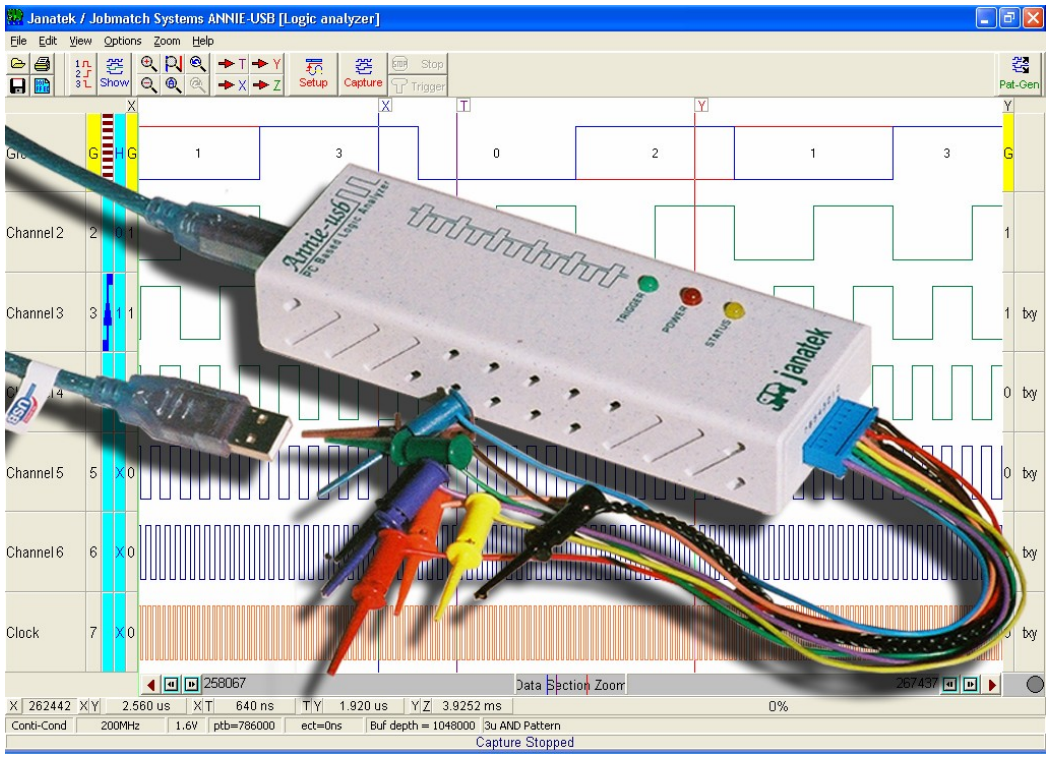
Annie-USB

PC-Based logic analyzer

User's manual

Release 2



janatek electronic designs

Before attempting to connect or operate this product, please read these instructions, especially the safety precautions and guarantee conditions

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IMPORTANT NOTICE (Disclaimer/Copyright...)

BEFORE INSTALLING THE ANNIE-USB HARDWARE READ THROUGH THIS MANUAL AND GIVE SPECIAL ATTENTION TO THE HARDWARE INSTALLATION AND SAFETY PRECAUTION SECTIONS.

Much effort has been made to ensure that the contents of this manual is complete and without errors, but should this not be the case Janatek cannot be held responsible for any damage resulting directly or indirectly from such errors. We will however, appreciate being informed of any errors detected in the manual, the software or the hardware.

Janatek only claims compliance to electromagnetic compatibility/susceptibility, safety, etc. and standards specifically stated in this manual or printed on our official packaging. We cannot accept responsibility if any of our products are exported (e.g. by dealers) to any country that might have specific regulations to which any of our products do not comply.

Janatek reserves the right to change the contents of this manual without notice and at any time.

CHECK LIST

Please check your Annie-USB package to ensure that it contains the following items:

- This user's manual.
- Annie-USB main unit.
- USB cable for connecting the Annie-USB to PC USB port.
- Test leads x 8.
  (One connector with 8 test leads and one fixed ground lead).
- Annie-USB software on CD/floppy.
- Guarantee registration form.

IMPORTANT SAFETY CONDITIONS

READ ALL THE FOLLOWING PRECAUTIONS:

In this manual, when referring to 'PC', 'Notebook computer' is also implied, except when specifically referring to 'Notebook computer'.

The instrument is intended for indoor use only.

Do not use near water and do not spill any liquids onto the unit.

Ensure that the unit is used on stable surfaces only. Dropping the unit may cause serious damage to it.

Slots and openings at the back and sides of the unit are for ventilation. Ensure that the openings are not blocked by covering the unit under papers, books, etc. while it is powered.

Always remove the power to the unit under test before attaching or removing logic analyzer probes to IC pins. This will prevent short circuit damage to the unit under test.

Do not use the product in direct sunlight. This could result in the overheating of the unit.

Do not push any objects through the ventilation holes, for it may cause short circuits that could damage the product.

Do not attempt to service the product yourself. Opening the product will void the guarantee. A faulty unit should be returned to the dealer with a detailed description of the problem.

Switch off the PC, unplug the Annie-USB from the PC and return the whole product to the dealer for service if any of the following should happen:
-If the unit does not operate normally when the instructions in the user's manual are followed.
-If liquid has been spilled onto the unit.
-If the unit has been exposed to rain or water.
-If the unit has been dropped.

GUARANTEE CONDITIONS

A one-year guarantee is applicable, unless differently stated on the product registration card.

Should your Annie-USB become defect during the guarantee period, it will be repaired free of charge by Janatek under the following conditions:

The unit should be returned to the manufacturer or approved dealer. A copy of the original sales invoice to the end user must be included.

The Annie-USB has no user serviceable parts. Only the manufacturer or authorised repair agents appointed by the manufacturer are allowed to do repairs on the product. Should the unit be opened by any unauthorised person, the guarantee will be void.

The user must ensure that the product is always used within its design specification. Refer to the product specifications in this manual.

The user must ensure that the safety precautions as stated in this manual are adhered to.

The guarantee only applies to failures that occur while the unit is used under "normal" operational conditions i.e. the product is used according to its specifications and the safety conditions are adhered to.

Janatek cannot be held responsible for any damage that might occur due to the improper use of this product.

Janatek cannot be held responsible for any damage resulting from errors in the manual or software.

The guarantee is not transferable, should the end user sell this product.

This guarantee does not provide for postage costs. It will be paid by the end user or dealer.

SYSTEM REQUIREMENTS

Operating environment	Windows 98, ME, 2000, XP, or later compatible versions. (Not NT)
PC	PC as required by your specific operating system.
RAM	16 Mbytes plus the minimum ram size as specified by your specific operating system. Windows performs faster with adequate RAM
Mouse	Operating with Windows
Disk space	8 Mbytes plus the minimum disk space as specified by your specific operating system.
Display screen	VGA,SVGA or equivalent

The Annie-USB uses the PC for command and display purposes only. Its data capturing functions are completely independent of the PC. Therefore the capture functioning of the Annie-USB is completely independent of the speed of the PC.

TRADEMARK ACKNOWLEDGMENTS

Windows is a trademark of Microsoft Inc.
IBM is a trademark of International Business Machines Corporation.

INSTALLATION

Software Installation

Run 'SETUP.EXE' from the supplied install discs/CD. Follow the on-screen instructions until completion of the installation.

After installation an icon called "Annie-USB" should be part of your Windows desktop. The program can be run by double clicking your mouse on the icon.
If an icon is not displayed on the Windows desktop, run the software as follows:
a. Click on the "Start" button in the bottom left corner of the desktop.
b. Select "Programs".
c. From the list of installed programs, select the Annie-USB software. (Janatek -> Annie-USB)

Hardware Installation

- Connect the supplied USB cable to the Annie-USB unit and to your PC. You do not need to switch your PC off to install the hardware. According to the USB specification, USB is "hot-pluggable" which means that you may connect or remove USB devices, while your PC is switched on.
- Windows will automatically detect that an USB instrument has been connected to the USB port and determine its identity. It will then look for a suitable driver. If it is the first time the instrument is connected to the USB port, Windows will ask you for the driver. Point Windows to the installation disk/CD to install the "Stage1" driver.
- Run the software. The software will initialise the USB port. When the software is run for the first time, Windows will again automatically detect the connection of a USB instrument. Point the Windows driver installer to the Annie-USB install disk/CD to install the "Stage 2" driver.
- This process of driver installation is described in more detail in the following section.
- The software will now continue.
- From here on Windows "knows" which drivers your Annie-USB requires and will install it automatically when you connect your instrument or run the software.
- If you have problems installing the hardware, refer to the "Troubleshooting – Sorting out driver problems" section.

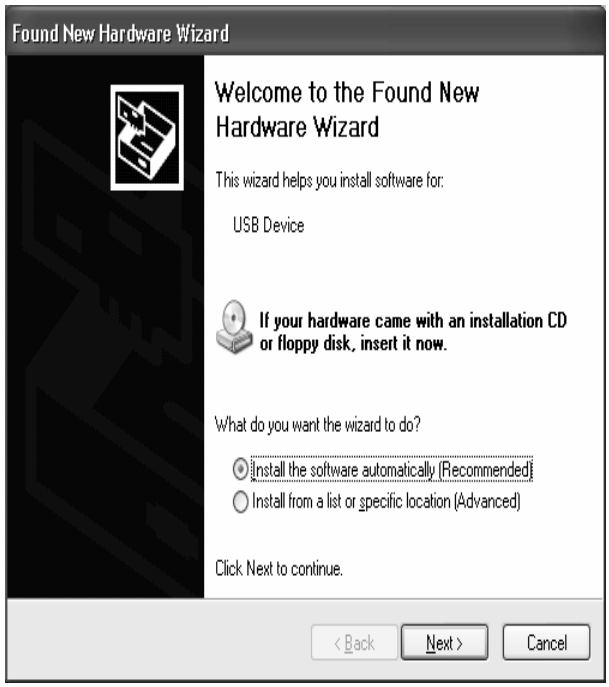
Driver installation

The Annie-USB uses two USB drivers:

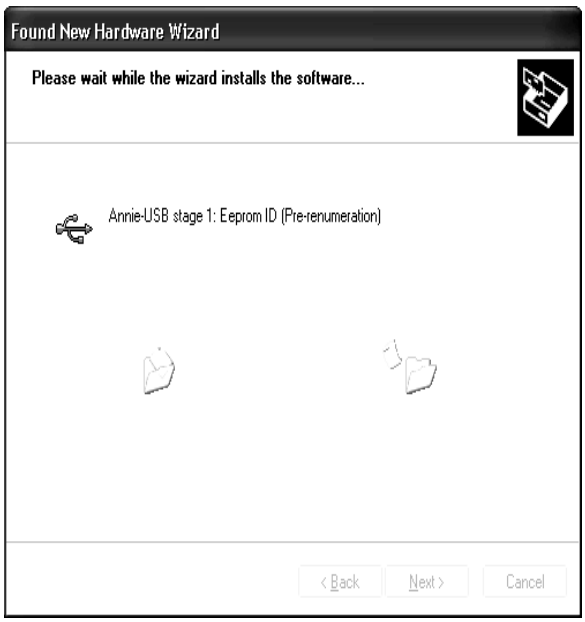
- The first driver is installed when the Annie-USB is connected to the PC for the first time.
- The second driver is installed when the software is run for the first time.

Installation of the first USB driver

The installation described here is for Windows XP. The details are slightly different for Windows 2000, 98, etc, but the general procedure is quite similar. Insert the CD/floppy containing the USB drivers into the CD/floppy-drive.



- Plug the Annie-USB into the PC USB port. Windows will automatically detect the new hardware and the installation wizard will appear.
- Select "Next" to start the "automatic" installation. Windows will search the floppy and CD drives for the required drivers.
- Windows 2000 has an intermediate dialog box where you should select the floppy/CD.
- Windows will now look for a suitable driver for the Annie-USB and find it on the CD/floppy. (AnUsbPre.inf)
- XP will warn about possible driver incompatibilities. The driver that we use is the official driver for the USB controller used in the hardware as supplied by the component manufacturer. Click "Continue" to install the software. It may take a few minutes.



After the driver installation has been completed, close the installation wizard by clicking on "finish". The first USB driver (Stage 1 driver) is now installed.

Installation of the second USB driver

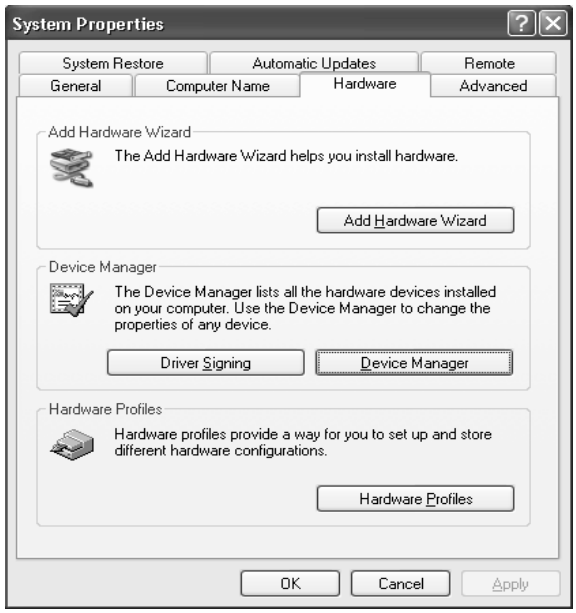
- When the software is run for the first time, firmware is downloaded to the hardware which will result in Windows detecting the "new hardware" for a second time and the installation wizard will reappear again automatically.
- Follow the same procedure as before to install the second driver (Stage 2 driver, AnUsbPos.inf). After installation of the second driver it may be necessary to quit and restart the Annie-USB software.

