Onyx2™ DPLEX Option Hardware User's Guide

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About This Guide

The Onyx2 digital video multiplexer (DPLEX) hardware described in this document requires both hardware (primarily boards and cables) and software to be complete.

This guide presents the information necessary to an end user that wants to understand the hardware in an Onyx2 system with DPLEX graphics. Each chapter in the book addresses a particular area, with further refinement at the section level. References are made to external documents when needed.

Structure of This Document

This guide contains the following chapters:

- Chapter 1, “Introduction to the Onyx2 DPLEX Option,” illustrates and describes the DG5 and DPLEX board assembly and provides applicable parts and safety information.
- Chapter 2, “Onyx2 DPLEX Cabling Configurations,” uses text and drawings to describe the proper DPLEX cabling scheme for cascades up to eight pipes. Examples of two and three matched DPLEX cascade pairs are also provided.
- Chapter 3, “DPLEX Software Configuration and Troubleshooting,” provides information on procedures for enabling or disabling a DPLEX pipe. Hardware configuration commands and other information for checking on DPLEX functions are listed.
- Chapter 4, “Onyx2 DPLEX Theory of Operation,” covers basic information on the operational theory of the DPLEX video hardware.

Purpose of This Guide

This manual is intended to assist Onyx2 DPLEX option users to

- use the DPLEX hardware options properly
- understand the correct levels of software required to support the DPLEX options
- reconfigure the DPLEX system cabling for different levels of functionality
- run an audit of the system to check the DPLEX option graphics

For More Information on Using Onyx2 Systems

The following documents provide additional information about Onyx2 systems. These documents can be found in the Silicon Graphics Technical Publications Library, at http://techpubs.sgi.com/library/

- *InfiniteReality Video Format Combiner User's Guide*, part number 007-3279-*xxx*
- *Origin and Onyx2 Theory of Operations Manual*, part number 007-3439-*xxx*
- *Onyx2 Deskside Workstation Owner's Guide*, part number 007-3454-*xxx*
- *Onyx2 Rackmount Owner's Guide*, part number 007-3457-*xxx*

Chapter 1

Introduction to the Onyx2 DPLEX Option

This chapter provides an introduction to the Onyx2 Digital Video Multiplexer (DPLEX) option product and introduces information necessary to understand the basic functions of the option.

Product Description

The Onyx2 DG5 with DPLEX option is a board assembly that installs in the Onyx2 graphics module in the same way (and same location) as a standard DG5-2 board. It provides specialized, high-resolution, digital and analog imagery capabilities for Onyx2 deskside and rackmount systems.

The DPLEX hardware option consists of an external low voltage differential signalling (LVDS) balanced cable, and a DG5 with DPLEX board set. All necessary genlock and swap ready cables are installed either at the factory or by Silicon Graphics trained field personnel. This hardware users guide is recommended for any customer wishing to modify the physical cabling of the DPLEX after the initial installation.

Each DPLEX option assembly is essentially composed of a DG5-2 board with an attached DPLEX daughter card. DPLEX allows you to join or "cascade" the video outputs of two or more graphics pipes and output them to a single monitor or other video device (such as a video projector). The pipes in the DPLEX cascade are always linked using LVDS, swap ready, and genlocking (sync) cables.

Note: The DPLEX option is always initially configured by a field installer either when the Onyx2 system is installed or when it is upgraded. Any reconfiguration of the pipes after installation should be carefully considered. See the hardware cabling and configuration information in Chapter 2. For customer support information see the section "Product Support" on page 3. Chapter 3 provides information on using the ircombine interface to modify the DPLEX cascade configuration.

An LVDS cable connects each DPLEX board to the next DPLEX in the group. This group is referred to as a "cascade." Two or more DPLEX boards cascade their video frame data out through a single DPLEX video connection. Figure 1-1 shows the DG5 and DPLEX board assembly and its connectors.

Some key uses for DPLEX are distortion correction (required for Dome Simulators) and interactive visualization of massive polygonal datasets, as in full-product digital prototype applications.

See Chapter 4 for a theory of operations overview of the DPLEX board.

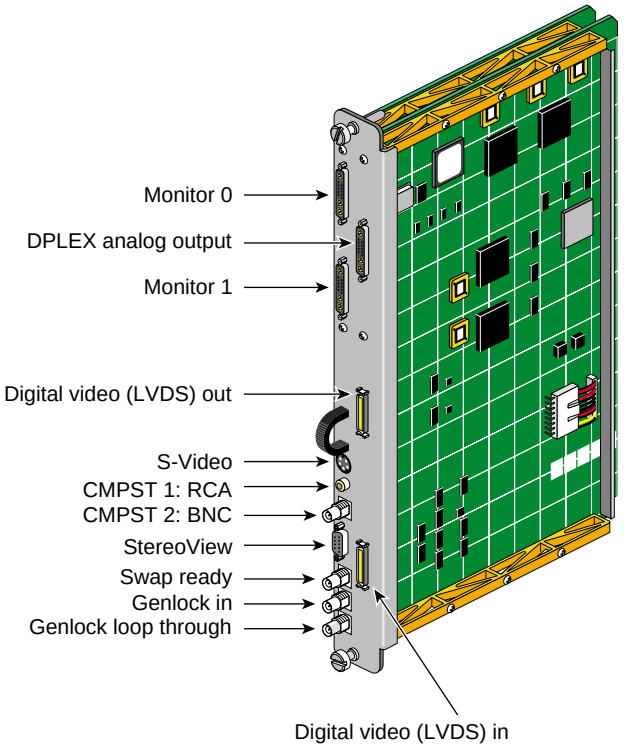

Figure 1-1 DPLEX Board Set

Restrictions and Important Notes

The DPLEX boards are *not* compatible with the Onyx2 DD02 (also called DVP2) option. The two options can be operated in the same Onyx2 rack system, but may not share the same graphics pipe. You cannot connect the two options together.

There are two versions of the monitor adapter cable (018-0634-002 in Figure 2-2) in the field. This cable is also known as a 13W3M to 13W3F 2BNC cable. You should always use the -002 version of this cable with DPLEX. If you encounter a situation where you must use 018-0634-001, note that in the -001 cable assemblies the horizontal/vertical pinouts are reversed. If you are using the -001 version, you must use the V Sync connector as the genlock input. All the instructions in this manual assume that you are using 018-0634-002.

Other important DPLEX information to remember:

- The DPLEX option cannot be used in older Onyx InfiniteReality systems.
- The DPLEX option requires IRIX release 6.5.3 or later.
- Application software must be modified for multipipe DPLEX operation.

Product Support

Silicon Graphics provides a comprehensive range of product support for its products. If you are in North America and would like support for your Silicon Graphics products, contact the Technical Assistance Center at 1-800-800-4SGI or your authorized service provider. If you are outside North America, contact the Silicon Graphics subsidiary or authorized distributor in your country.

Chapter 2

Onyx2 DPLEX Cabling Configurations

This chapter provides some examples of the configurations available with the DPLEX option products. The configurations documented are examples only and do not necessarily reflect what may be installed at a particular site. The term “cascaded set” refers to a set of DPLEX pipes (two or more) that are cabled together to provide higher performance imagery capabilities than a single pipe can provide.

LVDS Cable Requirements

The basic connection rules for the DPLEX LVDS cables are as follows:

- Each cascaded set of DPLEX pipes must be connected with LVDS cables in a daisy-chain fashion.
- The digital video out connector on the primary DPLEX pipe does not send video out to another DPLEX.
- DPLEX pipes with LVDS cables connected in a ring configuration are not supported.

If you need more information on LVDS functions, see the IEEE 1596.3 scalable coherent interface (SCI) LVDS specification.

Genlock Cabling Guidelines

All the DPLEX pipes in a cascaded set must be genlocked for proper functionality. The DG5 genlock in and loop through connectors on the assembly provide these links.

There are two probable sources for the DPLEX cascade genlock signal to originate:

- The green or H sync connector from the (primary) output pipe in the DPLEX cascade.
- An external genlock source, often called “house sync” coming into the Onyx2 system.

In either case, the last DPLEX in the genlock daisy chain must always have its genlock loop through connector (located on the DG5 part of the assembly) terminated with a 75 ohm BNC terminator. The exception to this rule is for DPLEX cascades of more than four pipes; see “Requirements for Genlocking More than Four Pipes” on page 7.

Note: Always use the minimum length of cable necessary to make the genlock connections. Excessive cable lengths (especially with lower quality cable) can cause attenuation problems and result in improper genlocking. See the information in the next section, “Requirements for Genlocking More than Four Pipes” for larger configuration cabling requirements.

Getting the sync signal from the analog (13W3) connector on the DPLEX output pipe requires use of a special 13W3 cable (p/n 018-0634-002). Always use the light color “H” sync connector (on 018-0634-002) to set the internal genlock.

Caution: There are two versions of the monitor adapter cable (018-0634-002 in Figure 2-2) in the field. This cable is also known as a 13W3M to 13W3F 2BNC cable. You should always use the -002 version of this cable with DPLEX. If you encounter a situation where you must use 018-0634-001, note that in the -001 cable assemblies the horizontal/vertical pinouts are reversed. If you are using the -001 version, you must use the V Sync connector as the genlock input. All the instructions in this manual assume that you are using 018-0634-002.

You can use the ircombine graphical interface software to configure the DPLEX boards. See Chapter 3 for more information.

You can also use the */usr/gfx/setmon* command option to properly set genlock. The ***-g*** argument to */usr/gfx/setmon* enables external genlocking (video clocking). See the setmon(1G) man page for details on all the */usr/gfx/setmon* options.

Requirements for Genlocking More than Four Pipes

In configurations greater than four pipes it is highly recommended that the genlock sync function be distributed from the source (house sync or primary pipe) using a “star” video distribution amplifier (also known as a line driver or splitter). Failure to use a video distribution amplifier with a cascade of more than four pipes may cause video sync distortion. Need for a video distribution amplifier is influenced by the distance between pipes in a cascade and the quality of the cables used for genlocking.

Swap Ready Cabling Guidelines

Swap ready cabling must be connected properly to all pipes in the DPLEX cascade. If swap ready is not properly regulated, the DG5 buffers may transfer video data at an incorrect interval. Figure 2-1 shows the DG5 and DPLEX assembly connectors.

For a two-pipe DPLEX cascade, just connect the two swap ready connectors together. For more than two pipes, use “T” connectors to make the connections. No terminators are used with swap ready cabling.

