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Installation and Operation Manual

Selenio X50™

Broadcast-Quality Up/Cross/Downconverter

Version 4.1

Publication Information

Trademarks

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X50

Broadcast-Quality Up/Cross/Downconverter

Installation and Operation Manual

Version 4.1
May 2019

Preface

Manual Information

Purpose

This manual details the features, installation, operation, maintenance, and specifications for the X50 Up/Cross/Downconverter.

Audience

This manual is written for engineers, technicians, and operators responsible for the installation, setup, and/or operation of X50 Up/Cross/Downconverter.

Revision History

Table P-1 Document Revision History

Edition	Date	Revision History
A	November 2009	Initial Release
B	December 2009	New specifications added
C	June 2010	Information about phasing, Dolby E® alignment, new conversion standards, and logo generator
D	September 2012	New or revised information of the following: Advanced Audio Processing, GPI specifications, control interface, data passing, power save mode, parameter control scripts, logo storage, servicing instructions, and 3G specifications
E	January 2013	Addition of new SFP options
4.0	August 2015	Updates to button controls, auto routing, system presets, failsafe procedure, composite video output, logo generator, GPI, control script, analog audio specs, servicing
4.1	May 2019	Addition of WPF client application for remote control of device

Writing Conventions

To enhance your understanding, the authors of this manual have adhered to the following text conventions:

Table P-2 Writing Conventions

Term or Convention	Description
Bold	Indicates dialog boxes, property sheets, fields, buttons, check boxes, list boxes, combo boxes, menus, submenus, windows, lists, and selection names
Italics	Indicates E-mail addresses, the names of books or publications, and the first instances of new terms and specialized words that need emphasis
CAPS	Indicates a specific key on the keyboard, such as ENTER, TAB, CTRL, ALT, or DELETE
Code	Indicates variables or command-line entries, such as a DOS entry or something you type into a field
>	Indicates the direction of navigation through a hierarchy of menus and windows
hyperlink	Indicates a jump to another location within the electronic document or elsewhere
Internet address	Indicates a jump to a website or URL
Note: 	Indicates important information that helps to avoid and troubleshoot problems

Obtaining Documents

Product support documents can be viewed or downloaded from our website. Alternatively, contact your Customer Service representative to request a document.

Unpacking/Shipping Information

Unpacking a Product

This product was carefully inspected, tested, and calibrated before shipment to ensure years of stable and trouble-free service.

1. Check equipment for any visible damage that may have occurred during transit.
2. Confirm that you have received all items listed on the packing list.
3. Contact your dealer if any item on the packing list is missing.
4. Contact the carrier if any item is damaged.
5. Remove all packaging material from the product and its associated components before you install the unit.

   Keep at least one set of original packaging, in the event that you need to return a product for servicing.

Product Servicing

Except for firmware upgrades and jumper selections, the X50 is not designed for field servicing. Return the X50 unit to the Harris Customer Service Center for all hardware upgrades, modifications, or repairs.

Returning a Product

In the unlikely event that your product fails to operate properly, contact Customer Service to obtain a Return Authorization (RA) number, and then send the unit back for servicing.

If the original package is not available, you can supply your own packaging as long as it meets the following criteria:

- The packaging must be able to withstand the product's weight.
- The product must be held rigid within the packaging.
- There must be at least 2 in. (5 cm) of space between the product and the container.
- The corners of the product must be protected.

Ship products back to us for servicing prepaid and, if possible, in the original packaging material. If the product is still within the warranty period, we will return the product prepaid after servicing.

Restriction on Hazardous Substances (RoHS) Directive

Directive 2002/95/EC—commonly known as the *European Union (EU) Restriction on Hazardous Substances (RoHS)*—sets limits on the use of certain substances found in electrical and electronic equipment. The intent of this legislation is to reduce the amount of hazardous chemicals that may leach out of landfill sites or otherwise contaminate the environment during end-of-life recycling. The Directive, which took effect on July 1, 2006, refers to the following hazardous substances:

- Lead (Pb)
- Mercury (Hg)
- Cadmium (Cd)
- Hexavalent Chromium (Cr-V1)
- Polybrominated Biphenyls (PBB)
- Polybrominated Diphenyl Ethers (PBDE)

In accordance with this EU Directive, products sold in the European Union will be fully RoHS-compliant and "lead-free." Spare parts supplied for the repair and upgrade of equipment sold before July 1, 2006 are exempt from the legislation. Equipment that complies with the EU directive will be marked with a RoHS-compliant symbol, as shown in **Figure P-1**.

Figure P-1 RoHS Compliance Symbol

Waste from Electrical and Electronic Equipment (WEEE) Directive

The *European Union (EU) Directive 2002/96/EC on Waste from Electrical and Electronic Equipment (WEEE)* deals with the collection, treatment, recovery, and recycling of electrical and electronic waste products. The objective of the WEEE Directive is to assign the responsibility for the disposal of associated hazardous waste to either the producers or users of these products. As of August 13, 2005, producers or users are required to recycle electrical and electronic equipment at end of its useful life, and must not dispose of the equipment in landfills or by using other unapproved methods. (Some EU member states may have different deadlines.)

In accordance with this EU Directive, companies selling electric or electronic devices in the EU will affix labels indicating that such products must be properly recycled. Contact your local Sales representative for information on returning these products for recycling. Equipment that complies with the EU directive will be marked with a WEEE-compliant symbol, as shown in **Figure P-2**.

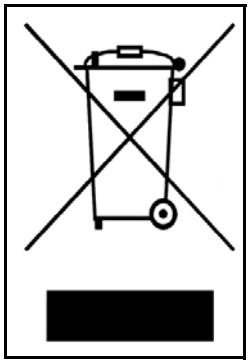


Figure P-2 WEEE Compliance Symbol

Safety

Carefully review all safety precautions to avoid injury and prevent damage to this product or any products connected to it. If this product is rack-mountable, it should be mounted in an appropriate rack using the rack-mounting positions and rear support guides provided. To protect a frame from circuit overloading, connect each frame to a separate electrical circuit. If this product relies on forced air cooling, all obstructions to the air flow should be removed prior to mounting the frame in the rack.

If this product has a provision for external earth grounding, ground the frame to the earth using the protective earth ground on the rear panel.

IMPORTANT! Only qualified personnel should perform service procedures.

Always disconnect the power supply before removing the lid.

Safety Terms and Symbols in this Manual

WARNING

Statements identifying conditions or practices that may result in personal injury or loss of life. High voltage is present.

CAUTION

Statements identifying conditions or practices that can result in damage to the equipment or other property.

1 Introduction

Product Features

The X50 is a standalone up/down/cross converter in a 1-RU format. The X50 can provide broadcast quality multi-standard conversion along with support for aspect ratio change and AFD processing, closed captioning processing, video processing amplifier and video frame synchronization and delay, with built-in color correction. Audio processing capabilities include handling of 16 channels of embedded audio and 8 channels of discrete audio via AES or analog interfaces, with audio synchronization and delay for audio-to-video tracking.

Full handling of the embedded audio metadata is provided, with the ability to de-embed and re-embed metadata from external sources. An optional fiber optic sub-module (SFP) complements the SDI electrical inputs and outputs.

Inputs

- Two auto-sensing SD/HD/3G SDI inputs and one SD/HD/3G SDI fiber input with embedded audio, VANC data (WSS/VI/AFD, audio metadata and closed captioning/ teletext data)
- One SD/HD component YPrPb input
- One SD composite input
- One S-Video input
- Error monitoring (EDH, CRC) on each SDI input
- Genlock input with loopback: analog composite with support for tri- and bi-level sync
- DARS input, unbalanced
- Four AES inputs, unbalanced
- Eight-channel analog audio inputs, balanced
- RS-422 serial port for external metadata
- Four GPI inputs, TTL

Outputs

- Two SD/HD/3G SDI outputs and one SD/HD/3G SDI fiber output carrying the converted program signal with embedded audio, VANC data (WSS/VI/AFD, audio metadata and closed captioning/teletext data)
- One SD/HD component YPrPb/RGB output
- One SD composite output
- One S-Video output
- One HDMI output (audio and video streams)
- User-selectable input and output video standard/formats
- Four AES outputs, unbalanced

- Eight-channel analog audio outputs, balanced
- RS-422 serial port for external metadata
- Four GPIO outputs, TTL

Video Processing

- Dual-output processor supporting simultaneous down- and cross conversion; simultaneous up- and ARC conversion
- Advanced 10-bit image processor
- 12-bit adaptive 3D comb filter color decoder
- Motion adaptive de-interlacing for exceptional vertical resolution
- Color space conversion between SD (601) and HD (709)
- User-configurable picture-resizing aspect ratio conversion (H/V size, H/V position and cropping)
- Fixed preset aspect ratios that include 16:9 anamorphic, 16:9 middle cut, 14:9, 4:3 and pixel true
- Variable ARC controls
- Aspect ratio adjustment according to embedded WSS/VI/AFD information
- User-selectable color for the internally-generated background, 1…8 colors
- Support for up to twelve frames of delay through the entire video path
- Clean cut transition during aspect ratio change
- SDI video clipping
- Video noise reduction and detail enhancement
- Video proc amp controls
- Color correction
- I-Wings, 3D Combine, and 3D Undo modes

ANC Processing

- Trans-coding of CC or TT according to input and output video formats
- WSS, VI, and AFD processing: detection, insertion or re-insertion

Audio Processing

- Embedded audio processing (de-embed, delay/sync, sample rate conversion, embed) for sixteen channels (four groups)
- Discrete audio processing for eight channels (four AES pairs or eight analog mono channels)
- Audio proc amp controls (gain, phase invert)
- Handling of any embedded compressed audio with fixed delay
- 24-bit audio processing; word-length control on embedded and AES outputs
- Support for compressed and linear PCM in the same audio group
- Support for AES input sampling rates from 32 kHz to 108 kHz
- Audio delay that matches video propagation plus additional user delay of up to 2.5 seconds
- Audio input delay range of 0-1.25 seconds.
- Audio output delay of 0-1.0 seconds
- Plug-in advanced audio submodule option with software license keys for Dolby Digital/ Dolby E decode and encode, DTS® Neural Loudness Control and DTS® Neural Surround™ Up/Down Mix and MultiMerge

Other

- 10/100 Ethernet connectivity
- Store-and-recall AFD presets through CCS-P and SNMP
- User-selectable LOV modes: Pass, Freeze, Black, and Test Pattern
- Built-in SD/HD/3G test generator containing cross hatch pattern, color bar signal, black, white, and horizontal sweep with chroma or luma-only signals
- Clean handling of hot switch on input
- Front panel and CCS Pilot control accessibility
- Store-and-recall of control parameters via CCS applications and control panels
- Logo/trouble slide storage and presentation capability

Options

The base X50-AV-2PS model is a 1RU frame sync, converter, and processor with audio processing and dual power supplies. **Table 1-1** lists the available options. For unbalanced-to-balanced AES connections, we recommend the AES baluns listed on page 10.

Also, recommended is the 10REMTOOL for removing 1.0/2.3 FPB connectors on the X50. This product is available from White Sands Engineering. See the following document:

http://www.whitesandsengineering.com/downloads/catalog.pdf

Table 1-1 X50 Orderable Options

Name	Description
OP+SFP+TR13P	Small Form Factor Pluggable (SFP) for fiber optic modules: 1310 nm wavelength transceiver with pathological support for baseband video
OP+OP+SFP+TR27P to OP+SFP+TR61P	Small Form Factor Pluggable (SFP) for fiber optic modules: 1270 to 1610 nm wavelength transceivers with pathological support for baseband video
X50OPTCAB-AES	BNC-to-DIN 1.0/2.3 AES interface cable
X50OPT-ADVAUD	APM (Audio Processing Module) plug-in advanced audio processing; this hardware requires software key license options
X50OPT-SK-DDD	Software key license for one Dolby Digital Pro decoder (5.1 or 2.0)
X50OPT-SK-DDE	Software key license for one Dolby Digital Pro encoder (5.1 or 2.0)
X50OPT-SK-DED	Software key license for one Dolby E encoder
X50OPT-SK-DEE	Software key license for one Dolby E encoder
X50OPT-SK-DTS	Software key license for DTS Neural Technologies options ■ Three software key licenses are required for DTS Neural Surround UpMix or DownMix or 5.1 DTS Neural Loudness Control ■ Four software key licenses are required for DTS Neural Surround MultiMerge ■ One software key license is required for 2.0 DTS Neural Loudness Control

Front and Back Views

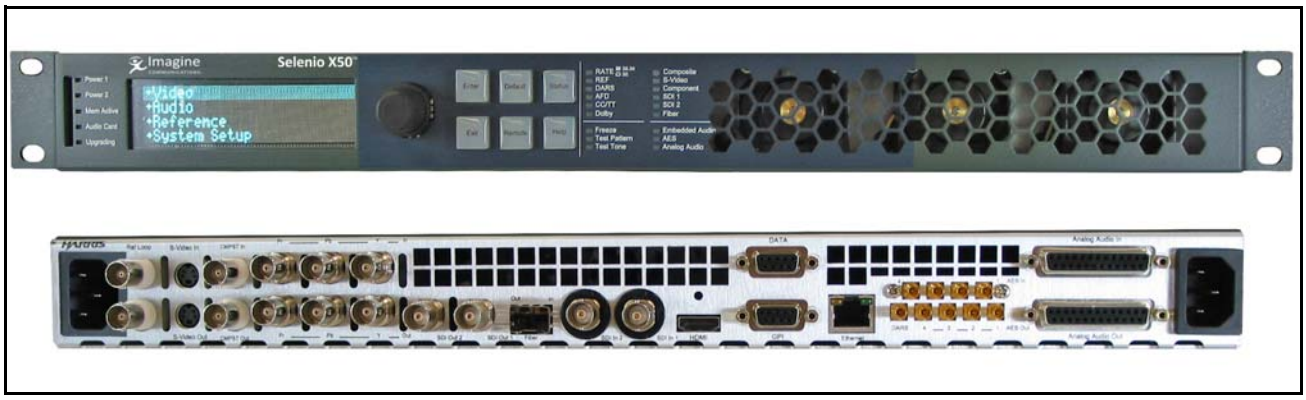


Figure 1-1 Front and Back Views

Pinouts

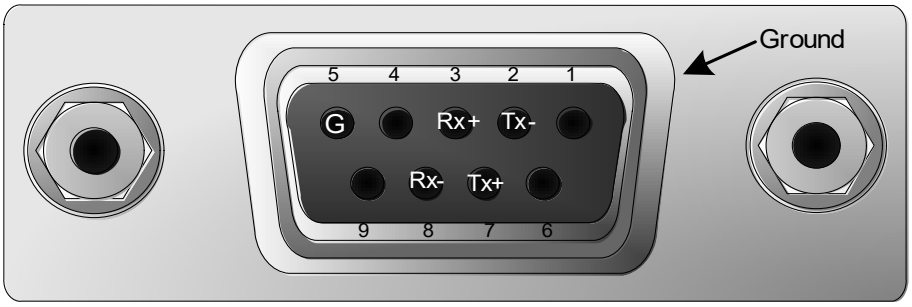


Figure 1-2 Female Back Panel Data Pinouts

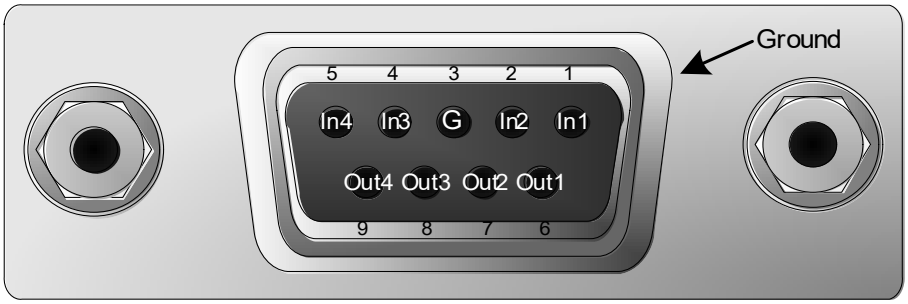


Figure 1-3 Female Back Panel GPI Pinouts

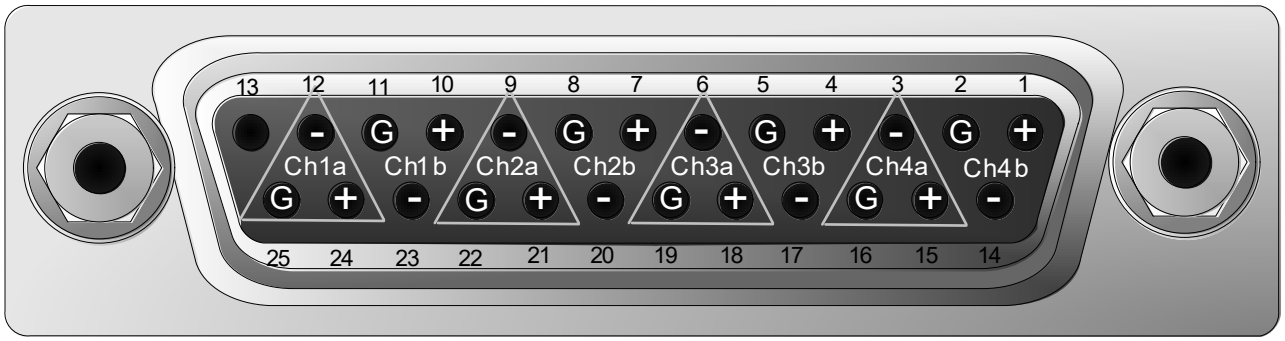


Figure 1-4 Female Back Panel Analog Audio Input and Output Pinouts

Signal Flow

Figure 1-5 on page 6 illustrates the signal flow for the X50.

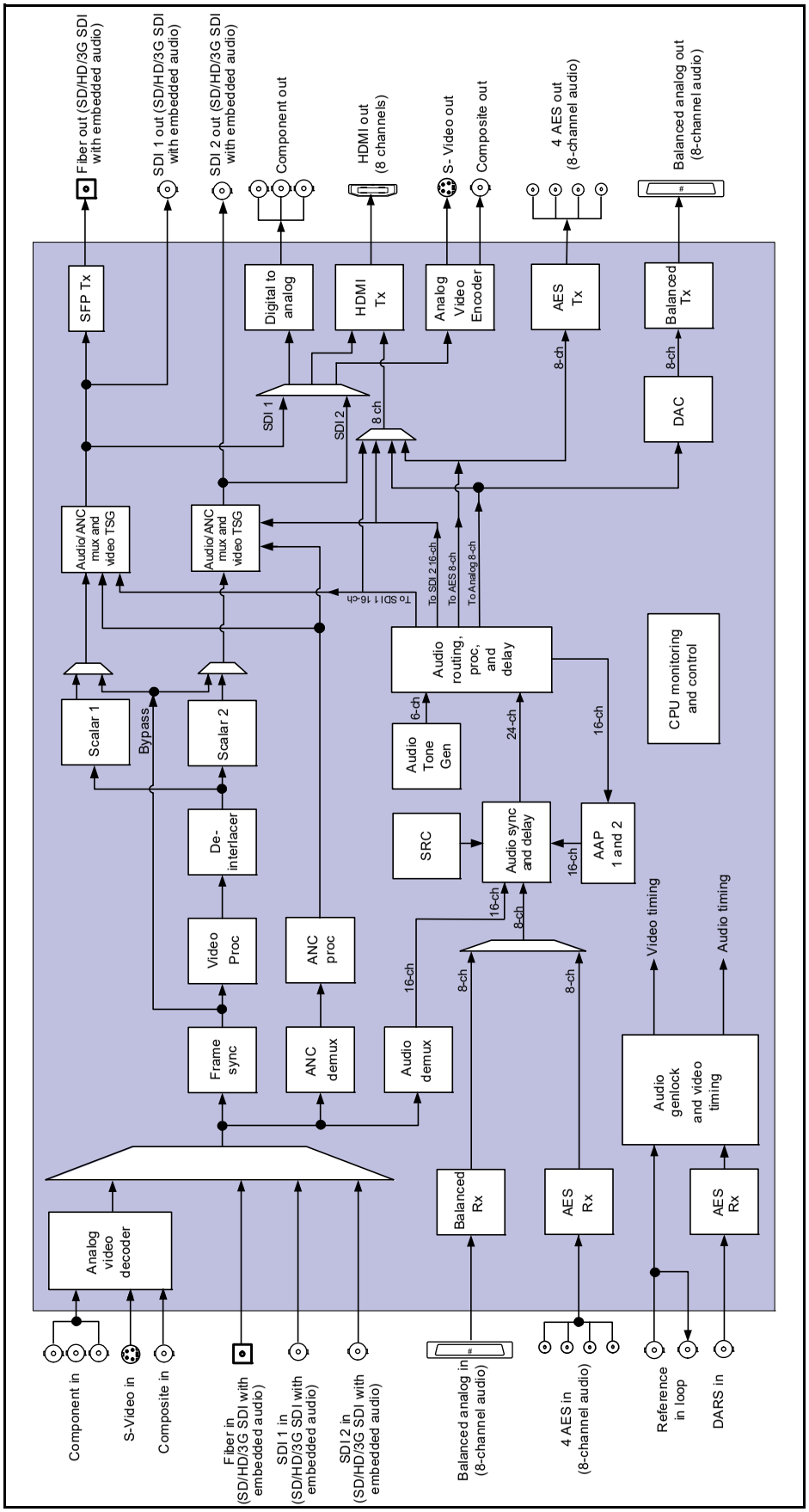


Figure 1-5 X50 Signal Flow

2 Installation

Preparing for Installation

Prior to installing your system, ensure that certain environmental and electrical conditions are met.

Electrical Requirements

The X50 power supplies have a universal input of 100-240 VAC at 47 to 63 Hz (nominal), 75 W. There is no voltage selector switch.

Each frame has space for two power supplies; however, a single power supply can meet the requirements of a fully-loaded frame.

Environmental Requirements

X50 units are cooled by forced air drawn in from the front, and exhausted through the rear. There must be free passage for air flow at the front and back of each unit to allow for adequate ventilation. Take care to select a dry, well-ventilated location with a minimum of dust.

X50 units are designed for mounting in a standard 19-in. (48-cm) rack using front-mounting ears and rear support brackets, occupying a 1RU vertical space of 1.75 in. (4.4 cm).

When installing an X50 in a rack, ensure that there is adequate space behind the mounting ears and clearance for the rear connecting cables. Allow about 10 inches (25 cm) of slack in the rear connecting cables for frame access and maintenance.

After unpacking the frame, and before installing into a console or rack, allow at least 30 minutes for temperatures to equalize and to eliminate any condensation that may have developed. X50 frames require an ambient temperature of 41º to 95º F (5º to 35º C) with a relative humidity of 10-90% (non condensing).

Rack Mounting

Although the pre-installed frame-mounting ears provide the main support for the X50 within a rack, you must install arms, brackets, and a cable relief bar at the rear of the unit to support the weight of cabling and frame stacking.

The following items are included:

- Rear support arms (164-000306Q00)
- Cable tie bar (164-000305Q00)
- Brackets (741-983A_Q)
- Bracket screws (4-40X1/4 PH_Q)
- Tie bar screws (6-32X3/8 PH)
- Rack Ears (164-100062Q00)

Note: *The frame mounting ears and the rack support brackets are reversible. You can install them with the ears at the front and support brackets at the rear, or with the ears at the rear and the support brackets at the front.*

Figure 2-1 Mounting Ears in Front Position

The following procedure describes how to install the rack supports.

1 Locate the support package in the box, consisting of two support arms, two brackets with screws, a tie bar, and tie bar screws. (See **Figure 2-2**.)

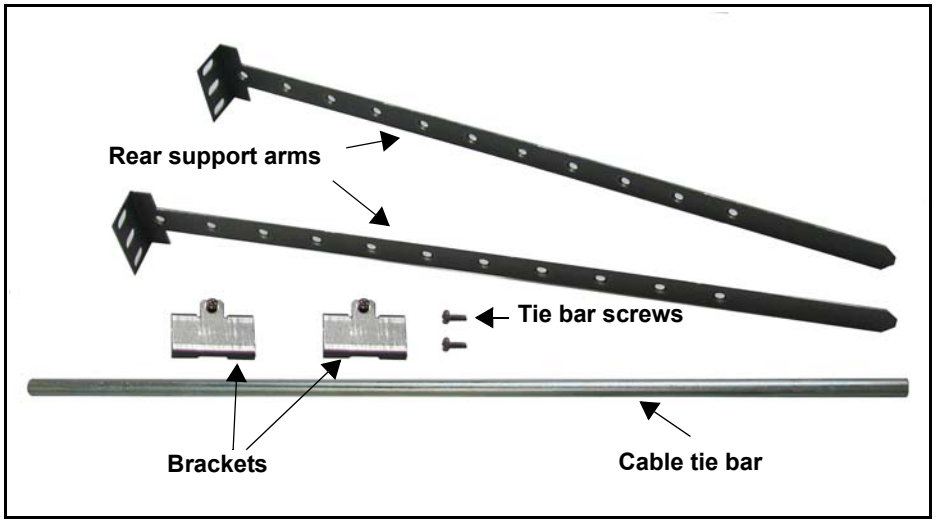


Figure 2-2 Rack Support Brackets

2 Attach the brackets to the sides of the frame using the screws that are provided. (See **Figure 2-3** on page 9.)

CAUTION

To prevent damage to components inside the frame, do not use screws longer than those provided.

Figure 2-3 Bracket Installation

3 Attach the cable relief bar between the two support arms using the screws that are provided.

You can secure the cable relief bar through any of the screw holes on the arm. (See **Figure 2-4** on page 9.)

Figure 2-4 Attaching the Cable Relief Bar

4 Push the X50 into the front of the rack, and attach the frame's front-mounting ears to the rack using the appropriate screws (not provided).

5 Slide the two arms into their slots from the back of the frame and attach the arms to the back of the rack (**Figure 2-5**).

Figure 2-5 Installed Support Arms and Cable Relief Bar

Jumpers

The analog audio input on the X50 can be set to either **600**Ω or **Hi-Z** impedance. For instructions on changing the jumper settings, see ***Changing Jumper Settings*** on page 118.

Selecting an External Balun

The following baluns from Neutrik are recommended for the unbalanced-to- balanced AES connections on the X50:

- NADITBNC-F: Female chassis XLR 110Ω input to female BNC 75Ω output
  http://www.neutrik.com/fl/en/audio/210_309314683/NADITBNC-F_detail.aspx
- NADITBNC-M: Female BNC 75Ω input to male chassis XLR 110Ω output
  http://www.neutrik.com/fl/en/audio/210_2044239418/NADITBNC-M_detail.aspx
- NADITBNC-FX: Female cable end XLR 110Ω input to-female BNC 75Ω output
  http://www.neutrik.com/fl/en/audio/210_1576769505/NADITBNC-FX_detail.aspx
- NADITBNC-MX: Female BNC 75Ω input to male cable end XLR 110Ω output
  http://www.neutrik.com/fl/en/audio/210_1923043515/NADITBNC-MX_detail.aspx

Configuring Network Settings

When shipped, the X50 is configured with a default IP address, subnet mask, and default gateway. If you intend to control the unit remotely, or connect it to a network hub/switch along with other X50 units, you will need to reconfigure the IP with unique network settings. Local control (with a direct Ethernet crossover connection to a PC) does not require any IP configuration.

Supported Network Protocols

The X50 supports the following network protocols for remote/network control:

- CCS Protocol
- HTTP
- SNMP

Making Required Hardware Connections

If you are connecting an X50 directly to a PC (no network connection), connect one end of a crossover Ethernet cable to the **Ethernet** RJ-45 port on the back of the frame, and the other end to the PC **Ethernet** port. If you are establishing a network connection, connect a straight-through 10/100Base-T Ethernet cable between the X50 **Ethernet** port and the network hub/switch.

Setting IP and Subnet Mask Addresses

To allow devices to communicate on a network, you need to set all X50 devices to the same subnet (network location). When shipped, X50 units are configured with the same default IP (device identifier) and subnet addresses. These addresses need to be changed so that each unit is uniquely identified and the network location of all units is accurately reflected. An IP address is made up of a four-item set of numbers (octet). For a class C network, you must change the first three items in the octet to identify the location (address) of the unit on your network, and also change the last item in the octet to uniquely identify the device from other X50 units. Consult your IT department for suitable address ranges, subnets, and gateways for your network.

Default IP Address and Subnet Mask

The default (factory-configured) IP address for every X50 unit is **192.168.100.250**.

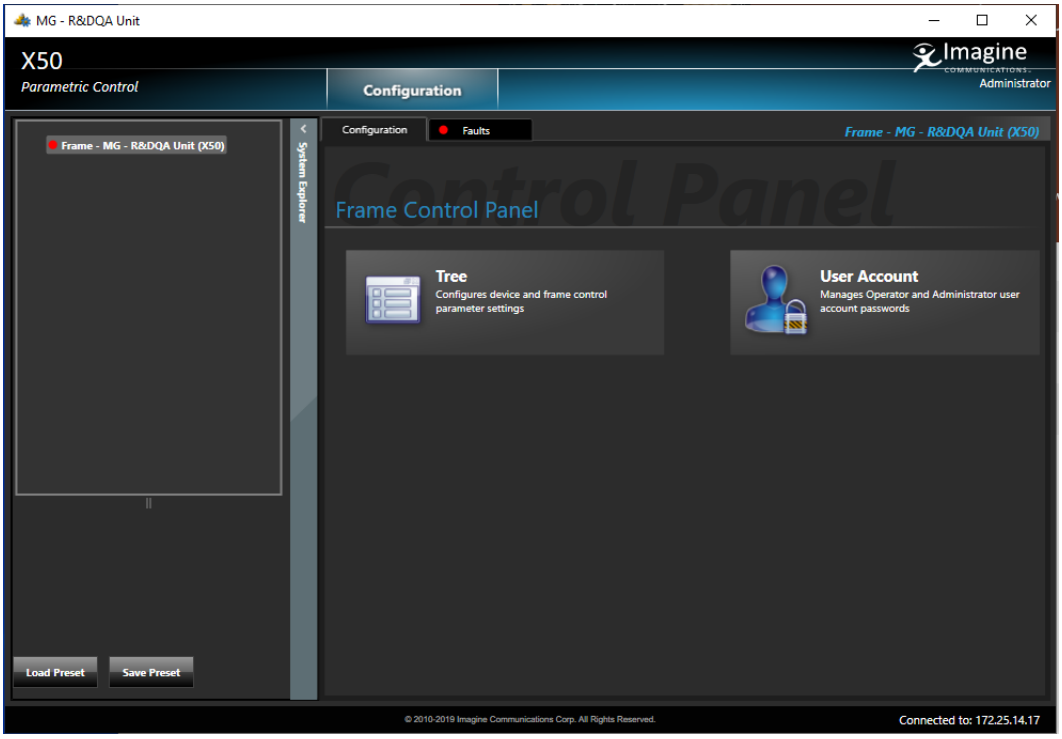
The default subnet mask address for every X50 is **255.255.255.0**.

Setting the IP Address of a Single Unit using the Web or Client Desktop App

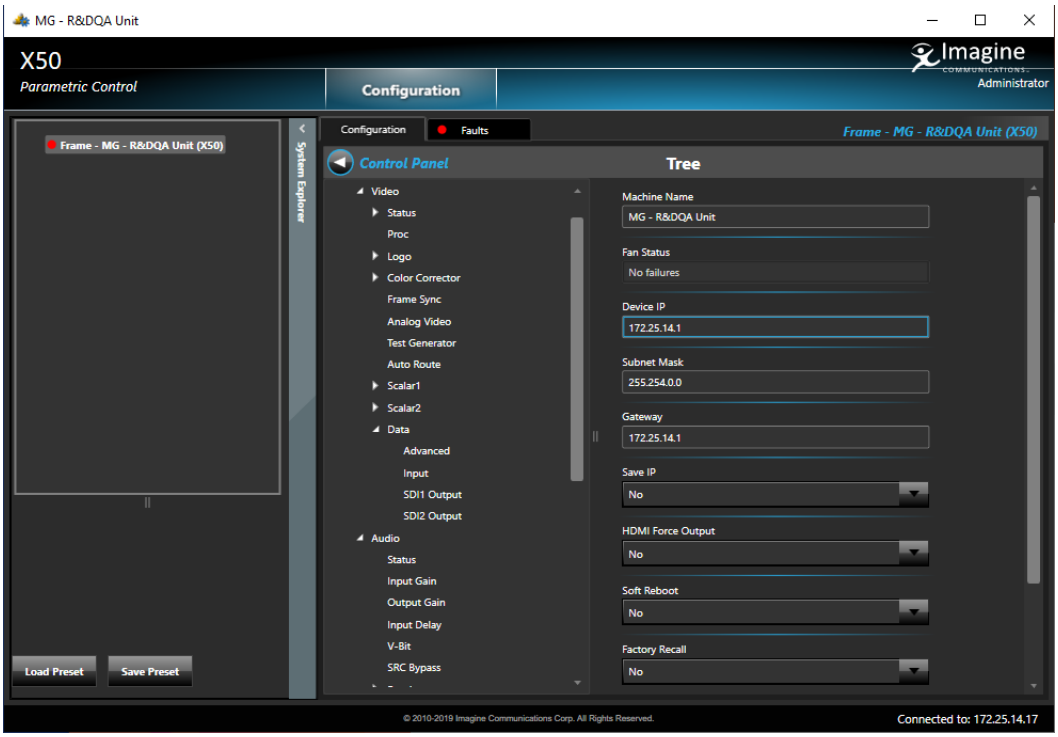
Once you have accessed the Selenio X100, the interface for monitoring and control of the device is functionally identical, whether you are using Silverlight or the WPF client application. Follow these steps to set the IP address:

1 Log in using default IP address in Desktop Client or populate IP address in the address bar for the web browser supported by the Silverlight plugin (see Configuring for Web Browser Control for information on installing Silverlight, if required).

2 Click **Configuration** on the right of the bar at the top of the screen and then select **Tree**.



3 Choose **System Setup** from the menu.



4 Enter an appropriate Device IP, Subnet Mask and Gateway for your network.

5 Select **Save IP** and then select the **Yes** option.

6 Open a new Desktop Client or Webpage with the modified IP settings.

Setting the IP Address of a Single Unit with a Local or Remote Control Panel

Follow these steps to configure the network addresses using a local or remote control panel:

1 Follow this path: **System Config** > **Setup** (in the RCP, select **Device Setup**).

2 Scroll to the **Device IP** parameter, and then press **Enter**.

If this is a new unit being configured, the default IP displays. Otherwise, the current IP address of the unit displays.

3 Change the IP address by following these steps:

- **a** Press **Enter** to navigate to one of the four number sets in the octet.
- **b** Modify the address value by using the scroll knob to set a new number.
- **c** Press **Enter** to move to the next item in the octet, and then repeat step (b) above.
- **d** Press **Exit** when you are finished configuring the address.

4 Scroll to the **Subnet Mask** parameter, and then press **Enter.**

If this is a new unit being configured, the default subnet mask displays. Otherwise, the current subnet displays.

5 Repeat the procedure described in step 4, this time for the subnet mask.

6 Scroll to the **Gateway** parameter, and then press **Enter**.

If this is a new unit being configured, the default gateway displays. Otherwise, the current gateway address displays.

7 Repeat the procedure described in step 3, this time for the gateway parameter.

8 Select **Save IP**, and then press **Enter**.

9 Select **Yes** option and then press **Enter**.

10 Press **Exit** to return to the **Setup** menu.

Rebooting the X50 is not required.

Setting the IP Addresses of Multiple Units

If you have multiple X50 systems that require network configuration, you will need to set unique IP addresses and assign a subnet mask and gateway address for each of them one at a time. The following procedure summarizes the required steps:

1 Apply power to the first X50 unit with a frame-mounted local control panel.

When ready for configuration, the main X50 menu shows on the display screen.

2 Configure the network settings for the first X50, as described in the procedure on page 13.

3 Restart the X50 unit.

4 Plug in the next X50 system, configure its network information, and then restart the unit.

Follow this procedure for all remaining X50 units that require configuration.

5 Connect all X50 systems and remote panels to a network hub or switch using a 10/100Base-T Ethernet cable.

6 Ensure that all configured X50 units are detected on the network.

To do this, press **Remote** on the front panel. All X50 units configured with the same subnet mask address will display (you will see a list of all detected IP addresses).

If a unit or RCP is not detected, ensure that the subnet mask address is accurate. Alternatively, confirm that all units were restarted after configuring any network settings.

Remote Control of the X50

This section provides the following general configuration procedures:

Configuring for Web Browser Control

The control interface allows up to 10 simultaneous monitoring connections. Each connection shows device fault and parameter information. When a change occurs to a device, such as a fault or a parameter change, that change will appear on the monitoring screens of other users.

