# Importer

# Pre-Installation 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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# About this manual

This manual provides information about preparing for the delivery and installation of an Importer. 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 Importer.

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

## 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.

## Importer manuals

The Importer documentation suite contains the following documents:

**Importer Pre-installation Manual, Importer-PREINST.** The Pre-installation Manual provides instructions and reference information needed when planning and preparing for the installation of an Importer.

**Importer Installation Manual, Importer-INST.** The Installation Manual provides instructions and reference information needed when installing an Importer.

**Importer Operating and Maintenance Manual, Importer-OPS-MAINT.** The Operating and Maintenance Manual provides instructions for operating, maintaining and troubleshooting an Importer. It also provides reference information needed when performing diagnostic procedures.

**HD Radio™ Importer Users Guide.** This guide provides detailed instructions for operating the Importer. It was produced by iBiquity and is provided as a supplement to the Operating and Maintenance manual.

The full suite of Importer documents is 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 Importer.

### 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 Importer. Documentation is provided in Acrobat (PDF) format. You can use the documentation online or print the sections that you need.

# SECTION 1: DESCRIPTION

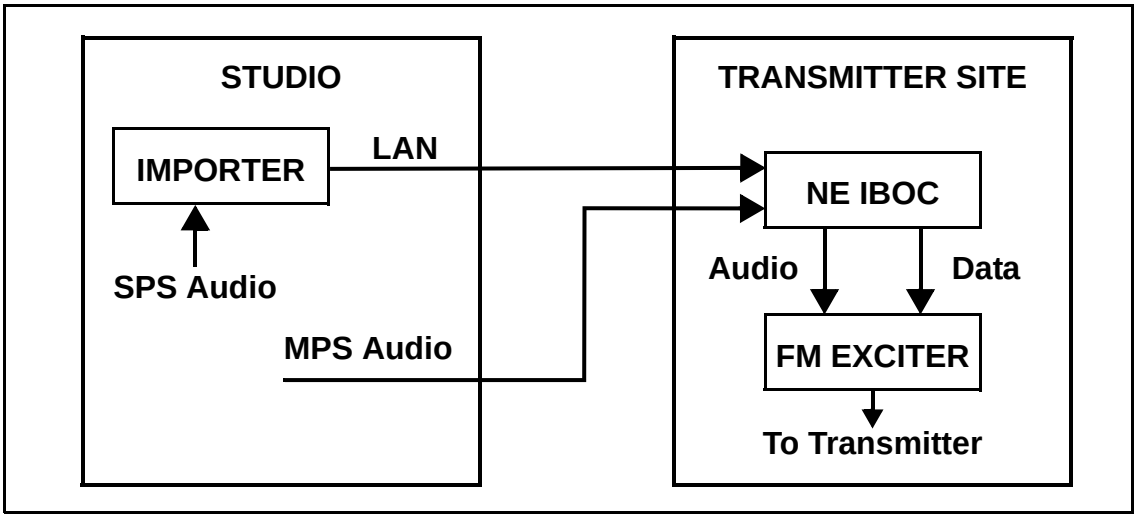
This section provides a description of the Importer and its associated digital radio system.

## IMPORTER OVERVIEW

The Importer is used in digital radio transmission systems (see Figure 1.1) with Nautel's NE IBOC (In-Band-On-Channel) signal generator or Exporter. The Importer allows multiple broadcasts within a single FM channel. It consists of a PC with compatible audio cards to support the secondary program. The Importer's application software enables partitioning of the available transmitted HD (high definition) data bandwidth, between main program service (MPS) audio and other audio and data services, collectively called advanced application services (AAS). Audio AAS are called secondary program services (SPS), and include and program associated data (PAD).

