



TELEDYNE LECROY
Everywhereyoulook™

**Teledyne LeCroy
Envision X84
CSI-2 Protocol Suite**

**User Manual
Version 4.0**

Important Information

Safety and Handling

The circuit boards are delicate and require care in handling and installation. Do not remove circuit boards from their protective plastic coverings or from the shipping box until you are ready to install the boards.

If a board is removed from the chassis for any reason, be sure to store it in its original shipping box. Do not store boards on top of workbenches or other areas where they might be susceptible to damage or exposure to strong electromagnetic or electrostatic fields. Store circuit boards in protective anti-electrostatic wrapping and away from electromagnetic fields.

Disclaimer

In no event shall Teledyne LeCroy be liable for any consequential damages whatsoever (including unlimited damages for loss of business profits, business interruption, loss of business information, or any other losses) arising out of the use of or inability to use this product, even if Teledyne LeCroy has been advised of the possibility for such damages.

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1 About This Manual

Manual Scope and Organization

This manual is intended to describe the capabilities and operation of the Envision X84 Protocol Analyzer and Envision X84 CSI Protocol Suite software application.

Conventions

<code>monospace</code>	examples of syntax and programming examples
bold	denotes items that you must enter or select. Also denotes default conditions of API parameters.
<i>italic</i>	specialized terms, ...

Related Documentation

Envision_X84_v1018 Datasheet

http://teledynelecroy.com/files/pdf/envision_x84_v1018.pdf

Envision X84 Protocol Analyzer API Manual

2 Envision X84 Protocol Analyzer

The Envision X84 Protocol Analyzer has a robust event-based infrastructure that is used for capturing detailed CSI-2 protocol information on a C/D-PHY bus during CSI camera testing. Using this data, real-time viewing of CSI-2, C/D-PHY operation is simple. For example, time correlated viewing of C/D-PHY CSI-2 events, both HS and LP, including errors. Also, per-lane low-level C/D-PHY states can be viewed and correlated with high-level protocol, to debug errors. This document explains the use and operation of the Envision X84 CSI-2 Protocol Suite and the functionality of the Envision X84 Protocol Analyzer.

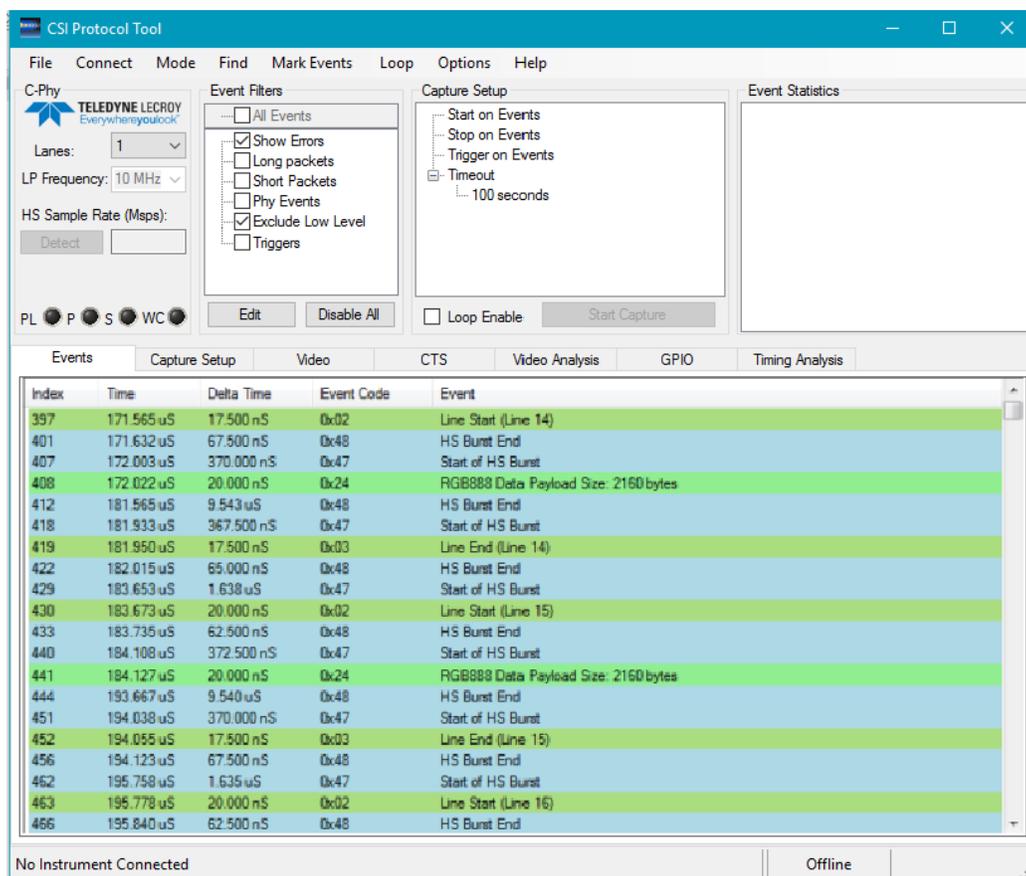


Figure 1 - Envision X84 CSI-2 Protocol Suite

The Envision X84 Protocol Analyzer is connected to the host computer via 1 Gb Ethernet connection and supports up to 3 lanes in C-Phy mode and 4 lanes in D-Phy mode, with frequencies up to 2500 Mps. The Analyzer connects to the device under test with MMCX connectors for each lane.



Figure 2 - Envision X84 Protocol Analyzer

3 Envision X84 CSI-2 Protocol Suite Events Overview

The Envision X84 Protocol Analyzer captures all CSI protocol packet events along with low-level state events and payload data into separate on-board memories. All events are time stamped for detailed time based debugging. The State Event memory is 32MB deep, the Packet Event memory is 256MB deep (each event is 16 bytes) and the Payload memory is 1.5 GB deep allowing the saving of more than 100 images depending on image size and image format.

The Envision X84 CSI-2 Protocol Suite is used to display and analyze the captured events. All events except for Packet Events (item #4 below) are categorized as State Events and are saved in the State Event memory with a specific State Event code. Packet Events are stored in the Packet Event memory with the MIPI CSI-2 Data Type Code, while Long Packet Payload data is stored in the Payload memory.

Below in Figure 3, the specific timing of the low-level state events and the packet event of a CSI-2 transaction is detailed.