Note: *Navigator version 4.6 no longer supports a specific GUI for the X50. Instead, a Silverlight web server launches when you click on a code-updated X50 in Navigator.*

Logging In To the X50 Control Interface

To open a browser connection to an X50, follow these steps:

1. In your browser, enter the IP address of the X50, and then click **Enter** to connect.

   If the X50 is in a failed state (i.e., disconnected), then you will see a "browser cannot display the page" or "browser could not connect" message.

2. Enter a defined user name and password.

   The default user name is Administrator, and by default there is no password (leave the field blank).

3. Click **Enter**.

   The **X50** control interface appears.

   The number of PCs connected to the X50 has an impact on receiving data in a timely fashion. If a large number of users are logged into the frame, response time may become slower. Up to ten separate PCs can be connected to the X50 at any one time. If additional users attempt to connect to the X50, they will receive a message:

   Server Busy. Please try again later.

   When you are not actively using the interface, please log off out of the system.

Exiting the Control Interface

To log off the X50 control interface, do one of the following:

- Close your browser.
- Navigate to a different page in your browser.
- Click **Logout** in the top right corner of the control panel.

Using the Selenio X50 Client Desktop Application

The Selenio X50 Client Desktop Application uses Windows Presentation Foundation (WPF) as an interface to control and monitor Selenio X50 devices.

Installing the Selenio X50 Client Desktop Application

1. Download and run the Selenio Parametric Control 1.2.0.exe installer.

   An InstallShield Wizard launches.

2 Follow the instructions that appear on the screen.

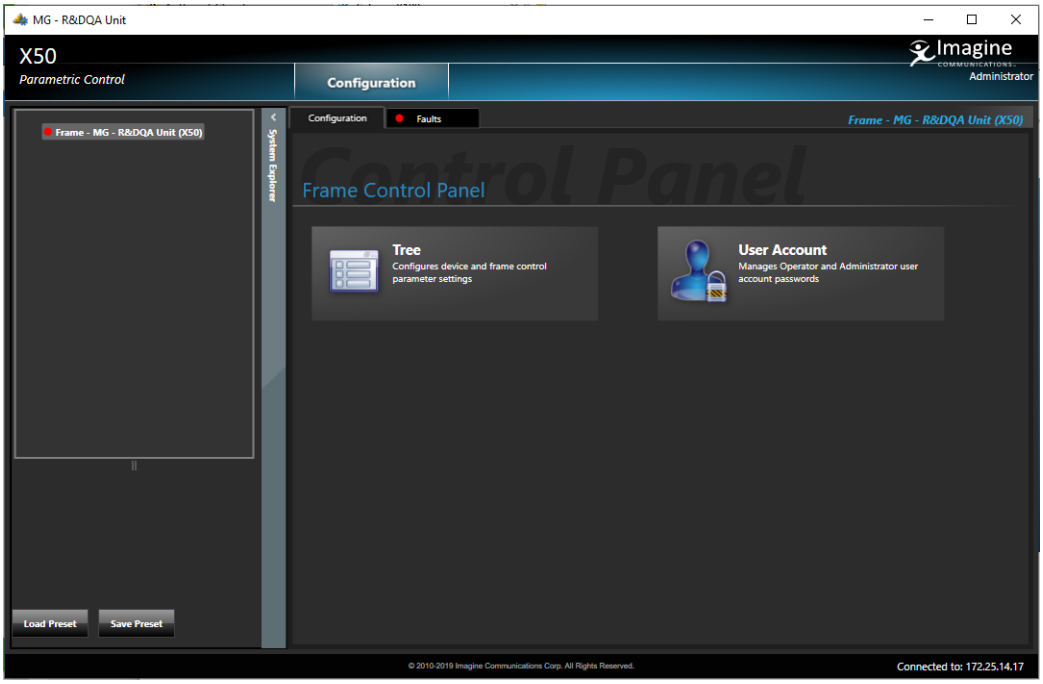
3 When installation is complete, click **Finish**.

Launching the Selenio X50 Client Desktop Application

1 Enter the IP address of the X50 device in the **Controller IP** field.

2 Select a User Name from the menu, enter the password associated with that user, and click **Login**.

A paned display box opens.



For a standard parameter list as described in the Controls chapter of this manual, click the **Tree** button.

Using the X50 Silverlight Application

Web Browser Control requires the MS Silverlight plug in. Go to https://www.microsoft.com/silverlight/ to download the software and install instructions. Silverlight is not supported on all Web browsers. If your browser does not support Silverlight, the option will not appear when you enter the IP address of the Selenio X50 device.

If the computer you are attempting to log in from supports but does not have Silverlight installe, when you enter the IP address of the Selenio X50 frame, the following message will appear:

Note: *If you are using Windows 7 operating system, a security dialog box may appear. Click* ***Ok*** *to confirm that you want to go to the page. If you click* ***No*** *on this dialog box, you will instead see a "Page cannot be displayed" message.*

An internet connection is not required for the PC to complete the install. Follow the instructions that appear on the screen. When installation is complete, click **Finish**.

The Selenio Controller Desktop App functionality is the same as documented for the Silverlight application.

Preparing for Remote Control via Control Panel

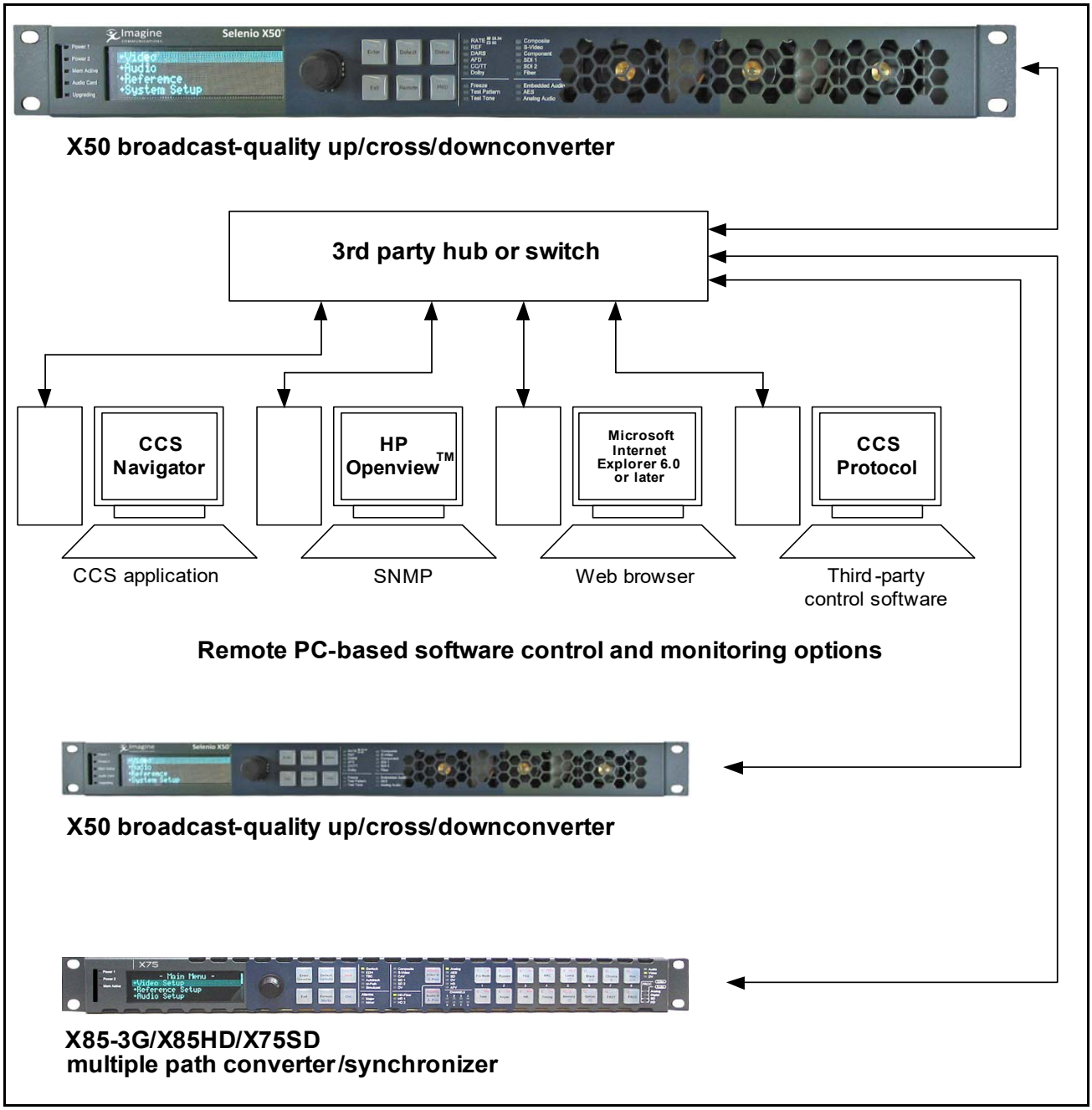


Figure 2-6 Network Configuration Diagram

Control panels remotely control X50 units via broadcast. You will need to configure the switchers and routers in your network accordingly.

Follow these steps to prepare your X50 models for remote control:

1 Reconfigure each X50 with unique IP addresses and other appropriate network settings, including shared subnet mask addresses.

See ***Setting IP and Subnet Mask Addresses*** on page 11 for details.

2 Restart each X50, and then wait 20 seconds to allow for network detection.

3 Connect all X50 units to a TCP/IP-based network hub or switch using 10/100Base-T Ethernet cable.

4 Discover all units found on the network, and then select the one you wish to control.

Selecting a Remote Unit to Control

You can remotely control all X50 units that share the same subnet. Follow these steps:

1 Ensure all connections and network settings have been made.

2 On the X50, press the **Remote** button to bring up a list of available units for control (see **Figure 2-7**).

Figure 2-7 List of Systems Available for Remote Control

The **<local device >** option shown on-screen represents the unit you are using (the local unit that is in front of you), and is always available on this list. An asterisk (*) beside the name indicates that this is the remote system currently being controlled by the panel.

Note: *Instead of IP addresses, you can give alphabetical names to individual X50 units that will appear in the list. To do this, see the* ***Machine Name*** *parameter.*

3 Use the control knob to scroll through the list of available X50 devices, highlight the unit you wish to control, and then press **Enter**.

The X50 screen reads **Connecting...**

4 Wait a few moments.

The menu of the selected X50 unit appears along with all of that unit's settings.

5 Operate the selected unit as required.

Once a unit is selected for remote control, all front panel features operate as if you were actually at the front panel of the selected remote unit. This means that the VFD panel, status indicators, and buttons (with the exception of the **Remote** and **Option** button) all control and/or reflect the status of the remote unit, *not* the one you are physically operating.

Note: *The light on the* ***Remote*** *button flashes while the unit is remotely controlling a device.*

6 To switch to another unit, or to control the local device you are physically operating, press the **Remote button**, and then select a new device to control.

7 Select **<local device >** to resume normal single-unit operation.

Configuring SNMP Support

With SNMP support, you can use a standard MIB browser to monitor parameters and alarms. You must set SNMP options using CCS Pilot or Navigator. Before you can configure SNMP support, you must discover the X50.

Setting SNMP Options

Devices that support SNMP will have an **SNMP** tab in the **Configuration** window. To configure an X50 that supports SNMP, follow these instructions.

1 While your CCS software is in Build mode, right click on the X50 and choose **Configuration**.

The **Configuration** window opens.

2 Click the **SNMP** tab, and then click the **Read** button.

The CCS network polls the module and retrieves its current settings. It fills in all the fields on the **SNMP** tab of the **Configuration** window with the settings that are on the device.

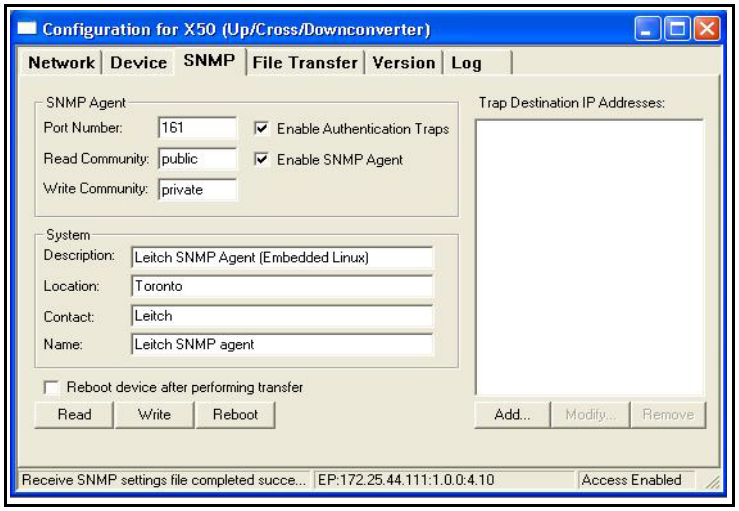


Figure 2-8 SNMP Tab on device Configuration Window

In the top left portion of the window are SNMP Agent settings.

Table 2-1 SNMP Agent Fields of SNMP Tab

Field	Function
Port Number	(Can be from 0 to 65535) The network port used by the SNMP agent; port 161 is the default for X50
Read Community	Has to match the “read community” setting in your MIB browser

Table 2-1 SNMP Agent Fields of SNMP Tab

Field	Function
Write Community	Has to match the “write community” setting in your MIB browser
Enable Authentication Traps	When checked, authentication traps are sent if the read or write community doesn’t match between the SNMP agent and MIB browser
Enable SNMP Agent	When checked, SNMP support is available; if not checked, SNMP support is disabled

Below the **SNMP Agent** settings are **System** settings. The information in these fields describes the device that is currently selected in the **Navigation** window. This is user-defined information that, once provided by an administrator, is available on the device when it is retrieved by a MIB browser.

Table 2-2 System Fields of SNMP Tab - MIB-2 System Information

Field	Explanation
Description	The default is “Leitch SNMP Agent”
Location	The physical location of the device
Contact	The contact person for this device
Name	Name of the device

The **Trap Destination IP Addresses** field contains a list of IP addresses that will receive SNMP traps. It is in the format IP Address:Port Address:SNMP version.

3 To add new Trap Destination IP Addresses, see ***Adding New Addresses for SNMP Traps*** on page 21. To modify them, see ***Modifying an SNMP Trap Destination*** on page 22.

4 (Optional) If you wish the device to reboot automatically when you send the new configuration to it, place a check beside **Reboot device after performing transfer**.

5 Click **Write** to send the new configuration to the device.

6 If you did not place a check beside **Reboot device after performing transfer** in step 6, click **Reboot** now and your changes to the configuration will take effect.

Note: *The device must be rebooted before changes will take effect.*

Adding New Addresses for SNMP Traps

To add a new SNMP trap destination, follow this procedure:

1 Click **Add** beneath the **Trap Destination IP Addresses** field. The **Add Trap Destination** window opens.

Figure 2-9 Add Trap Destination Window

2 Choose the SNMP version that you would like to use for traps.
3 Choose the IP address of that trap destination.
4 Choose the port number. The default is 162, but an administrator can set this to any number between 0 and 65535.
5 Click **Apply**. A new line is added in the **Trap Destination IP Addresses** field.
6 Repeat steps 2 through 5 to add more rows to the window.
7 Click **OK** to return to the **SNMP** tab of the **Configuration** window.

Modifying an SNMP Trap Destination

To modify a trap destination, follow this procedure:

1 In the **Trap Destinations IP Addresses** list, click on the item you would like to modify.
2 Click the **Modify** button. The **Modify Trap Destination** window opens.

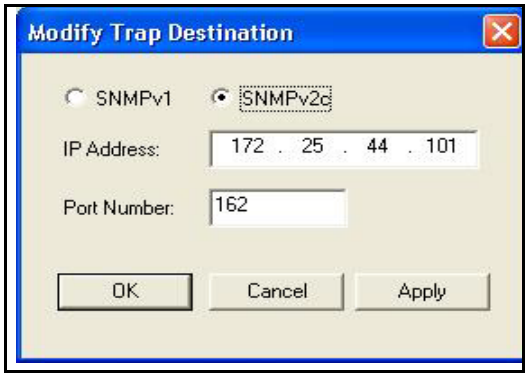


Figure 2-10 Modify Trap Destination Window

3 Choose the SNMP version of the traps using the radio buttons at the top of the window.
4 Enter the IP address of that trap destination in the **IP Address** field.
5 Enter the port number in the **Port Number** field.
The default value is 162.

6 Click **Apply**. The selected entry in the **Trap Destination IP Addresses** field is updated.
7 Repeat steps 2 through 6 to further update the row.
8 Click **OK** to close the **Modify Trap Destination** window.

Configuring Third-Party SNMP Software Control

SNMP is an industry-standard protocol that allows other manufacturers' control software to remotely monitor and control the X50.

Harris provides MIB files that can be downloaded from the website. Two general MIB files (**leitch.mib** and **ccsAlarm.mib**) set up the structure to define parameters and alarms. Once these two MIBs are installed, you will want to install a MIB for each distinct module for which you wish to set up third-party software control.

You can use any standard MIB browsing software with your X50.

1 Make the required network connections between the X50 unit(s) and your PC with installed SNMP browser/control software.

The SNMP configuration process for the X50 directs the SNMP agent where to send alarms (SNMP traps). This file must be modified before it is loaded back to the X50. For information on configuring SNMP, see page 20.

2 Load the leitch.mib file into your SNMP browser/control software.

This MIB sets up the basic structure for product specific Harris MIBs. It can be found under the **Private** > **Enterprise** branch, and sets up the leitchProducts and leitchCommon sub-branches.

The **leitchCommon** branch is initially empty. The **leitchProducts** branch contains folders for different families of Harris devices—for example, **LeitchX75**, **NEO** and **X50.**

3 Load **ccsAlarm.mib** into your SNMP browser/control software.

This MIB adds a **ccsAlarms** sub-branch to the **leitchCommon** folder. When it is installed, you will be able to receive traps with proper information as to where the alarms are triggered from.

4 Load product-specific X50 MIB files into your SNMP browser/control software.

A product-specific MIB provides a clear path to the parameters and alarms on the device. Harris MIBs can be downloaded from our website.

X50 MIBs will appear in the X50 folder under the **leitchProducts** folder. See Figure 2-11 on page 24.

5 Configure your MIB browser to connect to the unit by entering the **IP address**, **Port** (if you have changed the Port from its default in the configuration), and other standard configuration settings.

Your browser should now be able to connect to the SNMP agent running on the X50 unit. If you wish to receive traps, start up the trap receiver in your MIB browser software.

Note: *To verify that your configurations are correct, you can walk MIB2.*

Monitoring and Control Using MIBs

Each X50 unit's MIB can be fully expanded. When you expand an X50 MIB node in the tree view, there are three sub-folders (see **Table 2-3**).

Table 2-3 MIB Sub-Folders

Tree View Item	Contents
Objects	Lists the parameters for the device; all configurable and read-only parameters appear here (see **Figure 2-11**)
Identities	Lists the alarms information for the device which is used by the MIB browser to make trap messages more meaningful (see ***Alarms in MIB Browser*** on page 25.)
Conformities	A group of standard MIB information that guarantees that the MIB conforms to standard SNMP format

To view a complete list of the parameter settings on the X50, walk the MIB for that X50, walk the X50 at an IP address, or walk the X50 type.

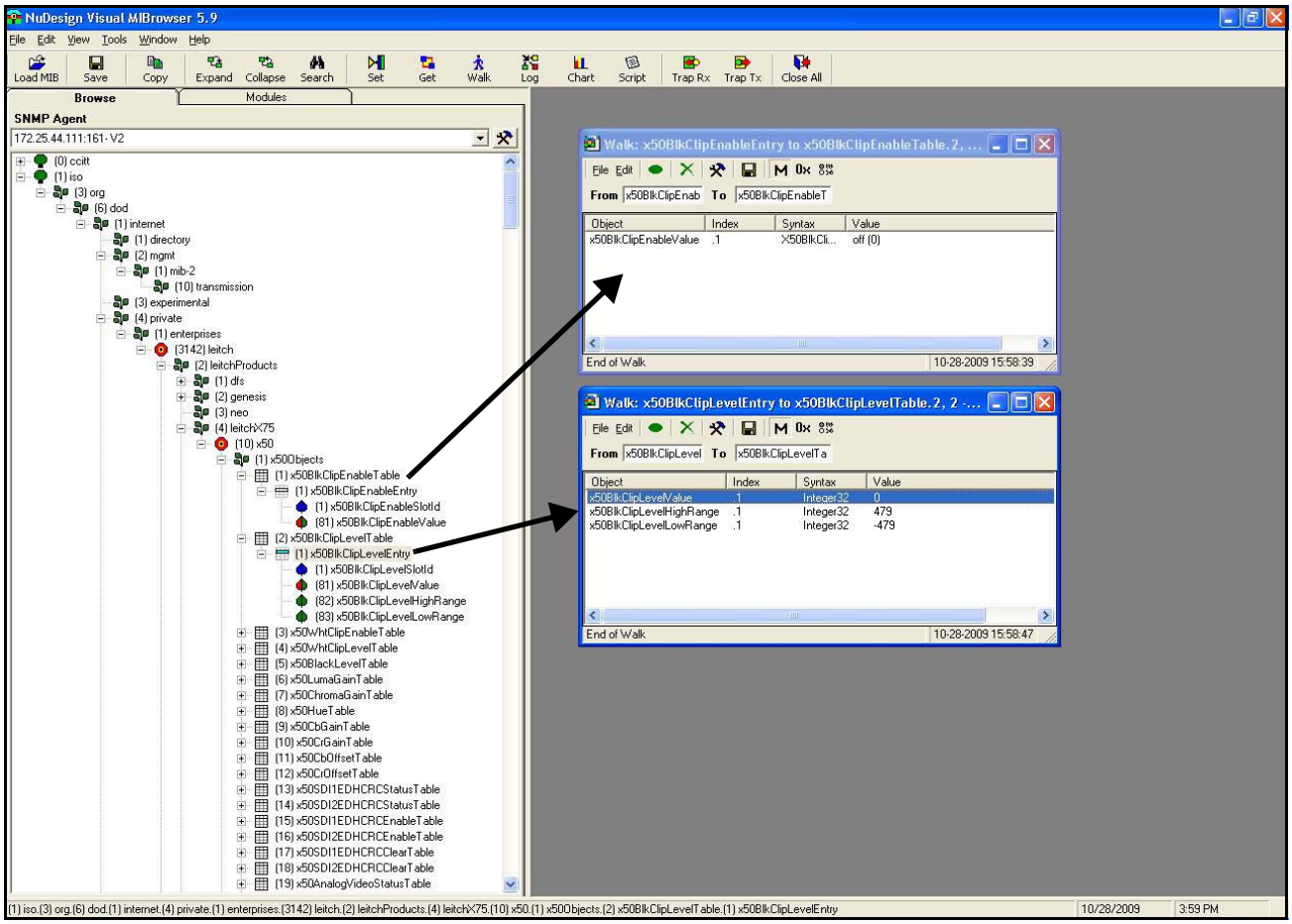


Figure 2-11 Typical MIB Loaded into NuDesign MIB Browser

Navigating Parameters in a Leitch MIB

X50 MIBs make it possible to view a parameter's range, walk a device or a frame, or receive alarm traps for a device (see **Figure 2-12**). For details on accessing these features, see the documentation that accompanies your third-party control software.

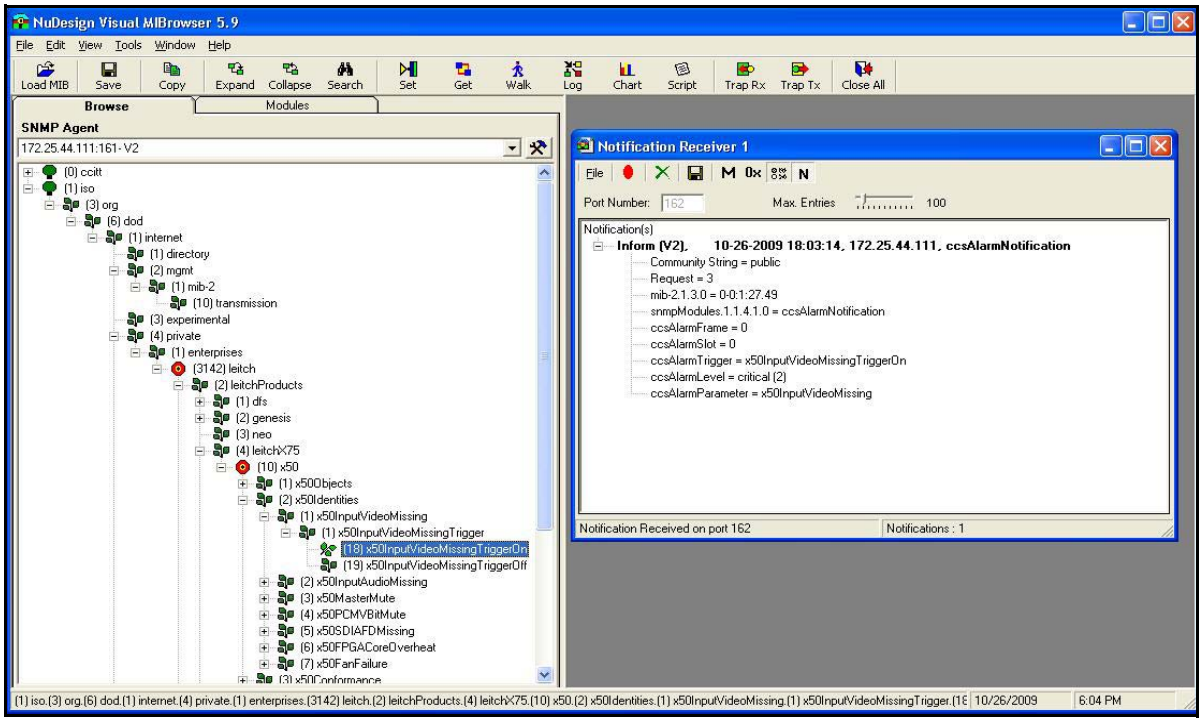


Figure 2-12 Alarms in MIB Browser

Parameters that have a limited list of options have two listings under the **Entry** branch of the tree. Parameters that have a range (as in a slider) of options have four listings under the **Entry** branch of the tree.

Table 2-4 Sub-Branches Under a Parameter in a Leitch MIB

Sub-Branch	Contains
Slot ID	(Does not apply to the X50)
Value	The current setting of this parameter
High Range (slider ranges only)	The top value of this parameter
Low Range (slider ranges only)	The bottom value of this parameter

For information on the parameters for each individual device, see that device's documentation, posted on our website. Some Harris products have HTML forms that display their parameters, and these are also posted on our website.

3 Controls

Overview

You can control the X50 using many different interfaces:

- Local front panel X50 controls
- Remote front panel controls on other X50 units
- CCS Level 3-enabled control hardware and software products
- X50 Web browser

For detailed information about the operation of Dolby and DTS Neural audio options, see ***Advanced Audio Processing*** on page 67.

Front Panel Controls

The X50 supports local and remote front panel control, CCS software, CCS-enabled controls panels, SNMP, and web browsers. At the control panel, you can change parameters using the rotary switch, push buttons, status LEDs, and VFD. When using the control panel, you will find some entries in the main menu begin with a + symbol. This indicates there are multiple levels for that item. The complete list of control parameters is available from our website.

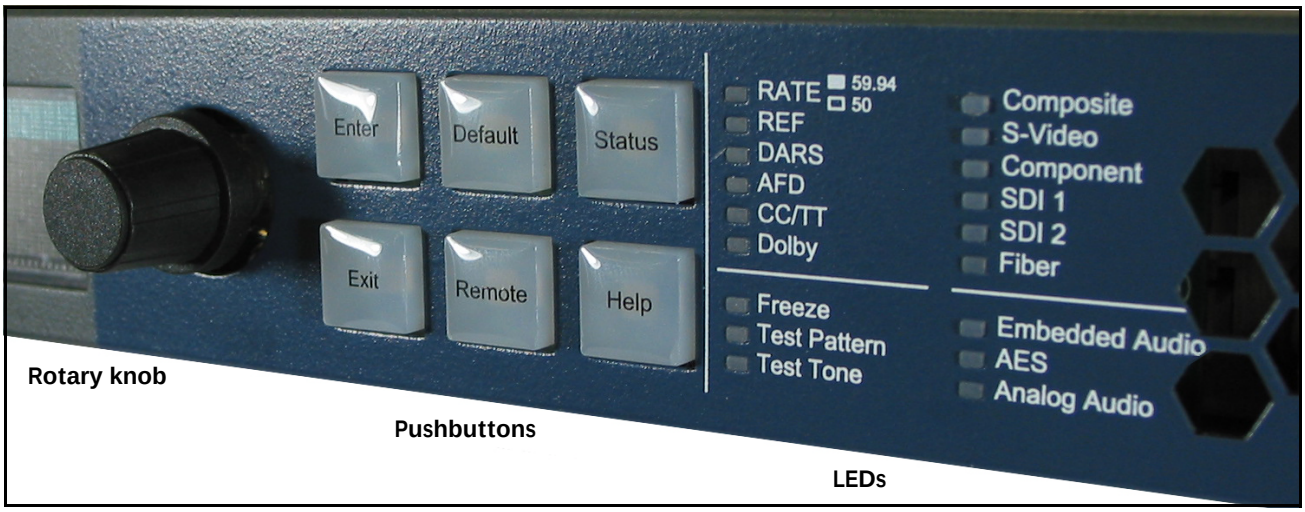


Figure 3-1. X50 Controls and LEDs

Push Buttons

Table 3-1 Push Button Controls

Name	Function
Enter	Selects or "takes" an option or value in a parameter
Exit	Exits from one level in the parameter tree to a higher lever in the tree
Default	Resets all of the X50 parameters to their default values, and flashes when you have selected a default value for a parameter (to reset all of the parameters using this control, you must press and hold the button for one second)
Remote	Enables the controls to operate other remote X50, X75, and X85 units (to activate this control, you must press and hold the button for one second)
Status	■ Displays the current machine status and/or error conditions (the VFD switches back to *control* mode to display the menu structure when you press the **Enter** or **Exit** button) ■ Hold the button for one second to obtain a **Faults** list. (Before the alarms in the list are operational, you must enable them, either in the **Faults** list, or in the X50 software GUI. To enable an alarm in the **Faults** list, select the line, press the **Enter** button, and then select **Enable**.) ■ If the square beside the item is filled, the alarm has been triggered. 
Help	Displays a brief description of a selected parameter's function (hold the button for one second to view the control panel's display options, including intensity, backlight, screen saver, and Lock Panel*)

*The Lock Panel feature prevents the enabling of a function by accidental activation of a button. Press **Default + Exit** to escape this feature.

LEDs

When LEDs are *lit*, the item next to the LED is either selected, enabled, or present. A *flashing* LED indicates the item is in an error condition. An LED that remains *unlit* is either not applicable, or—in the case of **Rate**—indicates an output frame rate of 50. The **Dolby** LED illuminates when an AAP is configured as a Dolby E or Dolby Digital encoder, and the encoder is currently operating.

Table 3-2 Left-Side LEDs

Name	Meaning when Lit
Power 1 and Power 2	Indicates which power supplies are in use
Mem Active	Shows that the internal or SD card memory is in use; normal operation of the X50 may be interrupted
Audio Card	Indicates the presence of an advanced audio module (future use)
Upgrading	Indicates the X50 software is being upgraded; normal operation is interrupted

Main Menu Items

Table 3-3 Main Menu

Name	Function
Video	Provides parameters for changing video settings
Audio	Provides parameters for changing audio settings
Reference	Sets the reference standard for the system
System Setup	Sets the options for general system setup; includes version information, license credits, GPI settings, scripts, power save options, IP address information, output formats, and input audio
Input Video Select	Selects the video source to be processed
SDI 1 Out Format	Selects the output video format on SDI 1
SDI 2 Out Format	Selects the output video format on SDI 2
Analog/HDMI Out Select	Selects the video source for the analog/HDMI video outputs when the SDI Routing Mode is set to Dual
HDMI Out Select	Selects the video source for the HDMI video output when the SDI Routing Mode is set to Linked
Component Out Select	Selects the video source for the component video output when the SDI Routing Mode is set to Linked
Composite Out Select	Selects the video source for the composite video output when the SDI Routing Mode is set to Linked
Output Frame Rate	Sets the output frame rate
Input Audio Select	Selects the source audio to be processed

Note: *Certain video/audio inputs and outputs can be disabled by the power-saving controls under* ***System Setup > Green (Power Save)****. If a selection or a control related to an interface is missing, check its power save status.*

Auto Routing Active Video Input

The read-only **Auto Routing Active Video Input** parameter (**Video > Status**) indicates which video input is currently in use when the **Auto Routing** feature is operating. Possible values are: **Analog Video**, **SDI 1/Fiber**, and **SDI 2**.

Web Browser Control

The **Configuration** page of the web browser control provides access to parameters (**Tree**) and to administrative privileges (**User Account**).

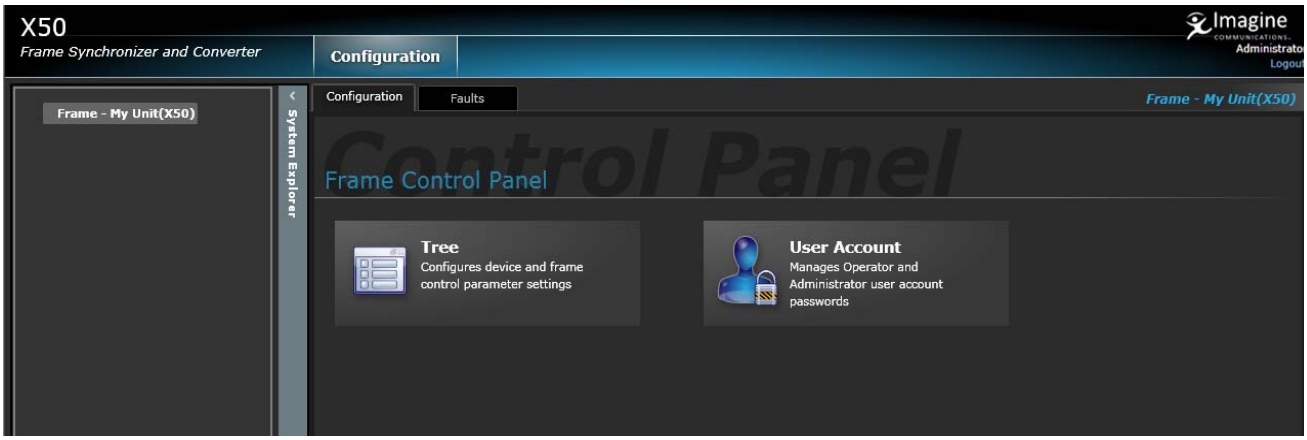


Figure 3-2. Configuration Page

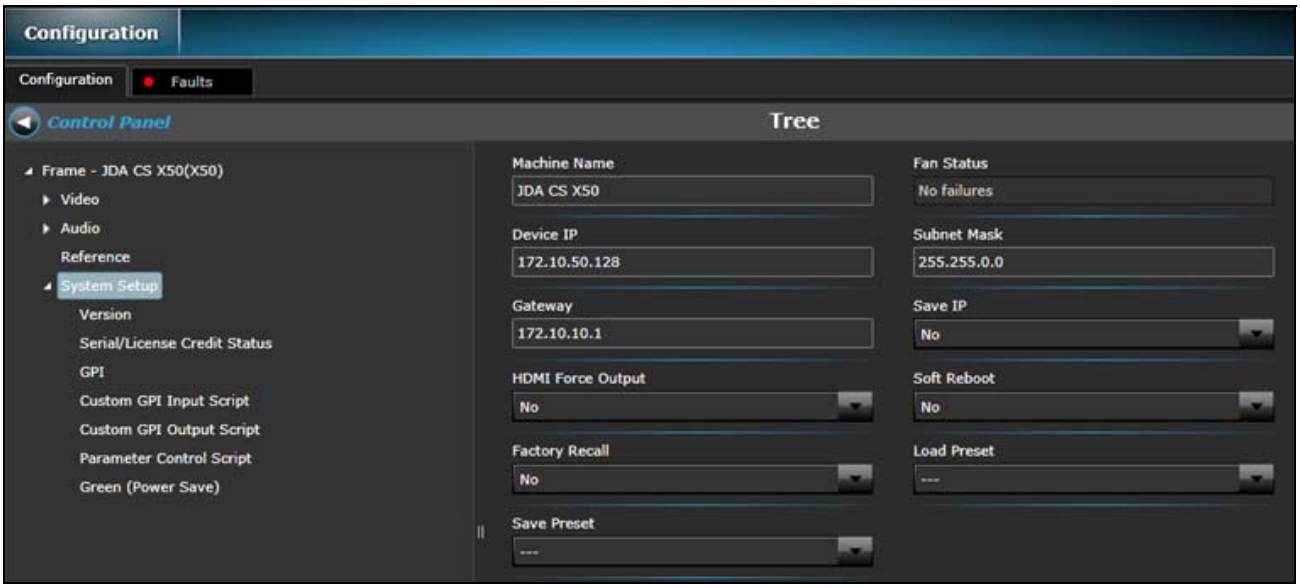


Figure 3-3. Web Browser Tree View

System Presets

Up to ten parameters in the X50 can be saved to **System Presets**, for quick recall at a later time.