Troubleshooting

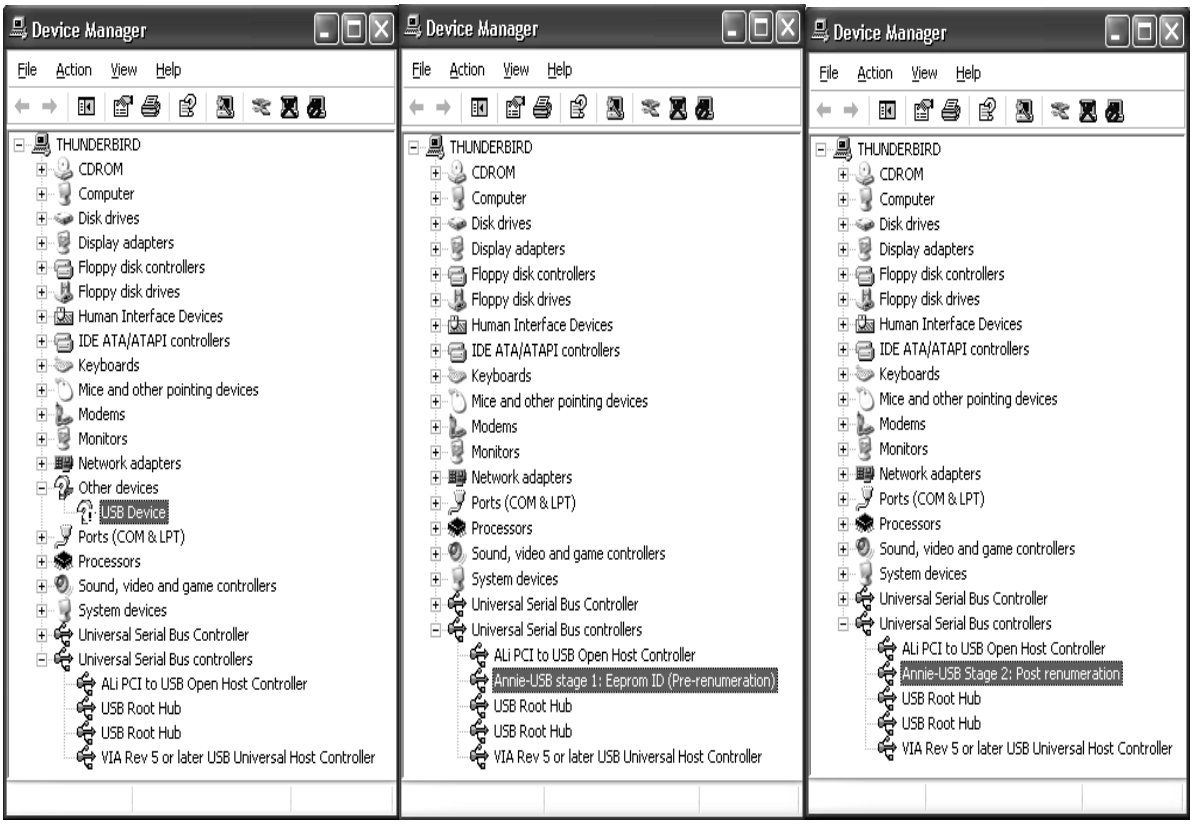
Driver installation problems

If the Annie-USB software fails to find the hardware: Check that the Annie-USB is connected correctly to the PC. You can force Windows to re-detect a USB instrument by unplugging it from the PC and replugging it. You can unplug and replug while the PC is powered, since USB is "hot pluggable". Check that the USB drivers install correctly as described below:

Open the control panel and click on "System". In the system dialog box, click the "hardware" tab and then the "device manager" button.



The 3 pictures below show the device manager. (a) When a new device is detected. (b) After the first driver was installed correctly. (c) After the second driver was installed correctly. A yellow mark with any driver indicates that the driver did not install correctly. If this is the case double click on the driver and "Update" the driver. It may be necessary to lead the installation wizard to ensure that the driver is updated from the CD/floppy drive.



a. New USB device b. Stage 1 driver c. Stage2 driver

Sorting out driver problems:

A: If you have problems communicating with the Annie-USB, start by doing the following:
-If the Annie-USB is connected to the USB port, unplug it from your PC.
Quit the software.
-If the software and Annie-USB has been working properly before, wait 20 seconds and reconnect the Annie-USB to the USB port. If you have already done this, shut down and switch the PC off completely, and switch it back on again. Connect the Annie-USB and run the software.

B: Ensure that your Annie-USB software is compatible with your operating system e.g.: The software will not run on Windows NT. Early versions of Windows 98 can also give problems and may require updating.

C: Ensure that the USB peripheral is enabled on your PC.

-If you are currently using any other USB device successfully (e.g. USB mouse), you can assume that the PC USB port is working properly.
-Follow in Windows this route: "Start → Control panel → System → Hardware → Device manager → Universal serial bus controllers". If you click on the small "+" next to "Universal serial bus controllers" you will see the installed USB devices.
-For USB to work at all you should see at least the driver for the USB host controller and USB root hub. These should be installed using your Windows installation CD.
-The USB peripheral must be enabled in the "CMOS set-up" of your PC. The CMOS set-up program is usually entered by pressing the "Del" key while the PC is booting. DO NOT make any changes here if you are not sure of what to do. Ask someone who is familiar with this level of PC hardware.
-Keep the control panel open on the "Start → Control panel → system → Hardware → Device manager → Universal serial bus controllers" with the USB drivers visible.
-Connect the Annie-USB to the USB port. Windows will detect this connection. It will look for a suitable driver and if found it will be installed automatically.
-If Windows cannot find a suitable driver it will ask for it and you should lead it to the correct directory with the Annie-USB drivers (e.g. CD/floppy).
-After Windows has installed the Annie-USB driver, it will appear in the Device manager. After first connecting the Annie-USB (before running the software), this should include the Logic analyzer Stage-1. Double click on the Logic analyzer driver to open the page indicating the status of the driver. The driver should be indicated as "working properly". If an error is indicated for the driver then you can use this dialog box to update it again from the provided Annie-USB installation disk.

D: Now run the Annie-USB software. During the program start-up, you should see how Windows detects the Annie-USB software identity and installs the Stage-2 driver.
-If this is the first time the software is run, Windows should ask for the driver. Direct it to the correct directory. (The driver will be displayed in the Device manager). Follow the same procedure as before to ensure that the driver is "working properly".
-If the drivers are working properly the software will proceed to "configure" the software and the hardware.
-You may need to restart the software at this stage.

E: More tips:
-Ensure that you have the latest Annie-USB software version and drivers, since there may be a software bug that has been sorted out in a later version
-The directories where the drivers ('.sys' and '.inf' files are placed by Windows) can be obtained from the device manager. (Double click on the USB driver entry, look for driver properties). Delete/rename the files to force Windows to ask for the drivers again, when the hardware is connected to the PC.
-You can force windows to re-detect USB hardware, by unplugging it from the PC (while the PC is powered) and re-plugging it.
-Should software driving USB hardware hang, it is always a good idea to unplug the USB hardware, to get rid of any pending USB instructions. The software may then be quit normally.

Corrupted data:

If the data is corrupt, or the signal quality is not what you would expect, it may be that you are not using the instrument correctly. Please refer to the section: "Logic analyzer usage considerations" Pay special attention to the section "Digital ground connection". REMEMBER to always connect the ground lead/s for optimum signal quality.

Annie-USB over-current protection:

The Annie-USB is protected by a 1.6A (or less) resetable fuse. The fuse will reset if power is removed completely for 3 minutes. If, on reapplying the power, the fuse again cuts the power to the unit, contact your vendor for repairs.

MAIN FEATURES OVERVIEW – Annie-USB

The Annie-USB is a user-friendly, yet sophisticated PC based logic analyzer.

Flexible internal sampling rates

A maximum sampling rate of **500/200MHz on 8 channels simultaneously** is provided, depending on the specific model.

Internal sampling rates available: 500MHz (available on specific models), 200MHz, 100MHz, 50MHz, 25MHz, 10MHz, 5MHz, 2.5MHz, 1MHz, 500KHz, 250KHz, 100KHz, 50KHz, 25KHz, 10KHz, 5KHz and 1.25 kHz.

The Annie-USB could also be used as a digital data logger. Log rates can be set from 1 second to 1 hour (in one-second steps).

Deep data buffer

A **1 Meg Samples/channel buffer** is available at all sampling rates for each channel (except in the 500MHz mode on specific models, where 4k samples/channel is provided). The large buffer ensures that longer sampling periods can be achieved at any specific sampling frequency. This reduces the need to scale down to a lower sampling frequency, with the resulting reduction in sampling resolution. Therefore, the large buffer ensures more accurate time measurements of longer high frequency signals. The pre-trigger and post-trigger buffer sizes are fully adjustable across the total buffer spectrum.

Flexible trigger options

Flexible trigger options are at the user's disposal. For pattern triggering, the incoming digital signals are compared to a user specified trigger pattern (1, 0 and don't care settings allowed). Edge triggering may be performed on any one channel and may be set to occur on a rising, falling or either rising or falling edge (change of state). Pattern and edge triggering may be combined:
-Pattern OR Edge: A trigger will occur on a pattern or edge trigger condition, whichever occurs first.
-Pattern AND Edge: A trigger will occur when the edge condition occurs while the pattern condition is true.
-Pattern THEN edge / Edge THEN pattern: The Annie-USB will initially wait for the first condition to occur. After the first condition was detected it will wait for the second condition to occur which will be the final trigger, resulting in the data capture completion and display.

A trigger may be forced while the Annie-USB is waiting for a trigger condition to occur, by using the mouse. If a "Condition1-THEN-condition 2" is active and the Annie-USB is waiting for the first condition, forcing the trigger will force only the first condition. If the Annie-USB is waiting for the second condition, forcing the trigger

will force the second condition.

Input signals may be displayed '**unconditionally continuously'** such that the display screen is continuously updated regardless of what the input signals look like. The input signals may also be displayed '**conditionally continuously'**. In this case the screen is updated only after a trigger condition is detected.

Variable threshold

The digital input voltages are compared to a selected **threshold voltage**, determining whether it is high or low. A variety of threshold voltages are available for selection.

External clock functions

Synchronous (state) capturing may be done by using an external clock, applied to channel 7. Capturing may be specified to occur on the rising edge, falling edge or rising and falling edges of the clock.
Two basic external clock modes are available:
a. The data buffer configured as a **ring buffer**: In this mode the capturing is done similarly to when an internal frequency is selected, except that the clock input is taken from channel 7.
b. The data buffer implemented as a **linear buffer**: In this mode data may be captured from the first clock received, into the buffer. Data capture will stop and the displayed when the buffer is full. Should there not be enough clock cycles to fill up the buffer, the user could at any time stop the process and have the limited number of captured samples displayed.
The first sample to be captured may be specified to be the **first clock received**, or it may **wait for a trigger condition** to occur and then start capturing the data from the first clock that follows the trigger. A very useful trigger setting to use in this case is to set the trigger to occur when a specific pattern is valid on the clocking edge (Pattern AND Edge setting). This would ensure that a transitional pattern (glitch) state, when the pattern lines change state, does not cause a trigger, but only the clocked pattern can cause the trigger.

Low power consumption

When the Annie-USB is not active, it automatically enters a **sleep mode**, using only a fraction of its active power.

Easy-to-use software

The easy-to-use software takes full advantage of the user-friendly Windows environment. The power of the **multitasking environment** is utilised to run the Annie-USB software and the user's unit under test software simultaneously, if the unit under test is driven from a PC. No separate PC is required! The user software may be launched from within the Annie-USB software or via the normal Windows route. The Annie-USB software may be run in a window in the background, waiting

to be triggered, while commands may be executed in a user's program running in the foreground. After a trigger has occurred the user simply switches windows to view the captured data. Remember that although multitasking applications could slow down the PC, the Annie-USB operates completely independent of the PC. The PC merely acts as a command and display interface between the user and the Annie-USB.

Display features

The **data display** is very flexible. A few of the most significant display features are mentioned:
Any number of channels may be displayed, each with its user specified name. The channel order may be changed to any display order. The whole data buffer may be viewed at one time, or the user may zoom in until only a few samples are displayed. Data combinations may be searched for and jumped to. A trigger line indicates the trigger position, while X, Y and Z cursors are used for time measurements.
Channels may be grouped together, with the group values displayed in different formats in the timing display.
Data may also be viewed in hex and binary formats.