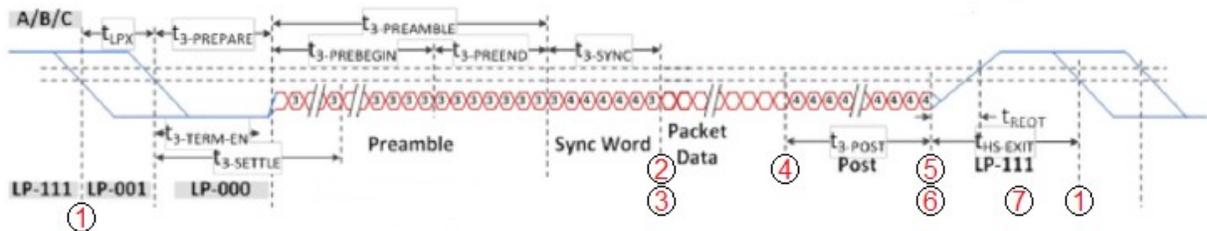


Figure 3 – MIPI C-PHY Timing Diagram

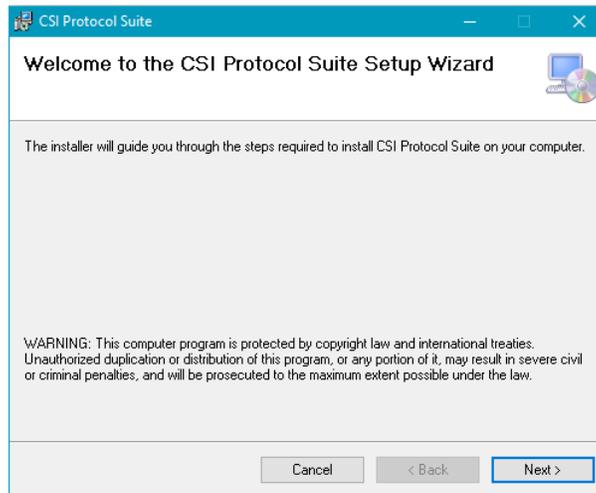
1. Low-level per lane Exit Stop State Events
 - 0x4F - Exit Stop State Lane 0 Event
 - 0x60 - Exit Stop State Lane 1 Event
 - 0x6B - Exit Stop State Lane 2 Event
 - 0x76 - Exit Stop State Lane 3 Event (D-PHY Only)
2. Low-level per lane Enter HS Mode Events (Sync Word Received)
 - 0x4C - Enter HS Mode Lane 0 Event
 - 0x5D - Enter HS Mode Lane 1 Event
 - 0x68 - Enter HS Mode Lane 2 Event
 - 0x73 - Enter HS Mode Lane 3 Event (D-PHY Only)
3. Start of HS Burst Event – (All Active Lanes Enter HS Mode)
 - 0x47 - Start of HS Burst Event
4. Packet Event – (Packet Data received)
 - CSI Packet Data Type Code Event
5. HS Burst End Event (Post Word Received on any Active Lane)
 - 0x48 - HS Burst End Event
6. Low-level per lane Exit HS Mode Events (Post Word Received)
 - 0x4D - Exit HS Mode Lane 0 Event
 - 0x5E - Exit HS Mode Lane 1 Event
 - 0x69 - Exit HS Mode Lane 2 Event
 - 0x74 - Exit HS Mode Lane 3 Event (D-PHY Only)
7. Low-level per lane Enter Stop State Events
 - 0x4E - Enter Stop State Lane 0 Event
 - 0x5F - Enter Stop State Lane 1 Event
 - 0x6A - Enter Stop State Lane 2 Event
 - 0x75 - Enter Stop State Lane 3 Event (D-PHY Only)

4 Software Installation and Analyzer Setup

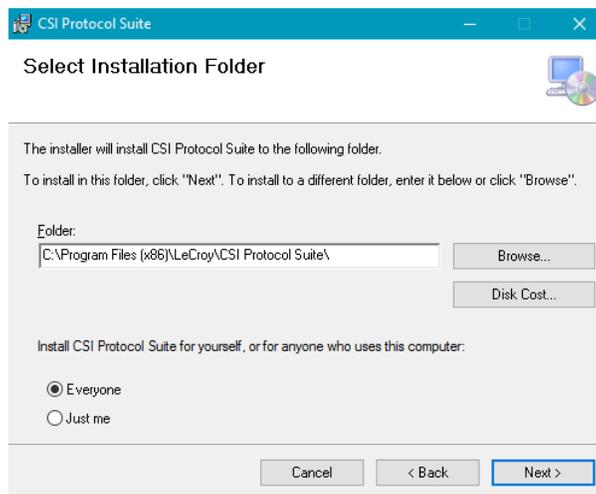
4.1 Installing Envision X84 CSI-2 Protocol Suite

The Envision X84 CSI-2 Protocol Suite is installed with the setup.exe in the installation package available for the Teledyne LeCroy website. [Envision X84 CSI-2 Protocol Suite Analysis Software](#) .

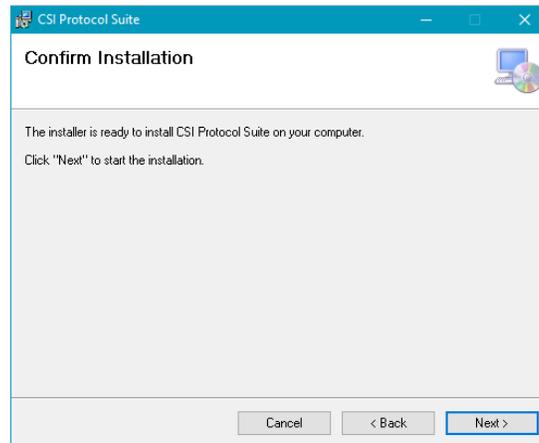
Click on the setup.exe file supplied with the Analyzer to start the installation:



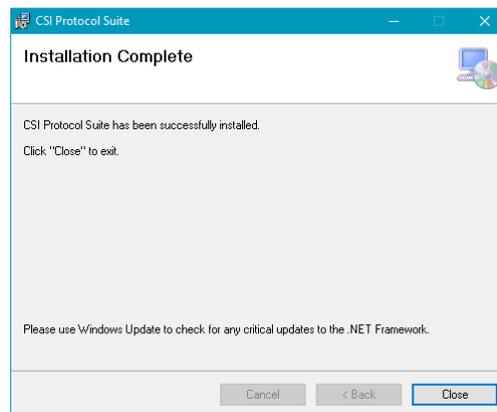
Click the next button to continue:



Leave the installation folder as the default or browse to a specific location. Select who the tool is to be installed for and click the next button to continue:



Click the next button to start the installation (click yes to allow Windows to install the software):



Click close to exit.

Once the software is installed the Envision X84 CSI-2 Protocol Suite can be accessed from the standard Window menus at:

Start/AllPrograms/CSITool.exe

By default, the CSI Analyzer software is located at:

C:\Program Files (x86)\Teledyne LeCroy\CSITool

The following folders and files are created during the installation:

Bin directory - Contains executables and DLL used to control the Analyzer

Envision X84 CSI-2 Protocol Suite.exe - Tool to control the CSI 2.0 Analyzer.

TevCsi.dll - 'C' DLL.

TevCsi.lib – 'C' Library.

NewtonSoft.Json.dll – Utility DLL

CsiConfig.json – Configuration file.

Plugins Directory – Directory containing optional tool plugins

Include directory – Contains 'C' header files

TevCsi.h – CSI Analyzer API header file

TevCsiTypes.h – CSI Analyzer Data Types header file

4.2 Setting up the Envision X84 Protocol Analyzer

Follow the steps below to setup the Envision X84 Protocol Analyzer:

1. Connect the AC Power Cord to the Analyzer
2. Setup host PC Ethernet Port
 - a. Use a unused Ethernet Adapter on the host PC
or use a USB 3.0 to Gigabit Ethernet Adapter
 - b. Set the IP address of the Ethernet Adapter to 192.168.137.1
3. Connect a Ethernet cable from the host PC to the Analyzer
 - a. The IP address of the Analyzer is 192.168.137.100
4. Connect the CSI DUT to the lane inputs using MMCX connectors
5. Power on the Analyzer.

The Analyzer Status LED has three states;

RED – Power applied internal processor not booted

YELLOW – Internal processor booted, waiting for Tool connection

GREEN – Tool connected

Once power is applied and the internal processor boots, launch the Envision X84 CSI-2 Protocol Suite and connect to the Analyzer using the Connect menu.

5 Envision X84 CSI-2 Protocol Suite

The Envision X84 CSI-2 Protocol Suite is used to configure and start captures of CSI 2.0 Protocol Events from the Device Under Test. Using the Envision X84 CSI-2 Protocol Suite GUI users setup the number of events to be captured, view and analyze the captured events, view and analyze any video frames that have been captured.