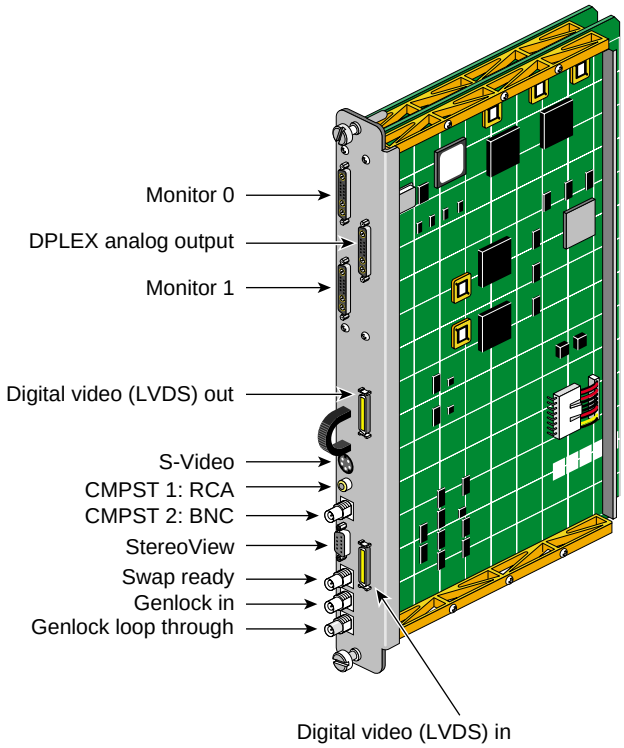

Figure 2-1 DG5 and DPLEX Connectors

Cabling a Two-Pipe DPLEX Cascade

To properly cable a two-pipe DPLEX cascade, you need the following cables and connectors:

- Two 75 ohm genlocking cables with female BNC connectors at each end. The length of these cables is determined by the distance between the pipes and in some cases by the distance from an external genlock source. A 75 ohm genlock terminator is also required.

  Note: If the installation requires use of an external genlock (house sync), determine what connector is required for the external equipment.

- One 75 ohm cable with female BNC connectors at each end is required for swap ready signaling between the pipes.

When you have all the cables, follow these steps to cable a two-pipe DPLEX cascade.

1. Determine if you will set genlock for the DPLEX cascade externally (house sync), or internally from the primary (lowest number) DPLEX pipe.
   - For an external genlock signal, connect the external genlock line (house sync) to the genlock in connector on the first DG5/DPLEX board set in the cascade. This is shown as pipe 0 in Figure 2-3.
   - For internal genlock, connect the 018-0634-002 cable to the pipe 0 13W3 monitor 1 connection on the DG5 board, and cable the H sync connection to the genlock input of pipe 0. See Figure 2-2 for an example.
2. Connect a 75 ohm genlock cable from the genlock loop through connector on pipe 0 to genlock in on pipe 1.
3. Terminate the genlock loop through connector on pipe 1 with a 75 ohm terminator.
4. Connect the two pipe's swap ready connectors with a 75 ohm cable. No terminators are used with swap ready.
5. Plug the 40-pin digital video cable from the digital video out (top) connector on pipe 1 to the digital video in connection on pipe 0.
6. Connect the DPLEX analog display cable to the 13W3 monitor connector on DPLEX pipe 0 (the rightmost 13W3 connector). This is the monitor that will receive the DPLEX cascaded output.
7. Connect the system default monitor to the 13W3 monitor connector 0 on pipe 0. The connector is located at the top of the DG5.

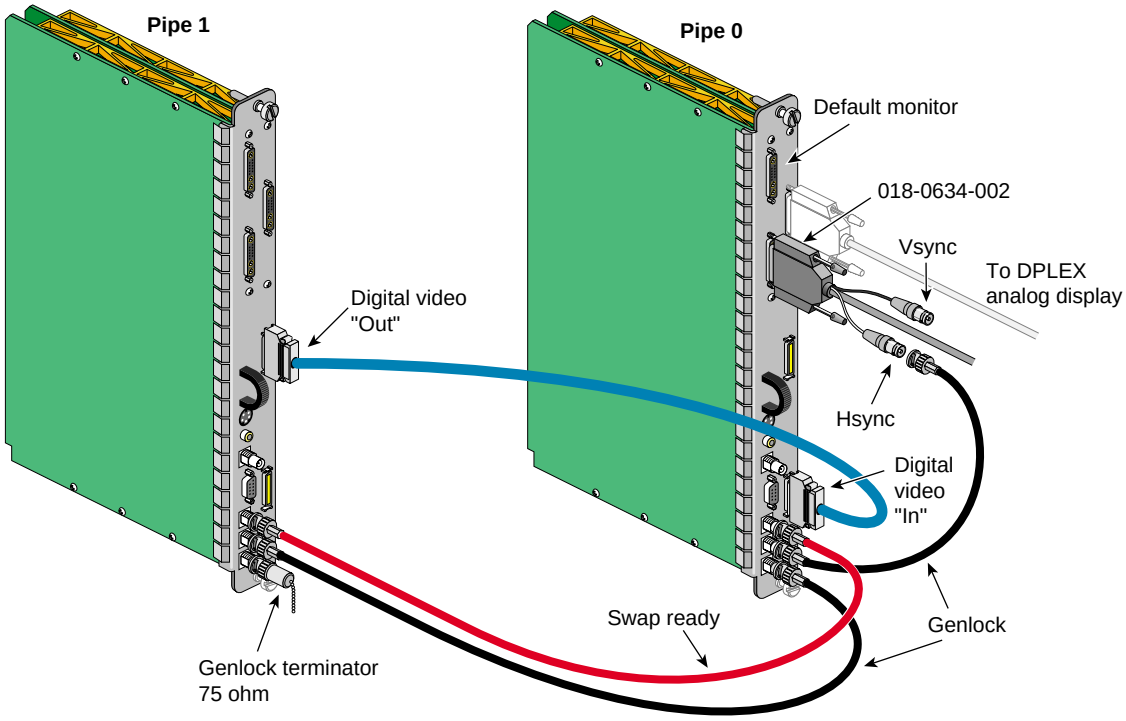

Figure 2-2 Cabling a Two-Pipe DPLEX Cascade (Internal Genlock)

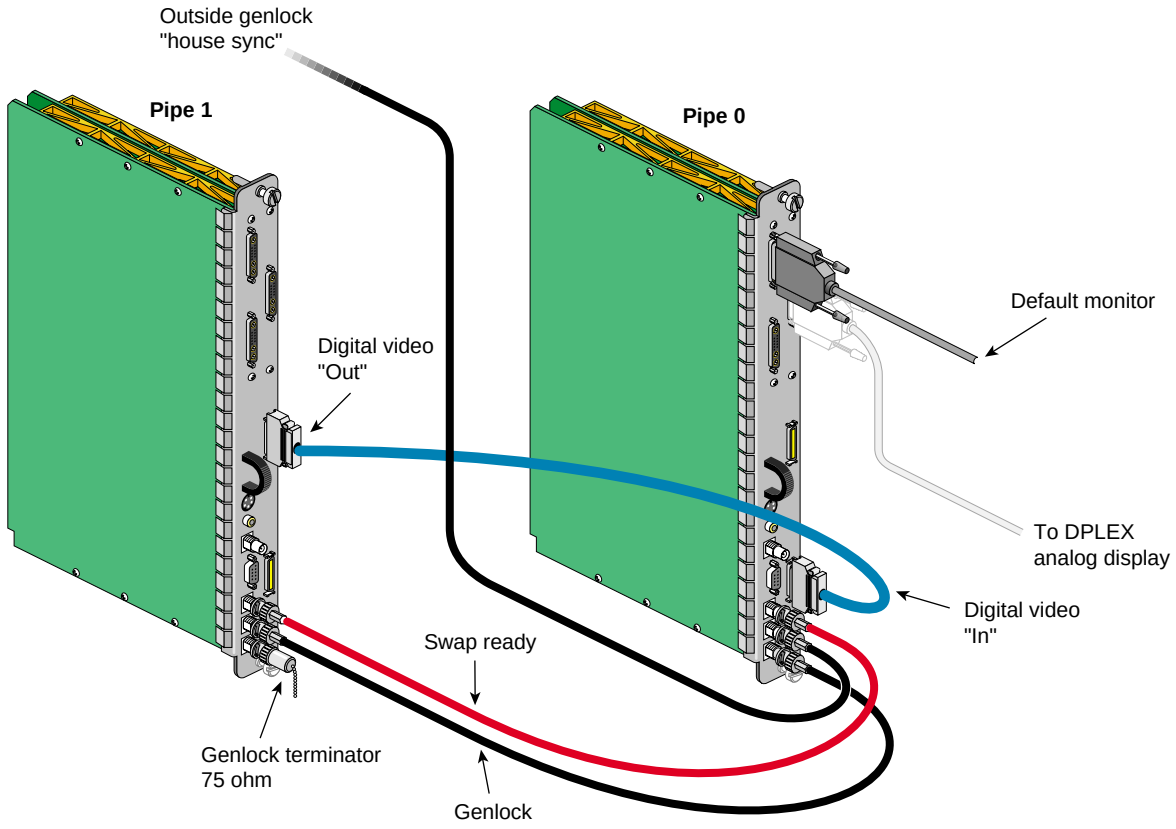

Figure 2-3 Cabling a Two-Pipe DPLEX Cascade (External Genlock)

Cabling a Three-Pipe DPLEX Cascade

Use the following instructions to properly connect a three-pipe version of the DPLEX cascade. To properly cable the DPLEX cascade, you need the following cables and connectors:

- Three 75 ohm genlock cables with female BNC connectors at each end. The length of these cables is determined by the distance between the pipes and possibly by the distance from an external genlock source. A 75 ohm genlock terminator is required.

  Note: If your equipment requires use of an external genlock (house sync), determine what connector is required for the external equipment.

- Two 75 ohm cables with female BNC connectors at each end are required for swap ready signaling between the pipes. You will also need a BNC "T" connector with one female and two male connectors.

When you have all the cables follow these steps to cable a three-pipe DPLEX cascade.

1. Determine if you will set genlock for the DPLEX cascade externally (house sync) or internally from the primary (lowest number) DPLEX pipe.
   - For an external genlock signal, connect the external genlock line (house sync) to the genlock in connector on the first DG5/DPLEX board set in the cascade. This is shown as pipe 0 in Figure 2-4.
   - For internal genlock, connect the 018-0634-002 cable to the pipe 0 13W3 monitor 1 connection on the DG5 board, and cable the H sync connection to the genlock input of pipe 0. See the two-pipe version in Figure 2-2 for an example.
2. Connect a 75 ohm genlock cable from the genlock loop through connector on pipe 0 to genlock in on pipe 1.
3. Connect a 75 ohm cable from the genlock loop through on pipe 1 to the genlock in on pipe 2.
4. Attach the 75 ohm terminator to the genlock loop through connector on pipe 2.
5. Attach the swap ready "T" connector to a swap ready input on a DG5 in the cascade. Figure 2-4 shows it attached to pipe 0, but any pipe may be used.
6. Connect the swap ready cables from the other two pipes to the "T" connector.
7. Connect a digital video (LVDS) cable from the digital video out connector on pipe 2 to the digital video in on pipe 1.

8. Attach a digital video cable from the digital video out connector on pipe 1 and route it to the digital video in connector on pipe 0.
9. Connect the DPLEX analog display cable to the 13W3 monitor connector on DPLEX pipe 0 (the rightmost 13W3 connector). This is the monitor that will receive the DPLEX cascaded output.
10. Connect the system default monitor to the 13W3 monitor connector 0 on pipe 0. The monitor 0 connector is located at the top of the DG5.

