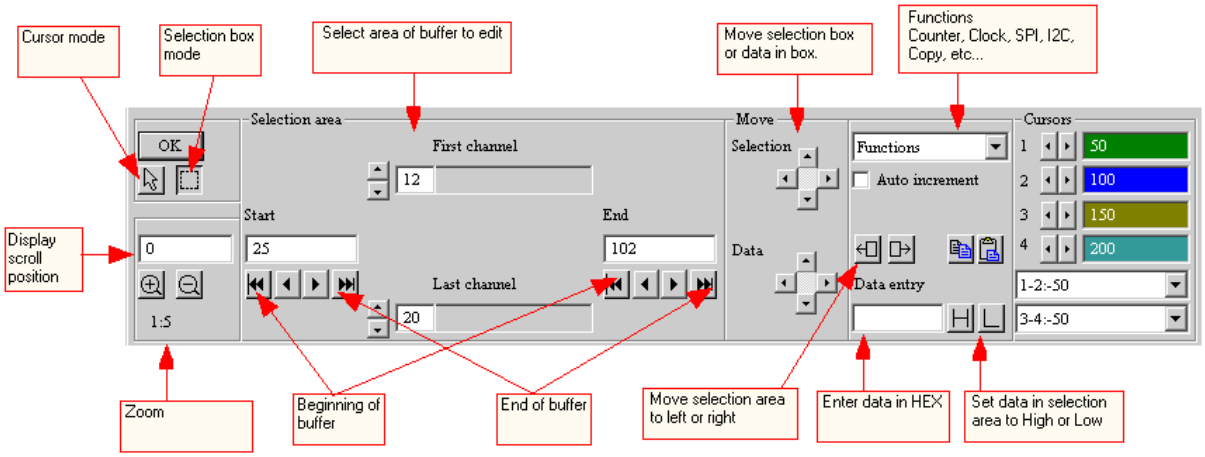
The pattern generator pods output TTL level signals and the voltages can not be changed.

See also: Toolbar, Trigger mode, and Pattern edit.

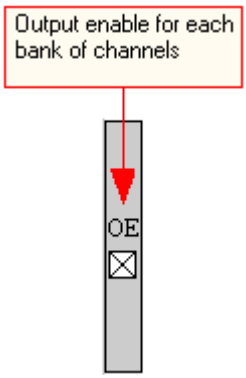
5.3.2 Pattern Generator Functions

5.3.2.1 Pattern Editor

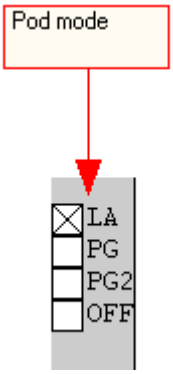
The Pattern editor lets you edit Pattern Generator data and define which sections of the data buffer are for input (Logic Analyzer) and output (Pattern Generator).



IO-3200 series



LA-5000 series



The controls are located on the top portion of the window.

Pattern data is manipulated by selecting an area of the buffer and entering data.

Making a "Selection":
1. Use the controls on the upper left portion of the window to define a "Selection".
2. Hold the ALT key and the left mouse button to draw a rectangle on the screen.

Changing your "Selection":
1. Use the controls on the upper left portion of the window to define a "Selection".
2. Hold the ALT key and the left mouse button and select an edge of the rectangle and resize it.
3. Use the Page Right/Left jump buttons  to move the "Selection" on region right or left.
4. Use the 

tool to move the "Selection" up/down or left/right.

Changing the data in your "Selection":

1. Use the  buttons to set data to Logic "High" or "Low".
2. Use the edit box to enter numeric (HEX) data. The number of nibbles you will need to enter varies depending on the number of channels in your selection.
3. Use the Functions menu to build Counters, Clocks, I2C Generation, Invert data, Copy data from Logic Analyzer channels, Copy/Paste data within the Pattern Generator buffers.

Cutting and pasting data (Simple)

1. Use the  buttons to copy/paste data within the PG buffer.
2. Use the "Copy (advanced)" or "Paste(advanced)" options in the Function menu.

Expand/Compress the data

Use the  buttons to compress or expand the data in the selection.

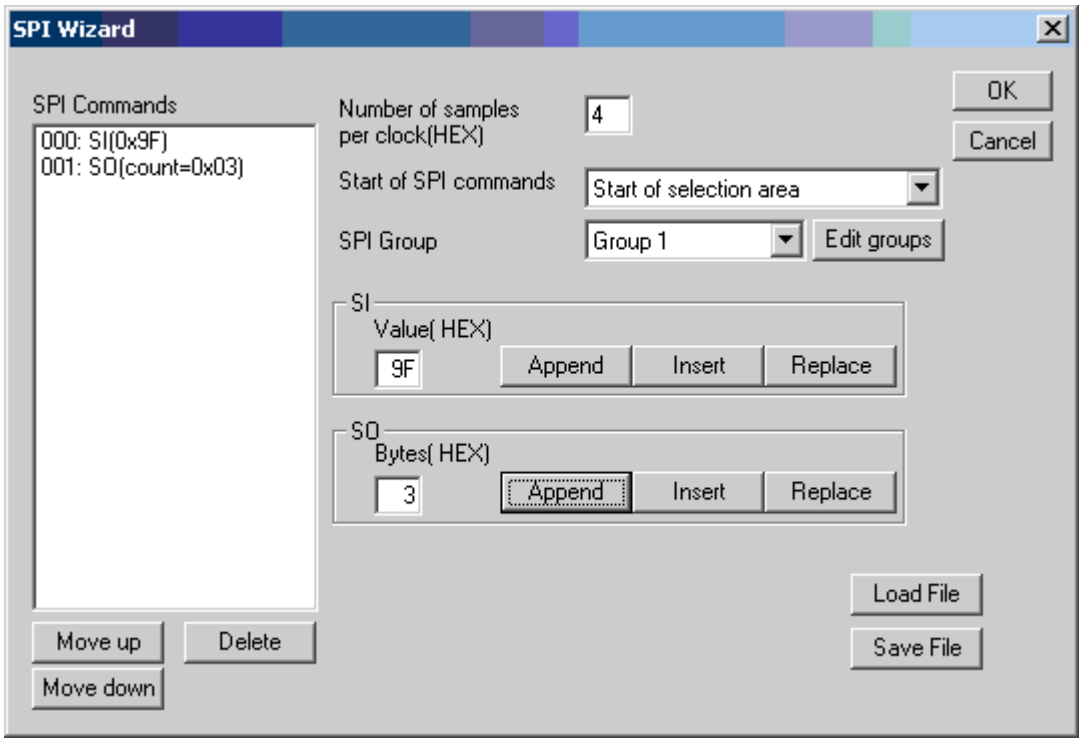
Functions menu

1.	I2C Generator	I2C data generator wizard.
2.	SPI Generator	SPI data generator wizard
3.	Counter	Counter wizard.
4.	Clock	Clock wizard.
5.	Invert	Invert selected data.
6.	Input	Set selected data range to input (Logic Analyzer) mode.
7.	Output	Set selected data range to output (Pattern Generator) mode.
8.	Copy Channel	Copy data from the Logic Analyzer data buffers.
9.	Copy (Advanced)	Copy Pattern Generator data into various temporary buffers.
10.	Paste (Advanced)	Paste Pattern Generator data from various temporary buffers into other regions of Pattern buffers.

IO-3200 series
The IO-3200 channels are divided into 4 blocks (ch 0..7, 8..15, 16..23, and 24..31). A Pattern Generator block can be divided into many segments. Each of those segments can be in "input only" or "input/output" mode. When in "input/output" mode the pattern generator is outputting data and it will affect the data.

LA-5000 series
The LA-5000 channels are divided into 3 blocks per 40 channels. Each block can be used for Logic Analysis, Pattern Generation or turned off. Use the pod mode buttons to configure the pods.

5.3.2.2 SPI Generator Wizard



The SPI wizard will generate data patterns for the Pattern Generator in SPI protocol.

Setup:

Create a group of 4 channels in SPI mode. See "Edit groups".
The SPI bus has 4 channels: SCLK, SO, SI and CS.

Define where in the buffer you would like the data generated.
Use the "Start of SPI commands" menu for this.

Define pulse width of SPI clock
The SPI clock pulse width is a function the clock rate of the IO-3200 and the number of samples each clock signal lasts for. For example: If the sample rate with 1MSa (1uS) and "Number of samples per clock" was 4 each SPI clock would be 4uS wide.

Operations:

SI Append:	Append an byte of data to command list.
SI Insert:	Insert one or more bytes of data into the command list. note: You must select one or more lines in the list prior to insertion.
SI Replace:	Replace one or more commands in the list. note: You must select one or more lines in the list prior to the replacement.
SO Append:	Append one or more "SO" read commands to the list.
SO Insert:	Insert one or more "SO" read commands to the list. note: You must select one or more lines in the list prior to insertion.
SO Replace:	Replace one or more commands in the list. note: You must select one or more lines in the list prior to the replacement.
Delete:	Select one or more lines to be deleted from the list.
Move up:	

Move down: Select one or more lines in the list and move them up or down.

Load File:
Save File: Load and save SPI command files. See SPI file format for more information.

How to:

Example: How to output a "9F" on the "SI" bus and read in 3 bytes on the "SO" bus.

1. Make sure you have an SPI Group. Use the "Edit groups" buttons if necessary.
2. Select position in buffer for this block of SPI data from the "Start of SPI commands" menu.
3. Enter "9F" in the data entry box in the "SI" section.
4. Click on SI: Append
5. Enter "3" in the data entry box in the "SO" section.
6. Click on SO: Append
7. Click on OK

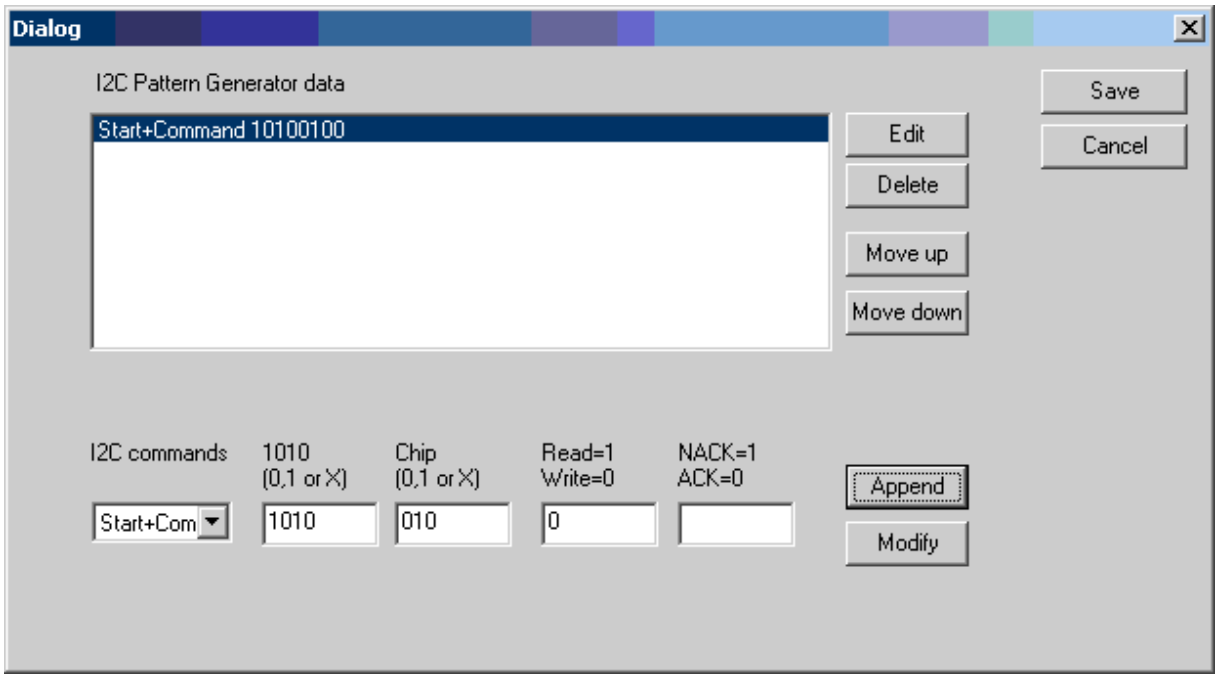
LA-5000 series:

The SI, CS and Clock channels should be configured for Pattern Generation.
The SO channel should be configured for Logic Analysis.

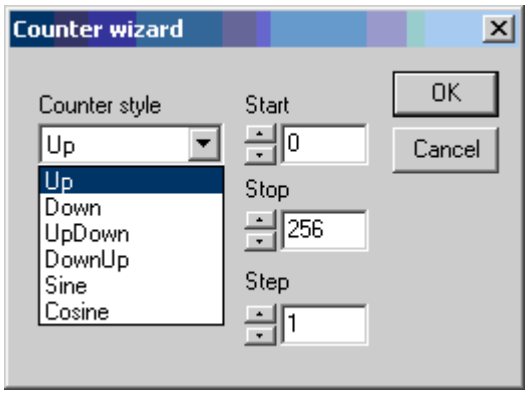
IO-3200 series:

The channels are devided into 4 blocks (ch 0..7, 8..15, 16..23, and 24..31). A Pattern Generator block can be divided into many segments. Each of those segments can be in "input only" or "input/output" mode.
Due to the way the Pattern Generator works and the way the SPI bus works the "SO" signal must be in a different bank of channels than the other 3 lines and that bank should have "OE"(Output Enable) turned off.

5.3.2.3 I2C Generator Wizard



5.3.2.4 Counter Wizard



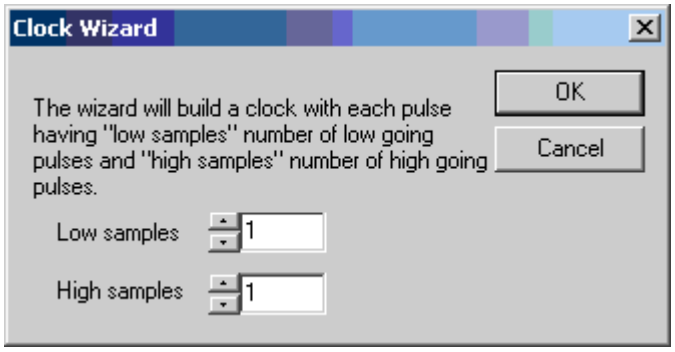
Use this window to generate a counter within the Pattern Generator data.
The counter will be created within the currently selected region.

Counter style Set counter direction.
Start First value of counter.
Stop Last value of counter.
Step Number of samples per counter level.

Note:
The counter will loop if reaches the "stop" value before it reaches the end of the selected region.

5.3.2.5 Clock Wizard

The wizard will build a signal that goes from high to low and keeps repeating.

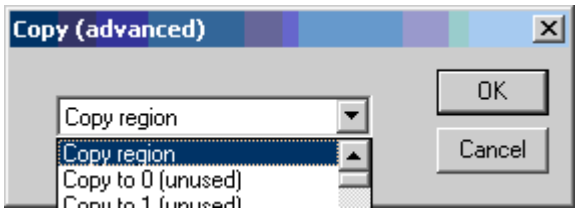


Use this window to generate a clock within the Pattern Generator data.
The width of the low pulse is defined by the "Low samples" box and the width of the high pulse is defined by the "High samples" box.

The clock will be created within the currently selected region.

Low samples Width of low edge.
High samples Width of high edge.

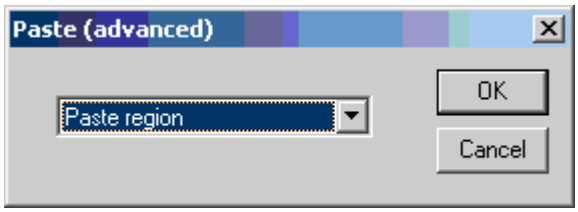
5.3.2.6 Copy



Use this window to copy a selected region to one of the clipboard buffers.

See also: Paste

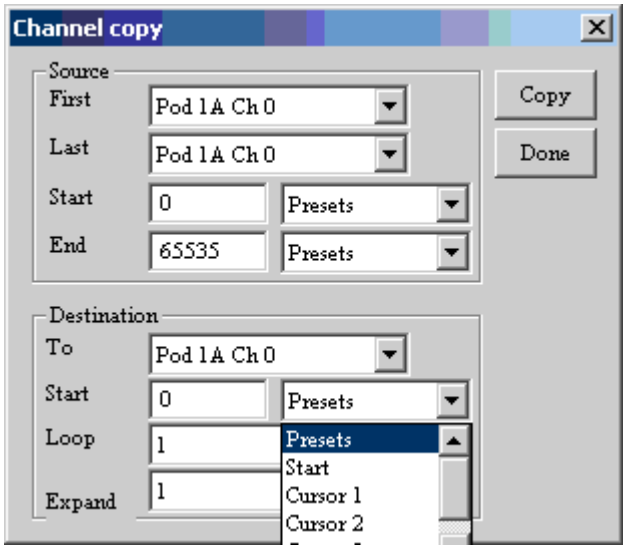
5.3.2.7 Paste



Use this window to paste into the selected region from one of the clipboard buffers.

See also: Copy

5.3.2.8 Copy channel



This window is used to copy captured Logic Analyzer data to the Pattern Generator buffer.

Source

First First channel to copy from.
Last Last channel to copy from.