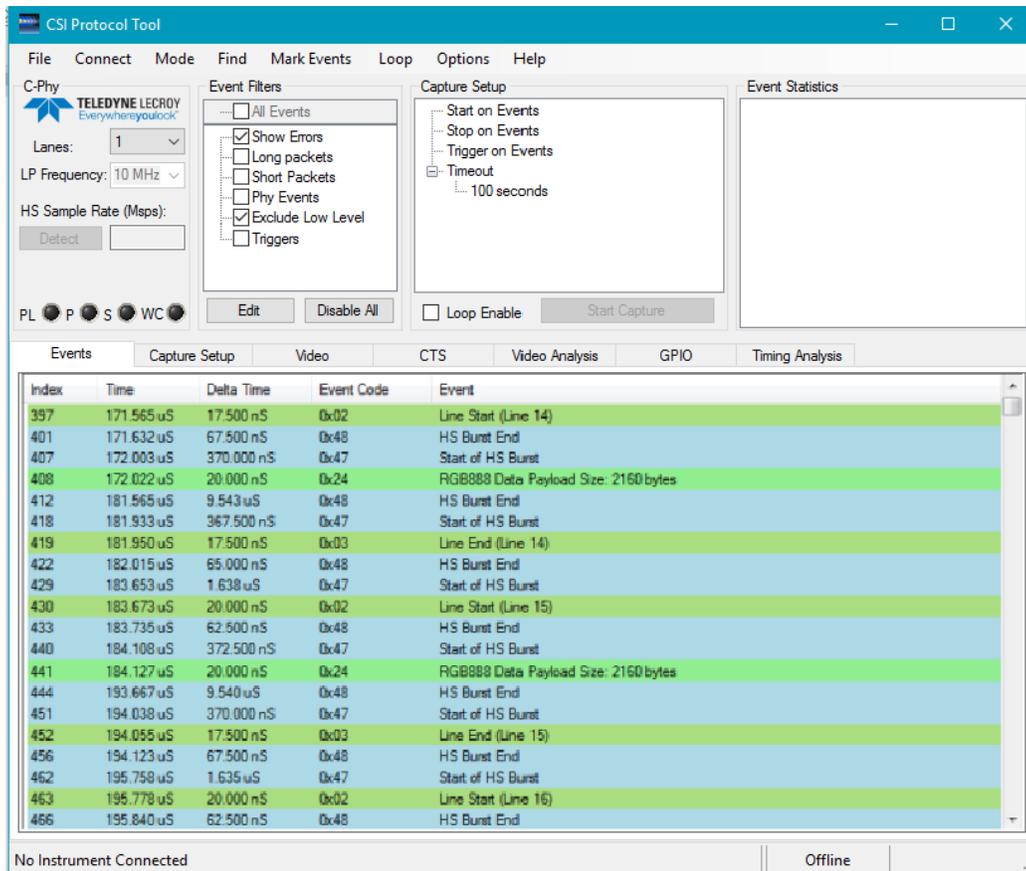


Figure 4 - Envision X84 CSI-2 Protocol Suite

The Envision X84 CSI-2 Protocol Suite GUI is split into halves, the top half, the Control Panel, is used to setup and control the Analyzer and the bottom half, the Analyze Panel, has multiple tabs to analyze and view the captured events and images

5.1 Envision X84 CSI-2 Protocol Suite Control Panel

The Envision X84 CSI-2 Protocol Suite Control Panel is shown in Figure 5, it allows the user to setup the capture criteria and initiate captures. The Control Panel is broken into different sections. The Control Section, the Event Filter Section, the Capture Setup Section and the Statistics Section. Each of these sections are explain in detail below.

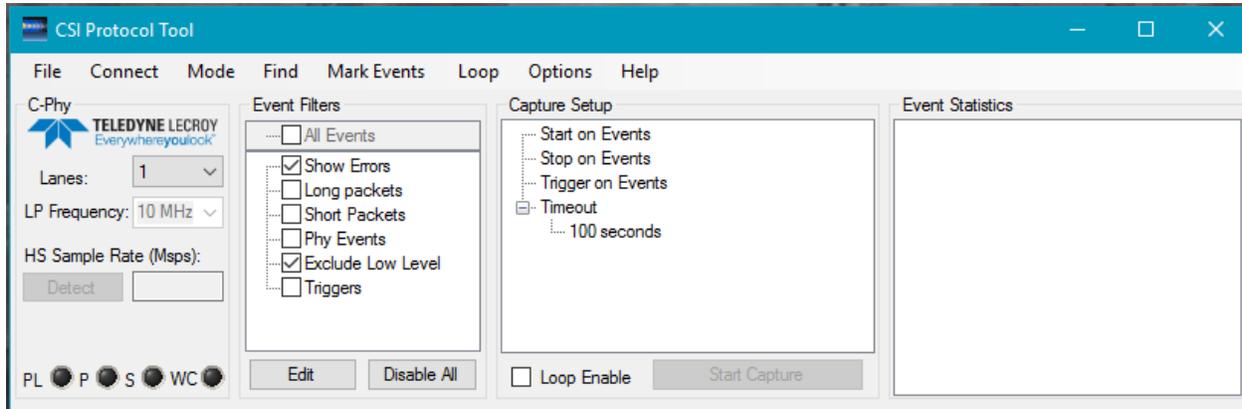


Figure 5 - Control Panel

5.1.1 Control Section

The Control section is used to select the number of lanes to capture using the lanes dropdown **Lanes: 3**. Changing lanes reconfigures the Analyzer to operate on that many lanes. The LP Frequency control is used to set the LP Frequency used during LP Read Responses. The HS Sample Rate displays the HS Sample Rate that the HS data was transmitter in the CPHY Physical Layer and is used to program the HS Sample Rate for the DPHY Physical Layer. The Status Lights display error conditions of the Payload Memory Overflow (PL), Packet Memory Overflow (P), State Memory Overflow (S) and Lane Word Count Mismatch error (WC).

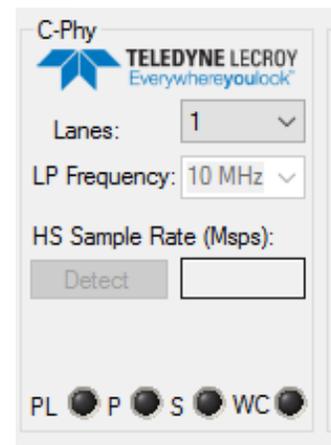


Figure 6 - Control Section

5.1.2 Event Filters Section

The Event Filters section is used filter Events in the Event Viewer. The built-in filters are shown in Figure 7. Selecting any of the filters will display only the selected Events. Selecting the 'Exclude Low Level Events' filter will exclude all Low-Level State events except for the Start of HS Burst (0x47) and HS Burst End (0x48) events from the Events Display. Clicking the button will de-select all the filters and display all the events. The user can add their own custom event filters by click button. This will display the Event Code Filter Dialog.

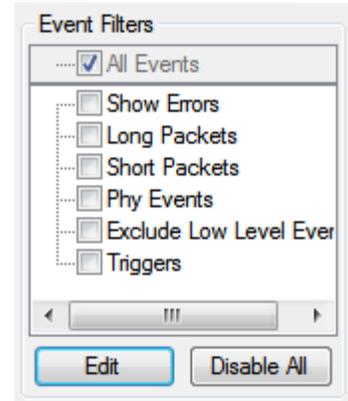


Figure 7 - Filters Section

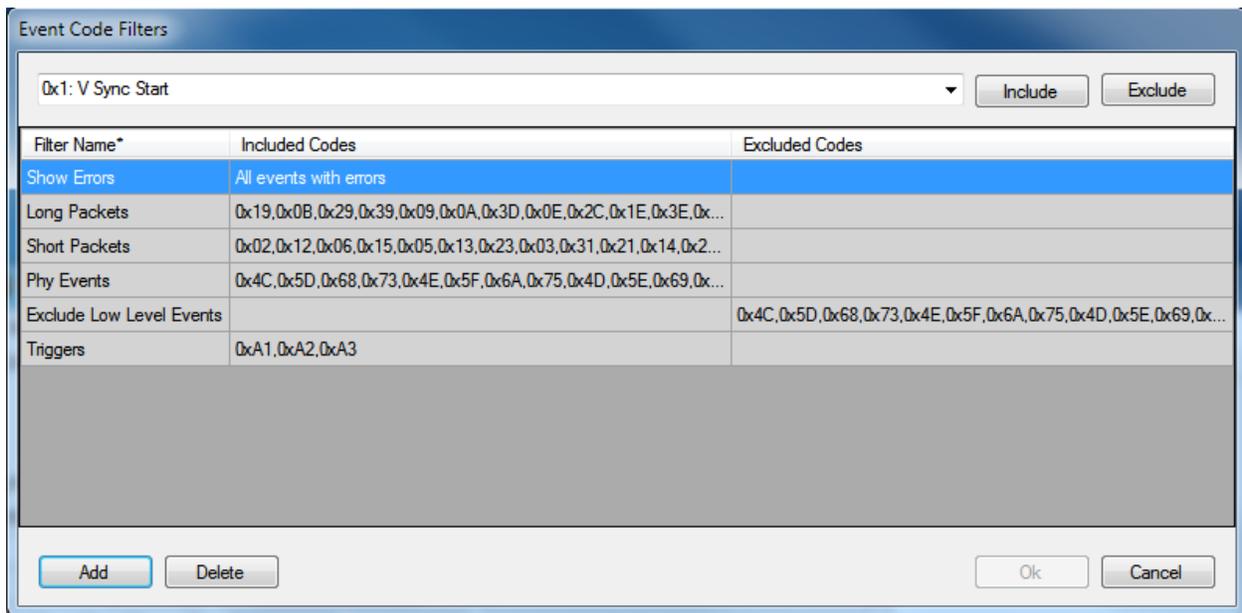


Figure 8 - Event Code Filters Dialog

The Event Code Filters Dialog displays the current Event Filters. The user can add or delete any custom event filters. Filters can include event code and/or exclude events codes from the event display. Included code will be displayed if the filter is selected, while excluded codes will not be displayed. To create a custom filter, click the

button to add a row to the filter table. Enter the name of the filter, and then add codes to the Included Codes by selected the Event Code from the code dropdown list and click the button, use the to exclude the code.

