NVIDIA QUADRO G-SYNC II

User Guide

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Introduction to
NVIDIA Quadro G-Sync II

The NVIDIA® Quadro™ G-Sync™ II is an option card for the
NVIDIA Quadro 6000, 5000, Quadro FX 5800, and FX 4800
graphics boards. Featuring frame lock and genlock functionality,
the Quadro G-Sync II delivers unprecedented levels of realism,
visualization and collaborative capabilities by enabling advanced
multi-system and multi-device visualization environments.

Note: It is important to register your NVIDIA Quadro G-Sync II in order
         to receive NVIDIA Customer Care online and phone support. You
         can register your Quadro G-Sync II at www.nvidia.com/register

About This Guide

This User Guide discusses the installation and configuration
of the NVIDIA Quadro G-Sync II option card.

NVIDIA Quadro G-Sync II User Guide

NVIDIA Quadro G-Sync II

System Requirements

- Operating System (32-bit or 64-bit)
  - Microsoft Windows XP
  - Microsoft Windows Professional x64 Edition, Microsoft Windows Vista 32 bit and 64 bit Microsoft Windows 7 32 bit and 64 bit
  - Linux
  - Solaris x86
- Processor
  - Intel Pentium 4 or Xeon processor or higher
  - AMD Opteron processor or higher
- RAM
  - 2 GB minimum, 4 GB recommended
- System Interface
  - 1 open expansion slot

Implementing SLI Technology

To take advantage of NVIDIA's SLI™ technology combined with Genlock/Frame lock functionality, you must install one NVIDIA Quadro G-Sync II card in conjunction with two supported NVIDIA Quadro graphics boards in a Quadro SLI certified chassis.

See http://www.nvidia.com/object/quadro_sli.html for more information..

NVIDIA Frame Synchronization

Visual computing applications that involve multiple displays or even multiple windows within a display can require special signal processing and application controls in order to function properly.

For example, in order to produce quality video recording of animated graphics, the display graphics must be synchronized with the video camera. As another example, applications presented on multiple displays must be synchronized in order to complete the illusion of a larger, virtual canvas.

The NVIDIA Quadro G-Sync II option card and Frame Synchronization software lets you synchronize windows and displays for various visual computing applications.

Unpacking

Prior to unpacking your new NVIDIA Quadro G-Sync II option card, it is a good idea to make sure you meet all the system requirements (page 3) for a smooth installation.

Be sure to inspect each piece of equipment shipped in the packing box. If anything is missing or damaged, contact your reseller.

NVIDIA Quadro G-Sync II Equipment

The following equipment is included in the
NVIDIA Quadro G-Sync II box.

One (1) NVIDIA Quadro G-Sync II Option Card

Installs into an open expansion slot in your computer.

Two (2) Ribbon Cables

Used to connect the primary G-Sync connector
on the G-Sync II option card to the G-Sync
connector on the Quadro FX graphics board.

One (1) Quadro G-Sync Cable

Used to connect multiple Quadro G-Sync II enabled systems.

Safety Instructions

To reduce the risk of fire, electric shock, and injury
always follow basic safety precautions.

Note: All hardware must be installed prior to installation of the drivers.

■ Remove power from your computer by disconnecting the AC
main source before cleaning. Do not use liquid or aerosol cleaners.
Use a soft, damp cloth from cleaning exposed surfaces.

■ Do not operate this product near water or
when your hands or body are wet.

■ Do not place this product on soft surfaces that could
block the ventilation slots and cause overheating.

■ Do not place this product near a heating register or radiator.

■ Place this product securely on a stable surface. Serious
damage to this product may result if it falls.

■ Do not allow anything to rest on the power cord.
Do not place this product where a person can step
or trip on the power cord or telephone cords.

■ Do not disassemble this product. There are
no user-serviceable parts inside.

■ Do not put lighted candles, cigarettes, cigars,
and so forth, on this product.

■ Do not overload the AC main source and power extension
cords. Doing so increases the risk of fire and electric shock.

Installing NVIDIA Quadro G-Sync II Card

Before you begin, make sure that the supported Quadro graphics board and NVIDIA drivers are correctly installed.

The following is additional information concerning installation of the NVIDIA Quadro G-Sync II card.

Note: The NVIDIA Quadro G-Sync II option card must be used only in conjunction with an NVIDIA Quadro 6000, 5000, FX 5800, or FX 4800 graphics board.

1. Install the Quadro G-Sync II option card into any available expansion slot within six inches of the G-Sync connector on the appropriate Quadro graphics board.

2. Use the cable that comes with your Quadro G-Sync II option card to connect the primary G-Sync connector to the Quadro FX graphics board G-Sync connector shown below.

Quadro graphics board — Cable connecting the Quadro G-Sync card to the Quadro graphics board

Quadro G-Sync II

NVIDIA Quadro G-Sync II User Guide
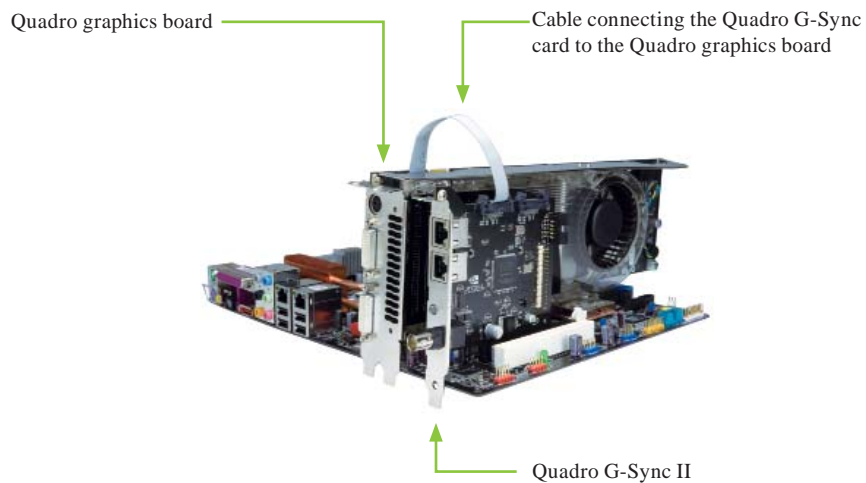
NVIDIA Frame Synchronization Under Windows

This section describes how to set up frame synchronization under Windows. It contains the following sections:

- How To Set Up Genlock
- How To Set Up Frame Lock
- Setting Up Genlock + Frame Lock

How To Set Up Genlock

The following are the basic steps to genlocking a system.
Detailed instructions are provided in the related sections:

- Set Up the Hardware
  Connect the external sync source to the BNC
  connector on the graphics board.

- Set Up the Software
  Use the NVIDIA Control Panel Workstation->Synchronize
  displays page to establish the system as the server, to
  choose the sync source, and configure the sync pulse.

Set Up the Hardware

1. Start the system, then connect the external source signal to the House
   Sync connector (BNC) of the Quadro G-Sync II option card.
   The Quadro G-Sync II supports the following
   external synchronization signal types:

   - TTL (3.3 volt level)

   - Composite Bi-level (NTSC or PAL sources
     use bi-level composite signals)

   - Composite Tri-level (HDTV sources commonly
     use tri-level composite signals)

1. Check the LED on the connector panel.

   ■ A green LED means the hardware has detected the timing signal and you can proceed to the next step.

   ■ An occasional red flash is OK.

   ■ A solid red LED means the hardware can't detect the timing signal.

   ■ Check the signal source and correct the problem before proceeding.

Sync Source   **NVIDIA Quadro G-Sync II Connector Bracket**   **Server**
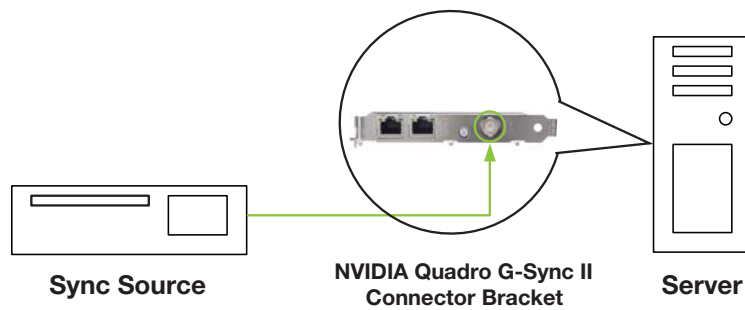
Set Up the Software

This section provides intructions for using the NVIDIA Control Panel to set up the genlock system.