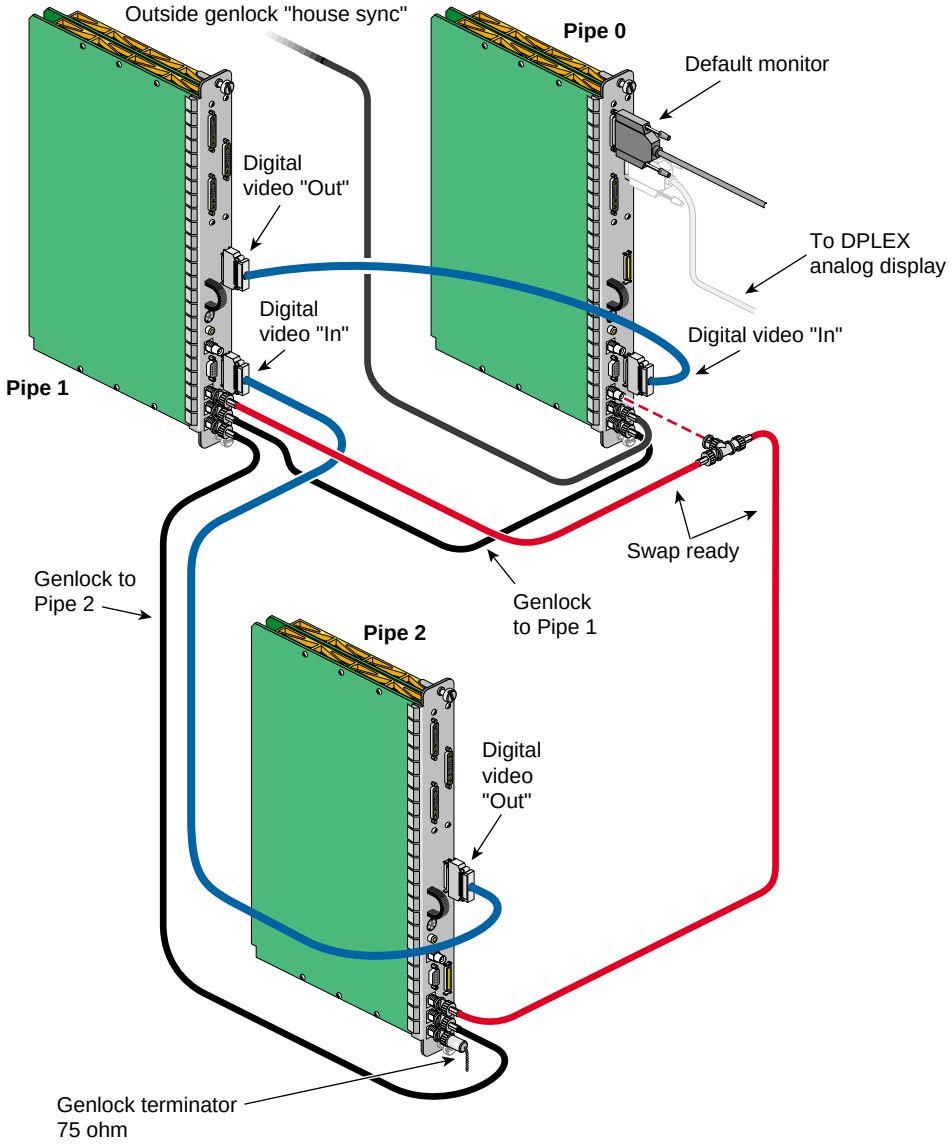

Figure 2-4 Three-Pipe DPLEX Cascade Cabling Example (External Genlock)

Cabling a Four-Pipe DPLEX Cascade

Connecting a four-pipe DPLEX cascade is an extension of the procedure for cabling a three pipe cascade. Use the following instructions to connect a four-pipe version of the DPLEX cascade. To properly cable the DPLEX cascade, obtain the following cables and connectors:

- Four 75 ohm genlock cables with female BNC connectors at each end. The length of these cables is determined by the distance between the pipes and in some cases by the distance from an external genlock source. A 75 ohm genlock terminator is also required.

  Note: If the installation requires use of an external genlock (house sync), determine what connector is required for the external equipment.

- Three 75 ohm cables with female BNC connectors at each end are required for swap ready signaling between the pipes. You will also need two BNC "T" connectors with one female and two male connectors.

When you have all the cables available, use the following steps and figures to cable a four-pipe DPLEX cascade.

1. Determine if you will set genlock for the DPLEX cascade externally (house sync) or internally from the primary (lowest number) DPLEX pipe.

- For an external genlock signal, connect the external genlock line (house sync) to the genlock in connector on the first DG5/DPLEX board set in the cascade. This is shown as pipe 0 in Figure 2-5.
- For internal genlock connect the 018-0634-002 cable to the pipe 0 13W3 monitor 1 connection on the DG5 board, and cable the H sync connection into the genlock input of pipe 0. Figure 2-6 shows an example.

2. Connect a 75 ohm cable from the genlock loop through connector on pipe 0 to the genlock in connector on the second DG/DPLEX assembly (shown as pipe 1 in Figure 2-5). Repeat this procedure for the third and fourth pipes.
3. Terminate the final pipe with a 75 ohm terminator. See Figure 2-5 for an example.
4. Attach an LVDS cable from digital video out on pipe 3 to digital video in on pipe 2.
5. Connect an LVDS cable from digital video out on pipe 2 to digital video in on pipe 1.
6. Connect an LVDS cable from digital video out on pipe 1 to digital video in on pipe 0. Figure 2-6 shows the four DPLEX pipes with the LVDS and genlock cables connected.

7. Connect swap ready cables to each of the four pipes using the “T” connectors on two of the pipes. Figure 2-7 shows an example. No terminators are used with swap ready.
8. Connect the DPLEX analog display cable to the 13W3 monitor connector on DPLEX pipe 0 (the rightmost 13W3 connector). This is the monitor that will receive the DPLEX cascaded output. Figure 2-7 shows the four pipes with all cables connected using internal genlock. Figure 2-8 shows the four pipes with all cables connected using external genlock (house sync).
9. Connect the system default monitor to the 13W3 monitor connector 0 on pipe 0. The monitor 0 connector is located at the top of the DG5.

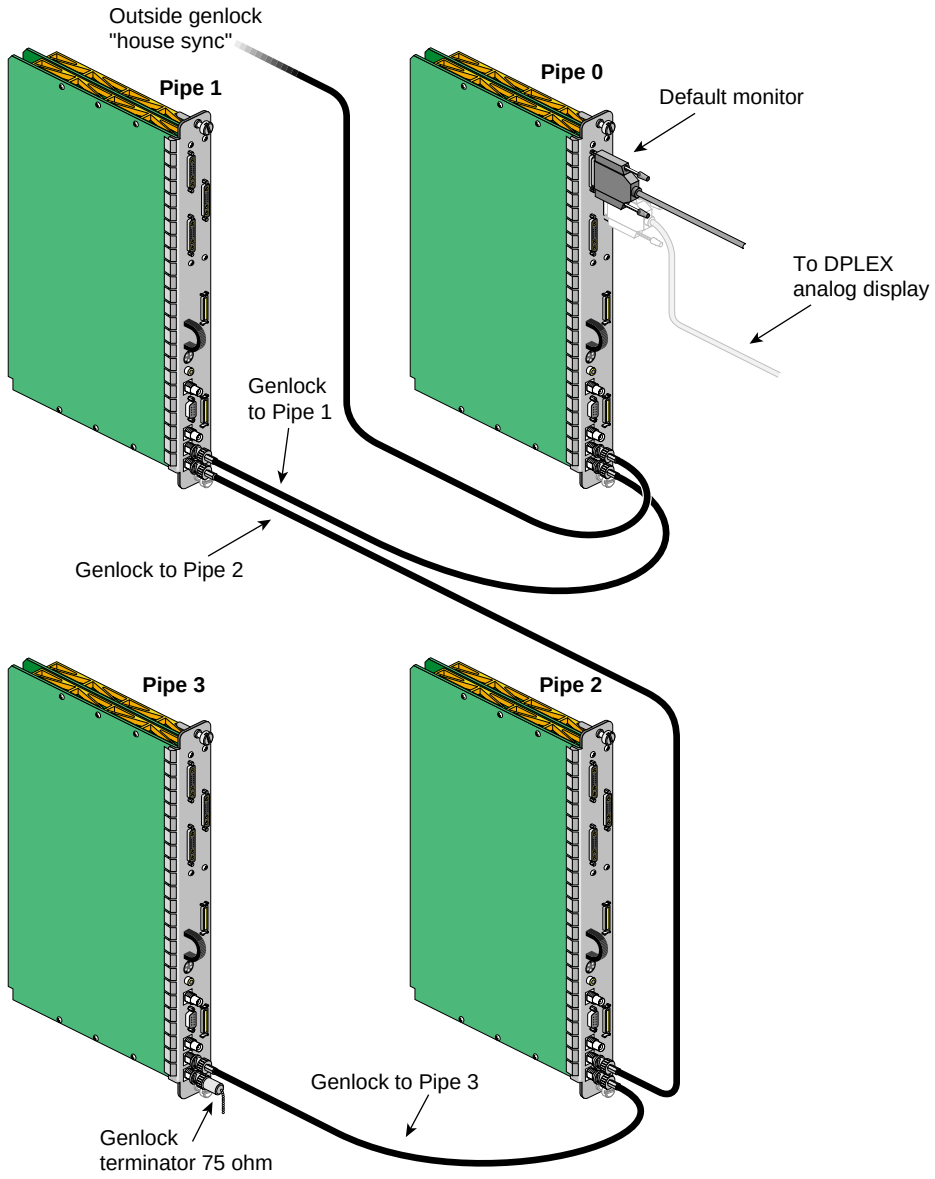

Figure 2-5 Four-Pipe DPLEX Genlock Cabling Example (External Genlock)

