

QUADRO SYNC

DU-06574-001_v01 | October 2012

User's Guide

DOCUMENT CHANGE HISTORY

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GETTING STARTED

The NVIDIA Quadro[®] Sync board is designed to fit into a free PCI Express slot within the system. It does not require power from the PCI Express connector on the motherboard and is designed to be with PCI Express and PCIe connectors.

SYSTEM REQUIREMENTS

- ▶ NVIDIA[®] Quadro[®] Professional Graphics Boards
 - The Quadro Sync board supports up to 4 matching Quadro graphics processing units (GPUs) which are compatible with Sync
 - For an up to date list of the Quadro boards compatible with Sync see www.nvidia.com/sync
- Operating Systems
 - Windows 7: 64-bit recommended, 32-bit supported
 - Linux: 64-bit recommended, 32-bit supported
 - Limited support for Windows XP 32-bit and 64-bit: 2 GPUs per Quadro Sync board, 2 displays per GPU and no support Multi-GPU NVIDA[®] Mosaic features
- Driver
 - R304 branch display drivers will support Quadro Sync for GPU topologies that do not use Mosaic
 - R310 branch and newer display drivers support Quadro Sync with Mosaic topologies
- Chassis Requirements
 - Single free PCIe slot
 - 6-pin PCI or SATA power connector

BOARD OVERVIEW

The Quadro Sync board is an accessory board to the Quadro Professional GPU. On the top edge are four connectors to connect it to the GPUs. The cables are included in the box.



Figure 1. Quadro Sync Board Overview

For high vibration environments there are cable retention clips, not pictured, which hold all cables securely in place on both the Quadro Sync board and Quadro GPU. Since the SATA power connector has no physical retention the board has a hole which can be used to secure the cable with a cable tie.

BOARD INSTALLATION

Prior to installing the Quadro Sync board, make sure to power down the machine and unplug the power connecter.

- 1. Place the Quadro Sync board in a free slot, note the PCIe edge fingers may not bottom out in the PCIe slot.
- Connect the Sync board and up to four Quadro boards with included ribbon cables. On the Quadro board make sure to connect to the connector labeled "SYNC | SDI". There is no need to connect the Quadro boards to the connectors on the Quadro Sync board in any particular order.
- 3. Connect a 6-pin PCIe or SATA power connector.
- 4. Optional: Place the included cable retention clips on both the Quadro Sync board and Quadro board(s).



Note: When properly installed the PCIe finger on the Quadro Sync board may not touch the bottom of the PCIe slot.

When using Quadro Sync in a system that supports NVIDIA SLI® an SLI bridge does not need to be connected unless you are planning to use SLI specific features like SLI Frame Rendering or SLI Anti-Aliasing. These SLI modes are not compatible with most of the features of Sync.

QUADRO DISPLAY DRIVER

Quadro Sync does not require a dedicated driver; all the files needed to operate it are included in the Quadro display driver. Drivers are available on the NVIDIA Web site at www.nvidia.com/drivers. When choosing the drivers for use with Quadro Sync, make sure to select the following from the pull down lists:

- "Quadro Sync Series" from the **Product Series** pull down list
- "Quadro Sync" from the **Product** pull down list

NVIDIA Driver Downloads

Option 1: Manually find drivers for my NVIDIA products.				
Product Type:	Quadro	•		
Product Series:	Quadro Sync Series	•		
Product:	Quadro Sync	•		
Download Type:	Quadro ODE Graphics Driver	•		
Operating System:	Windows 7 64-bit	•		
Language:	English (US)	•	SEARCH	

Option 2: Automatically find drivers for my NVIDIA products.

Figure 2. Quadro Drivers Compatible with Quadro Sync

Quadro Sync is supported for single GPU operations with the R304 branch driver, multi-GPU features are supported in the R310 and newer branch drivers.

WORKING WITH QUADRO SYNC

Whether working with a single node or visualization cluster the Quadro Sync board provides multiple forms of display synchronization:

- Multi-GPU Mosaic: Mosaic is a software technology that abstracts multiple physical displays into a larger virtual display. When the virtual display spans across multiple GPUs, the Quadro Sync board synchronizes the GPUs to ensure all the displays stay aligned.
- Frame Lock: Synchronize multiple displays, in one machine or spread across multiple machines in a cluster. For Frame Lock a single display is chosen as the timing master and all other displays in the cluster align to it. Frame Lock can be used with individual physical displays and single or multi-GPU Mosaic displays.
- Sync to an External Timing Source: Aligns a selected display to an external timing generator. The selected display can be a Mosaic or physical and can be used as the Frame Lock master if desired.

