

NV5/NV3.5 TRANSMITTER INSTALLATION MANUAL

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

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RELEASE CONTROL RECORD

Issue	Date	Reason
3.0	2011-11-10	Release 3 of product (NARF50B)

ABOUT THIS MANUAL

This manual provides information about installing an NV5/NV3.5 transmitter. This manual is intended for use by qualified, trained installers.

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 9-1 of the *NV5/NV3.5 Pre-Installation Manual*.

For extended warranty information, see “Pre-installation assistance” on page 10-1 of the *NV5/NV3.5 Pre-Installation Manual*.

NV5/NV3.5 TRANSMITTER MANUALS

The NV5/NV3.5 documentation suite includes the following documents:

NV5/NV3.5 PRE-INSTALLATION MANUAL, NV5/NV3.5-PREINST. Provides instructions and reference information needed when planning and preparing for the installation of an NV5/NV3.5 transmitter.

NAUTEL SITE PROTECTION MANUAL. Provides detailed information about protecting your site from lightning-related hazards.

NV5/NV3.5 INSTALLATION MANUAL, NV5/NV3.5-INST. Provides instructions and reference information needed when installing an NV5/NV3.5 transmitter.

NV5/NV3.5 OPERATING AND MAINTENANCE MANUAL, NV5/NV3.5-OPS-MAINT. Provides instructions for operating, maintaining and troubleshooting an NV5/NV3.5 transmitter. It also provides reference information needed when performing diagnostic procedures.

NV5/NV3.5 TROUBLESHOOTING MANUAL, NV5/NV3.5-TROUBLE. Provides detailed technical information about the NV5/NV3.5 transmitter, including electrical schematics and mechanical drawings.

NAUTEL WEBSITE / ONLINE RESOURCES

The Nautel website provides useful resources to keep you up to date on your NV5/NV3.5.

NAUTEL USER GROUP (NUG)

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

DOCUMENTATION: ONLINE AND PRINTED

The website's NUG section provides online access to all the documentation for your NV5/NV3.5. 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.

When using printed documents:

- To find keywords, go to the *Index* section at the end of the manual.
- To find a specific term, go to the *List of Terms* section near the end of the manual.

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 disconnect 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 are devices used in this equipment containing 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.

PHYSICAL HAZARDS



DANGER - MOVING BLADES

Fan blades can cause injury. Lock out power before removing safety features.

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:

- Personal safety - see [page xiii](#)
- Site safety - see [page xiv](#)
- Equipment safety - see [page xvi](#)

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://www.nautel.com/Training.aspx>, 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 flashovers 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
- 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: PREPARING FOR INSTALLATION

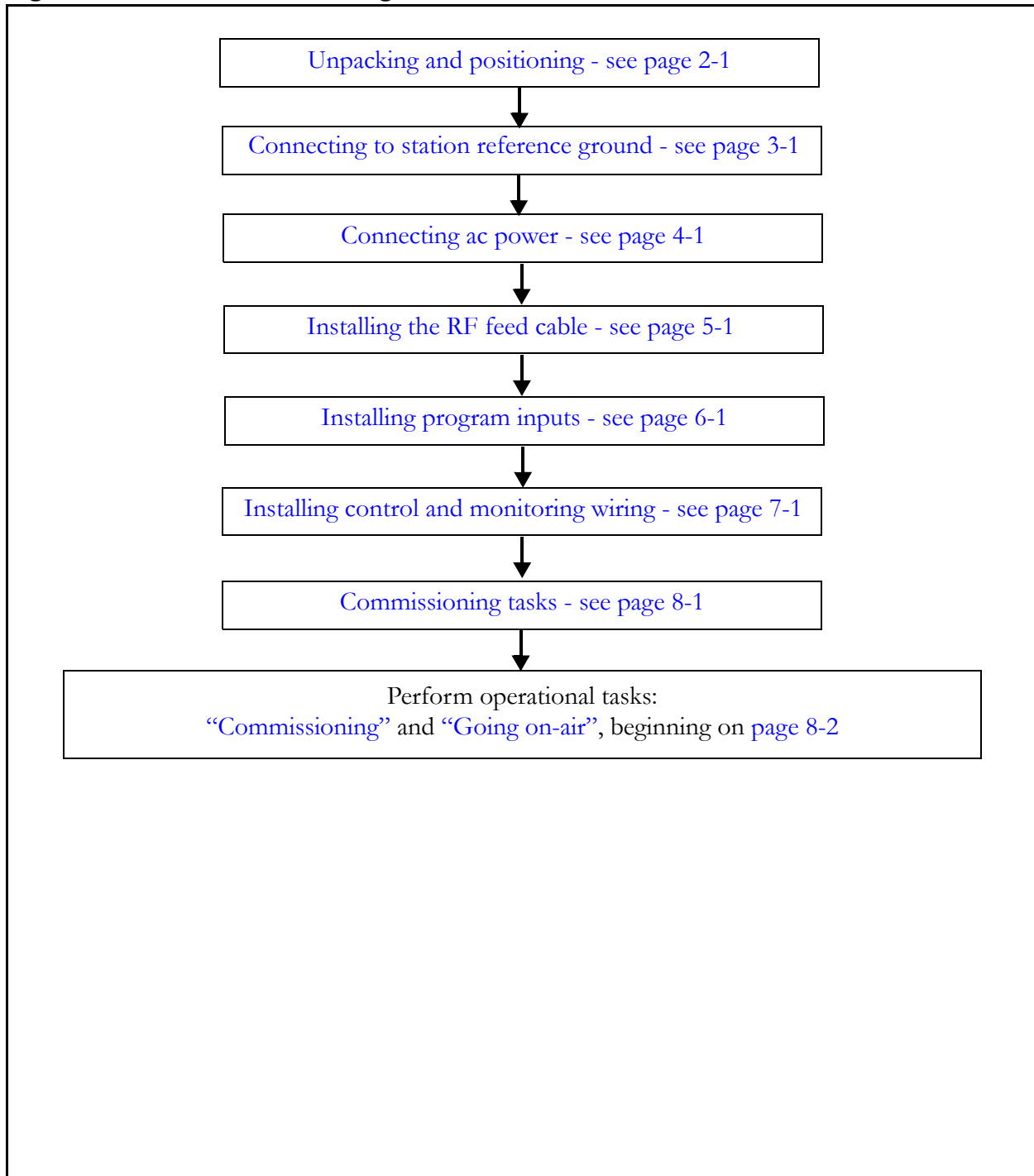
Before installing your NV5/NV3.5 transmitter, perform the following steps:

1. Ensure that you have performed the pre-installation tasks described in the *NV5/NV3.5 Pre-installation Manual*.
2. Make sure that you received all the components. (Check your packing list.)
3. Inspect all crates and packages for damage.
4. Report any damage immediately to your Nautel sales representative and the carrier.
5. Move the crates as close as possible to the transmitter's planned location.
6. Unpack the crates in accordance with the instructions provided on the outside of the crates.
 - For each crate, remove the panel labelled **open this side**. The panel is attached using Philips head screws.
 - Remove any visible packing material, including braces, from the crate's interior.
7. Review any assembly notes or instructions contained inside the transmitter crates. (For sites requiring custom configurations, the instructions provided with the transmitter replace the instructions provided here.)
8. Assemble your parts and tools. For a list of required tools, see [“Parts and tools” on page 9-1](#).
9. When you are ready to install the NV5/NV3.5 transmitter, follow the steps shown in [Figure 1.1 on page 1-2](#).

