1: INSTALLATION MANUAL

VX150 TO VX2

FM BROADCAST TRANSMITTER

Making Digital Radio **Work**

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The comparisons and other information provided in this document have been prepared in good faith based on publicly available information. For verification of materials, the reader is encouraged to consult the respective manufacturer's most recent publication on the official website or through contact with Customer Service.

CONTENTS

RELEASE CONTROL RECORD

ISSUE	DATE	REASON
0.1	2020-09-01	Preliminary release for VX150 to VX2 models. Supports hardware versions: VX150, VX300, VX600 (NARF81) VX1 (NARF79) VX1.5. VX2 (NARF80) Supports software version VX SW 1.0 and later.
0.2	2020-12-01	Implemented Engineering review comments, various sections
0.3	2021-01-14	Added Table 1.1.1 for Transmitter Configuration

About This Manual

Technical Support

Nautel offers technical support to customers over the Internet and by telephone. Nautel's customer support team will answer your questions and work with you to identify and resolve problems.

For 24-hour technical support, call toll free at 1.877.628.8353 (in USA and Canada only) or call 1.902.823.5100 (international) or find us on the Internet at http://www.nautel.com.

For parts and tools information, see "Parts and Tools" on page 2.10.1 of the VX Pre-Installation/Installation manual.

For extended warranty information, see "Pre-installation assistance" on page 1.10.1 of the VX Pre-Installation/Installation manual.

VX Series Transmitter Manuals

The VX series documentation suite includes the following documents:

Nautel Site Protection Manual

Provides detailed information about protecting your site from lightning-related hazards.

Volume 1, VX Installation (INS) Manual

Provides instructions and reference information needed when planning and preparing for the installation of the VX series transmitter.

Volume 2, VX Operating and Maintenance (OPS) Manual

Provides instructions for operating and maintaining the VX series transmitter.

Volume 3, VX Troubleshooting (TRB) Manual

Provides instructions for troubleshooting the VX series transmitter and replacing its sub-assemblies. It also contains detailed technical information, including parts lists, electrical schematics and mechanical drawings.

Nautel Website / Online Resources

The Nautel website provides useful resources to keep you up to date on your VX series transmitter. Frequently asked questions (FAQ), How To Videos, latest software versions are just a few of the many resources available.

Nautel User Group (NUG)

The Nautel Support website allows access to product manuals and the RF Toolkit when you create a free NUG account (see Figure below).

Figure 1: Accessing the NUG
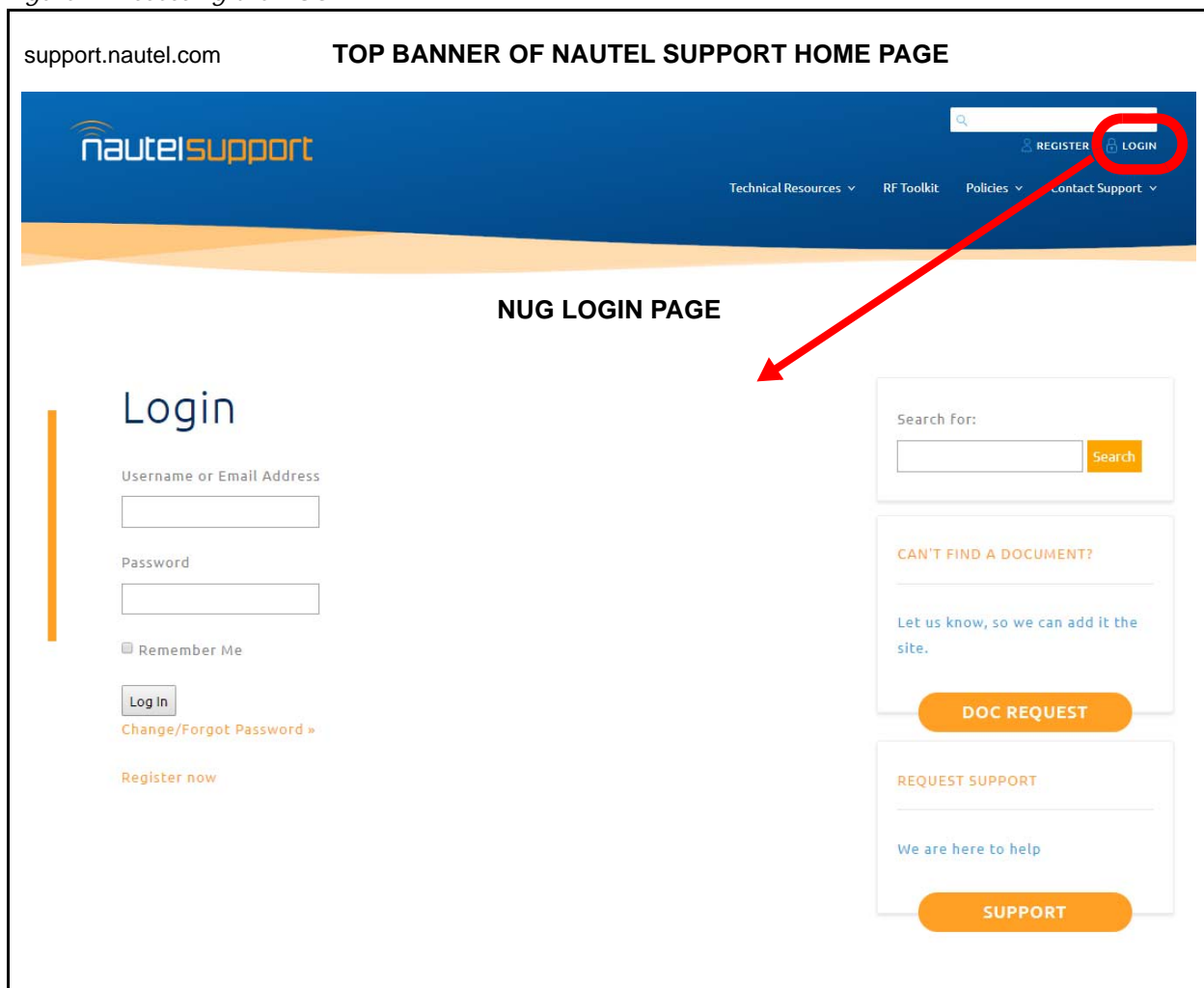
Online Documentation

The Technical Documentation section Of the Nautel Support website provides online access to all the documentation for your VX series transmitter. Documentation is provided in Acrobat (PDF) format. You can use the documentation online or print the sections that you need.

When using online documents:

■ Click on blue text (hyperlinks) to jump to a related section, or to get additional information (e.g., view a term's definition).

■ To search a document 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.

About Safety

All Nautel transmitters are designed to meet the requirements of EN60215, Safety Requirements for Radio Transmitters. The philosophy of EN60215 is that the removal of any cover or panel that can only be opened using a tool is a maintenance activity, and that any person performing a maintenance activity is expected to be trained for that activity. Under EN60215, it is assumed that trained personnel will be knowledgeable and will take precautions such as removing all power to the transmitter before accessing its components.

Electrical Hazards

To remove power from the transmitter, switch off and lock out the ac power. There are three amber LEDs at the bottom rear of the cabinet that glow to remind anyone who has not turned off the power that the system is live and serious danger is present.

DANGER - HIGH VOLTAGE

 Indicates dangerous voltage (in excess of 72 volts), capable of causing a fatal electrical shock, are present on or near parts bearing this label.

> **WARNING: It is not enough to switch off RF power. The power line is still connected. Disconnect and lock out the upstream supply before servicing.**

Mount the transmitter ac power disconnect switch/breaker close to the transmitter so that it can be reached quickly in an emergency. Clearly label the switch/breaker (e.g., EMERGENCY SWITCH).

After turning off the power, always perform a measurement to confirm that the power is off before touching anything within the transmitter. If the wrong breaker was opened, the equipment will be live.

> **WARNING: Do not use an ordinary multimeter to check for voltage, since it may have been left inadvertently on the AMP (A) range, triggering a short and an arc blast that could result in severe burns and even death.**

Use only a non-contact voltage probe or a safety voltmeter (available from vendors such as Fluke, Ideal, and Teagam).

Use a proper lockout procedure to ensure that another worker cannot accidentally reapply power while you are performing maintenance on any part of the transmitter or site.

Lightning Hazards

Before opening the transmitter and touching internal parts, remove and solidly ground the antenna connection.

> **WARNING: It is not enough to ground the antenna terminal with the antenna still connected. Even a small impedance in the ground strap will result in lethal voltages during a lightning strike.**

RF Hazards

A serious RF hazard and very high voltages exist in the vicinity of the antenna and its networks during normal operations.

Toxic Hazards

There may be devices used in this equipment that contain beryllium oxide ceramic, which is non-hazardous during normal device operation and under normal device failure conditions. These devices are specifically identified with "(BeO)" in the Description column of the Troubleshooting Manual's parts list(s).

Do not cut, crush or grind devices because the resulting dust may be hazardous if inhaled. Unserviceable devices should be disposed of as harmful waste.

Other Hazards

Ensure that appropriate fire alarms and fire extinguishers are available. Extinguishers must be suitable for use on electrical fires.

Many other site safety risks exist. It is beyond the scope of this manual to identify all the risks and procedures.

Safety Precautions

This section provides very important information about protecting the safety of personnel and equipment:

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■

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Personal Safety

Training

The training of any personnel who will have physical access to the site or the transmitter is very important. Personnel must be familiar with the transmitter, so that they can avoid physical danger, and be aware of hazards to themselves and the equipment.

Nautel offers a number of training courses covering the basic fundamentals of RF systems and transmitters, and the operation and maintenance of the transmitter. For more information about available courses and schedules, go to the Nautel website at http://support.nautel.com/training/, or ask your Nautel sales representative.

Site Orientation

When you give personnel access to the transmitter site (e.g., hiring new personnel, or giving access keys to personnel), perform a site orientation to ensure that they are familiar with the site, on-site procedures, and on-site hazards. Cover the following topics:

■ Securing the site (locking doors and fences) to prevent unauthorized access

■ How and when to call for technical support or emergency assistance

■ Areas of the site and pieces of equipment that are off limits

Voltage Awareness

Ensure that all personnel that are able to access areas with high voltage circuits or high field strengths are aware of the hazards associated with high voltage. Cover the following topics:

- High voltage or high field strength areas where caution is required

- Physical risks of electric shock

- Risks for personnel with pacemakers or other medical implants

- Induced voltages in high field strength areas

- On-site risks during thunderstorms and lightning strikes

- Operation of safety interlocks (if installed)

First Aid

Nautel does not offer first aid training, since the hazards associated with high voltage and RF energy are not specific to the transmitter. However, the customer should provide first aid training to all personnel who have access to the transmitter site. First aid training should include CPR, care of burns, artificial respiration, and defibrillation if specific equipment is available on-site.

Site Safety

Controlling Access

Transmitters and antennas generate and carry dangerous voltages that can be harmful or fatal. It is very important that you control access to the site and its equipment. To secure your transmitter site, use:

- Locking steel or security doors to prevent casual access

- A perimeter fence to keep trespassers away from the antenna system and feedline

- "No Trespassing" signs

- An alarm system

Marking Hazards

Place warning signs close to any hazardous areas or systems (e.g., the feedline or the antenna system). Make the signs large enough that they cannot be missed. Provide signage in all languages used in the region. These signs are intended not only for authorized personnel, but also for emergency responders or accidental trespassers.

Qualifying Site Personnel

Make sure that personnel who have access to the site are qualified to work around electronics and high voltage systems.

Ac Power Protection

You should take steps to protect equipment from surges (over-voltage spikes) on the ac power lines. Surges may occur during thunderstorms, or because of malfunctions in the electrical distribution grid. Surge suppressors and ac power conditioners can prevent serious damage to your on-site equipment, including the transmitter.