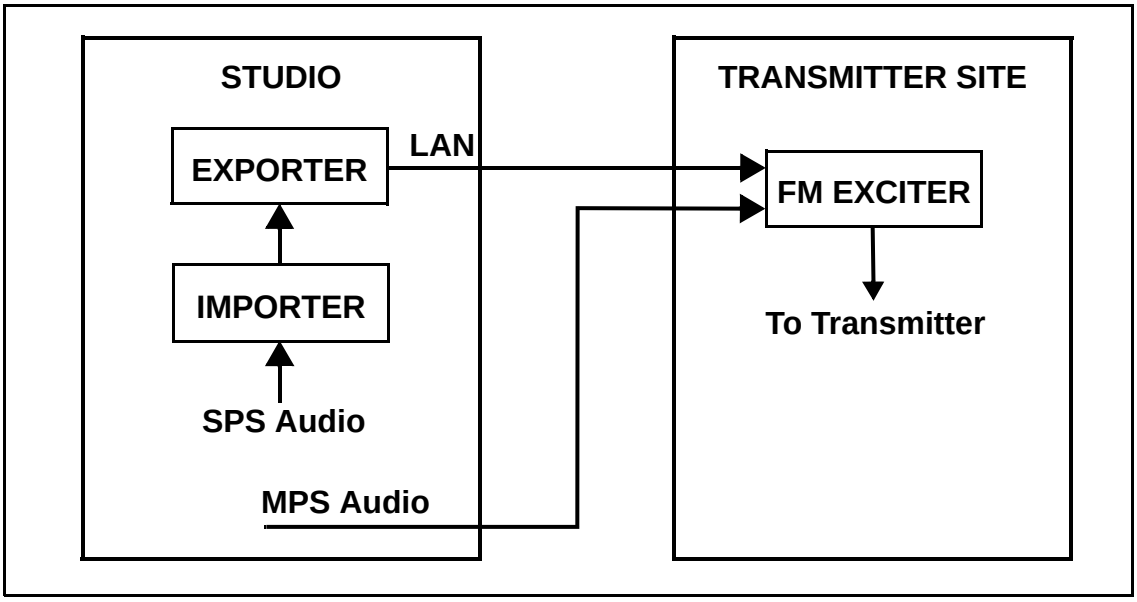
The front panel has a lockable cover and LEDs to indicate hard drive activity (HDD) and power. (Two additional LEDs are unused.) The rear panel has standard PC connections for monitor, mouse, keyboard, parallel port (DB25), one serial port (DB9), and four USB ports – two on the front and two on the back. Installed audio cards include cables and connectors for audio, and synchronizing inputs and outputs (specific to the type of audio card).

**Figure 1.1: Typical system with an Importer and NE IBOC**




*Note: The Importer can also be located at the transmitter site. This requires sending SPS audio to the transmitter site instead of through a LAN connection.*

**Figure 1.2: Typical system with an Importer and Exporter**




*Note: The Importer and Exporter can also be located at the transmitter site. This requires sending SPS audio to the transmitter site instead of through a LAN connection.*

# SECTION 2: PRE-INSTALLATION TASKS

This section provides a list of tasks that you must perform prior to delivery and installation of the Importer.

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 an Importer, perform the following tasks:

1. Ensure the correct Importer configuration is ordered. Consider the audio card, SPS (analog or AES), and equipment requirements. For detailed information, see "Configuring the Importer audio" on page 2-2.

2. Select a location for the Importer in the studio or the transmitter site. For detailed information, see "Selecting a location for the Importer" on page 2-2.

3. Prepare the network (LAN) connection between the Importer and the NE IBOC or Exporter. Consider the Importer's location and the amount of other networked equipment at the transmitter site. For detailed information, see "Planning the LAN connection" on page 5-1.

4. Consult your network manager to obtain IP address information for the Importer, NE IBOC or Exporter, and gateway. For detailed information, see "IP address information" on page 5-2.

5. If you are going to use SPS sample rate synchronization, determine how it can best be implemented.
   For detailed information, see "Synchronizing the SPS sample rate" on page 6-1.

