# NV5/NV3.5 Transmitter

# Pre-installation Manual

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nautel

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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.

# Contents

# Release control record

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

# About this manual

This manual provides information about preparing for the delivery and installation of an NV5/NV3.5 transmitter. This manual is intended for use by field technicians, site managers, and installation planners.

## Using this manual

Read the task list provided in Section 2, "Pre-installation tasks" on page 2-1. The task list describes the preparations you must make prior to receiving and installing the NV5/NV3.5 transmitter.

Later sections of the manual provide reference information regarding physical, cooling, electrical, and antenna requirements.

## 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 xv
- Site safety - see page xvi
- Equipment safety - see page xviii


## 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: Description

This section provides a basic description of the NV5/NV3.5 transmitter and includes the following topics:



## Capabilities

### Power

The NV5/NV3.5 is a solid-state, VHF, frequency modulated broadcast transmitter that is capable of continuous RF output power up to 5.5 kW (NV5) or 4.13 kW (NV3.5) (in analog mode of operation). See Table 1.1 for continuous power capability for all modes of operation.

**Table 1.1: RF Output Power Ratings**

| Mode | Power (W) |
|---|---|
| Analog (FM) | 5,500 (NV5) or 4,130 (NV3.5) (maximum; into a 1.2:1 VSWR)<br>5,000 (NV5) or 3,750 (NV3.5) (rated; into a 1.5:1 VSWR)<br>150 (minimum) |
| Hybrid -20 dB | 4,000 (NV5) or 3,000 (NV3.5) (maximum; into a 1.2:1 VSWR)<br>3,650 (NV5) or 2,750 (NV3.5) (rated; into a 1.5:1 VSWR)<br>500 (NV5) or 375 (NV3.5) (minimum) |
| Hybrid -14 dB | 3,750 (NV5) or 2,813 (NV3.5) (maximum; into a 1.2:1 VSWR)<br>3,422 (NV5) or 2,567 (NV3.5) (rated; into a 1.5:1 VSWR)<br>469 (NV5) or 352(NV3.5) (minimum) |
| Hybrid -10 dB | 2,625 (NV5) or 1,969 (NV3.5) (maximum; into a 1.2:1 VSWR)<br>2,000 (NV5) or 1,500 (NV3.5) (rated; into a 1.5:1 VSWR)<br>275 (NV5) or 206 (NV3.5) (minimum) |
| HD Digital | 1,500 (NV5) or 1,130 (NV3.5) (maximum; into a 1.2:1 VSWR)<br>1,400 (NV5) or 1,050 (NV3.5) rated; into a 1.5:1 VSWR)<br>250 (NV5 and NV3.5) (minimum) |

The operator can vary the power continuously or switch to preset power levels using the NV5/NV3.5 advanced user interface (AUI). Presets store the power level, active exciter, and mode of operation [analog (FM), hybrid (FM+HD) or all-digital (HD)].

## 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. This design is ideally suited for all N+1 configurations.

## Antenna tolerance

The NV5/NV3.5 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.

## Remote control and monitoring

You can monitor all key parameters of NV5/NV3.5 operation, and control common functions, such as power output and exciter selection, from a remote location.

The NV5/NV3.5 allows for discrete remote control and monitoring, using a multiconductor signaling cable from the transmitter to a remote control board. You can also use a web browser, from any web-interfaced device, to access 100% of the transmitter's local functionality.

## Redundancy

The NV5/NV3.5 features redundancy in all key systems:

- RF power modules
- Exciters
- PA and IPA power supplies
- Low voltage power supplies
- Cooling fans
- Cooling fan power supplies

### Ac power

The NV5/NV3.5 can operate from a 50/60 Hz, three-phase ac power source between 180 and 264 V ac or between 312 and 457 V ac. It can also operate from a 50/60 Hz, single-phase ac power source between 180 and 264 V ac. For detailed electrical requirements (e.g., input power, maximum line current, etc.), refer to Table 5.1 in Section 5, "Electrical requirements".

The transmitter can also be factory configured with a UPS interface option (see Options), which enables continued operation of low voltage supplies and exciters during brief ac power losses. For UPS requirements (e.g., power capability, output voltage range, etc.), refer to Table 5.1 in Section 5, "Electrical requirements".

## Options

### Standby exciter

The NV5/NV3.5 supports the use of a standby exciter. When the standby exciter is installed, set the NV5/NV3.5 in auto exciter changeover mode to enable the standby switching feature.

### UPS interface

The NV5/NV3.5 can be readily upgraded to interface with a user-provided UPS. When purchased, the UPS interface assembly (Nautel Part # 206-5145-01) is factory installed on the top of the transmitter cabinet. It contains two ac connectors that provide UPS power to the transmitter's low voltage power supplies and exciters (sides A and B) during an ac brown-out period. This allows continued AUI navigation and reduces reboot times.

# Section 2: Pre-installation tasks

This section provides a list of tasks that you must perform prior to delivery and installation of the NV5/NV3.5 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 NV5/NV3.5 transmitter, perform the following tasks:

*NOTE:*
*Refer to Figure 2.1 on page 2-5 for quick reference pre-installation information for the NV5/NV3.5.*

1. Ensure that the correct transmitter configuration is ordered. Check the ac power requirements, preset frequency, operating mode(s), and other options.

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 ac power service into the planned transmitter location, and select a location for the ac power switching assembly (available from Nautel) 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 quick reference to ac power requirements, see Figure 2.1 on page 2-5. For detailed information, see "Main electrical power" on page 5-1.

5. Install lightning protection on the antenna tower.

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 - soldering iron, screwdrivers, wrenches, etc. (see Section 9, "Parts and tools" on page 9-1).

   - Test equipment - oscilloscope and digital multimeter.

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

8. Terminate the transmitter end of the RF feedline with the appropriate mating connector. Unless otherwise specified in contract documents, the transmitter will accept a 1-5/8 inch (standard), 3-1/8 inch or 7/8 inch EIA flange connector.

9. Arrange manpower or lifting equipment to move and assemble the transmitter. You will need a forklift to move the transmitter into place for installation.

10. Implement a safety interlock, if required.

11. Prepare to integrate the NV5/NV3.5 transmitter into your station control circuitry, if required.

12. Train your station technicians and operators on the use and maintenance of the NV5/NV3.5 transmitter.

## Selecting a location for the transmitter

To ensure that the desired location for the NV5/NV3.5 transmitter is suitable, perform the following tasks:

1. Ensure that the floor area where the transmitter will be located is able to support the weight of the transmitter system. For quick reference to transmitter weights, see Figure 2.1 on page 2-5. For detailed information, see "Physical requirements" on page 3-1.

2. Measure the space to ensure that the transmitter will fit. For quick reference to transmitter dimensions and clearances, see Figure 2.1 on page 2-5, or see Section 3, "Physical requirements".

3. Ensure that transmitter room doors and the pathway of access from the receiving dock or building exterior to the installation location are large enough to accommodate the transmitter.

## Installing an antenna feedline

When installing an antenna feedline for the NV5/NV3.5 transmitter, perform the following tasks:

1. Ensure that the RF feedline that will connect the transmitter and the antenna system has a suitably rated coaxial cable.

2. Connect the shield of the antenna feedline coaxial cable directly to the station reference ground where it enters the building. For more information about the station reference ground, see "Station reference ground" on page 5-4.

3. Install lightning protection devices. For more information about lightning protection, refer to the *Lightning Protection* section of Nautel's *Recommendations for Transmitter Site Preparation Manual*.

4. Pass the center conductor and the shield of the feedline cable through a ferrite toroid that is positioned between the shield ground at the building entrance and the shield termination at the transmitter. Install the ferrite toroid prior to installing flanges on the feedline cable.

    - To obtain the proper size ferrite toroid, contact Nautel support for recommendations (see page 10-3), or consult additional, outside suppliers.

## Figure 2.1: NV5/NV3.5 Pre-installation Guide

### REQUIRED CLEARANCES

Front: 1.2 m (4 ft)
Rear: 0.9 m (3 ft)
Sides: 0
Top: 1.2 m (4 ft)

### WEIGHT

Uncrated: 136 kg (300 lbs)
Crated: 279 kg (615 lbs)

### COOLING

**Maximum Intake Air Temperature (varies with site altitude as follows):**

50°C (122°F) at sea level
47°C (116.6°F) at 500 m (1640 ft)
44°C (111.2°F) at 1000 m (3281 ft)
40.4°C (104.7°F) at 1600 m (1 mile)

**Air Conditioning Requirements in Closed Room Cooling (based on maximum output power):**

FM mode: 1.04 (NV5) or 0.89 (NV3.5) tonnes
FM+HD (-20 dB) mode: 0.86 (NV5) or 0.76 (NV3.5) tonnes
FM+HD (-14 dB) mode: 1.36 (NV5) or 1.02 (NV3.5) tonnes
FM+HD (-10 dB) mode: 1.22 (NV5) or 0.91 (NV3.5) tonnes
HD mode: 1.04 (NV5) or 0.78 (NV3.5) tonnes

**Forced air cooling systems require a minimum of 250 CFM.** The static pressure at the exhaust duct must be slightly negative. The static pressure at the intake duct must be neutral or slightly positive.

