Broadcast Electronics
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VPe XG
FM HD Radio Exciter Option
Technical Manual

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Revision B
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VPe XG – FM HD Radio Exciter Option
Technical Manual

Broadcast Electronics Product Warranty (Two-Year Limited)

BE hereby warrants all new products manufactured by BE against any defects in material or workmanship at the time of delivery thereof, or that develop under normal use within a period of two (2) years from the date of shipment.

BE reserves the right to repair equipment under warranty with new or refurbished equipment or parts. BE's sole responsibility with respect to any equipment or parts not conforming to this warranty is to replace or repair such equipment upon the return thereof F.O.B. to BE's factory in Quincy, Illinois, U.S.A. In the event of replacement pursuant to the foregoing warranty, only the unexpired portion of the warranty from the time of the original purchase will remain in effect for any such replacement.

This warranty shall exclude the following products, component parts and/or assemblies:

(a) Transmitter power output tubes shall only carry the original manufacturers' or suppliers' standard warranty in effect on their original shipment date.

(b) All computers, computer peripherals, cables, hard disk drives, etc., shall only carry the manufacturers' or suppliers' standard warranty in effect on their original shipment date.

(c) "Components", defined as separate and individual parts (e.g. transistors, integrated circuits, capacitors, resistors, inductors, fans, etc), resold by BE from another manufacturer or supplier, shall only carry a 90 day warranty, effective the date of shipment. Any such 'Components' being returned for warranty claim must be (1) returned in their original packaging and (2) must be in new, unused condition. BE is unable to process or resolve component defects or performance concerns on components that have been soldered, installed, wired or in any way altered from new their new condition.

(d) "Resale Equipment", defined as equipment purchased from another manufacturer or supplier, then resold by BE, shall only carry such manufacturer's or supplier's standard warranty in effect as of the original shipment date. All warranty claims against any and all 'resale equipment' sold by BE must be filed directly with the original equipment manufacturer. BE is unable to process or resolve equipment defects or performance concerns on products or services not manufactured by BE.

This warranty shall not extend to claims resulting from any acts of God, terrorism, war, defects or failures caused by Purchaser or user abuse or misuse, operator error, or unauthorized attempts to repair or alter the equipment in any way.

Under no circumstances shall BE be responsible for indirect, incidental or consequential damages, including, but not limited to transportation costs, non-authorized repair or service costs, downtime costs, costs for substituting equipment or loss of anticipated profits or revenue, incurred by Purchaser, whether based in contract, tort or for negligence or breach of statutory duty or otherwise. The terms of the foregoing warranty shall be null and void if the equipment has been altered or repaired without specific written authorization from BE, or if not installed according to BE's instruction manuals, including, but not limited to, the absence of proper grounding, surge (TVSS) protection on the AC circuit panel or proper lightning protection/grounding on all output circuits, or if equipment is operated under environmental conditions or circumstances other than those specifically described in BE's product literature or instruction manual which accompany the equipment. **The warranty shall be voided if the product or subassembly is equipped with a tamper seal and that tamper seal is broken.** BE shall not be liable for any expense of any nature whatsoever incurred by the original user without prior written consent of BE. The warranty provided herein shall terminate at the end of the period set forth above. **This warranty extends only to the original Purchaser and is not transferable.** There are no third party beneficiaries of any of the provisions of

this warranty. If the equipment is described as “used” equipment, it is sold as is and where is and no warranty applies unless authorized in writing.

EXCEPT AS SET FORTH HEREIN, AS TO TITLE AND AS SPECIFICALLY REQUIRED BY LAW, THERE ARE NO OTHER WARRANTIES, OR ANY AFFIRMATIONS OF FACT OR PROMISES BY BE, WITH REFERENCE TO THE EQUIPMENT, OR TO MERCHANTABILITY, FITNESS FOR A PARTICULAR APPLICATION, SIGNAL COVERAGE, INFRINGEMENT, OR OTHERWISE, WHICH EXTEND BEYOND THE DESCRIPTION OF THE EQUIPMENT ON THE FACE HEREOF.

IMPORTANT INFORMATION

EQUIPMENT LOST OR DAMAGED IN TRANSIT

When delivering the equipment to you, the truck driver or carriers' agent will present a receipt for your signature. Do not sign it until you have:

1) Inspected the containers for visible signs of damage and 2) Counted the containers and compared with the amount shown on the shipping papers. If a shortage or evidence of damage is noted, insist that notation to that effect be made on the shipping papers before you sign them.

Further, after receiving the equipment, unpack it and inspect thoroughly for concealed damage. If concealed damage is discovered, immediately notify the carrier, confirming the notification in writing, and secure an inspection report. This item should be unpacked and inspected for damage WITHIN 15 DAYS after receipt. Claims for loss or damage will not be honored without proper notification of inspection by the carrier.

RF PRODUCT TECHNICAL ASSISTANCE, REPAIR SERVICE, PARTS -

Technical assistance is available from Broadcast Electronics by letter, prepaid telephone or E-mail. Equipment requiring repair or overhaul should be sent by common carrier, prepaid, insured, and well protected. If proper shipping materials are not available, contact the RF Technical Services Department for a shipping container. Do not mail the equipment. We can assume no liability for inbound damage, and necessary repairs become the obligation of the shipper. Prior arrangement is necessary. Contact the RF Technical Services Department for a Return Authorization.

Emergency and warranty replacement parts may be ordered from the following address. Be sure to include the equipment model number, serial number, part description, and part number. Non-emergency replacement parts may be ordered directly from the Broadcast Electronics stock room at the number shown below.

RF TECHNICAL SERVICES

Telephone: +1 (217) 224-9617
E-Mail: rfservice@bdcast.com
Fax: +1 (217) 224-6258

FACILITY CONTACTS

Broadcast Electronics, - Quincy Facility
4100 N. 24th St. P.O. BOX 3606
Quincy, Illinois 62305
Telephone: +1 (217) 224-9600
Fax: +1 (217) 224-6258
General E-Mail: bdcast@bdcast.com
Web Site: www.bdcast.com

PARTS

Telephone: +1 (217) 224-9617
E-Mail: parts@bdcast.com

RETURN, REPAIR, AND EXCHANGES

Do not return any merchandise without our written approval and Return Authorization. We will provide special shipping instructions and a code number that will assure proper handling and prompt issuance of credit. Please furnish complete details as to circumstances and reasons when requesting return of merchandise. All returned merchandise must be sent freight prepaid and properly insured by the customer.

MODIFICATIONS

Broadcast Electronics, reserves the right to modify the design and specifications of the equipment in this manual without notice. Any modifications shall not adversely affect performance of the equipment so modified.

SAFETY PRECAUTIONS

PLEASE READ AND OBSERVE ALL SAFETY PRECAUTIONS

ALL PERSONS WHO WORK WITH OR ARE EXPOSED TO POWER TUBES, POWER TRANSISTORS, OR EQUIPMENT WHICH UTILIZES SUCH DEVICES MUST TAKE PRECAUTIONS TO PROTECT THEMSELVES AGAINST POSSIBLE SERIOUS BODILY INJURY. EXERCISE EXTREME CARE AROUND SUCH PRODUCTS. UNINFORMED OR CARELESS OPERATION OF THESE DEVICES CAN RESULT IN POOR PERFORMANCE, DAMAGE TO THE DEVICE OR PROPERTY, SERIOUS BODILY INJURY, AND POSSIBLY DEATH.

DANGEROUS HAZARDS EXIST IN THE OPERATION OF POWER TUBES AND POWER TRANSISTORS

The operation of power tubes and power transistors involves one or more of the following hazards, any one of which, in the absence of safe operating practices and precautions, could result in serious harm to personnel.

A. HIGH VOLTAGE - Normal operating voltages can be deadly. Additional information follows.

B. RF RADIATION - Exposure to RF radiation may cause serious bodily injury possibly resulting in Blindness or death. Cardiac pacemakers may be affected. Additional information follows.

C. HOT SURFACES - Surfaces of air-cooled radiators and other parts of tubes can reach temperatures of several hundred degrees centigrade and cause serious burns if touched. Additional information follows.

D. RF BURNS - Circuit boards with RF power transistors contain high RF potentials. Do not operate an RF power module with the cover removed.

HIGH VOLTAGE

Many power circuits operate at voltages high enough to kill through electrocution. Personnel should always break the primary AC Power when accessing the inside of the transmitter.

RADIO FREQUENCY RADIATION

Exposure of personnel to RF radiation should be minimized, personnel should not be permitted in the vicinity of open energized RF generating circuits, or RF transmission systems (waveguides, cables, connectors, etc.), or energized antennas. It is generally accepted that exposure to "high levels" of radiation can result in severe bodily injury including blindness. Cardiac pacemakers may be affected.

The effect of prolonged exposure to "low level" RF radiation continues to be a subject of investigation and controversy. It is generally agreed that prolonged exposure of personnel to RF radiation should be limited to an absolute minimum. It is also generally agreed that exposure should be reduced in working areas where personnel heat load is above normal. A 10 mW/cm^2 per one tenth hour average level has been adopted by several U.S. Government agencies including the Occupational Safety and Health Administration (OSHA) as the standard protection guide for employee work environments. An even stricter standard is recommended by the American National Standards Institute which recommends a 1.0 mW/cm^2 per one tenth hour average level exposure between 30 Hz and 300 MHz as the standard employee protection guide (ANSI C95.1-1982).

RF energy must be contained properly by shielding and transmission lines. All input and output RF connections, such as cables, flanges and gaskets must be RF leak proof. Never operate a power tube without a properly matched RF energy absorbing load attached. Never look into or expose any part of the body to an antenna or open RF generating tube or circuit or RF transmission system while energized. Monitor the tube and RF system for RF radiation leakage at regular intervals and after servicing.

HOT SURFACES

The power components in the transmitter are cooled by forced-air and natural convection. When handling any components of the transmitter after it has been in operation, caution must always be taken to ensure that the component is cool enough to handle without injury.

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1 Overview

The VPe XG device is required for adding HD broadcast capability to the STX line of RF transmission products. The product comes with the next generation Exgine HD carrier generator and Vector Power Enhancement, VPe, adaptive pre-distortion control.

1.1 Instructions

Use this document as a technical resource for the VPe XG system option. Follow the detailed installation instructions and interfacing descriptions to integrate the VPe XG in your STX broadcast system. Refer to user interface detail sections for descriptions of front panel LED display dynamics, interfacing through the transmitter control center, Exgine web page, VPe web page, and system troubleshooting. Follow detailed maintenance directions and, after troubleshooting and diagnosing failures, follow complete sub-system replacement steps.

1.2 Other Documents

Exporter, transmitter, and (optionally) Importer systems are all required for HD broadcast system operation. This document may contain references to these system types for interconnection requirement purposes, however details specific to these types of products are not included in the scope of this manual.

Electronic copies of these and other BE technical documents can be retrieved from the Broadcast Electronics website at http://www.bdcast.com/information-center/. Follow navigation on the left side of the page – authorized login is required for download of technical documents.

Quality HD Radio broadcast specification is managed by iBiquity Digital Corporation, the licensing body for all core HD Radio systems. The latest detailed system validation instructions and links to NRSC standard documentation can be found at the iBiquity Digital website at http://www.ibiquity.com/broadcasters.

