LOGIC ANALYZER

LAP-F1

USER GUIDE

V1.2 OCTOBER 2015

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Precautions

Users are advised to carefully review this section to avoid potential hazards to persons, this product and other products connected to it.

- *To protect the instrument and the Device under Test (DUT), grounding is required during signal acquisition.*
- *Follow the "Operating environment" recommendations from Table 2:1.*
- *Protect the LAP-F1 from static discharge.*
- *Avoid direct impacts and rough handling.*
- *The LAP-F1 is an IEC 61010-1 Level 2 instrument. The relevant pollution caution is: "Normally only non-conductive pollution occurs. But temporary conductivity caused by the occasional condensation must be kept in mind."*
- *Do not place heavy objects on the LAP-F1.*
- *As a Class A product, the LAP-F1 may cause radio interference in a domestic environment.*
- *Do not disassemble the LAP-F1 as this will void the warranty and may affect its operation.*

1. Introduction

1.1. Preface

This User Guide presents the Zeroplus* LAP-F series logic analyzers, their operation and software. The purpose of the User Guide is to help users understand and get familiar with the operations of the instruments and the software. Throughout the document, the instruments software is referred to as ZP-Logic and the instruments as LAP-F1, LAP-F2 or LAP-F1/2 when the content concerns both instruments.

Zeroplus attaches great importance to users' suggestions. Users are welcome to give us feedback by email or telephone. Thank you for purchasing the LAP-F logic analyzer.

** Zeroplus is short for Zeroplus Technology Co. Ltd*

1.2. About this document

This User Guide is organized as follows: First, the characteristics of the LAP-F1/2 are presented, followed by installation and setup procedures. The next section familiarizes the user with the software user interface. Section 4 then goes in-depth on the software functions.

NOTE The software functions in chapter 4 are sorted by their locations on the ZP-Logic Main Menu.

NOTE The latest version of this document can be downloaded from the Zeroplus website.

NOTE Right-click menus are found under the corresponding view modes in chapters 4.48.1 and 4.48.2.

1.3. Product Introduction

The LAP-F1 and LAP-F2 are multi-purpose, PC-based logic analyzers. They offer uncompromised breadth in one single instrument: high sample rate, large channel count and deep memory, with the LAP-F2 being a bit sharper than its little brother.

But the LAP-F1/2 logic analyzers are not only about GHz and Mb. The extensive protocol library consisting of more than 110 protocol decoders, direct streaming to disk, channel folding, eMMC decoding capability, user-friendly software and a host of other functions make debugging a joy. All of these functions are described in chapter 4.

1.4. Package Content

All items contained in the LAP-F1/2 package are listed in Table 1:1. If any of the items is missing or damaged, please contact your distributor as soon possible.

Item	LAP-F1	LAP-F1	LAP-F2	Detail
	40 ch.	64 ch.	32 ch.	
Logic analyzer	*1*	*1*	*1*	
CD w/ driver, software and manual	*1*	*1*	*1*	
Gen. purpose probes with flying leads	*20*	*32*	*-*	*P100ST type*
Gen. purpose probes with flying leads	*-*	*-*	*32*	*P300ST type*
eMMC probes	*4*	*4*	*4*	
eMMC Clock In probe	*1*	*1*	*1*	
USB 3.0 cable	*25*	*37*	*37*	*A to A type; 32.5 cm*
Signal/ground cable pair	*40*	*64*	*32*	*7.5 cm*
Clip-on connector	*80*	*128*	*72*	
USB 3.0 cable; PC-to-LAP-F1	*1*	*1*	*1*	*A to B type; 1.5 m*
Power cord	*1*	*1*	*1*	*1.8 m*
Power cable	*1*	*1*	*1*	*9 V*
BNC cable	*1*	*1*	*1*	*1 m*

USB3.0 expansion card	1	1	1	UTB300 Combo SATA 3

Table 1:1 LAP-F1 and LAP-F2 package content

1.5. System Requirements

1.5.1. Operating System Requirement

The LAP-F1/2 supports operating systems from Microsoft only. See Table 1:2 below for a list of supported operating systems. Please contact our Technical Support team if you have questions about older operating systems.

Supported OS	Versions
Windows 8.1	32- and 64-bit (Recommended)
Windows 7	32- and 64-bit
Windows Vista	32- and 64-bit

Table 1:2 Supported operating systems

1.5.2. Hardware Requirements

The requirements below are both for the LAP-F1 and the LAP-F2.

Item	Value	Type
CPU	2 GHz	Minimum
Memory		
RAM	2 GB	Minimum
RAM	4 GB	Recommended
Hard disk	80 GB	Minimum
Interface		
	USB 3.0	Recommended support
	USB 2.0 and USB 1.1	Recommended compatibility
Display		
Display size	17”	Recommended
Display resolution	1,024 x 768	Minimum
Display card	8 Mb SDRAM	Recommended

Table 1:3 PC hardware requirements and recommendations

1.6. Product Specifications

1.6.1. Product Photos

Figure 1-1 Top view of the LAP-F1

Figure 1-2 Top view of the LAP-F2

1.6.2. Specifications

Items that are not identical for the two models are highlighted in green. Items in black are identical for LAP-F1 and LAP-F2.

Item	LAP-F1	LAP-F2
Supported operating systems	See Table 1:2	
Acquisition Channels	40 or 64	32
Interface	USB 3.0 (2.0 compatible)	
Sampling Frequency		
Internal (Timing)	1 GHz	2 GHz
External (State)	200 MHz (Dual-edge)	
Memory/channel	4, 8, 16, 32, 64 Mb	64, 128, 256, 512 Mb and 1, 2 Gb
Trigger		
Trigger Channels	32 (plus OR triggering between the two groups of 32 and 8/32 ch.)	32
Trigger Events	Pattern / Edge / Pulse-width / Interval (Time)	
Trigger Delay	Yes	
Trigger Sequence Levels	256	
Trigger Pass	1-65,535	
Trigger Voltage	4 simultaneous levels; 1 for each of the 4 ports	2; 1 per port
Auxiliary Cursors	250	
Protocol Triggers (HW)	I2C, I2S, SPC, SVID, UART, CAN2.0B	
eMMC trigger	4 channels only; see Special functions below for full support	
Test signal		
Bandwidth	100 MHz (DC)	
Voltage range	> = 2V to 5V level signal	
Trigger Voltage adjustment range	± 5 V	
Trigger Voltage Resolution	DAC 12bits : 2.44 mV/step	
Software functions		
Languages	English, Chinese (Traditional), Chinese (Simplified)	
Zooming & Panning	Two cursor modes	
Wavefrom & UI customization	Modify the appearance of channels, menus, traces, windows etc	
State List & Waveform View	Present the samples as a list of 1s and 0s or as a waveform	
DSO Connection	Connect to and import signals from DSOs	
Files Comparison	Compare 2 files to quickly see where and how they differ	

Navigator	*Instantly navigate to distant parts of the waveform*
Memory View	*See what the memory looks like; what is read/written to each address*
Packet List	*Breakdown of all packets in list form*
Statistics	*Table view of number of periods, periods that satisfy conditions etc*
eMMC Decoder	*Decode 4 eMMC signals for free*
Real-time Signal Activity	*Live view of probe activity*
Protocol Decoders	*More than 110 free, built-in protocol decoders*
Miscellaneous	
Phase Errors	*< 3 ns*
Power	*AC (IN): 100-240 V 50/60 Hz; DC (OUT): 9 V / 5.55 A*
Dimensions	*322 x 180 x 38 mm*
Special Functions (Optional)	*See chapter 1.6.4.*
Certifications	*CE and FCC*

Table 1:4 LAP-F1 specifications

1.6.3. Available Models

Model	Channels	Memory depths available
LAP-F1	*40*	*4, 8, 16, 32 and 64 Mb/channel*
LAP-F1	*64*	*4, 8, 16, 32 and 64 Mb/channel*
LAP-F2	*32*	*64, 128, 256, 512 Mb/channel and 1, 2 Gb/channel*

Table 1:5 Available memory depths

1.6.4. Optional Features

Table 1:6 lists the optional features; see chapters 4.40, 4.43, 4.44 and 4.45 for further details. All of these functions are available for the LAP-F2. For the LAP-F1, all but the Memory Segmentation functions are available.

Feature	Description
Channel Folding	*LAP-F1/2 offers the ability to concentrate the total memory on a limited number of channels. Ex: The 40 channels model with 4 Mb/ch. has 8 Mb available if only 16 channels are active; 16 Mb for 8 channels etc; see chapter 4.44 for details..*
eMMC 5.1 / SD 3.0	*Get the special eMMC probes and unlock 32 channels at for 2 GHz sampling to fully trigger and decode all the signals of eMMC5.1/SD3.0; see chapter 4.40 for details.*

Long-Time Record	*This function is used to stream samples directly to disk. Up to 64 channels can be streamed at an average rate of 300MB/s using USB 3.0. The Long-Time Record function can be used to acquire signals for 7 hours to 35 days depending on the acquisition setup and available storage; see chapter 4.43 for details.*
Memory Segmentation	*Split the available memory into segments. During normal operation, the memory will be filled when the logic analyzer triggers. When the Memory Segmentation function is activated, a part (segment) of the available memory will store data from the first occurrence of the event, and then another part of the memory will store data from the second occurrence of the event, and so on until the memory is full.*

Table 1:6 Optional features

1.6.5. Electrical Specifications

Item	Minimum	Normal	Maximum
Phase error	*0.2 ns*	-	*3 ns*
Working Voltage (DC)	-	*9 V*	-
Standby Current	-	-	*1.9 A*
Working Current	-	-	*2.0 A*
Standby Power	-	-	*17 W*
Working Power	-	-	*18 W*

Table 1:7 LAP-F1/2 electrical specifications

1.6.6. Probe Specifications

The LAP-F1 and LAP-F2 both come with general purpose probes; one per channel. Note that there are some differences between the LAP-F1 and the LAP-F2 probes. 4 eMMC probes are also included in the standard purchase.

3 additional probe types are available for sale: General purpose, Low-voltage, Negative logic and eMMC/SD. These are presented in **Table** 1**:**9.

Item	Description	
	For the LAP-F1	For the LAP-F2
Code	P100ST	P300ST
Incl. in base purchase	Yes	Yes
Signal Type	Single-ended	Single-ended
Channels (Max)	64	32
Input Impedance	530 kohm ±10%	
Capacitance	8.2 pF ±2 pF	
DUT Bandwith (Max)	100 MHz	
Transm. Rate (Max)	100 Mbit/s	
Trigger Level	User-defined	
Trigger Level Range	V_{IH}: 2 to 5 V	
Input Signal	-5 to 5 V	
Input DC V (Max)	±5 V	

Table 1:8 LAP-F1/2 general probes specifications

The special purpose probes listed below are all compatible with both the LAP-F1 and the LAP-F2.

Item	Low-voltage	Negative Logic	eMMC/SD
Code	P120LV	P120NE	P200EM
Incl. in base purchase	No	No	4 incl.
Signal Type	Single-ended	Single-ended	Single-ended
Channels (Max)	64	64	32
Input Impedance	190 kohm ±10%	190 kohm ±10%	190 kohm ±10%
Capacitance	4.3 pF ±2 pF	4.3 pF ±2 pF	4.3 pF ±2 pF
DUT Bandwith (Max)	120 MHz	120 MHz	200 MHz
Transm. Rate (Max)	120 Mbit/s	120 Mbit/s	400 Mbit/s
Trigger Level	User-defined	User-defined	User-defined
Trigger Level Range	V_{IH}: 0.6 to 5 V	V_{IH}: 0.3 to 5 V or	V_{IH}: 0.6 to 5 V

		V_{IH}: -0.2 to -1.5 V	
Input Signal	0V to 5V	-5 to 5V	0 to 5V
Input DC V (Max)	±10 V	±10 V	±10 V

Table 1:9 LAP-F1/2 special purpose probes specifications

NOTE Voltages that exceed the Input DC level can damage the probes.

1.6.7. Port Overview

Figure 1-3 shows the ports of the LAP-F1. The LAP-F2 ports are identical.

Figure 1-3 Rear view of the LAP-F1.

Port	Number	Description
Signal Channels	32	USB connections to probes for signal acquisition.
CLK IN	1	External clock input for State mode acquisitions; see chapter 4.17
JTAG	1	Case by case usage; sits below the CLK IN port;
STACK	1	Stack multiple instruments to increase channel count; not currently available for LAP-F1/2.
TRIG. OUT	1	Connect to DSO for external triggering; see chapter 4.17.2
USB	1	Connection to the PC; both USB 3.0 and 2.0 are supported.
CLK OUT	1	LAP-F1/2 clock output.
DC	1	External power supply; see chapters 1.6.5 and 2.2.

Table 1:10 LAP-F1/2 input ports

In Figure 1-4, cables are connected to the LAP-F1 ports listed above. Some of the 32 signal channel ports are seen in the left part of the picture.

Figure 1-4 Cable connections to the LAP-F1

2. Installation and Setup

2.1. Software Installation

NOTE For users who have internet access, we recommend that you download the latest version of the ZP-Logic software from our website: www.zeroplus.com.tw

Close all other programs and connect the LAP-F1/2 to the PC via USB. Insert the ZP-Logic Software CD into the CD-ROM. If the CD does not auto play, open the set.exe file manually. The dialog box from Figure 2-1 will be shown.

Figure 2-1 Main installation window

Choose the Application Setup as this option will install both the software and the instrument driver. The Driver Setup is for driver reinstallation.

Before the installation starts you will be asked to read the License Agreement carefully. “I accept the terms of the license agreement” must be checked to continue.

Clicking “Next” throughout the installation to install the standard version is recommended, but options for customizing the installation are also available for users who want that. Upon completion, the user will be prompted to restart the computer; it is recommended to do so.

When the ZP-Logic is launched for the first time, a Find New Hardware dialog box will appear and the driver will then be installed automatically. ZP-Logic will also download all the available protocol decoders, as seen in Figure 2-2.

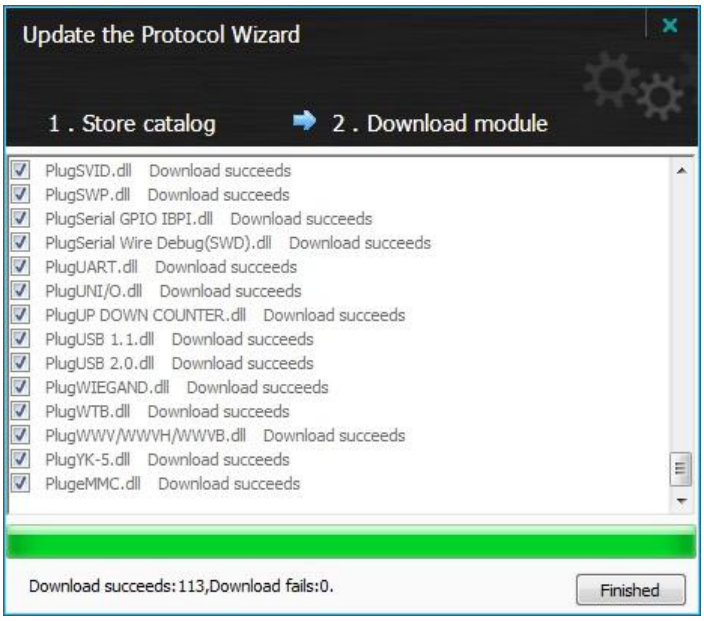


Figure 2-2 Protocol Wizard interface

Once the ZP-Logic and the driver installations have finished, the LAP-F1/2 and the ZP-Logic are ready for use.

2.2. Hardware Setup

This procedure is identical for LAP-F1 and LAP-F2. First prepare the probes. Connect the USB cables with the probes as shown in Figure 2-3.

Figure 2-3 USB connection to the General Purpose probes

Proceed to connect the USB cables to the instrument; see Figure 2-4.

Figure 2-4 Test cables connected to the LAP-F1

Connect the LAP-F1/2 to the PC using the USB, then power up the instrument to ensure that it's working. Connect the AC power cord to the transformer and the DC cable to DC plug of the LAP-F1/2. The power lamp indicated in Figure 2-5 turns on when the power is connected.

Figure 2-5 Signal cable connection and power lamp location

2.3. Connection to DUT

The LAP-F1/2 comes with two flying lead type of probes included: one General purpose probes per channel and four eMMC probes. (Additionally, Low-voltage probes and negative logic probes are available for purchase.) Both of the probe types are active, i.e. they are not merely pieces of wire but have active components in the probe head that amplify, filter, isolate and in other ways improve the signal quality. These characteristics make the probes well-suited for high-speed signal measurements.

Each active probe provides two channels and consists of four cables: two signal cables and two ground cables that all have Dupont pods on the ends; see Figure 2-6.

Note that each port on the LAP-F1/2 carries to signals; the probes connected to port A0 will show as traces A0 and A1 in the software and so on. The two probe signal cables are numbered; the lowest number will correspond to the lowest numbered channel in the software. Ex: If a brown probe with numbers 12 and 13 is connected to the 4th D-port, then probe lead 12 will be shown on channel D6 in the software and lead 13 on channel D7. See the port names on Figure 2-5.

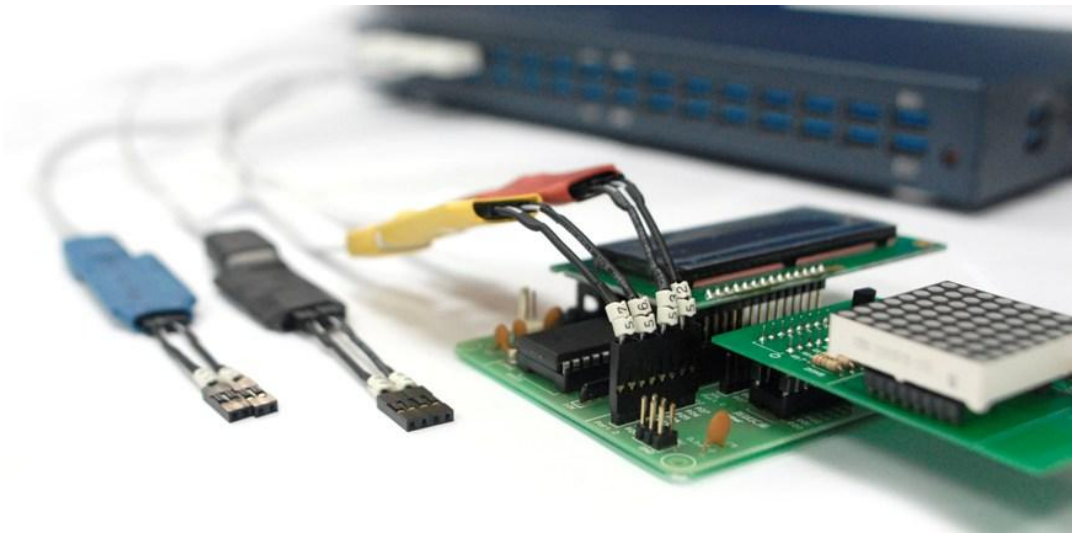


Figure 2-6 Connection to DUT (yellow and orange probes)

NOTE Each USB cable from the probe to the LAP-F1/2 carries two signals. The two signals are completely independent.

NOTE There is one ground cable per signal cable (to have short ground leads).

NOTE The signal cables are transparent and the ground cables are black.

NOTE Zeroplus also offers another two probe types: Low-voltage and negative logic probes. Both are flying lead type and active.

NOTE Each signal-ground pair of cables is glued in one end and flies in the other. If the ground pins are not conveniently positioned on the DUT, it is possible to turn the cable pairs around so that the ground pins can be left hanging.

NOTE The supplied probes are numbered and colored since this can help eliminate confusion. However, all probes of one type are electrically identical so it is not necessary to follow the numbering.

NOTE There is a second way to find out which of the signal cables will correspond to the lowest-numbered channel of the port: Look at the probe from the USB connection side of the PCB; the lowest numbered channel will be the left one.

NOTE If the probes do not connect well to the DUT pins, users can try to use the supplied clip-on (grip) connectors. Connect the signal lead to the clip-on pin then, compress the clip-on to reveal two metal prongs that can be hooked onto the contact points.

NOTE To avoid large attenuation, the cable length between signal pad and the DUT should not exceed 3 cm. This is achieved with the provided probes.

2.4. eMMC Probe Tuning

NOTE This procedure only concerns eMMC probes; the Trigger Voltage of General Purpose, Low-voltage and Negative Logic probes are adjusted as described in chapter 4.17.1.

Figure 2-7 shows an eMMC probe. Turn the tiny screw as explained in the steps below to adjust the Trigger Level.

Figure 2-7 eMMC probe tuning screw

STEP 1 Connect the probe to the LAP-F1/2.

STEP 2 Connect the Dupont connector of the probe with a 50/50 clock signal or another 50/50 signal that can be used as a reference.

STEP 3 Capture the signal. The aim of this exercise is to have the trace of the acquisition show as equally long periods of high and low.

STEP 4 If more than 50% of the trace is high, turn the screw on top of the probe clockwise to reduce the duty cycle and vice versa if more than 50% of the trace is low.

STEP 5 Repeat steps 3-5 until the duty cycle of the reference signal is 50/50.

2.5. Trigger In/Out

The LAP-F1/2 can be connected to a DSO (or another instrument) for external or internal triggering.

NOTE It is also possible to display the analog waveform of a connected DSO in ZP-Logic. This is described in chapter 4.17.2.

2.5.1. Trigger In

The LAP-F1/2 can be triggered by an external source, most commonly a DSO or another logic analyzer. The external trigger should then be connected to the STACK port of the LAP-F1/2 and the External Trigger checkbox in the Trigger Setup (Figure 4-25) must be selected.

2.5.2. Trigger Out

When the trigger conditions have been met the LAP-F1/2 can emit a signal that can be used to trigger another instrument. This signal can be sent on the occurrence of three different events; these are detailed in Table 4:22. The signal is sent from the BNC port.

To trigger out, the “Send output signal upon triggering” must be checked in the Trigger Options dialog box (Figure 4-26).

2.6. Operating Environment and Maintenance

Please follow the below instructions when using, cleaning or storing your LAP-F1/2 and probes. Please also see the Precautions chapter prior to the Introduction.

Type	Desription	
Cleaning		
Clean with a soft, damp cloth using a mild detergent.		
Do not spray any liquid on the LAP-F1/2.		
Do not immerse the LAP-F1/2 in any liquid.		
Do not use harsh chemicals or cleaners containing substances such as benzene, toluene, xylene or acetone.		
Operating environment		
Temperature (Working)	*Min: 5° C*	*Max: 35° C*
Temperature (Storage)	*Min: -20° C*	*Max: 60° C*
Rel. humidity (Working)	*Min: 20%*	*Max: 85%*
Rel. humidity (Storage)	-	*Max: 90%*
Altitude	-	*Max: 2,000 m*
Insolation	*Avoid direct sunlight.*	
Environment	*Use in a dust free, non-conductive environment.*	

Table 2:1 General advices for cleaning, operation and storage

3. User Interface

The ZP-Logic user interface is shown in Figure 3-1.

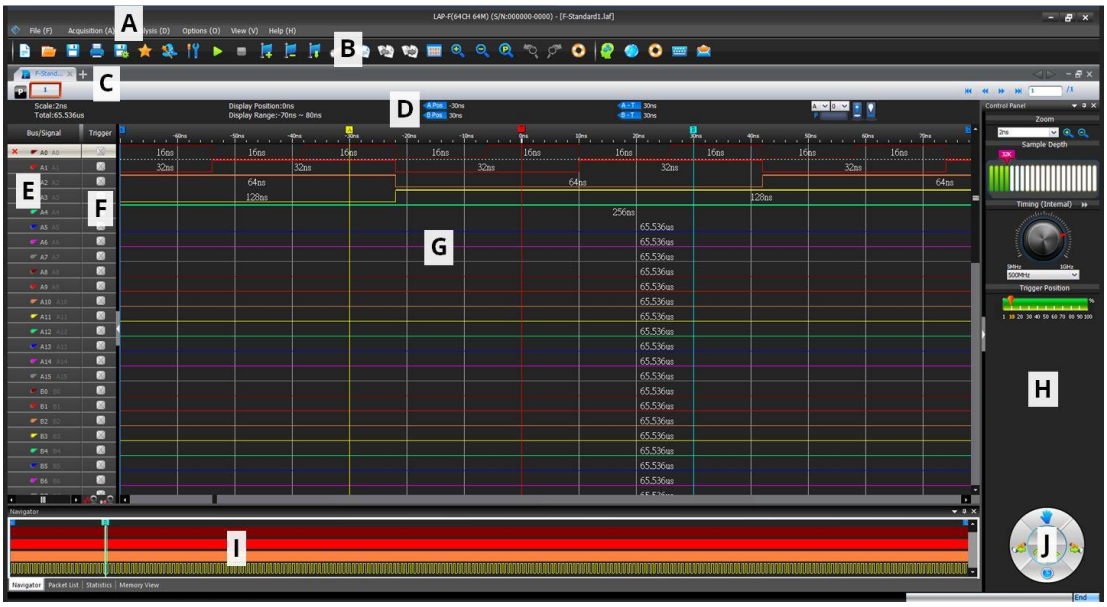


Figure 3-1 ZP-Logic user interface

The ZP-Logic window can be divided into sections; see Table 4:55. Note that many functions can be accessed with Hot Key combinations.

Name	Area	Description
Main Menu	*A*	*All operations can be accessed from the Main Menu bar. The organization of chapter 4 corresponds to that of the Main Menu; see chapter 4 for details.*
Quick Access Toolbar	*B*	*The Quick Access Toolbar provides convenient access to frequently used functions; see chapter 4.11.3 for details.*
File Bar	*C*	*The File Bar consists of File Page, Memory Page and Show All. The File Page displays the new added files. File Page can be minimized, restored and closed.*
Timing Bar	*D*	*Facilitates quick reading of the samples and traces; see Table 4:55 for details.*
Channel Column	*E*	*See and edit channels; see Figure 4-62 for details.*
Trigger Column	*F*	*Set trigger conditions; Figure 4-64 for details.*
Waveform Area	*G*	*Displays the captured signals as traces or as a numeric list; see chapter 4.48 for details.*
Control Panel	*H*	*The Control Panel gives quick access to acquisition settings; see chapter 4.51*

		for details.
Secondary Display	*I*	*Area where the Navigator, Memory View, Packet List, Statistics and LTR Monitor are shown; see chapters 4.52, 4.53, 4.54, 4.55 and 4.56.*
Action Wheel	*J*	*The Action Wheel provides shortcuts to functions related to acquisition and searching; see Figure 4-71 for more details.*

Table 3:1 UI description; "Area" refers to the letter codes on the figure above

NOTE The Control Panel and the Secondary Display can be repositioned or hidden. Right-click to bring up the menu from Figure 3-2.

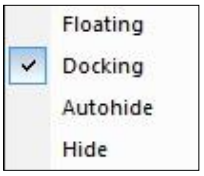


Figure 3-2 Reposition/hide sector; right-click menu

Item	Description
Floating	*Move the Control Panel/Secondary Window freely; see Figure 3-3 for an example.*
Docking	*Fix the Control Panel/Secondary Window to its position.*
Autohide	*The control panel hides in the right edge, users could move the cursor to the icon of "Control Panel" to show it.*
Hide	*Don't show the Control Panel/Secondary Window; use the View menu to have it appear again.*

Table 3:2 Reposition/hide sector; right-click menu description

Figure 3-3 shows an example where the Control Panel is "floating"; if the user un-clicks the mouse when hovering over one of the arrows the Panel will be repositioned to the corresponding transparent/blue area (in the example the user is holding the mouse over the upward arrow).

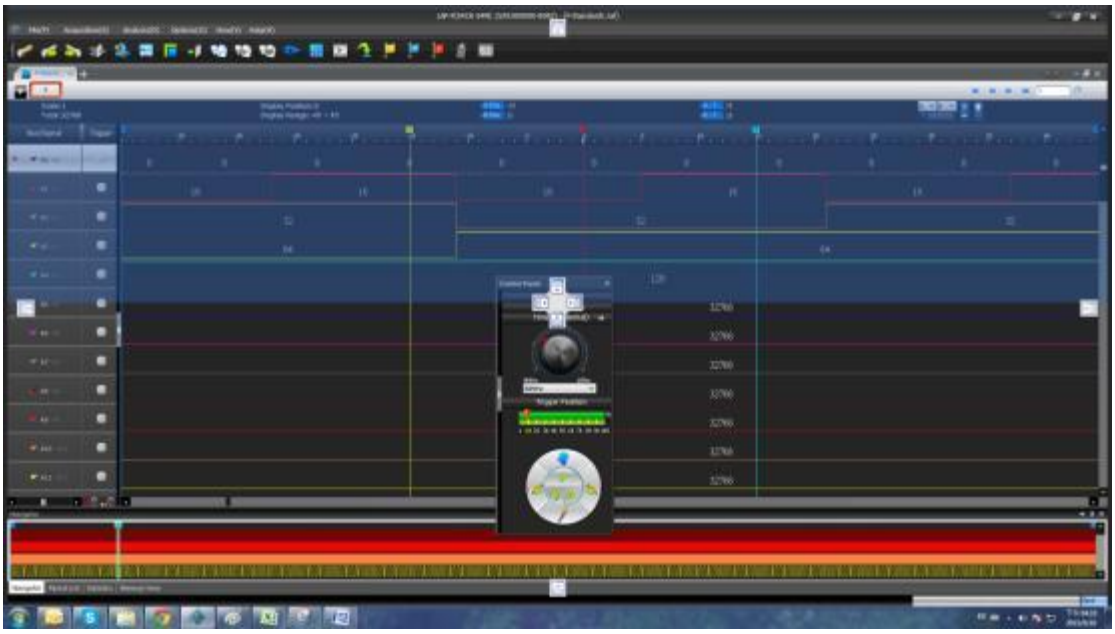


Figure 3-3 Repositioning the Control Panel example

4. Software Operations

This chapter follows the ZP-Logic Main Menu organization. Each section starts off by showing the corresponding drop-down menu from the Main Menu. The functions are presented one by one in the succeeding subchapters.

