

HD MULTICAST+ IMPORTER/EXPORTER

TECHNICAL INSTRUCTION MANUAL



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The comparisons and other information provided in this document have been prepared in good faith based on publicly available information. The reader is encouraged to consult the respective manufacturer's most recent published data for verification.

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RELEASE CONTROL RECORD

Issue	Date	Reason
0.1	2017-02-17	Initial release of HD Multicast+ Importer/Exporter manual
0.2	2017-10-02	Implement additional power consumption and IP Address Setup content
0.3	2018-01-19	Added Warranty info, new rear panel drawing and Sub-assembly drawing to support NAE111A.
0.4	2018-04-20	Added MSAC information to Section 8. Compatible with software version HDMC-IPR/XPR SW 1.1.

STANDARD WARRANTY

Nautel guarantees all mechanical and electrical parts of Nautel Transmitters for a period of forty eight months, and all other Nautel manufactured equipment (including Importers and Exporters) for a period of twelve months from date of shipment, provided the equipment has been installed, operated and maintained in accordance with Nautel's recommendations, and the equipment has not been misused, neglected or modified. Nautel's liability is limited, at the absolute discretion of Nautel, to repairing or replacing returned equipment that to the satisfaction of Nautel has been found defective.

Warranty for third-party items is provided by the Original Equipment Manufacturer. Exercise of such warranty shall be between the Buyer and the Third-Party.

1. Properly qualified technical personnel must install, maintain, and repair the equipment in accordance with Nautel recommendations and good engineering practice.
2. A "Part Failure" shall be deemed to have occurred when the part has become defective, or does not have the characteristics required for the specified equipment performance:
 - a. when the equipment is operated within the design parameters, and
 - b. when the equipment is installed and adjusted according to Nautel's prescribed procedures as stated in the instruction manual.
3. Nautel shall provide replacements for all "Parts" to the Buyer when they become defective during the warranty period, and upon the return of the defective part. Replacement parts warranty to be 90 days or end of original warranty; whichever comes first.
4. If the Buyer receives a replacement module, as part of Nautel's module exchange program, the old module must be returned to Nautel within 30 days of receipt of the new module, at the buyers expense. If the old module is not received after 30 days, the customer will be invoiced. The buyer is responsible for installing the replacement/ repaired module in the transmitter.
5. In the event that a "Part" fails during the warranty period and causes damage to a subassembly which cannot be readily repaired in the field, the entire subassembly so damaged may be returned to Nautel for repair. The repairs will be made without charge to the Buyer.

6. Written authorization must be obtained before returning any equipment or goods for any reason. Equipment or goods returned under this warranty shall be delivered to Nautel's premises at the Buyer's expense. Where no-charge warranty replacements or repairs are provided under items 2, 3, 4, or 5, Nautel will pay that part of the shipping costs incurred in returning the part/assembly to the Buyer. Note: the Buyer is responsible for any and all import fees, duties or taxes.
7. Nautel does not warrant or guarantee, and will not be liable for:
 - a. defects or failures caused in whole or in part by abuse, misuse, unauthorized repair attempts, unauthorized alteration or modification of the equipment;
 - b. equipment built to customer specifications that is later found not to meet customer needs or expectation;
 - c. performance of equipment when it is used in combination with other equipment not purchased, specified, or approved by Nautel;
 - d. damages and performance limitations due to outside forces such as lightning, excessive heat or cold, excessive ac surges or high corrosive environments;
 - e. changes made by personnel other than Nautel authorized personnel, including charges incurred; and
 - f. for any costs for labor performed by the customer without Nautel's prior written approval.
8. Nautel does not warrant that software:
 - a. is free of errors, bugs or defects;
 - b. will be compatible with third party software;
 - c. results, output or data provided through or generated by the software are accurate, complete, or reliable; and
 - d. errors found will be corrected.
9. Nautel shall have the right and shall be provided full access to investigate whether failures have been caused by factors beyond its control.
10. In no event shall Nautel be liable for any consequential damages arising from the use of this equipment.

11. This warranty is in lieu of all other express warranties of Nautel, whether express or implied, and Nautel does not assume, nor is any other person authorized to assume on Nautel's behalf, any other obligation or liability.
12. Third party items ordered, the guarantee/warranty of these items will be from the manufacturer of these items. Exercise of such warranty shall be between the Buyer and the third party provider.
13. Nautel provides telephone and email support for its products for the life of the product at no charge. After the warranty period, parts and on-site support for the equipment are offered at a rate to be determined upon request.

TECHNICAL ASSISTANCE

Nautel's field service department provides telephone technical assistance on a 24 hour, seven days a week basis. Requests by other media (fax or e-mail) will be responded to the next working day if received after Nautel's normal working hours. Contact the appropriate field service centre:

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MODULE EXCHANGE SERVICE

In order to provide Nautel customers with a fast and efficient service in the event of a problem, Nautel operates a factory rebuilt, module exchange service which takes full advantage of the high degree of module redundancy in Nautel equipment. This module exchange service is operated from Nautel's factory in Bangor, Maine and Hackett's Cove, Nova Scotia. These two locations allow us to provide a quick turn around service to keep our customers on the air. During the warranty period, repair and exchange of modules is at no charge to the customer. When the warranty has expired, a charge of 80% of the list price for all exchanged modules is made. If the faulty module is returned to Nautel within 30 days, a credit is issued reducing this charge by one half to 40% of the list price. USA customers are required to contact our Bangor, Maine facility. Canadian and overseas customers should contact our Nova Scotia, Canada facility.

EQUIPMENT BEING RETURNED TO NAUTEL

For all equipment being returned to Nautel and all requests for repairs or replacements:

- Obtain an RMA number from Nautel (you must have an RMA number to return equipment)
- Mark the item as 'field return'
- Mark the item with the RMA number assigned by Nautel
- Address the item to the appropriate Nautel facility

Complete and accurate information regarding the equipment being returned will ensure prompt attention and will expedite the dispatch of replacements. Refer to the nameplate on the transmitter and/or the appropriate module/assembly to obtain name, type, part and serial number information. Refer to the parts list of this manual or the appropriate service instruction manual for additional ordering information.

The following information should accompany each request (* denotes minimum required information):

- *Model and serial number of equipment
- *Name of part/assembly
- Serial number of part/assembly
- *Complete reference designation of part/assembly

- *Nautel's part number of part/assembly
- *OEM's part number of part/assembly
- Number of hours in use
- Nature of defect
- *Return shipping address

EXTENDED WARRANTIES

Nautel's standard four-year warranty provides excellent coverage and satisfies most customers' needs. However, if you want extended coverage, Nautel offers one and two-year Extended Warranty Plans to cover electrical and mechanical repairs or replacements for all Nautel equipment.

COVERAGE

The Extended Warranty Plan includes:

- A module exchange program for many common modules and circuit boards (North America only)
- Toll-free hotline (North America only)
- Necessary labor performed by Nautel authorized personnel to repair the product back to factory specifications
- Necessary components
- Modifications to correct performance problems
- Return shipping

DETAILS

Extended Warranty Plans must be purchased prior to the expiration of original four-year warranty.

One-year Extended Warranty Plans add an additional year (12 months) of coverage after the end of the customer's standard four-year warranty. The two-year plan adds an additional two years (24 months).

Only repairs done at Nautel's facilities or by Nautel authorized personnel will be covered by the Extended Warranty Plans.

You must ship faulty products back to Nautel, prepaid, and in the original package or in a package that provides equivalent protection.

Nautel can choose to repair or replace equipment.

PURCHASING A ONE OR TWO-YEAR EXTENDED WARRANTY PLAN

If the transmitter is still covered by its original four-year warranty period, you can contact Nautel by telephone, fax, mail, or email with the model number, serial number and date of purchase.

Once you purchase a Nautel Extended Warranty Plan, you receive an extended warranty plan certificate, plan number, and a toll-free number (North America only) to call for any service-related issues.

USING THE EXTENDED WARRANTY PLAN

Contact Nautel's Canadian or U.S. service facility by phone, fax, or email as soon as a problem occurs. The following will be required when contacting Nautel:

- Extended warranty plan number
- Product model number
- Serial number
- Brief description of the problem

If Nautel's service technicians are unable to solve the problem over the telephone, Nautel will give you an RMA number. You then return the module or circuit board to a Nautel service facility so that Nautel can provide a replacement. Do not ship a component back to Nautel until you have an RMA number.

ABOUT THIS MANUAL

This manual provides information about preparing for the delivery and installation of an HD Multicast+ Importer/Exporter. This manual is intended for use by field technicians, site managers, and installation planners.

USING THIS MANUAL

Read the task list provided in [Section 2, “Pre-installation tasks” on page 2-1](#). The task list describes the preparations you must make prior to receiving and installing the HD Multicast+ Importer/Exporter.

Later sections of this manual provide reference information regarding physical, cooling, LAN, and synchronization requirements.

PERFORMING PROCEDURES

When using procedures in this manual, perform each step in sequence.

- If you are asked to **see** another section of this manual, or another document, refer to that section or document for additional information, and continue the procedure.
- If you are asked to **go** to another step within the procedure, jump directly to that step without performing the intervening steps.
- If you are asked to **go** to another section or document, stop the procedure and perform the tasks described in the section or document.



CAUTION: FAILURE TO COMPLY WITH RECOMMENDATIONS MAY VOID YOUR MANUFACTURER'S WARRANTY. FOR MORE INFORMATION, REVIEW YOUR WARRANTY DOCUMENTS.

FEATURES OF THIS MANUAL

This manual contains a number of useful features:

ONLINE (PDF FILES)

- Click on blue text (hyperlinks) to jump to a related section or get additional information (for example, to view a definition of a term).
- To find keywords, use Find in Acrobat Reader's Edit menu.
- To quickly find a specific section, click the section in the PDF file's Bookmarks list.

PRINTED

- To find keywords, go to the Index at the end of the manual.
- To find a specific term, go to [Section 8, "List of terms" on page 8-1](#).

HD MULTICAST+ IMPORTER/EXPORTER PLUS MANUALS

The HD Multicast + Importer/Exporter documentation suite contains the following documents:

HD MULTICAST+ IMPORTER/EXPORTER TECHNICAL INSTRUCTION MANUAL, NHB-HDMC-IPR-XPR-TIM. The Technical Instruction Manual provides instructions and reference information needed when planning and preparing for the installation of an HD Multicast + Importer/Exporter, installing an HD Multicast + Importer/Exporter and operating, maintaining and troubleshooting an HD Multicast + Importer/Exporter. It also provides reference information needed when performing diagnostic procedures.

Documents are also provided in Acrobat PDF format on the Nautel website, in the Nautel User Group (NUG) section.

ONLINE RESOURCES

The Nautel website provides useful resources to keep you up to date on your HD Multicast + Importer/Exporter.

NAUTEL USER GROUP (NUG)

The website includes a special section that customers can log into in order to access the Nautel customer newsletter, product manuals, frequently asked questions (FAQ), information sheets, and information about field upgrades.

ONLINE DOCUMENTATION

The website's NUG section provides online access to all the documentation for your HD Multicast + Importer/Exporter. Documentation is provided in Acrobat (PDF) format. You can use the documentation online or print the sections that you need.

SECTION 1: DESCRIPTION

This section provides a description of the HD Multicast+ Importer/Exporter and its associated digital radio system.

- [Overview](#)
- [Location - see page 1-2](#)
- [Physical Requirements - see page 1-4](#)
- [Ac Power Consumption - see page 1-5](#)
- [Cooling Requirements - see page 1-5](#)

OVERVIEW

The HD Multicast+ Importer/Exporter represents the latest in FM HD Radio Technology. It has the functionality of both an Exporter and an Importer in a single 2RU chassis. It includes a GPS disciplined clock to ensure accurate system synchronization. It is a cost effective solution for situations where the Exporter and Importer can be co-located.

The HD Multicast+ Importer/Exporter accepts AES/EBU format audio for the main program service, HD1, as well as the secondary services, HD2, HD3 and HD4. Program Service Data, for all channels, is accepted via Ethernet.

The HD Multicast+ Importer/Exporter outputs a single data stream (E2X link) to an Exgine equipped FM Exciter. Nautel's Reliable HD Transport Protocol, an optional E2X Data Protocol which can enhance reliability when operating over a less than optimal Ethernet link or STL, is also included (supported by Nautel Exgine only).

Local or remote Graphic User Interfaces are available for control and monitoring functions.

LOCATION

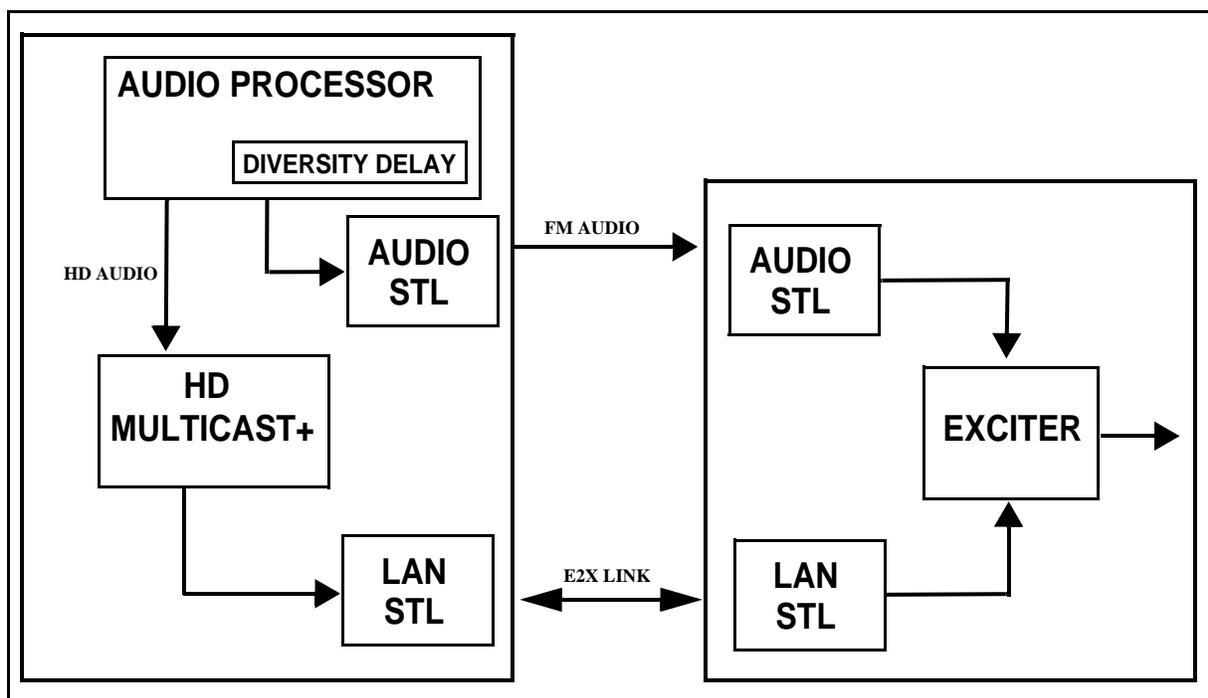
The HD Multicast + Importer/Exporter can be located at either the broadcast studio or the transmitter site.

BROADCAST STUDIO SITE

If the HD Multicast + Importer/Exporter is located at the broadcast studio, a reliable Ethernet link or LAN STL must exist between the studio and the transmitter site. This Ethernet link should have a minimum bandwidth of 150 Kbps based on configuration. It will also be necessary to send the HD1 Audio from the Audio processor to the transmitter site.

See [Figure 1.1](#).

Figure 1.1: Typical HD Multicast+ Importer/Exporter System (Broadcast Studio location)

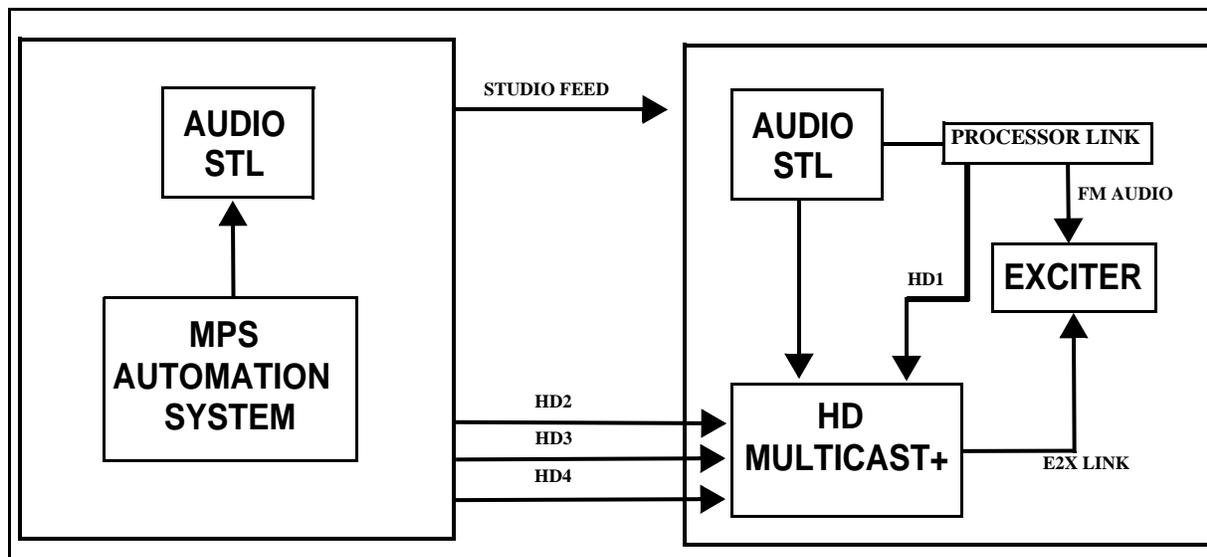


TRANSMITTER SITE

If the HD Multicast+ Importer/Exporter is located at the transmitter site. A connection that can handle all of the MPS and SPS audio streams will be required. The HD Multicast+ Importer/Exporter will operate in an environment from 0°C to 45°C at sea level.

See [Figure 1.2](#).

Figure 1.2: Typical HD Multicast+ Importer/Exporter System (Transmitter Site location)



PHYSICAL REQUIREMENTS

Figure 1.3: HD Multicast+ Importer/Exporter



DIMENSIONS

The HD Multicast + Importer/Exporter is a rack-mountable unit with the following dimensions:

- **Height:** 2RU, or 8.89 cm (3.5 inches)
- **Width:** 48.3 cm (19 inches)
- **Depth:** 47.5 cm (19.5 inches)

CLEARANCES

Ensure that the clearances at the front and the rear of the HD Multicast + Importer/Exporter's host cabinet allow sufficient room for easy installation and operation.



CAUTION:

Do not block the vents on the side of the HD Multicast+ Importer/Exporter. This is especially important in higher ambient temperature environments.

WEIGHTS

The HD Multicast + Importer/Exporter weighs approximately 10.9 kg (24 lbs).

AC POWER CONSUMPTION

The HD Multicast + Importer/Exporter is capable of operating from a 90-264 V ac, single phase, 47-63 Hz power source. The power consumption for the HD Multicast+ Importer/Exporter is specified as follows:

- Typical current - 0.4 A @ 120 Vac (0.2 A @ 220 Vac)
- Peak current - 0.6 A @ 120 Vac (0.3 A @ 220 Vac)

COOLING REQUIREMENTS

The maximum internal chassis temperature of the HD Multicast + Importer/Exporter must not exceed 50°C (122°F). To satisfy this requirement:

- Do not allow the HD Multicast + Importer/Exporter room ambient air temperature to exceed 45°C (113°F) at sea level. De-rate 3°C (5.4°F) per 500 m – or 2°C (3.6°F) per 1,000 feet – above sea level.

Example:

At 1,600 m (1 mile) above sea level, maximum ambient temperature should not exceed 20.4°C (67°F). Cooler temperatures are recommended, in order to improve the reliability of the Importer.

- Do not install the HD Multicast + Importer/Exporter next to other warm equipment.

SECTION 2: PRE-INSTALLATION TASKS

This section provides a list of tasks that you must perform prior to delivery and installation of the HD Multicast+ Importer/Exporter.