1.3 Installation and Initial Setup Summary

All of the following steps are required to get a standard VPe XG system running:

1. Rack Mounting
2. AC Power
3. RF Feedback Sample
4. BE-Interface Cable
5. 10 MHz Cable
6. RF Drive Cable
7. Data Ethernet Port
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9. Indicate VPe Presence with STX System
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11. Turn on AC
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13. Setup Digital Operation Mode
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21. Feedback Tuning
22. Verify Spectrum
23. Adjust Power Amplification
24. Switch to Antenna and Begin Broadcast

1.4 Product Specifications

Figure 1 – VPe XG

Table 1 – Technical Specifications

Parameter	Specification
Physical	
Height	1 RU 1.75” (4.45 cm)
Width	19” (48.3 cm) EIA Rack Mount
Depth	22.5” (57 cm) including connectors
Weight	11 lbs (5.0 kg) unpacked
Environmental	
Temperature	-10°C to +50°C
Altitude	10,000ft (3048M) maximum
Humidity	95% maximum, non-condensing
AC Input	
Connector	IEC C14
Voltage	90 to 264 V AC Split Phase
Frequency	47-63 Hz
Power Factor	≥0.98
Surge Protection	Not included – External surge protection required
Power Consumption	54 W (calculated)
Power	0.5 Amps Typical at 110V
RF Output	
Connector	BNC
Expected Impedance	50 Ohms
Power	-20 dBm to 20 dBm (depending on setup)
Carrier Frequency	
Range	87.5MHz to 108MHz; 10kHz increments
Stability	+/-150 Hz
Modulation	
Type	Direct-to-Channel – FM, FM+Digital (OFDM), All Digital
Capability	Absolute Maximum +\- 450 kHz From Carrier

RF Feedback Input	
Connector	BNC
Impedance	50 Ohms +/- 10%
Absolute Maximum Power	20 dBm
Input Range	2 – 20 dBm
10 MHz Input	
Connector	BNC
Wave Form	Sine
Expected Accuracy	+/- 25 Hz or better
Impedance	50 Ohm +/- 10%
Expected Level	1 V p-p nom, 0.1 V p-p min, 3 V p-p max
1 Pulse Per Second Input	
Connector	BNC
Wave Form	Square, Rising Edge
Expected Pulse Width	100 µs nom, 10 µs min
Impedance	High, ~1 M Ohm
Expected Level	3.3V CMOS: 0-1V LOW, 2.3-5.5V HIGH
10 MHz Output	
Connector	BNC
Wave Form	Sine wave
Expected Impedance	50 Ohm
Level	1.0 V p-p minimum into 50 Ohms
Accuracy	+/- 25 Hz internal clock, 10 MHz Input accuracy if external
1 Pulse Per Second Output	
Connector	BNC
Wave Form	Square, Rising Edge
Pulse Width	100 µs nom
Expected Impedance	High, > 5 k Ohm
Level	3.3V CMOS
44.1kHz Word Clock Out	
Connector	BNC
Wave Form	Square, Rising Edge
Duty Cycle	50% nominal
Expected Impedance	High, > 5 k Ohm
Level	3.3V CMOS
Accuracy	+/- 0.1Hz
HDC AES OUT	
Standard	AES3
Connector	XLR
Expected Impedance	110 Ohm
Level	2.0 V p-p nominal (digital square wave)
Sample Rate	44.1kHz

VPe Ethernet Port	
Connector	RJ45
Network Type	10/100Base-T
Auto-MDIX	Yes
Data Ethernet Port	
Connector	RJ45
Network Type	10/100Base-T
Auto-MDIX	No
GPS Antenna Input	
Connector	None (hole plug, reserved feature)
TTL Logic Inputs/Outputs	
Wiring method	Terminal block or D-Subminiature solder cup
Expected Impedance	1k Ohm minimum
Level	+5V CMOS
Regulatory	
FCC; IC; CE; BETS-6; IEC215	Meets or exceeds requirements

1.5 Default Operation

Defaults for general system settings, basic VPe settings, and basic Exgine settings are stored in the transmitter system controller/exciter. These types of settings are not carried over within the VPe XG system.

Defaults for advanced VPe or Exgine settings are not controlled through the system controller exciter. These advanced settings can only be changed or reset through the web pages for those sub-systems.

2 Preparing to Install

2.1 Verify Contents of Shipment

☐ 909-4000-C		VPe XG Assembly
☐ 979-4000		VPe XG Installation Kit
☐ 418-1550-010	2	10-Pin Terminal Block Plug
☐ 420-0007	4	Phillips Screw 12-24X3/4"
☐ 420-0710	4	Phillips Screw 10-32X5/8"
☐ 421-0002	4	EIA Rack Screw CLIPS 12-24
☐ 423-1018	4	Fiber Washer .500X.218X.030
☐ 682-0001	1	AC Cord, American
☐ 682-0003	1	AC Cord, European
☐ 949-4162	1	BE-Interface Cable Harness
☐ 949-4163	1	BNC-BNC 1FT Coaxial Cable
☐ 949-4164	1	BNC-SMA 2FT Coaxial Cable
☐ 949-4166	1	VPe/TX Interface Stub
☐ 979-6103		VPe XG Manual Binder
☐ 597-6101	VPe XG Technical Manual	
☐ 598-0010-001	1	1” BE Blue Binder

2.2 Items Sold Separately or Not Supplied

☐ Broadcast Electronics STX Generation II family FM transmission system with system controller and exciter platform and the following installed features:

- ☐ Dummy load rated at full transmitter RF output power
- ☐ Output RF sample for spectrum analyzer
- ☐ Output RF sample for VPe RF feedback (sized per RF feedback input specifications)
- ☐ Coaxial cabling for all RF samples

Note: RF output sample coupler and RF feedback cable kits are available for purchase upon request. This includes kits for integration with BE’s C, S, T, and STX families of transmitters.

☐ HD Radio Exporter

☐ IP Networking switch with ports for Ethernet connectivity to all system Ethernet ports:

- ☐ Local PC (port for configuration)
- ☐ Exgine Data
- ☐ VPe
- ☐ Exporter and/or studio-transmitter link
- ☐ STX (optional)

☐ IP Networking cables for all ports

Optional

☐ Remote station interface controller and wiring for desired monitoring connections

2.3 Tools and Materials

- ☐ PC with Ethernet capability a web browser installed
- ☐ Spectrum Analyzer
- ☐ Small Flat screwdriver
- ☐ Large Phillips screwdriver
- ☐ 5/16” Wrench
- ☐ Soldering iron and solder (required for some systems for installation steps section 3.9 Indicate VPe Presence with STX System)

Cable Management

- ☐ Tie-wraps

2.4 Estimated Time for Installation

A first time installer with the standard system setup may take as little as about one hour from unpacking to RF power-on.

More time may be spent in the final tuning stages to optimally balance transmitter efficiency/lifespan and HD signal quality.

3 Installation and Initial Setup

3.1 Rack Mounting

On the front mounting rails, locate the desired set of one rack unit. Non-threaded rails: Use provided clips in the lowest and highest holes of the two selected rack units.

Insert four provided screws in felt washers. Prop the VPe XG up in place and secure the system in the rack with the screws as shown.

Figure 2 – Rack Mounting

3.2 AC Power

Connect AC power from the transmitter, or use one of the provided AC power cables to plug into a power socket at the installation facility.

Figure 3 – AC Power Input

3.3 RF Feedback Sample

Connect the BNC cable from the RF sample port (sold separately) to the RF FEEDBACK input.

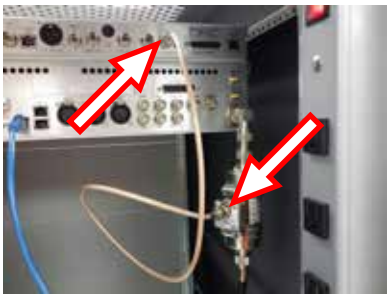


Figure 4 – RF Sample to Feedback Input

3.4 BE-Interface Cable

Connect D-subminiature ends of the provided 949-4162 BE-Interface cabling harness to the 25-pin BE-INTERFACE on the VPe XG and the 37-pin BE- INTERFACE on the STX system. Use a small flat screwdriver to secure the screws on the connectors.

Figure 5 – BE-Interface Cable

Standalone system configurations: connect the provided 949-4166 miniature rectangular wire stub to the BE-Interface cable MR connector shown (left). If using a transmitter integration cable, such as the 949-4161 STXe extended I/O cable shown (right).

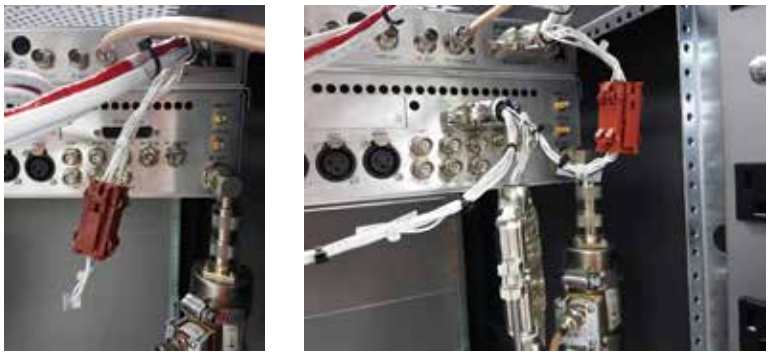


Figure 6 – Typical BE-Interface to Transmitter Interface Connections

3.5 10 MHz Cable

Connect the provided 949-4164 BNC to SMA cable from VPe XG 10 MHz output to STX 10 MHz input.

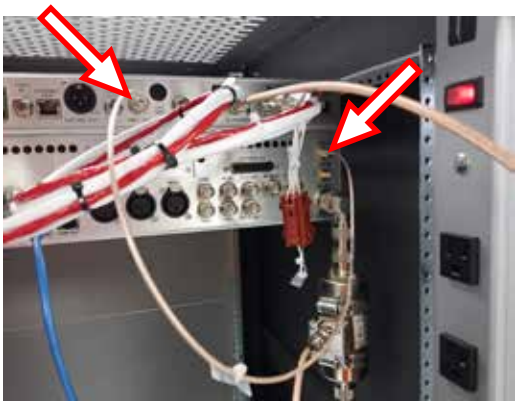


Figure 7 – 10 MHz Cable

3.6 RF Drive Cable

Use coaxial cabling to connect VPe XG RF OUT to the appropriate RF drive input for the system. In STXe 60 (as pictured), STXe 500, and STX LP Generation II 1kW systems use the provided 949-4163 BNC cable to connect to PA RF IN. In STX LP Generation II 2kW, 3kW, and 5kW systems use the exciter drive cable that comes with those transmitters to typically connect between EXC RF OUT and RF SPLITTER IN.

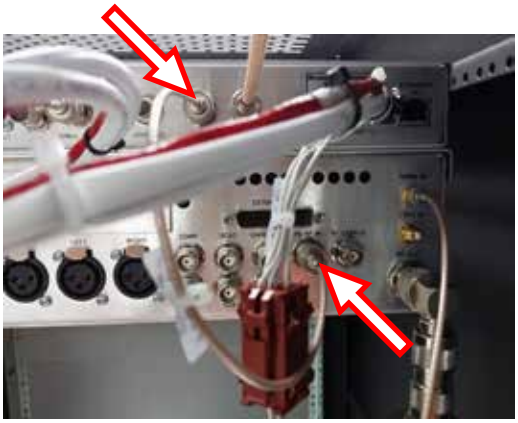


Figure 8 – RF Drive Cable

3.7 Data Ethernet Port

Connect an Ethernet cable from network equipment (sold separately) to the ETHERNET DATA port.

Figure 9 – Exgine Data Ethernet Port

3.8 VPe Ethernet Port

Connect an Ethernet cable from network equipment (sold separately) to the VPe Ethernet port.

Figure 10 – VPe Ethernet Port

3.9 Indicate VPe Presence with STX System

System setups with wiring harnesses, such as 949-4161 STXe extended I/O cables, that are already equipped for the VPe setup can skip this section.

1. Reverse the final steps of failsafe installation steps in the STX system technical manual to remove the shell from the 37-pin D-Subminiature GPIO connector.

2. Wire pin 14 to a ground connection, such as pin 37. Pin numbers are molded into the solder cup connector. This connection may be direct wiring or through an external controller as needed for engineered systems.

3. Replace the connector shell on the solder cup connector, and replace the connector on the STX system. Secure screws with a small flat screwdriver.

3.10 Exporter

Verify that the IP data connection is networked through the local switch or across an IP studio-transmitter link.

Hybrid systems: connect delayed FM AES audio from the Exporter to the AES input. External audio processing between the Exporter and Exgine is highly recommended.