6. Order any accessories or optional equipment that you may need. See "Parts and tools" on page 7-1.

7. Train your station technicians and operators on the use of the Importer. For a list of available technical and user documents, see *Importer manuals* in 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/

## CONFIGURING THE IMPORTER AUDIO

To configure the Importer audio inputs, perform the following tasks:

1. Determine the number of audio cards to be installed in the Importer by the quantity (1 or 2) and type (AES or analog) of audio channels you are using. Select from the following [options a) and b) are available from Nautel]:

   a) A single LynxOne audio card supports one AES/EBU channel (input and output) and one stereo analog channel (input and output).

   b) Two LynxOne audio cards are required if you are using two SPS channels that are both AES/EBU.

2. If you are using AES format audio, the sample rate into the audio cards must be 44.1 kHz.

3. If you are using analog audio, ensure the audio card sample rate is set to 44.1 kHz.

4. For best audio performance, synchronize the 44.1 kHz audio sample rate to the HD system 10 MHz reference. See also "Synchronizing the SPS sample rate" on page 6-1.

## SELECTING A LOCATION FOR THE IMPORTER

To ensure that the desired location for the Importer is suitable, perform the following tasks.

1. Determine whether the Importer and its host cabinet will be located in the studio or the transmitter site. Consider the following choices and associated requirements:

   a) If you install the Importer at the transmitter site with the associated NE IBOC or Exporter, you will ease the connection required between the studio and the transmitter site. In this case you will need to send only SPS audio to the Importer rather than a LAN connection. See also "Planning the LAN connection" on page 5-1.

   b) If you install the Importer at the studio, but have the NE IBOC or Exporter at the transmitter site, you will need to provide a LAN connection over the studio-transmitter link (STL). Ensure the STL can support this capability. See also "Planning the LAN connection" on page 5-1.

c) If the Importer is co-located at the studio with the Exporter, you will need a simple Cat-5 Ethernet cable and suitable Ethernet routing device to connect the equipment. In this case all HD program information must be sent to the transmitter site through an Ethernet enabled STL.

2. Ensure you have a cabinet and room space suitable for installing the Importer. See "Physical requirements" on page 3-1 and "Cooling requirements" on page 4-1.

3. Ensure the Importer is near a standard 120 V ac power outlet.

# Section 3: Physical requirements

This section provides physical specifications for the Importer and its components, and lists physical site requirements. This section includes the following topics:

- Dimensions
- Clearances
- Weight

## Dimensions

The Importer has the following dimensions:

- Height: 3U, or 13.3 cm (5.25 inches)
- Width: 48.3 cm (19 inches)
- Depth: 63.5 cm (25 inches)

## Clearances

Ensure there are minimum clearances of 1.3 m (4.0 feet) at the front and the rear of the Importer's host cabinet to allow room for installation, operation and ventilation. There is no clearance required on either side of the Importer.

## Weight

The Importer weighs 18 kg (40 lbs).

# Section 4: Cooling requirements

This section provides information about heating and cooling requirements for the Importer.

The Importer's maximum chassis temperature must not exceed 38°C (100°F). To satisfy this requirement:

- Do not allow the Importer room ambient air temperature to exceed 30°C (86°F)at sea level. De-rate 3ºC (5.4°F) per 500 m – or 2ºC (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 Importer next to other warm equipment.