RF Protection

Transmitters and their antenna systems create intense radio frequency fields at the transmitter site, particularly near the feedline, antenna and tower. At some sites, these fields may cause biological effects, including the heating of body tissues. Intense fields can also create dangerous high voltages on ungrounded, conductive surfaces and objects. At certain points where high voltage conductors come close to grounded conductors (e.g., at feedline junctions or on the tower), dangerous electrical arcing or overs can occur. It is very important that you take the following steps to prevent damage to equipment or personnel due to RF fields:

- Use safety interlocks to de-energize transmitters if personnel open doors or panels accessing high field areas

- Place warning signs in any locations where high fields can occur

- Train personnel about the short-term and long-term hazards of RF radiation

- Use personal RF monitors to alert personnel when hazardous RF radiation levels are present

- Physically block access to the area around the antenna system, feedline and tower

- Ground all exposed conductive surfaces or objects in high field areas

The RF connection to the transmitter output can be a serious safety hazard. Connect a 50 Ω test load during installation and commissioning. It is recommended that a switch be used to automatically connect the transmitter to the antenna system without human contact with the transmitting conductors.

Safety Interlocks

The transmitter contains an electrical interlock, which is an external circuit that turns off the RF output if any of its switches are opened.

Ac Disconnect Switch

Safe operation of the transmitter requires an ac disconnect switch. Lock the ac disconnect switch in the disconnected (open) position during the installation process.

Equipment Safety

Electrostatic Protection

The transmitter's systems are very rugged and resistant to damage. However, it is possible for damage to occur because of high voltage electrostatic discharges during servicing. Train all service personnel to ground themselves to bleed off any static charge before opening the transmitter or touching any exposed components. Provide a grounding wand or known ground (e.g., a grounded metal table) that personnel can use to discharge themselves.

Surge Protection

Surge protection is recommended for your entire site. However, even if you do not use a surge protector on the service entrance to the site, you should install a surge protector in the transmitter's ac power feed to prevent over-voltage from entering the transmitter.

Lightning Protection

The transmitter is designed to resist lightning strike damage. However, intense or repeated strikes could damage the transmitter. We recommend that you install lightning suppression on the antenna, tower and feedline to reduce the effect of lightning strikes on the transmitter itself (and to protect the rest of your site equipment and your personnel). For detailed information about lightning protection, see the Nautel Site Preparation Manual, available from your Nautel sales agent, or online from the Nautel website.

Physical Protection

Consider physical hazards to equipment at your site, including the transmitter. Ensure that equipment is protected from weather (e.g., rain or flooding), even during extreme weather events. Place equipment so that it is not in the path of swinging doors or high-traffic areas. Do not allow wheeled items like office chairs or tables with wheels in the transmitter room, as these may damage equipment if accidentally pushed or knocked over. Do not place the transmitter under water pipes, drains, or sprinklers. Keep any equipment that generates heat, like the transmitter, away from flammable materials like ceiling panels, cubicle dividers, and curtains.

Earthquake Protection

If the transmitter site is in a region that experiences any noticeable earthquake activity, take steps to prevent the transmitter from shifting or rocking during an earthquake. Even during minor earthquakes, rocking or movement of the transmitter is likely to damage the feedline connection, and could even cause a catastrophic failure of the ac power feed into the transmitter. During larger earthquakes, the weight of the transmitter chassis could be hazardous to nearby equipment or personnel.

SECTION 1.1: DESCRIPTION

This section provides a basic description of the VX150 to VX2 transmitters and includes the following topics:

- Capabilities

- Transmitter Configuration - see page 1.1.2

- Options - see page 1.1.3

Capabilities

Power

The VX150 to VX2 transmitters are solid-state, VHF, frequency modulated broadcast transmitters that are capable of continuous RF output power up to 165 W (VX150), 330 W (VX300), 660 W (VX600), 1100 W (VX1), 1650 W (VX1.5) or 2200 W (VX2) into a maximum 1.2:1 VSWR.

The operator can vary the power continuously or switch to preset power levels using the transmitter's remote advanced user interface (AUI) or the front panel user interface (UI).

Frequency

The transmitter is broadband and can operate at any frequency in the FM broadcast band (87.5 - 108 MHz), into a nominal 50 ohm, unbalanced transmission line.

Antenna Tolerance

The VX transmitter will operate at rated power even with a VSWR of 1.5:1. A higher VSWR results in a protective foldback of output power. The greater the VSWR, the greater the reduction in RF power until shutdown occurs at 3:1 VSWR.

Remote Control and Monitoring

You can monitor all key parameters of VX transmitter's operation, and control common functions, such as power output and preset settings, from a remote location.

The VX series transmitter allows for discrete remote control and monitor wiring to two 9-pin D-sub connectors on the rear panel. You can also use a web browser, from any web-interfaced device, to access most of the transmitter's local functionality (excludes system parameters that must be configured locally and factory settings).

Ac Power

The VX series transmitter can operate from a nominal 50/60 Hz (between 47 and 63 Hz), single-phase ac power source at voltages between 90 and 265 V ac (VX150, VX300 and VX600) or between 185 and 265 V ac (VX1, VX1.5 and VX2).

The VX1, VX1.5 and VX2 models can operate at reduced power at lower ac voltages (between 90 and 185 V ac).

For detailed electrical requirements (e.g., input power, maximum line current, etc.), refer to Table 1.5.1 in Section 1.5, "Electrical Requirements".

Transmitter Configuration

VX150 to VX2 transmitters are factory shipped with a base-level, standard configuration, with the hardware and features shown in Table 1.1.1.

Table 1.1.1: VX150 to VX2 Transmitter Configurations

MODEL/ NOMENCLATURE	AC INPUT RANGE	RF OUTPUT CONNECTOR	PA POWER SUPPLY OUTPUT	NUMBER OF POWER AMPLIFIERS	PS INTERFACE PWB
VX150, VX300 and VX600 (Nautel Part # NARF81)	185-265 V ac	TYPE N (female)	18-53 V dc (Nautel Part # UG132)	1	Nautel Part # NAPI118/01
VX1 (Nautel Part # NARF79)	90-265 V ac	7/16 DIN (female)	23-65 V dc (Nautel Part # UG136)	1	Nautel Part # NAPI118
VX1.5 and VX2 (Nautel Part # NARF80)	185-265 V ac	7/16 DIN (female)	23-65 V dc (Nautel Part # UG136)	2	Nautel Part # NAPI118

Options

There are options available, that can be factory installed prior to equipment delivery (contact your Sales representative for more details) or easily field-installed by the user.

Audio Processor

The VX series transmitter can be upgraded with an internal audio processor, available from Nautel, which is mounted on pillars on top of the power supply.

Surge Protection Panel

Nautel can provide an ac power surge protection unit to aid in protecting the VX series transmitter from lightning. If purchased, refer to the surge protection unit's manual for installation details.

SECTION 1.2: PRE-INSTALLATION TASKS

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

> **WARNING! 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 VX series transmitter, perform the following tasks:

1. Ensure that the correct transmitter configuration is ordered. Check the ac power requirements, preset frequency, and other options. If your ac power source is different than the factory configuration (See "Ac Power" on page 1.1.2 for example), contact Nautel to arrange reconfiguration.

   NOTE: *For VX150, VX300 and VX600 transmitters, the ac input voltage range is 90 - 265 V ac. For VX1, VX1.5 and VX2 transmitters, RF output power is limited to approximately 33% of rated power when the ac input voltage is between 90 - 185 V ac.*

2. Select a location for the transmitter in the transmitter room. Determine whether additional heating, ventilating or cooling capacity is needed at the site. Identify any special requirements regarding air flow around the cabinet (for example, ducting hot air away from the cabinet, or bringing in external cooling air).

3. If this is an upgrade or replacement transmitter (that is, if the site is already set up for a transmitter), proceed to Step 7. If you are upgrading a site, verify the feedline, the lightning protection systems, and the ac power service.

   NOTE: *Be aware of lightning protection issues when installing ac power and RF feedline. Lightning protection is essential to protect both personnel and equipment at your site. Refer to the Lightning Protection section of Nautel's Recommendations for Transmitter Site Preparation Manual.*

4. Install the ac power service into the planned transmitter location, and select a location for the ac surge protection panel (if purchased) near the transmitter. Consult with an electrician prior to receiving the transmitter regarding local electrical codes and special considerations based on transmitter power consumption and requirements. For detailed information, see "Electrical power" on page 1.5.1.

5. Install lightning protection on the antenna tower. Refer to the *Recommendations for Transmitter Site Preparation Manual*, provided with the transmitter.

6. Place a work area with a clear table surface near the transmitter. Provide electrostatic protection measures in the work area.

7. Order any accessories or optional equipment that you may need. Typical requirements include:

   ❖ Tools - screwdrivers, nut drivers, soldering iron, etc. (see Section 1.12, "Parts and Tools" on page 1.12.1 for further details).

   ❖ Test equipment - oscilloscope and digital multimeter.

   ❖ Peripheral equipment - PC or laptop, LAN/network connection, etc.

   ❖ If you are using a network connection (as opposed to a direct connection with a laptop), consult with your network administrator to determine whether the VX transmitter's network feature will be enabled. If so, determine whether DHCP will be used. DHCP allows network IP addresses to be assigned automatically. To use DHCP, you must have a visible DHCP server on your network. If you are not planning to use DHCP (i.e., your network does not have a DHCP server or you are connecting directly to a laptop), you must obtain an IP address and netmask from your network administrator as well as gateway and nameserver(s) as applicable. If more than one transmitter exists on the LAN, consider port forwarding when commissioning the transmitter.

8. Terminate the transmitter end of the RF feed line with the appropriate mating connector. The VX150 to VX2 transmitters accepts a male N-type connector (VX150, VX300 and VX600) or a 7/16 male DIN connector (VX1, VX1.5 and VX2).

9. Implement a safety interlock, if required.

10. Prepare to integrate the VX150 to VX2 transmitter into your station control circuitry, if required.

11. Train your station technicians and operators on the use and maintenance of the VX150 to VX2 transmitter.

Selecting a Location for the Transmitter

To ensure that the desired location for the VX150 to VX2 transmitter is suitable, perform the following tasks:

1. Ensure that the cabinet in which the transmitter will be installed is able to support the weight of the transmitter. See "Physical Requirements" on page 1.3.1.

2. Measure the cabinet space to ensure that the transmitter will fit. See "Physical Requirements" on page 1.3.1.

SECTION 1.3: PHYSICAL REQUIREMENTS

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

- Dimensions

- Clearances - see page 1.3.2

- Weight - see page 1.3.2

Dimensions

The VX150 to VX2 transmitter has the following overall dimensions. See Figure 1.3.1.