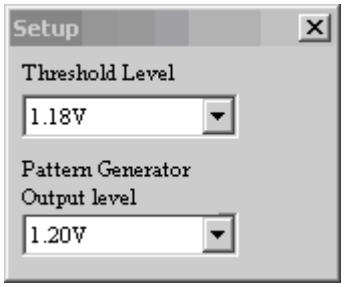
Start Start of data range.
Stop End of data range.

Destination
To First destination channel.
Start Start of destination range.
Loop Set this to > 1 to repeat the data.
Expand Set this to > 1 to stretch the data.

5.3.3 Threshold voltage and Pattern Generator voltage (IO-3200)

Threshold Level:
Signals below the Threshold voltage are considered a logical "0" (low) and signals above it are "1" (high).

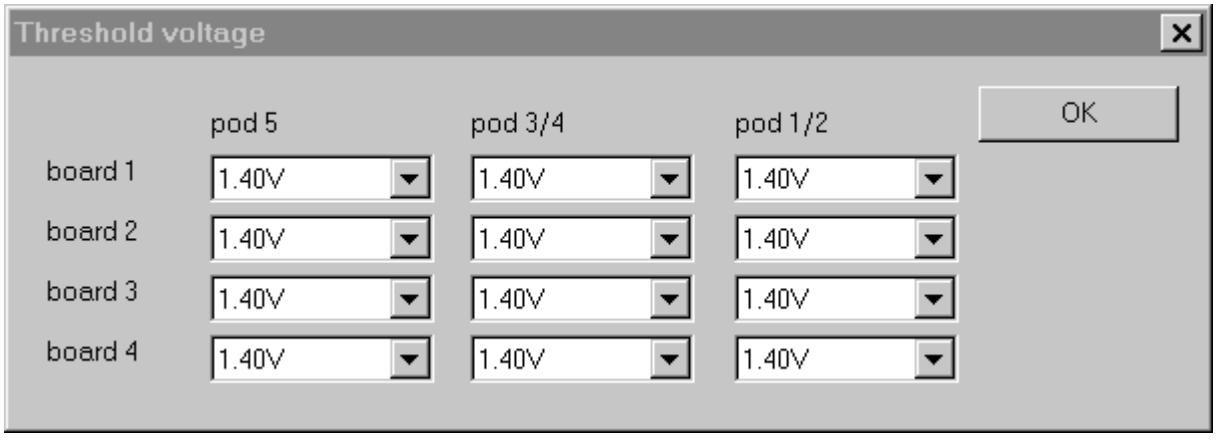
Pattern Generator Level:
This voltage is the level which defines a logical "0" (low) and a "1" (high).



5.3.4 Threshold voltage setup (LA-5000, LA-4000, LA-2124)

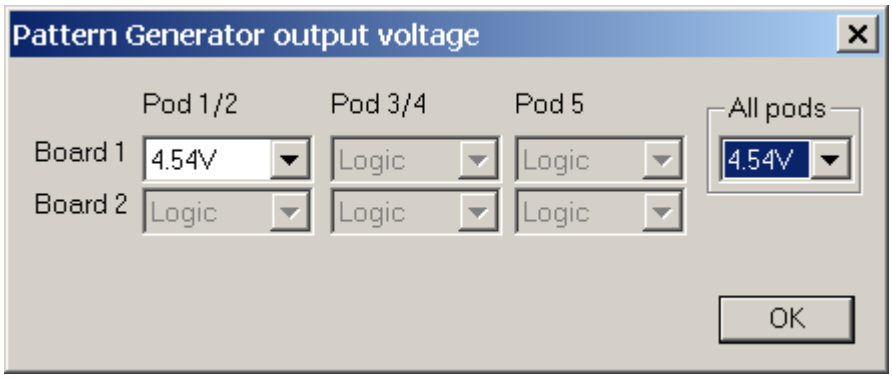
Signals below the Threshold voltage are considered a logical "0" (low) and signals above it are "1" (high).

Set the threshold voltage for one or more pods. Multiple threshold voltages can be set. Each pod represents 8 channels.



5.3.5 Pattern generator output voltage (LA-5000)

The Pattern Generator output level is adjustable with the "Pattern Generator type II" pods. Low (0) is always 0 V and High (1) can be set between 1.5 V and 4.54 V. This window will let you edit the output level of all pods that have been set to "Pat gen (type II)" in the Pod mode window.



Note: In this picture only pods 1/2 of board 1 were configured as type II pods.

See also: Pod mode

Note:
Type II pods can be used with the LA-4000 series analyzers but the voltage level is not adjustable.

5.4 Trigger menu

Go	Start looking for trigger event.
Stop	Stop looking for trigger event.
End	End capture and display data captured up to this point independent of trigger status.
Trigger word	Define trigger event.
Threshold level	Set threshold level.
Mode	Set trigger mode.
Trigger out enabled	Enable/Disable trigger output pin (IO-3200 series only).

See also: Trigger Mode and Trigger position .

5.4.1 Trigger position

The trigger position defines how much data is captured prior to the trigger event and how much data is stored after it. You set the Trigger position by moving the trigger cursor. This feature allows you to see the data that led up to the trigger as well as what happened after the trigger.

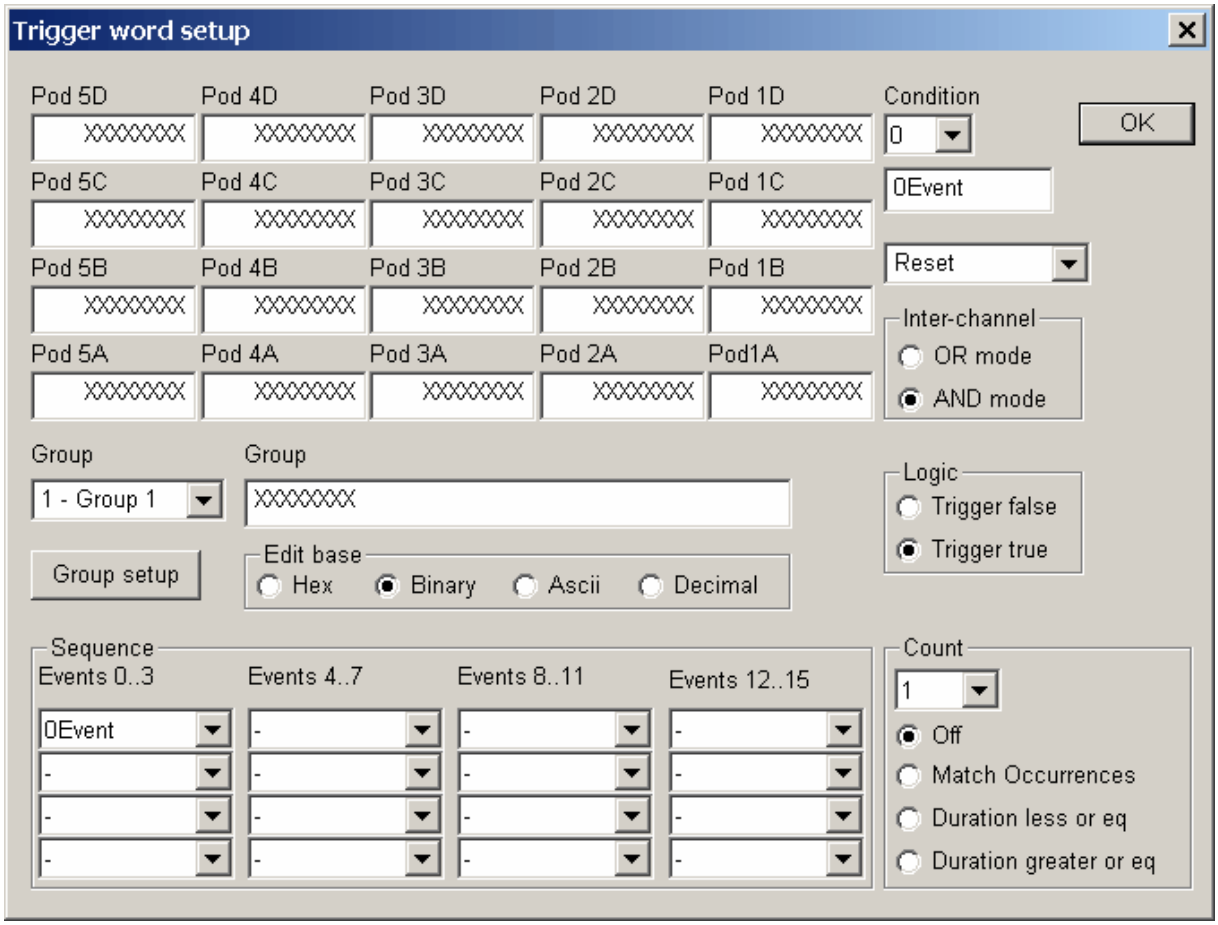
The trigger cursor can be moved in the following ways:
1. Select it in the control window and using the arrows to position it.
2. Clicking on it and dragging it Timing window.
3. Clicking on it and dragging it Timing window (thumbnail portion at the top of the window).
4. Pressing the "T" key and clicking on the Timing window will put the trigger cursor where you clicked. See hotkeys for more information.

5.4.2 Trigger word setup

Setting trigger word (LA-2124)
Setting trigger word (LA-5000 or LA-4000 series)
Setting trigger word (IO-3200)

Setting trigger word from Timing window

5.4.3 Trigger word setup (LA-5000 and LA-4000)



Each of the trigger words has the same number of bits as the Logic Analyzer has channels. Each bit represents one channel. Each bit can be set to 0, 1 or X (don't care).

Editing by channel/pod.

The upper portion of the display shows all of the channels in binary representation and can be edited.

Example:

If the trigger word = "XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXX1".
This means trigger the Logic Analyzer when channel 0 goes to logic high.

If the trigger word = "XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXX01". This means trigger the Logic Analyzer when channel 0 is high and channel 1 is low at the same time.

Editing by group.

Below that you can edit the data based on channel groups. This data can be edited in binary, hex, ASCII or decimal. If the data has an X(don't care) bit it can only be edited in binary.

Edit base: Select which base you want to edit in.

Trigger sequence.

A sequence of up to 16 trigger words (conditions) can be set. The Logic Analyzer can look for up to 16 trigger words before it triggers.

Condition Select which word you want to edit.

Logic Trigger if condition is true or false.

Inter-channel(Not available with LA-4000 series)

AND-mode	Trigger if all of the channels match trigger word. Note: At least 1 channel must not be matching before the Logic Analyzer will start looking for the trigger word.
OR-mode	Trigger if any of the channels match trigger word. Note: All channels must not be matching before the Logic Analyzer will start looking for the trigger word.

Count

Count	The number of times you want to see the last word in the sequence before you trigger.
Match occurrences	Look for the last word in sequence exactly "count" times.
Less or equal	Look for the last word in sequence exactly or less than "count" times.
Greater or equal	Look for the last word in sequence exactly or greater than "count" times.

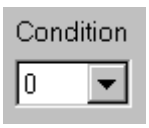
How to set trigger word:

1) The trigger words are edited here:

Edit the pattern:

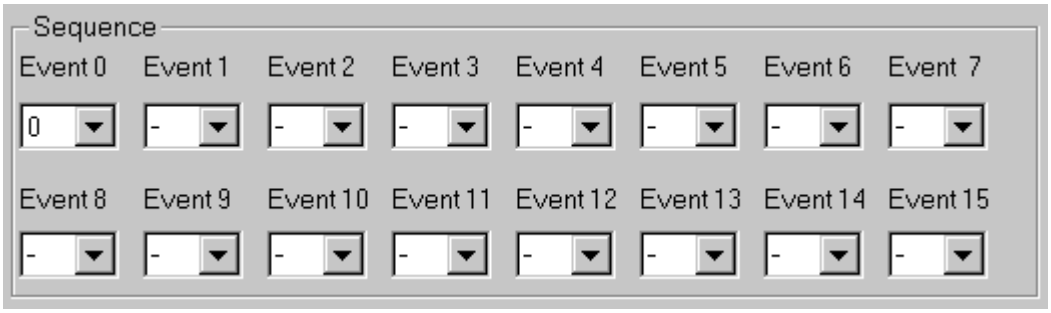
The LSB is to the right. Each bit can be set to "X","1" or "0" (Don't care, true, false)

2) You can build a library of 16 trigger words (called conditions).

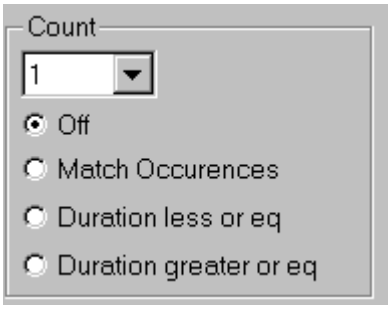
You select which one you want to edit with this control. 

3) The LA-4000 series Logic Analyzers have 16 level sequential triggering. That means that can

specify up to 16 conditions and the Logic Analyzer won't trigger until all of the conditions have been met in the order specified.
Note: You don't need to use all 16 of the levels and patterns can be repeated.



Use the list boxes to select which condition from the library of trigger patterns you want in each trigger level. Any level set to "-" will be skipped.
Note: A pattern can be repeated in the sequence.



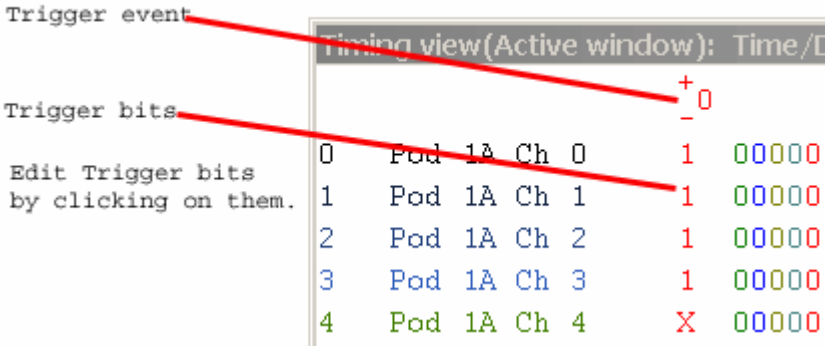
The last word in the sequence has some extra features:

Match Occurrences:	The LA won't trigger until the word appears "Count" number of times.
Duration less or eq.	The LA won't trigger if the word appears more than "Count" number of times.
Duration greater or eq.	The LA won't trigger if the word appears less than "Count" number of times.

4) You can set the trigger logic to "True" (trigger when pattern matches) or "False" (trigger when pattern stops matching).

How to set trigger word (alternate method):

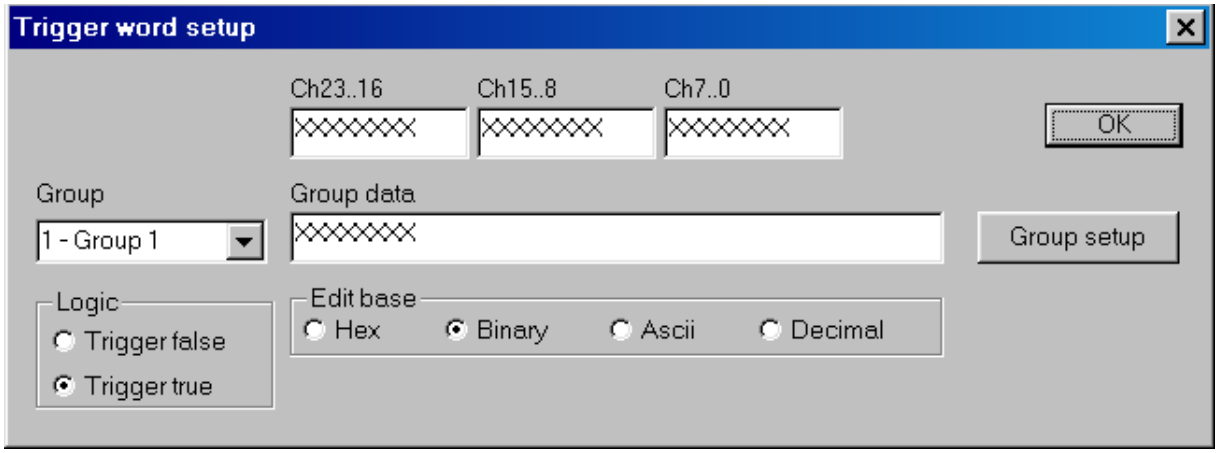
The trigger word can also be set from the Timing window. The left side of the Timing window can be configured to display the trigger values associated with each displayed channel. Clicking on the individual bits will toggle the values.



If the Trigger word values are not displayed on the Timing window please go to the Column setup window to configure the Timing window.

See also: Trigger position, Column setup, and Timing window

5.4.4 Trigger word setup (LA-2124)



Each of the trigger words has the same number of bits as the Logic Analyzer has channels. Each bit represents one channel. Each bit can be set to 0, 1 or X (don't care).

Editing by channel/pod.

The upper portion of the display shows all of the channels in binary representation and can be edited.

Example:

If the trigger word = "XXXXXXXX XXXXXXXX XXXXXXX1".
This means trigger the Logic Analyzer when channel 0 goes to logic high.

If the trigger word = "XXXXXXXX XXXXXXXX XXXXXX01".
This means trigger the Logic Analyzer when channel 0 is high and channel 1 is low at the same time.

Editing by group.