CAUTION: FAILURE TO COMPLY WITH RECOMMENDATIONS MAY VOID YOUR MANUFACTURER'S WARRANTY. FOR MORE INFORMATION, REVIEW YOUR WARRANTY DOCUMENTS.

PREPARING FOR INSTALLATION

To prepare for installation of the HD Multicast+ Importer/Exporter perform the following tasks:

1. Select a location for the HD Multicast+ Importer/Exporter in the studio or the transmitter site. For detailed information, see [“Selecting a location for the HD Multicast+ Importer/Exporter” on page 2-2.](#)
2. Prepare the network (LAN) connection between the HD Multicast+ Importer/Exporter and the Exciter. Consider the HD Multicast+ Importer/Exporter's location and the amount of other networked equipment at the transmitter site.



IMPORTANT:

The HD Multicast+ Importer/Exporter uses the embedded version of the Windows10 Operating System. To ensure maximum performance, all firewall and Malware detection is disabled. Consult with your IT department that the device is installed securely on the network.

3. Consult your network manager to obtain IP address information for the HDMC+, Exciter, (Exgine), and gateway.
4. Order/obtain any accessories or optional equipment that you may need. See Section 3, [“Parts and tools” on page 3-1.](#)
5. Train your station technicians and operators on the use of the HD Multicast+ Importer/Exporter. For a list of available technical and user documents, see the *About this manual* section at the beginning of this document. For information about Nautel training courses, go to the Nautel website at <http://www.nautel.com/support/training/>

SELECTING A LOCATION FOR THE HD MULTICAST+ IMPORTER/EXPORTER

To ensure that the desired location for the HD Multicast + Importer/Exporter is suitable, perform the following tasks.

1. Ensure you have a cabinet and room space suitable for installing the HD Multicast + Importer/Exporter. Also, though it is not required, a UPS is recommended to avoid interrupts due to brown-out conditions. Refer to [“Physical Requirements” on page 1-4](#) for dimensions and clearances.
2. Ensure the HD Multicast + Importer/Exporter is near a standard ac power outlet, 120 V ac, single phase power outlet.
3. The HD Multicast + Importer/Exporter contains a GPS receiver that must be connected to a GPS antenna (refer to [Figure 2.1](#)) that has a clear view of the sky. The supplied GPS antenna cable is 50 feet long, and the dome-shaped antenna mounts on a user-supplied pole.

Figure 2.1: GPS Antenna and Cable



SECTION 3: PARTS AND TOOLS

This section describes parts associated with the HD Multicast+ Importer/Exporter, and tools needed during installation and routine operation.

- Parts supplied by Nautel
- Parts not supplied by Nautel
- Tools for installation

PARTS SUPPLIED BY NAUTEL

AC POWER CABLE

An ac power cable is included with the HD Multicast+ Importer/Exporter.

DOCUMENTATION

This Technical Instruction Manual accompanies the HD Multicast+ Importer/Exporter. Additionally, the documentation is provided online. See [“Online resources” on page xix](#).

PARTS NOT SUPPLIED BY NAUTEL

A monitor, keyboard and USB mouse are required to complete the installation/setup of the HD Multicast+ Importer/Exporter.

Nautel may not supply some parts and materials required to complete installation. The parts you need vary with the installation requirements.

TOOLS FOR INSTALLATION

The tools you need during HD Multicast+ Importer/Exporter installation include the following:

- Philips screwdrivers, sizes # 1 and # 2

SECTION 4: UNPACKING AND INSTALLATION

To install an HD Multicast + Importer/Exporter, perform the following tasks:

1. Unpack the HD Multicast + Importer/Exporter from shipping box.
2. Remove the HD Multicast + Importer/Exporter's top cover. Make sure that there are no loose components, and that all connectors and PCI cards are properly seated.
3. See [Section 5, "Connecting the HD Multicast + Importer/Exporter" on page 5-1](#) to install the HDMC+ and optional UPS at the studio or transmitter site in the cabinet space you have prepared.
4. **Do not** connect ac power to the HD Multicast + Importer/Exporter at this time.

SECTION 5: CONNECTIONS

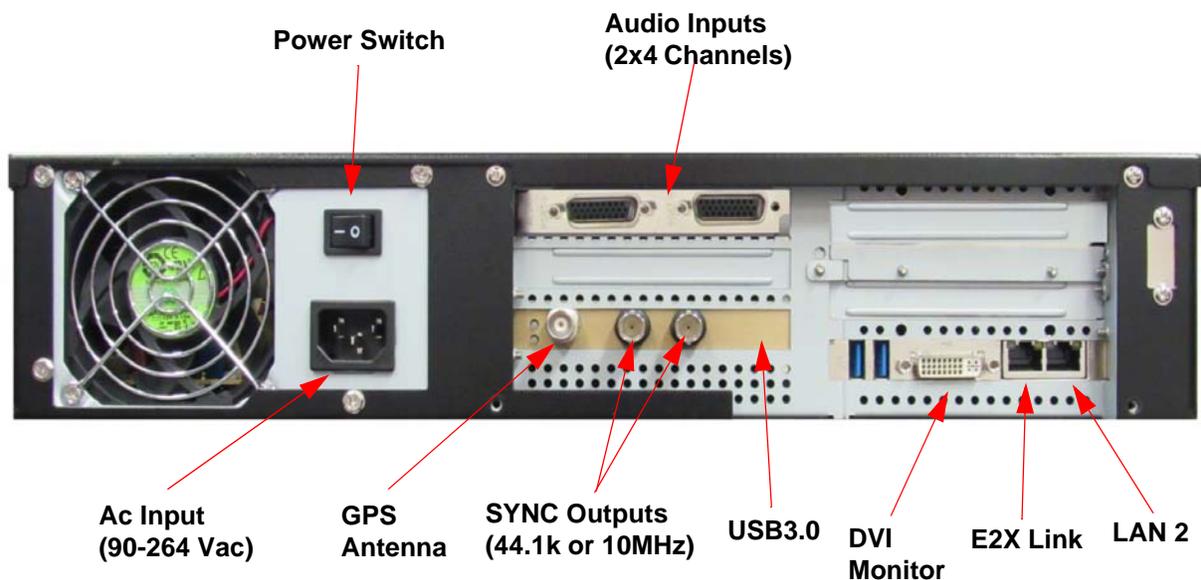
This section describes the interconnection between the HD Multicast+ Importer/Exporter, user-supplied audio processor(s), and UPS. Typical configurations are illustrated at the end of this section. See [Figure 5.2 on page 5-3](#), “[HD Multicast+ Importer/Exporter Typical Connection Diagram](#)”.

It is assumed that there will be user-supplied audio processing, on both the IBOC and Analog MPS Audio.

Make the following connections, also shown in the [Figure 5.1 on page 5-2](#) and [Figure 5.2 on page 5-3](#).

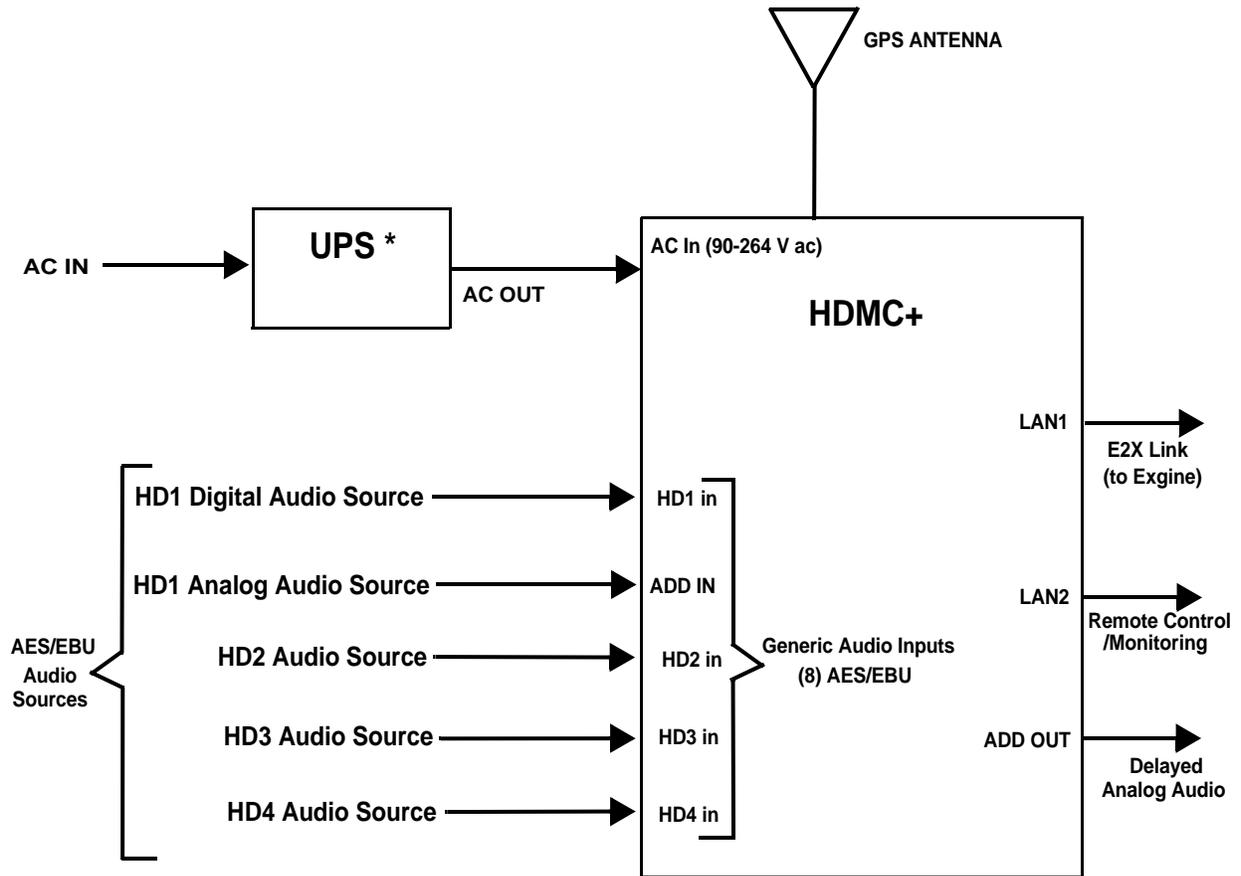
- **Ac and UPS Power Connections**
Use standard 120 V ac, 60 Hz line cords. An ac line cord (Nautel Part # JN25) is provided with the HD Multicast+ Importer/Exporter. Use of an Uninterruptible Power Supply (UPS) is highly recommended.
- **Monitor, Keyboard and Mouse Connections**
Connect the user supplied monitor to the DVI Monitor Input plug and the keyboard and mouse to the two USB3.0 jacks on the rear of the HD Multicast+ Importer/Exporter.
- **HD Multicast+ Importer/Exporter Audio Input Connections**
Two audio cable harnesses (Nautel part # UA161) are provided in the ancillary kit, to connect the audio input feeds to the HD Multicast+ Importer/Exporter. There are 8 audio inputs available. Any audio input can be used for any HD channel.
- **Exciter Link Ethernet Connection**
Use CAT5 Ethernet cable, provided in the ancillary kit.
- **Sync Outputs**
Two configurable BNC outputs provide either 44.1 kHz or 10 MHz sync outputs for synchronizing audio cards or exciter.
- **GPS Antenna**
Obtain the GPS antenna (Nautel Part # UD63) and GPS cable (Nautel Part # 198-5508 or Nautel Part # 198-3305-01) from the ancillary kit.

Figure 5.1: HD Multicast+ Importer/Exporter: back panel



* Use included cable harness (Nautel Part # UA161)

Figure 5.2: HD Multicast+ Importer/Exporter Typical Connection Diagram



* UPS is optional, but recommended

SECTION 6: QUICK SETUP PROCEDURE

This section provides information on setting up the HD Multicast+ Importer/Exporter with the goal of being on-air with an IBOC signal.

- [Power up the HD Multicast+ Importer/Exporter - see page 6-1](#)
- [License the HD Multicast+ Importer/Exporter - see page 6-2](#)
- [Verify the System Configuration - see page 6-4](#)
- [Configuring the Audio Inputs - see page 6-6](#)
- [Configuring the Ethernet IP Addresses - see page 6-10](#)
- [Configuring the E2X Link - see page 6-11](#)
- [Setting the Operating Mode - see page 6-13](#)
- [Set System Time and Date - see page 6-13](#)
- [Setting Call Sign - see page 6-14](#)
- [Backup your Configuration - see page 6-15](#)
- [Run the System - see page 6-15](#)

POWER UP THE HD MULTICAST+ IMPORTER/EXPORTER

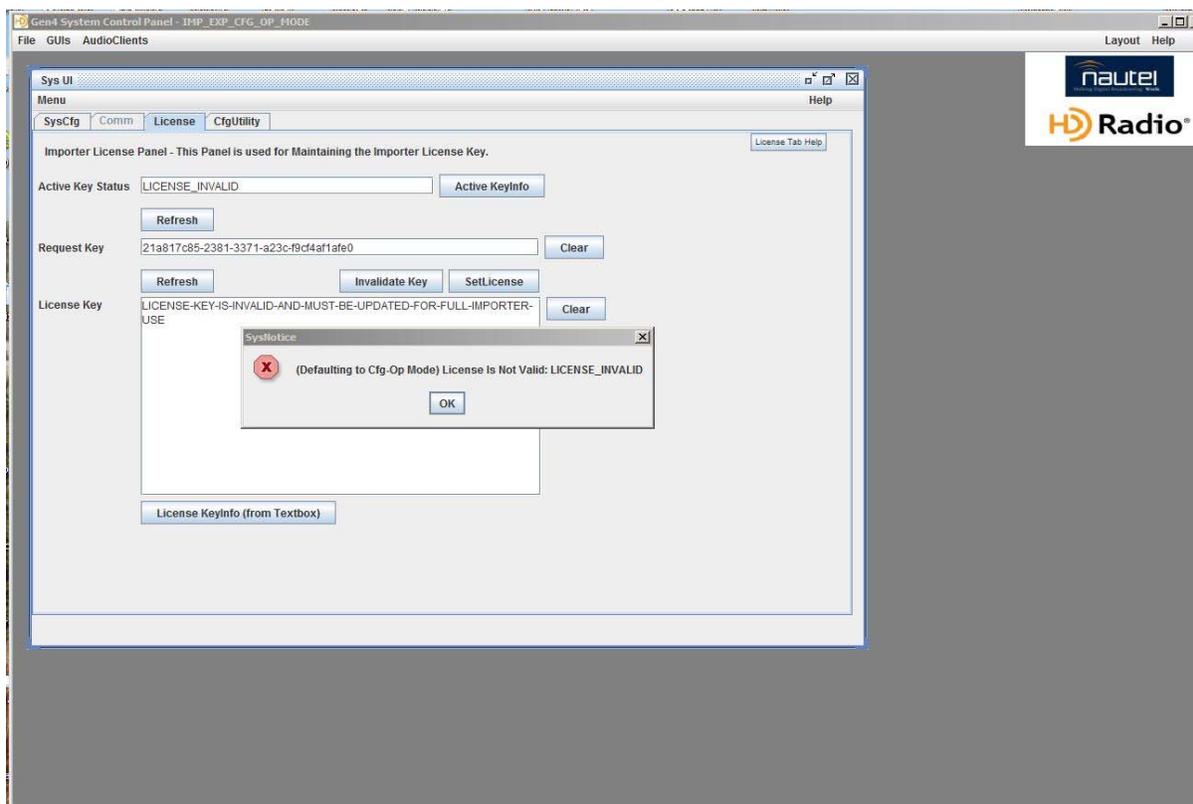
Prior to starting this procedure, ensure that the IBOC carriers cannot be broadcast either by muting the exciter, or by disconnecting the LAN connection from the HD Multicast+ Importer/Exporter and the Exgine.

Connect a monitor (DVI input), keyboard (USB) and USB mouse to the HD Multicast+ Importer/Exporter for initial start-up.

1. Verify that the power switch on the power supply on the rear panel of the HD Multicast+ Importer/Exporter is in the ON position.
2. Apply Ac power. The system will start up.

3. Allow the system to boot and stabilize. The system will initially be in Configuration (Cfg-Op) Mode and will indicate that the license is not valid. See [Figure 6.1](#).

Figure 6.1: HD Multicast+ Importer/Exporter License Dialog



LICENSE THE HD MULTICAST+ IMPORTER/EXPORTER

The HD Multicast+ Importer/Exporter will not operate without a valid license key. This license must be activated by iBiquity Digital. You must obtain a request key from your system, send the key to iBiquity Digital, receive a valid key from iBiquity Digital and apply that key to your system.

Step by step instructions are as follows:

Note:

A Quick Guide is included with the HD Multicast+ Importer/Exporter which explains the licensing process.

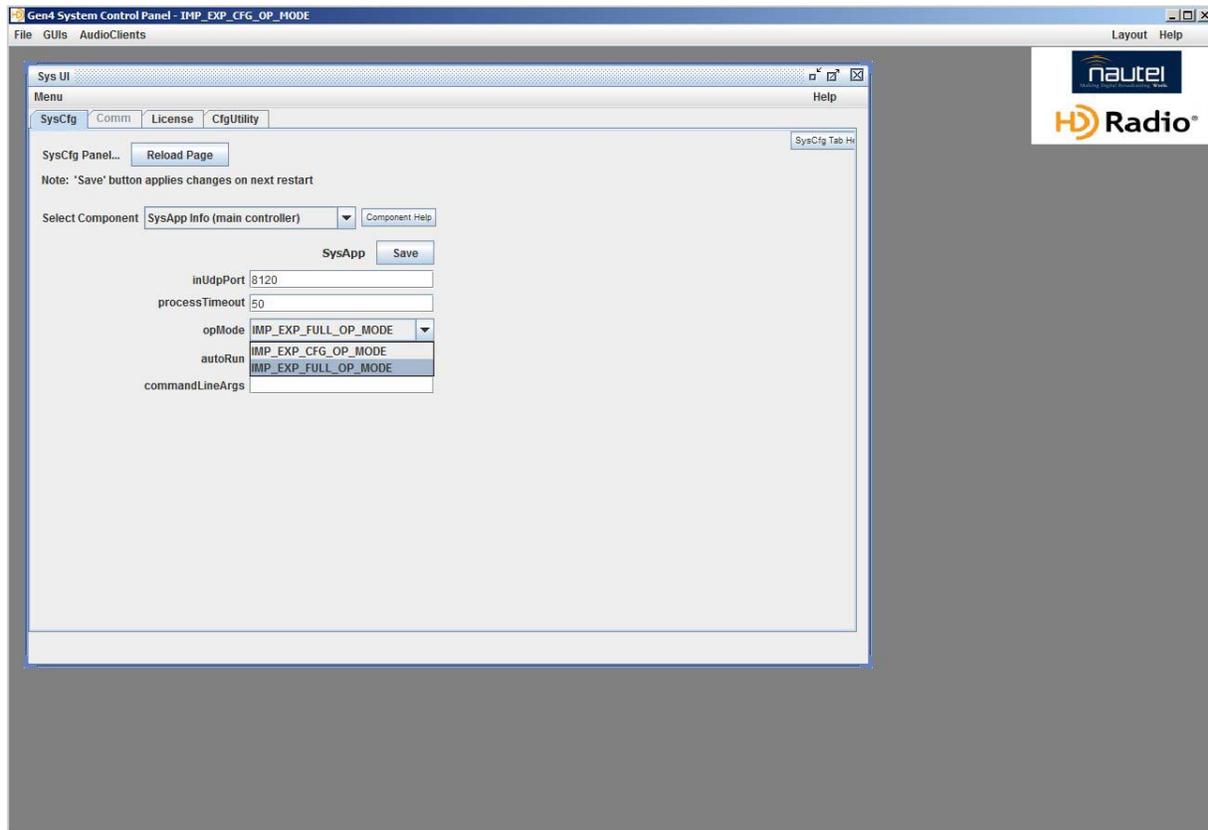
1. Enter the **License** tab of the **Gen4 System Control Panel UI**.
2. View the Active KeyInfo. This indicates whether the HD Multicast+ Importer/Exporter is currently licensed. It will also show the expiry date of a valid license.
3. If the license is not valid, click the **Refresh** button above the **Request Key** field. This will populate the Request Key field with a current Request Key.
4. Using a web browser, go to <https://key.iquity.com/register>. Fill in the requested information and register a Broadcaster Account. Use **IB9890** in the Registration Code field.
5. Click **Send**.
6. Once the registration is successful, a Verification link will be sent to your email address. By clicking on the Verification link, a **Login** window will appear where you enter your email address and password previously input on the registration screen.
7. In the **Options** window, select **Request New License**.
8. Complete the License Request form. Enter the Request key from step 5 in the Request Key entry box at the bottom of this form.
9. Click **Submit**. A License Key will be generated. The license key is very large so it should be cut and pasted into a text file or directly into the **License Key** window on your HD Multicast+ Importer/Exporter.
10. Click the **Set License** button in the **License Entry UI**. A message indicating that a valid license has been entered will appear at the bottom of the window.