5.1.3 Setup Section

The Setup section is used display the current protocol capture criteria setup. The capture criteria is set in the Capture Setup Tab (explained below in Section 5.2.2), the user can specify what specific event can Start and Stop the protocol capture along with specifying what event can cause an external trigger pulse. A Wait time (if no events are specified) or timeout can be set to stop the capture after a specific amount of time.

The  button is used to initiate a capture of the CSI traffic. The  checkbox is used enable the Loop Capture option. While looping the Envision X84 CSI-2 Protocol Suite can check for event and/or video errors. (See the Loop explanation below) If more than one event criteria are set the capture starts or completes on the first occurrence to meet the criteria.

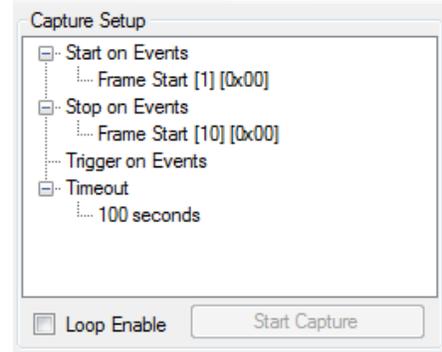


Figure 9 - Setup Section

Right-Clicking in the Capture Setup window will display one of the two context-sensitive pop-up menus that allows for the adding to, clearing, editing or deleting from the setup criteria without having to go to the Capture Setup Tab. Selecting Clear or Delete will delete the selected setup criteria, while selecting Add or Edit menu options will display the Criteria Setup Dialog, where the Event and/or Count can be changed. Double-Clicking on an Event will directly bring up the Edit Event Dialog

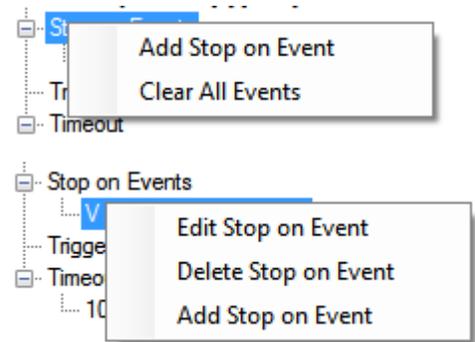


Figure 10 - Setup Popup Menus

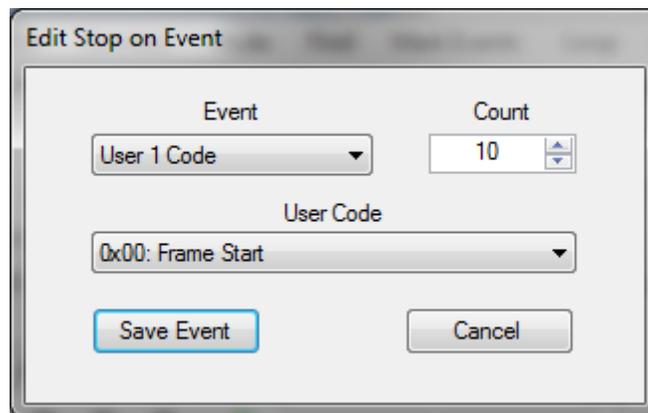
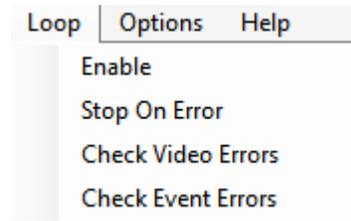


Figure 11 - Criteria Setup Dialog

5.1.4 Looping Captures

The Envision X84 CSI-2 Protocol Suite can loop captures and check for event errors and/or video errors in each looped capture. The Envision X84 CSI-2 Protocol Suite can stop looping on any of the errors, so the faulty event capture can be further analyzed.



Use the **Enable** menu option or click **Loop Enable** to enable the Loop Capture feature. The **Start Capture** button will change to **Start Loop** to signify the tool is in loop mode. To check for Video Errors or Event Errors select the appropriate menu option. Select **Stop On Error** to have the tool stop if an error occurs.

Checking for video errors will compare the captured video to the golden frame as long as the **Compare Frames** option on the Video Tab is checked. See the Video Tab section below. Otherwise the video frames will be display but not checked.

Once looping is started by clicking the **Start Loop** button capturing will be started, the button will change to 'Stop Loop' and when a capture is completed the captured will be re-started until the 'Stop Loop' button is clicked, which will stop the looping after the current capture is complete. Once the 'Stop Loop' button is clicked, the button will change to 'Abort Loop', which allows the user to abort the current capture instead of waiting for it to be completed.

5.1.5 Event Statistics Section

The Event Statistics Section displays the statistics captured during event capture. It displays the number of Short and Long Packets, the Total Packets captured, along with the number of Bursts captured. It also displays any errors that are captured if there are any errors. There are also real time hardware counters for these statistics, the real time statistics can be displayed by selecting **Real Time Statistics** from the Options Menu.

Event Statistics	
Short Packets	20103
Long Packets	134115
Total Packets	154218
Bursts	9901

Figure 12 - Statistics Section

5.2 Envision X84 CSI-2 Protocol Suite Analyzer Panel

The Envision X84 CSI-2 Protocol Suite Analyzer Panel is shown in Figure 13, it is where the captured events and payload data is displayed and analyzed. The Analyzer Panel has multiple Tabs for different functions. The Events Tab is used to view the time stamped events. The Capture Setup Tab is used to set the capture start and stop criteria. The Video Tab is used to display and compare captured image data. The PRBS Tab is used to view PRBS mode word count and error counts. The CTS Tab is used to process the events as they pertain to the CSI-2 Conformance Test Specification and displays the results. The Timing Analysis Tab is used to obtain detailed timing information between different events captured. The Video Analysis Tab is used to obtain the specific Video Frame information of a captured video stream. All the Tabs in the Analyzer Panel are explained in detail below.

Index	Time	Delta Time	Event Code	Event
397	171.565 uS	17.500 nS	0x02	Line Start (Line 14)
401	171.632 uS	67.500 nS	0x48	HS Burst End
407	172.003 uS	370.000 nS	0x47	Start of HS Burst
408	172.022 uS	20.000 nS	0x24	RGB888 Data Payload Size: 2160 bytes
412	181.565 uS	9.543 uS	0x48	HS Burst End
418	181.933 uS	367.500 nS	0x47	Start of HS Burst
419	181.950 uS	17.500 nS	0x03	Line End (Line 14)
422	182.015 uS	65.000 nS	0x48	HS Burst End
429	183.653 uS	1.638 uS	0x47	Start of HS Burst
430	183.673 uS	20.000 nS	0x02	Line Start (Line 15)
433	183.735 uS	62.500 nS	0x48	HS Burst End
440	184.108 uS	372.500 nS	0x47	Start of HS Burst
441	184.127 uS	20.000 nS	0x24	RGB888 Data Payload Size: 2160 bytes
444	193.667 uS	9.540 uS	0x48	HS Burst End
451	194.038 uS	370.000 nS	0x47	Start of HS Burst
452	194.055 uS	17.500 nS	0x03	Line End (Line 15)
456	194.123 uS	67.500 nS	0x48	HS Burst End
462	195.758 uS	1.635 uS	0x47	Start of HS Burst
463	195.778 uS	20.000 nS	0x02	Line Start (Line 16)
466	195.840 uS	62.500 nS	0x48	HS Burst End

Update Time: 0.2 secs Offline

Figure 13 - Analyzer Panel

5.2.1 Event Tab

The Events Tab is where all the captured events are displayed. There are several columns in the Event Table.