# SECTION 5: PLANNING THE LAN CONNECTION

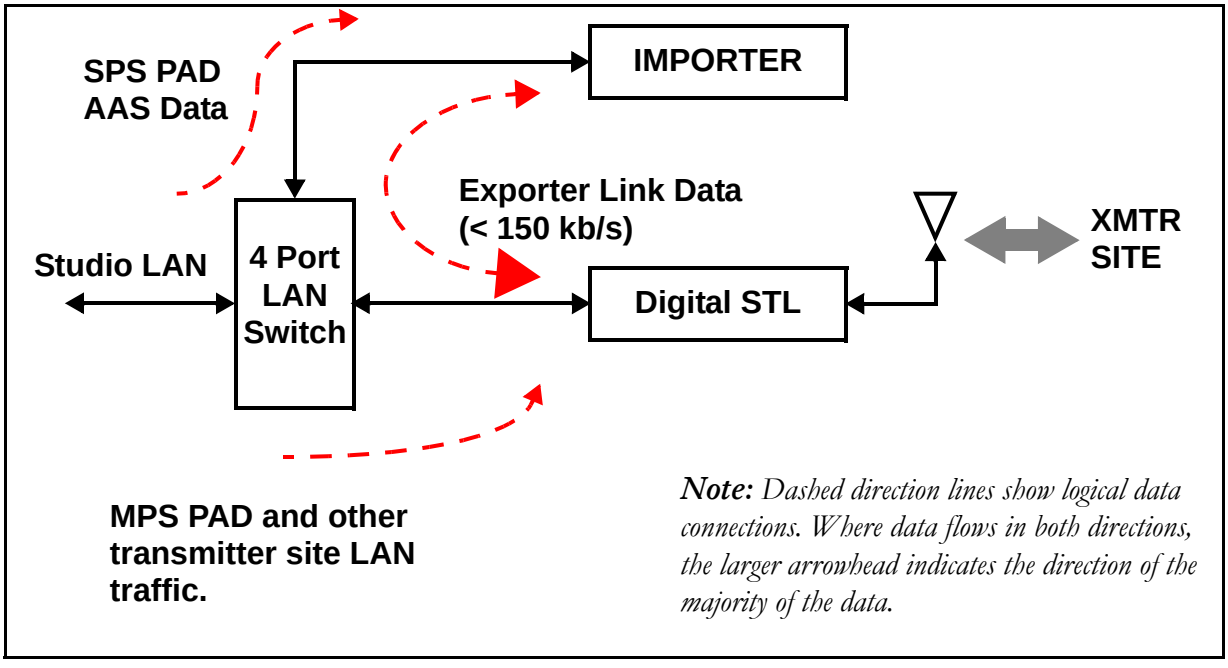
This section provides information about the LAN connection between the Importer and the NE IBOC or Exporter. Assess your existing network's capabilities, or establish a network that meets the requirements of this section. This section includes the following topics:

- Managing network traffic
- STL capacity
- IP address information

## MANAGING NETWORK TRAFFIC

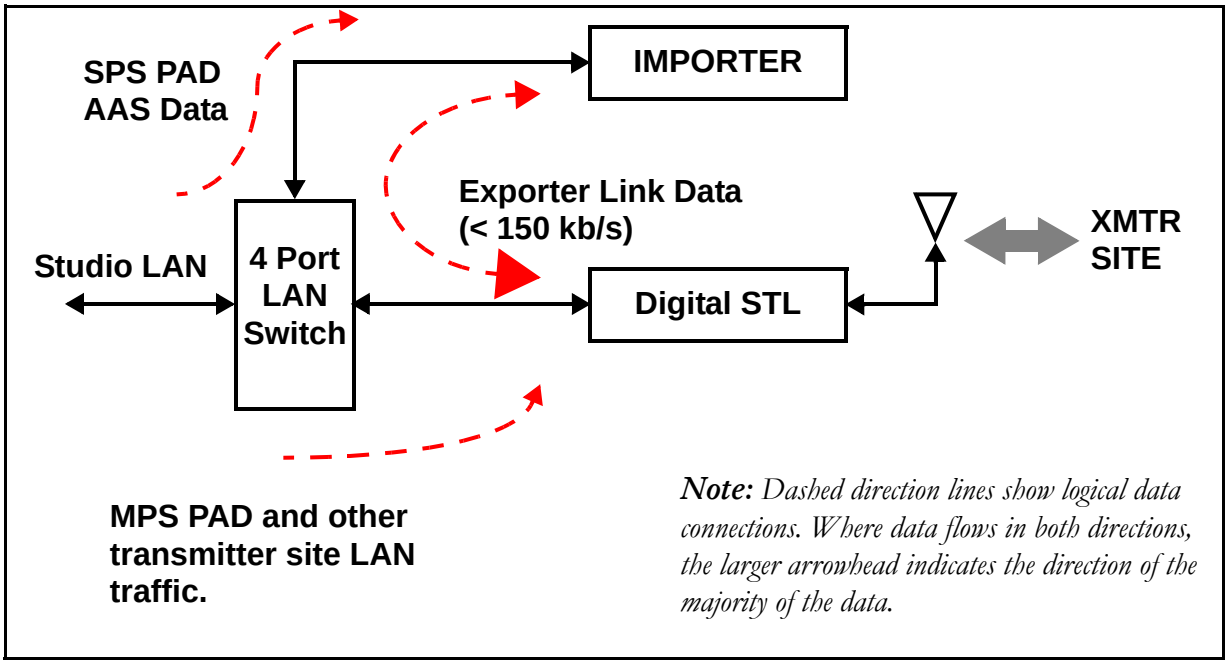
Network traffic between the Importer and NE IBOC or Exporter contains time sensitive information, such as audio, and cannot tolerate variation in transport time. Consider using network devices such as switches to intelligently route the network traffic. If possible, avoid using network hubs, which are slow in nature. The simplest configuration is to place the Importer close to the NE IBOC or Exporter and connect them using a single crossover Cat-5 cable. Figure 5.1 shows an Importer connected to a LAN to allow communication with the NE IBOC at the transmitter site, via the STL. The STL is shared with other LAN traffic between the studio and transmitter site.