Below that you can edit the data based on channel groups. This data can be edited in binary,

hex, ASCII or decimal. If the data has an X(don't care) bit it can only be edited in binary.
Edit base: Select which base you want to edit in.

Logic Trigger if condition is true or false.

Inter-channel

AND-mode Trigger if all of the channels match trigger word.
Note: At least 1 channel must not be matching before the Logic Analyzer will start looking for the trigger word.
OR-mode Trigger if any of the channels match trigger word.

Note: All channels must not be matching before the Logic Analyzer will start looking for the trigger word.

Example:

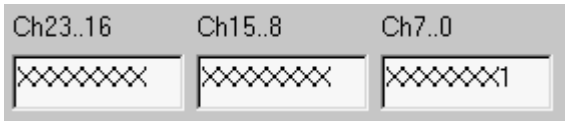
If the trigger word = "XXXXXXXX XXXXXXXX XXXXXXX1".
This means trigger the Logic Analyzer when channel 0 goes to logic high.

This means trigger the Logic Analyzer when channel 0 is high and channel 1 is low at the same time.
If the trigger word = "XXXXXXXX XXXXXXXX XXXXXX01".

Ch23..16
Edit pattern for channels 23 to 16
Ch15..8
Edit pattern for channels 15 to 8
Ch7..0
Edit pattern for channels 7 to 0
Logic
Trigger if condition is true or false.

How to set trigger word:

1) You can edit all 24 channels at a time.

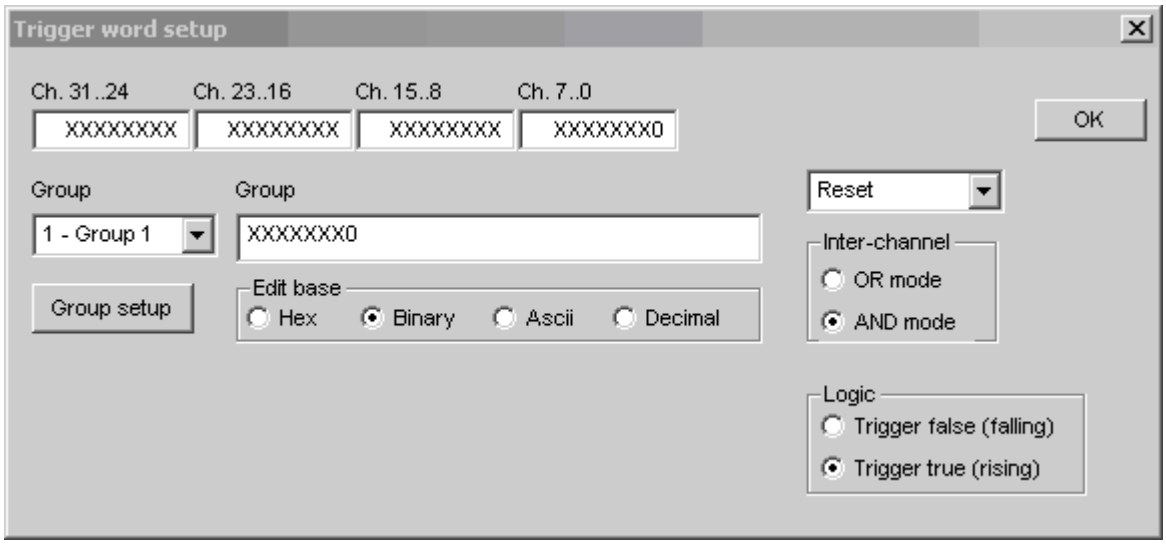
Edit the pattern: 

The LSB is to the right. Each bit can be set to "X","1" or "0" (Don't care, true, false).

2) You can set the trigger logic to "True" (trigger when pattern matches) or "False" (trigger when pattern stops matching).

See also: Trigger position

5.4.5 Trigger word setup (IO-3200)



Each of the trigger words has the same number of bits as the Logic Analyzer has channels. Each bit represents one channel. Each bit can be set to 0, 1 or X (don't care).

Editing by channel/pod.

The upper portion of the display shows all of the channels in binary representation and can be edited.

Example:

If the trigger word = "XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXX1".
This means trigger the Logic Analyzer when channel 0 goes to logic high.

If the trigger word = "XXXXXXXX XXXXXXXX XXXXXXXX XXXXXX01".
This means trigger the Logic Analyzer when channel 0 is high and channel 1 is low at the same time.

Editing by group.

Below that you can edit the data based on channel groups. This data can be edited in binary, hex, ASCII or decimal. If the data has an X(don't care) bit it can only be edited in binary.
Edit base: Select which base you want to edit in.

Logic Trigger if condition is true or false.

Inter-channel

AND-mode Trigger if all of the channels match trigger word.
Note: At least 1 channel must not be matching before the Logic Analyzer will start looking for the trigger word.
OR-mode Trigger if any of the channels match trigger word.

Note: All channels must not be matching before the Logic Analyzer will start looking for the trigger word.

Example:

If the trigger word = "XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXX1".
This means trigger the Logic Analyzer when channel 0 goes to logic high.

This means trigger the Logic Analyzer when channel 0 is high and channel 1 is low at the same time.
If the trigger word = "XXXXXXXX XXXXXXXX XXXXXXXX XXXXXX01".

Ch31..24
: Edit pattern for channels 31 to 24

Ch23..16
: Edit pattern for channels 23 to 16

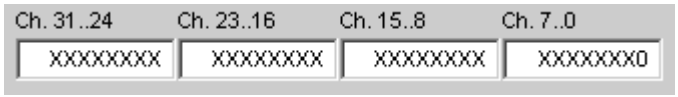
Ch15..8
: Edit pattern for channels 15 to 8

Ch7..0
: Edit pattern for channels 7 to 0

Logic
: Trigger if condition is true or false.

How to set trigger word:

1) You can edit all 32 channels at a time.

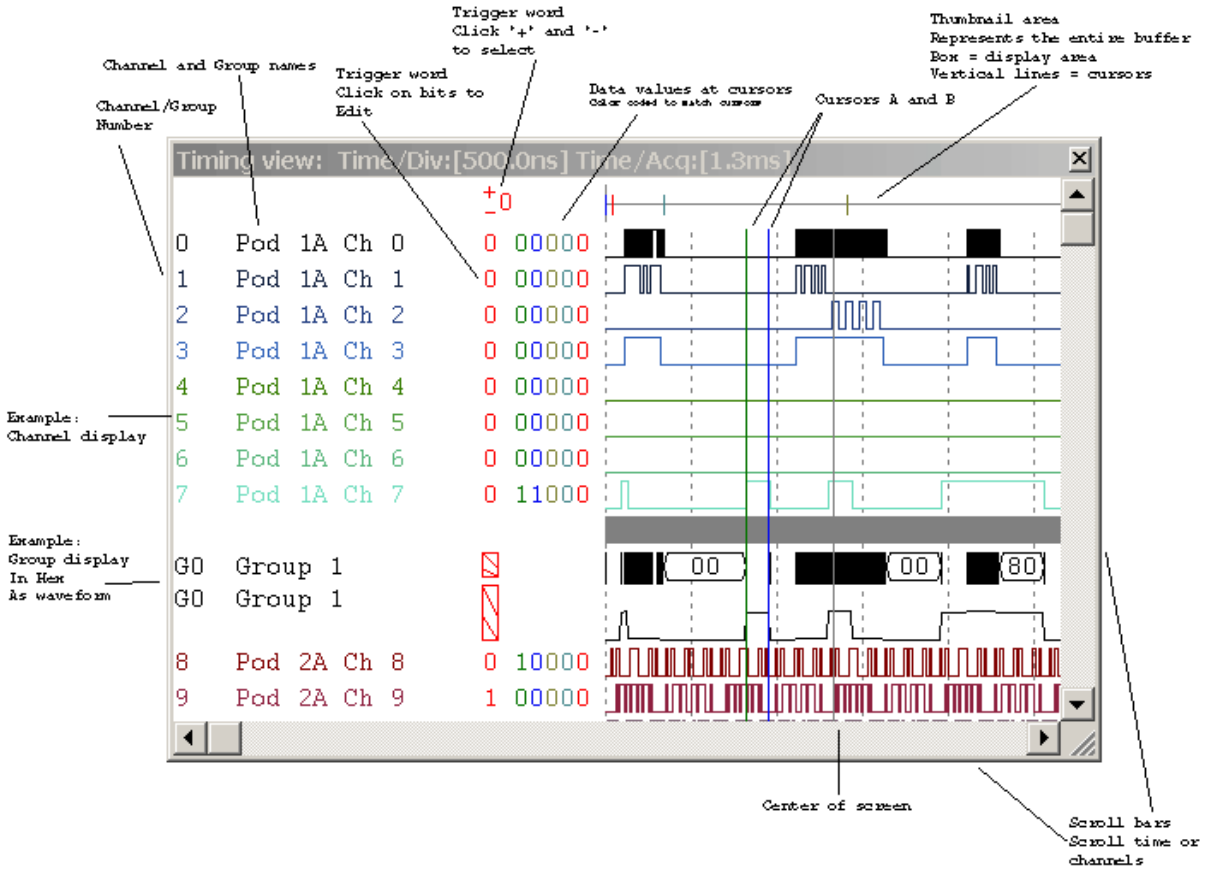
Edit the pattern: 

The LSB is to the right. Each bit can be set to "X","1" or "0" (Don't care, true, false).

2) You can set the trigger logic to "True" (trigger when pattern matches) or "False" (trigger when pattern stops matching).

See also: Trigger position

5.4.6 Setting trigger word from timing window



Clicking on the Trigger word bits will toggle them between '0', '1' and 'X'.
If a group of channels is displayed clicking on the box symbol will cause a window to appear that will allow you to edit the trigger word associated with that group of channels.
Clicking on the '+' and '-' symbols will switch between words in the trigger word sequence. (Available on Logic Analyzers with multi-level triggering).

See also: Advanced trigger word setup (LA-5000 or LA-4000) and Advanced trigger word setup (LA-2124)

5.4.7 Trigger mode

Set trigger acquisition mode.

Single	The LA looks for the trigger event. When it is found acquire a single buffer worth of data and stop.
Normal	The LA looks for the trigger event. When it is found acquire a buffer worth of data, re-arm and repeat until stop is hit.
Auto	Similar to Normal except that it will acquire regardless of the trigger event.
One Shot (w/o trigger)	Acquire one buffer of data without waiting for Trigger word. (IO-3200 series only)
Continuous Pattern Generator Output	Continuous Pattern Generator output without acquiring data. (IO-3200 series only)

See also: Toolbar

5.4.8 Trigger Out/In

Trigger Out

IO-3200 The pin Labeled "Ext clk1" can be configured as a trigger out connector. Use the "Trigger->Trigger out enabled" menu option to enable trigger out and to disable External Clock 1.
The pins goes from low to high when the Logic Analyzer is triggered and can be used to trigger another instrument.

LA2124 The pin Labeled "Trig" is the trigger out connector. It goes from low to high when the Logic Analyzer is triggered and can be used to trigger another instrument.

LA4000/LA5000 The BNC connector on the back of the Logic Analyzer is a trigger output. It goes from low to high when the Logic Analyzer is triggered and can be used to trigger another instrument.

Trigger In

Any/all of the Logic Analyzer inputs can be used as a trigger input. See: setting trigger word.

See also: Trigger

5.5 Rate menu

Select an internal clock rate or an external clock for sampling.

If you are using an internal clock the rate should be set to a value 4 or more times faster than your signal source.

Clock menu for IO-3200
Clock menu for LA-5240 and LA-5280
Clock menu for LA-5540, LA-5580 and LA-55160

Clock menu for LA-2124
Clock menu for LA-4240-32K and LA-4280-32K
Clock menu for LA-4540-128K, LA-4580-128K and LA-45160-128K

5.5.1 Rate menu for IO-3200

This menu allows you to select memory size and sample rate (Internal clock or external clock).

IO-3208A and IO-3232A

Ext clock[0] Rising	Sample on rising edge of the external clock 0 input.
Ext clock[0] Falling	Sample on falling edge of the external clock 0 input.
Ext clock[0] Rising & 1 Falling	Sample when external clock 0 input is rising and external clock 1 input is falling.
Ext clock[0] Falling & 1 Rising	Sample when external clock 0 input is falling and external clock 1 input is rising.

32ch 4K	Set buffer length and number of channels
32ch 64K	
32ch 256K	
---	
200 MSa (5 ns)	Sample on Internal clock(16 or 32 channel).
..	
1 Sa (1 s)	

IO-3232B

Ext clock[0] Rising	Sample on rising edge of the external clock 0 input.
Ext clock[0] Falling	Sample on falling edge of the external clock 0 input.
Ext clock[0] Rising & 1 Falling	Sample when external clock 0 input is rising and external clock 1 input is falling.
Ext clock[0] Falling & 1 Rising	Sample when external clock 0 input is falling and external clock 1 input is rising.

32ch 4K	Set buffer length and number of channels
32ch 64K	
32ch 256K	
32ch 512K	
32ch 1M	
16ch 8K	
16ch 128K	
16ch 512K	
16ch 1M	
16ch 2M	
---	
400 MSa (2.5 ns)	Sample on Internal clock(16 channel only).
200 MSa (5 ns)	Sample on Internal clock(16 or 32 channel).
..	
1 Sa (1 s)	

Note: The software only transfers data to the PC when the buffer is full. If you are using a slow clock it might take a long time to fill the buffer.

Recording time/Acquisition time/Capture time/Buffer Length
The Logic analyzer will acquire data for time equal to Buffer length * clock rate.
Example:

If buffer length = 128K and sample rate = 100KHz. The LA will record for 1.32 seconds (128K * 10 us).

Total time is displayed on the title bar of the Timing window

5.5.2 Rate menu for LA-2124

This menu allows you to select memory size and sample rate (Internal clock or external clock).

LA-2124-128K

1K	Set buffer length to 1K sample points
128K	Set buffer length to 128K sample points

External Rising	Sample on rising edge of the external clock input.

External Falling	Sample on falling edge of the external clock input.
100 MSa (10 ns)	Sample on Internal clock.
..	
5 KSa (200 us)	Sample on Internal clock.

Note: The software only transfers data to the PC when the buffer is full. If you are using a slow clock it might take a long time to fill the buffer.

Recording time/Acquisition time/Capture time/Buffer Length
The Logic analyzer will acquire data for time equal to Buffer length * clock rate.
Example:

If buffer length = 128K and sample rate = 100KHz. The LA will record for 1.32 seconds (128K * 10 us).

Total time is displayed on the title bar of the Timing window

5.5.3 Rate menu for LA-4540-128K, LA-4580-128K and LA-45160-128K

This menu allows you to select memory size and sample rate (Internal clock or external clock).

8K	Set memory to 8K mode	
128K	Set memory to 128K mode	
---	---	
		Active Pods
External[0] Rising	Use external (Pod 5A, bit 0) Rising edge.	All Pods active.
External[0] Falling	Use external (Pod 5A, bit 0) Falling edge.	All Pods active.
External ...		All Pods active.
500 MSa (2 ns)		Pod 1* is at 500MHz, Pod 2* & 3* are off Pod 5* is at 125MHz,
250 MSa (4 ns)		Pods 1* & 2* are at 250MHz, Pod 3* & 5* are off Pod 5* is at 125MHz,
100 MSa (10 ns)		All Pods active.
..		
1 Sa (1 s)		All Pods active.

Pattern Generator functions are not available at 250MHz and 500MHz modes.

Note: The software only transfers data to the PC when the buffer is full. If you are using a slow clock it might take a long time to fill the buffer.

Recording time/Acquisition time/Capture time/Buffer Length
The Logic analyzer will acquire data for time equal to Buffer length * clock rate.
Example

If buffer length = 8K and sample rate = 1KHz. The LA will record for 8.096 seconds (8K * 1ms).

Total time is displayed on the title bar of the Timing window

5.5.4 Rate menu for LA-4240-32K and LA-4280-32K

This menu allows you to select memory size and sample rate (Internal clock or external clock).

LA-4240-32K
LA-4280-32K

	Active Pods	**Note:**
8K		Set memory to 8K mode
32K		Set memory to 32K mode
---	---	---
External[0] Rising	All Pods active.	Use external clock bit 0(Pod 5A, bit 0) rising edge.
External[0] Falling	All Pods active	Use external clock bit 0(Pod 5A, bit 0) falling edge. .
External ...	All Pods active.	
200 MSa (5ns)	Pods 1* & 2* are at 200MHz, Pod 3* & 5* are off Pod 5* is at 100MHz,	
100 MSa (10 ns)	All Pods active.	
..		
1 Sa (1 s)	All Pods active.	

Pattern Generator functions are not available at 200MHz mode.

Note: The software only transfers data to the PC when the buffer is full. If you are using a slow clock it might take a long time to fill the buffer.

Recording time/Acquisition time/Capture time/Buffer Length
The Logic analyzer will acquire data for time equal to Buffer length * clock rate.
Example:
If buffer length = 8K and sample rate = 1KHz. The LA will record for 8.096 seconds (8K * 1ms).

Total time is displayed on the title bar of the Timing window

5.5.5 Rate menu for LA-5540, LA-5580 and LA-55160

This menu allows you to select memory size and sample rate (Internal clock or external clock).