The Quadro Sync board supports mixing and matching the different synchronization options to build the correct configuration your installation needs. Installations with Quadro Sync can become complex and architecture decisions can impact performance and reliability, for questions on how to architect systems with Quadro Sync or Mosaic contact <u>QuadroSVS@nvidia.com</u>.

MULTI-GPU MOSAIC CONFIGURATION

MOSAIC OVERVIEW

Mosaic is a technology that combines multiple displays or projectors into a single virtual display. It's cable of creating a projector overlap region or subtracting the area behind screen bezels to create a single unified display surface. With Quadro Sync and supported Quadro GPUs up to 16 displays can appear as one to the operating systems and any application that runs on them. The image in Figure 3 is an example of a 3 × 3 display wall connected to 3 Quadro K5000 graphics boards.



Figure 3. 3 x 3 Mosaic with Quadro Sync

When working with multi-GPU Mosaic, Quadro Sync automatically keeps all the displays that are part of the Mosaic synchronized.

For more information on Mosaic refer to the NVIDIA Web site at <u>www.nvidia.com/svs</u>.

CONFIGURING MOSAIC

No special configuration is required for Mosaic; configure it either through the control panel, with the configureMosaic utility or through one of the programmatic interfaces.

The configureMosaic utility is not part of the standard driver download but is easily downloaded from <u>www.nvidia.com/drivers</u>.

NVIDIA Driver Downloads

Option 1: Manually find drivers for my NVIDIA products.				
Product Type:	Quadro 💌			
Product Series:	Quadro Series 💌			
Product:	Quadro K5000 💌			
Download Type:	Mosaic Utility 💌			
Operating System:	Windows 7 64-bit			
Language:	English (US)	SEARCH		

Figure 4. NVIDIA Driver Downloads

Mosaic is compatible with the other synchronization methods covered in this user's guide. When combining Mosaic with other forms of synchronization make sure to enable Mosaic first then continue with synchronizing.

FRAME LOCK CONFIGURATION

Frame Lock synchronizes all the selected displays in a system and across systems in a cluster. A single display is selected as the timing master and the Quadro Sync boards will adjust all the other displays to synchronize with it. This operation may take a few minutes.

CONNECTING NODES IN A VISUALIZATION CLUSTER

If using the multi-node synchronization features of Quadro Sync the nodes in the cluster will need to be connected together. Connecting the nodes require CAT-5 Ethernet cables that are not included. It is recommended that you use high quality cables, using the shortest length possible for your installation. Do NOT use Ethernet hubs or switches to branch or extend the signal. Quadro Sync is not compatible with TCP/IP protocols and the board will not operate if it connected to networking equipment.

CAUTION: Do not connect the Quadro Sync board to TCP/IP networking equipment.

Choose one node as the timing master, the machine that will control the timing on all the others. For clusters using active stereo it is recommended that the timing master also drive the stereo sync output. From the timing master, connect a CAT 5 cable between the Frame Lock connectors on the timing master and a client machine, it does not matter which connector you use. It is recommended to create two signal chains off the timing master like in the following diagram (Figure 5).



Figure 5. Frame Lock Connections on Timing Server

FRAME LOCK CONNECTOR LEDS

The Frame Lock connector LEDs indicate how the frame lock signal is flowing from one Quadro Sync board to the next. The light indicates if the port is receiving a Frame Lock signal or sending a Frame Lock signal. The ports will auto-configure so different nodes in the cluster may have different LED configurations.

Frame Lock LED Status

Port is an output but no signal is present



Port is an input but no signal detected



Port is an output and sending a signal, the frequency of the blinking is the refresh rate of the signal



Port is an input and receiving a signal, the frequency of the blinking is the refresh rate of the signal

When connecting the Frame Lock ports, the timing server will send two outputs and all the other nodes will configure themselves to one output and one input.

VISUALIZATION CLUSTER SETUP ORDER

When configuring a visualization cluster the order of operations for configuration is important:

- 1. Start with the Timing Master
 - a) Enable Sync to Vertical Blank
 - b) Enable stereo with the correct stereo mode if using stereo
 - c) Configure and enable the timing master
- 2. Configure each client machine
 - a) Enable Sync to Vertical Blank
 - b) If using stereo set and enable the same stereo type as the timing master
 - c) Enable Frame Lock on each machine

RESTARTING A VISUALIZATION CLUSTER

Similar to configuration a cluster should be re-started in a particular order to minimize the synchronization time:

- 1. Start all the client machines
- 2. Once all client machines are stable start the Timing Master

Depending on the configuration it can take many minutes for a cluster to fully synchronize.

WINDOWS DRIVER CONFIGURATION

Before configuring any of the synchronization modes verify in the NVIDIA Control Panel that the Vertical Sync setting is on and if using stereo that the correct Stereo display mode is selected and enabled. For best performance in a cluster it is recommended that you select the Workstation App – Dynamic Streaming driver preset as well.