- Height: 2 RU or 3.5 in (8.9 cm)

- Width: Standard 19 in (48.3 cm) EIA rack mount [min. opening of 17.5 in (44.5 cm)]

- Depth: Less than 21 in (53.3 cm), from front panel to end of RF output connector

Figure 1.3.1: VX150 to VX2 Transmitter

VX1 shown for reference
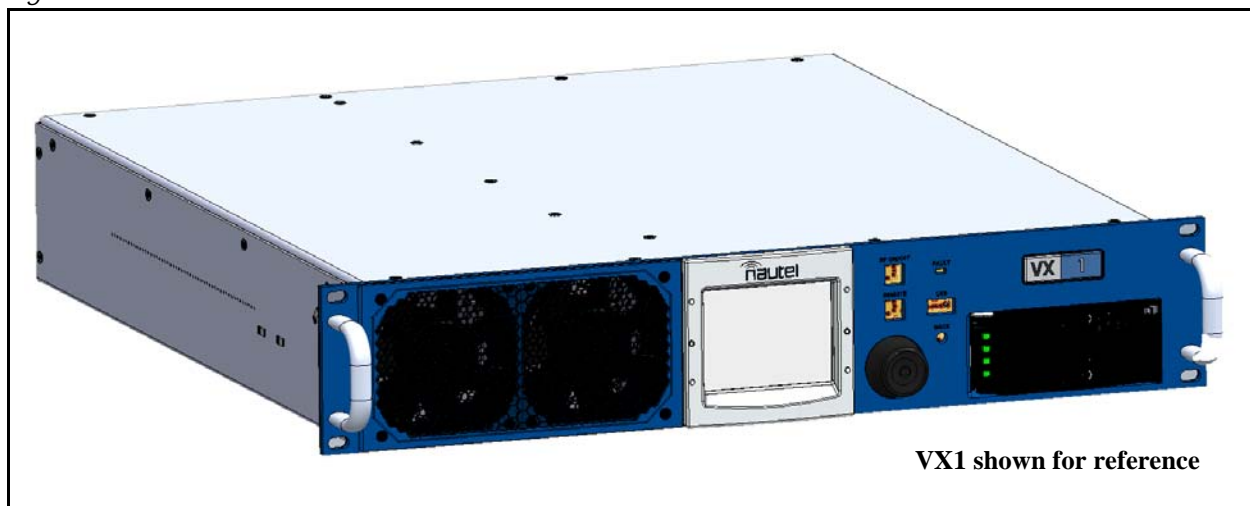
Clearances

Provide a minimum clearance of 61 cm (2 ft.) at the front, back and right-hand side of the VX150 to VX2 transmitter to allow for air flow (intake in the front, exhaust in the rear) and for physical access to the front and rear panels for installation and maintenance.

Check the clearance around the host cabinet to ensure that you will be able to open all doors and access panels. Ensure adequate space is available at the front of the cabinet to allow pulling out the transmitter for servicing fan filters and internal parts/assemblies. Also consider access to the rear of the cabinet for making connections to the transmitter.

Internal fans pull cooling air through air filters in the front of the transmitter. The cooling air exhausts through grills at the rear and at the right-hand side of the transmitter.

Weight

The unpacked weight of the VX150 to VX2 transmitter is less than 30 lbs (22.7 kg), making it safe for one person to lift the transmitter for installation and maintenance.

The packed (boxed) weight of the VX150 to VX2 transmitter is less than 70 lbs (31.8 kg).

SECTION 1.4: COOLING REQUIREMENTS

This section provides information about heating and cooling requirements for the VX series transmitter site. Topics in this section include:

■   Air Flow in the Transmitter

■   Cooling - see page 1.4.2

■   Heating - see page 1.4.2

Air Flow in the Transmitter

See Figure 1.4.1. The VX transmitter draws cool (intake) air through air filters in the front of the transmitter. The incoming air circulates under the PA's through the power supply section (on the right) and is exhausted by grills in the chassis, located on the sides and rear of the transmitter. An air exchange rate of 80 CFM achieves acceptable intake/exhaust temperature rise.

Figure 1.4.1: Air flow in the VX series transmitter
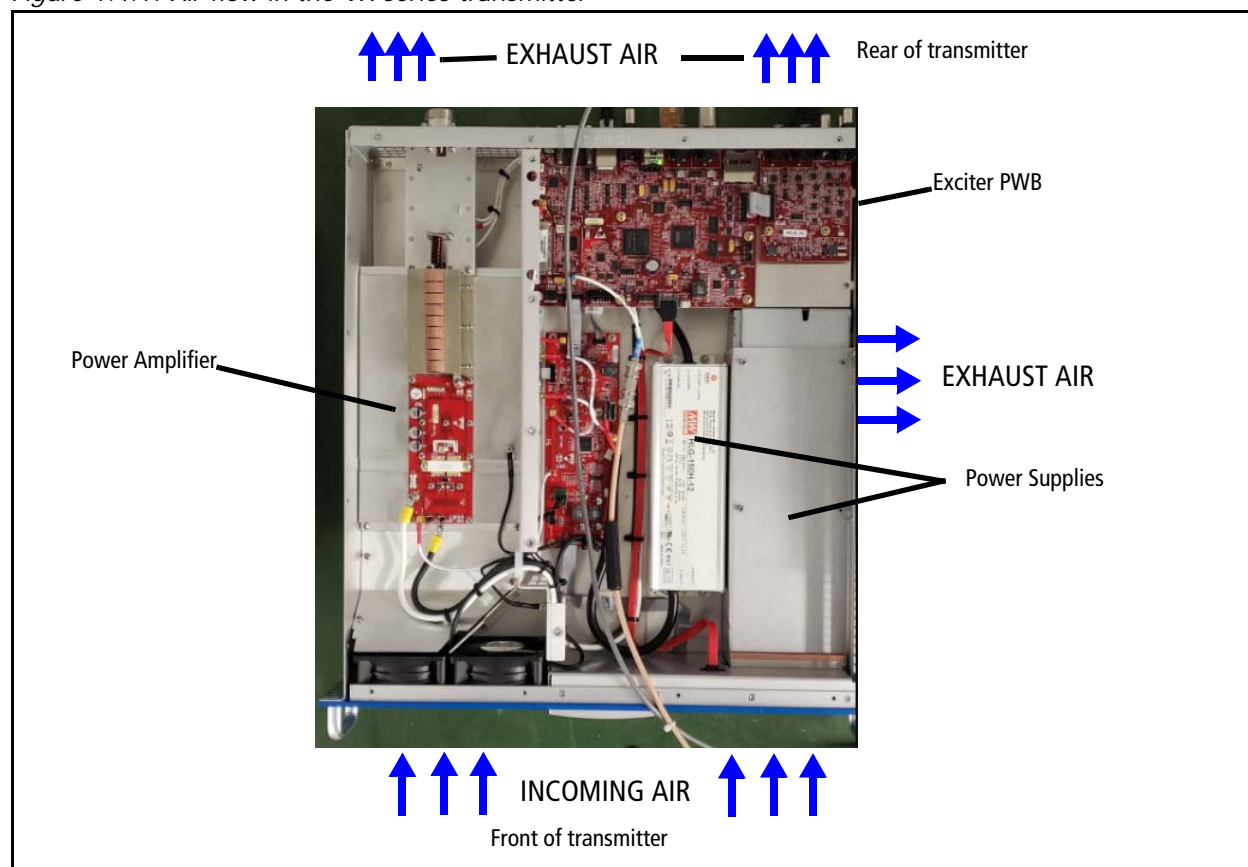
Cooling

Do not allow the transmitter room ambient air temperature to exceed 50°C (122°F) at sea level. Cooler temperatures are recommended in order to improve the reliability of the transmitter. The transmitter contains protection circuits that monitor the intake temperature and may inhibit or reduce the RF output power if the temperature exceeds the acceptable limit. At higher altitudes, derate the maximum intake air temperature as follows:

- De-rate the ambient temperature 3°C (5.4°F) per 500 m – or 2°C (3.6°F) per 1,000 feet – above sea level.

    Example: At 1600 m (1 mile or 5280 ft) above sea level, maximum ambient temperature should not exceed 40.4°C (104.7°F).

Ensure that hot, exhaust air from the transmitter is not drawn back into the transmitter's cool air intake.

Cooling Plant Requirements

Table 1.4.1: Cooling Plant Requirements for the VX Transmitter

TRANSMITTER (FM MODE)	OUTPUT POWER (WATTS)	TYPICAL EFFICIENCY (%)	WASTE HEAT (WATTS)	BTU/HOUR	TYPICAL AIR CONDITIONING REQUIRED IN CLOSED ROOM COOLING (TONNES)
VX150	165	51.3	80	273	0.023
VX300	330	64.6	117	399	0.033
VX600	660	73.7	174	594	0.049
VX1	1100	75.2	273	932	0.078
VX1.5	1650	72.5	454	1550	0.129
VX2	2200	74.9	552	1884	0.157

Calculating BTU Cooling Requirements

To determine the number of British thermal units (Btu) being generated per hour as waste heat, multiply the waste heat (in watts), derived from the transmitter output power and its typical efficiency, by 3.413.

Heating

The transmitter room must contain a heating system that will ensure the ambient air temperature does not drop below 0°C (32°F).

SECTION 1.5: ELECTRICAL REQUIREMENTS

This section describes electrical power and electrical protection requirements associated with the VX series transmitter. This section includes the following topics:

■   Electrical Power

■   Station Reference Ground - see page 1.5.3

> **CAUTION!** Technical pre-commissioning activities described in this section require technical decisions and the customization of electrical circuits. Do not attempt to perform these activities unless you are a certified electrician.

NOTE: *This section provides the information required to determine your electrical and station reference ground wiring/connections and plan for their connection to the transmitter. Physical connections are made in* Section 1.10, "Completing External Connections" on page 1.10.1.

Electrical Power

The VX series transmitter can operate from a nominal 50/60 Hz (between 47 and 63 Hz), 90-265 V ac single-phase ac power source. Ac power enters the transmitter through a IEC 60320, C20 type connector (Nautel part # JT202) on the rear panel. Nautel supplies a mating connector (Nautel part # JD43) which has 3 terminal connections that accepts 12-16 AWG wire.

Voltage Stability

The ac power source nominal voltage must be stable to within rated limits (see Table 1.5.1 on page 1.5.2) under all loading conditions. The transmitter contains circuitry that maintains the RF output at the preset power level for ac voltage variations within the specified range.

Power Consumption and Typical Line Currents

The input power requirement for the VX transmitter is shown in Table 1.5.1 (for analog mode). Use Table 1.5.1 to determine the maximum line current and maximum inrush current values for a given ac supply voltage.

Nautel recommends the ac power source have a 25% over-capacity to ensure adequate regulation.

Table 1.5.1: VX Electrical Requirements

TRANSMITTER (FM MODE)	INPUT POWER (VA)	AC SUPPLY (V ac)	TYPICAL LINE CURRENT (A)
VX150	350	1-Ph, 240 V ac (90-265)	1.5
VX300	400	1-Ph, 240 V ac (90-265)	1.7
VX600	940	1-Ph, 240 V ac (90-265)	3.9
VX1	1520	1-Ph, 240 V ac (185-265)	6.3
VX1.5	2500	1-Ph, 240 V ac (185-265)	10.4
VX2	3200	1-Ph, 240 V ac (185-265)	13.3

Typical line current values are based on maximum RF output power, nominal ac voltage (240 V ac) and typical efficiency.

The maximum inrush current value (per line) is present for half an ac cycle (between 8 and 10 ms). It is more than four times the typical line current and is provided to aid in planning for upstream protection.

Observe local electrical codes when determining wire size and circuit breakers.

Nautel recommends that you base your wire sizes and breaker ratings on the typical line current for analog mode plus a nominal 25%.

Ac Transient Power Protection

Protect all conductors from the ac power source by connecting bi-directional surge protection devices between each conductor and the station reference ground. Install a ferrite toroid on the ac feed between the transmitter and the bi-directional surge protector. Pass all the conductors and ground, as a group, a minimum of two turns, through a ferrite toroid. Ferrite toroids are provided in the transmitter's Ancillary Kit.

A surge protector panel containing suitably rated varistors is available from Nautel. If purchased, install the surge protector panel close to the station reference ground, and as close as possible to the ac service entrance.

The ac power source usually has the lowest impedance path to ground during a lightning strike and normally carries most of the lightning-induced current away from the transmitter site. When lightning hits the power source (for example, striking a transmission line near the transmitter site), a significant induced current may flow towards the transmitter. The goal of lightning protection is to route the current around the transmitter to the best available ground.

For detailed information about surge protectors and lightning protection, refer to the Lightning Protection section of Nautels' *Recommendations for Transmitter Site Preparation Manual*.

Station Reference Ground

Install a station reference ground that provides a continuous, low impedance path to the earth.

If a surge protector is not being used, connect the transmitter's designated safety ground point, the shield of the coaxial feedline, and the ground connection of the power source directly to the station reference ground using a low-impedance copper conductor (minimum 3/4" braid, 4-inch strap, or 0 AWG wire). Ensure that the site's ac service entrance ground is directly connected to the station reference ground outside the transmitter building.