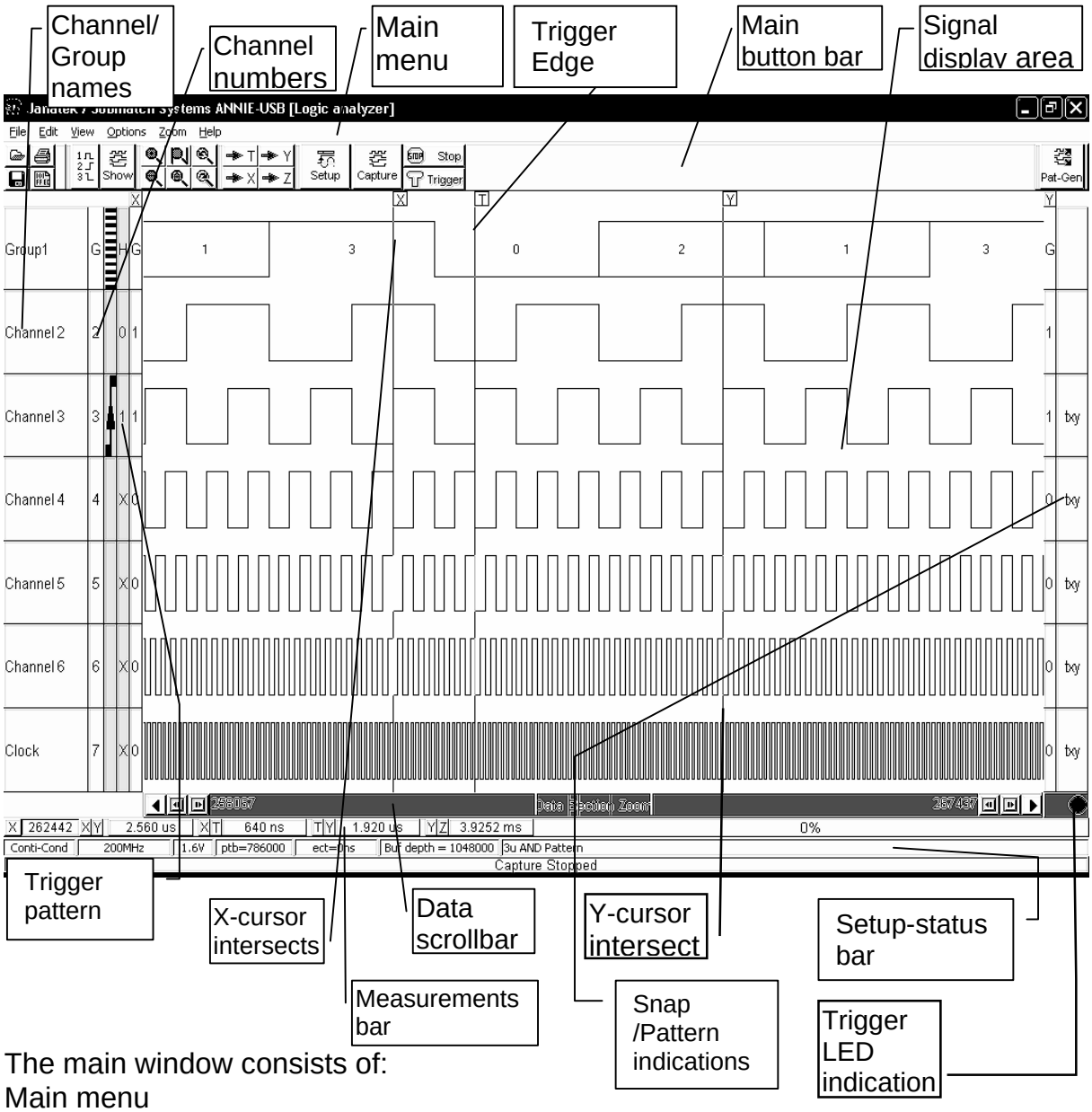
Displays may be printed or saved to disk.

The **LED indicators** provide an extra indication giving instantaneous confirmation to the user of the current Annie-USB status. The trigger LED is mirrored in the software main window.

Pattern generator

The Annie-USB can also be used as an 8-bit wide pattern generator. The patterns may be created in the **pattern editor**, or loaded from a file.

MAIN WINDOW



The main window consists of:
Main menu
Main button bar
Signal display area
X and Y-cursor intersects
Measurements bar
Data scrollbar
Snap/pattern indications
Trigger LED indication
Set-up-status bar
Channel names
Channel numbers
Edge trigger indication
Pattern trigger indication

Below follows a description of each of the main window areas as indicated on the previous page.

Main menu

Many, but not all, of the main button bar functions are duplicated in the menu items. Functions not available on the main button bar have to be accessed through the main menu.

'File' menu option

Open file

Use *Open file* to load a previously saved signal file.
The *'Open'* dialog box will appear to help you find the file.
When a file is opened the environment is recreated, as it was when the file was saved.

Save file

Use *Save file* to save the captured data to disk.

The complete set-up, including cursor positions, channel names, channel order, etc. will be saved.

The *'Signal info'* dialog box will appear, allowing you to enter information concerning the signals, to be saved with the data.

The *'Save As'* dialog box assists the user in saving the file in the intended directory.

File format:
Using this save option the file is saved in the following format:
Two files are created.
The two files will have the same name, but the one will end with ".txt" and the other with ".dat". The two files are linked to each other via this common name.
The configuration info is saved in a text file with the ".txt" ending to the filename.
The captured data samples are saved sequential in the ".dat" file. It contains 1048000 (Decimal) bytes.

Save bitmap

Saves a bitmap file of the captured signals. Custom information such as a heading, description, automatically generated date and time information, etc. can be added to the bitmap. This bitmap file has the appearance much like the "Print signals" printer output.

Save Window

Saves a bitmap file (.BMP) of the main window and is equivalent to a screen capture. This file could be read by most word processors.

Save Text

Saves the data in hexadecimal text.
The saved text file may be viewed, using any text editor.

The text file format is as follows:
Eight samples are saved each separated from the previous by a "space".
The eight samples are followed by a "Carriage return", which is followed by a "line feed"
For the next eight samples the pattern is repeated and so on to end of the display data buffer.
Each data sample consists of eight bits and is saved as a two-digit hexadecimal number.
"Space" is "14" in hexadecimal.
"Carriage return" is "0D" in hexadecimal.
"Line feed" is "0A" in hexadecimal.

Save Default

Use this menu option to save the basic software configuration with which the software should start up.

The information saved in the configuration file consists of the *'Options'* dialog box information, as well as the check box settings of the *'Signal info'* dialog box.

Note that information such as channel order, set-up information such as the sampling rate, threshold voltage, etc. is not saved as part of the default configuration. This information is saved though when a signal file is saved. When a signal file is loaded these settings are restored, as they were when the signal file was saved. Refer to the *'Open file'* and *'Save file'* menu options.

Print signals

Use '*Print'* to send the current displayed signals to the printer.

Before the print starts, the *'Signal info'* dialog box will appear, giving you the chance to enter information you would like to be printed with the signals.

Before printing the signals, you may switch off the channels you don't want to appear on the print. Use the 'Show' button or the *'View/Show channels'* menu option.

Print bitmap

Prints the main window bitmap

Print text

Prints the captured data in a compact hexadecimal format or hexadecimal with binary.

The *'Print text'* dialog box appears, allowing you to specify the range of samples to be printed. The default print range is the range from the data scrollbar left zoom post to the -right zoom post.

Each byte represents a data sample of all channels.

Each bit of the data byte represents the state of that channel input when the sample was taken.

Channel 0 is represented by the least significant bit and channel 7 by the most significant bit.

Printer Set-up

The *Printer Set-up* dialog box is used to change the options for the current printer selected.

Project

If the unit under test (UUT) is PC based, you may run the UUT software by selecting this option.

This option displays the *'Project'* dialog box, which is used to find and run the project file.

Refer to the section on dialog boxes for more information concerning the *'Project'* dialog box.

The user program may also be started through normal Windows methods; just like any other second application would normally be started.

When the UUT software is run and does not appear in a window (e.g. DOS programs), press *'Alt+Enter'* to place it in a window.

To take measurements on a PC-based UUT, one would run both the Annie-USB and UUT software.
Size the two program windows such that when the one is in the foreground, at least part of the other window may be seen in the background.
Let's assume you've hooked up probes to the UUT and the hardware is ready for a capture.
Once the Annie-USB has been prepared for a capture by using the *'Set-up'* dialog box, press *'Capture'* on the main button to start the data capture.
The Annie-USB should now be waiting for a trigger from the UUT, displaying the 'Waiting for trigger' message.

Now click on the UUT program window in the background to bring it to the foreground.
Execute an instruction to the UUT, which should cause the desired trigger.
The 'trigger' LED on the Annie-USB will indicate immediately the detection of a trigger by switching off.
The Annie-USB window running in the background will transfer and display the captured data.
Switch to the Annie-USB software to inspect the captured data.
Easy!

Quit

This option may be used to quit the program.

'Edit' menu option

Channel names and Groups

Clicking on the *'Channel names'* option will display *the 'Change channel names'* dialog box, which could be used to edit the channel names, colors, switching channels on or off, etc.

Refer to the *'Change channel names'* dialog box section for detail on its usage. Channel names may also be changed in the main window by clicking the mouse directly onto the name you would like to change.

Channels can also be grouped into sets. After selecting the channels to be grouped together, right-click the mouse for the pop-up menu. Select "group channels" to group them. To ungroup or edit a group, select the group to be ungrouped or edited, then right-click the group for the pop-up menu and select "ungroup " or "edit group".
Refer to the "Combine channels in a group" dialog box.

Signal information

Selecting this option will display the *'Signal info'* dialog box which may be used to log information concerning the captured data.

Refer to the *'Signal info'* dialog box in the 'Dialog boxes' section.

Copy bitmap to clipboard

A copy of the main window is copied to the Windows clipboard.

'View' menu option

Show Channels

This option displays the *'Show Channels'* dialog box, which is used to switch channels off which you don't want to appear in the main window, such as unused channels.
When printing the signals, switch off the channels you don't want to appear on the print.
It is also used to set channel, background and cursor colours.
Refer to the *'Show channels'* dialog box in the dialog boxes section.

Data as text

This option is used to display the data in a hexadecimal format.
Each byte represents a data sample of all channels.
Each bit of the data byte represents the state of that channel input when the sample was taken.
Channel 0 is represented by the least significant bit and channel 7 by the most significant bit.

Search Pattern

Clicking on '*Search Pattern'* displays the '*Search Pattern'* dialog box which is used to search for any signal bit combinations (patterns) that may occur in the data.

Refer to the *'Search Pattern'* dialog box section for further details on using this dialog box.

'Options menu option

Selecting this option displays the *'Options'* dialog box

Use this dialog box to set general environment and hardware configuration options.

Refer to the *'Options'* dialog box in the 'Dialog boxes' section for more details on using this dialog box.

'Zoom' menu option

All: Zoom to display all the data in the signal display area.
In: Zooms into the data.
Out: Zooms out, displaying more data in the signal display area.
X-Y: Zooms to display all the data between the X and Y cursor lines, as they are currently placed, in the signal display area.
X-Z: Zooms to display all the data between the X and Z cursor lines, as they are currently placed, in the signal display area.
Y-Z: Zooms to display all the data between the Y and Z cursor lines, as they are currently placed, in the signal display area.

'Help' menu option

A hypertext help is available under the *'Contents'* option.
An *'About'* dialog box may be displayed giving information on the current software and the manufacturer.

Main button bar

The button bar displays the speed buttons. These buttons are used to execute the most commonly used functions with a single click of the left button of the mouse.

The buttons at the top of the main window provides quick access to frequently used menu functions as well as a few functions not represented in the menus.

'Open signal file' button

Opens a previously saved signal file
Clicking this button has the same effect as selecting the *'File/Open file'* main menu option.

The *'Open'* dialog box will appear to help you find the file.
When a file is opened the environment is recreated, as it was when the file was saved.

'Save signal file' button

Saves a signal file

Clicking this button has the same effect as selecting the *'File/Save file'* main menu option.

The complete set-up, including cursor positions, channel names, channel order, etc. will be saved.

The *'Signal info'* dialog box will appear, allowing you to enter information concerning the signals, to be saved with the data.

The *'Save As'* dialog box assists the user in saving the file in the intended directory.

Print button

Print the current signal display

Text Display button

Open the Text display dialog box. Aaa

'Normalise channel order' button

If the channel order has been changed, clicking this button will normalise the channel order to its original order of 0 to 7. A channel is moved by dragging its channel number to a new position.

'Show channels' button

This option displays the *'Show channels'* dialog box, which is used to switch channels off which you don't want to appear in the main window, such as unused channels.

It is also used to set the channel, background and cursor colours.