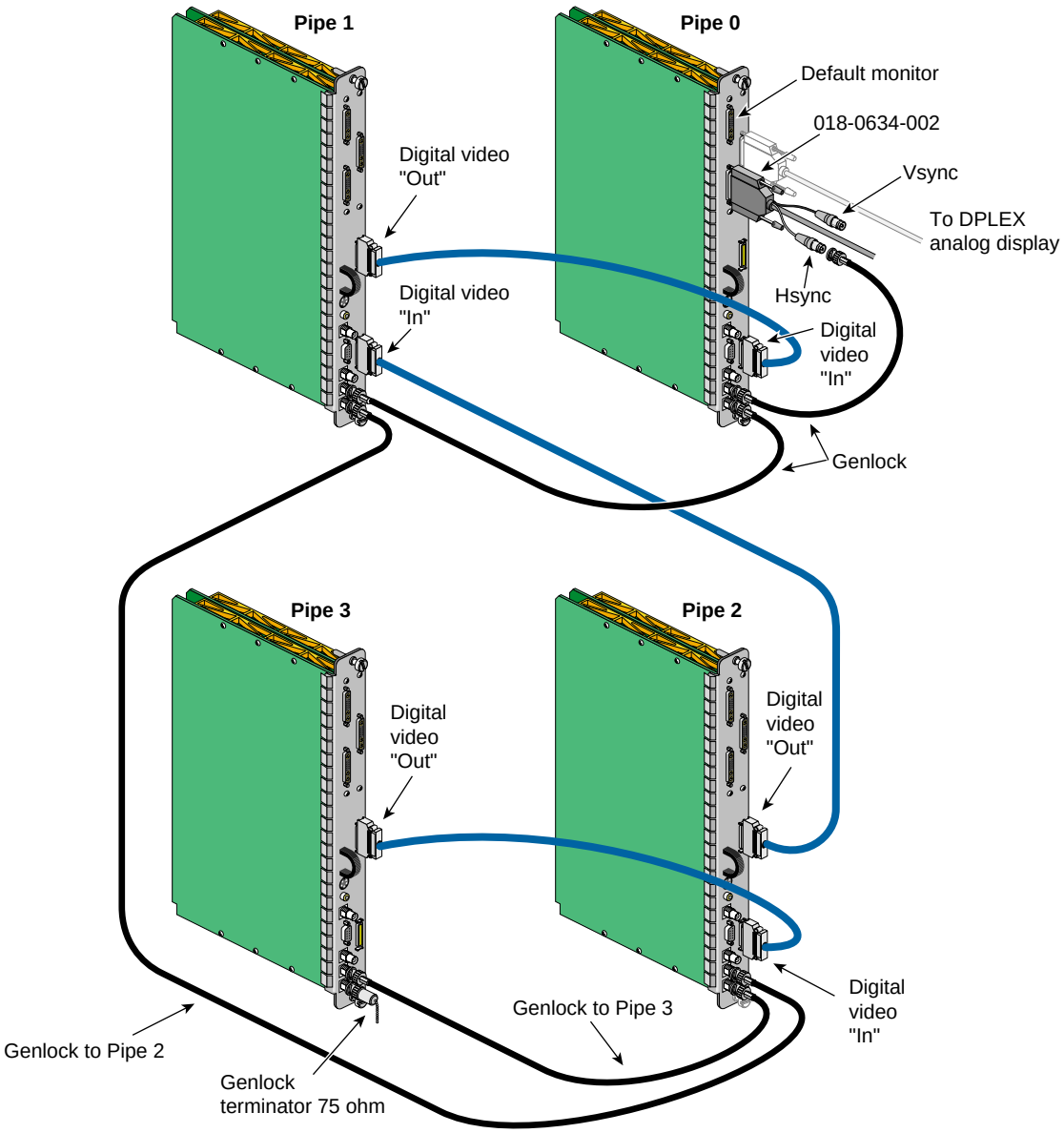

Figure 2-6 Four-Pipe Genlock and LVDS Cabling Example (Internal Genlock)

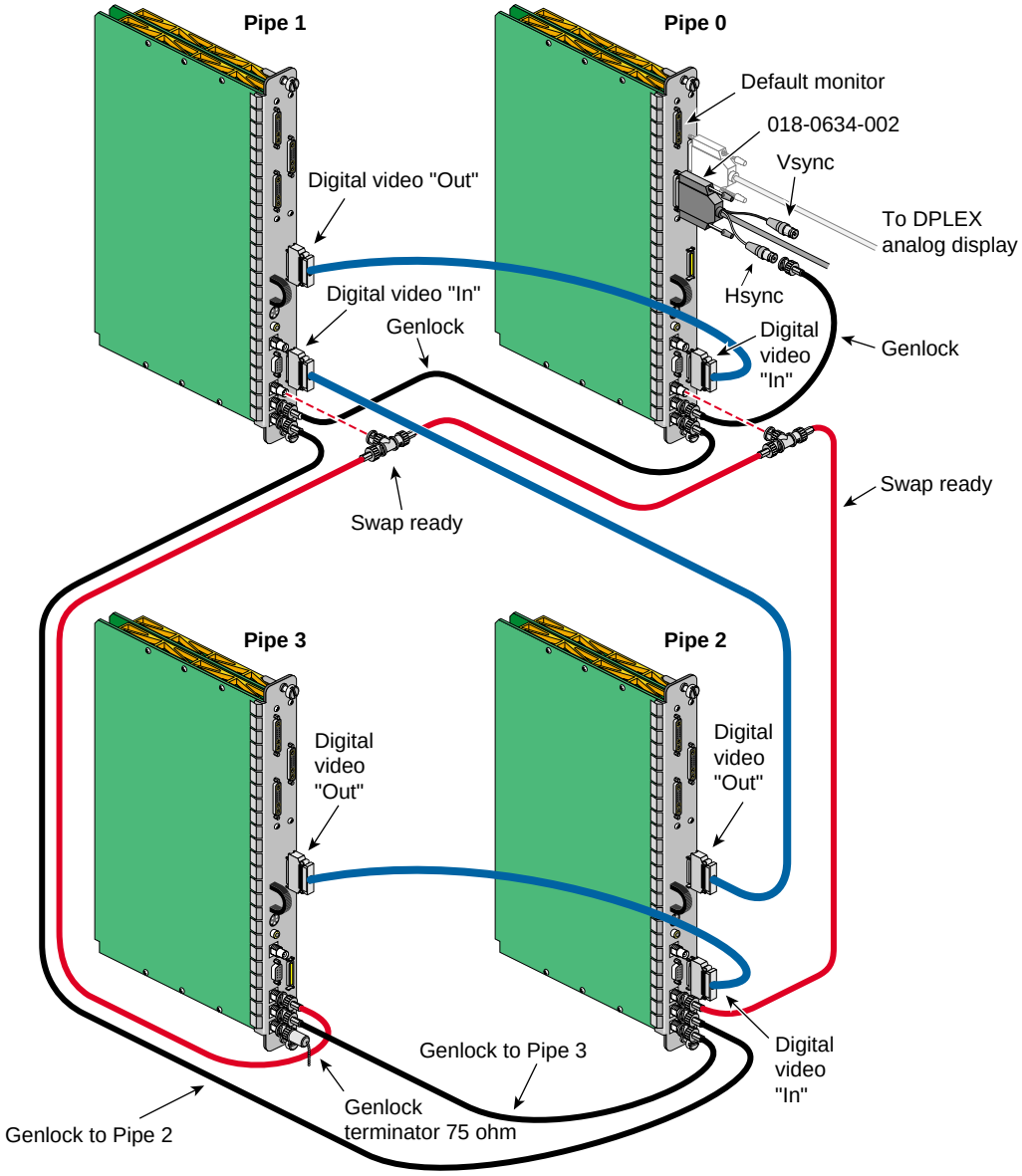

Figure 2-7 Four-Pipe Complete Cabling Example (Internal Genlock)

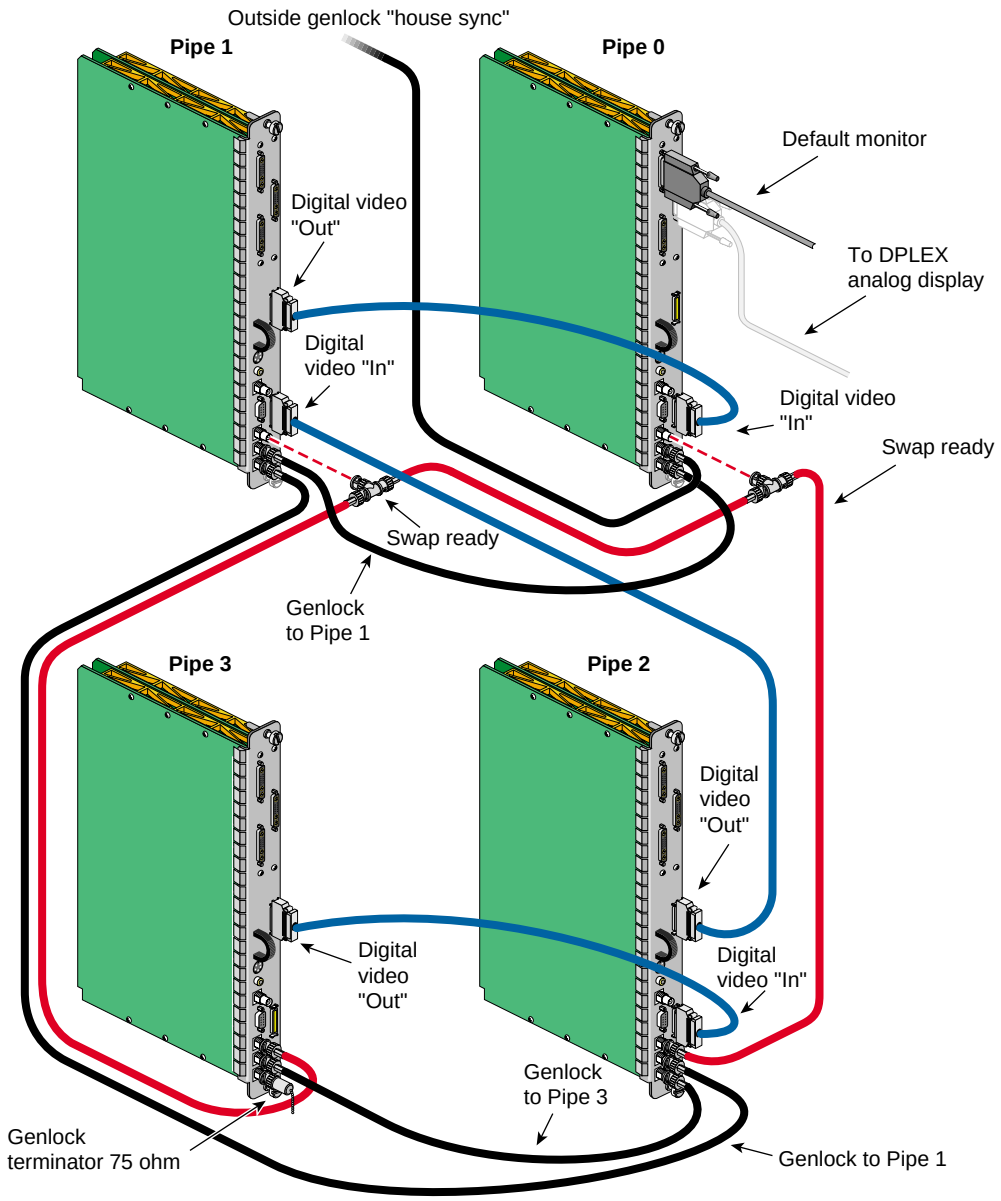

Figure 2-8 Four-Pipe Complete Cabling Example (External Genlock)

Cabling a Six-Pipe DPLEX Cascade

The cabling for a six-pipe DPLEX follows most of the same cabling concepts used to connect a four-pipe cascade. The significant exception is the use of a star video distribution amplifier (also called a line driver or splitter) to make all the genlocking connections.

Use the following instructions to connect a six-pipe version of the DPLEX cascade. To properly cable the DPLEX cascade you will need the following cables and connectors:

- A one-to-eight video distribution amplifier. A minimum 300 MHz video bandwidth device is recommended. Note that the loop output internal termination jumper must be set to terminate the genlock loop.
- Six 75 ohm genlock cables with female BNC connectors at each end. The length of these cables is determined by the distance between the pipes and by the distance from the video distribution amplifier source.

  Note: If the installation requires use of an external genlock (house sync), determine what connector is required for the external equipment.
- Five 75 ohm cables with female BNC connectors at each end are required for swap ready signaling between the pipes. You also need four BNC “T” connectors with one female and two male connectors.

When you have all the cables available, use the following steps and figures to cable a six-pipe DPLEX cascade.