- Basic Genlock Setup

- Detecting the House Sync Signal

- Using the House Sync Signal

- Restoring an Unstable Display

Basic Genlock Setup

1. Right-click the desktop and then from the pop-up menu click NVIDIA Control Panel.

2. From the NVIDIA Control Panel *Select a Task* pane, under the Workstation heading, click **Synchronize displays** to open that page.
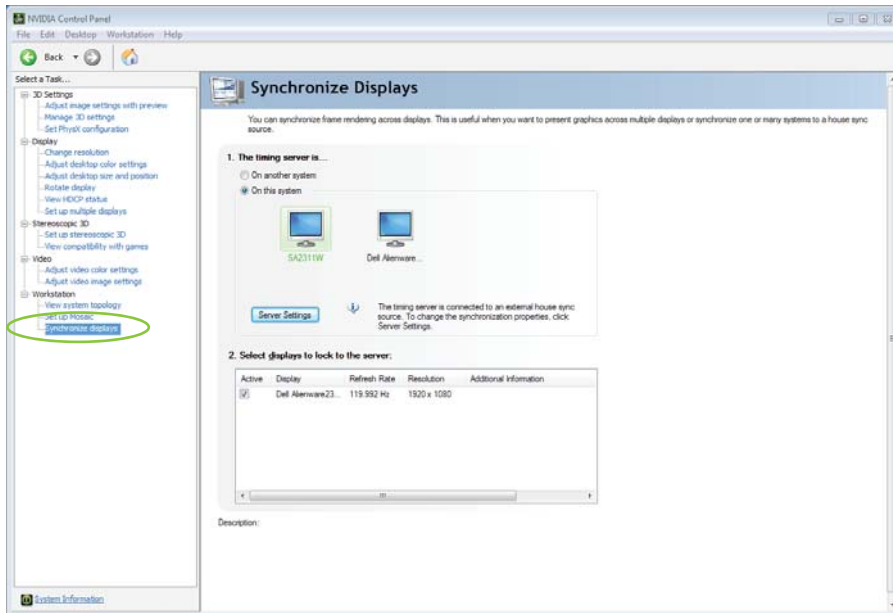
3.   Under **The timing server is**, click the **On this system** radio button.

4.   Click **Apply.**

The graphics board should automatically detect the sync signal and no further action is needed.

The following sections provide information on other tasks such as how to adjust the synchronization to the external house sync. You can also consult the online help by pressing **F1** to open the Help file and then opening the **Workstation->Frame Synchronization** contents.

Detecting the House Sync Signal

Normally, the software automatically detects the signal type that is being used. If necessary, you can force the software to detect the signal type as follows:

1.   On the system that you have set up to be the server, right-click the desktop and then from the pop-up menu click NVIDIA Control Panel.

2.   From the NVIDIA Control Panel *Select a Task* pane, under the Workstation heading, click **Synchronize displays** to open that page, then click **Edit Settings** to open the *Server Settings* dialog box.

3.   Click the **Sync signal detection** list arrow and then click the item corresponding to the house signal source.

4.   Click **OK** to save the settings.
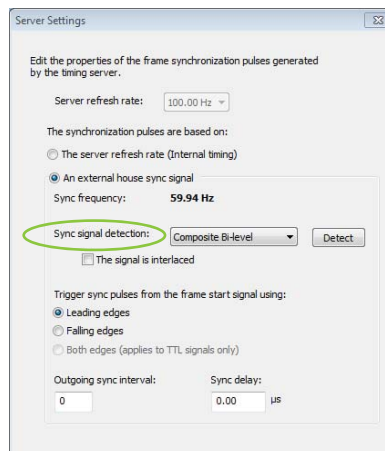
Using the House Sync Signal

This section describes how to:

- Select which edge of the house sync signal to use as the trigger

- Double the trigger frequency from the house sync signal

- Properly handle interlaced house sync signals

- Introduce a timing delay to the house sync signal

1. From the NVIDIA Control Panel *Select a Task pane*, under **Workstation**, click **Synchronize Displays.**

2. Make sure that the **On this system** radio button under **The timing server** is selected.

3. Open the Server Settings dialog box using one of the following methods:

   - From the Synchronize Displays page, click **Server Settings**.

4. Under **The synchronization pulses are based on**, click the **An external house sync signal** radio button.

The *Server Settings* dialog box will show the incoming house sync frequency. A frequency of 0.00 Hz indicates that the system has not yet been set as the server.
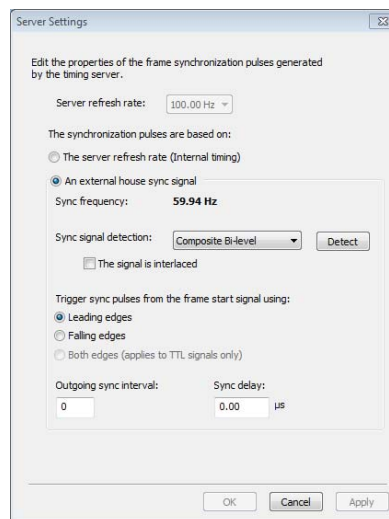
5. Configure additional synchronization settings as needed:

    ■   Select which edge of the sync signal to use to trigger
        the sync pulses - leading or falling edge.

    ■   If necessary, you can double the sync frequency by
        clicking the Both edges radio button under Trigger
        sync pulses from the frame start signal using.

Note: This control is available only for TTL signals.

House signal
Sync Pulse
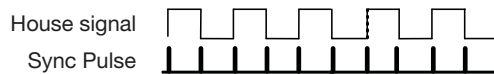
Outgoing Sync triggered from leading and falling edge

    ■   If the external signal is an interlaced signal - such as
        is used to drive a 1080i display - then click the **The
        external signal is an interlaced signal** check box.

    ■   This causes the first field of an interlaced signal to
        be used to synchronize the display. For example, for
        a 60Hz interlaced signal, the effective 120 Hz field
        sync is converted to a 60 Hz frame-sync signal.

    ■   To introduce a timing delay to the house sync signal:
        In the **Sync delay** text box enter the delay (in
        microseconds) that you want to introduce.

6. Click **OK**.
    A *Monitor Settings* dialog box appears, asking if
    you want to keep the changed settings.

7. Click **Yes** to keep the new settings, or click **No**
    to revert to the previous settings.

Restoring an Unstable Display

If your display becomes unstable and you want to restore it to its original configuration, do one or more of the following:

- Click **Restore Defaults** and then click **Apply**.

- Disconnect the external house sync.

Viewing the Connection Status

See the section *Checking the Connection Status* (page 24).

How To Set Up Frame Lock

The following are the basic steps to frame locking several systems. Detailed instructions are provided in the section *Set Up the Hardware* (page 17).

- Set Up the Hardware
  Connect all the systems together using standard CAT5 patch cabling.

Note: WARNING! The voltage and signal on the frame lock ports are different from Ethernet signals. Do not connect a Frame lock port to an Ethernet card or network hub. Doing so can cause damage to the hardware.

- Set Up the Server Software
  Use the NVIDIA Control Panel **Synchronize Displays** page to establish the system as the server.

- Set Up the Client Software
  Use the NVIDIA Control Panel **Synchronize Displays** page for each client to enable frame lock on that system and to add an optional delay to the sync pulse before transmitting to other clients.

Set Up the Hardware

1. Daisy chain the graphics cards together using a standard CAT5 patch cable plugged into the external RJ45 connector.

   - You can connect to any of the two RJ45 connectors located on the G-Sync II bracket.

   - Each connector automatically configures itself as an input or output after all the connections are made and one system is configured as a synchronization server (see *Set Up the Server Software* on page 18). A flashing green LED indicates an input and a flashing yellow LED indicates an output. If there is no server assigned and connected, then both LEDs are a steady green.

2. Designate one of the cards to be the server device. The remaining cards are client devices.
   The server determines the trigger pulse for the client devices. The trigger pulse is derived from the v-sync of the server video.
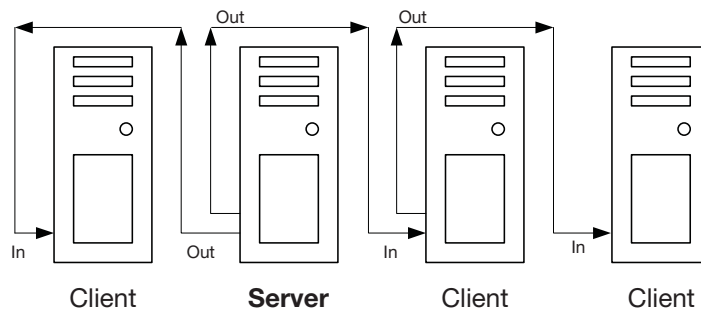
Set Up the Server Software

This section provides instructions for using the **NVIDIA Control Panel** to set up the frame lock server.

Basic Server Setup

Note: If you are synchronizing stereo displays, make sure stereo
         is enabled before synchronizing the displays.

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1. On the system that you have designated to be the timing server, right-click the desktop and then from the pop-up menu, click **NVIDIA Control Panel**.
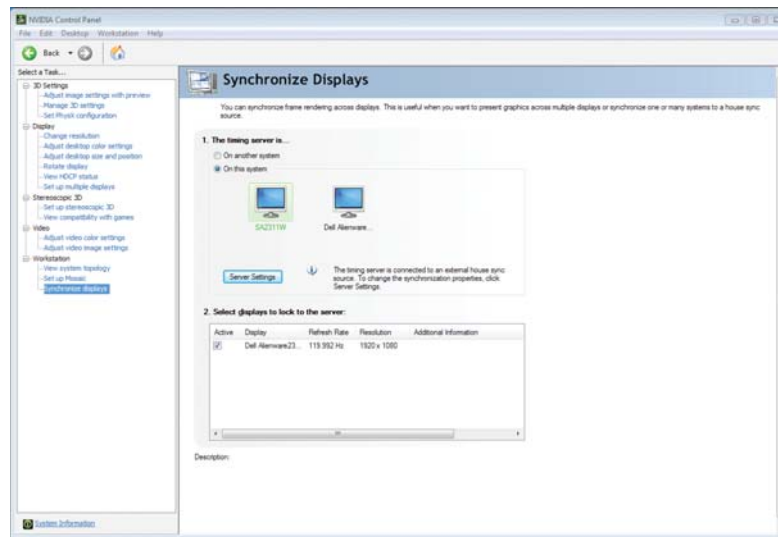
2. From the **NVIDIA Control Panel** *Select a Task* pane, under the Workstation heading, click **Synchronize displays** to open that page.