TIP	When you have completed a task or step, put a check mark beside the step number.
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CAUTION: FAILURE TO COMPLY WITH RECOMMENDATIONS MAY VOID YOUR MANUFACTURER'S WARRANTY. FOR MORE INFORMATION, REVIEW YOUR WARRANTY DOCUMENTS.
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Figure 1.1: Flowchart - Installing the transmitter

SECTION 2: UNPACKING AND POSITIONING

To install an NV5/NV3.5 transmitter, perform the following tasks:

1. Lift and slide the transmitter cabinet off the base of its crate. Crated and uncrated cabinet weights are shown in [Table 2.1](#).


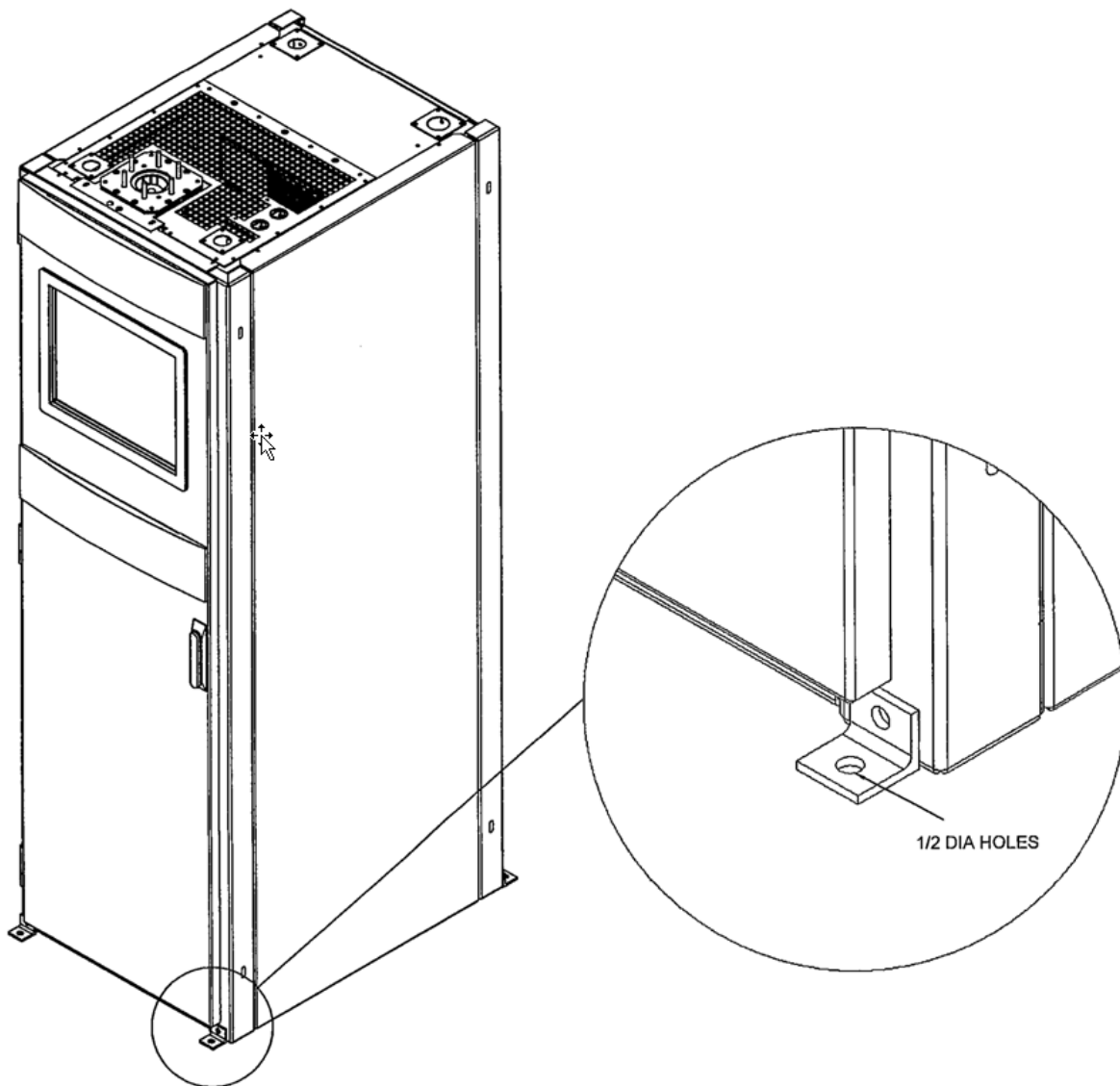
	<p>WARNING: DO NOT ATTEMPT TO MOVE THE TRANSMITTER UNLESS SUFFICIENT MANPOWER OR MECHANICAL ASSISTANCE IS AVAILABLE TO MOVE IT INTO POSITION WITHOUT DAMAGING THE CABINET OR CAUSING INJURY TO PERSONNEL.</p>
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Table 2.1: NV5/NV3.5 Cabinet Weights

Cabinet	Crated Weight	Uncrated Weight
Transmitter Cabinet	279 kg (615 lbs)	136 kg (300 lbs)

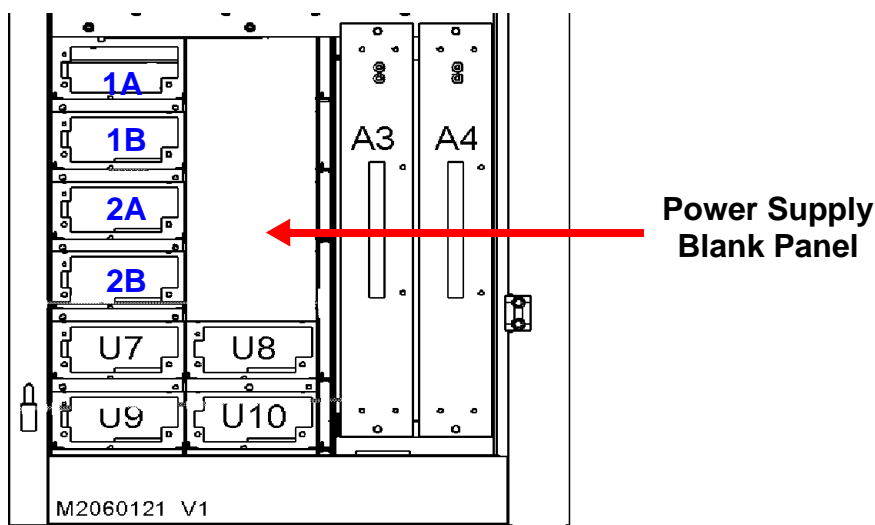
2. Using necessary mechanical assistance (forklift, etc.), position the cabinet in its final location. Open the front door.
3. If you purchased the “Anchor Bracket Kit” (Nautel Part # 206-5021-01) to anchor your transmitter against seismic activity, locate the kit in your ancillary crate. The kit contains four angle brackets and four sets of M10 hardware (bolts, flat washer and split washer). Install the four angle brackets to the transmitter as shown in [Figure 8 on page 2-3](#). Secure the brackets to the transmitter room floor with user-provided hardware that is suitable for 1/2-inch diameter holes. Readjust the leveling from [Step 4](#), by adding shims as necessary.
4. Open the front door and temporarily remove the power supply blank panel (see [Figure 2.2 on page 2-3](#)).
5. As desired, remove the two M8 shipping screws in the back of each RF power module. These screws do not need to be removed unless you are removing an RF power module from the transmitter. After they have been removed the shipping screws are no longer required.
6. Remove the grey, plastic power supply shipping panel in the lower, front compartment of the transmitter cabinet (covers the module power supplies). The panel is secured using M4 hardware. Reinstall the power supply blank panel.

