

# Exostiv Probe Client

## User's Guide

Rev. 1.0.0 - September 6, 2024

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## Revision History

Revision	Modifications
1.0.0	<ul style="list-style-type: none"><li>• Initial revision</li></ul>

## Introduction - Requirements for using the Exostiv Probe Client

The Exostiv Probe Client is the interface used to capture and analyze data from a running FPGA with the Exostiv Probe – EP16000 type.



The Exostiv Probe Client window is configured to match the objects and settings defined with the Exostiv IP generation and insertion. These settings are defined (and the IP generated) with the Exostiv Core Inserter application. Using these settings simply consist in loading the same .bpf project file into the Exostiv Probe Client application.

Each Exostiv IP that was generated with the Exostiv Core Inserter has got a unique identification number. This ID is used when connecting the Exostiv Probe to the target FPGA to check if the project that is loaded in the Exostiv Probe Client software corresponds to the Exostiv IP loaded in the target FPGA.

Hence, here are the cases when Exostiv Probe Client **will not be usable**:

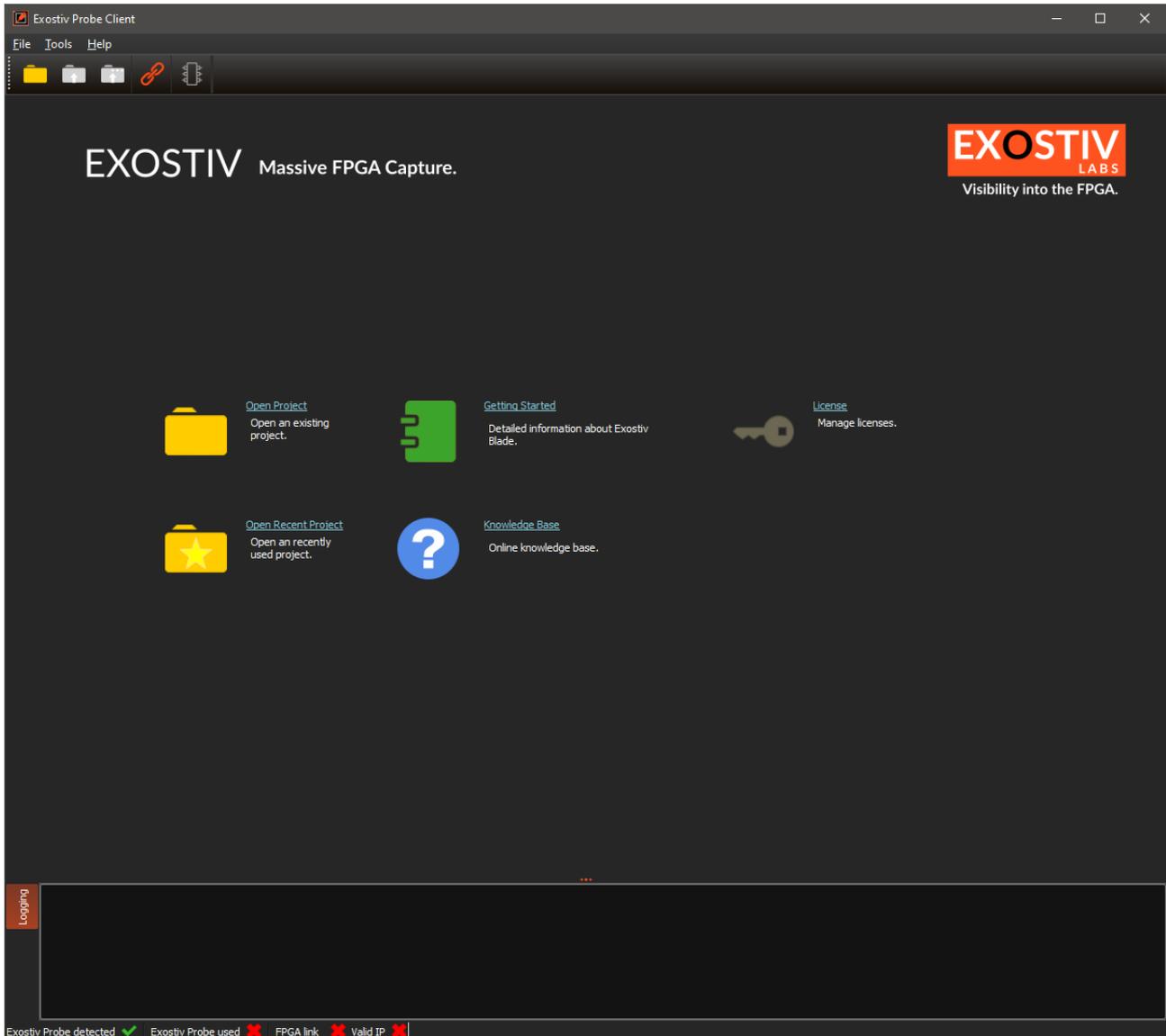
- **There is no 'project' defined:** in such a case, there is Exostiv IP defined and hence, the probe cannot be connected to the target FPGA. Exostiv Probe Client does not have any valid setting about the capture units and data sets of the target design.
- **The Exostiv IP core has not been synthesized nor implemented in the target FPGA:** in such a case, there may exist some projects settings, but there is no implementation of the target design instrumented with the Exostiv IP. Exostiv Probe won't be able to connect.
- **The project settings have been modified but the Exostiv IP core has not been synthesized or there is no implementation of the newly instrumented target FPGA:** in such a case, the project does not match the settings of the IP core that is loaded in the FPGA (if any). Exostiv Probe won't be able to connect.