3. Under **The timing server is**, click the **On this system** radio button. 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,

then under **Select displays to be active clients**, select the check boxes for any displays that you want to be clients.

4. Click **Apply**.The following sections provide information on other tasks. You can also consult the online help by pressing **F1** to open the Help file and then opening the **Workstation->Frame Synchronization** contents.

Changing the Timing Signal Frequency

Follow these instructions if you are using the server to generate the timing signals and you want to change the timing signal frequency.

1. From the **NVIDIA Control Panel** *Select a Task* pane, under the Workstation heading, click **Synchronize displays**.

2. Make sure that the **On this system** radio button under **The timing server** is selected.

3. Click **Edit Settings** to open the *Server Settings* dialog box.

4. Under **The synchronization pulses are based on**, click the **Internal timing signal with a refresh rate of** radio button.

5. Click the list arrow and select a refresh rate, then click **OK**.
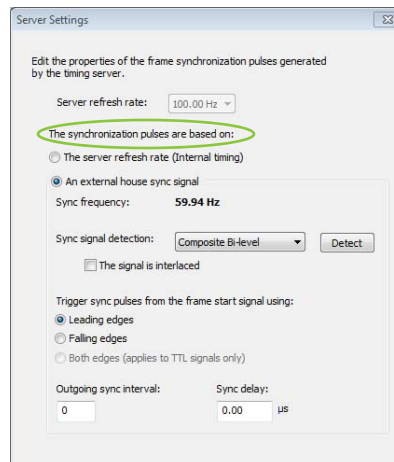
The refresh rate of the server display as well as the frequency of the timing signal will change based on your selection.

Set Up the Client Software

This section provides instructions for using the **NVIDIA
Control Panel** to set up the frame lock client systems.

Basic Client Setup

Perform the following steps for each client system:

1. Right-click the desktop and then from the pop-
    up menu click **NVIDIA Control Panel**.

2. From the **NVIDIA Control Panel** *Select a Task* pane, under the
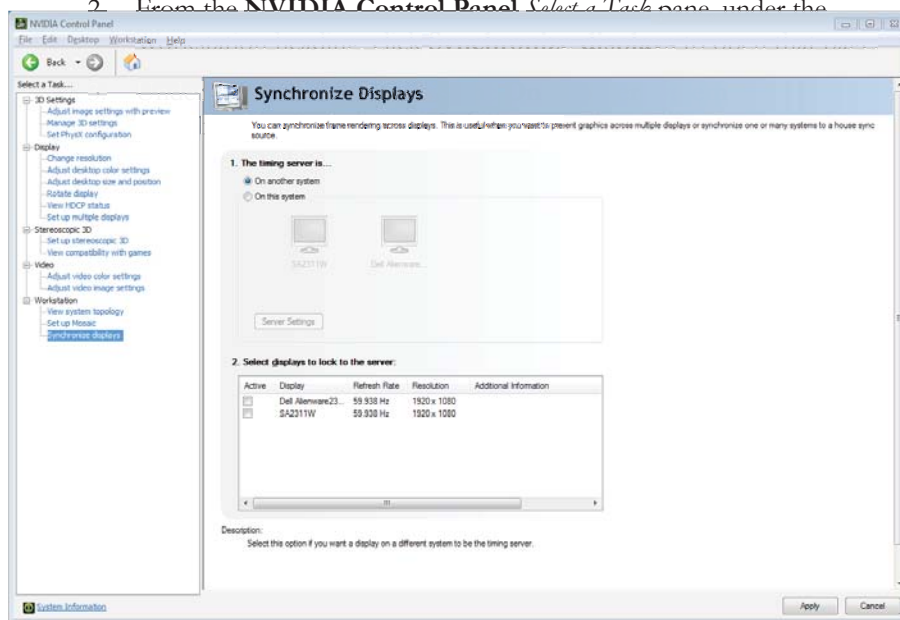
4. Under **Select displays to lock to the server**, select the check boxes for the displays that you want to be clients. You can select only displays whose refresh rates match that of the server. Selected displays will be synchronized to the server.

5. Click **Apply**.

The following sections provide information on other tasks. You can also consult the online help by pressing **F1** to open the Help file and then opening the **Workstation->Frame Synchronization** contents.

Introducing a Timing Delay at Client Systems

You can introduce a sync offset, or a delay between the source trigger point coming into the client system and the actual sync pulse. The value can be in the range of 0 to the time needed to display an entire frame.

Sync Delay (Skew)
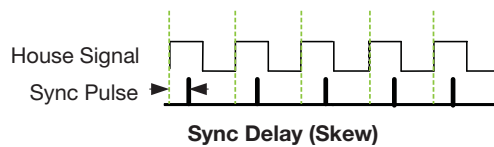
Perform the following steps wherever you want to introduce a delay in the timing signal transmission chain:

1. From the **NVIDIA Control Panel** *Select a task* pane, under **Workstation**, click **View System Topology.**

2. Right-click the G-Sync image, then click **G-Sync settings** from the pop-up menu to open the *G-Sync Settings* dialog box.

3. In the **Sync delay** text box, enter the delay (in microseconds) that you want to introduce to the timing signal, then click **OK**.

Viewing the Connection Status

See the section *Checking the Connection Status* (page 24).

Swap Sync Setup

The application controls synchronization of buffer swaps (swap sync) between applications. Proper connection and synchronization of the timing signal are required for proper synchronization of buffer swaps.

See *Using the OpenGL Extensions* (page 55) for instructions on how an application can use the extensions to accomplish swap sync.

Setting Up Genlock + Frame Lock

The procedures in the previous two sections describe the more common uses of the Quadro G-Sync II. A third use involves a combination of genlock and frame lock.

In this setup, a set of client systems are connected to a system that is designated as the server, as described in *How To Set Up Frame Lock*. The difference is that the server system is genlocked to an external house sync, as described in *How To Set Up Genlock*.
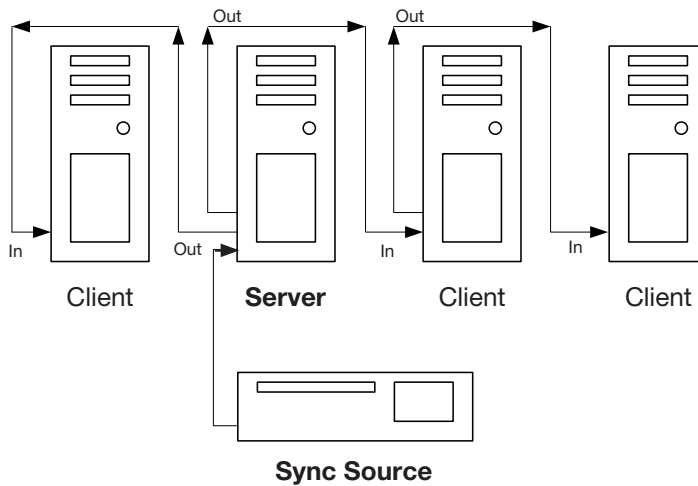
Example of Genlock + Frame Lock Configuration

Checking the Connection Status

The **View System Topology** page provides a graphical view of the status of your frame-sync environment. It shows all the displays in your system and provides frame-lock status information for each display as well as connection status information for the Quadro G-Sync II option card. In addition to viewing status information, you can also change various settings using the **View System Topology** page.