Figure 2.1: Installing Seismic Anchoring Brackets

7. Remove the output cover packing plate from the RF output connector on top of the transmitter. The packing plate - along with two or three spacer plates (depending on the RF output connector size) - is secured using four M6 screws. Remove only the packing plate. Leave the spacer plates in place. If necessary, refer to Figures 4.1 through 4.3 (as applicable) in section 4 of the *Operations and Maintenance Manual* to verify proper orientation of the RF output connector plates.

8. Obtain the “Output Stud Plate”, which was bagged and packed with the ancillaries. Using the M6 screws retained in [Step 7](#), install the output stud plate on top of the spacer plates. Firmly tighten M6 hardware. Note that the output stud plate’s studs contain the necessary securing hardware (nuts, flat washers and split washers) to connect the RF output to a dummy load or the antenna system in [Section 8, “Commissioning tasks”](#). For 7/8 inch EIA RF outputs, you will also need to install adapter JS59, which was also packed with the ancillaries.
9. Verify that the ac power cable conduit from the ac disconnect switch reaches the ac entrance hole at the top of the cabinet. Ac power cables will be connected in [Section 4, “Connecting ac power”](#).
10. Verify that the RF feed cable reaches the RF output connector on the top of the cabinet. The RF feed cable will be connected in [Section 5, “Installing the RF feed cable”](#).

Figure 2.2: Power Supply Blank Panel Location



SECTION 3: CONNECTING TO STATION REFERENCE GROUND

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

See [Figure 3.1 on page 3-2](#) as an installation guide.

1. Locate the safety ground stud assembly (E1) for the transmitter at the bottom rear of the cabinet.
2. Attach a continuous, low impedance conductor (minimum four-inch copper strap, or equivalent wire) between the station reference ground and the stud assembly (E1) in the cabinet. Ensure the reference ground conductor is at least 3 mm (1/8 in) from the cabinet's exterior.



CAUTION:

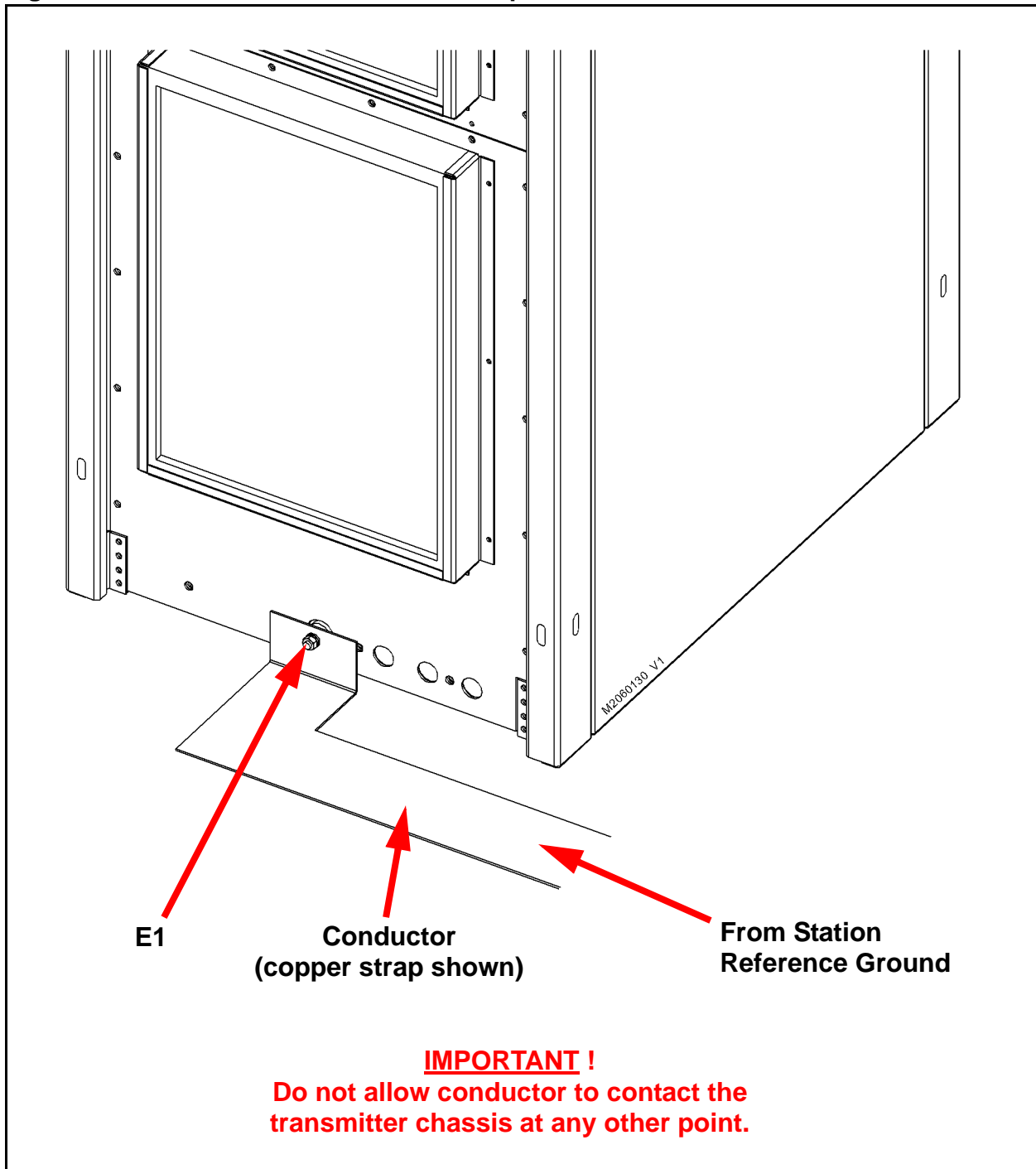
It is important that the conductor attached to E1 does not contact the transmitter chassis at any other point.

3. For information about grounding the lightning protection, see the *NV5/NV3.5 Pre-Installation Manual*.

For detailed information about lightning protection, see the *Nautel Site Preparation Manual*, available from your Nautel sales agent, or online from the Nautel website.

4. Firmly tighten all hardware.

Figure 3.1: Station Reference Ground Strap Connection



SECTION 4: CONNECTING AC POWER

Connect the main ac power and, if applicable, the UPS backup power source to the transmitter as follows:

1. Switch off the main ac power at the service entrance. Remove the rear filter panels to allow access to the ac input terminal block (see [Figure 4.1 on page 4-3](#)).
2. Get two ferrite toroids (Nautel Part # LP23, 85.7 mm) from the ancillary kit.