If a surge protector is being used, connect the transmitter's designated safety ground point, the shield of the coaxial feedline, and the ground connection of the power source directly to the surge protector, using a a low-impedance copper conductor (minimum 3/4" braid, 4-inch strap, or 0 AWG wire). Connect the surge protector to the station reference ground using a similar low-impedance coper conductor.

Ensure that the transmitter site's grounding rods are adequate. For more information about electrical grounding protection, see Nautel's *Recommendations for Transmitter Site Preparation Manual*.

SECTION 1.6: RF OUTPUT REQUIREMENTS

This section describes requirements associated with the antenna and RF cabling to be used with the VX series transmitter. Antenna considerations include the following:

■   Antenna Feed Cable

■   Antenna System

For detailed information about protecting the antenna system from lightning strikes, see Nautel's *Recommendations for Transmitter Site Preparation Manual*.

NOTE: *This section provides the information required to determine your antenna feed cable and plan for its connection to the transmitter. Physical connections are made in* Section 1.10, "Completing External Connections" on page 1.10.1*.*

Antenna Feed Cable

The antenna feed line interconnecting the transmitter and the antenna system should be a suitably rated coaxial cable. The RF output is configured to accept a male N-type connection (VX150, VX300 and VX600) or a male 7/16 DIN connection (VX1, VX1.5 and VX2).

Antenna System

Ideally, the antenna system should present 50 ± j0 ohms impedance at the carrier frequency and have sufficient bandwidth to allow transmission of the modulated carrier. The transmitter will function at rated power while operating into a maximum VSWR of 1.5:1, after which the transmitter begins to fold back the RF output (up to a VSWR of 3:1). Circuitry within the transmitter will prevent damage to the transmitter from high VSWR loads.

SECTION 1.7: PROGRAM INPUTS

The VX series transmitter accepts a variety of analog and digital program inputs. This section describes the requirements associated with the audio feeds to the transmitter. All connections are made at the rear of the transmitter (see Figure 1.7.1: on page 1.7.5). Where D-sub connectors are used as the interface, Nautel provides associated mating connectors in the ancillary parts kit to facilitate customer connections.

NOTE: *This section provides the information required to determine your program inputs and plan for their connection to the transmitter. Physical connections are made in* Section 1.10, "Completing External Connections" on page 1.10.1.

- Analog Inputs
    - ❖ Left and Right Inputs - see page 1.7.1
    - ❖ MPX/SCA Inputs - see page 1.7.2

- Digital Inputs - see page 1.7.2
    - ❖ AES/EBU Inputs - see page 1.7.2
    - ❖ RBDS/RDS Input - see page 1.7.2

- Other Features - see page 1.7.2
    - ❖ Carrier Frequency and Pilot Phase Control (10 MHz and 1 PPS IN) - see page 1.7.2
    - ❖ Pilot/MPX Sample - see page 1.7.3
    - ❖ External Audio Playlist via USB - see page 1.7.3

Analog Inputs

Each VX series transmitter exciter accepts the following analog inputs:

Left and Right Inputs

Balanced analog left/right or monaural input (left only) (30 Hz to 15 kHz, -12 to +12 dBu) can be applied to ANALOG AUDIO IN, 3-pin female XLR connectors. The VX series transmitter's remote AUI or front panel UI allows for configuration of the audio input mode (left, right or stereo). Provision is made for adjustment of the input sensitivity and pre-emphasis, adjustable between -12 and +12 dBu. The input impedance for each input is 600 Ω.

NOTE: Transmitters are factory set to provide 100% modulation (± 75 kHz) with an analog L/R input level of precisely 1.24 V rms (+4.7 dBu).

MPX/SCA Inputs

NOTE: *Transmitters are factory set to provide 10% modulation (± 7.5 kHz) with an SCA input level of precisely 1.0 V rms (2.8 V pk-pk). If the main program source is MPX input, meters for MPX SCA will display "N/A".*

Two unbalanced inputs (20 kHz to 100 kHz) are provided on the MPX SCA1 IN and MPX SCA2 IN female BNC connectors, which accept pre-modulated SCA information. The levels are nominally 2.8 V pk-pk for ± 75 kHz carrier deviation, and are adjustable between 1.0 V and 5 V pk-pk. The input impedance for each input is 10 kΩ.

Digital Inputs

Each VX series transmitter exciter accepts the following digital inputs:

AES/EBU Inputs

The VX series transmitter accepts AES/EBU digital audio via the AES/EBU IN 1 and AES/EBU IN 2, 3-pin female XLR connectors (110 Ω balanced; supports sample rates between 32 to 192 kHz). The VX series transmitter's remote AUI or front panel UI allows for configuration of the audio input mode (left, right or stereo) and level (in dBfs). Default factory setting is -4.0 dBFS.

RBDS/RDS Input

NOTE: The VX transmitter also supports stand-alone RBDS/RDS operation. In this mode, RBDS/RDS parameters are configured through the remote AUI or front panel UI.

The VX transmitter accepts UECP or ASCII data for its internal RBDS/RDS generator via RS-232 on the RDS/RBDS (A1J3A) 9-pin, female D-type connector. The data is framed and modulated on a 57 kHz sub-carrier, which forms part of the composite signal.

Other Features

Carrier Frequency and Pilot Phase Control (10 MHz and 1 PPS IN)

Each VX series transmitter provides carrier frequency and pilot phase control from a precision GPS reference on the exciter's 10 MHz IN female BNC connector (between 0.5 V and 2 V pk-pk sine wave input; 50 Ω) and 1 PPS IN female BNC connector (5 V TTL input level, 10 kΩ).

Pilot/MPX Sample

Each VX series transmitter exciter provides either a 19 kHz pilot sample (500 mV pk-pk) on the 19 kHz OUT female BNC connector. The output is selectable through the local (or remote) AUI or the controller UI.

External Audio Playlist via USB

IMPORTANT! The transmitter's USB ports are not designed to act as charging ports.

The transmitter can be configured to accept an external audio playlist on a USB drive that is connected to either of the two USB connectors on the rear panel of the transmitter or the single USB connector on the front panel. When properly configured using the AUI's Presets menu (see below for details).

For preset setting requirements, see the *VX Operations and Maintenance Manual*.
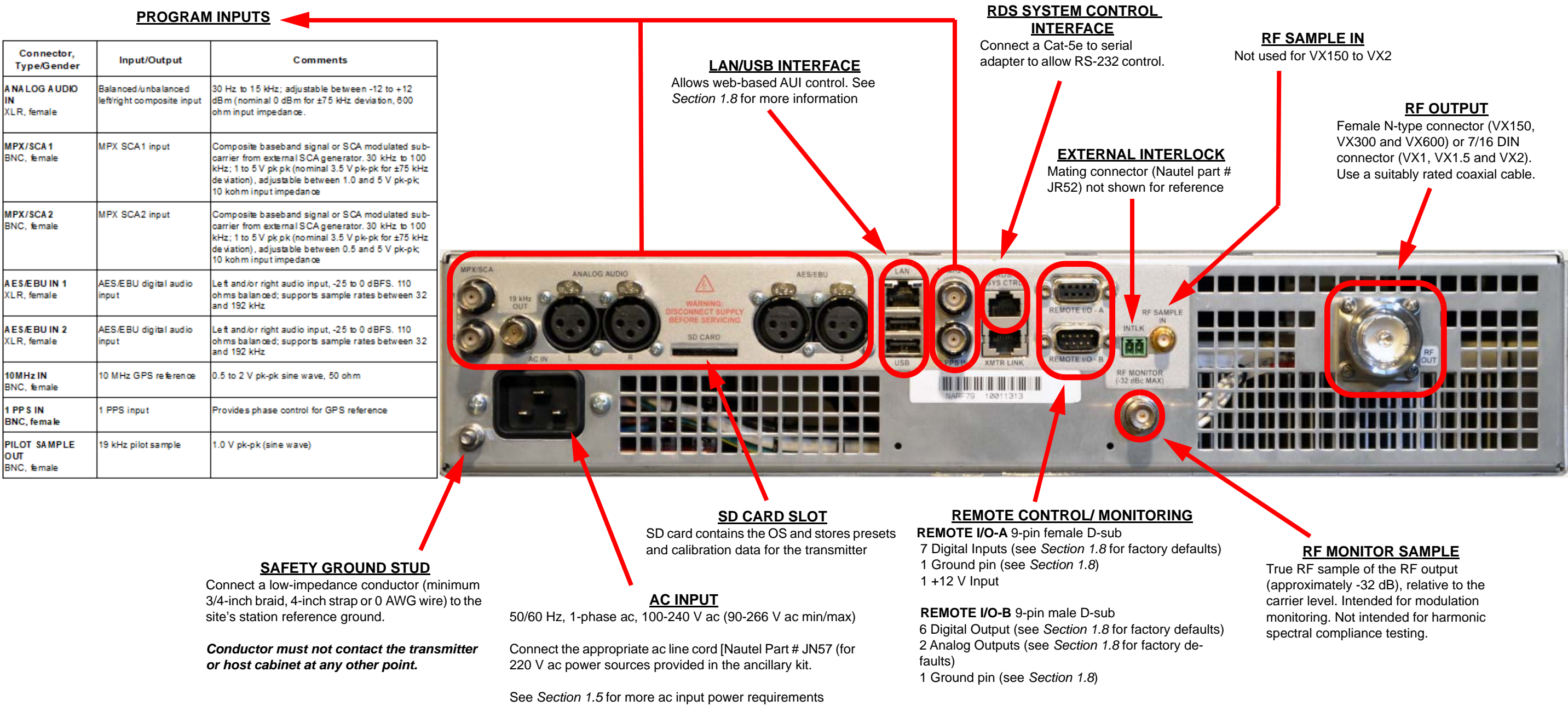
PROGRAM INPUTS

Connector, Type/Gender	Input/Output	Comments
ANALOG AUDIO IN XLR, female	Balanced/unbalanced left/right composite input	30 Hz to 15 kHz; adjustable between -12 to +12 dBm (nominal 0 dBm for ±75 kHz deviation, 600 ohm input impedance.
MPX/SCA 1 BNC, female	MPX SCA1 input	Composite baseband signal or SCA modulated sub-carrier from external SCA generator. 30 kHz to 100 kHz; 1 to 5 V pk-pk (nominal 3.5 V pk-pk for ±75 kHz deviation), adjustable between 1.0 and 5 V pk-pk; 10 kohm input impedance
MPX/SCA 2 BNC, female	MPX SCA2 input	Composite baseband signal or SCA modulated sub-carrier from external SCA generator. 30 kHz to 100 kHz; 1 to 5 V pk-pk (nominal 3.5 V pk-pk for ±75 kHz deviation), adjustable between 0.5 and 5 V pk-pk; 10 kohm input impedance
AES/EBU IN 1 XLR, female	AES/EBU digital audio input	Left and/or right audio input, -25 to 0 dBFS. 110 ohms balanced; supports sample rates between 32 and 192 kHz
AES/EBU IN 2 XLR, female	AES/EBU digital audio input	Left and/or right audio input, -25 to 0 dBFS. 110 ohms balanced; supports sample rates between 32 and 192 kHz
10MHz IN BNC, female	10 MHz GPS reference	0.5 to 2 V pk-pk sine wave, 50 ohm
1 PPS IN BNC, female	1 PPS input	Provides phase control for GPS reference
PILOT SAMPLE OUT BNC, female	19 kHz pilot sample	1.0 V pk-pk (sine wave)

LAN/USB INTERFACE
Allows web-based AUI control. See *Section 1.8* for more information

RDS SYSTEM CONTROL INTERFACE
Connect a Cat-5e to serial adapter to allow RS-232 control.

RF SAMPLE IN
Not used for VX150 to VX2

RF OUTPUT
Female N-type connector (VX150, VX300 and VX600) or 7/16 DIN connector (VX1, VX1.5 and VX2). Use a suitably rated coaxial cable.