### HEATING

Minimum transmitter room ambient air temperature is 0°C (32°F)

### AC INPUT WIRE LIMITATIONS

| AC source | Line range (hex key size) | Ground stud (M8 threaded) |
|---|---|---|
| 3-Ph or 1-Ph | 2/0 AWG - 14 AWG (3/16" hex key) | 2/0 AWG - 14 AWG (use appropriate lug) |

### AC INPUT SPECIFICATIONS

| Mode of operation | Input power (kVA) | AC supply (VAC) | Maximum line current (A) (low line) |
|---|---|---|---|
| FM (analog) | 9.3 (NV5) 7.3 (NV3.5) | 3-Ph, 180 - 264 | 30 (NV5), 23 (NV3.5) |
| Worst-case eff. = 60% (NV5) or 57% (NV3.5) | | 3-Ph, 312 - 457 | 17 (NV5), 14 (NV3.5) |
| | | 1-Ph, 180 - 264 | 51 (NV5), 41 (NV3.5) |
| FM+HD (-20 dB) | 7.6 (NV5) 5.7 (NV3.5) | 3-Ph, 180 - 264 | 25 (NV5), 18 (NV3.5) |
| Worst-case eff. = 53% | | 3-Ph, 312 - 457 | 14 (NV5), 11 (NV3.5) |
| | | 1-Ph, 180 - 264 | 42 (NV5), 32 (NV3.5) |
| FM+HD (-14 dB) | 8.6 (NV5) 6.5 (NV3.5) | 3-Ph, 180 - 264 | 28 (NV5), 21 (NV3.5) |
| Worst-case eff. = 44% | | 3-Ph, 312 - 457 | 16 (NV5), 12 (NV3.5) |
| | | 1-Ph, 180 - 264 | 48 (NV5), 36 (NV3.5) |
| FM+HD (-10 dB) | 7.0 (NV5) 5.2 (NV3.5) | 3-Ph, 180 - 264 | 22 (NV5), 17 (NV3.5) |
| Worst-case eff. = 38% | | 3-Ph, 312 - 457 | 13 (NV5), 10 (NV3.5) |
| | | 1-Ph, 180 - 264 | 39 (NV5), 29 (NV3.5) |
| HD (digital) | 5.2 (NV5) 3.9 (NV3.5) | 3-Ph, 180 - 264 | 17 (NV5), 13 (NV3.5) |
| Worst-case eff. = 29% | | 3-Ph, 312 - 457 | 10 (NV5), 7 (NV3.5) |
| | | 1-Ph, 180 - 264 | 29 (NV5), 22 (NV3.5) |

Maximum line current values are based on maximum RF output power, minimum ac voltage (180 or 312 V ac, as applicable) and worst-case efficiency.

The maximum inrush current value (per line) is present for half an ac cycle (between 8 and 10 ms) and is based on an ac input voltage of 230 V ac. The maximum inrush current per line is approximately 198 A for three-phase ac power sources and 342 A for single-phase ac power sources.

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

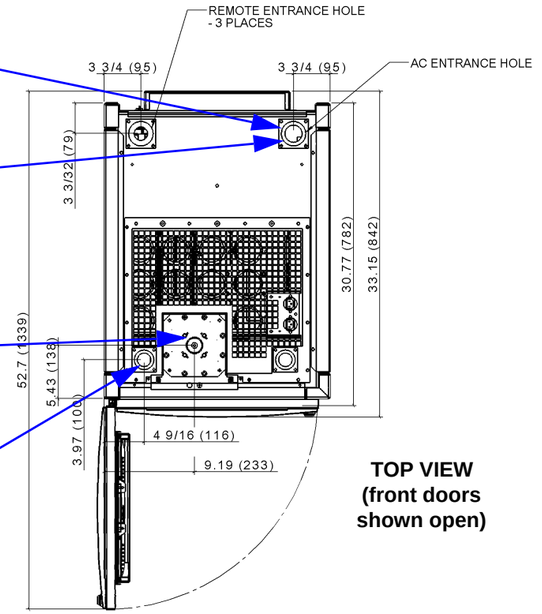
Nautel recommends that you base your wire sizes and breaker ratings on the maximum line current for analog mode plus a nominal 25%.

**TB1: Ac terminal block** (directly below entrance hole; in bottom section of transmitter cabinet)

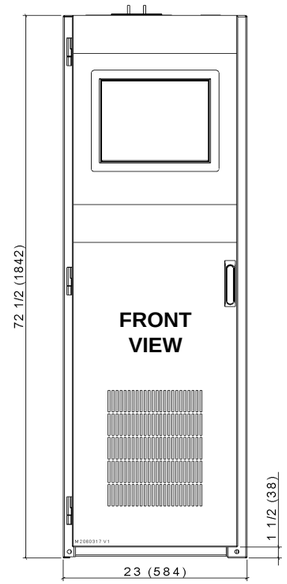
**AC CABLE ENTRY**
1-3/4 in. (44 mm)
accepts 1-1/4 in. conduit

**RF OUTPUT**
Standard: 1-5/8 inch EIA
Options: 3-1/8 inch EIA or 7/8 inch EIA

**REMOTE CABLE ENTRY (3 places)**
1-3/8 in. (35 mm);
accepts 1 in. conduit




**TOP VIEW (front doors shown open)**




ALL DIMENSIONS IN INCHES (mm)

# Section 3: Physical requirements

This section provides physical specifications for the NV5/NV3.5 transmitter and its components, and lists physical site requirements. This section includes the following topics:

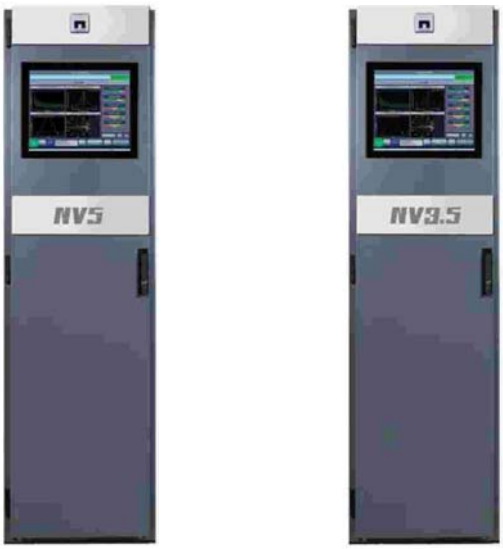


## Dimensions

The NV5/NV3.5 main transmitter (see Figure 3.1) has the following overall dimensions. See Figure 3.2 through Figure 3.5 for detailed dimensional views.

- Height: 184.2 cm (72.5 in)
- Width: 58.4 cm (23 in)
- Depth: 84.5 cm (33.3 in), including rear filter panels (installed for open air cooling) OR 81.3 cm (32 in.), with rear filter panels removed.

**Figure 3.1: NV5/NV3.5 transmitter**



## Clearances

For the transmitter cabinet, the required minimum clearances are 1.2 m (4.0 feet) at the front to allow for the swing of the front doors, 1.2 m (4.0 feet) at the top to allow for cable and ducting, and 0.9 m (3.0 feet) at the rear to allow for maintenance.

Check the clearance to ensure that you will be able to open all doors and access panels.

Also consider access to the rear of the transmitter during servicing, and access to the front of the transmitter during power module replacement. You must allow space to open the front door and slide out any of the power modules. These modules slide straight in and out of the module compartment in the front of the transmitter.

Internal fans pull cooling air through air filters in the back of the transmitter. The cooling air exhausts through a grill on top of the transmitter.