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

3. Select the appropriate wire size for your main ac power cables. See the *NV5/NV3.5 Pre-Installation Manual* for assistance.
4. Run the main ac power cables in a suitable 1-1/4 inch conduit, from the ac disconnect switch to the top of the transmitter. Pass **all** main ac power source wires, including the ground wire, through the ferrite toroids obtained in [Step 2](#). If practical, wires should pass through a minimum of two times (two turns). An ac entry hole is provided at the top of the transmitter to accept 1-1/4 in. conduit.
5. Verify that the station reference ground is connected to the safety ground stud at the back of the cabinet.
6. Route the main ac power cables from the ac entry hole to the ac input terminal block (TB1) ([Figure 4.1 on page 4-3](#)). Secure the cables within the transmitter using Nautel Part # HAC15 snap-mount tyrap (for 0.25" holes), which are provided in the ancillary kit.
7. Cut each wire to the required length and remove approximately 1.9 cm (3/4 in.) of insulation from the end of each conductor.
8. Connect the main ac power source as follows:
 - For three-phase ac power sources connect the three ac line inputs to terminals 1A (**L1**), 2A (**L2**) and 3A (**L3**) of terminal block TB1. Connect the ac neutral (as required, such as with ac power source voltages between 312 and 457 V ac) to terminal 4A (**N**). Secure all wires in their respective terminals. Torque securing hardware on TB1 to 13.6 N-m (120 in-lbs) using the 3/16 inch hex wrench in the ancillary kit

- For single-phase ac power sources (European/Asian standards), connect the ac line and neutral inputs to terminals 1A (L1) and 2A (L2/N) respectively. Connect the ac ground to the station reference ground terminal. Secure all wires in their respective terminals. Torque securing hardware on TB1 to 13.6 N-m (120 in-lbs) using the 1/2 inch hex wrench in the ancillary kit.
 - For single-phase ac power sources (North American standards), connect the two 110 V ac lines (neutral not required) to terminals 1A (L1) and 2A (L2/N). Connect the ac ground to the station reference ground terminal. Secure all wires in their respective terminals. Torque securing hardware on TB1 to 13.6 N-m (120 in-lbs) using the 1/2 inch hex wrench in the ancillary kit.
9. Reinstall the rear filter panels.
 10. If your transmitter contains the optional UPS interface assembly (A100), connect a user-provided UPS as follows:

**NOTE:**

Refer to the Electrical Requirements section of the NV5/NV3.5 Pre-installation Manual to ensure your UPS meets the minimum electrical requirements.

- Connect the user-provided ac cables (with IEC 60320 C-13 plugs) between the UPS and the UPS interface assembly on top of the transmitter cabinet (see [Figure 4.2 on page 4-4](#)).
- If you want to operate without a UPS, refer to the “Non-Standard Maintenance” section of the *NV5/NV3.5 Operations and Maintenance Manual* to change ac connections within the transmitter.

Figure 4.1: Ac Input Terminal Block Connections

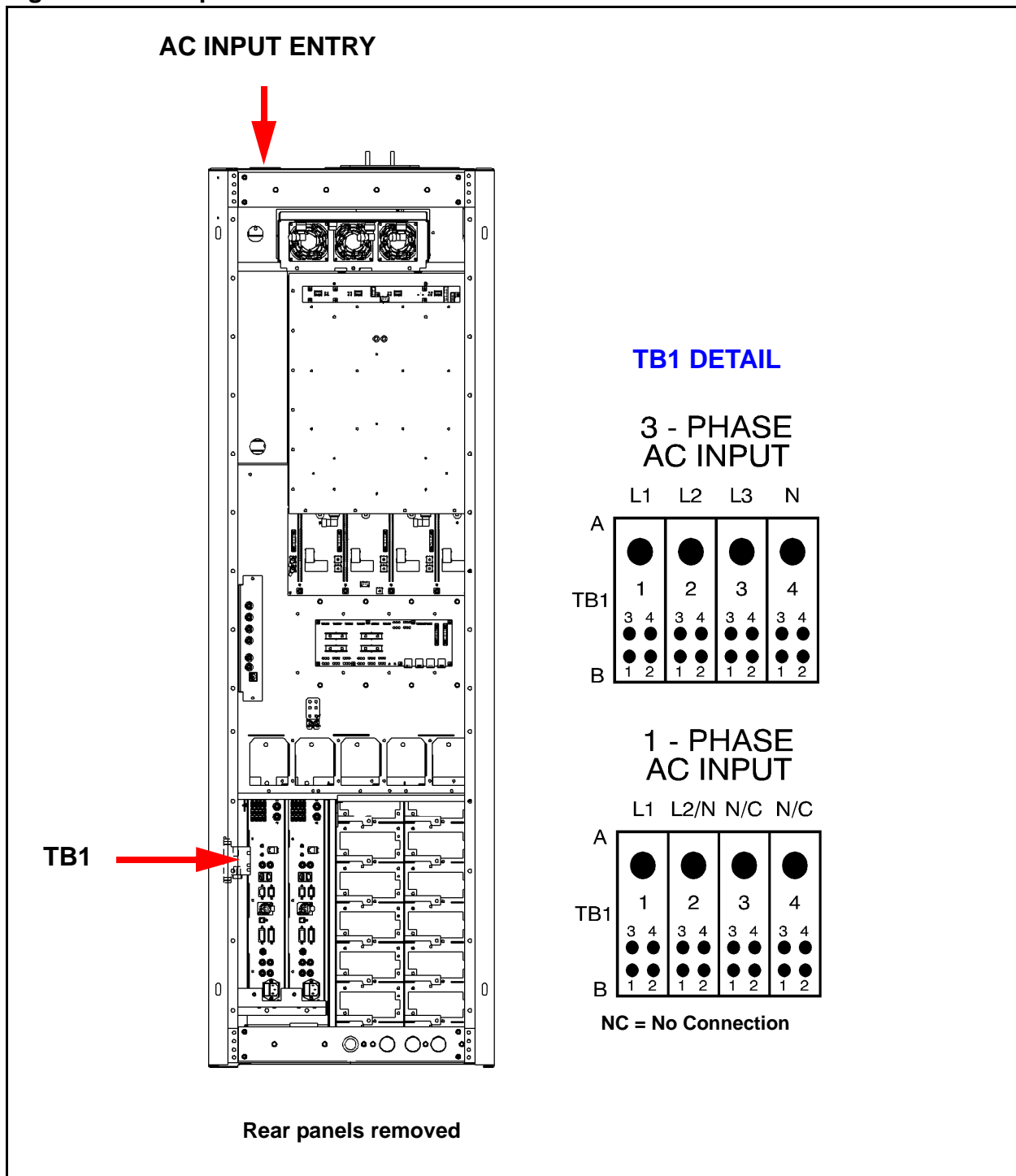
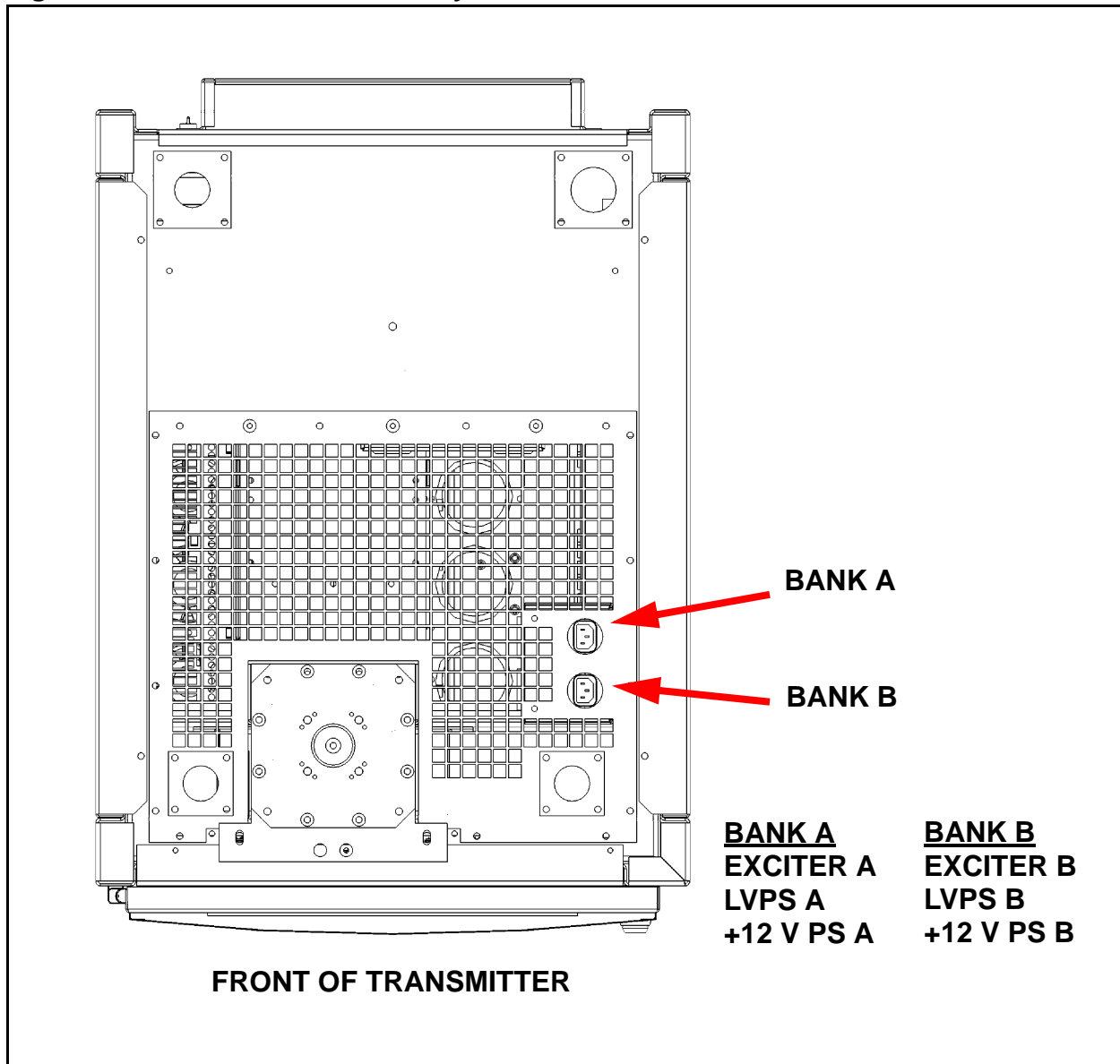