VERIFY THE SYSTEM CONFIGURATION

Your system can be set up to have up to 3 secondary audio channels along with the HD1 Main program Service. The software includes a large number of pre-defined configurations which allocate the available bandwidth to the various audio channels and data services. The included pre-defined configurations will include a configuration appropriate for most circumstances. Appendix A of this document includes a listing of the included pre-defined configurations as well as a description of the acronyms used.

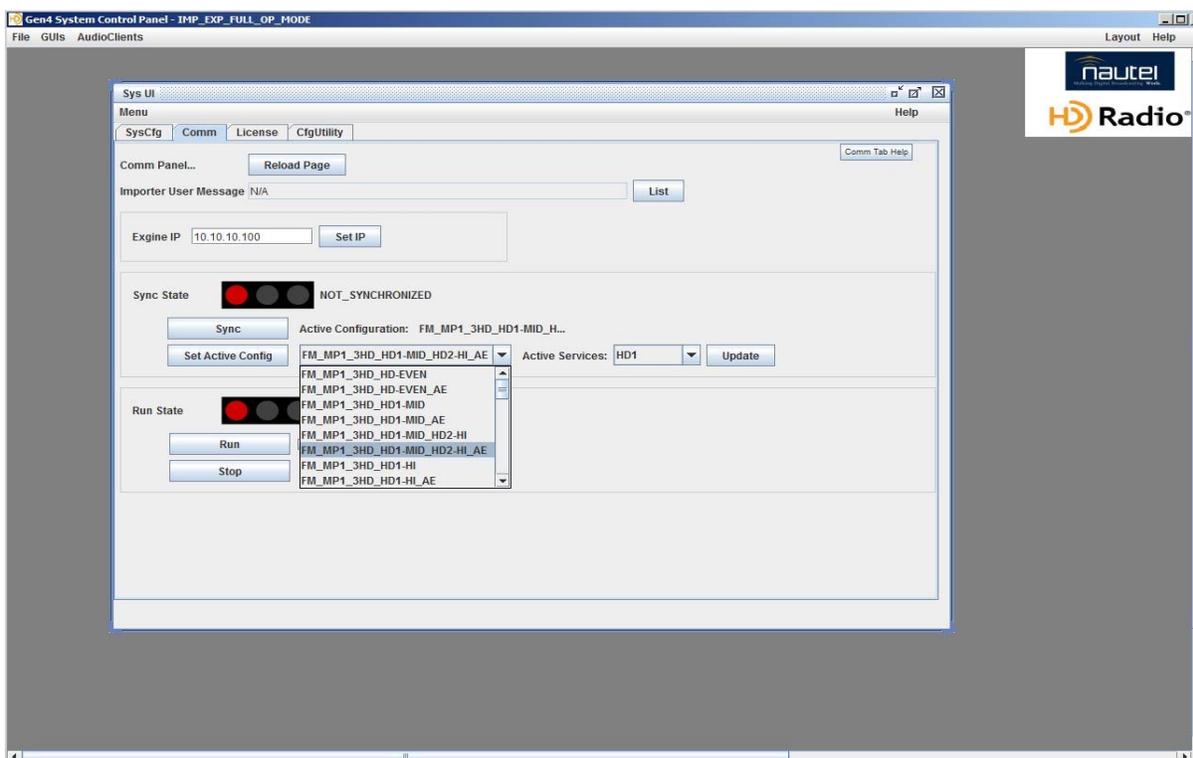
In order to verify and/or modify the current configuration, the system will have to have to be in Operational mode.

1. Enter the Sys UI > SysCfg dialog (see [Figure 6.2 on page 6-5](#)). Go to the **Select Component** dropdown menu and select **SysAppInfo** (main controller).
2. The **opMode** dropdown menu includes two items:
 - i. Configuration Mode (IMP_EXP_FULL_CFG_MODE)
 - ii. Operational Mode (IMP_EXP_FULL_OP_MODE)
3. Select **IMP_EXP_FULL_OP_MODE** (Operational mode)
4. Click **Save**.
5. Restart the software by selecting **File > Restart System**.

Figure 6.2: Op Modes

The system is now in **Operational** mode and the **Comm** dialog in the **Sys UI** is now active. In the **Comm** tab:

1. Click the down arrow beside the **Set Active Config** button. All of the available configurations will be displayed in the dropdown menu (see [Figure 6.3 on page 6-6](#)).
2. Select the configuration which is appropriate for your station (number of secondary channels, bandwidths).
3. Click **Set Active Config**.

Figure 6.3: Active Configuration Dialog

CONFIGURING THE AUDIO INPUTS

The HD Multicast+ Importer/Exporter includes an Audio card with 8 separate stereo channels. Any of these channels can be used for any of the available audio services. These are AES/EBU inputs. The default configuration assigns HD1 to channel 1, HD2 to channel 2, HD3 to channel 3 and HD4 to channel 4 and ADD (Analog Diversity Delay) to Channel 5. If you wish to change this, use the procedure below.

1. Setting the Audio Input for HD1 (MPS)
 - i. In the Gen4 System Control Panel, select **GUIs**.
 - ii. Select **Exp UI**.
 - iii. Select **MPS** (See [Figure 6.4 on page 6-8](#)). This is the Input Setup for HD1, the Main Program Service.

- iv. From the dropdown menu, choose one of the Lynx AES16e channels. Channels are listed as ASIO Lynx Recorder 1 -8.
- v. See [Figure 6.5 on page 6-8](#) for physical location of connectors on the LynxAES16e card.
- vi. It is possible to output a copy of the MPS from the Audio card in AES/EBU format. If desired, select one of the outputs in the **Audio Output Device** dropdown menu.
- vi. The **Blend Control** dropdown menu is best set to **BLEND_CTRL_ENABLE**. This will indicate to the receiver that it should enable blending.

**Note:**

Time alignment of the analog and digital audio must be performed prior to operating the HD Multicast+ Importer/Exporter on-air.

2. Setting the Audio Input for ADD (Audio Diversity Delay)

If the Diversity Delay is going to be set in the HD Multicast+ Importer/Exporter, as opposed to in the Audio processor or the Exciter, follow the following instructions to set up the Audio Input:

- i. In the **EXP UI**, select the **ADD** tab.
- ii. Select an input channel from the **Audio Input Device** dropdown menu.
- iii. Select an output channel from the **Audio Output Device** dropdown menu.

See [page 8-6](#) for a complete description of setting up the Diversity Delay.

Figure 6.4: HD1 (MPS) Audio input Selection

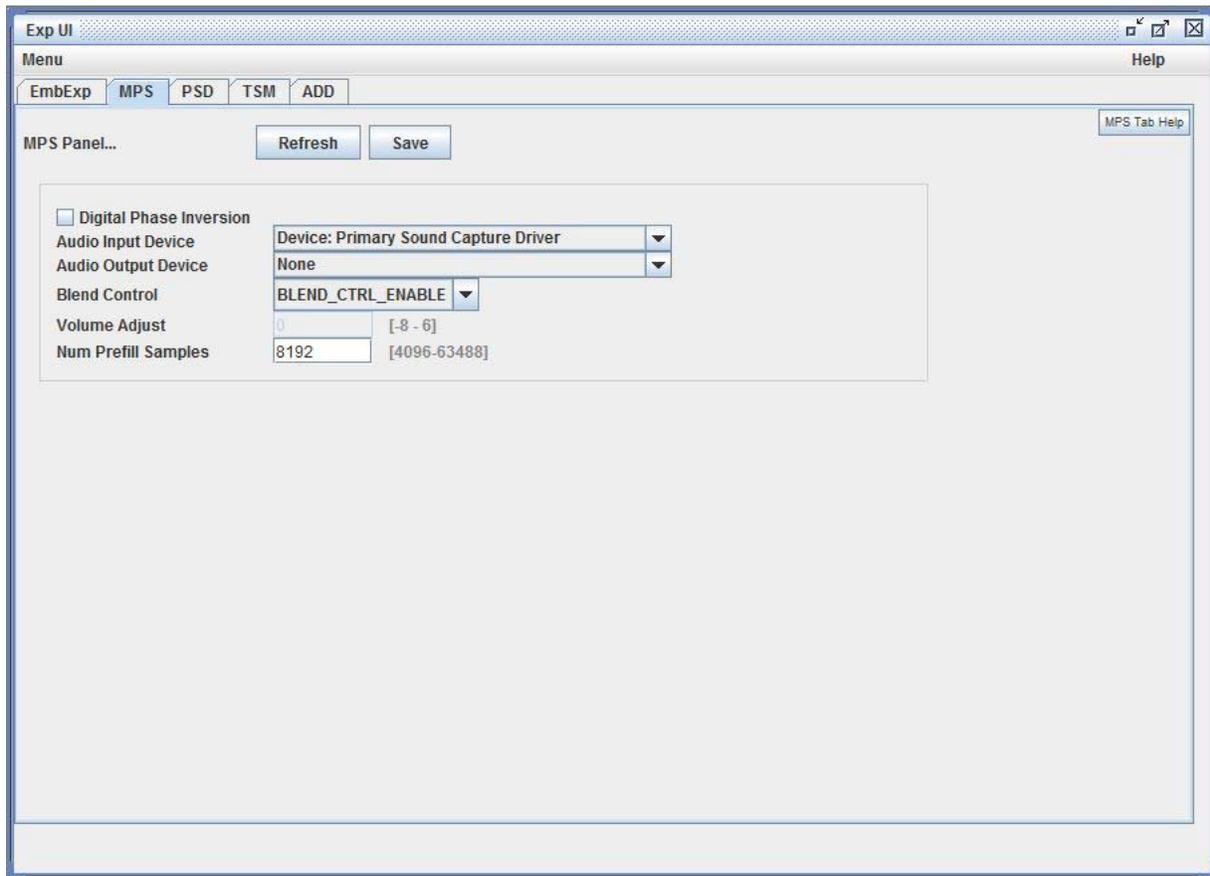
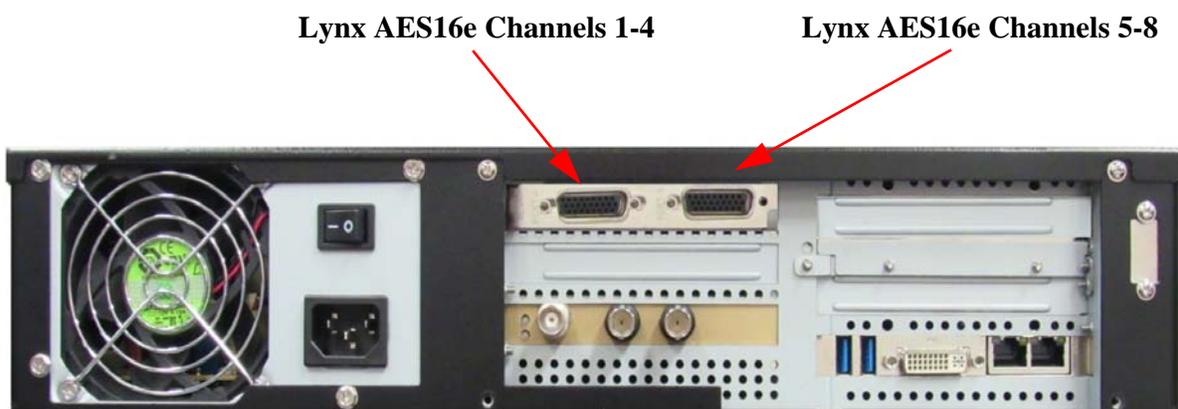
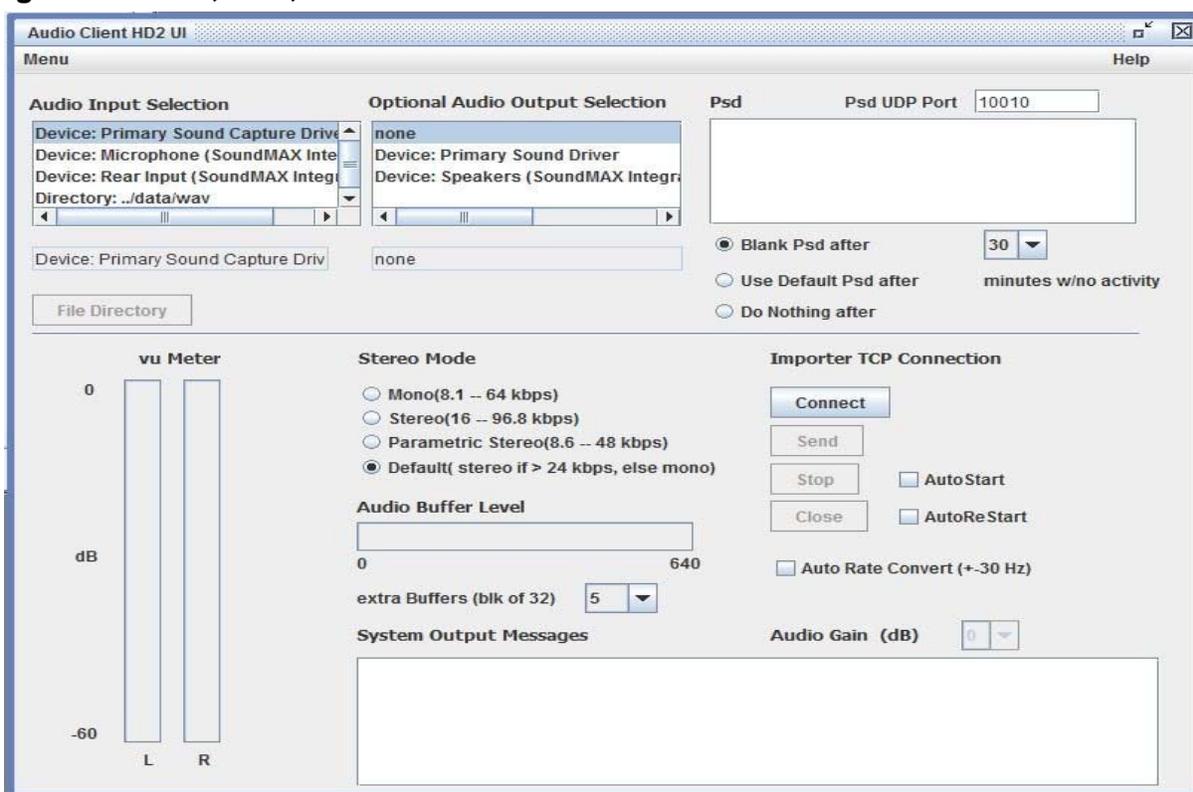


Figure 6.5: Physical Location of Audio Inputs



3. Setting the Audio Input for HD2, HD3 and HD4 (see [Figure 6.6 on page 6-9](#))
 - i. Go to the **AudioClients** menu item at the top of the **System Control Panel**.
 - ii. Select the Audio Service that you wish to assign a hardware input to.
 - iii. In the **Audio Input Selection** dialog, choose an unused channel.
 - iv. If desired, a copy of the audio for this channel can be output from the audio card. This is set in the **Optional Audio Output Selection**.
 - v. In most circumstances, you should also check the Autostart and Auto-restart boxes. This will automate the startup of these clients.

Figure 6.6: HD2, HD3, and HD4 Audio Client



CONFIGURING THE ETHERNET IP ADDRESSES

In order to communicate properly, the LAN components must have its own individual IP addresses. The HD Multicast + Importer/Exporter are pre-configured and tested with compatible addresses prior to shipping. These addresses may be changed at the customer's installation site should it become necessary.

**Note:**

Before proceeding with IP address changes, you should verify with your network administrator that no other devices have been – or can be through DHCP – assigned the HD Multicast + Importer/Exporter's intended IP address. Consult with your network administrator to acquire acceptable IP and Netmask addresses.

In the Windows Control Panel, select **Network and Sharing Center > Change Adapter Settings**, there are three Ethernet Adapters. Each adapter and its function are explained below.

ETHERNET 1: MULTICAST+ IP ADDRESS

This is the IP address of the HD Multicast + Importer/Exporter. It is shipped with a default IP address of 10.10.10.10.

This should be a Static IP address, not assigned automatically by DHCP. It must be compatible with the system Engine.

ETHERNET 2: REMOTE MONITORING IP ADDRESS

The second Ethernet Adapter is used for Remote Control Monitoring. This IP address is typically set to automatically find an available IP address (DHCP), but it can also be user defined.

See [Section 11, "Remote Control" on page 11-1](#) for detailed description.

ETHERNET 3: LOOPBACK ADAPTER

The third adapter is called “LoopBack Adapter” and is an internal IP address of the HD Multicast+ Importer/Exporter is for use of Nautel’s Reliable HD protocol.

**Note:**

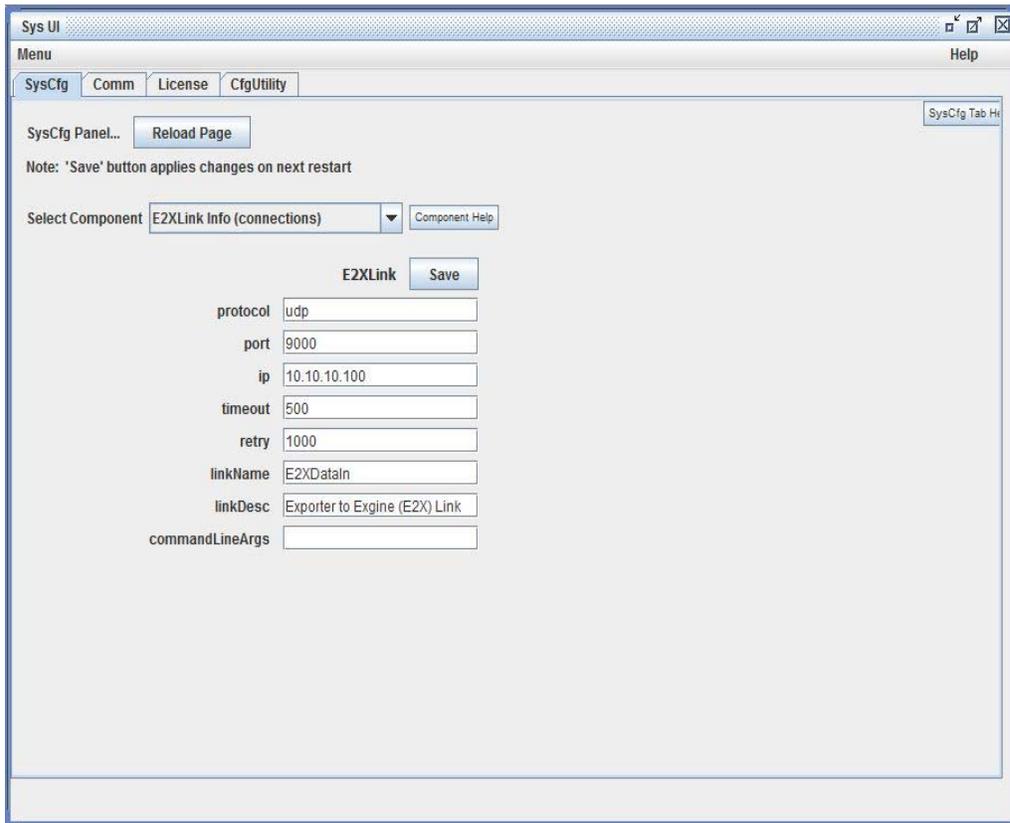
This LoopBack Adapter IP Address and Mask settings are factory set and must not be changed.