8K	Set memory to 8K mode	
128K	Set memory to 128K mode	
256K	Set memory to 256K mode (Pattern generator not available in this mode)	
---	---	---
		Active Pods
External[0] Rising	External (Pod 5A, bit 0) Rising edge.	All Pods active.
External[0] Falling	External (Pod 5A, bit 0) Falling edge.	All Pods active.
External ...		All Pods active.
500 MSa (2 ns)		Pod 1*,3*,5* are at 500MHz, Pod 2*, 4* are off
250 MSa (4 ns)		All Pods active.
..		
1 Sa (1 s)		All Pods active.

Pattern Generator functions are not available at 250MHz and 500MHz modes.

Note: The software only transfers data to the PC when the buffer is full. If you are using a slow

clock it might take a long time to fill the buffer.

Recording time/Acquisition time/Capture time/Buffer Length
The Logic analyzer will acquire data for time equal to Buffer length * clock rate.
Example
If buffer length = 8K and sample rate = 1KHz. The LA will record for 8.096 seconds (8K * 1ms).

Total time is displayed on the title bar of the Timing window

5.5.6 Rate menu for LA-5240 and LA-5280

This menu allows you to select memory size and sample rate (Internal clock or external clock).

	Active Pods	**Note:**
8K		Set memory to 8K mode
32K		Set memory to 32K mode

External[0] Rising	All Pods active.	Use external clock bit 0(Pod 5A, bit 0) rising edge.
External[0] Falling	All Pods active	Use external clock bit 0(Pod 5A, bit 0) falling edge. .
External ...	All Pods active.	
200 MSa (5ns)	Pods 1* & 2* are at 200MHz, Pod 3* & 5* are off Pod 5* is at 100MHz,	
100 MSa (10 ns)	All Pods active.	
..		
1 Sa (1 s)	All Pods active.	

Pattern Generator functions are not available at 200MHz mode.

Note: The software only transfers data to the PC when the buffer is full. If you are using a slow clock it might take a long time to fill the buffer.

Recording time/Acquisition time/Capture time/Buffer Length
The Logic analyzer will acquire data for time equal to Buffer length * clock rate.
Example:
If buffer length = 8K and sample rate = 1KHz. The LA will record for 8.096 seconds (8K * 1ms).

Total time is displayed on the title bar of the Timing window

5.5.7 External clock setup

External Clock setup
LA-2124
LA-5000 and LA-4000
IO-3200

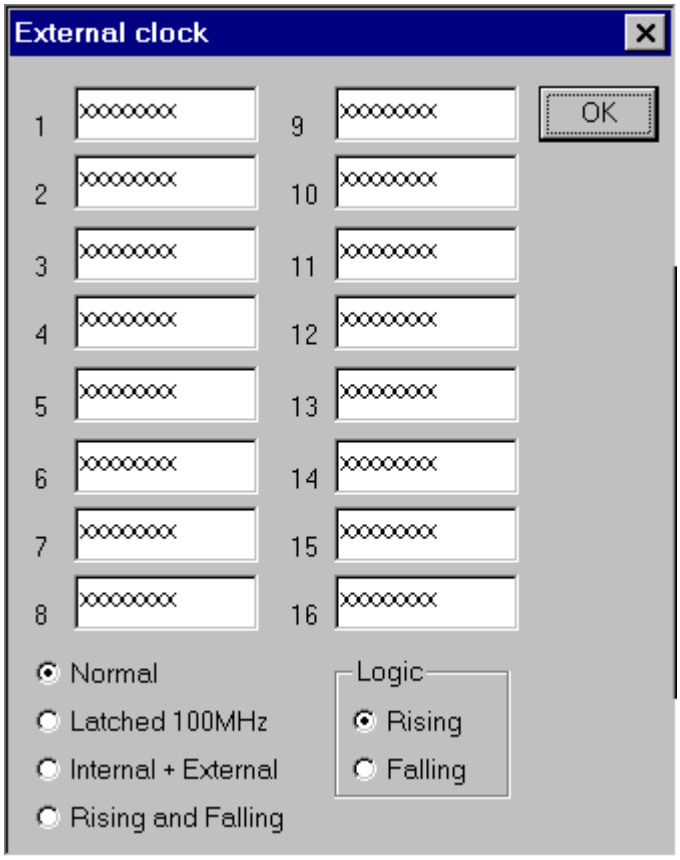
5.5.8 External clock (LA-5000 and LA-4000)

External clock (LA-5000 and LA-4000)

External clock setup. The LA has 8 external clock inputs. These inputs can be combined to create very complex clocking.

Pod 5A is used for the external clock.

Note:
The LA only transfers data to the PC after it has received a full buffer worth of data. If your clock is very slow it might take a long time to fill the buffer. Please make sure your clock happens enough times to fill the buffer.



1..16	16 sets of 8 bit patterns that are OR'd together to form a complex clock. Each bit represents one of the inputs on pod 5A. Each bit can be set to 0, 1 or X.

Modes:

Normal	External clock
Latched 100MHz	Clock on external + 100MHz internal Mix of internal + external clock. This AND's the external clock with a 100MHz internal clock. Example: If external Pattern 1 = xxxxxxx0 and all other patterns are xxxxxxxx. The LA will sample when bit 0 is low and the internal clock is high. In this example the LA will sample approximately 10 times if bit 0 stays low for 100ns.
Rising and falling	Clock on the rising and the falling edge of the external clock.

Logic:

Logic rising	Clock on the external rising edge.
Logic falling	Clock on the external falling edge.

How to use:

1) Each word represents the 8 external clocks  . Each bit can be set to 0(low), 1(high) or X(don't care).
2) The 16 words are OR'd together to form a complex clock.
3) Set clock mode:

Normal	Sample on the external clock.
Internal + external	Mix of internal + external clock.
Rising and falling	Clock on the rising or the falling edge of the external clock.

4) Set Logic to rising or falling.

Examples:

Example 1: Pattern 1 = xxx1xxx0 and all other patterns are xxxxxxxx
Result: Sample when line 4 is HIGH and line 0 is LOW.

Example 2: Pattern 1 = xxx1xxx0, Pattern 2 = xxxx xx11 and all other patterns are xxxxxxxx
Result: Sample when line 4 is HIGH and line 0 is LOW
or
when Lines 1 and 0 are HIGH.

See also: GO, STOP and END keys.

5.5.9 External clock (IO-3200)

External clock setup. The IO-3200 has 2 external clock inputs. This input can be set to rising or falling. The LA will acquire 1 sample every time it sees a clock.

Ext clock[0] Rising	Sample on rising edge of the external clock 0 input.
Ext clock[0] Falling	Sample on falling edge of the external clock 0 input.
Ext clock[0] Rising & 1 Falling	Sample when external clock 0 input is rising and external clock 1 input is falling.
Ext clock[0] Falling & 1 Rising	Sample when external clock 0 input is falling and external clock 1 input is rising.

Note 1: The LA only transfers data to the PC after the data buffer is full. Slow external clocks might take a very long time to fill the buffer.
Note 2: Make sure that your external clock has enough pulses to fill the buffer or the instrument will never transfer data.

5.5.10 External clock (LA-2124)

External clock (LA-2124)

External clock setup. The LA has up to 1 external clock input. This input can be set to rising or falling. The LA will acquire 1 sample every time it sees a clock.

Note 1: The LA only transfers data to the PC after the data buffer is full. Slow external clocks might take a very long time to fill the buffer.
Note 2: Make sure that your external clock has enough pulses to fill the buffer or the instrument will never transfer data.

5.5.11 Memory mode

Select memory mode:

IO-3208A and IO-3232A

Max speed	channels (memory size)
200MSa	32 (32 @ 4K each)
	32 (32 @ 64K each)
	32 (32 @ 256K each)

IO-3232B

Max speed	channels (memory size)
400MSa	16 (16 @ 8K each)
	16 (16 @ 128K each)
	16 (16 @ 512K each)
	16 (16 @ 1M each)
	16 (16 @ 2M each)
200MSa	32 (32 @ 4K each)
	32 (32 @ 64K each)
	32 (32 @ 256K each)
	32 (32 @ 512K each)
	32 (32 @ 1M each)
	16 (16 @ 8K each)
	16 (16 @ 128K each)
	16 (16 @ 512K each)
	16 (16 @ 1M each)
	16 (16 @ 2M each)

LA-2124-128K

Max speed	channels (memory size)
up to 25MSa external	24 (24 @ 128K each)
up to 100MSa internal	24 (24 @ 128K each)

LA-4240-32K

Max speed	channels (memory size)
up to 50MSa external	40 (40 @ 32K each)
up to 100MSa internal	40 (40 @ 32K each)
200MSa	24 (16@ 200MSa@64K and 8@100MSa@32K) Pods 1a & 2a are at 200MSa, Pod 5a is at 100MSa, Pod 3a & 4a are off

LA-4540-128K

Max speed	Channels (memory size)
up to 80MSa external	40 (40@128K each)
up to 100MSa internal	40 (40@128K each)
250MSa	24 (16@250MSa@256K and 8@125MSa@128K) Pods 1a & 2a are at 250MSa,

	Pod 5a is at 125MSa, Pods 3a & 4a are off
500MSa	16 (8@500MSa@256K and 8@125MSa@128K) Pod 1a is at 500MSa, Pod 5a is at 125MSa, Pods 2a, 3a & 4a are off

LA-4280-32K

Max speed	**Channels (memory size)**
up to 50MSa external	80 (80 @ 32K each)
up to 100MSa internal	80 (80 @ 32K each)
200MSa internal	48 (32@200MSa@64K and 16@100MSa@32K) Pods 1a, 2a, 1b & 2b are at 200MSa, Pods 5a & 5b are at 100MSa, Pods 3a, 4a, 3b & 4b are off

LA-4580-128K

Max speed	**Channels (memory size)**
up to 80MSa external	80 (80 @ 128K each)
up to 100MSa internal	80 (80 @ 128K each)
250MSa	48 (32@250MSa@256K and 16@125MSa@128K) Pods 1a, 2a, 1b & 2b are at 250MSa, Pods 5a & 5b are at 125MSa, Pods 3a, 4a, 3b & 4b are off
500MSa	32 (16@500MSa@256K and 16@125MSa@128K) Pods 1a & 1b are at 500MSa, Pods 5a & 5b are at 125MSa, Pods 3a, 4a, 3b & 4b are off

LA-45160-128K

Max speed	**Channels (memory size)**
up to 80MSa external	160 (160 @ 128K each)
up to 100MSa internal	160 (160 @ 128K each)
250MSa	96 (64@250MSa@256K and 32@125MSa@128K) Pods 1a, 2a, 1b, 2b, 1c, 2c, 1d & 2d are at 250MSa, Pods 5a, 5b, 5c & 5d are at 125MSa, Pods 3a, 4a, 3b, 4b, 3c, 4c, 3d & 4d are off
500MSa	64 (32@500MSa@256K and 32@125MSa@128K) Pods 1a, 1b, 1c & 1d are at 500MSa, Pods 5a, 5b, 5c & 5d are at 125MSa, Pods 3a, 4a, 3b, 4b, 3c, 4c, 3d & 4d are off

---

LA-5240

Max speed	**channels (memory size)**
up to 50MSa external	40 (40 @ 32K each) (with pattern generator)
up to 100MSa internal	40 (40 @ 32K each) (with pattern generator)
200MSa	24 (16@ 200MSa@64K and 8@100MSa@32K) (pattern generator not available) Pods 1a & 2a are at 200MSa, Pod 5a is at 100MSa, Pod 3a & 4a are off

LA-5540

Max speed	Channels (memory size)
up to 80MSa external	40@128K each (with pattern generator)
up to 250MSa internal	40@128K each (with pattern generator) 40@256K each (pattern generator not available)
500MSa	24@500MSa@512K (pattern generator not available) Pod 1a, 3a, 5a are at 500MSa, Pods 2a & 4a are off

LA-5280

Max speed	Channels (memory size)
up to 50MSa external	80 (80 @ 32K each) (with pattern generator)
up to 100MSa internal	80 (80 @ 32K each) (with pattern generator)
200MSa internal	48 (32@200MSa@64K and 16@100MSa@32K) (pattern generator not available) Pods 1a, 2a, 1b & 2b are at 200MSa, Pods 5a & 5b are at 100MSa, Pods 3a, 4a, 3b & 4b are off

LA-5580

Max speed	Channels (memory size)
up to 80MSa external	80@128K each (with pattern generator)
up to 250MSa internal	80@128K each (with pattern generator) 80@256K each (pattern generator not available)
500MSa	48@500MSa@512K (pattern generator not available) Pod 1a, 3a, 5a are at 500MSa, Pod 1b, 3b, 5b are at 500MSa, Pods 2a & 4a are off Pods 2b & 4b are off

LA-55160

Max speed	Channels (memory size)
up to 80MSa external	160@128K each (with pattern generator)
up to 250MSa internal	160@128K each (with pattern generator) 160@256K each (pattern generator not available)
500MSa	96@500MSa@512K (pattern generator not available) Pod 1a, 3a, 5a are at 500MSa, Pod 1b, 3b, 5b are at 500MSa, Pods 2a & 4a are off Pods 2b & 4b are off

5.6 Timing menu

Timing window...	Display the Timing window.
Timing Setup..	Setup the Timing window.
Zoom	Adjust horizontal zoom.
Zoom dialog box...	Zoom dialog box.
Zoom Origin	Select reference point for zoom. Options include: Center of screen, Left edge of screen, Cursor A, Cursor B, Cursor C, Cursor D and Trigger Cursor.
Edit channel names/Colors	Set channel names and colors.
Grid	Display grid.
Cursor A to Timing	Move cursor to Timing window.
Cursor B to Timing	Move cursor to Timing window.

Trigger cursor to Timing	Move cursor to Timing window.
Move all cursors to Timing	Move all cursors to Timing window.
Align Timing with State win	Align the start of the Timing window with the Statelist window.
Timing to cursor A	Move start of Timing window to cursor.
Timing to cursor B	Move start of Timing window to cursor.
Timing to cursor T	Move start of Timing window to cursor.

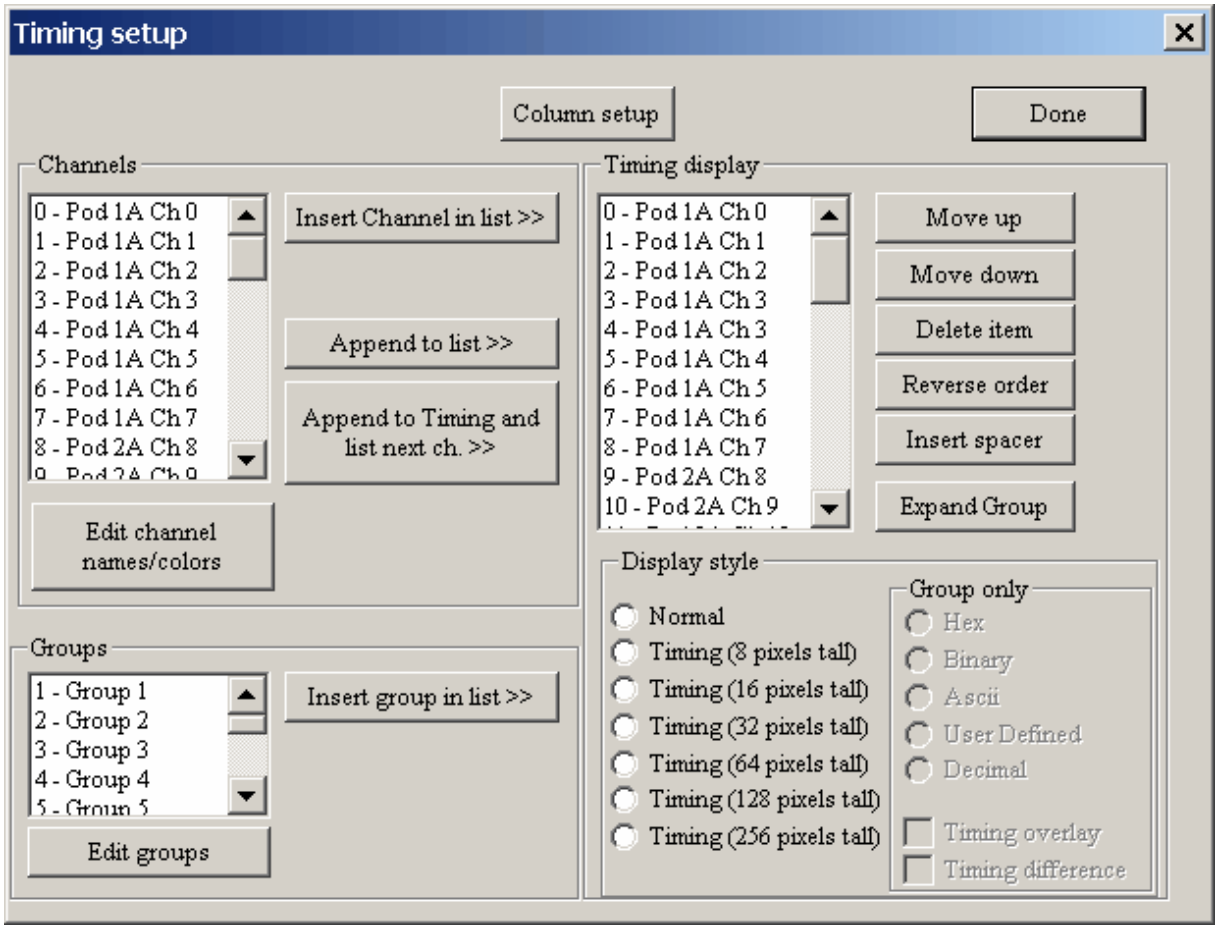
5.6.1 Timing setup

Normal setup
Advanced setup

5.6.2 Timing Setup (Advanced)

The Timing window is organized in rows. Each row can display a channel, channel group or a spacer to separate areas.