NOTE ZP-Logic will automatically check online for updates upon startup.

File

Press ALT + F to open this Main Menu item with the keyboard.

4.1. Menu Layout

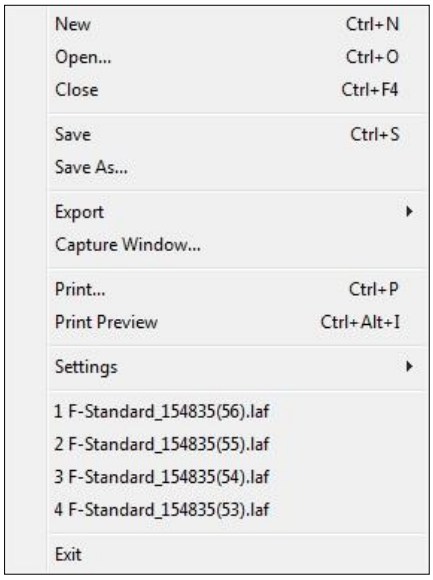


Figure 4-1 File drop-down menu

4.2. New

Create a new, empty file.

Hot Key: CTRL + N.

4.3. Open

Open an existing file. When selecting a file in the Open file dialog box, file information such as author name, creation date, project title will be shown in the lower part of the dialog box. Some of this information is user-added to the file when saving; the rest is automatically added by ZP-Logic.

Hot Key: CTRL + O.

4.4. Close

Close the active file. When closing a file that has previously not been saved, ZP-Logic prompts the users to save it before closing.

Hot Key: CTRL + F4.

4.5. Save

Save the active file. If the file has not been saved before, the Save As dialog box will open; see chapter 4.6.

Hot Key: CTRL + S.

4.6. Save As

Save As is useful for users who wish to save a file under a different name or type or change the destination folder. The Save As dialog box also opens when the user saves a file for the first time so that these parameters can be defined.

The Save As dialog box lets users input file information such as author name and a note. This information is used for previews in the Open file dialog box; see chapter 4.3.

NOTE Acquisitions are stored as temporary files that are instantly available to the user for most software functions. These temporary acquisition files need to be processed before they can be saved.

Since file processing slows down the software, users can choose not to process the temporary acquisition files automatically. If chosen, users who try to save a file (or initiate certain other functions) will be informed that the acquired data needs to be processed to proceed. This setting is accessed under General in the Options dialog box as "Automatically process acquired data (NB: Slower)" shown in Figure 4-7.

4.7. Export

Users can choose between three types of exports: Waveform, Packet List or Memory View. The characteristics of each type are presented below.

4.7.1. Waveform

This chapter treats the export of waveforms; please refer to chapter 4.48.1 for more details on the Waveform View itself. The Export Waveform dialog box is shown in Figure 4-2.

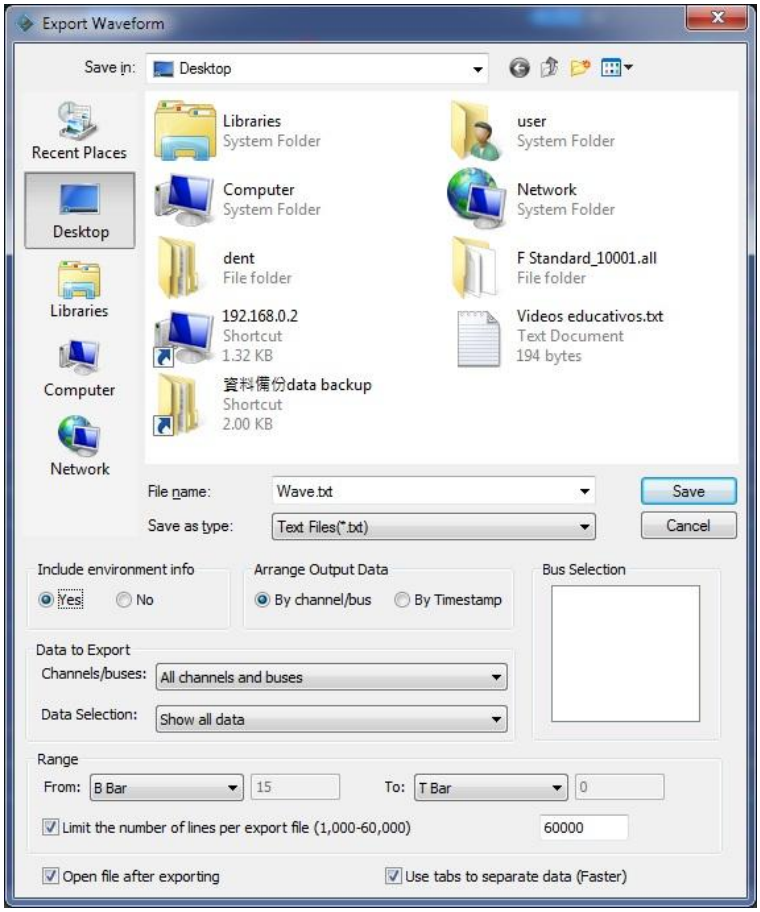


Figure 4-2 Export Waveform dialog box

Item	Description
File name	*Input the file name; the default is Wave.*
Save as type	*Save the file as .txt or .csv; the default is .txt.*
Include environment info	*Include acquisition parameters etc. in the export file; checked by default.*
Arrange Output Data	
By channel/bus	*Each column in the export file contains data for one channel; default option.*
By Timestamp	*Each column in the export file contains data for one timestamp.*
Data to Export	
All channels and buses	*Export channel, bus and protocol decoder data.*
All buses (excl. channels)	*Export bus and protocol decoder data.*
Buses with PD (incl. channels)	*Export protocol decoder data (channel data included).*
Buses with PD (excl. channels)	*Export protocol decoder data (channel data not included).*
Data Selection	
All Data	*Export all data.*
Show changes in state only	*Export data for timestamp X only if at least one signal has changed state from*

	timestamp X-1 to timestamp X.
Show changes in data only	*Export data for timestamp X only if at least one data has changed state from timestamp X-1 to timestamp X (for buses only).*
Bus Selection	*Select buses to be included in the export file.*
Range	
From, To	*Select the range for the data to be exported; the measure for the range is time (with the exception of Memory Page which is measured in pages).*
Limit the number of lines per export file	*Limit the size of exported files; if there are data don't fit on the amount of lines selected by the user then multiple files will be created.*
Open file automatically after exporting	*Open the exported file once it is ready; activated by default.*
Use tabs to separate data (Faster)	*When selected, blank spaces in the export file are replaced by tabs; this increases the writing by up to 50%; selected by default.*

Table 4:1 Export Waveform dialog box description

NOTE To export a waveform, the temporary acquisition file must be processed; see note in chapter 4.6 for details.

4.7.2. Packet List

This chapter treats the export of Packet Lists; please refer to chapter 4.54 for more details on the Packet List function itself. The Export Packet List dialog box is shown in Figure 4-3.

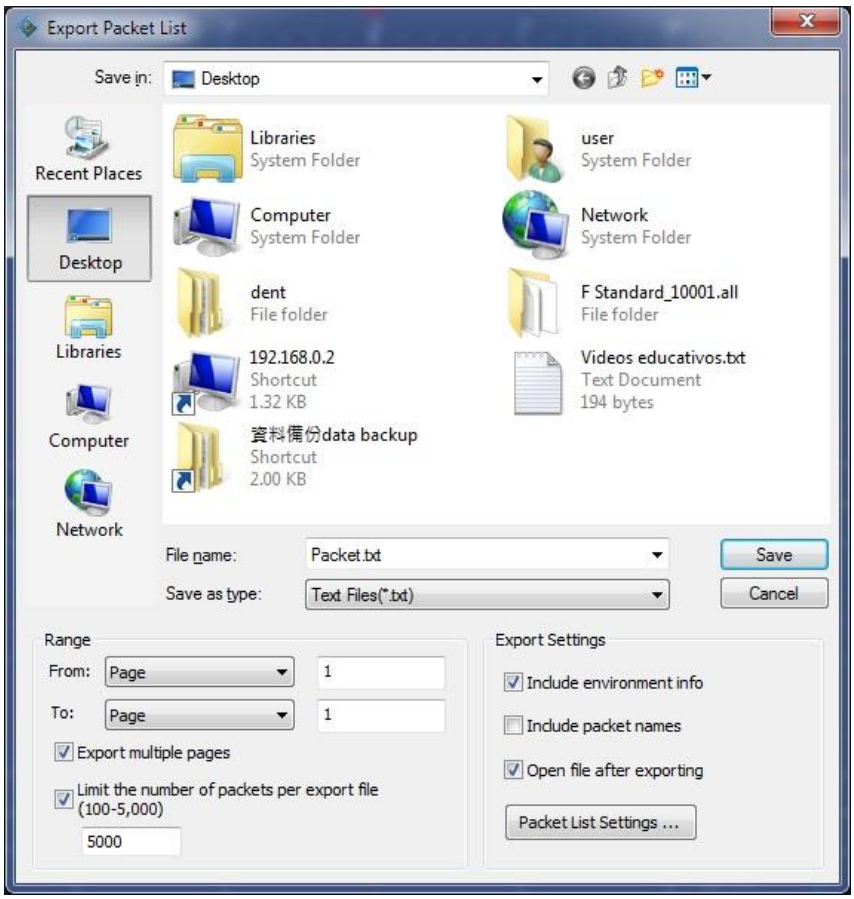


Figure 4-3 Export Packet List dialog box

Item	Description
File name	*Input a file name; the default is Packet.*
Save as type	*Export in .csv or .txt format; the default is .txt.*
Range	
From, To	*Select the range for the data to be exported; the range is measured in pages.*
Export multiple pages	*If the file to be exported comprises more than one Memory Page these can be exported together; unchecked by default.*
Limit the number of packets per export file (100-5,000)	*Set the maximum quantity of lines per export file; if the file length overshoots the limitation then several files will be created; selected by default.*
Export Settings	
Include environment info	*Include acquisition parameters etc. in the export file; checked by default.*
Include packet names	*Include packet titles in the export; unselected by default.*
Open file after exporting	*Open the exported file once it is ready; activated by default.*
Packet List Settings	*Open the Packet List Settings dialog box; see details in Figure 4-77.*

Table 4:2 Export Packet List dialog box description

4.7.3. Memory View

This chapter is about exporting the Memory View; please refer to chapter 4.52 for more details on the Memory View function itself. The Export Memory View dialog box is shown in Figure 4-4.

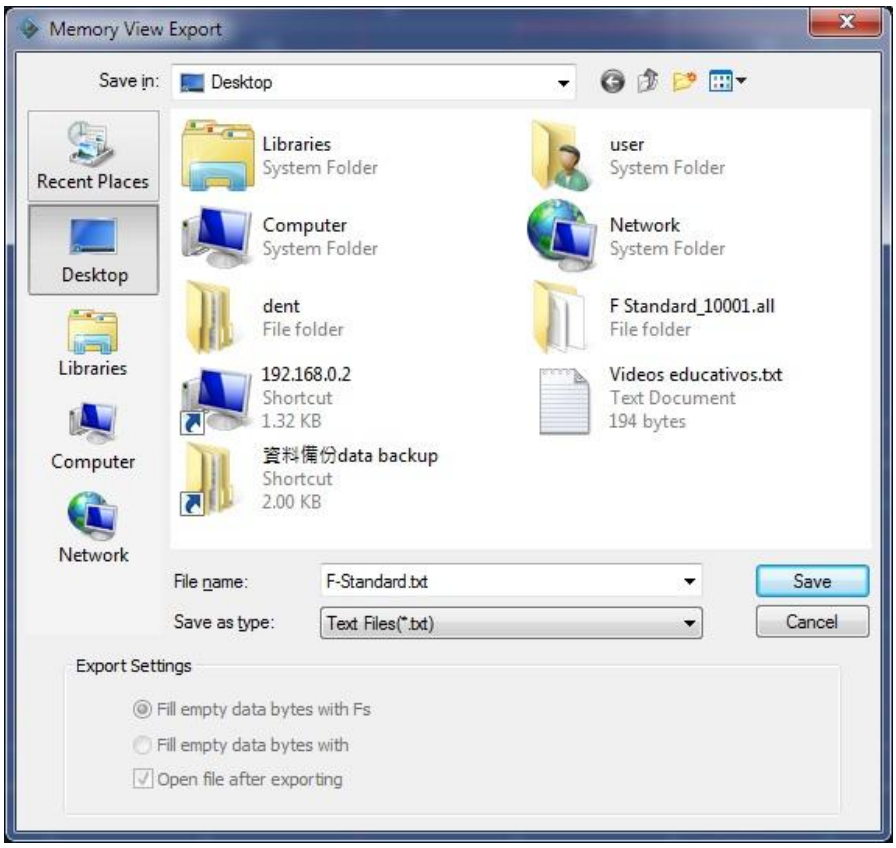


Figure 4-4 Export Memory View dialog box

Item	Description
File name	*Choose a name for the file to be saved; the default is ZP-Logic.*
Save as type	*Export in .txt, .csv or .bin format; the default is .txt.*
Export Settings	*Available for .bin exports.*
Fill empty data bytes with Fs	*Fill empty spaces with the letter F; selected by default.*
Fill empty data bytes with zeros	*Fill empty spaces with the number 0.*
Open file after exporting	*Open the exported file once it is ready; selected by default.*

Table 4:3 Export Memory View dialog box description

4.8. Screen Capture

Select a part of the screen – or all of it – and store it as a file or a picture; see the dialog box in Figure 4-5. If Clipboard is selected the file will be stored in the RAM. Some level of customization is possible as described in Table 4:4.

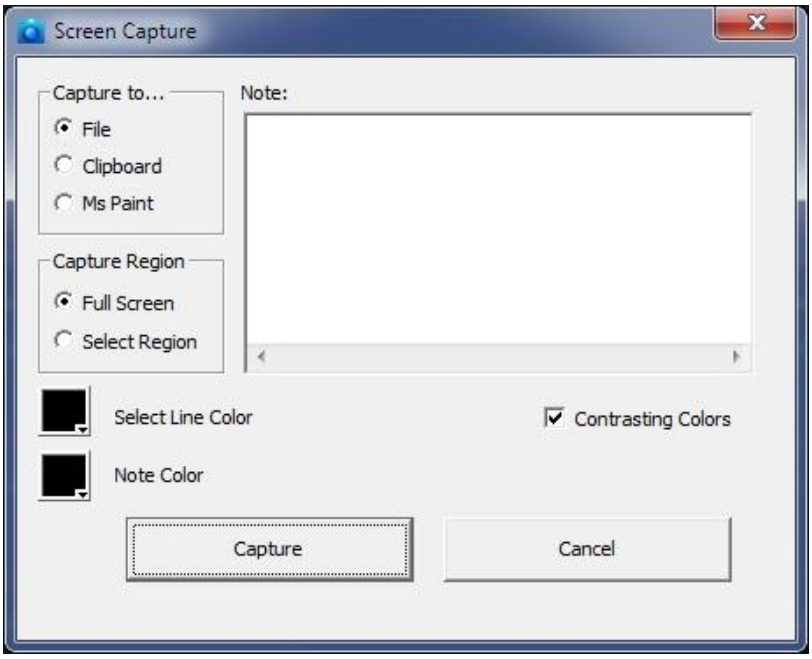


Figure 4-5 Screen capture dialog box

Item	Description
Capture to	
File	*Save the captured region in .bmp or .jpeg format.*
Clipboard	*Copy the captured region to the clipboard for editing in other softwares.*
MS Paint	*Open the captured region in MS Paint.*
Capture Region	
Full Screen	*Capture the full screen.*
Select Region	*Select a part of the screen to be captured by dragging a square with the left mouse button.*
Note	*Users can enter text to accompany the screen capture; if the field is not empty a blank area will be added below the screen capture where the text will be displayed.*
Note Color	*Change the color of the Note text.*
Line Color	*Change the color of the Select Region frame; by default this is black.*
Invert Colors	*The Select Region frame color is the opposite of Line Color; selected by default.*

Table 4:4 Screen capture dialog box description

4.9. Print

The print function works on the part of the waveform or state list that is viewed at the moment of printing. The Timing Bar (above the waveform) and the Channel Column with the trigger conditions is also printed. The Waveform/State List background is printed as white and an extra field containing the file name, date and page number is added to the top of the page.

The print option dialog box has a standard layout that lets the user choose what to print and also gives access to other printer properties; see Figure 4-6.

Hot Key: CTRL + P.

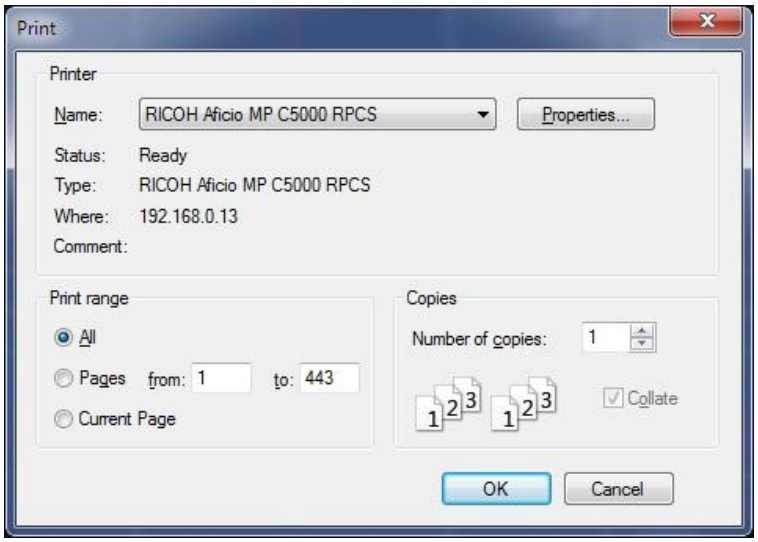


Figure 4-6 Print Setup dialog box

Item	Description
Name	*Select a printer.*
Properties	*Open the Print Properties dialog box for more print options.*
Print range	
All	*Print the entire waveform or state list.*
Pages	*Print parts of the waveform or state list. What is currently being viewed is regarded as one page.*
Current Page	*Print the current view.*

Copies	
Number of copies	*Number of copies to be printed.*
Collate	*Organization of multiple copies. Ex: 2 copies of 3 pages will print 1, 2, 3, 1, 2, 3 when collate is checked (default option) and 1, 1, 2, 2, 3, 3 when unchecked.*

Table 4:5 Print Setup dialog box description

4.10. Print Preview

Preview what the printed file will look like. When opening the Print Preview, a new toolbar will appear above the preview; this is used for zooming and navigation between pages. Press Esc to leave the Print Preview.

Hot Key: Press CTRL + ALT + I.

4.11. Settings

The appearance and behavior of the user interface and functions can be customized. Configurations, options and settings are gathered under this menu item.

4.11.1. General

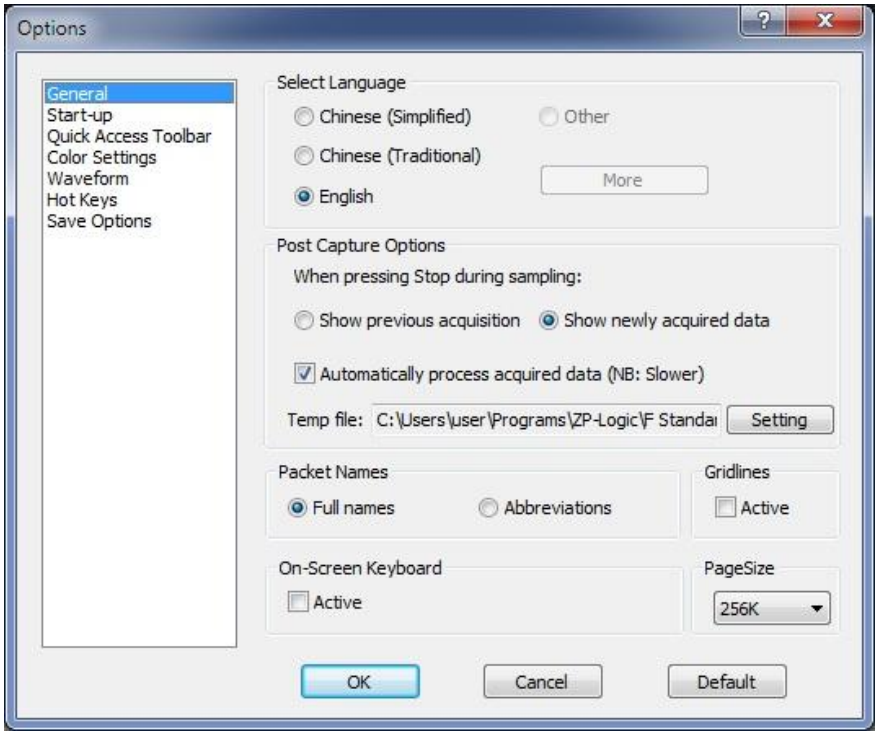


Figure 4-7 General settings dialog box

Item	Description
Select Language	*Choose between English, Chinese (Simplified) and Chinese (Traditional); the one selected during installation is the default. The More option is used by customers who have developed a proprietary language pack.*
Post Capture Options	
Show previous acquisition	*This option governs the software behavior when the user presses Stop in the middle of an acquisition. If this option is selected then the previous acquisition will be displayed again.*
Show newly acquired data	*When pressing Stop during an acquisition, the data acquired up until the Stop moment are displayed; this is the default option.*
Automatically process acquired data (NB: Slower)	*Process the data upon finalizing acquisitions; if unchecked the ZP-Logic will prompt the user to process data when launching certain functions. See a more detailed explanation in chapter 4.6.The function is turned on by default.*
Temp	*Location of temporary acquisition files.*
Gridlines	*Show vertical gridlines in the waveform area; unchecked by default.*
Packet Name	

Full names	*Display the full names of packets; this is the default option.*
Abbreviations	*Display packet names abbreviated to a single letter: Data is shown as D etc. This option lets users see the packet type for short packets where the full name would otherwise not be shown due to space limitations (which is a combination of packet size and zoom level).*
Keyboard	*Open an on-screen keyboard when inputting numbers. The on-screen keyboard is operated with the mouse; by default it is not shown.*
PageSize	*PageSize relates to our Memory Page feature. To speed up the loading of waveforms, large acquisitions are divided into pages. The PageSize determines the size of these pages. Ex: A 16 Mb acquisition will be split into 8 pages if the PageSize is set to 2 Mb. 1½ pages are displayed at a time and the user moves between pages by means of the File Bar; see Figure 3-1 for the location of this. It is also possible to navigate between pages using the Go To function; see chapter 4.30.*

Table 4:6 General settings dialog box description

4.11.2. Start-up

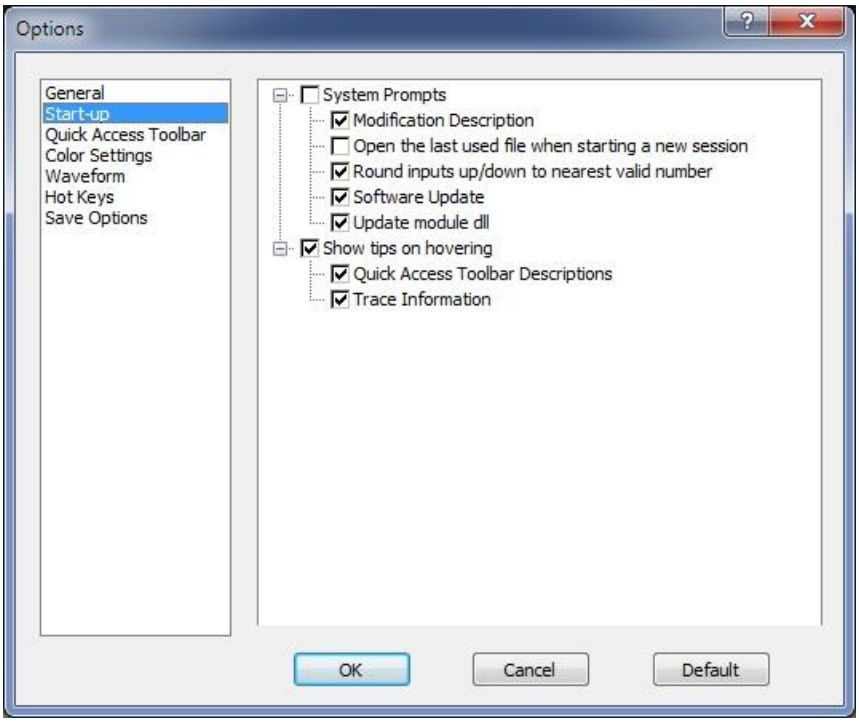


Figure 4-8 Start-up settings dialog box

Item	Description
System Prompts	
Modification Description	*Show modification descriptions.*

Open the last used file when starting a new session	*The last saved file is opened when ZP-Logic starts; selected by default.*
Round inputs up/down to nearest valid number	*Illegal input values are automatically rounded to the nearest valid value; selected by default.*
Show Tips on Hovering	
Quick Access icon names	*Show function names when hovering over the Quick Access Toolbar icons; selected by default.*
Trace Information	*Show channel name, signal state and trace information when hovering over a trace in the waveform view; selected by default.*

Table 4:7 Start-up settings dialog box description

4.11.3. Quick Access Toolbar

The Quick Access Toolbar consists of shortcut icons to commonly used functions. It is located below the Main Menu and is shown by default. Table 4:9 lists all functions that can be placed on the Quick Access Toolbar.

Users can customize the Quick Access toolbar by organizing the icons into groups. ZP-Logic comes with pre-defined groups; a Standard group and one group for each of the Main Menu items. The Standard group consists of a selection of common functions; the second type provides shortcut icons to all the functions under a Main menu item. Users can modify the Quick Access Toolbar in three ways:

- By selecting the group or groups that are displayed
- By adding or removing items from the pre-defined groups
- By creating a custom group

These modifications are done from the Quick Access Toolbar dialog box shown in Figure 4-9.

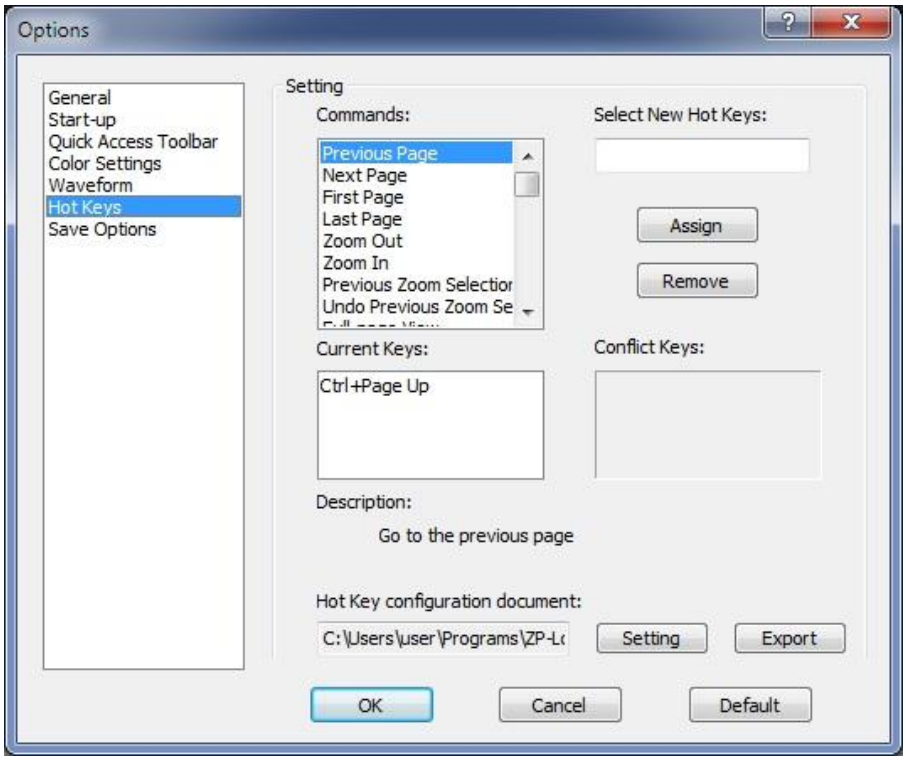


Figure 4-9 Quick Access toolbar dialog box

Item	Description
Group	*Select the group or groups to be displayed as large shortcut icons below the Main Menu; the Standard group is selected by default. Groups can be added, deleted or renamed (with exception of the Standard group).*
Item	*Check/uncheck items to add/remove them from the selected group (in blue in the left column).*
Autohide	*The Quick Access toolbar is hidden whenever the mouse cursor does not hover over it; this option is unchecked by default.*
Large Icons	*Set the icon size to 32x32 px; the default size is 24x24 px.*

Table 4:8 Quick Access Toolbar dialog box description

Table 4:9 below shows all the icons that can be placed on the Quick Access Toolbar and which function they link to.