→ ***Check the documentation about the Exostiv Core Inserter application to know how to synthesize Exostiv IP and implement the instrumented design.***

- **The project that's loaded in Exostiv Probe Client does not match the Exostiv IP loaded in the target FPGA:** in such a case, the projects settings do not match the IP settings and the Probe won't connect. Therefore, the Exostiv Probe Client won't be usable.

→ ***Please load the target FPGA with the configuration file that corresponds to the active project in Exostiv Probe Client.***

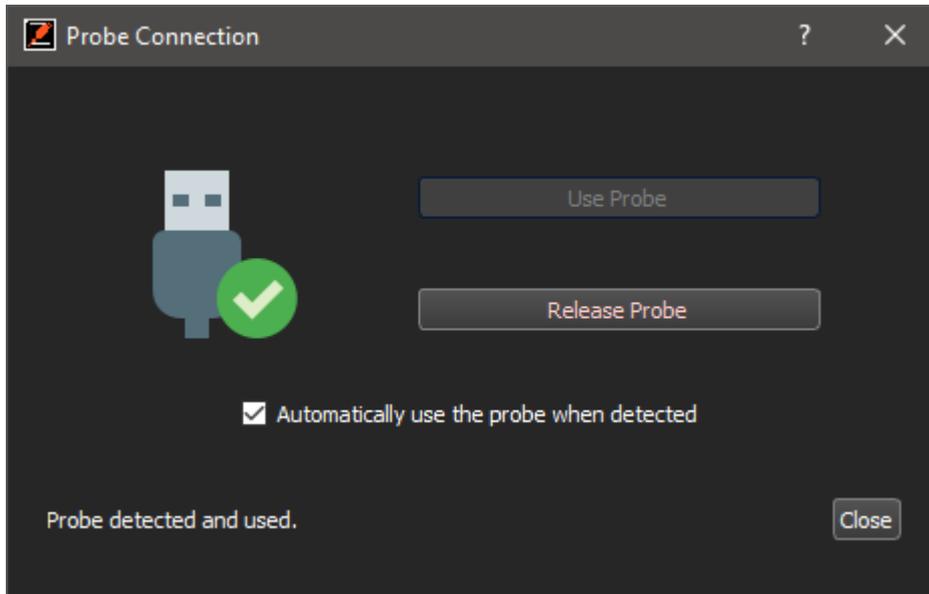
## Exostiv Probe Client – Welcome screen



From the welcome screen, a project file can be loaded (Open Project > file with extension .bpf). Project files are created with the Exostiv Core Inserter application.

## Probe connection

The probe connection button located in the toolbar opens the probe connection controls:



It provides the following controls:

- **Use Probe:** manually reserve to the Exostiv Probe connected to the PC.
- **Release Probe:** manually release the Exostiv Probe.
- **'Automatically use the probe when detected'** : selecting this tick box sets the tool in automatic detection and use. In this case, there is no need to use the 'Probe connection' function, as the probe will be automatically detected and used.

# Exostiv Probe Client – Overview

Capture unit selection



**Trigger and data qualification controls**

Signal Name	AND Equation	Operation
1	<input checked="" type="checkbox"/> u_demo/vid_SOF	== F bin

**Waveform viewer for the selected capture unit**

**Logs**

```

September 5 13:45:02 - Info: (hw): (0x00000000).
September 5 13:45:02 - Info: (hw): <XCVR>: Channel(3): Received UUID from IP = 0xcb85_17fe_f677_44b6_beb6_98b3_a60f_f41b (0x00000000).
September 5 13:45:02 - Info: (hw): BER report for Link(2):
September 5 13:45:02 - Info: (hw): Channel(0)::error(s)=0
September 5 13:45:02 - Info: (hw): Channel(1)::error(s)=0
September 5 13:45:02 - Info: (hw): Channel(2)::error(s)=0
September 5 13:45:02 - Info: (hw): Channel(3)::error(s)=0 (0x00000000).
September 5 13:45:02 - Info: (hw): <LNK>: IP ECO status registers. (LinkId=2, ECO_support=ENABLED, ECO_ID=0) (0xf001001b).
September 5 13:45:02 - Info: (hw): <LNK>: Link synchronised and enabled. (LinkId=2) (0xf0010010).
    
```

Exostiv Probe detected  Exostiv Probe used  FPGA link (4 transceivers at 12.5 Gb/s)  Valid IP