Figure 4.2: UPS Interface Assembly Connections



SECTION 5: INSTALLING THE RF FEED CABLE

Prepare and install an RF feed coaxial cable as follows:



Note:

Nautel recommends that you perform the commissioning procedure in [Section 8](#), “[Commissioning tasks](#)” before connecting the transmitter to its antenna system.

1. Make sure that the ac power is turned off at the ac service entrance.
2. Connect the 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 is in place and is cut to the required length. Do not install the EIA flange connector at this point.
4. Get two ferrite toroids (Nautel Part # LP23, 2.187” inner diameter) from the ancillary kit. These toroids are sufficient to accommodate 1-5/8 inch coaxial cable or hardline. If larger ferrite toroids are required, the user must provide them. Install two ferrite toroids on the transmitter end of the coaxial cable or hardline.
5. Install the appropriate size EIA flange connector on the feed cable.



Note:

The transmitter's RF output connector is an optional EIA flanged output connection (3-1/8 inch, 1-5/8 inch or 7/8 inch), which is user-specified.

6. If the RF feed cable's EIA flange connector does not have a male connector for the centre conductor, obtain an EIA bullet for the EIA flange connector.



CAUTION:

It is extremely important that the EIA bullet is properly inserted in the EIA flange connector in [Step 6](#) and then in the cup connector in [Step 8](#). It is highly recommended that you obtain and use a new EIA bullet. Use sufficient insertion force to ensure low contact resistance. Failure to observe these recommendations may result in damage to the transmitter.

7. Locate and remove the hardware (nuts, split washers and flat washers) from the output stud plate on the top of the transmitter RF output connector. The size of the hardware depends on the size of the RF output connector (3/8 inch hardware for 3-1/8 output; 5/16 hardware for 1-5/8 and 7/8 output).
8. Carefully install the RF feed cable's EIA flange connector on the RF connector's flange-mounting studs. Ensure its bullet mates with the rigidly mounted cup connector inside the RF output connector. Secure using attaching hardware removed in [Step 7](#). Ensure nuts are firmly tightened

SECTION 6: INSTALLING PROGRAM INPUTS

This section describes how to route program input wiring to the NV5/NV3.5 transmitter's exciter(s).

PLANNING

Make sure you have read and fully understood the program input options described in the *NV5/NV3.5 Pre-installation Manual* before proceeding.

ROUTING CABLES

See [Figure 6.1 on page 6-2](#) and [Figure 6.2 on page 6-3](#).

Route the desired analog and digital program input cables to the back of the NV5/NV3.5's exciters .

1. Route program input cables through the cable entry hole in the top, rear of the cabinet.
2. Route all cables through an appropriate sized ferrite toroid, provided in the ancillary kit, then to the back of the exciter(s) (A3 and A4, as applicable). If possible, route the cable through two turns of the ferrite toroid. Secure the cables within the transmitter using Nautel Part # HAC15 snap-mount tyrap (for 0.25" holes), which are provided in the ancillary kit.
3. Remove plastic cap-plugs from the connectors on the exciters.
4. Connect the appropriate program input cable(s) to the exciter connector(s) described in ["Analog inputs"](#) or ["Digital inputs"](#) in the *NV5/NV3.5 Pre-installation Manual*.