**Figure 5.1: Example of a LAN configuration**



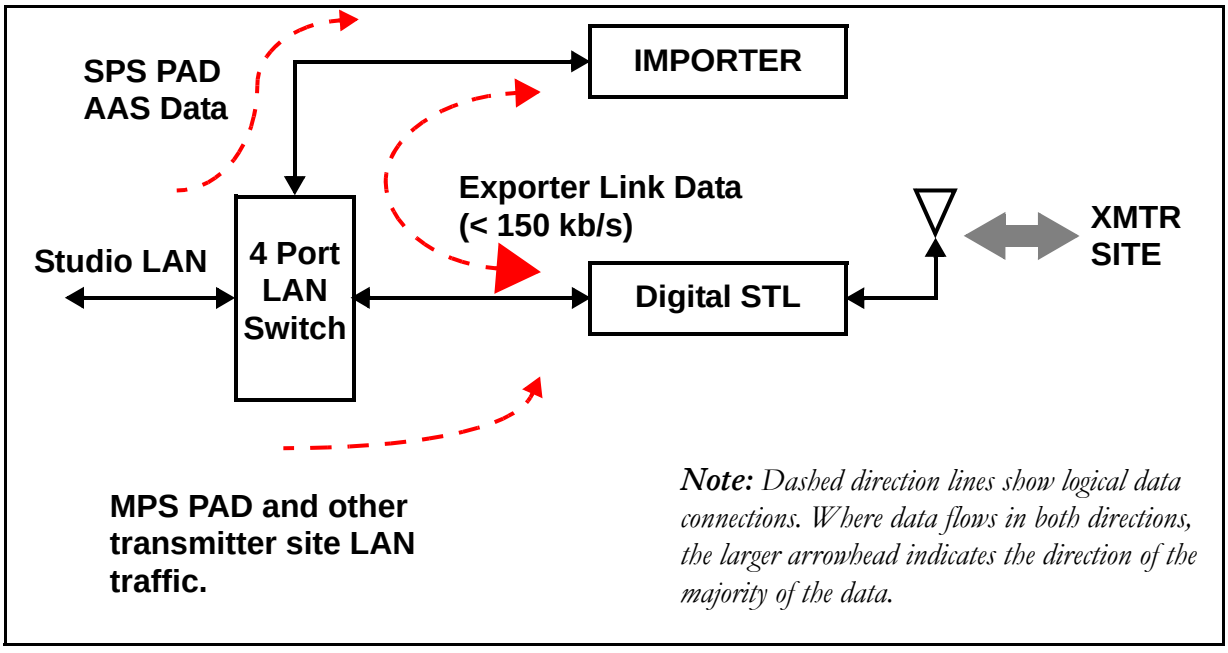

*Note: MPS PAD, SPS PAD, and AAS data are optional HD data services.*

**Figure 5.2: Example of a LAN configuration**




*Note: MPS PAD, SPS PAD, and AAS data are optional HD data services.*

**Figure 5.3: Example of a LAN configuration**




*Note: MPS PAD, SPS PAD, and AAS data are optional HD data services.*

### NETWORK SWITCH

Incorporating a network switch (see Figure 5.1 on page 5-1) ensures that the connection to the Importer carries only SPS PAD and exporter link data, and that the connection to the digital STL carries only exciter link data, MPS PAD (for the NE IBOC or Exporter), and any traffic for other devices at the transmitter site.

### NETWORK BANDWIDTH

It is assumed that the Importer and NE IBOC or Exporter have fixed IP addresses. Because STLs have limited total throughput, the available networking bandwidth depends on how much of the throughput is being used for audio or other services. Determining available bandwidth depends on the type of STL and how it is being used.

## STL CAPACITY

The STL capacity on the LAN channel must be approximately 150 kb/s to send the Importer data to the NE IBOC or Exporter.

## IP ADDRESS INFORMATION

Since the Importer will be connected to the NE IBOC or Exporter over a LAN, you will need to determine the IP addresses for the Importer, the NE IBOC or Exporter, and the gateway. Consult with your network manager for this information. If they are to be connected together directly, the choice of IP address is arbitrary. For example the following could be used:

- NE IBOC or Exporter IP: 10.10.10.10
- Importer IP: 10.10.10.12
- Gateway IP: 10.10.10.2

# Section 6:
# Synchronizing the SPS sample rate

This section aids in assessing the feasibility of synchronizing the SPS sample rate to a 10 MHz reference. This section includes the following topics:

- General considerations
- Methods to achieve synchronization
- Additional equipment

## General considerations

You can achieve the best SPS audio performance if you synchronize the 44.1 kHz audio sample rate to a GPS reference. The difference in audio quality may not be perceptible, or even important, given that SPS channels are typically lower quality audio. To synchronize, you may require considerable equipment infrastructure (see "Additional equipment" on page 6-3) depending on the system configuration.

The station manager should review *Methods to achieve synchronization* in this section and determine whether it is a worthwhile investment.

## Methods to achieve synchronization

There are different ways to synchronize the SPS audio sample rate, based on the number of channels and the location of the Importer. Consider the following:

### Using the EASU for single channel applications

Nautel supplies an Exciter Auxiliary Services Unit (EASU) in an 8.9 cm (3.5 inch or 2U) chassis with each NE IBOC or Exporter. The EASU provides all of the necessary functionality to achieve optimal synchronization for a single channel. When supplied with an NE IBOC or Exporter, the EASU synchronizes the main program AES. However, it does have additional outputs, word clock and spare main program AES that you can use as inputs to a sample rate converter.