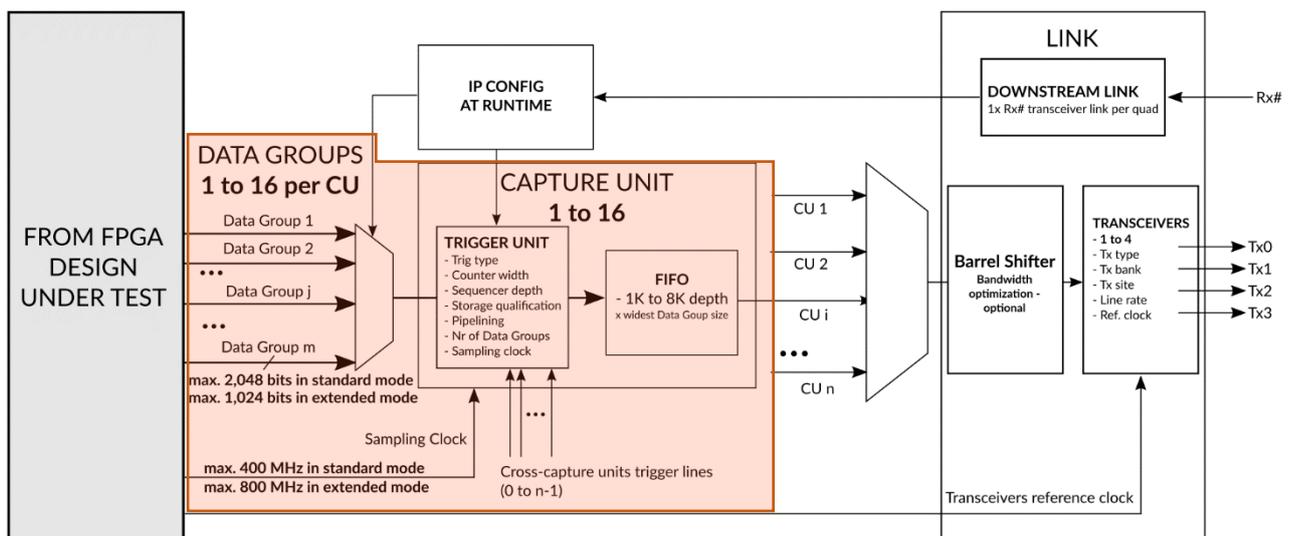
Exostiv Probe Client provides controls grouped by capture unit. Each Capture Unit has got its own 'tab'. An extra 'Multi-Capture' tab is also available to control captures from multiple capture units at once.

A capture unit is a functional entity inserted in the Exostiv IP that connects to up to 16 multiplexed 'data groups'.

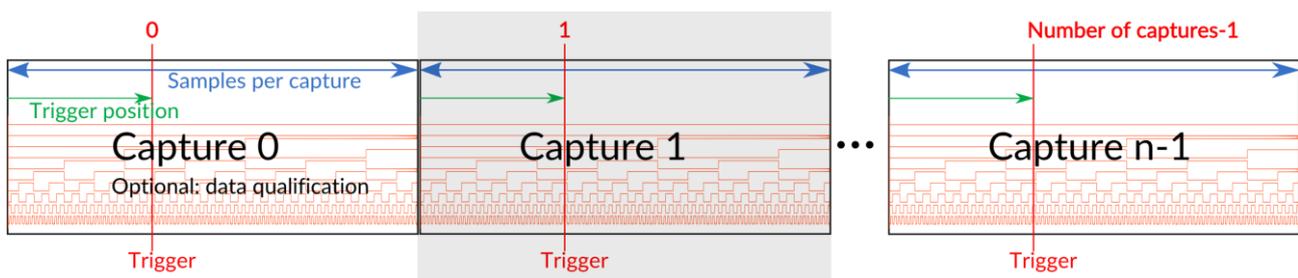
Each data group can count 2,048 connections to logic nodes of the target FPGA.

Each capture unit contains logic for defining trigger conditions and – optionally – data qualification conditions. It also contains a memory buffer used as a FIFO.

The figure below shows a general view on Exostiv IP. The colored area shows what is controlled from the Dashboard Exostiv Probe Client at runtime. The other parts are used automatically by the Dashboard software and the probe to change the IP settings and access the captured data at run-time.



## Capturing data – overview

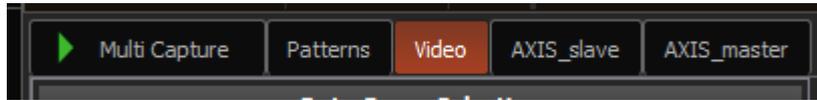


Typically, capturing data involves defining the following:

- A 'trigger' condition, which is used to detect a logic condition based on the connected FPGA nodes, which defines when data must be recorded.
- A 'Samples per capture' value, which defines the number of samples to be recorded once a trigger condition is detected.
- A 'trigger position' in the capture: it defines the position of the trigger condition in the 'Capture'.
- A 'Number of Captures', which defines the number of such trigger conditions that must be detected to end the capture process. A 'capture' ends once it has recorded the required number of samples. Then the capture unit waits until the trigger condition is met again and records a new capture. The process repeats until the specified number of captures is collected.
- Optionally, a 'data qualification' condition can be defined to filter the captured data. This condition is built as a logic condition on the target FPGA signals connected to the selected capture unit.

## Capture Unit Selection - Tab organization.

Each capture unit can be controlled from its own tab. Click on the capture unit tab that you want to control and use.



Except for the 'Multi Capture tab', each tab provides the following controls, for **one single capture unit**.

- **Data Group Selection:** defines the data group to be observed from the selected capture unit.
- **Capture Control:** defines the way data is captured, the number of samples to capture, the trigger position in the capture and provides status about a running capture. This area also contains the '**START/STOP**' buttons used to control a capture and the controls for automatically exporting the waves.
- **Trigger and Data Qualification:** this whole area is used to define trigger and data qualification conditions for the capture.
- **Waveform Viewer:** each capture unit tab includes its own waveform viewer to visualize, format and export the captured data.