Icon	Function	Icon	Function
	Create File		Analog Display
	Open File		Pointer
	Save File		Hand
	Save File As		Zoom Out
	Save Settings		Zoom In
	Export Waveform		Display All Waveform
	Export Packet List		Previous Zoom
	Export Memory View		Cancel Previous Zoom
	Screen Capture		Add Bar
	Print file		Delete Bar
	Single Capture		Reposition Bar
	Repeated Capture		Customize
	Stop		Highlight Data
	Sampling Setup		Don't Show Information
	Find		Frequencies
	Find previous		Number of Samples
	Find next		Time
	Add Channel/Bus		Waveform

	DSO Connection		State List
	Active Range		Real-time Frequencies
	Noise Filter		Navigator
	Files Comparison		Packet List
	Previous Difference		Statistics
	Next Difference		Memory View
	Boolean Operation		Show on Both Screens
	Arithmetic Operation		Show on Primary Screen
	Go To		Show on Secondary Screen
	Level Status		Image Decode
	Center display on A-bar		Refresh
	Center display on B-bar		Help
	Center display on T-bar		Hot Keys Map
	About ZEROPLUS		Send Feedback
	About ZP-Logic		

Table 4:9 Quick Access toolbar icons

4.11.4. Colors

Users can customize the colors of bars, texts, traces and other elements of the user interface. To change the color of an element, click the corresponding color bar in the Color column of the dialog box shown in Figure 4-10 to access the

color palette. Proceed to select a predefined color or define a custom color for the element.

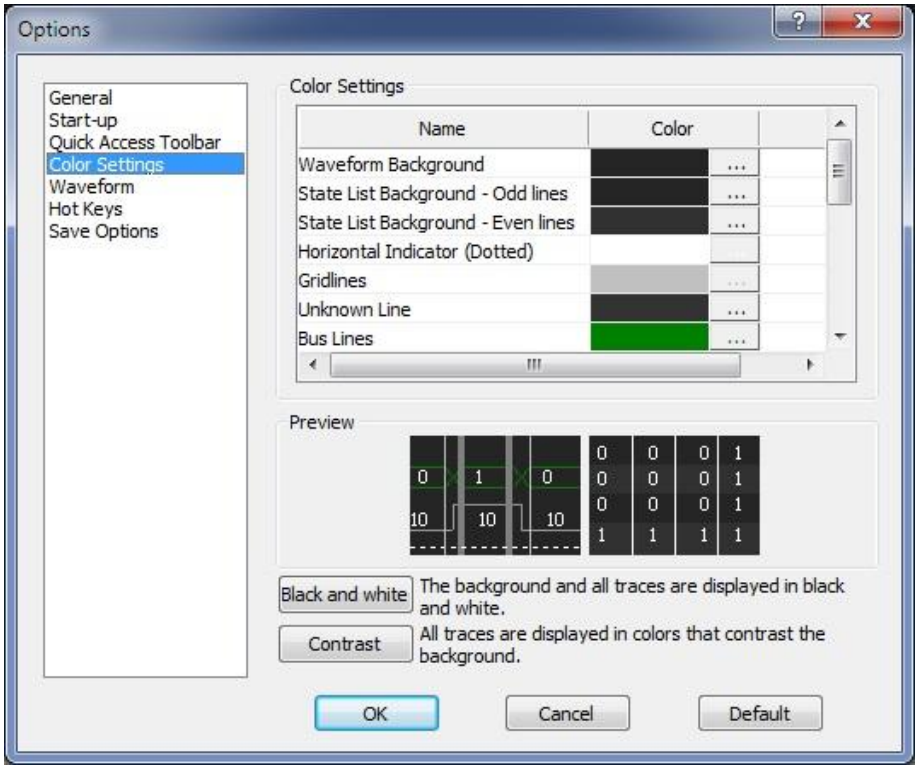


Figure 4-10 Color settings dialog box

Item	Description
Color Settings	
Name	*Customizable element.*
Color	*Current color of the element; click it to change the color.*
Preview	*Preview the color selections; the left frame shows the Waveform and the right the State List.*
Black and white	*The background and all traces are shown in black and white.*
Contrast	*All traces are displayed in colors that contrast the background.*

Table 4:10 Color settings dialog box description

4.11.5. Waveform

The appearance of the traces and surrounding information can be changed from the dialog box in Figure 4-11.

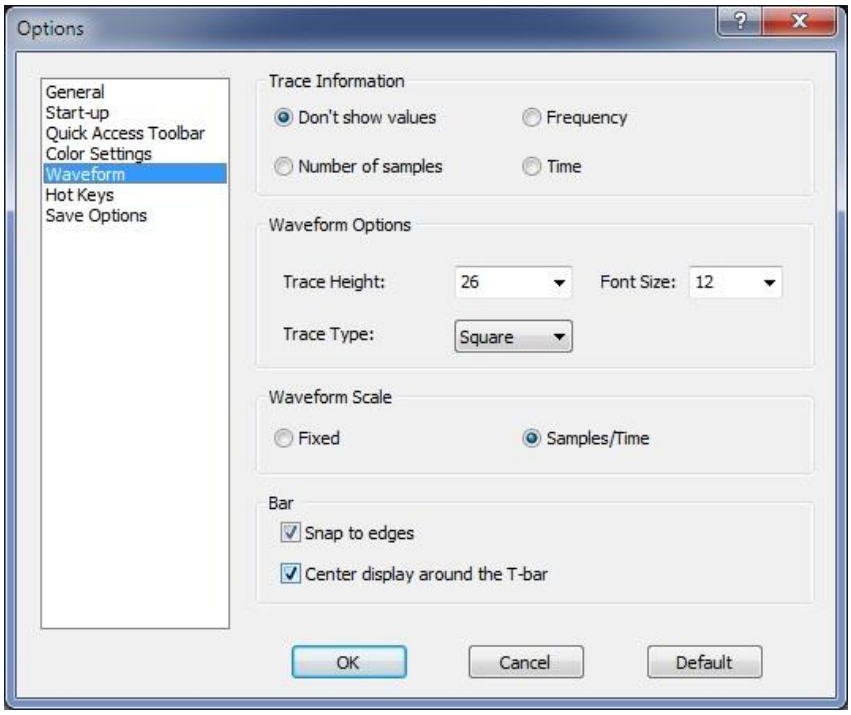


Figure 4-11 Waveform settings dialog box

Item	Description
Trace Information	
Frequency	*Show frequencies between two edges. The frequency of full period (rising to rising edge) is displayed. See Table 4:46 for more details on the Trace Information.*
Number of samples	*Show number of samples between two edges.*
Time	*Show the time between two edges.*
Don't show values	*No information is shown inside the traces; this is the default option.*
Waveform Settings	
Trace Height	*Set the trace amplitude from 22 to 180 px; the default is 26.*
Font Size	*Set the font size from 6 to 60. The default is 12.*
Waveform Mode	*Choose between saw tooth- and square-shaped traces.*
Ruler Mode	
Fixed	*The center of the screen is fixed at 0 sec.*
Samples/Time	*Second is defined as the trigger event; this is the default option.*
Bar	
Snap to edges	*Bars snap automatically to the nearest trace edge when being repositioned.*
Center display around the T-bar	*Center the waveform area around the T-bar when the trigger condition is met.*

Table 4:11 Waveform settings dialog box description

4.11.6. Hot Keys

In ZP-Logic, Hot Keys are keyboard combinations that invoke a function. See Table 4:57 for a complete description of all Hot Keys. Figure 4-12 shows the dialog box used to customize the Hot Keys.

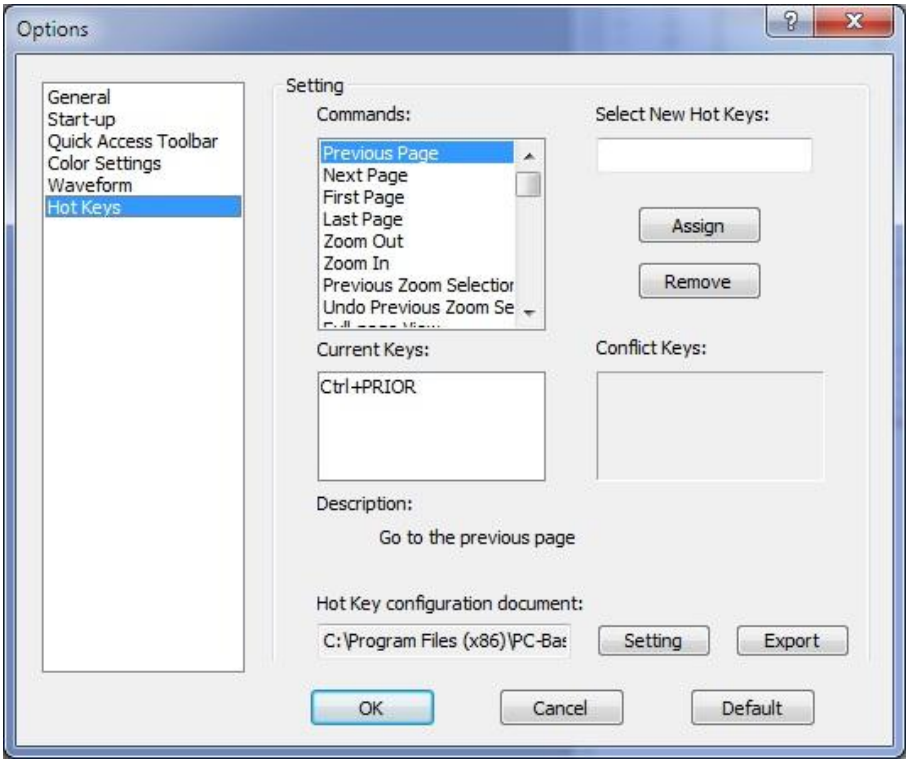


Figure 4-12 Hot Key settings dialog box

Item	Description
Commands	*Select a Command (function) for which a Hot Key can be assigned.*
Select New Hot Keys	*Input the new Hot Keys combination (or single key) and click Assign to make the change effective.*
Current Keys	*Displays the current Hot Keys for the selected command.*
Conflict Keys	*If the new Hot Keys are already in use, the command currently using them will be shown.*
Description	*Displays a brief description of the selected command.*
Shortcut-key Setting document	*Export the Hot Keys configuration document or load a different one.*

Table 4:12 Hot Key settings dialog box description

4.11.7. Save Options

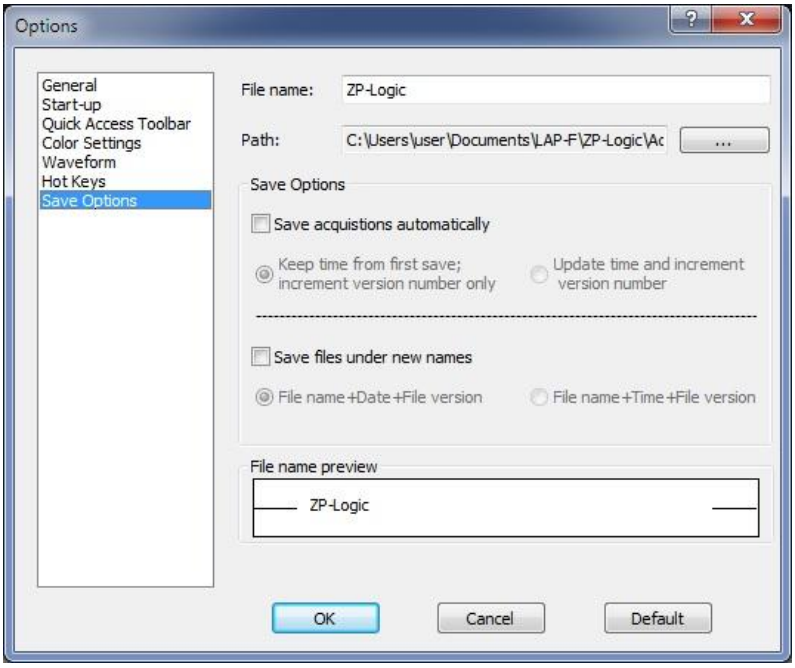


Figure 4-13 Save Options dialog box

Item	Description
File name	*Choose a name for the files to be saved; the default is ZP-Logic.*
Path	*Choose where to save files; the default is C:\Documents and settings\Administrator\ My Documents\ ZP-Logic Data (if C: is the system disk).*
Save Options	
Save acquisitions automatically	*Auto-save all acquisitions.*
Keep time from first save; increment version number only	*When saving multiple acquisitions the file names will all preserve the time of the first save and only change version number. If the first acquisition was made 3:45:12 pm and the next 3:55:47 the names will become; FileName154500 and FileNameTime154500(1). This can be useful for sorting the files.*
Update time and increment version number	*In the example above the file names would become; FileName154512 and FileName155547(1); this is the default selection.*
Save files under new names	*Files will overwrite each other if this option is not checked. It is therefore common to combine this option with the Save As function.*
File Name + Date + File Version	*Add the date [Year, Month, Day] and version number after the file name. Ex: August 25th 2015 becomes ZP-Logic_20150825(1).*

File Name + Time + File Version	*Add the time (Hour, Minute, Second) and the version number after the file name. Ex: 13:45:02 pm becomes ZP-Logic_134205(1); default selection.*
File Name Preview	*Preview the name of files to be saved.*

Table 4:13 Save settings dialog box description

If the "Auto Add the Serial No" and is not activated, "Keep time from first save; increment version number only" and "Update time and increment version number" will be disabled. In other words, any new file that is saved will overwrite the existing file.

4.12. Exit

Exit ZP-Logic. The software prompts users to save unsaved files.

Hot Key: ALT + F4.

Acquisition

Press ALT + A to open this Main Menu item with the keyboard.

4.13. Menu Layout

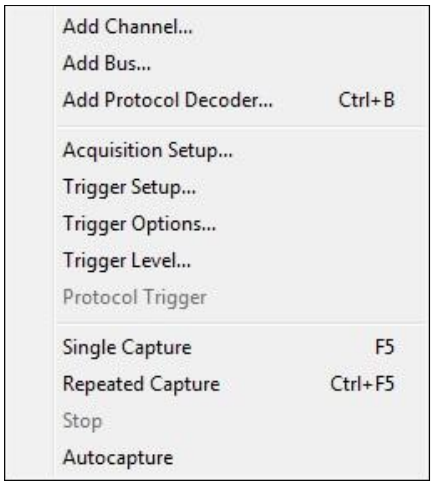


Figure 4-14 Acquisition drop-down menu

4.14. Add Channel

To add one or several channels, select the channels to be included and bring them over to the right column using the arrow. The CTRL and SHIFT keys can be used to mark several channels at the same time. Using the lower arrows channels can also be removed. To finalize the inclusion of new channels the user must choose whether he wants all other channels to be deleted or not. The select channels dialog box is shown in Figure 4-15 where four channels have been added.

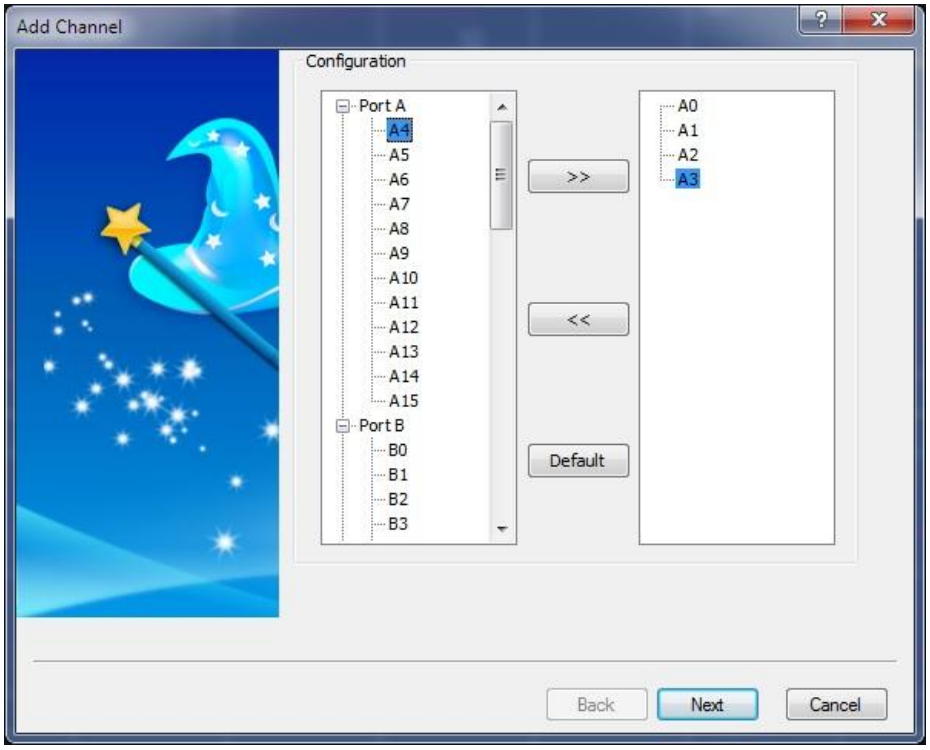


Figure 4-15 Add Channel dialog box

4.15. Add Bus

Adding a bus follows the same routine as adding a channel (chapter 4.14), but the dialog box differs slightly; see Figure 4-16. First, it links to the Advanced Settings dialog box; see Figure 4-17. Second, the right-most column indicates which is the most significant bit and which is the least. Show caution to ensure

that channels are added in the correct sequence; the first channel added will become the LSB and the final addition will be the MSB.

Hot Key: CTRL + B.

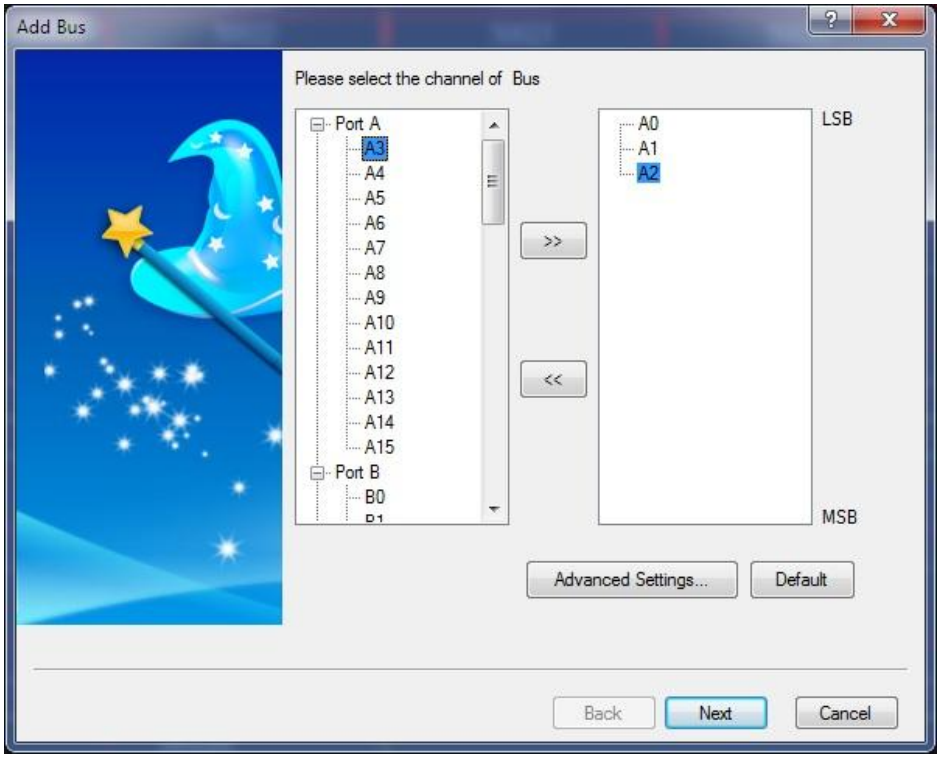


Figure 4-16 Add Bus dialog box

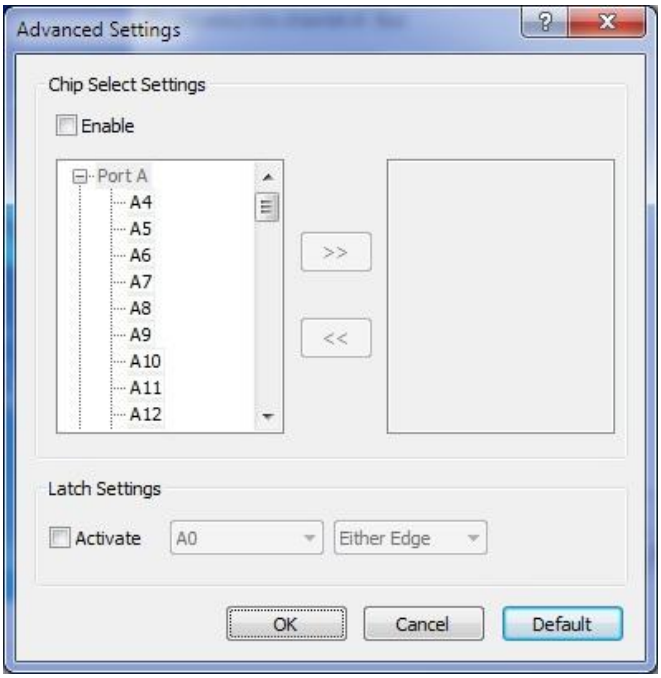


Figure 4-17 Add Bus / Advanced Settings dialog box

Item	Description
Chip Select	
(Channel and Level)	*The Chip Select function emulates a real chip select. The function is similar to the Latch function (below) in that it decodes bus data, but it only does so when all the conditions are met.*
Latch Settings	
(Channel and Event)	*The Latch function is used to analyze/decode bus activity that does not use a specific protocol (referred to simply as a Bus in ZP-Logic). When selecting a channel and an event (for instance A0 and Falling Edge), the bus data will be decoded and displayed at every occurrence of this event.*

Table 4:14 Add Bus / Advanced Settings dialog box description

4.16. Add Protocol Decoder

Select the desired Protocol Decoder from the dialog box shown in Figure 4-18. The protocol decoders are arranged by industry in a list where each section can be collapsed/expanded using the minus/plus symbol to the left of the protocol decoder names. The right part of the dialog box shows a brief description of the selected protocol decoder.

NOTE Right-click on a decoder to add it to the topmost Favorites list.

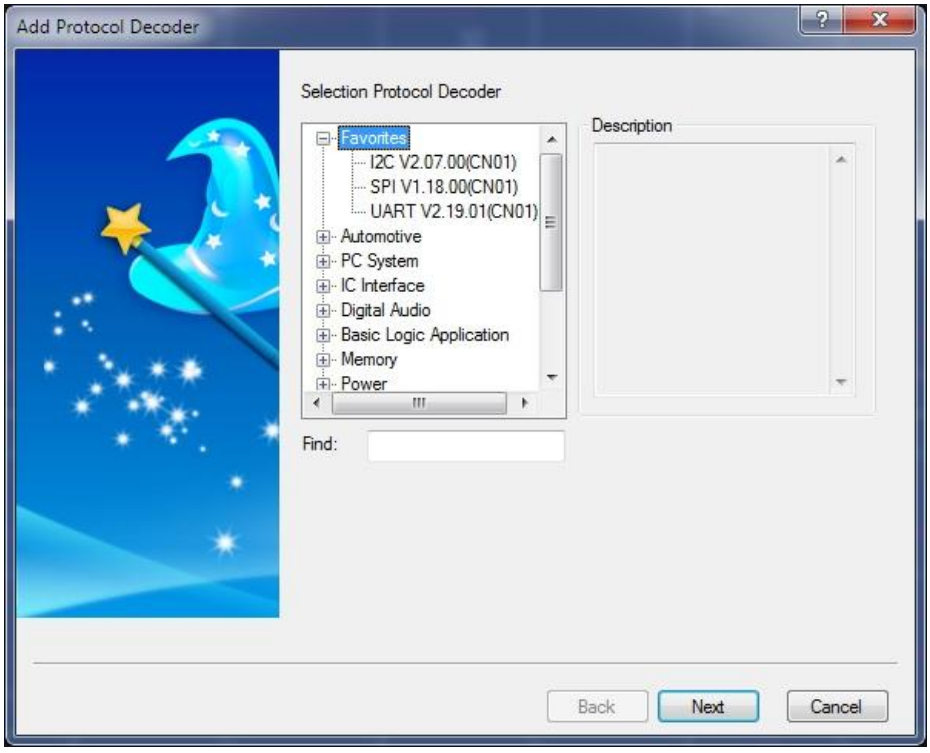


Figure 4-18 Add Protocol Decoder dialog box

The LAP-F1/2 comes with more than 110 free protocol decoders; these are listed in Table 4:15. The protocol decoders are individual modules that are separated from the ZP-Logic software.

The protocol decoder dialog box shown in Figure 4-19 is an example that shows the I2C decoder setup. Note that all protocol decoder dialog boxes have distinct designs.

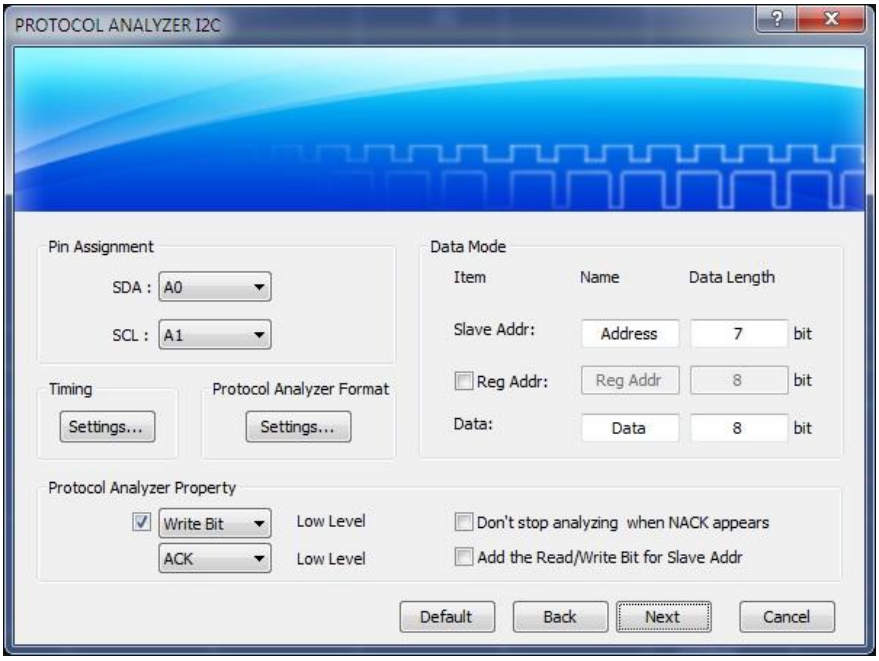


Figure 4-19 I2C Protocol Decoder Setup dialog box

Table 4:15 lists the protocol decoders available in ZP-Logic.

Built-in Protocol Decoders		
1-WIRE	*IDE*	*Philips RC-6*
1-WIRE (Advanced)	*IRDA*	*PMBus 1.1*
3-WIRE	*ISO7816 UART*	*PROFI BUS*
7-SEGMENT LED	*JK FLIP-FLOP*	*PS/2*
AC97	*JTAG 2.0*	*PSB Interface*
AES_EBU	*KEELOQ Code Hopping*	*PT2262/PT2272*
AMD_SVI2	*KNX*	*QI*
ARITHMETICAL LOGIC	*LCD 12864*	*Quad SPI*
BDM	*LCD1602*	*RGB Interface*
BMS	*LED Pitch Array*	*S/PDIF*
CAN 2.0B	*LG4572*	*S2Cwire/AS2Cwire*
CCIR656	*LIN 2.1*	*SAMSUNG K9 (NAND Flash)*
CMOS IMAGE	*Line code*	*SCCB*
Compact Flash 4.1	*Low Pin Coun*	*SD2.0/SDIO*
DALI Interface	*LPC-SERIRQ*	*SDQ*
DDC EDID	*LPT*	*Serial GPIO IBPI*
Differential Manchester	*MANCHESTER*	*Serial Wire Debug (SWD)*

DIGITAL LOGIC	MCU-51 DECODE	SHT11
DigRF	MDDI	SIGNIA 6210
DM114/DM115	MHL-CBUS	SLE4442
DMX512	MICROWIRE	SMBus 2.0
DP AUX Channel	MICROWIRE (EEPROM 93C)	SPI
DS1302	MIDI	SPI PLUS
DS18B20	MII	SPI (EEPROM AT25F)
DSA Interface	MILLER	SSI Interface
DSI Bus	MIL-STD-1553	ST7669
FLEXRAY 2.1A	MIPI DSI	STBus
FWH	MIPI_CSI-2	SVID
GPIB	ModBus	SWP
HART	MODIFIED MILLER	UART
HD Audio	MODIFIED SPI	UNI/O
HDMI CEC	MVB	UPDOWNCOUNTER
HDQ	NEC PD6122	USB 1.1 plus
HPI	OPENTHERM 2.2	USB 2.0
I2C	PCI	Wiegand
I2C (EEPROM 24L)	PCM	WTB
I2C (EEPROM24LCS61/24LCS62)	PECI	WWV/WWVH/WWVB
I2S	Philips RC-5	YK-5

Table 4:15 Built-in protocol decoders

4.17. Acquisition Setup

Fundamental sampling choices such as channel assignment, acquisition mode, memory depth and acquisition rate are selected in the Acquisition Setup dialog box; see Figure 4-20 below. This is also where users can adjust the voltage threshold for triggering and configure a DSO connection.