1. Open the NVIDIA Control Panel and select Manage 3D Settings



2. Select Workstation App-Dynamic Streaming as the Global Preset

3. Enable Vertical Sync

NVIDIA Control Panel File Edit Desktop 3D Settings Help				X
🕒 Back 👻 🌍				
Select a Task =- 3D Settings	ي ا	Manage 3D Settin	gs Restore Defaul	
Adjust image settings with preview <mark>Manage 3D settings</mark> Set PhysX Configuration		You can change the global 3D settings ar automatically each time the specified proc	nd create overrides for specific programs. The overrides will b	
Display Change resolution Adjust desktop color settings	I	would like to use the following 3D setti		
Rotate display View HDCP status		Global Settings Program Settings		
Set up digital audio Adjust desktop size and position		<u>G</u> lobal presets:		
Set up multiple displays		3D App - Default Global Settings	▼ @ Restore	
- Stereoscopic 3DSet up stereoscopic 3DView compatibility with games		Settings:		:
- Video		Feature	Setting	
Adjust video color settings		Maximum pre-rendered frames	Use the 3D application setting	
		Multi-display/mixed-GPU acceleration	Multiple display performance mode	
		OpenGL rendering GPU	Auto-select	
Set up Mosaic		Power management mode	Adaptive	
		Stereo - Display mode	Custom	
		Stereo - Enable	Off	
		Stereo - Swap eyes	Off	
		Threaded optimization	Auto =	
		Triple buffering	Off	
		Vertical sync	On 🔽	
			Our Set the 3D application setting ▼	
			Off	
			Adaptive	
	Desc	ription:	Adaptive (half refresh rate)	
		ertical sync locks the frame rendering rate to orizontal tearing effects in the 3D image.	the monitor refresh rate. This improves image quality by eli	imina
System Information	•	1	"	Þ

4. If using stereo Select the **Stereo-Display Mode** and enable Stereo with the **Stereo-Enable** entry

🗲 Back 👻 🕥			
ect a Task - 3D Settings Adjust image settings with preview	Manage 3D Sett	ings Restore De	faults
<mark>Manage 3D settings</mark> Set PhysX Configuration	You can change the global 3D settin automatically each time the specified	gs and create ovenides for specific programs. The ovenides I programs are launched.	will be
- Display Change resolution Adjust desktop color settings	I would like to use the following 3D	settings:	
Rotate display View HDCP status Set up digital audio	Global Settings Program Settings		
Adjust desktop size and position Set up multiple displays	Global presets: 3D App - Default Global Settings	Restore	
Stereoscopic 3D Set up stereoscopic 3D	Settings:		
····View compatibility with games ·· Video	Feature	Setting	 Image: A set of the set of the
Adjust video color settings	Exported pixel types	Color indexed overlays (8 bpp)	
- Morkstation	Maximum pre-rendered frames	Use the 3D application setting	
View system topology	Multi-display/mixed-GPU acceleration	Multiple display performance mode	
Set up Mosaic	OpenGL rendering GPU	Auto-select	
	Power management mode	Adaptive	
	Stereo - Display mode	Generic active stereo	
	Stereo - Enable	Off 💌	
	Stereo - Swap eyes	On The second se	
	Threaded optimization		
	Triple buffering	Off	
	Vertical sync	On	*

Enabling Frame Lock

When enabling Frame Lock across a cluster you must define a display to be the timing server which all the clients will then connect to. Following the guidelines in the "Connecting Nodes in a Visualization Cluster" section of this guide, it is recommended this node be in the "middle" of the cluster.

For best results synchronizing the cluster configure the Timing Master first, then the client machines so you can verify each client synchronizes correctly as you add it. After the cluster is configured it is recommended to re-boot the cluster in the opposite order: clients then Frame Lock master.

Note: When rebooting the cluster after configuration boot the client nodes first, then once the clients are stable boot the timing master.

Configure Frame Lock Master

To enable Frame Lock on the master open the Synchronize Displays tab in the NVIDIA Control Panel.

- 1. Open the NVIDIA Control Panel and select Synchronize Displays
- 2. Select "The timing server is **On this system**" radio button

NVIDIA Control Panel		3
File Edit Desktop Workstation Help		
🚱 Back 🔻 🜍 1 🚮		
Sect a Task Sect Task Descent a Task	Synchronize Displays You can synchronize frame rendering across displays. This is useful when you want to present graphics across multiple displays or synchronize one or many systems to a house sync source. Image: the timing server is On another system On this system Image: the timing server is Image: the time server Image: the timage: the time server	A E
System Information	Cancel	•

Note: Master node refers to the node that is used as the Timing Server. There can only be one Timing Server in a cluster. All others nodes are commonly referred to as "clients" or "slaves."