1. Determine if you will set genlock for the DPLEX cascade externally (house sync) or internally from the primary (lowest number) DPLEX pipe.
   - For an external genlock signal, connect the external genlock line (house sync) to the in connector on the video distribution amplifier.
   - For internal genlock connect the 018-0634-002 cable to the pipe 0 13W3 monitor 1 connection on the DG5 board, and cable the H sync connection into the video distribution amplifier.
2. Connect the six genlock cables from the video distribution amplifier to the genlock in connector on each DG5 DPLEX assembly (see Figure 2-9). Be sure the amplifier’s loop output internal termination jumper is set to terminate the genlock loop.
3. Attach an LVDS cable from digital video out on pipe 5 to digital video in on pipe 4. Repeat this procedure on the next four pipes, note that the digital video out connector on the primary pipe (pipe 0 in the illustration) is not terminated.

4. Connect swap ready cables to all the pipes using “T” connectors as applicable. No terminators are used with swap ready. See Figure 2-9 for an example.
5. Connect the DPLEX analog display cable to the 13W3 monitor connector on DPLEX pipe 0 (the rightmost 13W3 connector). This is the monitor that will receive the DPLEX cascaded output.
6. Connect the system default monitor to the 13W3 monitor (connector 0 on pipe 0). The monitor 0 connector is located at the top of the DG5.

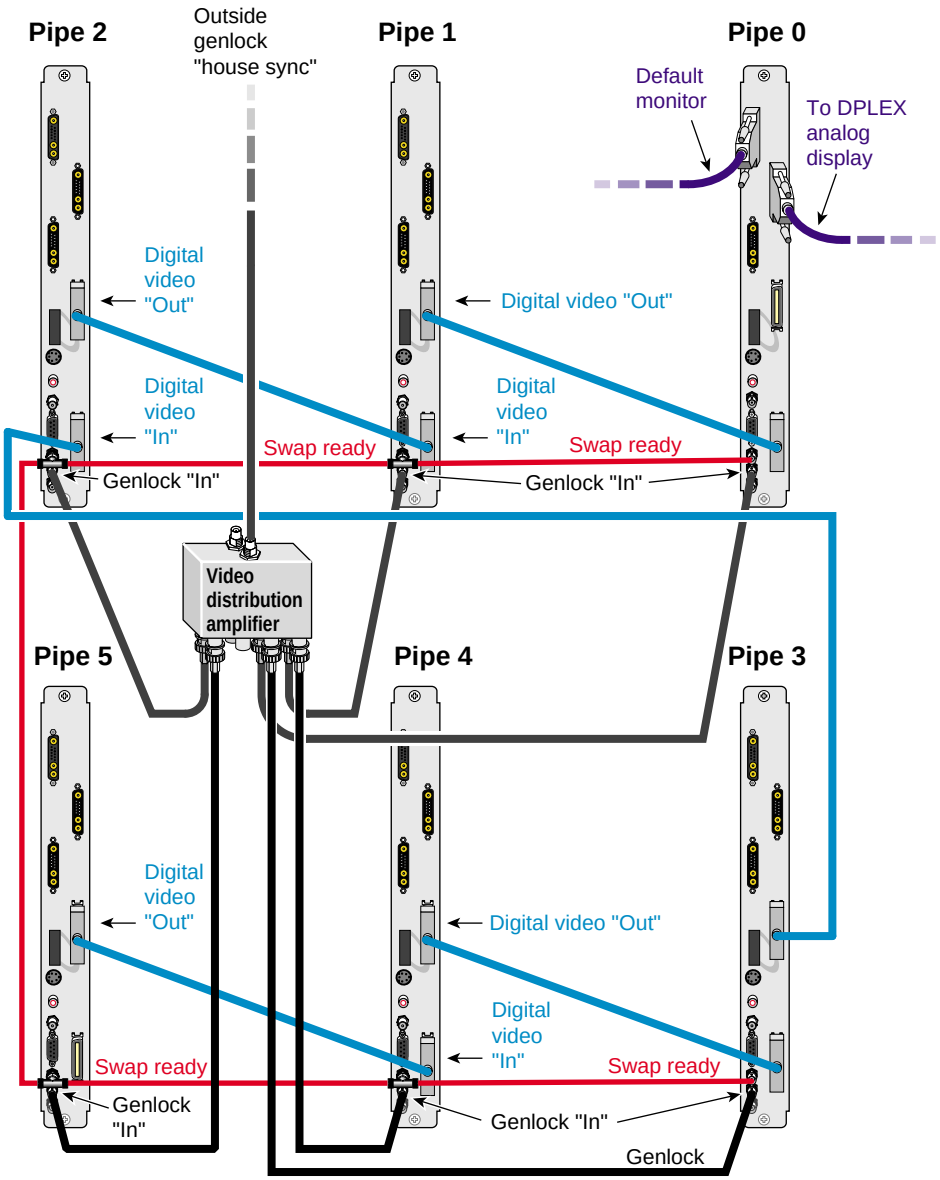

Figure 2-9 Six-Pipe DPLEX Cabling Example

Cabling an Eight-Pipe DPLEX Cascade

The cabling for an eight-pipe DPLEX follows most of the same cabling concepts used to connect a four-pipe cascade. The significant exception is the suggested use of a star video distribution amplifier (also known as a line driver or splitter) to make all the genlocking connections.

Use the following instructions to connect an eight-pipe version of the DPLEX cascade. To properly cable the DPLEX cascade you will need to obtain the following cables and connectors:

- A one-to-eight video distribution amplifier. A minimum 300 MHz video bandwidth device is recommended. Note that the loop output internal termination jumper must be set to terminate the genlock loop.
- Eight 75 ohm genlock cables with female BNC connectors at each end. The length of these cables is determined by the distance between the pipes and by the distance from the video distribution amplifier source.

  Note: If the installation requires use of an external genlock (house sync), determine what connector is required for the external equipment.
- Seven 75 ohm cables with female BNC connectors at each end are required for swap ready signaling between the pipes. You also need six BNC “T” connectors with one female and two male connectors.

When you have all the cables available, use the following steps and figure to cable an eight-pipe DPLEX cascade.

1. Determine if you will set genlock for the DPLEX cascade externally (house sync) or internally from the primary (lowest number) DPLEX pipe.

- For internal genlock connect the 018-0634-002 cable to the pipe 0 13W3 monitor 1 connection on the DG5 board, and cable the H sync connection into the video distribution amplifier.
- For an external genlock signal, connect the external genlock line (house sync) to the in connector on the video distribution amplifier.

2. Connect the eight genlock cables from the video distribution amplifier to the genlock in connector on each DG5 DPLEX assembly (see Figure 2-10). The termination jumper must be set to terminate the genlock loop on the amplifier.

3. Attach an LVDS cable from digital video out on pipe 7 to digital video in on pipe 6. Repeat this procedure on the next six pipes, note that digital video out connector on the primary pipe (pipe 0 in the illustration) is not terminated.
4. Connect swap ready cables to all the pipes using “T” connectors as applicable. No terminators are used with swap ready. See the example in Figure 2-10.
5. Connect the DPLEX analog display cable to the 13W3 monitor connector on DPLEX pipe 0 (the rightmost 13W3 connector). This is the monitor that will receive the DPLEX cascaded output.
6. Connect the system default monitor to the 13W3 monitor (connector 0 on pipe 0). The monitor 0 connector is located at the top of the DG5.

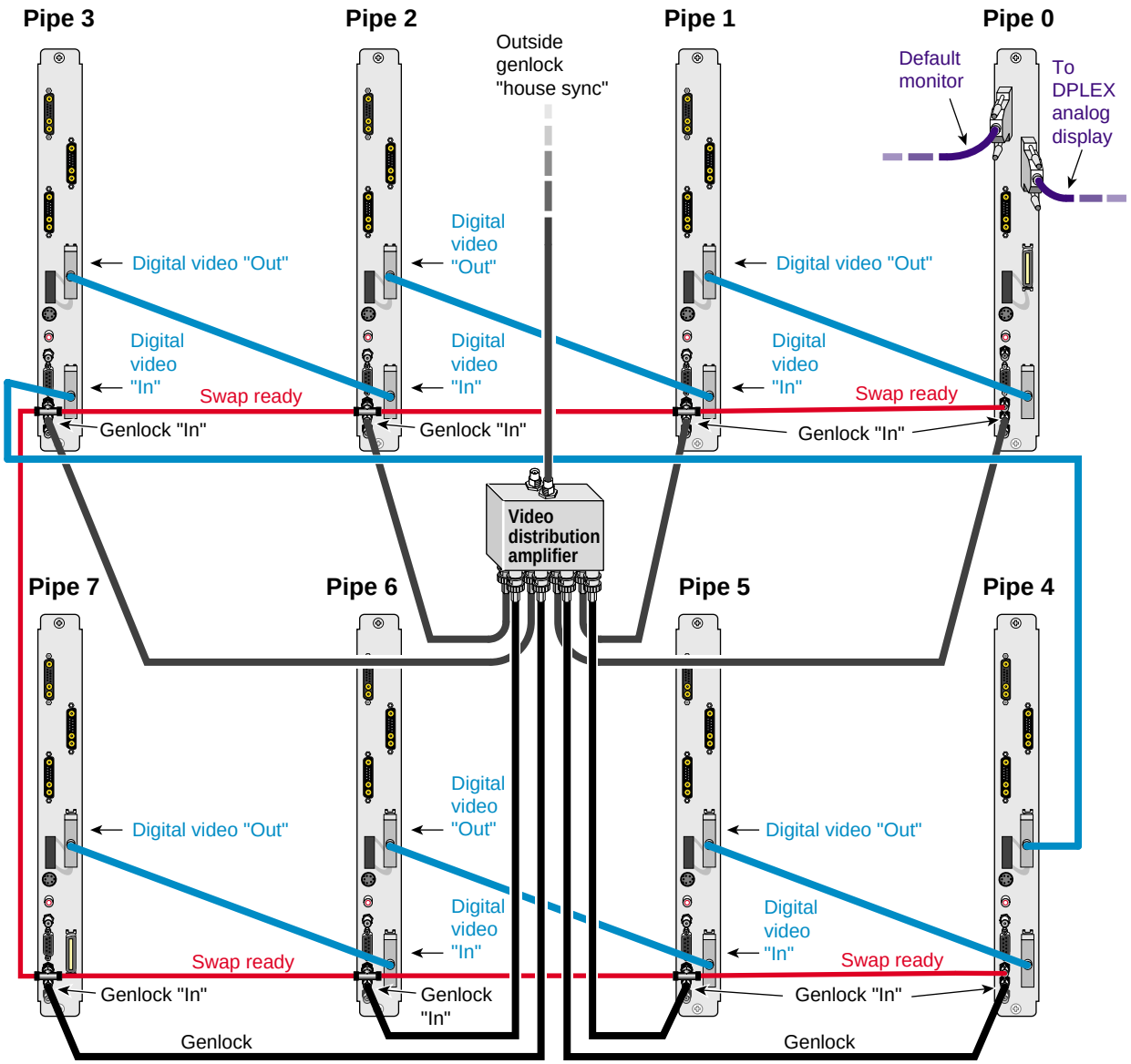

Figure 2-10 Eight-Pipe DPLEX Cabling

Cabling Multiple DPLEX Cascades in an Onyx2 System

This section provides information on cabling requirements when using more than one DPLEX cascade in an Onyx2 system. You may have a requirement for two or three DPLEX cascades to drive images to separate displays or projectors. In most cases you have a single application driving these displays and the cascades need to be genlocked together, (in some cases a video distribution amplifier may be required). The swap ready cabling must also be connected between the DPLEX cascades when they are all operating in concert. See Figure 2-11 and Figure 2-12 for example cabling configurations.