In the "Timing display" section you will see a list of the channels in the display order. You can change the order, delete and insert new display lines.



You can also format each by size or base.

Single channel - display options:

Normal	Display timing waveform 12 pixels tall.
Timing(8)	Display timing waveform 8 pixels tall.

Timing(16)	Display timing waveform 16 pixels tall.
Timing(32)	Display timing waveform 32 pixels tall.
Timing(64)	Display timing waveform 64 pixels tall.
Timing(128)	Display timing waveform 128 pixels tall.
Timing(256)	Display timing waveform 256 pixels tall.

Group - display options:

Timing(8)	Display group as timing waveform 8 pixels tall.
Timing(16)	Display group as timing waveform 16 pixels tall.
Timing(32)	Display group as timing waveform 32 pixels tall.
Timing(64)	Display group as timing waveform 64 pixels tall.
Timing(128)	Display group as timing waveform 128 pixels tall.
Hex	Display group in Hex format. Data must be Zoomed.
Binary	Display group in Binary format. Data must be Zoomed.
Decimal	Display group in Decimal format. Data must be Zoomed.
Timing Overlay	Each channel in the group will be displayed on the same line as a waveform. This is used to compare channels.
Timing Difference	This options shows the differences between the channels in a group.

Use Edit channel name/color 

to change channel names or colors.

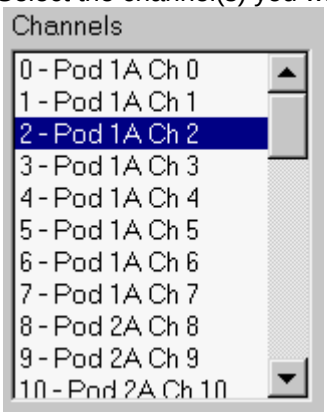
You can edit and create groups with Group setup. 

Timing columns are configured with column setup. 

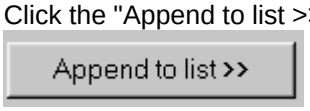
This window will appear when you click on Timing Setup in the Timing menu or when you click on the names in the Timing window.

Adding one or more channels to the Timing display:

1. Select the channel(s) you want to add from the "channels" window:



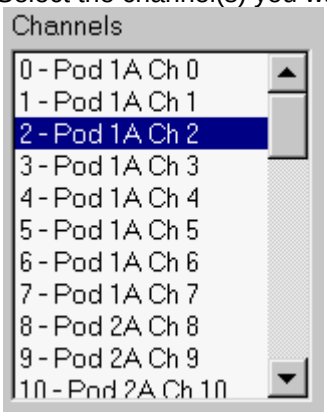
2. Click the "Append to list >>" button.



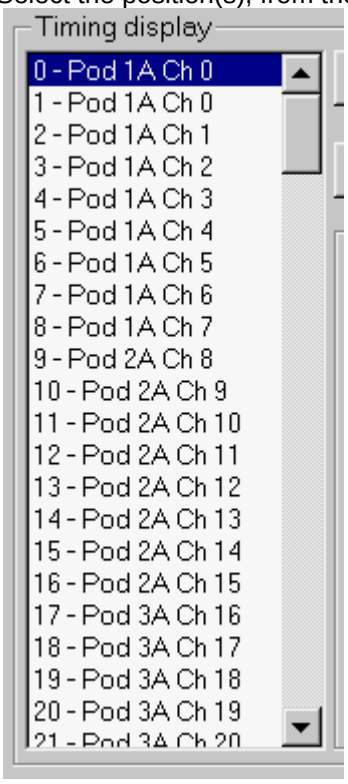
3. "Pod 1A Ch 2" will be added to the end of the list.

Inserting one or more channels in the Timing display:

1. Select the channel(s) you want to add from the "channels" window.



2. Select the position(s), from the "Timing display" window, where you to insert the channel(s).

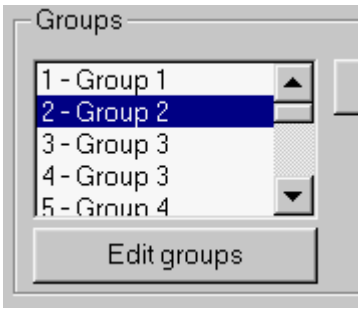


3. Click the "insert in list >>" button

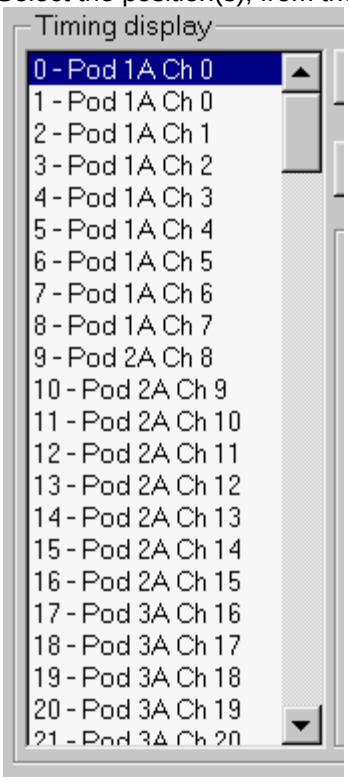
4. "Pod 1A Ch 2" will be added to the list before "Pod1A ch 0"

Inserting one or more groups in the Timing display:

1. Select the group(s) you want to add from the "Group" window.



2. Select the position(s), from the "Timing display" window, where you to insert the group(s).

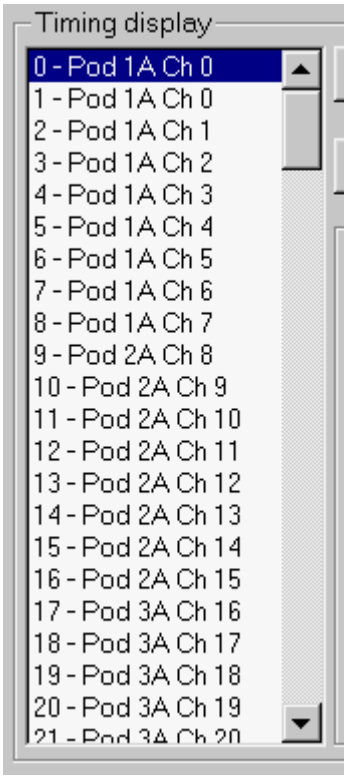


3. Click the "insert in list >>" button

6. "Group 2" will be added to the list before "Pod1A ch 0"

Deleting items from the from the Timing display:

1. Select the channel(s)/group(s), from the "Timing display" window, you want to delete.



2. Click the "Delete item" button.

3. "Pod 1A Ch 0" will be deleted from the list.

Editing one or more channel(s) name or color:

1. Select Channel(s).
2. Click on the "Edit channel names/colors" button

Editing one or more group(s):

1. Select the group(s)
2. Click on the "Edit groups" button

Insert spacer:

Spacers are used to separate timing display lines to make it easier to organize your data. The spacers are the same color as the grid.

To insert a spacer
1. Select an insertion point on the Timing display list.
2. Click on "Insert spacer" button.

The height of the spacer can be set with the "Display style" radio buttons.

Changing the vertical position of an item:

Use the "Move up" and "Move down" buttons.

You can activate this window from the timing menu or by clicking on the channel names in the timing display.

See also: How to (timing setup)

Reversing display order of all display items:
Select one or no lines and click on the "Reverse order" button.

Reversing display order of 2 or more display items:
Select more than one line "Reverse order" button.

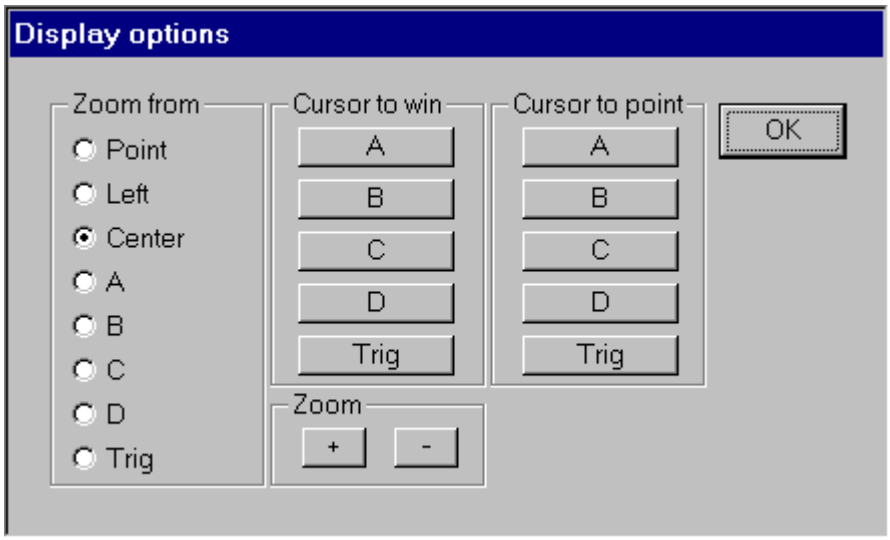
5.6.3 Zoom menu

Data in the Timing window can be zoomed in (more detail) or zoomed out (more data). The display is compressed/expanded in the horizontal direction only. The vertical size and format of the data can be changed in the Timing Setup window

Zoom can be changed in the following ways:
1. Timing->zoom menu
2. Zoom toolbar buttons 
3. Control click(Timing window) Zooms in on point clicked.
   Shift click(Timing window) Zooms out on point clicked.
4. Right clicking on the data area of the timing window brings up a zoom dialog box.

See also: timing menu, Toolbar, Zoom Origin and the Zoom dialog box.

5.6.4 Zoom dialog box



This window appears when you right click in the waveform area of the timing window.

In this window you can do the following:

Zoom:

Zoom in or out with the + or - buttons.

Select a zoom reference point (only active in this window).

Point: Only active if you right clicked on the timing window to bring up this window.

The zoom point is the point you right clicked.

Left: Zoom around the left edge.

Center: Zoom around the center of the screen.

A Zoom around cursor A.

B Zoom around cursor B.

C Zoom around cursor C.

D Zoom around cursor D.

Trigger: Zoom around trigger cursor.

Move cursor to window:

To move a cursor to the timing display window click its button.

Cursor to point:

Move selected cursor to the point you right clicked on (only available by right clicking the timing window).

5.6.5 Column Setup

The left side of the Timing window can have up to 8 columns of information. They include the following:

Channel/group numbers

Channel/group names

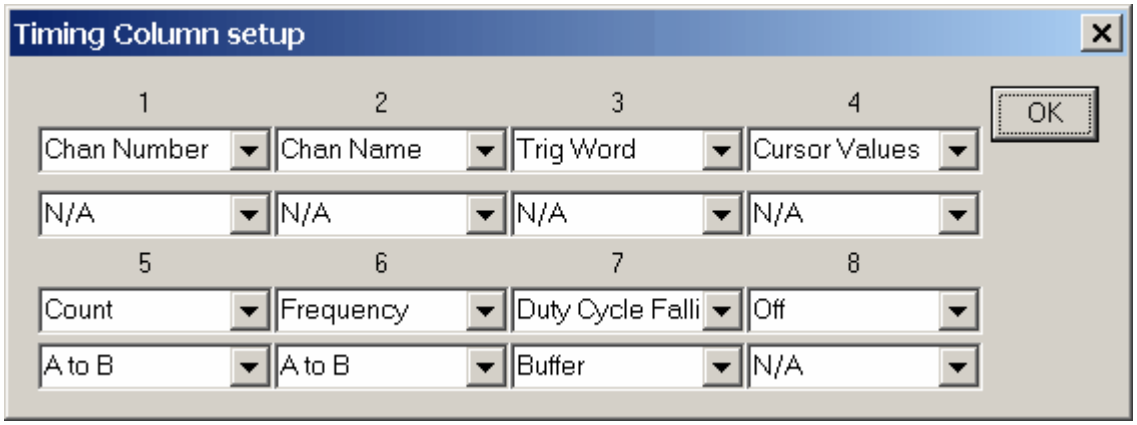
Trigger bits

Values of data at each cursor (they are color coded to match the cursors).

Various measurements (LA-5000 series only)

- Pulse count
- Period
- Frequency
- Duty cycle falling
- Duty cycle rising
- Width falling
- Width rising

Each measurement column can be configured to work on a specific range of data (the entire buffer or between 2 cursors).



See also: How to (timing setup, Timing window

5.6.6 Analog display of a group

The timing window displays data in a "timing waveform" style display.

Single channel

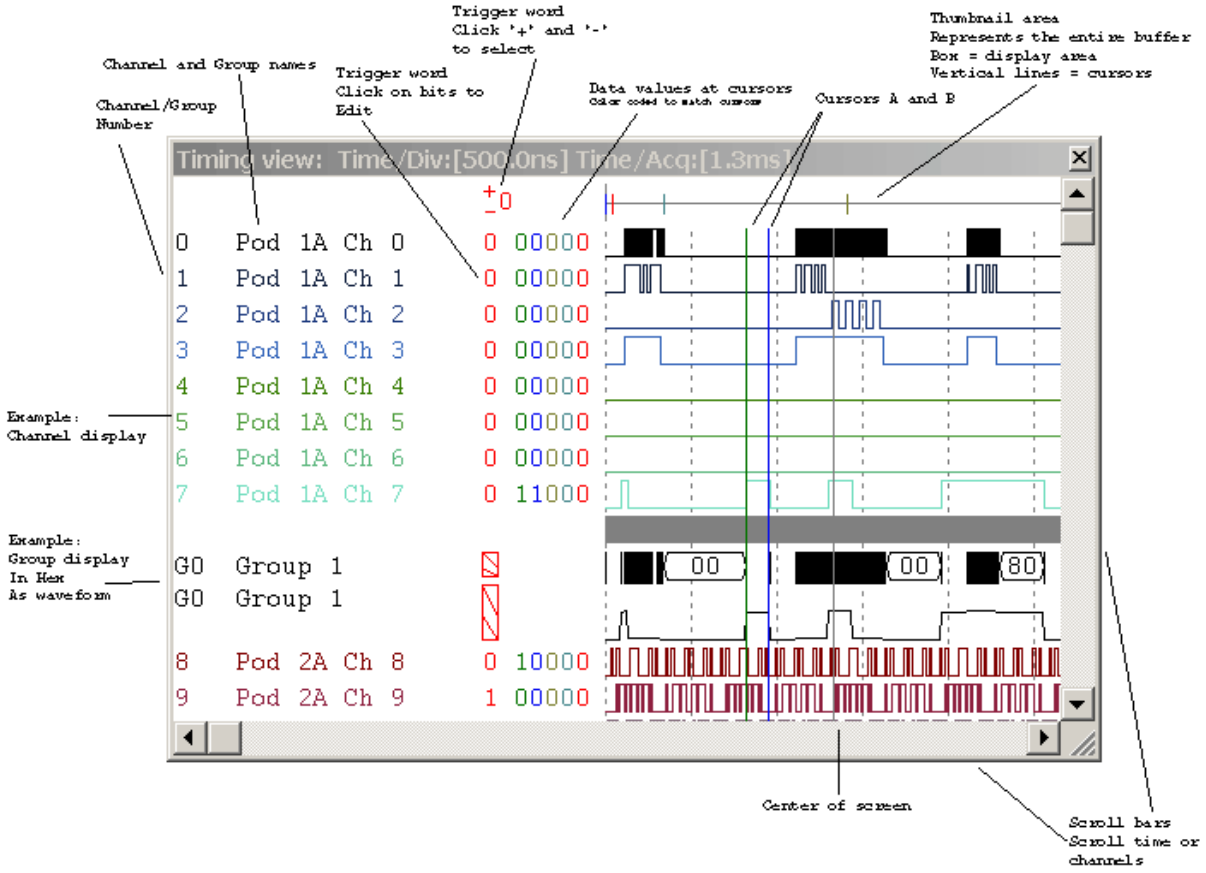
Use the Timing setup to define the height and color of each line of data.

Groups of channels

A group of channels can be displayed in the timing window in an "Analog" style. This is not true analog. This is a group of channels that are each one bit wide. The first channel is the lsb and the last channel is the msb. A value is calculated from this "word" and displayed in an "analog" style.

A group of channels can also be displayed in hex, ASCII, binary or decimal.

Use timing setup to select single or groups for each line.



In the above example "Group One" is in Hex and "Group 2" is in Timing(16) format.

See also:

Group define
Timing setup

5.7 Statelist menu

Statelist window	Display Statelist window.
Statelist setup...	Setup statelist display parameters.
Group Define...	Define channel grouping.
Edit Translation table	Edit Translation table.
Cursor A to Statelist	Move cursor to Statelist window.
Cursor B to Statelist	Move cursor to Statelist window.
Cursor C to Statelist	Move cursor to Statelist window.
Cursor D to Statelist	Move cursor to Statelist window.
Trig cursor to Statelist	Move cursor to Statelist window.
Move all cursors to Statelist.	Move all cursors to Statelist.
Align Statelist with Timing win	Align the start of the Statelist window with the Timing window.
Statelist to cursor A	Move start of Statelist window to cursor.
Statelist to cursor B	Move start of Statelist window to cursor.
Statelist to cursor T	Move start of Statelist window to cursor.