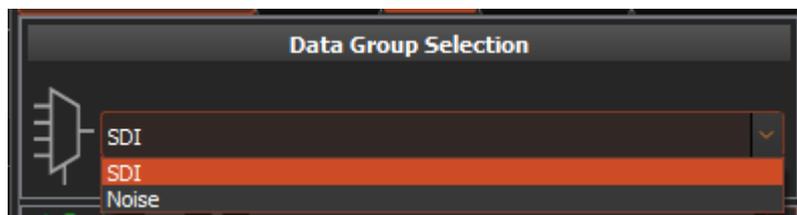
The settings for one single capture unit are defined from the corresponding tab. To capture data from more than one capture unit, please check 'Multiple Capture Control'.

## Data Group Selection

Each Capture Unit can be connected to up to 16 data groups. The **Data Group Selection** drop-down list shows the data groups as defined in the project when setting up Exostiv IP with the Core Inserter.

This control changes the settings of the IP in the target FPGA so data from the selected data group of the selected capture unit can be captured. The selection can be done for each capture unit.

In RTL flow, the 'Data Group Selection' area features an additional button 'Edit Probes' (see picture below).



# Capture Control

▶ Multi Capture
Patterns
Video
AXIS\_slave
AXIS\_master

**Data Group Selection**

SDI
▼

▶▶
■
↓

**Capture Control**

**Status**

---

Status	-
Capture	-
Capture sample	-
Progress	<div style="border: 1px solid #ccc; width: 100%; height: 15px;"></div>

**Data**

---

Transfer mode	<div style="border: 1px solid #ccc; padding: 2px;">Stream to Probe</div>	
Number of captures	<div style="border: 1px solid #ccc; padding: 2px;">500</div>	1 to 16,380
Samples per capture	<div style="border: 1px solid #ccc; padding: 2px;">20480</div>	2,048 to 714,496
Manual data download	<input type="checkbox"/>	
Disable wave encoding	<input type="checkbox"/>	

**Trigger & Qualification**

---

Trigger position	<div style="border: 1px solid #ccc; padding: 2px;">11192</div>	2 to 20,478
<div style="display: flex; align-items: center; margin: 5px 0;"> <div style="width: 100%; border: 1px solid #ccc; position: relative;"> <div style="position: absolute; top: -5px; left: 50%; transform: translate(-50%, -50%); background-color: #f00; border-radius: 50%; width: 10px; height: 10px;"></div> </div> </div>		
Trigger counter	<input type="checkbox"/> <div style="border: 1px solid #ccc; padding: 2px;">1</div>	1 to 4,096
Qualification counter	<input type="checkbox"/> <div style="border: 1px solid #ccc; padding: 2px;">1</div>	1 to 4,096

Control	Effect / Action	
 Run with trigger	Runs the capture taking all the defined settings into account: transfer mode, number of captures, samples per capture, trigger position, trigger & data qualification conditions.	
 Run immediately	Runs a single capture of the length defined by the 'samples per captures'. The trigger and data qualification settings are ignored.	
 Stop	Stops (interrupts) a running capture. When stopped, the data that has been already captured are uploaded and displayed for processing.	
 Connect Probe	Attempts to detect and connect to an Exostiv Probe present on the USB port of the workstation.	
 Manual data download	Available when the 'manual data download' option tick box is selected. Enables the user to download of data from the probe memory to the PC.	
<b><u>Status</u></b> : progress bars with the number of captures and the collected samples in the running capture.		
<b><u>Data</u></b>		
Transfer mode	Burst to Probe	In this mode, data is transferred by bursts whose size do not exceed the size of the FIFO implemented in the capture unit. This mode does not involve 'streaming' data to the Exostiv Probe. Single or multiple burst can be sent.
	Stream to Probe	In this mode, data is transferred by bursts whose size is bigger than the size of the FIFO implemented in the capture unit. This mode involves 'streaming' data over the transceivers. Hence, it could generate 'overflows' if the bandwidth required to stream the data exceeds what's available on the gigabit transceivers.
Number of captures	1 to a maximum computed automatically.	Defines the number of captures of size defined by the 'Samples per capture'. The range next to the control helps compute the possible values.  This range is based on the total memory available in the probe, the transfer mode and the number of defined capture units and the number of samples per capture.
Samples per capture (top control – drop down list)	32 to the capture unit's FIFO length by steps of power of 2.	Defines the size of each capture in 'Burst to Probe' mode. The range next to the control helps compute the possible values.
Samples per capture (bottom control)	Capture unit's FIFO length to a maximum computed automatically, by steps of 512 (auto rounded to closest upper value).	Defines the size of each capture in 'Streaming to Probe' mode. The range next to the control helps compute the possible values.
Manual data download	Tick box	When selected, this option disables the automatic transfer of data from the probe memory to the PC. Only the data transferred manually by clicking onto the  button is transferred to the PC.
Disable wave encoding	Tick box	When selected, the captured data is not encoded as waveform for the waveform viewer. The display in the waveform viewer is not refreshed. In this case, only the raw data is available.
<b><u>Trigger &amp; Qualification</u></b>		
Trigger position	2 to Samples per capture-2	Defines the position of the trigger in each capture. The value specifies a sample number.

Control	Effect / Action	
Trigger counter	1 to max value of the counter	Allows triggering on specific (counted) trigger events only. Requires the insertion of the trigger counter during the core insertion.
Qualification counter	1 to max value of the counter	Allows triggering on specific (counted) qualification events only. Requires the insertion of the trigger counter during the core insertion.

