

XR6/XR3 TRANSMITTER

OPERATIONS AND MAINTENANCE MANUAL

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

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ABOUT THIS MANUAL

This manual provides technical information needed when operating, maintaining and troubleshooting an XR6/XR3 transmitter. This manual is intended for use by transmitter operators and field technicians.

USING THIS MANUAL

If you are responsible for configuring or operating a transmitter, see [Section 2, “Operating the transmitter”](#) on page 2-1 and [Section 3, “Using the event log”](#) on page 3-1.

If you are performing scheduled maintenance, or planning your maintenance schedule, see [Section 4, “Routine maintenance”](#) on page 4-1.

If you are performing a test or adjustment, as instructed during a troubleshooting task, see [Section 5, “Test and adjustment”](#) on page 5-1.

PERFORMING PROCEDURES

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

- If you are asked to **see** another section of this manual, or another document, refer to that section or document for additional information, then continue the procedure.
- If you are asked to **go** to another step within the procedure, jump directly to that step without performing the intervening steps.
- If you are asked to **go** to another section or document, stop the procedure and perform the tasks described in the other section or document.
- If you are asked to **check a voltage**, use a digital voltmeter and test the voltage relative to ground (unless otherwise instructed).
- If you are asked to **check a signal**, use an oscilloscope and test the signal relative to ground (unless otherwise instructed).



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

Tip: When you have completed a task or a step, put a checkmark beside the step number.

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 technical support, call the Customer Support Team at 902-823-3900 or - in U.S.A. and Canada only - call toll free at 1-877-6NAUTEL (662-8835). 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 *XR6/XR3 Pre-Installation Manual*.

For accessories or spares, see [“Accessories”](#) on page 10-1 of the *XR6/XR3 Pre-Installation Manual*.

For standard warranty information, see [“Pre-installation assistance”](#) on page 11-1 of the *XR6/XR3 Pre-Installation Manual*.

For extended warranty information, see [“Pre-installation assistance”](#) on page 11-1 of the *XR6/XR3 Pre-Installation Manual*.

XR6/XR3 TRANSMITTER MANUALS

The XR6/XR3 documentation suite includes the following documents:

XR6/XR3 PRE-INSTALLATION MANUAL, XR6/XR3-PREINST. The Pre-installation Manual provides instructions and reference information needed when planning and preparing for the installation of an XR6/XR3 transmitter.

NAUTEL SITE PROTECTION MANUAL. The Site Protection Manual provides detailed information about protecting your site from lightning-related hazards.

XR6/XR3 INSTALLATION MANUAL, XR6/XR3-INST. The Installation Manual provides instructions and reference information needed when installing an XR6/XR3 transmitter.

XR6/XR3 OPERATING AND MAINTENANCE MANUAL, XR6/XR3-OPS-MAINT. The Operating and Maintenance Manual provides instructions for operating, maintaining and troubleshooting an XR6/XR3 transmitter. It also provides reference information needed when performing diagnostic procedures.

XR6/XR3 TROUBLESHOOTING MANUAL, XR6/XR3-TROUBLE. The Troubleshooting Manual provides detailed technical information about the XR6/XR3 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 XR6/XR3.

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. Registration is available online and is required.

DOCUMENTATION: ONLINE AND PRINTED

The website's NUG section provides online access to all the documentation for your XR6/XR3. 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 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.

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 overs can occur. It is very important that you take the following steps to prevent damage to equipment or personnel due to RF fields:

- Use safety interlocks to de-energize transmitters if personnel open doors or panels accessing high field areas
- Place warning signs in any locations where high fields can occur
- Train personnel about the short-term and long-term hazards of RF radiation
- 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

Refer to the functional block diagram: [“XR Series Transmitter Block Diagram”](#) on page 1-7.

This section provides a high-level description of the transmitter’s key sections. The transmitter circuitry is subdivided into five basic stages:

- Ac/dc power stage
- Exciter stage
- RF power stage
- RF output filter (includes combiner)
- Control/monitor stage

XR6/XR3 ELECTRICAL SCHEMATICS

The descriptions in this section all refer to the XR6/XR3 electrical schematics located at the end of the *XR6/XR3 Troubleshooting Manual*.

REDUNDANCY

The XR6/XR3 features redundancy in all key systems:

- RF power modules (optional fully redundant backup is available)
- Exciters
- Cooling fans

AC/DC POWER STAGE

See electrical schematic **SD-3**. The ac/dc power supply stage contains the input power transformer that receives the main ac input to the transmitter. It also contains the transmitter’s low voltage power supplies. Three-phase versions of the ac/dc power supply stage also include a contactor, a three-phase voltage rectifier, Hall Effect current sensor and B+ power supply/distribution PWB. Single-phase versions of the ac/dc power stage also include a control transformer, a rectifier/SCR control assembly and an SCR control/B+ distribution PWB.

In three-phase transmitters the output of the rectifier is fed through the Hall Effect current sensor, which supplies a dc current signal to the distribution PWB. The distribution PWB provides a dc current sample to the control/display PWB. In single-phase transmitters the output of the rectifier/SCR control assembly is applied to the SCR control/B+distribution PWB, which supplies the dc current signal to the distribution PWB.

The rectifier output is also applied to the B+ distribution PWB (three-phase) or the SCR control/B+distribution PWB (single-phase), which then provides the B+ voltage to the RF power module and LVPS power supplies, and a B+ sample to the exciter interface PWB. Voltages from the low voltage power supplies are then supplied throughout the transmitter.

In three-phase XR6 transmitters there are three B+ dc voltage levels that are automatically selected to provide optimum performance: 312 V, 190 V, and 115 V. In three-phase XR3 transmitters there are two such levels: 220 V and 115 V. In single-phase XR6 transmitters there are four B+ dc voltage levels that are automatically selected to provide optimum performance: 315 V, 196 V, 115 V and 69 V. In single-phase XR3 transmitters there are also four levels: 220 V, 196 V, 115 V and 69 V.

AC POWER TRANSFORMER

The XR6/XR3's power transformer can be set to use a range of input voltages. See [Section 3, "Installing the power transformer" on page 3-1](#) in the *XR6/XR3 Installation Manual*.

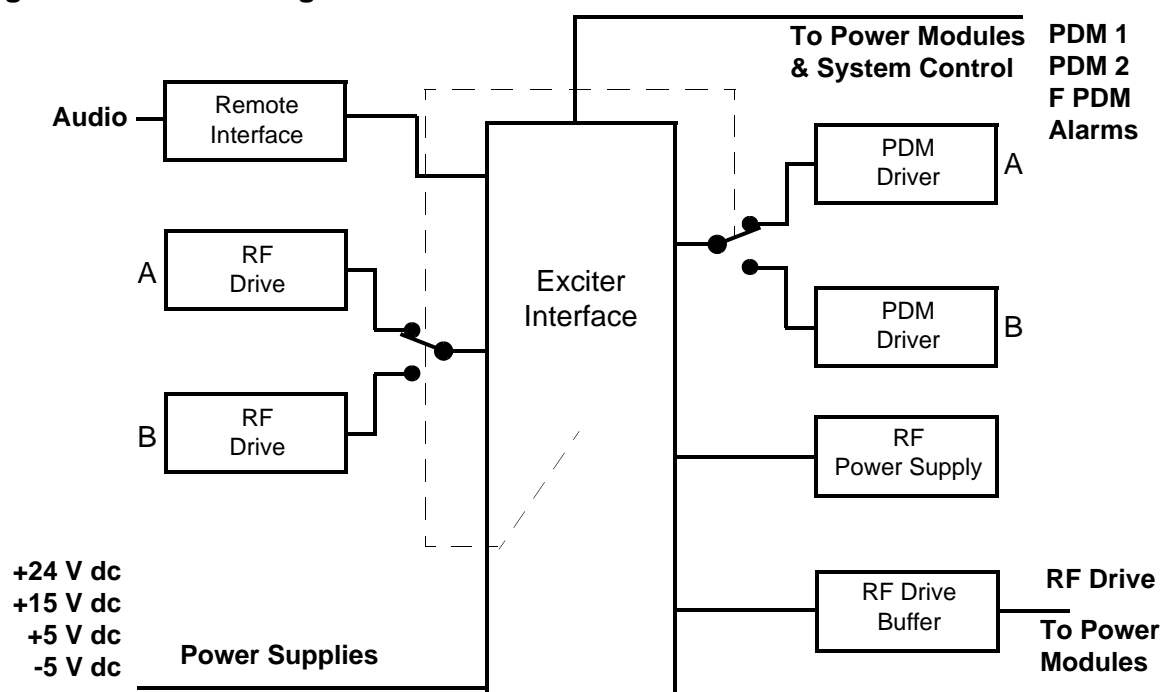
EXCITER STAGE

See electrical schematics **SD-1**, **SD-2** and **SD-3** and [Figure 1.1 on page 1-3](#). The exciter stage consists of an exciter interface PWB (A2A1), RF synthesizer PWBs A (A2A2) and B (A2A4), interphase PDM driver PWBs A (A2A3) and B (A2A5), distribution PWB (A11), and RF drive buffer PWB (A15). The exciter stage contains two independent exciter sections (A and B), which can be selected automatically or by local or remote control.

EXCITER INTERFACE PWB

The exciter interface PWB (A2A1) accepts audio from the remote interface PWB, carrier reference, exciter selection, reset, and inhibit controls from the control/monitor stage. It also receives low-level, regulated dc voltages and a B+ sample from the ac/dc power stage, and a sample of the PA volts from the RF power stage. Each exciter section generates its own RF frequency source, PDM and digital control signals, for use in the RF power stage. The exciter interface PWB passes signals to the RF drive buffer PWB, which then outputs the RF drive signals to the RF power module in the RF power stage.

The exciter interface PWB also provides physical interconnection for the RF synthesizer PWBs (A and B), and interphase PDM driver PWBs (A and B).

Figure 1.1: Exciter Stage

DISTRIBUTION PWB

The distribution PWB (A11) provides inputs to the exciter stage and accepts voltage and control signals from the exciter stage for distribution to the RF power modules, RF drive buffer PWB, and control/monitor PWB.

RF SYNTHESIZER PWBs

The RF synthesizer PWBs A (A2A2) and B (A2A4) contain microprocessor-controlled synthesizers which use direct digital synthesis (DDS) techniques to generate the required RF carrier frequency signals F_c (A) and F_c (B). The F_c (A) and F_c (B) signals are provided to the RF drive buffer PWB, via the exciter interface PWB.

The RF synthesizer PWBs also provide signals at twice the pulse duration switching frequency, $2F_{pdm}$ (A) and $2F_{pdm}$ (B). Rotary DIP switches allow for the selection of any frequency in the broadcast band. The $2F_{pdm}$ outputs are applied to the associated interphase PDM driver PWBs through the exciter interface PWB, and are used to drive the PDM ramp integrator circuits on the interphase PDM driver PWBs.

INTERPHASE PDM DRIVER PWBs

The interphase PDM driver PWBs (A2A3 and A2A5) generate the required interphase PDM drive signals for the modulator assemblies in the RF power modules. These PDM drive signals determine the transmitter output power level as well as the output modulation level.

The Carrier Ref input is applied from the control/display PWB, via the exciter interface PWB, to determine the output power of the transmitter. A sample of the B+ supply voltage is applied to the carrier level control circuit which is designed to hold the transmitter output power constant with variations in the unregulated B+ supply. An inhibit PDM input is applied from the control/display PWB to inhibit the interphase PDM drive during a system during alarm/fault conditions. A reset input provides a reset pulse to reset protection circuits internal to the interphase PDM driver PWB.

RF DRIVE BUFFER PWB

The RF drive buffer PWB (A15) buffers the carrier frequency signal F_c , generated by the active RF synthesizer PWB (A or B), to provide the RF drive voltages to the RF power stage. The buffered F_c signal is then applied to the transmitter's RF power stage.

The RF drive buffer PWB also serves as an input for the **Phase** signal when IBOC operation is selected (the **Mag** signal goes to the remote interface PWB).