CONFIGURING THE E2X LINK

The Ethernet data link between the HD Multicast+ Importer/Exporter and the Engine (Exciter) is called the E2X Link. The IP address, IP protocol, and Data port of the system’s Engine card must be entered in the HD Multicast+ Importer/Exporter’s E2X Link Info dialog.

1. Obtain the IP address, port number and IP protocol of the Engine. In Nautel systems, they are typically (these are the default values in the unit when shipped):
 - IP Address = 10.10.10.100
 - Port Number = 9000
 - Protocol = UDP
- i. Go to the SysCfg page of the SYS UI.
- ii. Select the **E2XLink Info** item in the **Select Component** dropdown menu. See [Figure 6.7 on page 6-12](#).
- iii. Enter the appropriate values.

Figure 6.7: E2X Link Menu



SETTING THE OPERATING MODE

The operating mode of the Exporter Plus is typically set at the factory. The default mode is FM_MP1_3HD-EVEN. This is MP1 mode with HD1, HD2 and HD3 enabled (main channel + 2 secondaries).

Verify the desired operating mode is set properly as follows:

- i. Go to the **Comm** page of the **SYS UI**.
- ii. Select the desired mode of operation in the **Active Configuration** dialog.
- iii. Click **Set Active Configuration**.



THE OPERATING MODE AND CALL SIGN CAN ONLY BE CHANGED WHEN STOPPED (ON THE MAIN PAGE).

SET SYSTEM TIME AND DATE

The current time is sent as part of the payload in an HD Radio system. The HD Multicast+ Importer/Exporter acquires its time from the Windows 10 Operating System. Prior to shipping, the time and date will be set. Adjustment of the time zone may be required on receipt of the system.

To adjust the time zone, perform the following procedure:

1. Right click on the time in the lower right corner of the Desktop.
2. Select **Adjust Date/Time** from the menu that appears. This will open the Windows Date and Time dialog where Time Zone can be adjusted.

SETTING CALL SIGN

Prior to shipping, the Call Sign has been factory set on the HD Multicast + Importer/Exporter.

To change the Call Sign, perform the following steps (Station Message and Slogan are also set from this screen):

1. In the **EXP UI** menu, select the **EmbExp** tab. In the SIS panel, the Station Name (Call Sign) can be changed. Enter the Call Sign in the “Short Name” field. See [Figure 6.8](#).
2. Click **Save** when done.

Figure 6.8: Station Info

SIS:

Country Code [A-Z][A-Z]

FCC ID [1-524287]

Station Name (Call Sign)

Short Name Append "-FM"

UnvShort Name Append "-FM" Encode

Slogan

Name Encode

Station Message

Info Encode High Priority

BACKUP YOUR CONFIGURATION

Once your system is setup and ready to run, you should back up your configuration. There are two backup methods:

1. Use the dedicated “backup” application from the Windows 10 Start Menu. This will automatically place a backup of the configuration file in a location that the system will use should the configuration files become damaged. This configuration can be recalled at any time by using the dedicated “restore” function. It is stored locally on the HD Multicast+ Importer/Exporter harddrive.
2. Use the **Backup** feature in the **CfgUtility** in the **SysUI**. This allows you to choose a location, such as a removable flash drive, to save the backup of the configuration file. This is useful to have on hand in the event of a hardware failure. The **Restore** feature in this same dialog can be used to retrieve the configuration.

RUN THE SYSTEM

Now that all the settings have been made and verified, the system can go on-air.

1. Go to the **SysV1 > Comm** menu.
2. Click **Run**. The sync state and run state lights will turn orange and then green as the system starts.
3. Typically you should tick the **Autorun** (on restart) box. This will cause the system to start running when the software is started.

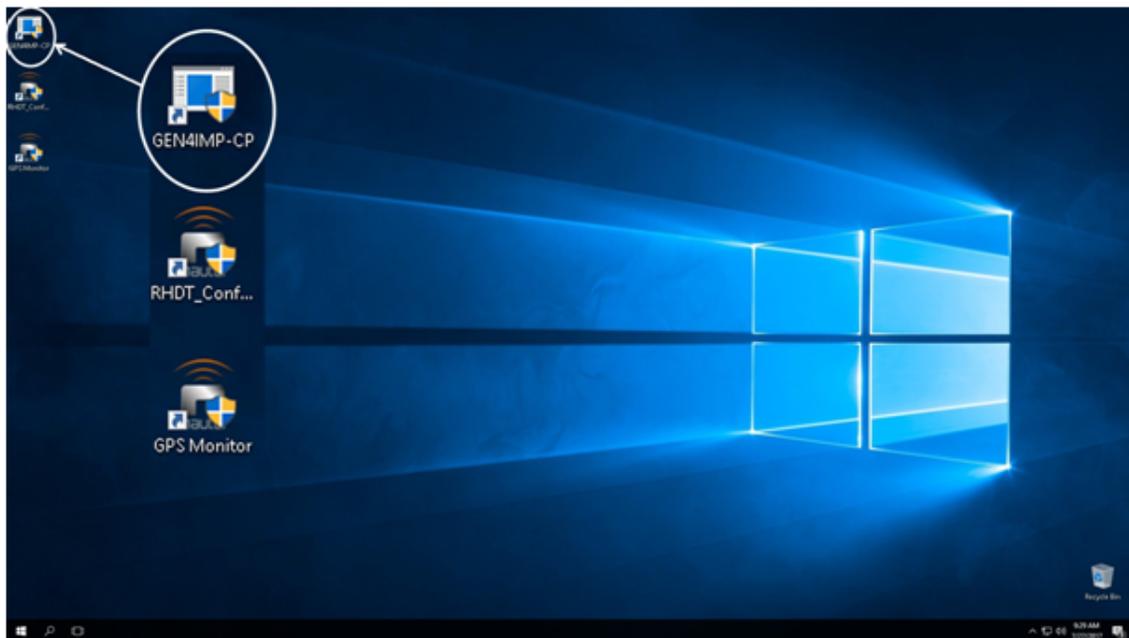
SECTION 7: RUNNING THE SYSTEM MANUALLY

The HD Multicast+ Importer/Exporter software runs automatically, from a batch file, when the system starts. This section describes how to start the software manually, from the Desktop, if the system is stopped and the software exited.

FROM THE DESKTOP

Run the HD Multicast+ Importer/Exporter software by clicking the “GEN4IMP-CP” icon at the top left of the desktop. Icons are also available for running the GPS Monitor or the Reliable HD Transport configuration. See [Figure 7.1](#).

Figure 7.1: GEN4IMP-CP Desktop Icon



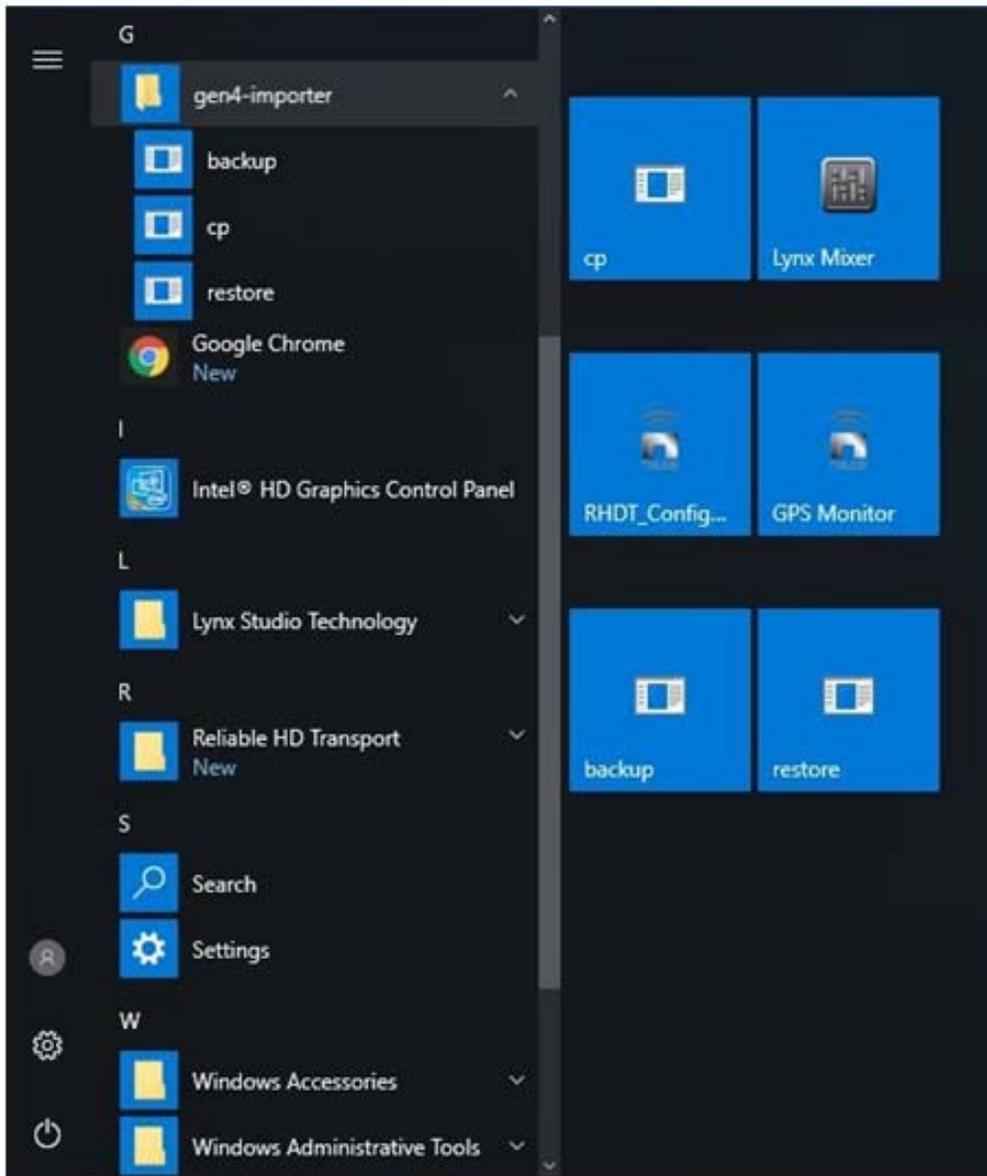
FROM THE START MENU

The HD Multicast+ Importer/Exporter software is listed in the Start Menu under the heading “**gen4-importer**”. There are a number of menu items that can be run from here, including the System Control Panel. See [Figure 7.2 on page 7-3](#).

- **backup** - Saves the current system configuration in a restorable zip file. This is a useful option if doing a code upgrade.
- **cp** - Runs the System Control Panel
- **restore** - Restores the system configuration that was saved with the backup command.

It is also possible, in Windows 10, to pin useful Start Menu items to the area beside the Start Menu. This is a convenient location for commonly used programs. All programs can be started by clicking the appropriate block.

Figure 7.2: Start Menu

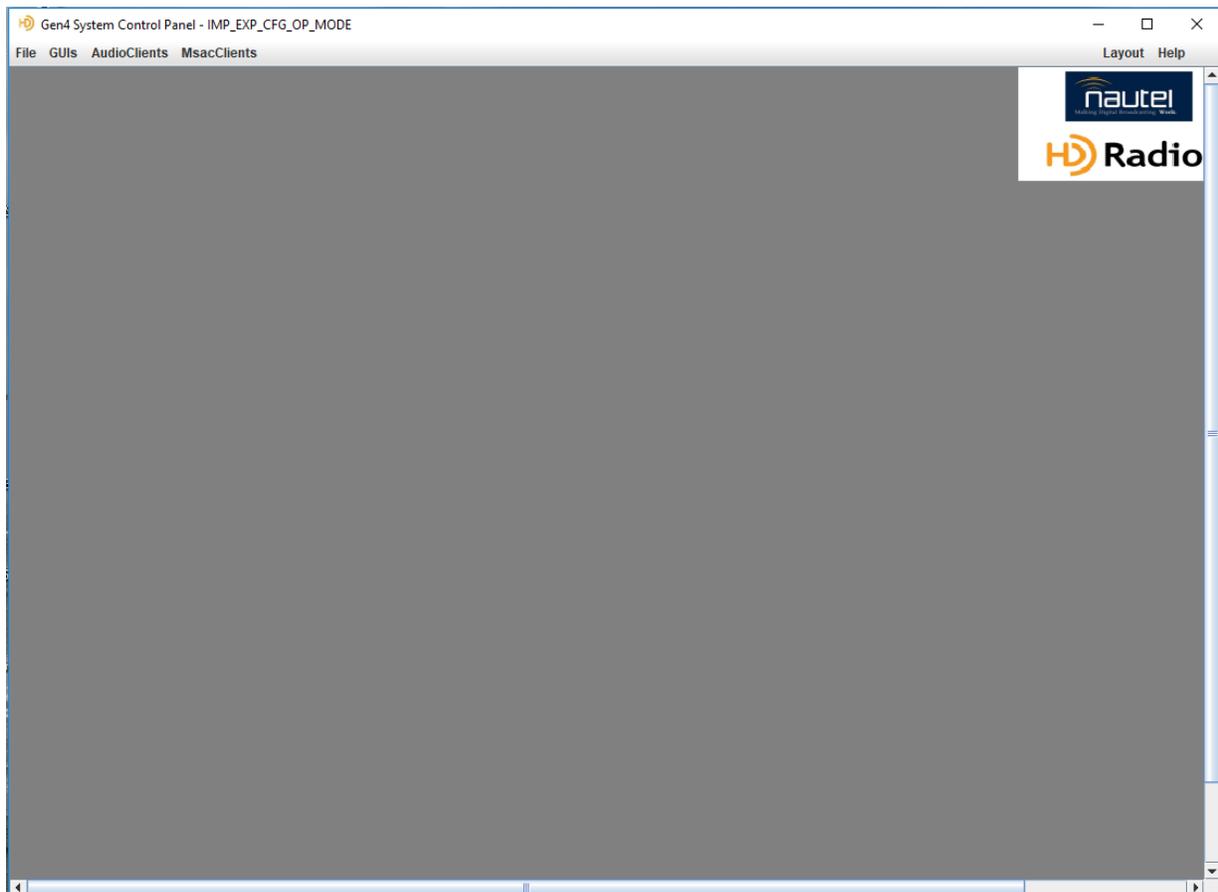


SECTION 8: MENU STRUCTURE & FUNCTIONAL DESCRIPTION

This section provides information about the HD Multicast+ Importer/Exporter Software Menu structure and provides brief functional descriptions. Refer to [Figure 8.10 on page 8-21](#) for a graphical overview.

The software includes a main Control Panel which has four sub-menus (see [Figure 8.1](#)) - the File menu, the GUIs menu, the AudioClients menu, and the MsacClients menu. The Control Panel starts automatically when power is applied. It can be started from the Desktop or programs menu by selecting the “cp” icon or menu item.

Figure 8.1: Gen4 System Control Panel



- GEN4 System Control Panel/File Menu - see page 8-3
 - Log Panel - see page 8-3
 - Restart System - see page 8-3
 - Enable Status Bar - see page 8-3
 - Exit - see page 8-3

- GEN4 System Control Panel/GUIs Menu - see page 8-3
 - EXP UI (Exporter UI) - see page 8-3
 - EmbExp Tab - see page 8-4
 - MPS Tab - see page 8-4
 - PSD Tab - see page 8-5
 - TSM Tab - see page 8-5

- Diversity Delay - see page 8-6
 - Monitor UI - see page 8-9
 - Monitor Tab - see page 8-10
 - MonCfg Tab - see page 8-10
 - Log Levels Tab - see page 8-10

 - SYS UI - see page 8-11
 - SysCfg Tab - see page 8-11
 - Comm Tab - see page 8-11
 - License Tab - see page 8-11
 - CfgUtility tab - see page 8-12

- GEN4 System Control Panel/AudioClients Menu - see page 8-13
 - Audio Input Selection - see page 8-14
 - Optional Audio Output Selection - see page 8-14
 - Stereo mode - see page 8-14
 - Vu Meter - see page 8-14
 - Audio Buffer Level - see page 8-14
 - System Output Messages - see page 8-14
 - Connect Button - see page 8-14
 - Send Button - see page 8-14
 - Stop Button - see page 8-15
 - AutoStart - see page 8-15
 - AutoReStart - see page 8-15
 - Auto Rate Convert - see page 8-15

- [GEN4 System Control Panel/MsacClients Menu - see page 8-16](#)
 - [MSAC Client User Interface buttons/selections - see page 8-17](#)
 - [Station Logo Images - see page 8-18](#)
 - [Auto-loading the MSAC Client - see page 8-19](#)
-

GEN4 SYSTEM CONTROL PANEL/FILE MENU

LOG PANEL

The HD Multicast + Importer/Exporter maintains a log which includes system warnings and errors or just basic information. It is accessed through the Log Panel.

RESTART SYSTEM

If changes are made to the system configurations while the system is operational, they may be saved, but not applied until the system is restarted. Use this menu item for a restart.

ENABLE STATUS BAR

The Status Bar displays system events, such as the startup of various processes and/or user interfaces. Enable Status bar causes this item to be constantly visible.

EXIT

Selecting the Exit menu item will shutdown the system.

GEN4 SYSTEM CONTROL PANEL/GUIs MENU

EXP UI (EXPORTER UI)

Clicking on the GUI's menu in the Gen4 System Control Panel allows for the selection of the EXP UI. This is the GUI used for setting up the Exporter portion of the system. See [8.2 on page 8-4](#).

Figure 8.2: HD Multicast+ Importer/Exporter EXP UI

The screenshot shows the 'Exp UI' window with the 'EmbExp' tab selected. The interface includes a menu bar with 'EmbExp', 'MPS', 'PSD', 'TSM', and 'ADD'. Below the menu is a toolbar with 'Refresh' and 'Save' buttons, and a status indicator 'Importer inactive'. The main configuration area is divided into several sections:

- Core:** Primary Carrier Cfg: FM_HYBRID_MP1_MP11_DYNAMIC_BASE
- SMX:**

Bandwidth	MPS Size	AAS Size
P1	8485	9776
P2	0	0
P3	0	0
P4	0	0

ImporterToExporter Delay: 0
- MPS:**
 - Decode Digital Enable
 - Service Prog Type: NON_SPECIFIC
 - Sound Exp: None
 - Core Channel Mode: STEREO
- SIS:**
 - Country Code: US [A-Z][A-Z]
 - FCC ID: 21 [1-524287]
 - Station Name (Call Sign):
 - Short Name: HD [Append "-FM" checked]
 - UnvShort Name: HD-Radio [Append "-FM" checked]
 - Encode: ISO_8859_1
 - Slogan Name: HD1 [Encode: ISO_8859_1]
 - Station Message Info: HD Radio...www.HD-Radio.com [Encode: ISO_8859_1] High Priority

EMBEXP TAB

Refer to 8.3 on page 8-5. The **EmbExp** (Embedded Exporter) tab is used to select the Primary Carrier Configuration. The only available option at this time is the default configuration of FM_HYBRID_MP1_DYMANIC_BASE. This covers all currently legal transmission modes.

The **EmbExp** tab also includes the Station information settings. Station information is transmitted along with the program material. Depending on the type of receiver, some of this information is displayed.

MPS TAB

The Audio Input capture device for the main channel HD1 is assigned in this tab.

PSD TAB

The **PSD** tab provides an interface for manually inputting and sending Program Service Data (PSD). Song Title, Artist, Album and Genre can be transmitted by filling in the appropriate entry boxes and clicking **Send**. Comments can also be sent.

The default HD1 PSD port is 11000 and is not user configurable.