- Index Column – Displays the Index of the Event.
- Time Column – Displays the Time Stamp of the Event.
 - To display the time in all in us select Uniform Time from the Options Menu.
- Delta Time Column – Displays the time delta from the event displayed before the event.
- Event Code Column – Displays the event code of the Event.

- Event Column – Displays the description of the Event.

The events in the Event Table are color coded.

- Yellow – Low-Level State Events. These are the per lane low-level events explained in **Error! Reference source not found.**. These events can be filter with the Exclude Low Level Events Filter.
- Blue – Low-Level Burst State Events. These are the burst events explained in **Error! Reference source not found.**. Also Low Power State Events and Trigger Events are displayed in blue.
- Green – CSI Protocol Long Packet Events.
- Dark Green – CSI Protocol Short Packet Events.
- Pink – All events that have will be displayed in pink.

CSI Protocol Packet events will display any parameters (commands and data) in the Event description. Also Low Power Packets will be marked as such in the description as shown below in Figure 14.

Index	Time	Delta Time	Event Code	Event
1	0.000 μ S	0.000 μ S	0x50	Low Power Data Receive Mode Lane 0
2	3.405 μ S	3.405 μ S	0x15	DCS Short Write 0xFF 1 Parameter 0xD0 Low Power Packet
5	35.725 μ S	32.320 μ S	0x50	Low Power Data Receive Mode Lane 0
6	39.130 μ S	3.405 μ S	0x15	DCS Short Write 0xFB 1 Parameter 0x1 Low Power Packet
9	67.178 μ S	28.047 μ S	0x50	Low Power Data Receive Mode Lane 0
10	70.588 μ S	3.410 μ S	0x15	DCS Short Write 0xAB 1 Parameter 0x70 Low Power Packet
13	96.603 μ S	26.015 μ S	0x50	Low Power Data Receive Mode Lane 0
14	100.010 μ S	3.408 μ S	0x15	DCS Short Write 0xC0 1 Parameter 0x70 Low Power Packet

Figure 14 - Low Power Packets

Detailed Event Information – Right-Clicking on an event row in the Event Table will display a pop-up with the Detailed Event Information for the event. Along with the information in the event row, the pop-up contains the Count of the specific event along with the Average Time Interval between the specific events. If the event contains payload data the bytes of the payload data is also displayed (up to 80 bytes). This is shown below in Figure 15.

Index	Time	Delta Time	Event Code	Event
3	5.000 nS	5.000 nS	0x48	HS Burst End
10	377.500 nS	372.500 nS	0x47	Start of HS Burst
11	395.000 nS	17.500 nS	0x03	Line End (Line 489)
14	455.000 nS	60.000 nS	0x48	HS Burst End
21	825.000 nS	370.000 nS	0x47	Start of HS Burst
22	842.500 nS	17.500 nS	0x01	Frame End (Frame 1)
23	885.000 nS	42.500 nS	0xA1	Start Trigger Received
26	907.500 nS	22.500 nS	0x48	HS Burst End
33	2.093 μ S	1.185 μ S	0x47	Start of HS Burst
34	2.115 μ S	22.500 nS	0x02	Line Start (Line 490)
37	2.175 μ S	60.000 nS	0x48	HS Burst End
44	12.480 μ S	10.305 μ S	0x47	Start of HS Burst

Event Information
 Code: 0x01
 Count: 22
 Event: Frame End (Frame 1)

Figure 15 - Detailed Event Information Pop-up

- Find Previous (Shift+F3) – Finds the previous occurrence of the find criteria.
- Go to Index (Ctrl+G) –Allows the user to go to a specific index in the event table.
- Go to Time (Ctrl+T) – Allows the user to go to a specific time in the event table.
- Next Error (Ctrl+E) – Allows the user to go to the next error.
- Previous Error (Ctrl-Shift+E) – Allows the user to go to the previous error.

Marking Events – The events in the event table can be marked with commands in the Mark Events Menu and the corresponding shortcuts:

Mark Events	Options	Help
Mark New Block	Ctrl+N	
Mark End Block	Ctrl+M	
Mark Clean	Ctrl+C	

Figure 18 - Mark Events Menu

- Mark New Block (Ctrl+N) – Sets the start event of a new Marked Event Block.
- Mark End Block (Ctrl+M) – Sets the end event of the Marked Event Block. The events between the marked start event and the marked end event will be highlighted as shown in Figure 19. The Statistics Section will display the statistics for the Marked Block instead of all the events and right clicking on an event in the Marked Block will display the count for the block instead of the entire events.
- Mark Clean (Ctrl+C) – Will clear the Marked Block..
- Marking Events can also be done by clicking on an event to set the start of the marked events and then Shift-Clicking an event to set the end of the marked events

Events	Capture Setup	Video	CTS	Video Analysis	Timing Analysis
Index	Time	Delta Time	Event Code	Event	
13	747.500 nS	45.000 nS	0x09	Null Packet	
14	845.000 nS	97.500 nS	0x09	Null Packet	
15	895.000 nS	50.000 nS	0x09	Null Packet	
16	997.500 nS	92.500 nS	0x09	Null Packet	
17	1.035 uS	47.500 nS	0x09	Null Packet	
18	1.275 uS	240.000 nS	0x01	V Sync Start	
19	1.325 uS	50.000 nS	0x31	H Sync End	
20	1.325 uS	0.000 pS	0xA1	Start Trigger Received	
21	1.372 uS	47.500 nS	0x08	End of Transmission	
22	1.410 uS	37.500 nS	0x4E	Enter Stop State Lane 0	
23	1.412 uS	2.500 nS	0x48	HS Burst End	
24	1.415 uS	2.500 nS	0x40	Exit HS Mode Lane 0	
25	22.205 uS	30.870 uS	0x4F	Exit Stop State Lane 0	
26	32.647 uS	362.500 nS	0x4C	Enter HS Mode Lane 0	
27	32.658 uS	10.000 nS	0x47	Start of HS Burst	
28	32.675 uS	17.500 nS	0x09	Null Packet	
29	32.772 uS	97.500 nS	0x09	Null Packet	
30	32.820 uS	47.500 nS	0x09	Null Packet	
31	32.818 uS	97.500 nS	0x09	Null Packet	
32	32.967 uS	50.000 nS	0x09	Null Packet	
33	33.020 uS	92.500 nS	0x09	Null Packet	
34	33.107 uS	47.500 nS	0x09	Null Packet	
35	33.202 uS	95.000 nS	0x09	Null Packet	
36	33.255 uS	52.500 nS	0x09	Null Packet	
37	33.348 uS	92.500 nS	0x09	Null Packet	
38	33.397 uS	50.000 nS	0x09	Null Packet	

Figure 19 - Marked Event Block

5.2.2 Capture Setup Tab

The Capture Setup Tab is used to set current protocol capture criteria setup. The user can specify what specific event can Start and Stop the protocol capture along with specifying what event can cause an external trigger pulse. A Wait time (if no events are specified) or timeout can be set to stop the capture after a specific amount of time.