**Figure 3.2: NV5/NV3.5 top view (open air cooled)**

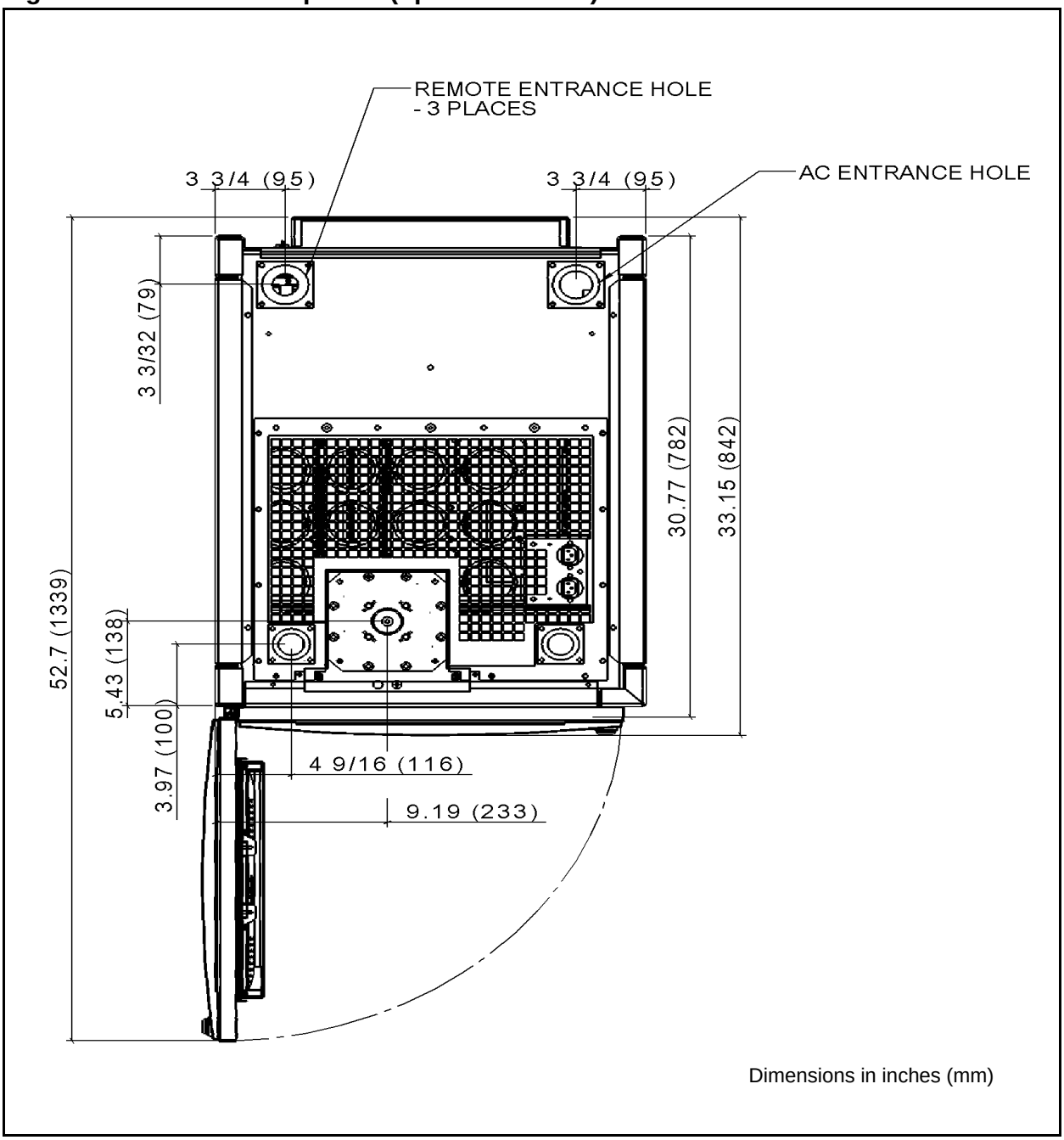
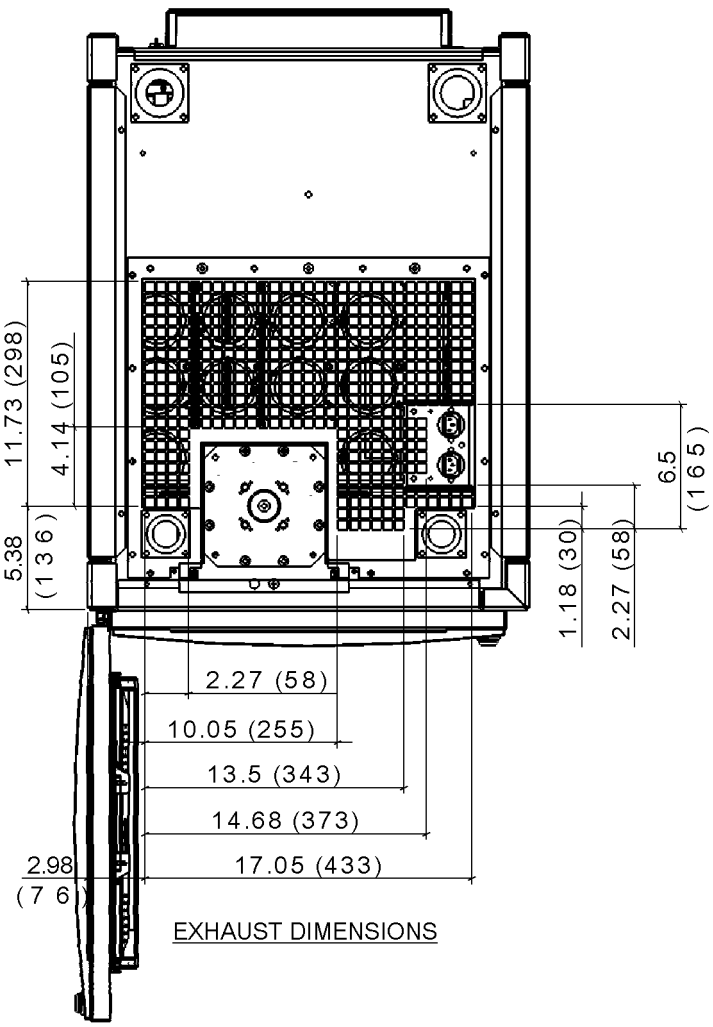


**Figure 3.3: NV5/NV3.5 top view (exhaust dimensions)**




Dimensions in inches (mm)

**Figure 3.4: NV5/NV3.5 front view**

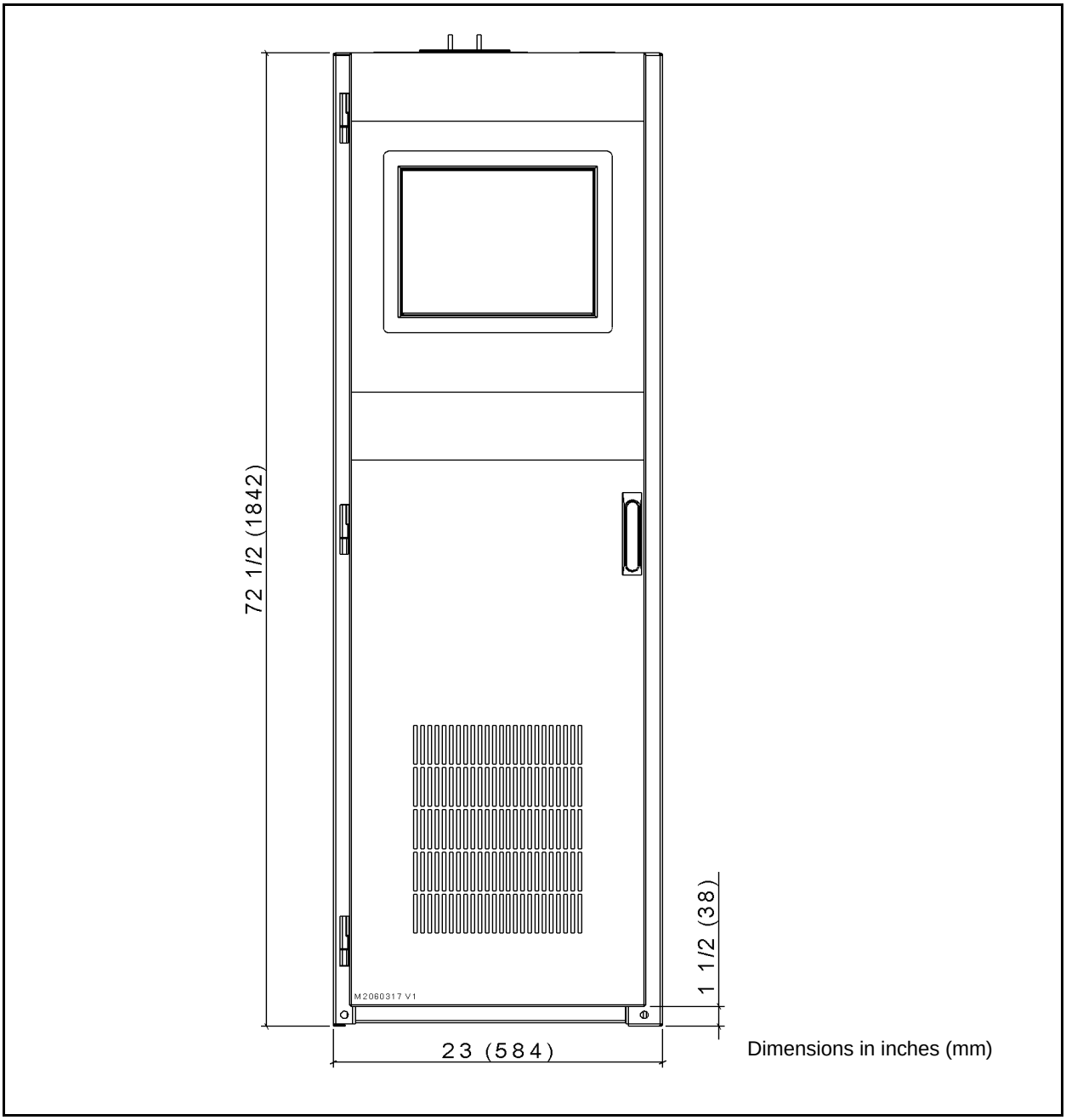
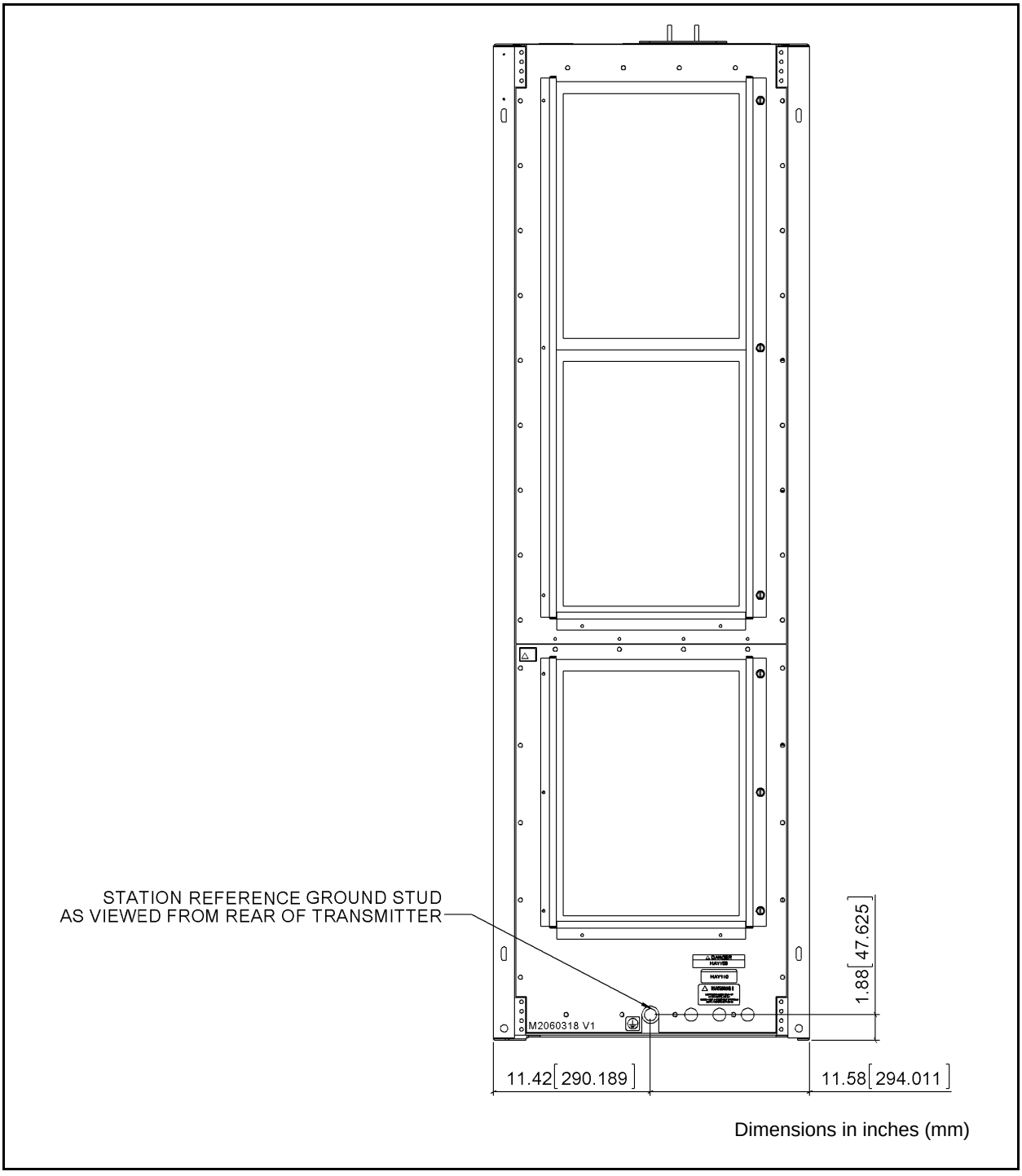


**Figure 3.5: NV5/NV3.5 rear view**



## Weight

See Table 3.1 for transmitter weights, including crated and uncrated weights.