Basic cabling guidelines for multiple DPLEX cascades are:

- Each DPLEX cascade must have a DPLEX analog display output cable, (this cable should be connected to the lowest number pipe in the DPLEX cascade).
- Digital video cables should be connected only between the pipes in an individual DPLEX cascade (not between cascades).
- Genlock all the individual DPLEX cascade boards together if they are using the same application software for a common purpose.
- Connect the individual DPLEX cascade boards together with swap ready cables unless they are running independent (different) applications.

Note: In some cases the Onyx2 system may be configured with multiple DPLEX cascades running independent (different) applications. In this instance, the DPLEX cascades are *not* connected together with swap ready or genlock cabling. The swap ready and genlock cabling is connected only between the DPLEX board assemblies in each individual cascade.

Figure 2-11 shows two DPLEX pairs cabled to run the same application. Internal genlocking is shown in the example figure.

Figure 2-12 shows three DPLEX pairs cabled to run the same application. External genlocking is shown in the example figure.

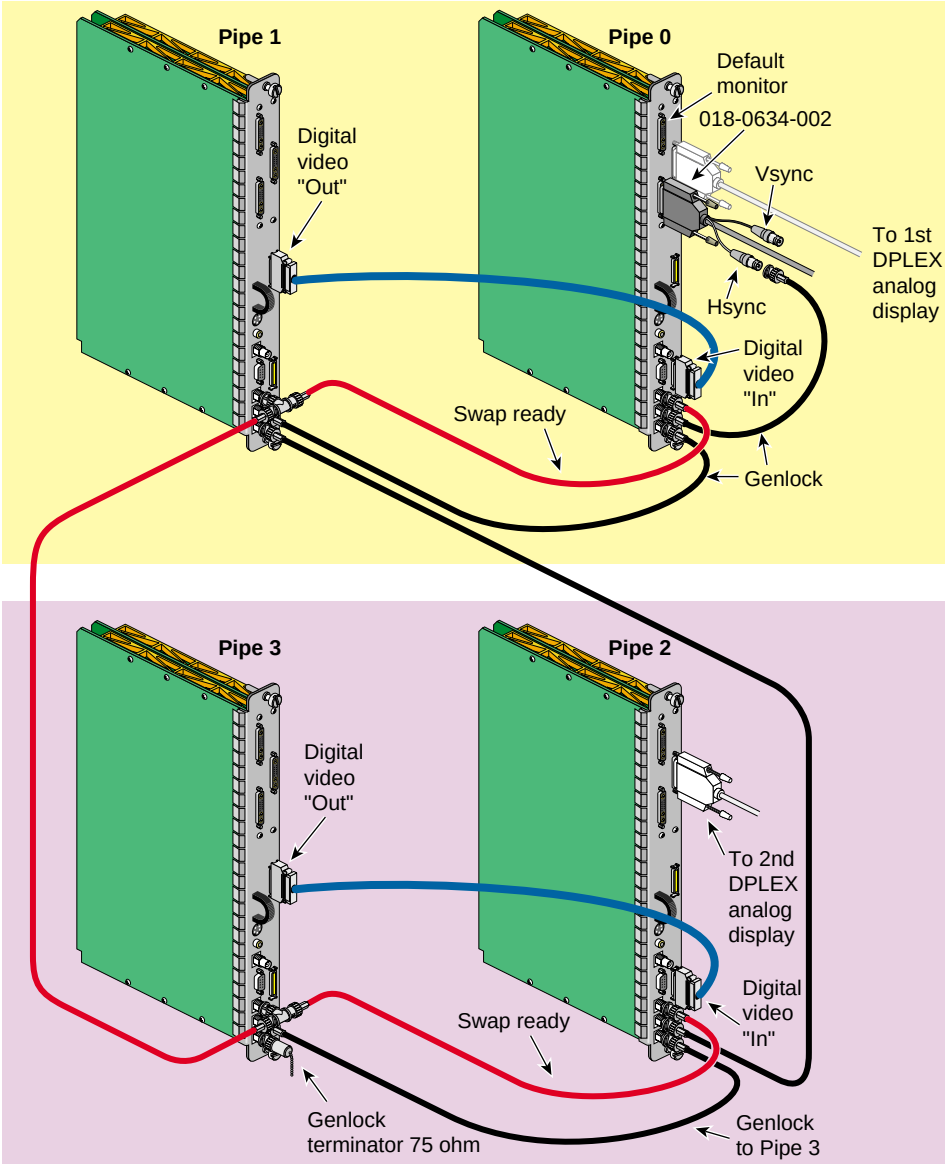

Figure 2-11 Two DPLEX Cascades Cabled to Run the Same Application

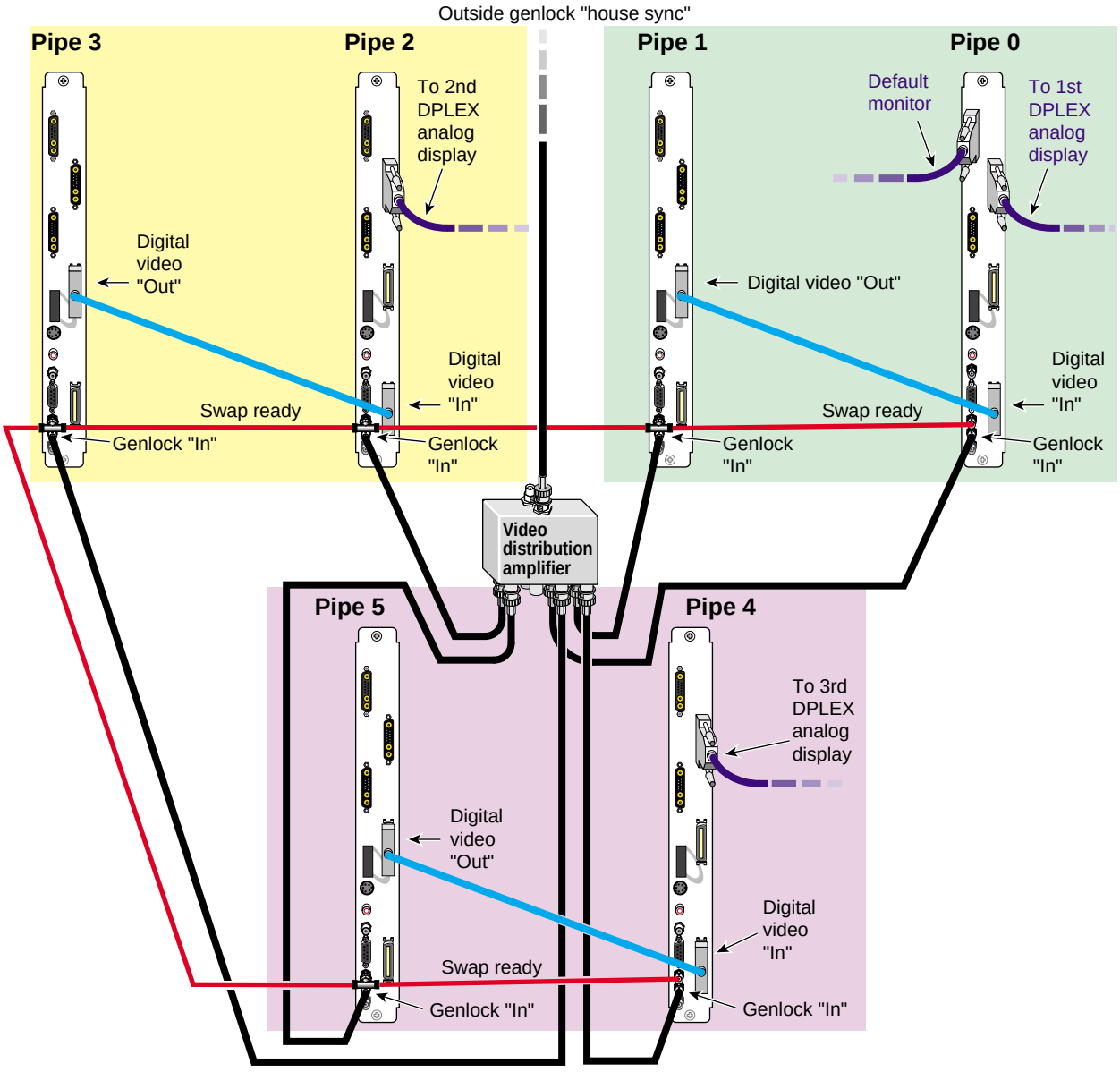

Figure 2-12 Three DPLEX Cascades Cabled to Run the Same Application

Chapter 3

DPLEX Software Configuration and Troubleshooting

This chapter provides information on software administration and troubleshooting options available with Onyx2 DPLEX. The examples given do not reflect what may be installed at any specific customer site.

Using the Video Format Combiner GUI to Enable DPLEX Channels

The basic combiner screen has been modified to show a DPLEX option. Figure 3-1 shows the combiner interface main screen with the DPLEX option selected.

To display the Combiner's graphical user interface, type:

```
/usr/gfx/ircombine -gui
```

To specify a different display from the current workstation, such as a different pipe of a rackmount system, a remote workstation, or a specific pipe of a remote rackmount system as the target on which to display the combination, use a command similar to:

`/usr/gfx/ircombine -gui -target` *dplexsystemname:0.0* **`-display`** *remotename:0.0*

When the first pipe in the DPLEX cascade must genlock internally:

1. Create a combination with channel 0 on pipe 0 set to 1280x1024_60. Then set channel 1 to 1280x1024_60 and the DPLEX channel to 1280x1024_60. If the genlock signal is coming from an outside source, (house sync) the format on channel 1 does not need to be loaded. See Figure 3-1.
2. Click Edit globals.
3. In the Combination Attributes window, set the Sync Source to Loopback Ch1 unless the genlock signal is coming from an outside source (house sync), in which case set it to External.
4. Save this combination as *dplexpipe0.cmb* or something similar.

5. Click the Download combination button and the settings are loaded.
6. Quit ircombine and then restart it with the target option specifying the next pipe in the DPLEX cascade.

   Note: Presuming the physical cabling is correct, the additional pipes in the cascade genlock to the pipe 0 channel 1 genlock loop, see Chapter 2 for information on physical cabling.
7. Create a combination with channel 0 at 1280x1024_60 on the next DPLEX pipe. Set the DPLEX output to 1280x1024_60.
8. Click Edit globals.
9. In the Combination Attributes window, set the Sync Source to External and Sync Format to 1280x1024_60. Whenever the sync comes from another pipe, it is also External.
10. Save the combination as *dplexpipe1.cmb* or something similar.
11. Click the Download combination button to save the settings.

    Note: *dplexpipe1.cmb* can be reused for additional pipes if no changes to the DG channels are needed. All DPLEX boards must run the same video format.
12. Repeat steps 6 through 11 for any additional pipes in the DPLEX cascade.