1. Right-click the desktop and then from the pop-up menu click **NVIDIA Control Panel**.

2. From the **NVIDIA Control Panel** *Select a Task* pane, under the Workstation heading, click **View System Topology** to open that page. The **View System Topology** page shows the displays and graphics cards connected within that system.
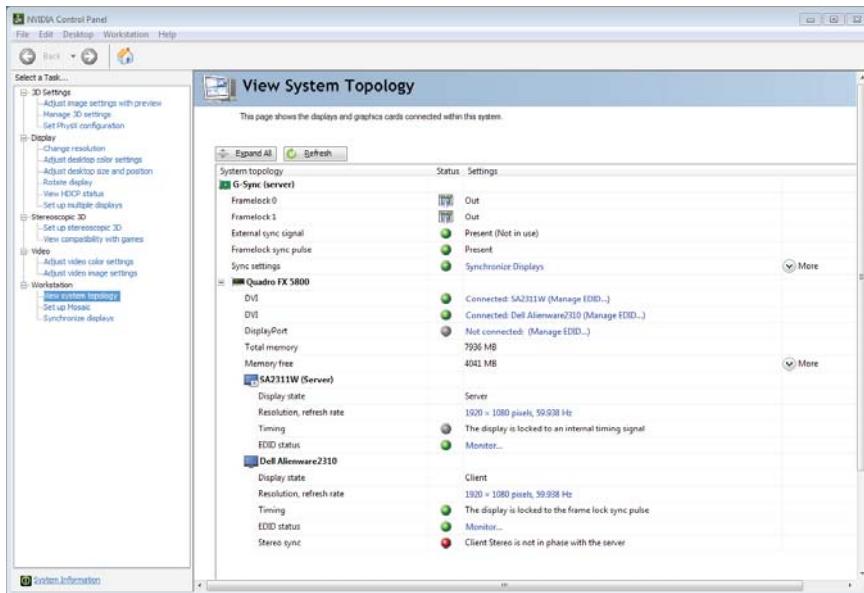
3. Click any of the *display* icons to view the status box that appears at the bottom of the page.
   The display status box shows whether the:

   - Display is using internal timing

   - Display is locked to a house sync signal

   - Display is locked to a frame lock sync pulse

   - Display stereo signal is in phase with the server

4. Click the G-Sync II card icon to view the status box that appears at the bottom of the page.
   The G-Sync II card status box shows:

   - Whether or not the frame lock ports are used

   - The direction of the timing signal at each frame lock port - either IN or OUT

   - Whether or not a house sync signal is present

Swap Sync

The application controls synchronization of buffer swaps (swap sync) between applications. Proper connection and synchronization of the timing signal are required for proper synchronization of buffer swaps.

See *Using the OpenGL Extensions* (page 55) for instructions on how an application can use the extensions to accomplish swap sync..

NVIDIA Quadro G-Sync II User Guide

NVIDIA Frame Synchronization Under Linux

This section describes how to set up frame synchronization under Linux. It contains the following sections:

- Using the nvidia-settings Utility
- How To Set Up Genlock
- How To Set Up Frame Lock
- Setting Up Genlock + Frame Lock
- Leveraging Frame Lock/Genlock in OpenGL
- Writing a Frame Lock NV-CONTROL Client

Using the nvidia-settings Utility

Configure frame lock and genlock using the nvidia-settings utility. After booting the system starting X Windows, run nvidia-settings as follows:

```
% nvidia-settings
```

From the **nvidia-settings** frame lock panel, you can add or remove G-Sync (and display) devices to the frame lock/genlock group, monitor the status of that group, and enable or disable frame lock and genlock.

For information about the page, click **Help** at the lower right corner of the interface.

How To Set Up Genlock

The following are the basic steps to genlocking a system. Detailed instructions are provided in the related sections:

- Set Up the Hardware
  Connect the external sync source to the BNC connector on the graphics boards.

- Set Up the Software
  Use the **nvidia-settings** frame lock panel to establish the system as the server, to choose the sync source, and configure the sync pulse.

Set Up the Hardware

1. Start the system, then connect the external source signal to the House Sync connector (BNC) of the Quadro G-Sync II option card.

   The Quadro G-Sync II supports the following external synchronization signal types:

   - TTL (3.3 volt level)

   - Composite Bi-level (NTSC or PAL sources use bi-level composite signals)

   - Composite Tri-level (HDTV sources commonly use tri-level composite signals)

2. Check the LED on the connector panel.

   - A green LED means the hardware has detected the timing signal, and you can proceed to the next step

   - An occasional red flash is OK.

   - A red LED means the hardware can't detect the timing signal.

   - Check the signal source and correct the problem before proceeding.

Sync Source   **NVIDIA Quadro G-Sync II Connector Bracket**   **Server**
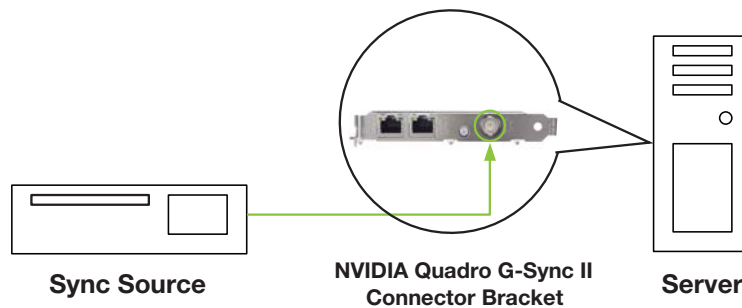
Set Up the Software

Basic Genlock Setup

1. Go to the **nvidia-settings** frame lock panel.

2. Click **Add Devices**, then add the X Server that contains the display and G-Sync II cards that you want to sync to this external source.
   > An X Server is typically specified in the format: `system:m`
   > For example: `mycomputer.domain.com:0 or localhost:0`

   After adding an X Server, the G-Sync Devices section shows the X server name, the graphics card attached to the X server, and the displays attached to the graphics board.

3. Check the **Server** check box for one of the displays connected to the system in order to designate the system as the frame lock server.

4. Click the **Use House Sync** if Present checkbox.

5. Click **Enable Frame Lock**.
   The display device(s) may take a moment to stabilize. If it does not stabilize, you may have selected a synchronization signal that the system cannot support–click **Disable Frame Lock** and then check the external sync signal.

Any time you modify the genlock settings (for example, by
        clicking Use House Sync if Present or Add Devices), you must
        first click Disable Frame Lock to disable synchronization.

The G-Sync section shows the status of the sync signals for the X server

- After connecting the house sync, the external sync
  signal frequency is displayed in the section **Rate**.

- The Receiving, Timing, Stereo, and House indicators should be green.

- If the Timing LED is red—indicating the display is not
  synchronized to the timing signal—then see Synchronizing
  to the External House Signal for further instructions.

- See "Understanding the Status Indicators" for more
  information about the status indicators.

Synchronizing to the External House Signal

This section describes other steps you may need to
take after connecting a house sync signal.

- Adjusting for Interlaced External House Signals
  If the external signal is an interlaced signal, then check
  the **Sync to field 1** check box and click **Apply**.

- Generating a Sync Frequency Slower than the External House Signal
  If the external sync frequency is not support by your display because
  it is too high or if you are using an interlaced signal, you can generate
  a sync signal of a reduced frequency by entering a number in the **Sync
  interval** box.
  This number represents the number of external sync pulses to
  receive before generating the synchronization pulse. For example,
  if the house sync frequency is 120 Hz, then entering 1 in the
  Outgoing sync interval box results in a 60 Hz sync pulse.

Outgoing Sync Interval value of 1
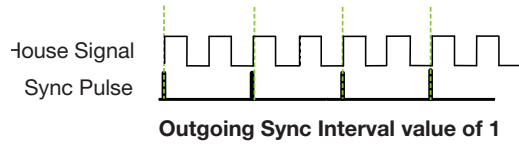
This action overrides any refresh rate that you may have selected from the refresh rate list.

■ Generating a Sync Frequency Faster than the External House Signal
   You can double the sync frequency by triggering the sync pulse off both the leading and falling edge of the source sync signal. This works only with TTL level signals.

Click the **Sync Edge** list arrow and then select both leading and falling edges.

Outgoing Sync triggered from leading and falling edge
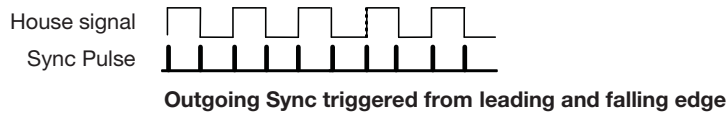
■ Detecting the Incoming Signal Type
   Quadro G-Sync II supports the following external synchronization signal types:

   ▫ TTL (3.3 volt level)

   ▫ Composite Bi-level (NTSC or PAL sources use bi-level composite signals)

   ▫ Composite Tri-level (HDTV sources commonly use tri-level composite signals)

Normally, the software automatically detects the signal type that is being used. If necessary, you can force the software to detect the signal type as follows:

1. Click **Detect** to force detection of the signal type.

2. The software tests each signal type and stops when it detects a match.

3. If the signal type cannot be detected, click the **Video Mode** list box arrow and then click the item corresponding to the signal source.

4. Click **Composite, Auto** if you want the frame lock board to classify the signal as bi-level or tri-level.

Understanding the Status Indicators

The G-Sync Devices section displays the status of the sync signals as well as the status of the RJ45 ports. The two ports are represented by connector icons.