**Table 3.1: Weight of components**

| Crate contents | Uncrated weight | Crated weight |
|---|---|---|
| Transmitter (with modules) | 136 kg (300 lbs) | 279 kg (615 lbs) |

# Section 4: Cooling requirements

This section provides information about heating and cooling requirements for the NV5/NV3.5 transmitter site. Topics in this section include:



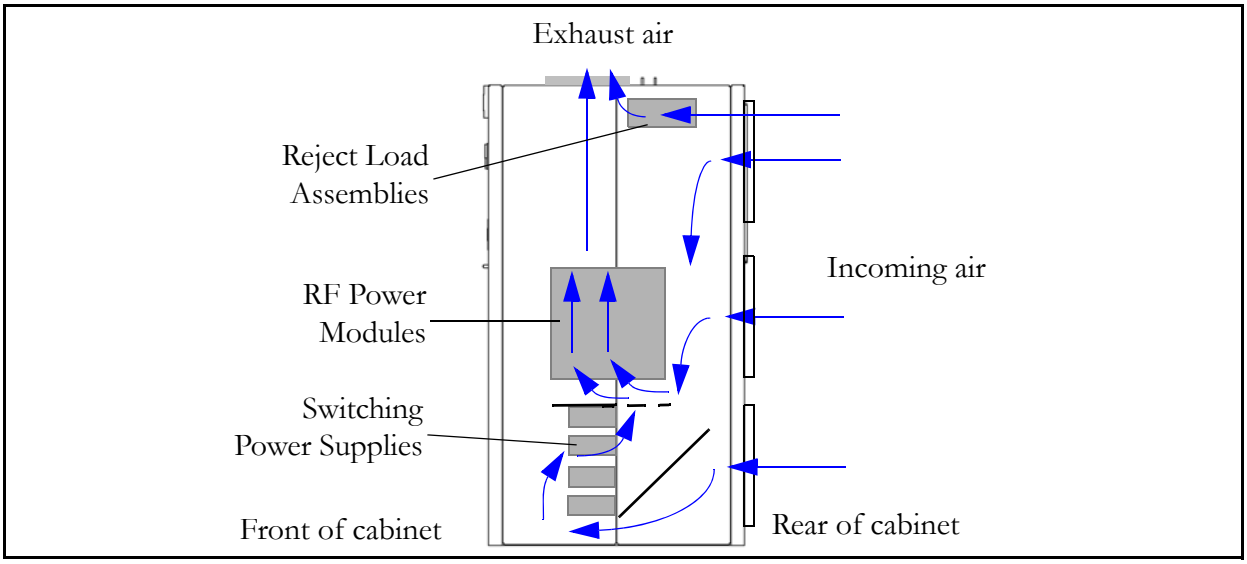
## Air flow in the transmitter

The following paragraphs define ventilation and cooling terminology used in this manual.

**Open ventilation systems.** For open ventilation systems (see Figure 4.1 on page 4-1), which is the default method of cooling, the transmitter intakes air from the room and exhausts it into the room. For the NV5/NV3.5, intake air is drawn in through air filters in the back. The air circulates down into the RF power modules and power supplies, and then is exhausted up through the combiner section by a set of fans. Warm air exits the transmitter through the grill at the top.

**Closed room cooling.** For closed room cooling, the air in the room does not exchange with outdoor air. Any heat generated in the room must be cooled using air conditioning. One (1) ton of air conditioning is required for 12,000 BTUs (3,514 W) of waste heat.

**Figure 4.1: Air flow in the NV5/NV3.5 transmitter (open ventilation system shown)**



# 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. At higher altitudes, derate the maximum intake air temperature as follows:

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

**Example:** At 1600 m (1 mile) above sea level, maximum ambient temperature should not exceed 40.4ºC (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 4.1: Cooling plant requirements for the NV5/NV3.5**

| Mode of operation | Transmitter output (watts) | Worst-case Efficiency (%) | Waste heat (watts) | BTU/hour (x1000 Btu) | Air conditioning required in closed room cooling (tonnes) |
|---|---|---|---|---|---|
| FM | 5,500 (NV5)<br>4,125 (NV3.5) | 60 (NV5)<br>57 (NV3.5) | 3,667 (NV5)<br>3,112 (NV3.5) | 12.514 (NV5)<br>10.621 (NV3.5) | 1.04 (NV5)<br>0.89 (NV3.5) |
| FM+HD (-20 dB) | 4,000 (NV5)<br>3,000 (NV3.5) | 53 | 3,546 (NV5)<br>2,660 (NV3.5) | 12.102 (NV5)<br>9.079 (NV3.5) | 1.01 (NV5)<br>0.76 (NV3.5) |
| FM+HD (-14 dB) | 3,750 (NV5)<br>2,813 (NV3.5) | 44 | 4,773 (NV5)<br>3,580 (NV3.5) | 16.289 (NV5)<br>12.219 (NV3.5) | 1.36 (NV5)<br>1.02 (NV3.5) |
| FM+HD (-10 dB) | 2,625 (NV5)<br>1,969 (NV3.5) | 38 | 4,283 (NV5)<br>3,213 (NV3.5) | 14.618 (NV5)<br>10.965 (NV3.5) | 1.22 (NV5)<br>0.91 (NV3.5) |
| HD | 1,500 (NV5)<br>1,125 (NV3.5) | 29 | 3,672 (NV5)<br>2,754 (NV3.5) | 12.534 (NV5)<br>9.400 (NV3.5) | 1.04 (NV5)<br>0.78 (NV3.5) |

### 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), which is 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 5: Electrical requirements

This section describes electrical power and electrical protection requirements associated with the NV5/NV3.5 transmitter. This section includes the following topics:



**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.**

Refer to Nautel's *Recommendations for Transmitter Site Preparation* for information about requirements associated with lightning protection.

## Main electrical power

The transmitter can operate from a 50/60 Hz 3-phase or 1-phase ac power source. You select the specific voltage range when you order the transmitter. You can also reconfigure the transmitter for a different ac power source.

### Voltage stability

The ac power source nominal voltage must be stable to within rated limits (see Table 5.1 on page 5-2) under all loading conditions. The transmitter contains circuitry that maintains the RF output at the preset power level for voltage variations within the specified range.

### Power consumption

Power consumption varies depending on the transmitter's mode of operation (analog, hybrid -20 dB, hybrid -10 dB or digital). Use Table 5.1 on page 5-2 to determine the actual input power requirements for a given transmitter configuration. If the transmitter configuration is variable (between all modes), use the analog (FM mode) power source capacity information. Nautel recommends using the highest current values (FM mode) when determining wire ratings.

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

**Table 5.1: NV5/NV3.5 Input power requirements**

| Mode of operation | Input power (kVA) | Ac supply (vac) | Maximum line current (A) (low line) |
|---|---|---|---|
| FM (analog)<br><br>Worst-case eff. = 60% (NV5) or 57% (NV3.5) | 9.3 (NV5)<br>7.3 (NV3.5) | 3-Ph, 180 - 264<br>3-Ph, 312 - 457<br>1-Ph, 180 - 264 | 30 (NV5), 23 (NV3.5)<br>17 (NV5), 14 (NV3.5)<br>51 (NV5), 41 (NV3.5) |
| FM+HD (-20 dB)<br><br>Worst-case eff. = 53% | 7.6 (NV5)<br>5.7 (NV3.5) | 3-Ph, 180 - 264<br>3-Ph, 312 - 457<br>1-Ph, 180 - 264 | 25 (NV5), 18 (NV3.5)<br>14 (NV5), 11 (NV3.5)<br>42 (NV5), 32 (NV3.5) |
| FM+HD (-14 dB)<br><br>Worst-case eff. = 44% | 8.6 (NV5)<br>6.5 (NV3.5) | 3-Ph, 180 - 264<br>3-Ph, 312 - 457<br>1-Ph, 180 - 264 | 28 (NV5), 21 (NV3.5)<br>16 (NV5), 12 (NV3.5)<br>48 (NV5), 36 (NV3.5) |
| FM+HD (-10 dB)<br><br>Worst-case eff. = 38% | 7.0 (NV5)<br>5.2 (NV3.5) | 3-Ph, 180 - 264<br>3-Ph, 312 - 457<br>1-Ph, 180 - 264 | 22 (NV5), 17 (NV3.5)<br>13 (NV5), 10 (NV3.5)<br>39 (NV5), 29 (NV3.5) |
| HD (digital)<br><br>Worst-case eff. = 29% | 5.2 (NV5)<br>3.9 (NV3.5) | 3-Ph, 180 - 264<br>3-Ph, 312 - 457<br>1-Ph, 180 - 264 | 17 (NV5), 13 (NV3.5)<br>10 (NV5), 7 (NV3.5)<br>29 (NV5), 22 (NV3.5) |

Maximum line current values are based on maximum RF output power, minimum ac voltage (180 or 312 V ac, as applicable) and worst-case efficiency.