This button performs the same function as the *'View/Show channels'* main menu option.

When printing the signals, switch off the channels you don't want to appear on the print.

Refer to the *'Show channels'* dialog box in the 'Dialog boxes' section.

Zoom buttons

 Zoom in, to see more detail of a specific portion of the data buffer.

 Zoom out, to see more data samples.

 Zoom X-Y. View the data between the X and Y cursor lines.

 Zoom all, to view the whole data buffer.

 Zoom Previous: View the data at the previous zoom setting. If more than one capture has been taken at the same zoom setting, clicking "zoom previous", will not take you back to the previous capture, since the zoom setting did not change. It will take you back to the previous zoom position within the data buffer.

 Zoom Next: When you have gone backward to a previous zoom setting, using "Zoom Previous", you can go forward again by using "Zoom Next".

'Set-up' button

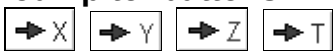
This button is used to display the *'Set-up'* dialog box, which is used to set trigger options, the sampling rate, threshold voltage, pre- and post-trigger buffer sizes, etc.

Refer to the *'Set-up'* dialog box in the 'Dialog boxes' section.

'Capture' button

The 'Capture' button is used to execute data captures.

'Jump to' buttons



These buttons will cause the data display to move to the trigger (T), X-cursor line (X), Y-cursor line (Y), Z cursor-line (Z) positions, respectively.

Stop button

Stops single or continuous data capture.

Trigger button

Forces trigger at any stage during single or conditional continuous capture, when the Annie-USB is waiting for a trigger to occur.

If triggering has been set for "Condition1-THEN-Conditon2" and the Annie-USB is waiting for the first condition, forcing the trigger will force only the first condition. If the Annie-USB is waiting for the second condition, forcing the trigger will force the second condition

Pattern generator

Opens the pattern generator dialog box. Only available on specific Annie models.

A pattern generator outputs user-defined logic patterns on its data-lines that can be used to drive digital inputs. This function is very useful in testing situations. For example, serial data signals can be simulated by using the pattern generator to output data, strobe and clock lines.
Patterns can be defined and edited in the 'Pattern Editor' or from a data file supplied by the user. For more information, refer to the 'Pattern Generator Dialog Box'.

Signal display area

The signal display area is where the captured data is displayed in graphical form. The displayed signals correspond to the data between the two zoom posts on the data scrollbar.

Data may be scrolled or zoomed by means of the data scrollbar.
More zooming options are provided by the *'Zoom'* main menu option.

Time differences between signal edges are taken by placing the mouse arrow cursor on (or close to) the edge you would like to measure from and clicking the appropriate mouse button to snap the wanted cursor line to the edge. Use the left mouse button for the X, right for the Y and middle (or shift+left) for the Z cursor line.
If the cursor is snapped to an edge, it will be indicated by the snap indications.
Cursor-line to cursor-line time differences may be read from the measurements bar.

Cursors may be switched off by clicking on the small nametag at the top of the cursor.

All cursors that are off may be switched on simultaneously by using the "view/cursors on" menu option.

The order in which the signals are being displayed may be changed. Refer to the section on channel numbers.

Trigger LED indication

The trigger LED on the Annie-USB is duplicated in the software in the main display window.

Snap indications

Edge snapping makes it easy to put a cursor line exactly on an edge. The snap indication shows when a cursor line is exactly on an edge. The user can accept with confidence that a measurement taken between two cursor lines snapped on edges will give an accurate reading.

Since a much larger number of data may be displayed on the data display area than the number of screen pixels that are available, one pixel may represent a number of actual data samples. When taking time measurements on such a zoomed out screen, using the X, Y and Z cursor lines, it is important that the cursor lines are placed on the exact samples representing the signal edges before a measurement is taken. If the cursor has not snapped to the data edge, the measurement will not be accurate.

A cursor line is snapped to an edge by placing the arrow cursor on (or close to) the actual data edge in the signal display area from which you would like to measure and clicking the mouse button. (Click left for the X, right for the Y and middle (or shift+left) for the Z cursor). The cursor will snap to the edge pointed to and an

indication to this effect will be given in the cursor edge snap-indication area. An 'X', 'Y' or 'Z' is displayed to indicate which cursor line is on the edge. The trigger line (T) is not indicated in the snap indications. It will, of course, always be snapped to at least the trigger position in the data.

When a pattern trigger condition has been selected, the pattern will be indicated in this area, while the logic analyzer is waiting for a trigger. Clicking in this area while snapped cursors are displayed will also display the selected pattern.

X and Y-cursor intersects

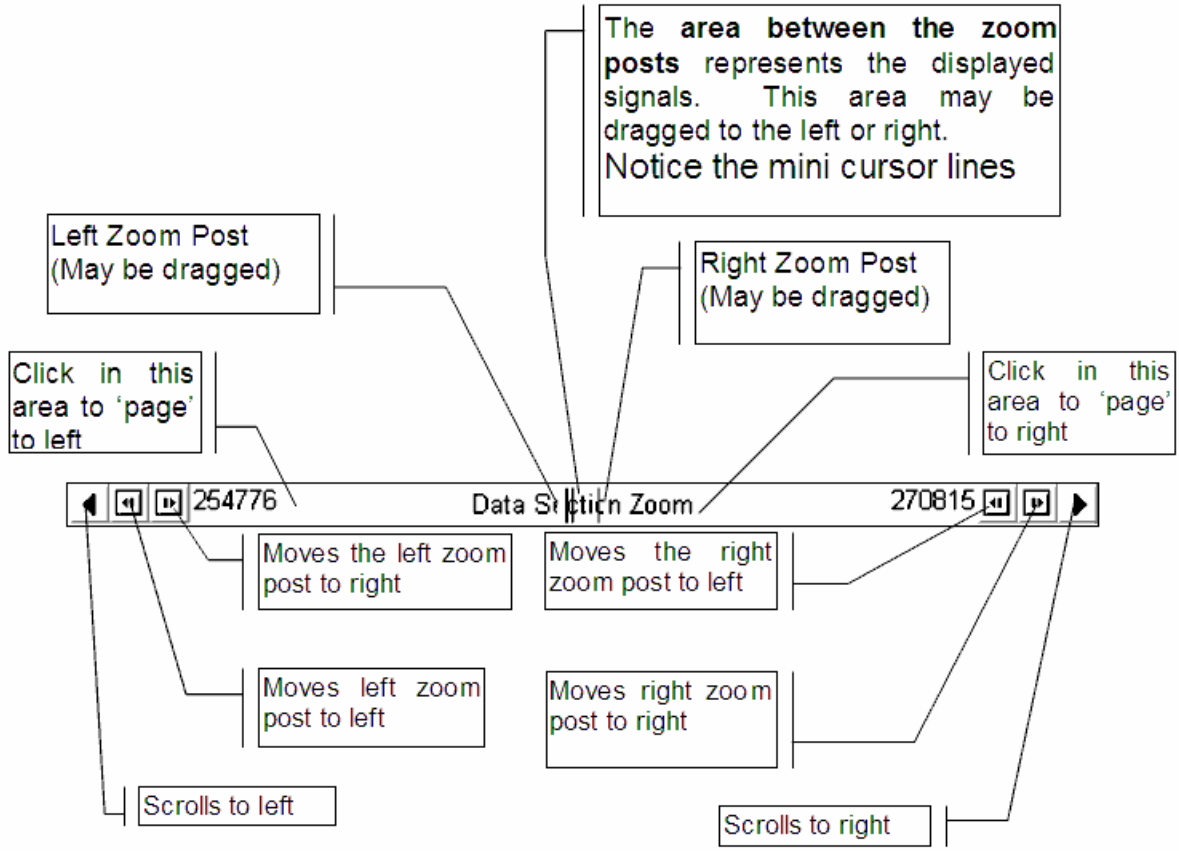
The channel values where cursor lines intersect the channel signals are indicated in these areas. Click on the cursor names (e.g. "X") at the top to change to another cursor.

A button display is used to improve readability. The buttons are for display purposes only and cannot be clicked.

When a cursor line is exactly on a signal edge, the signal value to the right of the edge will be indicated. (If it is a high to low edge, a '0' will be indicated. If it is a low to high edge, '1' will be indicated).

Data scrollbar

The data scrollbar is used for signal scrolling and zooming. The keyboard may also be used for some scrolling and zooming functions.



Zooming and scrolling by dragging

The data scrollbar represents the whole data buffer of 1 Meg samples per channel.

The data displayed in the signal display area is represented on the data scrollbar by the area between the left zoom post and the right zoom post.

A special cursor appears if the mouse cursor is placed on either the left or right zoom post on the data scrollbar. When this cursor appears, the edge may be dragged by pressing the left button of the mouse and dragging the edge to its new desired position.

Another special cursor will appear if the mouse cursor is placed between the two zoom posts on the data scrollbar. If you now press down the mouse button and drag, both zoom posts will move in the direction you are dragging. In this case you are therefore not zooming, but scrolling to a new position in the data buffer.

Zooming and scrolling using the scrollbar buttons
The two inner buttons (of the three) on the left-hand and right-hand sides of the data scrollbar are used to move the left and right zoom posts respectively. The direction, in which the zoom post is moved, is indicated on the button clicked.

The outer buttons on the data scrollbar are used to move both zoom-posts together in the same direction, thus scrolling the data.

The data may also be scrolled in bigger steps: Click in the scrollbar between the left zoom post and the left edge of the scrollbar to 'page' leftwards. Similarly, 'page' rightwards by clicking in the data scrollbar right from the right-hand zoom post.

Data-bar and data section views
When the program is started up, you will notice the word 'Data-bar' in the centre of the scrollbar and '0' on the left-hand side and '1048000' on the right-hand side. This indicates that the data scrollbar represents the full data buffer of 1048000 data samples (per channel).

Should you zoom in until the two zoom posts are right next to each other and then try to move them even closer, you will find that they will suddenly open up again. The words 'Data Section Zoom' are written in the middle of the scrollbar. The data limits on the left- and right-hand sides of the scrollbar will not be '0' and '1048000' any more, but will be replaced with two new numbers.

What happened is that the data the scrollbar now shows does not represent the whole data buffer anymore but only the small portion of data between the two zoom posts on the 'Data-bar' (before it opened up). You are now zoomed to a section of the data, with the limits of the section indicated on the left- and right-hand sides of the 'Data Section Zoom'.

Should you zoom out again, by moving the zoom posts further and further apart, the data scrollbar will eventually revert back to the 'Data-bar' view.

Mini cursors
When data has been captured and is displayed in the signal display area, you will notice that a small vertical line is drawn between the two zoom posts on the data scrollbar. This line represents the position of the trigger line (T) in the data buffer.

The lines on the data scrollbar are called 'mini cursors'. They also appear to indicate the positions of the three cursor lines (X, Y and Z).

The special cursor lines P (Trigger precondition) and S (Search Cursor) are also indicated.

The mini cursors have the colours of the trigger or cursor lines they represent.
If the pre- and post trigger buffers were selected to be equally sized the trigger (T)

mini cursor will be in the middle of the data scrollbar.

The position of the trigger line on the data scrollbar is determined by the pre-/post trigger buffer size setting in the *'set-up'* dialog box.

The data to the left of the trigger mini cursor on the data scrollbar comprises the pre-trigger buffer and the data to the right comprises the post-trigger buffer.

Scrolling and zooming using the keyboard

KEY	ACTION
4 on keypad (num lock on)	Scroll left
6 on keypad (num lock on)	Scroll right
1 on keypad	Scroll left
3 on keypad	Scroll right
+ on key pad	Zoom In
- on keypad	Zoom Out
* on keypad	Zoom All
T	Jump to Trigger-line
X	Jump to X-cursor-line
Y	Jump to Y-cursor-line
Z	Jump to Z-cursor-line

Measurements bar

The measurements-bar displays cursor to cursor measurements.

Measurements displayed

The status bar displays the following:

The absolute cursor line sample position

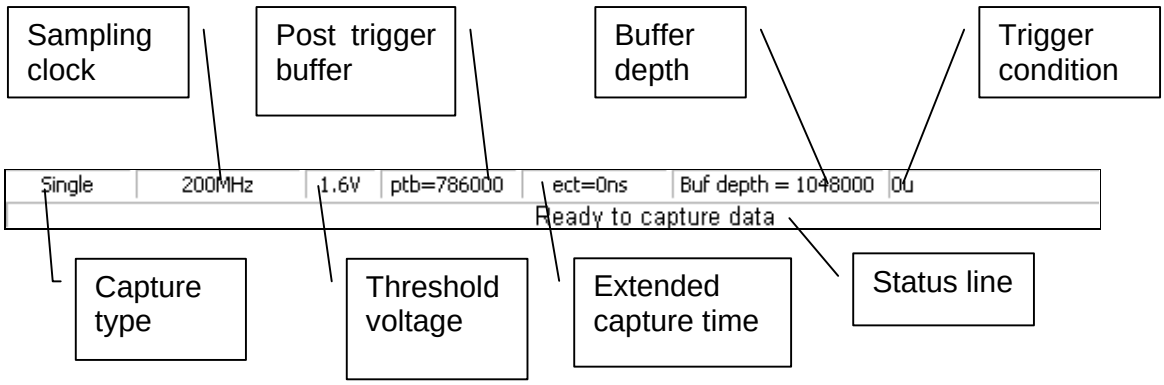
Four cursor-line to cursor-line time difference / frequency measurement

Which time differences are displayed, are set by clicking on the small button to select another cursor line. It may also be set in the *'Options'* dialog box.