EXTERNAL INTERLOCK
Mating connector (Nautel part # JR52) not shown for reference

SAFETY GROUND STUD
Connect a low-impedance conductor (minimum 3/4-inch braid, 4-inch strap or 0 AWG wire) to the site's station reference ground.

Conductor must not contact the transmitter or host cabinet at any other point.

AC INPUT
50/60 Hz, 1-phase ac, 100-240 V ac (90-266 V ac min/max)

Connect the appropriate ac line cord [Nautel Part # JN57 (for 220 V ac power sources provided in the ancillary kit.

See *Section 1.5* for more ac input power requirements

SD CARD SLOT
SD card contains the OS and stores presets and calibration data for the transmitter

REMOTE CONTROL/ MONITORING
REMOTE I/O-A 9-pin female D-sub
7 Digital Inputs (see *Section 1.8* for factory defaults)
1 Ground pin (see *Section 1.8*)
1 +12 V Input

REMOTE I/O-B 9-pin male D-sub
6 Digital Output (see *Section 1.8* for factory defaults)
2 Analog Outputs (see *Section 1.8* for factory de-faults)
1 Ground pin (see *Section 1.8*)

RF MONITOR SAMPLE
True RF sample of the RF output (approximately -32 dB), relative to the carrier level. Intended for modulation monitoring. Not intended for harmonic spectral compliance testing.

Figure 1.7.1: VX150 to VX2 - Rear Panel Connections

SECTION 1.8: CONTROL AND MONITOR WIRING

This section describes the types of control and monitoring for the VX150 to VX2 transmitter. All connections are made to the rear panel of the transmitter (see Figure 1.7.1: on page 1.7.5). Consider the following information and plan for the necessary requirements (wiring, remote switches/ indicators, LAN, etc.):

- ■ Front Panel UI Control

- ■ Remote Inputs - see page 1.8.2

- ■ Remote Outputs - see page 1.8.4

- ■ Analog Outputs - see page 1.8.6

- ■ Web Based AUI Control - see page 1.8.7

- ■ SNMP Control/Monitoring - see page 1.8.8

- ■ External Interlock - see page 1.8.9

NOTE: *This section provides the information required to determine your control and monitor wiring and plan for their connection to the transmitter. Physical connections are made in* Section 1.10, "Completing External Connections" on page 10-1*.*

Front Panel UI Control

The VX1's front panel user-interface (UI) lets you locally control a number of transmitter functions and set parameters.

For detailed information about the front panel UI, refer to the VX Operating and Maintenance Manual. In addition, the front panel UI lets you define and control the on/off status, the preset RF power level, and the system alarm reset remotely using a conventional remote control interface (see Remote Inputs - see page 1.8.2 and Remote Outputs - see page 1.8.4) or a LAN (see Web Based AUI Control - see page 1.8.7.

Remote Inputs

You can connect up to seven (7) remote inputs to the REMOTE I/O-A, 9-pin female D-sub connector on the rear panel of the transmitter (see Figure 1.7.1: on page 1.7.5), which allow you to remotely control various operational characteristics of the transmitter. Each input is mapped to a control that is preset at Nautel, that is not user-configurable.

See Table 1.8.1 on page 1.8.3 for a list of the preset inputs, their default functional descriptions and their associated pins on the REMOTE I/O-A, 9-pin female D-sub connector.

Refer to the *VX Operations and Maintenance Manual* for instructions on changing the remote input settings.

Unless otherwise noted these inputs are only accepted by the transmitter if remote control is enabled. That setting can only be made by a local user using the front panel UI or remote AUI. All inputs are active when a ground (0 V) is applied, if configured as such.

The external remote input circuits interface with the transmitter via the REMOTE I/O-A 9-pin female D-sub connector and then with internal opto-couplers. The opto-couplers buffer and isolate the external circuits and prevent any unwanted transients from affecting the transmitter.

Remote Input Connections

Remote inputs 1 through 7, as required, connect to the pins of REMOTE I/O-A 9-pin female D-sub connector on the rear of the transmitter. See Table 1.8.1 on page 1.8.3 to determine the input pin associated with each remote input, the default remote inputs and their functions.

Nautel provides a D-sub mating connector (Nautel Part # JS224) and connector shell (Nautel Part # JS225) in the ancillary kit to facilitate customer connections to the controller, as applicable.

When the remote input is configured for logic '0', a negative logic (current-sink-to-ground) command must be applied to the appropriate remote input (1 through 7). To avoid a ground loop, obtain the ground from pin 7).

Table 1.8.1: Factory Defined (Default) Remote Inputs

REMOTE INPUT #	INPUT (CHANNEL)	FUNCTION	PIN OF REMOTE I/O-A
1	RF On	Same as pressing the RF On button. Tells the transmitter to provide RF power if possible.	7
2	RF Off	Same as pressing the RF Off button. Tells the transmitter to disable RF power.	8
5	Preset 1 Select	Selects preset 1 as active.	15
7	Preset 2 Select	Selects preset 2 as active.	4
3	Power Trim +	Increases the power level of the current preset. Apply a momentary ground input to increase the power by 1% of rated, or apply a longer duration ground input to increase power by 1% every 0.5 s.	14
4	Power Trim -	Decreases the power level of the current preset. Apply a momentary ground input to decrease the power by 1% of rated, or apply a longer duration ground input to decrease power by 1% every 0.5 s.	2
6	Protect Reset	Causes a reset for latched alarms.	1
Ground	-	Ground	7

NOTE: *Default channels shown. Other Remote Input options exist. Default control logic for remote inputs is Falling Edge.*

Remote Outputs

Six (6) remote outputs, that indicate either the presence of various alarms or the status of operator controlled circuits, are available for remote monitoring on the REMOTE I/O-B 9-pin male D-sub connector on the rear panel of the transmitter (see Figure 1.7.1: on page 1.7.5). The sources and active logic levels of these remote outputs are preset at Nautel. See Table 1.8.2 on page 1.8.5 for a list of the factory preset outputs, their descriptions and their associated output pins on the REMOTE I/O-B 9-pin male D-sub connector.

A switching device for each remote output, configurable through the front panel UI or remote AUI, provides the desired active logic state, when a true condition exists.

For example, if a remote output is configured as Output Low When On (see the VX *Operations and Maintenance Manual* for the specific text displayed on the front panel UI or remote AUI), then the remote output's switching circuit will provide a current-sink-to-ground when a logic true (on) condition exists and an open collector for a logic false (off) condition.

Each switching circuit must present impedance between the switching device and a dc voltage source that limits current flow to no more than 40 mA. Each circuit's positive voltage source must not exceed 23 V dc. The internal +15 V supply is capable of providing 100 mA for all active status outputs. If you require more current capability, use an appropriate external power supply.

Remote Output Connections

Remote outputs 1 through 6, as required, connect to terminals of REMOTE I/O-B 9-pin male D-sub connector on the rear panel of the transmitter. See Table 1.8.2 on page 1.8.5 to determine the output pin associated with each remote output.

Nautel provides a D-sub mating connector (Nautel Part # JS223) and connector shell (Nautel Part # JS225) in the Ancillary kit to facilitate customer connections to the controller, as applicable.

Table 1.8.2: Factory Defined Remote Outputs

REMOTE OUTPUT #	DEFAULT OUTPUT (CHANNEL)	FUNCTION	PIN OF REMOTE I/O-B
1	RF On Status	Indicates the on/off status of the transmitter's RF power stage. By default, the output is low (current-sink-to -ground) when RF is on (enabled) and high (open collector) when RF is off (disabled). Alternate control setting: 'Output Low When RF Off'.	1
2	RF Output Fault	Indicates if fault is occurring that is inhibiting or limiting the RF output. By default, the output is low (current-sink-to -ground) when an RF output fault exists and high (open collector) when no RF output fault exists. Alternate control setting: 'Output Low When No Fault'	2
3	Preset 1 Status	Indicates the status of preset power level 1. By default, the output is low (current-sink-to -ground) when Preset 1 is selected and high (open collector) when Preset 1 is not selected. Alternate control setting: 'Output Low When No Preset 1'.	3
4	Preset 2 Status	Indicates the status of preset power level 2. By default, the output is low (current-sink-to -ground) when Preset 2 is selected and high (open collector) when Preset 2 is not selected. Alternate control setting: 'Output Low When No Preset 2'.	4
5	Remote Status	Indicates the local/remote control status of the transmitter. Changes can only be made remotely if the transmitter's remote control is enabled. The local user's control of the transmitter is unaffected, without restriction. The output is low (current-sink-to-ground) when remote control is enabled and high (open collector) when remote control is disabled. Alternate control setting: 'Output Low When Local' (where remote control is disabled).	6
6	Summary Alarm	The output is low (current-sink-to-ground) when any alarm is occurring (true condition) and high (open collector) when there is no alarm (false condition). Alternate control setting: 'Output Low When False'.	7

NOTE: *Default channels shown. Many other options exist including most alarms, etc. Typical control logic for remote outputs is Output Low When True*.

Analog Outputs

The transmitter provides two sample signals that let you monitor performance. The sources of these analog outputs are pre-defined and are not user-configurable. See Table 1.8.3 for a list of these outputs, their descriptions and their associated output terminals on the REMOTE I/O-B 25-pin female D-sub connector on the rear panel of the transmitter (see Figure 1.7.1: on page 1.7.5).

The outputs are op-amp buffered outputs from an internal digital-to-analog converter (DAC). The dc voltage of each output is between 0 and 6 V (full-scale deflection can be scaled by the user; 6 V is default), and varies within the real limits of the parameter being monitored. The monitoring circuit's impedance for each analog output must be greater than 1,000 ohms.

Analog Output Connections

The two analog outputs connect to pins of 8 and 9 of REMOTE I/O B (9-pin male D-sub connector) on the rear panel of the transmitter. See Table 1.8.3 to determine the pin or terminal associated with each analog output. Ground/shield connections are available on pin 7.

Nautel provides a D-sub mating connector (Nautel Part # JS223) and connector shell (Nautel Part # JS225) in the Ancillary kit to facilitate customer connections to the controller, as applicable.

Table 1.8.3: Analog Outputs

ANALOG OUTPUT	DESCRIPTION	PIN OF REMOTE I/O-B
Forward Power	Reports a sample of the transmitter's forward power. This dc voltage is a linear function and is full-scale (default is 6 V; user-configurable from 0 to 6 V) when the forward power is the transmitter's nameplate power (150 W for VX150, 300 W for VX300, 600 W for VX600, 1000 W for VX1, 1500 W for VX1.5, 2000 W for VX2).	8
Reflected Power	Reports a sample of the transmitter's reflected power. This dc voltage is a linear function and is full-scale (default is 6 V; user-configurable from 0 to 6 V) when the reflected power is 12% of the transmitter's nameplate power (see forward power levels above; e.g., 120 W for VX1.	9

RF Monitor Sample

A true RF sample of the RF output voltage waveform is available for external monitoring on the RF MONITOR BNC connector on the rear panel of the transmitter (see Figure 1.7.1: on page 1.7.5). The coupler yields approximately -32 dB (± 1.5 dB), relative to the carrier level, at the FM broadcast carrier frequency (88 - 108 MHz).

Web Based AUI Control

An Ethernet port is available on the LAN connector on the rear panel of the transmitter (see Figure 1.7.1: on page 1.7.5). This port allows a user with proper authentication to remotely control and interrogate the VX series transmitter's operational status. Most of the functionality is available on the remote AUI and front panel UI, provided the user has been granted proper authorization. Refer to the *VX Operations and Maintenance Manual* for details on setting user permissions and for a menu tree that shows all available functions/features of the AUI and front panel UI.

IMPORTANT! **Nautel insists you use shielded Cat5 cable or better to make this connection**.