If the system has multiple displays, the driver automatically selects the primary display to be the timing server and all other displays are the clients. To change the configuration, click the icon of the display that you want to be the timing server

3. Press Apply.

Configure Frame Lock Clients

The clients machines are also configured through the synchronize displays section of the NVIDIA Control Panel. Since there is already a timing master on the chain when you open the control panel it will only offer the option to synchronize to the master.

- 1. Open the NVIDIA Control Panel and select Synchronize Displays
- 2. Select the displays to synchronize from the box
- 3. Press Apply

NVIDIA Control Panel		
File Edit Desktop Workstation Help		
🔇 Back 🔻 🔘 🚮		
Select a Task		
⊜-30 Settings	Synchronize Displays	
-Adjust image settings with preview -Manage 3D settings -Set PhysiX Configuration	You can synchronize frame rendering across displays. This is useful when you want to present graphics across multiple displays or synchronize one or ma	rry systems to a house sync source.
Deplay Charge resolution Adjust device point settings Adjust device point settings Adjust device point settings Adjust device point settings Adjust device point Set up device device Adjust device many settings Adjust device many settings	1. The timing server is On another system On this system Dipulsys on this system can only be clarata because a server already south. biocoming sync public frequency: 50 549 Hz	
- ognadnen de dingdings	2. Select displays to lock to the server:	
	Active Deplay Refresh Rate Resolution Additional Information	
	Oet E243WFP 59 540 Hz 1520 x 1200	
	< »	
	Description: Selection: a checkbox synchronizes the decity with the transp server. A display connot synchronize # its refresh rate does not match the refresh rate of the transp server.	
System Information		Apply Cancel

During the synchronization the displays may blink as they adjust their timing. The Status LEDs on the Quadro Sync board and the System Topology Viewer in the control panel will report when the cluster is synchronized.

Note: The Quadro Sync board requires the timings of all displays be within ±20 ppm to properly synchronize. See the "Sync Timing Limits" section for more information.

To disble Frame Lock reverse the process.

LINUX DRIVER CONFIGURATION

The NVIDIA Control Panel on Linux allows one node to manage all nodes in the cluster. To work properly the security settings need to be set properly or client nodes may not appear.

Set Driver Security to Allow Remote Management

Any X Server can be added to the frame lock group, provided that

- 1. The system supporting the X Server is configured to support frame lock and is connected via RJ45 cable to the other systems in the frame lock group.
- 2. The system driving nvidia-settings can communicate with the X server that is to be included for frame lock. This means that either the server must be listening over TCP and the system's firewall is permissive enough to allow remote X11 display connections, or that you've configured an alternative mechanism such as ssh(1) forwarding between the machines.

For the case of listening over TCP, verify that the "-nolisten tcp" commandline option was not used when starting the X server. You can find the X server commandline with a command such as

% ps ax | grep X

If "-nolisten tcp" is on the X server commandline, consult your Linux distribution documentation for details on how to properly remove this option.

For example, distributions configured to use the GDM login manager may need to set "DisallowTCP=false" in the GDM configuration file (e.g., /etc/gdm/custom.conf, /etc/X11/gdm/gdm.conf, or /etc/gdb/gdb.conf; the exact configuration file name and path varies by the distribution). Or, distributions configured to use the KDM login manager may have the line

```
ServerArgsLocal=-nolisten tcp
```

in their kdm file (e.g., /etc/kde3/kdm/kdmrc). This line can be commented out by prepending with "#".

3. The system driving nvidia-settings can locate and has display privileges on the X server that is to be included for frame lock.

A system can gain display privileges on a remote system by executing

% xhost +

on the remote system. See the xhost(1) man page for details.

Configure Frame Lock

1. On the master machine open the NVIDA X Server Settings and select Frame Lock

4 🔊	IVIDIA X Server Settings
A Server Avideo Settings	
Cursor Shadow	
OpenGL Settings	
OpenGL/GLX Information	G-Sync Devices
Antialiasing Settings	
▼ GPU 0 - (Quadro FX 5800)	
Thermal Settings	
PowerMizer	
DFP-0 - (Dell Alienware2310)	
DFP-1 - (Dell Alienware2310)	
▼ GPU 1 - (Quadro FX 5800)	E
Thermal Settings	
PowerMizer	Add Devices Remove Devices Show Extra Info
DFP-0 - (Dell Alienware2310)	
DFP-1 - (Dell Alienware2310)	House Sync-
▼ GPU 2 - (Quadro FX 1800)	Use House Sync if Present
Thermal Settings	Sync Interval:
PowerMizer	
DFP-0 - (LEN)	Sync Edge: Rising 🔍
VCS 0 - (NVIDIA QuadroPlex 2200 D2	
Frame Lock	Video Mode: Composite, Auto Detect
nvidia-settings Configuration	Test Link 📄 Enable Frame Lock
	🔯 <u>H</u> elp