Clicking on the cursor-line to cursor-line time reading will switch the reading to a frequency reading and vice versa.

Set-up-status bar

The set-up-status bar provides information regarding the Annie-USB set-up- and capture status.



Capture type
Indicates what kind of capturing the Annie-USB is set up for:
Single capture, unconditional continuous, conditional continuous or logger.

Sampling clock
Indicates which clock will be used to do the sampling:
Any of the internal sampling clock frequencies, logger or external clock.

Threshold voltage
Shows the current threshold voltage set-up

Post trigger buffer
Shows the current post trigger buffer setting

Extended capture time/ Post trigger delay
"Post trigger delay" - Shows the current extended capture time setting.

Trigger condition
Shows the current trigger condition:

Examples:
0u: (Channel 0, up).
A Trigger will occur on a rising edge on channel 0

5d: (Channel 5, down)
Trigger will occur on a falling edge on channel 5.

6c: (Channel 6, Change of state)
A Trigger will occur on a rising edge or falling edge on channel 6, in other words, if channel 6 would change state.

Pattern OR 0u
A Trigger will occur if the current pattern condition is met or if a rising edge on channel 0 occurs (whichever happens first). The pattern condition will be shown in the snap/pattern boxes on the right-hand side of the main window, while the Annie-USB is waiting for the trigger to occur.

Pattern AND 0d
A Trigger will occur should a falling edge occur on channel 0, while the pattern condition is valid.

0c THEN pattern.
The first condition will be detected should channel 0 change of state. The Annie-USB will indicate that it is waiting for the first condition, until the first condition is detected. During this time the LED indication will be purple. When the first condition is detected the LED indication will become green indicating that the second (final) trigger condition is awaited.

Internal
This trigger condition will be displayed during unconditional continuous capture, indicating that the triggering does not depend on a set trigger condition, but is internally forced.

Status line
This panel is used for general messages to the user, mostly regarding the Annie-USB capture status.

Channel/Group names
The channel/group names are displayed as entered by the user.

Channel/group names may be changed by clicking on a name twice. Using multiple selection, the same function may be done on all the selected channels, e.g. to set a new color for the selected channels.

Multiple channel selection is done by clicking on the first name to be selected, then moving to the last name to be selected and then clicking on it while holding down the "shift" key. All the names between the first and last will also be selected. You could select any specific names by holding the "ctrl" key in and clicking with the mouse on the names to be selected. In this case only the names on which you click will be selected. Holding the 'ctrl" key in and clicking on an already selected name will unselect that channel name.

When clicking the right mouse button on a channel/group name a pop-up menu will appear, allowing you to rename the channel, change its color, etc. When multiple names are selected the change will apply to all of the selected channels. If multiple names are selected and you do a name change for the selected channels, the

name will be the same for all, except that a number will be added to each. E.g.: If you type the name "data" the names "data 0", "data 1", "data 2", etc. will be allocated. If you typed e.g. "data 3" the names "data 3", "data 4", "data 5", etc. will be allocated.

After selecting channels to be grouped, right-click on the selection and a pop-up menu will appear. Select "group channels" to group them. To ungroup or edit a group, select the group to be ungrouped or edited, then right-click the group for the pop-up menu and select "ungroup " or "edit group".

Channel numbers

Next to the channel names are the channel numbers which correspond to the channel numbers on the Annie-USB faceplate.

The order in which channels are displayed may be changed by dragging a channel number, to a new position.

The channel order may be normalised to its original 0 to 7 order by clicking the *'Normalise channel order'* button on the main button bar.

Edge and Trigger indicators

The selected edge and pattern will be displayed if part of the trigger set-up, e.g. the pattern would not be displayed on the main window if only edge trigger is selected.

For single channels (with edge trigger enabled in the Setup dialog box), clicking on this column will change the trigger level for the specific channel.

For a group, a group symbol will be indicated in this column. ()
To set an edge trigger for a channel within a group, click on the "Setup" button to do the setting within the Setup dialog box.

For single channels (with pattern trigger enabled in the Setup dialog box), clicking on this column will change the trigger level for the specific channel.

For a group, the format of the group: "H" (Hexadecimal), "D" (Decimal) or "A" (ASCII) will be indicated in this column. To set a Pattern trigger for a channel within a group, click on the "Setup" button to do the setting within the Setup dialog box.

LOGIC ANALYZER USAGE CONSIDERATIONS

This section describes aspects that are important when using a logic analyzer. To get the best measurements, any measuring instrument should be used correctly. A basic understanding of the operational principles will help to interpret measured results.

Digital ground connection

Always connect the black "gnd" lead(s) to the digital ground on your unit under test when taking measurements.

The digital ground connection is very important.

Do not confuse it with the "Earth" connection, which is usually available from the wall power plug and connects to the PC chassis. The earth is for the protection of the user.

For the Annie-USB, the digital ground connection is the thick black lead that plugs to the front of the unit with the test leads.

Try to connect it to the UUT (Unit Under Test) digital ground, closest to the highest frequency that will be measured. The higher the frequencies measured the more important this becomes and a special effort in this regard should be made, especially when measuring frequencies of, say, more than 10 MHz.

The Annie-USB digital ground is connected to the PC digital ground. If the UUT digital ground is also connected to the PC digital ground, you may well find that not connecting the logic analyzer digital ground will seemingly make no difference to the measurements taken. It is strongly recommended that you should not be tempted by this to neglect the digital ground connection, because at higher frequencies or low threshold voltage settings, you may start experiencing "unexplained" mark-space variations and glitches. This is caused by ground potential variations caused by ground line impedance. The effect of such ground line impedance becomes greater with increase of signal frequency.

Trigger condition

The trigger condition is the criteria the logic analyzer uses to know when the data the user actually wants to see is available. After the capture has occurred it will be displayed. The trigger position will be indicated by the trigger line. Inspecting the position of the trigger line, you will see that the signal states at the trigger line will correspond to the trigger conditions settings as set in the set-up dialog box.

The trigger circuit of the Annie-USB is completely independent of the sampling clock. Therefore the Annie-USB can be triggered by conditions that occur for very short time durations compared to the selected sampling clock period. It is thus possible that the Annie-USB could trigger on a glitch condition that will not appear

in the displayed data. The user could therefore have the peace of mind that the set trigger condition cannot slip by undetected, because the sampling clock might be set too slow to sample the trigger condition while it is actually occurring.

Pre-/post trigger buffer

After data has been captured, it is displayed at the trigger position.
The data captured before the trigger position is the "pre-trigger data".
The data captured after the trigger is the "post-trigger data".

While the logic analyzer is waiting for the trigger condition to occur it is continuously capturing data into the pre-trigger buffer.
When the trigger occurs, it starts filling the post-trigger buffer.
When the post trigger buffer is full, data capture stops and the data is displayed.

To see more of the data during the time before the trigger position, enlarge the pre-trigger buffer size and vice versa.

Clock sources & Sampling rate

The sampling rate is the rate at which the data signals at the data channel inputs are sampled.
Higher sampling rates provide higher sampling resolutions, but results in the quicker filling of the data buffer, and should therefore not be used for capturing slow varying signals.

Internal clock: (500/200MHz down to 1.25 kHz)

These frequencies are generated internally in the Annie-USB and are used for general capturing and viewing of the input signals. The internal frequency selected depends on the input signal, e.g. to capture high frequencies like glitches, one would typically use the 500/200MHz setting. Should one measure a 250 ms reset pulse, a much lower sampling frequency must be chosen, like 100 kHz.

Clock used for slow logging:

These clock frequencies are obtained from the PC and are dependant on the PC clock accuracy and stability as well as the operating system time scheduling.

The digital logger is typically used to measure very slow changing signals like changes in room temperature and humidity.
Before logging actually starts, you will be asked whether the data should be logged to your hard disk. Since logging may be active for hours or even days, this will protect your data from being deleted if power to the PC was interrupted.

External clock:

This clock must be applied by the user to the channel 7 input. The user could specify whether the sampling must occur on the rising edge, falling edge or on both rising and falling edges.

Use the external clock for synchronous capturing. This is also called "state" capture e.g. data could be captured on the rising edge of a micro-controller read signal, by using the read signal as the clock input. The logic analyzer will then capture the same data that the micro-controller reads. The text display should be used to analyze this data.

The data buffer configured as a **ring buffer**: In this mode the capturing is done similar to when an internal frequency is selected, except that the clock input is taken from channel 7.

The data buffer implemented as a **linear buffer**: In this mode data may be captured from the first clock received, into the buffer. Data capture will stop and the data displayed when the buffer is full. Should there not be enough clock cycles to fill up the buffer, the user could stop the process at any time and have the limited number of captured samples displayed.

The first sample to be captured may be specified to be the **first clock received**, or it may **wait for a trigger condition** to occur and then start capturing the data from the first clock that follows the trigger. A very useful trigger setting to use in this case is to set the trigger to occur when a specific pattern is valid on the clocking edge (Pattern AND Edge setting). This would ensure that a transitional pattern (glitch or race, when the pattern lines change state) condition does not cause a trigger, but only the clocked pattern can cause the trigger.

Threshold voltage

The threshold voltage level is the level that the logic analyzer uses to establish whether the signal is a logical high or –low at the moment it samples the signal.

The measured signal is compared to the threshold voltage. If the sampled value is higher than the threshold voltage it will be displayed as being "high", if not, it will be displayed "low".

Extended Capture time (ECT)/ Post trigger delay

Refer to the section on the Set-up Dialog box.
(Also referred to as "Post trigger delay")

Data Capture stages

The progress of the capture is displayed on the status line in the dialog box. Every capture goes through the following stages:
(1) Filling pre-trigger buffer.
(2) Waiting for trigger.
(3) Filling post-trigger buffer.
(4) Extended capture time, time-out (applicable if ECT > zero).
(5) Transferring data to the PC.
(6) Data display.

During stage (1) the pre-trigger buffer is filled. Triggering is disabled during this period.

During stage (2) the Annie-USB actively captures data into the pre-trigger buffer keeping it full with the current samples.

When a trigger is detected the Annie-USB captures the post trigger buffer. Stage (3)

If the extended capture time (ECT) is set to 0, the end of stage (4) will end active data capture. Should the ECT be set to a value not equal to 0, more data will be captured into the data buffer for the set ECT time period. The oldest data in the data buffer will be lost. Should the ECT be long enough, the trigger point will be moved right out of the data buffer. For more detail on the ECT refer to the section describing the set-up dialog box.

During stage (5) the data is transferred from the Annie-USB to the PC.

Stage (6) displays the data after which the user can view it and take measurements.

Data capture is completely unaffected and remains accurate during all the data capturing stages (1…4). No samples or accuracy is lost moving from one stage to the next.

Some of these stages may occur too fast to show on the status line, especially when the sampling frequency is high.

While the logic-analyzer is in the "waiting for trigger" state, a trigger may be forced by clicking the *'Trigger'* button. Capture may be stopped by clicking the 'stop' button.

Continuous capture

Refer to the section on the Set-up dialog box.

Mark-Space

The mark-space ratio of a square wave refers to the time that the signal is high verses the time the signal is low during one period. A 50% mark-space indicates that the signal is high half of the period and low for the other half.
Say you are measuring a signal of 10 MHz (50% mark-space), using a sampling frequency of 40 MHz, you could expect the signal to be displayed with a 50% mark-space. The sampling frequency is 4 times the rate of the measured signal; therefore one could expect that the measured signal would be sampled twice while it is high and twice while it is low.

The real world, unfortunately, does not work according to the ideal:
-The measured signal could be smaller than expected, because of bandwidth limitations in its propagation path.
-The signal could be distorted.
-The logic analyzer threshold may be set too high or too low
-The measured signal frequency might be unstable.
-A poor digital ground connection might cause ground potential variations.
-Etc.
Any of these could result in the measured signal being captured, say, three times on the high and once on the low. This will result in the signal being displayed with a 75% mark-space.

Remedy:
-Always try to use the maximum sampling frequency that is practical.
-Vary the threshold voltage.
-Ensure that the digital ground connection is good. Refer to the section discussing the digital ground connection.

Glitches

Refer to the section on the "Digital ground connection".
Refer to "Trigger condition" for details regarding capturing of glitches and trigger conditions that are relatively short compared to the sampling clock period.

Pattern generator

Refer to the section on the "Pattern generator dialog box".

It is important to remember that the pattern generator outputs signals, while the logic analyzer takes signals as inputs. Therefore, after using the Annie-USB as a logic analyzer, you need to remove all test clips (which are currently contacted to outputs on your unit under test) and connect them to inputs.