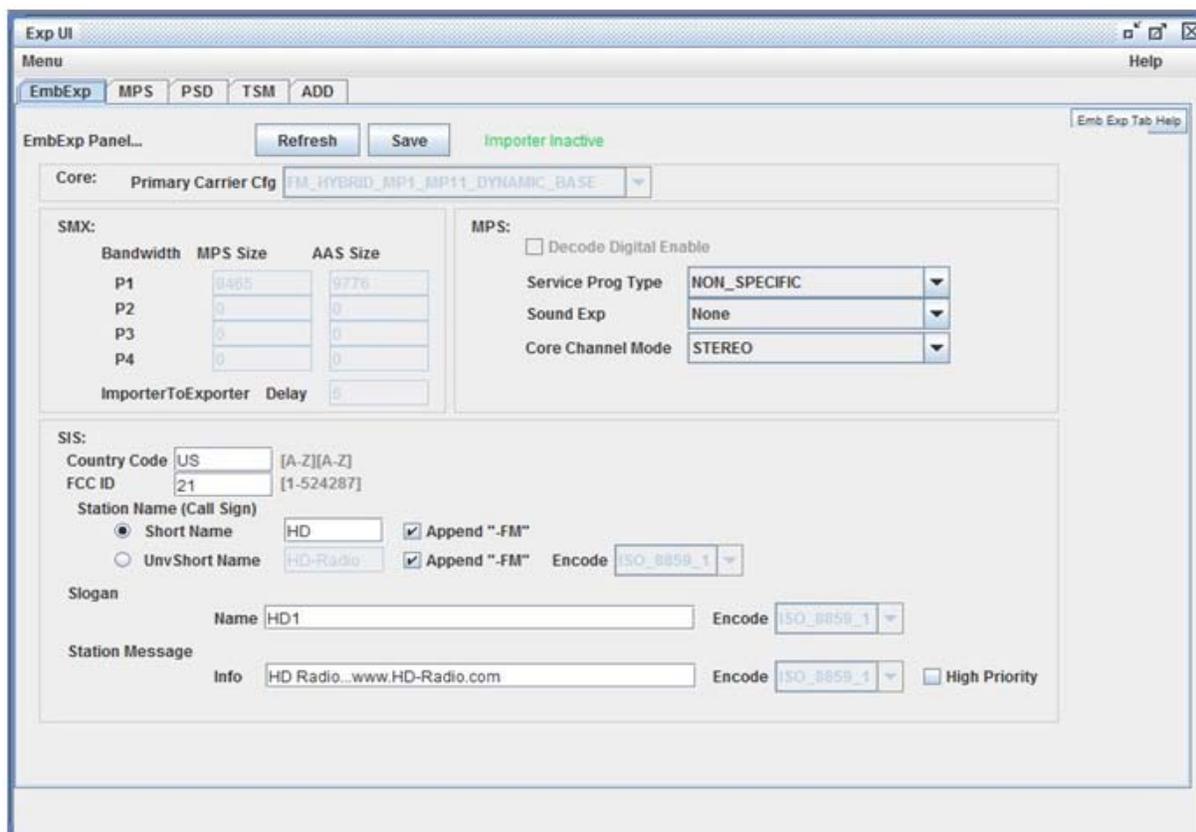
TSM TAB

The **TSM** tab is primarily informational. The location and altitude of the antenna can be input in the Position dialog. The Time dialog allows for the setting of the UTC offset and the Daylight Savings time schedule. The system uses Windows OS time, which is set up separately in the Operating System.

ADD TAB

The **ADD** tab is not used in the current product.

Figure 8.3: HD Multicast+ Importer/Exporter EXP UI



DIVERSITY DELAY

A feature of any IBOC system is the receiver's ability to transition between analog and digital playout when digital signal reception is poor. This transition should be unnoticeable for the listener, so it is important that any delay caused by digital signal processing is matched on the analog signal. This delay is typically around 7 seconds in the HDMC+ system but is somewhat variable.

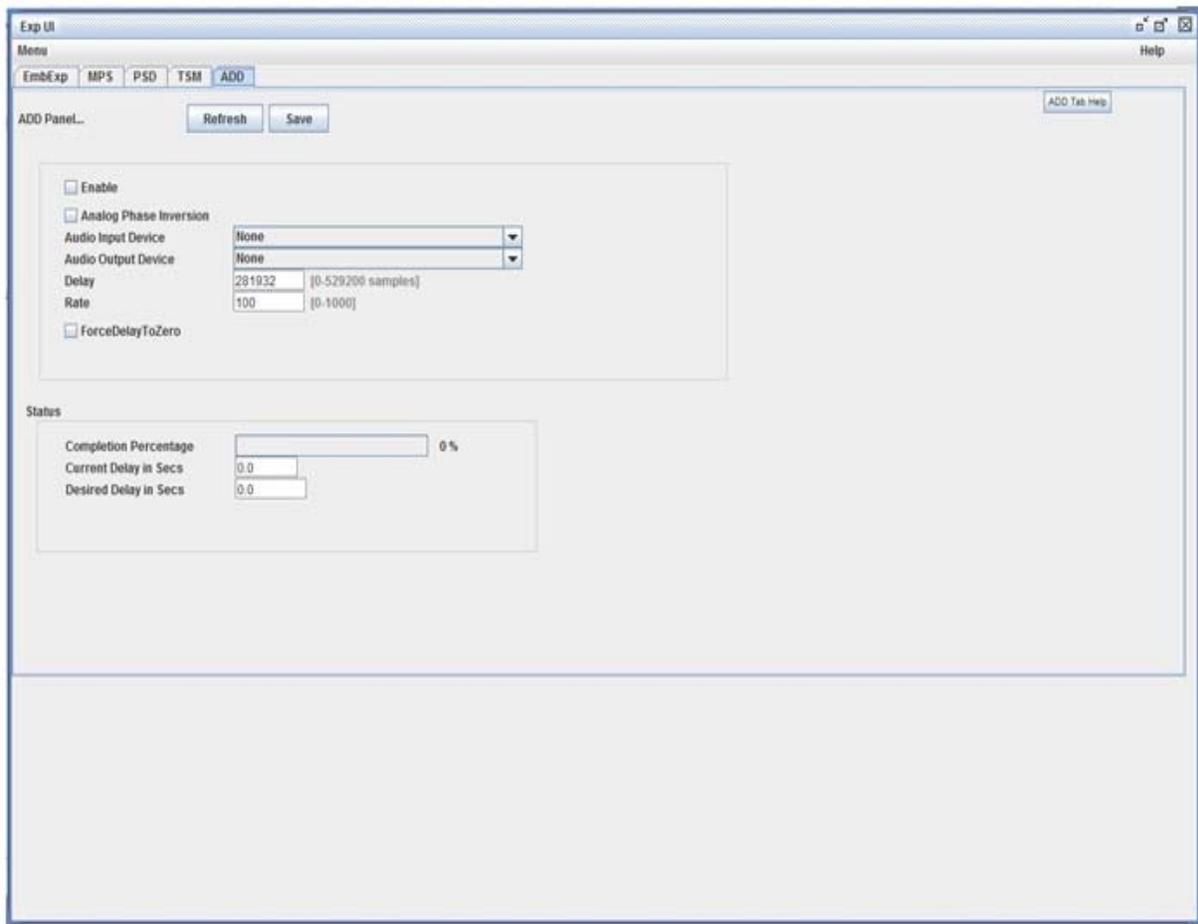
Delaying the Analog signal may be accomplished in several ways depending on the equipment on hand. It is often done in the Audio Processor or the Exciter. It can also be done in the HD Multicast+ Importer/Exporter.

If a hybrid station is broadcasting a live event, the 7 second time delay is unacceptable. In situations such as this it is common to disable the digital carriers and simply broadcast a non-delayed Analog signal. This is known as Ballgame Mode. Transitioning to and from Ballgame mode can be done by slowly reducing or increasing the diversity delay in such a way that the listener will not notice any changes to the audio during the transition. This is known as ramping.

If you are using the internal Diversity Delay mechanism of the HD Multicast+ Importer/Exporter, it is important to note that it does not include Audio Bypass circuitry. If the power fails, or another malfunction occurs, the analog portion of the broadcast will not be passed through the HD Multicast+ Importer/Exporter to the Exciter and you will be off air. Consider using additional external AES switching circuitry to ensure that the analog broadcast remains on air, should a failure occur.

The Analog Diversity Delay UI (ADD) is found as one of the tabs in the Exporter UI. It is illustrated in [8.4 on page 8-7](#).

Figure 8.4: Analog Diversity Delay



“ADD” Controls:

The controls which are available in the ADD dialog are described below. It is necessary to click the Save button in order for these controls to take effect:

- **Enable:** The Enable box turns the diversity delay functionality of the system on.
- **Analog Phase Inversion:** When checked, the phase of the Analog Audio is inverted.
- **Audio Input Device:** Select the AES Audio input from a drop down list of available devices.

**Note:**

By selecting the “Use MPS as ADD source” the same input that is being used for the HD1 channel will be used as the Analog source. This may be desirable if only a single audio feed is available. It will not allow for separate processing of the Digital and Analog audio.

- **Audio Output Device:** Select the AES Audio output which will feed the Analog input of the Exciter.
- **Delay:** This is the Analog Diversity Delay time in 44.1KHz Audio Samples. Each sample equates to 22.6 us of delay.
- **Rate:** This controls the Rate at which the Ramping of the Diversity Delay occurs. If the Rate is set to 0 when the delay is changed the change will happen instantaneously. If the rate is set to a higher number, such as 100, the delay will take effect more slowly: one additional audio sample will be inserted for every 100 audio samples. The higher the rate, the longer it takes for the full delay to be reached.
- **Force Delay to Zero:** Instantaneously (upon clicking Save) removes the Analog Delay.

“ADD” Status:

- **Completion Percentage:** Displays how much of the ramping function has completed.
- **Current Delay in Seconds:** Real time display of how much the Analog is delayed.
- **Desired Delay in Seconds:** Displays the target diversity delay.

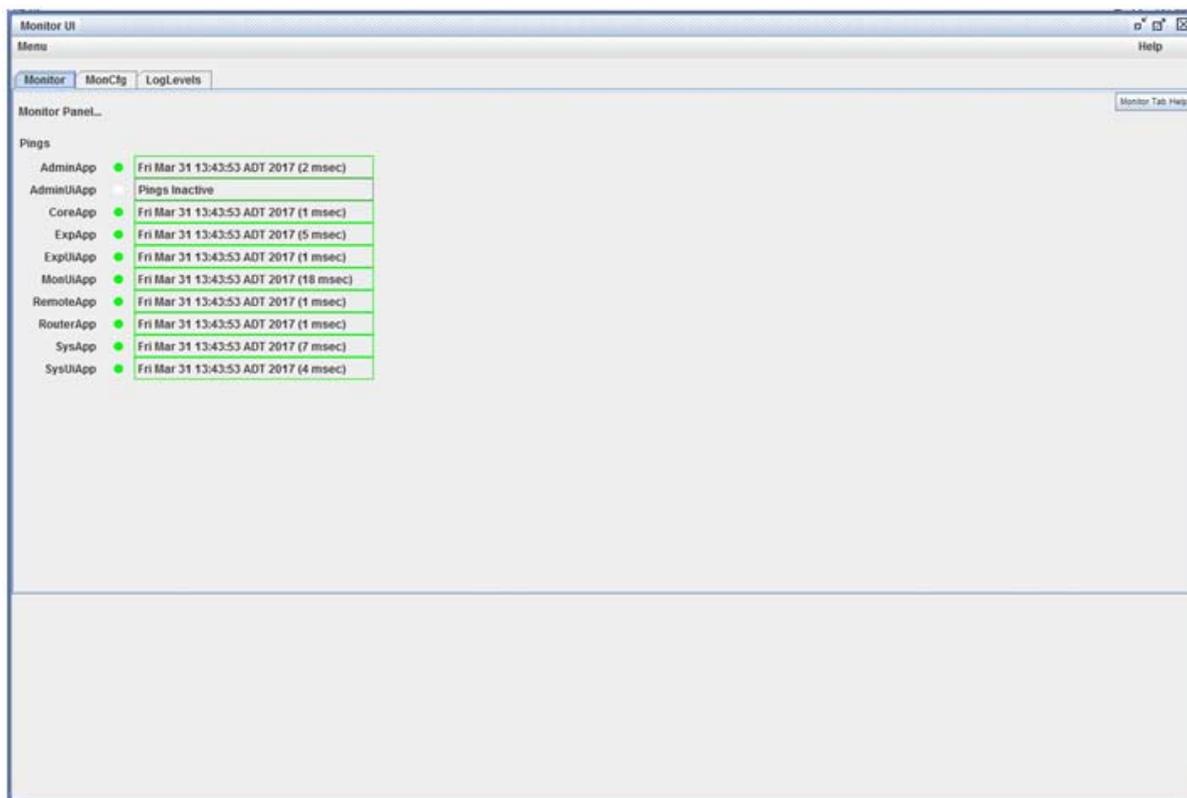
Diversity Delay Function notes and caveats:

- Exciter synchronization with the HDMC+ is critical in order to maintain precise Diversity Delay. If the Exciter is being synchronized via the Ethernet stream it is normal for some minor variations in the delay to occur. The synchronization over Ethernet mechanism has a very long time constant and it can take hours to fully synchronize. Ultimately the average delay will be zero but the instantaneous delay may not.
- External Diversity Delay controllers are available which dynamically alter the delay to keep it accurately synchronized. The HDMC+ does not interface with these devices. Dynamic Diversity Delay correction is not available with this device.

An offset may be introduced to the Diversity delay if the Exporter is powered down, suffers a power failure, is restarted or if the application is restarted. If any of these conditions occurs the diversity delay must be reset

MONITOR UI

The HD Multicast+ Importer/Exporter software includes monitoring of system processes. The Monitor UI provides the means for viewing any warning or error messages, which may occur, as well as the current status. See [8.5 on page 8-10](#).

Figure 8.5: HD Multicast+ Importer/Exporter Monitor UI

MONITOR TAB

The **Monitor** Tab shows the round trip ping time of each process. Properly running processes should include a green dot, while failed or not running processes will be red.

MONCFG TAB

Allows for altering the Ping Period parameter, which is used in the Monitor tab.

LOG LEVELS TAB

The level of Error/Status logging in the HD Multicast+ Importer/Exporter can be changed in this dialog. Typically, to prevent the logging process from slowing down the system, the logging should be set to INFO.

SYS UI

The system runs automatically when the Gen4 Control Panel is started. Several important features are included in this UI, including setting the Operational mode, Licensing the system, and starting and stopping the system.

SYS CFG TAB

The system may be set to run in the configuration mode (CFG) or the fully operational mode (FULL). Certain functions, such as licensing, must be done only while in configuration (CFG) mode. In order to run the system, it must be in Operational (OP) mode.

The system can also be configured to automatically start running when the Control Panel is run by setting the autoRun parameter to true.

COMM TAB

The **Comm** tab allows inputting several important items. The system must be in Operational mode to access this menu. Functions which are controlled from here include:

- Exporter IP Address (also found in more detail in SysCfg > E2Xinfo)
- Active Configuration Selection (choose defined configuration of audio channel bandwidths)
- Sync (Importer <-> Exporter bandwidth synchronization)
- Run (system is producing and sending E2X data)

The AutoRun parameter is also available in this dialog. When the Control Panel software is started and AutoRun is selected, the system will immediately begin sending the E2X data.

LICENSE TAB

The HD Multicast+ Importer/Exporter must have a valid license issued by iBiquity in order to operate. The following procedure describes how to obtain a license from iBiquity.

1. In the main Gen4 System Control Panel, the License tab of the Sys UI window will be open. A License-Invalid message will appear. Enter the **GUIs** menu.
2. View the Active Key Status. This indicates whether the HD Multicast+ Importer/Exporter is currently licensed. Clicking the **License KeyInfo** button will show the expiry date of a valid license.

3. If the license is not valid, click the **Refresh** button above the Request Key field. This will populate the Request Key field with a current Request Key.
4. Using a web browser, go to <https://key.ibiquity.com/register>. Fill in the requested information and register a Broadcast Account. Use **IB9890** in the Registration Code field.
5. Click **Send**.
6. Once the registration is successful, a link to the Login window will appear.
7. Click the Login link and enter your email address and password (previously input on the registration screen).
8. In the Options window, select Request New License.
9. Complete the License Request form. Enter the Request Key from [Step 5](#) in the Request Key entry box at the bottom of this form.
10. Click **Submit**. A License Key will be generated. The License Key is very large so it should be cut and pasted into a text file or directly into the License Key window on your HD Multicast+ Importer/Exporter.
11. Click the **SetLicense** button in the License Entry UI. A message indicating that a valid license has been entered will appear at the bottom of the window.

**Note:**

This licensing system uses the Ethernet MAC address as part of the validating process. This means that making any subsequent changes to the Ethernet Adapter configuration in the HD Multicast+ Importer/Exporter can invalidate the License Key. This will persist until the Ethernet Adapter configuration is restored to the same state as when the license key was acquired or until a new key is obtained. Simply unplugging an Ethernet cable may cause the key to become invalid.

CFGUTILITY TAB

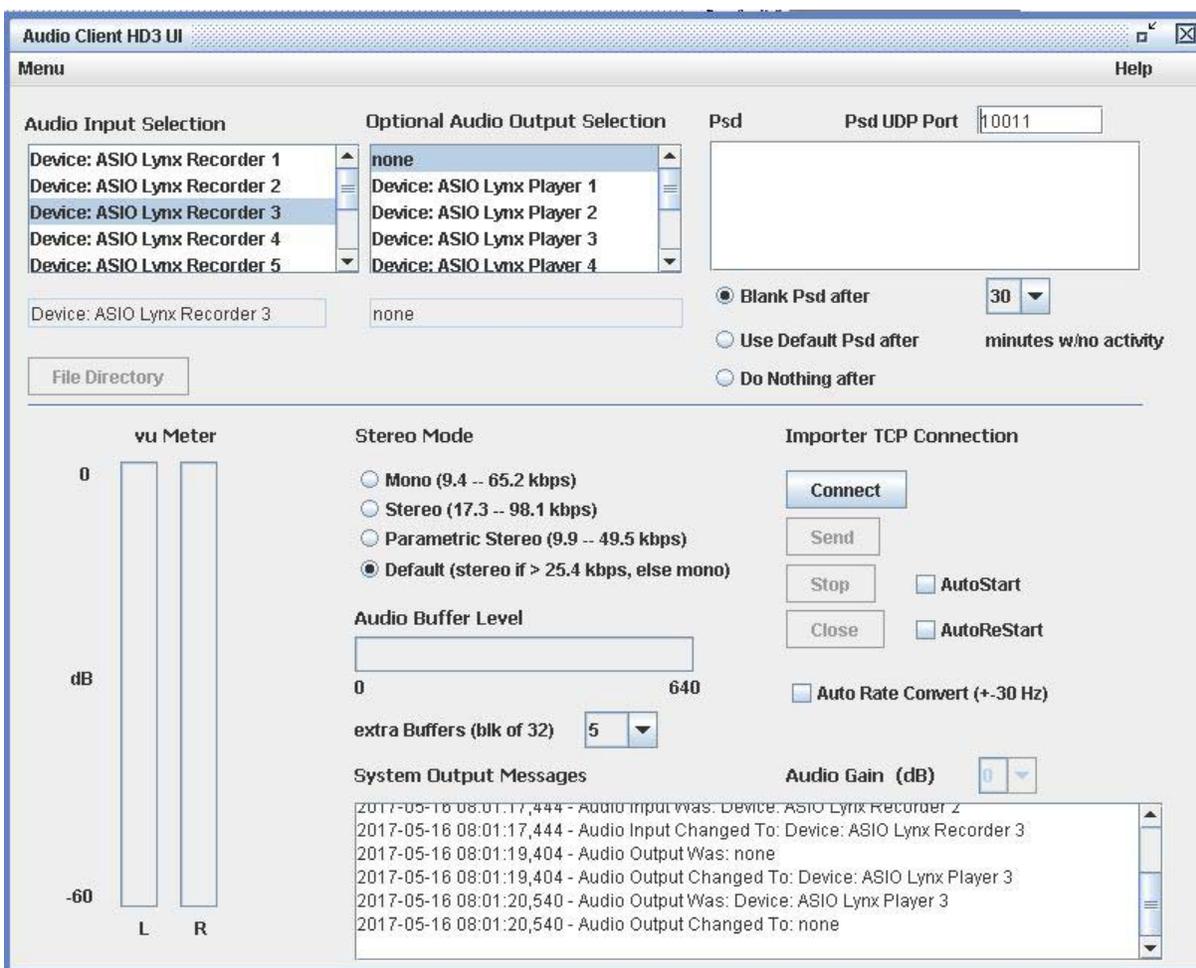
The CfgUtility will allow you to save a copy of the system's configuration. The configuration will consist of a zip file which includes a number of .CFG files. This can be saved to the hard drive on the HD Multicast+ Importer/Exporter or to a removable hard drive/flash device.