## USING AN AUDIO PROCESSOR AS A SAMPLE RATE CONVERTER

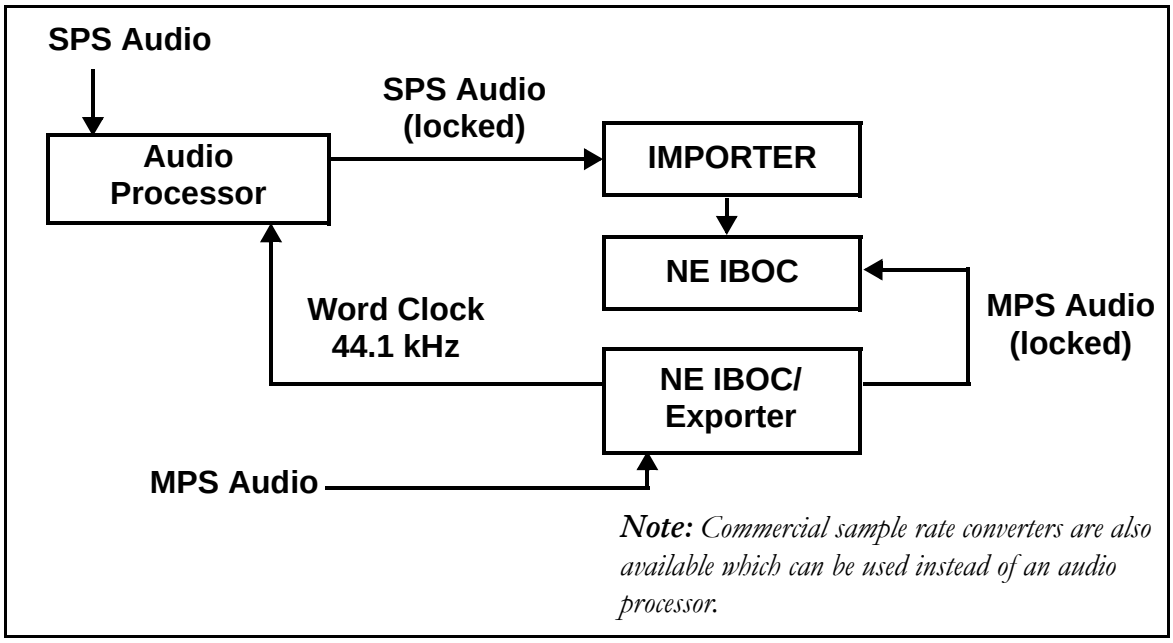
Some audio processors can provide the sample rate conversion function. An audio processor must be able to accept either a word clock or another AES input as a synchronizing signal for its output AES sample rate.

### IMPORTER LOCATION

If the Importer will be co-located with the NE IBOC or Exporter, and a suitable audio processor will be used to condition the SPS audio, the audio processor may be able to perform the synchronization. See Figure 6.1 for a block diagram of this setup.

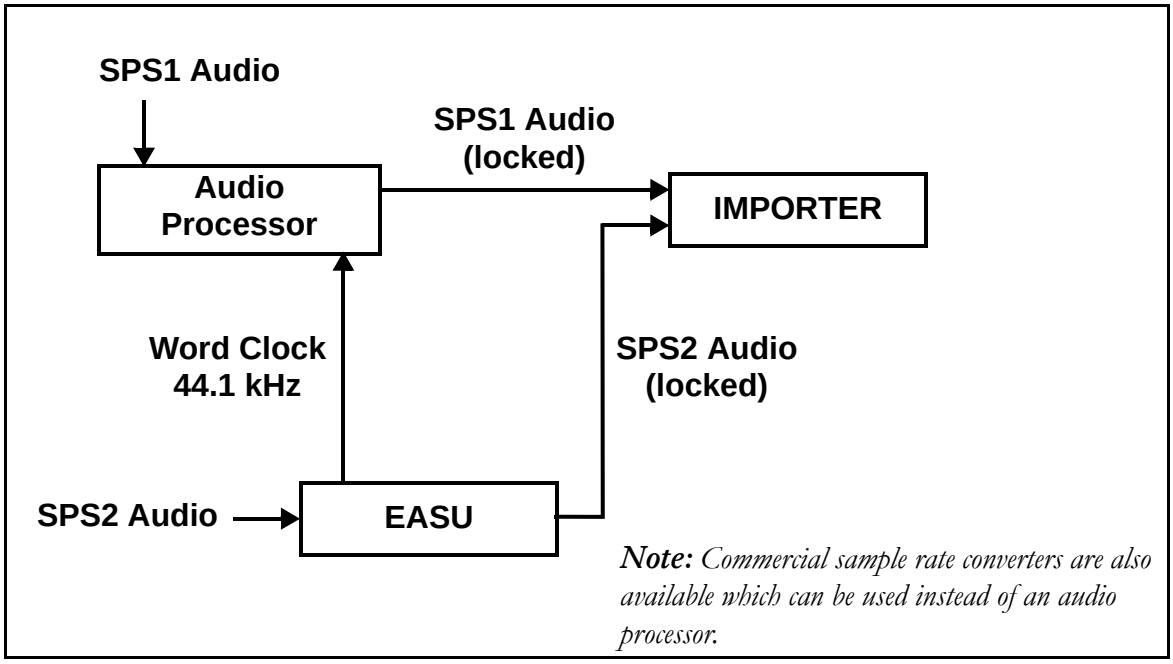
If the Importer will not be co-located with the NE IBOC or Exporter, you can purchase a second EASU to install near the Importer. Since the EASU can only synchronize a single audio source, you will need to use the EASU word clock, or a spare AES output, as an input to a sample rate converter (audio processor) if you are using more than one SPS. See Figure 6.2 on page 6-3 for a block diagram of this setup.