NVIDIA Quadro G-Sync II Port
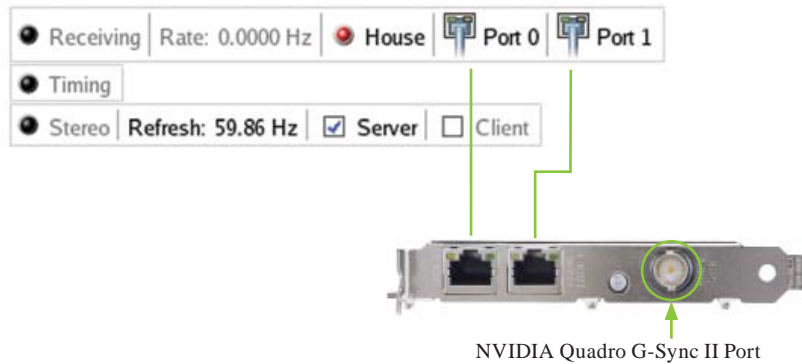
Sync and Connection Status for the Genlock Server

- Sync Status
  - Receiving - Green indicates that a sync pulse is present.
  - House - Green indicates that a signal is
    present at the BNC connector
  - Timing - Indicates whether the timing is locked to the sync signal
    Green: The timing is locked to the house sync.
    Grey: The timing is locked to the internal V-Sync.
    Red: The display is not synchronized to the timing signal
  - Stereo - Always green indicates that it is in sync with a timing signal.
- Port Status
  - Out/Out is the normal indicator for the server device.
  - In/In indicates that the system is not selected as a
    server or client and is not frame-lock enabled.

How To Set Up Frame Lock

Set Up the Hardware

1. Daisy chain the graphics cards together using a standard CAT5
   patch cable plugged into the external RJ45 connector.

   - You can connect to any of the two RJ45 connectors
     located on the G-Sync II card bracket.

   - Each connector automatically configures itself as an input or
     output after all the connections are made and one system is
     configured as a synchronization server. A flashing green LED
     indicates an input and a flashing yellow LED indicates an output.
     If there is no server assigned and connected,
     then both LEDs are a steady green.

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2.   Designate one of the displays to be the server device. The remaining displays are client devices.
     The server determines the trigger pulse for the client devices. The trigger pulse is derived from the V-Sync signal of the server video.

Four frame locked systems

Set Up the Server Software

Frame Lock is supported across an arbitrary number of Quadro G-Sync II systems.

Note: All displays connected to the same GPU to be included in the frame lock group must be configured with identical display-mode timings and refresh rates.

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

■ 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.

■ 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 "#".

- 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.
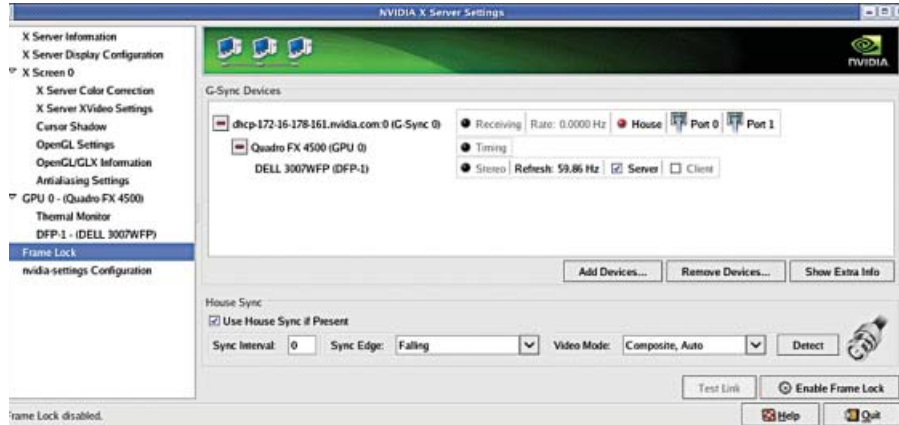
Use the following procudure to set-up the server software:

1. Go to the **nvidia-settings** frame lock panel.

2. Add the X server that contains the display devices that you would like
   to include in the frame lock group by clicking **Add Devices**.
   Any X Server can be added to the frame lock group, provided that:

   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.

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

   An X Server is typically specified in the format: system:m

   For example: mycomputer.domain.com:0 or localhost:0

   Like the genlock status indicators, the Port0 and Port1 columns in
   the table on the frame lock panel contain indicators whose states
   mirror the states of the physical LEDs on the RJ45 ports. This lets
   you monitor the status of the ports from the software interface.

3. Select the **Server** check box for the display that
   you want to use as the frame lock server.

4. To gain display privileges on a remote system, execute

   `% xhost +` on the remote system.

   See the xhost (1) main page for details. Typically, frame lock
   is controlled through one of the systems that will be included
   in the frame lock group. While this is not a requirement, note
   that nvidia-settings will only display the frame lock panel
   when running on an X server that supports frame lock.

5. To enable synchronization on these display devices, click **Enable
   Frame Lock**.

   The screens may take a moment to stabilize. If they do not stabilize,
   you may have selected mode timings that one or more of the systems
   cannot support.

   In this case, you should disable synchronization by clicking
   Disable Frame Lock, and then fix the mode timings.

Note: Any time you modify the genlock settings (for example, by
clicking Use House Sync if Present or Add Devices), you must
first click Disable Frame Lock to disable synchronization.

Test the Connections

To test the connections, click **Test Link** on the
nvidia-settings frame lock panel.

The **G-Sync Devices** section displays the status of the
sync signals as well as the status of the RJ45 ports. The
two ports are represented by connector icons.

NVIDIA Quadro G-Sync II Port
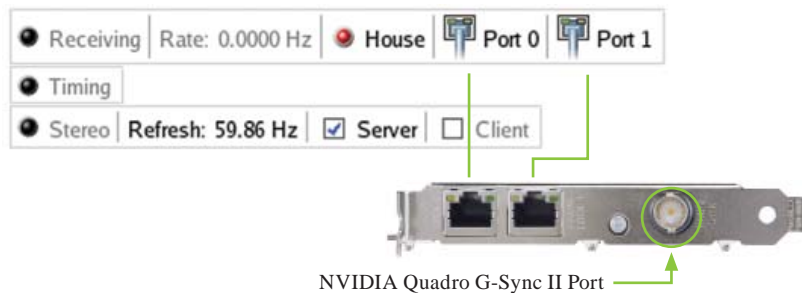
Sync and Connection Status for the Server

■ Sync Status

▫ Receiving - Green indicates that a sync pulse is present.

▫ Timing - Indicates whether the timing is locked to the sync signal
Grey: The timing is locked to the internal V-Sync.

▫ Stereo - Always green indicates that it is in sync with a timing signal.

■ Port Status

▫ Out/Out is the normal indicator for the server device.

▫ In/In indicates that the system is not selected as a
server or client and is not frame-lock enabled.

Sync and Connection Status for the Client

■ Sync Status

▫ Receiving - Green indicates that a sync pulse is present.

▫ Timing - Indicates whether the timing is locked to the sync signal
Green: The timing is locked to the signal on the frame lock
conector.
Red: Either no signal on the frame lock connector is
detected, or the lock to the signal has been lost

▫ Stereo - Steady green indicates that the client's stereo
timing is locked to the server's stereo signal.

▫ Port Status

▫ Out/Out is the normal indicator for the server device.

▫ In/In indicates that the system is not selected as a
server or client and is not frame-lock enabled.

Swap Sync

The application controls synchronization of buffer swaps (swap sync)
between applications. Proper connection and synchronization of the
timing signal are required for proper synchronization of buffer swaps.

See *Using the OpenGL Extensions* (page 55) for instructions on how
an application can use the extensions to accomplish swap sync.

Setting Up Genlock + Frame Lock

The procedures in the previous two sections describe the more common uses of the Quadro G-Sync II option card. A third use involves a combination of genlock and frame lock.

In this setup, a set of client systems are connected to a system that is designated as the server, as described in *How To Set Up Frame Lock*. The difference is that the server system is genlocked to an external house sync, as described in *How To Set Up Genlock*.

1. Follow the instructions under *How To Set Up Frame Lock* and then attach an external sync source to one of the systems included in the frame lock group.

2. Check the **Server** check box of the display that
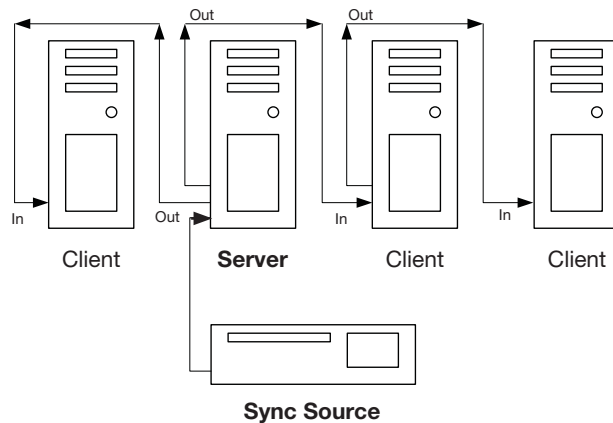
3. Check the **Use House Sync if Present** check box.

4. Enable synchronization by clicking **Enable Frame Lock**.

As with other frame lock/genlock controls, you must select the signal server while synchronization is disabled.

Leveraging Frame Lock/Genlock in OpenGL

With the `GLX_NV_swap_group` extension, OpenGL applications can be implemented to join a group of applications within a system for local swap sync, and bind the group to a barrier for swap sync across a frame lock group. A universal frame counter is also provided to promote synchronization between systems.

Frame Lock Restrictions

The following restrictions apply when enabling frame lock:

- All frame lock display devices that are connected to the same Quadro must have the same display-mode timings.