The maximum inrush current value (per line) is present for half an ac cycle (between 8 and 10 ms) and is based on an ac input voltage of 230 V ac. The maximum inrush current per line is approximately 198 A for three-phase ac power sources and 342 A for single-phase ac power sources.

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

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

## AC power switch

Install an external ac power disconnect between the ac power source and the transmitter. Nautel can provide a suitable ac power disconnect, if required. For safety, place the ac disconnect close to the transmitter and label it TRANSMITTER EMERGENCY ON/OFF SWITCH.

## 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. In addition, pass all the conductors and ground, as a group, through a ferrite toroid. Install a ferrite toroid on the ac feed between the transmitter and the bi-directional surge protector.)

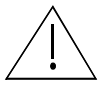
- To obtain the proper size ferrite toroid, contact Nautel support for recommendations (see page 10-3), or consult additional, outside suppliers.

A surge protector panel containing suitably rated varistors is available from Nautel. 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.*

**Recommended configuration.** Use a 4-wire Wye (star) configuration, with the three phases balanced to ground.



**CAUTION:**
**Do NOT use open delta three-phase ac power sources that use two identical transformers. These systems are susceptible to third harmonic distortion and line transients, and may cause peak voltages to exceed the line voltage. This can cause increased power supply noise or even component failure (for example, rectifier failure).**

# UPS backup

The transmitter can be configured to operate with a UPS backup. If this option is purchased, a UPS interface assembly is factory installed on top of the transmitter. The UPS is intended to provide ac voltage to the transmitter's low level circuits (LVPS modules and exciters) during ac brown-out periods to ensure continued navigation of the front panel AUI as well as reducing rebooting times.

The UPS must be provided by the user and meet the following specifications:

## Output Voltage

The UPS must be able to provide two outputs, each with voltage between 85 V ac and 264 V ac to accommodate the input requirements of the transmitter's low level power supplies, which are universal input.

## Power capability

The UPS must be rated for a minimum of 216 W/270 VA for dual exciter transmitters. Subtract approximately 50 W from the minumum rating for single exciter transmitters.

## Interconnecting cables

The UPS interface assembly contains two IEC 60320 C-14 ac input connectors. The user must provide suitably rated electrical cables (with IEC 60320 C-13 plugs) that are of sufficent length to connect between the user-provided UPS and the top of the trasmitter cabinet.

## 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 cabinet'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 copper strap that is at least 10 cm (4 in.) wide. 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 cabinet'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 10 cm (4 in.) copper strap. Connect the surge protector to the station reference ground using a copper strap that is at least 10 cm (4 inches) wide.

Ac power enters the transmitter cabinet through a 1-3/4 inch (4.4 cm) hole in the top of the cabinet (see Figure 3.2 on page 3-3).

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 6: RF output requirements

This section describes requirements associated with the antenna and RF cabling to be used with the NV5/NV3.5 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*.

## Antenna feed cable

The antenna feed cable interconnecting the transmitter and the antenna system should be a suitably rated coaxial cable. As a standard, the RF output is configured to accept a non-gas type 1-5/8 inch EIA flange (male) connection (appropriate male inner connector not provided with the transmitter).

## Antenna system

The antenna system must present 50 ± j0 ohms impedance at the carrier frequency. 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 7: Planning program inputs

The NV5/NV3.5 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 back of the single or dual NVE50 exciters (see Figure 7.1 on page 7-2). Where a D-sub connector is used as the interface, Nautel provides associated 15-pin D-sub connector parts (Nautel Part # JU33) in the ancillary parts kit to facilitate customer connections.



## Analog inputs

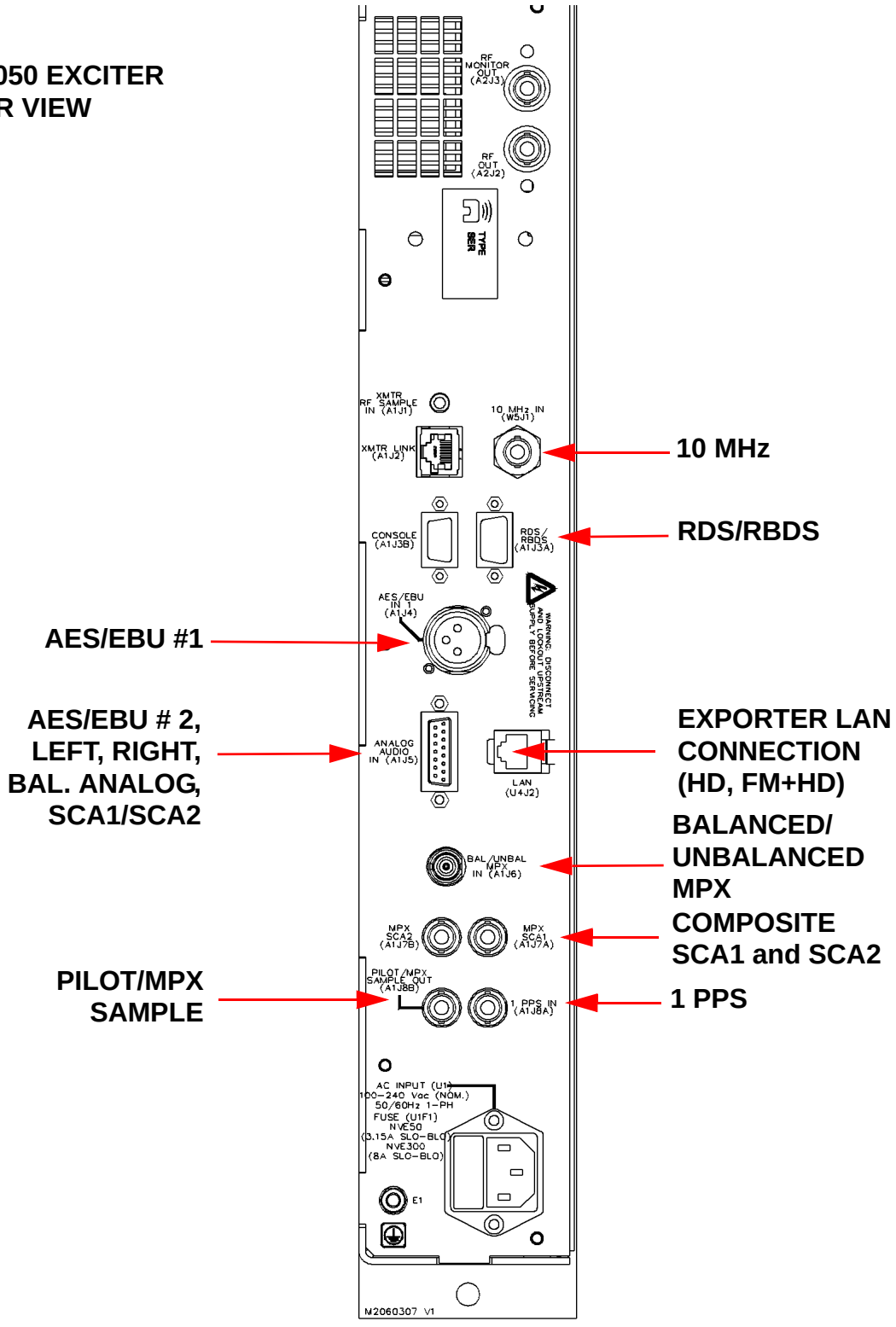
The NV5/NV3.5 exciters accept the following analog inputs:

### Left and right inputs

An analog left/right or monaural input (left only) (30 Hz to 15 kHz, 0 -12 dBm) can be applied to **ANALOG AUDIO IN (A1J5)** 15-pin male D-sub connector [left (+ on pin 7, - on pin 8, shield on pin 15) and right (+ on pin 13, - on pin 14, shield on pin 6)]. The NV5/NV3.5's front panel AUI allows for configuration of the audio input mode (left, right or stereo). Provision is made for adjustment of the input sensitivity and pre-emphasis.

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

**Figure 7.1: Program Input Connections**



## SCA generator input

Internal dual SCA generators can be interfaced via ANALOG AUDIO IN (A1J5) 15-pin male D-sub connector [SCA1 (+ on pin 4, - on pin 5, shield on pin 12) and SCA2 (+ on pin 10, - on pin 11, shield on pin 3)]. The input impedance is 600 Ω and the adjustment range is 0 to +12 dBu.

*NOTE:*
*Exciters are factory set for a 1.24 V rms (4.7 dBu) SCA generator input level.*

## MPX input

Balanced and unbalanced wideband MPX (composite) inputs (30 Hz to 100 kHz) are provided on the BAL/UNBAL MPX IN (A1J6) female BNC connector. The UNBAL/BAL jumper (A1E1) inside the exciter allows selection between balanced (jumper installed between pins 2 and 3) and unbalanced (jumper installed between pins 1 and 2) mode. The levels are nominally 3.5 V pk-pk for +/- 75 kHz carrier deviation, and are adjustable between 0.5 V and 5 V pk-pk. The input impedance for each input is 10 kΩ.

*NOTE:*
*Exciters are factory configured to provide 100% modulation (+/- 75 kHz) with a wideband composite input level of precisely 1.24 V rms (3.5 V pk-pk).*

## MPX SCA inputs

Two unbalanced inputs (20 kHz to 100 kHz) are provided on the MPX SCA1 (A1J7A) and MPX SCA2 (A1J7B) 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 0.5 V and 5 V pk-pk. The input impedance for each input is 10 kΩ.