RF POWER STAGE

See electrical schematic **SD-3**. The RF power stage includes the RF power blocks.

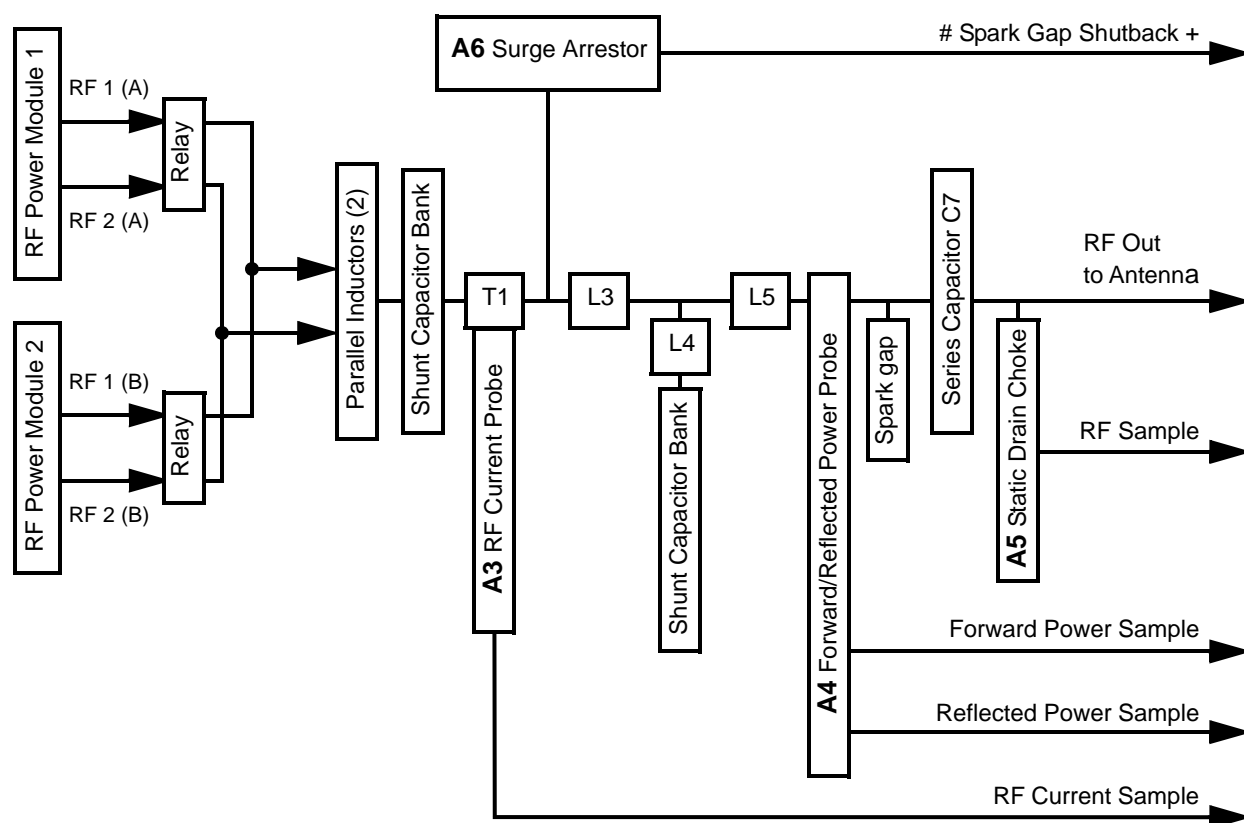
Each RF power block contains an RF power module, fan tray, relay, and connections to the distribution PWB. Each RF power module accepts RF drive and control voltages from the exciter and RF drive stages. B+ and +24 V dc voltages are input from the B+ distribution PWB and the +24 V dc supply in the RF power stage. The outputs of the RF power modules are applied to the RF combiner/output filter stage.

RF power module reset to the RF power stage originates in the control/monitor stage. RF power monitoring and RF power stage status information are applied to the control/monitor function.

RF OUTPUT FILTER

See electrical schematic SD-4. The RF outputs from the RF power modules are combined, monitored, and filtered by the RF output filter stage, and then provided to the antenna system.

Figure 1.2: XR6/XR3 RF Output Filter



NOTE:

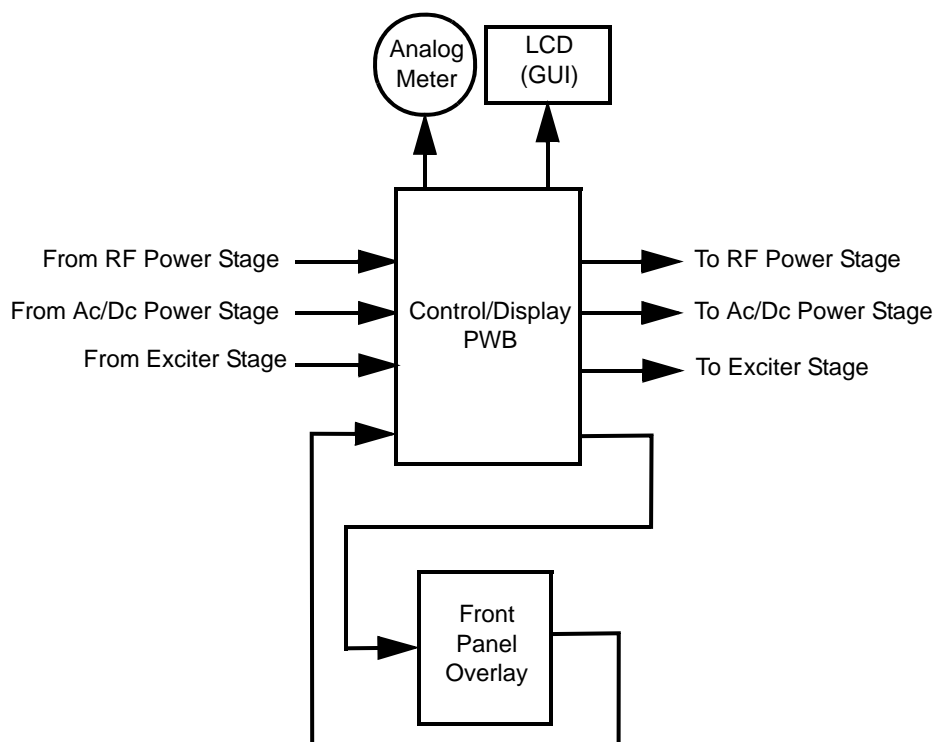
The XR6/XR3 has one (optionally two) RF power modules. Each RF power module has two parallel inductors in the combiner.

CONTROL/MONITOR STAGE

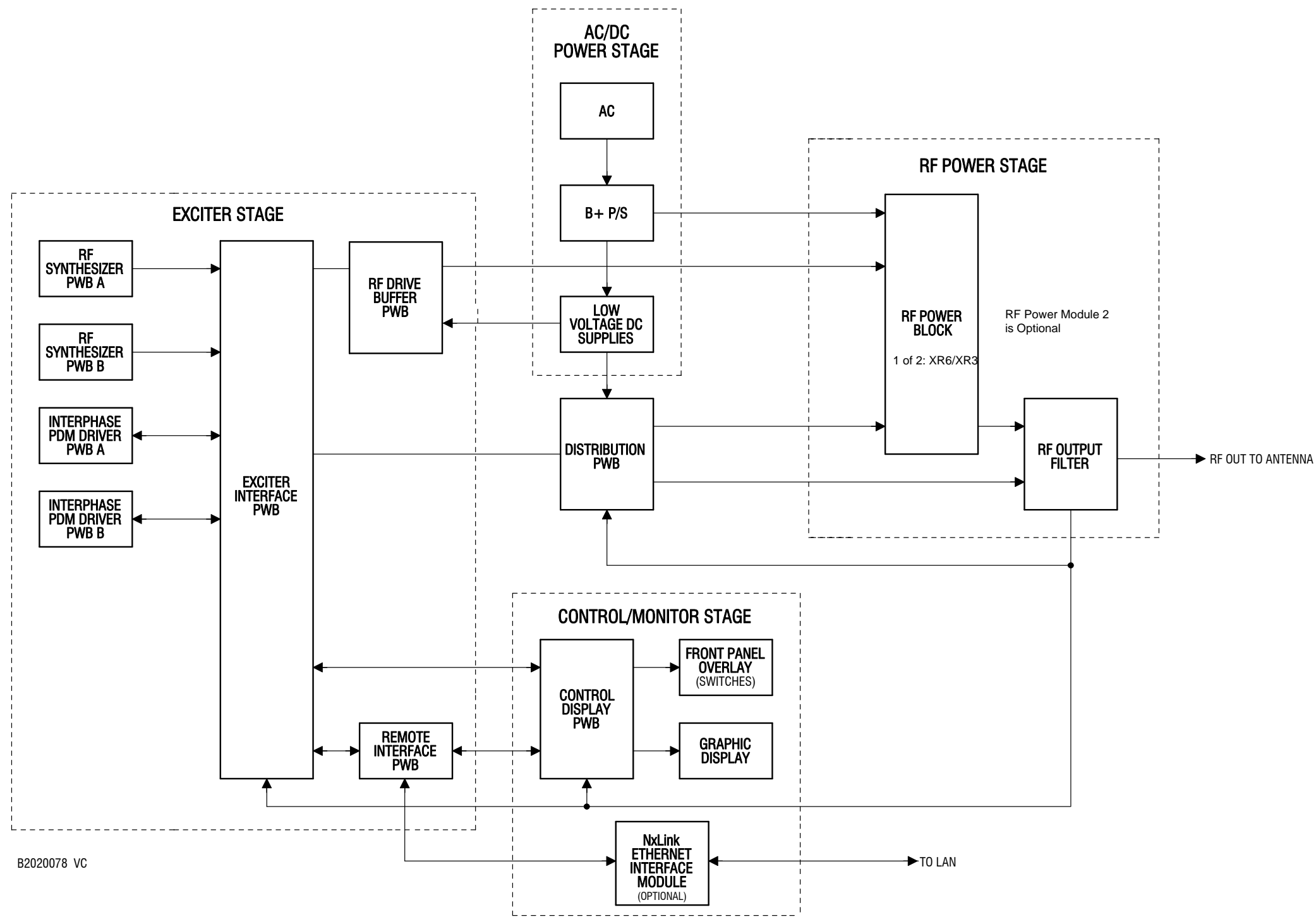
See electrical schematics SD-1 and SD-5 through SD-8.

The control/monitor stage monitors critical signal samples and status/alarm signals from the exciter stage, RF power stage, and ac/dc power stage. For example, RF power monitoring and RF power stage status information is applied to the control/monitor stage. Based on the value and status of each input, the control/monitor stage produces the appropriate control signals for the exciter stage and the RF power stage to ensure the proper operation and protection of the transmitter.

Figure 1.3: Control/Monitor Stage



XR Series Transmitter Block Diagram



SECTION 2: OPERATING THE TRANSMITTER

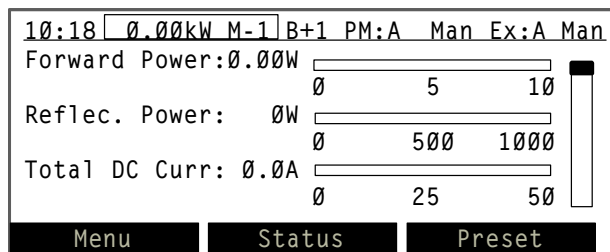
This section provides information about operating the XR6/XR3 transmitter:

- [Graphic user interface - see page 2-2](#)
- [Viewing alarm status - see page 2-7](#)
- [Changing automation settings - see page 2-9](#)
 - [Power Scheduler - see page 2-9](#)
 - [Auto Exciter Transfer - see page 2-9](#)
 - [Auto Scheduler mode - see page 2-9](#)
- [Changing general settings - see page 2-10](#)
 - [Controlling presets - see page 2-10](#)
 - [Changing power preset schedules - see page 2-12](#)
 - [Changing meter groups - see page 2-14](#)
 - [Viewing digital meters - see page 2-14](#)
 - [Setting the clock - see page 2-16](#)
 - [Adjusting screen contrast - see page 2-20](#)
- [Viewing software version information - see page 2-19](#)
- [Changing hardware settings - see page 2-20](#)
 - [Setting thresholds - see page 2-22](#)
 - [Calibrating meters - see page 2-24](#)
 - [Calibrating analog meter - see page 2-24](#)
 - [Calibrating B+ thresholds and switching points - see page 2-25](#)
 - [Setting high power lockout limit - see page 2-27](#)
 - [Configuring NxLink \(optional\) - see page 2-31](#)

GRAPHIC USER INTERFACE

The XR6/XR3's graphic user interface (GUI) is an LCD display panel mounted on the front of the transmitter. The GUI provides information about transmitter's status and settings, and includes a set of buttons that let you use menus to select commands and options.