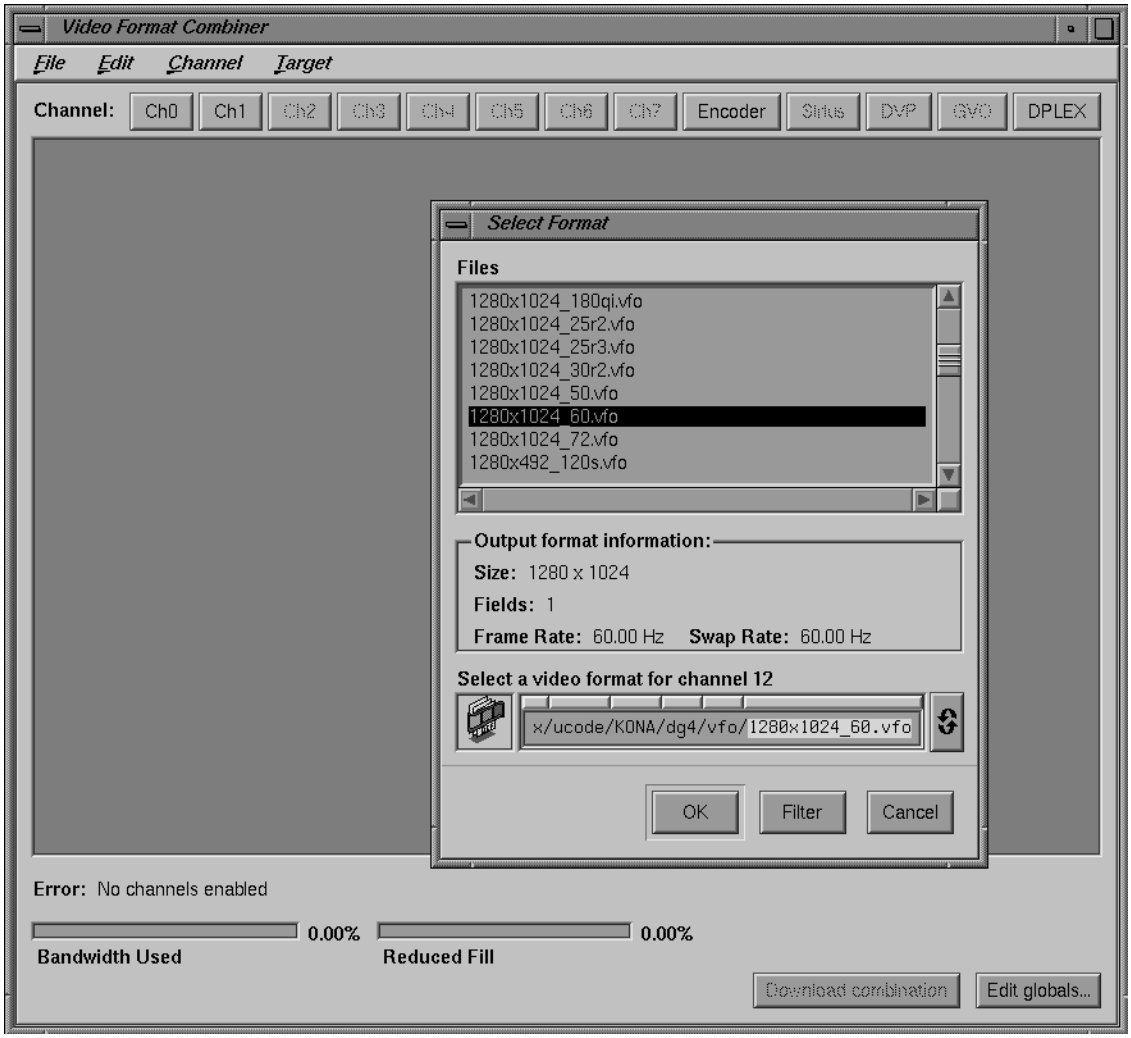

Figure 3-1 Combiner Main Screen Example with DPLEX Selected

Deleting One Pipe from a DPLEX Cascade

Deleting a pipe from an existing DPLEX cascade requires halting the system and recabling the pipes in the DPLEX cascade to connect the new configuration. This section provides an example of converting a four-pipe DPLEX cascade to a three-pipe cascade. Use the following steps to delete one of the pipes from the cascade:

1. Shut down the system and use the information in Chapter 2 to convert the cabling of the DPLEX to a three-pipe cascade.
2. Restart the system.
3. Use the *setmon* command or the Combiner interface to change the definition of the pipe that is no longer part of the DPLEX cascade. If you use *ircombine*, use the **-target** option to set the disconnected pipe. (For more information, see the setmon (1G) man page or the *InfiniteReality Video Format Combiner User's Guide)*.
4. Create a combination that uses the DG channels as appropriate to the new configuration. Set the sync source to Internal (see Figure 3-2). Note that if the sync comes from another pipe, the source should be set to external.
5. Save the combination and close the ircombine interface.

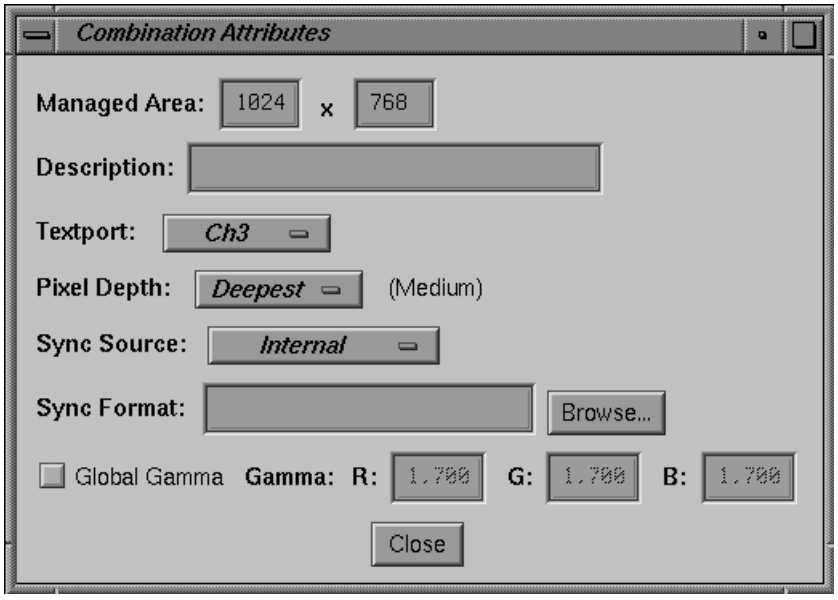

Figure 3-2 Example Combination Attributes Window

Adding One Pipe to a DPLEX Cascade

Adding a pipe to an existing DPLEX cascade requires halting the system and recabling the pipes in the DPLEX cascade to connect the new configuration. This section provides an example of converting a two-pipe DPLEX cascade to a three-pipe cascade. The same steps should be used for converting a three-pipe to a four-pipe and so on. Follow these steps to add a pipe to the cascade:

1. Shut down the system and use the information in Chapter 2 to convert the cabling of the DPLEX from a two-pipe to a three-pipe cascade.
2. Restart the system.
3. Use the *setmon* command or the Combiner interface to change the definition of the new pipe that is now part of the DPLEX cascade. If you use *ircombine*, use the **-target** option to set the new pipe. (For more information, see the setmon (1G) man page or the *InfiniteReality Video Format Combiner User's Guide*).
4. Set the DPLEX output to 1280x1024_60. (Use the Managed Area fields if you are using the Combiner interface).

   Note: DPLEX supports formats with pixel clocks between 31 and 110 MHz.
5. Set the sync source to External. Note that whenever the sync comes from another pipe, it is External.
6. Set the sync format to be the same video format as that sent from the genlock master. This is shown as pipe 0 channel 1 in the cabling examples when an outside (house sync) source is not used. (Use the Sync Format field when using the Combiner interface).
7. Save the new combination and close the ircombine interface.

Checking DPLEX Physical Connectivity (Cabling)

All the DPLEX pipes in a cascaded set must be connected, genlocked, and properly wired for swap ready signals to function. If you have followed all the cabling instructions (see Chapter 2) the physical cabling should be complete. The following sections provide information on checking the cabling configurations using software function tests.

You can also use the */usr/gfx/setmon* command option to properly set genlock. The *-g* argument to */usr/gfx/setmon* enables external genlocking (video clocking). See the setmon(1G) man page for details on all the */usr/gfx/setmon* options.

Using irsaudit for Limited Checks

The irsaudit provides only a limited check on individual DPLEX boards. Note that the window manager should *not* be running, as irsaudit needs to take direct control of the graphics hardware. You can stop the window system using */usr/gfx/stopgfx* from root.

Note that you cannot run irsaudit from the DPLEX output monitor.

The operator must have root privilege to run irsaudit. See the irsaudit(1) man page for details.

Entering irsaudit with no arguments following the command runs a standard set of tests that stops upon encountering a first failure. This may be useful for testing the general state of a new or upgraded system.