5.7.1 Statelist setup

The statelist window is organized in columns. Each column is a channel group. Each group has one or more channels in it.

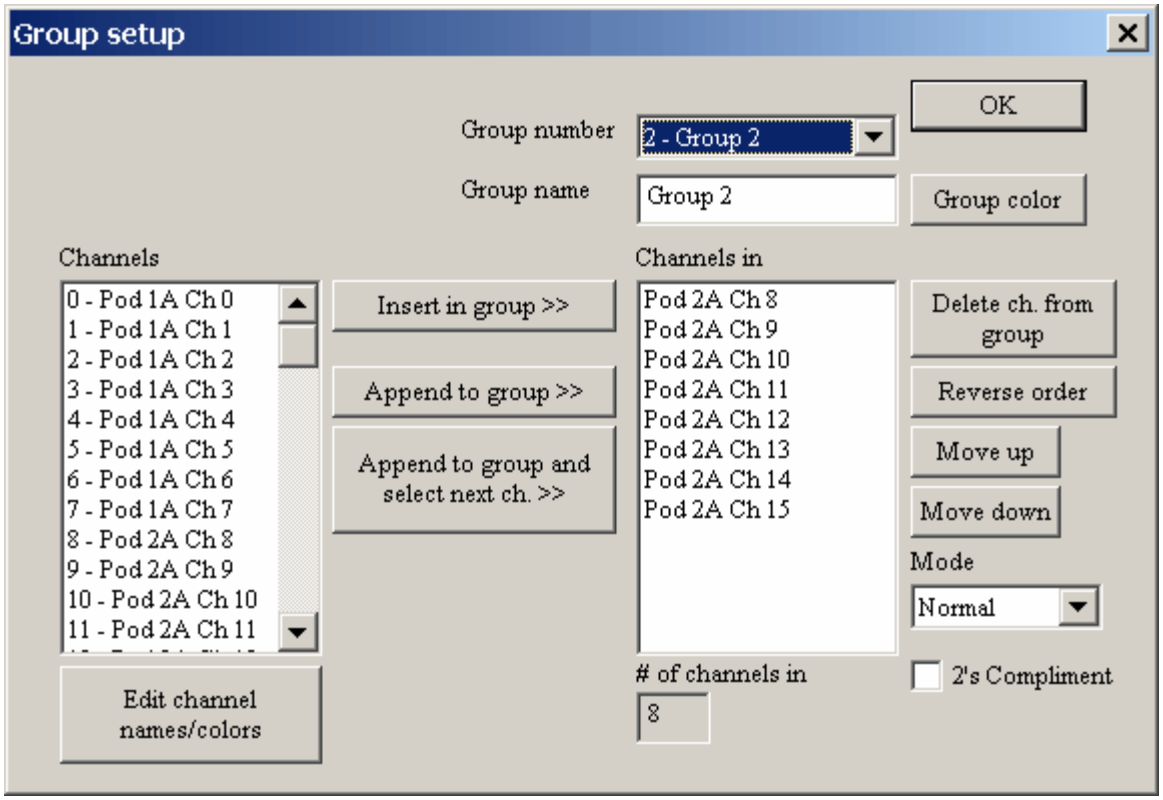
This window lets you do the following:

Select which column displays which group.
Choose a base (Hex, ASCII, Decimal or Translation table) for the column.
Note:
You can display a group in more than one column and in different bases.

By default the groups are organized by pod. You can edit and create groups with Group define.

Activate this window via the state menu or by left clicking the group names in the statelist display.

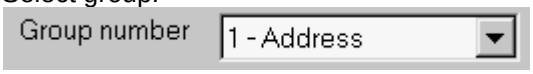
5.7.2 Group define



The channels can be organized into groups for display in the Statelist or Timing windows. The default organization is by pods.
In this window you can do the following:

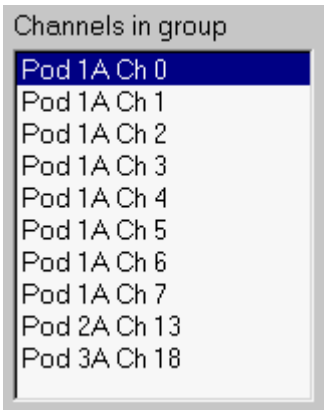
Defining groups:

1. Select group.

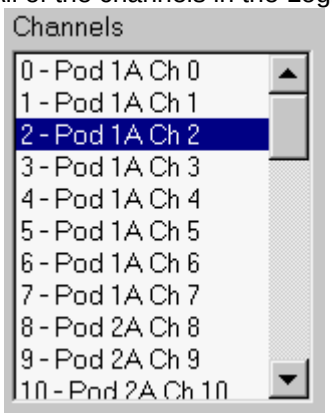


2. Edit name (14 character maximum).

3. The channels currently in the group are listed in the "Channels in group" window:



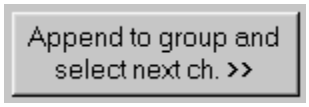
4. All of the channels in the Logic Analyzer are in the "channels" window:



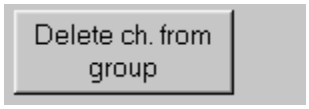
5. Use the following buttons to edit the list of channels in the selected group:

Inserts the channel selected in the "channel" window" in the "channels in group" list.

Appends the channel selected in the "channel" window to the "channels in group" list.

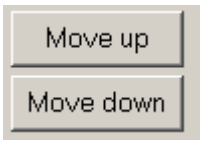


Appends the channel selected in the "channel" window to the "channels in group" list and to select the next channel in the "channel" window.

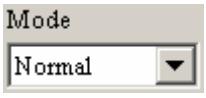


Deletes the selected channel from the "channels in group" window.

Reverses the order of the channels in the "channels in group" window.



The "Move up" and "Move down" buttons move the selected channel up or down in the "channels in group" window.

5. Select mode with the mode box. 

If your Logic Analyzer has the I2C option you can select one group to be displayed as I2C commands.

6. Select 

mode to display the values of the group in 2's Compliment math.

7. Edit a channels name or color by clicking on the 

button.

Activate this window via the state menu ,serial menu or from statelist setup.

5.7.3 Translation tables

Translation tables work with the statelist display. They allow you to do simple disassembly type functions. They "Translate" a numeric value into a text string".

You can enter the following in to the table:

Bit pattern	32 bits wide of 1, 0, or X (don't care)
String	The string that will replace the bit pattern.
Number of samples to skip.	Number of clock cycles to skip before starting to look for more patterns.

Example:

If MOV AX,BX had an opcode of 0x9 and it took 3 clock cycles to execute.

Set the following:

Bit pattern to	01001
String to	MOV AX,BX
Skip to	2

5.8 Serial menu

Serial view(I2C)	Display I2C serial window.
Serial view(SPI)	Display SPI serial window.
Group Define..	Define channel grouping.

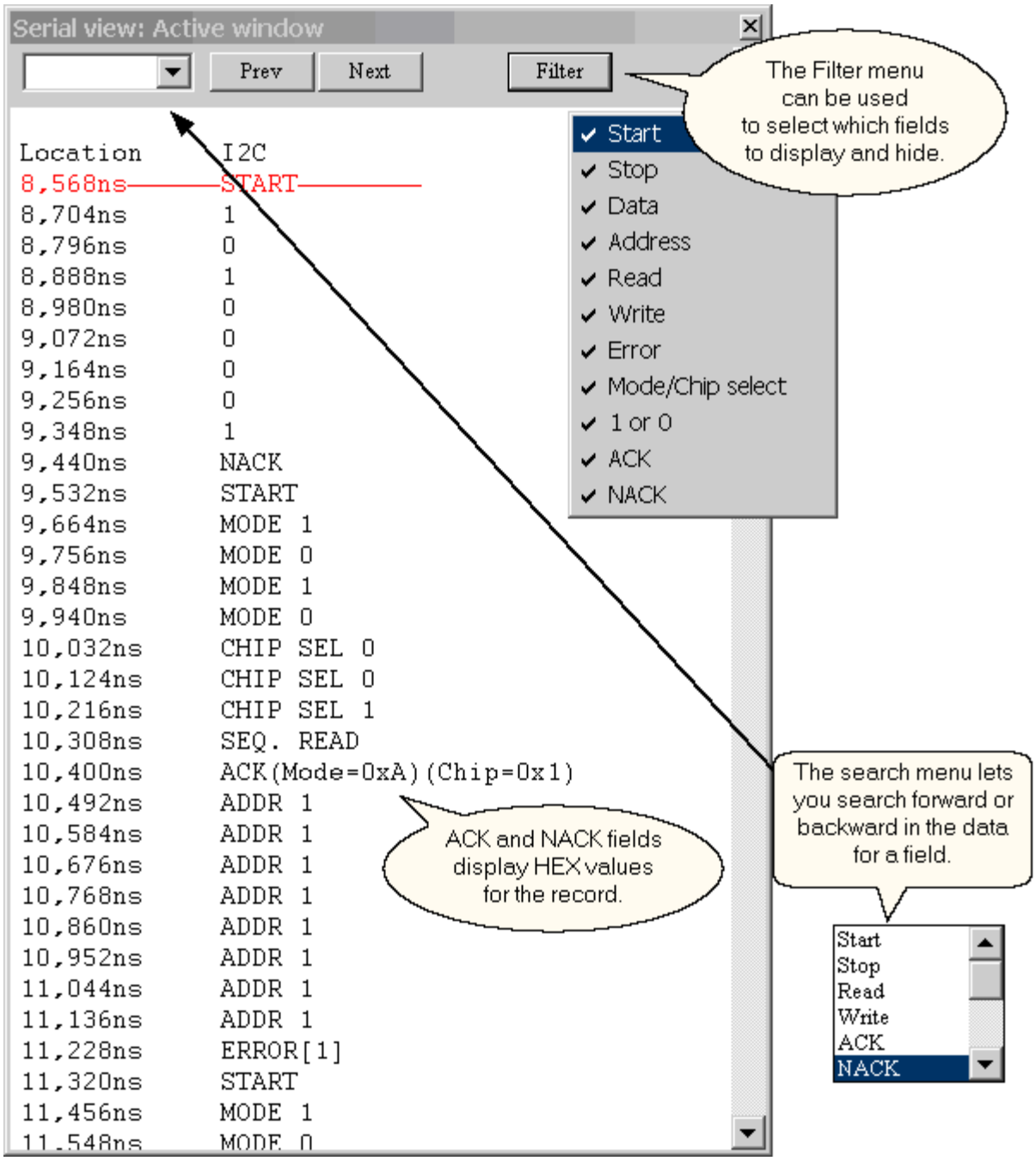
5.8.1 I2C window

The I2C window will show the disassembled I2C commands from the data stream of a group defined as I2C in the group define window.

Data is displayed in 2 columns. The first is an index to the location in the buffer and the second contains the I2C commands.

Double clicking on a line focuses the Timing and Statelist windows on that point.

Right clicking will display a menu that lets you position the cursors and align this window with other windows.



Sample rate:

Most people will choose to select an internal clock rate that is 4 to 10 times the I2C clock rate. You can use an external clock, but you can not use the I2C as an external clock source for the LA.

5.8.2 SPI Window

The SPI window decodes and displays SPI commands. Before you use the SPI decoder you will need to define a group of four channels and set the mode to SPI (SPI 0, SPI 1, SPI 2 or SP 3).

Any four channels can be used, but they must be in the following order:
First channel: CLK
Second channel: SI
Third channel: SO
Forth channel: CS

The software supports the four standard SPI bus modes:
SPI 0, SPI 1, SPI 2 or SP3

Most SPI buses use CS low to indicate an SPI stream. There is an option for CS active high in the group setup window.

Data is displayed in 3 columns. The first is an index to the location in the buffer, the second shows SI commands and the third shows SO commands.

Sample rate:
Most people will choose to select an internal clock rate that is 4 to 10 times the SPI clock rate. You can use an external clock, but you can not use the SPI clock as an external clock source for the LA.

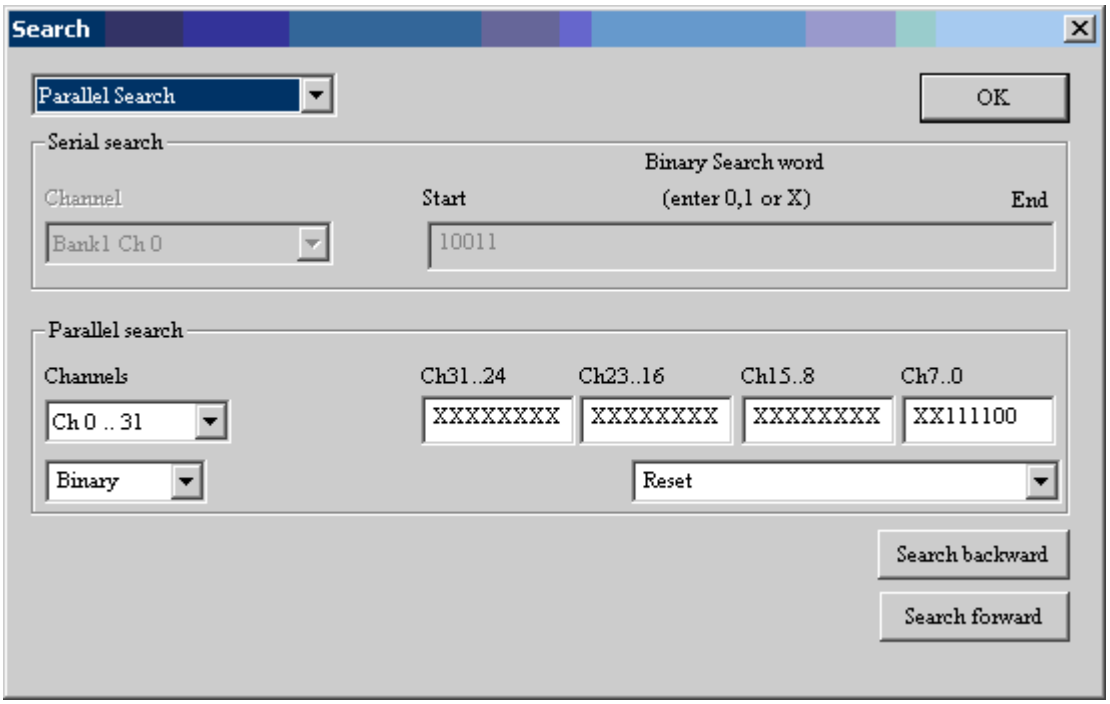
5.9 Search menu

Setup	Setup search pattern
Forward	Forward search
Reverse	Reverse search

5.9.1 Search Setup

Data can be searched in two ways:
Parallel search: Search across multiple channels at the same time.
Serial search: Search within one channel for a serial stream of data.

Parallel search:



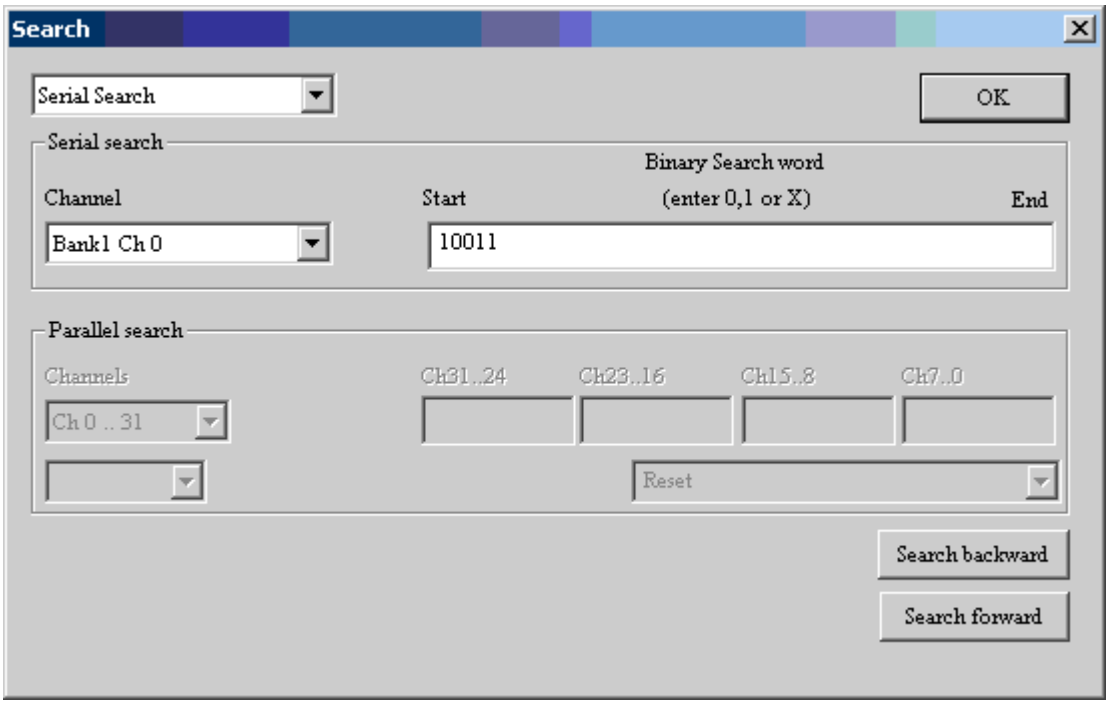
Search across multiple channels at the same time.