XR3/XR6 GUI



Information is displayed in a series of screens that serve specific functions. The GUI provides *soft menus* that change, depending on the information screen being displayed, and the transmitter's status.

CHECKSUM ERROR SCREEN

1. In the unlikely event that the **CHECKSUM** error screen appears on the GUI when the transmitter's power is first turned on, the data stored in the EEPROM has changed to an unknown state. In such a case, contact Nautel customer service.
 - Telephone: +1.902.823.5100

- Fax: +1.902.823.3183
 - Email: support@nautel.com
2. If the transmitter's GUI functions normally when the power is turned on, and then the **CHECKSUM** error screen appears while changes are being made using the GUI, then it may be possible to return the data stored in the EEPROM to a known condition by restoring the factory settings (see [“Calibrating B+ thresholds and switching points”](#) on page 2-25).

HARDWARE SETTINGS WARNING

Whenever **Hardware Settings** is selected from the **General Settings** page, a warning screen displays to remind you that modifying the hardware settings can affect system operation. If you really want to change the hardware settings, press the **Continue** button to proceed. Otherwise, press the **Back** button to return to the **Main Menu** page.

GUI PAGES

[Table 2.1](#) defines the available GUI pages.

Table 2.1: GUI Pages

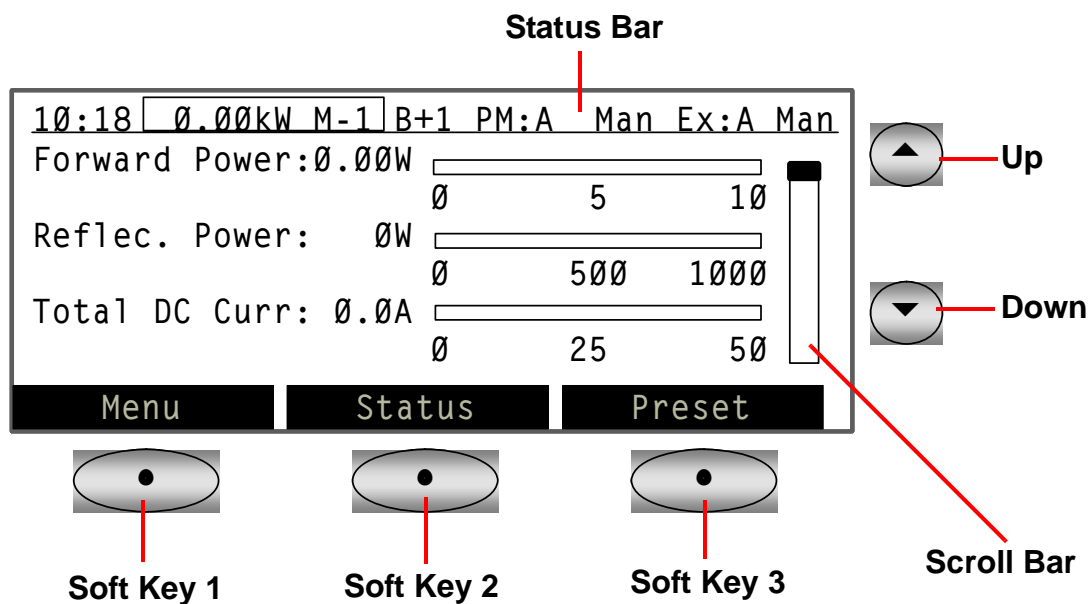
GUI Page	Function	See Page
MainMenu	Choose options and navigate to other pages.	page 2-6
General settings	Access general transmitter settings.	page 2-10
Status	View transmitter alarm status messages.	page 2-7
Meters	View meters showing operating measurements.	page 2-15
Preset control	Turn presets on and off.	page 2-11
Preset edit	Edit transmitter presets.	page 2-11
Power Preset Schedule	Set schedules for power presets.	page 2-13
Events Log	View a list of events.	page 3-1
View Event	View the details of an event from the events log.	page 3-2
Clearing the Events Log	Clear the list of events.	page 3-6
Power Modules	View status of RF modules. Select active RF modules. Set auto module changeover.	page 2-8

Table 2.1: GUI Pages

GUI Page	Function	See Page
Automation Control	Turn automatic functions on and off.	page 2-9
Change Meter Groups	Choose the digital meters to display in the GUI.	page 2-14
Software Version	View software version information.	page 2-19
Real Time Clock	View or set the transmitter's clock.	page 2-16
LCD Contrast Setting	Change the contrast of the LCD screen.	page 2-20
Hardware Settings	Navigate to Set Thresholds, Calibrate Meters, Calibrate Analog Meters, and Factory Settings pages.	page 2-21
Calibrate Meters	Calibrate the digital meters available in the GUI.	page 2-24
Set Thresholds	Change the thresholds that protect the transmitter.	page 2-22
Calibrate Analog Meter	Calibrate the analog meter located on the front of the transmitter.	page 2-25
Calibrate B+ Thresholds and Switching Points	Calibrate the high and low B+ thresholds as well as the switching points for the transmitter's various B+ levels.	page 2-26
Set High Power Lockout Limit	Enable the high power lockout feature and change the high power lockout limit.	page 2-28
Factory Settings	Restore factory settings.	page 2-25
Configure NxLink	Configure the address information for the optional NxLink Ethernet interface module.	page 2-31

USING GUI PAGES

Each GUI page provides information about a specific transmitter function. The status bar at the top of every page shows the time, the current power, the Preset Scheduler status (M for manual or A for automatic), the current preset number, the current B+ level, the active power module, the power module transfer function status, the active exciter, and the exciter transfer function status.



Five buttons, called *soft keys*, appear below and to the right of the GUI screen. These buttons let you scroll through information, move from page to page, and change settings. The actions that take place when you press **Soft Key 1**, **2**, or **3** are shown in the black labels on the screen directly above each soft key (e.g., **Edit** or **Back**).

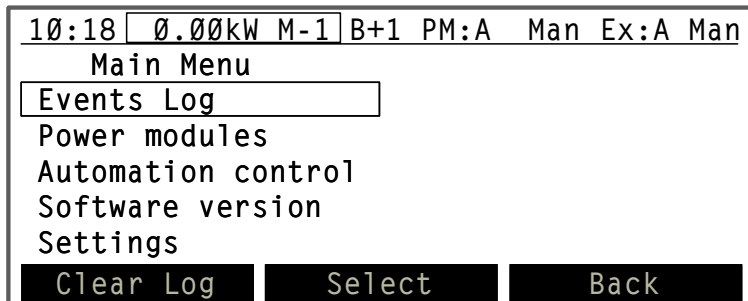
VIEWING INFORMATION. When you move to a new GUI page, the page is displayed in the *Select* mode. In the *Select* mode, press the desired **Soft Keys** to move the cursor (the selected area of the screen), and scroll through lists or menus. You can use the **Up** and **Down** buttons to scroll through information on any page that has a vertical scroll bar.

EDITING SETTINGS. In screens where you can edit information, use the **Up** and **Down** buttons to move the cursor and highlight the information you wish to change, then press **Soft Key 2** (the **Edit** button) to enter *Edit* mode. After editing the information, press the **Save** button to save the changes, or the **Cancel** button to discard your changes, and return to the *Select* mode.

NAVIGATING FROM PAGE TO PAGE

You can navigate from page to page using the **MainMenu** page. Use the **Up** and **Down** buttons to highlight the desired option, then press the **Select** button to select the highlighted option.

Figure 2.1: Main Menu



Select **Events log** to view a log showing transmitter system events (see [“Viewing the event log” on page 3-1](#)). When **Events Log** is highlighted, the **Clear Log** button appears. Press it to clear the entire events log.

Select **Power modules** to view or select power module options (see [“Controlling power modules” on page 2-8](#)).

Select **Automation control** to change the settings for auto exciter switchover and the power scheduler (see [“Changing automation settings” on page 2-9](#)).

Select **Software version** to view information about the version of software installed on the transmitter (see [“Viewing software version information” on page 2-19](#)).

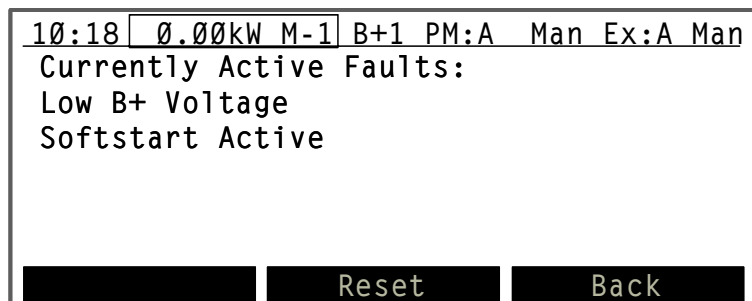
Select **Settings** to access pages that control a range of transmitter functions (see [“Changing general settings” on page 2-10](#)).

Press the **Back** button to return to the [Meters page](#) (see [Figure 2.10 on page 2-15](#)).

VIEWING ALARM STATUS

If an alarm is present, a **Status** button appears as **Soft Key 2** on many of the GUI pages. Press the **Status** button to go to the [Status page](#). The **Status** page shows any active faults.

Figure 2.2: Status page



Press the **Reset** button to reset the power modules, clear any active cutbacks, and reduce the estimated soft start relay temperature to 150°C (302°F) if it is over that temperature.



Note:

The software keeps track of the calculated temperature of the soft start relays and triggers this fault if that value is greater than 150°C (302°F). While this fault is on, RF power will not be available.

Press the **Back** button to return to the [Meters page](#).

CONTROLLING POWER MODULES

Figure 2.3: Power Modules page

10:18	0.00kW M-1	B+1	PM:A	Man	Ex:A	Man
Transfer Mode: Manual						
Desired Config: A enabled, B standby						
Current Status: A enabled						
Use Arrow Keys to Select a value. Press EDIT to modify the value.						
PM Reset		Edit		Back		

On this page the user can perform a power module reset by pressing the **PM Reset** button.

The user can set the **Transfer Mode** to *Auto* or *Manual*. In *Auto* mode, if the enabled power modules fail, the transmitter will perform a power module changeover to replace the failed power module with the designated standby power module.

The user can select which power module is active and which is the standby by editing the *Desired Config* option. The possible combinations are:

- Module A enabled, with module B on standby.
- Module B enabled, with module A on standby.

The *Current Status* line displays the currently-enabled module(s). If no power module is currently enabled, an unusual situation, then the message *None enabled* will be displayed.

Press the **Back** button to return to the **Main Menu** page.

CHANGING AUTOMATION SETTINGS

You can control the power scheduler and the auto exciter transfer functions using the Automation Control page. To view the **Automation Control** page, select **Automation Control** from the [Main Menu](#).

Figure 2.4: Automation Control page

10:18	0.00kW M-1	B+1	PM:A	Man	Ex:A	Man
Power Scheduler: <input type="text" value="Manual"/>						
Exciter Mode: Manual						
Use the arrow keys to select a value to change. Press EDIT to make changes.						
		Edit		Back		

POWER SCHEDULER

You can enable or disable the **Power Scheduler** by selecting the **Power Scheduler** field and pressing the **Edit** button. You can then use the **Up** or **Down** buttons to change the setting to *Manual* or *Auto*. (If you enable the scheduler, it may take a few seconds to begin operating.)