TUTORIAL OVERVIEW: ANNIE-USB USAGE

This is a short description of how the Annie-USB may typically be used.

When referring to mouse 'clicks' without specifying which mouse button should be pressed, the left button is assumed.

Assume that the hardware and software have been installed and are up and running.

Connect the **ground connection** from the Annie-USB to the digital ground of the Unit Under Test (UUT). It is important to connect the Annie-USB ground hook to the digital ground of UUT. A good ground connection is very important to ensure the optimum signal quality, don't just connect it to the chassis of the UUT. The ground hook should be used regardless whether the UUT and the PC have a common ground or not.

Connect probes to the UUT outputs you would like to take measurements of.

The channels not used may be switched off.

Enter channel names (by clicking on the channel names or by using the *'Edit'* menu option). Selection of multiple channels is done by holding down the "shift" or "ctrl" button while clicking on the channel names. Use the right mouse button to set the channel names, colors, etc, for the selected channels.

Group channels by using multiple select to select the channels which should be part of the group, then right-click on one of the selected channels to open the channels pop-up menu and select the "Combine channels in a group" edit box.

Prepare the Annie-USB for data capture. (Click the *'Set-up'* button): The set-up dialog box will appear.
On the 'trigger' page do the following selections:

- Select the **edge to trigger** for edge triggering or **pattern to trigger** for pattern triggering. You may simply click on the preferred option in the 'trigger method' box if the correct edge/pattern is already indicated. Edge- and pattern trigger may be combined.

On the 'General' page do the following selections:

- Set the desired **pre-trigger/post-trigger setting** (scroll bar)
- Set the desired internal **sampling frequency**. (Pull-down list)
- Set the desired **threshold voltage**. (Pull-down list)
- Return to the main screen. (Click 'OK' to accept the settings and leave the dialog box.)

The selected set-up will be displayed in the Set-up-status bar.

The Annie-USB is now ready to capture data.

Click on the *'Capture'* button to **start the data capture**. Note that the 'Trigger' and 'Status' LED on the Annie-USB unit will light up. The software indicator will also light.

If a 'slow' sampling rate is selected and the pre-trigger buffer is set large enough, the message 'Filling pre-trigger buffer' will be displayed while it is capturing enough data to fill the pre-trigger buffer. For high sampling rates this phase is too quick to see.

While the Annie-USB is waiting for the trigger condition to occur, the 'Waiting for trigger' status will be displayed. When a trigger is detected the 'Trigger' LED will go off.

The **post-trigger data** will now be captured according to the post-trigger buffer size as set by the user, displaying the 'capturing post-trigger data' status. For high sampling rates this phase is too quick to see. The 'Status' LED will remain on until data capture ends.

After the post-trigger data has been captured, the Annie-USB will **transfer the whole data buffer to the PC**, displaying the 'Transferring data to PC' status. Note: the data capture process is continuous and is uninterrupted throughout all the different stages.

After the captured data has been transferred from the Annie-USB to the PC, the data will be displayed.

The **trigger line** will be on the screen when the data is displayed after a single capture.

You may now **zoom and scroll** the data, using the data scrollbar.

The **display order of the channels** may be changed according to your liking. (Click on channel number of the channel you want to move, then click on the new position) The display order can be normalised instantaneously, by clicking on the *'Reset display order'* button on the button bar.

Take time measurements as follows:

- Move the cursor arrow to the **first edge** you would like to measure from. Click the left mouse button on the edge. The X cursor line will be placed on that edge. The cursor actually snaps to the exact sample representing that edge. Looking at the snap indication area at the right-hand side of the main window, you will see that an 'X' in the relevant channel's snap box indicates that the cursor has snapped onto the exact edge. This is important for accurate time measurements, especially when the display represents a large number of data samples such that each screen pixel actually represents a lot of samples.
- Move the arrow cursor to the **second edge;** the one you would like to measure

to. This may of course be on another channel signal. Press the right button of the mouse to place the Y cursor line onto this edge. Note in the relevant snap box that the Y cursor line has snapped to the desired edge.

- **Read the time difference** between the X and Y cursor lines from the status bar at the bottom of the main window.
- Measurements between the X, Y, Z cursors and the trigger line (T) may be read from the measurements bar. The Z-Cursor is placed by clicking the middle button on a three-button mouse or by holding down the 'shift' key and clicking the left button.

To search for the occurrence of any data combination, do a **pattern search** (*'View'* menu). Assume you would like to know whether the channel 2 data has ever been high while the data in both channels 5 and 6 has been low: Select channel 2 a '1' (high) and channels 5 and 6 each a '0' (low) and the rest of the channels 'X' (don't care). Start the search. If the combination occurs in the data, the display will automatically jump to it. You can repeat the search for another occurrence.

You may **print the current display area** (*'File'* menu). The printer should of course be set up correctly before printing (also from *'File'* menu). You may also print a bitmap of the main window.

The captured **data may be saved to disk**. The current configuration, hardware set-up, channel names, zoom position, etc. is saved with the captured data. Before the data is saved, a dialog box will appear allowing you to add information concerning the captured data, which will be saved with the data. When the data is reloaded this information may be viewed in the 'Signal information' dialog box.

The **current set-up may be saved as the new default configuration**. (*'File'* menu option). The information contained within the *'Set-up'* dialog box, channel names etc. are saved as part of the configuration, if this option is checked in the Options dialog box. When a signal file is saved, this information is saved as part of it. By loading a signal file, you can therefore recover the exact set-up, as it was when you saved the signal file.

Using the multitasking environment to run PC based UUT software:

- If the Unit Under Test (UUT) is PC based, it and its software may be driven from the same PC as the Annie-USB and its software.
- Size the Annie-USB window so that it is not full screen. (Standard Windows functions)
- Select the 'Project' option in the 'File' menu option. This displays the *'Project'* dialog box. Select and run your project UUT program.
- If the UUT program does not start in a window, press 'Alt+Enter' to run it in a window. (Standard Windows key press. Windows may also be set to open DOS applications in a window)
- Size the window so that the Annie-USB software window can be seen in the background. (Standard Windows usage)

- Click on the Annie-USB window to bring it to the foreground. The UUT program window should now be seen in the background. (Standard Windows usage)
- Set up the Annie-USB for capture and start a capture (as described before). The Annie-USB should be displaying the 'Waiting for trigger' status.
- Click on the UUT program window, visible in the background, to bring it to the foreground.
- The Annie-USB software is now running in the background and the Annie-USB is waiting as actively as ever, for a trigger to occur.
- Execute a command to the UUT that should cause a trigger.
- If the Annie-USB has been triggered you will see it on the hardware, as well as in the software running in the background.
- Click on the Annie-USB program window in the background to bring it forward and to view the captured data.

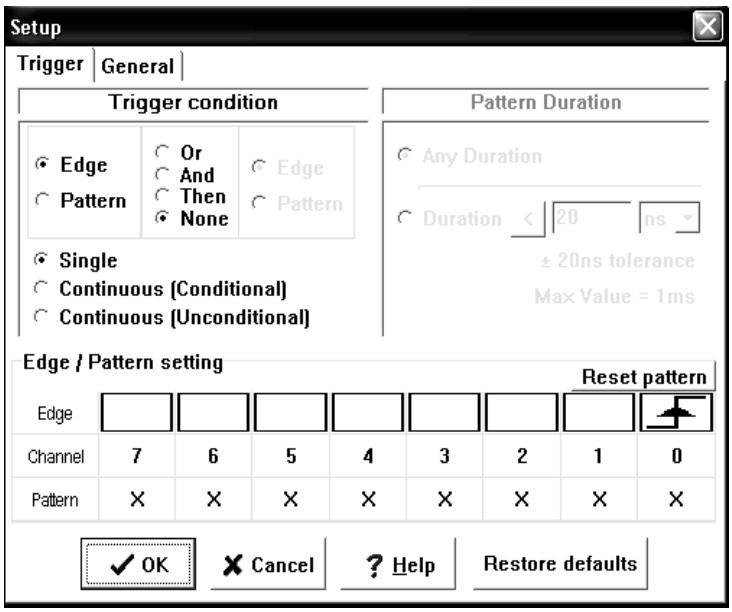
We hope that through this tutorial overview you have established a sufficient 'feel' for the Annie-USB and its software to allow you to easily pick up the rest of the features they offer.

DIALOG BOXES

In this section we will look at some of the more important dialog boxes.

Set-up dialog box

Trigger page



This page contains all the options needed to specify the conditions to which the Annie-USB will trigger.

Trigger condition

Edge and pattern condition may be linked to another edge or pattern condition via one of the following: None, Or, And, Then:

NONE:
Triggering is only allowed on an Edge or Pattern condition.

OR: (Condition-1 OR Condition-2)
The trigger will occur on either condition-1 or condition-2, whichever occurs first.

AND: (Condition-1 AND Conditon-2)
The trigger will occur when the edge occurs while the pattern condition is valid. The pattern setting, for the channel for which the edge is set, must be set to "don't care".

THEN: (Condition-1 THEN Condition-2)
The logic analyzer will first wait for condition-1 to occur. After condition-1 has occurred, the logic analyzer will wait for condition-2 to occur. After condition-2 has occurred the capture will complete and the captured data displayed.

If 'unconditional continuous' trigger is clicked, the trigger condition will be de-activated automatically. Should the *'Capture'* button on the main menu be clicked, 'unconditional continuous' capture will start. Data will be captured and displayed at regular intervals, regardless of what the input signals look like (unconditionally).

If 'conditionally continuous' is selected the trigger conditions will remain active. In this case clicking 'capture' on the main menu will start 'conditional continuous' capture. The screen will now be updated only after a legal trigger condition

occurred. A 'waiting for trigger' message will be displayed, should no triggers be detected. This feature is extremely handy for looking at continuous data transmissions, e.g. data on serial lines etc. It is also handy in the case where the logic analyzer will receive only single triggers, which are under user control; for it will update the screen with each trigger. There would be no need to press 'capture' before each data capture.

The triggering of the Annie-USB operates completely independent of the sampling clock. Refer to "Logic analyzer usage considerations/Trigger condition
.

Summary of trigger conditions

The following table summarises the Edge/pattern trigger conditions available:

Trigger condition – Annie-USB
Edge up
Edge down
Change of state*
Pattern (Any duration)
Pattern < Duration (glitch capture)
Pattern > Duration
Pattern OR Edge up
Pattern OR Edge down
Pattern OR Change of state
Pattern AND Edge up
Pattern AND Edge down
Pattern AND Change of state
Pattern THEN Edge up
Pattern THEN Edge down
Pattern THEN Change of state
Edge up THEN Pattern
Edge down THEN Pattern
Change of state THEN Pattern

*Change of state = Edge up OR Edge down

Any of the above conditions may be combined with 'Conditional Continuous' capturing.

Edge/Pattern setting

The edge and pattern trigger set-up is organised in such a way that each channel is represented by a rectangle. The option for each channel is changed by clicking the left mouse button on the picture in the rectangle associated with that channel.

The pictures in the Edge Trigger area rotates between  "disabled",  "rising edge",  "falling edge" and  "Change of state".
(Change of state: Trigger on the low-to-high transition (rising edge) or high-to-low transition (falling edge) - whichever occurs first).

The pattern-trigger-bits rotate between  "don't care'",  "low" and  "high" when they are clicked. The trigger will occur when all channel inputs marked '0' are low and all those marked '1' are high. The channels marked 'X' are not taken into consideration.

Pattern duration

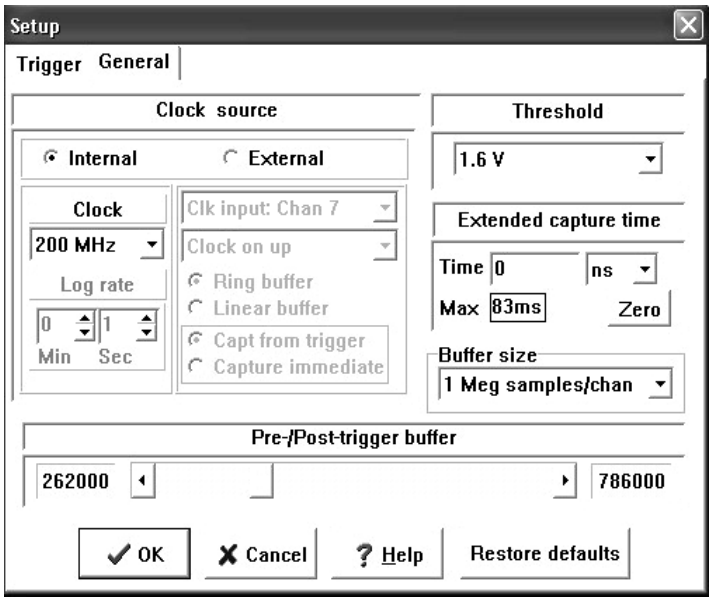
A trigger condition may be set to occur only if a pattern is valid for more than, or less than, a specified time period.