You can save to--and load from--the following locations:

- Control panel
- SD-card
- Web browser user interface

To save and load presets at the control panel, press and hold the **Help** button. Then follow **Options > Panel Presets**.

To save and load presets using the SD card, press and hold the **Help** button. Then follow **Options > SD Card Presets**.

To save and load presets using the web browser user interface, set the UI to **Tree View**. Then in the bottom left corner, select either **Load Preset** or **Save Preset.**

Figure 3-4 User Interface Preset Controls

To save presets locally or on a SD card, go to the front panel of the X50. The presets are accessible at: **System Setup > Load Preset** and **Save Preset.**

Note: The control panel screen indicates whether a **Preset** is stored in the panel, or on an SD card. A hyphen beside the filename (**-**) indicates the logo is stored in the X50 panel, and a hash (**#**) symbol indicates storage on an SD card. Thus, it's possible to pull up **Presets** both from the panel and the SD card at the same time, even if they have the same filename.

Faults (Alarms)

The **Faults** page in the user interface provides information that includes:

- Fault Name
- Error Level
- Enable/Disable capability
- Priority (1 to 5 is Minor; 6 to 10 is Major)
- Trigger in seconds
- Clear in seconds
- Acknowledgment
- Active/Inactive status

You can sort the faults under these topics and by their **ID** number. Also, you can select faults individually (Ctrl + click) or in a batch (Shift + Ctrl + click), and make changes to them using the options shown on the right side of the UI screen.

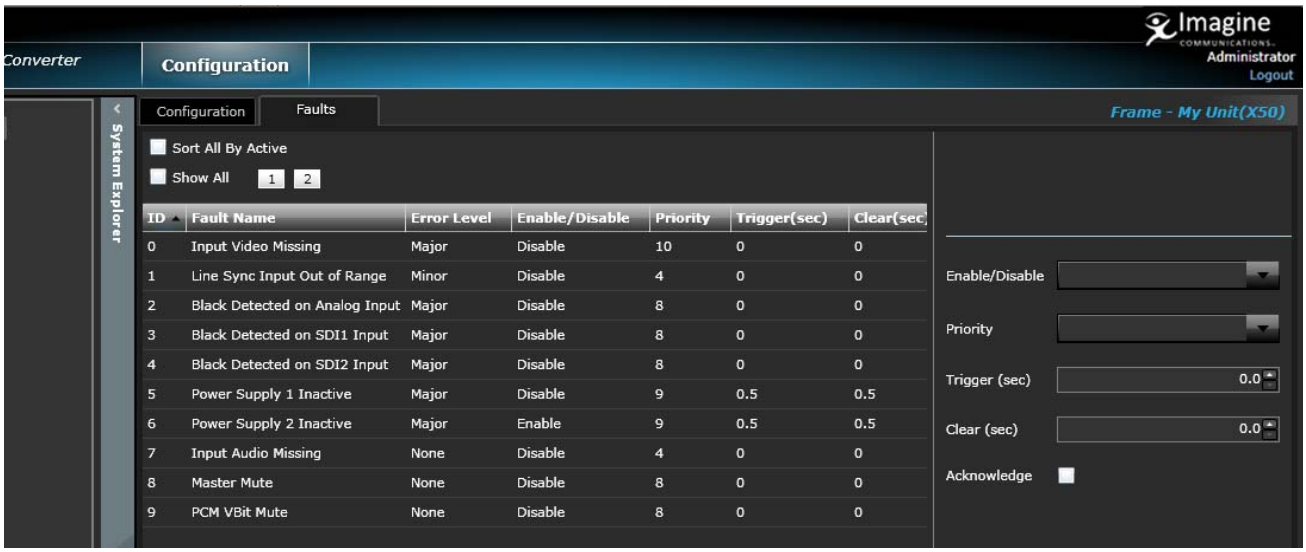


Figure 3-5. Faults Page

Unit Recovery Using Failsafe Load Procedure

In the unlikely event of a loss of control due to software corruption, follow these steps:

1. Download the latest X50 firmware from the Imagine Communications website to a PC connected to the X50.
2. While holding the **Enter** + **Status** buttons simultaneously, power cycle the unit.
3. Continue to hold both buttons until the image on the front panel display screen returns to the Imagine Communications logo.

   The unit is now ready for the failsafe firmware upgrade.
4. Unzip the **x50upgrade.exe** file within a folder.
5. Launch the file **x50Upgrade.exe** to open the Uploader utility.
6. Type the unit's **IP Address** into the appropriate field and then press the **Upload** button.

   When the procedure is complete, a notification appears.

Aspect Ratio Conversion

You can set the output aspect ratio conversion using **Custom**, **Standard**, or **Automatic** controls. These three methods are found in the **ARC Preset** parameter, with the following options.

- Custom
- Standard ARCs
  - Anamorphic
  - 4:3 Pillar Box
  - 14:9 Pillar Box
  - 16:9 Cut
  - 4:3->21:9 Ltr
  - 16:9 Letter Box
  - 14:9 Letter Box
  - 4:3 Cut
  - 16:9->21:9 Ltr
- Automatic ARCs
  - AFD
  - AFD - ALTR
  - VI
  - VI - ALTR
  - WSS
  - WSS - ALTR

Depending on the current conversion mode (Up, Down, Cross, or SD-ARC), different subsets of these options will be in effect. Thus, for example, an ARC setting that is visible in upconversion may not be visible in downconversion.

***Note**: In some regions, SD-SDI normal analog blanking is not part of the 4:3 active video area, causing the 4:3 image to have an active video length of 702 (PAL/625) or 704 (NTSC/525) instead of 720. In these situations, the ARC will need adjustments. Use the **SD Width** parameter* (**Video > Scalar x > Advanced**) to set the module to either ***720** (default) or **702(PAL)/704(NTSC)**.*

Custom ARC

To make a custom ARC setting, select options in the **Advanced**, **Variable**, and **Crop** parameters of **Scalar 1** and **Scalar 2**.

***Note:** When individual values are matched with a particular pre-defined standard aspect ratio, **ARC Preset** will change, to reflect that matching standard aspect ratio.*

Automatic ARC

Active Format Description (AFD), *Video Index* (VI), and *Wide-Screen Signalling* (WSS) are different systems in which embedded data automatically control the output aspect ratio. When you set **ARC Preset** to **AFD**, **AFD-ALTR**, **VI**, **VI-ALTR**, **WSS**, or **WSS-ALTR,** the X50 converts the aspect ratio according to the upstream AFD, VI, or WSS code.

The **x-ALTR** versions of these options interpret the code in an alternative way.

AFD transmits data in the VANC space of the SDI signal, enabling both 4:3 and 16:9 television monitors to optimally present video with preset ARC and safe area information. Without AFD, converted video may appear distorted or "cut off" when it appears on different monitors.

See **Figure 3-6** on page 34 for a comparison of AFD and non-AFD aspect ratio conversion.

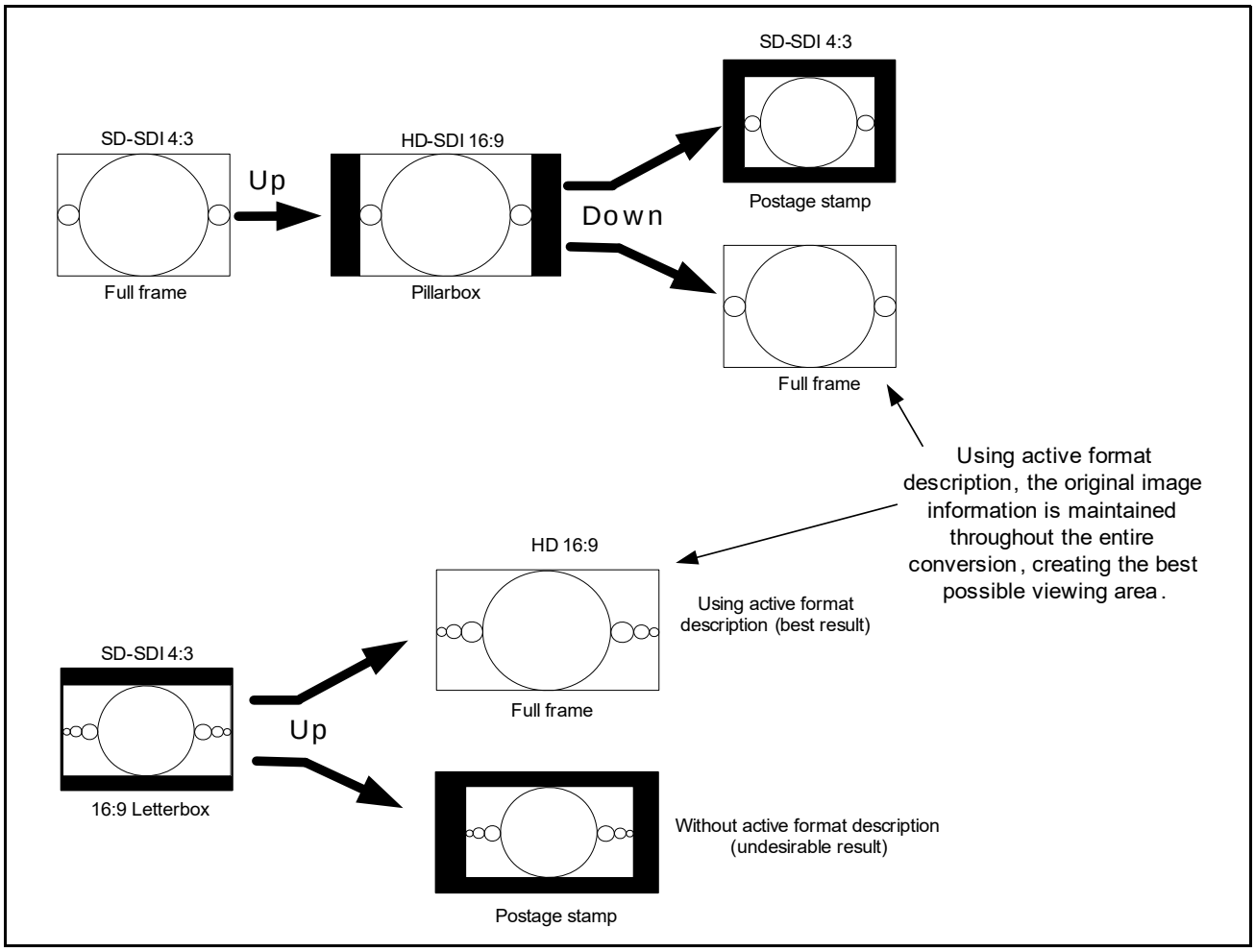


Figure 3-6. AFD and Non-AFD ARC

VI provides embedded code in 525-line and 625-line component digital video signals. This code makes it possible for picture and program related source data to be carried in conjunction with a video signal.

WSS is embedded code in a 625-line system. It contains information on the aspect ratio range of the transmitted signal and its position as it would appear on a conventional 4:3 display.

Figure 3-8 on page 36 and **Figure 3-9** on page 37 show the different AFD, VI, and WSS code selections. **Figure 3-7** on page 35 explains the meanings of the diagrams.

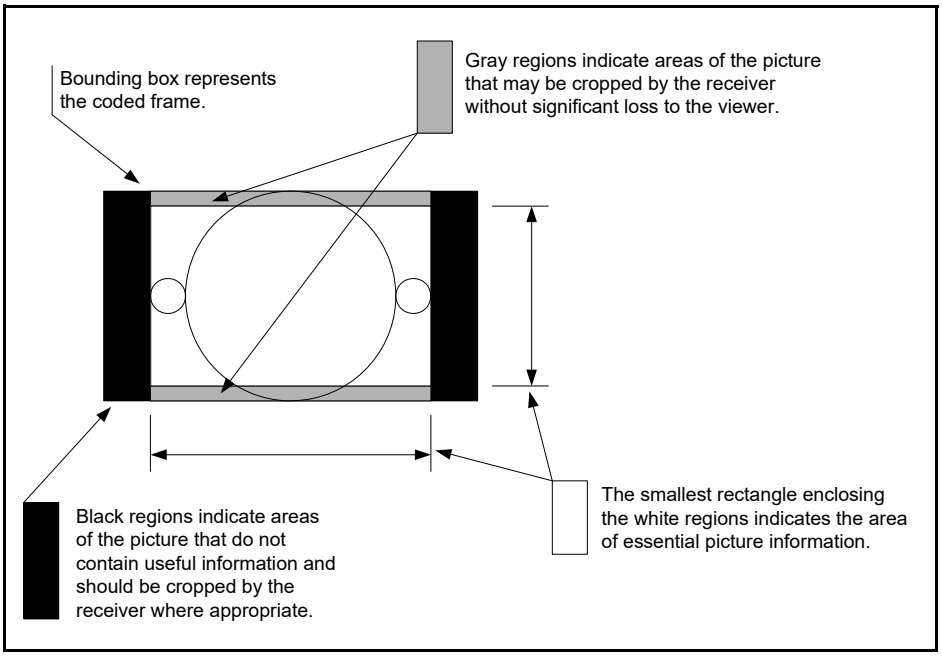


Figure 3-7 AFD Diagram Explanation

AFD 4:3 code and description

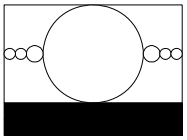
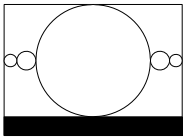
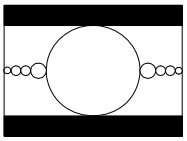
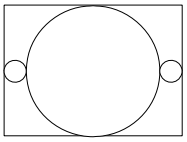
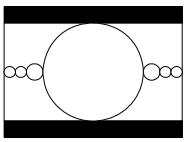
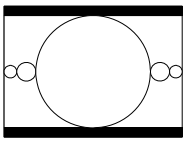
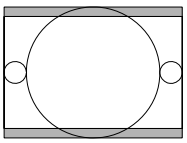
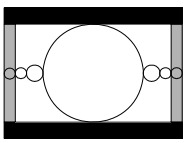
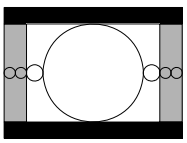
WSS name	AFD and VI Select parameter options	Illustration in a 4:3 coded frame	Description
16:9 Top	16:9 Top		Image with a 16:9 aspect ratio as letterbox at the top of a 4:3 coded frame
14:9 Top	14:9 Top		Image with a 14:9 aspect ratio as letterbox at the top of a 4:3 coded frame
>16:9	>16:9 in 4:3		Image with aspect ratio greater than 16:9 as a vertically centered letterbox in a 4:3 coded frame
Full Frame	4:3 Full		Image is full frame, with an aspect ratio that is the same as the 4:3 coded frame
16:9 Center	16:9 L		Image with a 16:9 aspect ratio as a vertically centered letterbox in a 4:3 coded frame
14:9 Center	14:9 L		Image with 14:9 aspect ratio as a vertically centered letterbox in a 4:3 coded frame
Full A 14:9	4:3 A 14:9		Image with a 4:3 aspect ratio and with an alternative 14:9 center in a 4:3 coded frame
None	16:9 L A 14:9		Image with a 16:9 aspect ratio and with an alternative 14:9 center as a vertically centered letterbox in a 4:3 coded frame
None	16:9 L A 4:3		Image with a 16:9 aspect ratio and with an alternative 4:3 center as a vertically centered letterbox in a 4:3 coded frame

Figure 3-8. AFD Descriptions for 4:3

AFD 16:9 code and description

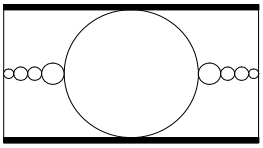
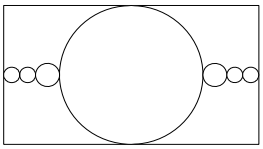
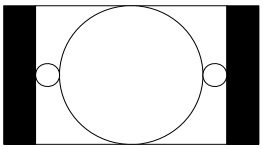
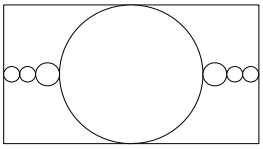
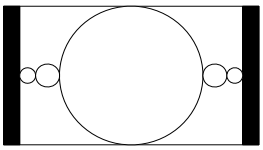
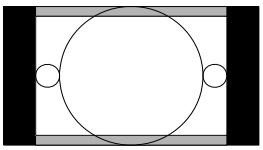
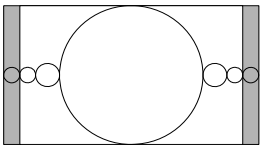
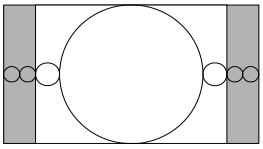
WSS name	AFD and VI Select parameter options	Illustration in a 16:9 coded frame	Description
None	>16:9 in 16:9 AFD Code: 0100		Image with aspect ratio greater than 16:9 as a vertically centered letterbox in a 16:9 coded frame
Anamorphic	16:9 Full AFD Code: 1000		Image is full frame, with an aspect ratio that is the same as the 16:9 coded frame
None	4:3 P AFD Code: 1001		Image with a 4:3 aspect ratio as a horizontally centered pillarbox image in a 16:9 coded frame
None	16:9 Prtctd AFD Code: 1010		Image is full frame, with a 16:9 aspect ratio and with all image areas protected
None	14:9 P AFD Code: 1011		Image with a 14:9 aspect ratio as a horizontally centered pillarbox image in a 16:9 coded frame
None	4:3 P A 14:9 AFD Code: 1101		Image with a 4:3 aspect ratio and with an alternative 14:9 center as a horizontally centered pillarbox image in a 16:9 coded frame
None	16:9 A 14:9 AFD Code: 1110		Image with a 16:9 aspect ratio and with an alternative 14:9 center in a 16:9 coded frame
None	16:9 A 4:3 AFD Code: 1111		Image with a 16:9 aspect ratio and with an alternative 4:3 center in a 16:9 coded frame

Figure 3-9. AFD Descriptions for 16:9

Examples of Automatic Aspect Ratio Conversion

You can enable automatic ARC controls by setting the **ARC Preset** parameter to **AFD**, **AFD-ALTR**, **VI**, **VI-ALTR**, **WSS,** or **WSS-ALTR**. When you set **ARC Preset** to **AFD** and the upstream video has AFD code embedded in it, the system will present the video signal in the appropriate aspect ratio, and generate new downstream AFD code accordingly. (You can confirm that AFD is available in the input signal by checking the **AFD Present** parameter.)

For example, in upconversion mode, an upstream signal with an AFD code of **1000** indicates the output will be a full frame 4:3 image. The X50 creates a **4:3 Pillar Box** arc, and the output HD image becomes a 4:3 pillar box. The resulting AFD code becomes **1001** (4:3 center).

In another example, the X50 is in downconversion mode. The upstream signal has AFD code **1111,** indicating a 16:9 ratio with alternative 4:3 center. If you set the **ARC Preset** parameter to **AFD**, the X50 creates an output of 16:9 letter box and the resulting AFD code becomes **1111**. If you set **ARC Preset** to **AFD-ALTR**, system does a center cut ARC, the output becomes 4:3 full, and the resulting AFD code becomes **1000**. This result is commonly used in the USA.

Figure 3-10 on page 39 to **Figure 3-13** on page 42 show all of the conversion patterns.

In the event that the current ARC is controlled by AFD, VI or WSS, and this data disappears from the input signal, the X50 provides you with two options:

- Retain the current aspect ratio as set by the last AFD, VI, or WSS data.
- Reset to the aspect ratio settings that were in use before the AFD, VI, or WSS data took control

The **Auto ARC Reset** parameter controls this feature. Select **Yes** to have the module reset to older values in the event of loss of data; select **No** (the default) to retain the current ARC.

Some AFD code "encourages" cropping out some of the active video area. To prevent this, set **AFD Crop Enable** to **Disable**.

The **Out Aspect Ratio** parameter controls the output aspect ratio of the SD signal, and it will affect how the AFD performs the automatic conversion. (It is assumed that an SD signal may be either 4:3 or 16:9, but an HD signal will always have a 16:9 ratio.) The default value of the **Out Aspect Ratio** parameter is **4:3.**

Output AFD, VI and WSS

You can insert AFD, VI and WSS data into an output video stream either manually or automatically. This function is controlled by the **AFD Control, VI Control,** and **WSS Control** parameters. If you are using VI according to the SMPTE proposed RP-186+ standard as of January 11, 2007, you must ensure you have enabled the standard by setting **Enable AFD in VI**, (located in the same path as the other output control).

The AFD embedder attempts to embed packets into the specified line after the existing VANC packets in the video stream. If the existing packets occupy more than 1260 pixels, the AFD embedding will not occur.

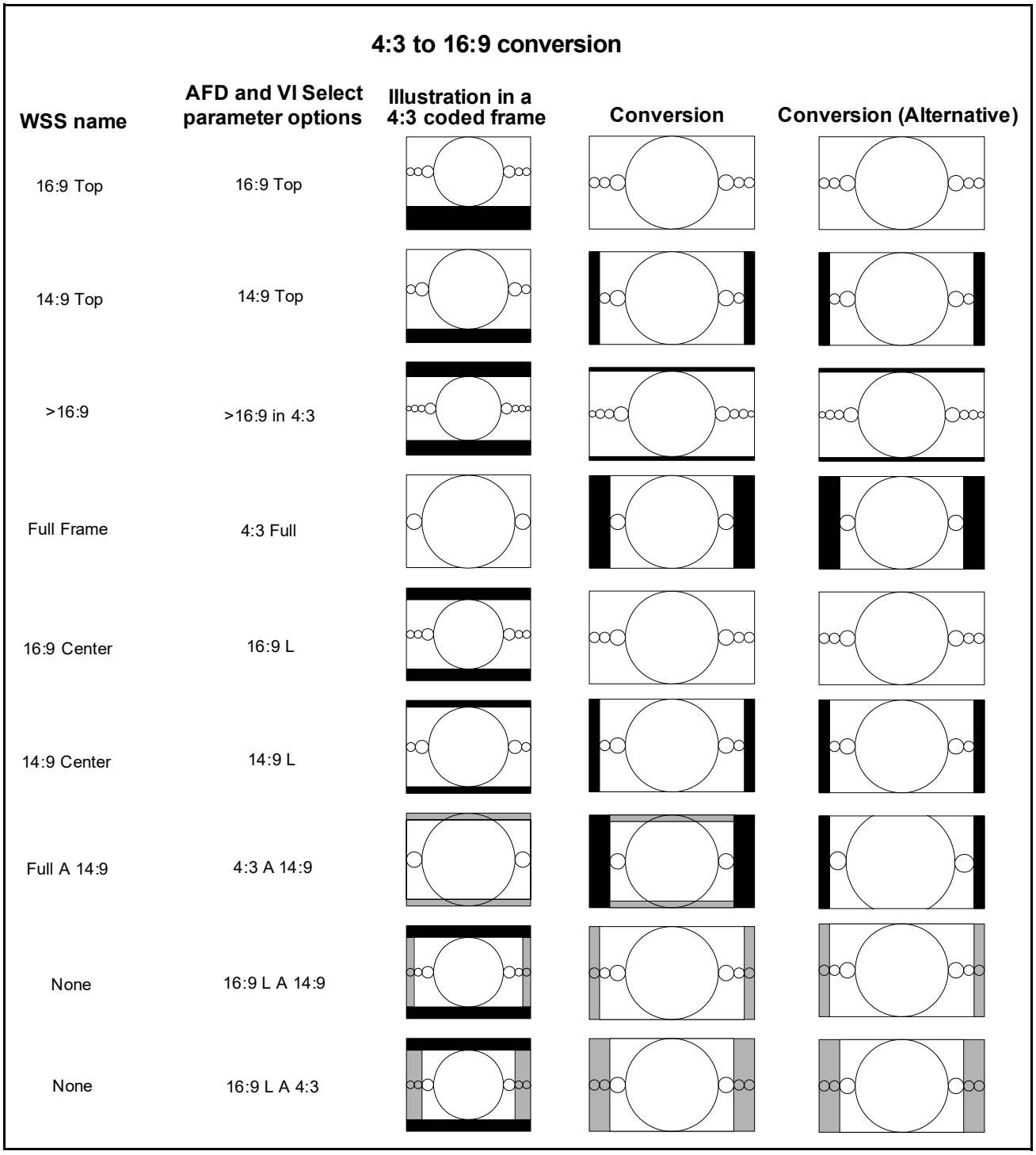


Figure 3-10. 4:3 to 16:9 Conversion

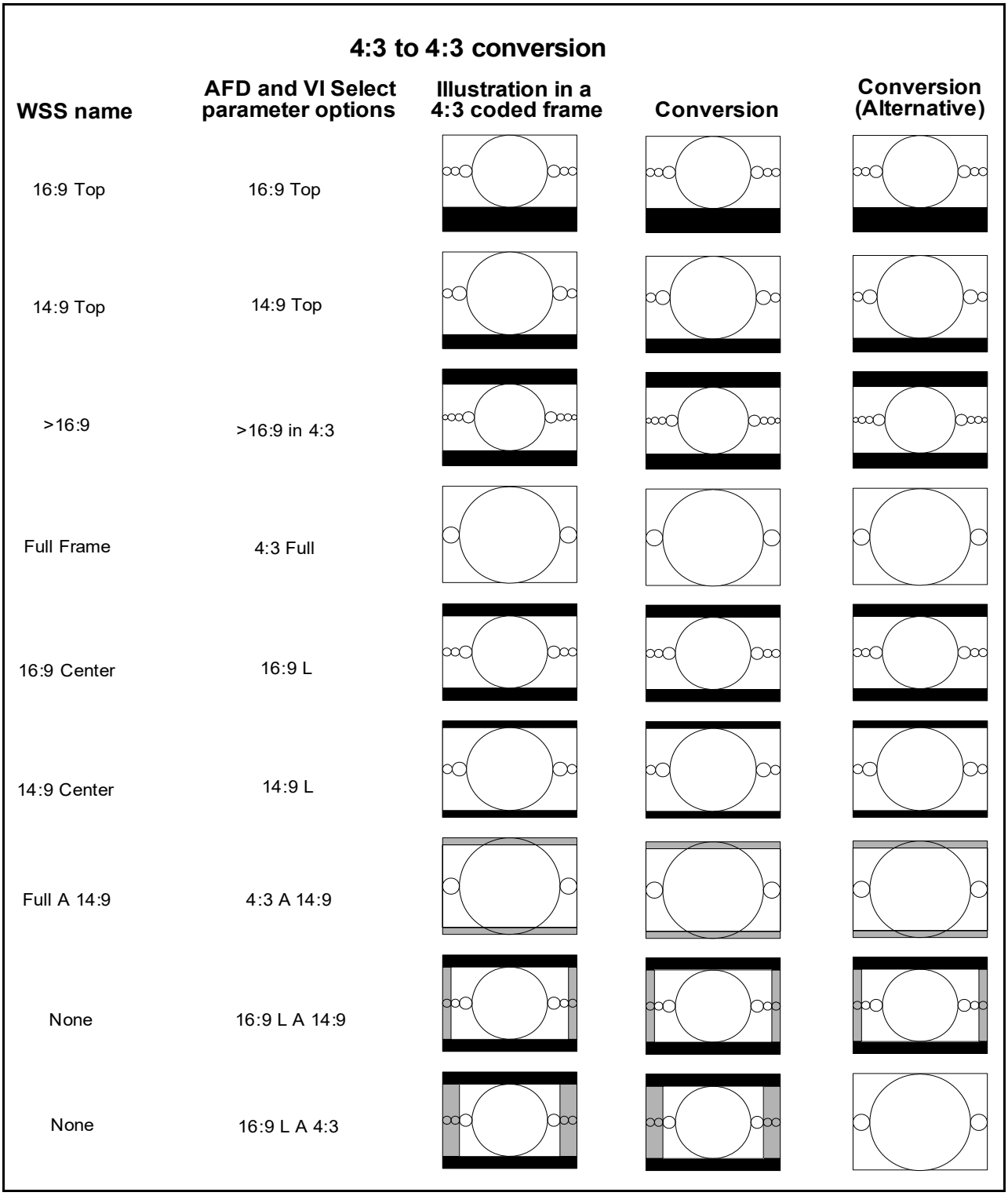


Figure 3-11. 4:3 to 4:3 Conversion

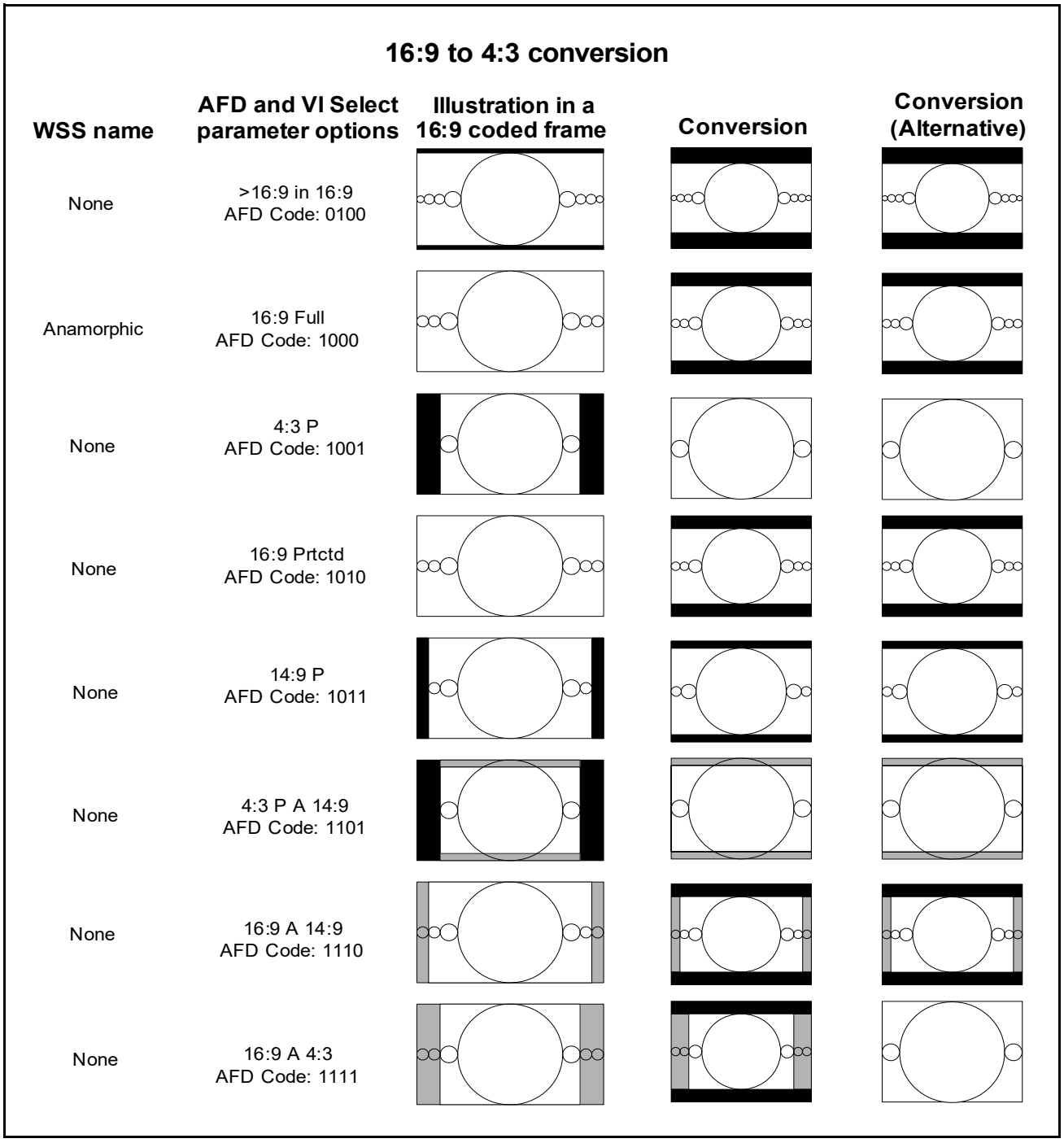


Figure 3-12. 16:9 to 4:3 Conversion

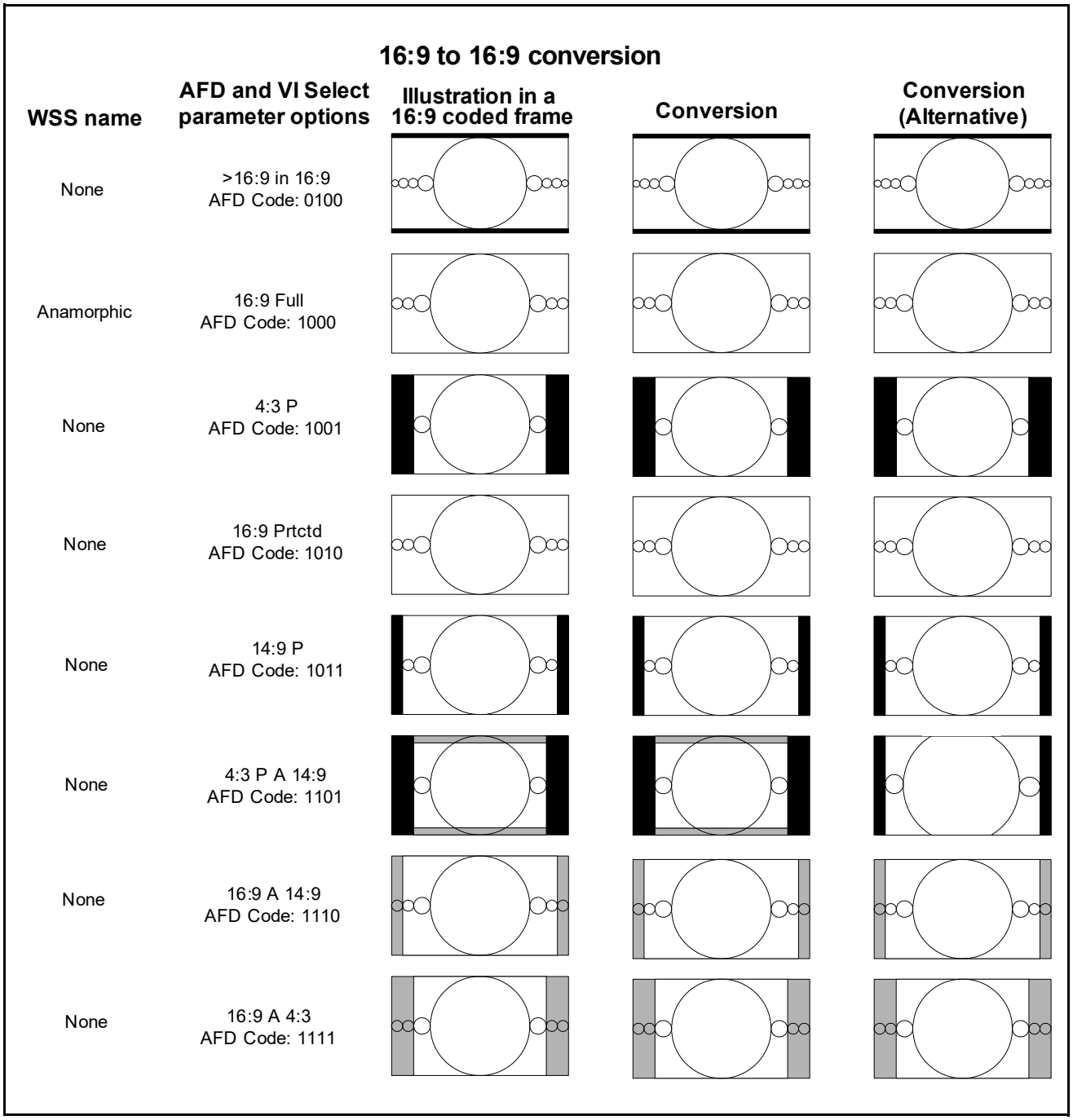


Figure 3-13. 16:9 to 16:9 Conversion

AFD/VI/WSS Alignment

The following settings are required to enable AFD/VI/WSS alignment:

- The menu option **Video >Data > (SDI1 Output/SDI2 Output) > (AFD Control/VI Control/WSS Control)** must be set to **Insert Auto**. This is the mode in which the AFD/VI/WSS code embedded at the output reflects the ARC setting applied to the video.
- The menu option **Video > (Scalar1/Scalar2) > ARC Preset** must be set to either **AFD, AFD-ALTR**, **VI**, **VI-ALTR**, **WSS,** or **WSS-ALTR**. These are modes in which the ARC setting applied to the video follows the code present in the input signal.