AUTO EXCITER TRANSFER

You can enable or disable the **Auto Exciter Transfer** function by selecting the *Exciter* mode value and pressing the **Edit** button. You can then use the **Up** or **Down** buttons to change the setting to *Manual* or *Auto*.

AUTO SCHEDULER MODE

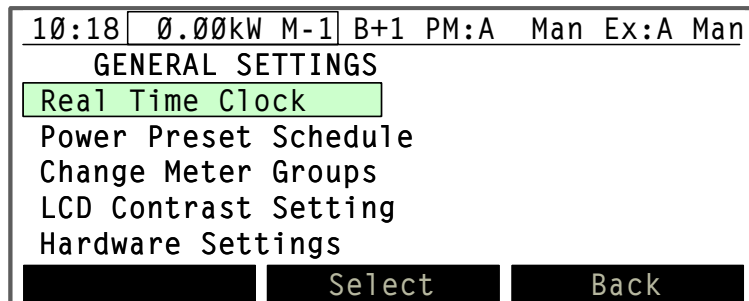
In *Auto Scheduler* mode, the scheduler controls which preset is active. In this mode you cannot change the active preset (or use the [Preset Control page](#)), and you cannot edit the parameters ([Preset Edit page](#)) of any preset other than the currently active preset. The status bar indicates the preset (**A-1** through **A-6**) that is currently active. To make changes, switch to *Manual* mode or make changes to the schedule.

Press the **Back** button to return to the **Main Menu**. (See [“Main Menu” on page 2-6](#).)

CHANGING GENERAL SETTINGS

The **General Settings** menu lets you navigate to pages that allow you to set the transmitter's real-time clock, change the power preset schedule, change meter groups, adjust the LCD contrast, and change hardware settings (if required). To view the **General Settings** menu, select **Settings** from the [Main Menu](#).

Figure 2.5: General Settings menu



Use the **Up** and **Down** buttons to move the cursor to the desired option, then press the **Select** button. See:

- [Setting the clock - see page 2-16](#)
- [Controlling presets - see page 2-10](#)
- [Changing meter groups - see page 2-14](#)
- [Adjusting screen contrast - see page 2-20](#)
- [Changing hardware settings - see page 2-20](#)

Press the **Back** button to return to the **Main Menu** (see [“Main Menu” on page 2-6](#)).

CONTROLLING PRESETS

SELECTING PRESETS. The **Preset Control** page lets you see and edit the power level, power module setting and exciter setting for each of the XR6/XR3's six presets. To view the **Preset Control** page, select **Preset** from the [Meters page](#).

Figure 2.6: Preset Control page

10:18	0.00kW	M-1	B+1	PM:A	Man	Ex:A	Man
#	Power	Exc	PM	#	Power	Exc	PM
1	0.00kW	A	B	4	0.00kW	A	A
2	0.00kW	A	B	5	0.00kW	A	A
3	0.00kW	A	A	6	0.00kW	A	B
Current Preset (1)							
Use Arrow Keys to Select a Preset to wor							
Set		Edit		Back			

Scrolling text

When you first enter the **Preset Control** page, the **Current Preset (#)** field is selected. If the current preset is not the preset you want to work with, use the **Up** and **Down** buttons to select an alternate preset from the list.

Press the **Set** button to activate the selected preset. If you are in auto scheduler mode, you can only **Set** the preset that is supposed to be active according the preset schedule. The **Set** button will not be displayed when another preset is highlighted.

To change the settings for a selected preset, press the **Edit** button to go to the [Preset Edit page](#).

Press the **Back** button to return to the [Meters page](#).

EDITING PRESETS. The **Preset Edit** page lets you edit the settings for a preset.

Figure 2.7: Preset Edit page

10:18	0.00kW	M-1	B+1	PM:A	Man	Ex:A	Man
Preset 1		Power: 0.00kW					
		Main Exciter: A					
RF Pwr Monitor		Gain: 0512					
		Main PM: A					
Use Arrow Keys to Select a value							
Press EDIT to modify the value							
		Edit		Back			

Press the **Up** or **Down** buttons to select either main exciter, RF power monitor gain, or main power module. Then press the **Edit** button to alter the selected setting. Your changes take effect immediately. For example, if you change the RF power monitor gain, the RF power monitor output changes immediately.

To edit power level, see [“Changing power level” on page 2-12](#).

Holding down the **Up** or **Down** button while changing a setting will cause the rate of change to increase.

Press the **Back** button to return to the [Preset Control](#) page.



Note:

You cannot increase the power level from 0 if RF Off is selected.

CHANGING POWER LEVEL. You can change the transmitter's power level at any time by pressing the **Power - Increase** or **Power - Decrease** button. This change does not alter the preset's stored power level. Instead, you enter a manual editing mode, identified on the status bar as **MAN** (in manual preset mode) or **AUT** (if operating in automatic preset scheduler). This text replaces the normal active preset status text (e.g., **M-1** for manual or **A-1**).



Note:

Momentary power reductions may occur while increasing or decreasing the RF output power. This is due to crossing a B+ switching threshold. If the RF output power is decreased through a B+ switching threshold, there may be a humming sound, a shutback and a quick recovery.

To make a manually changed power level become part of a preset, enter the appropriate **Preset Edit** page (see [Figure 2.7 on page 2-11](#)).

The **Power** field is now selectable for editing and is accompanied by an animated arrow and the text **Different**, indicating that there is a difference between the active power level and the preset's stored power level.

Press the **Set Power** button to store the current power level into the preset. This changes the preset parameters, but does not make the preset active.



Note:

*To restore the transmitter to a preset power level, highlight the desired preset and press **Set**.*

CHANGING POWER PRESET SCHEDULES. You can program a monthly schedule for the transmitter. Use the **Power Preset Schedule** page to set the times at which power presets take effect. You can define a different schedule for each month of the year. To view the **Power Preset Schedule** page, select **Power Preset Schedule** from the [General Settings](#) menu.

Figure 2.8: Power Preset Schedule page

10:18	0.00kW	A-1	B+1	PM:A	Man	Ex:A	Man
Month: All Months							
1:	0:05	2:	1:00	3:	22:25		
4:	--:--	5:	--:--	6:	--:--		

Use Arrow Keys to select a month.
Then press SELECT to make changes.

Select Back

The first section of the **Power Preset Schedule** page lets you select the month. The second section shows the start time for each preset for the selected month.

Use the **Up** and **Down** buttons to scroll through the current settings.

To edit the preset data:

1. Select a month. Use the **Up** and **Down** buttons to find the desired month, then press the **Select** button. The cursor moves from the **Months** field to the **Preset** table. (The *All Months* option displays presets for all months of the year, letting you make global changes that overwrite settings for individual months.)
2. Select a preset entry. Use the **Up** and **Down** buttons to select the preset entry you wish to change.
3. Edit the preset by pressing the **Edit** button. The cursor moves to the preset's time.
 - Use the **Up** and **Down** buttons to increase or decrease the start time for the preset. (The time is in 24-hour format. For example, 06:00 is 6 a.m. and 18:00 is 6 p.m.)
 - Press the **Clear** button if you want to remove the preset from the schedule. (The time will appear as --:--, and the preset will not operate during the month. If you clear an entry for *All Months*, the selected preset is turned off for all months.)
 - Press the **Cancel** button if you want to discard your changes, reverting to the original value.
 - Press the **Back** button to back up to the last field or step.
 - Press the **Save** button to store the highlighted value and leave *Edit* mode.

In Select mode, press the **Back** button to return to the [General Settings menu](#).

CHANGING METER GROUPS

The XR6/XR3 provides meter groups of three parameters and allows you define the meters being viewed to make the digital meters more convenient. The meters are displayed on the [Meters page - see page 2-15](#). You can also edit the meter groups, customizing the meters that are displayed on each screen, using the [Change Meter Groups page - see page 2-14](#). To view the **Change Meter Groups** page, select **Change Meter Groups** from the [General Settings menu](#).

Figure 2.9: Change Meter Groups page

10:18	0.00kW M-1	B+1	PM:A	Man	Ex:A	Man
Forward Power: 0.00W						
		0	5	10		
Reflec. Power: 0W						
		0	500	1000		
Total DC Curr: 0.0A						
		0	25	50		
		Edit		Back		

Use the **Up** and **Down** buttons to move the cursor to the desired field.

Press the **Edit** button to highlight the current selection, and press the **Up** and **Down** buttons to scroll through the available meters.

Press the **Save** button to save your changes.

Press the **Cancel** button to revert to the previous setting and return to *Select* mode.

Press the **Back** button to return to the [General Settings menu](#).

VIEWING DIGITAL METERS

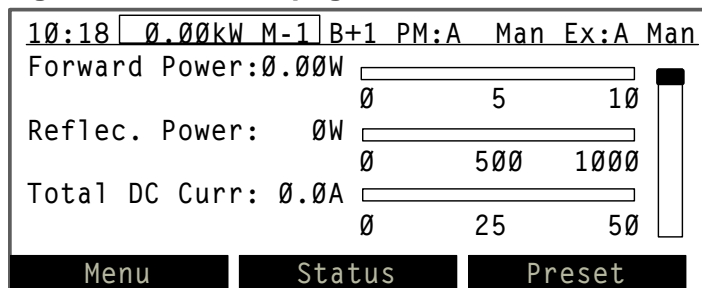
You can use the GUI to view digital meters (meter scales shown on the GUI screen). The **Meters** page displays up to 12 different meters (three at a time). The meters provide current information about the system. Measurements include:

- Forward power
- Reflected power
- Total dc current

- PA voltage
- B+ voltage
- RF drive P/S voltage
- Fan P/S voltage
- +24 V P/S voltage
- +15 V P/S voltage
- +5 V P/S voltage
- -15 V P/S voltage
- VSWR
- Temperature
- PDM A duty cycle
- PDM B duty cycle

The **Meters** page appears automatically when you stop performing other tasks with the GUI.

Figure 2.10: Meters page



Press the **Up** or **Down** buttons to scroll to different meters.

Press the **Menu** button to go to the [Main Menu](#).

If an alarm is active, a **Status** button appears. Press the **Status** button to go to the [Status page](#).

Press the **Preset** button to go to the [Preset Control page](#).

SETTING THE CLOCK

The XR6/XR3's internal clock has a backup battery, and maintains accurate time even during power outages. However, you need to reset the clock when the transmitter is first installed, or if the backup battery has failed. (Until the clock is set, the clock display will show an incorrect time or 'garbage' characters.)

You can set the XR6/XR3's clock using the [Real Time Clock page](#). To view the **Real Time Clock** page, select **Settings** from the [Main Menu](#), then **Real Time Clock** from the [General Settings menu](#).

Figure 2.11: Real Time Clock page

10:18	0.00kW	M-1	B+1	PM:A	Man	Ex:A	Man						
<table border="1"><thead><tr><th>Time</th><th>Day</th><th>Date</th></tr></thead><tbody><tr><td>11:01:00</td><td>Thu</td><td>19 Oct 06</td></tr></tbody></table>								Time	Day	Date	11:01:00	Thu	19 Oct 06
Time	Day	Date											
11:01:00	Thu	19 Oct 06											
Use Arrow Keys to Select a value. Press EDIT to modify the value.													
Calibrate		Edit		Back									

The [Real Time Clock page](#) contains editable fields for **Time** (Hours, Minutes and Seconds), **Day** (of the week) and **Date** (Day, Month and Year). The XR6/XR3's clock operates in 24-hour format.

Use the **Up** and **Down** buttons to move the cursor over the fields from left to right to highlight a value. To change the highlighted value, press the **Edit** button, then press the **Up** or **Down** button to increase or decrease the value. Press the **Save** button to store the change. Press the **Cancel** button to abort the change.

If the real time clock drifts over time, use the **Calibrate** button to display the [Calibrate Clock page](#). This page allows for correction of a known time offset.