Figure 6.1: Routing Program Input Cables

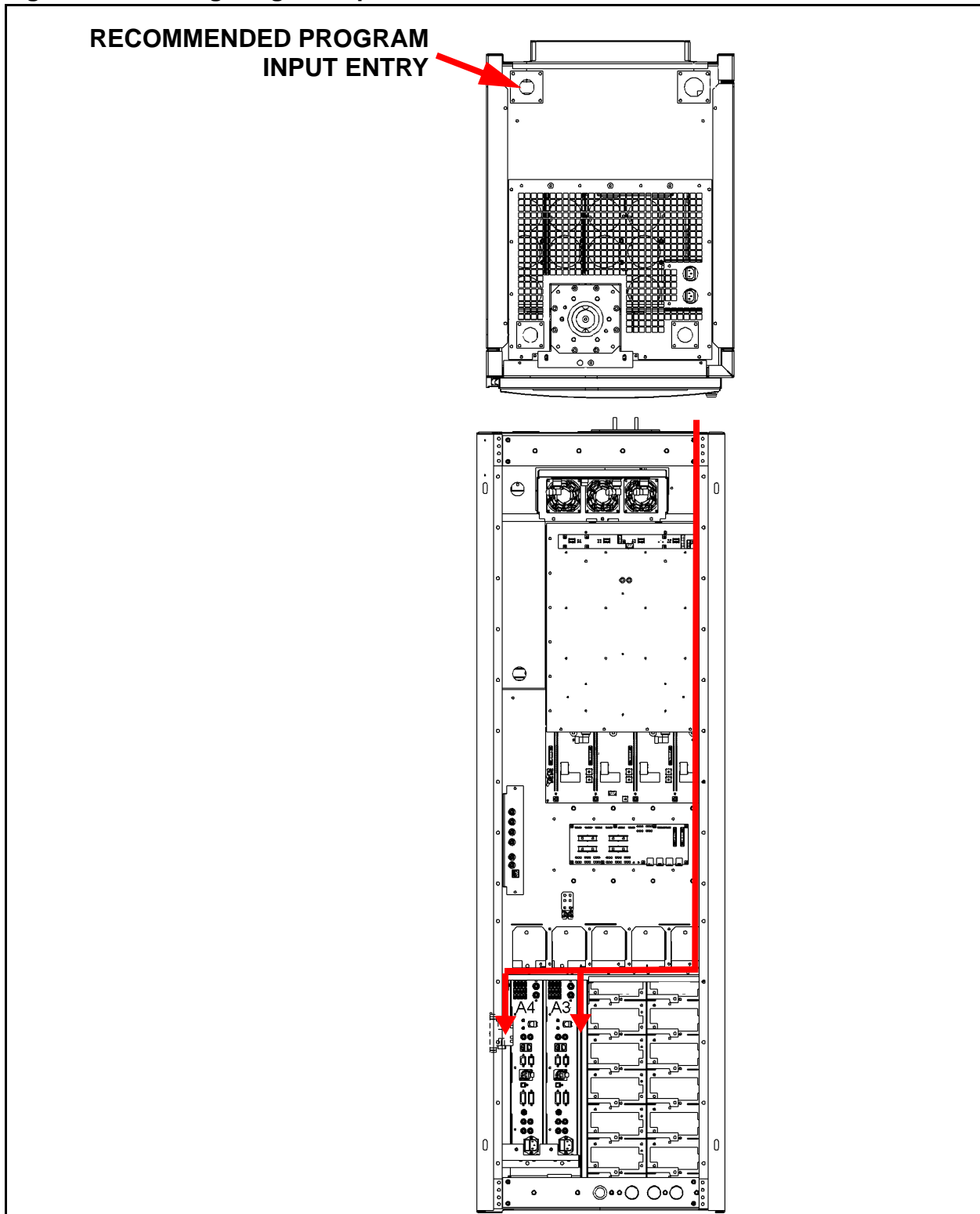
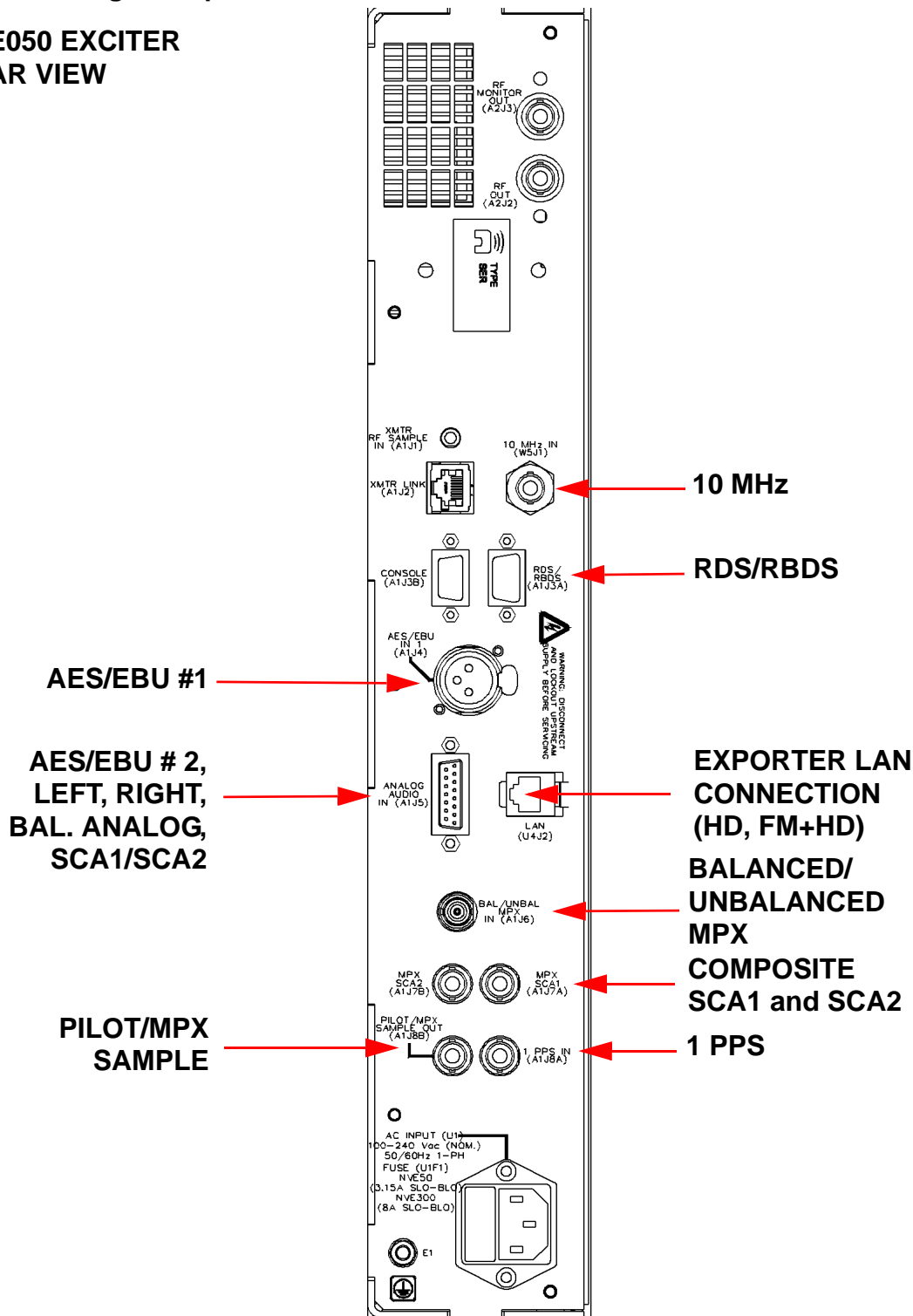


Figure 6.2: Program Input Connections

**NVE050 EXCITER
REAR VIEW**



SECTION 7: INSTALLING CONTROL AND MONITORING WIRING

This section describes how to route wiring associated with the remote control and monitoring of the NV5/NV3.5 transmitter.