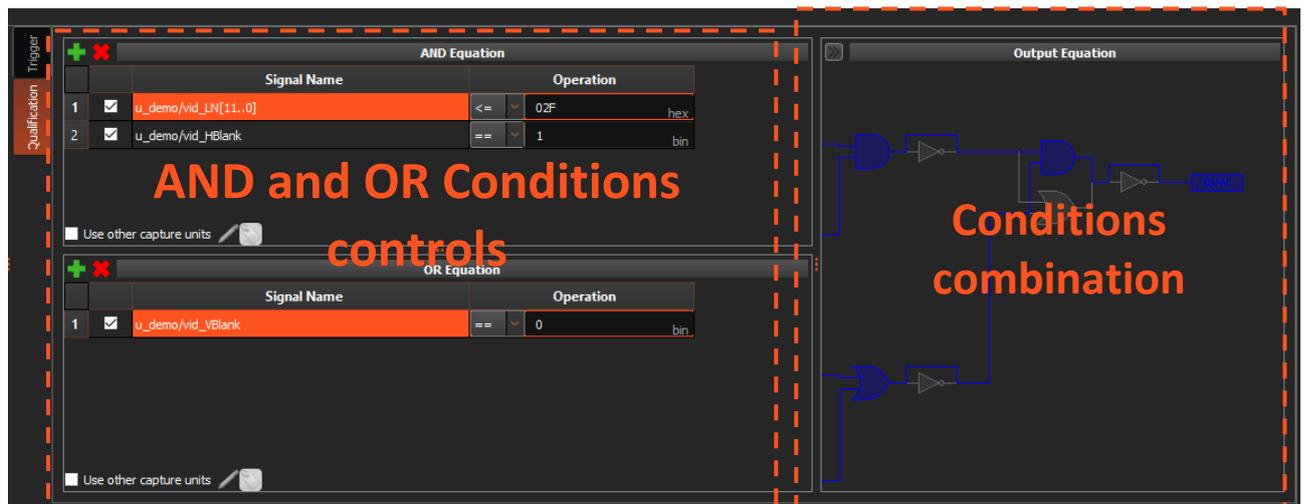
## Trigger & Data Qualification

### Trigger & Data Qualification: overview

The trigger & data qualification controls are split into 2 areas, as described in the figure below.

The trigger and the data qualification conditions are based on the definition of the following:

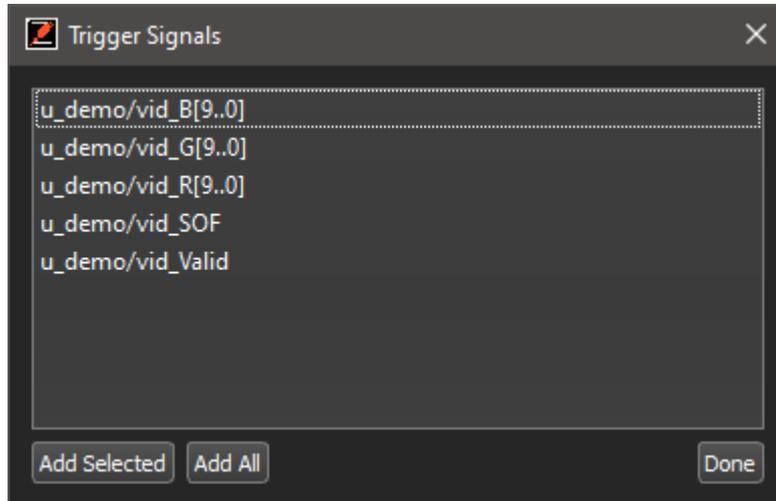
- One AND equation: it specifies a set of conditions on the capture unit's signals combined as a logic AND.
- One OR equation: it specifies a set of conditions on the capture unit's signals combined as a logic OR.
- Each equation can use a combination of conditions local to the selected capture unit and the result of the trigger or data qualification from another capture unit.
- The AND and the OR equations described above are combined to form the trigger or the data qualification unit. This combination is defined with the right-hand, as a graphical combination. Please refer to the figure below for an overview of the available paths.



## Defining Trigger & Data Qualification: usage and rules

Suppose you'd like to modify the AND Equation of the trigger. Please proceed as follows:

1. To add a condition to the list, click on the '+' sign at the top. This opens a window called 'Trigger Signals'.

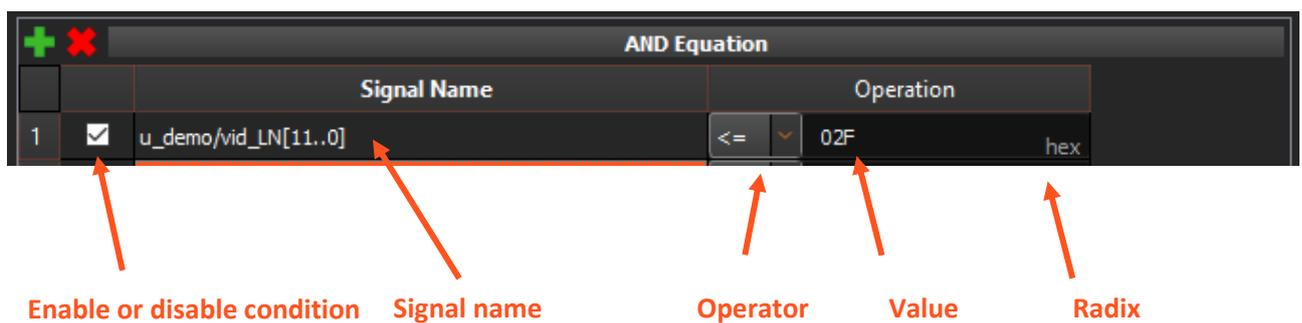


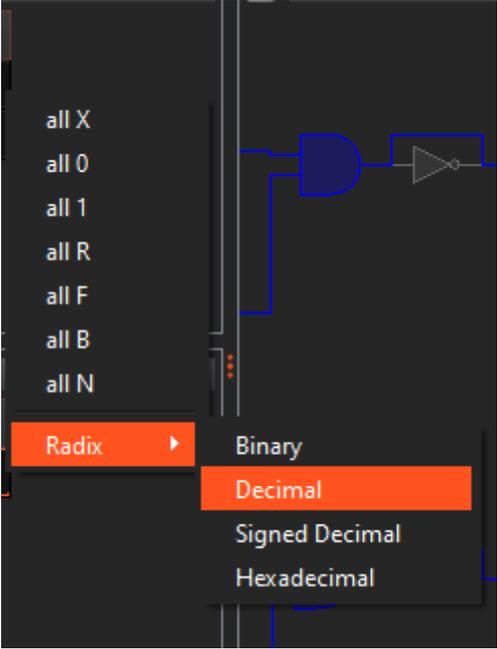
In this window you can find the list of the signals still available to add a condition to the AND equation.



*This list is composed of the signals from the selected data group connected to the selected capture unit, that are not already used in either the AND or the OR equation. So each signal that is marked as 'trigger' during core insertion (please refer to [Error! Reference source not found.](#)) can be used once in the equations defining the triggers.*

2. Select the desired signals and click on 'Add Selected'. Or 'Add All'. Then, click on 'Done'. The added signals disappear from the list.
3. The AND equation window is completed with the signals we have added:
4. Each of the lines in the Equation window is formatted as follows:

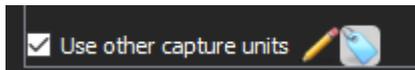


Control	Description
<p><b>Enable / Disable condition</b></p>	<p>Select to enable condition. Unselect to disable condition.</p>
<p><b>Operator</b></p>	<p>Drop-down list with the available operators:            Always available:            == : equality            != : inequality</p> <p>Only available if Levels/Edges/Comparisons was chosen as an option for 'Trigger unit type' at Core Insertion (refer to <a href="#">Error! Reference source not found.</a>)            &gt; : greater than            &lt; : smaller than            &gt;= : greater or equal to            &lt;= : smaller or equal to            [...] : in range            ![...] : out of range</p>
<p><b>Value</b></p>	<p>Value for combination. Right-click on the fields shows some of the options at bit level.</p> <p>Bit level (binary) possible values:            X : don' care            0 : logic 0            1 : logic 1            R : rising edge            F : falling edge            B : any edge            N : no edge</p> <p>Hexadecimal or Decimal values can also be entered if the corresponding radix is chosen (see below).</p>
<p><b>Radix</b></p>	<p>Radix for 'Value'. Right-click to open the menu to change this:</p>  <p>bin : Binary            dec : Decimal            hex : Hexadecimal</p>

## Cross-capture unit trigger

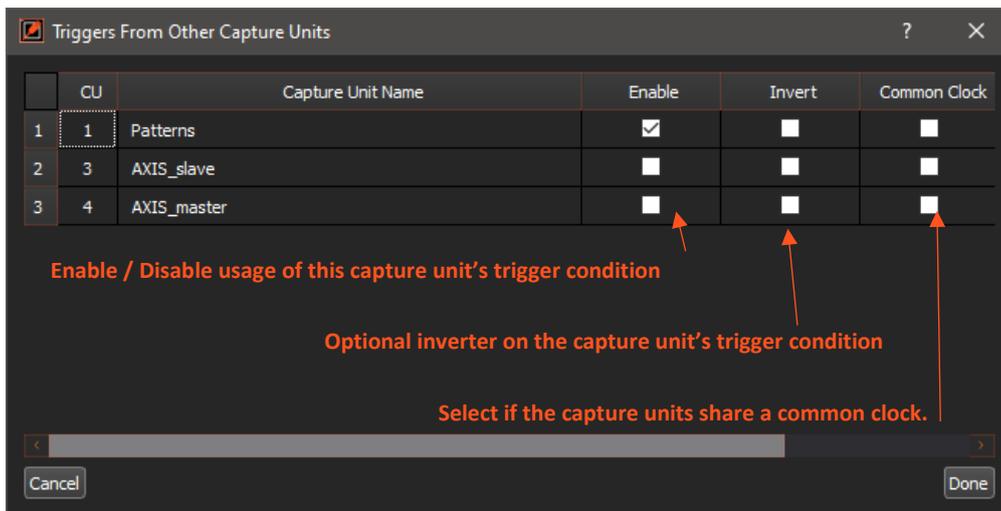
By default, it is possible to use the result of a trigger condition from one capture unit as a source trigger condition for another capture unit. Because capture units are not always located in the same clock domain, some options are available.

At the bottom of each (AND or OR) equation window, locate the following control 'Use other capture units'. Select tick box to enable it.



Click on the 'pencil icon' to edit the options: 

A window opens, with the list of the available capture units (different from the active CU):



Click on 'Done' once set up.