Figure 2.12: Calibrate Clock page

10:18	0.00kW M-1	B+1	PM:A	Man	Ex:A	Man
Current RTC Calibration:			<input type="text" value="8"/>			
Estimated FT Frequency: 512.008 Hz						
Effective 30-day Correction:			-42.2 sec			
Previous 30-day Correction:			-42.2 sec			
Delta 30-day Correction:			0.0 sec			
			Edit		Back	

To change the highlighted Current RTC (real time clock) Calibration value, press the **Edit** button, then press the **Up** or **Down** button to increase or decrease the value. As you change the value, you can also observe changes to the other fields:

- **Estimated FT Frequency:** Displays the estimated FT (frequency test) frequency, in Hz, for the Current RTC Calibration value.
- **Effective 30-day Correction:** Displays the absolute number of seconds that the clock will gain (positive value) or lose (negative value) over a 30-day period for the Current RTC Calibration value.
- **Previous 30-day Correction:** Displays the absolute number of seconds that the clock will gain (positive value) or lose (negative value) over a 30-day period for the previously set value of Current RTC Calibration.
- **Delta 30-day Correction:** Displays the difference between the Previous 30-day Correction and the Effective 30-day Correction to facilitate a subsequent adjustment from the previous setting.

Press the **Save** button to store the change. Press the **Cancel** button to abort the change.

Two procedures are included to calibrate the transmitter's clock:

- [30-Day Drift Estimation](#) - see page 2-18
- [RTC Frequency Measurement](#) - see page 2-18.

30-DAY DRIFT ESTIMATION

1. Set the XR6/XR3's clock (see [“Setting the clock” on page 2-16](#)) according to a selected independent time standard.
2. After 30 days, compare the XR6/XR3's clock time to the same independent time standard. Note the time difference.
3. In the **Calibrate Clock** page, adjust the Current RTC Calibration value until the Delta 30-day Correction time is as close as possible to the difference noted in [Step 2](#). NOTE: If the XR6/XR3's clock gained time on the standard, the Delta 30-day Correction value should be negative; If the XR6/XR3's clock lost time on the standard, the Delta 30-day Correction value should be positive.
4. Press the **Save** button to store the calibration value.
5. Reset the XR6/XR3's clock according to the time standard.
6. The calibration is complete.

RTC FREQUENCY MEASUREMENT

1. Connect a frequency counter, capable of measuring 512 Hz within 0.001 Hz, to a nominal 512 Hz, 5 V CMOS square-wave on TP51 of the control display PWB (A1A1). Note the measured frequency.
2. In the **Calibrate Clock** page, adjust the Current RTC Calibration value until the Estimated FT Frequency value is as close as possible to the measured frequency in [Step 1](#).
3. Press the **Save** button to store the calibration value.
4. Reset the XR6/XR3's clock (see [“Setting the clock” on page 2-16](#)) according to a selected independent time standard.
5. The calibration is complete.

VIEWING SOFTWARE VERSION INFORMATION

You can view the version of the software installed on the transmitter itself, or version information about components installed in the transmitter with the [Software Version page](#). To view the **Software Version** page, select **Software Version** from the [Main Menu](#).

Figure 2.13: Software Version page

10:18 0.00kW M-1 B+1 PM:A Man Ex:A Man

Release 2.2.1	NAPC147u 2.2.1d
Oct 18 2006	NAPC147c 1.0.1
Nautel Limited	NAP183u 1.0.0

[Refresh](#) [Back](#)

The left side of the page shows the release number and the date of the release. The right side of the page shows information about the individual components in the current release.

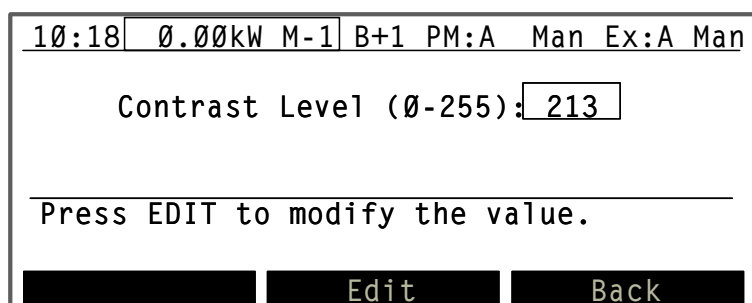
Press the **Refresh** button to update the values on the screen after, for example, upgrading one of the software modules or after a power failure.

Press the **Back** button to return to the **Main Menu**. (See “Main Menu” on page 2-6.)

ADJUSTING SCREEN CONTRAST

The XR6/XR3's LCD screen (used to display the GUI) is set by default to a contrast suitable for most locations. The XR6/XR3 also adjusts the contrast setting automatically to compensate for changes in temperature. However, depending on your preferences and light conditions, you may wish to increase or decrease the contrast manually using the [LCD Contrast Setting page](#). To view the **LCD Contrast Setting** page, select **Settings** from the [Main Menu](#), then **LCD Contrast Setting** from the [General Settings menu](#).

Figure 2.14: LCD Contrast Setting page



10:18 0.00kW M-1 B+1 PM:A Man Ex:A Man

Contrast Level (0-255): 213

Press EDIT to modify the value.

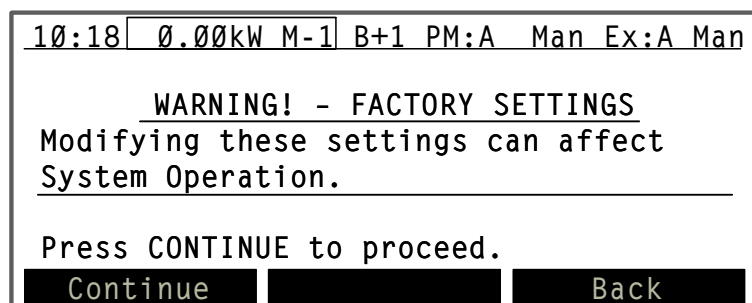
Edit Back

To change the contrast, press the **Edit** button and then use the **Up** and **Down** buttons to increase or decrease the setting.

CHANGING HARDWARE SETTINGS

You can set thresholds, calibrate digital and analog meters, and restore factory settings using the [Hardware Settings menu](#). To view the **Hardware Settings** menu, select **Settings** from the [Main Menu](#), then **Hardware Settings** from the [General Settings menu](#). The [Hardware Settings Warning page](#) appears. Press **Continue** to proceed to the [Hardware Settings menu](#) - see page 2-21.

Figure 2.15: Hardware Settings Warning page

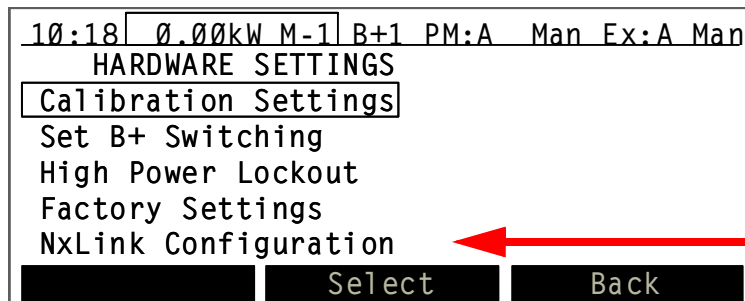


10:18 0.00kW M-1 B+1 PM:A Man Ex:A Man

WARNING! - FACTORY SETTINGS
Modifying these settings can affect
System Operation.

Press CONTINUE to proceed.

Continue Back

Figure 2.16: Hardware Settings menu

Displayed only if the NxLink is installed and communicating with the transmitter's controller.

Use the **Up** and **Down** buttons to move the cursor to the desired option, then press the **Select** button. See:

- [Setting thresholds](#) - see page 2-22
- [Calibrating meters](#) - see page 2-24
- [Calibrating analog meter](#) - see page 2-24
- [Calibrate B+ Thresholds and Switching Points \(3-phase ac power\)](#) - see page 2-26
- [Calibrate B+ Thresholds and Switching Points \(1-phase ac power\)](#) - see page 2-26
- [Calibrate B+ switching points](#) - see page 2-27
- [Setting high power lockout limit](#) - see page 2-27
- [Configuring NxLink \(optional\)](#) - see page 2-31

Press the **Back** button to return to the [General Settings menu](#).

If you select **Factory Settings**, a warning screen appears.

Press the **Continue** button to move to the [Factory Settings menu](#) - see page 2-29.

SETTING THRESHOLDS

If required, you can use the [Set Thresholds page](#) - see [Figure 2.17](#) to adjust the thresholds used to control and protect the XR6/XR3 transmitter.



WARNING: THESE SETTINGS ARE ADJUSTED AT THE FACTORY AND SHOULD NOT REQUIRE ANY ADJUSTMENT. THESE SETTINGS AFFECT CRITICAL SYSTEM PROTECTIONS. MAKING CHANGES TO THESE SETTINGS MAY VOID YOUR WARRANTY. CONTACT NAUTEL BEFORE MAKING CHANGES.

To view the **Set Thresholds** page, select **Settings** from the [Main Menu](#), **Hardware Settings** from the [General Settings menu](#), **Calibration Settings** from the [Hardware Settings menu](#), then **Set Thresholds** from the Calibration Settings menu.

Figure 2.17: Set Thresholds page

10:18	0.00kW M-1	B+1 PM:A	Man Ex:A	Man
Set Thresholds				
Reflected Power Shutback: <input type="text" value="85"/>				
(Approximate value): 1063 W)				
Use the arrow keys to select a value to change. Press EDIT to make changes.				
View Summary		Edit	Back	

Use the **Up** and **Down** buttons to select the desired threshold.

- **Reflected Power Shutback:** Sets the reference voltage for the high reflected power shutback circuitry.
- **RF Current Shutback :** Sets the reference voltage for the high RF current shutback circuitry.
- **DC Current zero offset:** Sets the value of the dc offset used to zero the transmitter's RF current probe.
- **Carrier Ramp-Up Interval:** Sets the interval (in tenths of seconds) for the transmitter to ramp up to its maximum carrier reference value after being turned on. If the transmitter is ramping up to a power level that is less than the maximum carrier reference, the ramp up time will be less than the interval setting.

To change a threshold, select the threshold and press the **Edit** button. Press the **Up** and **Down** buttons to change the threshold value. For future reference, record the threshold value before and after making a change.

Use the **View Summary** button to view a list of all thresholds and their current settings.

CALIBRATING METERS

To view the **Calibrate Meters** page, select **Settings** from the [Main Menu](#), **Hardware Settings** from the [General Settings menu](#), **Calibration Settings** from the [Hardware Settings menu](#), then **Calibrate Meters** from the Calibration Settings menu.

Figure 2.18: Calibrate Meters page

Press the **Up** and **Down** buttons to scroll to the desired meter reading. (The VSWR meter does not appear, since it is a *calculated* value and cannot be directly calibrated.)

To change a calibration value, press the **Edit** button and then use the **Up** and **Down** buttons to increase or decrease the value. Record the associated **Scale Factor** value before and after the change for future reference.



Note: The transmitter is calibrated at the factory. Do not change calibration settings unless absolutely required.

CALIBRATING ANALOG METER

You can recalibrate the XR6/XR3's analog *forward power* meter, if necessary, using the **Calibrate Analog Meter** page.



Notes:

The transmitter is calibrated at the factory. Do not change calibration settings unless absolutely required.

*While the **Calibrate Analog Meter** page is displayed, the meter will only deflect to full or half scale. Exit the **Calibrate Analog Meter** page to return the meter to normal operation.*

To view the **Calibrate Analog Meter** page, select **Settings** from the **MAINMENU** page. Next, select **Hardware Settings** from the [General Settings menu](#), **Calibration Settings** from the [Hardware Settings menu](#), then select **Calibrate Analog Meter** from the Calibration Settings menu.