For example, say you are measuring a 1MHz signal. You know that the minimum time that this signal should be high is 500ns, since the signal period is 1uS. You can allow for some mark-space variation, but certainly, if a pulse of less than say 200ns occurs it must be a glitch. You can therefore set the Annie-USB to trigger on any pulse less than 200ns. This is called "glitch capturing".

Reset pattern button

The *'Reset pattern'* button is used to change all the pattern bit conditions to "don't care".

General page



Sampling clock

See also "Logic analyzer usage considerations / Clock sources"

Internal

The sampling clock is selected in the 'Clock' box.

This is the frequency at which the Annie-USB will sample all 8 channel inputs. The sampling rate is totally independent of how many channels are used.

The digital logger is the last item in the pull-down list.

When the "Logger" option is selected the "Log rate" pull-down box becomes enabled for selection of the required log period.

External

This clock must be applied by the user to the channel 7 input. The user could specify whether the sampling must occur on the rising or falling edge.

Use the external clock for synchronous capturing. This is also called "state" capture. E.g. one could have data being captured on the rising edge of a micro-controller read signal, by using the read signal as the clock input. The logic analyzer will then capture the same data that the micro-controller reads. The text display should be used to analyze this data.

The data buffer configured as a **ring buffer**: In this mode the capturing is done similarly to when an internal frequency is selected, except that the clock input is taken from channel 7.

The data buffer implemented as a **linear buffer**: In this mode data may be captured from the first clock received, into the buffer. Data capture will stop and the data displayed when the buffer is full. Should there not be enough clock cycles to fill up the buffer, the user could at any time stop the process and have the limited number of captured samples displayed.

The first sample to be captured may be specified to be the very **first clock received**, or it may **wait for a trigger condition** to occur and then start capturing the data from the first clock that follows the trigger. A very useful trigger setting to

use in this case is to set the trigger to occur when a specific pattern is valid on the clocking edge (Pattern AND Edge setting). This would ensure that a transitional pattern (glitch/race) condition, when the pattern lines change state, does not cause a trigger, but only the clocked pattern can cause the trigger.

Pre-/post trigger buffer

The 'Pre-/post trigger buffer' group shows the pre-trigger and post-trigger buffer sizes. The pre/post trigger buffer sizes can be set by using the scroll bar. The total buffer size is 1048000(Decimal) and therefore not the full 1024K (Hex), which is 1048576(decimal). The 576-byte difference (1024K Hex - 1048000 Decimal) is not displayed.

Threshold level

Incoming signals are compared to a fixed threshold voltage. If the signal voltage is lower than the threshold voltage when it is sampled, it will be taken as a '0' and if it is higher than the threshold voltage, it will be taken as a '1'.

The available levels allow optimal usage with the most common technology type (TTL, 5V-CMOS, 3.3V-CMOS, 2.5V-CMOS etc.) At lower frequencies it may not be very important which level is selected, but at high frequencies you might want to ensure that the threshold is set to the applicable technology type.

Extended Capture Time (ECT)/Post-Trigger Delay

The Extended Capture Time (ECT) group is used to set a time period that will be timed out after the post trigger buffer has been filled. It can also be referred to as a "Post trigger delay"

During this time the logic analyzer will keep capturing data. Capture will stop and the data displayed when the ECT has been timed out.

The process of capturing the post trigger buffer and then the ECT is completely smooth and uninterrupted.

If a short ECT is set the effect will be the same as if the post trigger buffer size has been increased. If the ECT is long enough the trigger point will not be in the eventually displayed data any more.

The effect of the ECT is therefore to move the window of captured data forward in time. You can capture data "long" after the trigger has occurred, without reducing the sampling rate.

The Trigger-to-Cursor measurements (e.g. T-X) are slightly less accurate when the trigger point is not within the data buffer (Refer to technical specifications).

The "Zero" button offers a quick way to set the ECT to zero.
The maximum allowed ECT is displayed. It varies depending on the sampling

frequency chosen.

Example-1:
Problem: Say for instance that you know that a certain event in your data should happen 1ms after, say, a strobe-S has gone low. Now let us further assume that it is difficult to trigger on the desired event, because there is a lot of unpredictable data in-between. You would also like to sample at 200MHz, because if you lower the sampling rate to get the desired data into the data buffer you would not be able to see the desired data properly, because of reduction in sampling resolution.
Solution: Set an ECT of 1ms and capture. The desired data should now be in the data buffer. Scan through the data visually or use the "view/search" dialog box to find the desired data.

Example-2:
Problem: Assume you have a very long serial string of configuration data, for configuring a FPGA. For some reason the FPGA is not configuring correctly and you would like to inspect the whole string of data. The string of data is much too long to fit into the logic analyzer buffer when you are capturing at the sampling rate that you prefer for the inspection.
Solution:
Set the post trigger buffer to maximum. Set a trigger condition to cause a trigger at the start of the data string. Do a capture (ECT=0) to capture the first portion of the string. To capture the next portion of the string, set the ECT to the time it took to fill the post trigger buffer.
This time = (Post trigger buffer size) x (Sampling period).
Ensure that you get the last of the previous data string portion so that you could add this portion to the previous. In the same way you would add to the ECT to get the third portion to the data string, and so on.

Options dialog box

Environment page

Hints: These options are used to switch hints in different parts of the software on or off.

If the '*Beep on trigger'* checkbox is set, a beep will sound when a trigger is detected, when a single capture is done. During continuous capture (unconditional or conditional), this checkbox is ignored.

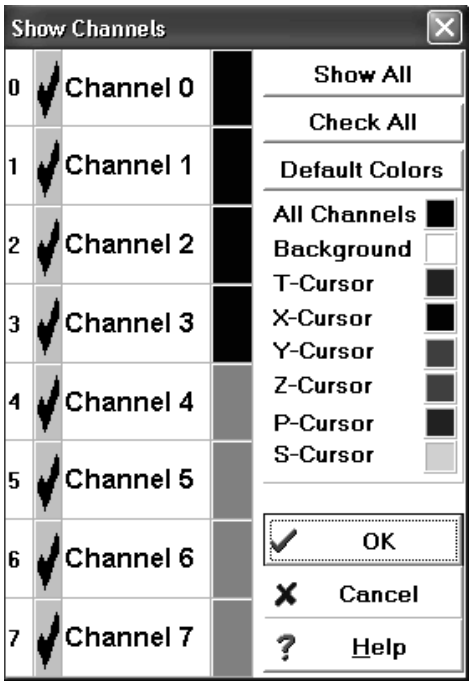
If the *'Auto-Save default configuration'* checkbox is checked, the current configuration will be saved as the default configuration. This is done when the program is quit. If this checkbox is not checked, you may save the default configuration by selecting the *'File/Save default'* menu option.

Time measurements page

On this page you may specify which cursor-line to cursor-line or cursor-line to trigger-line measurements are to be displayed on the main window measurements bar.

Which cursor-line to cursor-line measurements are displayed may also be set by clicking on the small cursor name buttons on the measurements bar (main window).

Show channels dialog box



This box is handy for changing a number of channel names in succession.

By tabbing from one name to the next, the names will be automatically hi-lighted. You don't need to delete the previous name; it will disappear when you start typing the new name.

Multiple channel selection is done by clicking the first name to be selected, then moving to the last name to be selected and clicking on it while holding down the "shift" key. All the names between the first and last will also be selected. You could select any specific names by holding the "ctrl" key in and clicking with the mouse on the names to be selected. In this case only the names on which you click will be selected. Holding the 'ctrl" key down and clicking on an already selected name will unselect that channel name.

When clicking the right mouse button on a channel name a pop-up menu will appear, allowing you to rename the channel, change its color, etc. When multiple names are selected the change will apply to all of the selected channels. If multiple names are selected and you do a name change for the selected channels, the name will be the same for all, except that a number will be added to each. E.g. If you type the name "data" the names "data 0", "data 1", "data 2", etc. will be allocated. If you typed e.g. "data 4" the names "data 4", "data 5", "data 6", etc. will be allocated.

These check boxes are used to remove channels from the signal display, which you don't want to see, such as unused channels.

The channels that are switched off are also not printed.

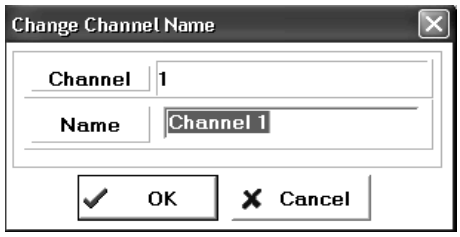
Although a channel might be switched off, it is handled in the software like any other, the only difference being that it is not displayed. For example if data is captured while a certain channel, connected to the unit under test, is switched off, you may simply switch the channel back on to see the captured data. You don't need to do another capture.

A button is provided to overrule the selection as set in the check boxes and display all the channels. This same button is used to enable the check box selection.

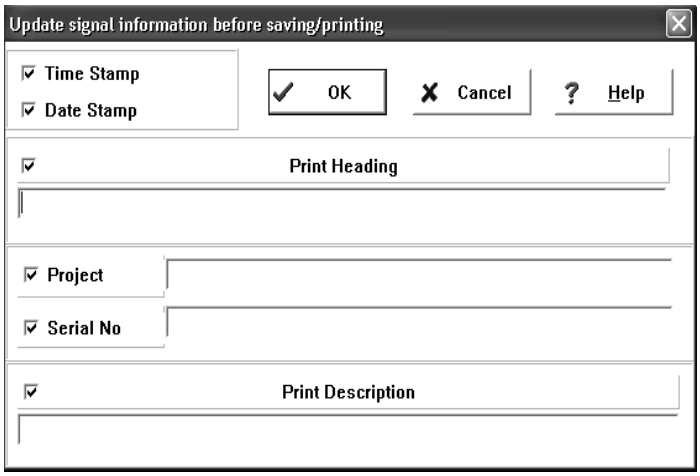
All the channel checkboxes may be set, by clicking the "Check All" buttons.

Click on the colour boxes to set colours for the channels, background, and cursor lines. Revert to the original default colours by clicking the "default colours" button.

To change channel names, you may also click the mouse in the main window on any channel name. The following dialog box will appear:



Signal info dialog box



The signal information dialog box is used to hold information concerning a set of captured data.

Before printing or saving the signals, this dialog box will appear and provides for the following information to be entered:
(1) Heading
(2) Description: General information
(3) Project information: The project under which the work is done or the name of the product that is being tested.
(4) Serial Number: The serial number of the unit tested.

Date- and time stamps are taken with each capture.

The check boxes specify which of the information will appear on printouts.
When a signal file is saved, all the information is saved, regardless of whether the check boxes are checked.

When the signal info dialog box appears before saving or printing, the '*Cancel'* button will abort the process if clicked.

Clicking the '*OK'* button will allow the *'Save As'* dialog box to appear in the case of file saving, or the signal print will start in the case of printing.

Data as text dialog box

Bin + Hex Page

This page displays the captured data in text format as follows:

1. Sample number in hexadecimal.
2. Samples the value as 8-bit binary byte. Channel-7 is represented by the most significant bit and channel 0 by the least significant bit.
3. The sample value as a hexadecimal number.
4. The sample number in decimal.

Each byte represents a data sample of all channels.

Each bit of the data byte represents the state of that channel input when the sample was taken.

Hex Compact page

This page displays the captured data in text format as follows:

1. Sample number in hexadecimal.
2. Eight samples in hexadecimal format.
3. The sample number in decimal (Same number as at beginning of line in hexadecimal)

Use the jump-to buttons to jump to the X, Y, Z, and T positions in the data.

Clicking the "print" button will print the data in the current format.

Search pattern dialog box

This feature is used to search for any pattern combination in the sampled data.

After setting up the pattern to be searched, click the *'Search'* button to find the first occurrence of that pattern.

Searches may be set to start from the beginning of the buffer, form the X-cursor, Y-cursor or T-trigger line.

If the pattern is found a special cursor line will indicate the position in the signal display area.

Any further occurrence of the pattern may be found by pressing the *'Next'* button.

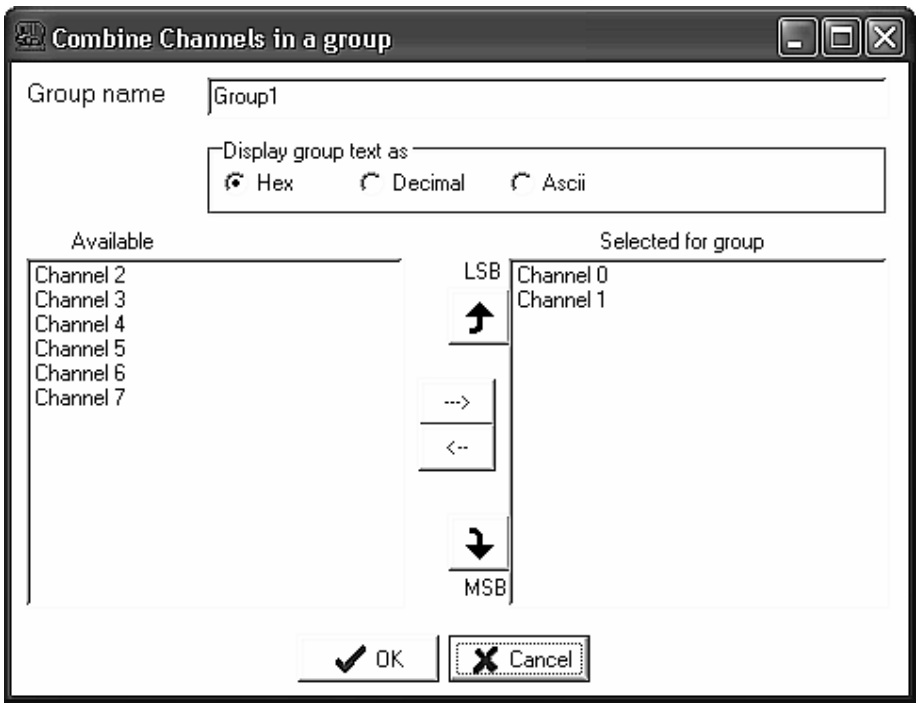
These subsequent searches are done at edges only.