2. Click **Add Devices...** and enter the name of the hostname/ip address and XServer ID of the XServer you want to add. For example localhost:0.0 or in this case our machine named viz0:0.0.

e	Add X Screen	×
?	Please specify the X server to be added to the frame lock group).]
	X <u>C</u> ancel	

3. Select the display that is the Server and those that are clients. There can only be on server per Frame Lock group

<u></u>	NVI	DIA X Server Settings			
Anualiasing settings					
X Server XVideo Settings	G-Sync Devices				
Cursor Shadow					
OpenGL Settings	viz0:0 (G-Sync 0)	Receiving Rate: 0.0000 Hz 9 Hc	ouse Port 0 Port 1		
OpenGL/GLX Information	Quadro FX 5800 (GPU 0)	• Timing			
Antialiasing Settings	Dell Alienware2310 (DFP-0)	Stereo Refresh: 60.000 Hz S	Server 🗌 Client		
▼ X Screen 3	Dell Alienware2310 (DFP-1)	Stereo Refresh: 60.000 Hz S	erver 🗹 Client		
X Server Color Correction	Quadro FX 5800 (GPU 1)	Timing			
X Server XVideo Settings	Dell Alienware2310 (DFP-0)	Stereo Refresh: 60.000 Hz S	erver 🗹 Client		
OpenGL Settings	Dell Alienware2310 (DFP-1)	Stereo Refresh: 60.000 Hz S	erver 🗹 Client		
OpenGL/GLX Information					
Antialiasing Settings					
▼ GPU 0 - (Quadro FX 5800)					
Thermal Settings					
PowerMizer					
DFP-0 - (Dell Alienware2310)					
DFP-1 - (Dell Alienware2310)			Add Devices	emove Devices	Show Extra Info
▼ GPU 1 - (Quadro FX 5800)					
Thermal Settings	House Sync				
PowerMizer	Use House Sync if Present				
DFP-0 - (Dell Alienware2310)	Sync Interval:				
DFP-1 - (Dell Alienware2310)		v			3
GPU 2 - (Quadro FX 1800)					
Thermal Settings PowerMizer		▼ Detect			
DFP-0 - (LEN)					
				Test Link	Enable Frame Lock
Selected frame lock client device.				8 H	elp 🛛 🖉 Quit

4. Add the other nodes in the same way as step 2 and then set the Client displays as desired

		NVIDIA X Server Settings					
OpenGL/GLX Information Antialiasing Settings ♥ X Screen 1	G.Sync Devices						
X Server Color Correction X Server XVideo Settings Cursor Shadow OpenGL Settings OpenGL/GLK Information Antialiasing Settings X Server Color Correction X Server XVideo Settings Cursor Shadow OpenGL Settings OpenGL/GLK Information Antialiasing Settings © GPU 0 - (Quadro FX 5800) Thermal Settings PowerMizer DFP-0 - (Dell Alienware2310) DFP-1 - (Dell Alienware2310)	 viz0:0 (G-Sync 0) Quadro FX 5800 (GPU 0) Dell Allenware2310 (DFP-0) Quadro FX 5800 (GPU 1) Dell Allenware2310 (DFP-0) Dell Allenware2310 (DFP-1) viz1.0 (G-Sync 0) Quadro 5000 (GPU 0) Dell Allenware2310 (DFP-0) 	Receiving Rate: 60 0000 Hz House Timing Stereo Refresh: 60 000 Hz Server Timing Stereo Refresh: 60 000 Hz Server Stereo Refresh: 60 000 Hz House Timing Stereo Refresh: 60 000 Hz House Timing Stereo Refresh: 60 000 Hz Server	Client Client Client Client Port 0				
Thermal Settings PowerMizer DFP-0 - (Dell Alienware2310) DFP-1 - (Dell Alienware2310) 7 GPU 2 - (Quadro FX 1800) Thermal Settings	Hause Sync Lise House Sync If Present Sync Interval			Add Devices.	Remove Di	evices	now Extra Inf
PowerMizer DFP-0 - (LEN) VCS 0 - (NVIDIA QuadroPlex 2200 D2 Frame Lock	Video Mode. Composite, Auto	Detect				_	
DFP-0 - (LEN) VCS 0 - (NVIDIA QuadroPlex 2200 D2	Video Mode. Composite, Auto				Test Link	S Disable	Prame Lock

SYNC TO AN EXTERNAL TIMING SOURCE

EXTERNAL TIMING SOURCES

The Quadro Sync board supports three types of external timing sources through the BNC connector on the bracket.