Figure 2.19: Calibrate Analog Meter page

10:18	0.00kW M-1	B+1 PM:A	Man Ex:A	Man
Full-Scale Meter Deflection: <input type="text" value="217"/>				
Full-Scale Meter Reading: 9.00 kW				
Half-Scale Meter Reading: 2.26 kW				
Use the arrow keys to select value to view. Ensure that all meter readings match. Press EDIT to make changes.				
		Edit	Back	

To recalibrate the analog meter, perform the following steps (see [Figure 2.19](#)):

1. Use the **Up** and **Down** buttons to select **Full-Scale Meter Deflection**. Press the **Edit** button, then press the **Up** and **Down** buttons, to adjust the meter until it reads exactly full scale (full deflection to the right). Press the **Save** button to save your calibration. (Pressing the **Cancel** button discards your changes.)
2. Use the **Up** and **Down** buttons to select **Full-Scale Meter Reading**. Press the **Edit** button, then press the **Up** and **Down** buttons, to adjust the digital value until it reads exactly the same as the full-scale meter indication. Press the **Save** button to save your calibration.
3. Use the **Up** and **Down** buttons to select **Half-Scale Meter Reading**. Press the **Edit** button, then press the **Up** and **Down** buttons to adjust the digital value until it reads exactly the same as the pointer. Press the **Save** button to save your calibration.

CALIBRATING B+ THRESHOLDS AND SWITCHING POINTS

You can recalibrate the XR6/XR3's high and low B+ voltage thresholds, if necessary, using the **Calibrate B+ Thresholds and Switching Points** page. You can also determine the points at which the XR6/XR3 B+ voltage switches between levels 0 (low), 2 (medium) and 3 (high) for 3-phase XR6; levels 0 (low) and 3 (high) for 3-phase XR3; or levels 0 through 3 for 1-phase XR6/XR3.



Notes:

The transmitter is calibrated at the factory. Do not change calibration settings unless absolutely required.

To view the **Calibrate B+ Thresholds and Switching Points** page, select **Settings** from the **MAIN MENU** page (Figure 2.1 on page 2-6). Next, select **Hardware Settings** from the **General Settings** menu, then select **B+ Switching** from the **Hardware Settings** menu.

Figure 2.20: Calibrate B+ Thresholds and Switching Points (3-phase ac power)

10:18	0.00kW M-1	B+2 PM:A	Man	Ex:A	Man
Carrier Ref = 0 PDM A = 0.00 B = 0.00					
B+ Lvl	Car. Ref. Limit		B+ Thresholds		
	Minimum	Maximum	Discon.	Recon.	
3	88	167	250 V	265 V	
2	52	89	155 V	165 V	
1	0	0	0 V	0 V	
Edit			Back		

XR6 uses 3 B+ levels (0, 2 and 3)

Scroll down to view B+ level 0

XR3 uses 2 B+ levels (0 and 3; level 2 line also displays '0's


Figure 2.21: Calibrate B+ Thresholds and Switching Points (1-phase ac power)

10:18	0.00kW M-1	B+1 PM:A	Man	Ex:A	Man
Carrier Ref = 0 PDM A = 0.00 B = 0.00					
B+ Lvl	Car. Ref. Limit		B+ Thresholds		
	Minimum	Maximum	Discon.	Recon.	
3	96	113	174 V	185 V	
2	54	97	156 V	165 V	
1	33	55	91 V	97 V	
Edit			Back		

Scroll down to view B+ level 0

CALIBRATE B+ THRESHOLD. If required, you can use the **Calibrate B+ Thresholds** page (Figure 2.20 or Figure 2.21) to adjust the thresholds used to disconnect and reconnect the B+ dc voltage to the XR6/XR3 transmitter.

To calibrate the B+ thresholds, perform the following steps (see Figure 2.20 or Figure 2.21):



CAUTION:
Do not calibrate B+ thresholds unless specifically instructed by Nautel personnel. Decreasing the Recon. (reconnect) level can damage the transmitter.

1. Use the **Up** and **Down** buttons to select the appropriate **Discon.** (disconnect) level, noting it is in the left-hand **B+ Thresholds** column. Press the **Edit** button, then press the **Up** and **Down** buttons, to adjust the threshold (in volts) as desired. Press the **Save** button to save your calibration. (Pressing the **Cancel** button discards your changes.)

2. Use the **Up** and **Down** buttons to select the appropriate **Recon.** (reconnect) level, noting it is in the right-hand **B+Thresholds** column. Press the **Edit** button, then press the **Up** and **Down** buttons, to adjust the threshold (in volts) as desired. Press the **Save** button to save your calibration. (Pressing the **Cancel** button discards your changes.)

CALIBRATE B+ SWITCHING POINTS. The XR6/XR3 transmitter uses multiple B+ voltage levels [0 (low) and 3 (high) for three-phase XR3s; 0 (low), 2 (medium) and 3 (high) for three-phase XR6; four levels (0, 1, 2 and 3) for single-phase XR3s and XR6s] to optimize transmitter performance. These levels are automatically switched as pre-defined minimum and maximum limits are reached. If required, you can use the **Calibrate Switching Points** page ([Figure 2.20](#) or [Figure 2.21](#)) to adjust the limits used to determine the B+ switching points.

The **Carrier Ref** value represents the current value. It is relative to the **Minimum** and **Maximum Car. Ref. Limit** values.

The **PDM A** and **B** values represent the current duty cycle of the PDM drive signal. B+ switching typically occurs at a duty cycle of approximately 40%.

To recalibrate the B+ switching points, perform the following steps (see [Figure 2.20](#) or [Figure 2.21](#)):

1. Use the **Up** and **Down** buttons to select the appropriate **Minimum** level, noting it is in the left-hand **Car. Ref. Limit** column. Press the **Edit** button, then press the **Up** and **Down** buttons, to adjust the threshold value as desired. Press the **Save** button to save your calibration. (Pressing the **Cancel** button discards your changes.)
2. Use the **Up** and **Down** buttons to select the appropriate **Maximum** level, noting it is in the right-hand **Car. Ref. Limit** column. Press the **Edit** button, then press the **Up** and **Down** buttons, to adjust the threshold value as desired. Press the **Save** button to save your calibration. (Pressing the **Cancel** button discards your changes.)

SETTING HIGH POWER LOCKOUT LIMIT

You can set the high power limit for the high power lockout feature using the **High Power Lockout** page.

To view the **High Power Lockout** page, select **Settings** from the **MAINMENU** page. Next, select **Hardware Settings** from the [General Settings menu](#), then select **High Power Lockout** from the [Hardware Settings menu](#).

Figure 2.22: High Power Lockout page

10:18	0.00kW M-1	B+1	PM:A	Man	Ex:A	Man
High Power Lockout: Enabled High Pwr Lock Carrier Limit: 45 (Current Carrier Reference: 32 Use the arrow keys to select a value to change. Press EDIT to make changes. <div style="display: flex; justify-content: space-around; margin-top: 10px;"> Edit Back </div>						

To set the high power lockout limit, perform the following steps (see [Figure 2.22](#)):



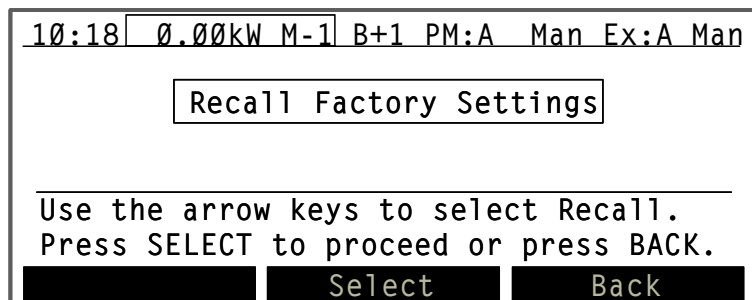
Note: When the high power lockout feature is enabled, the remote Preset 6 control input (J2-22) of the remote interface PWB (A2A6) is used to activate and de-activate the lockout. There is no remote control of preset 6 while high power lockout is enabled.

1. Use the **Up** and **Down** buttons to select **High Power Lockout**. Press the **Edit** button, then press the **Up** and **Down** buttons, to select **Disabled**. Press the **Save** button to save your setting. (Pressing the **Cancel** button discards your changes.)
2. Set the transmitter's output power to the desired lockout power level. Note the **Current Carrier Reference** value carrier reference value, which corresponds to the transmitter's output power.
3. Use the **Up** and **Down** buttons to select **High Pwr Lock Carrier Limit**. This value represents the carrier reference (output power) limit for the high power lockout feature. When the high power lockout feature is activated, the transmitter power cannot increase beyond this limit. Press the **Edit** button, then press the **Up** and **Down** buttons to change the value to the same value as the **Current Carrier Reference**. Press the **Save** button to save your setting. (Pressing the **Cancel** button discards your changes.)
4. Use the **Up** and **Down** buttons to select **High Power Lockout**. Press the **Edit** button, then press the **Up** and **Down** buttons, to select **Enabled**. Press the **Save** button to save your setting. (Pressing the **Cancel** button discards your changes.)
5. Apply an active input to the remote *Preset 6* control (J2-22) on the remote interface PWB (A2A6) to activate the high power lockout feature.

RESTORING FACTORY SETTINGS

You can restore the factory settings, discarding all settings made to the transmitter, including meter calibration settings, threshold settings, LCD contrast, meter groups, preset schedules and preset settings. To view the **Factory Settings** menu, select **Settings** from the [Main Menu](#), **Hardware Settings** from the [General Settings menu](#), then **Factory Settings** from the [Hardware Settings menu](#).

Figure 2.23: Factory Settings menu



Press the **Select** button to restore the factory settings. A warning appears, asking you to confirm that you wish to proceed.

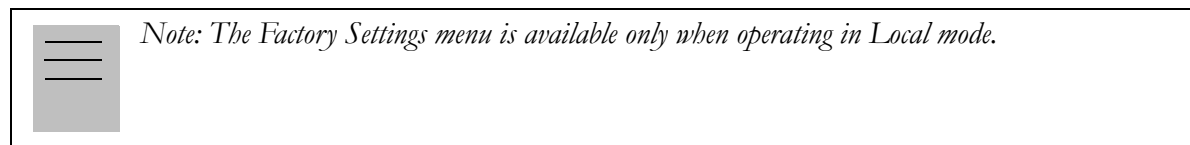
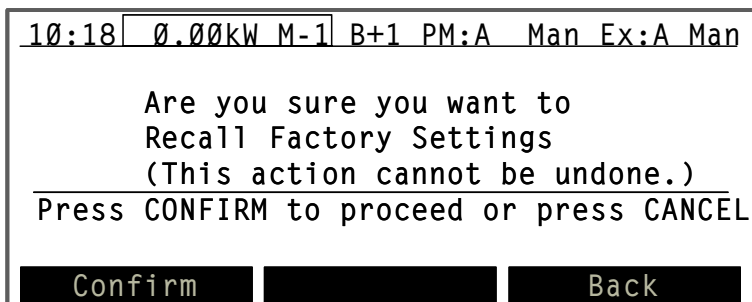


Figure 2.24: Factory Settings warning page



Press the **Cancel** button to cancel the request, leaving your transmitter settings intact, or press the **Confirm** button to restore the factory settings.



CAUTION:
This action cannot be undone

CONFIGURING NxLINK (OPTIONAL)

You can configure the NxLink Ethernet interface module, if installed, using the **NxLink Configuration** page.

To view the NxLink Configuration page, select **Settings** from the **MAINMENU** page. Next, select **Hardware Settings** from the [General Settings menu](#), then select **NxLink Configuration** from the [Hardware Settings menu](#) (only displayed if NxLink module is installed and communicating with the transmitter's controller; the screen should take less than one minute to appear).

Figure 2.25: NxLink Configuration page

10:18 0.00kW M-1 B+1 PM:A Man Ex:A Man

NxLink Configuration

IP Address:	0. 0. 0. 0
Netmask:	255.255. 0. 0
Gateway:	192.163. 1. 2
DNS Server:	192.168. 1.248
DHCP'd Address:	0. 0. 0. 0

Save Select Back

To configure the NxLink, perform the following steps (see [Figure 2.25](#)):

1. Use the **Up** and **Down** buttons to select **IP Address**, **Netmask**, **Gateway** or **DNS Server**. **DHCP'd Address** is not a selectable field. The address is automatically assigned when the NxLink is connected to a LAN (if DHCP is available on the network and the IP Address is set to 0.0.0.0 (as shown)).
2. Press the **Edit** button on the highlighted address field to enable editing of the address. Press the **Up** and **Down** buttons to move left to right through the address sections.
3. Press the **Back** button to exit address editing and press the **Save** button to save the NxLink configuration.