Remote Access

The only access to the remote AUI is through the LAN connector on the rear panel of the transmitter.

For security purposes, Nautel recommends you place your transmitter behind a router acting as a firewall. To allow remote AUI access to a transmitter behind a firewall, the firewall must allow TCP traffic through the following ports:

- TCP port 80: required to allow the web browser operating on the remote computer to access the web server operating on the transmitter.

- TCP port 7005: Used for RDS/RBDS communication.

- TCP ports 161 and 162: Used for Agents and Traps SNMP, respectively.

- UDP port 123: Used as the NTP port for time synchronization.

Once your transmitter is isolated behind a firewall, there are a variety of standard network management techniques that can be used to establish a connection, including routing tables and a virtual private network (VPN).

Detailed information about network management is beyond the scope of this manual. Selecting a specific technique often depends on your existing network configuration. Nautel recommends that the planning, implementation and ongoing support of a network that includes a transmitter be undertaken by a team that includes at least one member with suitable knowledge of network management.

NOTE: If you have more than one transmitter on the same LAN, you will need to use port forwarding to allow access to individual transmitters on the network.

SNMP Control/Monitoring

SNMP (Simple Network Management Protocol) is a request-response protocol where the client and agent communicate using binary packets. For Nautel transmitters, SNMP is used to communicate transmitter control commands (e.g., RF on/off, active preset, power adjustments, etc.) as well as monitor data such as alarm states and meter values. Although there are multiple versions of the protocol in widespread use, Nautel only supports SNMPv1 and SNMPv2c, and traps are only supported for SNMPv1.

Nautel provides the central software component, the SNMP agent, which is a program that runs on the transmitter. The SNMP agent interacts with SNMP client software applications, which range from simple MIB browser applications like the free one provided by iReasoning© to customized solutions such as those provided by Burk©. Nautel does not provide SNMP client software.

Access to SNMP control/monitoring is through the USB connector (A1J8B) on the rear panel of the transmitter. When you log into the remote AUI, you can access the User Settings -> SNMP Configuration page to set the SNMP Agent Port number, Read Community and Write Community passwords and SNMP Trap information.

If you are planning to use SNMP, contact Nautel to obtain MIB files for your client software.

MIB files are available through Nautel's FTP site: ftp://www3.nautel.com/SNMP_MIBs/

Email Server

The transmitter's remote AUI allows you to configure an email notification feature, which can initiate emails to specified users when specific alarm or status conditions occur (refer to the VX *Operations and Maintenance Manual* for details).

The VX series transmitter supports email servers that are both unsecure and secure; requiring authentication (user name/password) as well as encryption. Consult with your network administrator for more details.

External Interlock

An external safety interlock is available on the INTLK terminal block on the rear panel of the transmitter. This connection allows you to connect an external safety interlock circuit that provides an emergency RF inhibit control for the VX transmitter. It must present a short circuit (low impedance) between the terminals when the interlock circuit is intact and it is safe to enable the RF output. It must present an open circuit when any interlock switch is activated and the RF output should be inhibited. A mating connector (Nautel part # JR52) is supplied in the ancillary kit to facilitate this connection.

SECTION 1.9: UNBOXING AND INSTALLING THE TRANSMITTER

Unboxing the Transmitter

Before installing your VX150 to VX2 transmitter, perform the following steps:

1. Ensure that you have read and understood the planning requirements described in the previous sections of this manual.

2. Inspect the shipping box for damage. Report any damage immediately to your Nautel sales representative and the carrier.

3. Unpack the box. Remove all items from packing and place them on a suitable work area. Check your packing list to make sure that you received all the components, including the VX150 to VX2 transmitter, the VX150 to VX2 Quick Start Guide, VX Series USB device (contains technical manual set and unpacking/installation video) and ancillary kit.

4. Assemble your parts and tools. For a list of required tools, see "Parts and Tools" on page 1.12.1.

5. When you are ready to install the VX series transmitter, proceed to "Mounting the Transmitter" on page 1.9.2.

NOTE: *The VX150 to VX2 Quick Start Guide provides a more streamlined method to unpack, install and commission your transmitter. If you used the Quick Start Guide to successfully commission your transmitter, Nautel recommends you use the information in this Installation Manual to verify your installation or for more in depth information, as required.*

> CAUTION! FAILURE TO COMPLY WITH RECOMMENDATIONS MAY VOID YOUR MANUFACTURER'S WARRANTY. FOR MORE INFORMATION, REVIEW YOUR WARRANTY DOCUMENT.

Mounting the Transmitter

To mount the VX150 to VX2 transmitter in a cabinet, refer to the following installation aids provided with the VX transmitter:

- Unpacking/Installation Video (located on the USB device that also contains the technical documentation suite): step-by-step video that shows how to unpack your VX transmitter and properly mount it in a cabinet.

- VX150 to VX2 Quick Start Guide: full-colour foldout guide that provides instructions to install the VX transmitter in a cabinet and achieve on-air operation.

NOTE: *Unless otherwise specified, all hardware referenced in the Unpacking/Installation video or the VX150 to VX2 Quick Start Guide is included in the VX150 to VX2's Ancillary kit (Nautel Part # 235-8010).*

SECTION 1.10: COMPLETING EXTERNAL CONNECTIONS

This section provides instructions to complete the user-provided connections to the rear panel of the VX150 to VX2 transmitter (see Figure Figure 1.7.1: on page 1.7.5), that were described in previous sections, including:

■   Connecting Ac Power - see page 1.10.2

■   Connecting Station Reference Ground - see page 1.10.3

■   Installing and Connecting the RF Feed Cable - see page 1.10.4

■   Connecting Program Inputs - see page 1.10.6

■   Connecting Remote Control/Monitor Wiring - see page 1.10.7

NOTE: *The VX150 to VX2 Quick Start Guide provides a more streamlined method to unpack, install and commission your transmitter. If you used the Quick Start Guide to successfully commission your transmitter, Nautel recommends you use the information in this Installation Manual to verify your installation or for more in depth information, as required.*

Connecting Ac Power

To connect ac power to the transmitter, perform the following steps:

> **WARNING! ENSURE THAT WIRING SIZES ARE APPROPRIATE. AC WIRING MUST BE INSTALLED BY A QUALIFIED, LOCALLY-CERTIFIED ELECTRICIAN.**

> **DANGER! ENSURE AC POWER IS DISCONNECTED AND LOCKED OUT AT THE SOURCE BEFORE PROCEEDING**.

1. Make sure you have completed the planning requirements described in Section 1.5, "Electrical Requirements" on page 1.5.1 before proceeding.

2. Switch off the ac power at the service entrance.

3. Obtain the ac power connector (Nautel part # JD43), provided in the Ancillary kit.

4. Route the user-provided ac power cable from the service entrance to the rear panel of the transmitter.

5. Connect the ac power cable to the JD43 connector as follows (see Figure 1.10.1 for details):

    ❖ Connect the ac power cable's line wires to the two Line terminals on the connector and tighten the Phillips screws.

    ❖ Connect the ac power cable's ground wire to the ground terminal on the connector and tighten the Phillips screw.

Figure 1.10.1: JD43 Ac mains connector

Example with assembled cable

Connecting Station Reference Ground

To connect to the station reference ground, perform the following steps:

1. Make sure you have completed the planning requirements described in "Station Reference Ground" on page 1.5.3 before proceeding.

2. Locate the safety ground stud for the transmitter on the rear panel (see VX150 to VX2 - Rear Panel Connections - see page 1.7.5).

3. Attach a continuous, low impedance copper conductor (minimum 3/4" braid) between the station reference ground and safety ground stud. Ensure the station reference ground conductor is at least 3 mm (1/8 in) from the exterior of the transmitter or host cabinet.

    > CAUTION! IT IS IMPORTANT THAT THE CONDUCTOR ATTACHED TO THE STATION GROUND DOES NOT CONTACT THE TRANSMITTER CHASSIS AT ANY OTHER POINT.

4. For information about grounding the lightning protection, see the "Lightning Hazards" on page 1.1.xvi. For detailed information about lightning protection, see Nautel's *Recommendations for Transmitter Site Preparation Manual*, available on the USB documentation provided with the transmitter or online from the Nautel website.

5. Firmly tighten all hardware.

Installing and Connecting the RF Feed Cable

Prepare and install an RF feed coaxial cable as follows:

> **WARNING! ENSURE THAT AC POWER IS NOT BEING APPLIED TO THE TRANSMITTER DURING THIS PROCEDURE.**

NOTE: *Nautel recommends that you perform the commissioning procedure in* Section 1.11, "Commissioning", *which connects the transmitter to a dummy load, before connecting the transmitter to its antenna system.*

When installing an antenna feedline for the VX150 to VX2 transmitter, perform the following tasks:

1. Make sure you have completed the planning requirements described in Section 1.6, "RF Output Requirements" before proceeding. Ensure that the RF feedline that will connect the transmitter to the antenna system is suitably rated.

2. Connect the VX transmitter's RF output to a dummy load, if available, during the commissioning procedure's initial turn on. If the RF feed cable is not connected to a switching circuit that permits antenna/dummy load selection, connect the RF feed cable for the dummy load to the transmitter's RF output until transmitter commissioning is complete.

3. Verify the RF feed cable to the antenna system is in place and is cut to the required length. Do not install the feed cable's mating connector (male N-type for VX150 - VX600, or a male 7/16 DIN for VX1- VX2) at this point.

4. Obtain one or two ferrite toroids (Nautel Part # LXP38) from the Ancillary kit. Install the ferrite toroid(s) on the VX transmitter end of the RF feed cable. If practical, the RF feed cable should pass through a minimum of two times (one turn) (see Figure 1.10.2 on page 1.10.5).

5. Install the appropriate size connector for the VX transmitter (male N-type for VX150 - VX600 or a male 7/16 DIN for VX1 - VX2) on the RF feed cable.