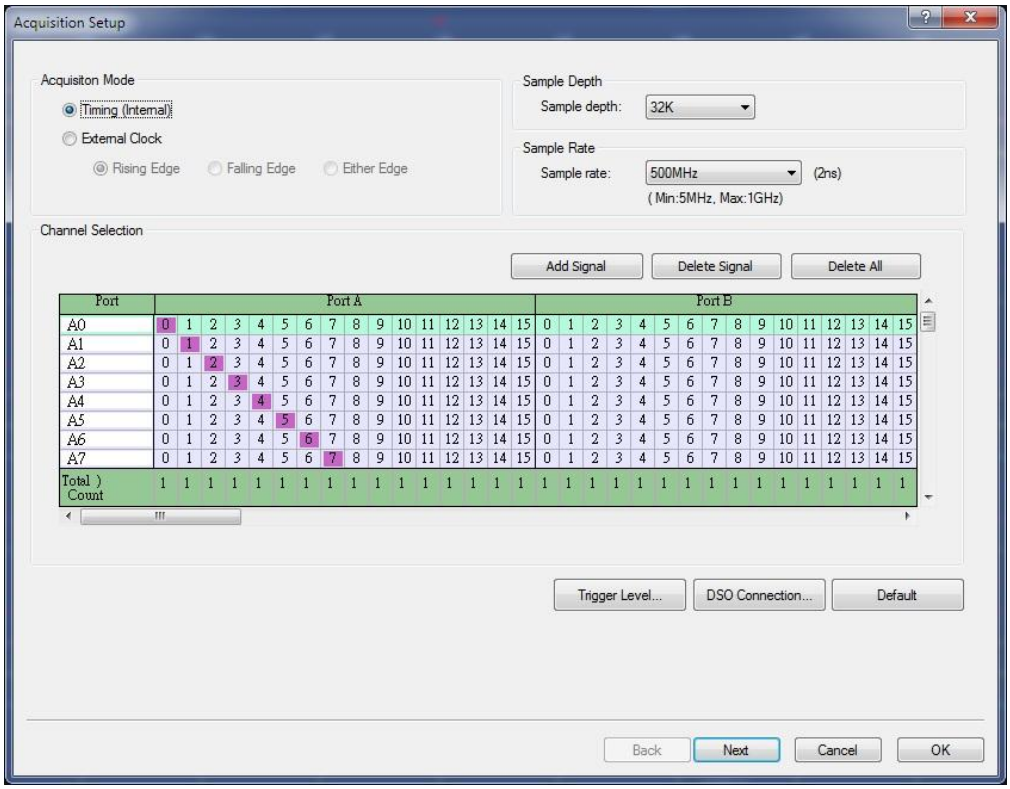


Figure 4-20 Acquisition Setup dialog box

Item	Description
Acquisition Mode	
State (External Clock)	*In State mode (also called synchronous acquisition) the clock that governs when to sample data is provided by the DUT. State mode provides a view of how the system is executing. One sample is taken per clock cycle and the user must specify whether he wants to sample on rising or falling DUT clocks, or on either. The State mode sample rate goes from 0.001 Hz to 200 MHz.*
Timing (Internal Clock)	*In Timing mode (also called asynchronous acquisition) the input signals are sampled and stored at equal time intervals based on LAP-F1/2s internal clock. The Timing mode sample rate goes from 5 MHz to 1 GHz.*
Acquisition Choices	
Sample Depth	*Determine the amount of data to be acquired per channel; it is set to 32 kb by default.*
Sample Rate	*The sample rate or acquisition frequency determines how often samples are taken. Press CTRL + U to increase the sample rate and CTRL + D to decrease it.*
Channel Selection	
(Purple checkboxes)	*One probe is connected to each of the channel ports of the LAP-F1/2 and each probe samples one signal. By default, Port A0 (Probe0) is linked with channel A0 in the*

	software etc. Channels can be renamed and rearranged: The left column shows the channel name in ZP-Logic and the purple coloring determines which of the ports/probes is linked to the channel.
Add Signal	*Add a channel. The user must define which probe the new channel should be linked to; by default it's unassigned.*
Delete Signal	*Delect the selected channel.*
Delete All	*Delect all channels.*
Trigger Level	*See chapter 4.20.*
DSO Connection	*Set up a DSO Connection; see chapter 4.36.*

Table 4:16 Acquisition Setup dialog box description

4.17.1. Trigger Level

The Trigger Level defines when a signal changes state. In other words; if the voltage of a signal is inferior to the Trigger Level it will be regarded as 0 (Low), and vice versa. Similarly, when the signal voltage rises from below to above the Trigger Level, the LAP-F1/2 will consider that a change of state from Low to High has occurred and that the new state is 1 (High). The Trigger Level is sometimes referred to as Trigger Voltage or Threshold Level.

The LAP-F1/2 lets users use up to 4 different Trigger Levels at a time; one for each of the four ports A, B, C and D. For each level, four pre-defined levels are available: TTL, CMOS (5 V), CMOS (3.3 V) and ECL. It is also possible to user-define the Trigger Level. See the dialog box in Figure 4-21.

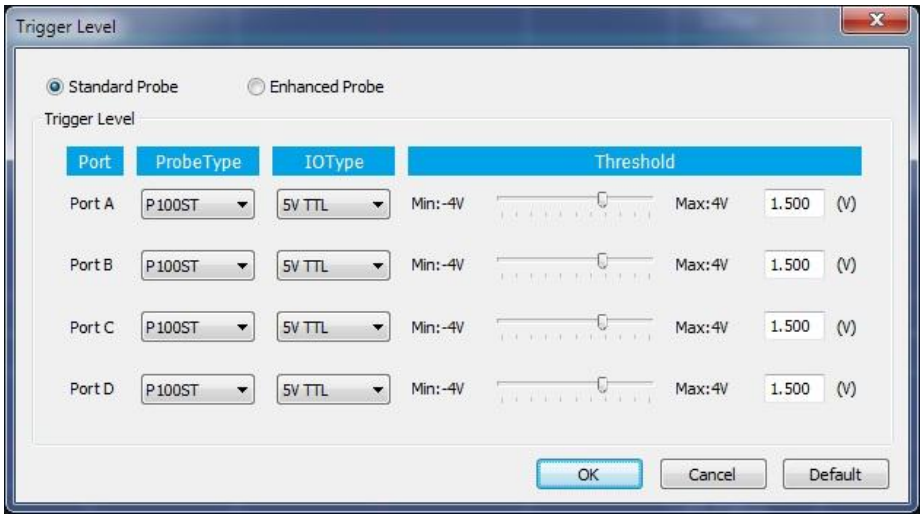


Figure 4-21 Trigger Level dialog box for Standard Probes

Item	Description
Probe Type	
Standard	*All currently available probe types (General Purpose, Low-voltage, Negative Logic and eMMC) are all defined as Standard in this menu.*
Enhanced	*The Enhanced probes are still under development.*
Trigger Level	
Port	*The 4 ports can have individual trigger voltage levels. (Port A has ch. A0-A15 etc).*
Probe Type	*Select the probe type being used: P100ST is the General Purpose probe, P120LV the Low-voltage probe and P120NE the Negative Logic probe.*
IO Type	*Choose between four pre-set trigger levels.*
Threshold	*Adjust the duty cycle; voltages below the threshold are defined by the LAP-F1/2 as Low or 0, and voltages above are defined as 'High' or 1.*

Table 4:17 Trigger Level dialog box; Standard Probe description

4.17.2. DSO Connection

A DSO Connection can be set up when users want to import and display a DSO signal in the ZP-Logic software. This can be useful since the LAP-F1/2 does not have the ability to capture analog signals. The supported DSO models are listed in Table 4:19.

Two operation modes are possible; the connection can be set up with LAP-F1 as master or slave depending on which instrument the user wants to provide the

trigger signal. The two modes are described in continuation. The connection setup follows in chapters 4.17.2.1 and 4.17.2.2.

4.17.2.1. LAP-F1 as Master

When the LAP-F1/2 is the master the DSO is the slave. In this mode, the Trigger Out of the LAP-F1/2 connects with the Trigger In of the DSO. When the trigger event occurs, the LAP-F1/2 sends a trigger signal to the DSO which, upon receiving the signal, starts to capture data. See the complete connection diagram in Figure 4-22.

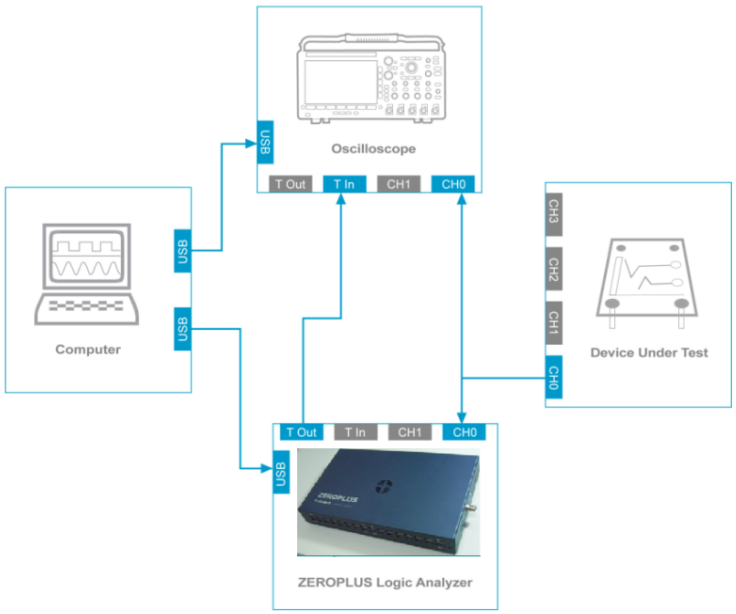


Figure 4-22 Connection diagram with LAP-F1 as waster

4.17.2.2. LAP-F1 as Slave

When the LAP-F1/2 is the slave the DSO is the master. In this mode, the Trigger Out of the DSO connects with the Trigger In of the LAP-F1/2. When the trigger event occurs, the DSO sends a trigger signal to the LAP-F1/2 which, upon receiving the signal, starts to store data. See the complete connection diagram in Figure 4-23.

Users can try to connect the DSO Trigger Out to any regular channel of the LAP-F1/2 if the BNC connector is occupied by another instrument.

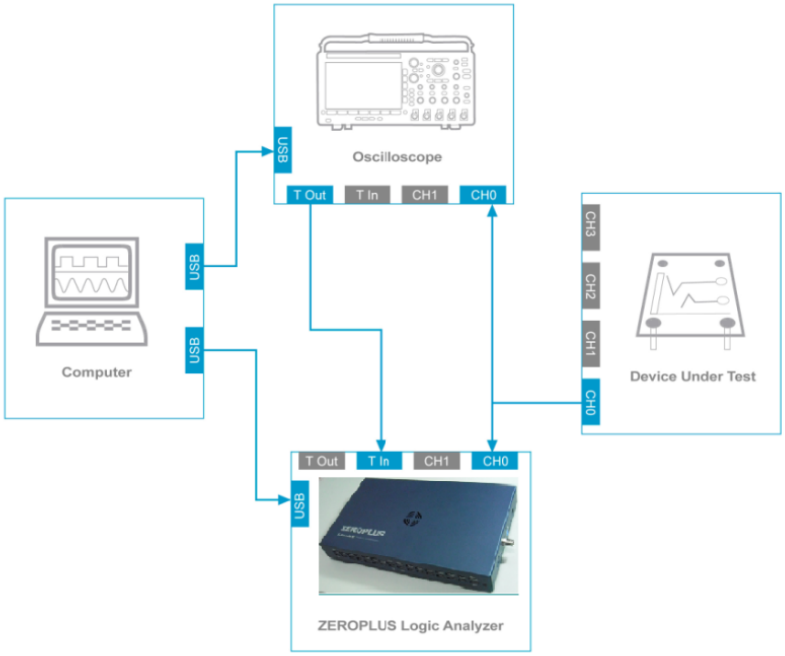


Figure 4-23 Connection diagram with LAP-F1/2 as slave

4.17.2.3. Settings

Up to 4 analog signals can be shown; see the settings dialog box in Figure 4-24.

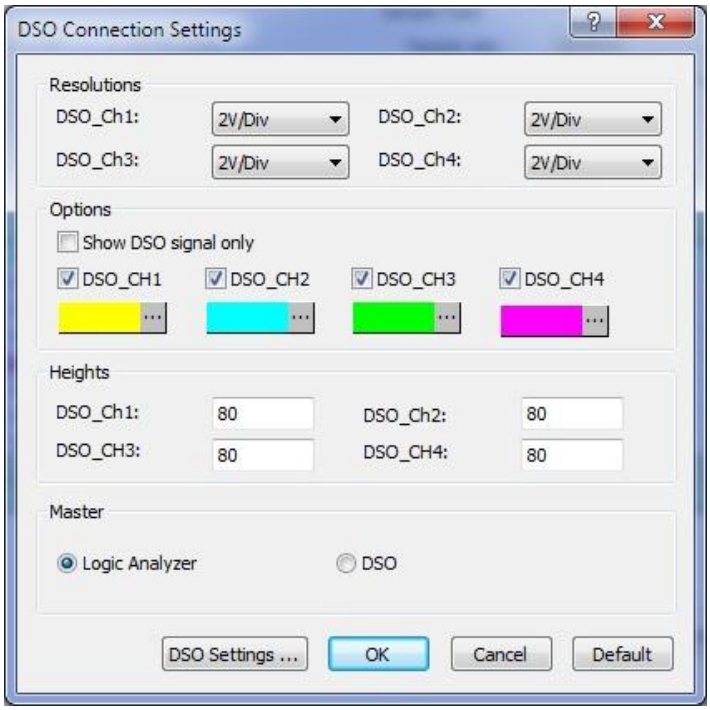


Figure 4-24 DSO Connection dialog box

Item	Description
Resolutions	
DSO_Ch1-4	Adjust the vertical resolution of the input signals in Volts/Division ranging from 3V/Div to 2mV/Div in a total of 11 steps.
Options	
Show DSO signal only	Do not display any of the regular signals.
DSO_Ch1-4	Choose which DSO signals to display in the waveform area and their colors.
Heights	
DSO_Ch1-4	Set the trace height in pixels. 30-400 pixels can be chosen; the default is 80 px.
Master	
Logic Analyzer	The LAP-F1 is master and the DSO slave; see chapter 4.17.2.1; default option.
DSO	The LAP-F1 is master and the DSO slave; see chapter 4.17.2.2; default option.
DSO Settings	Open the DSO Settings dialog box; the interface will depend on the DSO brand.

Table 4:18 DSO Connection dialog box description

4.17.2.4. Supported Oscilloscope Models

The supported DSO models are listed in Table 4:19.

Manufacturer	Model	Connection Mode
Tektronix	TDS1000 Series	USB
	TDS2000 Series	USB
	TDS3000 Series	USB, TC/IP, GPIB
	TDS5000 Series	GPIB
	TDS6000 Series	Built-in GPIB
OWON	SDS7102 Model	USB
PicoScope	3206B Series	USB
GwInstek	GDS-1000A Series	USB
	GDS-3000 Series	USB
Agilent	DSO5000 Series	USB
BK Precision	2540B, 2542B, 2540B-GEN, 2542B-GEN	USB

Table 4:19 Supported oscilloscope models

To use the LAP-F1/2 with any of the DSOs listed above it is necessary to install software from the manufacturer; see Table 4:20 for details.

Brand	Driver	Website
Agilent	Windows USB Driver	www.chem.agilent.com
BK Precision	Windows USB Driver	http://www.bkprecision.com/
GwInstek	Windows USB Driver	www.gwinstek.com
Owon	Windows USB driver	www.owon.com.cn
PICO	Windows USB driver	www.picotech.com
Tektronix	Tekvisa Connectivity Software V3.3.4	www.tektronix.com

Table 4:20 DSO driver needed for the DSO connection

4.18. Trigger Setup

Trigger Setup is used to define a set of trigger conditions. The LAP-F1/2 will trigger on the first event that satisfies all the conditions; see the dialog box in Figure 4-25.

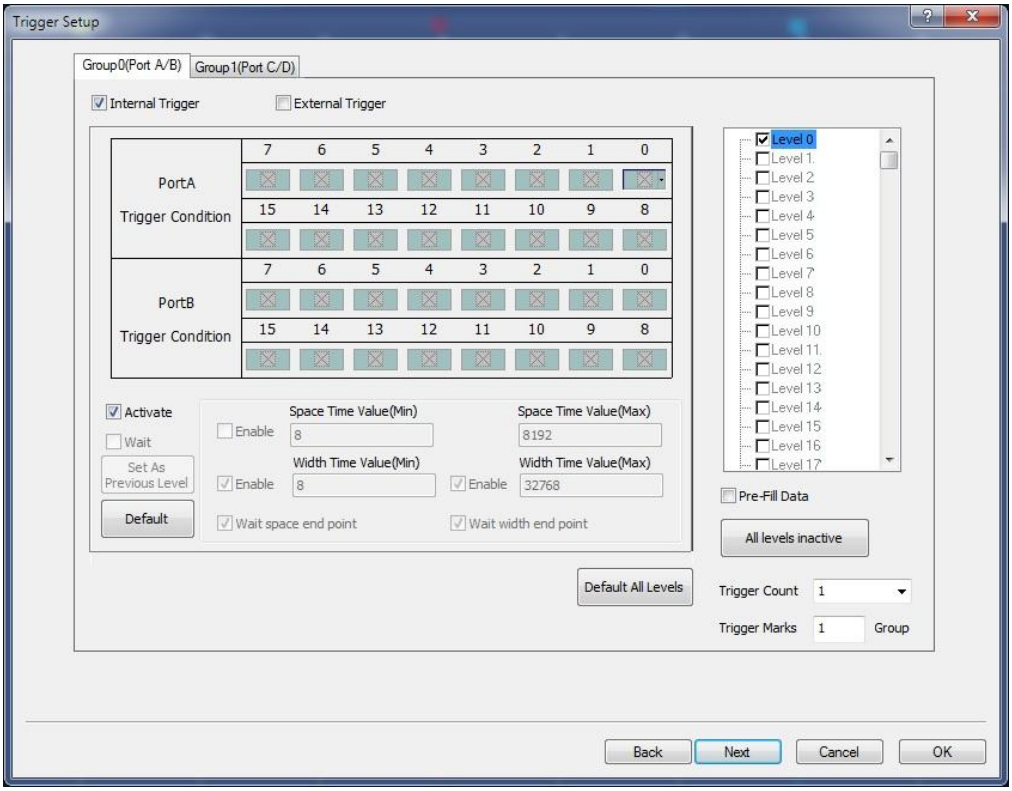


Figure 4-25 Trigger Setup dialog box

Item	Description
Group 0 (Port A/B) and Group 1 (Port C/D)	The first 16 channels are sampled by ports A0-7 (Group A), the next 16 in ports B0-7 (Group B) etc. For the 40 channel LAP-F1 model all ports from channel C9 to D15 are disabled. For LAP-F2, Group C and D are disabled. For LAP-F1 trigger conditions can only be set for 32 channels at a time. However; there exists an OR relationship between the Group 0 and Group 1; this OR condition is automatically enabled if the user sets trigger conditions in both of the groups.
Trigger Mode	
Internal Trigger	Fulfillment of a condition set makes the LAP-F1/2 emit a trigger signal.
External Trigger	The trigger signal is provided by an external source, most commonly a DSO.
Trigger Condition	5 trigger conditions are available: High Level (1), Low Level (0), Rising Edge (transition from low to high), Falling Edge (transition from high to low) and Either Edge (Rising or Falling Edge).
Activate	Enable the trigger setup; this is done on a level-to-level basis
Wait	Wait is used for multilevel triggering with High/Low conditions. Ex: You want to set up a Rising (R), Rising, High (H) trigger where the High event satisfies a certain pulse-width (PW). When an RRH event is found, the LAP-F1/2 will check if the High satisfies the PW condition. If that is not the case, the LAP-F1/2 will either keep looking for an H that satisfies the condition and trigger when it finds it (Wait is enabled), or it will restart the search and look for a new RRH pattern that satisfies the PW condition (Wait is disabled; default option).
Set As Previous Level	Copy the trigger conditions from the previous level.
Default	Reset the level to default.
Pulse-widths and Intervals	
Enable Interval (Time)	Interval triggering can be activated when there are at least 2 levels.
Interval (Time) – Min	When Interval is enabled, for the condition set to be satisfied there needs to be a certain distance in time from trigger level X to trigger level X-1; the default min and max values are 180 and 8,192 clocks.
Enable Pulse-width	Pulse-width conditions can be set for High/Low trigger conditions.
Pulse-width – Min	Set the length of periods – be it High or Low- as a trigger condition.
Wait till Interval Max to trigger	When an Interval condition is set and this option is enabled, the LAP-F1/2 will not trigger immediately (i.e. when the H/L event being looked for changes state) upon finding an event that satisfies the Interval condition, but wait until the Interval Max number of samples is reached and then trigger. The Interval Max is counted from

	the beginning of the H/L event in question.
Wait till Pulse-width Max to trigger	When a pulse-width condition is set and this option is enabled, the LAP-F1/2 will not trigger immediately (i.e. when the H/L event being looked for changes state) upon finding an event that satisfies the pulse-width condition, but wait until the Pulse-width Max number of samples is reached and then trigger. The Pulse-width Max is counted from the beginning of the H/L event in question.
Trigger Levels	
Trigger Level	There are 256 Trigger Levels. When the conditions of Level 1 are satisfied the LAP-F1/2 looks for an event that satisfies the conditions of Level 2. When an event satisfying the last active trigger level is found the LAP-F1/2 triggers. Note that Level X must be activated before Level X-1 can be activated.
Pre-Fill Data	The Trigger Position combined with the Sample Depth determines how many bits of pre-trigger data should be stored. The Pre-Fill Data determines the ZP-Logic's behavior if the trigger event occurs before the pre-trigger data requirement has been fulfilled. If unchecked (default option) the LAP-F1/2 will override the Trigger Position/Sample Depth requirement and start storing data when the trigger event occurs. If checked, triggering will be postponed until the pre-trigger data requirement has been fulfilled.
All Levels Inactive	Disable all trigger levels.
Default All Levels	Set all trigger levels to default.
Trigger Count	Trigger on the Xth event that satisfies the trigger conditions; at the default value of 1 the LAP-F1/2 will trigger on the first event.
Trigger Mark	Place a vertical bar on all samples that meet the trigger conditions. By default, only one trigger bar is shown (the T-bar), but there can be up to 256 trigger bars. These are numbered T0, T1, T2 etc. (Trigger Marks are sometimes referred to as Cursors or Auxiliary Cursors).
Navigation	
Back	Go to the Acquisition Setup dialog box.
Next	Go to the Trigger Properties dialog box.
Cancel	Leave the dialog box without saving the setting.
OK	Leave the dialog box and save the settings.

Table 4:21 Trigger Setup dialog box description

NOTE If both Internal and External Trigger are checked, whichever of the events that occurs first will trigger the LAP-F1/2.

4.19. Trigger Options

Adjust trigger properties such as Trigger Position and Trigger Delay.

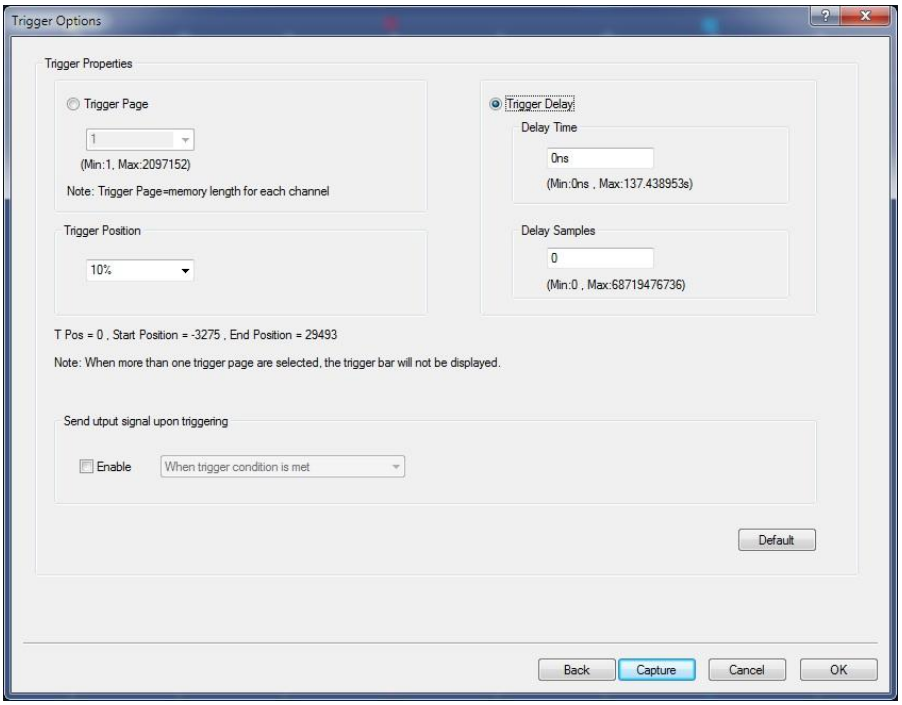


Figure 4-26 Trigger Options dialog box

Item	Description
Trigger Delays	
Trigger Page	*Where is the page concept explained?*
Trigger Delay	*Trigger a certain time or a certain amount of clock cycles after the trigger conditions have been met. The range goes from 0 ns to 687.19 seconds; the default is zero.*
Trigger Position	
	The trigger position determines which samples are stored. At the default 10%, 10% of the available memory is allocated to pre-trigger data and 90% to post-trigger data.
Send output signal upon triggering (Trigger Out)	
	See chapter 2.5.2; Trigger Out can be sent on the occurrence of 3 different events:
When trigger condition is met	*Send the Trigger Out signal when the LAP-F1/2 triggers.*
When clicking Capture	*Send the Trigger Out signal when the user clicks Capture.*
When clicking Stop	*Send the Trigger Out signal when the user clicks Stop.*

Table 4:22 Trigger Options dialog box description

4.20. Trigger Level

See chapter 4.17.1.

4.21. Protocol Trigger

The Protocol Triggers are sophisticated hardware triggers specially designed for certain protocols. These triggers open a well of triggering opportunities; for the supported protocols it is possible to trigger on packets, read/write conditions, addresses etc. The triggers are hardware based, i.e. everything happens in the instrument. The LAP-F1/2 comes with 6 protocol triggers:

- I2C
- I2S
- SPC
- SVID
- UART
- CAN2.0B

See the dialog box in Figure 4-27 for an example of the dialog box for the I2C trigger.

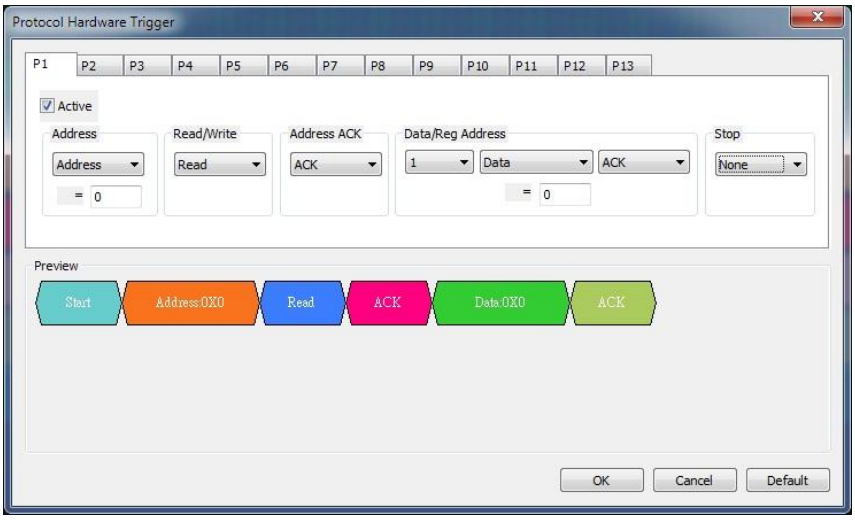


Figure 4-27 Protocol Trigger dialog box for I2C

Item	Description
Packet (P1, P2 etc)	*When activating several packets, the ZP-Logic triggers when the P1 conditions followed by the P2 conditions and so on have been met; note that the max amounts of packages depends on the Page Size.*
Active	*Activate the protocol trigger.*
Conditions	*Select the data pattern that is to be triggered on.*
Preview	*See a visual representation of the constructed condition set.*

Table 4:23 Protocol Trigger dialog box description

4.22. Single Capture

Capture samples one time using the current Acquisition Settings and Trigger Conditions.

Hot Key: F5.

4.23. Repeated Capture

Repeated Capture is used to restart acquisition periodically until a Stop Condition is met. The Stop Condition can either be a function of number of

triggers (trigger X times then stop) or of time (trigger periodically for X seconds then stop) ; see Figure 4-28.

Hot Key: CTRL + F5.