SECTION 3: USING THE EVENT LOG

This section provides information about using and interpreting the XR6/XR3's event log. The event log records key information such as setting changes, faults, and commands. You may wish to review the event log to check the transmitter's status, perform troubleshooting, or review recent changes to transmitter controls.

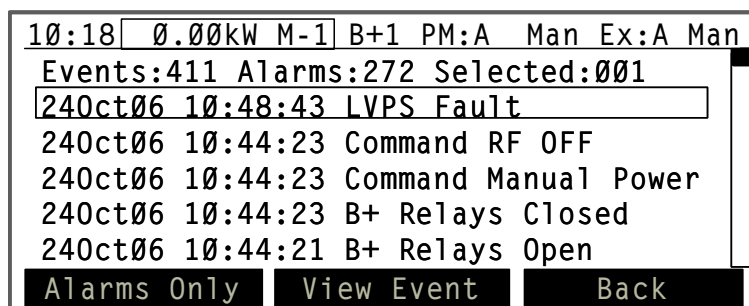
This section includes the following topics:

- [Viewing the event log](#)
- [Clearing the event log](#) - see page 3-6
- [Event log messages](#) - see page 3-7

VIEWING THE EVENT LOG

To view the XR6/XR3's log, select **Events Log** from the GUI's Main Menu. (See "[Graphic user interface](#)" on page 2-2.) The [Events Log page](#) appears on the XR6/XR3's LCD screen.

Figure 3.1: Events Log page



The [Events Log page](#) shows a list of recent faults and other events. The second line of the page shows the total number of events in the log, the number of alarms, and the index number of the event that is currently highlighted.

Press the **Up** and **Down** buttons to scroll through the event list. Press the **Alarms Only** button to limit the list to alarms (hiding other event notifications).

Press the **All Events** button to view all events in the log.

Press the **View Event** button to see the details of the currently selected event. The [View event page](#) appears. (See [Figure 3.2 on page 3-3.](#))

Press the **Back** button to return to the Main Menu. (See [“Main Menu” on page 2-6.](#))

VIEW EVENT PAGE

There are a series of **View Event** pages that let you view information about a selected event. Each page displays the state of the transmitter at the time of the event. The display shows the event number (index), the date and time of the event, and a description of the event.

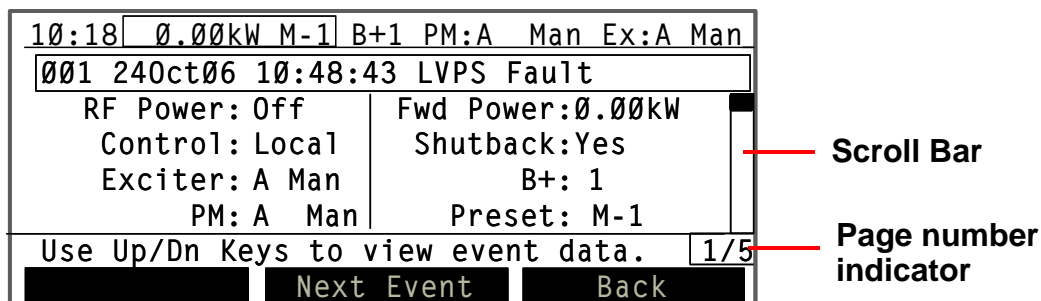
Press the **Up** and **Down** buttons to move forward and backward through the available event pages. An indicator appears in the bottom-right corner of the page, showing the page number and the total number of available event pages.

Press the **Next Event** button to view the next event in the list. This keeps you on the same page but displays information for the next event, making it easier to compare event information.

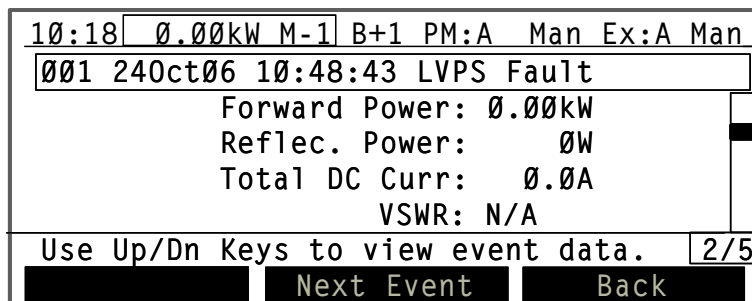
Press the **Back** button to return to the [Events Log page](#).

VIEW EVENT PAGE 1. View Event Page 1 provides general information about transmitter status, including:

- RF power: on or off
- Transmitter control: remote or local
- Exciter settings: Active side (A/B), and transfer mode (Auto/Man)
- Power module (PM) settings: Active module (A or B) - Transfer mode (Auto/Man)
- Forward power
- Shutback active at time of event: Yes/No
- B+ switching level: 1, 2 or 3 in XR6 transmitters or 1 or 2 in XR3 transmitters
- Preset setting: Preset number (A-1 to A-6 or M-1 to M-6). The A- or M- prefix indicates the Preset Scheduler Mode (automatic or manual)

Figure 3.2: View Event Page 1

VIEW EVENT PAGE 2. View Event Page 2 provides information about forward power, reflected power, total dc current, and VSWR.

Figure 3.3: View Event Page 2

If the VSWR cannot be calculated (for example, when forward power is 0 W), **N/A** appears.

VIEW EVENT PAGE 3. View Event Page 3 provides information about all dc voltages in the transmitter. Available measurements are B+ voltage, PA voltage, RF drive P/S voltage (62 V P/S), fan P/S voltage (48 V P/S), +24 V, +15 V, -15 V and +5 V power supplies.

Figure 3.4: View Event Page 3

10:18	0.00kW M-1	B+1 PM:A	Man Ex:A	Man
001 240ct06 10:48:43 LVPS Fault				
B+ Voltage:	0V	+24 Volt P/S:	0.0V	
PA Volt P/S:	0.0V	+15 Volt P/S:	0.0V	
RF Drive P/S:	0.0V	-15 Volt P/S:	-0.0V	
Fan P/S:	0.0V	+5 Volt P/S:	0.00V	
Use Up/Dn Keys to view event data.				3/5
Next Event		Back		

VIEW EVENT PAGE 4. View Event Page 4 provides the status of the alarm LEDs (from the front panel) at the time of the event.

Figure 3.5: View Event Page 4

10:18	0.00kW M-1	B+1 PM:A	Man Ex:A	Man
001 240ct06 10:48:43 LVPS Fault				
Exciter Off	Power Supply Off			
LVPS Off	O/P Network Off			
AC Mains Off	Changeover Off			
IPA/PA Off	Ext. Alarm Off			
Use Up/Dn Keys to view event data.				4/5
Next Event		Back		

"On" text is shown in reverse video.

VIEW EVENT PAGE 5+. View Event Page 5 and later View Event pages provide lists of faults present during the time of the event. Each page lists up to eight faults.

The current cutback level (0 to 8) is displayed at the end of the list of faults. A zero (0) means that there is no cutback.

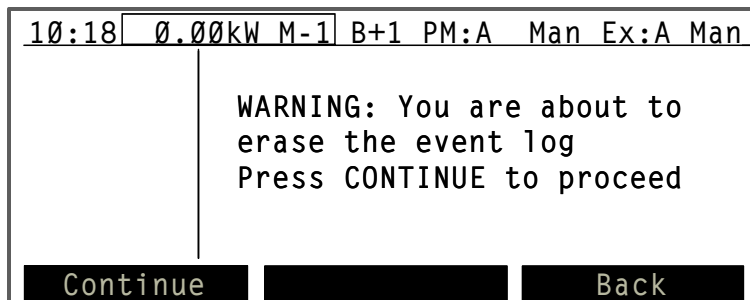
Figure 3.6: View Event Page 5+

10:18	0.00kW M-1	B+1 PM:A	Man Ex:A	Man
001	240ct06 10:48:43	LVPS Fault		
	LVPS Fault			
	Cutback Level 0			
Use Up/Dn Keys to view event data.				5/5
	Next Event		Back	

CLEARING THE EVENT LOG

If you entered the Events Log screen and one or more logs were present, a **Clear Log** button appears on the [Main Menu](#). To clear the entire contents of the Events Log, press the **Clear Log** button. A warning screen will appear.

Figure 3.7: Clear Log Warning page



Press the **Continue** button to clear the log, or press the **Back** button to return to the [Main Menu](#).

EVENT LOG MESSAGES

Table 3.1: Event messages

Event Log Messages	Explanation
Softstart Complete	B+ relays have closed.
Cmd. Auto Exciter	Automatic Exciter changeovers have been enabled.
Cmd. Man Exciter	Automatic Exciter changeovers have been disabled.
Comd. Power Preset (1-6)	Preset # (1-6) has been selected.
Command Auto Power	Automatic Preset changes using the Preset Scheduler have been enabled.
Command Manual Power	Automatic Preset changes using the Preset Scheduler have been disabled.
Command Exciter A	Changeover to Exciter A.
Command Exciter B	Changeover to Exciter B.
Command LOCAL	Remote control has been disabled. Local control is in effect.
Command REMOTE	Remote control has been enabled. Local control is limited.
Command RF OFF	RF Off has been ordered.
Command RF ON	RF On has been ordered.
EEPROM Restore Fail	There has been a power failure, and the backup settings have not been restored due to a settings corruption.
Return to normal	All shutbacks and cutback conditions have been cleared.

SECTION 4: ROUTINE MAINTENANCE

This section provides instructions for performing routine maintenance on the XR6/XR3 transmitter. This section includes the following topics:

- [Scheduled maintenance](#)
- [Replacing air filters - see page 4-2](#)
- [Performing on-air checks - see page 4-3](#)
- [Replacing the control/display PWB battery - see page 4-3](#)
- [Inspecting lightning protection systems - see page 4-4](#)

SCHEDULED MAINTENANCE

Scheduled maintenance consists of performing a visual inspection of the XR6/XR3 at scheduled intervals. The recommended minimum time between scheduled maintenance visits is three months. Local operating and environmental conditions may dictate more frequent visits, while in remote sites less frequent visits may be acceptable. Experience and system reliability will determine the most practical schedule for a specific installation.

CLEANING

At a minimum, follow the cleaning procedures listed below.



Note:

A site located in a dirty area using open-air cooling requires more extensive cleaning than a site located in a clean area using closed-air cooling.

1. Inspect the air filter. If the air filter becomes damaged, it should be replaced as soon as possible. See [“Replacing air filters” on page 4-2](#).
2. Clean the XR6/XR3 using a vacuum cleaner and a soft-bristle brush to remove loose dirt. Clean, damp rags should be used to remove dirt that cannot be removed with a vacuum cleaner. Never use compressed air to clean the XR6/XR3.

CHECKING HARDWARE

All hardware must be checked at least once a year. Thermal cycling from turning the XR6/XR3 on and off will require more frequent checks.

- To prevent damaging the hardware, ensure that the proper sized tools are used. In most cases, hardware is metric.
- A mounting surface or terminal that has changed colour indicates a loose hardware connection.
- Multi-stranded cables installed on terminal strips must be retorqued.

BATTERY REPLACEMENT

The XR6/XR3's control/display PWB contains a battery backup circuit that provides a memory of alarm occurrences during ac power failure. See [“Replacing the control/display PWB battery” on page 4-3](#).

REPLACING AIR FILTER

In order to maintain your transmitter warranty and prevent premature component failures, replace your transmitter's air filter periodically.

INTERVAL

Every six months in typical environments. Every three months in dusty, humid or harsh environments.

PARTS AND TOOLS

One replacement air filter.