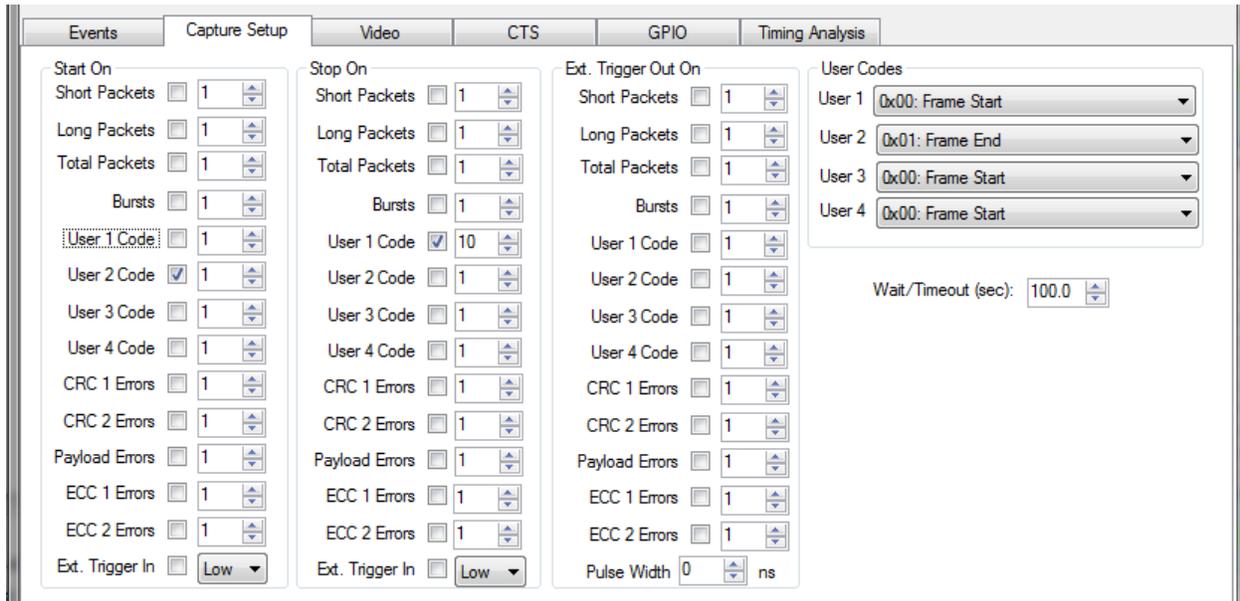


Figure 20 - Capture Setup Tab

To specify an event to start or stop on check the appropriate check box for that specific event or error type and set the number of events to wait for before starting or stopping the capture. If no Start On criteria is set the capture will start immediately. If no Stop On criteria is set the capture will stop after the specified Wait time. If more than one event criteria is set, the first criteria met will start/stop the capture.

External Trigger Out

An external trigger can be pulsed on any event or error type. The pulse width is set with the pulse width control. The pulse width can be set from 1 to 714 ns

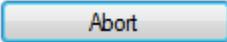
5.2.3 Video Tab

The Video Tab is where the capture images from a CSI Video Stream packet with image payload data are displayed. The raw payload data is read from the Analyzer and converted to a bitmap image and displayed. The Video Tab is hidden if the mode selected from the Mode Menu is PRBS.



Figure 21 - Video Tab

Clicking the  button will read in the raw image data and convert the raw image data to a bitmap and will display the image.

This will be done for all images captured. The  button can be clicked to abort the process of reading and converting images. Optionally, the bitmap image can be compared to a 'Golden'

bitmap image by checking the **Compare Frames** option and browsing

for the 'Golden' bitmap file by clicking the  button. This will display a file chooser dialog to allow the user to select the 'Golden'

file. If the **Compare Frames** option is checked, when  is clicked the process of reading and converting images to bitmaps will also compare the converted bitmap to the "Golden" bitmap.

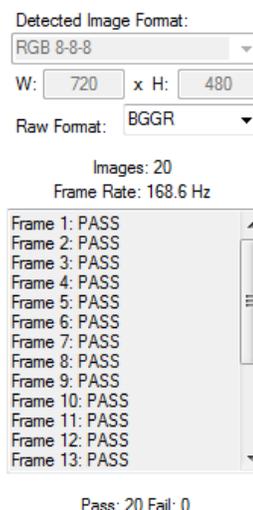


Figure 22 - Image Format

Any errors will be recorded in the images text box. If the **View Differences** checkbox is checked the any failed image will display an image of the differences between the captured image and the 'Golden' image with pixels that are the same white and different pixels black.

When an image is captured in video mode with pixel protocol packets the image format and width and height is determined from the protocol packets captured. The captured format, width and height are displayed in the controls shown in **Error! Reference source not found...** The Bayer raw format of the image should be selected from the

Raw Format: dropdown control to properly convert the image. As images are compared the pass/fail information for each image is displayed in the image information textbox.

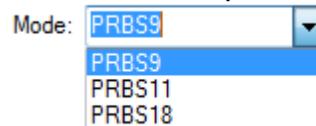
The Ignore Last Frame checkbox is used to have the instrument ignore incomplete frames at the end of the capture. If the capture is known to have a complete frame at the end of the capture, un-checking this control will have all captured frames displayed.

5.2.4 PRBS Tab

The PRBS Tab is used to perform PRBS testing. The seed for each lane can be set, and the when a PRBS capture is completed the number of PRBS words along with the number of errors for each lane is display. To put the Analyzer PRBS mode,

PRBS must be selected from the Mode menu. If PRBS Tab is hidden if the mode selected is not PRBS.

Once in PRBS mode click the button to initiate a PRBS capture. The



PRBS mode can be selected from the Mode dropdown box.

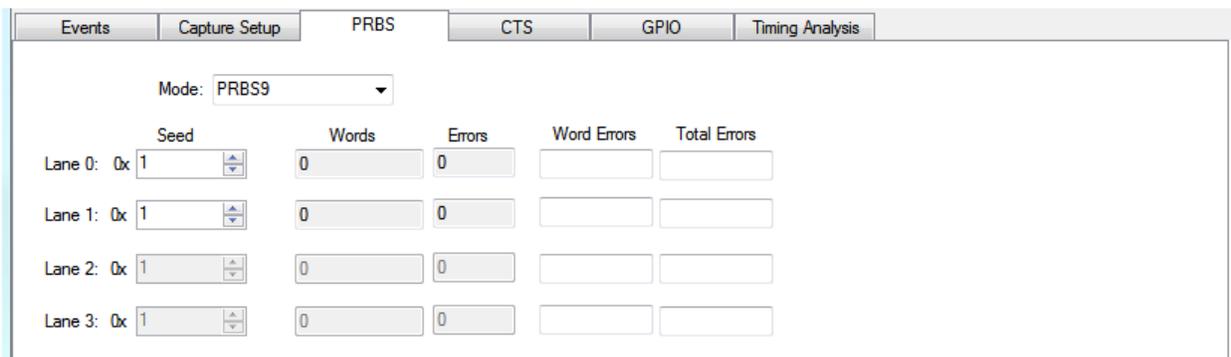


Figure 23 - PRBS Tab

5.3 CTS Tab

The Conformance Test functionality is an optionally available feature of the Envision X84 Protocol Analyzer. The CTS Tab is where the capture CSI Protocol traffic is analyzed for conformance to the CSI Conformance Specification. Once the CSI Protocol traffic is captured, the captured events and be processed for conformance to the CTS by clicking the button. The results are displayed in the CTS Test Result Table. This table display which Test Sections of the CTS the processed Protocol events pass or fail. The Event File tree displays the results of each individual captured event file, while the results table displays the results of all captured events

files. The Event Count table display the count of all the different protocol packets captured in all the captured events files.

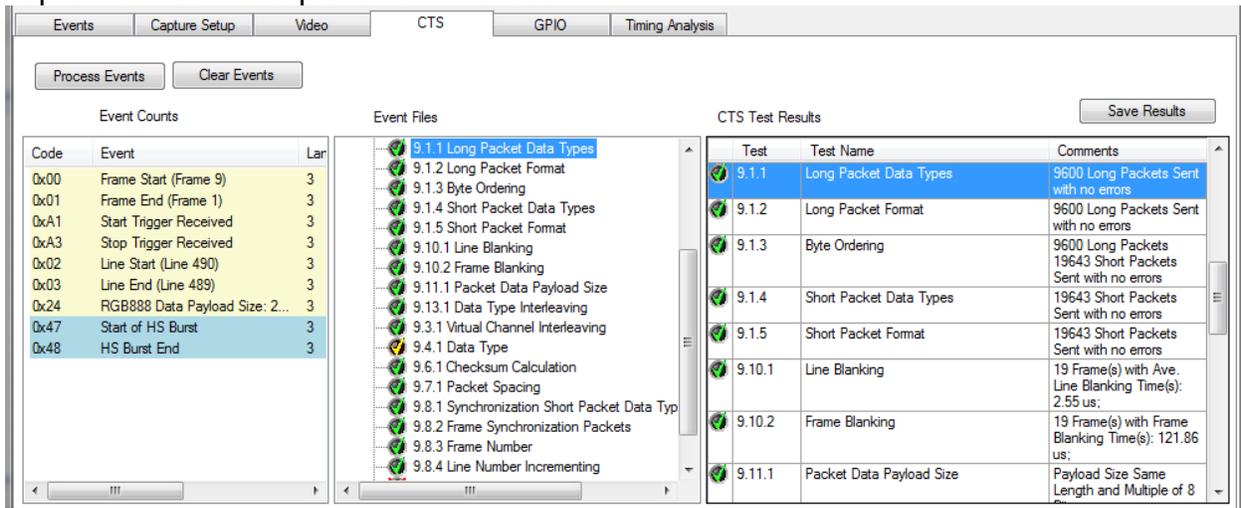


Figure 24 - CTS Tab

5.4 GPIO Tab

The GPIO Tab is to communicate with the camera over the CCI I2C bus or with GPIO pins. Also, macro files can be used to write command sequences to the camera.