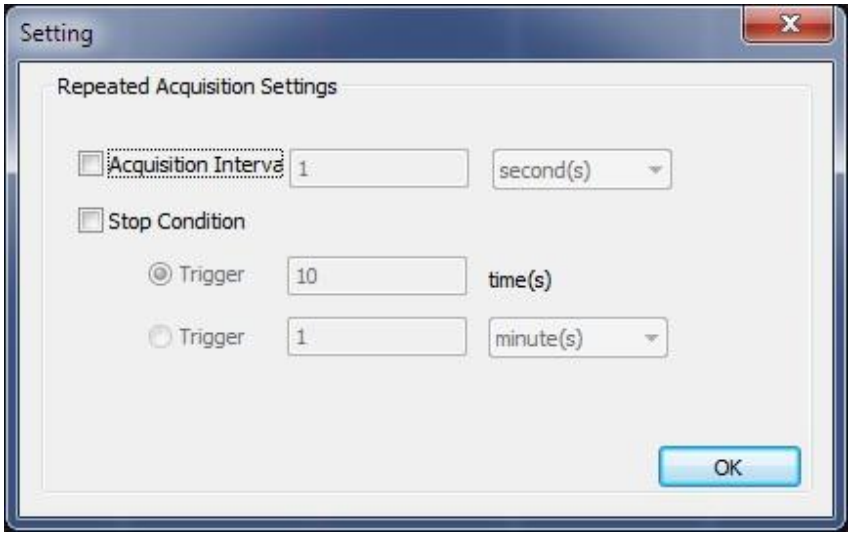


Figure 4-28 Repeated Capture dialog box

Item	Description
Acquisition Interval	*Choose how often acquisition should restart. The available intervals are: 1-2,592,000 seconds, 1-43,200 minutes, 1-720 hours or 1-30 days; it is 1 second by default.*
Stop Condition	
(Number of times)	*Choose the number of times the acquisition should be restarted. LAP-F1/2 will then restart acquisitions until the limit is reached. 1-65,536 times is available; 10 times is the default option.*
(Time)	*Choose how long (in time) the acquisitions should be restarted. LAP-F1/2 will then restart acquisitions until the limit is reached. The available time limits are: 1-2,592,000 seconds, 1-43,200 minutes, 1-720 hours and 1-30 days.*

Table 4:24 Repeated Capture dialog box description

4.24. Stop

– Show the previous (complete) acquisition

– Show the newly acquired data

Switch between the two alternatives in the General Settings; see Figure 4-7.

4.25. Autocapture

The Autocapture is similar to the Single Capture (chapter 4.22), but the optimal sample rate is auto detected by the software.

Analysis

Press ALT + D to open this Main Menu item with the keyboard.

4.26. Menu Layout

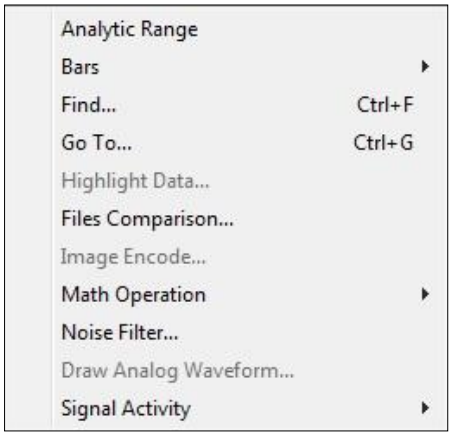


Figure 4-29 Analysis drop-down menu

4.27. Active Range

Adjust the analysis range by adjusting the position of the so-called Ds and Dp bars. The Ds-bar marks the beginning of the active range and the Dp-bar marks the end. The Active Range is used to reduce the size of acquisitions by hiding parts of the acquired data. This can be useful for navigation, reducing file sizes etc. These bars are locked whenever the user has not entered the Active Range.

NOTE Adjusting the Active Range will hide – not delete – data.

4.28. Bars

The ZP-Logic Waveform / State List areas come with 5 standard bars (these are sometimes referred to as Cursors). The bars delimit the analysis range and

facilitate navigation and observation. The five standard bars are described in Table 4:25.

Bar	Description
Ds bar	*Demarks the beginning of the buffer data area; use the Active Range function to adjust its position.*
Dp bar	*Demarks the end of the buffer data area; use the Active Range function to adjust its position.*
T-bar	*The T-bar marks the trigger event. Press T to center the waveform view on the T-bar.*
A-bar	*Default bar intended for navigation and measurement that the user can move freely. Press A to center the waveform view on the A-bar.*
B-bar	*Default bar intended for navigation and measurement that the user can move freely. Press B to center the waveform view on the B-bar.*

Table 4:25 Description of the five standard bars

4.28.1. Add

Users can insert up to 250 additional bars. When adding a bar the user can select color and where it should be positioned (in time). The bars will automatically be named A0-A9, B0-B9 etc. User comments can be added to the bars after addition; see Figure 4-65.

Note that there is a second way to add bars: In pointer mode (see 4.47.1), move the cursor to the very left part of the waveform. The pointer will convert to a plus symbol and when left-clicking a bar will be added.

4.28.2. Reposition

Move a bar; the bar's new position will depend on how the user enters the reposition dialog box:

- If the user accesses the function from the Main Menu, the chosen bar will be placed at the center of the waveform area.
- If the user accesses the reposition dialog box by right-clicking in the waveform area, the chosen bar will be moved to where the user clicked.

NOTE The T-bar cannot be moved and the Ds- and Dp-bars can only be moved using the Active Range function; see chapter 4.27.

NOTE Users can also center the waveform on a bar by means of keyboard shortcuts. This is not the same as repositioning the bar. To center the display on the T-bar press T and correspondingly for the A- and B-bars. To focus on user defined bars use the number keys. To focus on for example the D1-bar, press 1 four time.

4.28.3. Delete

Any bar that is not a standard bar can be deleted.

4.29. Find

Post acquisition, Find is used to look up events that satisfy a set of user-defined conditions. The user can switch between three types of searches in the upper drop-down list. The Single Condition Set search is shown by default, but the user can also look for a Sequential Condition set or do a Protocol Decoder Search.

Hot Key: CTRL + F.

Press **CTRL +** → to move to the next event that satisfies the Find conditions and **CTRL +** ← move to the previous event.

NOTE To search through all memory page it is necessary to process the acquired data; see the note in chapter 4.6.

4.29.1. Single Condition Set

A single condition set could for example be: Channel A0 = High AND Channel A1 = Rising. See the Find Single Condition Set dialog box in Figure 4-30. Note that it is not possible to look for two simultaneous edges.

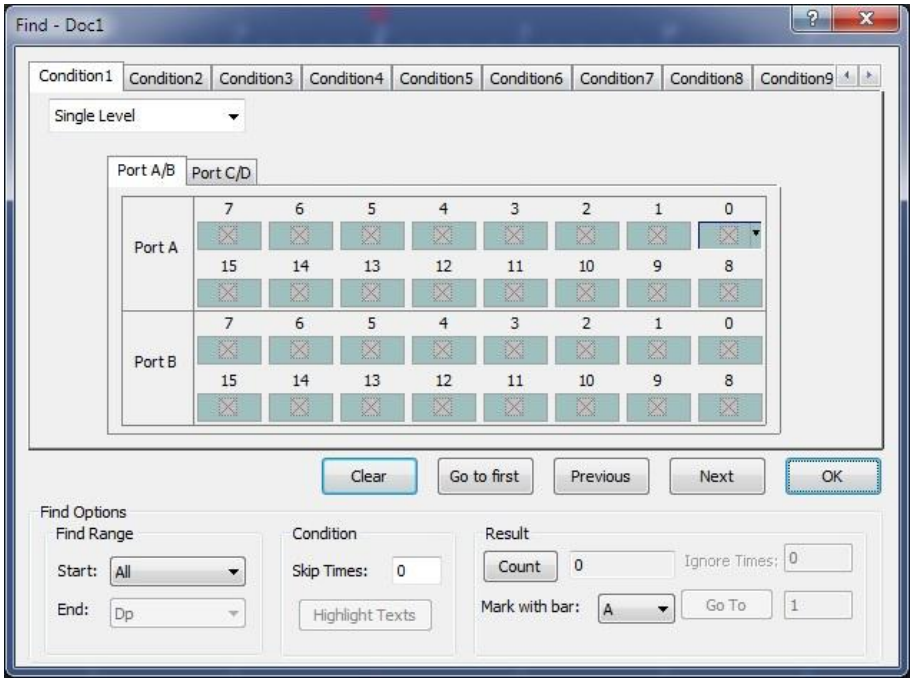


Figure 4-30 Find Single Condition Set dialog box

Item	Description
(Condition X)	*Click through the gray boxes for each channel to design the event to be found. The available conditions are: Indifferent, Low, High, Rising Edge, Falling Edge or Either Edge. Note that ZP-Logic cannot look for two simultaneous edges.*
Clear	*Clear all conditions.*
Find Range	
Start	*Set the data range within which ZP-Logic will look for the condition set. Any bar can be used as a starting point; by default the range encompasses the entire acquisition (alternative All).*

End	*End point for the Find Range.*
Condition	
Jump Results	*Look for every Xth time the condition set is met. Ex: 'Jump results' is set to 2. The user will then be taken to events 3, 6, 9 etc that satisfy the condition set. A maximum of 255 events can be skipped; the default value is 0.*
Highlight Texts	*Mark the packet names that meet the search conditions. This option is only available for Bus/Packet Finder searches.*
Results	
Count	*Count the number of events within the Find Range that meet the condition set.*
Mark with bar	*Mark event that meets the Find condition set with a bar; the A-bar is the default bar.*
Sample Number	*Samples are numbered with the trigger event defined as 0.*
Ignore Times	*If the value is N, then the statistics would cut the front N data. It is only Available in finding protocol analyzer and for statistics.*
Go To	*Input one index value matching statistics condition and click 'Go' to go to that value in the statistics data and mark it with a bar. It is disabled if the find range is changed and only enabled after statistics.*
Navigation	
Go to first	*Go to the first event that meets the Find condition set.*
Previous	*Find the previous event that meets the Find condition set.*
Next	*Find the next event that meets the Find condition set.*

Table 4:26 Find Single Condition Set dialog box description

4.29.2. Sequential Condition Set

The Sequential Condition Set search is used to look for a chain of events (conceptually it is similar to multi-level triggering). Ex: Channel A0 = High AND Channel A1 = Rising, followed by Channel A1 = Falling AND Channel 2 = Low.

To prepare a Sequential Condition Set search, click on the desired channel in Level 1, then use the keyboard to set the Find condition; see Figure 4-31. The valid keyboard inputs are listed in Table 4:27.

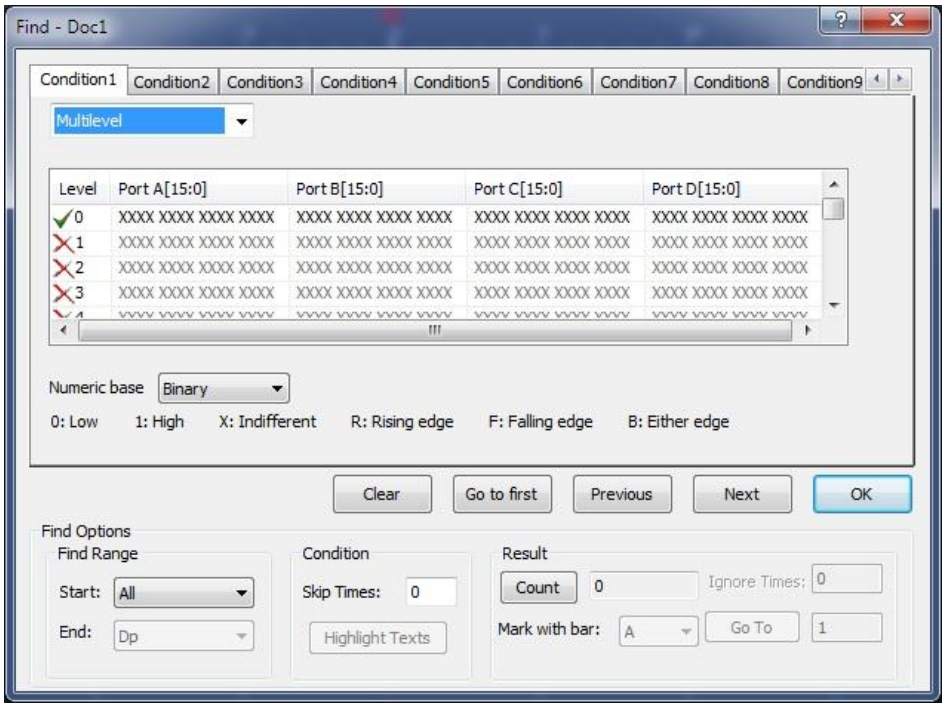


Figure 4-31 Find Sequential Condition Set dialog box

Item	Description
(Level)	*Click the left-most red crosses to activate levels. Green check marks are shown for channels that are active. Activating several levels lets users search for a chain of events such as in the example from the introduction to this chapter. 256 levels can be activated.*
Condition	*From left to right the Xs symbolize the 64 channels. Set the Find conditions of a channel and level by clicking the corresponding X to make it editable. The user can then type the desired Find condition; see how to represent the different Find conditions in the lines below.*
0: Low	*Type 0 to set the Find condition to Low.*
1: High	*Type 1 to set the Find condition to High.*
X: Indifferent	*Type X to set the Find condition to Indifferent (blank).*
R: Rising	*Type R to set the Find condition to Rising.*
F: Falling	*Type F to set the Find condition to Falling.*
B: Either	*Type B to set the Find condition to Either Edge.*
Numeric Base	*The above conditions work when Binary is chosen. When the hexadecimal numeric base is used, users cannot search for edges and can only set Indifferent for groups of 4 channels.*
(Other buttons)	*See Table 4:26.*

Table 4:27 Find Sequential Condition Set dialog box description

4.29.3. Packet Finder

The Packet Finder is used to search the acquired samples for specific data or packets. To enable this function a bus must be created first. The Packet Finder works with all protocols and automatically proposes the types of packets that can be searched for.

First, select the bus, then packet type and condition. If Condition is set to 'None' then ZP-Logic will look for all packets of the selected type; otherwise it will look for the selected packets that also satisfy the condition.

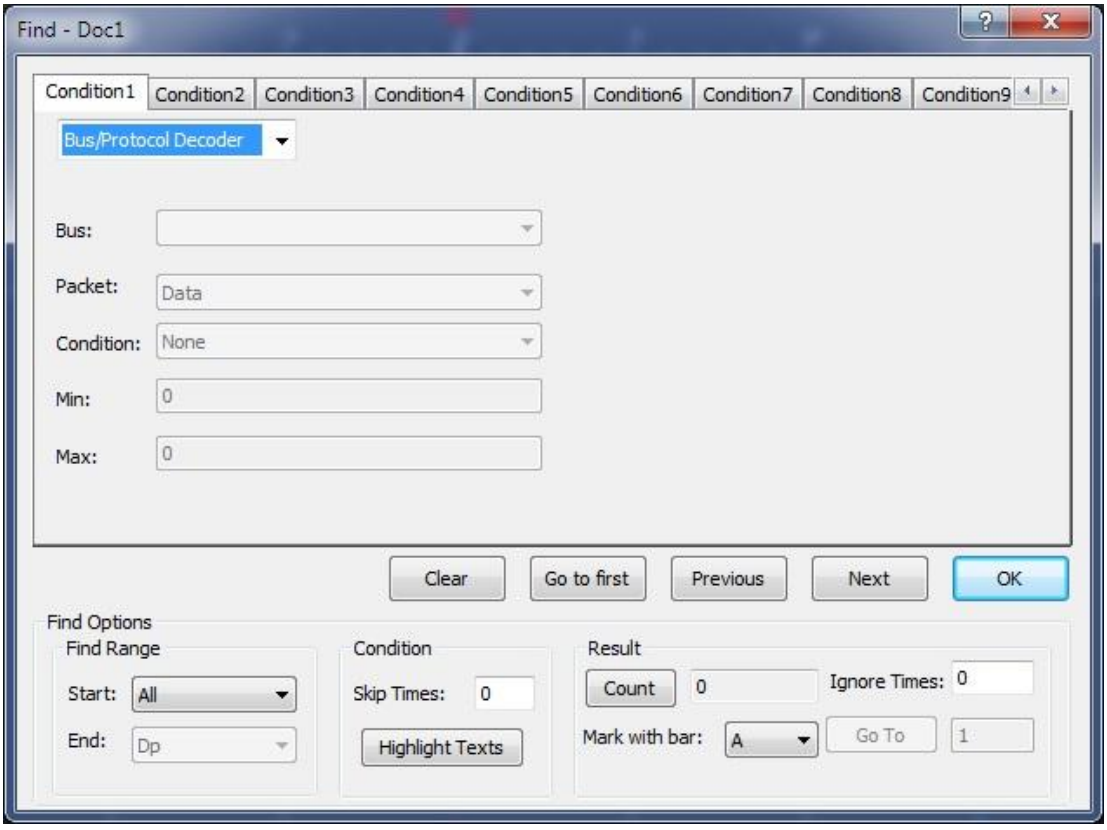


Figure 4-32 Packet Finder dialog box

Item	Description
Bus	*Select a bus from the drop-down list.*
Packet	*Select the packet type that is to be found; the types available in the drop-down are automatically updated depending on how the bus data are decoded.*
Condition	*Set the Find condition; these is either a factor of the values, a string or None. For values, these are further defined with the Min and Max inputs; for strings see Figure 4-33. None can be*

	used to find packets of a particular kind and to count them.
Min	*The Min input is used for ranges and == and !=conditions.*
Max	*The Max input is only used for ranges.*
Highlight Texts	*For data that satisfy the conditions text highlight color is applied.*
(Other buttons)	*See Table 4:26.*

Table 4:28 Packet Finder dialog box

For String searches the interface changes as shown in Figure 4-33.

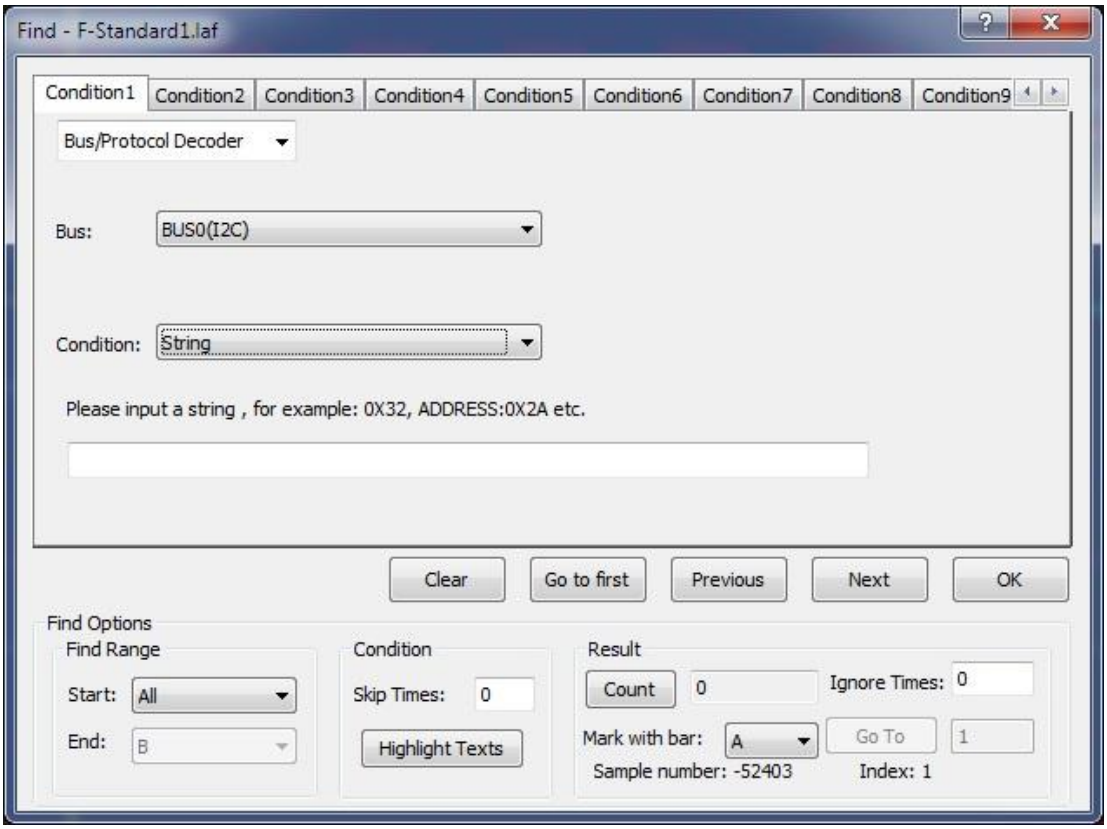


Figure 4-33 Packet Finder "String" dialog box

4.30. Go To

The Go To function is used to find and navigate to a bar or a Memory Page; see the dialog box in Figure 4-34.

Hot Key: CTRL + G.

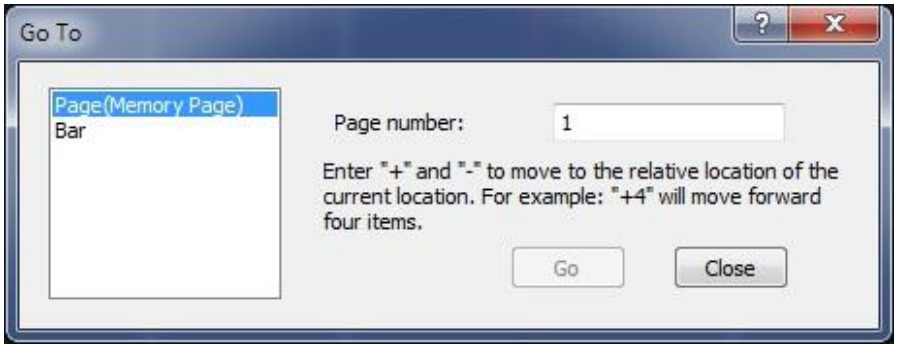


Figure 4-34 Go To dialog box

To go to a bar, select one from the drop-down menu. The waveform area will center on the selected bar. If there are several bars of type A (A0, A1, A2 etc) then click next to move from one bar to the next. The A-bar is the default choice.

It is also possible to go to a page (read about ZP-Logic's pagination in Table 4:6). Input a page number and click Go To to move to the page. In Figure 4-35 the user has used the Go To dialog box to move to page 3 as indicated by the red frame on the page bar in the upper left corner.

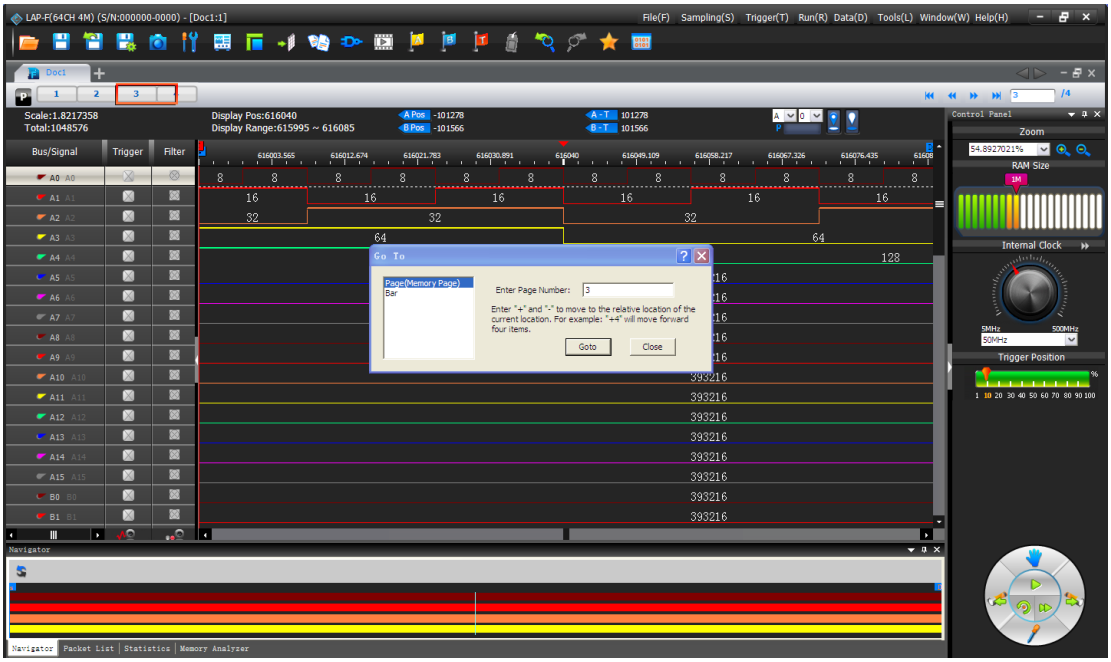


Figure 4-35 Go To example; the File bar shows that page 3 is shown

4.31. Highlight Data

Highlight Data colors data that satisfies a user-defined condition to make them stand out. See the dialog box in Figure 4-36.

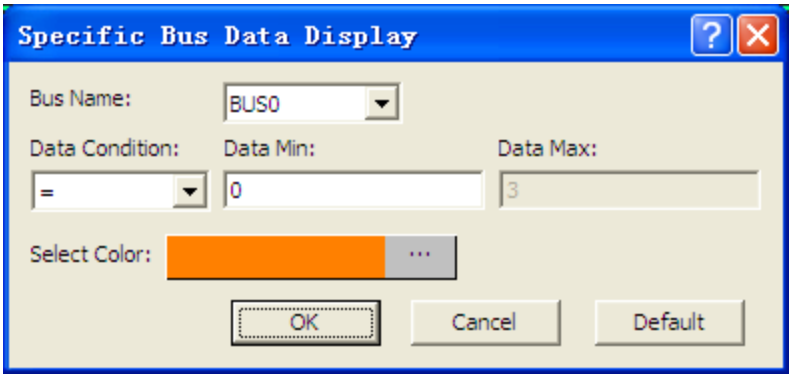


Figure 4-36 Highlight Data dialog box

Item	Description
Bus Name	*Select which bus the function should focus on.*
Condition	*Select a condition among =, !=, In Range and Not In Range; = is the default.*
Value / Minimum	*Input the value that is to be met.*
Maximum	*Input the maximum value (used for Range/Not in range only).*
Choose Color	*Data that meet the condition are highlighted with the selected color.*

Table 4:29 Highlight Data dialog box description

Figure 4-37 shows what how the Highlight Data function works. In the example, the conditions established in Figure 4-36 are used: The data belongs to BUS0 and are equal to zero. This are highlighted with an orange color. Had the function not been used, these data would have had the same white background color as the neighboring 0X1 data.

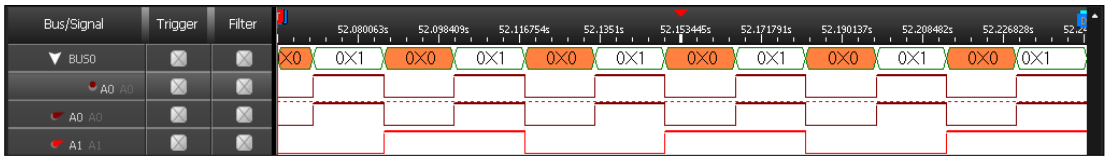


Figure 4-37 Highlight Data example; packets with Data Min = 0 are orange

4.32. Files Comparison

Files Comparison examines how and where two files differ from each other. The number of differences between the two files is listed channel by channel in the dialog box, and new, curly traces in the waveform area evidence where the two signals differ; see an example in Figure 4-39.

Figure 4-38 shows the Files Comparison dialog box and the result of a data comparison of two files in table format; the two files display a large number of differences.

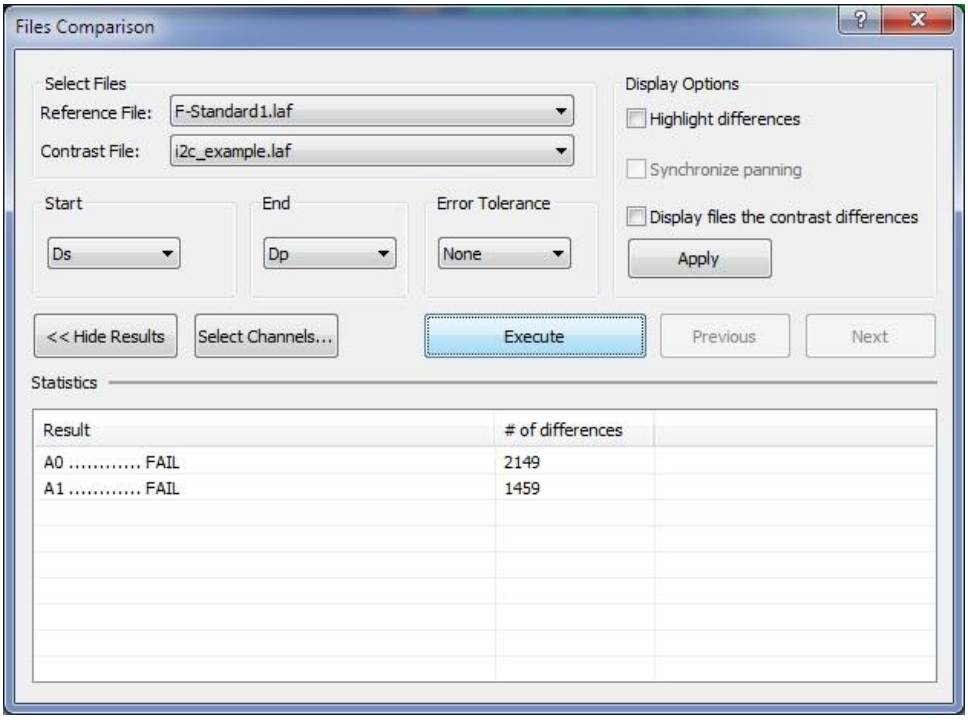


Figure 4-38 Files Comparison dialog box

Item	Description
Select Files	
Reference File	*Select a file. Note that only open files can be chosen. Only open files are available.*
Contrast File	*Select the file that is to be compared to the Reference File. When contrasting with None, the Reference File settings will be used to make an acquisition.*
Settings	
Start	*Select where to start the Files Comparison, using the reference file as base.*
End	*Select where to end the Files Comparison, using the reference file as base.*

Error Tolerance	*Define how many sample points that may differ between the two files before ZP-Logic regards the two files as unequal; 0-10 samples can be chosen (the default is 0).*
Display Options	
Show files horizontally	*Display the two files horizontally; unchecked by default.*
Synchronize navigation	*Synchronize panning across the two files. This option is unchecked by default and only available if "Show files horizontally" is checked.*
Highlight differences	*Mark the different waveforms with red wavy lines, the default is not selected.*
Apply	*Make changes effective.*
Hide/Unhide Results	*Hide/Unhide the Results area.*
Select Channels	*Select the channels to be contrasted. At least one must be chosen; by default all are selected.*
Execute	*Perform the Files Comparison. Note that this function needs to pre-process a temporary file; see note in chapter 4.6.*
Statistics	
Results	*Display the status of channels contrast, PASS means the data in the channel is identical for the two files and FAIL means the data is different.*
# of differences	*The column shows the number of differences between the two files for each channel.*
Navigation	
Previous	*Go to the previous difference between the two files.*
Next	*Go to the next difference between the two files.*

Table 4:30 Files Comparison dialog box description

The reference file and the contrast file are displayed horizontally in the waveform area. New, orange, wavy traces ~~~~~ (one for each channel) in the lower window show where the two files differ. The orange waves marking the differences can be discerned in the lower waveform area in Figure 4-39.