PROCEDURE

Take the following steps to replace XR6/XR3 air filter:

1. Order a new filter. You can order these standard sized filters from Nautel (Nautel Part # HAM68 or from the manufacturer (3M # 9806C) or obtain them from any local supplier of HVAC supplies.
2. Unpack the new filter and inspect it for damage.

3. Remove the old filter.
 4. Insert the new air filter into the brackets. Check the air filter markings or instructions to ensure proper orientation, noting air flows into the back of the transmitter.
 5. Dispose of the used air filter.
-

PERFORMING ON-AIR CHECKS

You should check the on-air quality of the transmitter's signal periodically. This check can be done locally at the transmitter site, or remotely from another location in the transmitter's coverage area.

INTERVAL

Every 12 months, or as required by law.

PARTS AND TOOLS

- High-quality receiver compatible with the modulation scheme used on the transmitter.
- A spectrum analyzer, if one is available.

PROCEDURE

1. Monitor the transmitter signal to identify any problems:
 - Use a high quality receiver to monitor audio quality.
 - Check the spectral output of the transmitter using a spectrum analyzer.
 - Take a portable receiver to different locations in your coverage areas to identify any problems with the antenna pattern or areas of localized interference.

REPLACING THE CONTROL/DISPLAY PWB BATTERY

Replace the battery on the control/display PWB once a year, or whenever the **Low backup battery** remote interface alarm appears. Chemical leakage from an old battery could cause damage. Also, the control/display PWB's microcontroller may not retain its settings if ac power is turned off while the backup battery power is low. The battery should be replaced while ac power is applied to the transmitter.

INTERVAL

Every 12 months.

PARTS AND TOOLS

Replacement battery. 3 V lithium coin cell, 20 mm (Nautel Part # BBLT01, Panasonic # Panasonic CR2032).

PROCEDURE

Perform the following steps to replace the battery:

1. Ensure ac power is being applied to the transmitter.
2. Open the front panel of the transmitter.
3. Replace the battery in XBT1 on the control/display PWB. See [Figure MD- 3](#) in the mechanical drawings section at the end of the *XR6/XR3 Troubleshooting Manual*.
4. Close the front panel.
5. Check for any alarms on the graphic user interface.
(See [“Viewing alarm status” on page 2-7.](#))

INSPECTING LIGHTNING PROTECTION SYSTEMS

You should inspect the lightning protection systems that are connected to your XR6/XR3 transmitter, ac power, RF feedline, antenna and tower periodically to ensure that your site, equipment and personnel are fully protected.

INTERVAL

Every 6 months.

PARTS AND TOOLS

Depends on your site, but may include a DVM, ladder, binoculars, and continuity tester.

PROCEDURE

Perform the following steps to test the lightning protection systems:

1. Test the continuity between ground available at your lightning arrestor and ground available on various pieces of equipment connected to the transmitter. Ensure that there is no resistance (0 ohms).
2. Physically inspect the lightning arrestor to ensure that all connections are tight. Also look for any sign of scoring or burning (indications of possible damage from earlier lightning strikes).
3. Using binoculars, visually inspect the hardware on the tower. Look for charred, broken or frayed connections and corrosion.

SECTION 5: TEST AND ADJUSTMENT

This section contains test and adjustment procedures for the XR6/XR3 transmitter. The test procedures use integral meters and precision test/monitoring equipment. The test procedures contain routine adjustment instructions to bring the parameter being tested within defined limits, where appropriate.

Follow all instructions in the order presented, particularly for personnel who are not familiar with detailed circuit theory and may not realize the impact a specific adjustment can have on other steps. These adjustments should be performed during initial turn-on and after major repairs or a frequency change.

TEST EQUIPMENT REQUIRED

To perform the procedures outline in this section you will need:

- a 50 Ω dummy load that is able to dissipate the RF power being applied to it (6 kW carrier, 9 kW total)
- an oscilloscope
- a digital multimeter
- an audio signal generator
- a modulation monitor

TEST PREREQUISITES

Complete the following steps before performing any testing or adjustment procedures:

1. Verify that nothing affecting the RF power stage has been changed since the initial start-up procedure (see [“Turning on the transmitter”](#) of the *XR6/XR3 Installation Manual*) was completed.
2. Switch off the ac power at the service entrance.

3. Connect the XR6/XR3's RF output to a precision 50 Ω dummy load that is able to accurately display the RF power being applied to it.

**WARNING:**

IF A JUMPER IS PLACED BETWEEN INTERLOCK INPUTS TB1-1/TB1-2 ON THE REMOTE INTERFACE BOARD, 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. Simulate the closing of all external interlocks. This requires a short circuit between TB1-1 and TB1-2 of the remote interface PWB. Ensure all networks connected to the transmitter's RF output are properly covered.
5. Switch on the ac power at the service entrance to turn on the transmitter.
6. Select **Control - Local** control.
7. Disable the RF power stage by pressing **Control - RF Off**.

STANDARD ADJUSTMENTS

Complete the following standard adjustments when the XR6/XR3 transmitter's operation has been established:

- [Modulation checks](#)

MODULATION CHECKS

Verify that the RF output is appropriately modulated when audio is applied:

1. Connect an appropriate modulation monitor to the remote interface PWB **RF MONITOR** connector (J8). The modulation monitor should have an impedance of 50 Ω to obtain accurate readings. If the remote interface PWB's **BYPASS/GAIN** switch (S2) is set to **BYPASS**, the **RF MONITOR** output is a nominal 1 V rms. If the remote interface PWB's **BYPASS/GAIN** switch (S2) is set to **GAIN**, the **RF MONITOR** output can be up to a nominal 5 V rms.
2. Verify that forward power is selected for display on the **RF KILOWATTS** meter.

3. Select the highest preset RF power level and verify that the RF output, displayed on the **RF KILOWATTS** meter, is the desired forward power level.
4. Verify that an audio signal generator is connected between TB2-1 (+) and TB2-3 (-) on the remote interface PWB, and that its output is preset to 1,000 Hz at a zero output level (turned off).
5. Turn on the audio signal generator and increase the output level of the audio signal generator until a modulation depth of 100% is attained, as indicated on the modulation monitor. The audio signal generator's output level should be +10 dBm.
6. Verify that the RF output's modulation envelope is acceptable.
7. If the program audio can be set to +10 dBm when 100% modulation is required, it is recommended the **AUDIO GAIN** potentiometer on the interphase PDM driver PWBs be left at the factory setting.
8. If the program audio cannot be set to +10 dBm when 100% modulation is required, the **AUDIO GAIN** potentiometer on the remote interface PWB must be reset as follows:
 - Determine the program audio level (in dBm) that will be applied when 100% modulation is expected. (It must be between 0 dBm and +12 dBm.)
 - Set the audio signal generator's output to the level that will be applied by the program audio when 100% modulation is expected.
 - Adjust the **AUDIO GAIN** potentiometer on the remote interface PWB for 100% modulation, as indicated on the modulation monitor.
9. Set the output level of the audio signal generator to zero (turned off).
10. Turn off the RF power stage: press and release the **Control - RF Off** switch. The **Control - RF Off** lamp will turn on and the **Control - RF On** lamp will turn off.
11. Disconnect the audio signal generator from TB2-1 (+) and TB2-3 (-) on the remote interface PWB.

NON-STANDARD ADJUSTMENTS

Complete the following non-standard adjustments only as directed by a troubleshooting or replacement procedure in the *XR6/XR3 Troubleshooting Manual*:

- [RF drive symmetry](#)
- [Exciter Gain](#)
- [Modulation Peak Limiting](#)

RF DRIVE SYMMETRY

Measure the symmetry of the RF drive being applied from the active RF synthesizer PWB to the RF power modules as follows:

1. Select exciter A as the active exciter.
2. Connect an oscilloscope to BNC connector J5 [RF DRIVE (TEST)] on the RF drive buffer PWB.
3. The oscilloscope should indicate a symmetrical (50% duty cycle) square wave with a nominal amplitude of 15 V peak-to-peak.
4. Adjust exciter A's RF synthesizer PWB's **SYMMETRY** potentiometer (R32) to obtain a 50% duty cycle.
5. If an external RF drive source is used, adjust the RF drive source to obtain a symmetrical square wave. If necessary, adjust the external generator according to its maintenance manual.
6. Select exciter B as the active exciter. Repeat [Step 3](#) through [Step 5](#) for exciter B.
7. Disconnect the oscilloscope from J5 of the RF drive buffer PWB.

EXCITER GAIN

Equalize the PDM pulse train between exciters A and B so that no change in RF output level occurs during exciter changeover, as follows:

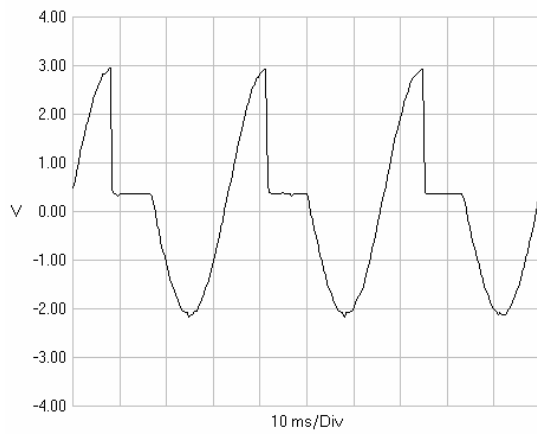
1. Select exciter A as the active exciter.
2. Turn on the XR6/XR3 and select the highest preset RF power level and verify that the RF output, displayed on the **RF KILOWATTS** meter, is the desired forward power level.
3. Select exciter B as the active exciter.
4. Adjust exciter B's interphase PDM driver PWB's **GAIN TRIM** potentiometer (R31) until the RF output is exactly the same as in [Step 2](#).

MODULATION PEAK LIMITING

Modulation peaks must be limited to reduce RF power amplifier stress current when the RF output's modulation envelope contains low frequency (long duration), high amplitude peaks. Verify the modulation peaks are limited as follows:

1. Connect an oscilloscope between TP7 and ground on the remote interface PWB.
2. Connect an audio signal generator between TB2-1 (+) and TB2-3 (-) on the remote interface PWB. Preset its output to 30 Hz at a zero output level (turned off).
3. Select exciter A as the active exciter.
4. Turn on the XR6/XR3 and select the highest preset RF power level and verify that the RF output, displayed on the **RF KILOWATTS** meter, is the desired forward power level.
5. Increase the output level of the audio signal generator until a modulation depth of 95% is attained, as indicated on the oscilloscope.
6. Adjust the remote interface PWB's **MOD PROT THRESHOLD** potentiometer (R165) until the trailing edge of each 30 Hz cycle is just being clipped (see [Figure 5.1 on page 5-6](#)).
7. Adjust the **MOD PROT THRESHOLD** potentiometer until the oscilloscope indication does not clip, but is on the edge of the clipping threshold.

Figure 5.1: Chopper Control Waveform
Audio = 30Hz (AC Coupled)



SECTION 6: 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- and right-channel audio data to the receiving device.

AMC. Amplitude Modulation Companding

ANTENNA TUNING UNIT (ATU). A device that matches the transmitter to the impedance of the antenna.

B+. The high voltage dc generated by the transmitter's ac power supply for use within the transmitter. The B+ voltage is used to supply the transmitter's modulators and other transmitter circuitry.

CUTBACK. A reduction in RF output power, caused by a total power limit fault or the occurrence of three shutbacks within a five second period.

DAM. Dynamic Amplitude Modulation.

DCC. Dynamic Carrier Control.

DSP. Digital Signal Processing.

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 AM radio channels.

IPM. Incidental Phase Modulation

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

PDM. Pulse Duration Modulation.

PRESET. A setting that controls power level, active exciter, and power scheduler status on a time-of-day and date basis. Exciters can be configured on a preset for a specific operating mode (for example, Exciter A - conventional AM, and Exciter B - IBOC). The XR6/XR3 allows you to pre-program up to six presets.

SHUTBACK. A complete loss of RF output power, caused by any one of a variety of faults, including high VSWR, low B+ voltage, high RF current, RF drive failure, external interlock or spark gap.

SURGE PROTECTION BOARD. 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.

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