- ▶ TTL: 3.3V, 50% duty cycle, high impedance
- Bi-Level Composite (NTSC/PAL): 75 Ω impedance
- Tri-Level Composite (HDTV): 75 Ω impedance
 - SMPTE Standard 240 compliant

CAUTION: Using timing signal Voltages above specification: +3.3 V for TTL, ±300 mV for Composite will damage the Quadro Sync board.

Note: When using TTL Sync it is important to use a high quality signal generator as variances in the external sync frequency will cause the displays to blink as they adjust their timings to follow the wandering input signal.

When a valid signal is connected to the BNC connector, the LED below it will illuminate solid green. Once the Quadro Sync board is using the external signal the same LED will flash green at the rate of the incoming sync signal.

When using an external sync both Windows and Linux will identify the incoming sync type and configure the board to use it at the same refresh rate. There are extra settings available to adjust how the board converts the external sync to the internal sync:

 Select which edge of external sync pulse triggers the internal pule, leading, trailing, or on TTL both

- Identify that the incoming signal is interlaced
- Set a Sync Interval defining how many incoming external sync pulses need to be received before the Quadro Sync board sends an internal pulse
 - The default value is 0, meaning every external packet is sent internally
 - Setting 1 will cause the Quadro Sync board to send every other received pulse causing the internal sync pulses to run at half the speed of the external
- Define a start Sync Delay in µSeconds between the external signal and internal sync pulses

Synchronize to an External Sync Source for Windows

- 1. Open the NVIDIA Control Panel and select Synchronize Displays
- Select "The timing server is On this system" radio button
- 3. Click the Server Settings button
- 4. Select An external house sync signal
- 5. Adjust the other options as needed
- 6. Press OK

Server Settings	23
Edit the properties of the frame synchronization pulses generated by the timing server.	
Server refresh rate: 59.95 Hz	
The synchronization pulses are based on:	
\bigcirc The server refresh rate (Internal timing)	
 An external house sync signal 	
Sync frequency: 59.94 Hz	
Sync signal detection: Composite v	
The signal is interlaced	
Trigger sync pulses from the frame start signal using:	
Leading edges	
Falling edges	
 Both edges (applies to TTL signals only) 	
Outgoing sync interval: Sync delay:	
0.00 µs	
Some settings have been automatically updated to match the incoming house sync signal.	
OK Cancel Ap	oply

Synchronize to an External Sync Source for Linux

- 1. Open the NVIDIA X Server Settings and select Frame Lock
- 2. Add Device if needed and configure a display to be the timing server
- 3. Select Use House Sync If Present and define and other options needed

<u>a</u>	NVIDIA X Server Settings	_ 🗆 🗙
X Server Information X Server Display Configuration マ X Screen 0		
X Server Color Correction X Server XVideo Settings Cursor Shadow OpenGL Settings OpenGL/GLX Information Antialiasing Settings GPU 0 - (Quadro K5000) Thermal Settings	Quadro Sync Devices dhcp-172-16-201-254.nvidia.com:0 (Quadro Sync 0) Receiving Rate: 0.0000 Hz House Timing Stereo Refresh: 59.950 Hz Server 	
PowerMizer DFP-3 - (DELL E248WFP) ▽ GPU 1 - (Tesla K20) Thermal Settings	Add Devices Remove Devices Show Ex	tra Info Collapse All
PowerMizer ECC Settings Frame Lock nvidia-settings Configuration	✓ Use House Sync if Present Sync Interval: O Sync Edge: Falling Video Mode: Composite, Auto Detect	A
Enabled use of house sync signal.		Enable Frame Lock

- 4. Press Enable Frame Lock
- 5. Once enabled the UI will reflect the status in the Device list and the House Sync options will be grayed out until Frame Lock is disabled

@	NVIDIA X Server Settings	
X Server Information		.
X Server Display Configuration		NUDIA
▽ X Screen 0		
X Server Color Correction	Quadro Sync Devices	
X Server XVideo Settings	dhcp-172-16-201-254.nvidia.com:0 (Quadro Sync 0)	Receiving Rate: 59.9490 Hz House Port 0 Port 1
Cursor Shadow	Quadro K5000 (GPU 0)	● Timing
OpenGL Settings	DELL E248WFP (DFP-3)	Stereo Refresh: 59.950 Hz Server Client
OpenGL/GLX Information	DELL E248WFF (DFF-3)	Stereo Refresh: 59.950 Hz V Server Client
Antialiasing Settings		
✓ GPU 0 - (Quadro K5000)		
Thermal Settings		
PowerMizer		
DFP-3 - (DELL E248WFP)	Add Devic	Ces Remove Devices Show Extra Info Collapse All
Thermal Settings		
PowerMizer	☑ Use House Sync if Present	
ECC Settings		
Frame Lock		
nvidia-settings Configuration	Sync Edge: Falling	CDV
	Video Mode: Composite, Auto Detect	
	Theomore, composite, Add Detect	
		Test Link Disable Frame Lock
Frame Lock enabled.		🔯 <u>H</u> elp

MONITORING DISPLAY SYNCHRONIZATION

When working with synchronized displays it can often be difficult to verify that all the displays are correctly synchronized. Quadro Sync provides both board and driver level indicators for the synchronization status.