The same dialog is used if you must restore from your backup.

GEN4 SYSTEM CONTROL PANEL/AUDIOCLIENTS MENU

The Audio which will be transmitted on the secondary audio channels, HD2, HD3 and HD4, is captured by the Audio Clients. These applications are the interface between the audio input hardware and the Importer core. They can be run locally on the HD Multicast+ Importer/Exporter or remotely on a network connected computer. They are accessed by selecting the AudioClients menu on the main Gen4 System Control Panel. See [Figure 8.6](#).

Figure 8.6: HD Multicast+ Importer/Exporter AudioClients



MENU: The “Menu” item at the top left of the window contains two items:

LOGIN INFO. IP Address of the Importer. This will be 127.0.0.1 if the client is being operated on the same computer as the Importer core.

DEFAULT PSD. This allows for manual entry and sending of Title, Artist and Album information.

AUDIO INPUT SELECTION

All available Audio Input channels will be displayed in the Audio Input Selection list. Prior to shipping, the inputs will be set as below (illustrated using default Lynx Studio AES16e Audio card)

- HD2: ASIO Lynx Recorder 2
- HD3: ASIO Lynx Recorder 3
- HD4: ASIO Lynx Recorder 4

OPTIONAL AUDIO OUTPUT SELECTION

An AES/EBU copy of the audio can be output to other devices if required. By default, these are not set.

STEREO MODE

By default, the Audio Client mode is set to produce stereo if the secondary channel bandwidth is approximately 24 kbps. If a secondary channel has been allocated a low bandwidth, it may only be possible to broadcast that channel in Mono or Parametric Stereo. High bandwidth channels can also be forced to Mono or Parametric Stereo, if desired.

VU METER

The level of the incoming audio is indicated by the Vu meters.

AUDIO BUFFER LEVEL

This is an indicator of the amount of audio samples currently in the buffer. It should reach a level of approximately 50% and remain there.

SYSTEM OUTPUT MESSAGES

Current status of the Audio Client will be indicated in this window.

CONNECT BUTTON

Clicking the **Connect** button will create a connection between the Importer Core software and the Audio Client.

SEND BUTTON

Clicking the **Send** button starts the process of capturing audio and sending it to the Importer for broadcast. The secondary channel will be enabled.

STOP BUTTON

Stops the secondary channel.

CLOSE

Closes the Audio Client window.

AUTOSTART

Ticking the **AutoStart** box will bypass the requirement of clicking the **Connect** and **Send** buttons. The Audio Client will immediately begin capturing audio and sending it to the Importer core.

AUTORESTART

The client will continually attempt to connect to the Importer core until it is successful.

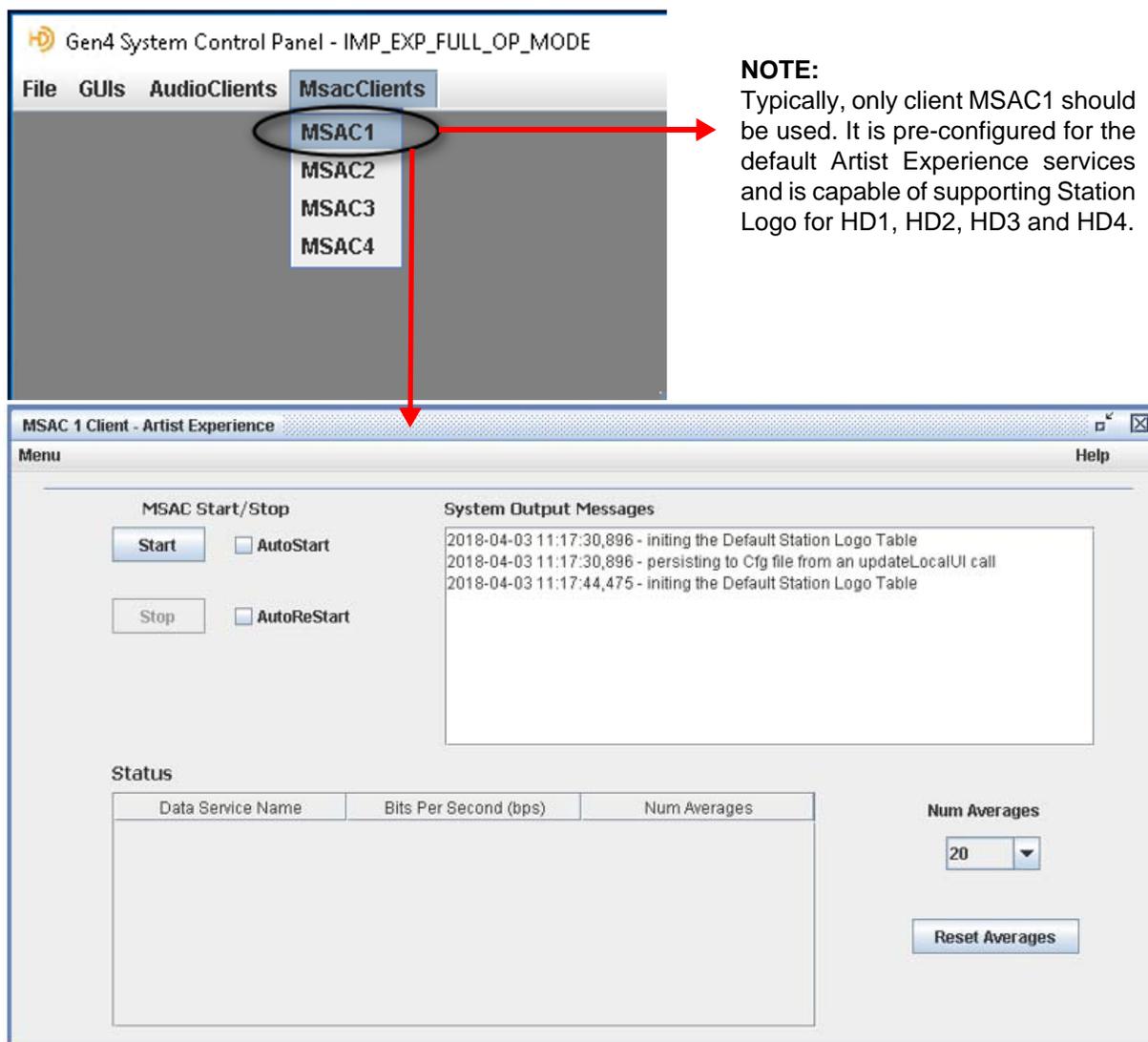
AUTO RATE CONVERT

The Auto Rate Convert function provides a software rate conversion to align signals up to 30 Hz off frequency (44.1 kHz). This function is unnecessary in the HD Multicast + Importer/Exporter as the audio is synchronized by the system audio card.

GEN4 SYSTEM CONTROL PANEL/MSACCLIENTS MENU

The HD Multicast+ software (V1.1 and newer) includes integrated MSAC clients to allow for Station Logo broadcasting. If you are using an MSAC client it must be used in conjunction with an Active Configuration that includes an "AE" suffix. MSAC clients are accessed by selecting the MsacClients menu on the main Gen4 System Control Panel and selecting the appropriate MSAC. See [Figure 8.7](#).

Figure 8.7: HD Multicast+ Importer/Exporter MsacClients



NOTE:
Typically, only client MSAC1 should be used. It is pre-configured for the default Artist Experience services and is capable of supporting Station Logo for HD1, HD2, HD3 and HD4.

MSAC CLIENT USER INTERFACE BUTTONS/SELECTIONS

START BUTTON: MSAC Client will connect to the Importer, if it is operational, and begin running.

STOP BUTTON: MSAC Client stops.

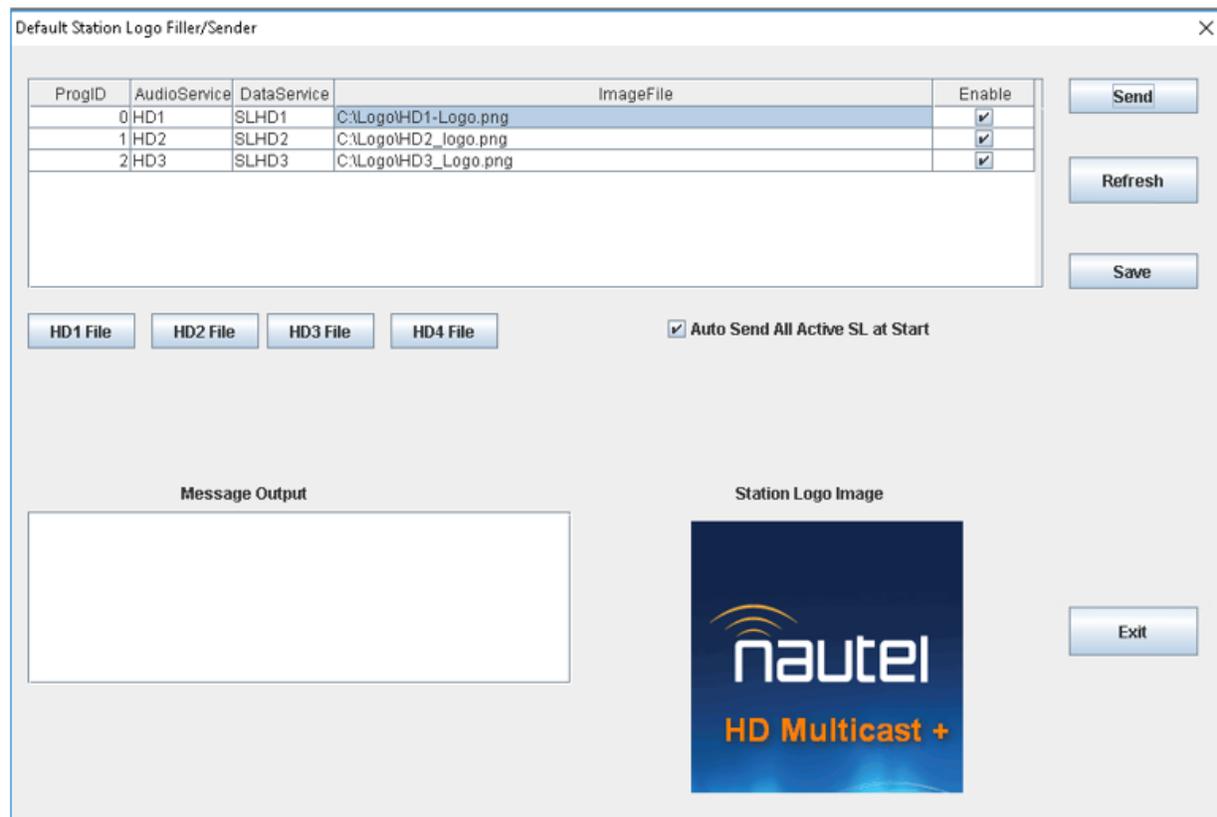
AUTOSTART CHECK-BOX: When selected, MSAC Client will attempt to connect to the Importer once without user intervention.

AUTORESTART CHECK-BOX: When selected, MSAC Client will attempt to connect to the Importer continuously until successful.

STATUS WINDOW: Displays the Station Logos being transmitted and their average bandwidth usage.

MENU: Clicking on the “Menu” item at the top left of the window provides additional control options:

- Login Info (for MSAC1): Username = aahd1; Password = aahd1
- Default Station Logo: used to manually load Station Logo images for HD1, HD2, HD3 and HD4 (see [8.8 on page 8-18](#)).
 - HD1 File - HD4 File buttons: Clicking any of these buttons enables a dialog for selecting a Station Logo image file for that particular channel. Station logos can be stored in any folder on the HD Multicast+ Importer/Exporter or in the root directory. Creating a specific folder for the Station Logo images is good practice.
 - Auto Send All Active SL at Start check-box: To eliminate the need for user intervention, when the MSAC Client opens, the Station Logo files will be sent.
 - Send button: Manually force the client to send the selected Station Logos.

Figure 8.8: Default Station Logo Filler/Sender Menu

STATION LOGO IMAGES

To ensure proper operation, images to be used for station logo must be correctly formatted. The basic specifications for a Station Logo file are as follows:

- resolution of 200 x200 pixels
- less than 24 kilobytes in size
- should be designed to display on a black or dark grey background
- should be in .jpg or .png format

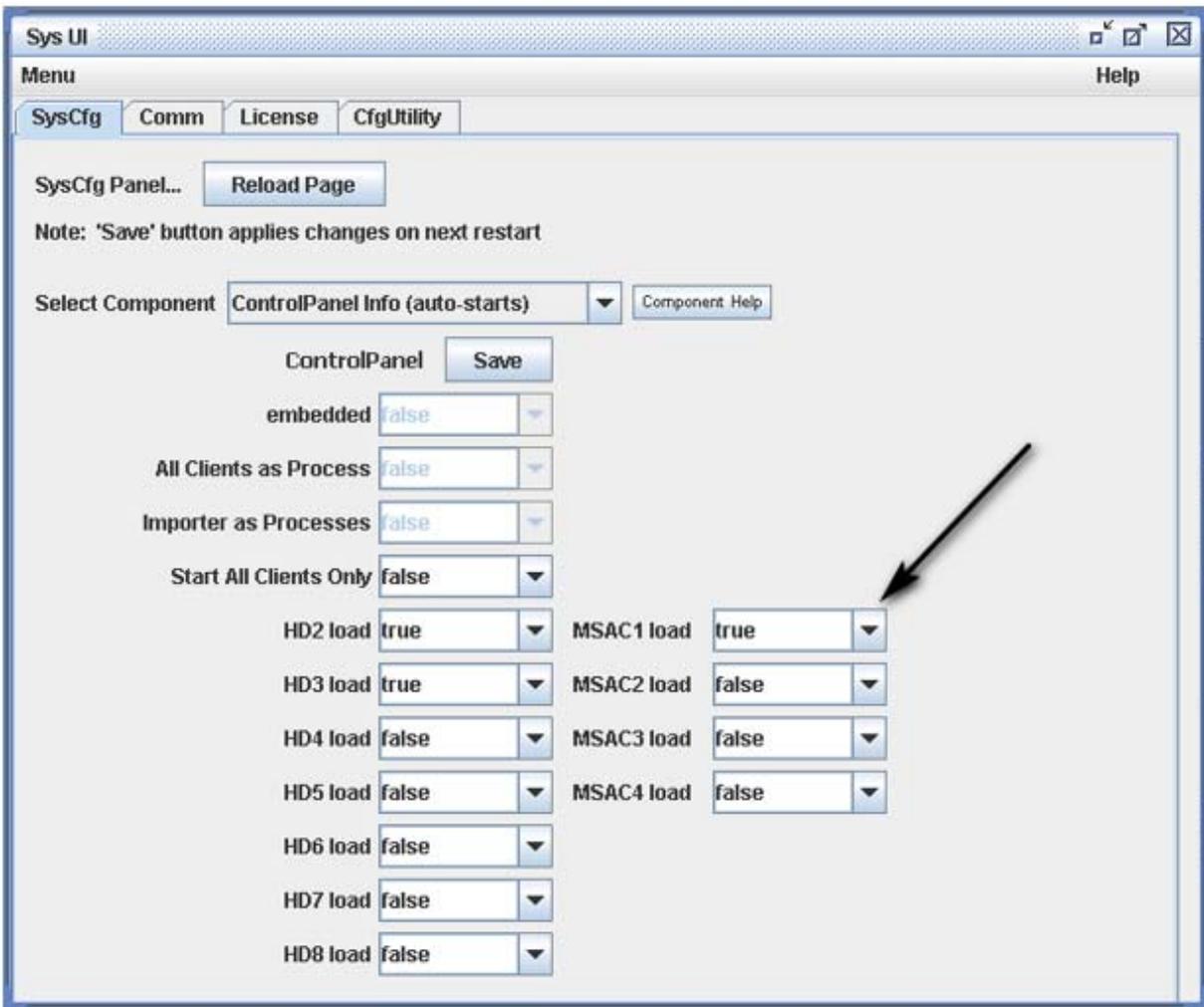
IMPORTANT!

**Verify your station logo prior to broadcasting. An online service exists to verify compliance of your station logos prior to putting them on the air. Test and verify and image intended for use at:
<http://www.hdlogoverify.com/>.**

AUTO-LOADING THE MSAC CLIENT

The MSAC client may be set to load automatically when the HD Multicast+ Importer/Exporter software is started by selecting 'true' in the desired MSAC1 load through MSAC4 load dropdown menu in the SysCfg -> ControlPanel menu (see [Figure 8.9](#)).

Figure 8.9: Sys UI Menu - Auto-Loading an MSAC Client



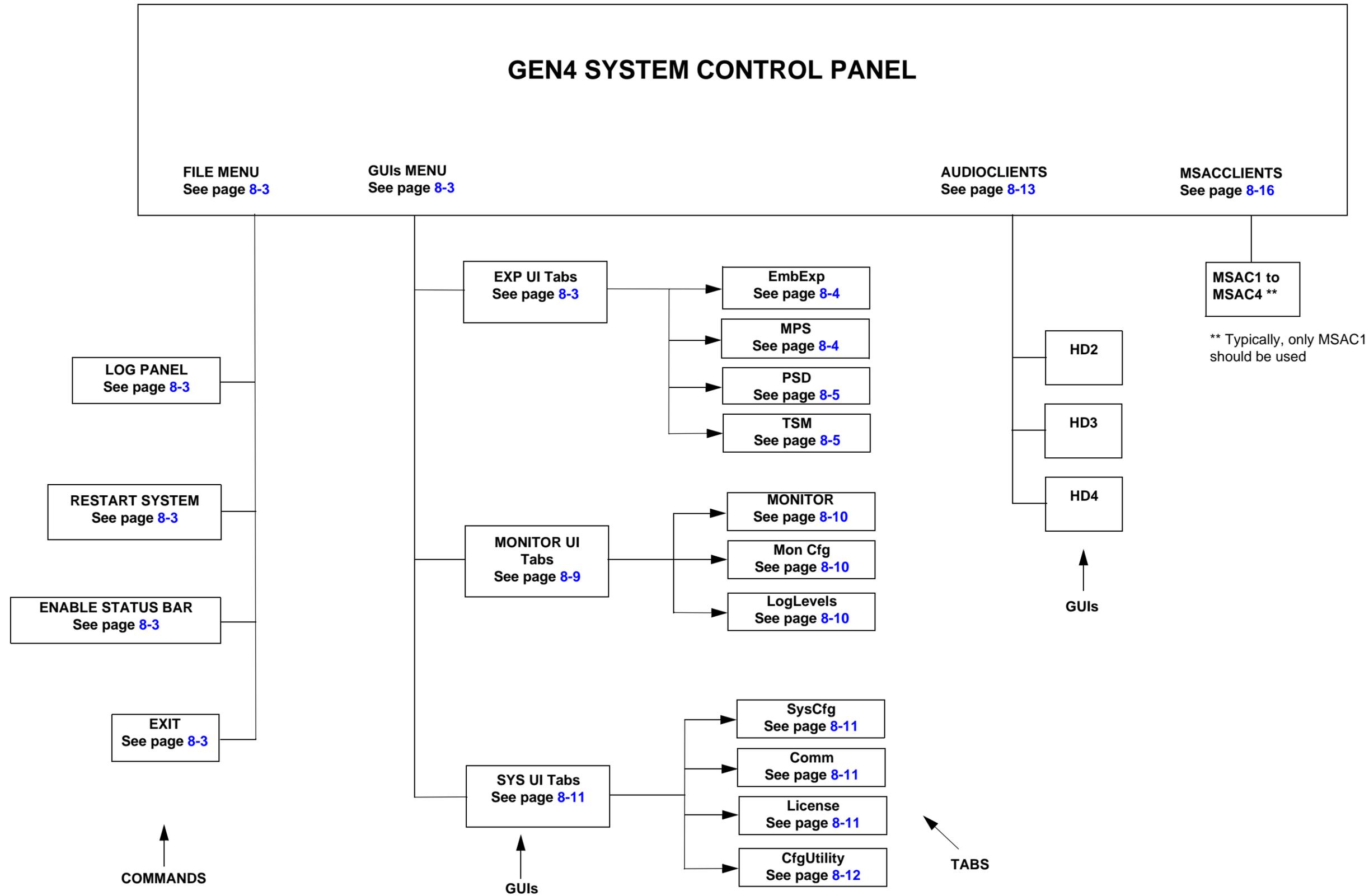


Figure 8.10: HD Multicast + Importer/Exporter - Software Menu Diagram

SECTION 9: GPS TIMING SUBSYSTEM

The HD Multicast+ Importer/Exporter includes a GPS subsystem which produces a highly accurate clock for system synchronization. The hardware includes a GPS Receiver and a voltage controlled 10.00 MHz ovenized crystal oscillator. The hardware is calibrated prior to shipping to ensure that an accurate system clock is available whether or not the system is connected to a GPS antenna.