- All display devices set as the frame lock client must have the same refresh rate as the frame lock server (master) display device. If a House Sync signal is used (instead of internal timings), all client display devices must have the same refresh rate as the incoming house sync signal.

- All X Screens (driving the selected client/server display devices) must have the same stereo setting. Refer to the Linux README. TXT file for instructions on how to set the stereo X option.

- The frame lock server (master) display device must be on a Quadro on the primary connector to the Quadro G-Sync II option card.

- If connecting a single Quadro to a Quadro G-Sync II option card, the primary connector must be used.

- In configurations with more than one display device per Quadro, we recommend enabling frame lock on all display devices on those Quadros.

Supported Frame Lock Configurations

The following frame lock configurations are supported:

- **Basic Frame Lock:** Single Quadro, Single X Screen, Single Display Device with or without OpenGL applications that make use of Quad-Buffered Stereo and/or the `GLX_NV_swap_group` extension.

- **Frame Lock + TwinView:** Single Quadro, Single X Screen, Multiple Display Devices with or without OpenGL applications that make use of Quad-Buffered Stereo and/or the `GLX_NV_swap_group` extension.

- **Frame Lock + Xinerama:** One or more Quadro(s), Multiple X Screens, Multiple Display Devices with or without OpenGL applications that make use of Quad-Buffered Stereo and/or the `GLX_NV_swap_group` extension.

- **Frame Lock + TwinView + Xinerama:** One or more Quadro(s), Multiple X Screens, Multiple Display Devices with or without OpenGL applications that make use of Quad-Buffered Stereo and/or the `GLX_NV_swap_group` extension.

- **Frame Lock + SLI SFR, AFR, or SLIAA:** Two Quadros, Single X Screen, Single Display Device with either OpenGL applications that make use of Quad-Buffered Stereo or the `GLX_NV_swap_group` extension.

- **For Frame Lock + SLI Frame Rendering**, applications that make use of both Quad-Buffered Stereo and the `GLX_NV_swap_group` extension are not supported

- **Frame Lock + Mosaic Technologies:** One or more Quadro or Quadro Plex configured for Mosaic with or without OpenGL applications that make use of the Quad-Buffered Stereo and/or the GLX_NV_swap_group extension.

Configuring Frame Sync Using the nvidia-settings Command Line

You can also configure frame lock using the nvidia-settings command line. This method is useful in a scripted environment for automating the setup process.

General Steps

1. Disable frame lock on all Quadros.

2. Make sure all display devices that are to be frame-locked have the same refresh rate.

3. Configure which Quadro/display device is to be the master.

4. Configure the house sync (if applicable).

5. Configure the slave display devices.

6. Enable frame lock on the master Quadro.

7. Enable frame lock on the slave Quadros.

8. Test the hardware connections using the test signal on the master Quadro.

Sample Configurations

Use the examples in this section as a guideline. The exact scripts that you use will depend on your hardware configuration.

For a full list of the **nvidia-settings** frame lock attributes, see the nvidia-settings (1) main page.

Genlock Example

Hardware Configuration

System 1

- One Quadro G-Sync II Option Card
- One Quadro
- One Display
- Sync Source
- House Sync

Genlock Example Script

1. Make sure frame lock sync is disabled.
   ```
   nvidia-settings -a [gpu:0]/FrameLockEnable=0
   nvidia-settings -q [gpu:0]/FrameLockEnable
   ```

2. Query the enabled displays on the Quadro.
   ```
   nvidia-settings -q [gpu:0]/EnabledDisplays
   ```

3. Check that the refresh rate is the one we want.
   ```
   nvidia-settings -q [gpu:0]/RefreshRate
   ```

4. Set the master display device to CRT-0.
   ```
   nvidia-settings -a [gpu:0]/FrameLockMaster=0x00000001
   nvidia-settings -q [gpu:0]/FrameLockMaster
   ```

The desired display device(s) to be set are passed in as a hexadecimal number in which specific bits denote which display devices to set

Examples:
```
0x00000001 - CRT-0
0x00000002 - CRT-1
0x00000003 - CRT-0 and CRT-1
0x00000100 - TV-0
0x00000200 - TV-1
0x00020000 - DFP-1
0x00010101 - CRT-0, TV-0 and DFP-0
0x000000FF - All CRTs
0x0000FF00 - All TVs
0x00FF0000 - All DFPs
```

Note: You can use the command:
```
nvidia-settings -q [gpu:0]/EnabledDisplays
```
to see all the available displays on a given Quadro.

---

5. Enable use of the house sync signal.

    ```
    nvidia-settings -a [framelock:0]/
    FrameLockUseHouseSync=1
    ```

6. Configure the house sync signal video mode

    ```
    nvidia-settings -a [framelock:0]/FrameLockVideoMode=0
    ```

7. Set the slave display device to none.
    This is to avoid having unwanted display
    devices locked to the sync signal.

    ```
    nvidia-settings -a [gpu:0]/FrameLockSlaves=0x00000000
    ```

    ```
    nvidia-settings -q [gpu:0]/FrameLockSlaves
    ```

8. Enable framelocking.

    ```
    nvidia-settings -a [gpu:0]/FrameLockEnable=1
    ```

9. Toggle the test signal.

    ```
    nvidia-settings -a [gpu:0]/FrameLockTestSignal=1
    ```

    ```
    nvidia-settings -a [gpu:0]/FrameLockTestSignal=0
    ```

Frame Lock Example 1

Hardware Configuration

System 1

- One Quadro G-Sync II Option Card
- Two Quadros
- Two Displays (one per Quadro)

System 2

- One Quadro G-Sync II Option Card
- Two Quadros
- Two Displays (one per Quadro)

Sync Source

- First display from system 1

Frame Lock Example Scripts

1. Disable frame lock.

    ```
    nvidia-settings -a myserver:0[gpu:0]/FrameLockEnable=0
    nvidia-settings -a myserver:0[gpu:1]/FrameLockEnable=0
    nvidia-settings -a myslave1:0[gpu:0]/FrameLockEnable=0
    nvidia-settings -a myslave1:0[gpu:1]/FrameLockEnable=0
    ```

1. Query the enabled displays on the Quadros.

   ```
   nvidia-settings -q myserver:0[gpu:0]/EnabledDisplays
   nvidia-settings -q myserver:0[gpu:1]/EnabledDisplays
   nvidia-settings -q myslave1:0[gpu:0]/EnabledDisplays
   nvidia-settings -q myslave1:0[gpu:1]/EnabledDisplays
   ```

3. Check the refresh rate is the same for all displays.

   ```
   nvidia-settings -q myserver:0[gpu:0]/RefreshRate
   nvidia-settings -q myserver:0[gpu:1]/RefreshRate
   nvidia-settings -q myslave1:0[gpu:0]/RefreshRate
   nvidia-settings -q myslave1:0[gpu:1]/RefreshRate
   ```

4. Make sure the display device we want as master is masterable

   ```
   nvidia-settings -q myserver:0[gpu:0]/
   FrameLockMasterable
   ```

5. Set the master display device (CRT-0).

   ```
   nvidia-settings -a myserver:0[gpu:0]/
   FrameLockMaster=0x00000001
   ```

6. Disable the house sync signal on the master device.

   ```
   nvidia-settings -a myserver:0[framelock:0]/
   FrameLockUseHouseSync=0
   ```

7. Set the slave display devices.

   ```
   nvidia-settings -a myserver:0[gpu:1]/
   FrameLockSlaves=0x00000001
   nvidia-settings -a myslave1:0[gpu:0]/
   FrameLockSlaves=0x00000001
   nvidia-settings -a myslave1:0[gpu:1]/
   FrameLockSlaves=0x00000001
   ```

8. Enable frame lock on server.

   ```
   nvidia-settings -a myserver:0[gpu:0]/FrameLockEnable=1
   ```

9. Enable frame lock on slave devices.

```
nvidia-settings -a myserver:0[gpu:1]/FrameLockEnable=1

nvidia-settings -a myslave1:0[gpu:0]/FrameLockEnable=1

nvidia-settings -a myslave1:0[gpu:1]/FrameLockEnable=1
```

10. Toggle the test signal.

```
nvidia-settings -a myserver:0[gpu:0]/
FrameLockTestSignal=1

nvidia-settings -a myserver:0[gpu:0]/
FrameLockTestSignal=0
```

Frame Lock Example 2

Hardware Configuration

System 1

- Two Quadro G-Sync II Option Cards
- Four Quadros
- Eight Displays (two per Quadro)
- Sync Source
- First display on the first Quadro

Frame Lock Example 2 Scripts

1. Make sure frame lock is disabled for all Quadros.

```
nvidia-settings -a [gpu:0]/FrameLockEnable=0

nvidia-settings -a [gpu:1]/FrameLockEnable=0

nvidia-settings -a [gpu:2]/FrameLockEnable=0

nvidia-settings -a [gpu:3]/FrameLockEnable=0
```

2. Query the enabled displays on the Quadros.

```
nvidia-settings -q [gpu:0]/EnabledDisplays
nvidia-settings -q [gpu:1]/EnabledDisplays
nvidia-settings -q [gpu:2]/EnabledDisplays
nvidia-settings -q [gpu:3]/EnabledDisplays
```