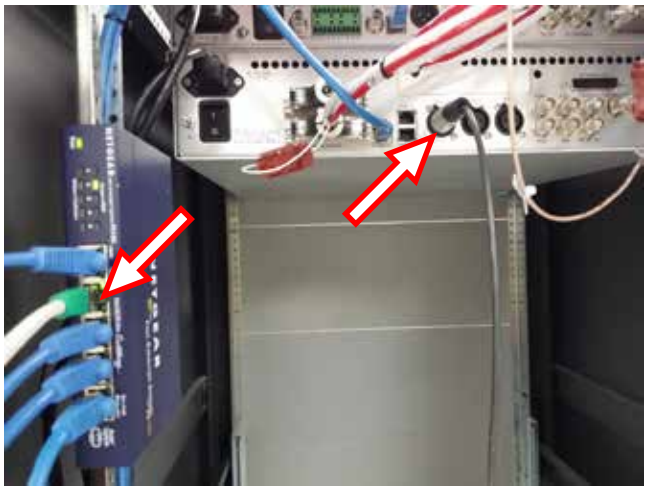


Figure 11 – Example Exporter Connections

3.11 Turn on AC

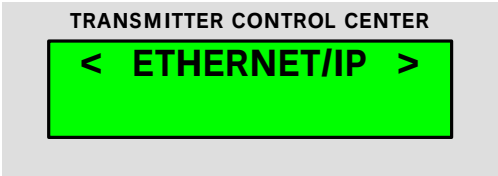
Flip the AC rocker switch on the VPe XG chassis to power on the system.

Turn AC power on to the STX system. RF transmission should remain off.

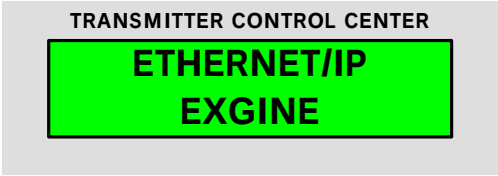
3.12 Exgine IP Configuration

Consult your network manager or internet service provider to ensure that the correct IP settings are used. IP setup in the Exgine and Exporter must be synchronized for successful transfer of data in HD broadcast systems.

1. From the main screen on the transmitter control center on the front panel of the STX system, press up or down to navigate to the ETHERNET/IP menu. Press enter to continue.

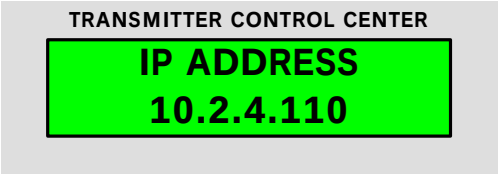


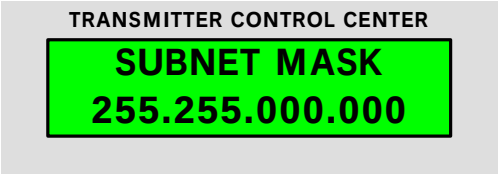
2. Press up or down to select the Exgine port. Press enter to continue.

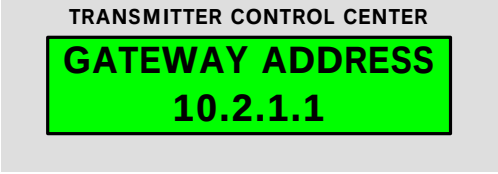


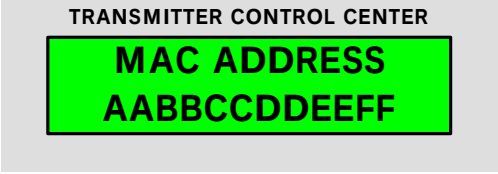
3. Press up or down to select the IP parameter to be observed or changed. Press enter to continue.

4. This level displays the current state of the IP port, which includes DHCP, IP address, subnet mask, gateway address, and MAC address. Press up or down to observe the currently active IP configuration (0.0.0.0 IP address typically indicates that the port is not yet up to date or connected), and then press enter to modify the static IP setting.

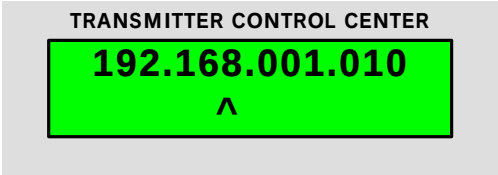








5. Press left or right to move the cursor to any of the 12 digits. Press up or down to increment or decrement the number. Press enter when finished making the setting change.

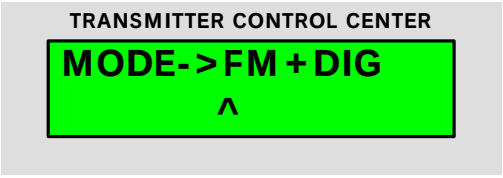


6. Give the systems minutes to synchronize. A successful IP setup will result in Green EXGINE STATUS LED on the front panel of the VPe XG.

3.13 Setup Digital Operation Mode

To set the system controller and exciter operation mode, navigate to the < SETUP > menu and press down to select the setting for the current mode (typically this will be "FM")

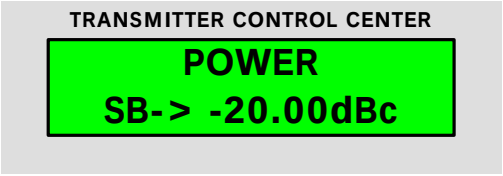
Press the enter button and use the up/down arrow buttons to select the desired operation mode.



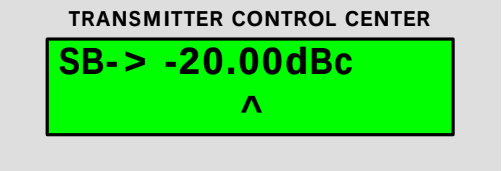
Press the enter button to save this setting and cause it to take effect in the system.

3.14 Set Sideband Level – FM+Digital Hybrid Mode Only

FM+Digital operation mode has a dedicated setting for total power level of digital carriers relative to the FM carrier (dBc). To accomplish this using the front panel LCD control interface, navigate to the < PWR SET > menu and navigate to sideband level control.



Use the left and right arrow buttons to move the cursor to the ones, or tenths place and adjust using the up and down arrow buttons. The setting immediately takes effect in the system.



3.15 Set Total Power Output Levels

The system controller and exciter system holds independent power control settings for all operating modes: FM, FM + Digital (hybrid), and Digital only. To adjust total output power settings for the desired power mode navigate to THE < PWR SET > menu. Use the up and down arrows to cycle through the sections until the desired mode displays.

Move the cursor using the left and right arrow buttons. Adjust the setpoint value at the cursor with the up and down arrow buttons. To save the setting and have it take effect on the system press the enter button.

3.16 Access VPe Web Interface

Repeat steps in the Exgine IP configuration section, but modify VPe IP setup (depending on desired network setup).

1. Connect a PC to the network with the VPe Ethernet Port
2. Direct a web browser to the VPe IP address.
3. Login with User Name “admin” and leave the password field blank.

Figure 12 – VPe Web Page Login

3.17 Set VPe Time and Date

Set VPe time and date through web page for more informative VPe event logging.

1. Click the SYSTEM menu button in the lower left corner, and click TIME/DATE.

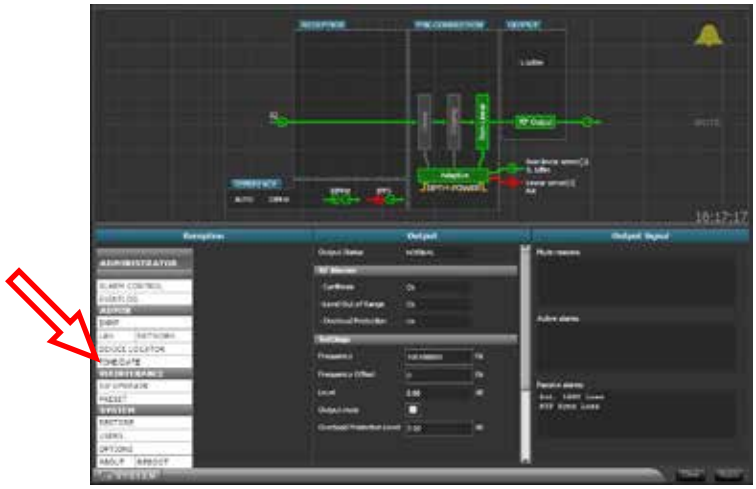


Figure 13 – SYSTEM Menu

2. Adjust the date, time, and Timezone fields to the current time. Click Apply when finished.

Figure 14 – Time/Date Setting Screen

The web page can be left open for a later setup step.

3.18 Access Exgine Web Interface

Access to the Exgine web page is required to change 10 MHz to external or to change the MAC address. Setups that do not require either can skip this step.

1. Connect a PC to the network with the Data Ethernet Port
2. Direct a web browser to the Exgine IP address.
3. Login with User Name “be_admin” and password “broadcast”.

Figure 15 – Exgine Login Page

3.19 10MHz Source

Exgine systems determine 10 MHz clocking from the Exporter data stream by default. Changing the 10 MHz source to a direct connection from a transmitter-site Exporter or other more accurate clock source improves the quality of RF signals, and is recommended for best signal broadcast quality.

1. Connect an external 10 MHz cable to 10 MHz IN on the back of the VPeXG. Valid sources include a shared external GPS 10MHz signal or an Exporter output.
2. In the Exgine Web Page, click Setup and the Sync tab.
3. Select EXT_10_MHz from the dropdown menu, and click Apply.

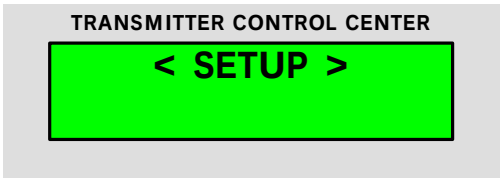
Figure 16 – Exgine 10 MHz Source Selection

3.20 Adjust Gain Calibration

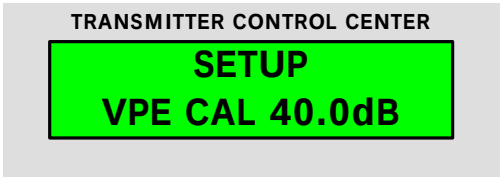
System gain varies widely depending on the type and range of power amplifiers. To operate correct power control in all expected configurations, the VPe XG is designed to internally allow user gain adjustment to offset overall system gain variations.

RF OUTPUT IS TURNED ON DURING THIS STEP. THE SYSTEM POWER OUTPUT MUST BE DIRECTED INTO THE FULL POWER DUMMY LOAD DURING THE GAIN CALIBRATION, FEEDBACK CALIBRATION, AND INITIAL ADAPTIVE PRE-DISTORTION.

1. Navigate to < SETUP > on the front panel of the STX system.

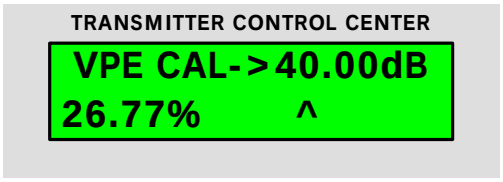


2. Press up and return to enter the VPE CAL screen. Ensure that the setting remains at the 40.0dB default. If it isn't, press enter and change it to 40.0 dB. Failure to do this may result in excessively high system gain that causes sudden spikes in forward power.

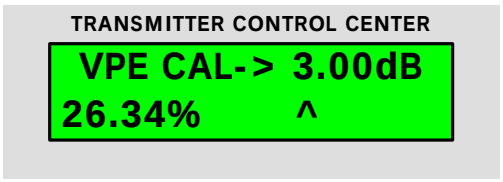


3. Turn system power amplification on.

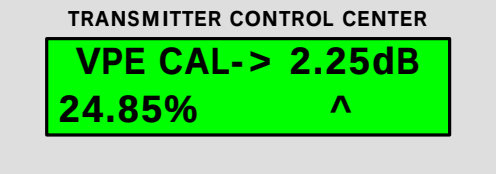
4. Navigate to the VPE CAL screen once again and press return to edit the cal setting. The displayed 26.77% indicates an STX system power control digital amplitude scale factor. 25.00% is the expected calibration, and 26.77% represents 110% of expected nominal power.



5. Decrease this gain attenuation setting by pressing the down button. Power (dB) out of the system increases in proportion to the setting change. Do this until the percentage begins to change.



6. Move the cursor to the right and begin adjusting in quarter dB steps, and continue to reduce until the amplitude scale factor is one adjustment step under 25.00%.



3.21 Feedback Tuning

At this time the system should be running at full power.