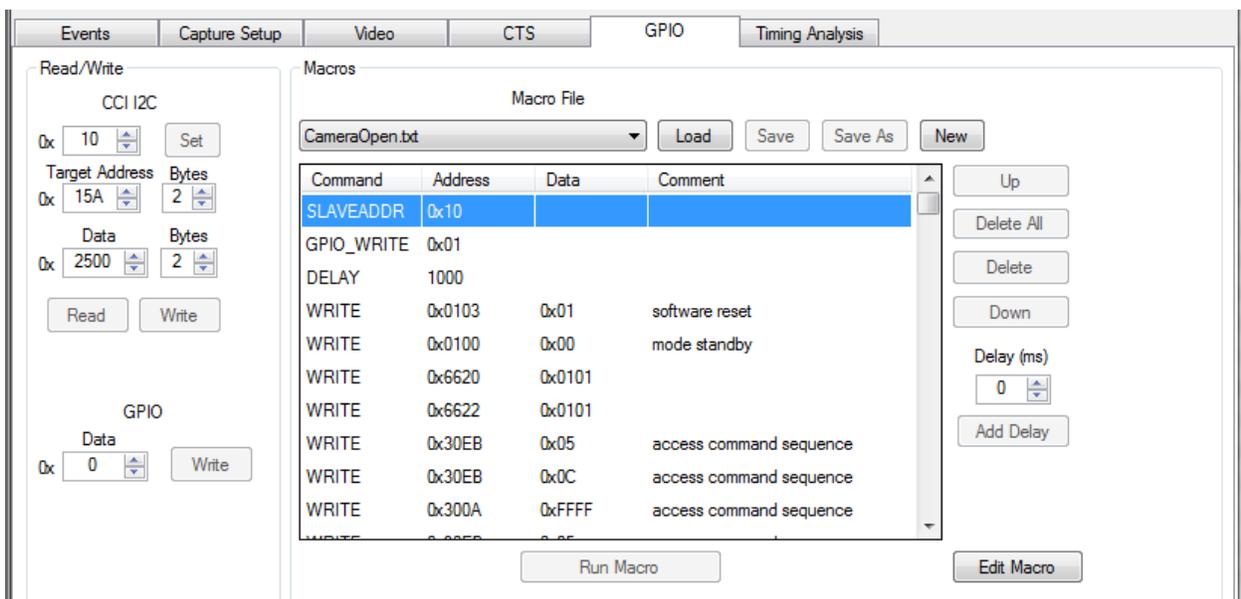
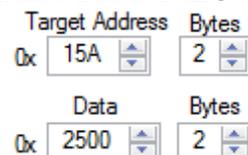


Figure 25 - GPIO Tab

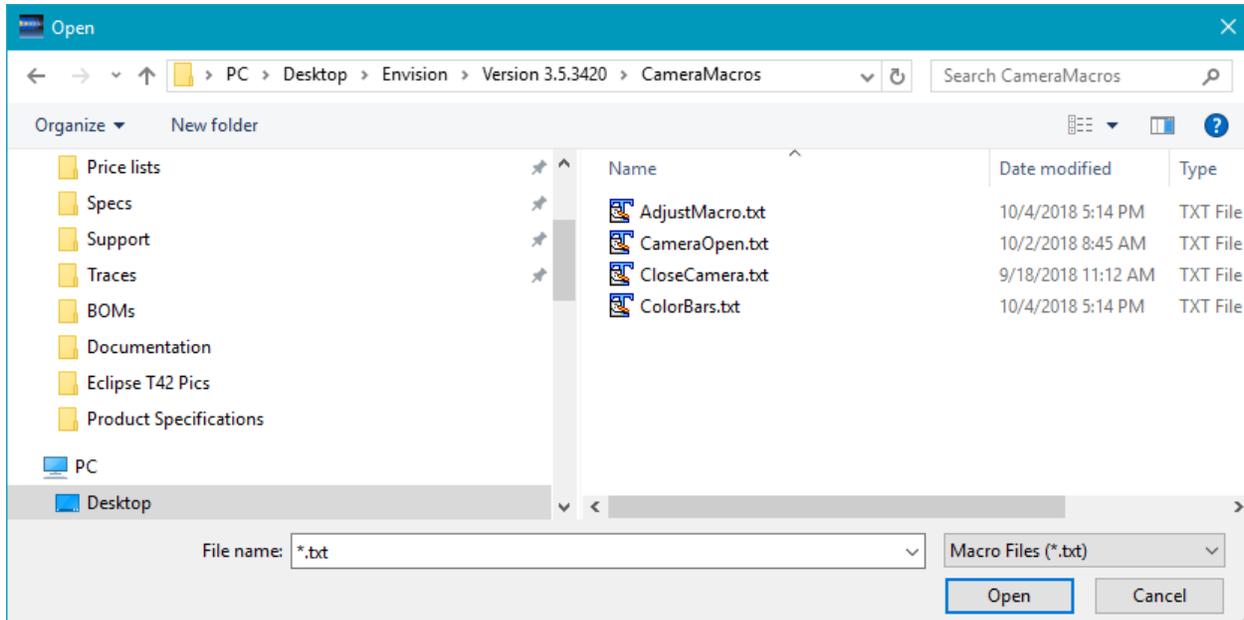
To write or read registers on the camera use the Read/Write controls. Set the I2C slave

address and click to set the I2C slave

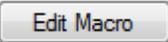


address. Use the Target Address and Data Controls to set the address and data values and number of bytes to be read or written. Click Read or Write to execute the command.
Camera Macro Files

Macro files can be use to send multiple I2C writes to the camera to perform different command sequences. To create a macro file click the  button to bring up a dialog box to select the folder to save the new macro into and to name the macro file.



Mouse to the folder location and enter the filename for the new macro file. This will load the empty macro file into the tool and allow for commands to be added.

Click the  button to put the tool into the macro editing mode. All commands will be added to the macro file and not written to the device whne in edit mode.

Execute any command or add a delay to the macro file by clicking the appropriate button.

For example the following actions will add commands to the macro file.

Set the Slave Address : 

Write 0x2500 (2 Bytes) to 0x15A: 

Add a 5ms delay: 

Write GPIO Bit 0 to a 1:

GPIO
Data
0x

Write 0x1 (1 Byte) to 0x100:

Target Address Bytes Data Bytes
0x 0x

Macros

Macro File

Command	Address	Data	Comment
SLAVEADDR	0x10		
WRITE	0x015A	0x2500	
DELAY	5		
GPIO_WRITE	0x01		
WRITE	0x0100	0x01	

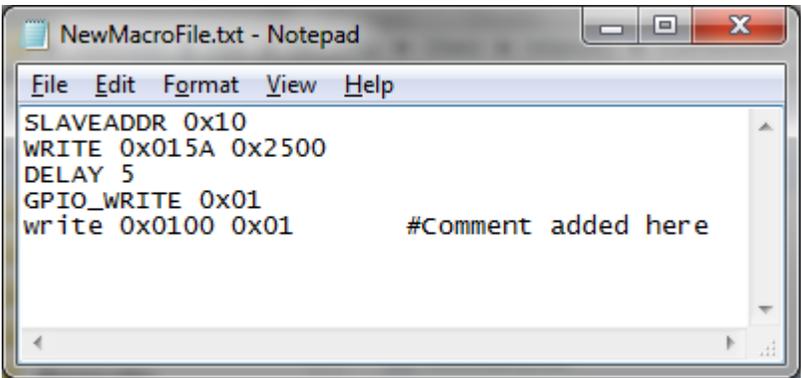
Delay (ms)

Use the buttons to save the macro file. The commands can be reorder or deleted using the and buttons. Comments can be added to the macro file by in the Comment cell and added the comment.