6. Mate the RF feed cable's connector to the RF OUT connector on the rear panel of the VX transmitter (see VX150 to VX2 - Rear Panel Connections - see page 1.7.5).
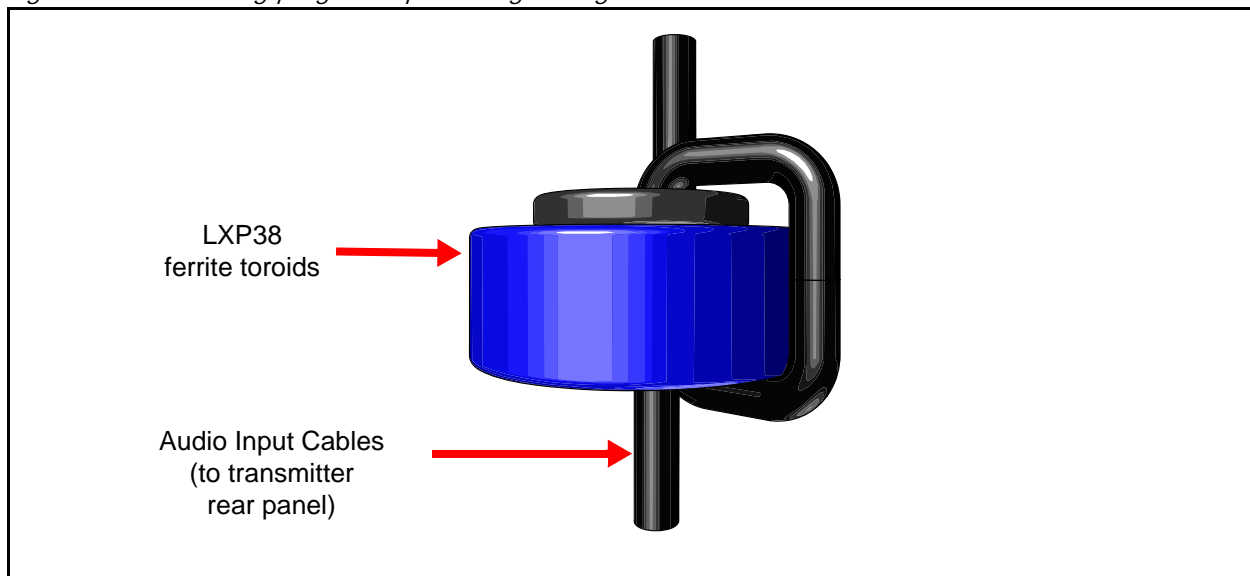
Figure 1.10.2: Routing RF Feed Cable through Ferrite Toroid (NEW DWG??)
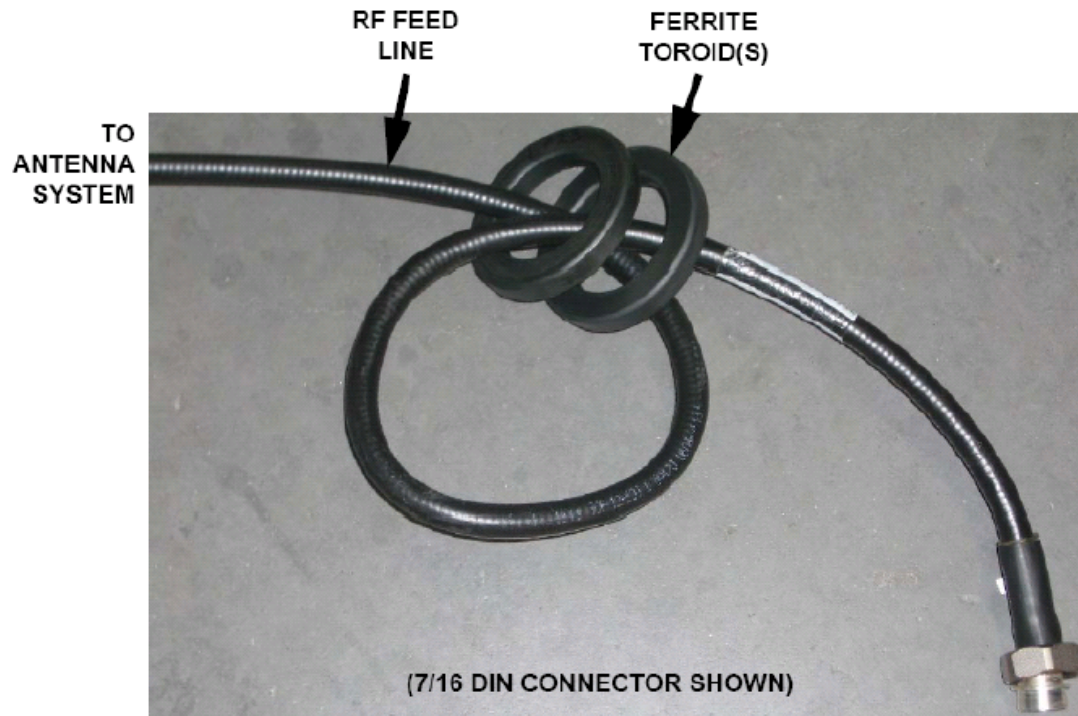
Connecting Program Inputs

1. Make sure you have completed the planning requirements described in Section 1.7, "Program Inputs" on page 1.7.1 before proceeding.

2. Route the desired analog and digital program input cables to the back of the of the transmitter.

3. Obtain two ferrite toroids (Nautel Part # LXP38, 19 mm inner diameter) from the Ancillary kit.

4. Pass all program input cables through the ferrite toroids obtained in Step 3. If practical, wires should pass through a minimum of two times (two turns) (see Figure 1.10.4 on page 1.10.7). Position the ferrite toroids just outside, or just inside, the program inputs to the transmitter.

Figure 1.10.3: Passing program input wiring through ferrite toroids

LXP38
ferrite toroids

Audio Input Cables
(to transmitter
rear panel)

5. With the program input cables near the rear of the transmitter, cut each wire to the required length, and install connectors, as necessary.

6. Remove plastic cap-plugs from the connectors on the rear panel, if applicable.

Connecting Remote Control/Monitor Wiring

1. Make sure you have completed the planning requirements described in Section 1.8, "Control and Monitor Wiring" on page 1.8.1 before proceeding.

2. Route all remote control/monitor cables to the rear panel of the transmitter.

3. Obtain two ferrite toroids (Nautel Part # LXP38, 19 mm inner diameter) from the Ancillary kit.

4. Pass all remote control and monitor cables through the ferrite toroids obtained in Step 3. If practical, wires should pass through a minimum of two times (two turns) (see Figure 1.10.4).

Figure 1.10.4: Passing remote/control monitor wiring through ferrite toroids

LXP38
ferrite toroids

Remote Control/Monitor
Cables (to transmitter
rear panel)
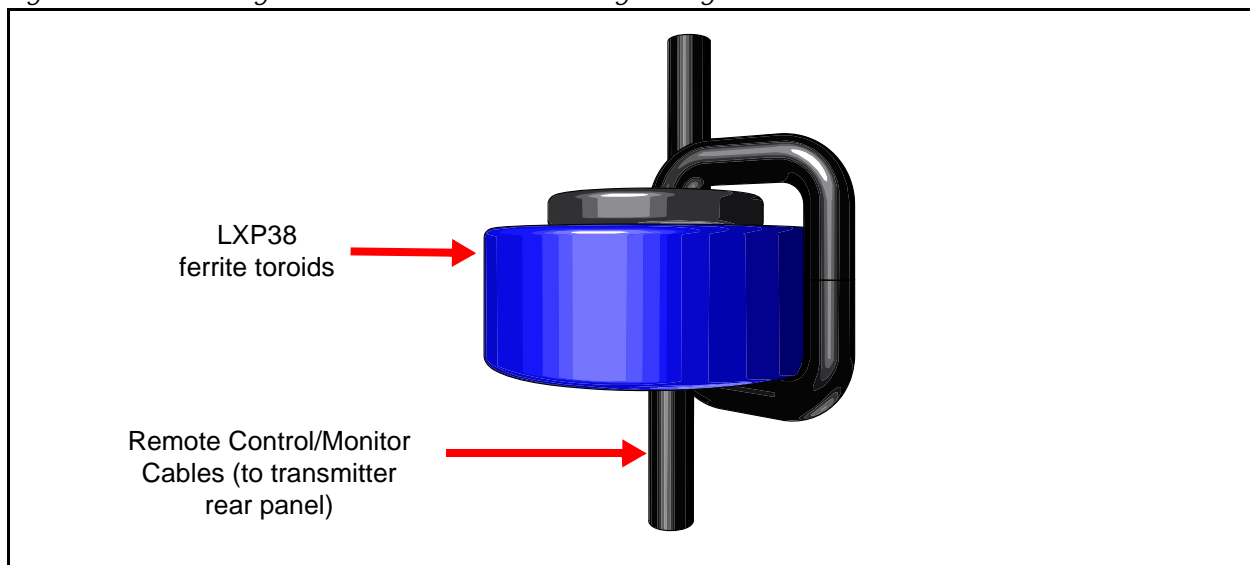
5. With the remote control/monitor cables near their destination, cut each wire to the required length, and install connectors, as necessary.

6. Connect the appropriate control/monitor cable(s) to the REMOTE I/O-A and REMOTE I/O-B D-sub connectors as described in Section 1.8, "Control and Monitor Wiring" on page 1.8.1. Nautel provides D-sub mating connectors (Nautel part #'s JS223 and JS224) and connector shell (Nautel Part # JS225) in the Ancillary kit to facilitate connections to the transmitter, as applicable.

7. For the transmitter's external interlock control, route a shielded cable to the INTLK connector. Use the mating connector (Nautel part # JR52) is supplied in the Ancillary kit to facilitate this connection.

8. For web based control of the transmitter, route an Ethernet (shielded Cat5) cable to the LAN connector.

SECTION 1.11: COMMISSIONING

> **WARNING! Before applying ac power and turning on the transmitter, you must customize some circuits to the station's power source and operating requirements. Do not perform this pre-commissioning unless you are a station engineer or a competent electronics technician.**

The transmitter contains solid-state devices that may be damaged if subjected to excessive heat or high-voltage transients. Ensure that circuits are not overdriven or disconnected from their loads while turned on.

The transmitter was precisely calibrated and tested during manufacturing. Do not change any adjustments other than those specified.

This section contains the following procedures:

- Pre-Commissioning Tasks - see page 1.11.2

- Commissioning - see page 1.11.3

    - Turning on the Transmitter - see page 1.11.3

- Network Setup - see page 1.11.5

Pre-Commissioning Tasks

1. Terminate the transmitter's RF output into a precision, 50 Ω, resistive dummy load that is adequately rated for the maximum expected total power output.

2. Verify all program inputs are connected to the back of transmitter.

    > **WARNING! If a jumper is placed between the INTLK inputs on the rear panel of the transmitter, safety features controlled by the external interlocks will be disabled. A fail-safe method of alerting personnel to this fact should be implemented. Voltages which are dangerous to life will be present on the RF output stages and the antenna system if the transmitter is turned on.**

3. Ensure the external interlock is closed. Nautel ships the VX transmitter with an external interlock mating connector that has a short circuit between the two contacts.

NOTE: A mating connector (Nautel part # JR52) is supplied in the Spares kit to facilitate this connection. It is intended to plug directly into the INTLK connector on the rear panel of the transmitter.

Commissioning

NOTE: The following procedures require the use of the transmitter's advanced user interface (AUI). If you require assistance to navigate the AUI, refer to the VX Operations & Maintenance Manual for more information.

Turning on the Transmitter

1. Switch on the ac power at the service entrance to turn on the transmitter. Confirm the ac voltage, noting the CSA label on the back of the transmitter.

2. Check the alarm and status indications on the AUI (Transmitter Status page). See the *VX Operating and Maintenance Manual*.

3. Select Local control.

4. Using the AUI, select a preset and set to minimum RF output power.

5. Press RF On. The RF On button will turn green.

6. Increase the power to normal operating levels while monitoring the Transmitter Status page for alarms.

7. Set up or select the desired operating preset. See the *VX Operating and Maintenance Manual*.

8. Set the correct time and date on the AUI display. See the *VX Operating and Maintenance Manual*.

To improve overall system security, change the login password for the AUI display. Nautel factory sets the AUI with a default login password. See the *"Editing Account Information"* section of the *VX Operating and Maintenance Manual*.

Going On-Air

> **WARNING! If a jumper is placed between the INTLK inputs on the rear panel of the transmitter, safety features controlled by the external interlocks will be disabled. A fail-safe method of alerting personnel to this fact should be implemented. Voltages which are dangerous to life will be present on the RF output stages and the antenna system if the transmitter is turned on.**

IMPORTANT! Before going on the air, if you want the safety interlocks to operate properly, the shorting jumpers installed in "Pre-Commissioning Tasks" on page 1.11.2, Step 3 should be removed (if installed).

1. Disconnect the Ac plug from the rear panel.

2. Connect the transmitter's RF output to an antenna system (or verify that the current connection is intact).

3. Connect the Ac plug to the rear panel to power up the transmitter.

4. Verify audio input levels using the AUI or front panel UI.

5. Use the local AUI or front panel UI to begin transmitter operations. For detailed instructions, refer to the VX Operating and Maintenance Manual.

    ❖ Set for desired power level.

    ❖ Turn the RF on via the remote AUI or front panel UI.

Network Setup

> **CAUTION!**
> **When connecting to a Nautel transmitter, we support both HTTP and HTTPS protocols. If using HTTP, the data traffic is not encrypted, meaning your username/password could be compromised. For security reasons, Nautel recommends using HTTPS whenever possible.**

If you wish to remotely control the transmitter via a network or directly through a laptop, configure your network parameters as follows:

1. Verify that the networking (DHCP on or off) decisions outlined in Section 1.2, "Pre-installation tasks" of the Pre-Installation Manual have been made. To use DHCP, you must have a visible DHCP server on your network. If you are not planning to use DHCP (i.e., your network does not have a DHCP server), you must obtain an IP address and netmask from your network administrator as well as gateway and nameserver(s) as applicable.