3. Verify that the refresh rate is the same for all displays.

```
nvidia-settings -q [gpu:0]/RefreshRate
nvidia-settings -q [gpu:1]/RefreshRate
nvidia-settings -q [gpu:2]/RefreshRate
nvidia-settings -q [gpu:3]/RefreshRate
```

4. Make sure the display device we want as master is masterable.

```
nvidia-settings -q myserver:0[gpu:0]/
FrameLockMasterable
```

5. Set the master display device (CRT-0).

```
nvidia-settings -a [gpu:0]/FrameLockMaster=0x00000001
```

6. Disable the house sync signal on the master device.

```
nvidia-settings -a [framelock:0]/
FrameLockUseHouseSync=1
```

7. Set the slave display devices.

```
nvidia-settings -a [gpu:0]/FrameLo
ckSlaves=0x00000002 # CRT-1

nvidia-settings -a [gpu:1]/FrameLockSla
ves=0x00000003 # CRT-0 and CRT-1

nvidia-settings -a [gpu:2]/FrameLockSla
ves=0x00000003 # CRT-0 and CRT-1

nvidia-settings -a [gpu:3]/FrameLockSla
ves=0x00000003 # CRT-0 and CRT-1
```

8. Enable frame lock on the master Quadro.

```
nvidia-settings -a [gpu:0]/FrameLockEnable=1
```

9. Enable frame lock on the slave devices.

   ```
   nvidia-settings -a [gpu:1]/FrameLockEnable=1
   nvidia-settings -a [gpu:2]/FrameLockEnable=1
   nvidia-settings -a [gpu:3]/FrameLockEnable=1
   ```

10. Toggle the test signal.

   ```
   nvidia-settings -a [gpu:0]/FrameLockTestSignal=1
   nvidia-settings -a [gpu:0]/FrameLockTestSignal=0
   ```

Writing a Frame Lock NV-CONTROL Client

The NVIDIA X driver exposes the nv-control X extension that allows the user to configure various features–including frame lock–from an X windows client.

This is a brief summary of some of the requirements for writing a **Frame Lock NV-CONTROL** client.

Writing a Frame Lock Client for NV-CONTROL 1.8 (and earlier)

See the sample **NV-CONTROL** clients in the samples directory for basic examples of how to set integer attributes. See the file **ctkframelock.c** for a much more involved example of how the **nvidia-settings** utility programs the frame lock attributes.

The constants referenced below are defined in **NVCtrl. h**. See the comments in that file for an explanation of each attribute. It may also be useful to search the **ctkframelock. c** file using a grep utility to see how each attribute is used.

The following are the basic steps:

1. Open a display connection to each X Screen you want to control in your frame lock cluster.
   Make sure you have privileges to establish the X connection.

2. Query the **NV_CTRL_FRAMELOCK** attribute to determine if frame lock is supported on each X screen.

3. Set **NV_CTRL_FRAMELOCK_MASTER** to **NV_CTRL_FRAMELOCK_MASTER_TRUE** on one node in the cluster; set it to **NV_CTRL_FRAMELOCK_MASTER_FALSE** on every other node in the cluster.

   - Set **NV_CTRL_FRAMELOCK_POLARITY** for each slave node in the cluster.
     Most likely, you want **NV_CTRL_FRAMELOCK_POLARITY_RISING_EDGE**.

   - Set **NV_CTRL_FRAMELOCK_SYNC_DELAY** as appropriate for each node.
     Most likely, you want 0.

   - Set **NV_CTRL_FRAMELOCK_SYNC_INTERVAL** as appropriate if you are using a house sync.
     Most likely, you want 0.

   - Set **NV_CTRL_FRAMELOCK_SYNC** to **NV_CTRL_FRAMELOCK_SYNC_ENABLE** on each X screen to enable frame lock.

   - (Optional) Set **NV_CTRL_FRAMELOCK_TEST_SIGNAL** to **NV_CTRL_FRAMELOCK_TEST_SIGNAL_ENABLE** followed immediately by **NV_CTRL_FRAMELOCK_TEST_SIGNAL_DISABLE**.
     This guarantees accuracy of the Universal Frame Count (as returned by **glXQueryFrameCountNV()**).

   - When you are done, set **NV_CTRL_FRAMELOCK_SYNC** to **NV_CTRL_FRAMELOCK_SYNC_DISABLE** on each X screen to disable frame lock.

During operation, you can also query any of these on each X screen:

- NV _ CTRL _ FRAMELOCK _ PORT0 _ STATUS

- NV _ CTRL _ FRAMELOCK _ PORT1 _ STATUS

- NV _ CTRL _ FRAMELOCK _ HOUSE _ STATUS

- NV _ CTRL _ FRAMELOCK _ SYNC _ READY

- NV _ CTRL _ FRAMELOCK _ STEREO _ SYNC

- NV _ CTRL _ FRAMELOCK _ ETHERNET _ DETECTED

- NV _ CTRL _ FRAMELOCK _ SYNC _ RATE

- NV _ CTRL _ FRAMELOCK _ TIMING

nvidia-settings registers a `gtk+` timeout function and queries the state of these on each X screen every few seconds.

Writing a Frame Lock Client for NV-CONTROL 1.9 (and later)

These are the two major changes to frame lock configuration in **NV-CONTROL** 1.9:

- Display devices (instead of X Screens) are now selected as the clients and slaves of a frame lock group.

- Frame lock attributes should now be set/queried on Quadros (`NV _ CTRL _ TARGET _ TYPE _ GPU`) and Quadro G-Sync II (frame lock) devices (`NV _ CTRL _ TARGET _ TYPE _ FRAMELOCK`) using the new **NV-CONTROL** targeting API.

See the sample **NV-CONTROL** clients in the samples directory for basic examples of how to use the new targeting API (`nv-control-targets.c`) and a basic frame lock client (`nv-control-framelock.c`). See the file `ctkframelock.c` for a much more involved example of how the **nvidia-settings** utility programs the frame lock attributes.

The constants referenced below are defined in `NVCtrl.h.`. See the comments in that file for an explanation of each attribute. It may also be useful to search the `ctkframelock.c` file using a grep utility to see how each attribute is used.

Querying the Frame Lock Capabilities of a System

1. Query the number of Quadro G-Sync II devices on the system by passing **NV_CTRL_TARGET_TYPE_ FRAMELOCK** to **XNVCTRLQueryTargetCount()**.

2. Query the Quadros attached to each Quadro G-Sync II device by querying the **NV_CTRL_GPUS_USING_FRAMELOCK** attribute for each Quadro G-Sync II device.

3. Query the enabled (available) displays on each Quadro using the **NV_CTRL_ENABLED_DISPLAYS** attribute.

Configuring the Frame Lock Group

This must be done while frame lock is disabled on the Quadro G-Sync II device:

1. Set the frame lock master display on one of the Quadros using the **NV_CTRL_FRAMELOCK_MASTER** attribute.

2. Set the rest of the display devices as slaves using the **NV_CTRL_FRAMELOCK_SLAVES** attribute.

3. Set **NV_CTRL_USE_HOUSE_SYNC** to **NV_CTRL_USE_HOUSE_SYNC_ TRUE** or **NV_CTRL_USE_HOUSE_SYNC_FALSE** on the master Quadro G-Sync II device, depending on whether or not you will be using a House Sync signal.
This refers to the G-Sync device that is attached to the Quadro that contains the display device currently set as the frame lock master.

4. Set **NV_CTRL_FRAMELOCK_POLARITY** for each slave Quadro G-Sync II device in the cluster.
Most likely, you want **NV_CTRL_FRAMELOCK_ POLARITY_RISING_EDGE**.

5. Set **NV_CTRL_FRAMELOCK_SYNC_DELAY** as appropriate for each Quadro G-Sync II device.
Most likely, you want 0.

6. Set **NV_CTRL_FRAMELOCK_SYNC_INTERVAL** as appropriate if you are
    using a house sync.
    Most likely, you want 0.

Enabling/Disabling Frame Lock

1. Enable frame lock on each Quadro by setting **NV_CTRL_
    FRAMELOCK_SYNC** to **NV_CTRL_FRAMELOCK_SYNC_ENABLE**.

2. (Optional) Set **NV_CTRL_FRAMELOCK_TEST_SIGNAL** to **NV_CTRL_
    FRAMELOCK_TEST_SIGNAL_ENABLE** followed immediately by
    NV_CTRL_FRAMELOCK_TEST_SIGNAL_DISABLE (on the Quadro that
    contains the master frame lock display).
    This guarantees accuracy of the Universal Frame Count
    (as returned by glXQueryFrameCountNV()).

3. When you are done, set **NV_CTRL_FRAMELOCK_SYNC** to **NV_CTRL_
    FRAMELOCK_SYNC_DISABLE** on each Quadro to disable frame lock.