If your Logic Analyzer has more channels than are currently displayed use the "Channels" listbox to select the additional channels.

The search mask can be edited in Decimal, ASCII, Hex or Binary(note in binary you can enter 0,1, and X (don't care))

The "Search forward" and "Search backward" allow you to search both forward and reverse directions. If a match is found (all bits much match) the current window is scrolled to the matching position.

Serial search:



Search within one channel for a serial stream of data.

The search mask is entered in Binary (0,1, and X (don't care)). The leftmost bit is the first bit searched for.

The "Search forward" and "Search backward" allow you to search both forward and reverse directions. If a match is found (all bits much match) the current window is scrolled to the matching position.

Hotkeys:

F3	Search window
CTRL F3	Search forward
Shift F3	Search backward

5.10 help menu

The Help menu offers the following commands, which provide you assistance with this application:

Help Topics	Offers you an index to topics on which you can get help.
About	Display copyright and version number of this application.

5.10.1 help about

Use this command to display the copyright notice and version number of your copy of this program.

Part

6 Windows

6.1 Toolbar

The toolbar is displayed across the top of the application window, below the menu bar. The toolbar provides quick mouse access to many tools.

File save.

Zoom in and Zoom out..

Increase sampling rate and Decrease sampling rate.

Start capture

Stop capture

End capture

Clear Data buffer

Trigger mode

Trigger word

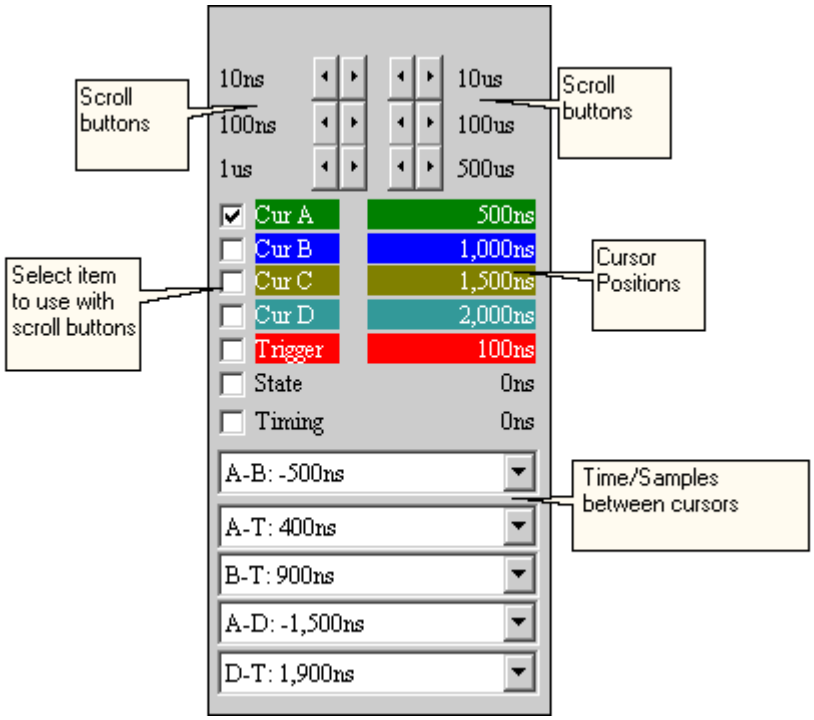
Edit Pattern Generator data

Print

6.2 Control window

Cursors are used to mark points of interest in the data, to measure time between events and to define pre/post trigger position.

This window is used to move cursors and change what area of the data buffer is being displayed in the Timing and Statelist windows. It also display the Trigger status and the time between the cursors.



Each cursor is displayed in a combination of its color and the background color.

Item selection
: Click on the item you want to move.

Movement
: Select an item by clicking on its box.

Use the arrow buttons  to move the selected item. Their are 6 sets of arrow buttons. Each set of buttons moves the selected item by the indicated amount.

Right clicking on one of the items brings up a context sensitive menu that allows you to reset, change color or change display units.

Measurements
: The position of each cursor, timing and statelist windows are displayed. The differences between some of the cursors are also displayed.

The value is either in Time or Sample units. To select between time and sample number display go to the view/samples or time menu.

Trigger/capture status
: Trigger/capture status is also displayed.

See also: How to: using cursors.

6.3 Timing window

This window shows the data in a timing waveform style display.

The title bar displays Time/Division (Time between vertical dotted lines) and Time/Acquisition (Total time recordable by Acquisition buffer - based on current Clock rate and buffer size).

Below the title bar is the thumbnail area. The long horizontal line represents the entire data buffer, the box represents the current display area and the vertical lines represent the cursors. You can click and drag on the box or cursors to reposition them.

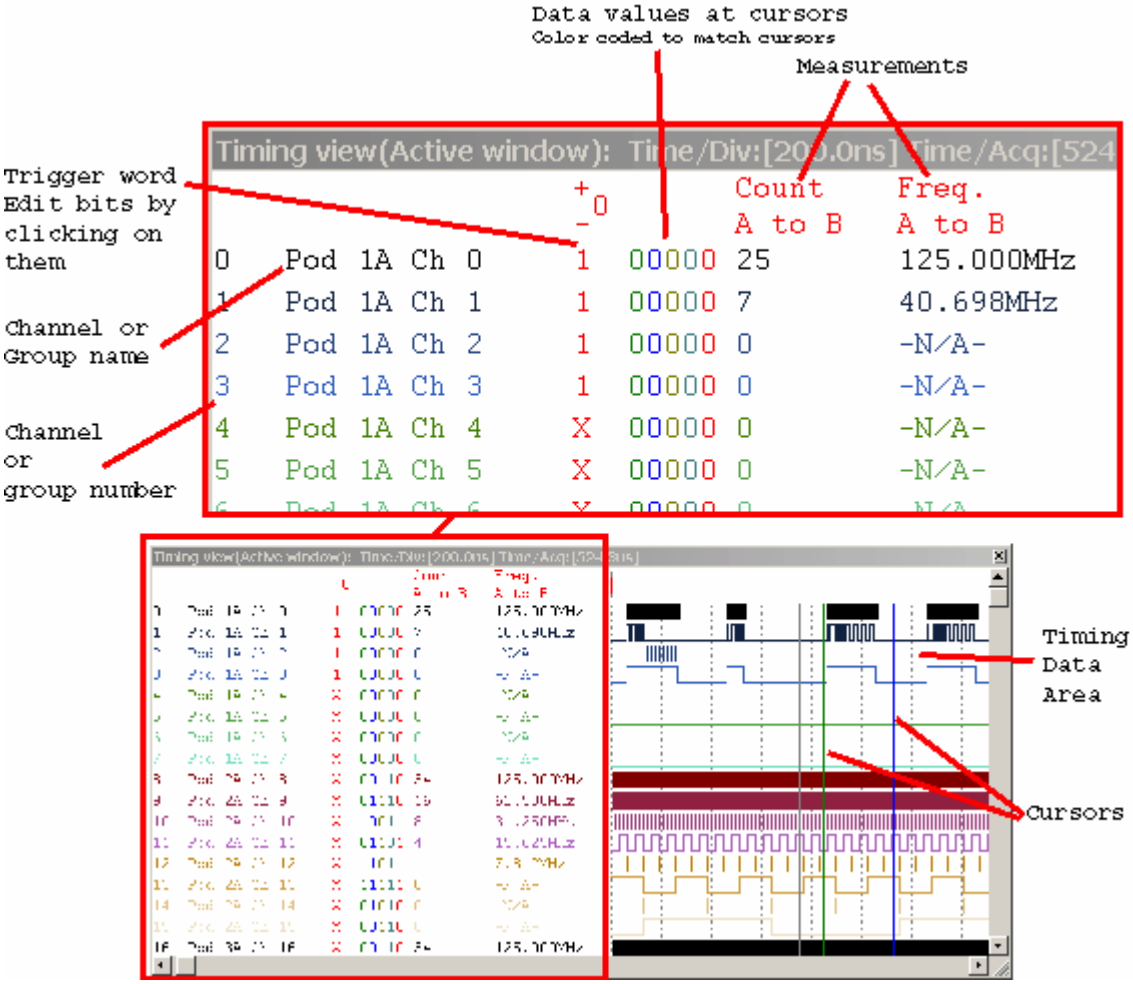
Below that is the data area. This area is divided into 2 sections:

1) 8 columns that can display the following
   Channel/group numbers
   Channel/group names
   Trigger bits
   Values of data at each cursor (they are color coded to match the cursors).
   Various measurements (LA-5000 series only)

   These columns are configured in the "Column setup" window. It can be accessed from the Timing menu, timing setup window or by right clicking in this region.

2) Timing data display

The vertical scroll bar moves the window up and down to display more channels. The horizontal scroll bar moves the data forward and backward in time. The starting point of the display is shown in the cursor window.



This window can be used with either the internal or external clocks.

The channel order and display characteristics can be changed with the Timing->timing setup menu or by right clicking on the left side of the window using menu.

You can also click on a channel name to reposition the channel.

Activate this window in the timing menu.

The size of the window can be changed by grabbing an edge of the window and dragging it.

Keyboard shortcuts:

When the Timing window is selected (title says "active window")

Left click + "A" key	moves the cursor to the window.
Left click + "B" key	moves the cursor to the window.
Left click + "C" key	moves the cursor to the window.
Left click + "D" key	moves the cursor to the window.
Left click + "T" key	moves the cursor to the window.
Left arrow:	scroll data with respect to time.
Right arrow:	scroll data with respect to time.
Up arrow:	scroll data with respect to channels.
Down arrow:	scroll data with respect to channels.

Holding shift key down while using arrows will scroll by a factor of 10.
Holding control key down while using arrows will scroll by a factor of 100.
Holding shift and control keys down while using arrows will scroll by a factor of 1000.

Control A:	Brings window to cursor.
Control B:	Brings window to cursor.
Control D:	Brings window to cursor.
Control T:	Brings window to cursor.
Shift A:	Brings cursor to window.
Shift B:	Brings cursor to window.
Shift C:	Brings cursor to window.
Shift D:	Brings cursor to window.
Shift T:	Brings cursor to window.

Note:
- This only works on the selected window.
- Click on the window to select it.
- The selected window will say "active window" in the title bar.

When either window is selected

Right click on timing window
- Brings up zoom dialog box.
- Allows you to zoom on center or left edge of screen.
- Other zoom features.

'Z'	zooms in on data
Shift Z	zooms out on the data

See also: How to:Setting up the Timing window.

6.4 Statelist window

This window shows the data in a statelist style display. The data will be displayed in columns. Each column represents a group of channels and can be displayed in different bases. Above each column will be its name. The horizontal scroll bar moves the window left and right to display more groups. The vertical scroll bar moves the data forward and backward in time. The starting point of the display is shown in the cursor window.

You can change the groups, column order and bases in the Statelist setup and group define menus.

This window will function with either the internal or external clocks.

Activate this window in the statelist menu.

The size of the window can be changed by grabbing an edge of the window and dragging it.

Right clicking will display a menu that lets you position the cursors and align this window with other windows.

Keyboard shortcuts:

If the State window is selected (title bar says "active window")

Up arrow:	Scroll data with respect to time.
Down arrow:	Scroll data with respect to time.
Left arrow	Scroll data with respect to channels.
Right arrow	Scroll data with respect to channels.

Holding shift key down while using arrows will scroll by a factor of 10.
Holding control key down while using arrows will scroll by a factor of 100.
Holding shift and control keys down while using arrows will scroll by a factor of 1000.

Control A:	Brings window to cursor.
Control B:	Brings window to cursor.
Control C:	Brings window to cursor.
Control D:	Brings window to cursor.
Control T:	Brings window to cursor.

Shift A:	Brings cursor to window.
Shift B:	Brings cursor to window.
Shift C:	Brings cursor to window.
Shift D:	Brings cursor to window.
Shift T:	Brings cursor to window.

Note:

This only works on the selected window.
Click on the window to select it.
The selected window will say "active window" in the title bar.

See also: How to: setting up Statelist window.

6.5 Scrollbars

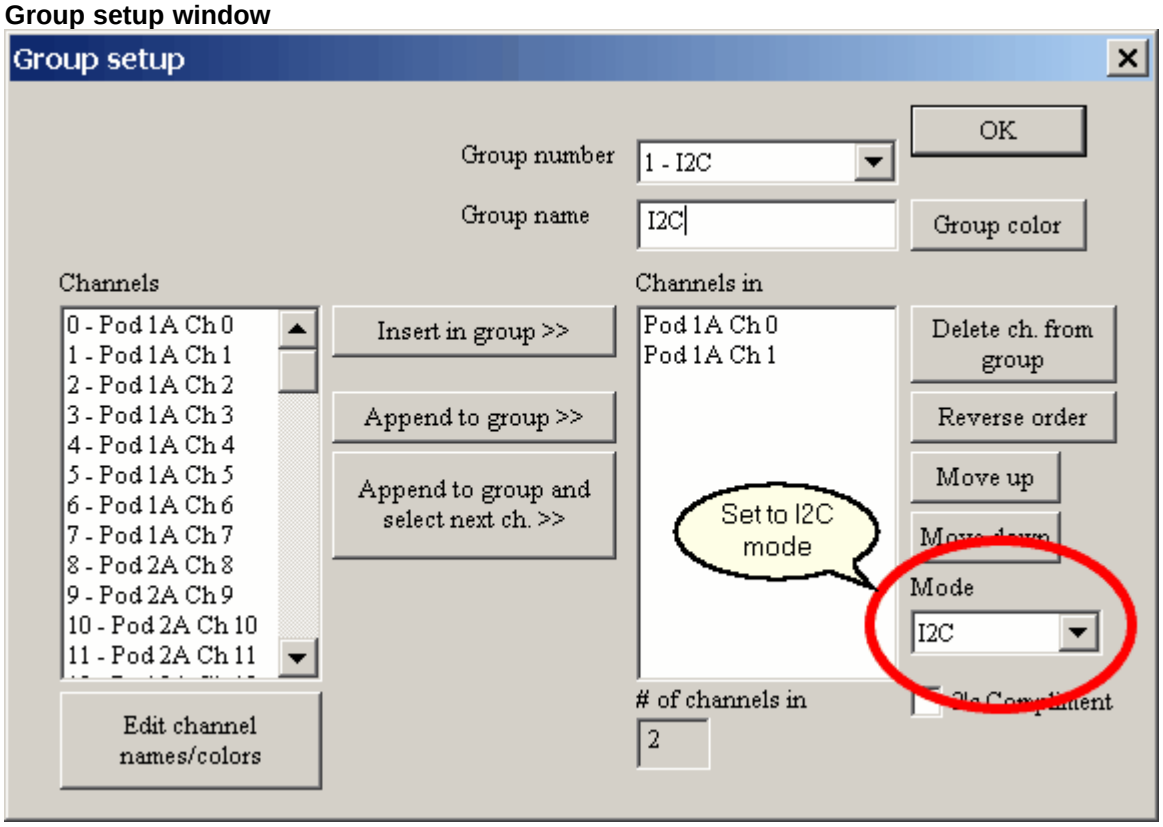
Displayed at the right and bottom edges of the document window. The scroll boxes inside the scroll bars indicate your vertical and horizontal location in the document. You can use the mouse to scroll to other parts of the document.