BOARD LEVEL STATUS INDICATIOR

The bracket of the Quadro Sync boards has multiple lights to provide configuration and status information

At system startup all LED's will turn and stay on until the graphics driver loads. Once the driver loads, the LEDs will start to show the status of the board and GPUs.

If the LEDs do not turn on at startup, verify that the external power is correctly connected and providing power.



Figure 6. Board Level Status Indicators

Note: : If the LED's on the bracket do not turn on at system start-up shutdown the system and verify the external power to the Quadro Sync board is connected and operating correctly.

Frame Lock and Stereo Sync Status LEDs

The two rows of status LEDs provide information on the current state of synchronization of the board. There is one LED for each of the GPUs that can be connected.

The top row of LED's shows the synchronization status of the connected GPUs.





SYNC LED Status



GPU present but not synchronized

GPU Not connected



GPU synchronized



GPU is synchronized but within 5% of the threshold of losing sync



GPU is synchronizing

STEREO LED Status



Stereo locked



Stereo in process of locking

Stereo not active/no GPU

SYSTEM TOPOLOGY VIEWER FOR WINDOWS

The System Topology Viewer provides a single screen overview of the GPU, displays and synchronization status.

Back 🕶 🕑 🛛 🟠					
Task	View System Topology				
djust image settings with preview anage 3D settings	This page shows the displays and graphics cards conne	cted within	n this system		
et PhysX Configuration ay		cico man	and oyucan.		
djust desktop color settings	Expand all				
otate display	System topology	Status	Settings		
ew HDCP status et up digital audio	System				
djust desktop size and position	Driver version		310.22		
et up multiple displays eoscopic 3D	Vertical sync	2	On		
et up stereoscopic 3D ew compatibility with games	3D Stereo	v	Enabled: Generic a	active stereo	
ew compatibility with games	Sync (server) Framelock 0	F	Out		
djust video color settings djust video image settings	Framelock 1		Out		
station	External sync signal	C IN	Not present		
ew system topology et up Premium Mosaic	Framelock sync pulse	~	Present		
hange ECC state	Sync settings	-	Synchronize Displ	ays	More
nchronize displays	😑 💓 Quadro K5000				
	DisplayPort (2)		Not connected EDID (Monitor), M	fulti-Display Cloning (Disabled)	
	DisplayPort (1)		Not connected EDID (Monitor), <u>N</u>	fulti-Display Cloning (Disabled)	
	DVI		Connected: auton EDID (Monitor)	nated computer control systems MDC5600-8CC (1 of 2)	
	DVI		EDID (Monitor)	nated computer control systems MDC5600-8CC (2 of 2)	
	Usage Mode		WDDM		
	Total memory		7936 MB		
	Memory free		3837 MB		More More
	 automated computer con (1 of 2) Display state 		Server		
	Resolution, refresh rate		1920 × 2160 pixels	49.996 Hz	
			Horizontal (2200)		
	Active		1920	2160	
	Border		0	0	
	Front porch		13	8	
	Sync width		140	10	
	Back porch		127	122	
	Polarity		Negative (-)	Negative (-)	
	Timing			ted to an internal timing signal	
	EDID source OS Screen Identifier		Monitor 1		
	automated computer con (2 of 2)		1		
	Display state		Client		
	Resolution, refresh rate		1920 × 2160 pixels	. 49.996 Hz	
			Horizontal (2200)		
	Active		1920	2160	
	Border		0	0	
	Front porch		13	8	
	Sync width		140	10	
	Back porch		127	122	
	Polarity		Negative (-)	Negative (-)	
	Timing	\checkmark		ted to the frame lock sync pulse	
	EDID source		Monitor		
	OS Screen Identifier		2 Client Steven in in	all and with the second	
	Stereo sync		Client Stereo is in	phase with the server	

Figure 8. System Topology Viewer for Windows

To use the topology viewer:

- 1. Open the NVIDIA Control Panel and select View System Topology
- 2. With multiple GPUs and displays, the Topology Viewer can get large, maximizing the control panel is recommended.
- 3. Start at the top and work down the page
 - a) Sync Board Settings, verify that the **Framelock sync pulse** and **External sync signal** are as expected

System topology Status		Status	Settings	
Syst	em			
	Vertical sync 📀 🤇		310.22	
			On	
3			Enabled; Generic active stereo	
	Sync (server)			
	Framelock 0	1	Out	
	Framelock 1	17	Out	
	External sync signal		Not present	
	Framelock sync pulse		Present	
	Sync settings		Synchronize Displays	More More
	Quadro K5000			