Project dialog box

If the unit under test (UUT) is PC based you may launch the software driving the UUT, using this dialog box.

Refer to the *'File/Project'* main menu item description for information on how to take measurements on a PC based UUT.

Combine channels in a group dialog box



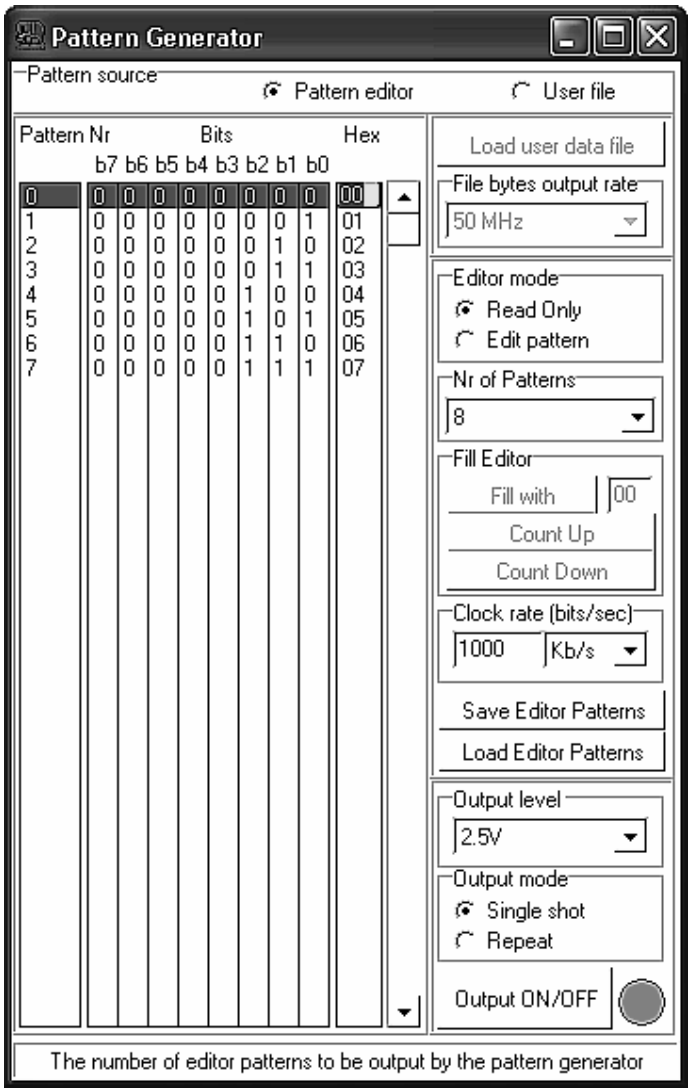
This dialog box appears when you right-click on the channel names or on a group name in the main window.

If you selected the channels to be grouped in the main window, these selected channels will appear in the "selected for group" box. All channels still available to be included in the group will appear in the "Available" box.
To add a channel to the group, select it in the "available" box and click the -> arrow to move it to the "Selected for group" box. To remove a channel from the group is done in a similar way. Use the up and down arrow to place the channels for least significant bit (LSB) to most significant bit (MSB). Select the group display format as Hexadecimal, ASCII or Decimal. When the group is displayed in the main window an "H", "D" or "A" next to the group name will indicate the format of the group.
Use the "Group name" box to name the group. You may of course also rename the group name on the main window by double clicking on it in the main window.
Refer to the picture of the main window where channels 1 and 2 are grouped together in accordance with the information displayed in the "Combine channels in

a group" dialog box as shown above.

Pattern Generator dialog box

The Annie-Usb is capable of producing output signals on its eight logic analyzer channels.



IMPORTANT: Whereas a logic analyzer measures output signals generated by a unit under test, the pattern generator changes the input port of the logic analyzer to an output port in order to output signals to a unit under test. If the Annie-USB has been working as a logic analyzer, all the probes need to be removed from the unit under test outputs, and reconnected to inputs on the unit under test, before the pattern generator may be activated. The pattern generator outputs are protected against short circuits as well as being driven by up to 5V outputs, but damage may occur to the unit under test.

The pattern can be entered via the pattern editor or by loading a user data file. This

is selected in the "**Pattern source**" group box.

The pattern editor can be used to program up to 256 patterns. The number of patterns is set in the "**Nr of patterns**" edit box.

The "**Fill editor**" group box can be used to initialize the editor with any constant value, or fill it with incrementing or decrementing values.
Any individual bits may be edited by clicking on the **"bits" columns**, b7…b0, in the editor. Hex values may directly be entered in the **"Hex" column**.

After the patterns have been programmed, they can be clocked to the pattern generator outputs at any of the rates set in the **"clock rate (bits/sec)"** group box.

The amplitude of the output pattern signals is set in the "output level" group box.

With the **"output mode"** set at **"single shot"** the patterns will be clocked out once only. With the "output mode" set at **"repeat"** the patterns will be clocked out continuously. In this case, after the last pattern was clocked out, the first pattern will be clocked out with the next clock cycle, thus starting the repeat of the patterns.

Patterns programmed into the pattern editor may be saved by clicking on the **"Save editor patterns"** button. Previously saved patterns may be loaded into the editor by using the **"Load editor patterns"**.

User file:
When the **"user file"** is selected in the **"Pattern source"** group box, the pattern generator would clock data obtained from a data file to the pattern generator outputs. The bytes would be clocked to the pattern generator at the frequency indicated in the **"File bytes output rate"** edit box.

The pattern generator output is activated with the **"Output ON/OFF"** button. The yellow "LED" next to the button indicates whether the outputs are active or not. The status LED on the Annie-USB also indicates these same conditions.

LED Hardware and software indicators

The power LED will be on when the Annie-USB is powered.

The trigger LED is on while the Annie-USB is waiting for a trigger. The trigger LED is duplicated in the software on the main display window.

The status LED is used to indicate that capture is active. When a slow sampling rate is used you will notice that the status LED remains on after the trigger LED goes off (indicating a trigger). The Status LED will remain on until the post trigger buffer is filled and capture ends.

Software trigger LED indicator colours:

Grey	- NOT waiting for trigger / Trigger done / LED off
Purple	- Waiting for first trigger condition (Condition-1 THEN Condition-2 setting)
Green	- Waiting for (final) trigger
Light blue	- Unconditional trigger. (The trigger is performed internally at a fixed period)

TECHNICAL SPECIFICATIONS

Internal sampling rates:	MHz: 200, 100, 50, 25, 10, 5, 2.5, 1 (500 on specific models) kHz: 500, 250, 100, 50, 25, 10, 5, 2.5 1.25
Digital logger:	1 Second to 1-hour sampling rates.
No. of channels:	8
Data buffer:	1048 000 (decimal) samples/channel
Connection to PC	USB 2.0 High Speed Mode (USB 1.1 Full Speed compatible)
Threshold voltage:	1.2V to 2.3V
Digital inputs	
Input voltage:	0 – 7V
Input bandwidth:	50MHz min
Input impedance:	1MΩ ±1% minimum , 8pF
Trigger methods: Pattern: (Pattern valid for any duration) Pattern valid < Duration Pattern valid > Duration Edge: Mouse/Keyboard Edge/Pattern combinations:	 1, 0, and "don't care" ("X") conditions selectable on all channels. The pattern must be valid for at least 20ns. Glitch Capture. Pattern duration may be specified in steps of 20ns to 1 ms. Duration tolerance of ±20ns Pattern duration may be specified in steps of 20ns to 1 ms. Duration tolerance of ±20ns Triggers on: Rising edge, falling edge, either rising or falling edge (change of state), of any one channel Trigger may be forced. Edge: Rising edge, falling edge, Change of state Pattern: Edge OR pattern: Edge or pattern condition that occurs first will cause a trigger. Edge AND Pattern: For a trigger the edge condition must occur while the pattern condition is valid. The pattern must be valid for at least 20ns before the edge and 20ns after the edge. Edge THEN Pattern / Pattern THEN Edge: The first condition is required before the second condition. At least 30ns is required from detection of the first condition to the second.

Continuous:	Unconditionally Continuous: Trigger forced internally and display updated with regular intervals. Conditionally Continuous: Display updated when a trigger condition is detected. Any of the above trigger conditions may be set as described above.
Pre-trigger and post-trigger buffer setting:	The data buffer is divided in pre- and post trigger sections. The pre-/post-trigger buffer relation may be changed in 1000 samples steps.
Software environment Windows:	Windows 98, ME, 2000, XP or later compatible versions. The power of the Windows multitasking environment is utilised to run the analyzer software and user's unit under test (UUT) software simultaneously (if the UUT is PC based). Hardware that interfaces with the PC may be driven from the PC while real-time measurements are performed on the hardware. (The logic analyzer and UUT software are simultaneously run on the same PC). The analyzer and the user program may be viewed simultaneously in the Windows environment.
Ease of use:	The software is very easy to use. Most functions are directly selectable by means of function buttons on the main screen.
User UUT application program launching:	The user application program may be run from the analyzer program menu or from Windows.
Display: No. of channels: Channel/group names Display order: Colors Zooming: Single capture	 Any number of channels may be displayed. User specified signal names Channel display order user specified Specify colors for individual signals, background. Data zoom: All captured data may be viewed on one screen. Zooming in to only a few samples displayed on the screen Easy data display window sizing using the mouse. Captures a single set of data

Continuous capture display:	Unconditionally: Continuously captures and displays data at a fixed update period. Conditionally: Updates the display each time a specified edge or pattern trigger condition is met.
Cursors:	T-trigger line: Indicates trigger position. P-trigger line: Indicates trigger condition-1 position in case of condition-1 THEN condition-2 setting. S-Cursor line indicates data search positions. X, Y and Z-cursor for time measurements. The values of the X and Y cursor lines, where they intersect the signal lines are shown.
Time measurements:	The time differences between any two cursor lines or trigger line may be displayed. Take measurement easily by clicking mouse on first edge and on second edge to get the time difference. The time difference may also be indicated as a frequency.
Edge snapping:	Cursors (X, Y & Z) snap to signal edges for accurate time measurements. (Especially useful when the display is zoomed out so that one screen pixel represents more than one data sample). The signal edges to which the cursors lines have been snapped are indicated
Pattern search:	Any channel conditions may be searched for. 1, 0 and don't care conditions specified. Also repeated search
Printed output:	The timing diagrams, bitmaps, binary and hex data, may be. Landscape and portrait.
Power requirements:	2.5W Max (Capturing data) The Annie-USB will be fused with a 1.6A (or less) Resetable fuse. Remove power for 3 minutes to reset.
Internal sampling clock stability	100 PPM

External clock	Input to channel 7. Unsynchronised capture: 25Mhz Max Synchronised capture: 10 MHz Max, 30ns data valid on channel 0-6 before and after the clock signal on channel 7 changes. Ring buffer configuration: Operates with pre and post trigger buffer. Linear buffer configuration: Start capture immediate or from trigger. No initial clock pulses are missed with either immediate or from trigger capture.
Logger sampling clock	Timing obtained from PC
Cursor to T-line accuracy	T-Line onscreen: ± 1 sampling clock period (1.25 kHz to 500/200 MHz) T-Line not onscreen (due to "large" ECT): 200 MHz: 140ns. 100 MHz: 180ns. 50 MHz down to 1.25 MHz: 10 x sampling clock period.
Pattern Generator:	
Pattern source	Pattern editor or user file
Nr of channels	8
Data to output clock	2MHz max
Minimum input impedance of load	4k7/100pF
Modes of Operation	Single/Continuous
Annie-USB unit weight Annie-USB unit dimensions	210 g 150mm x 86mm x 26mm
Annie-USB packaged Weight: Dimensions:	 ± 900g 320mm x 130mm x 76mm
Operating Temperature:	10°C - 40°C. (50°F-105°F)

Annie-USB Manufacturer

Janatek
PO Box 6186
Uniedal
7612
South Africa

Tel +27 21 887 0993
E-mail: info@janatek.co.za
Web: www.janatek.co.za