Checking General Status on DPLEX Pipes

The command */usr/gfx/gfxinfo* provides a batch of functional information for each pipe. Note that for all pipes other than the first, gfxinfo should report source as external and the genlock as true. If you use the **-v** command option to */usr/gfx/gfxinfo* you receive a detailed description of each pipe's components and functional status. See the following example of status for two DPLEX pipes. Note that the bold type is shown for emphasis because of the large amount of information presented.

```
% /usr/gfx/gfxinfo -v
Graphics board 0 is “KONAL” graphics.
        Managed (“:0.0”) 1280x1024
        Display has 2 channels
        4 GEs (of 4), occmask = 0x0f
        4MB external BEF ram, 32bit path
        1 RM7 board (of 1) 1/0/0/0
        Texture Memory: 64MB/-/-/-
        Medium pixel depth
        32K cmap
        DPLEX option detected
brd: 20160a06 3020c02/-/-/- f9211002
         ge: 0 14832057 14731057 14231057
        rm0: 15032057 15431057
              4631057 1/1/1/1
              4d31057 2/2/2/2/2/2/2/2
              4938057 4/4/4/4/4/4/4/4/4/4/4/4/4/4/4/4/4/4/4/4
```

```
         dg: 05532057
               5838057 1/1/1/1
               5631057 1/1
        GE:   NIC #:      0000.0009.9854 (family: 0b)
               Serial #:   CJK150
               Part #:     030-1129-001
        KT:   No NIC serial number available.
        RM0:  NIC #:      0000.000a.986e (family: 0b)
               Serial #:   DBT079
               Part #:     030-1054-001
        TM0:  NIC #:      0000.000e.62a5 (family: 0b)
               Serial #:   DBT121
               Part #:     030-1053-001
        RM1:  No NIC serial number available.
        TM1:  No NIC serial number available.
        RM2:  No NIC serial number available.
        TM2:  No NIC serial number available.
        RM3:  No NIC serial number available.
        TM3:  No NIC serial number available.
        BP:   No NIC serial number available.
        DG:   NIC #:      0000.002f.e630 (family: 0b)
               Serial #:   HPG092
               Part #:     030-1242-001
        DGOPT:NIC #:      0000.002c.e13c (family: 0b)
Serial #:   HSD973
               Part #:     030-1409-001
        Input Sync: Voltage - Video Level; Source - Internal; Genlocke
d - True
        Channel 0:
         Origin = (0,0)
         Video Output: 1280 pixels, 1024 lines, 60.00Hz (1280x1024_60.
vfo)
         Video Format Flags:  (none)
         Sync Output(s):
          Composite sync on Green
          Composite TTL sync on Aux 0
         Using Gamma Map 0
        Channel 1:
         Channel's Source Size: 96 pixels, 92 lines; Origin = (0,0)
         Video Output: 1280 pixels, 1024 lines, 60.00Hz (1280x1024_60.
vfo)
         Video Format Flags:  (none)
         Sync Output(s):
          Composite sync on Green
          Composite TTL sync on Aux 0
```

```
         Using Gamma Map 0
        Channel 2 (physical port 222):
         Origin = (0,0)
         Video Output: 1280 pixels, 1024 lines, 60.00Hz (1280x1024_60.
vfo)
Video Format Flags:  (none)
         Sync Disabled
         Using Gamma Map 0
Graphics board 1 is “KONAL” graphics.
        Managed (“:0.1”) 1280x1024
        Display has 2 channels
        4 GEs (of 4), occmask = 0x0f
        4MB external BEF ram, 32bit path
        1 RM7 board (of 1) 1/0/0/0
        Texture Memory: 64MB/-/-/-
        Medium pixel depth
        32K cmap
        DPLEX option detected
        brd: 20160a06 3020c02/-/-/- f9211002
         ge: 0 14832057 14731057 14231057
        rm0: 15032057 15431057
              4631057 1/1/1/1
              4d31057 2/2/2/2/2/2/2/2
              4938057 4/4/4/4/4/4/4/4/4/4/4/4/4/4/4/4/4/4/4/4
         dg: 05532057
              5838057 1/1/1/1
              5631057 1/1
        GE:   NIC #:      0000.0009.9858 (family: 0b)
              Serial #:   CKW000
              Part #:     030-1129-001
        KT:   No NIC serial number available.
        RM0:  NIC #:      0000.000a.48e8 (family: 0b)
              Serial #:   DBS160
              Part #:     030-1054-001
        TM0:  NIC #:      0000.000a.4ce5 (family: 0b)
              Serial #:   DBS176
              Part #:     030-1053-001
        RM1:  No NIC serial number available.
        TM1:  No NIC serial number available.
        RM2:  No NIC serial number available.
        TM2:  No NIC serial number available.
        RM3:  No NIC serial number available.
        TM3:  No NIC serial number available.
        BP:   No NIC serial number available.
DG:   NIC #:      0000.001e.3105 (family: 0b)
```

```
              Serial #:   HPG076
              Part #:     030-1242-001
        DGOPT:NIC #:      0000.001e.3109 (family: 0b)
              Serial #:   HSD984
              Part #:     030-1409-001
        Input Sync: Voltage - Video Level; Source - External; Genlocke
d - True
        Channel 0:
         Origin = (0,0)
         Video Output: 1280 pixels, 1024 lines, 60.00Hz (1280x1024_60.
vfo)
Video Format Flags:  (none)
         Sync Output(s):
          Composite sync on Green
          Composite TTL sync on Aux 0
         Using Gamma Map 0
        Channel 2 (physical port 222):
         Origin = (0,0)
         Video Output: 1280 pixels, 1024 lines, 60.00Hz (1280x1024_60.
vfo)
         Video Format Flags:  (none)
         Sync Disabled
         Using Gamma Map 0
Another way to query the Onyx2 system about the operational status of a
DPLEX cascade is to use the command:
/usr/gfx/hyperpipeinfo
Note that this command does not accept any arguments. To run the
command from another workstation you should rlogin and use a command
such as:
setenv DISPLAY :0.0
```

The following example shows an Onyx2 system with six pipes installed. In this example pipe 5 either does not have a DPLEX option or it's LVDS cable is disconnected. This is indicated by the -1 following the network id.

```
% /usr/gfx/hyperpipeinfo
opening default display :0.0
pipe :0.0        network id 0
pipe :0.1        network id 0
pipe :0.2        network id 0
pipe :0.3        network id 0
pipe :0.4        network id 0
pipe :0.5        network id -1
```

DPLEX Operation and API Information

The following listed man pages offer additional operational information on DPLEX:

- GLX_SGIX_hyperpipe
- glXQueryHyperpipeNetworkSGIX (3G)
- glXQueryHyperpipeConfigSGIX (3G)
- glXDestroyHyperpipeConfigSGIX (3G)
- glXBindHyperpipeSGIX (3G)
- glXHyperpipeConfigSGIX (3G)

DPLEX users can also obtain additional information by looking at the example program */usr/diags/IR/bin/hyper*. This example program configures the existing DPLEX network and runs a simple clock application on all the pipes.

The output of all these pipes is multiplexed at the output pipe. See the command line options for */usr/diags/IR/bin/hyper* for further details. The source for this program may be found in */usr/share/src/hyperpipe/hyper*. Note that the file *gl_dev.sw.gldev* must be installed in order to gain access to this example program. The program is intended only as a basic example.

Chapter 4

Onyx2 DPLEX Theory of Operation

This chapter provides basic information on the operational theory of the Onyx2 InfiniteReality2 Digital Video Multiplexer Option (DPLEX). Any example configurations documented do not necessarily reflect what may be installed at a customer site.

The DG5-2/DPLEX assembly has also been associated with the code name DDO3. Note that DPLEX is *not* compatible with the DVP2 (also known as DDO2) option for Onyx2.

General Functions

The DPLEX option is primarily a frame rate delivery enhancement to the visual simulation capabilities of the Onyx2 product line. The DPLEX option supports genlocked cabling configurations where two or more graphics pipes run a single monitor (or other video output device) to obtain the highest graphics performance. By cascading the graphics outputs of two or more pipes, the DPLEX high-performance video multiplexer can provide buffered frames at the highest possible speeds.

Every cascaded DPLEX Onyx2 graphics pipe includes framebuffer space (located physically on the RM boards). This is where the graphics data is rendered before being sent through the digital-to-analog (DAC) conversion process. The framebuffer is divided into two parts: front buffer and back buffer. While the front buffer sends its rendered display data to the output DACs, the other (back buffer) fills with new image data. After the writing is complete, the buffers are “swapped,” which means that the front buffer becomes the back buffer and vice versa.

Digital and Video Functions

Although the DPLEX option shares some functionality with the DDO2 option product, the two are neither compatible nor complementary in function.

The DPLEX option provides:

- digital video with 8-bit-per-component precision (8-bit DACs used for RGB analog outputs)
- a multi-board signalling and control method allowing pipes to contribute video frames to a single display (or output) in a specific sequence
- a 40-pin low-voltage differential signaling (LVDS) interconnect cabling scheme
- video formats from 31 to 110 MHz in pixel clock frequency
- a user-programmable video display frame sequence
- a minimum of one frame of video from each DG5/DPLEX pipe (switching is done on frame boundaries)
- the ability for each of the pipes in a cascaded DG5/DPLEX set to provide the cumulative video output (there is no hardware-designated video output master)

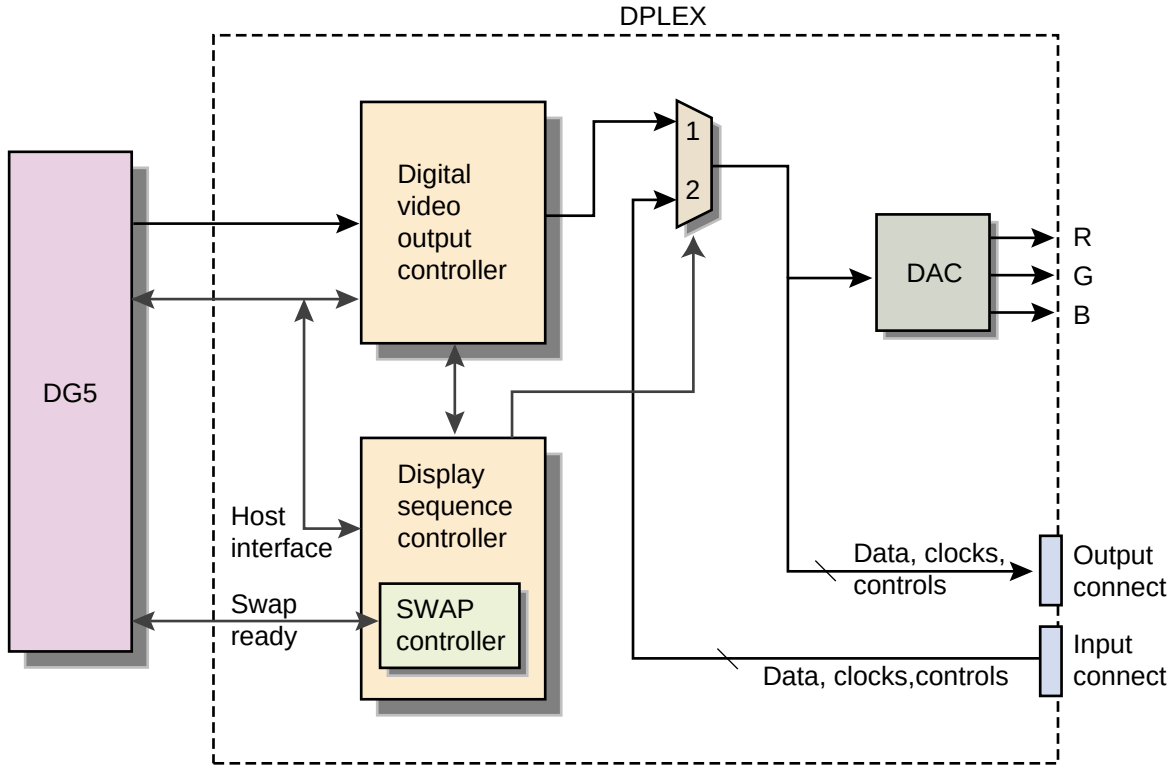

Figure 4-1 DPLEX Data Flow Diagram

Connectivity Functions

Each system configuration has different connection requirements. This section lists the standard connections used with DPLEX options.

Genlock

All DG5/DPLEX cascade assemblies are genlocked to a single video reference source:

- The primary graphics pipe within the DPLEX cascade (pipe 0 in the examples shown in this guide).
- An external genlocking signal (often called “house sync”).

In either case the genlock function uses 75 ohm coaxial cables and female BNC connectors. Each DG5 has a genlock in and a genlock loop through connector. The last genlock loop through connector in the daisy chain must always be terminated with a 75 ohm terminator.

Note: Genlocking of the DG5-2/DPLEX assemblies is accomplished specifically through the DG5 circuits.

Swap Ready

Each set of connected DG5/DPLEX boards must be interconnected with a swap ready cable. The cable uses BNC connectors to attach to the DG5 swap ready input.

Differential Signaling Cable (LVDS)

The low-voltage differential signaling (LVDS) cables always connect directly to the DPLEX daughter board. The LVDS video cables daisy-chain the DG5/DPLEX assemblies. Note that the graphics pipe (with the DG5/DPLEX) that is outputting the cascaded video information to a monitor or other device does *not* connect its 40-pin digital “video out” to another DG5/DPLEX assembly. There is no termination required with the LVDS cabling.

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