6.6 I2C window

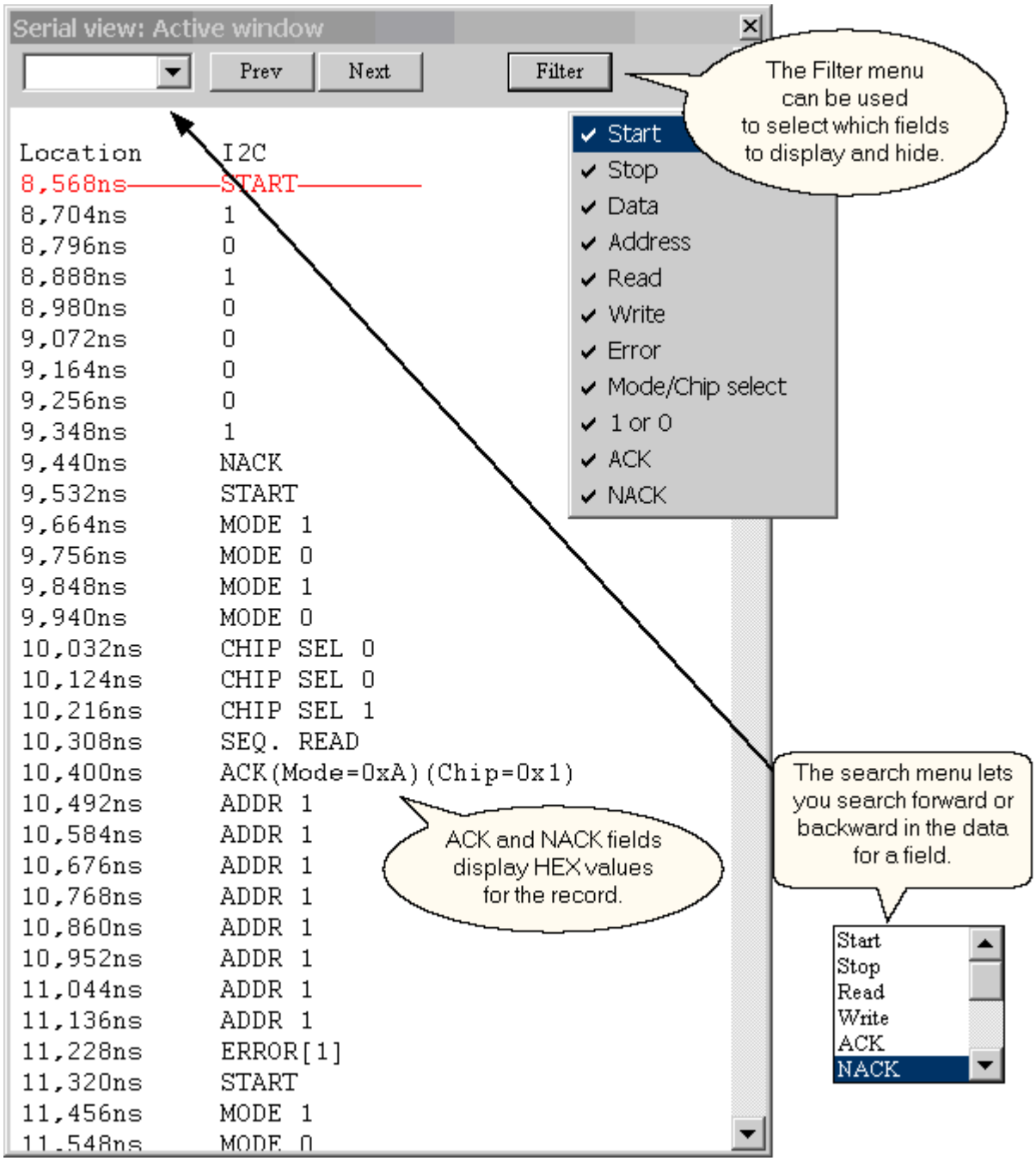
An optional I2C software disassembly package is available that displays captured I2C commands, data and address info. The screen looks very similar to the statelist window. The screen is organized in to two columns. The first column displays the address/sample time and the second column displays the I2C commands such as Read, Write, ACK, NACK, ADDR 1, ADDR 0, DATA 1, Data 0, Start, Stop, etc....

The serial window will disassemble a single group. This group must be set to "I2C" mode (See group define). and have two channels (Clock and data).

Group setup window



Serial Window



Contact Link Instruments sales department to order the I2C software.

Part

7 FAQ

Q. Can I see data that happened before the trigger?
A. Yes, see Trigger position.

Q. Can I automatically save the data after each capture?
A. Yes, see data logging.

Q. Can I share data with coworkers?
A. Yes, See file save, Export and open.

Q. How do I put a picture of the screen into my reports?
A. Hit the "Print Screen" key on you keyboard. This will copy a picture of the screen into the windows clipboard. You can now run your image editing software, word processor or others window software and paste the screen image into it. If you paste it into an image editor you can crop and annotate the image.

Q. Can I get a JPG or BMP file?
A. See "How do I put a picture of the screen into my reports" above.

Q. The Logic Analyzer is working accept one of the channels is dead.
A. Check to see if the wire is actually on the post. It is possible to jam the wire between the post and the plastic case and not make a connection.

Q. Does the Logic Analyzer have an external trigger in?
A. You can use any/all of the inputs as a trigger signal.

Part VIII

8 File formats

Data files(.LA)

This file contains settings in the traditional windows .INI format and 2 types of records in the following format:

1. Data

A header that starts with a `[` and ends with a `]' character. This header line must be less than 80 characters long.

The line has 4 tokens

Token 1: "Data"

Token 2: Channel ID A1,A2,D1,M1,M2.....
Where A stands for analog channels, D stands for digital channels(8), and M for memory locations.
Example 1: D1 means the first 8 digital channels.
Example 2: A2 means the second analog channel

Token 3: A six digit number for the start address of the data record. The number is coded in decimal.

Token 4: A six digit number for the length of the data record. The number is coded in decimal (maximum length per record is 32768).

Example "[Data D2 000000 004096]"
This line means load digital channels 8..15 with 4096 data points starting at address 0.

Following the data header will be the actual data stored in binary format.

2. Comment

A header that starts with a `[` and ends with a `]' character. this header line must be less than 80 characters long.

The line has 1 or more tokens.
token 1: "Comment"
token 2....: the comment

example "[Comment This file was saved on 1/1/1995 at 8:06]"

Data files(.CSV from file save/load)

Comma Separated Value files will have one or more channels worth of data separated by commas. This file format is used when you want a way to export data to other programs. Each line will represent one sampling of time. Each channel will be separated by a comma. Each line must have the same number of columns and commas.

Three types of comma separated files are supported.

Type 1: Type 1 has just the data
example A)
1,1,0,0,1,1,1,1,
0,0,0,0,1,1,1,1,

In this example you have 2 samples each with 8 channels.

Type 2A: Type 2 files are the same as type 1 with the exception that the first line a type 2 file contains the channel numbers. The channels don't have to be consecutive order.

example A)

0,1,2,3,4,5,6,7,
1,1,0,0,1,1,1,1,
0,0,0,0,1,1,1,1,

In this example you have 2 samples each with 8 channels (0,1,2,3,4,5,6 and 7)

example B)

10,6,2,5,4,5,16,17,
1,1,0,0,1,1,1,1,
0,0,0,0,1,1,1,1,

In this example you have 2 samples each with 8 channels (10,6,2,5,4,5,16 and 17).

Type 2B: This file format is used primarily for loading data into the Pattern Generator buffers of the IO-3200 series.

Type 3 files are the same as type 2 with a couple of extra fields in the first line.

The first column of the file has buffer positions. The column is indicated by a '#' symbol.

Logic Analyzer channels are coded with a number from 0 to the maximum channel number for your LA.

Pattern Generator channels are coded with a 'P' followed with a number that represents the channel.

example A)

#,P0,P1,P2,P3,4,5
0,1,0,0,1,0,1,
1,I,I,I,I,0,0,1,
4,1,0,0,0,1,1,
This file defines 4 pattern generator channels (0,1,2 and 3)
Pattern Generator channel 0 (output 1, input mode, undefined, undefined, output 1)
Pattern Generator channel 1 (output 0, input mode, undefined, undefined, output 0)
Pattern Generator channel 2 (output 0, input mode, undefined, undefined, output 0)
Pattern Generator channel 3 (output 1, input mode, undefined, undefined, output 0)
Logic Analyzer channel 4 (0,0,undefined, undefined, 1)
Logic Analyzer channel 5 (1,1,undefined, undefined, 1)

Data files(.CSV from file export)

Export can save a group or all channels. Comma Separated Value files will have one or more channels worth of data separated by commas. This file format is used when you want a way to export data to other programs. Each line will represent one sample.

All channels:

Binary mode: Each channel will be separated by a comma.

Channel order:
Pod0(ch7,ch6,ch6,ch5,ch4,ch3,ch2,ch0),
Pod1(ch7,ch6,ch6,ch5,ch4,ch3,ch2,ch0),
Pod2(ch7,ch6,ch6,ch5,ch4,ch3,ch2,ch0),
Pod3(ch7,ch6,ch6,ch5,ch4,ch3,ch2,ch0), etc....

Decimal mode: Data will be grouped by pod. Data will be in Decimal. Each pod worth of data will be separated by a comma.
ASCII mode: Data will be grouped by pod. Data will be in ASCII. Each pod worth of data will be separated by a comma.
Hex mode: Data will be grouped by pod. Data will be in Hex. Each pod worth of data will be separated by a comma.

Group:
Binary mode: Each channel will be separated by a comma.
Channel order: MSB ... LSB
Decimal mode: Data will be in Decimal. Each group worth of data will be separated by a comma.
ASCII mode: Data will be in Ascii. Each group worth of data will be separated by a comma.
Hex mode: Data will be in Hex. Each group worth of data will be separated by a comma.

Settings file(.INI)

These files store the Logic Analyzer settings. It is in the standard windows .INI format.

Translation table(.LXT)

See Translation tables .

MathCad(.PRN)

This is the same as .CSV except it does not have the commas.

I2C(.I2C)*

The I2C commands will be saved in a comma separated format.

SPI(.SPI)*

The SPI commands will be saved in a comma separated format.

```
//Each line represents one SPI command.
//Each line should end with a carriage return or a comma.

//SO commands: 'SO=nn  or SO=0xnn  or SO=nnh'  where nn is a hex number between 1 and FF. nn= Number of bytes to read.
//SI commands: 'SI=nn  or SI=0xnn  or SI=nnh'  where nn is a hex number between 0 and FF. nn= Byte to output on SI line.
//Comments begin with '//'

//Issue a "9F" on SI line
SI=0x9F

//read 1 byte on SO line
SO=0x01

//read 3 bytes on SO line
SO=0x03
```

*Only available on Logic Analyzers with the I2C option.

Part

9 Hot keys

Alt-F	File menu
Alt-E	Edit menu
Alt-V	View menu
Alt-R	Serial menu
Alt-A	State menu
Alt-I	Timing menu
Alt-P	Pattern menu
Alt-C	Clock menu
Alt-T	Trigger menu
Alt-S	Search menu
Alt-H	Help menu

R:	Decrease sample rate.
Shift R:	Increase sample rate.

W:	Trigger word window
G:	Go button.
S:	Stop button.
F2:	Edit pattern generator data.

Timing window selected

Control click	Zooms in on point clicked.
Shift click	Zooms out on point clicked.
Up arrow	Scroll data with respect to channels.
Down arrow	Scroll data with respect to channels.
Left arrow	Scroll data with respect to time (scrolls by 1 sample).
Right arrow	Scroll data with respect to time (scrolls by 1 sample).
Shift-Left arrow	Scroll data with respect to time (scrolls by 10 samples).
Shift-Right arrow	Scroll data with respect to time (scrolls by 10 samples).
Control-Left arrow	Scroll data with respect to time (scrolls by 100 samples).
Control-Right arrow	Scroll data with respect to time (scrolls by 100 samples).
Shift-Control-Left arrow	Scroll data with respect to time (scrolls by 1000 samples).
Shift-Control-Right arrow	Scroll data with respect to time (scrolls by 1000 samples).
Control A:	Brings window to cursor.
Control B:	Brings window to cursor.
Control D:	Brings window to cursor.
Control T:	Brings window to cursor.
Shift A:	Brings cursor to window.
Shift B:	Brings cursor to window.
Shift C:	Brings cursor to window.
Shift D:	Brings cursor to window.
Shift T:	Brings cursor to window.
"A" and left click	Brings cursor to point clicked.
"B" and left click	Brings cursor to point clicked.
"C" and left click	Brings cursor to point clicked.
"D" and left click	Brings cursor to point clicked.
Control '+':	Zoom in
Shift Z:	Zoom in

Control '-':	Zoom out
Z:	Zoom out
F5	Toggles Go state
G:	Go button.
S:	Stop button.
F3	Search window
CTRL F3	Search forward
Shift F3	Search backward
W:	Trigger word window.
M:	Change trigger mode.
R:	Decrease sample rate.
Shift R:	Increase sample rate.

Timing window (Right click)
Brings up zoom dialog box.
Allows you to zoom on center or left edge of screen.
Other zoom features.

Timing window (Left click on channel names)
Brings up Timing setup.

Note:
These commands only effect the selected window.
Click on the window to select it.
The selected window will say "active window" in the title bar.

State window selected

Up arrow	Scroll data with respect to time.
Down arrow	Scroll data with respect to time.
Left arrow	Scroll data with respect to groups.
Right arrow	Scroll data with respect to groups.
Shift-Up arrow	Scroll data with respect to time (scrolls by 10 samples).
Shift-Down arrow	Scroll data with respect to time (scrolls by 10 samples).
Control-Up arrow	Scroll data with respect to time (scrolls by 100 samples).
Control-Down arrow	Scroll data with respect to time (scrolls by 100 samples).
Shift-Control-Up arrow	Scroll data with respect to time (scrolls by 1000 samples).
Shift-Control-Down arrow	Scroll data with respect to time (scrolls by 1000 samples).
Control A:	Brings window to cursor.
Control B:	Brings window to cursor.
Control D:	Brings window to cursor.
Control T:	Brings window to cursor.
Shift A:	Brings cursor to window.
Shift B:	Brings cursor to window.
Shift C:	Brings cursor to window.
Shift D:	Brings cursor to window.
Shift T:	Brings cursor to window.

Statelist window (Left click on group names)
Brings up Statelist setup.

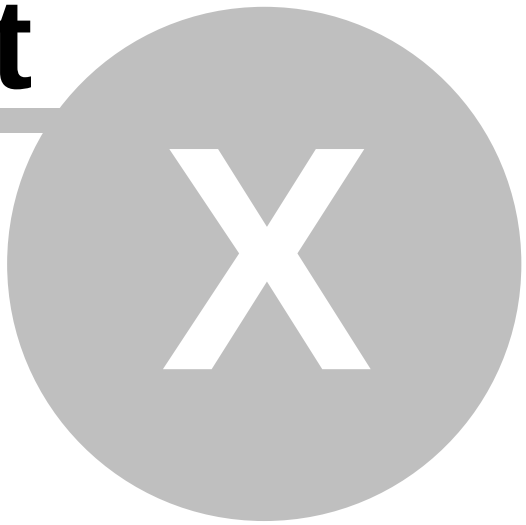
Note:
These commands only effect the selected window.

Click on the window to select it.
The selected window will say "active window" in the title bar.

Pattern Generator edit widow selected (IO-3200)

Control click	Zooms in on point clicked.
Shift click	Zooms out on point clicked.
"1" and left click	Brings cursor to point clicked.
"2" and left click	Brings cursor to point clicked.
"3" and left click	Brings cursor to point clicked.
"4" and left click	Brings cursor to point clicked.

Part



10 Technical support

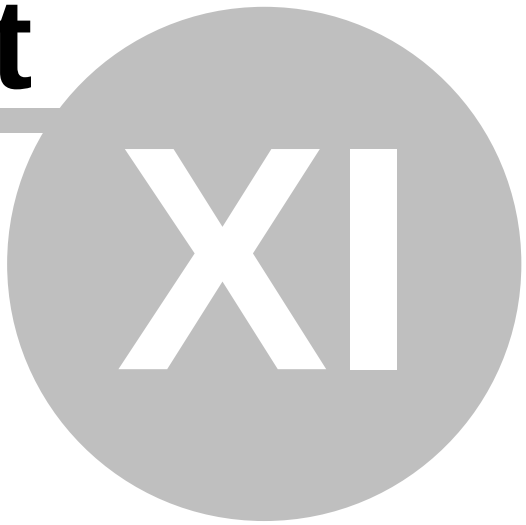
Technical support can be reached at

Link Instruments, Inc.
17a Daniel Road East
Fairfield, NJ 07004, USA
Phone: 973-808-8990 (9:00 - 5:00 eastern standard time)
Fax: 973-808-8786
Email: support@LinkInstruments.com

Software updates

Software can be downloaded from our website
Web: www.LinkInstruments.com

Part



11 Specifications

Memory modes and channel specs

See Memory modes.

LA-com-card(ISA) for the LA-4000 series Logic Analyzers

Address jumper positions for ISA card.

Jumper	Address						
	210-21F	230-23F	280-28F	2A0-2AF	300-30F	320-32F	380-38F
	3 2 1	3 2 1	3 2 1	3 2 1	3 2 1	3 2 1	3 2 1
JP1	X X	X X	X X	X X	X X	X X	X X
JP2	X X	X X	X X	X X	X X	X X	X X
JP3	X X	X X	X X	X X	X X	X X	X X

Software (LA-5000 series)

Operating systems supported

WIN 95/98/me:	Yes.
WIN NT/2000/XP	Yes.

Software (LA-4000 series)

Operating systems supported

DOS:	Yes.
WIN3.1:	Use DOS version of the software.
WIN95/98/me:	Yes.
WIN NT/2000/XP	Yes.

Software (LA-2124)

Operating systems supported

DOS:	Not supported.
WIN3.1:	Not supported.
WIN95/98/ME:	Yes.
WIN NT/2000/XP	Yes.

Part

12 Accessories

Accessories

Pattern generator pods (Not available for the LA-2124)
: Pattern generator pods can be purchased to convert the LA-4000 into a pattern generator.

Parallel port adapter (Not available for the LA-2124)
: An optional parallel port adapter is available for the LA-4000 series Logic Analyzers. It allows you to run the Analyzer from the parallel port of your computer.

USB adapter (Not available for the LA-2124)
: An optional USB adapter is available for the LA-4000 series Logic Analyzers. It allows you to run the Analyzer from the USB port of your computer.

ISA Communication cards (Not available for the LA-2124)
: Extra communication cards are available for this Logic Analyzer. You can install these cards in multiple computers and easily move the Logic Analyzer from computer to computer.

Clips and wires
: Extra clips and wires are available.

Software library
: Software libraries are available to allow the user to write custom programs to control the instrument.

I2C software
: An optional I2C software package is available that allows you to view a disassembled I2C data capture.

Part XIII

13 Warranty and copyright

Limited Warranty on Hardware
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