- b) Scroll down to the individual displays within the GPUs.
- c) Verify the Timing entry for the Server is locked to the internal or external timing

aut	tomated computer con (1 of 2)		
Display state Resolution, refresh rate		Server	
		1920 × 2160 pixels	, 49.996 Hz
		Horizontal (2200)	Vertical (2300)
	Active	1920	2160
	Border	0	0
	Front porch	13	8
	Sync width	140	10
	Back porch	127	122
	Polarity	Negative (-)	Negative (-)
Tir	ming	The display is lock	ed to an internal timing signal
EDID source OS Screen Identifier		Monitor	
		1	

d) For the other displays verify they are **locked** to the sync pulse and that **Stereo is in phase** if using stereo

auto	omated computer con (2 of 2)			
Dis	play state		Client	
Resolution, refresh rate			1920 × 2160 pixels,	. 49.996 Hz
			Horizontal (2200)	Vertical (2300)
	Active		1920	2160
	Border		0	0
	Front porch		13	8
	Sync width		140	10
	Back porch		127	122
	Polarity		Negative (-)	Negative (-)
Tim	ning		The display is lock	ed to the frame lock sync pulse
EDID source			Monitor	
OS	Screen Identifier		2	
Ster	reo sync	~	Client Stereo is in	phase with the server

SYNC TIMING LIMITS

The Quadro Sync board has the ability to align displays and sync sources up to ± 20 ppm difference in the display timings. If the timings are outside this range the board will not be able to synchronize them. The Frame Lock status LEDs on the board will indicate that the board is approaching these limits as well.

Display Refresh Rate (Hz)	Minimum (Hz)	Maximum (Hz)
200	199.996	200.004
120	119.9976	120.0024
100	99.998	100.002
60	59.9988	60.0012
50	49.999	50.001

Table 1.Sync Timing Limits

COMPLIANCE AND CERTIFICATIONS

The Quadro Sync board is compliant with the following regulations:

- Australian Communications Authority and Radio Spectrum Management Group of New Zealand (C-Tick)
- ▶ Bureau of Standards, Metrology and Inspection (BSMI)
- China Compulsory Certification (CCC)
- ► Conformité Européenne (CE)
- ► Federal Communications Commission (FCC) Class B
- Interference-Causing Equipment Standard (ICES)
- Imaging Science Foundation (ISF)
- Korean Communication Commissions (KCC)
- Underwriters Laboratories (UL, CUL)
- ► Voluntary Control Council for Interference (VCCI)

IMPORTANT SAFETY INFORMATION

NVIDIA products are designed to operate safely when installed and used according to the product instructions and general safety practices. The guidelines included in this document explain the potential risks associated with equipment operation and provide important safety practices designed to minimize these risks. By carefully following the information contained in this document, and the specific instructions provided with your product, you can protect yourself from hazards and create a safer environment.

The product is designed and tested to meet IEC-60950-1, the Standard for the Safety of Information Technology Equipment. This also covers the national implementation of IEC-60950-1 based safety standards around the world e.g. UL-60950-1. These standards reduce the risk of injury from the following hazards:

- ▶ Electric shock: Hazardous voltage levels contained in parts of the product
- ▶ Fire: Overload, temperature, material flammability
- Mechanical: Sharp edges, moving parts, instability
- Energy: Circuits with high energy levels (240 volt amperes) or potential as burn hazards
- ▶ Heat: Accessible parts of the product at high temperatures
- Chemical: Chemical fumes and vapors
- ▶ Radiation: Noise, ionising, laser, ultrasonic waves

Retain and follow all product safety and operating instructions. Always refer to the documentation supplied with your equipment. Observe all warnings on the product and in the operating instructions.

CAUTION: Failure to follow these safety instructions could result in fire, electric shock, or other injury or damage.

To reduce the risk of bodily injury, electric shock, fire, and damage to the equipment observe the safety labels included on the equipment.

Table 2. Symbols on Equipment

Sign	Meaning
	This symbol in conjunction with any of the following symbols indicates the presence of a potential hazard. The potential for injury exists if warnings are not observed. Consult your documentation for specific details
	 This symbol indicates the presence of hazardous energy circuits or electric shock hazards. Refer all servicing to qualified personnel. WARNING: To reduce the risk of injury from electric shock hazards, do not open this enclosure. Refer all maintenance, upgrades, and servicing to qualified personnel.
(\mathbf{x})	This symbol indicates the presence of electric shock hazards.The area contains no user or field serviceable parts. Do not open for any reason.WARNING: To reduce risk of injury from electric shock hazards, do not open this enclosure.

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