PLANNING

Make sure you have read and fully understood the control and monitoring options described in the *NV5/NV3.5 Pre-installation Manual* before proceeding.

ROUTING CABLES

1. Route remote control/monitor cables through the left or right-hand cable entry hole in the top of the cabinet. See [Figure 7.1 on page 7-2](#).
2. Route the remote control and monitor cables through a ferrite toroid (Nautel Part # LXP38, provided in the ancillary kit), then toward the remote interface PWB (A2), located behind the front door. See [Figure 7.2 on page 7-3](#). If possible, pass the cables through the ferrite toroid a minimum of two times (two turns). Secure the cables within the transmitter using Nautel Part # HT52 snap-mount tyrap (for 0.213" holes), which are provided in the ancillary kit.
3. Connect the appropriate control/monitor cable(s) to the connector(s) described in the “Digital inputs”, “Digital outputs” or “Analog outputs” section of the *NV5/NV3.5 Pre-installation Manual*. Note: The transmitter’s ancillary kit contains 8-pole mini-plugs (Nautel Part # JU33) and 2-pole mini-plugs (Nautel Part # JU32) to facilitate these connections.
4. If you are using web based control for the transmitter, route an Ethernet (shielded Cat5) cable to the control/interface PWB (A1), also located behind the front door. Connect the Ethernet cable to connector J21 on the control/interface PWB. See [Figure 7.2 on page 7-3](#).
5. If you are using an external interlock control for the transmitter, route a shielded cable to the control/interface PWB (A1), also located behind the front door. Connect the shielded cable to terminal block TB2 (between INTLK terminals 1 and 2) on the control/interface PWB. See [Figure 7.2 on page 7-3](#).

Figure 7.1: Remote Cable Entry

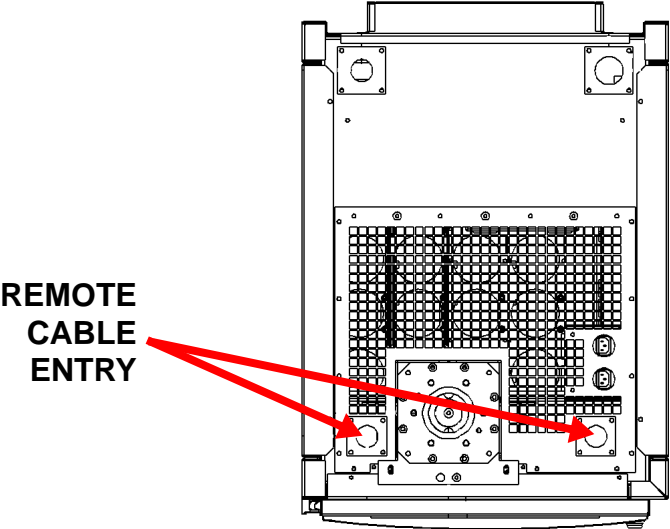
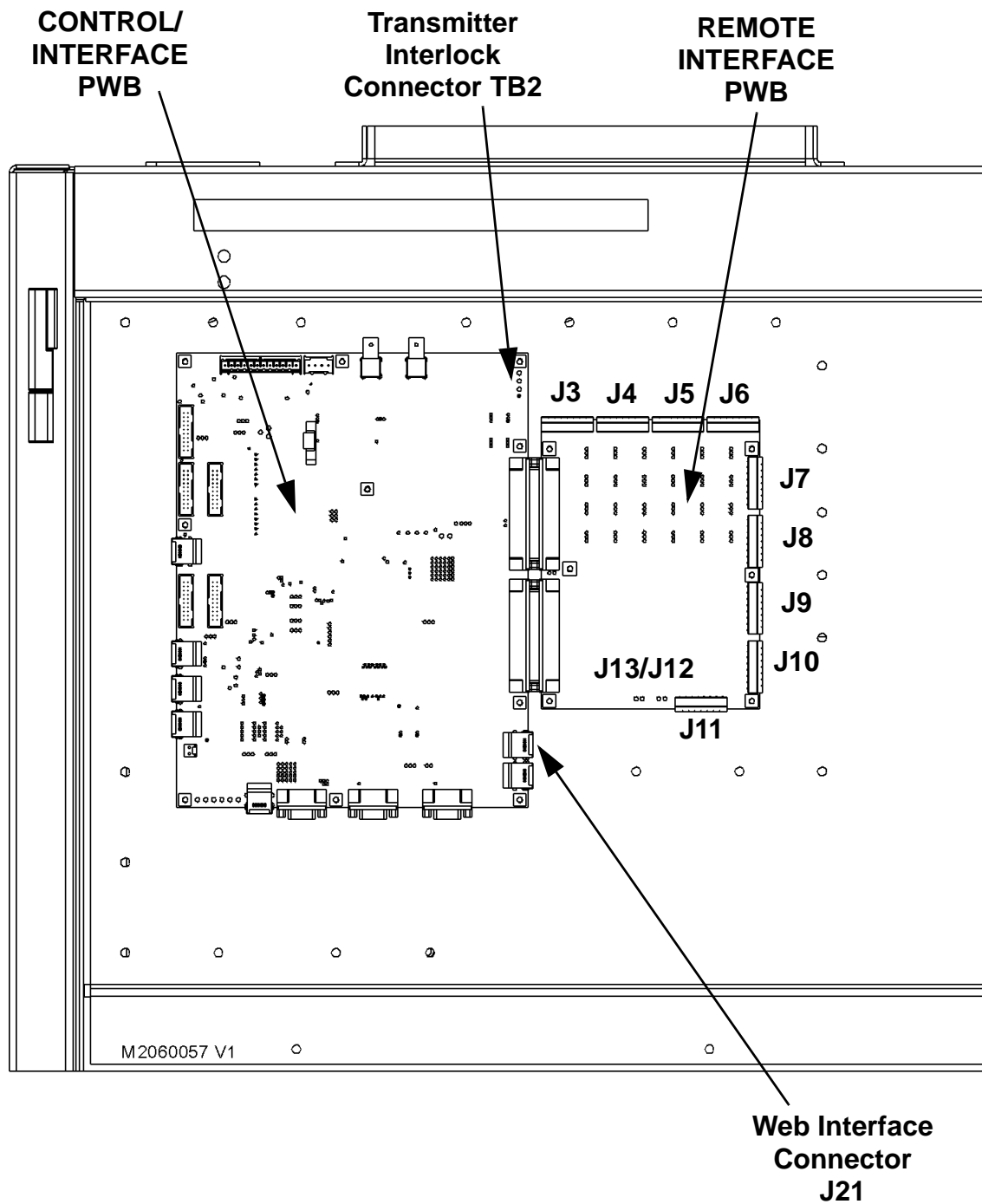


Figure 7.2: Remote Control/Interface and Web Interface Connections



SECTION 8: COMMISSIONING TASKS



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

PRE-COMMISSIONING TASKS

1. Terminate the transmitter's RF output into a precision, 50 Ω resistive dummy load that is able to dissipate the RF power being applied to it: 5 kW (NV5) or 3.75 kW (NV3.5) rated power, 7.5 kW (NV5) or 5.6 kW (NV3.5) total required.
2. Verify that all panels are installed, and that their attaching hardware is firmly tightened.
3. Verify all program input is connected to the back of the exciter(s).