1. Bring up the VPe web page on the PC. Take note of the Non-linear sense input power level.

Figure 17 – RF Feedback Level

2. Use a small flat screwdriver to adjust the RF feedback tuning on the back of the unit chassis until the Non-linear sense number reads 0 dBm within +/- 1 dB. Turning clockwise reduces input power, and turning counter-clockwise increases power.

3.22 Verify Spectrum

In hybrid FM + Digital systems, audio should be modulating the FM carrier during this process.

1. Connect a spectrum analyzer to a designated output RF sample port.

2. Set up a spectrum analyzer to verify the HD Radio broadcast signal (refer to HD regulatory details in other documents).

3. Issue an adaptive pre-distortion factory reset through the VPe web page.

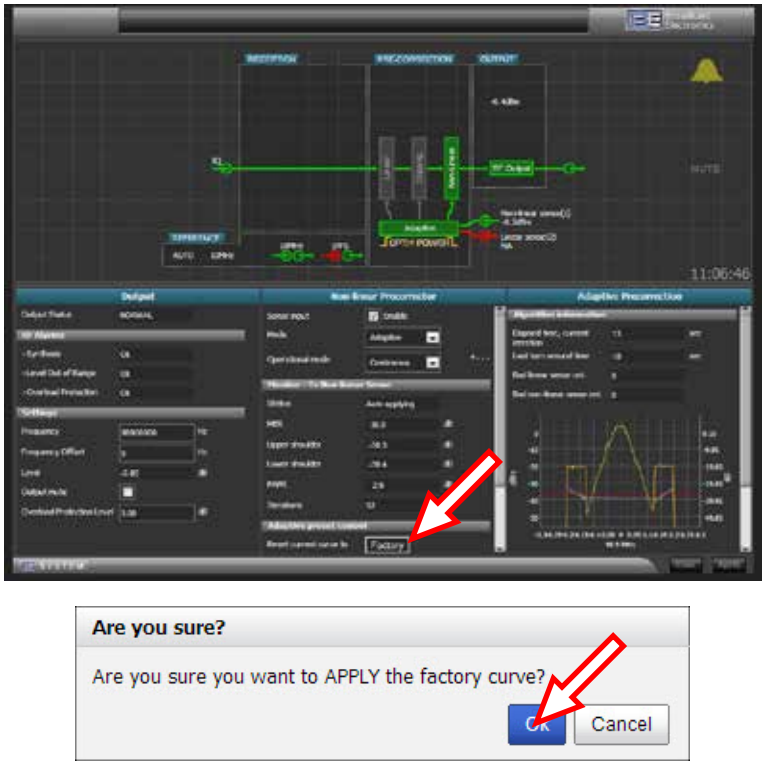


Figure 18 – Pre-correction Factory Reset

The spectrum will likely look similar to the figure here:

Figure 19 – Initial Spectrum

4. Allow the VPe system to iterate for approximately five minutes. A successful adaptation process will look similar to the figure here.

Figure 20 – Passing Spectrum

3.23 Adjust Power Amplification

If VPe has successfully controlled RF within regulatory limits, please skip this section.

Very low power amplification systems may operate sub-optimally without significant risk, however, as transmitters scale to higher power levels, thermal factors and inefficient power consumption become much more significant. In mid to high transmitter power ranges, added tuning effort can pay off considerably. Follow the steps in this section to verify valid operation.

ALWAYS CONSULT THE TRANSMITTER TECHNICAL MANUAL BEFORE ADJUSTING POWER AMPLIFIER SYSTEMS.

If VPe has not corrected the signal after more significant time, steps need to be taken to improve the linearity of the system. Follow directions in your transmitter's manual to make power amplifiers more linear. In STX transmitters, for example, PAV may need to be increased.

Always give VPe time to adapt after making changes in the system.

CHECK PA HEAT SINK TEMPERATURES. THE TEMPERATURE DIFFERENCE FROM SURROUNDING AIR TEMPERATURE (TEMP RISE) SHOULD NOT EXCEED RECOMMENDED OPERATION.

If the system still does not operate within spectral masks, reduce total power setpoint or IBOC side band power levels.

If the signal remains degraded, please contact RF Technical Services for assistance.

3.24 Switch Output to Antenna and Begin Broadcast

At this point in the setup process, the system should be able to operate within regulatory limits.

1. Power down the amplification system.
2. Turn off and lock out AC.
3. Switch the final output to a broadcast antenna signal path.
4. Turn RF back on.
5. Verify the spectrum still meets mask under these different, true antenna, load conditions.

4 Optional Installation Steps

4.1 Remote Station Interface Wiring

Refer to section 5.1 for Exgine Input/Output pin functions.

1. Insert control wiring into the provided terminal block connectors.
2. Use a small flat screwdriver to secure the wires.
3. Plug the terminal blocks into the appropriate connector slot.

5 Rear Panel Features

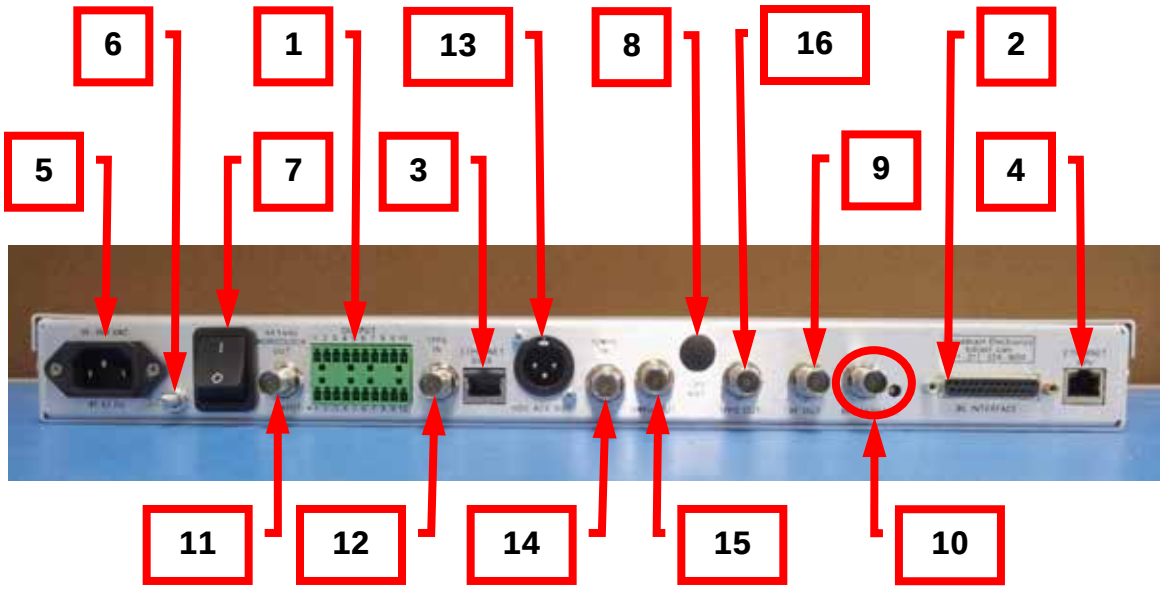


Figure 21 –Rear Panel Connectors

5.1 Exgine OUTPUT/INPUT

General purpose input/output Exgine terminal block connectors. These are used in remote station interface control and other machine interfacing to the Exgine module. Pin descriptions are below in Table 2.

Note that “low” logic refers to a connection to isolated logic ground pin OUTPUT 10. “High” logic is a connection to +5V. Active edge refers to a transition from the inactive state to the active state. For example, active low would be a momentary transition from the high state to the low state, and the implication is that no action is performed on the transition back to high. A momentary pulse such as this should be approximately 100ms in duration to ensure capture of the event.

Table 2 – OUTPUT Pins Description

Pin	Name	Description
1-9	Reserved	Reserved
10	ISO GROUND	Isolated ground

All inputs are internally pulled up to isolated +5V via 2kOhm resistor. Because this voltage is isolated, the isolated ground pin must be wired to a ground that is in common with the input driver source. One option to accomplish this is to wire-jump this pin to input chassis ground pin 10, and ensure connect chassis grounds are connected between the remote control system and the VPe XG.

Table 3 – INPUT Pins Description

Pin	Name	Description
1	DIG ON	Active low edge turns digital carriers on (or leaves them on).
2	DIG OFF	Active low edge turns digital carriers off (or leaves them off).
3-6	Reserved	Reserved
7	RESET Exgine	An active low signal causes the Exgine system to reset.
8-9	Reserved	Reserved
10	GROUND	Chassis ground

5.2 BE INTERFACE

Broadcast Electronics machine interface, a D-Subminiature 25 female connector. This jack is intended to interface with BE cable harness 949-4162. The harness caries logic controls, communications, digital I/Q, and machine interfacing. Any usable I/O logic is brought out to an MR cable-to-cable connector with the pin-out listed in the table below.

All logic inputs are internally pulled high via isolated +5V through 2kOhm resistors. Connect to within 0.8V of isolated ground to activate; ground must be common with input driving. Avoid asserting voltages.

Table 4 – VPe/TX Interface Connection

Pin	Direction	Name	Description
1	Input	UNMUTE	Requires sustained active low for the system to possibly output power through RF OUT.
2	Input	MUTE	A sustained active low to mute the RF output signal. This works independently of the UNMUTE input.
3	Output	HD STATUS	High when digital RF carriers are present (or expected to be present). Low when carriers are known to be off by control or detected failure.
4	Input	RESET VPe	An active low signal causes the VPe system (gateway controller and VPe module) to reset.
5	Input	Reserved	
6	N/A	ISO GND	Isolated Ground. Connect to ground that is common with drivers for all input pins in this interface.
7	Output	VPE XG PRESENT	Outputs logic low to indicate hardware setup configuration.
8	Output	Reserved	
9	N/A	N/A	(No connection)

5.3 ETHERNET DATA

Standard Ethernet communications for HD system control message and HD data from the Exporter. Direct connections to a PC require a crossover cable. Other network controller connection can be made with any 10- or 100Base-T Ethernet cable. Connect to STL, other networking equipment, or directly to an Exporter (products sold separately). An isolated network is recommended to prevent network traffic related service disruptions.

5.4 ETHERNET VPe

Standard Ethernet communications port for VPe system control and monitoring. Connect to a network switch, internet gateway, or directly to a PC.

IP-based interfaces such as the built-in website and SNMP require this to be connected and the network configured.

5.5 AC Input

Power input socket for electrically powering the unit. Plug into standard split phase outlets with a power cable.

5.6 Ground

Chassis ground bolt with nut intended to connect to optional external grounding straps. This minimizes analog audio noise caused by ground loops.

5.7 Power Switch

Double pole double throw power switch. This switch cuts power input to the VPe XG system just after the AC Input socket.

5.8 GPS ANT

GPS antenna, reserved.

5.9 RF OUT

Exciter RF output connector. This BNC connector outputs the internally generated exciter power level analog RF signal with digital carriers and transmitter power control scaling (for setups where this is applicable).

5.10 RF FEEDBACK and Calibration

Broadcast sample feedback input. This low power (exciter level) RF BNC input is expected to input an RF sample from the transmitter output including any channel filtering. The VPe system utilizes this signal to automatically pre-correct the RF out wave form. A potentiometer adjacent to the feedback input allows tuning of the feedback input RF power level during system setup.

5.11 44.1 kHz WORDCLOCK OUT

Digital audio clock BNC output for optional audio synchronization in some setups. This is synchronized with the system 10 MHz clock.

5.12 1PPS IN

Pulse per second input: this BNC is for future use in synchronized systems.

5.13 HDC AES OUT

Decoded HD1 AES audio output XLR: this digital audio output is for use in monitoring or alternate system setups.

5.14 10MHz IN

This input BNC is for setups with a superior external 10 MHz source, such as an external shared GPS clock. This does not auto-detect, and must be set in the Exgine web page. If this 10MHz source is selected but absent, the system will not output an RF signal.

5.15 10MHz OUT

RF frequency control BNC output for connection to system controller and exciter system internal to STX exciters and transmitters. This output is synchronized to the 10 MHz input when external clock source is selected in the Exgine.

5.16 1PPS OUT

Pulse per second output: this BNC is for future use in synchronized systems.