The 'label icon' allows defining a custom logic name for the condition.



### **Remark about cross-capture unit triggering with multiple clock domains:**

*When the same sampling clock is used for the capture units, the event sent from the source capture unit to the destination CU is fully synchronous and the detection thereof is immediate. In such a case, it is advised to select the option 'Common clock' so everything remains synchronous.*

*When the source and destination capture units do not use the same clock the source trigger event is latched into the destination capture unit. Once the event is seen at the output of the latch, the latch is reset. It is important to note that there will be an undefined time between the generation of the source event and its detection at the destination capture unit.*

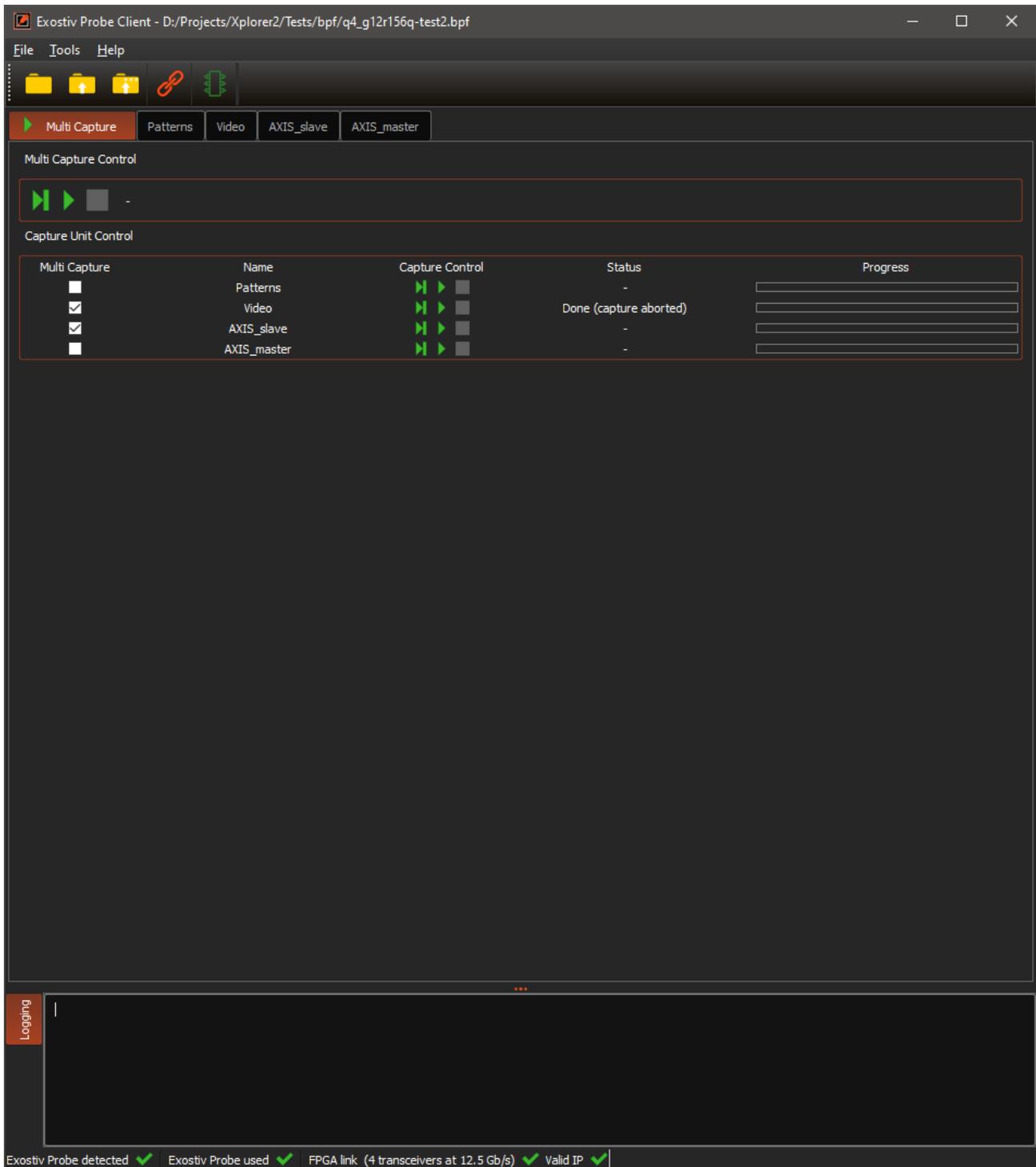


## Multiple Capture Tab

The left-hand tab is used to control captures from multiple capture units at the same time.

The capture settings must be defined for each capture unit separately.

Select the tick box corresponding to the desired Capture Units and use the run with trigger or run controls.