WRITE	0x0100	0x01	Comment added here
-------	--------	------	--------------------

.

Macro files are text files that can be edit by hand, the 1 rule to follow is that the number of hex digits in the address and data fields of a write commands determines the number of bytes are transmitted over the I2C bus. The address can be 1 or 2 bytes, while the data field can be 1, 2, 3 or 4 bytes.



5.5 Timing Analysis Tab

The Timing Analysis Tab is where the capture CSI Protocol traffic is analyzed for timing between different events. This can provide detailed timing of the CSI waveform captured.

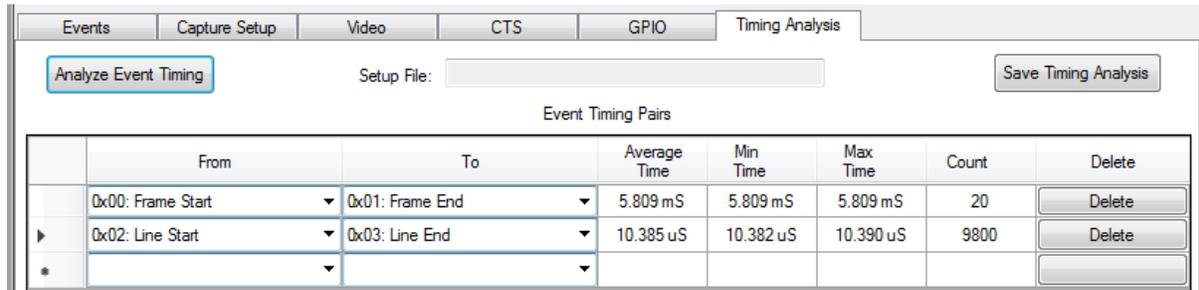


Figure 26 - Timing Analysis Tab

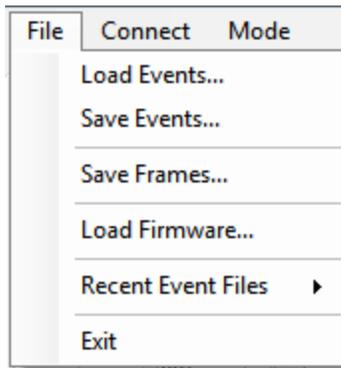
To add an analysis timing pair to the analysis table, click on the empty dropdown box to select an event from the dropdown box for the timing from column and timing to column.

Once the all timing pairs have been added to the timing tables click the **Analyze Event Timing**

button to calculated the timing for the timing pairs. Click the **Save Timing Analysis** button to save the timing analysis calculations to a file.

6 Envision X84 CSI-2 Protocol Suite Menu Options

6.1 File Menu



Load Event Files... The Load Event Files menu option is used to load previously captured event files for off-line analysis. Selecting this option will display the Load Event Files Dialog to select any one of the saved event files.

Save Events... The Save Event Files menu option is used to save the current captured event files to user named event files. Selecting this option will display the Copy Event Files dialog allowing the user to select which directory and base file name to copy the event files.

Figure 27 - File Menu

The event files are saved using the supplied base file name. For example, if the base name entered in the dialog is MyCapturedEvents then the files saved to the user selected directory are:

- MyCapturedEvents.events.bin
- MyCapturedEvents.packets.bin
- MyCapturedEvents.packet_data.0.bin
- MyCapturedEvents.sortedevents.bin
- MyCapturedEvents.sortedpackets.bin
- MyCapturedEvents.status.jsn
- MyCapturedEvents.status.txt

Save Frames... The Save Frames menu option allows the user to save the captured frame image files. The images have to be created with Get Video Data button in the Video tab to enable the menu option.

Load Firmware... The Load Firmware menu option is used to update the Analyzer firmware. A dialog will open to select the firmware file (.few file) to load. Once the firmware is updated the tool automatically disconnected and reconnected to the Analyzer.

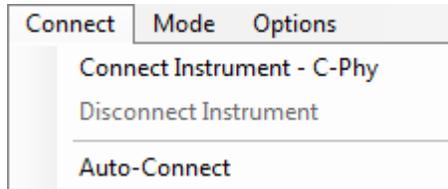
Recent Event Files ▶ The Recent Event Files menu allows the user to load previously loaded event files.

Exit The Exit menu option will Exit the Envision X84 CSI-2 Protocol Suite. Upon exiting the Envision X84 CSI-2 Protocol Suite a configuration file will be saved. This saves the current state of the Envision X84 CSI-2 Protocol Suite and the configuration

file will be loaded the next time the tool is started. The configuration file is saved in the Envision X84 CSI-2 Protocol Suite ProgramData directory:

C:\ProgramData\Teledyne LeCroy\Csi-2 IA\Envision X84 CSI-2 Protocol Suite.config.xml

6.2 Connect Menu



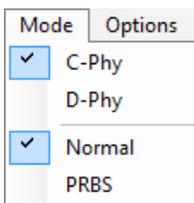
Connect Instrument - C-Phy The Connect Instrument menu option will connect the Envision X84 CSI-2 Protocol Suite to the Envision X84 Protocol Analyzer in the current protocol mode. The protocol mode is selected in the Mode menu.

Figure 28 - Connect Menu

Disconnect Instrument The Disconnect Menu option will disconnect the Envision X84 CSI-2 Protocol Suite from the Analyzer.

Auto-Connect The Auto-Connect Menu option, if selected will have the Envision X84 CSI-2 Protocol Suite connect to the Analyzer on start-up.

6.3 Mode Menu



C-Phy

D-Phy

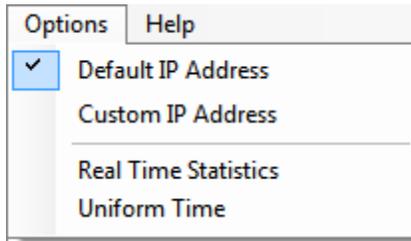
Selecting one of the Physical Layer modes from the Mode Menu determines the mode the Analyzer will be connected in when the tool is connected.

Normal

PRBS The Normal/PRBS Menu options allow the user to set the capture mode of the Analyzer into the PRBS mode (for PRBS testing) or the Normal CSI Protocol capture mode. In Normal Mode the Video Tab is visible and the PRBS Tab is hidden. In PRBS mode the PRBS Tab is visible and the Video Tab is hidden.

Figure 29 - Mode Menu

6.4 Options Menu



Default IP Address

Custom IP Address The IP Address menu options are used to determine the IP address of the Analyzer. The default IP Address of the Analyzer is 192.168.137.100. If the IP Address is changed use the Custom IP Address Menu option to set the custom IP Address.

Figure 30 - Options Menu

Real Time Statistics The Real Time Statistics menu option is used to change the Statistics Section of the Control Panel from Events Statistics to Real Time Statistics. The event Statistics are calculated from the event file data while the Real Time Statistics are hardware counts of the packet data.

Uniform Time The Uniform Time menu option will change the time column in the Events table from formatted time (to best units) to uniform time (all times in usecs).

7 Envision X84 Protocol Analyzer APIs

The Envision X84 Protocol Analyzer also comes with 'C' and 'C#' APIs for use in different programming environments for the automation of test suites. Please refer to the Envision X84 Protocol Analyzer API Manual for more information on automating your test suites.

8 Envision X84 Protocol Analyzer C-Phy Timing Limitations

The Envision X84 Protocol Analyzer C-PHY clock recovery circuit requires the following setting in the C-Phy waveform for proper operation at high frequencies. For example to run at 2.5 Gbps the HS Prepare time should be at least 95ns, the HS Exit time should be at least 500ns and Preamble should be at least 34×7 UI. These settings decrease with decreasing sample rate. Please see the Envision X84 Protocol Analyzer Datasheet for more information.