6 Front Panel Features

The front panel display serves as a general status indicator. At most, these LEDs can indicate four unique states: off, red, green, and amber (both red and green). Most only indicate with a single color on or the led completely off. See Troubleshooting for more details in full troubleshooting and problem isolation in the VPe XG system.

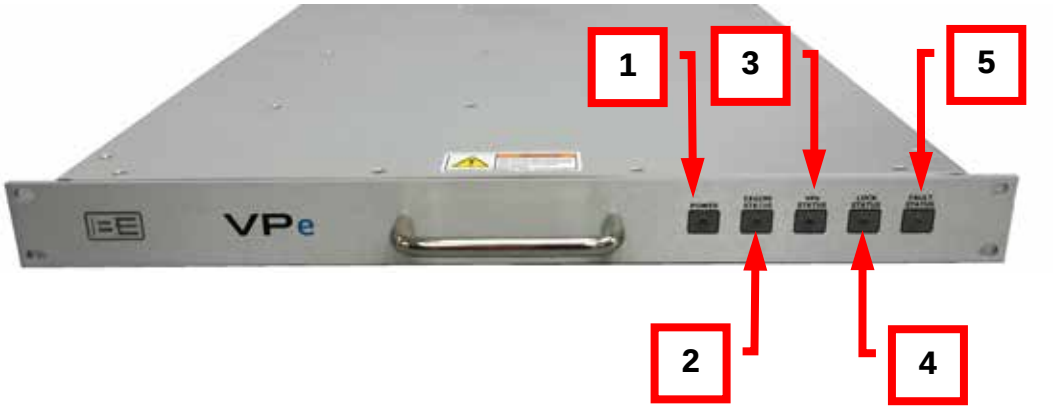


Figure 22 – Front Panel

6.1 POWER

A green LED indicates AC power is on, power supplies are successfully generating DC, and wiring is delivering power to the system.

In the unpowered state this LED is off (as are all other LEDs).

If this LED is on but all other LEDs are off or behaving erratically, there may be a problem in the gateway controller board.

6.2 EXGINE STATUS

Red and green LEDs indicate the monitoring status of the Exgine sub-system.

Red indicates the Exgine is not responding or a hardware failure is detected.

Amber indicates data from the Exporter has stopped unexpectedly.

Green indicates HD carriers are turned on and Exgine is processing HD data.

No color indicates that the HD carriers have been turned off.

6.3 VPE STATUS

Red and green LEDs indicate the monitoring status of the VPe sub-system.

Red indicates a critical problem. This may be loss of 10 MHz source, detected RF output failure, or communications are not responding.

Green indicates normal VPe function.

6.4 LOCK STATUS

A green LED indicates the status of 10 MHz clock generation and use. This LED is on when successfully locked to the selected source. This may take up to 24 hours if 10MHz is derived from the HD Ethernet stream. If external clock reference is selected, this will always quickly turn green, and external reference problems reveal in the VPe sub-system.

6.5 FAULT STATUS

A red LED indicates some error condition that prevents valid operation has occurred, but may or may not still be active. This LED remains on until the next fault reset command is issued through the STX system controller.

7 Theory of Operation

Refer to the system block diagram in Figure 23 on the following page.

Broadcast Electronics VPe XG systems require the system controller and exciter platform found in STX FM transmission systems. This includes STX LP Gen II transmitters and STXe exciters. BE has exciting plans to extend this platform into additional FM broadcasting products

Dedicated hardware is utilized for critical protection and safety control functions. Embedded microcontroller units are utilized for user interfacing (including IP), monitoring, and control functions.

Exgine systems input IP data messages containing coded digital wave forms (HD and DRM+) composed of orthogonal frequency division multiplexed OFDM carriers. HD carrier blocks occupy channels 100 to 200 kHz from center on both sides of traditional FM signals as “sidebands”. DRM+ replaces traditional FM channels entirely as a digital-only wave form. See standards documents for more details.

The controller and exciter platform is relied upon to generate a traditional FM carrier, perform FM+HD hybridization, and provide all scaling of carriers as required for transmission system operation and power control.

The operating mode setup determines how power is regulated. This is coupled to how the transmitter controls RF power at all power amplifiers and exciter drive RF power levels at the VPe XG output:

FM+Digital and Digital-only operating modes maximize power amplifier linearity and minimize digital carrier distortions throughout the broadcast system by utilizing constant RF amplifier network gain. A gain adjustment is performed during system setup to correct for overall transmission system gain variations. Exciter drive amplitude at the VPe XG RF output is regulated to control total output power.

VPe contains crest factor reduction and adaptive pre-correction technologies. Feedback input from a final transmission system output RF sample is analyzed in digital signal processors and modified per these control techniques before being output as an improved analog RF output.

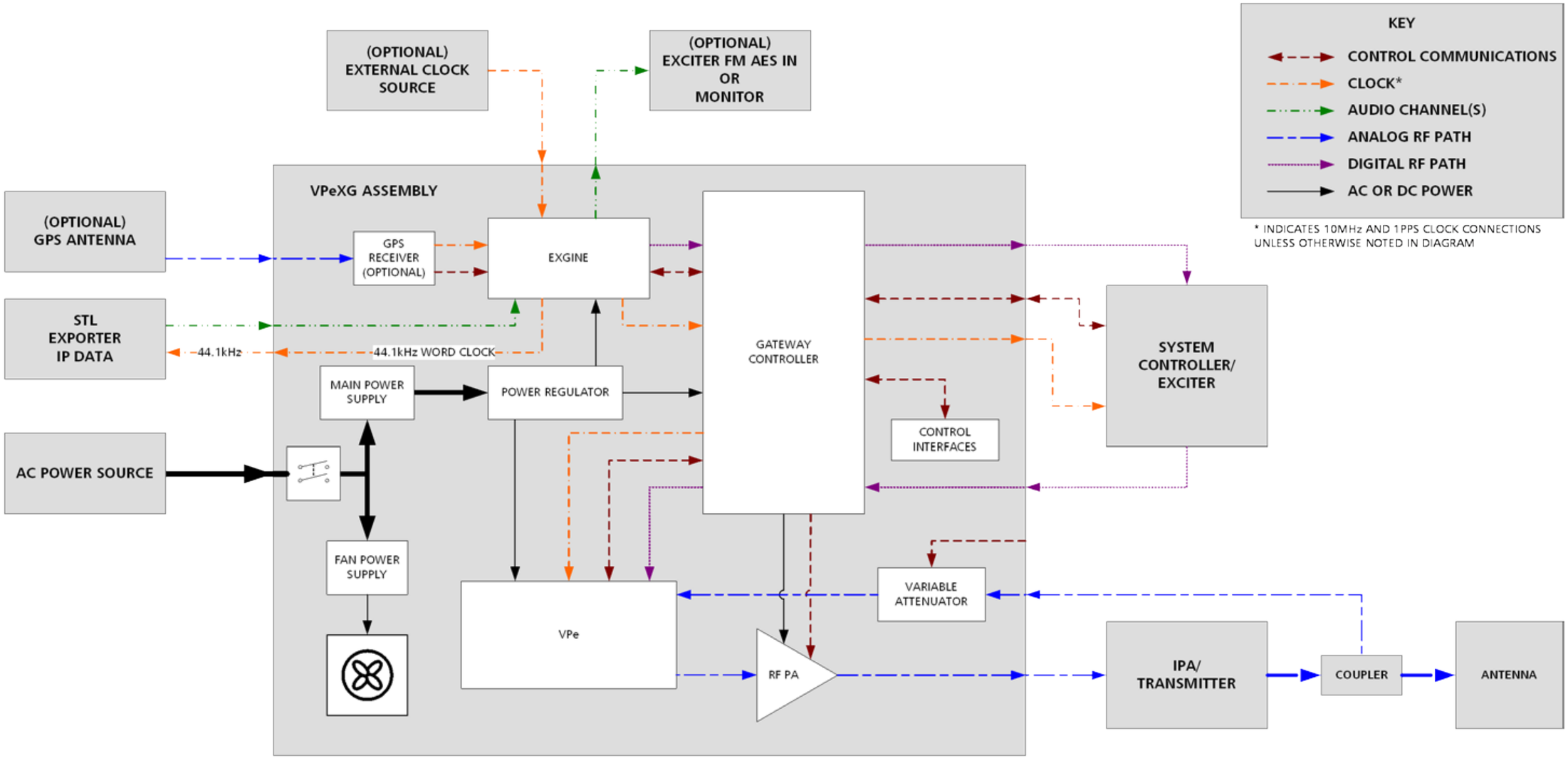


Figure 23 – VPe XG System Block Diagram

8 VPe Web Page

VPe is equipped with a built in HTTP web server. This requires networking equipment connections to the appropriate ETHERNET VPE RJ45 jack, and a computer with standard web browser. To connect, direct your web browser to the currently active IP address in VPe (setup during installation).

MODIFICATION OF ADVANCED SETTINGS MAY CAUSE VPE TO OPERATE IN A WAY THAT DAMAGES TRANSMISSION EQUIPMENT OR CAUSES THE SYSTEM TO FAIL TO MEET LOCAL REGULATIONS. IT IS THE RESPONSIBILITY OF THE SYSTEM ADMINISTRATOR/OPERATOR TO ENSURE SAFE AND ADEQUATE SYSTEM OPERATION THAT MEETS LOCAL REGULATORY REQUIREMENTS.

Log In with User Name: "admin" only (blank password entry).

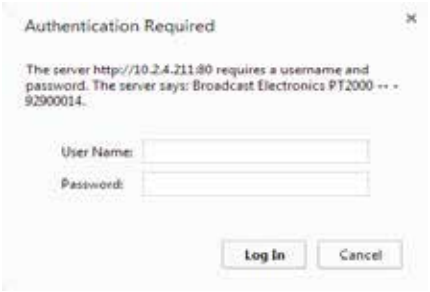


Figure 24 – Web Login

To access the various system elements in the following sections, simply click and hold the desired system element and then drag it to one of the three columns below the diagram as shown for the Adaptive Pre-correction block example in Figure 25 below. Graphical frames – such as "REFERENCE" and input/output indicators can also be manipulated in this manner. Also note that in select menus, "+…" to the right may be clicked to expand the interface and see additional options.

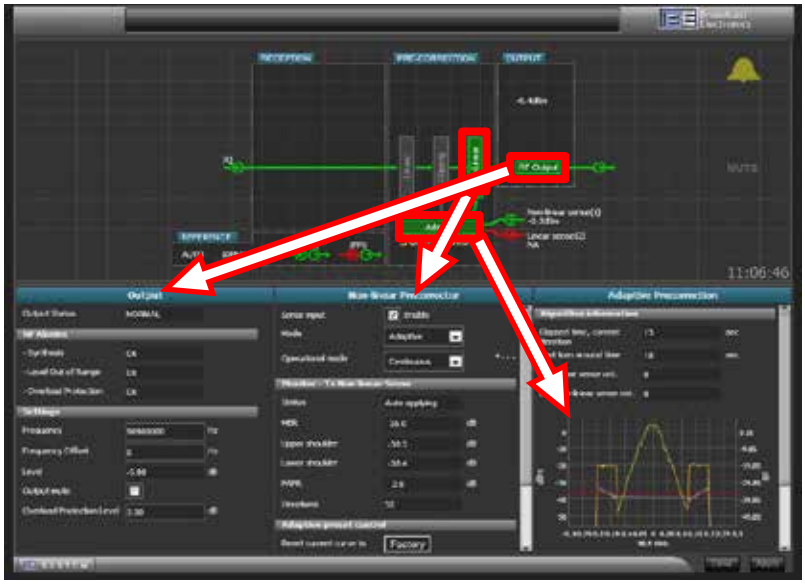


Figure 25 - Typical Drag and Drop

8.1 Reference 10MHZ

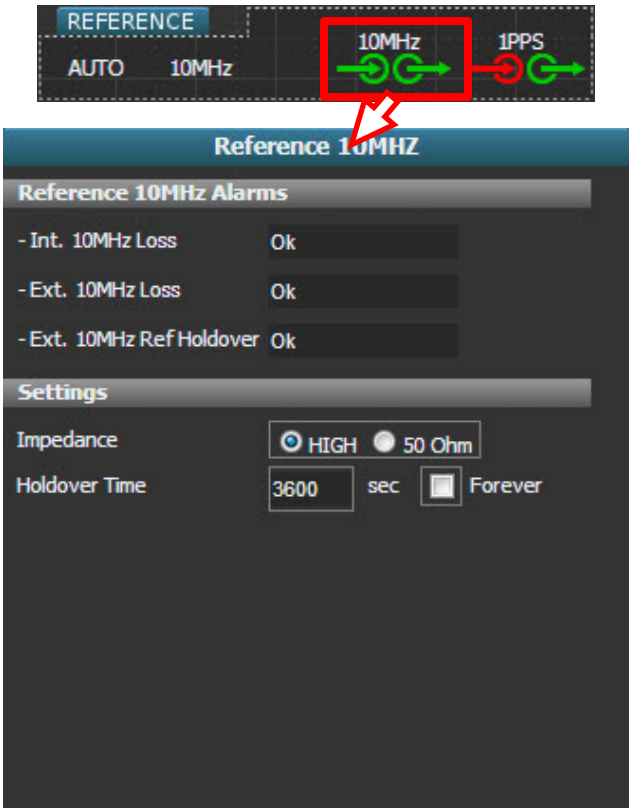


Figure 26 – Reference Control

Internal and External 10MHz loss should read “Ok”. If the 10MHz indicators are not green/ok there should also be a VPe XG front panel LOCK STATUS indication. This typically indicates a problem with the 10MHz input connection to the Exgine when routing externally (see Exgine 10MHz control information).