During operation you can also query any of these
on each Quadro or frame lock device:

- NV _ CTRL _ FRAMELOCK _ PORT0 _ STATUS

- NV _ CTRL _ FRAMELOCK _ PORT1 _ STATUS

- NV _ CTRL _ FRAMELOCK _ HOUSE _ STATUS

- NV _ CTRL _ FRAMELOCK _ SYNC _ READY

- NV _ CTRL _ FRAMELOCK _ STEREO _ SYNC

- NV _ CTRL _ FRAMELOCK _ ETHERNET _ DETECTED

- NV _ CTRL _ FRAMELOCK _ SYNC _ RATE

- NV _ CTRL _ FRAMELOCK _ TIMING

NVIDIA Quadro G-Sync II User Guide

Using the OpenGL Extensions

This chapter explains how to use the OpenGL extensions supported by the
NVIDIA driver for accomplishing frame synchronization of applications.

- *Frame Synchronization Using the OpenGL Extensions* explains the
  principles behind swap groups, and describes the OpenGL
  extensions to use to control frame lock and swap sync functions.

- *OpenGL Extensions* details the API calls for the extensions.

Frame Synchronization Using the OpenGL Extensions

Swap sync refers to the synchronization of buffer swaps of multiple application windows. By means of swap sync, applications running on multiple systems can synchronize the application buffer swaps between all the systems.

Swap sync requires

- ■ Proper connection and synchronization of the timing signals

- ■ A mechanism for binding several windows together so that buffer swaps can be synchronized across all windows

About Buffer Swaps

Key Points and Definitions

Buffer swaps are performed on windows.

- ■ Swap Groups
  If buffer swaps must be synchronized across several windows on a single Quadro, you can define a "group" that consists of the specified windows.

- ■ Swap Barriers
  If buffer swaps must be synchronized across several Quadros, you can define a "barrier" that consists of the specified Quadros.

Buffer Swap Criteria

The criteria for buffer swaps involves when a window is
ready to swap and when a group is ready to swap.

Window Buffer Swaps

Any rendering surface that is not a window—such as a non-visible
rendering buffer—is always ready, otherwise the following criteria must
be satisfied before a buffer swap for a window can be performed:

- The window itself must be ready, meaning:
  A buffer swap command has been issued for it.
  Its swap interval has elapsed.

- If the window belongs to a group, all the
  windows in the group must be ready.

- If the window belongs to a group and that group is bound to
  a barrier, all groups bound to that barrier must be ready.

Group and Barrier Buffer Swaps

- Buffer swaps for all windows in a swap group take place
  concurrently and buffer swaps for all groups using a barrier take
  place concurrently.For barrier swaps, the vertical retraces of the
  screens of all the groups must also be synchronized, otherwise
  there is no guarantee of concurrency between groups.

- An implementation may support a limited number of swap groups and
  barriers and may have restrictions on where the users of a barrier can
  reside.
  For example, an implementation may allow the users to reside
  on different display devices or even hosts. An implementation
  may return zero for any of maxGroups and maxBarriers returned
  by `QueryMaxSwapGroupsNV` if swap groups or barriers are
  not available in that implementation or on that host.

Frame Counter

The implementation provides a universal counter, or frame counter, among all systems that are locked together by swap groups/barriers. It is based on the internal synchronization signal which triggers the buffer swap.

- To obtain the current frame count, call `wglQueryFrameCountNV()`,`glxQueryFrameCountNV()()`.

- To reset the frame count back to zero, call, `wglResetFrameCountNV()`,`glxResetFrameCountNV()()`.

  In a system that has a Quadro G-Sync II device installed and enabled, **`ResetFrameCountNV()`** succeeds only when the frame lock device is configured as a master device.

Configuring for Swap Sync

Configuring Swap Groups

You can assign an OpenGL window to a swap group. There is a maximum number of allowable swap groups that can be created for any particular implementation. With the current hardware, the maximum number of swap groups is one.

- To determine the maximum swap group number, call `QueryMaxSwapGroupsNV()`

- To assign a window to a swap group, call `JoinSwapGroupNV()`

  and specify the swap group number.
  If rendering surface is already a member of a different group, it is implicitly removed from that group. If the swap group number is zero, the rendering surface is removed from the current group.
  To query the current swap group, call `QuerySwapGroupNV()`.

Configuring Swap Barriers

You can bind a group to a barrier. There is a maximum number of barriers that can be created. With the current hardware, the maximum number of barriers is one.

- To determine the maximum barrier number, call
  `QueryMaxSwapGroupsNV()`

- To bind a group to a barrier, call
  `BindSwapBarrierNV()`

  and specify the group and barrier numbers.
  If the barrier number is zero, then the group in unbound from the current barrier.
  To query the current barrier, call `QuerySwapGroupNV()`.

OpenGL Extensions

This section describes the relevant OpenGL **NV_swap_group** extensions supported by the NVIDIA display driver and shipped with the Quadro G-Sync II hardware.

These are exported in the WGL extension string which on Windows can be queried by **wglGetExtensionsStringARB**.

This section covers both the **WGL_NV_swap_group** extensions (exported on Microsoft WindowsNT/XP systems) and the **GLX_NV_swap_group** extensions (exported on Linux systems).

- `wglJoinSwapGroupNV()`, `glxJoinSwapGroupNV()`

- `wglBindSwapBarrierNV()`, `glxBindSwapBarrierNV()`

- `wglQuerySwapGroupNV()`, `glxQuerySwapGroupNV()`

- `wglQueryMaxSwapGroupsNV()`, `glxQueryMaxSwapGroupsNV()`

- `wglQueryFrameCountNV()`,`glxQueryFrameCountNV()`

- `wglResetFrameCountNV()`,`glxResetFrameCountNV()`

wglJoinSwapGroupNV(), glxJoinSwapGroupNV()

This call adds the OpenGL window with the device context hDC to the swap group specified by group. If hDC is already a member of a different group, it is implicitly removed from that group first.

Function	B00L `JoinSwapGroupNV` (HDC hDC, GLuint group);
Parameters In	hDC - Device context for the frame lock card, or a window residing on the frame lock card.
	group - Swap group number to which the device context is to be assigned. The value must be between 0 and `maxGoups` (see `wglQueryMzxSwapGroupsNV` (), `glxyQueryMaxSwapGroupsNV` ()
Parameters Out	N/A
Return Values	TRUE: Success
	FALSE: Failure

wglBindSwapBarrierNV(), glxBindSwapBarrierNV()

This call binds a swap group to a barrier.

Function	B00L `BindSwapBarrierNV` (GLuint group, GLuint barrier);
Parameters In	hDC - Device context for the frame lock card, or a window residing on the frame lock card.
	group - Swap group number that is bound to a barrier.
	barrier - Barrier number to which the swap group is to be bound. Value must be between 0 and `maxBarrier` (see `wglQueryMzxSwapGroupsNV` (), `glxyQueryMaxSwapGroupsNV` ()
Parameters Out	N/A
Return Values	TRUE: Success
	FALSE: Failure

wglQuerySwapGroupNV(), glxQuerySwapGroupNV()

This call returns the swap group number and barrier number to which the device context is bound.

Function	B00L QuerySwapGroupNV (HDC hDC, GLuint *group, GLuint *barrier);
Parameters In	hDC - Device context for the frame lock card, or a window residing on the frame lock card.
Parameters Out	*group - The group number to which the device context is bound, or assigned.
	*barrier - The barrier number to which the device context is bound.
Return Values	TRUE: Success
	FALSE: Failure. In this case *group and *barrier are undefined.

wglQueryMaxSwapGroupsNV(), glxQueryMaxSwapGroupsNV()

This call returns the maximum number of swap groups and swap barriers that are supported by the implementation.

Function	B00L QueryMaxSwapGroupsNV (HDC hDC, GLuint *maxGroup, GLuint *maxBarrier);
Parameters In	hDC - Device context for the frame lock card, or a window residing on the frame lock card.
Parameters Out	*maxGroups - The maximum group number supported by the implementation.
	*maxBarriers - The maximum barrier number supported by the implementation.
Return Values	TRUE: Success
	FALSE: Failure. In this case *maxGroups and *maxBarriers are undefined.

wglQueryFrameCountNV(),glx QueryFrameCountNV()

QueryFrameCountNV returns in count the current frame counter for swapGroup.

This call returns the current frame count of the swap group.

Function	B00L `QueryFrameCountNV` (HDC hDC, GLuint *carrier);
Parameters In	hDC - Device context for the frame lock card, or a window residing on the frame lock card.
Parameters Out	*count - The current frame count of the swap group.
Return Values	TRUE: Frame count successfully retrieved.
	FALSE: Frame count retrieved failed.

wglResetFrameCountNV(),glx ResetFrameCountNV()

This call resets to zero the frame count of the swap group. The call succeeds only on the master device.

Function	B00L `ResetFrameCountNV` (HDC hDC);
Parameters In	hDC - Device context for the frame lock card, or a window residing on the frame lock card.
Parameters Out	N/A
Return Values	TRUE: Frame counter successfully reset.
	FALSE: Frame counter not successfully reset.

References and Resources

Getting Driver Updates

During NVIDIA software installation, the installation wizard provides an option to check for updated software online. You can also download software updates by visiting: http://www.nvidia.com/content/drivers/drivers.asp

Registration, Support and Warranty

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- Conformité Européenne (CE)

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