- The menu option **Video > Scalar x > Advanced > AFD Crop Enable** must be set to **Off**. If you set the parameter to **On**, AFD alignment will not occur.

When all three conditions are met and the video input format is interlaced, the output AFD/VI/WSS code and new aspect ratio will be aligned with the video content. If the video input format is progressive, the output AFD/VI/WSS code and new aspect ratio will lag the video content by one frame.

AFD/VI/WSS alignment is delayed when there is a disturbance of the input video, or the input video selection is changed. However, the alignment will continue to operate normally if the input video is undisturbed and the AFD/VI/WSS code changes no more than once per second.

Closed Captioning and DVB Teletext Captioning

Although North America has dedicated standards for closed captioning of video (EIA-608 and 708), many countries in Europe and elsewhere have not yet adopted formal standards. For these countries, closed captioning is part of the DVB Teletext System as described in ITU-R BT-653-3. These specifications define all Teletext Systems (Systems A, B, C, D) used in the world and are also known as the World System Teletext (WST). A Teletext system is made of several pages of various data information and CC data is described in one these pages. System B is used in Australia, the UK, and Germany, among other countries.

Australian closed captions are inserted on line 21/334 in analog PAL broadcast signals, as per the ITU-R BT-653-3. When analog PAL is produced or converted to SDTV (625 digital), a digitized version of the closed captioning appears on line 21/334 (in the same way line 21 on NTSC signals is digitized and appears on the line 21 of SD-SDI signals). The document proposed by Free TV Australia indicates how to carry this CC data into the VANC area of SD-and HD-SDI signals by use of the SMPTE 334M VANC embedding protocol. For digital broadcasting, Australia intends to use the ETSI EN 300 472 standard that specifies the conveyance of ITU-R System B Teletext in DVB bit streams.

Closed Captioning and Teletext data that is embedded in the input stream is detected by the **CC/TT Present** parameter. This information is re-embedded into output video stream when you set the **CC/TT Embed** parameter to **On**. Closed captioning and Teletext are not supported when the frame rate converter is in use.

Generic Data Passing

VANC data are removed when video is converted through the scalar of the X50. The **Generic VANC** data passing function makes it possible to select one kind of VANC data (identified by its DID/SDID) and pass it from input to output. This requires the configuration of the following parameters: **Video > Data > Input > Data DID (hex)** and **Data SDID (hex)**. Field information for the VANC data is also required for the system to understand the nature of the VANC data and pass it properly. The X50 can pass up to 10 packets of the same generic data per frame.

To pass a data type that is one packet per frame/field, set **Video > Data > SDI x Output > Data Pass** to **Pass One Packet,** and then configure **Data Embed Field** and **Data Embed Line** properly to let the system know the nature of the data you want to pass.

To pass a data type that is more than one packet per frame, set **Data Pass** to one of the following selections:

- Pass Packets (Exact)

  This selection is only available when input and output standard are same; data on certain lines of the input video will be copied to the same line of the output video
- Pass Packets (Same Line)

  Data packets will be inserted into the same line as configured by **Data Embed Line**; if the line is not long enough for the amount of data, extra data will be inserted into the following line
- Pass Packets (Incremental)

  Data packets will be inserted one per line into continuous lines starting from the line as configured by **Data Embed Line**

To pass data from an interlaced video standard to a progressive video standard, data must be present on each field of the interlaced video standard. To pass data from a progressive standard to an interlaced standard, ensure the frame rate combination allows data to be embedded into each field of the interlaced standard.

The default value for DID/SDID is **ARIB** data. When generic data passing is configured to pass **ARIB** data, the current audio mode is reported, and the output current audio mode is configurable.

VPID (Video Payload Identifier) Enable

When you set **VPID Enable** to **No**, the packet descriptor from the input will be stripped out, and not passed to the output.

This feature is not available in SD 525 and 625 formats.

Green-Power Save

You can reduce power consumption on the module by shutting down the following specific circuits:

- Video decoder
- Video encoder
- HDMI
- DARS
- SRC (AES/Analog)
- AES Outputs
- Audio Codec
- GPI
- RS-422

Select **System Setup > Green (Power Save) > Yes** to turn *off* one of the interfaces, or **No** to leave it on.

Note: *Certain video/audio inputs and outputs can be disabled by the power-saving controls under* ***System Setup > Green (Power Save)****. If a selection or a control related to an interface is missing, check its power save status.*

Color Correction

The color corrector changes the following attributes of an input signal:

- Gain
- Offset
- White Slope
- Black Stretch
- Gamma Correction

These parameters include "lock" options that make it possible for you to adjust all of the options of a particular group in tandem, rather than separately.

White Slope and Black Stretch

The white slope is comprised of **G White Knee**, **B White Knee**, **R White Knee**, and **GBR White Knee Lock**. **Black Stretch** includes **G Black Knee, B Black Knee, R Black Knee**, and **GBR Black Knee Lock**.

Component knees determine the amount of additional gain applied to segments at the ends of the RGB transfer functions in the look-up tables.

The values displayed are a percent of the available correction. A positive white knee increases the slope of the last 15% of RGB values, and decreases the slope of the preceding 15%. A positive black knee parameter will increase the slope of the first 15% of the transfer function by the amount entered and decrease the slope of the next 15%, to return to the unmodified transfer function. Each component knee is added to the total knee (the sum cannot exceed 100%) to produce the correction applied to the respective component.

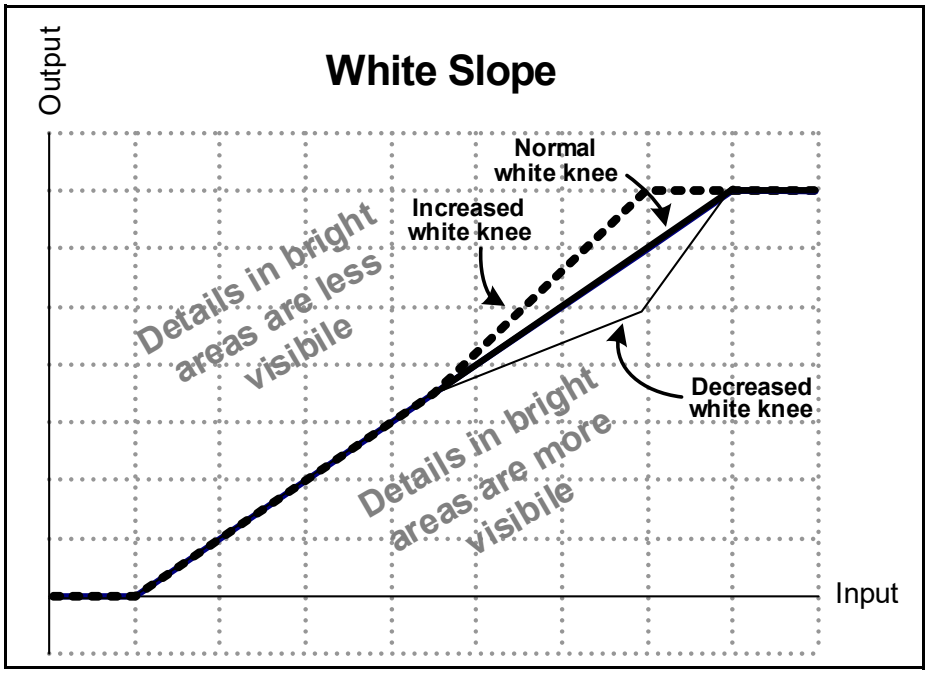


Figure 3-14 Examples of Increased and Decreased White Slope

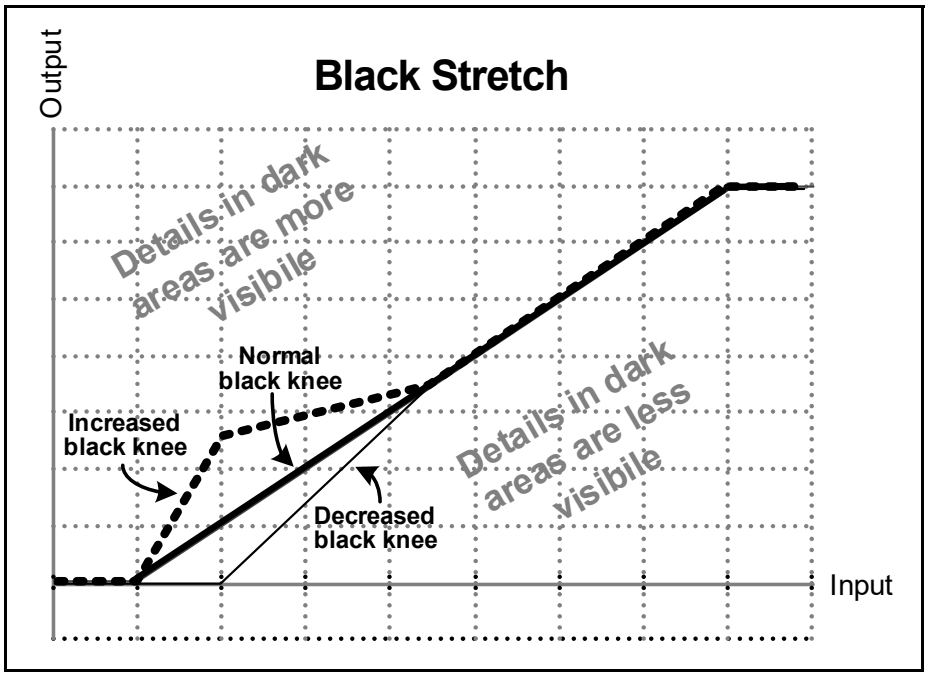


Figure 3-15 Increased and Decreased Black Knees

Gamma Correction

Gamma correction is applied to the RGB as a simple power function, and is applied to each component independently.

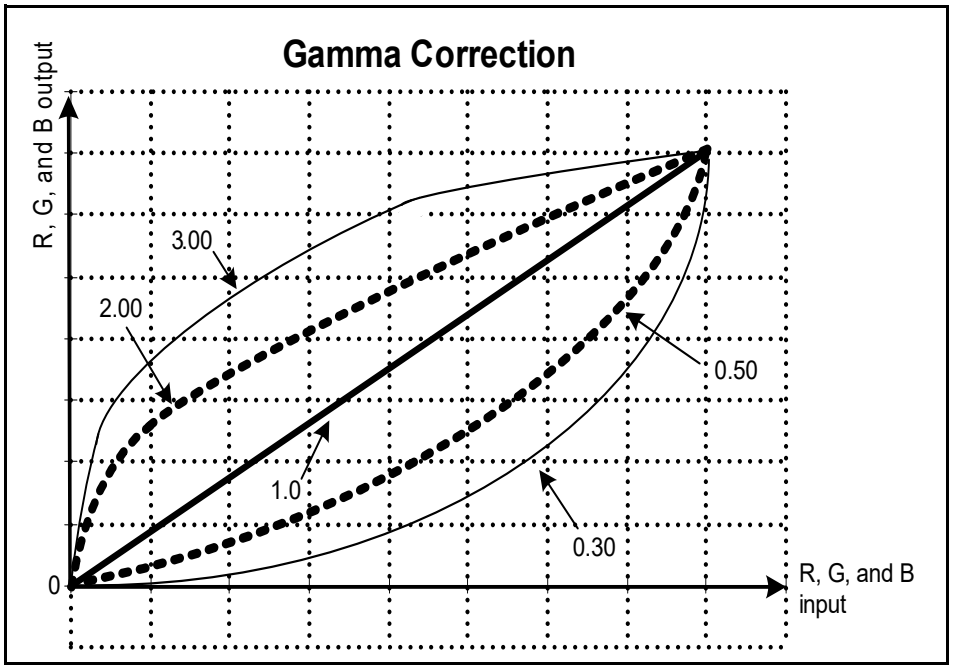


Figure 3-16 Example of Gamma Corrections to R, G, and B

Custom Splash Screen

You can add your station's logo or any other graphic to the startup splash screen on the VFD of the X50. To add a custom graphic, follow these steps:

1. Create a 24-bit Windows bitmap file of the size 128x32, using a graphics program.
2. If the logo has a background color of black, save the bitmap file as **logo.bmp**

   Or

   If the logo has a background of white, save the bitmap file as **logo-i.bmp** (the application will invert the colors of the logo before displaying).

3. Upload the file via Navigator's file transfer tab (or via FTP) to ***/*config**
4. Reboot the X50 to see the logo displays briefly.

Note: *If both* ***logo.bmp*** *and* ***logo-i.bmp*** *exist and are valid images,* ***logo.bmp*** *will be used.*

Using the Secondary Channel

The X50 provides independent horizontal and vertical phasing when you select **Unlocked** in **Video > Frame Sync > SDI Phase Lock**. If you select **Locked**, the horizontal and vertical phasing settings of the SDI output are locked together.

The **SDI Routing Mode** makes it possible for you to make the SDI 2 output the same as, or separate from the SDI 1 output. If you select **Dual**, SDI 1 and SDI 2 can have separate outputs. If you select **Linked**, SDI 2 will carry the same output signal as SDI 1. (This setting also affects the available output formats for Analog and HDMI).

Note: *When you adjust horizontal or vertical timing on one output SDI channel, the other SDI channel may produce video "glitches". Ensure that your X50 is not on-air if you make adjustments to the horizontal or vertical output timing.*

The **Audio/Video Sync** parameter provides automatic tracking of the audio and video signals (see **Figure 3-21** on page 54). However, this timing is based on the output of the primary (SDI 1) channel. Because different formats may have different propagation delays, the SDI 2 audio and video tracking may not be aligned with SDI 1. Audio/video alignment always follows SDI 1; the A/V alignment on the SDI 2 channel cannot be controlled separately.

Frame Rate Conversion

The X50 provides basic automatic frame rate conversion. When the X50 enables the FRC, audio/video alignment is variable ±1 frame. There must be a valid reference available for the selected output standard, and you must enable the **Sync** mode in **Audio/Video Sync**.

When the conversion involves increasing the frame rate, frames are repeated as required; when converting to a lower frame rate, frames are dropped. All of the frames at the output are identical to the input frames with two exceptions: sometimes a frame is repeated a second time, and sometimes a frame is dropped. If there is a lot of motion in the video, a jerky motion (called judder) may appear when converting from one frame rate to another. This is a normal artifact of basic frame rate conversion. Closed captioning and Teletext are not supported when the FRC is in use.

Composite Video

The X50 processes NTSC (SMPTE 170M), PAL-B (ITU 624-2), and PAL-M composite video that complies to ITU-R BT.470-6 standard (with burst amplitude of 300mV), as well as a variant that is used commonly in Brazil (with burst amplitude of 287mV). Ensure that you select the correct PAL-M standard for detection. An incorrect standard setting will distort the color level of the video. To select the PAL-M standard for detection, follow **Video > Analog Video > PAL-M Standard**, and then select either **Brazil** (default) or **ITU-BT470-6**.

Output Configuration

Obtaining a composite analog video output from the X50 is dependent on its SDI routing mode. Follow these steps to configure the composite video output either in **Dual** or **Linked** modes:

1 Under the main **Video** level, set the **SDI Routing Mode** to **Dual**.

This enables the **Composite Out Select** parameter. (When the **Dual** option is selected, one of the SDI outputs must be set to an SD format.)

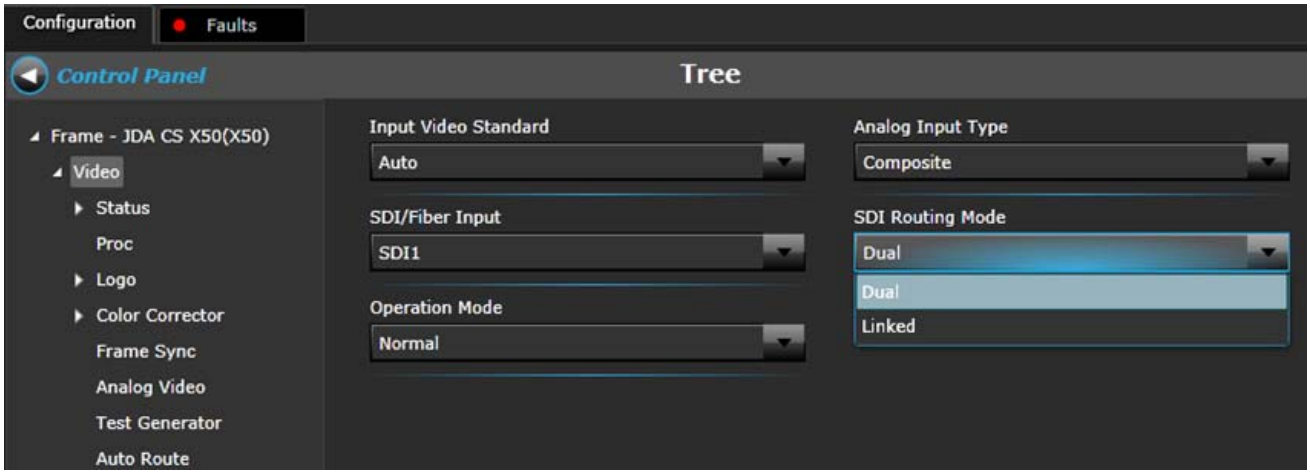


Figure 3-17. Selection of the SDI Routing Mode

2 Set either **SDI 1** or **SDI 2** in **Composite Out Select**.

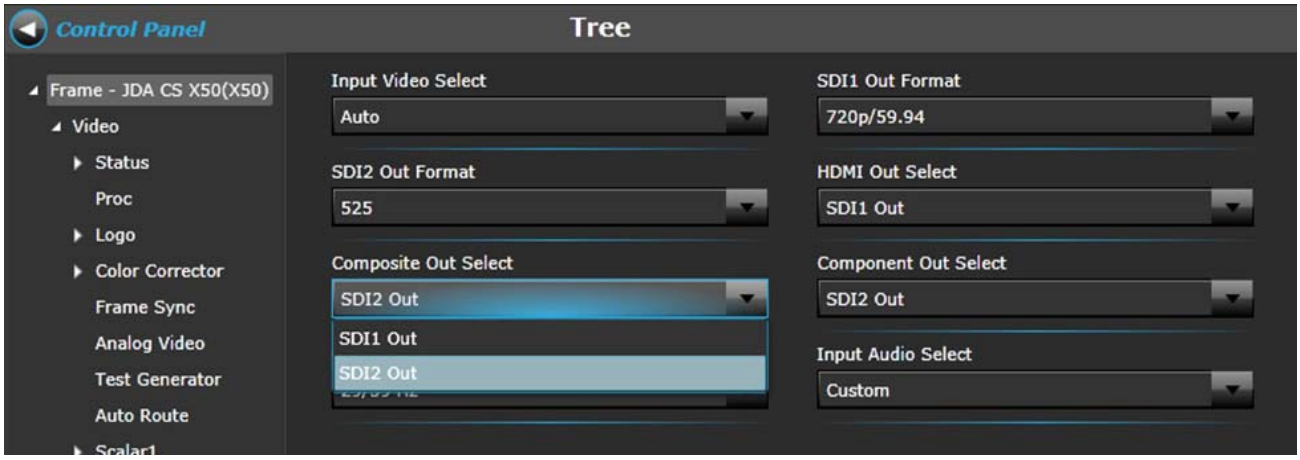


Figure 3-18. Composite Out Select Options

Alternately, set the **SDI Routing Mode** to **Linked**.

This action allows only one output standard on the two SDI outputs: **SDI 2** will mirror **SDI 1**. A larger selection of options is now available in the **Analog/HDMI Out Select** parameter.

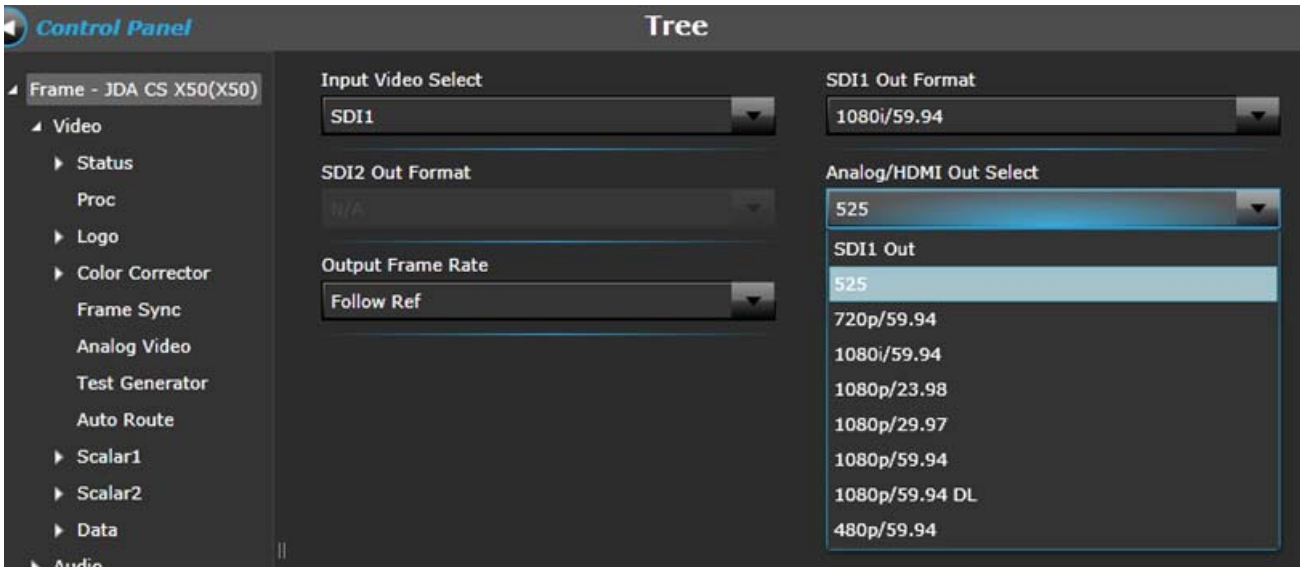


Figure 3-19. Analog/HDMI Out Select Options

3 For composite analog output, select **525** or **625**; for HDMI, select any SD- or HD-SDI output.

Auto Route Feature

When you set **Input Video Select** to **Auto,** the X50 automatically routes an alternate video source if the **Primary Input** selection fails. The option you select in **Backup Input 1** is the first alternate video source; if that source fails, the next priority is given to the selected source in **Backup Input 2**.

The **Auto Switch Delay** parameter makes it possible for you to set the amount of delay before the X50 switches to the next backup input. The adjustable range is between 0 and 5 seconds.

If the Primary Input signal returns when the X50 is routed to Backup Inputs 1 or 2, the X50 reverts to the Primary Input signal.

If the **Auto Route Black** parameter is set to **Yes**, the X50 also routes alternate inputs if black video is detected within the active picture region. The current black video detection status is monitored at **Video > Status**.

Note: *Certain video/audio inputs and outputs can be disabled by the power-saving controls under **System Setup > Green (Power Save)**. If a selection or a control related to an interface is missing, check its power save status.*

Proc Bypass

Proc Bypass is an option found in the **SDI1 Out Format** and **SDI2 Out Format** parameters. In the X50, this function bypasses the scalar and all processing (noise reduction, detail enhancement, color correction, etc.) but is downstream of the frame synchronization.

Output Format Selection

The **SDI Routing Mode** selects whether the SDI 2 output is independent or linked to SDI 1 (This setting also affects the available output formats for SDI2, Analog, and HDMI.)

I-Wings and 3D Modes

The default operation of the X50 is the **Normal** mode, found at **Video > Operation Mode**. Other **Operation Mode** options include I-Wings and various 3D controls.

To enable the I-Wings mode on the X50, select **Live I-Wings**. When operating in this mode, video from SDI 1 and SDI 2 input forms into one video stream. The SDI 1 input remains in the foreground, while video from SDI 2 input becomes the background (the "wings").

The 3D mode is enabled by selecting **3D Left/Right** or **3D Top/Bottom**. When the X50 is operating in a 3D mode, SDI 1 and SDI 2 input video forms into one frame-compatible video stream for side/side or over/under (half resolution) 3DTV signals.

In both I-Wings and 3D modes, frame sync and color corrector processing blocks are bypassed.

To undo a 3D function, select **3D Undo Left/Right (1080i)** or **3D Undo Top/Bottom (720p)**. When you select either of these options, the side/side or over/under 3D signal can be converted to left eye and right eye signals.

Note: 3D Undo Top/Bottom *for 1080 output standards is not supported at this time.*

Audio Processing

For detailed information about the use of Dolby and DTS Neural options, see ***Advanced Audio Processing*** on page 67.

The **Input Audio Select** parameter selects the audio source to be routed to all audio outputs. This pre-empts individual audio controls. The default **Map Through** option routes demux audio to mux and HDMI outputs, and AES audio to AES and analog outputs.

Figure 3-21 on page 54 shows the audio routing in the X50.

The **AES Present, Analog Present**, and **DMX Channel Present** read-only parameters display the status of the incoming audio feeds. When you select these parameters, each of the eight channels is displayed as a symbol.

The **AES Present** parameter has a unique feature that notifies you when an AES signal is available for that channel (visible as a **P** symbol on the channel), but the channel has been set to an analog input.

See **Figure 3-20** on page 52 for an explanation of these symbols.

Note: *The analog audio output of the X50 is always low-impedance. To ensure that you do not overload the audio output, always connect to high impedance downstream.*

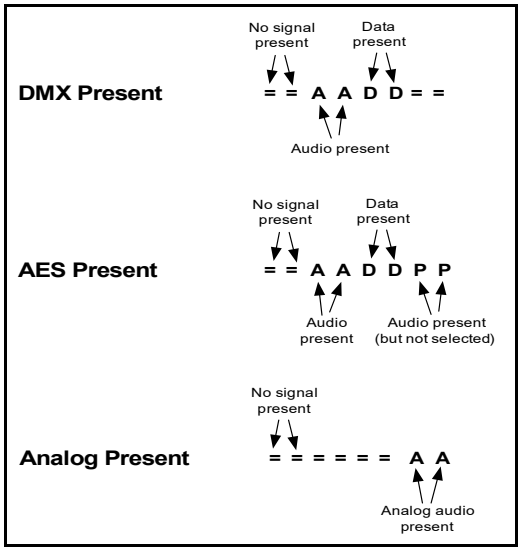


Figure 3-20 Audio Status Parameters

Audio Metadata

The audio metadata feature de-embeds audio metadata from various sources and then re-embeds the audio metadata into multiple outputs.

The audio metadata source may be one of the following:

- Metadata embedded in SDI (Methods A and B)
- Input of the serial port
- Metadata generator
- AAP 1 Dolby E Decoder Output (when a Dolby E decoder is configured in AAP 1)
- AAP 2 Dolby E Decoder Output (when a Dolby E decoder is configured in AAP 2)

The audio metadata may be inserted into the following outputs:

- SDI 1 and SDI 2 (Methods A and B)
- Serial port

Once the source is selected, it applies to all of the outputs.

Dolby E Alignment

It is important to maintain a proper timing relationship between the Dolby E header and the first line of video especially when recording video with embedded audio on tape transports. This is commonly known as the *guard band*. On the X50, the Dolby E alignment timing is determined by the value of the **SDI 1** or **SDI 2 Dolby E Start Line** embedder controls.

To use this feature, first enable the auto alignment (**Audio > Other > Dolby E Auto Align**), and then make your start line settings at **Audio > Embedder > SDI 1** or **SDI 2 Dolby E Start Line**.

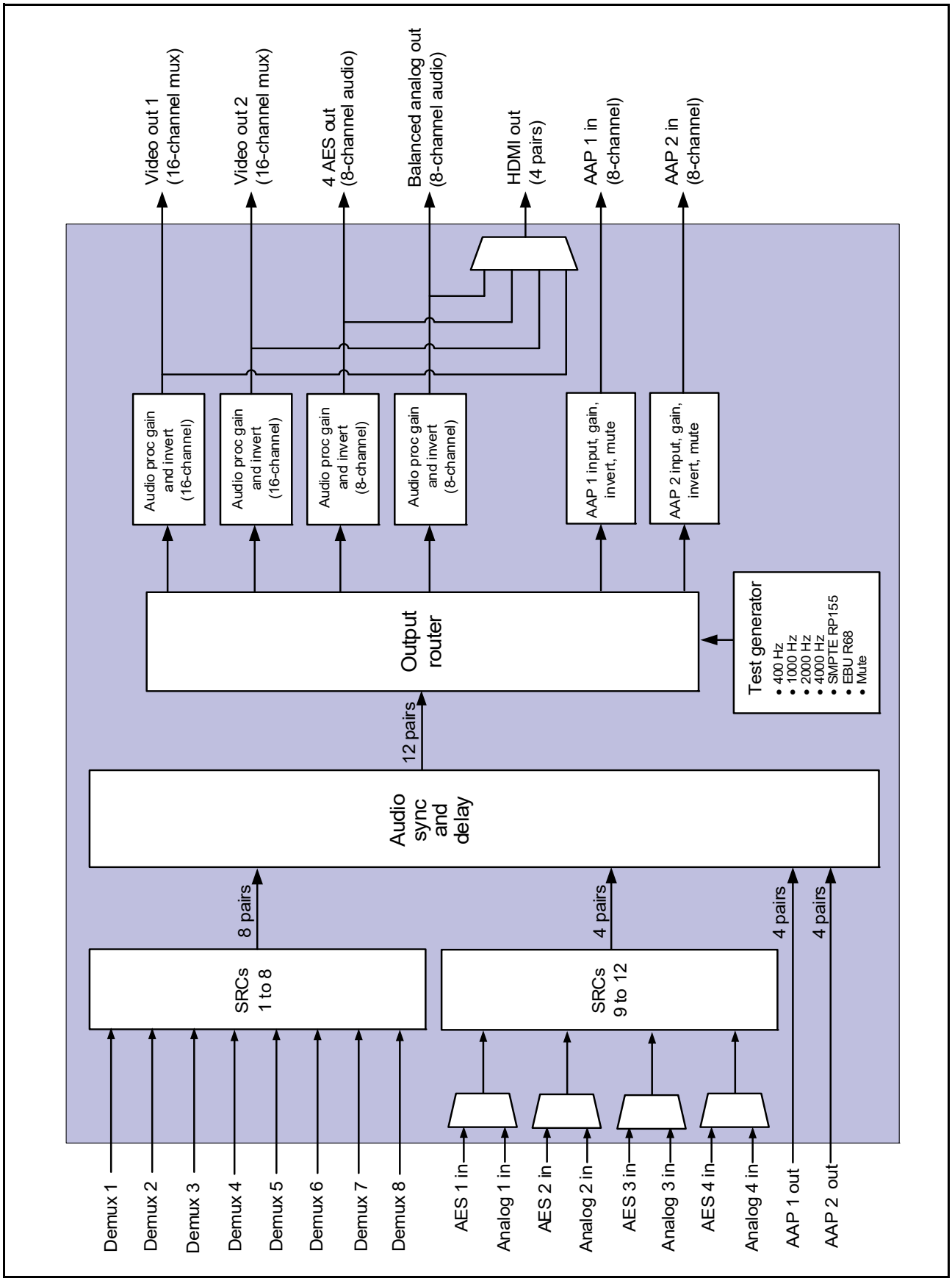


Figure 3-21. X50 Audio Routing

Logo Generator

The X50 logo generator and inserter provides on-demand insertion of pre-defined static SD-SDI and HD-SDI logo images.

Logos used by the X50 must be created or saved in the .mg2 file format, and initially stored on an SD card at your PC workstation. Then you must insert the card into the slot located in the front of the X50 frame. Logos that you insert into the video feed appear on the SDI 1 primary output.

LogoCreator software that you will need to convert the files to the .mg2 format can be downloaded from our website as part of the Icon Soft Tools package.

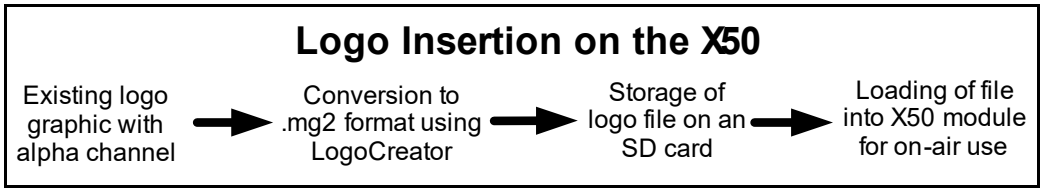


Figure 3-22 Progression of Logo to On-Air Signal

The files that you use as logos must be selected according to the video output standard set on the X50 **SDI1 Output** format. When the output standard changes on the module, the X50 automatically loads files that use the selected output standard.

The following SD cards are supported by the logo generator:

- SanDisk 1 GB and 2GB SD class 2
- SanDIsk 4GB SD class 4
- SanDisk 4GB SDHC class 10
- Kingston 1 GB and 2GB SD class 2
- Kingston 4GB SD class 4

New SD cards must be formatted to the FAT standard in a PC before use. Be sure to create a **Logos** folder and a **Presets** folder before you start.

Basic Steps to Installing Logo Files

If you are starting with existing graphics files, these basic steps are described in the following pages:

1. Install the LogoCreator conversion software.
2. Convert the logos to a .mg2 format.
3. Transfer the files to the SD card directly from the PC, and then insert the card into the X50.
4. Power cycle the X50 by following **System Setup > Soft Reboot**.
5. Set the parameters and load the logo.

Step 1: Install LogoCreator Software

All logos used by the X50 must either be generated as .mg2 files, or converted to that format. LogoCreator software is contained in the Icon Soft Tools package, found on our website.

For best results, LogoCreator requires a PC with the following system specifications:

- Intel Pentium III processor at 500 MHz or faster
- 512 MB or more of physical memory (RAM)
- Microsoft® Windows® XP or Windows 2000

If a version of LogoCreator already exists on the PC, ensure that you first uninstall the program and restart the computer. Then proceed with the steps below:

1. Close all other software applications running on the PC and then insert the IconTools CD-ROM into the computer's CD-ROM tray.
2. Using Windows Explorer, browse to the CD-ROM contents, and then double-click the **LogoCreator** folder.
3. Double-click **Setup.exe**.
4. When the **IconTools 3 Setup** box appears, click **Next**, and then follow the on-screen installation instructions.

Step 2: Convert Files to the .mg2 Format

Using LogoCreator, you need a source image file for the fill portion of your logo, and a source image file for the key portion. The fill is the picture or image you want to overlay onto the program output. The key is the cutout or shape of the desired logo, which may or may not be the same shape as the fill. Using LogoCreator, you will set the fill and key images to the same size (resolution) as the standard of the X50 output. LogoCreator infers the key from the alpha channel in a targa (.tga) file.

After you save the logo, the logo displays in your LogoCreator workspace. To save your logo files using LogoCreator, follow these steps:

1. In LogoCreator, select the **Video Standard** from the Menu bar.

Note: *When 720p or 1080p is required, use the* ***1080i*** *option in* ***Video Standard*** *to provide the best loading time. Ensure that you create 720p and 1080p graphics in full screen, with the logo already positioned correctly beforehand. Although the logo may not appear in the safe area in LogoCreator, it will be correctly placed in the final video output.*

2. Open the **Logo Set-Up** dialog box (**Figure 3-23** below).

   When you first open LogoCreator, the **Logo Set-Up** dialog box opens automatically. If the **Logo Set-Up** dialog box is closed, select **File > New** to open the dialog box.

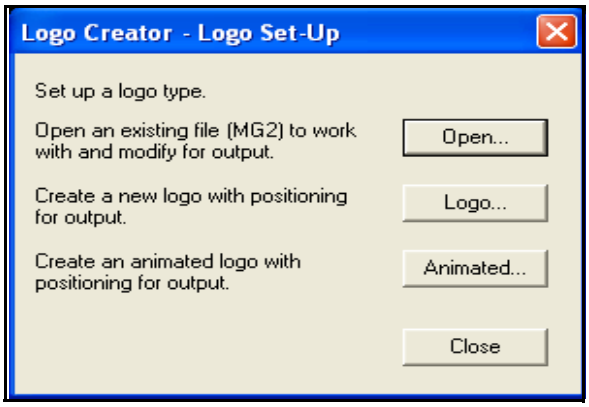


Figure 3-23 LogoCreator Setup Dialog Box

Note: *If you click the* ***Open*** *button directly in the* ***Logo Set-Up*** *box, the program will only launch files with a .mg2 prefix. If you attempt to open a file with any other prefix, the program will generate error messages.*

3 Click the **Logo** button to open the Static Logo dialog box.

4 Use the **Logo ID** box to assign the logo to a specific slot on your IconLogo system.

5 Enter a name for the logo in the **Name** box.

6 Click the **Open** button below the **Logo Image Preview** window.

The **Open** dialog box displays.