Recommended/Typical settings for Impedance and Holdover Time are shown in Figure 26.

8.2 Output

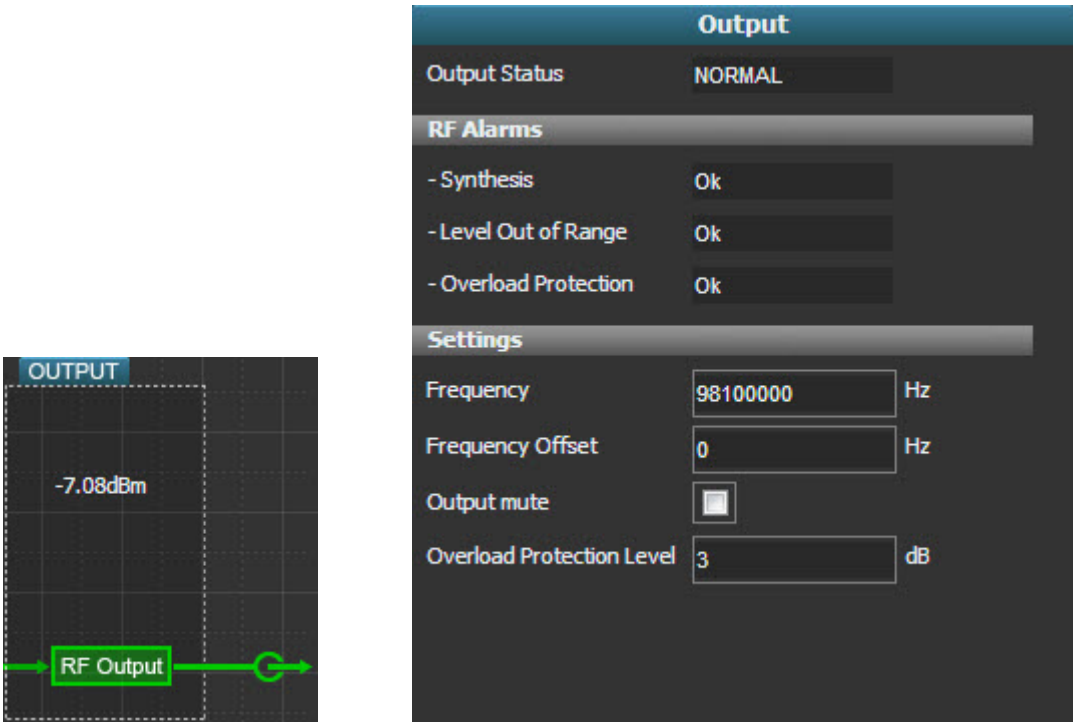


Figure 27 – Output Control

RF Output from VPe is a modified RF input signal with changes based on Precorrection control.

8.2.1 Frequency and Frequency Offset

Output frequency automatically synchronizes with the STX controller when a frequency change occurs. The Frequency offset should remain 0 to keep the center frequency consistent.

8.2.2 Output mute

Ensure that the mute checkbox labeled “Output mute” is not checked – during normal operation VPe should indicate that it is muted. If it is, see section 10.6.3.

8.3 Non-linear Precorrector

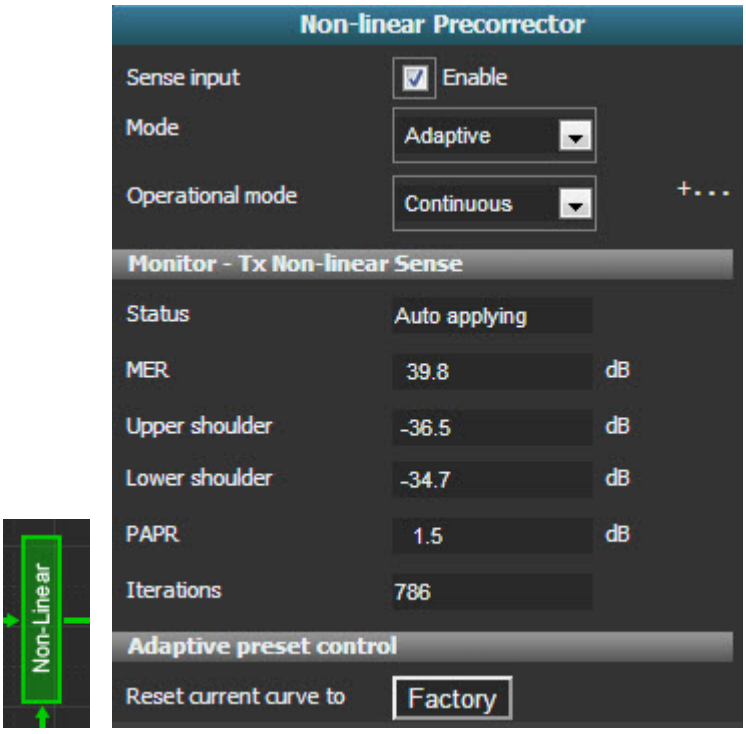


Figure 28 – Non-linear Precorrector Control

Always check Enable for the Non-linear sense input (feedback from the transmission line coupler). Mode should be set to Adaptive and Operational mode should be Continuous. Other modes should not be used in typical VPe system applications.

To start an adaptation re-initialization, click the "Factory" button which can be seen in the bottom of Figure 28, and click Ok in the dialog box that pops up.

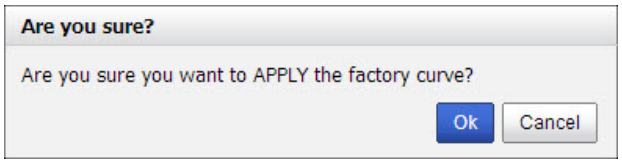


Figure 29 – Resetting the Non-linear Precorrector

8.4 Adaptive Precorrection

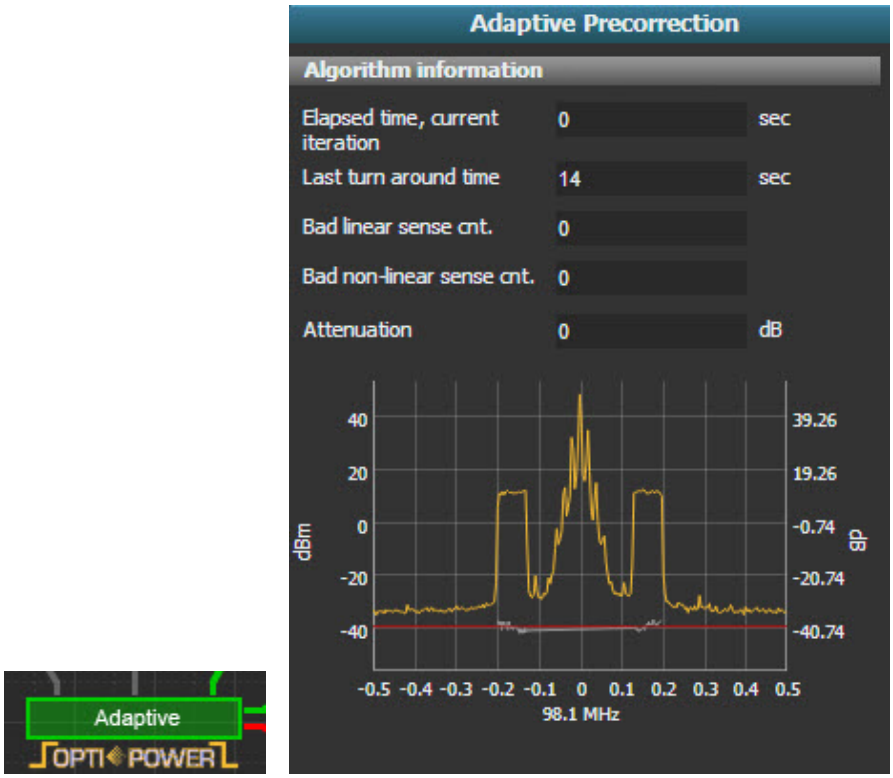


Figure 30 – Adaptive Precorrection Control

The Adaptive Precorrection panel provides various monitoring parameters, including a built-in spectrum analyzer, from analysis of the Non-linear sense feedback RF input. To view a full-page version of the spectrum analyzer as shown in Figure 31 below, simply click anywhere on the smaller version shown in the bottom of Figure 30.

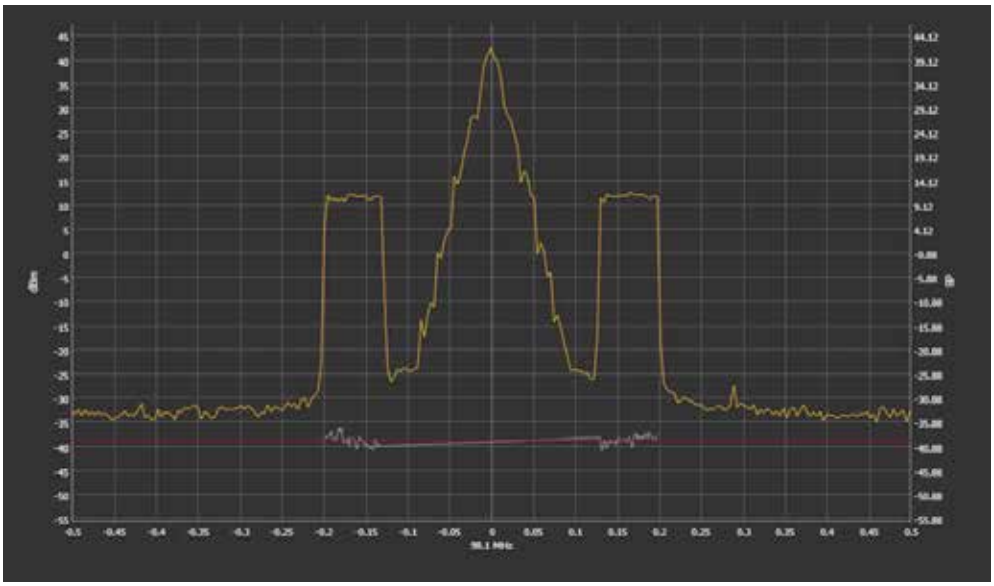


Figure 31 – Built-in Spectrum Analyzer

9 Exgine Web Page

Exgine is equipped with a built in HTTP web server. This requires networking equipment connections to the appropriate ETHERNET VPE RJ45 jack, and a computer with standard web browser. To connect, direct your web browser to the currently active IP address under Exgine (setup during installation).

Under “Have an account?” enter the user be_admin, password broadcast, and click the Login button. This will bring up the main page.

Figure 32 – Login Page

Click on the “Setup” link to access user interface items.