HARDWARE

Nautel's NAPX51 GPS Timing Reference PWB plugs into a PCI slot on the HD Multicast+ Importer/Exporter's backplane. It provides power for an active GPS Antenna, included with the system. As satellites are acquired by the system, a local high accuracy voltage controlled oscillator is precisely tuned to 10.000 MHz. Additional 44.1 kHz word clocks are derived from the 10.00 MHz signal and are used to drive the system's Audio Capture card(s). External connectors are available and are configurable to output either 44.1 kHz or 10.000 MHz. These outputs can be used to synchronize the Exciter, additional Audio card(s) or other devices. Once calibrated at the factory or tuned on site, the reference will maintain 10.000 MHz at high precision.

There are several jumpers on the board which are used to select different options (see [Figure 9.1 on page 9-2](#)):

- E1: Select Antenna Voltage either +3.3 V or +5 V (Nautel supplied antenna uses +3.3 V).
- E4: Lock Calibration value into Flash Memory (used in factory setup only).
- E6: Select Output 1 to be either 10.00 MHz or 44.1 kHz.
- E7: Select Output 2 to be either 10.00 MHz or 44.1 kHz.

GPS ANTENNA

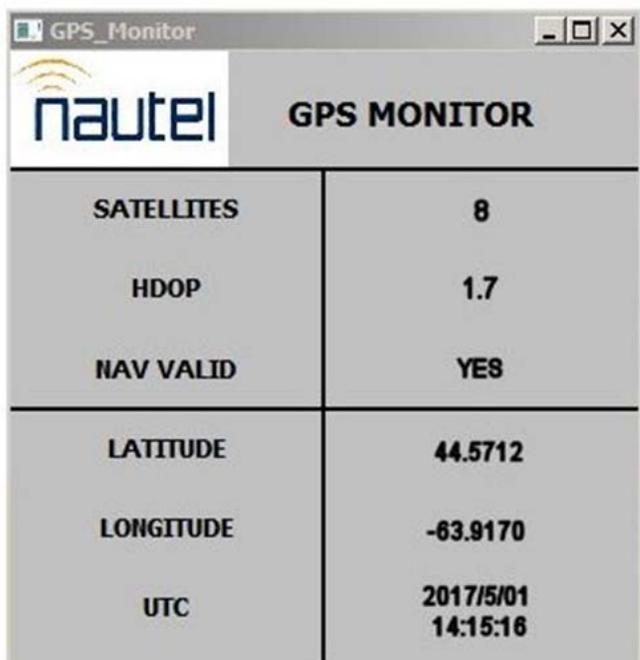
Install your GPS Antenna on a location which has a clear view of the sky.

GPS MONITOR SOFTWARE

Nautel includes a simple application for monitoring the state of the GPS Subsystem. This software simply displays information acquired directly from the GPS receiver chip.

Run this application by clicking the **GPS Monitor** shortcut on the desktop. The following information is available on the GPS Monitoring Application (see [Figure 9.3 on page 9-4](#)):

- Number of satellites in view
- HDOP (Horizontal Dilution of Precision)
 - This is an indicator of the present quality of the navigation data. A value less than 2 indicates that the quality is excellent
- NAV Valid
 - Indicates that the GPS receiver is outputting valid position data
- Latitude
- Longitude
- UTC (Coordinated Universal Time)

Figure 9.3: GPS Monitor Application

GPS MONITOR	
SATELLITES	8
HDOP	1.7
NAV VALID	YES
LATITUDE	44.5712
LONGITUDE	-63.9170
UTC	2017/5/01 14:15:16

**Note:**

This information presented by the GPS Monitor is indicative of the health of the GPS subsystem but is not tied to or used by the HD Radio software.

Front and rear panel GPS LED indicators are also included.

If the GPS is not connected or has not yet attained a valid fix, the LED's will be red.

If the receiver data is valid but not at its highest precision, the LED will be amber.

If the GPS LED is green, the clock is tuned to its highest precision and is currently tracking satellites.

The system is usable and accurate in all states, within required clock specifications.

SECTION 10: AUDIO CAPTURE

The HD Multicast+ Importer/Exporter includes a Lynx Studio AES16e AES/EBU Audio Capture card. This card can capture 8 stereo channels of AES/EBU audio and includes sample rate converters on all inputs.

The Lynx Studio software includes the “Lynx Mixer” application which allows for setting and viewing the card’s current configuration. In the HD Multicast+ Importer/Exporter system, the correct configuration of this card is important. The system’s GPS Timing reference Card is the master clock for the audio card. The clock is provided on a cable internal to the chassis which originates at the GPS Timing Reference and terminates at the Lynx card’s “Header” connection. A shortcut to the Lynx Mixer Application can be found on the desktop of the HD Multicast+ Importer/Exporter. See [Figure 10.1](#).

Figure 10.1: Lynx Mixer Application



Any of the 8 stereo channels may be used for any of the (up to four) HD channels. The HD Multicast+ Importer/Exporter is pre-configured with its four channels set as follows:

- ASIO LYNX RECORDER 1 = HD1 (MPS)
- ASIO LYNX RECORDER 2 = HD2
- ASIO LYNX RECORDER 3 = HD3
- ASIO LYNX RECORDER 4 = HD4

SAMPLE CLOCK

Current Source: The current source must be the Header.

Measured Rate: The clock sample originates on the GPS Timing Reference PWB and is 44.1 kHz. The Lynx card measures and reports this frequency.

Rate Lock: Must be active.

SynchroLock: May be active.

PREFERRED CLOCK SOURCE

Header: The measured value of the incoming clock is displayed. This must be the active clock source.

Digital In 1 - Digital In 8: Indicates than an audio source is connected. The frequency of the connected audio is reported.

SAMPLE RATE CONVERTER (SRC)

Digital In 1 - Digital In 8: Audio sources connected to the AES16e card will appear in this list, along with the SRC ratio. Since the system clock is 44.1 kHz, a 44.1 kHz AES stream will have a 1.000:1 SRC ratio.

SECTION 11: REMOTE CONTROL

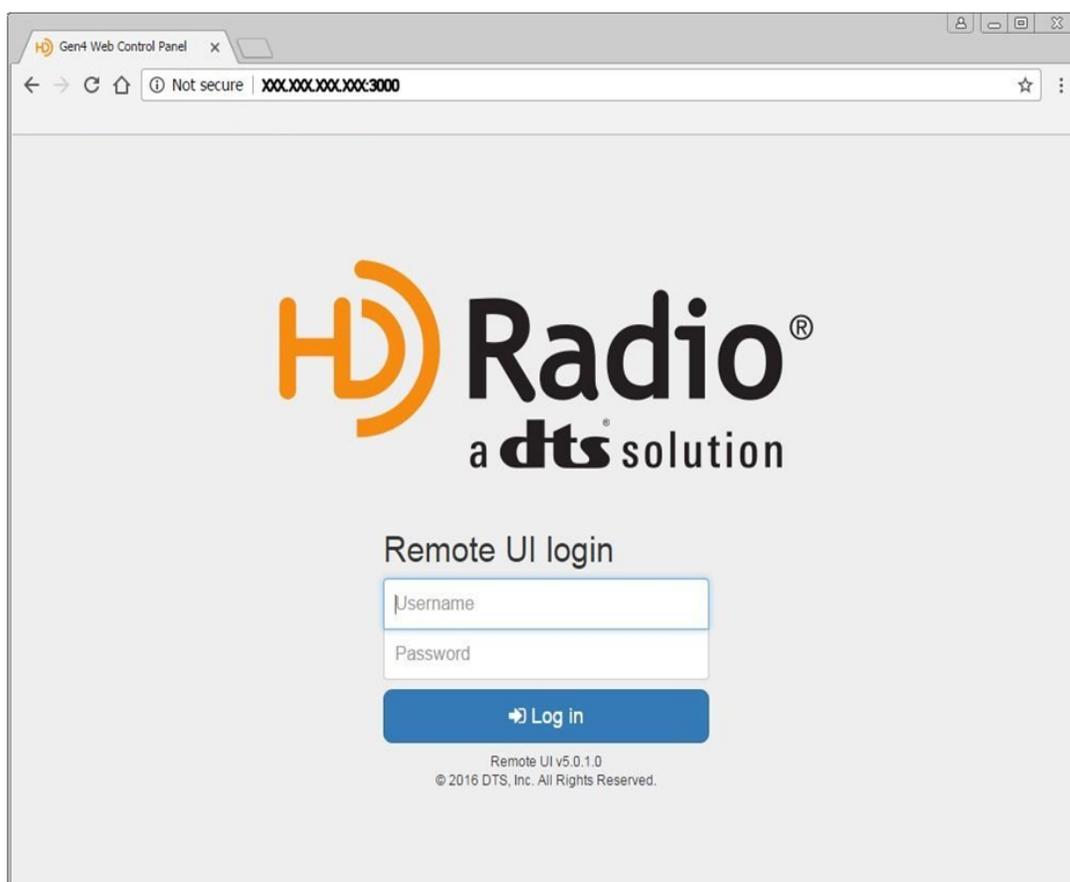
The HD Multicast+ Importer/Exporter can be controlled and monitored remotely with a standard web browser.

REMOTE UI LOGIN

Perform the following steps to log in remotely to the HD Multicast+ Importer/Exporter. See [Figure 11.1](#).

- Enter the IP Address of the HD Multicast+ Importer/Exporter, Port 3000, in the address bar of the web browser.
- Enter the Username: **HDuser**
- Enter the Password: the password is found on a tag, attached to the handle

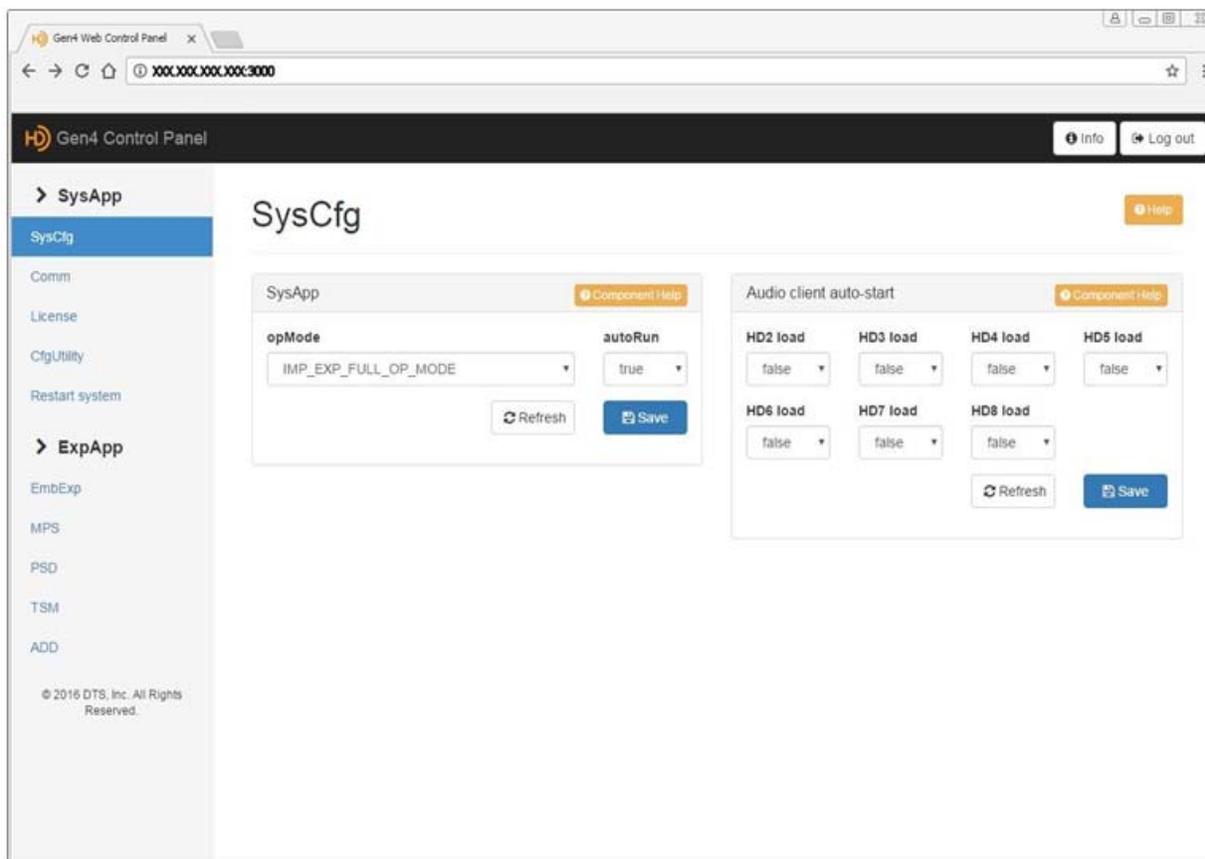
Figure 11.1: Remote UI Login Screen



The Remote UI includes all of the pages necessary to set up and run the Exporter application. It does not include the AudioClients dialog.

Figure 11.2 illustrates the main SysCfg page of the Remote User Interface. On the left side of the page is a list of links to each of the available pages. Each page includes entry fields which duplicate the fields described in Section 8, “Menu Structure & Functional Description” on page 8-1.

Figure 11.2: Remote UI SysCfg Page



SECTION 12: USING NAUTEL RELIABLE HD TRANSPORT

Nautel's Reliable HD Transport Protocol (RHDT) is included with the HD Multicast+ Importer/Exporter. The protocol introduces buffering, smoothing and data re-transmission capability to the standard HD Radio E2X link. It was developed to optimize the E2X link for situations when the system is being operated over less than optimal networks. It can reduce the amount of bandwidth required to reliably send HD data to an exciter, while at the same time, improving the robustness of the link. The risk of dead air is greatly reduced. It also provides the additional feature of allowing the user to send a single E2X data stream to multiple Exgine cards with different IP addresses. This protocol only works with Nautel Exciters equipped with Exgine cards only.

The HD Multicast+ Importer/Exporter must be configured to send E2X data to the RHDT module instead of the Exgine. RHDT is then configured to output its Ethernet stream to the Exgine card.

SETTING UP THE HD MULTICAST+ IMPORTER/EXPORTER FOR RHDT OPERATION

In the HD Multicast+ Importer/Exporter, the E2X link must be set as indicated below:

- Protocol = TCP
- IP = 169.254.10.10
- Port = 9000

See [Figure 12.1 on page 12-2](#).

Figure 12.1: E2X Settings

SETTING UP THE RHDT

Double-click the **RHDT_configuration** icon on the desktop of the HD Multicast + Importer/Exporter. The RHDT configuration window will open.

Using the RHDT Configuration Entry dialog:

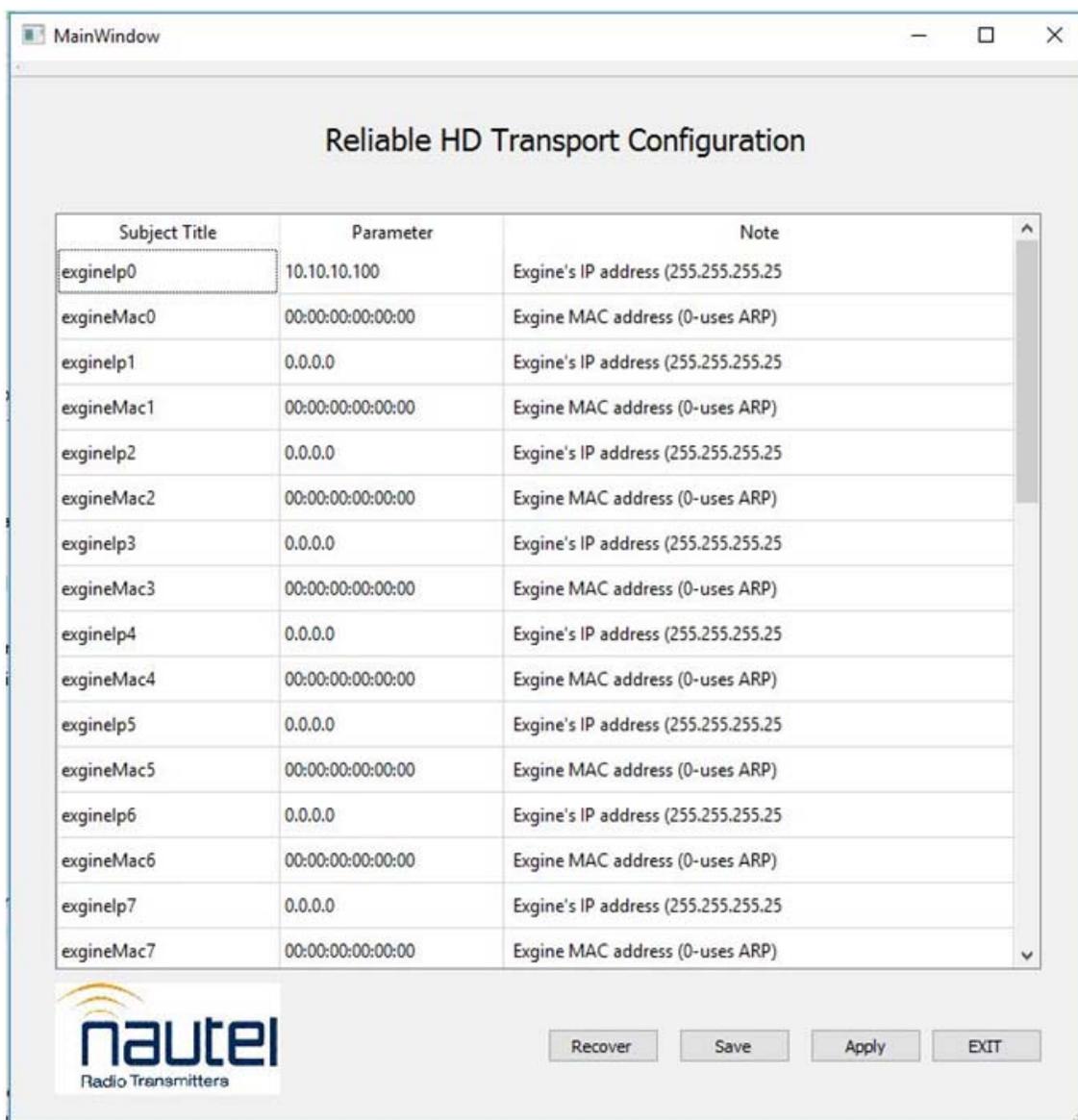
- Click any of the Parameter fields to change its value
- Click **Save** to store the data. This will be used the next time the RHDT is started.
- Click **Apply** to immediately use the entered data. This will cause a brief interruption in the HD transmission.
- Click **Recover** to restore the starting data value in any field which you are currently modifying.

CONFIGURING THE RHDT

RHDT provides the ability to transmit E2X data to up to 16 independent Engines. In the configuration dialog, these are labeled `exginelp0` to `exginelp15`. See [Figure 12.2](#).

RHDT also provides the ability to transmit E2X data to specific Ethernet MAC addresses instead of IP addresses. This should be used when the address resolution protocol cannot reach or return from the Engine, such as in the case of a unidirectional STL. All MAC address entry fields should be left as `00.00.00.00.00.00`, if not being specifically used.