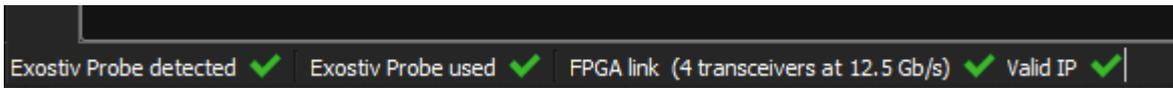


The screenshot shows the Exostiv Probe Client interface. At the top, there is a menu bar with 'File', 'Tools', and 'Help'. Below the menu bar is a toolbar with icons for file operations and capture control. The main window has several tabs: 'Multi Capture', 'Patterns', 'Video', 'AXIS\_slave', and 'AXIS\_master'. The 'Multi Capture' tab is active, showing a 'Multi Capture Control' section with play and stop buttons. Below this is the 'Capture Unit Control' section, which contains a table with the following data:

Multi Capture	Name	Capture Control	Status	Progress
<input type="checkbox"/>	Patterns	▶▶▶	-	Progress bar
<input checked="" type="checkbox"/>	Video	▶▶▶	Done (capture aborted)	Progress bar
<input checked="" type="checkbox"/>	AXIS_slave	▶▶▶	-	Progress bar
<input type="checkbox"/>	AXIS_master	▶▶▶	-	Progress bar

At the bottom of the interface, there is a 'Logging' section and a status bar with the following information: Exostiv Probe detected ✓, Exostiv Probe used ✓, FPGA link (4 transceivers at 12.5 Gb/s) ✓, Valid IP ✓.

## Status bar

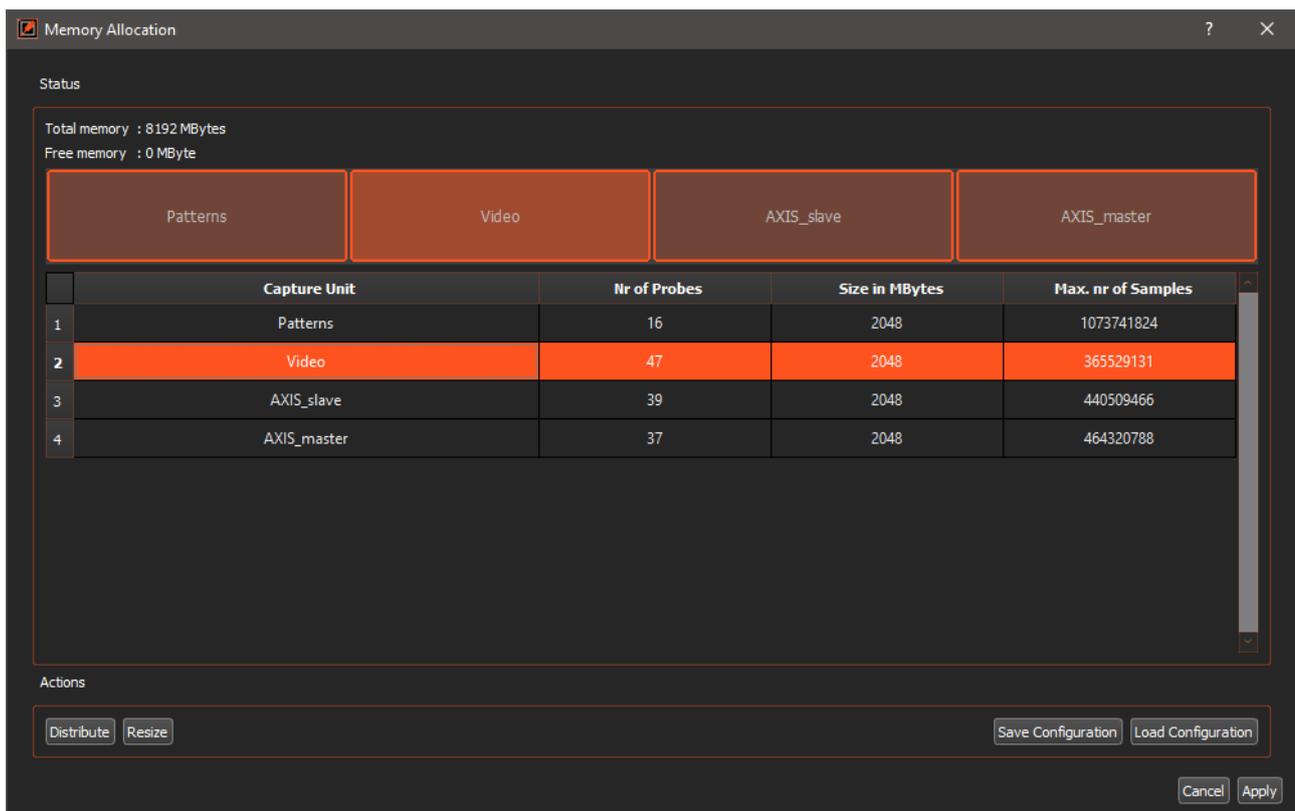


The Status bar returns the connection status of:

- Exostiv Probe: whether is it connected and detected over the PC USB port.
- Exostiv Probe usage: whether it is used by the application.
- FPGA Link: whether there is a valid connection with the target design IP. In addition, the number of used transceivers at their speed is provided.
- Valid IP: whether the IP that is detected in the target design is valid and corresponds to the project settings.

## Memory allocation

The 'Memory allocation' icon in the top  toolbar opens the memory allocation controls:



**Status**

Total memory : 8192 MBytes  
Free memory : 0 MByte

Patterns	Video	AXIS_slave	AXIS_master

	Capture Unit	Nr of Probes	Size in MBytes	Max. nr of Samples
1	Patterns	16	2048	1073741824
2	Video	47	2048	365529131
3	AXIS_slave	39	2048	440509466
4	AXIS_master	37	2048	464320788

**Actions**

Distribute    Resize    Save Configuration    Load Configuration    Cancel    Apply

These advanced controls allow defining / redistributing the Exostiv Probe memory allocated to each capture unit (by default, the memory is equally allocated to all CUs).

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