Figure 33 – Main Page

The “Update” link is used in the Exgine software update process. Refer to the VPe XG software update application guide for software update information.

9.1 DSP Status

The DSP status tab contains data from the HD DSP. This is presented for advanced HD troubleshooting.

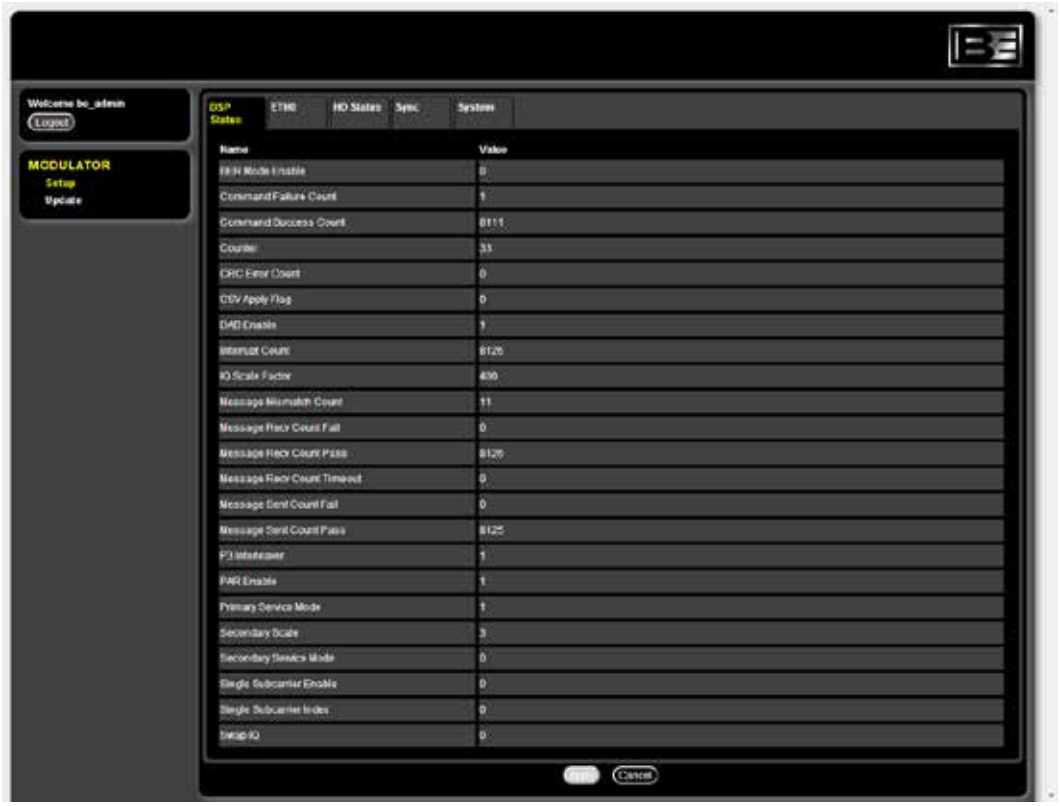


Figure 34 – DSP Status Page

9.2 ETH0

The Ethernet port tab provides more quickly refreshing status and alternate settings control for the Ethernet DATA port. These static IP settings are typically modified through the transmitter control center interface on the front of the STX exciter/transmitter.

Figure 35 – Ethernet Page

9.2.1 MAC Address

The MAC address can be changed on this web page to enable drop-in replacement of existing Exgine systems without changing any network setup.

Enter the MAC address in the field to the right of "MAC Address (User Defined)" and click Apply. The MAC address can be changed back to the factory MAC address, which is displayed in the field at the bottom of the list, at any time.

9.3 HD Status

HD status contains control settings and control status for the current HD operation.

Figure 36 – HD Status Page

9.3.1 Digital Carrier On Off

Digital carriers can be turned on or off here or via the INPUT pins on the back of the unit. This is intended for hybrid transmitter power control setup to establish safe FM levels in the event of HD data loss.

9.3.2 Digital IQ Level

Do not change Digital IQ Level from 400. Different settings may cause incorrect hybrid sideband carrier power levels.

9.3.3 DSP Status

DSP status only updates when Exporter Link is active. This can be COMMUNICATING or NOT COMMUNICATING.

9.3.4 Exporter Link

Exporter HD data stream status. This can be PRESENT or NOT PRESENT. A valid Exporter links is required to generate HD.

9.3.5 Main Program Service Mode

This status indicates the current HD operating mode MP1, 2, 3, 11, 5, or 6.

This should be in synchronization with the rest of the system during normal operation. If not, Exporter controls (or Importer if included in the system) should send a synchronization message.

9.3.6 PAR On Off

Peak to average ratio reduction should remain on at all times to avoid digital domain saturation.

9.3.7 Secondary Service Mode.

Status indicates the MS1-4 HD secondary service mode where carriers are added in the middle of the channel instead of an FM signal. 0 indicates that secondary service modes are off.

9.4 Sync

The Synchronization tab contains status and control for internal and external digital/RF clocking.

Figure 37 – HD Synchronization Page

9.4.1 10MHz Lock status

This displays the status of 10MHz control. Locking internally to the Ethernet data stream may take almost a day to indicate a successful lock when operating in a network with traffic-related timing variations or erroneous data.

Table 5 – 10 MHz Lock Statuses

Display	Behavior
Locked to External	Indicates that the 10MHz input is routed and used. This does not change to reflect the status of the input. Check the STX controller for a more detailed VPe XG 10MHz status.
Not locked	Reserved, do not use without an internal GPS option.
Locked to Internal	Routes the External 10MHz input.

9.4.2 Clock Lock status

Aggregate status indication for all internal clocking frequency and phase lock control. This is either Locked or Not locked.

9.4.3 Clock Source

This controls the internal 10MHz switch directly and absolutely. This should be set to the intended system setup.

Table 6 – 10MHz Control

Selection	Behavior
INT_VTCXO	Locks frequency and phase to the Ethernet stream.
EXT_GPS	Reserved, do not use without an internal GPS option.
EXT_10_MHz	Routes the External 10MHz input.

9.5 System

Figure 38 – System Page

9.5.1 Build Date

This indicates the current Exgine controller software load build date.

9.5.2 FPGA Revision

This displays the currently loaded FPGA firmware build revision.

9.5.3 Serial Number

The field shows the Exgine controller chip serial number

9.5.4 HD Revision Number

HD release revision currently loaded in the HD DSP device.

10 Troubleshooting

QUALIFIED TECHNICIAN CONSULTATION RECOMMENDED

Qualified technicians may refer to appropriate maintenance sections in the VPe XG installation and maintenance guide for any hardware debugging steps listed below.

10.1 System is Unresponsive or Unpowered

VPe systems will not function on any level when the system is completely unpowered. Follow steps below to attempt to verify partial function and isolate any power problems.

10.1.1 Remote – Power Troubleshooting

Note that non-responsive interfaces may or may not indicate power failures somewhere in the system.

Troubleshoot remotely by attempting to access VPe Ethernet interfaces. Check for any voltage on remote station interface input/output connections.

10.1.2 On-Site – Power Troubleshooting

Verify the front panel POWER LED status is off indicating some level of power failure.

Verify that AC main input. Ensure the power cable is completely plugged in and AC power is switched on.

Listen for a working fan; this can indicate AC is good and the fan power supply is still functional (keep in mind that in extreme cases both the fan and main power supplies may fail simultaneously).

Further isolate any power problems by observing subsystems. Plug a valid network connection into Ethernet ports to activate link and activity lights. Exgine is tied to the Data port. VPe module is tied to the VPe port. The gateway controller regulates front panel functions, and failure in the gateway system may cause system controller exciter communications to fail along with the front panel display in the VPe XG system.

Refer to the guide; remove the system from its mount, remove the top cover to access the interior, and verify DC harness connections.

Follow the steps in the guide to replace failed and non-responsive system modules.

10.2 General Faults

Look at the system controller log for the fault category. Access more detailed diagnostic information by using the VPe or Exgine Ethernet ports.

Events that can trigger a general fault include 1. Exgine communications fault 2. Exgine lock fault 3. VPe communications fault 4. VPE 10 Mhz input not present or invalidated 5. VPe RF out alarm

10.3 Lock

Verify that the 10MHz setup matches the desired source: internal versus external.

If setup for external, verify that the external source is valid, still functional, and connected.

Internal clock setups may take up to a day to lock to the Ethernet stream if the network causes significant jitter. A network with light traffic will generally lock in about 20-30 minutes. Take steps to improve network function until the system can lock.

10.4 Gateway Controller

The primary function of the gateway controller board assembly is to provide conduits for machine- and user- interfacing for critical signals, control, and monitoring. Other functions include power regulation for the Exgine and VPe board assemblies, a low power fixed gain RF output amplifier network, variable feedback attenuator, clock negotiation and output, and more (refer to the block diagram in Figure 23). Problems in this assembly may cause partial or complete failure symptoms in any of these areas.

1. Ensure that external cables are properly connected between the VPe XG BE-Interface and the system controller/exciter BE-Interface.

2. Reset the VPe gateway controller and VPe module by activating the reset pin on the BE-Interface connector at the VPe/TX interface cable connection.

3. Cycle AC power on the VPe XG unit

10.5 Exgine

Exgine sub-systems generate digital OFDM carriers. Exgine problems may cause bands to be intermittent or missing. In hybrid mode, an FM carrier might be present without side bands, which allows a receiver to lock to the FM signal but not an HD signal.

If detailed troubleshooting steps do not apply to the issue at hand or help resolve the problem:

1. Reset the Exgine by activating the reset INPUT pin.

2. Cycle AC power to the VPe XG unit.

10.5.1 General

Communications faults occur when there is no monitoring or control response from the Exgine system for 30 seconds or more.

Hardware faults occur when the clock that generates internal digital clocking reports that it is not locked.

Check the Exgine web page whenever possible to get detailed troubleshooting information if faults occur.

10.5.2 HD DSP Communications

If the Exgine HD core DSP does not respond to communications attempts, a failed communications status may be indicated in the STX system log. If this condition does not self-correct cycle power on the VPe XG.

10.5.3 Ethernet Link

1. Check the Ethernet cable connection.
2. Verify IP settings match the expected setup.

10.5.4 No HD Carriers

1. Verify the Ethernet link.
2. Carriers can be turned on and off in interfacing. Make sure that HD carriers are enabled by checking the DAB enabled status in the DSP portion of the web page.
3. Ensure that PAR is enabled.

10.6 VPe

VPe performs adaptive pre-distortion and converts digital RF to analog RF output. Problems here may cause the RF output signal to run outside of local regulatory limits or may cause RF output to fail completely.

10.6.1 General

Communications faults occur when there is no monitoring or control response from the VPe system for 30 seconds or more.

Hardware faults occur when the RF alarm from the VPe module persists for 5 seconds or more.

Try to access the VPe web page to gather more detailed operation status information whenever possible.

1. Attempt to reboot the VPe portion of the system (VPe gateway and VPe module) using the VPe reset input pin.
2. Cycle AC power to the VPe XG unit.

10.6.2 Events and Alarms

In default setups when an RF output alarm persists for 5 seconds or more a general fault will activate.