*NOTE:*
*Exciters are factory configured to provide 10% modulation (+/- 7.5 kHz) with an SCA input level of precisely 1.0 V rms (2.8 V pk-pk).*

# Digital inputs

The NV5/NV3.5 accepts the following digital inputs:

## IBOC

The NV5/NV3.5 requires up to two connections to an exporter: **LAN (U4J2)** (RJ45) and 3-pin female **AES/EBU IN 1 (A1J4)** (XLR). The AES/EBU connection is only required for FM+HD (hybrid) operation. The **LAN** connection is an Ethernet port and is normally connected to an Ethernet switch or hub. To connect **LAN** directly to an exporter, use an Ethernet cable.

Refer to the Importer and Exporter documentation for more information.

## AES/EBU

The NV5/NV3.5 accepts AES/EBU digital audio via the **AES/EBU IN 1 (A1J4)** 3-pin female XLR connector (110 Ω balanced; supports sample rates between 20 to 192 kHz) or the **OPTICAL** connector (supports sample rates between 20 and 96 kHz, PCM only). A second AES/EBU input can be applied to the **ANALOG AUDIO IN (A1J5)** 15-pin male D-sub connector (+ on pin 1, - on pin 2, ground on pin 9). The NV5/NV3.5's AUI allows for configuration of the audio input mode (left, right or stereo) and level (in dBfs).

## RBDS/RDS input

The NV5/NV3.5 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.

> *NOTE:*
> *The NV5/NV3.5 also supports stand-alone RBDS/RDS operation. In this mode, RBDS/RDS parameters are configured through the AUI.*

### Carrier frequency and pilot phase control

The NV5/NV3.5 provides carrier frequency and pilot phase control from a precision GPS reference on the exciter's **10MHz IN (W5J1)** female BNC connector (between 0.5 V and 2 V pk-pk sine wave input; 50 Ω) and **1PPS IN (A1J8A)** female BNC connector (5 V TTL input level, 10 kΩ).

### Pilot/MPX sample output

The NV5/NV3.5 provides either a 19 kHz pilot sample (500 mV pk-pk) or an MPX sample (500 mV pk-pk for +/- 75 kHz carrier deviation) on the exciter's **PILOT/MPX SAMPLE OUT (A1J8B)** female BNC connector. The output is selectable through the AUI.

# Section 8: Planning for control and monitoring

This section describes the types of control and monitoring for the NV5/NV3.5 transmitter. Consider the following information and plan for the necessary requirements (wiring, remote switches/ indicators, LAN, etc.):



## AUI control

The NV5/NV3.5's advanced user interface (AUI) lets you locally control a number of transmitter functions and set parameters. For detailed information about the AUI, refer to the *NV5/NV3.5 Operating and Maintenance Manual*. In addition, the AUI lets you define and control the on/off status, the active (A/B) exciter, the preset RF power level, the power level adjustment, and the system alarm reset remotely by means of a conventional remote control interface (see "Digital inputs" and "Digital outputs" on page 8-5) or a LAN (see "Web based control" on page 8-11).

## Digital inputs

You can connect to 24 digital inputs, which allow you to remotely control various operational characteristics of the transmitter. Each input is mapped to a control that is preset at Nautel, but is also user-configurable. See Table 8.1 on page 8-2 for a list of the preset inputs, their functional descriptions and their associated input terminals and control switches (see "Backup control switches" on page 8-5) on the remote interface PWB (A2). Refer to the *NV5/NV3.5 Operations and Maintenance Manual* for instructions on changing the digital input settings. Unless otherwise noted these inputs are only accepted by the transmitter if the remote/local status is set to remote. That setting can only be made by a local user using the front panel AUI.

The external digital input circuits interface with the transmitter via the remote interface PWB and then with opto-couplers on the control/interface PWB (A1). The opto-couplers buffer and isolate the external circuits and prevent any unwanted transients from affecting transmitter operation while remote control is selected at the transmitter.

## Table 8.1: Factory Defined Digital Inputs

| Digital Input | Function | Input Terminal/Switch |
|---|---|---|
| 1. RF On | Same as pressing the AUI RF On button. Tells the transmitter to provide RF power if possible. Provide an active pulse to select. | Terminal J7-8, Switch 01 |
| 2. RF Off | Same as pressing the AUI RF Off button. Tells the transmitter to disable RF power. Provide an active pulse to select. | Terminal J7-7, Switch 02 |
| 3. Reset | Causes a system reset. Provide an active pulse to select. | Terminal J7-6, Switch 03 |
| 4. Exciter A Select | Causes a changeover to select exciter A as the active exciter. Provide an active pulse to select. | Terminal J7-4, Switch 04 |
| 5. Exciter B Select | Causes a changeover to select exciter B as the active exciter. Provide an active pulse to select. | Terminal J7-3, Switch 05 |
| 6. Power Increase | Increases the power level of the current preset. Send a momentary active pulse to increase the power slightly, or send a signal of greater duration to continue increasing power. | Terminal J7-2, Switch 06 |
| 7. Power Decrease | Decreases the power level of the current preset. Send a momentary active pulse to decrease the power slightly, or send a signal of greater duration to continue decreasing power. | Terminal J8-8, Switch 07 |
| 8. Preset 1 Select | Selects preset 1 as active. Provide an active pulse to select. | Terminal J8-7, Switch 08 |
| 9. Preset 2 Select | Selects preset 2 as active. Provide an active pulse to select. | Terminal J8-6, Switch 09 |
| 10. Preset 3 Select | Selects preset 3 as active. Provide an active pulse to select. | Terminal J8-4, Switch 10 |
| 11. Preset 4 Select | Selects preset 4 as active. Provide an active pulse to select. | Terminal J8-3, Switch 11 |
| 12. Auto Exciter Changeover | Enables or disables automatic exciter changeover. Provide an active pulse to toggle between selecting automatic or manual. | Terminal J8-2, Switch 12 |
| 13. Not Assigned | - | Terminal J9-8, Switch 13 |
| 14. Not Assigned | - | Terminal J9-7, Switch 14 |
| 15. Not Assigned | - | Terminal J9-6, Switch 15 |
| 16. Not Assigned | - | Terminal J9-4, Switch 16 |
| 17. Not Assigned | - | Terminal J9-3, Switch 17 |
| 18. Not Assigned | - | Terminal J9-2, Switch 18 |
| 19. Not Assigned | - | Terminal J10-8, Switch 19 |

| Digital Input | Function | Input Terminal/Switch |
|---|---|---|
| 20. Not Assigned | - | Terminal J10-7, Switch 20 |
| 21. Not Assigned | - | Terminal J10-6, Switch 21 |
| 22. Not Assigned | - | Terminal J10-4, Switch 22 |
| 23. Not Assigned | - | Terminal J10-3, Switch 23 |
| 24. Not Assigned | - | Terminal J10-2, Switch 24 |

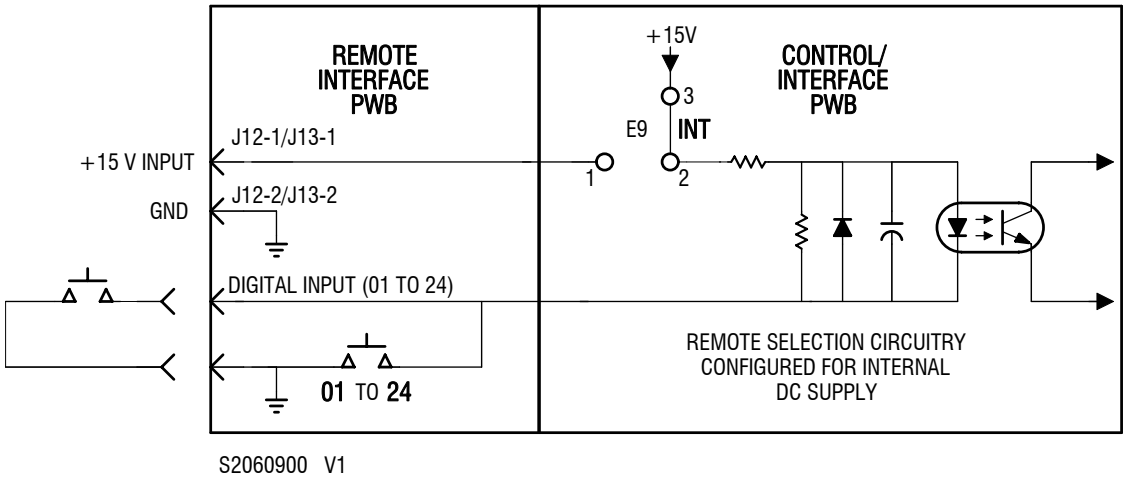
## External switching circuit requirements

The switching circuits for the remotely controlled functions must be the equivalent of a normally open (momentary) switch. The switches must be configured to operate as a single-ended input using the transmitter's 15 V dc as the source, or as a differential input using an external dc power supply (12 - 18 V) applied to J1-32 or J1-33. The control/interface PWB (A1) contains a selection circuit that lets you select internal (or single-ended, see Option 1) or external (or differential, see Option 2) dc power supply for all digital inputs.

Inputs are toggled between states by an active pulse unless otherwise noted. To ensure proper operation, the duration of the active pulse should be a minimum of 250 ms. Refer to the *NV5/NV3.5 Operations and Maintenance Manual* to see the various logic control options for digital inputs.

**Option 1 - Single Ended Input (Internal dc supply).** When you use the transmitter's 15 V as the source for a control function's opto-coupler, configure the circuits on the control/interface PWB (A1) for single ended inputs (see Figure 8.1 on page 8-3). The **INT/EXT** 3-pin header (E9) must have its 2-socket shunt post connected between pins 2 and 3 to configure the circuit.