Figure 4-39 Files Comparison ex; differences marked in the lower window

4.33. Image Decode

The Image Decode function is specially designed for display type protocols such as CMOS Image, 7-SEGMENT LED, LCD12864, LCD1602 etc. Captured data that are decoded with one of the supported protocols are decoded and displayed as the original picture. This makes for a painless and straightforward verification of the data being correct or not. See Figure 4-40 for an example of the function's output.

Figure 4-40 Image Decode for 7-Segment LED

- 7-Segment LED
- CCIR

- CMOS Image
- DM114/115
- DMX512
- LCD12864
- LCD1602
- LED Pitch Array
- LG4572

Note that it’s necessary to focus on the correct bus for the Image Decode function to be unlocked.

4.34. Math Operations

Create a new trace by performing a mathematical operation on two existing signals.

4.34.1. Arithmetic Operation

Using the Arithmetic operation function users can create a new signal through one the following arithmetic operations: Add, Subtract, Multiply or Divide.

ZP-Logic only accepts the creation of one arithmetic trace at a time.

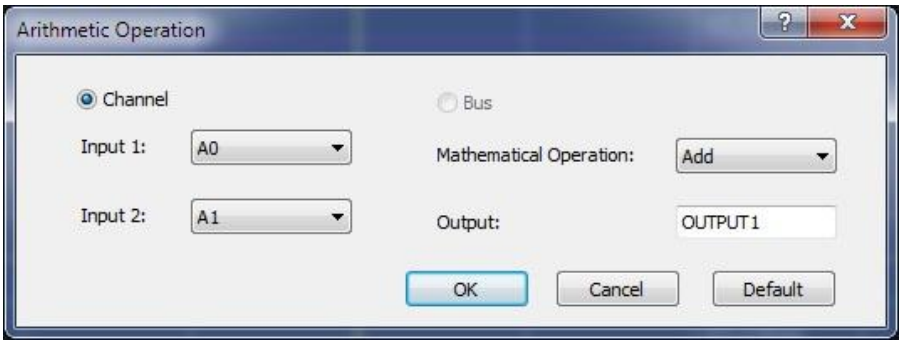


Figure 4-41 Arithmetic operation dialog box

Item	Description
Channel/Bus	*Choose to perform the operation on signals or buses (at least two buses must exist for this option to open).*
Input 1	*Select a signal.*
Input 2	*Select a signal to be joined with the first one using the arithmetic operator.*
Operation	*The available arithmetic operations are: Add, Subtract, Multiply and Divide.*
Output Name	*Input a name for the resulting trace.*

Table 4:31 Arithmetic operation dialog box description

Figure 4-42 shows the resulting trace from an ADD operation on signals A0 and A1.

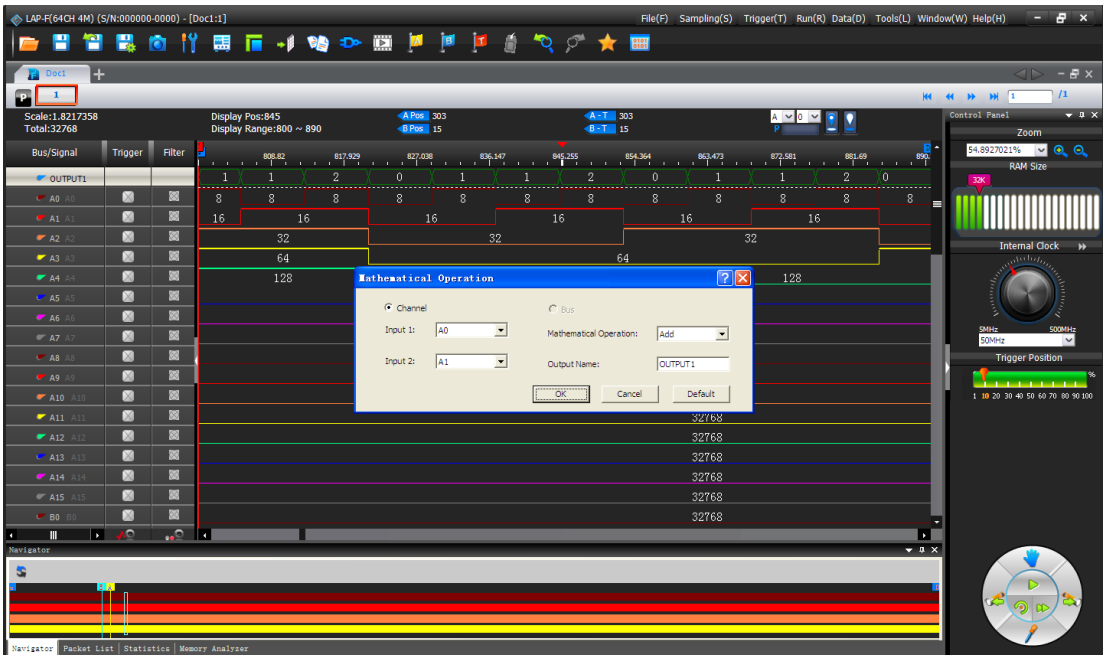


Figure 4-42 Arithmetic operation example; ADD A0 and A1

4.34.2. Boolean Operation

With the Boolean operation, users can create a new signal using one of the Boolean operators; see Figure 4-43.

Note that an Arithmetic operation can also be performed on buses, granted that at least two buses have been created. However, ZP-Logic only accepts the creation of one Boolean trace at a time.

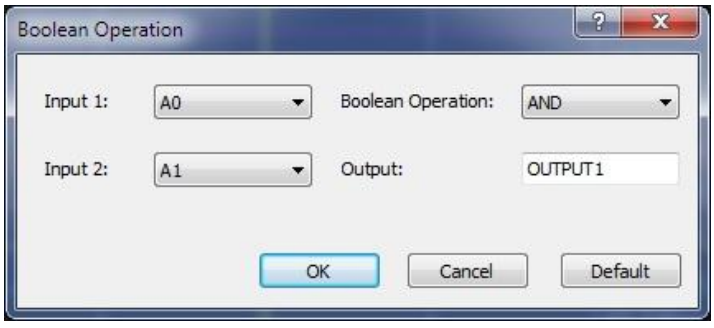


Figure 4-43 Boolean Operation dialog box

Item	Description
Input 1	*Select a signal.*
Input 2	*Select as second signal to be XX to the first one.*
Boolean Operator	*The available Boolean operators are: AND, OR, NAND, NOR, XOR, XNOR and NOT. NOT*

	takes only one argument and inverts it.
Output Name	*Input a name for the resulting trace.*

Table 4:32 Boolean Operation dialog box description

Figure 4-44 shows a trace created from signals A0 and A1 using the Boolean operator AND.

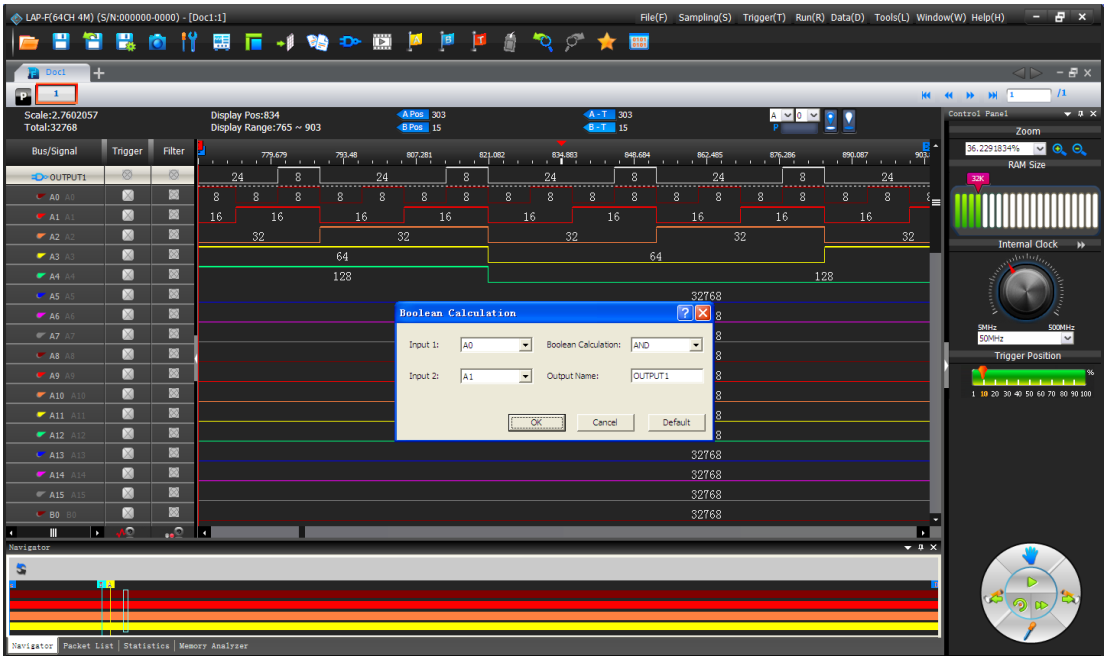


Figure 4-44 Boolean waveform example: A0 AND A1

4.35. Noise Filter

The Noise Filter is used to filter out short-lasting pulses or dips in signals that the user considers to be noise; see the dialog box in Figure 4-45.

After activating the Noise Filter, users select one or more channels to be filtered and move them to the right column using the right-pointing arrows. To select two or more channels at the same time, use the CTRL and SHIFT keys.

Once a channel is in the right column, the user can choose just how short pulses/dips in the signal of that channel have to be to be filtered out. Lengths are measured in sample points or time.

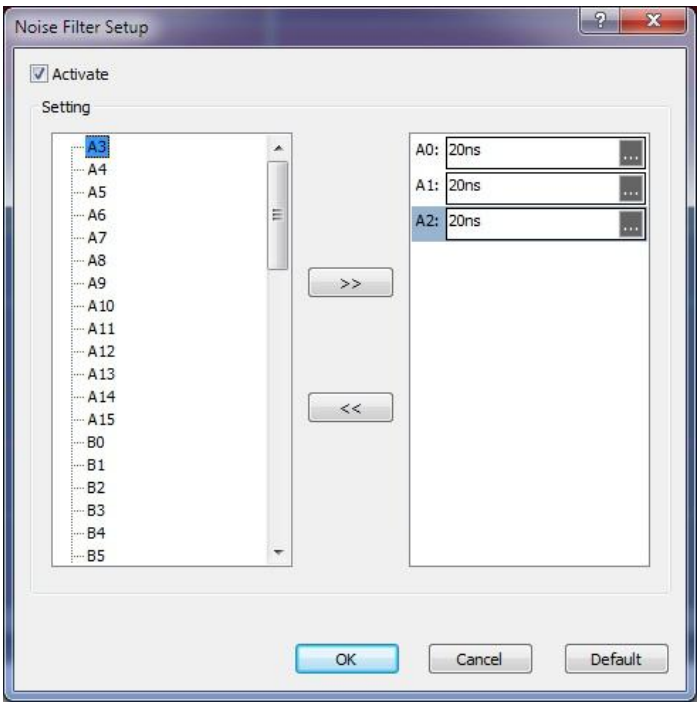


Figure 4-45 Noise Filter dialog box

4.36. Draw Analog Waveform

The Draw Analog Waveform function is used to plot traces based on the value of bus data. It is especially useful for data that can be conveniently displayed visually, such as an ADC output represented by a sine wave. The function is available for simple buses (no packets); see the setup dialog box in Figure 4-46.

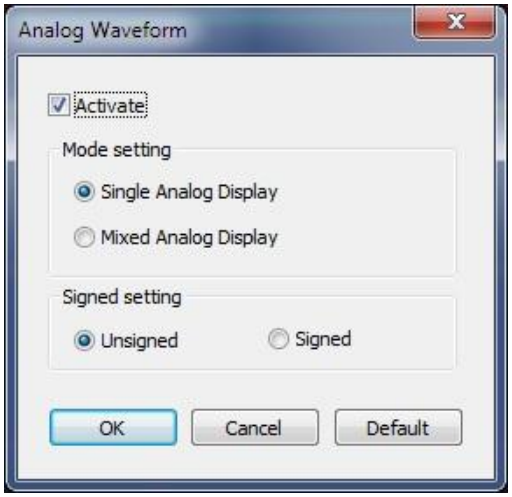


Figure 4-46 Draw Analog Waveform dialog box

Item	Description
Mode Setting	
Single Analog Display	*Draw the analog waveform on a dedicated channel; default option.*
Mixed Analog Display	*Show the drawing on top of the traces its based on.*
Signed Setting	
Unsigned	*Binary data are read as unsigned; default option.*
Signed	*Binary data are read as signed.*

Table 4:33 Draw Analog Waveform dialog box description

Figure 4-47 shows a simple example output based on four signals changing state on regular intervals (signals A0 in dark red to A4 in green are used in the example).

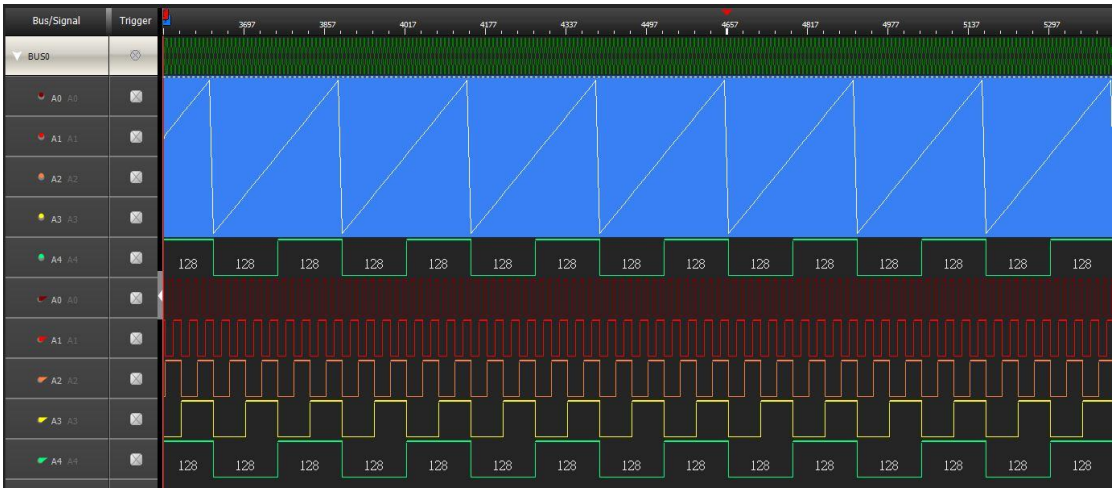


Figure 4-47 Draw Analog Waveform example

4.37. Signal Activity

Signal Activity offers the user real-time views of what the probes are seeing. Two modes are available; Real-time Frequencies and Signal Status. By means of these functions the LAP-F1/2 monitors signal frequencies and states, thus assuming the function of a frequency counter and that of a logic pen.

4.37.1. Real-time Frequencies

Real-time frequencies of all channels as measured by the probes are shown; see Figure 4-48. The frequencies are updated twice per second.

Figure 4-48 Real-time frequencies window

NOTE Other operations cannot be performed when the Real-time Frequencies window is open. Also, at least two periods must be captured for the function to work.

4.37.2. Signal Statuses

The Signal Statuses window shows another view of the probe activity; traffic lights indicate if channel signals are High (green light), Low (red) or transitioning (yellow); see Figure 4-49.

Figure 4-49 Signal Statuses window

Options

Press ALT + O to open this Main Menu item with the keyboard.

4.38. Menu Layout

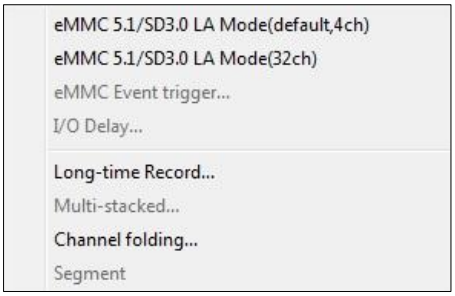


Figure 4-50 Options drop-down menu

4.39. eMMC/SD – Limited

The LAP-F1/2 can decode both eMMC5.1 and SD3.0 protocols. When making a standard purchase, the LAP-F1/2 offers the possibility to decode four eMMC signals (four special eMMC probes are delivered for this purchase). See Figure 4-51 for the eMMC display setup dialog box. These settings can be changed both before and after acquisitions.

NOTE To fully decode and trigger on all 11 eMMC signals users must purchase the optional Full eMMC/SD function; see chapter 4.40.

NOTE It is also possible to trigger on eMMC events; see chapter 4.41.

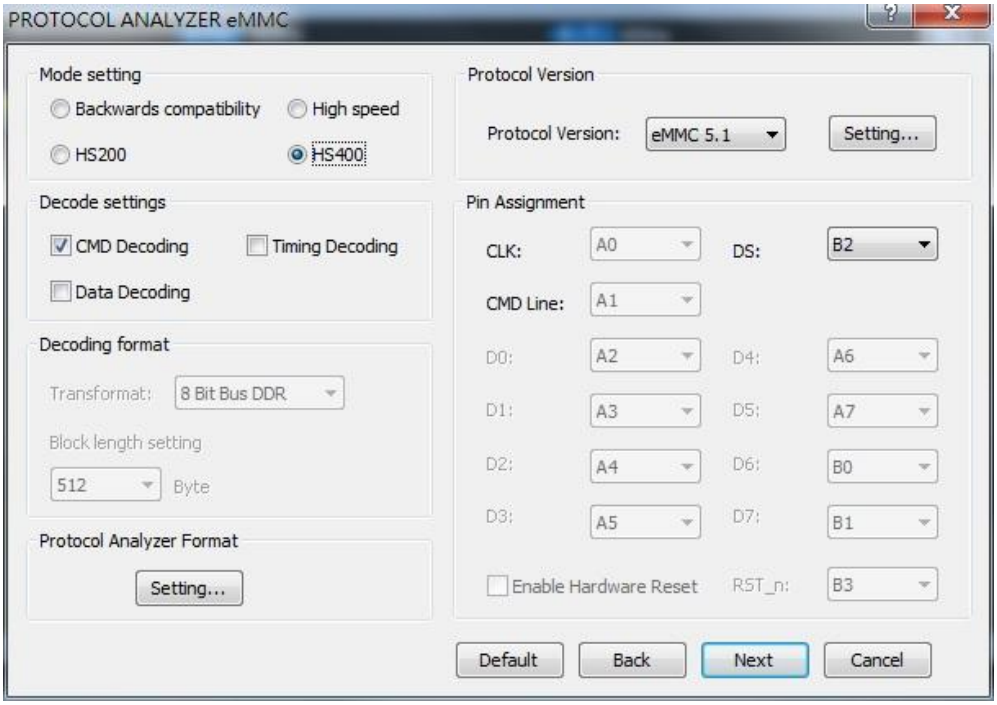


Figure 4-51 eMMC display dialog box

Item	Description
Mode Setting	*Change the data display method.*
Decode Settings	*Select which data are decoded and displayed.*
Decoding format	*Select bus technology.*
Settings	*Change colors and numeric base/encoding for numbers.*
Protocol Version	*Select the eMMC version number.*
Pin Assignment	*Select which signal to be displayed on which channel.*

Table 4:34 eMMC dialog box

4.40.eMMC/SD – Full

This optional function is available for both the LAP-F1 and the LAP-F2.

Purchasing the optional, full eMMC5.1 and SD3.0 decoding capability, the user will unlock 32 channels for 2 GHz sampling to fully trigger and decode all the signals of eMMC5.1/SD3.0. As eMMC only has 11 signals the remaining channels can be used for other high-speed acquisitions.

The menu is the same as the one shown in Figure 4-51.

4.41. eMMC Event Trigger

The eMMC Event Trigger is a protocol trigger like those presented in chapter 4.21. See the eMMC Event Trigger dialog box in Figure 4-52. Note that the three commands work like a multi-level trigger.

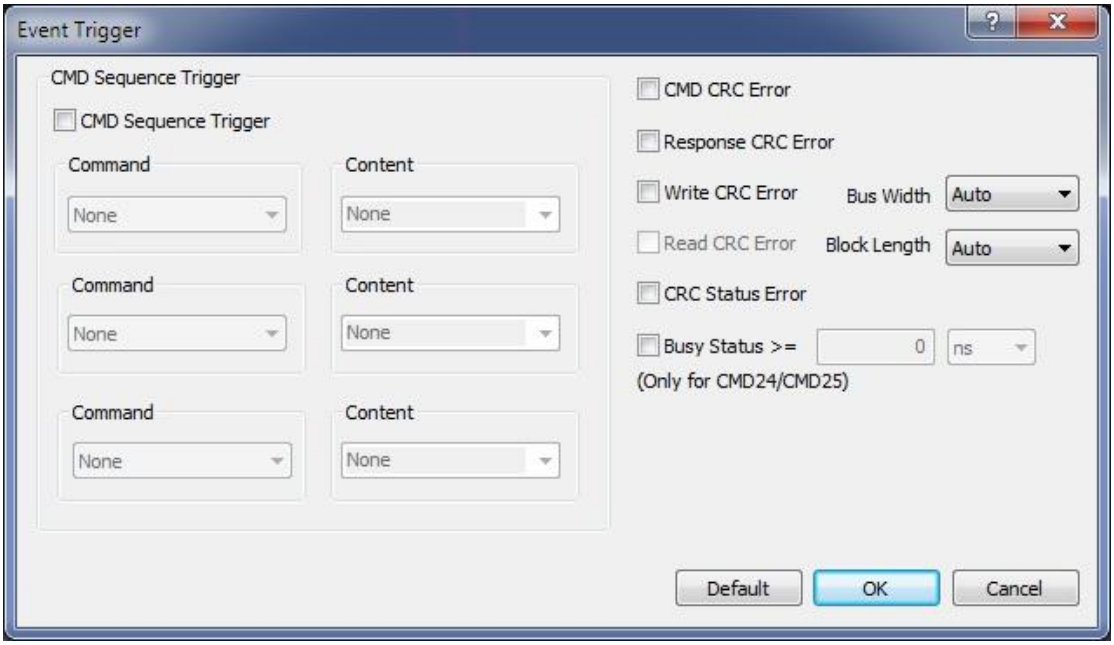


Figure 4-52 eMMC Event Trigger dialog box

4.42. I/O Delay

The I/O Delay function lets users correct eMMC timing skew.

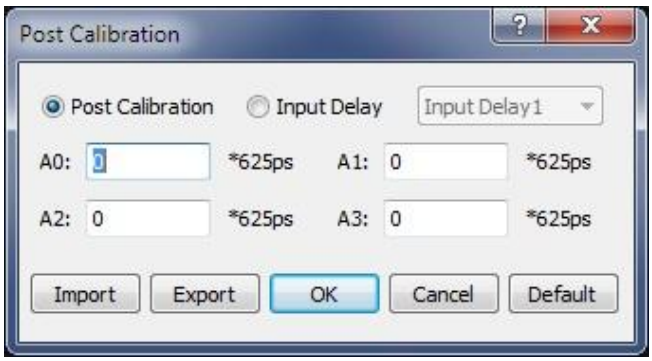


Figure 4-53 I/O Delay dialog box

Item	Description
Post Calibration	*This option is used to adjust timing skew post-acquisition.*
Input Delay	*This option is used to adjust timing skew pre-acquisition.*
A0-A3	*Insert the desired delay per channel. (4 channels are available in this example as the limited eMMC decoder capability is used).*
Import	*Import a timing information .cb file.*
Export	*Export a timing information .cb file.*

Figure 4-54 I/O Delay dialog box description

4.43. Long-time Record

This optional function is available for both the LAP-F1 and the LAP-F2.

The Long-time Record (LTR) function lets the user stream data directly to the computer over USB3.0, thus allowing much longer acquisitions than during normal operations when the samples are stored in the LAP-F1/2's internal memory. The LTR function is perfect for, as an example, burn-in tests. The maximum length of the acquisition depends on the acquisition rate, the number of channel sampled, and the available memory. Post acquisition, the user can search for patterns in the acquired data.

A relatively powerful PC is required to run the LTR function flawlessly. See Table 4:36 for the recommended PC setup.

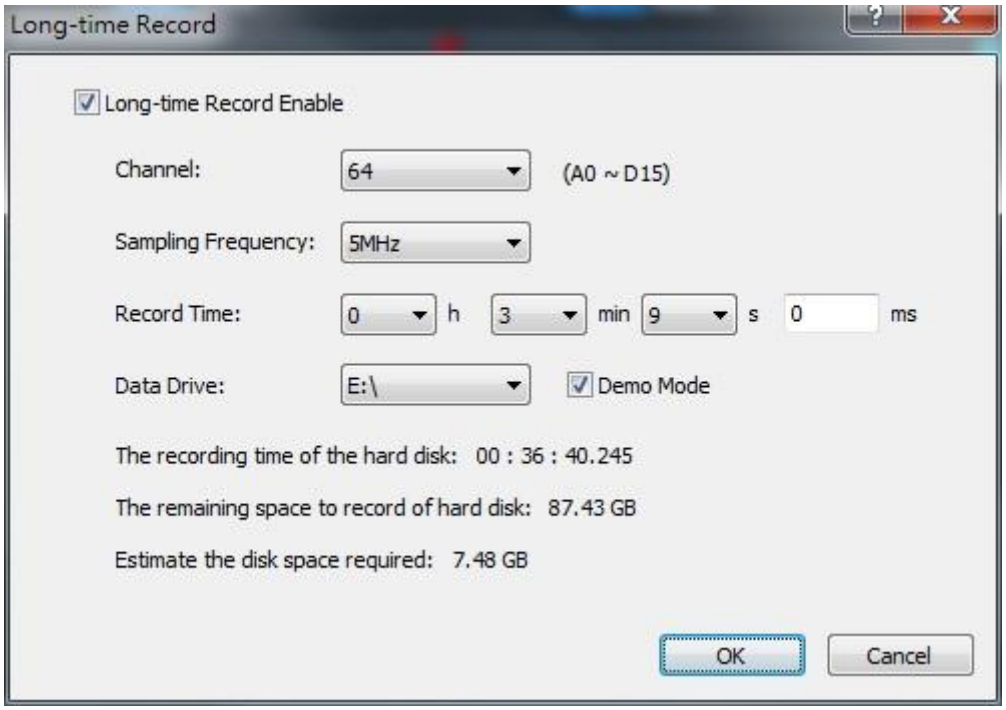


Figure 4-55 Long-time Record dialog box

Item	Description
Channel	*Signals to be acquired.*
Sampling Frequency	*How often samples are acquired.*
Record Time	*How long the LAP-F1/2 should acquire data.*
Date Drive	*Location of stored samples.*
Demo Mode	*Run the LTR function in Demo mode; users can run the LTR function on less powerful PCs, but the sampling frequency will be limited to 25 MHz (400 MHz is the normal) and there will be a risk of losing some data.*

Table 4:35 Long-time Record dialog box

Item	Description
Motherboard	*MSI H97M-E35*
CPU	*Intel i5-4460 3.2g*
RAM	*Kingston KVR16N11/8*
HDD	*Toshiba DT01ACA100 * 1, Toshiba DT01ACA200 * 4*
DVD	*ASUS DRW-24D3ST*
Power	*Cooltek 400 YM-ATX400*

Table 4:36 Standard PC requirments for the LTR function

NOTE While running the LTR function it is recommended that the PC is not used for anything else.

4.44. Channel Folding

This optional function is available for both the LAP-F1 and the LAP-F2.

Channel Folding is used to concentrate the total memory of the LAP-F1/2 on a limited number of channels. Much like folding a paper increases the thickness by a factor of two Channel Folding doubles the available memory per channel if half the channels are deactivated. Any channel can be deactivated regardless of the port it belongs to.

Note that the memory concentration works in steps. Ex: If you have 128 Mb available per channel when 32 channels are active, there will also be 128 Mb available for 31, 30 … 17 channels. It's first at 16 active channels that the available memory per channel doubles to 256 Mb.