7 Select your existing logo file and click the **Open** button to open the logo in the **Static Logo** dialog box.

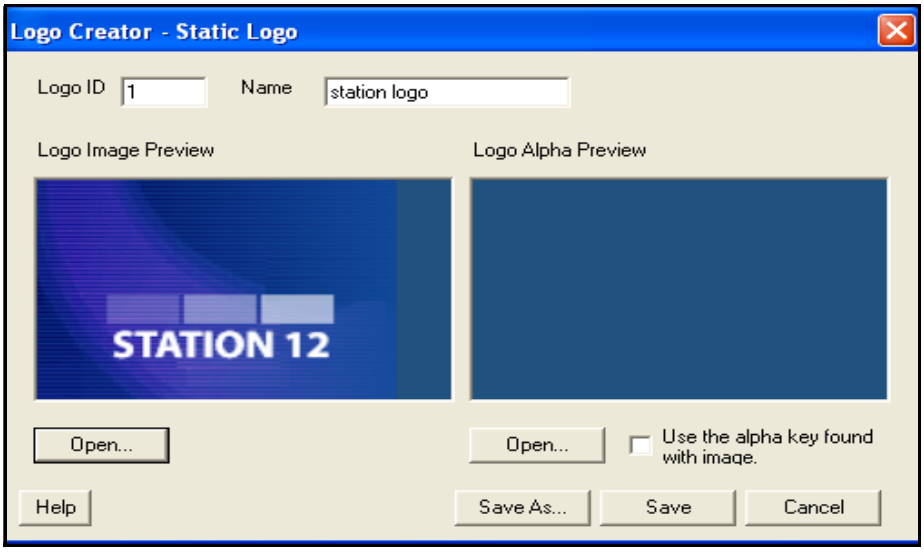


Figure 3-24 Static Logo Dialog Box

- A preview of the composited logo displays in the **Logo Image Preview** area.
- A preview of the image alpha displays in the **Logo Alpha Preview** area if the file contains alpha.

8 Select a file to use as the alpha channel for your logo.

You must select a file before you can save the logo.

- To use the original image's alpha channel, select the **Use the alpha key found with image** check box.
- To use a different image for the alpha channel, clear the **Use the alpha key found with image** check box, and then click the **Open** button to select a new file for your alpha channel.

Note: *An alpha channel is an 8-bit layer in a graphics file format that is used for expressing translucency (transparency). Typically, you define the alpha channel on a per-object basis. Different parts of an object will have different levels of transparency depending on how much background you want to show through.*

9 Click the **Save** button in the **Static Logo** dialog box.

The **Save Logo File** dialog box opens where you can save your logo as a .mg2 file. Once you save the logo as a .mg2 file, the logo displays in the LogoCreator workspace.

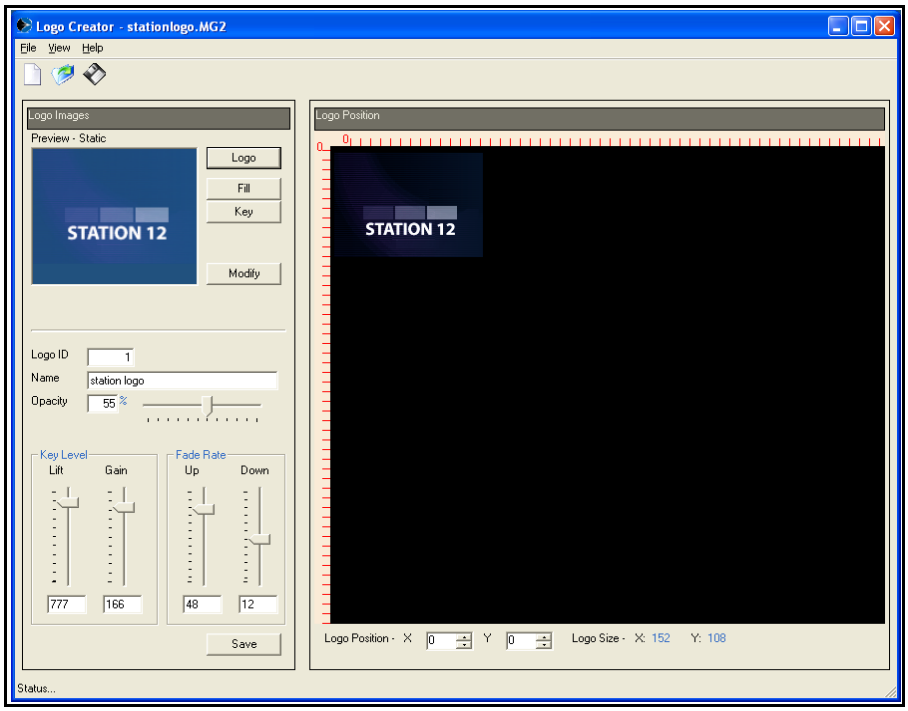


Figure 3-25 LogoCreator Work Space

Once you create a .mg2 logo you can open the file in LogoCreator, set the logo position, and modify specific logo attributes. LogoCreator also makes it possible to adjust the noise and strength of the key signal and apply fade on/off transitions to the logo.

Opening and Previewing an Existing .mg2 Logo

To make position, opacity, or key level changes to the .mg2 logo, follow these steps:

1 In LogoCreator, select **File > Open** to open the **Open Logo File** dialog box, or if the **Open Logo File** dialog box has already launched, click **Open**.

2 Using the **Open Logo File** dialog box, find and select your .mg2 logo file.

3 Click the **Open** button.

The .mg2 logo displays in the LogoCreator workspace.

In the upper left corner (**Figure 3-27**), you can preview the changes you make using the **Fill**, **Opacity**, and **Logo Position** options. (Other functions shown in the window are not supported on the X50.)

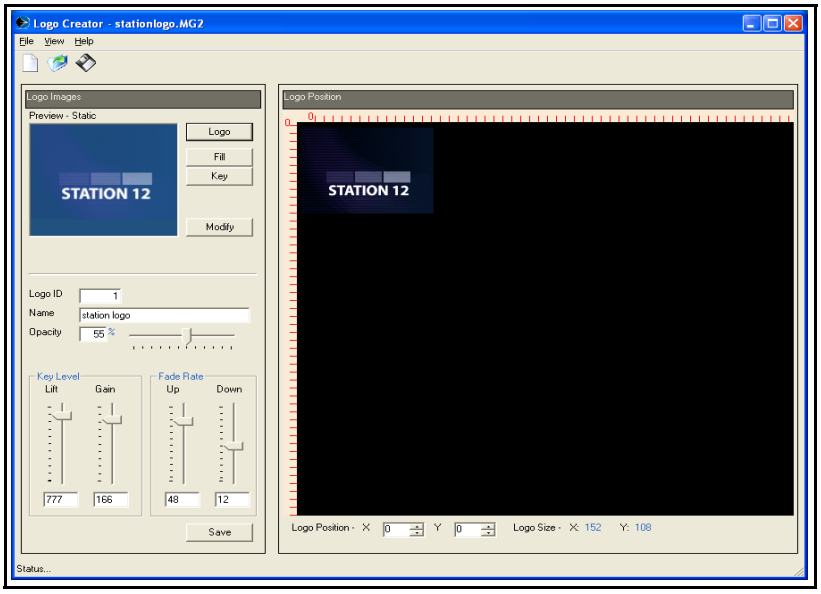


Figure 3-26 Opening a Logo

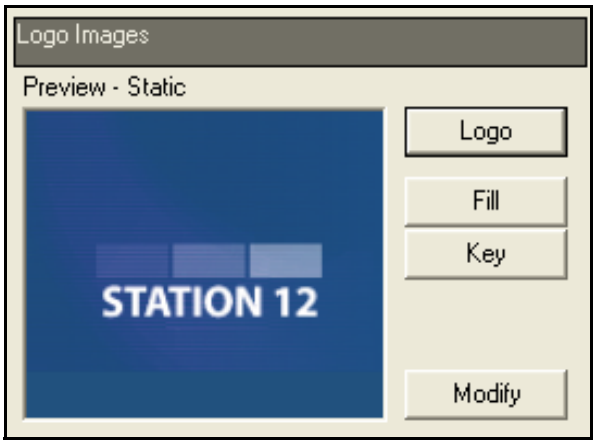


Figure 3-27 Preview Pane

Modifying the Position, Opacity, and Key Level

Using the **Modify** button, you can adjust the logo attributes you defined when you created the logo (you can also make these settings using the X50 controls at **Video > Logo**).

1. Click the **Modify** button to open the **Logo** dialog box, where you defined the logo attributes.
2. Use the options to adjust the logo properties.
3. Click **Save** to save the changes and return to the LogoCreator workspace.

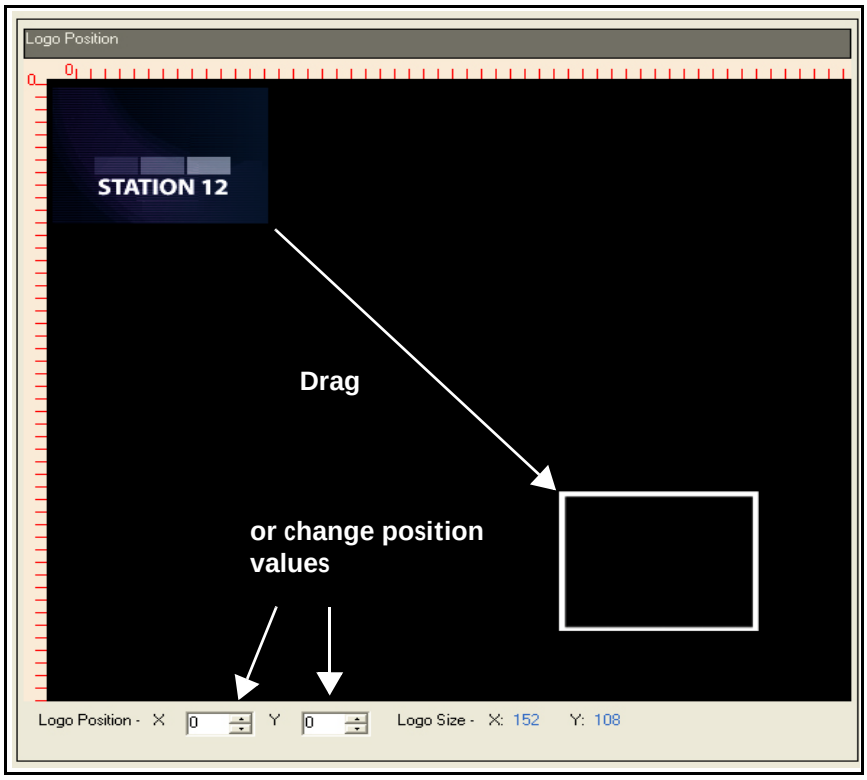


Figure 3-28 Positioning a Logo

To position your logo, either drag the logo to a new position, or use the **Logo Position X** and **Logo Position Y** boxes below the workspace to place your logo in an exact position. You can enter positive or negative values. The **X** value moves the logo horizontally and the **Y** value moves the logo vertically by the set number of pixels.

The **Opacity** sets the overall transparency level for the composited logo. Use either the **Opacity** field or slider to adjust the logo transparency. **100%** sets the logo as completely opaque. **0**% sets the logo as completely transparent.

Step 3: Transfer the Logos to the SD Card, and to the X50

When your logos have been created or converted to the .mg2 format, save them to your computer hard drive before saving them to the SD card. On the SD card, create a folder named **Logos** and store the logo files inside that folder. Then insert the card into the slot located on the left side of the X50.

Step 4: Set the Parameters and Load the Logo Files

Using the X50, you can preset a logo filename and its settings for each output standard. The preset logo will automatically load when the corresponding output standard is selected and becomes the active **SDI1 Output** format. You must correctly set the **Select Raster** parameter (**Video > Advanced Logo)** to edit the logo preset configuration for a specific output standard.

If you have selected a logo that matches the output standard and the logo is available for use, the **Load Status** parameter (under **Video > Logo**) will read **Loaded**. Select **Logo Enable** to activate the logo.

Table 3-4 Typical Card-to-X50 Logo Loading Times

Content	Format	Approximate Load Time from Card to X50
Bug logo, 1/16 screen	720p	8 seconds
Detailed 500 kB image, 1/4 screen	720p	2 minutes
Full screen, 8 Mb	1080p	6 minutes

GPI and Rules Engine

GPI

The X50 has four separate GPI inputs and four separate GPI outputs (found at **System Setup > GPI**). In certain operation modes, some events are not applicable. In these cases, a GPI trigger leads to no action.The GPIs are open collector style, with approximately 10 KΩ pull-ups to +5V. In other words, you can use contact closure-to-ground switches to control these GPI inputs.

All GPI related parameters can be found under **Control > GPI**.

Each GPI pin can be individually set to either input or output status; thus there are eight controls in total (parameters **GPI 0 Direction** to **GPI 7 Direction**), located at **GPI and Rules Engine > GPI > GPI Direction.**

GPI inputs make it possible to enable a test signal, insert a logo, control the ARC being used for a particular conversion mode, trigger SCTE-104 or BT-1685 data, and as well, insert the AFD, WSS or VI code.

GPI outputs can reflect the state of the current input video LOV status—whether the test signal is enabled, aspect ratio is used, or can be triggered on a specific input AFD, WSS or VI code.

The read-only parameters **GPI Input Level Status** and **GPI Output Level Status** display current GPI pin level information. From left to right, the symbols indicate the level status of GPI pins **0** to **7**. A value of **1** represents a high, **0** represents a low, and a **-** symbol represents **Not Valid—**which means the pin is assigned to the opposite direction. A ***** symbol shows the pin is constantly driving (output) or is driven (input) by SCTE-104 or BT-1685 data.

Rules Engine

When the X100 is in operation, signals often change, input video standards shift, and incoming audio channels may be altered. You can predict many such changes, and have the X100 respond accordingly. Script-based rules engine provide the flexibility to pre-edit the conditions to be monitored, and automatically make the necessary setting changes.

In summary:

- Rules Engines involve conditions and actions.
- Parameter Control Scripts use parameter status conditions to drive parameter controls.
- Custom GPI Input Scripts use GPI input status conditions to drive parameter controls.
- Custom GPI Output Scripts use parameter status conditions to drive GPI output values.

Custom GPI Input Script

To enable a custom GPI input script, set the direction of the specific pin in the **GPI Input To Edit** parameter **(GPI and Rules Engine > GPI > GPI Input)** and then set the **Event** parameter to **Custom GPI Input Script**. Enter your script into the **GPI Input Script (Part I)** field. The parameter allows a maximum of 251 characters to be entered. If additional script space is needed, use the **Custom Input Script (Part II to IV)** parameter. **GPI Input Script Status** reports the parsing and active status of the script. If a syntax error is detected when a new script is entered, this parameter will report **Error: x** message. The variable x is an index number starting from the beginning of the script to indicate around which character the script parser first encounters a syntax error. **Custom GPI Input Level Status** displays current custom GPI input pin level information. From left to right, the symbols indicate the level status of GPI ping **0** to **7**, where **1** represents a high, **0** represents a low, and **-** represents **Not Valid**—which means the pin is assigned to the output direction, or assigned to an event that is not a custom GPI input script.

GPI input scripts are made up of one or multiple statements. Each statement consists of one condition and one or multiple assignments. During device operation, if the condition in a statement becomes true, the assignment in the statement will take effect.

<script> ::= <statement> { <statement> }

<statement> ::= IF <condition> THEN <assignment> { <assignment> }

<condition> ::= <comparison> { <logic op> <comparison> }

<comparison> ::= GPIx <comparison op> y

Where **x** is in the range of [0, 7], **y** could be **0** or **1**

<assignment> ::= PARAM[x] = y

Where **x** is the **CCSP ID** of a device parameter, y is a value for that parameter. At this time, only integer and enum type of parameter assignments are supported. String type parameter assignment is not supported.

<comparison op> ::= == | > | < | >= | <= | !=

<logic op> ::= && | ||

Comparisons can be **AND**ed together using **&&**, and then can be **OR**ed together using **||**. The **AND** operation always has precedence over the **OR** operation when **AND** and **OR** both exist in a condition.

Custom GPI Output Script

To enable a custom GPI output script, set the direction of the specific pin in the select **GPI Output To Edit** parameter **(GPI and Rules Engine > GPI > GPI Output)** and then set the **Event** parameter to **Custom GPI Output Script**.

Enter your script into the **GPI Output Script (Part I)** field. The parameter allows a maximum of 251 characters to be entered. If additional script space is needed, use the **Custom Output Script (Part II to IV)** parameter. **GPI Output Script Status** reports the parsing and active status of the script. If a syntax error is detected when a new script is entered, this parameter will report **Error: x** message. The variable **x** is an index number starting from the beginning of the script to indicate around which character the script parser first encounters a syntax error. **Custom GPI Output Level Status** displays current custom GPI output pin level information. From left to right, the symbols indicate the level status of GPI ping **0** to **7**, with **1** representing a high, **0** representing a low, and **-** representing **Not Valid**—which means the pin is assigned to the input direction, or assigned to an event that's not custom GPI output script.

GPI output scripts are made up of one or multiple statements. Each statement consists of one condition and one or multiple assignments. During device operation, if the condition in a statement becomes true, the assignments in the statement will take effect.

<script> ::= <statement> { <statement> }

<statement> ::= IF <condition> THEN <assignment> { <assignment> }

<condition> ::= <comparison> { <logic op> <comparison> }

<comparison> ::= PARAM[x] <comparison op> y

Where **x** is the CCSP ID of a device parameter, **y** is a value for that parameter. The device parameter could be one of three types: integer, enum, string. Depending on the parameter type, **y** could take different format:

“Integer: **y** is integer value of the parameter

“Enum: **y** is the enum value index inside the enum

“String: **y** is in a '**zzzz**' string format, where **z** is a character. Special character ***** can be used as wild card. **AA*** and **AABB** will be considered as equal

<assignment> ::= GPOx = y

Where x is in the range of [0, 7], y could be **0** or **1**

<comparison op> ::= == | > | < | >= | <= | !=

<logic op> ::= && | ||

Comparisons can be **AND**ed together using **&&**, and then can be **OR**ed together using **||.** The **AND** operation always has precedence over the **OR** operation when **AND** and **OR** both exist in a condition.

Parameter Control Script

To use a **Parameter Control Script,** select **Enable** in the **Activate Script** parameter (**System Setup > Parameter Control Script**). Then create your content in **Script (Part I)** to change a parameter value based on some other parameters' value. If there is additional script necessary, use the **Script (Part II to IV)** parameters.

Script Status [RO] reports the parsing and active status of your custom input script.

The X50 make it possible for you to write user scripts for custom signal flow management, so that you can dynamically change selected parameters when a signal flow changes. This addresses the need for managing input video and audio signals that constantly change. In a typical scenario, a preset is recalled by an operator, or the operator determines what is at the input and then sets up the device to process the video and audio essence, data and metadata. This is known as “user-scripted signal flow management” or a “rules engine.”

Example

Some broadcasters have compliance issues that need to be addressed by specialized signal processing.

A common problem is the replacement of a mono audio channel dedicated to audio content for the visually-impaired, if the channel is absent. Service for the visually-impaired is required in Canada, and available soon in the United States and elsewhere. In Europe, this service is known as the Audio Description. In North America, it is known as Descriptive Video, DVS Descriptive Video Service, or Video Description.

When this mono audio channel is present at the input, the requirement is to pass it through to the output and into the Secondary Audio Program (SAP) channel. However, if the signal is absent, the X50 can detect the problem and perform one of the following through scripts:

- Sum and route the signal to the output channel feeding the SAP, if stereo audio is present (one PCM)
- Downmix to 2.0, then sum and route to the output channel feeding the SAP, if surround sound is present (three PCMs)
- Decode the audio, downmix to stereo, sum to mono, and then route to the output channel that feeds the SAP, if Dolby Digital or Dolby E is present (one non-PCM)

***Note:** In the above example, as audio channels change, the audio V-fades must be enabled by setting the **Fade Time** to a non-zero value. This setting will prevent clinks or pops from occurring downstream.*

Enabling the Parameter Control Script

To enable a parameter control script, set the **Activate Script** parameter to **Enable**. Enter your script into the **Script (Part I)** parameter (maximum **251** characters). If additional script space is needed, use the **Script (Part II to IV)** parameters.

Script Status [RO] reports the parsing and active status of the script. If a syntax error is detected when a new script is entered, this parameter will report **Error: x message** (***x*** is an index number starting from the beginning of the script to indicate around which character the script parser first encounters a syntax error).

Writing the Parameter Control Script

Parameter control scripts are made up of one or multiple statements. Each statement consists of one condition and one or multiple assignments. During device operation, if the condition in a statement becomes true, the assignment in the statement will take effect.

<script> ::= <statement> { <statement> }

<statement> ::= **IF** <condition> **THEN** <assignment> { <assignment> }

<condition> ::= <comparison> { <logic op> <comparison> }

<comparison> ::= **PARAM[x]** <comparison op> y

Where **x** is the CCSP ID of a device parameter, y is a value for that parameter. The device parameter could be one of three types: integer, enum, string. Depending on the parameter type, **y** could take different format:

- Integer: **y** is integer value of the parameter
- Enum: **y** is the enum value index inside the enum
- String: **y** is in a '**zzzz**' string format, where **z** is a character. Special character '*' can be used as wild card. '**AA***' and '**AABB**' will be considered as equal

<comparison op> ::**= == | > | < | >= | <= | !=**

For string type of parameter, only **==** and **!=** operators are supported.

<assignment> ::**= PARAM[x] = y**

Where x is the CCSP ID of a device parameter, y is a value for that parameter.

<logic op> ::**= && | ||**

Comparisons can be **AND**ed together using **&&**, and then can be **OR**ed together using **||.** The **AND** operation always has precedence over the **OR** operation when **AND** and **OR** both exist in a condition.

The following script condition

PARAM[400]==5 || PARAM[400]==3 || PARAM[400] >= 8 && PARAM[400] <= 12

should be interpreted as

PARAM[400]==5 || PARAM[400]==3 || (PARAM[400] >= 8 && PARAM[400] <= 12)

Script example:

```
IF PARAM[754]==2 THEN PARAM[755]=2
IF PARAM[754]==3 THEN PARAM[755]=3
IF PARAM[754]==7 THEN PARAM[755]=10
IF PARAM[754]<2 || PARAM[754] > 3 && PARAM[754]<7 THEN PARAM[755]=19
IF PARAM[733]=='AAAA AAAA AAAA AAAA' THEN PARAM[26]=4
```

Note: *Currently, a maximum of 30 statements is allowed in a script. A maximum of 40 assignments is allowed in a statement.*

4 Advanced Audio Processing

Overview

To use **Advanced Audio Processing** options, you will need to purchase the X50OPT-ADVAUD audio submodule, and a number of *Software Key License Credits* (see **Table 4-1** for the available licenses). The number of license credits that you need depends on which audio functions you select for DTS Neural, Dolby Digital (AC-3) Decoder, Dolby Digital (AC-3) Encoder, Dolby E Decoder, or Dolby E Encoder.

The DTS Neural **UpMix** mode, for example, requires three license credits, while the **MultiMerge** mode requires four. These credits are transferable across different DTS Neural options, and can be used for any combination of **DTS Neural Loudness Control, or DTS Neural Surround UpMix**, **DownMix**, and **MultiMerge**. However, they can only be used in the X50 for which they were purchased.

Table 4-1 Advanced Audio Processing Modes, Latency, and Credit Cost

Mode	Latency	Credit Cost
M1: UpMix (low/high latency)	26.86 ms (low) / 48.19 ms (high)	3 DTS
M2: DownMix	10.86 ms	3 DTS
M3: MultiMerge (low/high latency)	26.86 ms (low) / 48.19 ms (high)	4 DTS
M4: Loudness Control 2.0	58.86 ms	1 DTS
M5: Loudness Control 5.1	58.86 ms	3 DTS
M6: Loudness Control 4x2.0	58.86 ms	4 DTS
M7: Dolby Digital Decode with Downmix	33.25 ms	1 DDD
M8: Dolby E Decode	2 frames	1 DED
M9: Dolby E/Digital Decode with Downmix	2 frames (E or Digital)	1 DED, 1 DDD
M10: Dolby Digital Encode	69.43 ms	1 DDE
M11: Dolby E Encode	1.13 frames	1 DEE
M12: MultiMerge, Loudness Control (low/high latency)	74.86 ms (low) / 96.19 ms (high)	8 DTS
M13: UpMix, Loudness Control (low/high latency)	74.86 ms (low) / 96.19 ms (high)	4 DTS
M14: DownMix, Loudness Control	58.86 ms	4 DTS
M15: Loudness Control 5.1+2.0	58.86 ms	4 DTS
M16: Loudness Control 2x1.0	58.86 ms	1 DTS

Table 4-1 Advanced Audio Processing Modes, Latency, and Credit Cost *(Continued)*

Mode	Latency	Credit Cost
M17: Loudness Control + Dolby Digital Encode 5.1	125.43 ms	1 DDE, 3 DTS
M18: Loudness Control + Dolby E Encode 5.1+2.0	3.13 frames	1 DEE, 4 DTS
M19: Loudness Control + Dolby E Encode 4x2.0	3.13 frames	1 DEE, 4 DTS
M20: DD Decode + MultiMerge (low/high latency)	82.58 ms (low) / 103.91 ms (high)	1 DDD, 4 DTS
M21: DE Decode + MultiMerge (low/high latency)	2 frames + 16 ms (low) / 2 frames + 37.33 ms (high)	1 DED, 4 DTS
M22: DE/DD Decode + MultiMerge (low/high latency)	2 frames + 16 ms (low) / 2 frames + 37.33 ms (high)	1 DDD, 1 DED, 4 DTS

Installing the X50OPT-ADVAUD Audio Submodule

To use the Advanced Audio Processing features, the X50OPT-ADVAUD audio submodule must first be installed.

See page 108 for details.

Enabling DTS Neural and Dolby Modes

Follow these steps to enable the DTS Neural and Dolby Modes:

1 Navigate to **Audio > Advanced Audio Processing > AAP 1** or **AAP 2 Configuration > General** menu.

1 Set the **Processing Mode** to one of the advanced audio modes shown in **Table 4-1**.

2 Configure the routing in the **Audio > Routing > AAP Input Select** and **Audio > Routing** menus.

Note: *You must select the AAP mode first (**M1**, **M2**, **M3**, etc.) before configuring the routing; the AAP mode you select may change the routing settings*

2 In the drop down box at the top of the column, change your selection from **General** to the mode you selected in step 3.

3 Wait several seconds for the fields to refresh.

4 Configure the parameters that are available in your mode (parameters that are not applicable are grayed out).

Once you have selected your DTS Neural modes, the **Selection Status** parameter (**AAP x > General**) displays one of the following:

- Good
- Not Enough License Credit

5 From the main section of the **Advanced Audio Processing (AAP)** block, (select **AAP x Input Routing** and then select your audio sources.

6 In the **Audio Output Routing** block, select the destinations for your audio.

Dolby Products

Figure 4-1 and Figure 4-2 show how Dolby is used in typical X50 applications. Dolby Digital (AC-3) and Dolby E decoding takes place at ingest for voice-over. The **Dolby** LED on the front panel illuminates when an AAP is configured as a Dolby E or Dolby Digital encoder, and the encoder is currently operating.

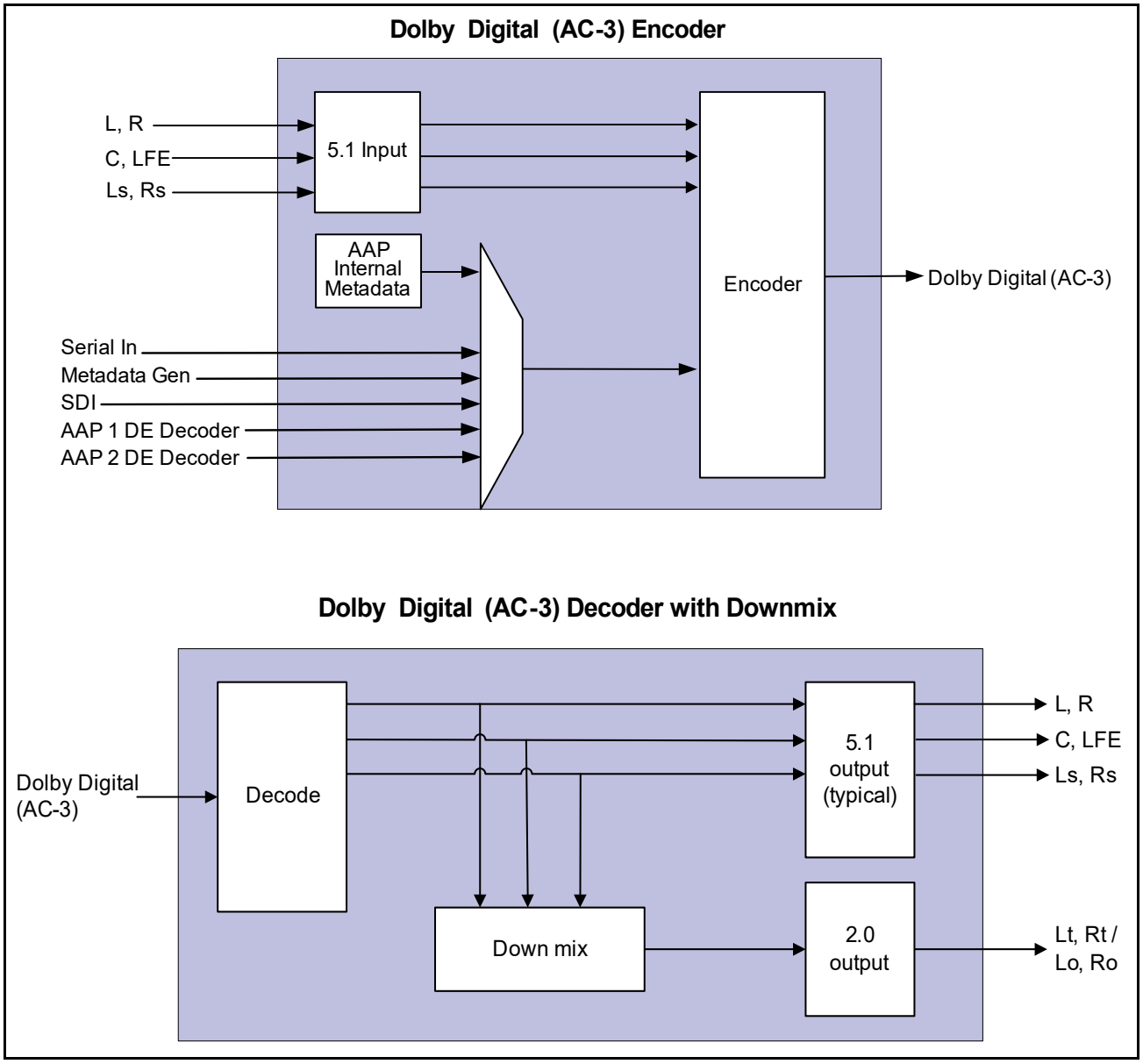


Figure 4-1. Dolby Digital Block Diagrams

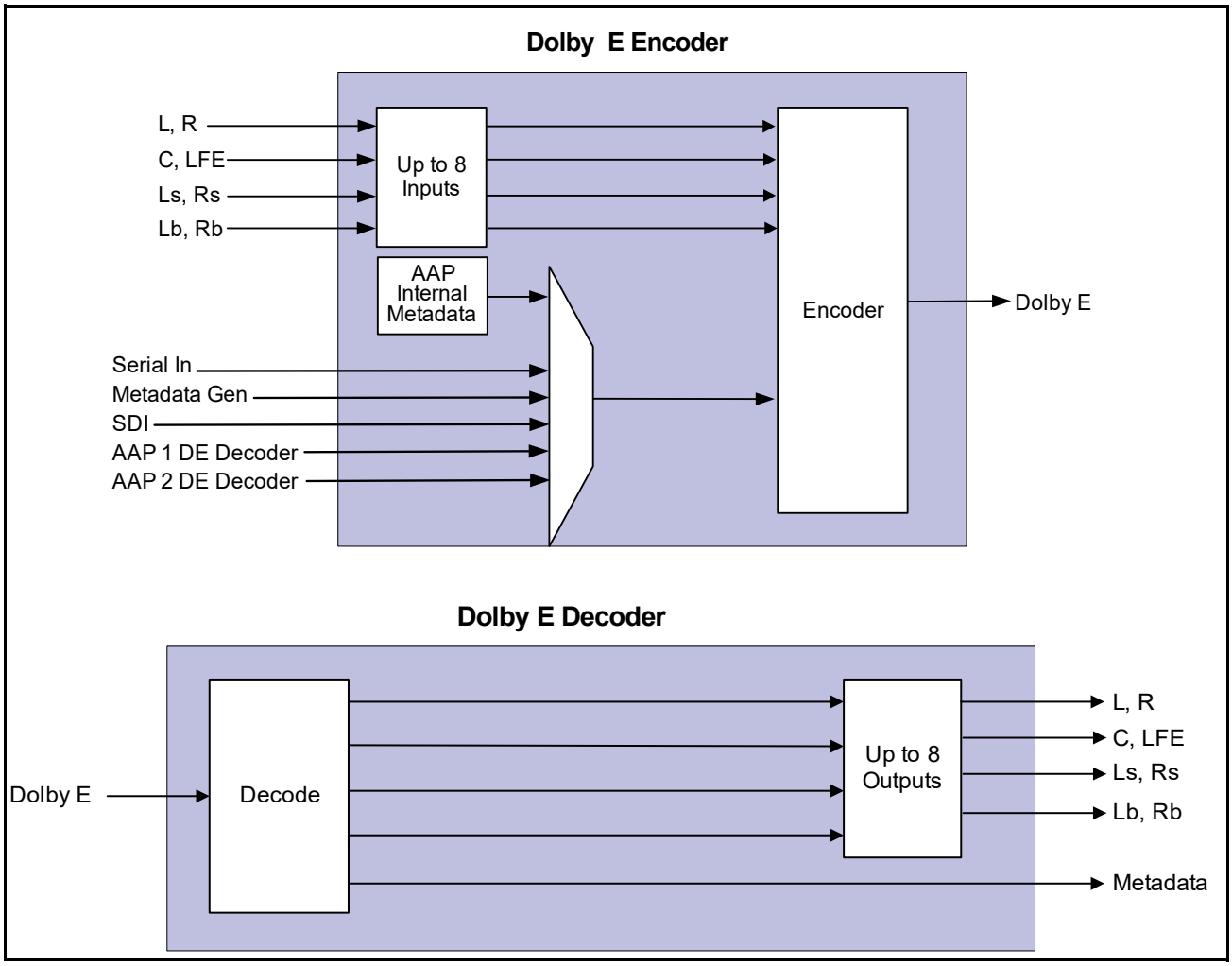


Figure 4-2. Dolby E Block Diagrams

Dolby-E Alignment

It is important to maintain a proper timing relationship between the Dolby-E header and the first line of video especially when recording video with embedded audio on tape transports. This is commonly known as the *guard band*. On the X50, the Dolby-E alignment timing is determined by the value of the **SDI 1** or **SDI 2 Dolby E Start Line** embedder controls in **EMB x >Controls**.

Note: *If Dolby E is embedded, the module's output frame rate must match the frame rate of the Dolby E stream.*

AAP Internal Metadata

Dolby Digital

When using Dolby Digital encoding, if you select **AAP Internal** metadata generator as the **Metadata Source** one program is available (the **Metadata Index** parameter is disabled). However, all other metadata sources have up to eight programs available. Use the **Metadata Index** parameter to select the program you wish to encode.

Dolby E

Using Dolby E encoding, up to eight metadata programs may be encoded, depending on the setting of the **Program Configuration** parameter. For example, if you set **Program Configuration** to **5.1+2**, two sets of metadata are encoded (one for **5.1**, one for **2**). If **Program Configuration** is set to **8x1**, eight sets of metadata are encoded. To configure the metadata settings for each program, navigate to the **AAP Internal Metadata** menu and select the desired program from the **Program Select** parameter. Then configure the metadata settings as required.