**Figure 6.1: Using an audio processor for SPS synchronization**




**Importer and NE IBOC or Exporter co-located**

**Figure 6.2: Multiple SPS**




**Importer and NE IBOC or Exporter not co-located**

## ADDITIONAL EQUIPMENT

You need the following additional equipment to synchronize the SPS audio sample rate:

- GPS receiver with a 10 MHz output (also part of EASU)
- Word clock generator that accepts a 10 MHz reference (also part of EASU)
- Sample rate converter or suitable audio processor (one per channel) that accepts an external sample rate word clock

# SECTION 7: PARTS AND TOOLS

This section describes parts associated with the Importer, and tools needed during installation and routine operation.

- Parts supplied by Nautel
- Parts not supplied by Nautel – see page 7-2
- Tools for installation – see page 7-2

## PARTS SUPPLIED BY NAUTEL

### AUDIO CARD ANCILLARIES

With each audio card that is purchased, a plastic bag is provided containing audio cables and a *LynxOne Installation and Users Guide*. You may not require all cables for your Importer installation.

### AC POWER CABLE

An ac power cable is included with the Importer.

### SOFTWARE

The CD containing the Microsoft Windows XP Professional software is included with the Importer. Nautel pre-loads the Importer so you do not need to install it initially. It is provided if you need to re-install it at a later date.

### DOCUMENTATION

Nautel includes the following documents with the Importer:

- Importer Pre-installation Manual, IMP-PREINST.

  The *Pre-installation Manual* provides instructions and reference information needed when planning and preparing for the installation of an Importer.

- Importer Installation Manual, IMP-INST.

  The *Installation Manual* provides instructions and reference information needed when installing an Importer.

- Importer Operating and Maintenance Manual, IMP-OPS-MAINT.

  The *Operating and Maintenance Manual* provides instructions for operating and maintaining an Importer. It also provides reference information needed when performing diagnostic procedures.

- HD Radio Importer User's Guide.

  The *HD Radio Importer User's Guide* provides detailed instructions for operating an Importer. It is provided as a supplement to the *Operating and Maintenance Manual*.

## PARTS NOT SUPPLIED BY NAUTEL

Nautel does not supply some parts and materials required to complete installation. The parts you need vary with the installation requirements. The list of parts you normally provide yourself during installation include:

- 19-inch cabinet space
- Standard PC compatible keyboard, mouse and monitor
- Cat-5 cable
- SPS audio sources

## TOOLS FOR INSTALLATION

The tools you need during Importer installation include the following:

- Philips screwdrivers, sizes # 1 and # 2

# SECTION 8: 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.

**EASU.** The Exciter Auxiliary Services Unit accepts the studio feed audio in AES/EBU format and converts it to the 44.1 kHz sampling rate used throughout the system. The EASU also contains the GPS receiver that locks onto the Global Positioning System, and determines the site location and time. This information is then passed onto the NE IBOC to be transmitted as part of the station information. The GPS receiver also provides 10 MHz and 1 PPS signals that are used within the NE IBOC for synchronization purposes.

**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 Ibiquity Digital Corporation.

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

**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.

**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 Connection.

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

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# Importer

# Pre-Installation Manual

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