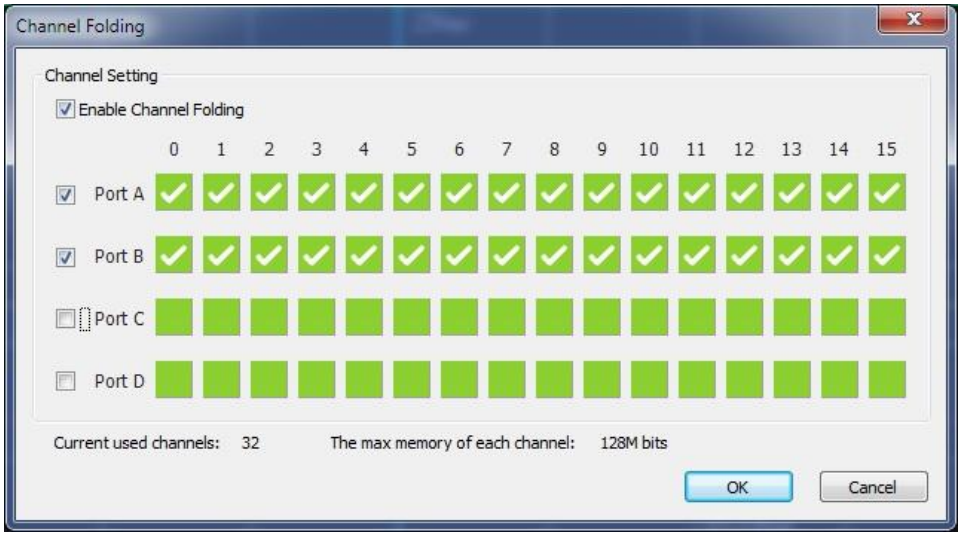


Figure 4-56 Channel Folding dialog box

Item	Description
Enable Channel Folding	*Enable the Channel Folding feature.*
Port A to D	*Each line represents the 16 channels of the port.*
(Checkboxes)	*A white check mark indicates that the channel is active. Click the check mark to deactivate the channel, and click green, empty boxes to activate channels.*

Current used channels	*Number of channels that have not been deactivated.*
The max memory of each channel	*Shows the memory available per channel (in Mbits) for the active channels.*

Figure 4-57 Channel Folding dialog box description

NOTE There is one exception to the duplication of available memory: For the 40 channel LAP-F1 model the active channels must be reduced to 16, not 20, to double the memory. Thereafter, the half channels/double memory pattern described above becomes valid.

4.45. Memory Segmentation

This optional function is available for the LAP-F2 only.

This function will be introduced by means of an example: A device always generates a 0xWRONG data in a packet. Making a normal capture with triggering on 0xWRONG, the user is able to see 1 second of data around the first 0xWRONG event. If the user uses the Memory Segmentation function to do this capture, he can rather see 0.25 seconds of each of the first, second, third and fourth occurrence of the event.

During normal operation, the memory will be filled when the logic analyzer triggers. When the Memory Segmentation function is activated, a part (segment) of the available memory will store data from the first occurrence of the trigger event, another segment of the memory will store data from the second occurrence of the event, and so on until the memory is full. (The storage of data from before/after an event is still governed by the Trigger Position.)

Each memory segment is 8 MB wide, and the user can store any number of segments from 1 to 1024. Note that this function can be combined with Channel Folding to increase the acquisition length of each segment for the channels that are left in use.

Figure 4-58 Memory Segmentation dialog box

Item	Description

Table 4:37 Memory Segmentation dialog box description

View

Press ALT + V to open this Main Menu item with the keyboard.

4.46. Menu Layout

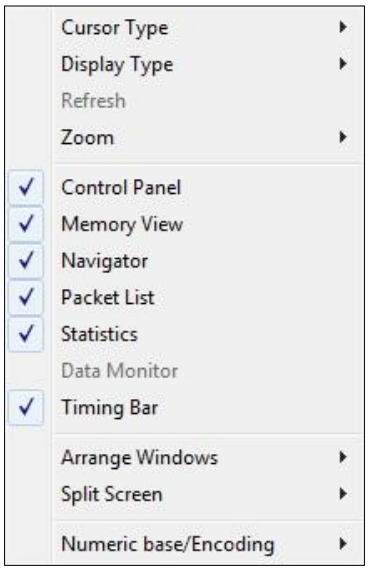


Figure 4-59 View drop-down menu

4.47. Cursor Type

The user can choose between two cursor types. Note that for both types, left/right movement in the waveform is achieved with the mouse wheel.

Hot Key: SPACE (the cursor mode changes temporarily when the user presses and holds the SPACE bar).

4.47.1. Pointer

In Pointer mode, the left mouse button is used for zooming; click and drag squares with the pointer to zoom in.

- To zoom in; form squares by dragging downwards/leftwards. The area covered by the square will be amplified to occupy the entire waveform area. In other words, form small squares to zoom in quickly.
- Zooming out is achieved by doing the opposite of zooming in; drag squares upwards/rightwards. The larger the square, the faster the zoom-out.
- To move a bar, left click on the bar name and drag sideways.

4.47.2. Hand

In Hand mode, the left mouse button is used for panning; click and hold the left mouse button to move left and write in the waveform area.

To move a bar, left click on the bar name and drag sideways.

4.48. Display Type

The menus that appear when right-clicking in the interface are found in these subchapters.

4.48.1. Waveform

In Waveform view, the state of each channel is shown as a trace that changes between high and low depending on the state of the signal. This is the default view mode.

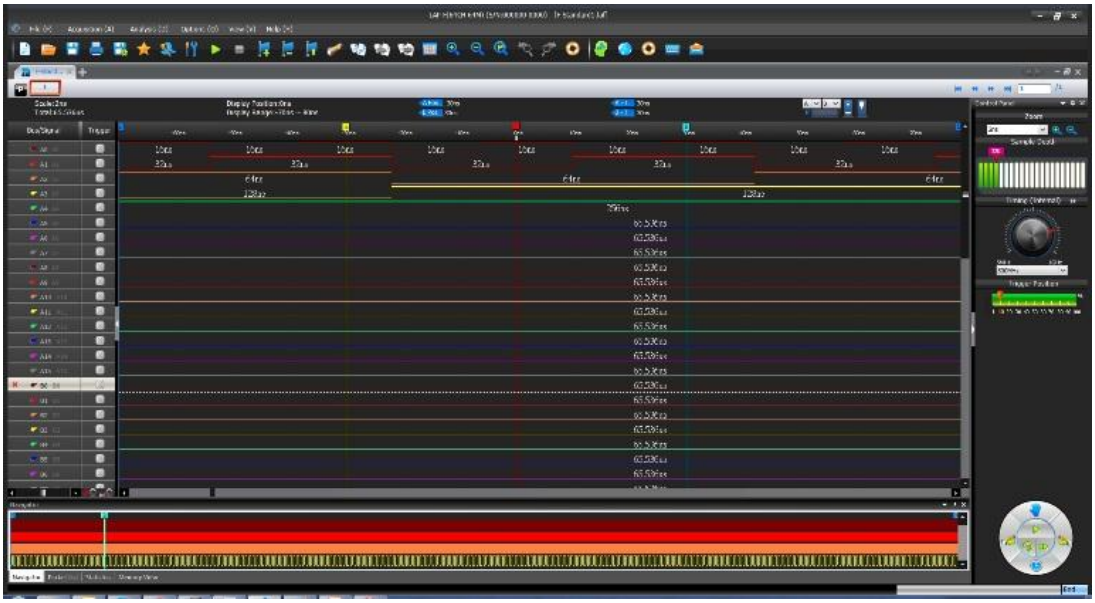


Figure 4-60 Waveform view

Figure 4-61 is shown when the user right-clicks in the trace area in Waveform View.

Figure 4-61 Waveform area; right-click menu

Item	Description
Trace Format	*Change the appearance of traces, bus outlines and analog waveforms by altering their color and width. In Figure 4-66, trace A1 (in red) has been given triple weight. Notice that when right-clicking in the waveform a dotted horizontal line appear and a channel is highlighted in the channel column. This points to which trace will be modified.*

Add Bar	*Add a bar; see chapter 4.28.1.*
Reposition	
A-bar	*Reposition the A-bar to the cursor location. Hot Key: SHIFT + A.*
B-bar	*Reposition the B-bar to the cursor location. Hot Key: SHIFT + B.*
Ds-bar	*Reposition the Ds-bar to the cursor location (available when Active Range is enabled).*
Dp-bar	*Reposition the Dp-bar to the cursor location (available when Active Range is enabled).*
More Bars	*Reposition other bars to the cursor location, including new added bars.*
Trace Type	
Square	*Display traces with vertical edges; this is the default option.*
Sawtooth	*Display traces with gradually ascending/descending edges.*
Packet Name	*Display abbreviated (initials) or full packet name.*
Find Pulse-width	*Find the pulse-width of a signal.*

Table 4:38 Waveform area; right-click menu description

Figure 4-62 is shown when the user right-clicks in the Channel Column in Waveform View.

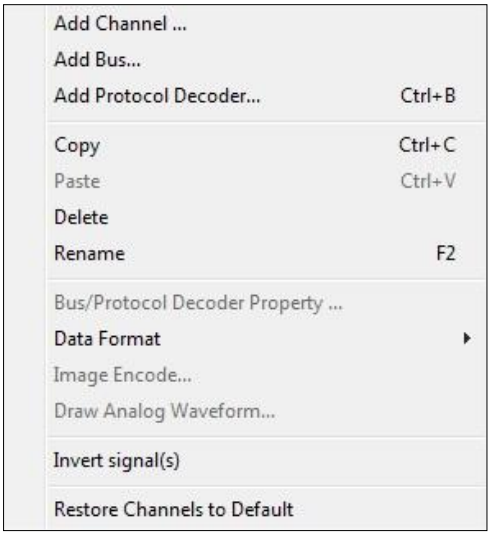


Figure 4-62 Channel/Bus column; right-click menu

Item	Description
Add Element	
Add Channel	*Add a channel; see chapter 4.14.*
Add Bus	*Add a bus; see chapter 4.15.*
Add Protocol Decoder	*Add a protocol decoder; see chapter 4.16.*

Clipboard / Format	
Copy	*Copy the selected channel or bus. Left-click with the mouse can be combined with pressing and holding SHIFT to select several channels or with CTRL to select a range of channels. Hot Key: CTRL + C.*
Paste	*Paste the copied channel(s) or bus(es). Hot Key: CTRL + V.*
Delete	*Delete the selected channel(s) or bus(es). Hot Key: DELETE.*
Rename	*Rename the selected channel or bus. This option is not available when multiple channels or buses are selected. Hot Key: F2.*
Functions	
Bus/Protocol Decoder Properties	*Access the bus or protocol decoder properties; see chapter 4.15 and 4.16. This item is only available when right-clicking on a bus and which menu is opened depends on whether a protocol decoder is assigned or not to the bus.*
Numeric Base / Encoding	*Change the data format; see chapter 4.60.*
Image Decode	*Display the data as an image; see chapter 4.33.*
Draw Analog Waveform	*Draw an analog waveform to indicate the change of state; see chapter 4.36.*
Invert	*For traces, display high levels as low and vice versa. Inverted traces are drawn with dotted lines and a horizontal, blue bar is shown above the channel name. All channels can be inverted independently. See Figure 4-63.*
Restore Channels to Default	*Restore all Bus/Channels settings to default.*

Table 4:39 Channel column; right-click menu description

NOTE Move the cursor to the bottom line of channel, the cursor will turn into an icon showing a two-sided arrow cut horizontally by a bar. Click and hold the left key and drag to adjust the height of trace.

Figure 4-63 shows an inverted signal. Note that the trace has become dotted and that a blue bar appears above the channel name (A3).

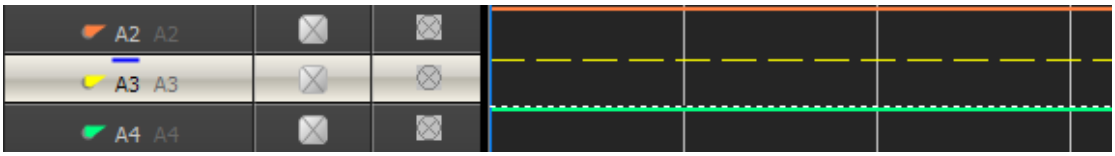


Figure 4-63 Signal inversion example; signal A3 is inverted

When right-clicking in the trigger column, the menu from Figure 4-64 is shown. The menu is used to set the channel's trigger condition as an alternative to clicking through the trigger box for the right condition.

Figure 4-64 Trigger colum; right-click menu

Item	Description
Indifferent	*No trigger condition.*
High	*Trigger on a high level, i.e. the state of the signal is 1.*
Low	*Trigger on a low level, i.e. the state of the signal is 0.*
Rising Edge	*Trigger on a change of state of the signal from 0 to 1 (low to high).*
Falling Edge	*Trigger on a change of state of the signal from 1 to 0 (high to low).*
Either Edge	*Trigger on a change of state of the signal; either from 0 to 1 (low to high) or from 1 to 0 (high to low).*
Default	*Reset the trigger conditions of all channels.*

Table 4:40 Trigger column; right-click menu description

When right-clicking in the trigger column, the menu from Figure 4-65 is shown.

Figure 4-65 Bar; right-click menu

Item	Description
Set As Trigger Condition	*Set the trigger condition of each channel to equal the state (or edge) of the channel where the selected bar is located.*
Delete Bar	*Delete the selected bar.*
Delete All Added Bars	*Delete all added bars.*

Edit Bar Comments	*For user-added bars: Add a comment after the bar name. Ex: Add START to bar A2 to display the name as A2 (START). Comments can be maximum 10 characters long.*

Table 4:41 Bar; right-click menu description

NOTE The T-bar has no right–click menu.

NOTE The A-bar, B-bar, Ds-bar and Dp-bar cannot hold comments or be deleted.

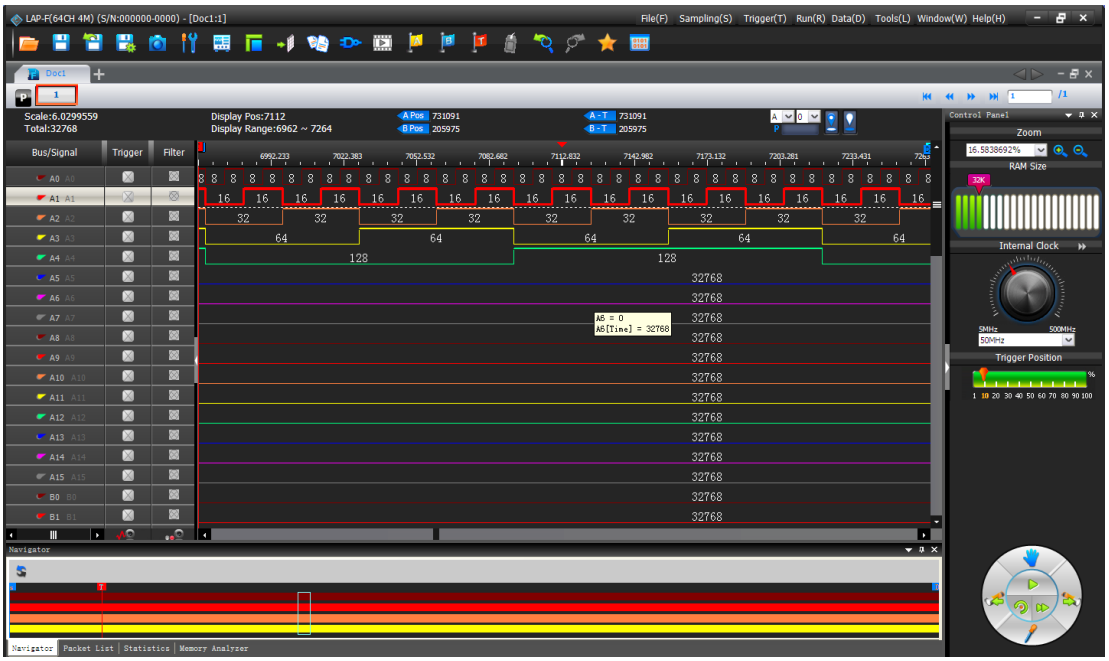


Figure 4-66 Example of trace formatting (ch. A1 has 3pt thickness)

4.48.2. State List

State List is a numeric view of the samples. As an alternative to the waveform traces, the State List shows all samples as digits. If the logic state of a signal is low then “0” is shown and if it is high then “1” is shown. Unknown states are shown as “U”. Each column shows the samples of one channel and the leftmost column shows the sampling time. The State List view is shown in Figure 4-67.

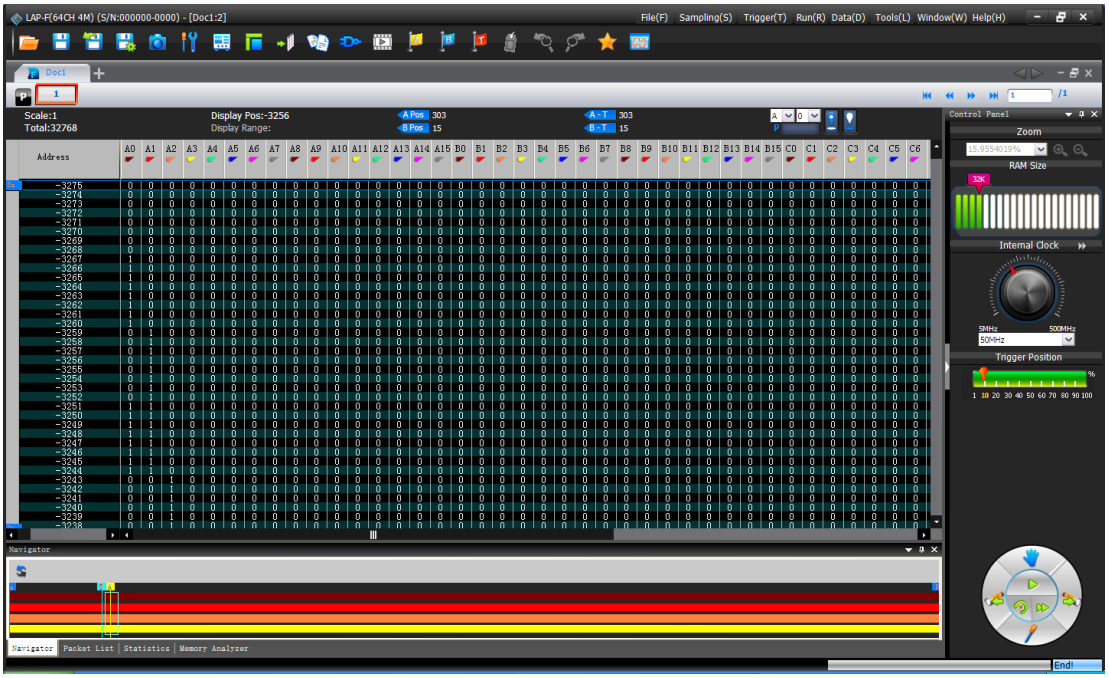


Figure 4-67 State List view

Note that there are three main presentations of the samples in the State List. One option is to show all samples. Alternatively, the user can select to display only those samples that include at least one change of state or in data. Table 4:42 shows an example of how this works: Samples #1, #2 and #3 are shown if the user views all samples. If the user chooses to show changes in state only then Sample #2 will be hidden, as all channel states are identical to those of sample #1. The purpose of showing samples with changes in state only is to facilitate observation by reducing the quantity of displayed data. Likewise, the user can choose to only show samples where there has been a change in the data; see an example of this in Figure 4-69.

NOTE No view mode will delete samples, only hide them.

Timestamp		ch. A1	ch. A2	ch. A3	ch. A4
0 ns	*(sample #1)*	*1*	*1*	*1*	*1*
5 ns	*(sample #2)*	*1*	*1*	*1*	*1*
10 ns	*(sample #3)*	*1*	*0*	*1*	*1*

Table 4:42 State List example; change of channel state

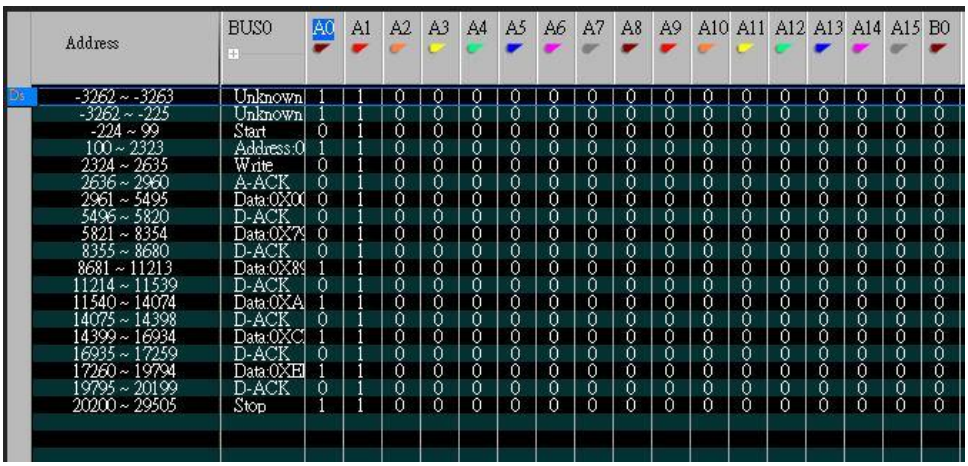
These presentation modes can be selected from by right-clicking in the State List number area; see Figure 4-68.

Figure 4-68 State List view; right-click menu in the number area

Item	Description
Add Bar	*Add a new bar to mark a sample in the list. The bar is added to the line where the cursor is placed. Contrary to the waveform bars, bars in the State List are horizontal since each line represents a time stamp.*
Reposition	
A-bar and B-bar	*Reposition the A- or B-bar to the cursor position.*
Ds- and Dp-bar	*Reposition the Ds- or Dp-bar to the cursor position. This option is only available if "Active Range" has been activated.*
More Bars	*Reposition another bar to the cursor position.*
Data Display	
All Data	*All samples are shown; this is the default display mode.*
Show changes in state only	*Hide samples with timestamp X if no signal has changed state from timestamp X-1 to timestamp X.*
Show changes in data only	*Hide samples with timestamp X if no data has changed from timestamp X-1 to timestamp X (for buses only); see Figure 4-69.*

Table 4:43 State List view; right-click menu in the number area

Figure 4-69 shows an example of the "Show changes in data only" function; had the function not been active there would have been tens of thousands of lines (one per sample) instead of twenty-something.



Address	BUS0	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	B0
-3262 ~ -3263	Unknown	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-3262 ~ -225	Unknown	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-224 ~ 99	Start	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100 ~ 2323	Address:0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2324 ~ 2635	Write	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2636 ~ 2960	A-ACK	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2961 ~ 5495	Data:0X00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5496 ~ 5820	D-ACK	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5821 ~ 8354	Data:0X79	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8355 ~ 8680	D-ACK	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8681 ~ 11213	Data:0X89	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11214 ~ 11539	D-ACK	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11540 ~ 14074	Data:0XA	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14075 ~ 14398	D-ACK	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14399 ~ 16934	Data:0XC	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16935 ~ 17259	D-ACK	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17260 ~ 19794	Data:0XE	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19795 ~ 20199	D-ACK	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20200 ~ 29505	Stop	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 4-69 Show changes in data only example (I2C)

In State List view, the menu from Figure 4-70 is shown when right-clicking in the channel row above the number area.

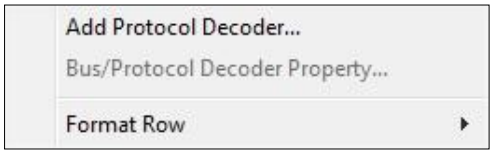


Figure 4-70 Channel/Bus (State List view); right-click menu

Item	Description
Add Protocol Decoder	*Add a protocol decoder; see chapter 4.16.*
Protocol Decoder Properties	*Set the protocol decoder properties; see chapter 4.16. This menu item is only available when clicking on a bus.*
Format Row	*Change the channel order or resize the column widths.*

Table 4:44 Channel/Bus (State List view); right-click menu description

4.49. Refresh

After the “Active Range” is activated, users can click it to refresh the selected data.

4.50. Zoom

Zooming can also be achieved using the mouse while holding CTRL; see chapter 4.47. Note also that all zoom functions are unavailable in the State List view.

4.50.1. In

Zoom in the waveform.

Hot Key: Z.

4.50.2. Out

Zoom out the waveform.

Hot Key: SHIFT + Z.

4.50.3. Fit to Screen

Show all data between Ds and Dp in the waveform view area.

Hot Key: CTRL + ALT + P.

4.50.4. Previous

Cancel the last zoom. In other words; go back to the previous zoom level.

Hot Key: CTRL + Z.

4.50.5. Cancel Previous

Undo the previous zoom command.

Hot Key: CTRL + Y.

4.51. Control Panel

The Control Panel provides direct access to important acquisition and triggering settings and thereby helps to speed up the user's interaction with ZP-Logic. An

example could be when the user wishes to redo a capture with a higher sample rate. The Control Panel is located in the rightmost part of the window estate.

See Figure 3-2 for the Control Panel right-click menu.

Item	Description
Zoom	*Adjust the waveform zoom level; see chapter 4.50.*
Memory depth	*Select the memory depth per channel; see Table 4:16.*
Sampling Mode	*Adjust the sample rate by selecting a value from the pull down menu, inputting a value by hand or by dragging the pointer of knob. Click the grey, double arrows to switch between external and internal acquisition mode; see Table 4:16 for explanations of these.*
Trigger Position	*The trigger position determines which samples are stored. At 10%, 10% of the available memory is allocated to pre-trigger data and 90% to post-trigger data.*
Action Wheel	*See Figure 4-71 and Table 4:46.*

Table 4:45 Control Panel description

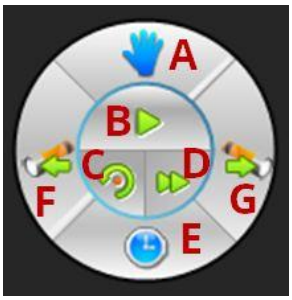


Figure 4-71 Action Wheel

#	Item	Description
A	*Cursor type*	*Switch between cursor types Hand and Pointer; see chapter 4.47.*
B	*Single Capture*	*Capture once; see chapter 4.22.*
C	*Autocapture*	*LAP-F1 selects the optimal sample rate and samples; see chapter 4.25.*
D	*Repeated Capture*	*Capture on regular intervals; see chapter 4.23.*
E	*Trace information*	*Show information inside the traces (between two edges); see the available information types in Table 4:11. Note that there needs to be sufficient space between the edges for information to be shown. See Figure 4-72 as an example of times being displayed.*
F	*Previous*	*Center the display around the previous event that satisfies the Condition Set of the Find function.*

G	Next	Center the display on the next event that satisfies the Condition Set of the Find function.

Table 4:46 Action Wheel description

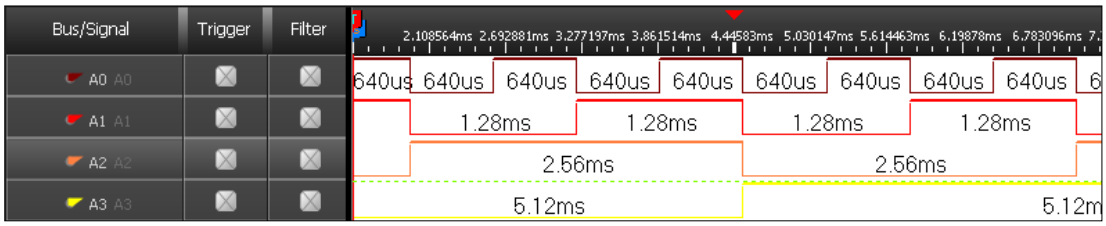


Figure 4-72 Time between two edges is displayed inside the traces

4.52. Memory View

Memory View lets users see what the memory looks like after the signals have been transmitted. By decomposing the packets into basic elements, the relationship between data and addresses in a protocol is clarified. The Memory View window is located in the Secondary Display Area.

Concretely, the Memory View window consist of tables that show which data have been read from- and written to which address in the memory. Write data are written in blue; Read in blue; see an example of read data in Figure 3-1.

Two view modes can be accessed by right-clicking: Compact (default) and Full. The Compact Mode saves space as the information is presented in a matrix form; addresses are found by adding the column number/letter to the end of the row name, and the data located at that address is read directly from the intersection of the row/column.