Note: *Dolby E is always in sync with the frame rate of the video. To ensure downstream decoders work correctly, you must make the correct settings in* ***Dolby E Sync Select*** *(default is* ***Processing Ch 1 Output)****.*

Dolby Audio Metadata

When you apply external metadata to the X50, the metadata properties persist even after you remove the external metadata from the module. Performing a **Factory Default** of the user settings *does not* clear the metadata properties that were received when external metadata was present. After you remove the external metadata, you must restart the module to clear the metadata properties.

For general information about the use of audio metadata in professional video applications, visit the Dolby Web site at www.dolby.com.

Dual-Input Dolby Decoder

The dual-input Dolby Decoder feature is available for all of the Dolby Decoder modes. Once an AAP is configured in one of the Dolby decoder modes, the Dual-Input function can be activated in the menu (**AAP-X Input Routing > AAP-X Dolby Source Select**) by selecting the appropriate source into **AAP-X Secondary Dolby Source Select** (the default is **None**).

This feature is useful for cases where a PCM program is available on one audio pair and a Dolby program is available on a different audio pair. In such cases, the PCM pair needs to be routed into the primary input, and the Dolby pair into the secondary input. The decoder will automatically switch to PCM bypass (from the primary input) whenever the Dolby stream stops.

Ensure that you check the read-only **Bitstream Format** parameter in the Dolby Decoder menu (within the AAP block) to determine whether PCM input (**Non-Dolby**) or one of the Dolby inputs is being processed.

Table 4-2 illustrates the behavior of the decoder. See the additional notes at the bottom of the table.

Table 4-2 Decoder Behavior

Mode	Input #1	Input #2	Output	Notes
[M7] DD Decoder	PCM	-	PCM	
	AC3	-	DEC	
	DE	-	MUTE	
	PCM	PCM	PCM #1	
	PCM	AC3	DEC #2	
	PCM	DE	PCM #1	
	AC3	PCM	DEC #1	
	DE	PCM	MUTE	
	AC3	AC3	DEC #?	Undetermined: one of the streams gets decoded
	AC3	DE	DEC #1	Undetermined: DEC #1 or MUTE
	DE	DE	MUTE	
	DE	AC3	DEC #2	Undetermined: DEC #2 or MUTE
[M8] DE Decoder	PCM	-	PCM	
	AC3	-	MUTE	
	DE	-	DEC	
	PCM	PCM	PCM #1	
	PCM	AC3	PCM #1	
	PCM	DE	DEC #2	
	AC3	PCM	MUTE	
	DE	PCM	DEC #1	
	AC3	AC3	MUTE	
	AC3	DE	DEC #2	Undetermined: DEC #2 or MUTE
	DE	DE	DEC #?	Undetermined: one of the streams gets decoded
	DE	AC3	DEC #1	Undetermined: DEC #1 or MUTE

Table 4-2 Decoder Behavior *(Continued)*

Mode	Input #1	Input #2	Output	Notes
[M9] DD/DE Decoder	PCM	-	PCM	
	AC3	-	DEC	
	DE	-	DEC	
	PCM	PCM	PCM #1	
	PCM	AC3	DEC #2	
	PCM	DE	DEC #2	
	AC3	PCM	DEC #1	
	DE	PCM	DEC #1	
	AC3	AC3	DEC #?	Undetermined: one of the streams gets decoded
	AC3	DE	DEC #?	Undetermined: the DE stream may get decoded
	DE	DE	DEC #?	Undetermined: one of the streams gets decoded
	DE	AC3	DEC #?	Undetermined: the DE stream may get decoded

Notes:
1. PCM = PCM audio or mute
2. AC3 = Dolby Digital stream
3. DE = Dolby-E stream
4. Avoid combinations shown with a gray background in this table. The decoder searches both input streams and locks to the first stream detected; the search order is input #1, then input #2. As such, the output depends on the alignment of the two input streams relative to each other.

The following important notes apply to the operation of the Dual-Input Dolby Decoder feature:

- The Dual-Input feature is available for all Dolby Decoder modes.
- In Dual-Input mode, inputs may come only from the same audio de-embedder.
- In Dual-Input mode, the secondary input is dedicated for Dolby-only streams.
- Based on its intended use, in Dual-Input mode the primary input is normally PCM.
- In Dual-Input mode, combinations where both inputs are Dolby should be avoided.

When an AAP is configured as a Dolby E encoder and is routed to an embedded output (or Dolby E from de-embedded or AES inputs is routed to an embedded output), the X50 will ensure the Dolby E header is aligned with the line specified by the **SDI 1/2 Dolby E Start Line** parameter. If audio output delay is then added to the embedded output pair containing Dolby E, the X50 will compensate by adding additional audio delay to ensure the Dolby E header is once again aligned. This additional delay could be up to one frame, depending on how much output audio delay is added.

The X50 aligns output audio/video timing between SDI 1 and SDI 2, as well as the AES and analog audio outputs. If an audio output is routed from an AAP, the X50 automatically compensates for the latency introduced by the AAP. If the AAP mode is changed, there will be a momentary audio disturbance in all audio outputs as the X50 realigns all audio/video outputs to compensate for the changed AAP latency.

DTS Neural Products

The block diagrams shown in **Figure 4-3** to **Figure 4-5** illustrate the uses of the different DTS Neural Software Key License Credits.

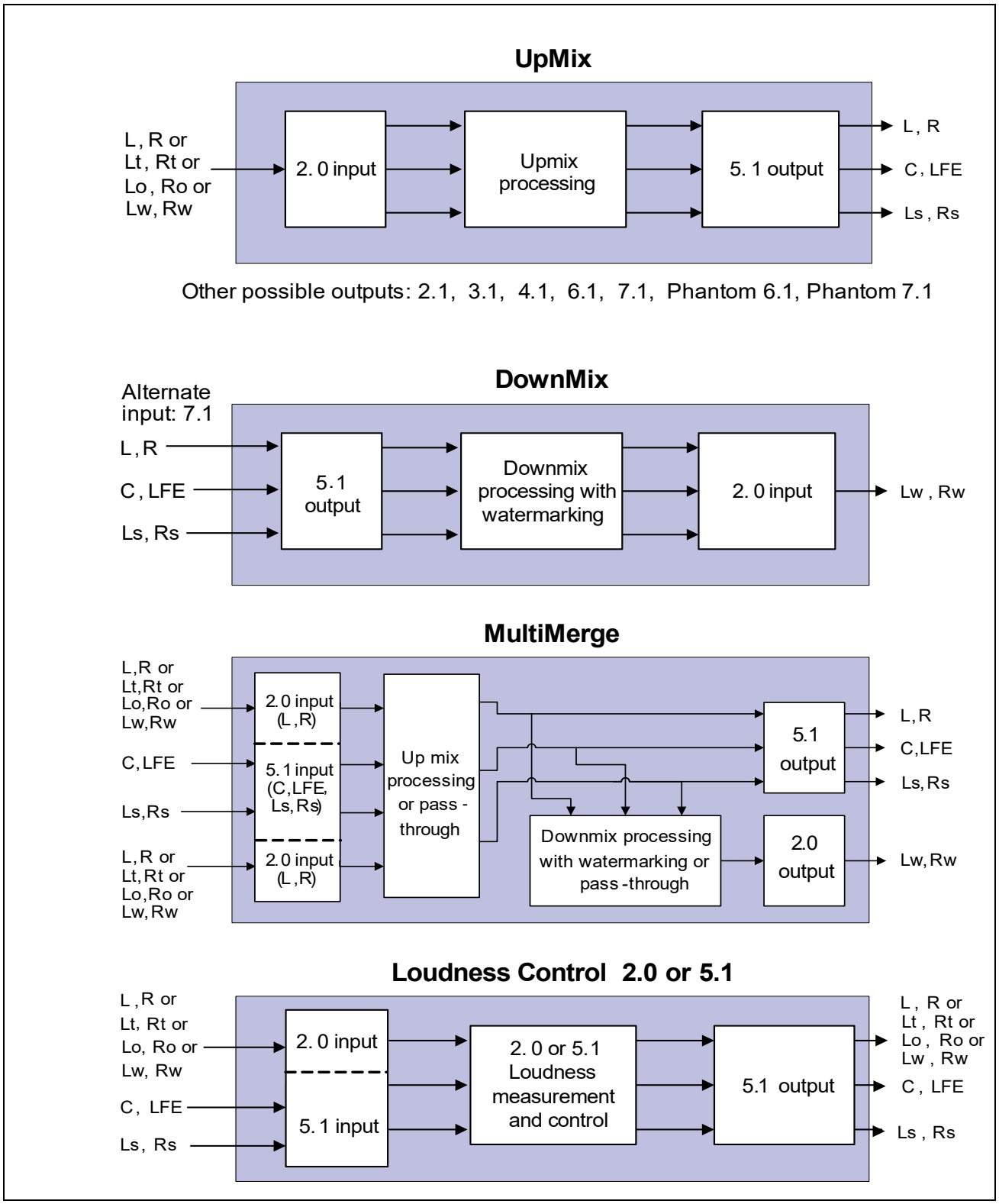


Figure 4-3. Block Diagrams for Single DTS Neural Audio Options

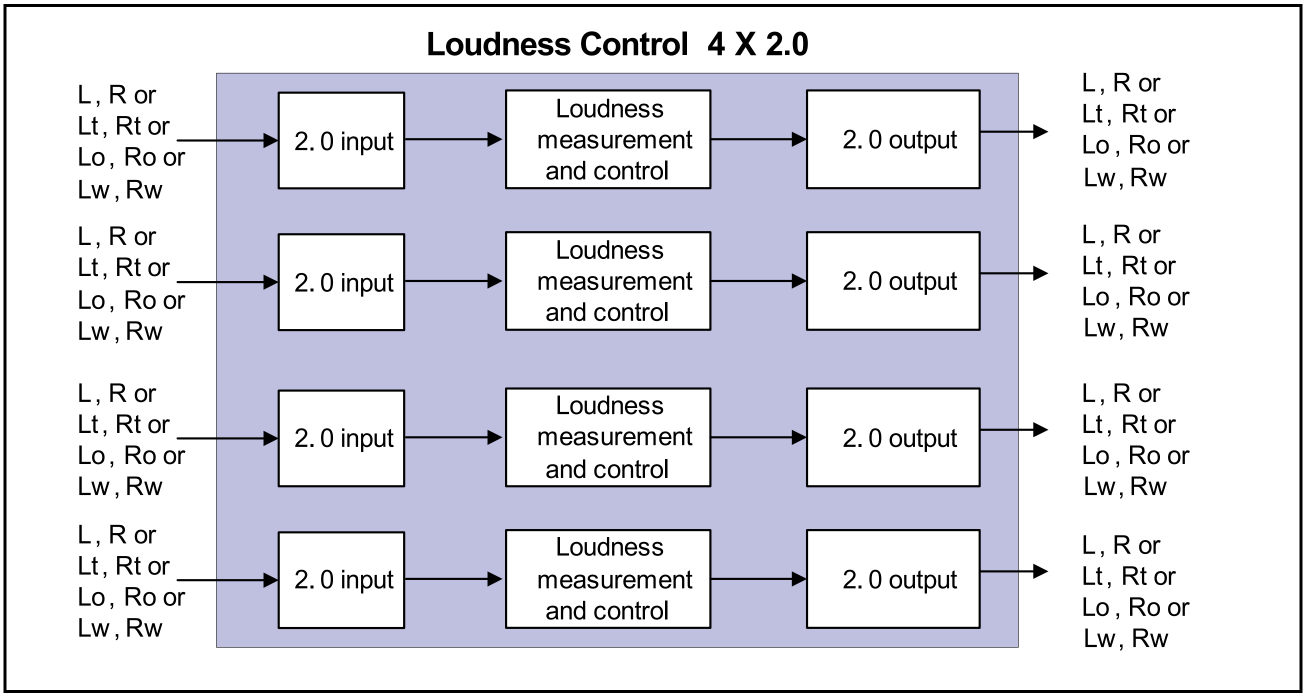


Figure 4-4. Block Diagram for Multiple DTS Neural Options

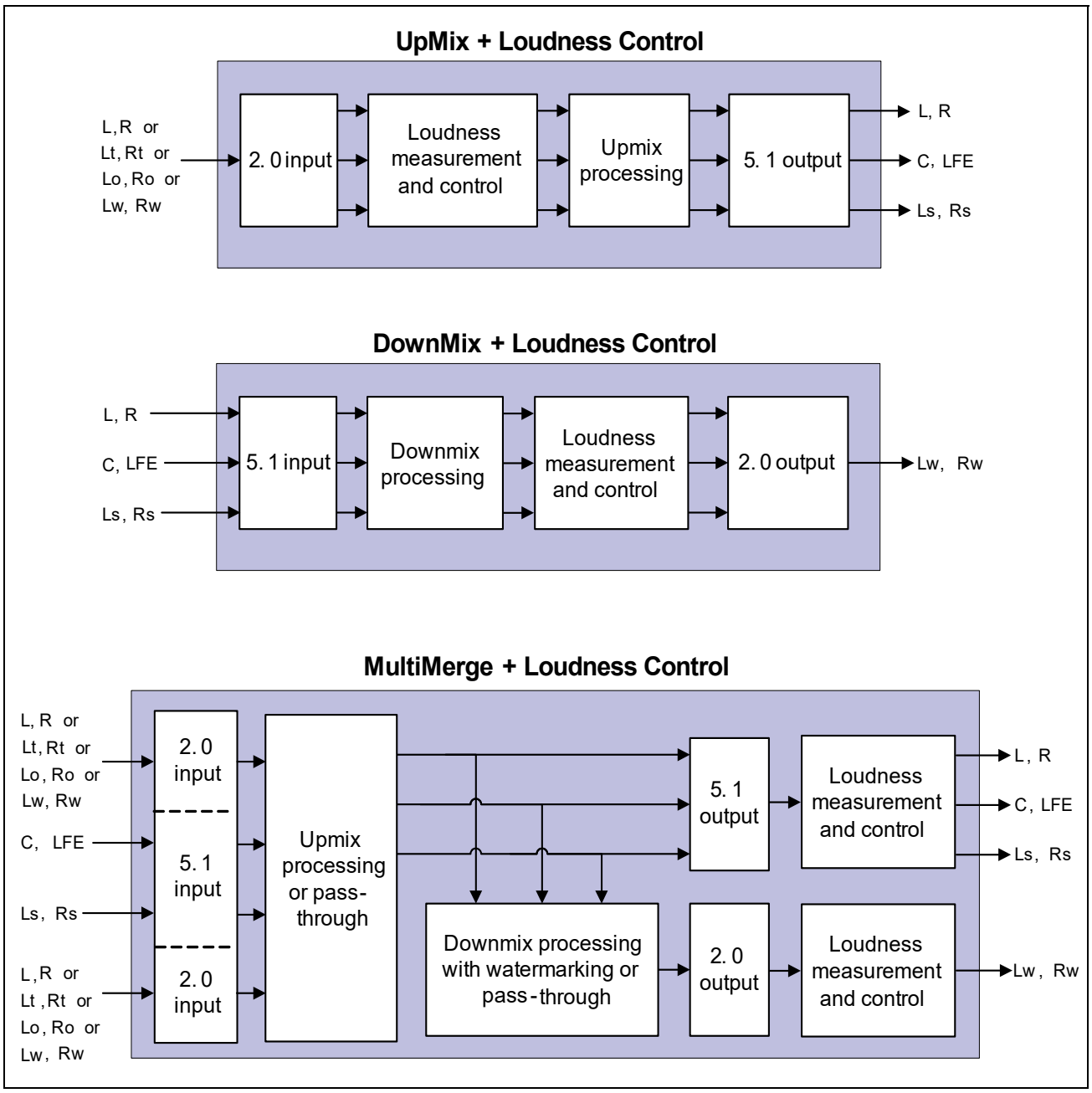


Figure 4-5. Block Diagrams for Multiple DTS Neural Options

DTS Neural Surround Audio UpMix

Overview

The DTS Neural Surround UpMix renders any two channel audio source (stereo, matrix encoded stereo, LtRt, or DTS Neural Surround LwRw) as surround sound. The DTS Neural Surround UpMix can simultaneously position individual elements within the surround field, creating high levels of image stability and granularity. The UpMix technology avoids taking "artistic license" with content by placing audio exactly where it would be heard in a professional LEDE (Live End Dead End) listening environment. For example, mono or pan-pot stereo will image in front of the listener, whereas stereo containing depth information will surround the listener. You can use the DTS Neural Surround UpMix as a stand-alone unit to monitor stereo production, or you can use it in tandem with the DTS Neural Surround DownMix as a complete 5.1 transport solution. **Figure 5** below shows an UpMix taking a two-channel audio source (stereo, matrix encoded stereo, LtRt or DTS Neural Surround LwRw) and rendering a 5.1 multi-channel mix.

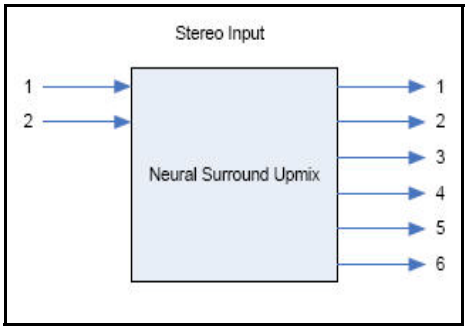


Figure 5. UpMix Block Diagram

Table 4-3 Channel Configurations for DTS Neural UpMix

Input Routing	Channel Name	2.1	3.1	4.1	5.1	6.1	7.1	Phantom 6.1	Phantom 7.1
1	Left (L)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	Right (R)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	Center (C)	Mute	Yes	Mute	Yes	Yes	Yes	Mute	Mute
4	Low Frequency Effects (LFE)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	Left Surround (Ls)	Mute	Mute	Yes	Yes	Yes	Yes	Yes	Yes
6	Right Surround (Rs)	Mute	Mute	Yes	Yes	Yes	Yes	Yes	Yes
7	Left Back (LB) or Center Back (CB)	Mute	Mute	Mute	Mute	Yes (CB)	Yes (LB)	Yes	Yes
8	Right Back (RB)	Mute	Mute	Mute	Mute	Mute	Yes	Mute	Yes

Table 4-4 DTS Neural Surround Audio UpMix Parameters

Parameter Name	Function	Options
UpMix Status	Indicates the state of the AAP mode	■ **Uninitialized** ■ Running ■ Not Running (bypassed) ■ Not Running
Channel Config	Controls the output channel configuration	■ 2.1 ■ 3.1 ■ 4.1 ■ 5.1 ■ 6.1 ■ 7.1 ■ Phantom 6.1 ■ Phantom 7.1
Latency	Specifies the latency profile of the up-mix	■ Low ■ High
DICE Processing Level	Specifies the amount of DICE processing to perform	**0** to 100
Depth	Specifies the amount of front-to-back bias to apply to the standard soundstage	-100 to 100 (**0**)
Front Width	Specifies the amount of narrowing or widening to perform on the front channels	-100 to 100 (**0**)
Surround Width	Specifies the wideness of the surround channels	-100 to 0 (**0**)
LFE Cutoff	Specifies the low-pass cutoff frequency of the LFE channel (0 specifies no LFE channel)	■ 0 Hz ■ 60 Hz ■ 80 Hz ■ 100 Hz ■ 120 Hz ■ 140 Hz
Final Limiter Ceiling	Specifies the threshold where final limiting on the up-mixed output occurs	■ -12 to 0

DTS Neural Surround Audio DownMix

Overview

The DTS Neural Surround DownMix enables 5.1 surround sound to be transported through any stereo infrastructure. The DownMix process is based upon the principle that both natural stereo and 5.1 content are two-dimensional; both contain width and depth spatial attributes.

The DTS Neural Surround DownMix can represent six channels of discreet audio sources in a stereo DownMix by transforming the sources into pure intensity and coherence encoding. By correcting overlaps of the signal sources in intensity, time, coherence, polarity, and phase before the six channels are combined, the DTS Neural Surround DownMix accounts for the problems suffered in traditional matrix encode systems—such as comb filtering, spatial location distortion, etc.

The proprietary DTS Neural Audio "watermark process" faithfully reproduces surround information when it is rendered by the DTS Neural Surround UpMix or any LtRt system. In brief, the DTS Neural Surround DownMix produces a stereo DownMix that accurately represents the original content whether monitored in mono, stereo, matrix or DTS Neural 5.1 Surround Sound.

Figure 6 below shows a DownMix taking a multi-channel audio source. The DownMix creates two-channel audio source using the DTS Neural Audio approach of embedding a watermark signal within the stereo audio signal patch. The watermark signal contains spatial and steering positioning information. The resulting stereo audio signal is also known as LwRw.

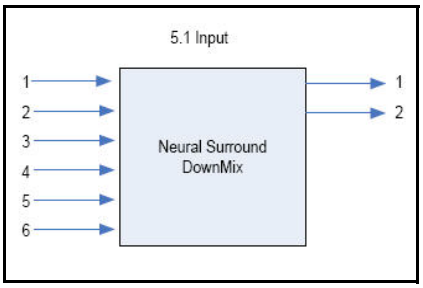


Figure 6. DownMix Block Diagram

Table 4-5 DTS Neural Surround Audio DownMix Parameters

Parameter Name	Function	Options
DownMix Status	Indicates the state of the AAP mode	■ **Uninitialized** ■ Running ■ Not Running (bypassed) ■ Not Running
Channel Config	Controls the input channel configuration	■ 5.1 ■ 7.1
L/R Encoding Mode	Specifies the encoding mode for the left and right channels	■ Phantom Center ■ Hard Center

Table 4-5 DTS Neural Surround Audio DownMix Parameters *(Continued)*

Parameter Name	Function	Options
LFE Cutoff	Specifies the low-pass cutoff frequency of the LFE channel (0 specifies no LFE channel)	■ 0 Hz ■ 60 Hz ■ 80 Hz ■ 100 Hz ■ 120 Hz ■ 140 Hz
Final Limiter Ceiling	Specifies the threshold where final limiting on the down-mixed output occurs (0 indicates no final limiting)	-20 dB to **0** dB
Active Correction	Specifies correction to the DownMix ICLD, ICPD and spectrum	■ **Off** ■ On

DTS Neural Surround Audio MultiMerge

Overview

The DTS Neural Surround MultiMerge enables broadcasters to transition from stereo to 5.1 surround sound, providing viewers with a 24/7 surround sound experience. With MultiMerge in line, 5.1 original content is passed unaffected to the viewer while original stereo content is UpMixed to a 5.1 surround sound image. This provides the viewer with a consistent surround experience.

The transition between 5.1 and stereo occurs seamlessly without the need of operator intervention. By offering a 24/7 5.1 signal, AC3 metadata does not transition between 2/0 and 3/2 mode. This prevents audio clicks, pops, and dropouts. The process also avoids taking “artistic license” with content by placing audio exactly where it would be heard in a professional LEDE (Live End Dead End) listening environment. For example, mono or pan-pot stereo will image in front of the listener, whereas stereo containing depth information, or LtRt encoding, will surround the listener.

You can use the MultiMerge in combination with the DTS Neural Surround DownMix device to pass 5.1 through stereo-only facilities and therefore eliminate the need for costly master control upgrades.

Figure 7 shows how the MultiMerge takes a two-channel audio source (stereo, matrix encoded stereo, LtRt or DTS Neural Surround LwRw) and render a 5.1 multi-channel mix; in combination with taking original multi-channel content and creating a stereo DownMixed signal, depending on the input configuration and content source used.

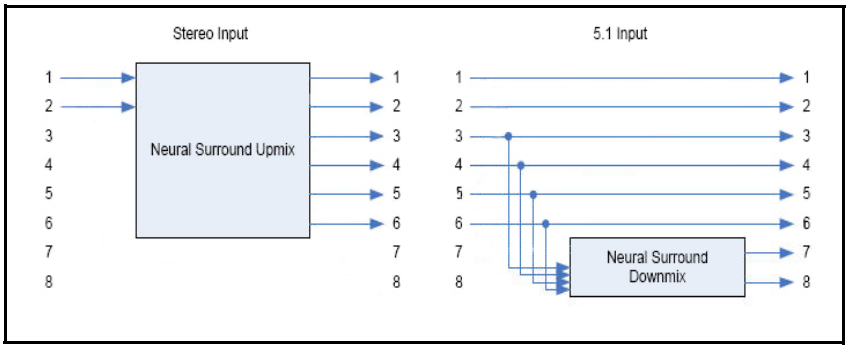


Figure 7. MultiMerge Block Diagram

Table 4-6 DTS Neural Surround Audio MultiMerge Parameters

Parameter Name	Function	Options
MultiMerge Status	Indicates the state of the AAP mode	■ **Uninitialized** ■ Running ■ Not Running (bypassed) ■ Not Running
Input Selection Mode	Specifies how input channels are selected.	■ **Mix** ■ Multi ■ Stereo ■ Aux ■ Multi Detect ■ Stereo Detect ■ Aux Detect ■ Multi Aux Stereo
Detected Input [RO]	Reports the current inputs that are included in the output	■ **Unknown** ■ Mix ■ Multi ■ Stereo
Input Noise Floor Threshold	Specifies the amount of signal required when detecting active inputs	■ -80 dB to -50 dB (**-60 dB**)
Input Crossfade Time	Specifies the transition time between inputs when switching due to detected level changes	50 ms to 750 ms (**200 ms**)
MultiMerge Mode	The operation mode for MultiMerge	■ **Auto** ■ Pass Through ■ Up Mix
Latency	Specifies the latency profile of the MultiMerge	■ **Low** ■ High
Noise Floor Threshold	Specifies the signal level that must be detected on any of the C, LFE, Ls or Rs for the content to be considered surround	-80 dB to -50 dB (**-60 dB**)
Crossfade Time	Specifies the transition time between up-mix and passthrough when in auto mode	50 ms to 750 ms (**200 ms**)
Upmix Depth	Specifies the amount of front-to-back bias to apply to the standard soundstage	-100 to 100 (**0**)
Upmix Front Width	Specifies the amount of narrowing or widening to perform on the front channels	-100 to 100 (**0**)
Upmix Surround Width	Specifies the wideness of the surround channels	-100 to 100 (**0**)
Upmix LFE Cutoff	Specifies the cutoff frequency for the generated LFE channel	■ 0 Hz ■ 60 Hz ■ **80 Hz** ■ 100 Hz ■ 120 Hz ■ 140 Hz

Table 4-6 DTS Neural Surround Audio MultiMerge Parameters *(Continued)*

Parameter Name	Function	Options
Downmix L/R Encoding Mode	Specifies the encoding mode for the left and right channels	■ **Phantom Center** ■ Hard Center
Downmix LFE Cutoff	Specifies the cutoff frequency of the input LFE channel	■ 0 Hz ■ 60 Hz ■ **80 Hz** ■ 100 Hz ■ 120 Hz ■ 140 Hz
Multi Final Limiter Ceiling	Specifies the threshold where final limiting on the surround output occurs	-20 dBFS to **0** dBFS
Stereo Final Limiter Ceiling	Specifies the threshold where final limiting on the auxiliary stereo output occurs	-20 dBFS to **0** dBFS

Table 4-7 Input Selection Mode Option Descriptions

Option	Notes
Mix	■ This option sums the Aux input to the L/R of the 5.1 input. ■ The AES1, AES2, AES3 inputs are 5.1 (L/R, C/LFE, Ls/Rs) in. ■ The AES4 input is 2.0 in (L/R) in. ■ The AES1 output is a sum of AES 1 and AES 4 (AES1L + AES4L, AES1R + AES4R). ■ The AES2 output is C/LFE. ■ The AES3 output is LsRs.
Multi	■ This option only sources audio from the 5.1 input. ■ Inputs are AES1 (L/R), AES2 (C/LFE), AES3 (Ls/Rs). ■ Outputs are AES1 (L/R), AES2 (C/LFE), AES3 (Ls/Rs). ■ AES4 is not used
Stereo	■ Audio is sourced from only the L/R pair, while simultaneously muting the C/LFE and Ls/Rs pairs of the 5.1 input (used in situations where there is information on the other inputs that you would want to ignore). ■ Input is AES1 (L/R) ■ Output is AES1 (L/R) ■ AES2, AES3, AES4 are not used
Aux	■ This option only sources audio from the Aux input. ■ Input is AES4 (L/R). ■ Output is AES4 (L/R). ■ AES1, AES2, AES3 is not used
Multi Detect	■ If audio is present on the 5.1 input, the Aux input is overridden. ■ Inputs are 2.0 on AES1 (L/R) or 5.1 on AES1 (L/R), AES2 (C/LFE), AES3 (Ls/Rs) or 2.0 on AES4 (L/R). ■ Outputs are 5.1 on AES1 (L/R), AES2 (C/LFE), AES3 (Ls/Rs) and 2.0 on AES4 (L/R)

Table 4-7 Input Selection Mode Option Descriptions *(Continued)*

<table>
<tr><th>Option</th><th>Notes</th></tr>
<tr><td>Stereo Detect</td><td>If audio is present on the L/R pair of the 5.1 input, the Aux input is overridden. Information on the C/LFE and Ls/Rs pairs of the 5.1 input is ignored.</td></tr>
<tr><td>Aux Detect</td><td>■ If audio is present on the Aux input, the 5.1 input is overridden.
■ This is an EAS application mode.
■ Inputs are 5.1 on AES1 (L/R), AES2 (C/LFE), AES3 (Ls/Rs), and EAS input on AES4 (L/R).
■ Output is 5.1 on AES1 (L/R), AES2 (C/LFE), AES3 (Ls/Rs).
■ When EAS appears on AES4 input, the output becomes EAS output on AES1 (L/R).</td></tr>
<tr><td>Multi Aux Stereo</td><td>■ If audio is present on the 5.1 input, the Aux input is overridden.
■ If only L/R is present on the 5.1 input and audio is present on the Aux, the L/R is overridden.
■ If there is no audio present on C/LFE, Ls/Rs, or Aux inputs, source from L/R.

<table>
<tr><th></th><th>MultiMerge Input</th><th>Scenario 1 (5.1)</th><th>Scenario 2 (Lt/Rt)</th><th>Scenario 3</th></tr>
<tr><td>AES 1</td><td>L/R</td><td>Yes</td><td>Yes (foreign language)</td><td>Yes (foreign language)</td></tr>
<tr><td>AES 2</td><td>C/LFE</td><td>Yes</td><td>No</td><td>No</td></tr>
<tr><td>AES 3</td><td>LS/RS</td><td>Yes</td><td>No</td><td>No</td></tr>
<tr><td>AES 4</td><td>Aux</td><td>No</td><td>Yes (desired language)</td><td>No</td></tr>
</table>
■ If 5.1 is present, take 5.1.
■ If there is no 5.1 or stereo available on either L/R or AUX, take AUX.
■ If stereo is only available on L/R, take L/R.</td></tr>
</table>

DTS Neural Loudness Control

Overview

The X50 offers two program channels of DTS Neural Loudness Control—a loudness leveling device that uses advanced psycho-acoustic and signal processing techniques to accurately detect and regulate the perceived loudness of stereo and 5.1 sources. Using this feature, you can regulate audio without creating the perception of being “squashed” or compressed.

One of the important aspects of loudness control is *frequency compensation*, also known as loudness shaping. Loudness studies dating back to Fletcher/Munson in the 1930s found that the human ear is more sensitive to different frequencies at different loudness levels. The **Loudness Shaping** (**Frequency Compensation**) parameter preserves the same perceptual frequency balance as the input signal, while correcting the loudness to match a desired **Target Level.**

For example, with **Loudness Shaping** enabled at a medium level, signals that fall below the **Target Level** setting have more gain added to middle frequencies than higher or lower frequencies. This preserves the original spectral balance. Conversely, signals that fall above the **Target Level** setting will have middle frequencies attenuated more than higher or lower frequencies. Because the **Loudness Shaping** parameter applies less gain to high and low frequencies, high or low frequency noise does not become over-emphasized.

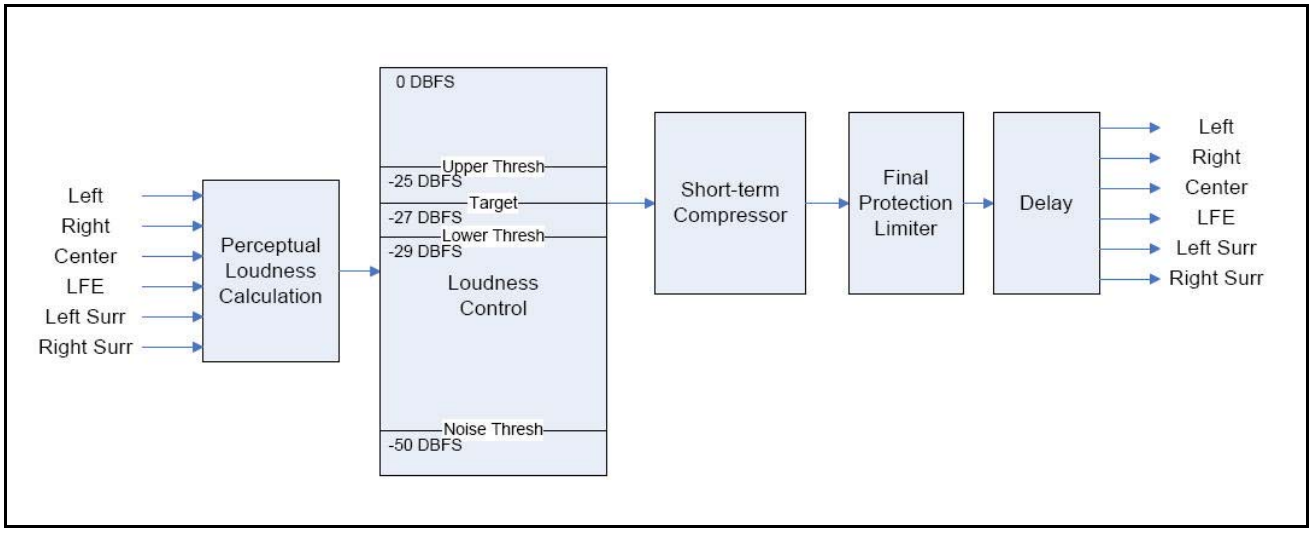


Figure 4-6. DTS Neural Loudness Control Block Diagram

Presets

The Loudness Control feature uses four different presets **(Ultra-Light, Light, Medium**, and **Aggressive).** Table 4-8 lists the values that each of these presets represents.

Table 4-8 DTS Neural Loudness Control Preset Settings

Parameter Name	Ultra Light	Light	Medium	Aggressive
Loudness Measurement Type	LEQ 1770	LEQ 1770	LEQ 1770	LEQ 1770
Target Loudness Level (dBeq)	--	--	--	--
LC Ratio	0.80	0.95	0.98	1.0
Upper Loudness Threshold (dB)	0.0	0.0	0.0	0.0
Lower Loudness Threshold (dB)	0.0	0.0	0.0	0.0
Freeze Window (dB)	5.0	4.0	2.0	1.0
Quiet Threshold (dBEq)	-55.0	-55.0	-55.0	-55.0
Attack	80.0	50.0	50.0	50.0
Release	300.0	220.0	150.0	100.0
Compressor Threshold (dB)	5.0	5.0	5.0	5.0
Compressor Ratio	0.5	0.5	0.5	0.5
Loudness Shaping	0.0	0.0	0.0	0.0
Final Limiter Ceiling (dBFS)	0.0	0.0	0.0	0.0
Loudness Control Function	0	0	0	0
Run Final Limiters	Enable	Enable	Enable	Enable
Meter Algorithms	Enable	Enable	Enable	Enable

Table 4-9 Recommended Presets, by Country

Country	Recommendation	Target Loudness	Allowable Variance	Suggested Preset
Australia and New Zealand)	OP-59	-24	Unknown at this time	Dependent on Allowable Variance
Canada	ATSC A-85	-24	+/- 2	Ultra Light, Light
Europe	EBU.R.128	-23	+/- 1	Medium, Aggressive
Japan	ARIB TR B-32	-24	+/- 1	Medium, Aggressive
US	ATSC A-85	-24	+/- 2	Ultra Light, Light
Belgium (French)	EBU.R.128	-23	+/- 1	Medium, Aggressive

Loudness Control Mapping

Each Loudness Control menu within each AAP block (**DTS Neural Loudness Ctrl 1/2/3/4**) corresponds to a loudness control function of a given AAP loudness control mode. Each mode containing LC may have one or more loudness control sections with related control parameter menus.