WARNING:
IF A JUMPER IS PLACED BETWEEN INTERLOCK INPUTS TB2-1/2 ON THE CONTROL/ INTERFACE PWB, 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.

4. Perform a visual inspection of the connectors that mate with the single-board computer (SBC, U6), located on the back of the front door. Pay particular attention to ribbon cable connectors U6W1P1 (mates with U6U1-COM2) and U6W2P1 (mates with U6U1COM3). If these connectors are disconnected or seem dislodged in any way, refer to the “[Single-Board Computer \(SBC\) Replacement](#)” procedure in the *NV5/NV3.5 Troubleshooting Manual* to determine proper connection and orientation.
5. Close the external interlock (if installed). If an external interlock is not installed, simulate the closing of the external interlocks by applying a short circuit between TB2-1 and TB2-2 of the control/interface PWB (A1).
6. Set the switch on the front of each RF power module to its ‘up’ position.

COMMISSIONING

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 factory configuration label is provided near the ac input terminal block.
2. Check the alarm and status indications on the control cabinet’s AUI (**Transmitter Status** page). See the *NV5/NV3.5 Operating and Maintenance Guide*.
3. Select **Local** control.
4. Using the AUI, select Preset 4, which is factory set for minimum RF output power (in FM mode).
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 *NV5/NV3.5 Operating and Maintenance Manual*.
8. Set the correct time and date on the AUI display. See the *NV5/NV3.5 Operating and Maintenance Manual*.

GOING ON-AIR

**WARNING:**

IF A JUMPER IS PLACED BETWEEN INTERLOCK INPUTS TB2-1/TB2-2 ON THE CONTROL/INTERFACE PWB, 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 8-1](#), [Step 5](#) should be removed.

1. Turn off the power using the ac disconnect switch, if one is being used, or else at the ac source.
2. Connect the transmitter's RF output to an antenna system (or verify that the current connection is intact).
3. Turn the transmitter's ac power back on.
4. Verify audio input levels using the AUI.
5. Use the AUI controls to begin transmitter operations. For detailed instructions, refer to the *NV5/NV3.5 Operating and Maintenance Manual*.

SECTION 9: PARTS AND TOOLS

This section describes parts associated with the NV5/NV3.5 transmitter, and tools needed during installation and routine operation. Topics include:

- [Parts supplied by Nautel](#)
- [Parts not supplied by Nautel - see page 9-2](#)
- [Parts ordering - see page 9-2](#)
- [Module replacement program - see page 9-2](#)
- [Tools for installation - see page 9-3](#)

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: +1.902.823.3900
877 6NAUTEL
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 NV5/NV3.5. This kit contains items needed during the installation process. The kit includes toroids, spare fuses, screws, miscellaneous hardware and some installation tools.

DOCUMENTATION

See “NV40 transmitter manuals” on page xi.

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, complete with center male connector 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.
-

PARTS ORDERING

You can order replacement parts from your Nautel sales agent, or directly from Nautel through the Nautel website.

MODULE REPLACEMENT PROGRAM

Nautel offers a module replacement program for customers who require expedited servicing and replacement of faulty modules. The module replacement 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)
- Philips screwdrivers, sizes #1 and #2
- Pliers
- Wire cutters
- Hex wrenches (Allen keys) (some provided in ancillary kit)
- Torque wrench with hex adapter, capable of 120 in-lbs (13.6 N-m)
- 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 10: 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 10-3](#)
- [On-site support - see page 10-3](#)
- [Training - see page 10-3](#)
- [Standard warranty - see page 10-4](#)
- [Extended warranties - see page 10-7](#)

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 NV5/NV3.5 transmitter. For support, contact Nautel Customer Service and request assistance (“[On-site support](#)” on [page 10-3](#)).

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 breaker panel or the building's service entrance. If local electrical codes allow Nautel personnel to connect the transmitter to the ac supply, using the customer's cable, that task is included in this service. Otherwise, the customer must ensure that an approved electrician is present for this task.
- 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 CDROM and in paper binders that are 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 NV5/NV3.5 transmitter installation can proceed as quickly as possible. For more information about on-site support, including scheduling and pricing, contact Nautel Customer Service:

- Telephone: +1.902.823.3900
- 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 Center. 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 Limited/Nautel Incorporated, hereinafter referred to as Nautel, guarantees all mechanical and electrical parts of the equipment for a period of 13 months from date of shipment.

1. 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.
 2. Nautel shall provide replacements for all "Parts" at no cost to the Customer when they become defective during the warranty period, and upon the return of the defective part.
 3. In the event that a "Part" fails during the warranty period and causes damage to a sub-assembly that cannot be readily repaired in the field, the entire sub-assembly so damaged may be returned to Nautel for repair. The repairs will be made without charge to the Customer.
 4. Where warranty replacements or repair are provided under items 2 or 3, Nautel will pay that part of the shipping costs incurred in returning the part/assembly to the Customer.
-

5. Warranty replacement parts and repair, which are provided under items 2 or 3, shall be guaranteed for a period of ninety days from date of shipment or until the end of the original warranty period, whichever occurs later.
6. Nautel will not assume responsibility for any charges incurred by other than Nautel employees.
7. Nautel shall have the privilege of investigating whether failures have been caused by factors beyond its control.
8. Nautel shall in no event be liable for any consequential damages arising from the use of this equipment.
9. When requesting a warranty repair/replacement, please provide complete and accurate information. Observe the instructions regarding [“Equipment being returned to Nautel” on page 10-6](#) and provide the information requested.
10. When ordering spare/replacement parts, please provide complete and accurate information. Refer to the parts list of the Repair manual for ordering information. Provide as much of the information requested for 'Equipment Being Returned to Nautel' on page two of this warranty as is practical. The information identified by an asterisk is the minimum required.

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

EQUIPMENT BEING RETURNED TO NAUTEL

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

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

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

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

- *Model and serial number of equipment
- *Name of part/assembly

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

EXTENDED WARRANTIES

Nautel's standard 13-month 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 13-month warranty.

One-year Extended Warranty Plans add an additional year (12 months) of coverage after the end of the customer's standard 13-month 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 13-month 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 11: 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 microphones). One cable carries both left-channel and right-channel audio data to the receiving device.

AUI. The Advanced User Interface is the 17-inch front panel that allows for extensive 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.

HD RADIO. High Definition (HD) Radio is another term for In-Band-On-Channel (IBOC) technology. HD Radio is a trademark of iBiquity Digital Corporation.

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

INTERMEDIATE POWER AMPLIFIER (IPA). Refers to circuitry within the transmitter's RF power modules which amplifies the exciter's RF output to a level sufficient to drive the final RF amplifiers.

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

LUT. Look-Up Table.

PRESET. A setting that controls power level, frequency and audio parameters. The NV5/NV3.5 allows you to pre-program multiple presets.

PWB. Printed Wiring Board.

SBC. Single Board Computer. Refers to the CPU and associated components located on the back of the transmitter's front door.

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.

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

NV5/NV3.5

INSTALLATION MANUAL

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