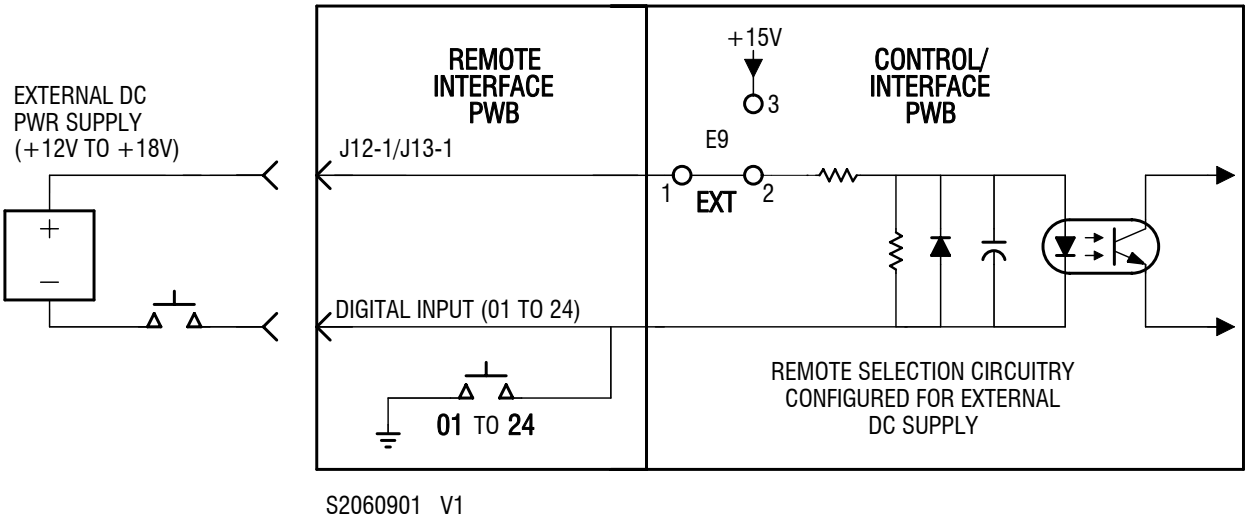
**Figure 8.1: Single-Ended Input Selected**



When the digital input is configured for logic '0', a negative logic (current-sink-to-ground) command must be applied to the appropriate digital input (1 through 24). To avoid a ground loop, obtain the ground from the remote interface PWB (J7-1 or 5, J8-1 or 5, J9-1 or 5 or J10-1 or 5).

**Option 2 - Differential Input (External dc supply).** When you use an external dc voltage (12 V to 18 V) as the source for a control function's opto-coupler, configure the control function's external switching circuit and the control/interface PWB's (A1) selection circuit for a differential input (see Figure 8.2). The INT/EXT 3-pin header (E9) must have its 2-socket shunt post connected between pins 1 and 2 to configure the circuit. 2-pole mini-plugs (Nautel Part # JU32) are provided in the transmitter's ancillary kit to act as interfacing connectors for external dc power source.

**Figure 8.2: Differential Input Selected**




S2060901 V1

The normally open/momentarily closed switch should be located between the dc supply's negative output and the digital input.

## Backup control switches

The remote interface PWB (A2) contains a push-button switch [01 (S1) through 24 (S24)] for each of the 24 digital inputs. Each switch provides a means to locally activate its associated digital input in the event that the associated AUI control is not available. See Table 8.1 on page 8-2 to determine the switch associated with each of the digital inputs.

Below each switch is a blank, white label to allow for labelling of the control.

The control/interface PWB (A1) also contains backup pushbutton switches that provide specific functions, such as RF ON, RF OFF, LCL/RMT (local/remote), RESET, PWR INCR (power increase) and PWR DECR (power decrease).

## Digital input connections

Digital inputs 1 through 24, as required, connect to the terminals of connectors J7, J8, J9 and J10 on the remote interface PWB (A2). See Table 8.1 on page 8-2 to determine the input terminal associated with each digital input. 8-pole mini-plugs (Nautel Part # JU33) are provided in the transmitter's ancillary kit to act as interfacing connectors for your digital inputs.

# Digital outputs

Up to 24 digital outputs, that indicate either the presence of various alarms or the status of operator controlled circuits, are available for remote monitoring on connectors J3, J4, J5 and J6 on the remote interface PWB (A2). The sources and active logic levels of these digital outputs are preset at Nautel, but are also user-configurable. See Table 8.2 on page 8-7 for a list of the factory preset outputs, their descriptions and their associated output terminals and status LEDs (see "LED configuration") on the remote interface PWB.

A switching device for each digital output, configurable through the AUI, provides the desired active logic when a true condition exists.

For example, if a digital output is configured as Output Low When On (see the *NV5/NV3.5 Operations and Maintenance Manual* for the specific text displayed on the AUI), then the digital output's switching circuit will provide a current-sink-to-ground when a logic true condition exists and an open collector for a logic false condition.

If the digital output is configured as Output Low When Off (see the *NV5/NV3.5 Operations and Maintenance Manual* for the specific text displayed on the AUI), then the digital output's switching circuit will provide an open collector when a logic true condition exists and a current-sink-to-ground for a logic false condition.

Each switching circuit must present impedance between the switching device and a dc voltage source that limits current flow to no more than 30 mA. Each circuit's positive voltage source must not exceed 28 V dc. A +15 V supply is available for use by the remote monitoring circuits on J14-1 or J14-2 (ground on J14-3 or J14-4).

## LED configuration

The remote interface PWB (A2) contains two LEDs (DS1 through DS48) and a shorting jumper (E1 through E24) for each of the 24 digital outputs. Setting the position of the associated shorting jumper determines whether the amber STATUS LED or the red ALARM LED is in circuit. For a status output, install the shorting jumper to short positions 1 and 2 of its post. For an alarm output, install the shorting jumper to short positions 2 and 3 of its post. Nautel pre-configures the LEDs associated with pre-defined digital outputs in Table 8.2 on page 8-7.

Below each LED is a blank, white label to allow for labelling of the status/alarm output.

## Backup monitoring LEDs

The control/interface PWB (A1) contains LEDs that provide specific status and alarm indications. Status indications include RF ON/RF OFF, LOCAL/REMOTE and low voltage power supply status (+5V, +15V, -15V, +12V). Alarm indications include a summary alarm (SMY ALARM) and more specific location alarms (OUTPUT NETWORK, IPA/PA, EXCITER, POWER SUPPLY or EXTERNAL. There are also LEDs that indicate the approximate RF output power level, from 100% down to 10% (in 10% steps), relative to maximum RF output power for that mode of operation. The LIMIT LED indicates that the transmitter is attempting to exceed its maximum (100%) RF output capability.

## Digital output connections

Digital outputs 1 through 24, as required, connect to terminals of connectors J3, J4, J5 and J6 on the remote interface PWB (A2). See Table 8.2 on page 8-7 to determine the output terminal associated with each digital output. 8-pole mini-plugs (Nautel Part # JU33) are provided in the transmitter's ancillary kit to act as interfacing connectors for your digital outputs.

## Table 8.2: Factory Defined Digital Outputs

| Digital Output | Description | Output Terminal/LEDs/ Jumper |
|---|---|---|
| 1. Transmitter Ready | Indicates the control/interface PWB is booted up and operating. Logic true if operating. Logic false if not operating. | Terminal J3-8, LEDs DS1 and DS2, Jumper E1 |
| 2. RF On Status | Indicates the on/off status of the transmitter's RF power stage. Logic true is RF is enabled. Logic false is RF is disabled. | Terminal J3-7, LEDs DS3 and DS4, Jumper E2 |
| 3. Remote Status | Indicates the local/remote control status of the transmitter. Changes can only be made remotely if the transmitter is set to remote mode. The local user's control of transmitter operation is limited, unless the transmitter is set to local mode. Logic high (open collector) if transmitter is in local mode. Logic low (current-sink-to-ground) if transmitter is in remote mode. | Terminal J3-6, LEDs DS5 and DS6, Jumper E3 |
| 4. Exciter Status | Indicates which exciter is presently active. Logic high (open collector) if exciter A is active. Logic low (current-sink-to-ground) if exciter B is active. | Terminal J3-4, LEDs DS7 and DS8, Jumper E4 |
| 5. Preset 1 Status | Indicates that preset 1 is currently active. Logic low (current-sink-to-ground) if active (inactive presets are open collector). | Terminal J3-3, LEDs DS9 and DS10, Jumper E5 |
| 6. Preset 2 Status | Indicates that preset 2 is currently active. Logic low (current-sink-to-ground) if active (inactive presets are open collector). | Terminal J3-2, LEDs DS11 and DS12, Jumper E6 |
| 7. Preset 3 Status | Indicates that preset 3 is currently active. Logic low (current-sink-to-ground) if active (inactive presets are open collector). | Terminal J4-8, LEDs DS13 and DS14 Jumper E7 |
| 8. Preset 4 Status | Indicates that preset 4 is currently active. Logic low (current-sink-to-ground) if active (inactive presets are open collector). | Terminal J4-7, LEDs DS15 and DS16, Jumper E8 |
| 9. Not Assigned | - | Terminal J4-6, LEDs DS17 and DS18, Jumper E9 |
| 10. Not Assigned | - | Terminal J4-4, LEDs DS19 and DS20, Jumper E10 |
| 11. Summary Alarm | Logic true condition (high or open collector) indicates that any alarm is occurring. | Terminal J4-3, LEDs DS21 and DS22, Jumper E11 |
| 12. Interlock Open Alarm | Logic true condition indicates the RF output is inhibited because an external interlock switch has been opened. | Terminal J4-2, LEDs DS23 and DS24, Jumper E12 |
| 13. External Fault Alarm | Logic true condition indicates that something external to the transmitter is in a fault condition (e.g., transmitter interlock, no HD data, audio loss, Exgine Ethernet fault, etc.). | Terminal J5-8, LEDs DS25 and DS26, Jumper E13 |