2. From the AUI, go the Menu -> User Settings -> Network Settings screen (see Figure 1.11.1 on page 1.11.6).

3. Ensure your network or laptop is connected to the LAN connector on the rear of the transmitter (see Section 1.10, "Installing Control/Monitor Wiring").

4. If your network has a DHCP server and DHCP is set to ON (factory default), IP addresses will be automatically assigned. Verify this has occurred by viewing the IP Address and Netmask address sub-menus (Gateway and Nameserver addresses are optional; view as applicable). The MAC Address field cannot be modified.

5. If your network does not have a DHCP server or you wish to assign static IP addresses (i.e., direct connection with a laptop), set DHCP to OFF. Enter the appropriate addresses in the IP Address, Subnet Mask, Default Gateway and Default Nameserver fields, as applicable.

NOTE: Refer to "Network Setup" section of the Operations and Maintenance Manual for more information.

6. Once you have established an IP address, you can login to the remote AUI, which allows you to remotely control and monitor the VX transmitter. See the "Operating the Transmitter" section of the Operations and Maintenance Manual for detailed AUI information.

Figure 1.11.1: Network Settings screen

All IP addresses shown are for reference purposes only

MAC Address: Set during factory testing; cannot be modified

DHCP or Static IP: Set to DHCP if your network has a DHCP server. Automatically assigns IP, netmask, gateway and nameservers. Set to Static IP if you do not have a DHCP server or if you wish to assign static addresses.

IP Address: Specify the IP address. Consult with your network administrator.

Subnet Mask: Typical netmask address shown. Consult with your network administrator.

Default Gateway: Specify the gateway address. Consult with your network administrator.

Default Nameserver: Specify a nameserver (or DNS) to enable the use of host names. If no nameserver is entered, only direct IP addresses can be used to configure the email server and any live streams such as Shoutcast.

Port Number: Specify the AUI port # for port forwarding. 3501 is the default port number.

SECTION 1.12: PARTS AND TOOLS

This section describes parts associated with the VX150 to VX2 transmitter, and tools needed during installation and routine operation. Topics include:

- Parts Supplied by Nautel - see page 1.12.2

- Parts Not Supplied by Nautel - see page 1.12.2

- Parts Ordering - see page 1.12.2

- Module Exchange Program - see page 1.12.3

- Tools for Installation - see page 1.12.3

Contacting Nautel

You can reach Nautel to order parts or for technical assistance at:

Nautel Limited
10089 Peggy's Cove Road
Hackett's Cove, NS Canada B3Z 3J4
Phone: +1.877.628.8353 (Canada/US)
          +1.902.823.5100 (International)

Fax: +1.902.823.3183

Email: support@nautel.com

Web: www.nautel.com

Parts Supplied by Nautel

Ancillary Parts Kit

An ancillary parts kit is shipped with the VX150 to VX2. This kit contains items needed during the installation process. The kit includes toroids, spare fuses, screws and miscellaneous hardware.

Documentation

See "VX150 to VX2 Transmitter Manuals" in the "About this Manual" section.

Parts Not Supplied by Nautel

Some parts and materials required to complete installation are not supplied by Nautel. The parts you need vary with the installation requirements. The list of parts you normally provide yourself during installation include:

- A suitable 50 Ω RF output coaxial cable, terminated by the proper connector (e.g., field flange), complete with center male connector (e.g., bullet) at the transmitter end.

- All external control and monitor wiring, including the associated terminating devices, conduit and conduit clamps.

- All electrical power cables, including conduit, terminating devices, and conduit clamps.

- Special tools, if required (e.g., torque wrench).

Parts Ordering

You can order replacement parts from the Customer Service Department, or directly from Nautel through the Nautel website.

Module Exchange Program

Nautel offers a module exchange program for customers who require expedited servicing and replacement of faulty modules. The module exchange program provides immediate replacement of failed modules with refurbished modules.

■   The replacement module is shipped to the customer as soon as the customer reports the failure. The customer then returns the failed module to Nautel using the same shipping package.

Tools for Installation

The tools you need during transmitter installation include the following:

Digital voltmeter (recommend 1000 V, CAT-III rating)

■   Phillips screwdrivers, sizes #1 and #2

■   Pliers, needlenose and lineman

■   Wire cutters/strippers

■   Soldering iron (<100 W)

■   Panel punch (Greenlee, etc.) for suitable size cable entry hole, as desired

■   Hex wrenches (Allen keys)

■   Torque wrench with hex adapter, capable of 120

■   8 mm Nutdriverin-lbs (13.6 N-m) (for ac input terminal block)

■   Metric and Imperial socket set up to 24 mm (15/16 inch)

■   Metric and Imperial wrench set up to 25 mm (1 inch)

■   Electrician's knife

SECTION 1.13: PRE-INSTALLATION / INSTALLATION ASSISTANCE

Nautel provides a number of support options to help you during pre-installation planning and preparation:

■   Pre-Installation Consulting

■   Installation and Commissioning Service

■   Online Documentation - see page 1.13.2

■   On-Site Support - see page 1.13.3

■   Training - see page 1.13.3

■   Standard Warranty - see page 1.13.4

■   Extended Warranties - see page 1.13.7

Pre-Installation Consulting

Nautel field support specialists are available to answer questions and work with you to ensure that your site will be ready for the installation of your VX150 to VX2 transmitter. For support, contact Nautel Customer Service and request assistance ("On-Site Support" on page 1.13.3).

Installation and Commissioning Service

Nautel offers an installation and commissioning service to customers who want assistance with configuring and commissioning a new Nautel transmitter. After the customer completes the transmitter assembly and installation, Nautel technical personnel will spend up to three days on-site to help make the ac power, RF and remote connections, and to assist with the configuration and testing of Nautel equipment.

The customer is responsible for ensuring that the following stages of installation have been completed, prior to the arrival of Nautel personnel:

■   Ac power wiring for the transmitter has been installed and connected at the transmitter and at the breaker panel or the building's service entrance.

- The customer has prepared the RF coaxial cable – used to connect the transmitter to the antenna – and installed the required connector. The customer has also installed the RF coaxial cable in place and connected it to the antenna, while leaving the transmitter end of the cable unconnected.

- Where required, all remote control and monitoring cables have been installed and connected to the station equipment (e.g., modulation monitor, frequency monitor, and power meter).

- The site has been made ready for the equipment, and adequate protection against lightning and lightning-induced transients has been provided.

- The transmitter has been unpacked, closely checked for any damage caused by shipping, and then assembled.

- The following test equipment has been made available at the site:

  - Two-channel oscilloscope (with probes)
  - Audio signal generator
  - Distortion analyzer
  - Spectrum analyzer
  - Modulation monitor
  - Frequency counter
  - 50 Ω test load (rated for 150% of carrier power, VSWR less than 1.1:1)

Nautel's service representative takes full responsibility for commissioning the transmitter, validating all external interfaces (i.e., the ac supply, RF output, remote control and monitoring equipment) and checking out the equipment prior to activation. The service representative turns on the transmitter, performs all adjustments and set-up procedures, and carries out proof of performance tests at the site. These tests ensure that the transmitter is operating normally in compliance with its specifications. The service representative also provides a demonstration and a short explanation of the operation of the transmitter. Finally, the customer signs an Acceptance of Installation Certificate that provides feedback to Nautel regarding the commissioning service.

Online Documentation

Nautel provides documentation online to customers, letting you familiarize yourself with specifications, operation, maintenance and troubleshooting prior to the delivery of your equipment.

- Documentation is also provided on USB and delivered with the transmitter.

On-Site Support

If you require on-site assistance, Nautel's field support specialists can help you prepare your site and ensure that your VX150 to VX2 transmitter installation can proceed as quickly as possible. For more information about on-site support, including scheduling and pricing, contact Nautel Customer Service:

■   Telephone: +1.902.823.5100

■   Fax: +1.902.823.3183

■   Email: support@nautel.com

After business hours (Atlantic time or Eastern time in North America), requests sent by fax or email will be acknowledged within one working day.

Training

Nautel's SBE-certified broadcast training programs satisfy your day-to-day knowledge requirements. Students participating in Nautel's broadcast transmitter or RF basics training programs earn one SBE credit for each completed day of training.

Nautel's comprehensive selection of training programs will help customer staff develop valuable skill sets, reduce downtime, and make the most of the customer's technology investment.

Nautel training programs are made up of individual modules that can be 'mixed and matched' to meet the customer's specific training needs. All Nautel training courses are available at the Nautel Training Centre. Training can also be provided at the customer's facility, and training the customer's technical staff on the customer's transmitter.

All training courses at the Nautel Training Centre combine classroom and hands-on laboratory work to ensure a balanced learning experience.

Nautel training courses feature:

■   Limited class sizes to ensure maximum student participation and access to equipment

■   Emphasis on need-to-know, day-to-day knowledge

■   Labs that focus on the tasks most often performed at the transmitter site

Many of our classes also include diagnostic lab exercises.

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.

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 or 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:

Nautel Limited
10089 Peggy's Cove Road
Hackett's Cove, NS Canada B3Z 3J4
Phone: +1.902.823.3900 or
Toll Free: +1.877.6NAUTEL (6628835) (Canada & USA only)
Fax: +1.902.823.3183

Nautel Inc.
201 Target Industrial Circle
Bangor, Maine USA 04401
Phone: +1.207.947.8200
Fax: +1.207.947.3693

Customer Service (24 hour support)
+1.877.628.8353 (Canada & USA only)

+1.902.823.5100 (International)

Email: support@nautel.com
Web: www.nautel.com

Module Exchange Service

In order to provide Nautel customers with a fast and efficient service in the event of a problem, Nautel provides - for North American customers only - a factory rebuilt, module exchange service which takes full advantage of the high degree of module redundancy in Nautel equipment.

For complete details on this service, see http://support.nautel.com/policies/repairs-exchange/

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.

SECTION 1.14: LIST OF TERMS

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

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 connector used in professional micros). One cable carries both left-channel and right-channel audio data to the receiving device.

AUI. The Advanced User Interface is the local touch screen on the front door and the advanced remote control/monitoring feature that allows for extensive remote control and monitoring of the transmitter.

CUTBACK. A reduction in RF output power, caused by the occurrence of multiple shutbacks within a pre-defined period.

DHCP. Dynamic Host Carrier Protocol.

DSP. Digital Signal Processing.

EEPROM. Electrically Erasable Programmable Read-Only Memory.

FOLDBACK. A reduction in RF output power, caused by adverse load conditions (high VSWR). No shutbacks or cutbacks have occurred.

LED. Light Emitting Diode (also referred to as lamp).

LVPS. Low Voltage Power Supply. A module or modules used in the ac-dc power stage that generates the low level dc supply voltage for the transmitter.

PRESET. A setting that controls power level, frequency and audio parameters. The VX150 to VX2 allows you to pre-program multiple presets.

PWB. Printed Wiring Board.

SHUTBACK. A complete, but temporary loss of RF output power, caused by any one of a variety of faults, including high VSWR, high reject load power, RF drive failure, or an open external interlock.

SHUTDOWN. A complete and permanent loss of RF output power. Typically follows repeated cutback, foldback or shutback events.

SURGE PROTECTION PANEL. An electrical panel that protects equipment from electrical surges in the ac power supply, antenna or site ground caused by lightning strikes.

UI. The User Interface is the controller module's front panel LCD screen that allows for extensive local control and monitoring of the transmitter.

VSWR. Voltage standing wave ratio. This is an expression of the ratio of reverse voltage to forward voltage on the feedline and antenna system. An ideal VSWR of 1:1 provides maximum transmitter-antenna efficiency.

VX-LP INSTALLATION MANUAL

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