Table 4-10 Loudness Control Mapping

Mode	Loudness Control Functions	Related Control Parameter Menu
Loudness Control 2.0	One loudness control function on the 2.0 channels	DTS Neural Loudness Ctrl 1
Loudness Control 5.1	One loudness control function on the 5.1 channels	DTS Neural Loudness Ctrl 1
Loudness Control 4 x 2.0	One loudness control function on each of the four 2.0 pairs	■ Ch 1 & 2: DTS Neural Loudness Ctrl 1 ■ Ch 3 & 4: DTS Neural Loudness Ctrl 2 ■ Ch 5 & 6: DTS Neural Loudness Ctrl 3 ■ Ch 7 & 8: DTS Neural Loudness Ctrl 4
MultiMerge, Loudness Control	Two loudness control functions	■ One for the 5.1 output (Ch 1-6): DTS Neural Loudness Ctrl 1 ■ One for the 2.0 output (Ch 7 & 8): DTS Neural Loudness Ctrl 2
Upmix, Loudness Control	One loudness control function for the 2.0 inputs to Upmix	DTS Neural Loudness Ctrl 1
Downmix, Loudness Control	One loudness control function for the 2.0 outputs from Downmix	DTS Neural Loudness Ctrl 1
Loudness Control 5.1 + 2.0	Two loudness control functions	■ One for the 5.1 outputs (Ch 1-6): DTS Neural Loudness Ctrl 1 ■ One for the 2.0 outputs (Ch 7 & 8): DTS Neural Loudness Ctrl 2
Loudness Control 2x1.0	Two loudness control functions	■ One for the first output (Ch 1): DTS Neural Loudness Ctrl 1 ■ One for the second output (Ch 2): DTS Neural Loudness Ctrl 2
Loudness Control + DD Encode 5.1	One loudness control for the 5.1 inputs to the DD encoder	DTS Neural Loudness Ctrl 1
Loudness Control + DE Encode 5.1+2.0	Two loudness control functions	■ One for the 5.1 inputs to the DE encoder (Ch 1-6): DTS Neural Loudness Ctrl 1 ■ One for the 2.0 inputs to the DE encoder (Ch 7 & 8): DTS Neural Loudness Ctrl 2
Loudness Control + DE Encode 4x2.0	Four loudness control functions	■ One for Ch 1 & 2 input to the DE encoder: DTS Neural Loudness Ctrl 1 ■ One for Ch 3 & 4 input to the DE encoder: DTS Neural Loudness Ctrl 2 ■ One for Ch 5 & 6 input to the DE encoder: DTS Neural Loudness Ctrl 3 ■ One for Ch 7 & 8 input to the DE encoder: DTS Neural Loudness Ctrl 4

Loudness Control Parameters

Table 4-11 DTS Neural Audio Loudness Control Parameters

Parameter Name	Function	Options
Loudness Control Function	Enables the Loudness Control feature	■ **Enable** ■ Disable
Loudness Control Status	Indicates the state of the AAP mode	■ **Uninitialized** ■ Running ■ Not Running (bypassed) ■ Not Running
Target Loudness Level	Specifies the loudness level that will be targeted	-40 dBEq to 0 dBEq (**-27 dBEq**)
LC Ratio	Controls the amount of gain or attenuation that is applied when loudness differences are measured	0% to 100% (**90%**)
Upper Threshold	Specifies the highest measured loudness of the input that will be permitted before attenuation is applied	**0 dB** to 20 dB
Lower Threshold	Specifies the lowest measured loudness of the input that will be permitted before gain is applied	-20 dB to **0 dB**
Freeze Window	Specifies the size of a window in which small loudness differences are allowed without the need to change gain or attenuation	0.0 dB to 10.0 dB (**1.0 dB**)
Quiet Threshold	Controls the noise floor level	-80 dBEq to -20 dBEq (**-50 dBEq**)
Attack Time	Controls how quickly the processing will respond to sharp increases in loudness	5 ms to 150 ms (**20 ms**)
Release Time	Controls how quickly the processing will respond to sharp decreases in loudness	20 ms to 500 ms (**120 ms**)
Compressor Threshold	Controls the amount of attenuation applied when short-term peaks exceed the compressor threshold	0 dB to 16 dB (**5 dB**)
Compressor Ratio	Controls the amount of attenuation applied when short-term peaks exceed the compressor threshold	0% to 100% (**40%**)
Loudness Shaping	Specifies the amount of loudness shaping desired	0.0 to 1.0 (**0.5**)
Final Limiter Ceiling	Specifies the threshold above which final limiting will be applied	-20 dBFS to 0 dBFS (**0 dBFS**)
Metering	Activates the real-time meter.	■ **Off** ■ On
Current Input Loudness [RO]	Reports the smoothed input loudness measurement	-60 dBEq to 20 dBEq (**0 dBEq**)
Current Input Peak [RO]	Reports the input peak measurement	-60 dBFS to 20 dBFS (**0 dBFS**)
Current Output Loudness [RO]	Reports the smoothed output loudness measurement	-60 dBEq to 20 dBEq (**0 dBEq**)
Current Output Peak [RO]	Reports the output peak measurement	-60 dBFS to 20 dBFS (**0 dBFS**)
Current Correction [RO]	Reports the amount of correction being applied	-60 dB to 60 dB (**0 dB**)
Current Compression [RO]	Reports the amount of compression being applied	-60 dB to 60 dB (**0 dB**)

5 Specifications

Video Input

3G/HD/SD-SDI

Table 5-1 3G/HD/SD-SDI Input Video Specifications

Item	Specification
Number of inputs	2
Standard	■ 3G: SMPTE 424M (2.97, 2.97/1.001 Gb/s), SMPTE 425 Level A, Level B-DL (YCrCb, 4:2:2, 10-bit with 16 channels of embedded audio) ■ HD: SMPTE 292M (1.485, 1.485/1.001 Gb/s) ■ SD: SMPTE 259M-C (270 Mb/s, 525/625 component video)
Connector	BNC (IEC169-8)
Impedance	75Ω
Return loss	■ >10 dB, typical, from 5 MHz to 2970 MHz ■ >15 dB, typical, from 5 MHz to 1485 MHz ■ >20 dB, typical, from 5 MHz to 270 MHz
Equalization	Hardware Revision 1* ■ 3G: Adaptive cable equalization for up to 164 ft (50 m), typical, of Belden 1694A co-axial cable ■ HD: Adaptive cable equalization for up to 492 ft (150 m) typical, of Belden 1694A co-axial cable ■ SD: >23 dB Belden 8281 co-axial cable Hardware Revision 2* ■ 3G: Adaptive cable equalization for up to 393 ft (120 m), typical, of Belden 1694A co-axial cable ■ HD: Adaptive cable equalization for up to 656 ft (200 m) typical, of Belden 1694A co-axial cable ■ SD: >23 dB Belden 8281 co-axial cable * See **System Setup > Version > Hardware Revision t**o obtain the information about your model

Fiber

Table 5-2 Fiber Input Specifications

Item	Minimum	Typical	Maximum	Note
OP+SFP+TR13P Single-Mode Transceiver Module				
Number of LC connector inputs	-	-	1	
Input wavelength	1260 nm	-	1620 nm	
Optical power monitor accuracy	-2 dB	0	2 dB	
Sensitivity at 270 Mb/s (SMPTE 259M)	-	-22 dBm	-20 dBm	Pathological
Sensitivity at 1.5 Gb/s (SMPTE 292M)	-	-22 dBm	-19 dBm	Pathological
Sensitivity at 3 Gb/s (SMPTE 424M)	-	-19 dBm	-18 dBm	Pathological
Overload	0 dBm	-	-	BER = 1E-12 against SDI matrix check field signals for video applications. BER = 1E-12 against PRBS 223-1 for datacom applications.
OP+SFP+TR27P to OP+SFP+TR61P Single-Mode Transceiver Modules				
Number of LC connector inputs	-	-	1	
Input wavelengths (18 Wavelengths from 1270 nm to 1610 nm, each step 20 nm)	1264.5	1270	1277.5	
	1284.5	1290	1297.5	
	1304.5	1310	1317.5	
	1324.5	1330	1337.5	
	1344.5	1350	1357.5	
	1364.5	1370	1377.5	
	1384.5	1390	1397.5	
	1404.5	1410	1417.5	
	1424.5	1430	1437.5	
	1444.5	1450	1457.5	
	1464.5	1470	1477.5	
	1484.5	1490	1497.5	
	1504.5	1510	1517.5	
	1524.5	1530	1537.5	
	1544.5	1550	1557.5	
	1564.5	1570	1577.5	
	1584.5	1590	1597.5	
	1604.5	1610	1617.5	

Table 5-2 Fiber Input Specifications *(Continued)*

Item	Minimum	Typical	Maximum	Note
Receiver sensitivity at 270 Mb/s (SMPTE 259M)	-	-20 dBm	--	Pathological; PRBS 223-1, BER=1E-12 sensitivity:-21 dBm
Receiver sensitivity at 1.5 Gb/s (SMPTE 292M)	0	--	-20 dBm	Pathological
			-21 dBm	PRBS 223-1, BER=1E-12
Receiver sensitivity at 3 Gb/s (SMPTE 424M)	0	--	-18 dBm	Pathological
			-20 dBm	PRBS 223-1, BER=1E-12
Receiver optical rise time/fall time (20% to 80%, unfiltered)	--	--	1.5 ns	SMPTE 259M
	--	--	800 ps	SMPTE 344M
	--	--	270 ps	SMPTE 292M
	--	--	135 ps	SMPTE 424M

Composite Video

Table 5-3 Composite Video Input Specifications

Item	Specification
Standard	■ NTSC (SMPTE 170M) ■ PAL-B (ITU 624-2) ■ PAL-M
Connector	BNC (IEC 169-8)
Processing	12-bit adaptive 3D comb filter color decoder
Input level	1.0 V pk-to-pk
Impedance	75Ω
Return loss	>40 dB, 0.1 MHz to 6 MHz
Common mode range	5.0 V
CMRR	60 dB @ 50/60 Hz, 5 V pk-to-pk

S-Video

Table 5-4 S-Video Input Specifications

Item	Specification
Standard	■ NTSC ■ PAL-B ■ PAL-M
Connector	4-pin DIN

Component Video

Table 5-5 Component Video Input Specifications

Item	Specification
Format	Betacam/SMPTE
Connector	BNC (IEC 169-8)
Input level	1.0 V pk-to-pk
Impedance	75Ω
Return loss	>40 dB, 1 kHz to 6 MHz

Genlock

Table 5-6 Genlock Input Specifications

Item	Specification
Connector	BNC (IEC169-8)
Impedance	75Ω
Return loss	■ >40 dB (typical) to 6 MHz ■ >35 dB (typical) to 30 MHz
Common mode range	5.5 V pk-to-pk
CMRR	60 dB @ 60Hz, 5 V pk-to-pk
Input level	■ 1 V pk-to-pk, -5.0 dB to +6.0 dB for NTSC/PAL-B ■ ±300 mV, -3.5 dB to +6.0 dB for Tri-Level Sync: ■ 1080i: 59.94/50 ■ 1080p: 29.97/25
Signal type	■ NTSC/PAL-B Analog Composite ■ ±300 mV Tri-Level Sync
Standard	■ SMPTE 170M (NTSC) ■ ITU-R BT.470-6 (PAL-B) ■ SMPTE 274M (1080i, 1080p)

Video Output

3G/HD/SD-SDI

Table 5-7 3G/HD/SD-SDI Output Video Specifications

Item	Specification
Number of outputs	2
Standard	■ 3G: SMPTE 424M (2.97, 2.97/1.001 Gb/s), SMPTE 425 Level A, Level B-DL (YCrCb, 4:2:2, 10-bit with 16 channels of embedded audio) ■ HD: SMPTE 292M (1.485, 1.485/1.001 Gb/s) ■ SD: SMPTE 259M-C (270 Mb/s, 525/625 component video)
Connector	BNC (IEC169-8)
Impedance	75Ω
Return loss	■ >10 dB, typical, from 5 MHz to 2970 MHz ■ >15 dB, typical, from 5 MHz to 1485 MHz ■ >20 dB, typical, from 5 MHz to 270 MHz
Signal level	800 mV ± 10%
DC offset	0.0V ± 0.5 V
Rise and Fall Time	■ 3G: <135 ps (20% to 80%) ■ HD: <270 ps (20% to 80%) ■ SD: 400 - 1500 ps (20% to 80%)
Overshoot	< 10% of amplitude (all outputs terminated)
Jitter	■ Timing jitter: ■ 3G: <2 UI peak to peak ■ HD: <1 UI peak to peak ■ SD: <0.2 UI peak to peak ■ Alignment jitter: ■ 3G: <0.3 UI peak to peak ■ HD: <0.2 UI peak to peak ■ SD: <0.2 UI peak to peak

Fiber

Table 5-8 Fiber Output Specifications

Item	Minimum	Typical	Maximum	Note
OP+SFP+TR13P Single-Mode Transceiver Module				
Number of LC connector outputs	-	-	1	
Standards	■ 3G: SMPTE 424M ■ HD: SMPTE 292M ■ SD: SMPTE 259M			
Peak wavelength	1280 nm	1310 nm	1340 nm	Measured at 25°C
Spectrum width (RMS)	-	1.5 nm	3 nm	
Average output power	-7 dBm	-	0 dBm	
Optical rise/fall time (3G HD-SDI)	-	105/120 ps	165/180 ps	20% to 80%, are measured following a fourth-order Bessel-Thompson filter with a bandwidth of 0.75 x clock frequency corresponding to the serial data rate.
Extinction ratio	5dB	7 dB	-	
Jitter	-	<110 ps	180 ps	SD-SDI Pathological
	-	<60 ps	100 ps	1.5 G SDI Pathological
	-	<45 ps	70 ps	3G HD-SDI Pathological
Laser safety level	Class 1			
OP+SFP+TR27P to OP+SFP+TR61P Single-Mode Transceiver Modules				
Number of LC connector outputs	-	-	1	
Transmitter output power	0 dBm	--	4 dBm	Output power is power coupled into a 9/125 mm single mode fiber.
Optical link budget	20 dB	--	--	
Transmitter optical rise time/fall time (20% to 80%, unfiltered)	--	--	1.5 ns	SMPTE 259M
	--	--	800 ps	SMPTE 344M
	--	--	270 ps	SMPTE 292M
	--	--	135 ps	SMPTE 424M
Spectrum width (RMS)	-	--	1 nm	-20 dB width
Extinction ratio	5 dB	7.5 dB	--	

HDMI

Table 5-9 HDMI Output Specifications

Item	Specification
Number of outputs	1
Standards	■ 525 ■ 625 ■ 1080i/59.94 ■ 1080i/50 ■ 1080p/23.98 ■ 720p/59.94 ■ 720p/50
Connector	HDMI
Compliance	HDMI 1.3

S-Video

Table 5-10 S-Video Output Specifications

Item	Specification
Standard	■ NTSC ■ PAL-B ■ PAL-M
Connector	4-pin DIN

Composite Video

Table 5-11 Composite Video Output Specifications

Item	Specification
Standard	■ NTSC ■ PAL-B ■ PAL-M
Connector	BNC (IEC 169-8)
Resolution	12 bits
Impedance	75Ω
Return Loss	>40 dB, 0.1 MHz to 6 MHz
Frequency response	-1.6 dB at 6 MHz
DC offset	<0.5 mV
Differential gain	<0.5%
Differential phase	≤1.2° pk-to-pk
Y/C gain	<1°, typical
Y/C delay	■ <10 ns (NTSC) ■ <23.1 ns (PAL)
Transient response	<0.5% K Factor
SNR	63 dB, typical, luma ramp

Component Video

Table 5-12 Component Video Output Specifications

Item	Specification
Format	Betacam/SMPTE
Connector	BNC (IEC 169-8)
Resolution	12 bits
Impedance	75Ω
Return loss	>40 dB, 1 kHz to 6 MHz
Frequency Response	■ -0.5 dB to 5.5 MHz (Y) ■ -3.27 to 3.0 MHz (Pb/Pr)
DC offset	<0.0 ±5 mV
Relative delay	<±10 ns
SNR	63 dB, typical, luma ramp

Audio Input

AES/DARS

Table 5-13 AES/DARS Input Specifications

Item	Unbalanced Specification
Number of inputs	4 x AES, 1 x DARS
Standard	AES3, SMPTE 276M
Type	Unbalanced, AC coupled
Connector	1.0/2.3 DIN
Sensitivity	≥100 mV
Impedance	75Ω
Return loss	>25 dB, 0.1 MHz to 6 MHz
Input sampling rate	32 kHz to 108 kHz
Bits	16, 20, or 24
Channel status and user bit	Maintained, but professional mode, 48 kHz. See page 102 for details.

Analog

Table 5-14 Analog Audio Input Specifications

Item	Specification
Number of inputs	8 mono channels
Type	Balanced
Connector	DB-25, Tascam-style cable snake for balanced 8-channel audio
Input audio level	28 dBu to 12 dBu for 0 dBFs (adjustable in 0.5 dB increments)
Input Impedance	High-Impedance or 600Ω, jumper selectable
CMRR	>80 dB @ 60 Hz, typical

Audio Output

AES

Table 5-15 AES Output Specifications

Item	Unbalanced Specifications
Number of outputs	4
Standard	AES3, SMPTE 276M
Type	Unbalanced, AC coupled
Connector	1.0/2.3 DIN
Signal amplitude	1.0 V pk-to-pk ±10%
Impedance	75Ω
Return loss	>25 dB, 0.1 MHz to 6 MHz
Jitter	<20 ns
DC offset	0.0 ±50 mV
Rise/fall time	30 ns to 44 ns (10% to 90%)
Output sampling rate	48 kHz
Bits	24, 20 or 16
Channel status and user bit	Maintained, but professional mode, 48 kHz. See ***Audio Bit Manipulation*** on page 101 for full details.

Analog

Table 5-16 Analog Audio Output Specifications

Item	Specification
Number of inputs	8 mono channels
Type	Balanced
Connector	DB-25, Tascam-style cable snake for balanced 8-channel audio
Output audio level	28 dBu to 16 dBu (adjustable in 2 dB increments)
Output Impedance	66Ω
Frequency response	0.15 dB, 20 Hz to 20 kHz
THD	≥80 dB, 20 Hz to 20 kHz
SNR	>100 dB typical
Crosstalk	>90 dB, 20 Hz to 20 kHz, typical
Linearity	<1.0 dB (-80 dBu to + 20 dBu), typical

Conversion Capabilities

Please see the separate X50 Conversion Table for this information, located on the Imagine Communications website.

Communications

GPI In/Out

Table 5-17 GPI In/Out Specifications

Item	Specification
Connector	DB-9
Inputs	■ Number: 4 ■ Internally pulled HIGH (+5V) ■ External: Contact closure to ground to trigger
Outputs	■ Number: 4 ■ TTL-compatible ■ 75Ω ■ Sink and source 64 mA (low), -32 mA (high)

RS-422

Table 5-18 RS-422 Specifications

Item	Specification
Standard	RS-422
Connector	DB-9

LAN

Table 5-19 LAN Specifications

Item	Specification
Connector	RJ-45
Type	10/100 Ethernet

Temperature

The X50 requires an ambient temperature of 41º to 95º F (5º to 35º C) with a relative humidity of 10-90% (non condensing).

Power Consumption

The X50 operates at 100-240 VAC, 47-63 Hz, 75 W.

Dimensions and Weight

Table 5-20 Dimension and Weight Specifications

Item	Specification
Weight	8.45 lb. (3.83 kg), excluding rack and cable supports
Height	1.72 in. (4.37 cm)
Width	17.47 in. (44.4 cm); 17.60 in. (44.7 cm) with rear supports
Depth	21.25 in. (54.0 cm)

A Laser Safety Guidelines

Laser Safety

WARNING

Use of controls, adjustments, and procedures other than those specified in this document may result in hazardous laser radiation exposure.

Optical fiber telecommunication systems use semiconductor laser transmitters that emit infrared light that is normally not visible to the human eye. Although a conventional laser produces a small beam of light, the power density is very high, and it can cause damage to your eyes.

If a beam of laser light enters the eye, the eye magnifies and focuses the energy on the retina. The energy that reaches the retina can be as much as 100,000 times more than at the cornea and, as a result, it can burn the retina.

Laser transmission products are classified in four major groups (Class 1, 2, 3, and 4), according to their emissions and potential for causing injury. Fiber optic transmitter modules in this series are designated Class 1.

Precautions for Enclosed Systems

In its normal operating mode, an optical fiber communication system is totally enclosed and presents no risk of eye injury. However, if the fiber optic cables that interconnect various components of an optical fiber disconnect or break, you may be exposed to laser emissions. Also, technicians may be exposed to laser emissions during installation and servicing.

Unlike some other laser designs, semiconductor lasers have a highly divergent beam that decreases rapidly with distance. The greater the distance, the less energy will enter the eye, and the less potential risk for eye injury.

WARNING

Eye damage may occur if an optical instrument such as a microscope, magnifying glass, or eye loupe is used to stare at the energized fiber end.

Under normal operating conditions, optical fiber telecommunication systems are completely enclosed; nonetheless, observe the following precautions:

1 Do not stare into optical connectors or broken fibers.
2 Ensure technicians have satisfactorily completed an approved training course before performing installation or maintenance.
3 Ensure there are appropriate warning labels near the optical ports of the modules.

Precautions for Unenclosed Systems

During service, maintenance, or restoration, an optical fiber telecommunication system is considered unenclosed. Under these conditions, follow these practices:

CAUTION

Only authorized, trained personnel shall be permitted to do service, maintenance, and restoration.

1 Avoid exposing the eye to emissions from unterminated, energized optical connectors at close distances.
2 Ensure that only authorized, trained personnel use optical test equipment during installation or servicing.
3 Turn off all laser sources before scanning a fiber with an optical test set.
4 Keep all unauthorized personnel away from the immediate area of the optical fiber systems during installation and service.

For guidance on the safe use of optical fiber communication systems in the workplace, consult *ANSI Z136.2, American National Standard for Safe Use of Lasers* in the U.S. or outside the U.S., *IEC-60825, Part 2*.

Label

The label shown is applicable to Class 1 laser products.

Figure A-1 Label for Class 1 Laser Products

B Audio Bit Manipulation

Overview

This appendix contains information on the manipulation of bits that occur when using X50 modules.

RX Key: N = not recognized, Y = recognized, S = recognized and stored or passed through or both

TX Key: N = not transmitted, Y = transmitted

Channel Status Bits

Table B-1 C-Bit Manipulation

Byte	Bit	Function	RX	TX	Remarks
0	0	[0] Consumer use [1] Professional use	N Y	N Y	Set to [1]
0	1	[0] Normal audio mode (linear PCM) [1] Non-audio (non-PCM)	S S	Y Y	Passed unmodified
0	2 to 4	[000] Not indicated [100] No emphasis [110] 50/15 µs [111] CCITT J.17	S S S S	Y Y Y Y	Passed unmodified
0	5	[0] Locked [1] Unlocked	N N	Y N	Set to [0]
0	6 to 7	[00] Not indicated [01] 48 kHz [10] 44.1 kHz [11] 32 kHz	Y Y Y Y	N Y N N	Set to [01]
1	0 to 3	[0000] Not indicated [0001] Two channel [0010] Mono [0011] Prim/sec [0100] Stereo [0101] to [1111] Undefined	N N N N N N	Y N N N N N	Set to [0]
1	4 to 7	[0000] Not indicated [0001] 192 bit block [0010] AES18 (HDLC) [0011] User defined [0100] to [1111] Undefined	N N N N N	Y Y Y Y Y	Set to [0]
2	0 to 2	[000] Not indicated [001] Audio data [010] Co-ordination signal [011] to [111] Undefined	N N N N	N Y N N	Set to [001] for 24-bit or 20-bit output bit width settings; and [000] for 16-bit output bit width setting
2	3 to 5	[000] Not indicated [001] Max length - 1 [010] Max length - 2 [011] Max length - 3 [100] Max length - 4 [101] Max length [110] to [111] Undefined	N N N N N N N	N N N N N Y N	Set to [101] for 24-bit output bit width setting; [100] for 20-bit or 16-bit output bit width settings
2	6 to 7	Reserved	N	Y	Set to [0]
3	0 to 7	Reserved	N	Y	Set to [0]
4	0 to 1	[00] Not a reference [01] Grade 1 reference [10] Grade 2 reference [11] Undefined	N N N N	Y N N N	Set to [0]
4	2	Reserved	N	Y	Set to [0]

Table B-1 C-Bit Manipulation *(Continued)*

Byte	Bit	Function	RX	TX	Remarks
4	3 to 6	[0000] Not indicated [1000] 24 kHz [0100] 96 kHz [1100] 192 kHz [1100] 22.05 kHz [0101] 88.2 kHz [1101] 176.4 kHz [1111] User defined	N N N N N N N N	Y N N N N N N N	Set to [0000]
4	7	[0] Sample frequency not scaled [1] Sample frequency scaled by 1/ 1.001	N N	Y N	Set to [0]
5	0 to 7	Reserved	N	Y	Set to [0]
6 to 9	0 to 7	Alphanumeric channel origin data	S	Y	Passed unmodified
10 to 13	0 to 7	Alphanumeric channel destination data	S	Y	Passed unmodified
14 to 17	0 to 7	Local sample address code	S	Y	Passed unmodified
18 to 21	0 to 7	Time-of-day sample address code	S	Y	Passed unmodified
22	0 to 3	Reserved	N	Y	Set to 0
22	4	Bytes 0 to 5 reliability flag	S	Y	Passed unmodified
22	5	Bytes 6 to 13 reliability flag	S	Y	Passed unmodified
22	6	Bytes 14 to 17 reliability flag	S	Y	Passed unmodified
22	7	Bytes 18 to 21 reliability flag	S	Y	Passed unmodified
23	0 to 7	CRC	Y	Y	Calculated on output

Validity and User Bits

Table B-2 V-Bit and U-Bit Manipulation

Bit Manipulation	RX	TX	Remarks
Validity (V) bit	S	Y	Passed unmodified
User (U) bit	S	Y	Passed unmodified

Miscellaneous Data

Table B-3 Miscellaneous Data

Item	RX Specification	TX Specification
Audio sampling frequency	32 to 48 kHz	48 kHz
Audio sampling word length	16 to 24 bits	24 bits

C Servicing

Overview

User-serviceable replacement parts are available for the following X50 components:

- X50OPT-ADVAUD audio submodule for Dolby and DTS Neural options
- X50SPR-DISP front panel PCB assembly (includes OLED display, shaft encoder, and circuit board)
- X50SPR-FAN fan module
- X50SPR-PSU power supply
- X50SPR-SE shaft encoder and knob
- 142-100017Q00 nylon shoulder washer
- Rack ears and rear support mounting parts (See page 7 for details, including installation)

There are two types of X50 cover assemblies, depending upon the date of manufacture. Each requires a different removal procedure. **Table C-1** shows the different servicing procedure required in each case.

Table C-1 Servicing Options

X50 Version	Service Requirement					
	Addition of Audio Submodule	**Failed LCD/ OLED Display**	**Failed Fan**	**Failed Power Supply**	**Failed/ Broken Shaft Encoder**	**Preventing a Broken Shaft Encoder**
Version 1 (Integrated front/top panel, green LCD, large shaft encoder hole)	Install new audio submodule on main board	Install refurbished X50	**Option 1**: Install new fan **Option 2:** Install refurbished X50	**Option 1:** Install new power supply **Option 2:** Install refurbished X50	**Option 1:** Install new shaft encoder **Option 2:** Install refurbished X50	Install shaft shoulder washer, (available directly from our Customer Service department)
Version 2 (separate front panel and lid, green LCD, small shaft encoder hole)	Install new audio submodule on main board	Install refurbished X50	Install new fan	Install new power supply	Install new shaft encoder	No service required
Version 3 (Separate front panel and lid, blue OLED, small shaft encoder hole)	Install new audio submodule on main board	Install new front panel assembly	Install new fan	Install new power supply	**Option 1:** Install new shaft encoder **Option 2:** Install new blue OLED PCB assembly	No service required

Cover Removal and Replacement

Version 1

The Version 1 unit includes a combined front cover/frame lid. Follow these steps to remove and replace the Version 1 front cover and lid:

1 Disconnect both AC power cords.

WARNING: You can receive an electric shock from exposed parts of the power supplies. Ensure that you remove AC power from both power supplies before you open the cover.

2 Remove 15 screws from the one-piece front panel/lid (12 on the top; 3 on the bottom).

3 Pull the scrolling knob straight off its shaft and then carefully slide the lid off the unit.

CAUTION! Do not tilt the front cover/lid as you remove it. This may damage circuit board components.

4 After you have completed servicing, replace the cover.

Approach the unit with the cover at a 10° angle, slide the front over the encoder shaft, and then, with the corner angle past the mounting ear, gently lower the lid and slide it into position.

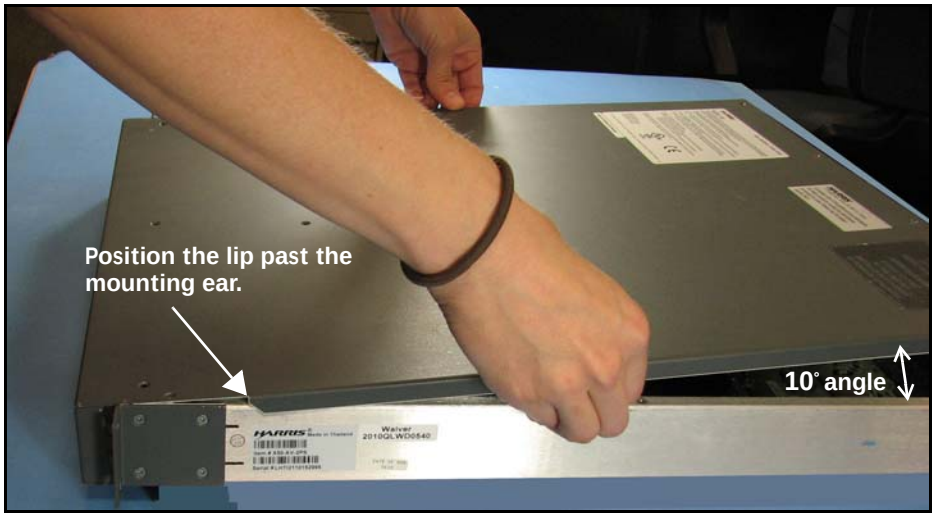


Figure C-1. Replacing the Cover

5 Gently re-insert the flexible LED tubes.

Use a pin to help re-insert the light tubes back into their slots. (See **Figure C-2** on page 107.) Do *not* attempt to adjust the LEDs located on the left side of the control panel (these are fixed circuit board LEDs).

Version 2 and 3

Versions 2 and 3 feature a separate front cover and lid. Follow these steps:

1 Disconnect both AC power cords.

WARNING: You can receive an electric shock from exposed parts of the power supplies. Ensure that you remove AC power from both power supplies before you open the cover.

2 Remove the 9 screws from the X50 lid.

3 Lift the cover straight up and off the frame.

The power supplies are now accessible for servicing. For other replacement parts, continue with the following steps.

4 Remove the 9 screws from the top and bottom of the dark grey front cover (do not remove screws from the side mounting ears).

5 Pull the scrolling knob straight off its shaft and then carefully slide the front cover off the unit.

CAUTION! Do not tilt the frame as you remove the cover. Damage may occur.

6 After you have completed servicing the unit, reverse steps 1 to 5.

As you replace the front cover, take care to gently re-insert the flexible LED tubes.

Use a pin to help re-insert the light tubes back into their slots. Do not attempt to adjust the LEDs located on the left side of the control panel (these are fixed circuit board LEDs).

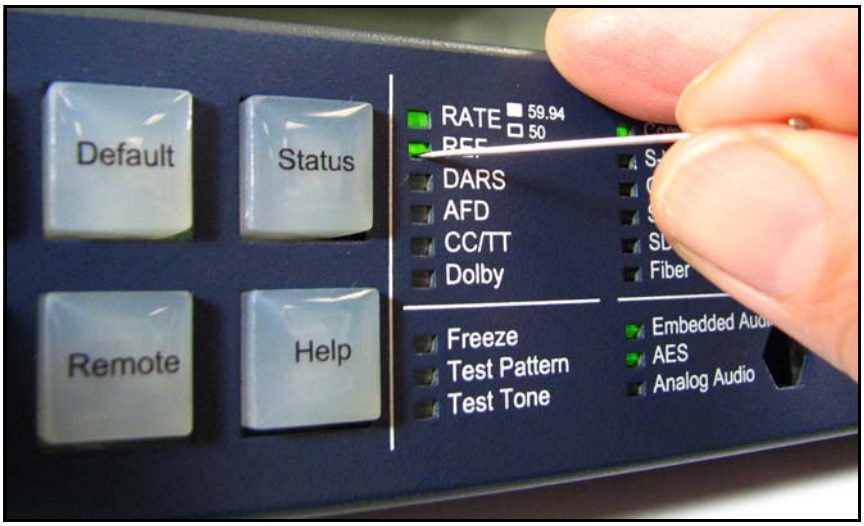


Figure C-2. Re-Aligning Flexible Light Tubes

Installation of Advanced Audio Processing Submodule

To use advanced audio processing in the X50, you must install an X50OPT-ADVAUD audio submodule and purchase the appropriate software license keys. The audio submodule kit includes the submodule board, two short screws, one longer screw, and one standoff. The procedure for both versions of the X50 is the same.

Follow these steps to install the audio submodule:

1. Remove the X50 cover, as described on page 106, ensuring *both* power supplies are disconnected.
2. Remove the main board mounting screw located behind the left power supply, as shown in **Figure C-3**.

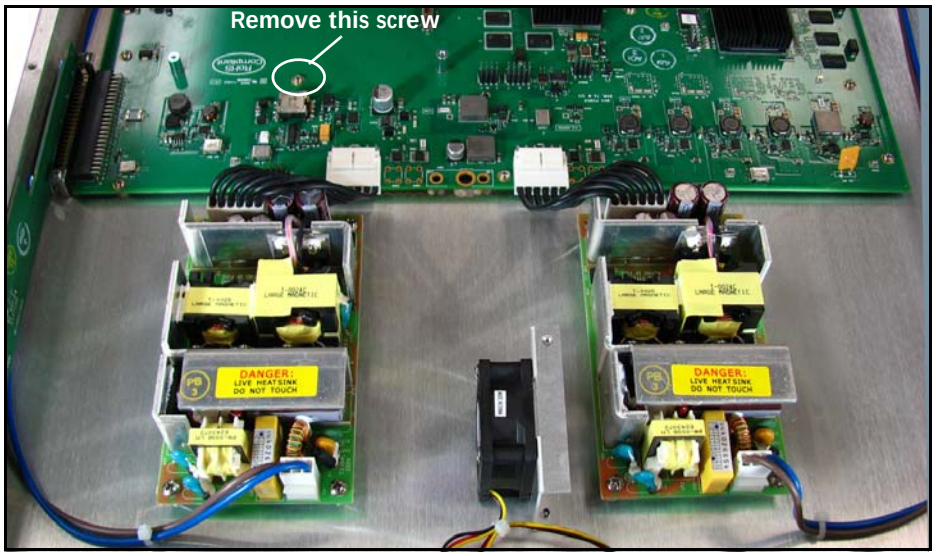


Figure C-3. Removal of Mounting Screw

3. Position and align the audio submodule over the standoffs, then gently press it into place.
   The audio submodule will lock into place as it is inserted into its connector.

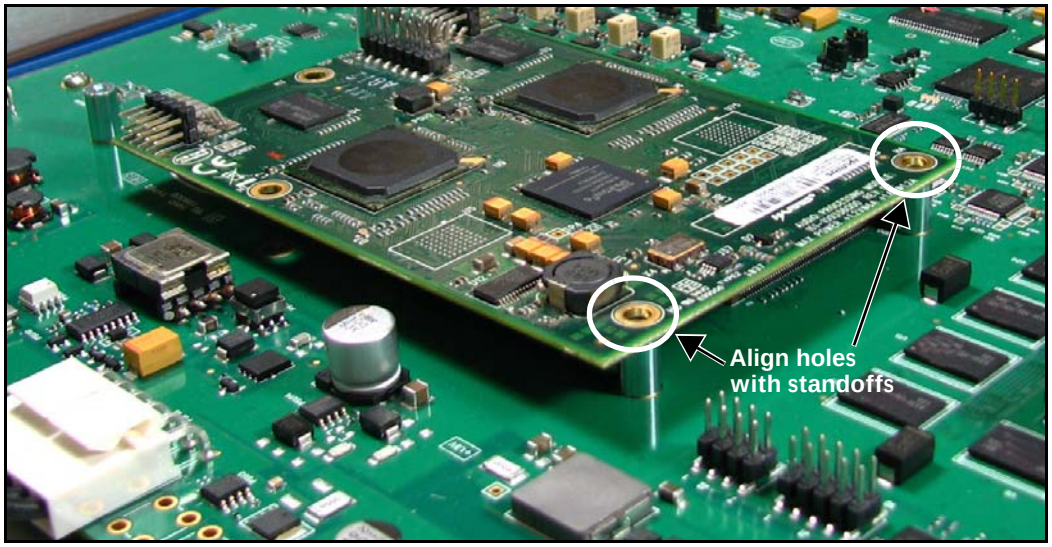


Figure C-4. Aligning with Standoffs

4 Insert a short screw into one of the standoffs, but do not tighten.

5 Remove the loose standoff supplied in the package and slide it under the audio submodule, above the hole where you removed the main board screw.