| Digital Output | Description | Output Terminal/LEDs/ Jumper |
|---|---|---|
| 14. High Temperature Alarm | Logic true condition indicates the RF power module heatsink's temperature exceeds 80°C (176°F) **OR** if an exciter or power supply module experiences a temperature related fault **OR** the transmitter is operating at reduced power due to fan failure(s). | Terminal J5-7, LEDs DS27 and DS28, Jumper E14 |
| 15. Output Network Fault Alarm | Logic true condition indicates that a fault is occurring that is related to the combiner/RF output section of the transmitter (e.g., high reflected power, high/low forward power, high reject power, etc.). | Terminal J5-6, LEDs DS29 and DS30, Jumper E15 |
| 16. Low RF Alarm 1 | Logic true condition (high or open collector) indicates the RF output power is below the user configurable threshold (default is 50%). | Terminal J5-4, LEDs DS31 and DS32, Jumper E16 |
| 17. Low RF Alarm 2 | Logic true condition (high or open collector) indicates the RF output power is below the low forward power 2 threshold (10%, not user configurable). | Terminal J5-3, LEDs DS33 and DS34, Jumper E17 |
| 18. High Reflected Power Alarm | Logic true condition indicates that the peak reflected power is exceeding 140 W (NV5) or 105 W (NV3.5) and/or the transmitter is in an SWR foldback, SWR shutback or SWR shutdown state. | Terminal J5-2, LEDs DS35 and DS36, Jumper E18 |
| 19. IPA/PA Fault Alarm | Logic true condition indicates that a fault is occurring that is related to the IPA or PA section of any RF power module. | Terminal J6-8, LEDs DS37 and DS38, Jumper E19 |
| 20. Exciter Fault Alarm | Logic true condition indicates that an exciter related fault is occurring. | Terminal J6-7, LEDs DS39 and DS40, Jumper E20 |
| 21. Changeover Alarm | Logic true condition indicates an automatic exciter changeo ver occurred and the reserve exciter is enabled as the active exciter. | Terminal J6-6, LEDs DS41 and DS42, Jumper E21 |
| 22. Power Supply Fault Alarm | Logic true condition indicates that a power supply related fault (e.g., LVPS fault, fan/IPA supply fault, etc.) is occurring. | Terminal J6-4, LEDs DS43 and DS44, Jumper E22 |
| 23. Low Battery/ Memory Fail | Logic true condition indicates the battery for the controller memory is below a safe operating threshold **OR** that the checksum for the controller EEPROM is incorrect. | Terminal J6-3, LEDs DS45 and DS46, Jumper E23 |
| 24. AC Fault Alarm | Logic true condition (high or open collector) indicates the ac input voltage is outside the acceptable range. | Terminal J6-2, LEDs DS47 and DS48, Jumper E24 |

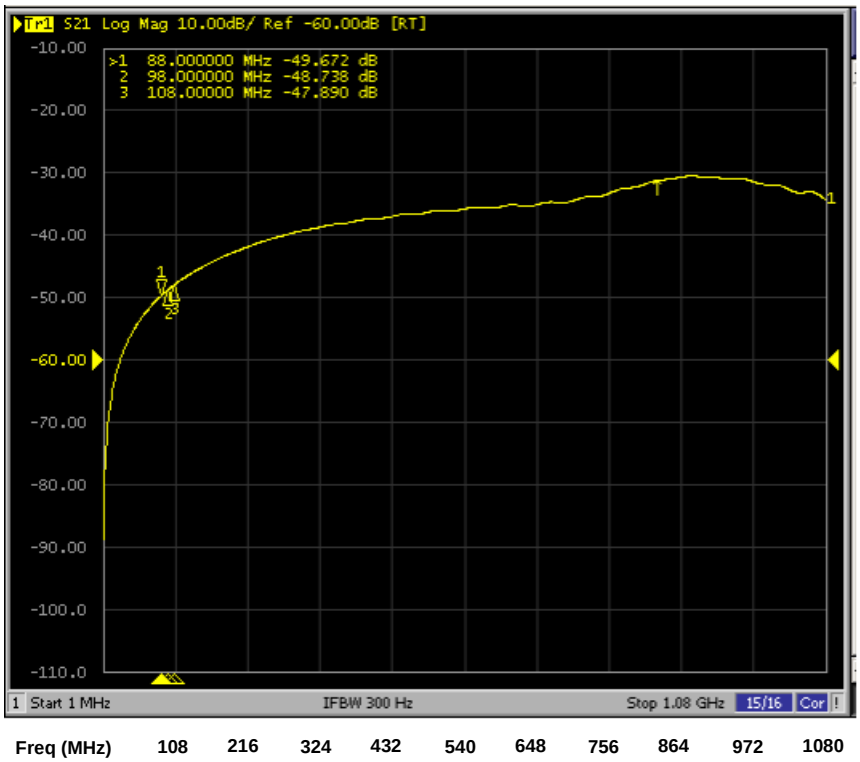
# Analog outputs

The transmitter provides sample signals that let you monitor performance. The sources of these analogs outputs are pre-defined and configured at Nautel. See Table 8.3 on page 8-10 for a list of these pre-defined outputs, their descriptions and their associated output terminals on the remote interface PWB. The outputs are op-amp buffered outputs from a digital-to-analog converter (DAC). The dc voltage of each output is between 0 to 6 V, 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.

## RF monitor sample

A true RF sample of the RF output voltage waveform is available for external monitoring at W22J1, located behind the front door. Figure 8.3 shows the frequency response of the RF monitor sample's coupler. The coupler yields approximately -49 dB (+/- 1.5 dB), relative to the carrier level, at the FM broadcast carrier frequency (88 - 108 MHz). Note that there is a "boost" in the coupler response at higher order (harmonic) frequencies. This boost can be up to +15 to +20 dB relative to the carrier frequency. Subtract the boost value - determined from Figure 8.3 - from any harmonic measurements made from this sample port. NOTE: there is a 1 to 2 dB tolerance on the boost values.

**Figure 8.3: RF Monitor Sample Frequency Response**



## Analog output connections

Analog outputs 1 through 8 connect to terminals of connector J11 on the remote interface PWB (A2). See Table 8.3 to determine the terminal associated with each analog output. Ground/shield connections are available on various terminals of connectors J3 through J10. Refer to the silkscreen labels on these connectors (ground terminals are identified as GND). An 8-pole mini-plug (Nautel Part # JU33) is provided in the transmitter's ancillary kit to act as an interfacing connector for your analog outputs.

### Table 8.3: Factory Defined Analog Outputs

| Analog Output | Description | Terminal |
|---|---|---|
| 1. Forward Power | Reports a sample of the transmitter's forward power. This dc voltage is a linear function and is full-scale (6 V) when the forward power is 6 kW (NV5) or 4.5 kW (NV3.5). | J11-1 |
| 2. Reflected Power | Reports a sample of the transmitter's reflected power. This dc voltage is a linear function and is full-scale (6 V) when the reflected power is 600 W (NV5) or 450 W (NV3.5). | J11-2 |
| 3. PA Voltage | Reports a sample of the PA voltage. This dc voltage is a linear function and is full-scale (6 V) when the PA voltage is 60 V. | J11-3 |
| 4. Total PA Current | Reports a sample of the total dc current of the final RF power stage amplifiers. This dc voltage is a linear function and is full-scale (6 V) when the dc current is 225 A (NV5) or 169 A (NV3.5). | J11-4 |
| 5. Exciter Forward Power | Reports a sample of the active exciter's forward power. This dc voltage is a linear function and is full-scale (6 V) when the exciter's forward power is 200 W. | J11-5 |
| 6. IPA Voltage | Reports a sample of the IPA voltage. This dc voltage is a linear function and is full-scale (6 V) when the IPA voltage is 60 V. | J11-6 |
| 7. Average IPA Forward Power | Reports a sample of the average IPA forward power level. This dc voltage is a linear function and is full-scale (6 V) when the average IPA power is 200 W. | J11-7 |
| 8. Ambient Temperature | Reports a sample of the transmitter's ambient temperature. This dc voltage is a linear function and is full-scale (6 V) when the ambient temperature is 90ºC. | J11-8 |

# Web based control

An Ethernet port is available on J21 of the control/interface PWB (A1) behind the front door. This port allows a user with proper authentication to remotely control and interrogate the NV5/NV3.5's operational status. All functionality available on the front panel AUI is available remotely, provided the user has been granted proper authorization (refer to the *NV5/NV3.5 Operations and Maintenance Manual* for details on setting user permissions). Nautel recommends you use shielded Cat5 cable to make this connection.

## Remote access

If the only access to the AUI will be through the front panel AUI, skip this section.

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 843**: used to perform a security check to allow teh remote web browser to access AUI content from the transmitter's web server.
- **TCP port 3501**: used for regular AUI-to-transmitter communication.

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.

### Email server

The transmitter's AUI (local or remote) 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 *NV5/NV3.5 Operations and Maintenance Manual* for details).

The transmitter's email service expects to be connected to an unsecure email server (i.e., not requiring a username/password to gain access). If you plan to use the email notification feature, make sure you have a secure network for your email server and the transmitter.

## External interlock

An external safety interlock is available between INTLK terminals TB2-1 and TB2-2 of the control/interface PWB (A1) behind the front door. This connection allows you to connect an external safety interlock circuit that provides an emergency RF inhibit control for the NV5/NV3.5. 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 requires inhibition. You can install any number of serial interlock switches.

# 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:



## 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 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
- Extended warranties - see page 10-4

## 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 (see "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:

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

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

  – Two-channel oscilloscope (with probes)

  – Audio signal generator

  – Distortion 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 can also be provided on CD-ROM 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 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 a customer's 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, for training the customer's technical staff on the customer's transmitter.

All Nautel training courses combine classroom and hands-on laboratory work to ensure a balanced learning experience. Many of our classes also include diagnostic lab exercises.

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

### NV series on-site or factory training

This includes product overview, site and pre-installation, theory of operation, testing and adjustments, operating instructions, system-level troubleshooting, component-level troubleshooting, component parts lists, and wiring route sheets.

## 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 to meet 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

## Pre-installation Manual

Document: NHB-NV3.5-NV5-PRE-3.0

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