Figure 12.2: RHDT Configuration Dialog



Additional parameters are also available. Typically, the factory settings are appropriate for these fields (see [Figure 12.3 on page 12-5](#)):

- e2xTosField: E2X Type of Service for Data packets
- e2xTosFieldHP: E2X Type of Service for Clock packets
- enableHPTraffic: Enable High Priority traffic
- enabledataPkRtx: Enable data retransmission
- maxReTransmitCount: Maximum number of retransmissions
- retransmitBufferDepth: Number of re-transmission requests in buffer
- maxBandwidth: Maximum Link bandwidth
- mainBandwidth: Bandwidth allocated to Main content

Figure 12.3: RHDT Typical Factory Settings

The screenshot shows a software window titled 'MainWindow' with the subtitle 'Reliable HD Transport Configuration'. It contains a table with three columns: 'Subject Title', 'Parameter', and 'Note'. The table lists various configuration parameters for engines and transport settings. At the bottom left is the Nautel Radio Transmitters logo, and at the bottom right are buttons for 'Recover', 'Save', 'Apply', and 'EXIT'.

Subject Title	Parameter	Note
exginelp12	0.0.0.0	Exgine's IP address (255.255.255.25
exgineMac12	00:00:00:00:00:00	Exgine MAC address (0-uses ARP)
exginelp13	0.0.0.0	Exgine's IP address (255.255.255.25
exgineMac13	00:00:00:00:00:00	Exgine MAC address (0-uses ARP)
exginelp14	0.0.0.0	Exgine's IP address (255.255.255.25
exgineMac14	00:00:00:00:00:00	Exgine MAC address (0-uses ARP)
exginelp15	0.0.0.0	Exgine's IP address (255.255.255.25
exgineMac15	00:00:00:00:00:00	Exgine MAC address (0-uses ARP)
e2xTosField	0	IP header Type of Service field (de
e2xTosFieldHp	0	IP TOS for clock pkts (decimal)
enableHpTraffic	disabled	If set creates high priority traffi
enableDataPktRetx	enabled	Enables retransmission of data pack
maxRetransmitCount	2	Maximum number of retransmissions p
retransmitBufferDepth	15	Number of seconds to keep a packet
maxBandwidth	300000	Maximum Bandwidth used by the expor
mainBandwidth	150000	Bandwidth allocated to main content

SECTION 13: TROUBLESHOOTING

The following troubleshooting information is included in this section:

- [Checking cable connections](#)
- [Parts Information - see page 13-2](#)
- Events Log Information - refer to [Monitor UI](#) section on [page 8-9](#)
- Electrical Schematic - see [page 13-5](#)

CHECKING CABLE CONNECTIONS

Verify that the HD Multicast+ Importer/Exporter's internal cables are connected properly as follows:

1. Remove the HD Multicast+ Importer/Exporter' top cover.
2. Inspect the cables and connections. If a connector is unseated or disconnected, ensure it is reconnected to its mate as identified in [Table 13.1](#). If necessary, see [Figure 13.1](#) on [page 13-3](#) to identify the exporter's sub-assemblies.

Table 13.1: Connector Mating Information

Connector	Mate
P1	U2-J8
P2	U3-CLOCK IN
P3	U2-J9
P4	U2-J5
P5	U1-MOTHERBOARD-COM1

PARTS INFORMATION

For the purposes of identifying parts and possibly ordering replacements, the HD Multicast + Importer/Exporter Plus' internal assemblies are identified in [Table 13.2](#), [Table 13.3](#) and [Figure 13.1 on page 13-3](#). The tables provide the reference designation, a description, and the Nautel part number for each item. The figure shows the location of the major components.

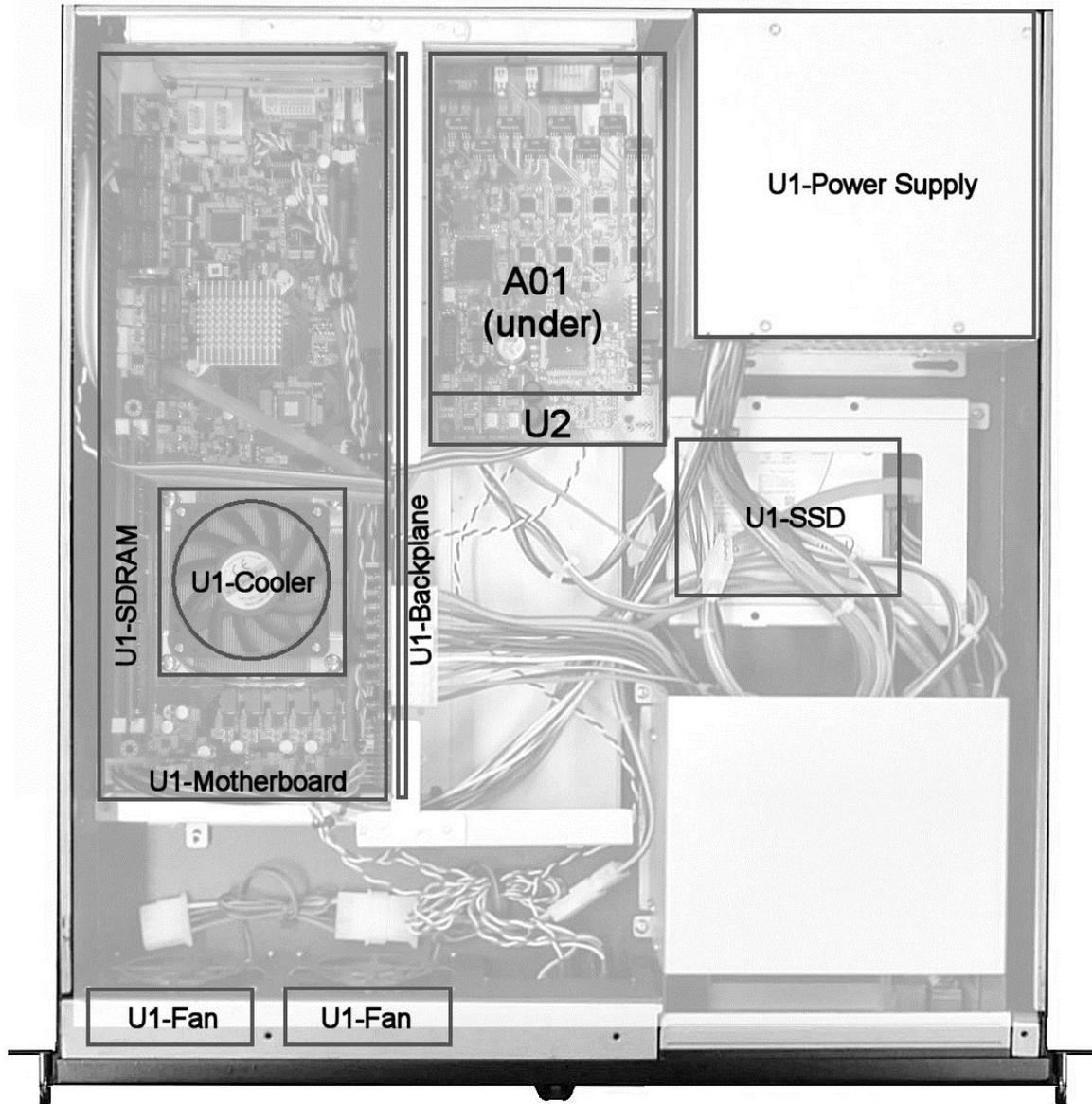
Table 13.2: HD Multicast+ Importer/Exporter Parts List (NAE111A)

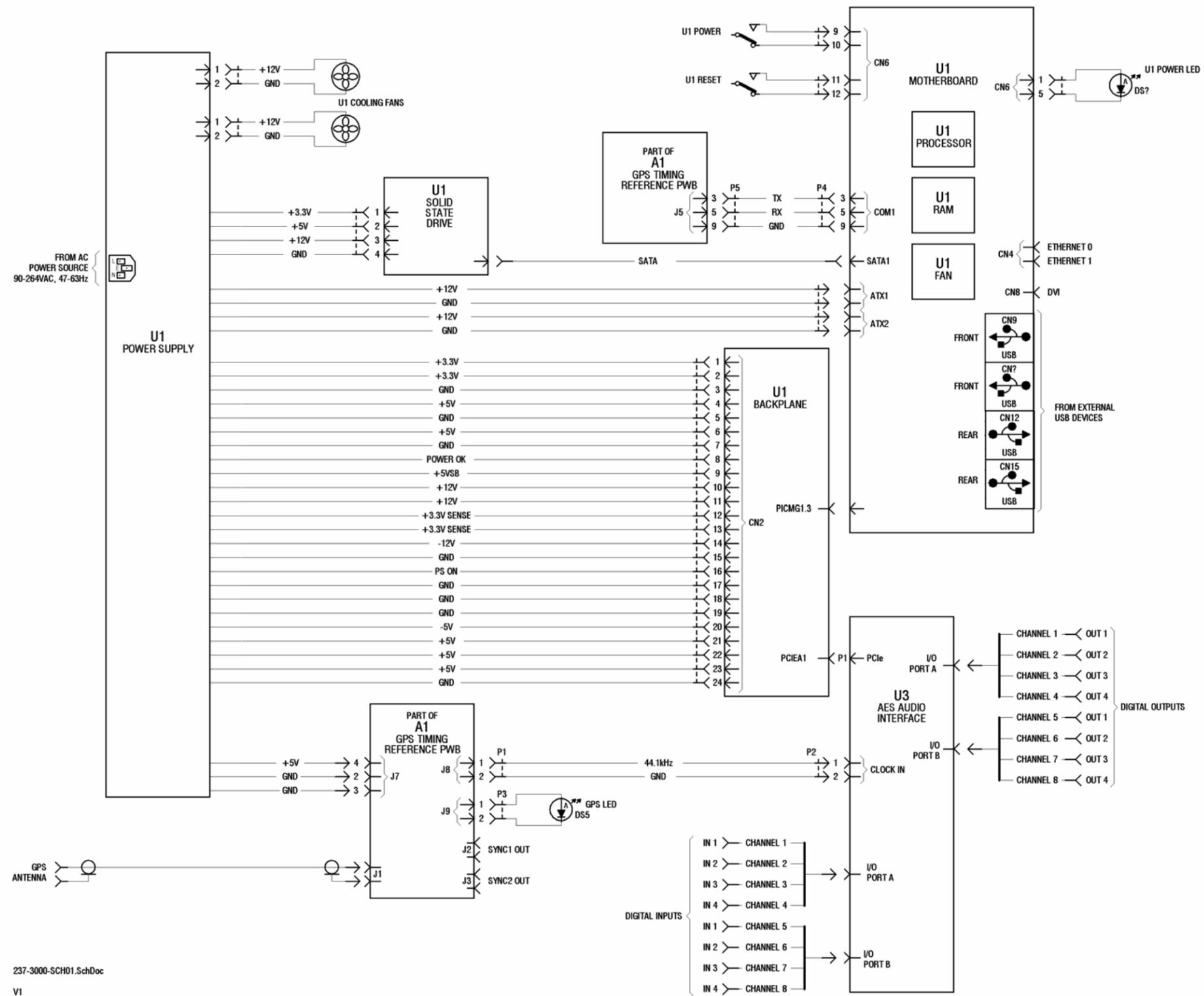
Reference Designation	Description	Nautel Part #
A1	GPS Timing reference PWB	NAPX51
U1	Computer, Rack Mount, 2RU, 19", i5, 8G RAM, PCIe, PCI (BOM)	UW197A
U2	Board, Audio, 16x AESEBU, 16x SRC, PCIe Bus	UA284

Table 13.3: Part List - UW197A

Reference Designation	Description	Nautel Part #
U1	Chassis, 2RU, 19" PICMG, 475 mm depth	UW191
U2	SBS, PICMG1.3, LGA1151, 6th gen iCore	UA287
U3	PCB Assy Backplane, PCIMG1.3, 2x PCI, 3x PCIe, 2RU, Butterfly	UA286
U4	Harddrive, SSD, SATA, 150GB, 2.5 in	UX187
U5	Memory, DDR4, 8GB, PC4-2133, 64 bit, DIMM	UX186
U6	IC, CPU, Intel Core i5-6500, FCLGA1151, SR2L6	UR118
U7	Power Supply, ATX, 2RU, 400W	UG112
U8	Fan, CPU Cooler, LGA1151, 12V, 4 wire	ZAP63
U9	Fan, 80mm, 12Vdc, 2 wire, 0.1" conn	ZAP62
U10	Fan, 80mm, 12Vdc, 2 wire, 0.1" conn	ZAP62
W1	Cable, DATA, 0.5m, Straight to Straight	UA90
W2	Cord, Line Assy, Mates with JN24, 125W	JN25

Figure 13.1: HD Multicast+ Importer/Exporter Sub-assemblies





237-3000-SCH01.SchDoc
V1

Figure 13-2: Electrical Schematic - HD Multicast+ Importer/Exporter

SECTION 14: LIST OF TERMS

This section defines some of the terms that are used in Nautel documentation.

AAS. Advanced Application Services

AES-EBU. Audio Engineering Society/European Broadcasting Union (AES/EBU) is the name of a digital audio transfer standard. The AES/EBU digital interface is usually implemented using 3-pin XLR connectors (the same type of connector used in professional microphones). One cable carries both left- and right-channel audio data to the receiving device.

CAT-5. Short for Category 5. Network cabling that consists of four twisted pairs of copper wire terminated by RJ45 connectors.

EOC. Ensemble Operations Center.

EXGINE. An HD™ Radio component which resides in the exciter. The Exgine decodes the Exciter link data and produces the appropriate I/Q modulation.

GPS. The Global Positioning System is a system of satellites and receiving devices used to compute positions on the Earth.

GUI. Graphical User Interface

HD™ RADIO. High definition (HD) Radio is another term for In Band On Channel (IBOC) technology. HD Radio is a trademark of the Ibisquity Digital Corporation.

IBOC. Nautel In-Band-On-Channel technology provides high quality digital audio over existing AM and FM radio channels.

IRSS. Ibisquity Reference System Software.

LAN. Local Area Network.

MPS. Main Program Service

NE IBOC. Nautel's In-Band-On-Channel signal generator. See IBOC. Required for XR series IBOC installations.

PAD. Program-Associated Data.

SPS. Supplemental Program Service. Sometimes called SAC. In initial tests, NPR called this Tomorrow Radio.

STL. Studio-transmitter Link. A studio-transmitter link sends a radio station's audio signals from a broadcast studio to a transmitter located some distance away from the studio.

TFTP. Trivial File Transport Protocol.

TSL. Transmitter-studio Link. A transmitter-studio link returns data (e.g., monitoring information) from a transmitter site to a broadcast studio located some distance away from the transmitter.

UDP. User Datagram Protocol. A core internet protocol whereby programs on networked computers can send short messages between one another.

VNC. Virtual Network Client.

XLR. A 3-pin connector used for a balanced audio cable. Used in pro-audio equipment and AES/EBU digital audio.

APPENDIX A:

IMPORTER DEFAULT USER CONFIGURATIONS

The Gen4 Imp-Exp is delivered with a set of **default** configurations for the MP1, MP2, MP3 and MP6 services modes. The bandwidth and channel settings for these configurations are provided in [Table 1.1 on page 1-2](#) through [Table 1.3 on page 1-4](#). The configurations with “_AE” appended to the name (i.e., Artist Experience (AE) configurations) contain Album Art (AA) and Station Logo (SL) Services. [Table on page 1-4](#) contains the configuration related settings for these services (i.e., Port Number, Service Associations, etc.).

CONFIGURATION NAMING CONVENTION

<FM/AM> _ <SvcMode> _ <#AudSvc>HD _ <AudBwAlloc> _ <ArtExp>

Where:

AudBwAlloc - indicates how the bandwidth is distributed amongst the audio programs

ArtExp - if “_AE” is appended to the end of the configuration name, then AA and SL services are included in the configuration

Table 1.1: FM_MP1_<BWOption> - Default Configurations and Bitrates

Service Name:	HD1	HD2	HD3	AE
Service Provider:	SELF	SELF	SELF	SELF
Service Type:	Audio	Audio	Audio	DATA
Program Id:	0	1	2	N/A
Channel:	P1	P1	P1	P1
BW Option	(bps)	(bps)	(bps)	(bps)
FM_MP1_3HD_HD-EVEN	32994	32132	32132	
FM_MP1_3HD_HD-EVEN_AE	32132	28859	28859	6384
FM_MP1_3HD_HD1-MID	47464	24897	24897	
FM_MP1_3HD_HD1-MID_AE	45569	22141	22141	6379
FM_MP1_3HD_HD2-HI	47464	29893	19902	
FM_MP1_3HD_HD2-HI_AE	45569	26620	17662	6379
FM_MP1_3HD_HD1-HI	63313	16973	16973	
FM_MP1_3HD_HD1-HI_AE	59350	15250	15250	6379
FM_MP1_2HD_HD1-HI	63657	33855		
FM_MP1_2HD_HD1-HI_AE	60384	32132		4290
FM_MP1_2HD_HD1-MID	53838	43674		
FM_MP1_2HD_HD1-MID_AE	51771	40746		4290
FM_MP1_2HD_HD-EVEN	48842	48670		
FM_MP1_2HD_HD-EVEN_AE	46775	45741		4290
FM_MP1_1HD	97766			
FM_MP1_1HD_AE	94493			2885

Table 1.2: FM_MP2_<BWOption> - Default Configurations and Bitrates

Service Name:	HD1	HD2	HD3	AE
Service Provider:	SELF	SELF	SELF	SELF
Service Type:	Audio	Audio	Audio	DATA
Program Id:	0	1	2	N/A
Channel:	P1	P1	P1	P3
BW Option	(bps)	(bps)	(bps)	(bps)
FM_MP2_3HD_HD-EVEN_AE	32132	32132	31960	11455
FM_MP2_3HD_HD1-MID_AE	46430	24897	24897	11455
FM_MP2_3HD_HD1-MID_HD2-HI_AE	46430	30065	19729	11455
FM_MP2_3HD_HD1-HI_AE	62279	16973	16973	11455
FM_MP2_2HD_HD1-HI_AE	63140	33683		11455
FM_MP2_2HD_HD-EVEN_AE	48670	48153		11455
FM_MP2_1HD_AE	97421			11455

Table 1.3: FM_MP3_<BWOption> - Default Configurations and Bitrates

Service Name:	HD1	HD2	HD3	HD4	AE
Service Provider:	SELF	SELF	SELF	SELF	SELF
Service Type:	Audio	Audio	Audio	Audio	DATA
Program Id:	0	1	2	3	N/A
Channel:	P1	*	*	*	P1
BW Option	(bps)	(bps)	(bps)	(bps)	(bps)
FM_MP3_4HD_HD-EVEN	32649	32132	32132	P3 24590	
FM_MP3_4HD_HD-EVEN_AE	32132	27654	27654	P3 24590	8220
FM_MP3_4HD_HD1-MID	47120	24897	24897	P3 24590	
FM_MP3_4HD_HD1-MID_AE	43502	21969	21969	P3 24590	8220
FM_MP3_4HD_HD1-MID_HD2-HI	47120	29893	19902	P3 24590	
FM_MP3_4HD_HD1-MID_HD2-HI_AE	43502	26620	17318	P3 24590	8220
FM_MP3_4HD_HD1-HI	62969	16973	16973	P3 24590	
FM_MP3_4HD_HD1-HI_AE	55561	15939	15939	P3 24590	8220
FM_MP3_3HD_HD-EVEN	48670	48498	P3 24590		
FM_MP3_3HD_HD-EVEN_AE	44880	44880	P3 24590		6465
FM_MP3_3HD_HD1-HI	63313	33855	P3 24590		
FM_MP3_3HD_HD1-HI_AE	60039	29721	P3 24590		6465
FM_MP3_2HD_HD1-HI	97593	P3 24590			
FM_MP3_2HD_HD1-HI_AE	92598	P3 24590			4215

*Channel is P1 unless otherwise noted with Bitrate value

HD MULTICAST+ IMPORTER/EXPORTER TECHNICAL INSTRUCTION MANUAL

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