Note: *This standoff is not threaded.*

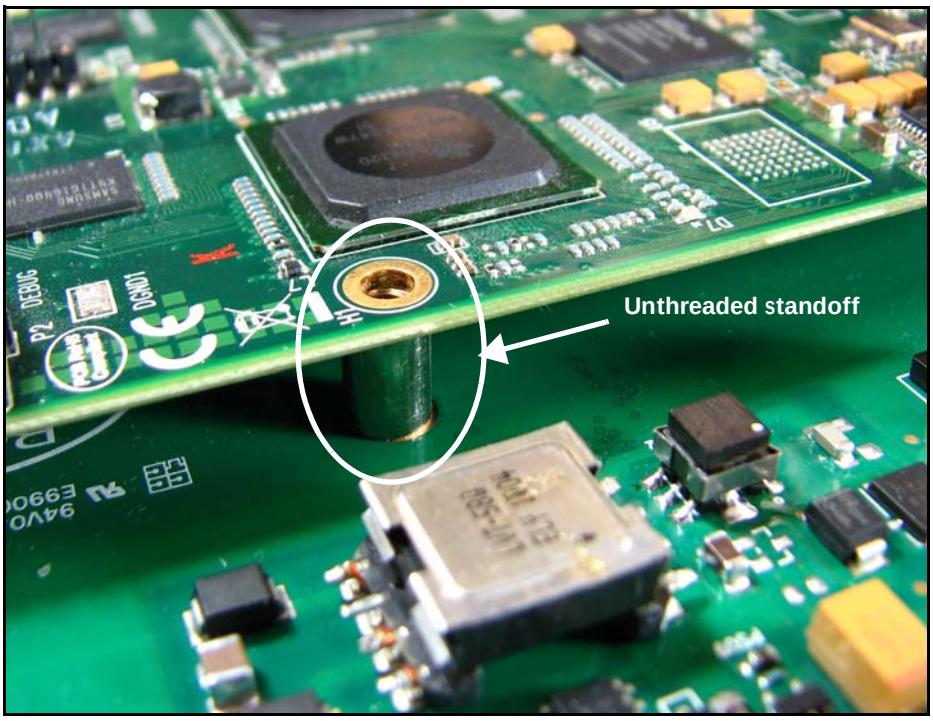


Figure C-5. Inserting Third Standoff

6 Insert the longer screw into this hole and lightly tighten.

7 Insert and tighten the final screw into the remaining standoff.

8 Lightly tighten the other two screws.

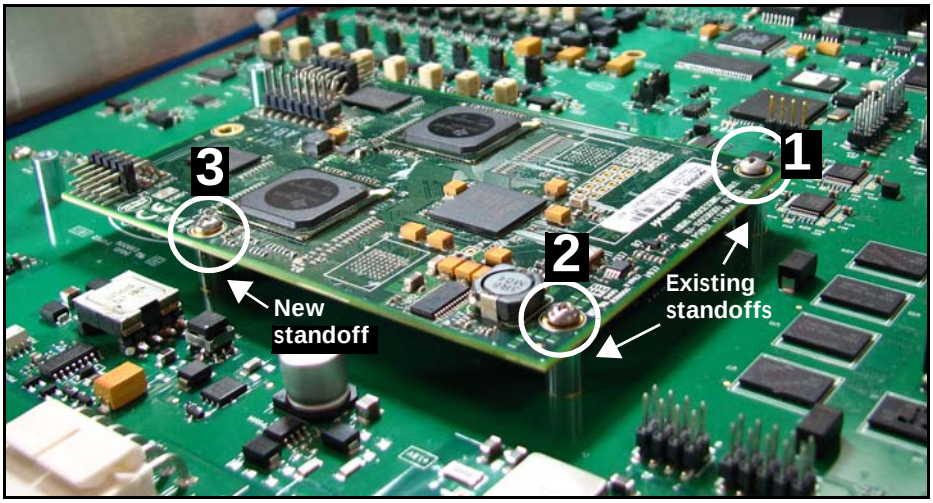


Figure C-6. Three Mounting Screws

9 Replace the cover as described earlier, and then re-attach the two power cords.

LCD or OLED Display Replacement

The LCD displays found on Version 1 and 2 units are not serviceable. All version 3 models are serviceable, using a blue OLED. For identification: measured diagonally, the Version 1 and Version 2 LCD screens are larger, at 3.5 inches (9.1 cm); Version 3 OLED screens are 3 inches diagonally (7.5 cm).

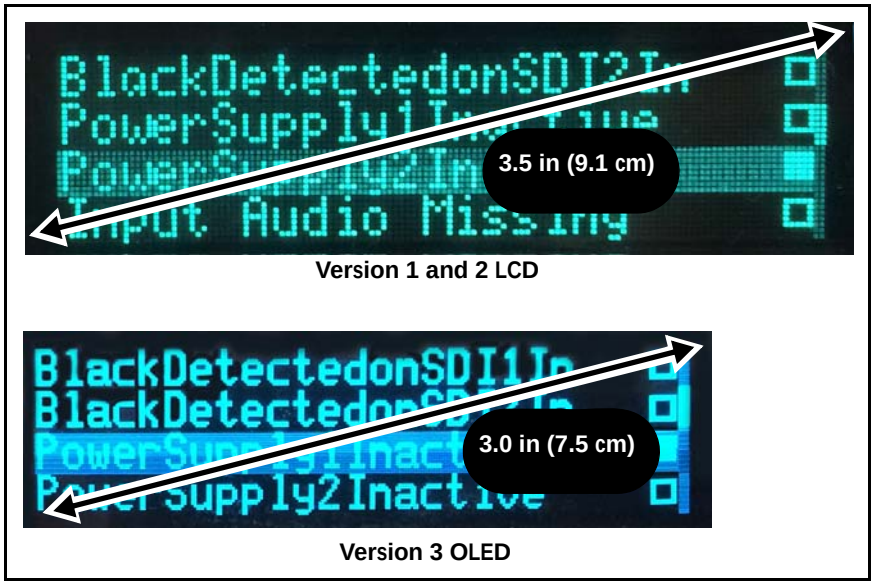


Figure C-7. Comparison of LCD and OLED Screens

Follow these steps to remove and replace an LCD or OLED display:

1. Remove the X50 cover, as described on page 106, ensuring *both* power supplies are disconnected
2. Remove the fan power supply connectors located behind the circuit board.

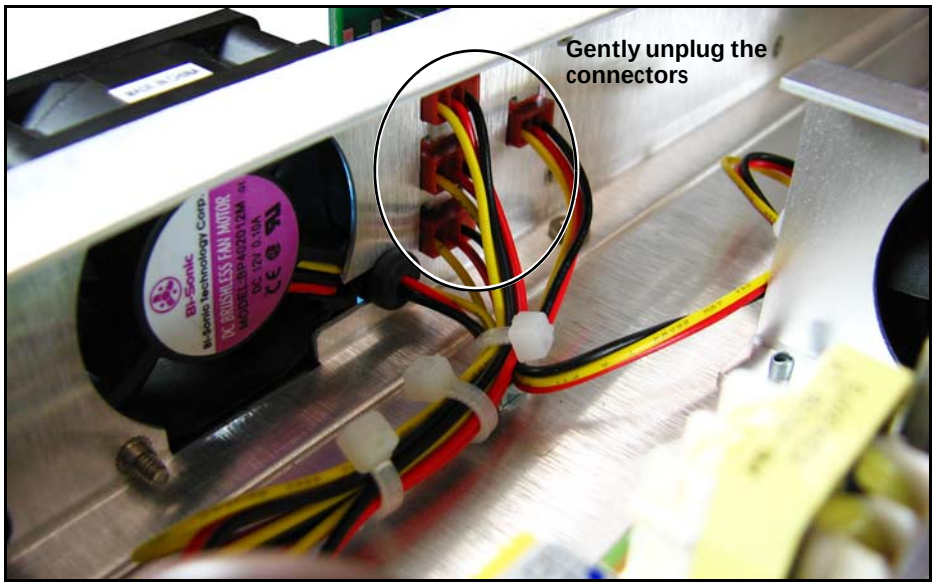


Figure C-8. Removing Connectors Behind Circuit Board

3 Remove the six circuit board mounting screws (**Figure C-9**).

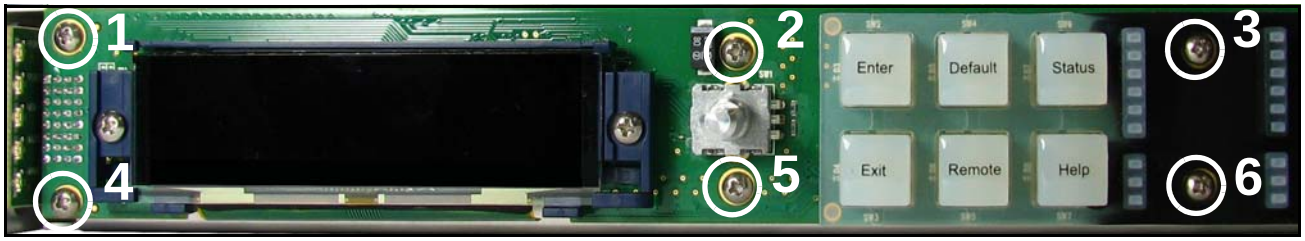


Figure C-9 Removal of the Mounting Screws

4 Gently pull the circuit board away from the face of the X50, and discard.

5 Align the new circuit board assembly, and gently press it into place, taking care not to bend the pins on the left side.

6 Install the six mounting screws supplied, and then re-attach the four fan power supply connectors

7 Replace the cover as described earlier, and then re-attach the two power cords.

Fan Module Replacement

The front fan modules are individually mounted and connected. An additional fan is located next to the right power supply.

Follow these steps to remove and replace a fan:

1. Remove the X50 cover, as described on page 106, ensuring *both* power supplies are disconnected
2. Snip and remove the plastic ties wraps holding the fan wires.

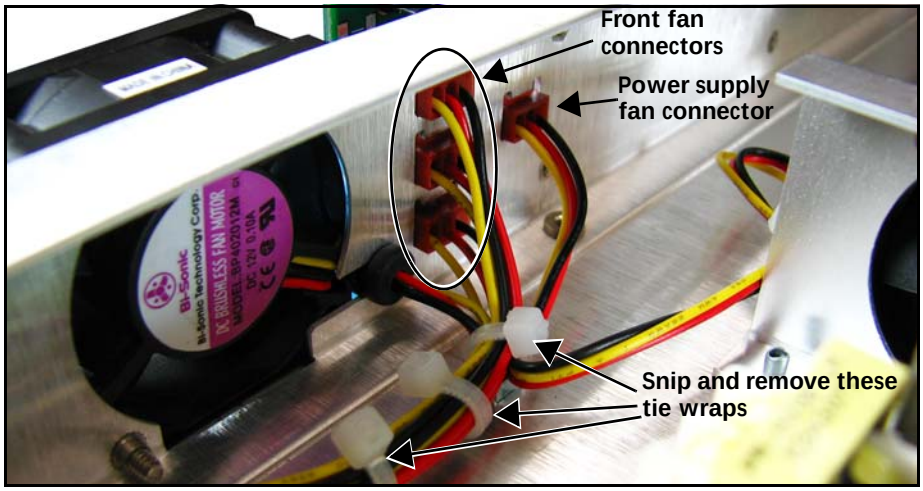


Figure C-10. Fan Wires

3. Carefully unplug the power connector for the failed fan.
4. Remove the two mounting screws for the failed fan, and then remove the fan.
5. Attach the new fan using the screws provided.
6. Attach the connector to the circuit board.
7. Carefully bundle and re-wrap the wires through the metal holders, ensuring that no wires contact the blades of the fans.
8. Replace the cover as described earlier, and then re-attach the two power cords.

Power Supply Replacement

Follow these steps to remove and replace a power supply:

1. Remove the X50 cover, as described on page 106 or page 107,ensuring *both* power supplies are disconnected.
2. Remove the input and output conductors of the failed power supply by pulling the connector and pressing the clip down.

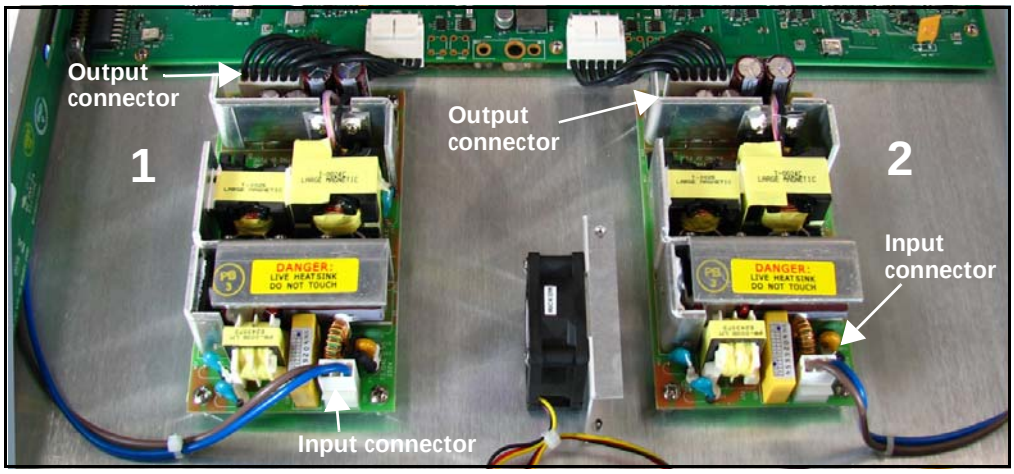


Figure C-11. Power Supply Removal

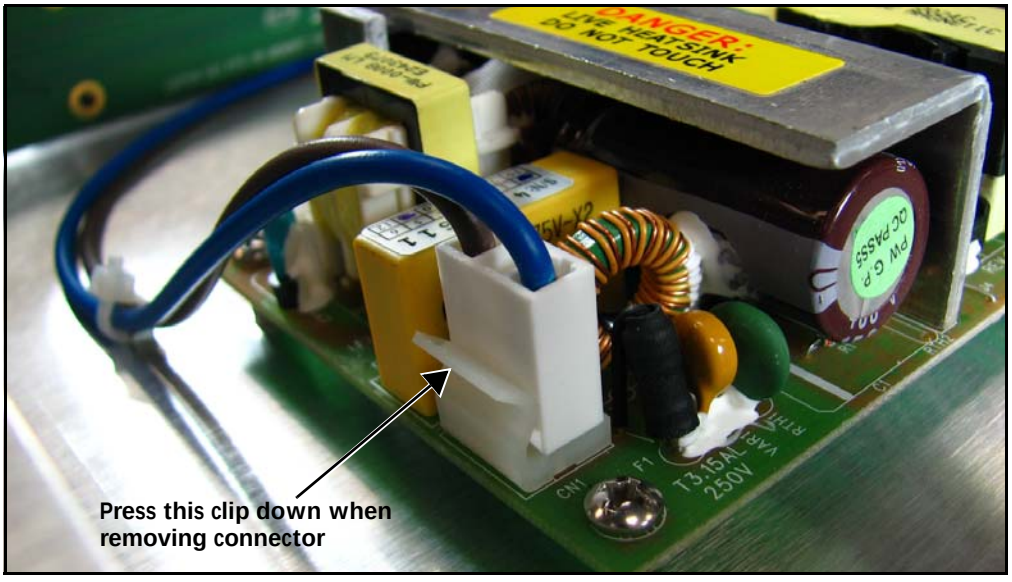


Figure C-12. Power Supply Connector

3. Remove the four power supply mounting screws, and the power supply unit.
4. Install the new power supply using the screws provided, and re-attach the connectors.
5. Replace the cover as described earlier, and then re-attach the two power cords.

Shaft Encoder Replacement

There are two possible replacement parts for a broken shaft encoder: a simple shaft encoder (X50SPR-SE) that must be soldered to the front circuit board, or a complete circuit board unit (X50SPR-DISP).

To replace a complete circuit board unit because of a broken shaft encoder, see ***LCD or OLED Display Replacement*** on page 110. To replace a broken shaft encoder separately, follow these steps:

1 Disconnect *both* power cords and remove the cover as described on page 106.

1 Remove the four electrical connectors located behind the circuit board.

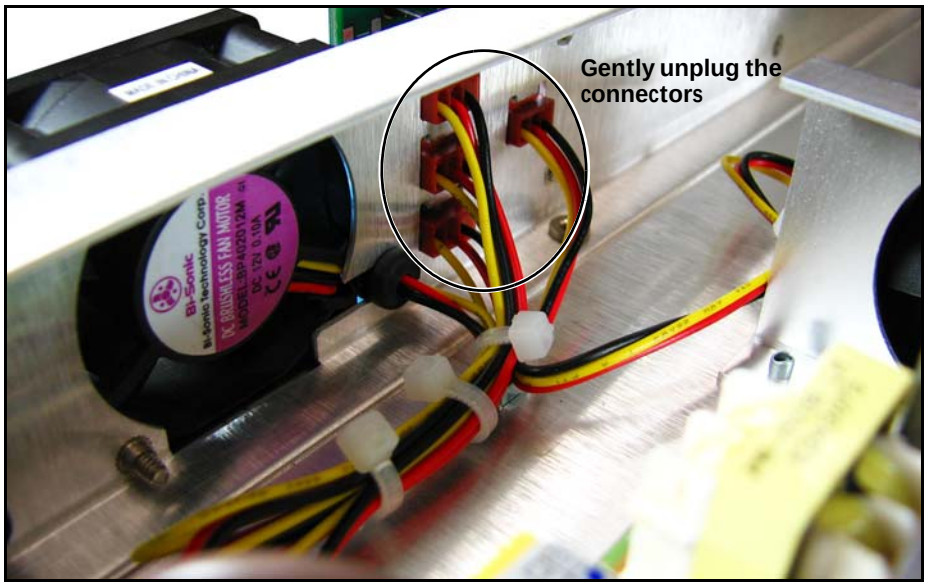


Figure C-13. Removing Connectors Behind Circuit Board

2 Remove the six circuit board mounting screws (**Figure C-14**).

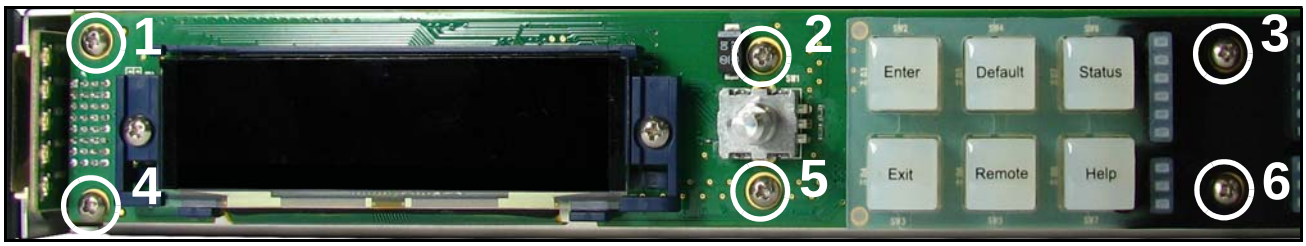


Figure C-14 Mounting Screws for Front Display Board

3 Gently pull the circuit board away from the face of the X50, taking care not to bend the memory board conductors on the left side.

4 From the back side of the circuit board, de-solder the two mounting hole pegs and the five through-hole pegs, using a solder sucker and wick (**Figure C-15**).

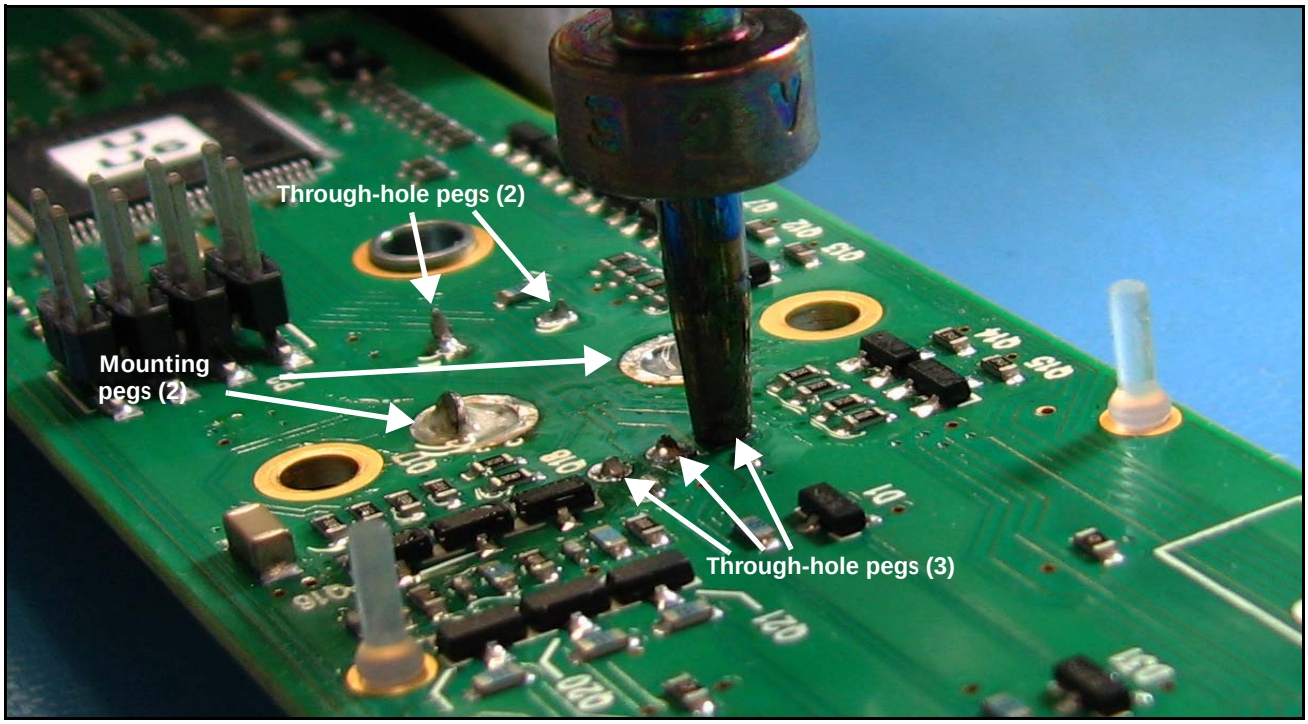


Figure C-15 De-soldering Encoder Pegs

5 From the front of the board, remove any remaining solder.

CAUTION! The traces on the board are fragile and may break if the connections are not totally clear. Ensure all solder is gone before you remove the shaft encoder from the board.

6 Remove the damaged shaft encoder.

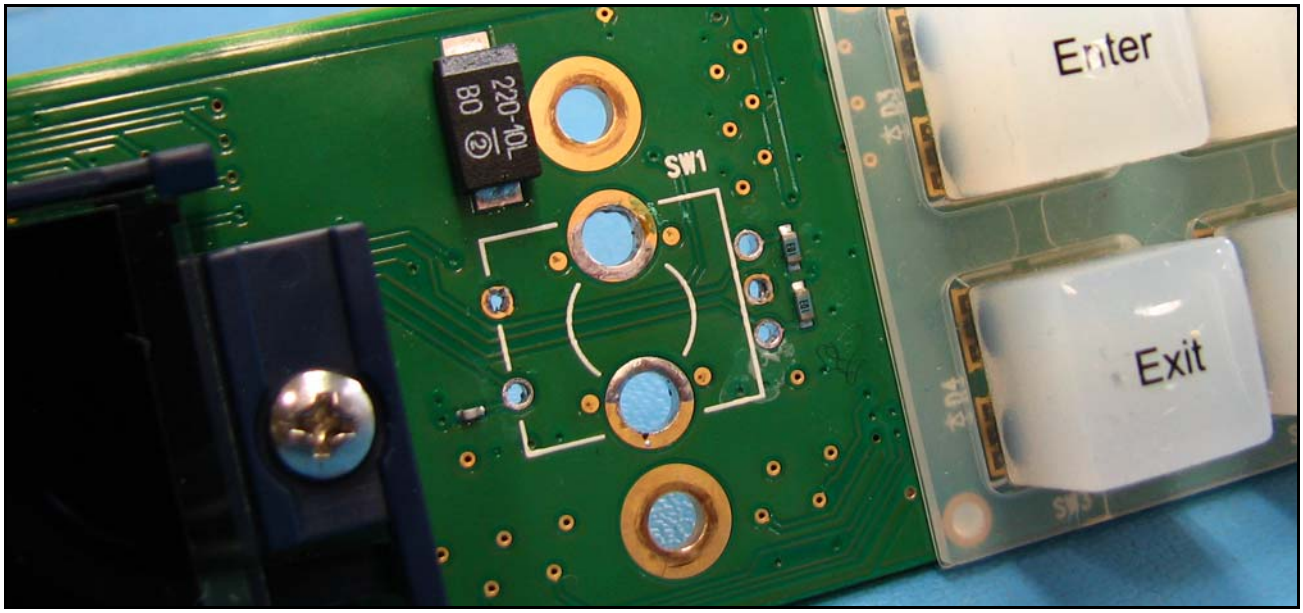


Figure C-16 Shaft Encoder Removed

7 Insert the new replacement shaft encoder from the front.

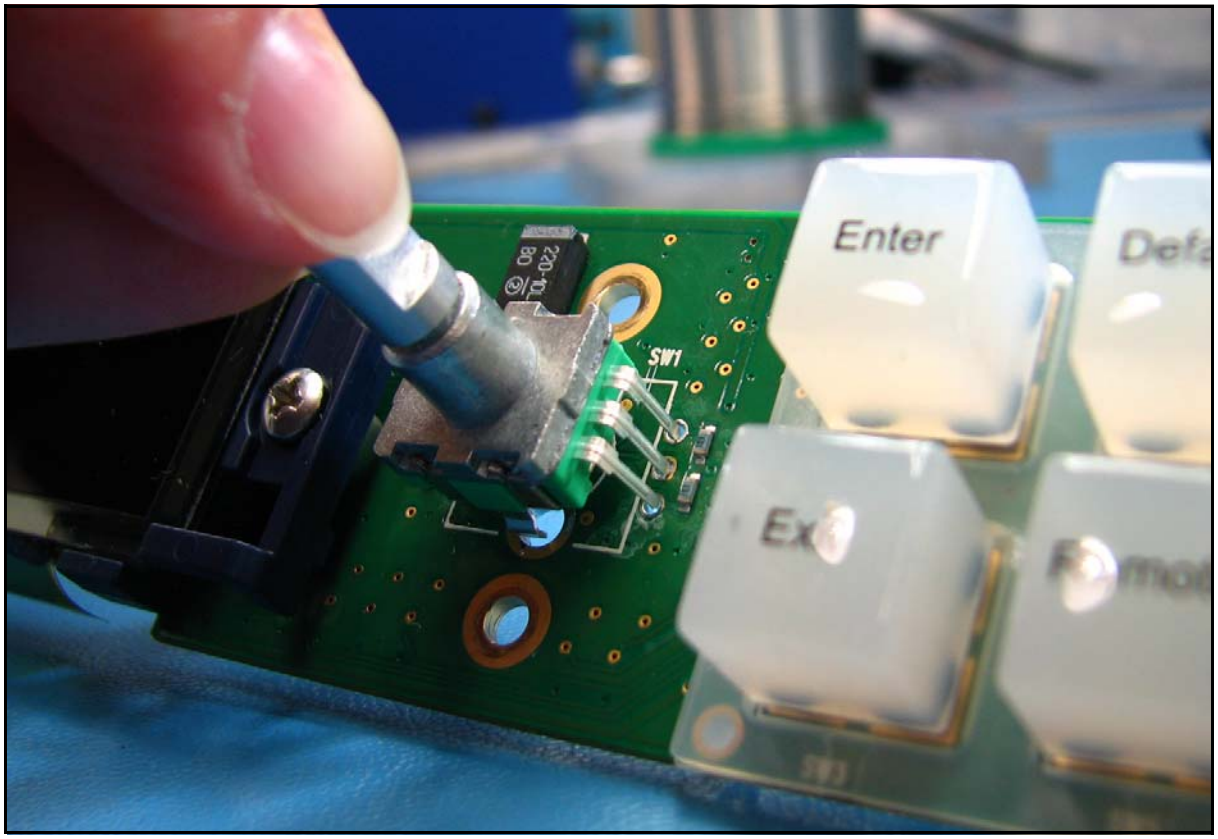


Figure C-17 Inserting New Shaft Encoder

8 Solder the connections to the back of the circuit board, ensuring the shaft encoder is flush with the circuit board.

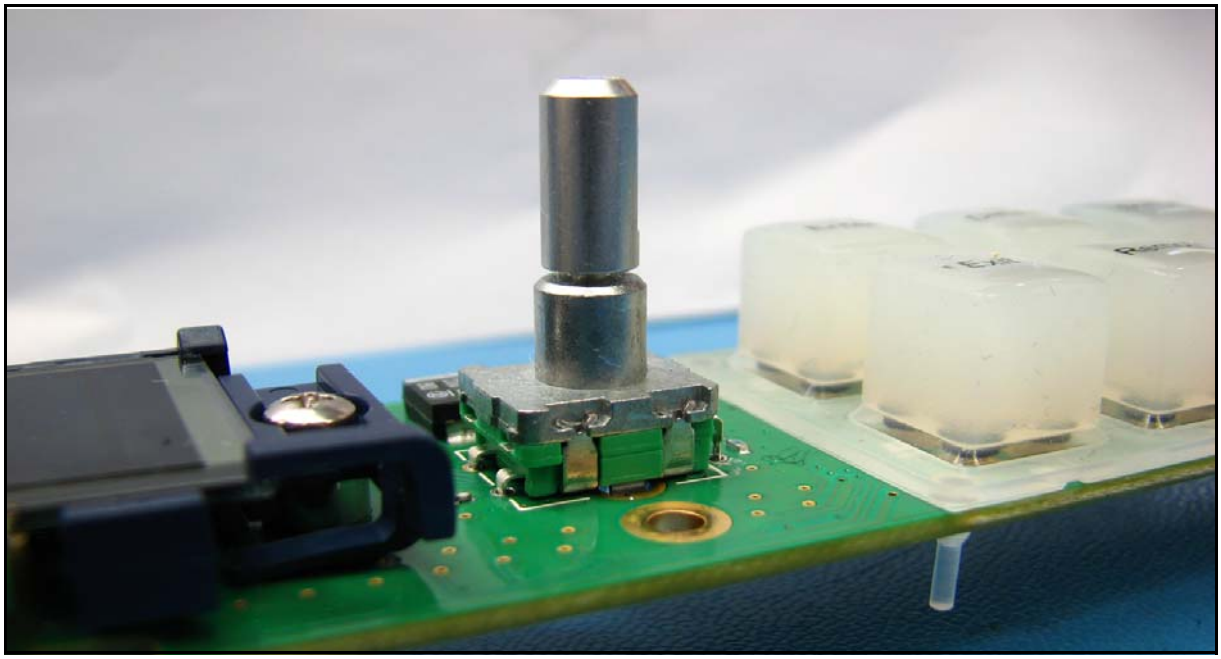


Figure C-18 New Shaft Encoder Installed

9 Gently press the circuit board back into place, taking care not to bend the pins on the left side.

10 Install the six mounting screws supplied, and then re-attach the fan electrical connectors.

11 Replace the cover as described earlier, and then re-attach the two power cords.

Preventing a Broken Shaft Encoder

Version 2 units contain a nylon shoulder washer that effectively reduces the chance of physical damage to the shaft encoder. Version 1 units can be retrofitted, using part number 142-100017Q00. To install this washer on a Version 1 X50 unit, follow these steps:

1 Remove the knob from its shaft by pulling it straight out.

2 Slide the shoulder washer over the shaft encoder as shown.

You may need to rotate the washer as you insert it into the hole.

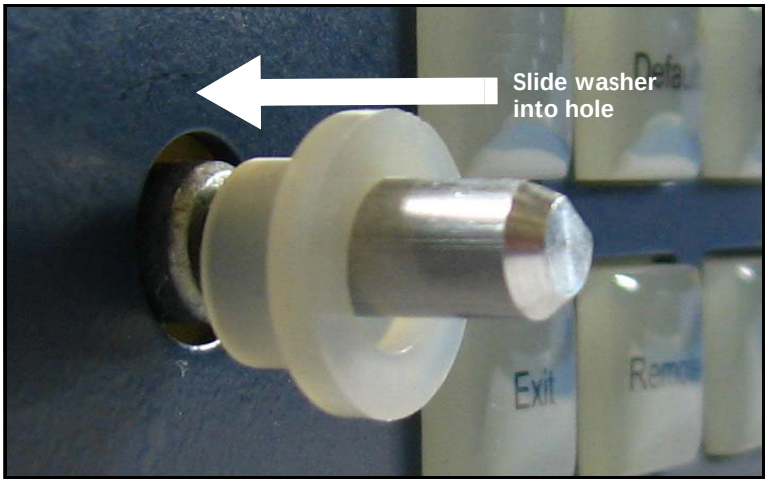


Figure C-19. Installation of Shoulder Washer

3 Replace the knob.

Changing Jumper Settings

The analog audio input on the X50 can be set to either **600Ω** or **Hi-Z** impedance (see **Figure C-20** on page 118). There are eight jumpers for this purpose, located near the rear of the main board inside the X50. (The default setting is **Hi-Z**.) The diagram on the circuit board shows how to align the jumpers.

To access the jumpers, follow these steps:

1. Remove the X50 cover, as described on page 106, ensuring *both* power supplies are disconnected.
2. Set the jumpers as required (**Figure C-20**).

WARNING: You can receive an electric shock from exposed parts of the power supplies. Ensure that you remove AC power from both power supplies before you open the cover.

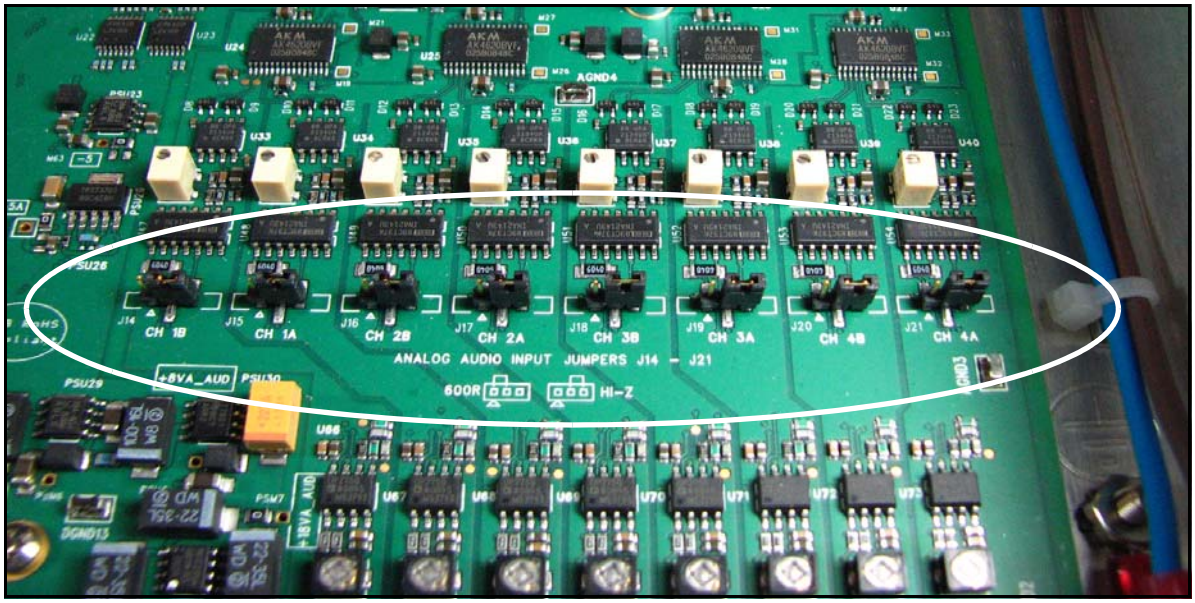


Figure C-20 Analog Audio Input Jumpers J14 to J21

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