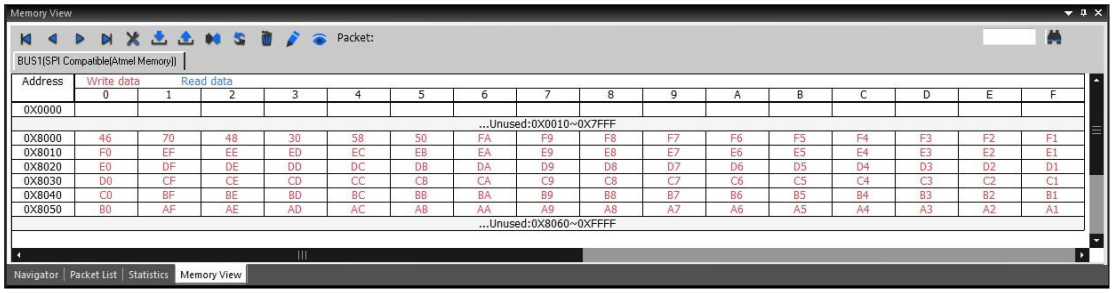


Figure 4-73 Memory View window showing an SPI protocol

Item	Description
	*Navigation buttons: Move between packets. The packet in focus will be in the middle of the waveform view area and marked by the reaction bar (A-bar by default). The packet data will be displayed in the Memory View window.*
	*Options; See Table 4:48.*
	*Import/Export/Merge: Users can import, export or merge .txt and .csv file for display in the Memory View or another software.*
	*Refresh.*
	*Reset: Delete the data in the Memory View window.*
	*Write Operation: The last written data will be shown in the cells as red text on white background. If there is incongruence between read and written data to the same address then errors will be shown on yellow background.*
	*Read Operation: The last read data will be shown in the cells as blue text on white background. If there is incongruence between read and written data to the same address then errors will be shown on yellow background.*
Packet	*Show the number of the packet where the reaction bar is located.*
	*Find: Input an address to look it up and highlight it with a blue frame.*

Table 4:47 Memory view description

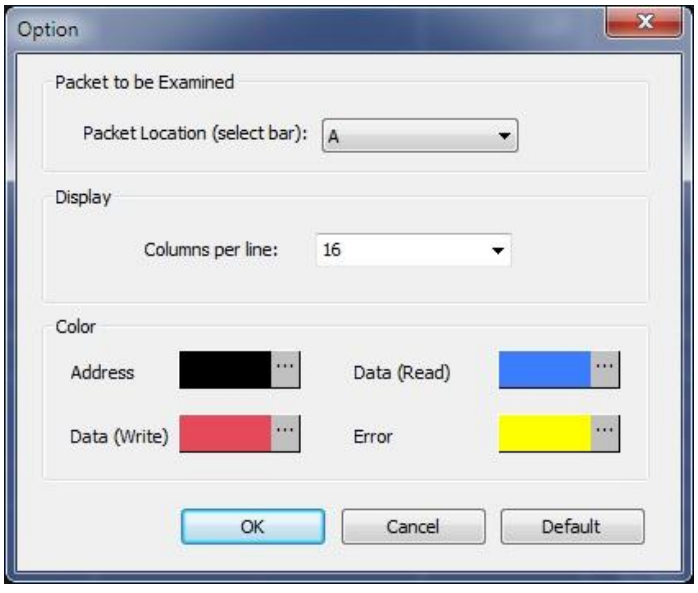


Figure 4-74 Memory View options dialog box

Item	Description
Packet Location	*The Memory View will analyze the packet that is located under the selected bar; the A-bar is selected by default. Note that the Ds, Dp and T-bars cannot be chosen.*
Columns per line	*Choose how many cells to display per line. 4-100 is the permitted range; 16 is default.*
Color	*Change the color settings.*

Table 4:48 Memory View options dialog box description

4.53. Navigator

The Navigator is a condensed form of the main waveform that is always zoomed to fit the entire capture of the pages in focus (see PageSize in Table 4:6). It facilitates waveform navigation by providing an overview of the entire acquisition and a tool for quick movement between distant parts of the acquisition. The Navigator is synchronized with the main waveform so users can shift the waveform focus from one part of the acquisition to another simply by clicking in the Navigator.

A light blue frame (in the left part of Figure 4-75) in the Navigator indicates which part of the waveform that is in focus; this frame naturally changes size when zooming as it is inverse proportional to the zoom rate. Four signals are shown at a time; scroll up or down to focus on other channels.

The Navigator is show by default under the waveform area in the Secondary Display area; see Figure 4-75.

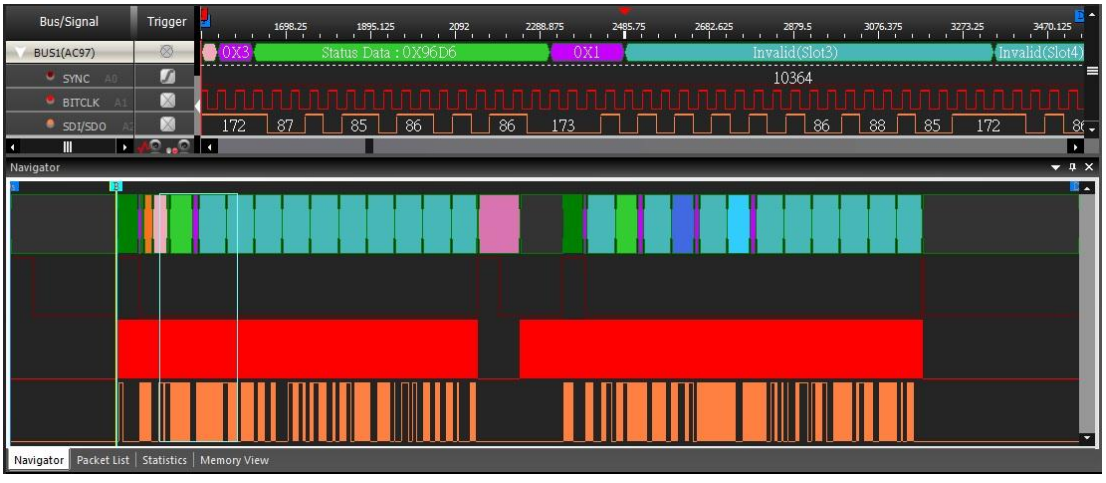


Figure 4-75 Navigator window example showing the AC97 protocol

4.54. Packet List

The Packet List shows all the acquired packets in their decomposed form. By presenting the packets in list form, the Packet List facilitates observation and analysis of all packets and their relation. Only packets under a protocol decoder can be displayed. The Packet List is located in the Secondary Display area; see Figure 4-76.

If packet in the Packet List is double-clicked, the waveform display focuses shifts focus to the location of that packet.

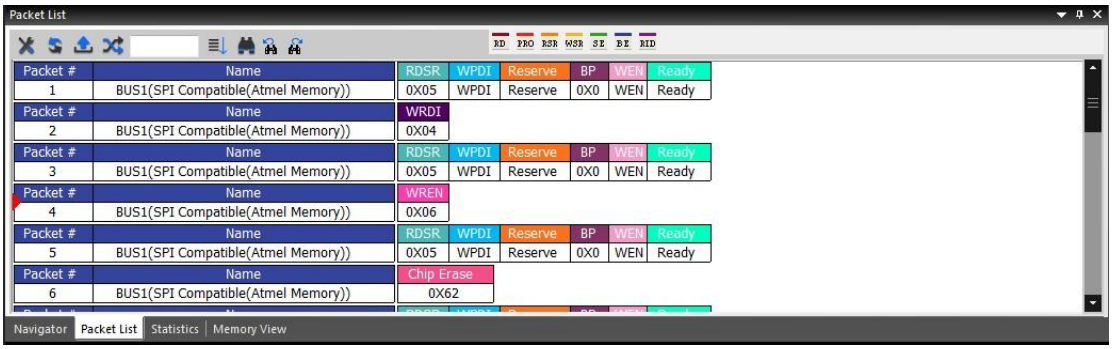


Figure 4-76 Packet List window example showing an SPI protocol

Item	Description
Menu Bar	
	*Settings; Open the Packet List Settings dialog box; see Figure 4-77.*
	*Refresh the content.*
	*Export: Export the packet list; see chapter 4.7.1.*
	*Synchronize Navigation; see Figure 4-78*
	*Find particular packet. This is only number search?*
	*it would go to the 6th packet, it would be displayed at the top of packet list. it would be displayed the first packet of String at the top. For strings.*
	*Go to the previous or next packet that satisfies the Find condition.*
Display Area	
Packet#	*The packet number is given by ZP-Logic and unrelated to the packet content.*
Name	*The packet name.*
Time Stamp	*The packet start point.*
Data	*The data in the packet.*

Length	*The length between the start point and the end point.*

Table 4:49 Packet List Items description

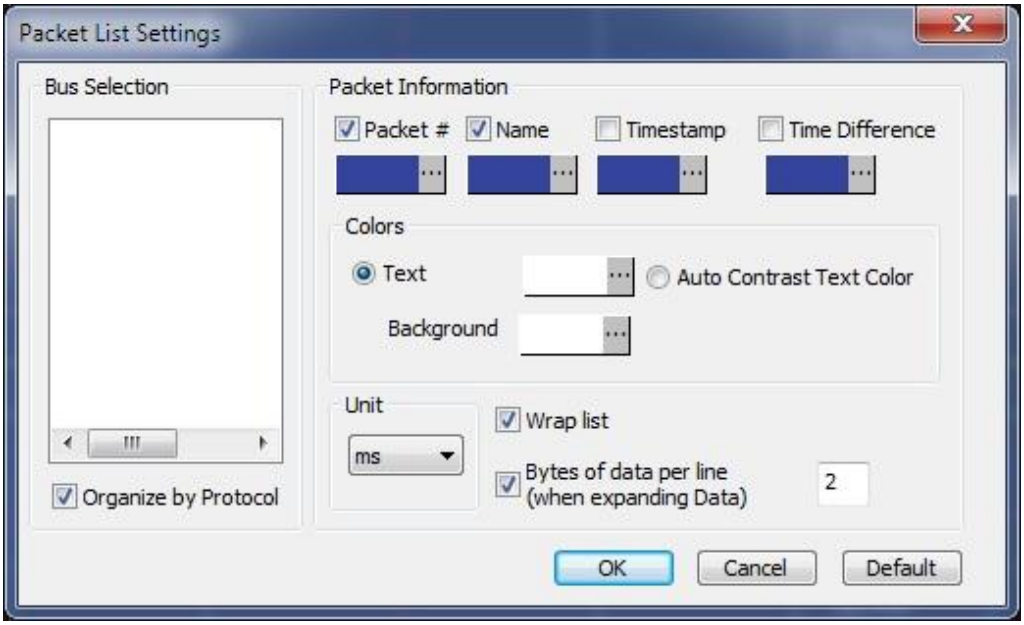


Figure 4-77 Packet List Settings

Item	Description
Bus Selection	*Select the buses to be displayed; all are selected by default.*
Packet Information	
Packet #	*Select the items to be displayed and their colors.*
Name	*Include the names of the packets.*
Timestamp	*Packet timing; the first being defined as zero.*
Time Difference	*Time difference from packet X to packet X-1.*
Colors	
Text	*Change the text color; by default it's white.*
Auto Contrast Text Color	*Automatically select text colors that contrast their background colors.*
Background	*Change the Packet List background color.*
Unit	*Change the time unit which is ms by default.*
Wrap list	*If a packet contains too much data for all to be shown on one line, it is shown over two or more lines; selected by default.*
Bytes of data per line	*When Wrap List is enabled, select how much data to be shown per line (between 1 and 64); applies to Data only.*
Organize by Protocol	*Classify the buses according to their protocol.*

Table 4:50 Packet List Settings description

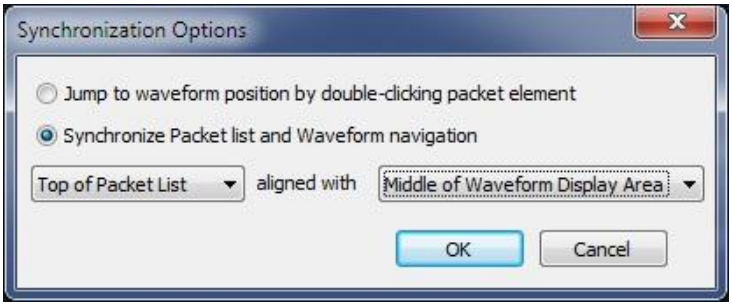


Figure 4-78 Packet List Settings / Synchronize navigation

Synchronize Navigation	
Synchronization	
Jump to waveform position by double-clicking packet element	*When double-clicking a packet in the Packet List, the focus of the waveform is centered on that packet.*
Synchronize Packet List and Waveform navigation	*When panning in the waveform, the focus of the Packet List shifts to the packet shown in the waveform, and vice versa.*
Alignment	
Top of Packet List	*The top Packet List element is used as reference point for synchronization.*
Middle of Packet List	*The middle of the Packet List is used as reference point for synchronization.*
Middle of Waveform Display Area	*The middle of the waveform is used as reference point for synchronization.*
Left of Waveform Display Area	*The left part of the waveform is used as reference point for synchronization.*

Table 4:51 Packet List Settings / Synchrovize navigation description

Figure 4-79 shows the menu that is shown when right-clicking in the Packet List.

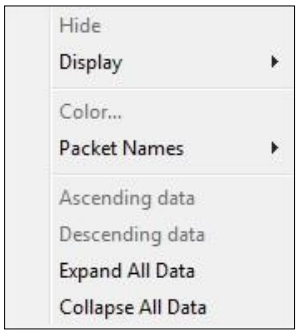


Figure 4-79 Packet List Right-click menu

Item	Description
Hide	*Hide the current selection of packets.*
Display	*Display the hidden packets.*
Color	*Change the packet color.*

Packet Name	*Show full or abbreviated packet names.*
Ascending	*Arrange the packets in ascending order.*
Descending	*Arrange the packets in descending order.*
Expand/Collapse All Data	*Only some Protocol Decoders support this function.*

Table 4:52 Packet List Right-click menu description

4.55. Statistics

Statistics Window is under the waveform view area after activated; it displays the quantity of positive and negative periods in a specific time range.

The Statistics window facilitates counting of signal transitions for each channel. Specifically, *Full-*, *Positive-* and *Negative periods* are all counted. *Conditional* counters are also shown; these count all periods that are shorter or longer than a set of user defined conditions. Finally, it is also possible to adjust the data range, i.e. to only count activity within a certain range of the total acquisition.

The Statistics window is shown in Figure 4-80; it is open by default and located in the Secondary Display area.

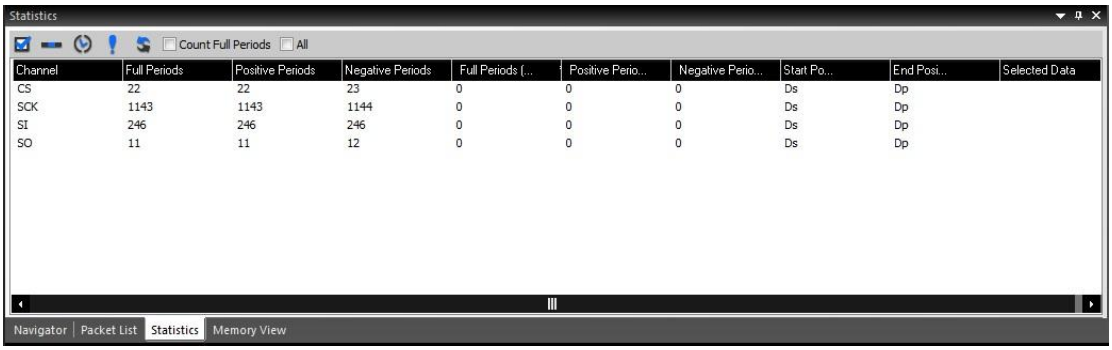


Figure 4-80 Statistics window example showing an SPI protocol

Item	Description
	*Channel Selection; see the dialog box in Figure 4-81.*
	Customize; decide which counters to show; except Probe (name) all parameters are selected by default; see the dialog box in Figure 4-82.
	*Filter; only count periods that fit the filter conditions. This function is not activated by default; see the dialog box in Figure 4-83.*
	*Highlight signals; mark channels that don't fit the filter conditions in red; see the dialog box in Figure 4-84.*
	*Refresh; re-run the counters if there has been any change to the acquisition or the settings.*
Count full periods only	*Periods that don't have both a rising and a falling edge will not be counted.*
All	*Consider all the acquired data. This function requires the processing of temporary files; see chapter 4.6.*

Table 4:53 Statistics window description

Figure 4-81 Statistics / Channel selection dialog box

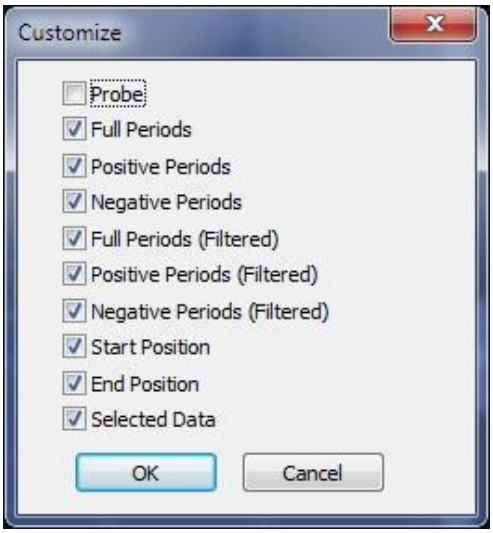


Figure 4-82 Statistics / Customize dialog box

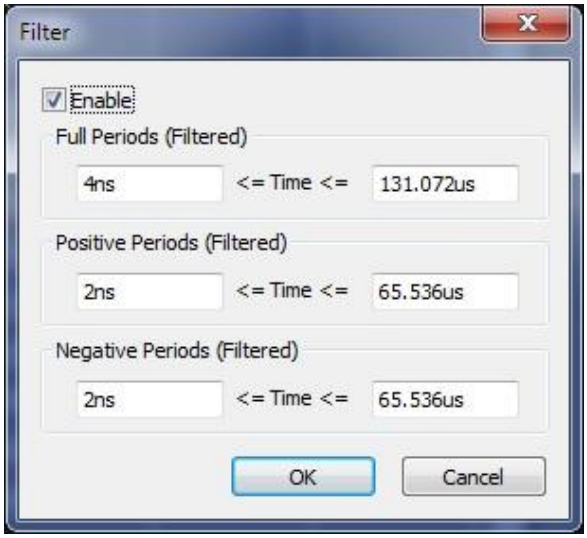


Figure 4-83 Statistics / Filter dialog box

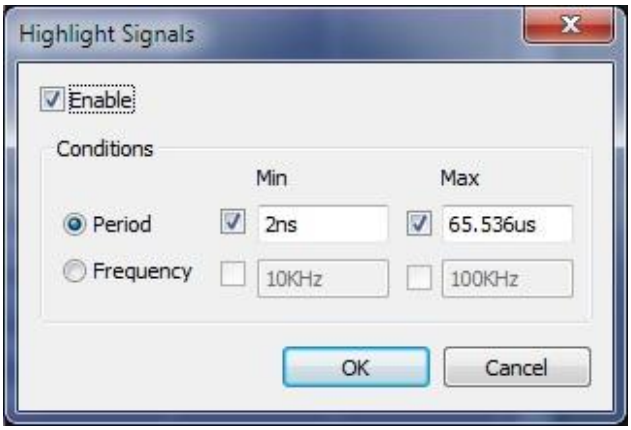


Figure 4-84 Statistics / Highlight signals dialog box

4.56. LTR Monitor

The LTR Monitor window is used to monitor the data transfer between the DUT and the computer when using the Long-term Record function. It is located in the Secondary Display area; see Figure 4-85.

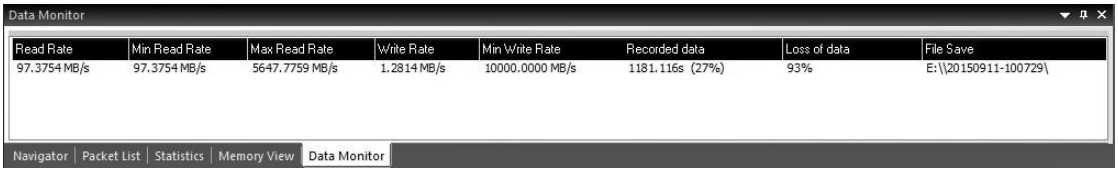


Figure 4-85 TLR Monitor window

NOTE The high Lost Data percentage in the example owes to the screenshot being taken in demo mode.

Item	Description
Read	
Read Rate	*The current rate at which the LAP-F1/2 reads data.*
Min Read Rate	*The minimum rate at which the LAP-F1/2 can read data.*
Max Read Rate	*The maximum rate at which the LAP-F1/2 can read data.*
Write	
Write Rate	*The current rate at which the LAP-F1/2 writes data.*
Min Write Rate	*The minimum rate at which the LAP-F1/2 can write data.*
Max Write Rate	*The maximum rate at which the LAP-F1/2 can write data.*
Recorded Data	*Data quantity currently acquired.*
Loss of data	*Data quantity currently lost.*
File Save	*Location where the acquired data are stored.*

Table 4:54 LTR Monitor window dialog box

4.57. Timing Bar

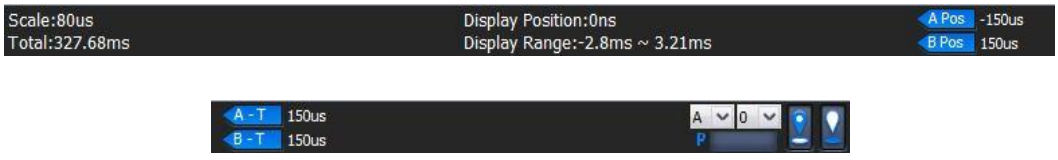


Figure 4-86 Timing Bar

Item	Description
Scale	*The scale is the inverse of the zoom level.*
Total	*Total acquisition time.*
Waveform Center	*Location of the current center of the waveform.*
Display Range	*Timing information for the part of the waveform currently in view.*
	*The position of the A-bar; click to select another bar.*
	*The position of the B-bar; click to select another bar.*
	*Time difference between the A and T-bars; click to select a different range.*
	*Time difference between the B and T-bars; click to select a different range.*
	*Select a bar.*
	*Memory Page on which the bar is located.*
	*Go to the selected bar.*
	*Reposition the selected bar to the current center of the waveform area.*

Table 4:55 Timing Bar description

4.58. Arrange Windows

The windows showing the files (as waveforms or as lists of states) can be moved around freely.

4.58.1. Horizontal

Display the open files above each other.

4.58.2. Vertical

Display the open files next to each other.

4.58.3. Reset Window Locations

Reset all windows to their default positions.

4.59. Split Screen

If more than one screen is connected to the computer ZP-Logic is running on, users can choose to show ZP-Logic on either one of the screens or on both.

4.59.1. Show on All

Show ZP-Logic on both detected screens. The waveform area is amplified to show a larger part of the traces.

4.59.2. Show on Primary

Show ZP-Logic on what is defined as the primary screen.

4.59.3. Show on Secondary

Show ZP-Logic on what is defined as the secondary screen.

4.60.Numeric Base / Encoding

Users can choose among seven types of number systems and encodings for the displayed bus data; see Table 4:56. Hexadecimal is the default format.

Numeric base / Encoding	Description
Binary	*Data are shown using the binary number system.*
Decimal	*Data are shown using the decimal number system.*
Decimal (Signed)	*Data are shown using the signed decimal number system; one bit (the first on the left) is used to specify the sign.*
Hexadecimal	*Data are shown using the hexadecimal number system.*
ASCII	*Data are encoded as ASCII characters; this only works for buses that comprise at least seven signals.*
Gray Code	*Data are encoded as Gray code.*
Complement	*Data are encoded as complements.*

Table 4:56 Available data formats

Help

Press ALT + H to open this Main Menu item with the keyboard.

4.61. Menu Layout

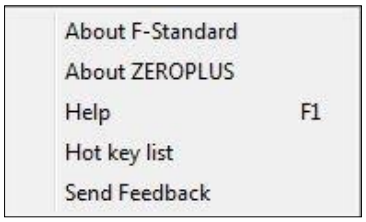


Figure 4-87 Help drop-down menu

4.62. About ZP-Logic

The About ZP-Logic window shows the software version, modification history, the instrument model, serial number and so on; see Figure 4-88. This window is almost identical to the information window shown the first time the ZP-Logic is started.

Figure 4-88 About ZP-Logic information window

4.63. About Zeroplus

The About Zeroplus item on the menu takes the user to the Zeroplus website; this is opened in a new tab in the default web browser.

4.64. Help

Click the Help item to open the Help file. The Help file contains descriptions of the installation procedure and of menus and functions, answers to FAQs etc. It is contains a Search function to facilitate lookups.

Hot Key: F1.

4.65. Hot Keys

The Hot Keys item displays a list of all Hot Keys combinations. Hot Keys are keyboard combinations that the user can press to execute an action or a function without having to open a menu or use the mouse. Some Hot Keys require only a single keystroke.

Users can customize the Hot Keys in the Settings menu; see chapter 4.11.6 for descriptions of the dialog box fields.

Key combination	Description
CTRL + N	Create a new file.
CTRL + O	Open an existing file.
CTRL + F4	Close the active file.
CTRL + S	Save the active file.
CTRL + ↑	Open the previous file that shares the same path and name.
CTRL + ↓	Open the next file that shares the same path and name.
CTRL + P	Print the active file.
CTRL + Alt + I	Print preview.
F5	Start acquisition.
CTRL + F5	Open the Repeated Capture dialog box.

CTRL + U	Increase the sample rate.
CTRL + D	Decrease the sample rate.
CTRL + F	Open the Find dialog box.
CTRL + ←	Go to the previous sample that meets the Find conditions.
CTRL + →	Go to the next find sample that meets the Find conditions.
CTRL + B	Open the Add Channel/Bus dialog box.
CTRL + G	Open the Go To dialog box
Space	Switch cursor type.
Z	Zoom out.
SHIFT + Z	Zoom in.
CTRL + Alt + P	Zoom to fit screen.
CTRL + Z	Return to the previous zoom level.
CTRL + Y	Cancel the last zoom.
F1	Open the Help file.
A	Center the waveform area around the A-bar.
B	Center the waveform area around the B-bar.
T	Center the waveform area around the T-bar.
SHIFT + A	Move the A-bar to the center of the current view.
SHIFT + B	Move the B-bar to the center of the current view.
SHIFT + T	Center the waveform area around the T-bar.
CTRL + Mouse Wheel	Zoom in/out.
←	Move the active bar to the left.
→	Move the active bar to the right.
↑	Move upwards in the channel list/waveform area.
↓	Move downwards in the channel list/waveform area.
CTRL + Page Up	Go to the previous memory page.
CTRL + Page Down	Go to the next memory page.
CTRL + Home	Go to the first memory page.
CTRL + End	Go to the last memory page.
Page Up	Move one waveform window to the right.
Page Down	Move one waveform window to the left.
Home	Go to the front end of the visible area.
End	Go to the tail end of the visible area.
CTRL + C	Copy the selected item(s) in the channel area.

CTRL + V	Paste the copied item(s) in the channel area.
Delete	Delete the selected item.
F2	Rename the selected item.
CTRL + A	Select all channels.
Number Key	Center the waveform around the selected bar (for Added bars).
SHIFT + Number Key	Move the corresponding bar to the center of the current view (for Added bars).
Esc	Cancel
Alt + Letter with a baseline	Perform the menu command (or command of other baseline).
Mouse Wheel	Move left/right in the waveform.
Alt + F4	Close ZP-Logic.
Alt + Space	Open the shortcut menu of the active window
CTRL + Tab	Switch between open files
Alt + Esc	Switch in the order of projects opened

Table 4:57 Hot Key descriptions

4.66. Send Feedback

The Send Feedback form can be used to contact our Technical Support if the user runs into a problem. Users are requested to provide contact information and a description of the problem. Attachments can also be uploaded; see Figure 4-89.

The benefit of using the Send Feedback form to contact the Technical Support is that data and information is automatically added to the communication: file information, instrument model, acquisitions settings, system parameters etc. This information makes it easier for the support team to get to the root of the problem and therefore improves response times.

Users who prefer to contact our Technical Support team by means of regular email should use the following address: service_2@zeroplus.com.tw

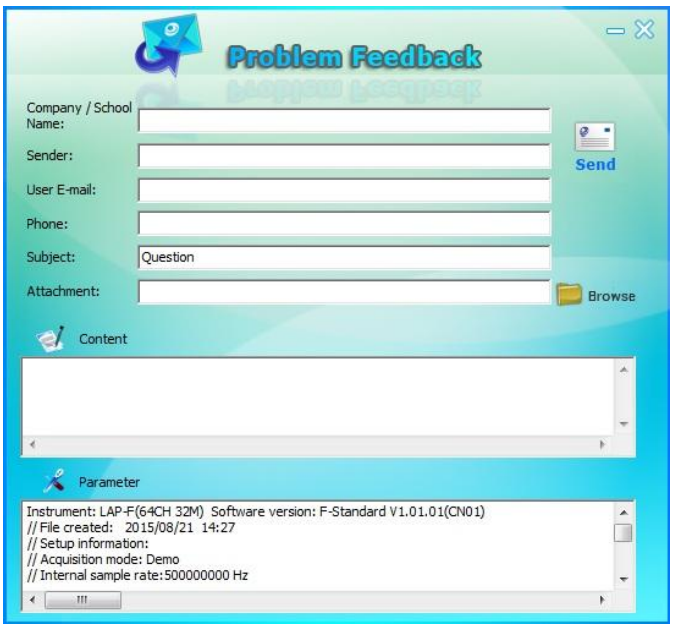


Figure 4-89 Send Feedback dialog box

Item	Description
Contact Information	
Company / School Name	*Name of the senders company / institution*
Sender	*Name of the sender*
User Email	*Sender's email address*
Phone	*Sender's phone number*
Subject	*Sender's brief description of the issue.*
Attachment	*Relevant files, graphs etc can be attached to the form.*
Content	*Elaborate a written description of the issue.*
Parameters	*ZP-Logic automatically adds information about the instrument type, acquisition settings etc. to the file to facilitate problem solving.*

Table 4:58 Send Feedback dialog box description

5. Contact Us

Sales Department	
Email	service_1@zeroplus.com.tw
Phone	+886-2-6620-2225 extension #221 or #311

Table 5:1 Sales department contact info

Technical Support	
Email	service_2@zeroplus.com.tw
Phone	+886-2-6620-2225 extension #374

Table 5:2 Technical support contact info