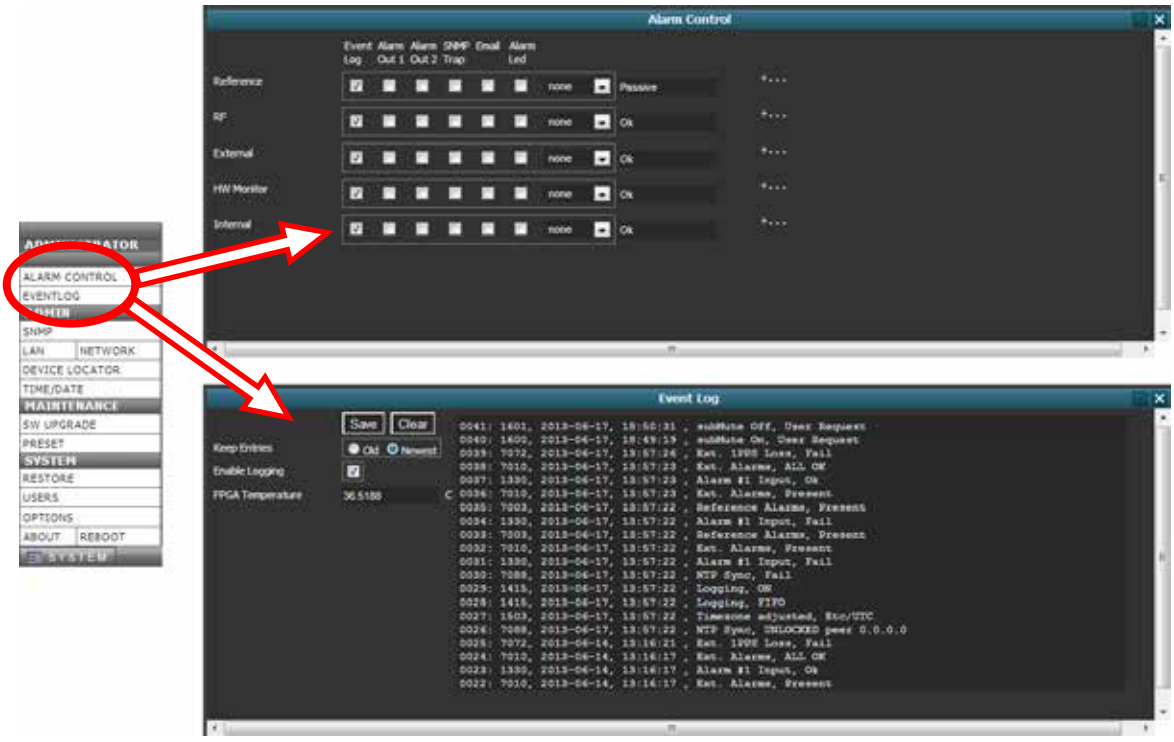


Figure 39 – Alarm Control and Event Log

VPe allows very specific control over alarm notifications and automatic responses to any active alarms. By default, all alarm activations are logged in the internal Event Log. Through use of Alarm Control shown in Figure 39, alarm notifications for unutilized systems can be disabled or have the notification escalated to SNMP traps, Email notifications, or even trigger mute or reboot of the VPe system.

10.6.3 Slow Adaptation

Substantial changes to the broadcast system may cause the adaptive precorrection process to take an excessively long amount of time to improve the signal. This will typically occur when amplifier characteristics change, as when power amplifiers in the transmitter are replaced, or sudden shifts in load characteristics.

The adaptive precorrector should be returned to a default known state via Factory reset, see section 8.3. As with initial setup, run the system at total output power into a test load while VPe works to correct the signal.

10.6.4 Mute

An RF output mute in VPe can be easily monitored by dragging the MUTE indicator (right side of the system block diagram) to one of the control columns, see Figure 40.

IF VPE IS MUTED FOR ANY REASON, MUTE THE EXCITER BEFORE ATTEMPTING TO RESUME OPERATION. FAILURE TO DO THIS MAY RESULT IN AN INITIAL SPIKE IN TOTAL POWER OUT THAT CAN DAMAGE EQUIPMENT.

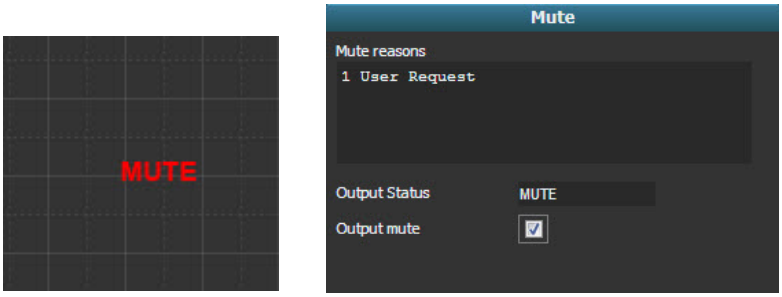


Figure 40 – Mute Status

11 Maintenance

The fan operation should be checked periodically to ensure that there is airflow.

Problems with system operation should be diagnosed and isolated. For troubleshooting, refer to the VPe XG Operation Manual. Once a problematic module has been identified and isolated, follow the directions below to replace it.

11.1 Remove the Top Cover

To perform remaining module replacement actions in this section, the top cover must be removed. Full precautions should be taken against electrostatic discharge. Any such shocks may cause permanent damage to any electronic components.

ENSURE AC POWER INPUT IS COMPLETELY DISCONNECTED BEFORE ACCESSING ANY INTERNAL MODULES

☐ Phillips Screwdriver

Figure 41 - Top

Use a Phillips screwdriver to unscrew all 14 top cover screws. Lift the cover to remove it.

Figure 42 – Open Top

11.2 Main Power Supply

Figure 43 – Main Power Supply Assembly

☐ 540-7512	1	VPe XG Main Power Supply Assembly
☐ Phillips Screwdriver		
☐ 1/4” Nut Driver (standoffs)		

3. Use a Phillips screwdriver to remove the four screws securing the main power supply polycarbonate cover and set the cover aside.

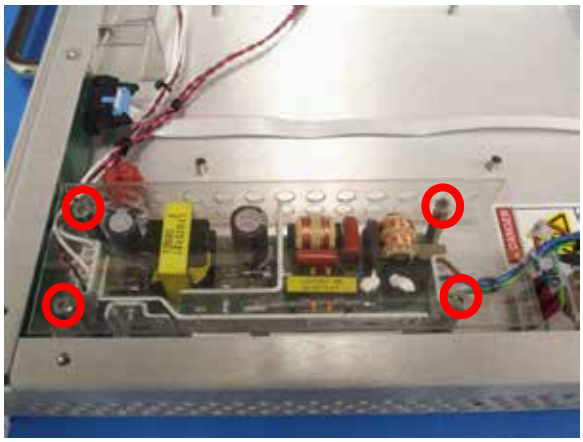


Figure 44 – Main PS Top Cover Screws

Note: when reinstalling the power supply cover, snug the cover screws. Do not over-tighten. The polycarbonate holes may stretch enough for screws to pass through.

4. Disconnect cables from the power supply by disengaging latches and pulling up on the connector.

Figure 45 – Main PS Cables

5. Use a 1/4" nut driver to remove the four standoffs with split locks that secure the power supply. The module sits on the chassis standoffs, so simply remove it.

Figure 46 – Main PS Standoffs

6. Repeat these removal steps in reverse to re-install the power supply assembly.

11.3 Front Panel Display

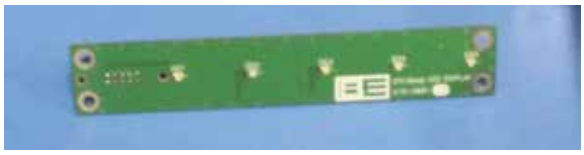


Figure 47 – Front Panel Display

☐ 919-6002	1	VPe XG/XPi10esp Front Display PCB Assembly
☐ Phillips Screwdriver		

1. Spread the latches apart and disconnect the ribbon cable.

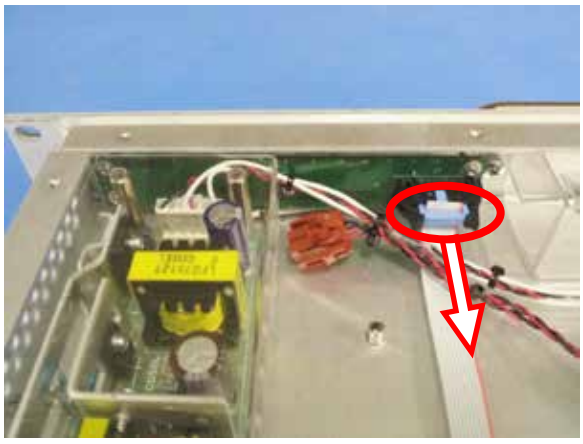


Figure 48 – Front Display Cable

2. Use a Phillips screwdriver to remove the four screws securing the main power supply polycarbonate cover and set the cover aside. Refer to Figure 44.

3. Reach in on the right of the board assembly and carefully pry the right side off the two snaps.

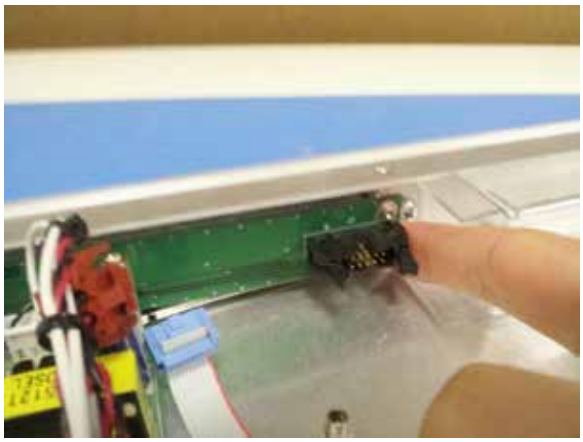


Figure 49 – Front Display Right Snaps

4. Gently twist the board assembly to unsnap the top, and then twist back to unsnap the bottom. Remove the board from the chassis.

Figure 50 – Front Display Left Snaps

5. Repeat these removal steps in reverse to re-install the front display board assembly.

11.4 Fan Power Supply

Figure 51 – Fan Power Supply

☐ 540-2512	1	VPe XG Fan Power Supply Assembly
☐ Phillips Screwdriver		

1. Use a Phillips screwdriver to remove the two screws on the side of the main chassis that secure the power supply assembly.

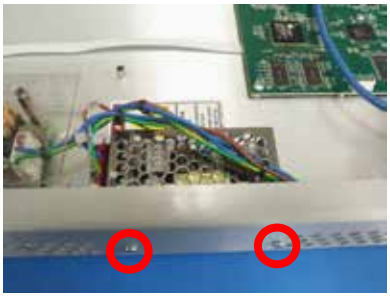
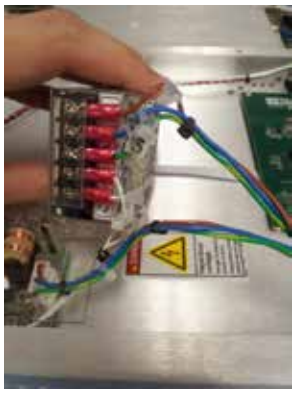


Figure 52 – Fan PS Screws

2. Pop off the polycarbonate cover on the screw terminals.



3. Use a Phillips screwdriver to loosen screw terminals (do not completely remove the screws). Slide the forked cable ends up and out of the screw terminals.

   To more easily ensure proper order, these cables can be swapped to the new power supply assembly one at a time.

4. Repeat these removal steps in reverse to re-install the fan power supply assembly.

11.5 Fan

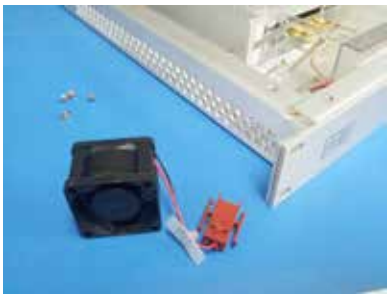


Figure 53 – VPe XG Fan

☐ 380-9009-001 1 VPe XG Fan Assembly
☐ Phillips Screwdriver (long shaft recommended)

1. Use a Phillips screwdriver to remove the screws on each side of the VPe assembly.

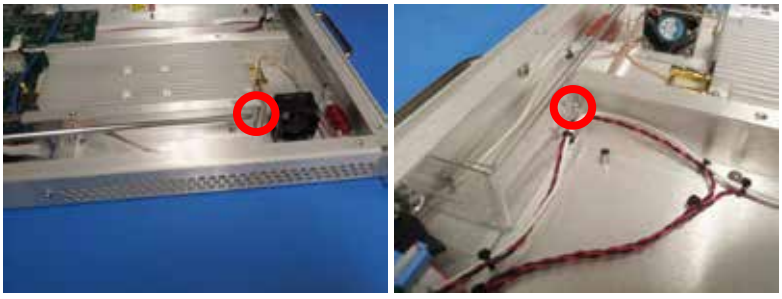


Figure 54 – Chassis Screws

2. Use a Phillips screwdriver to remove the front handle screw that secures the polycarbonate section to the main chassis.

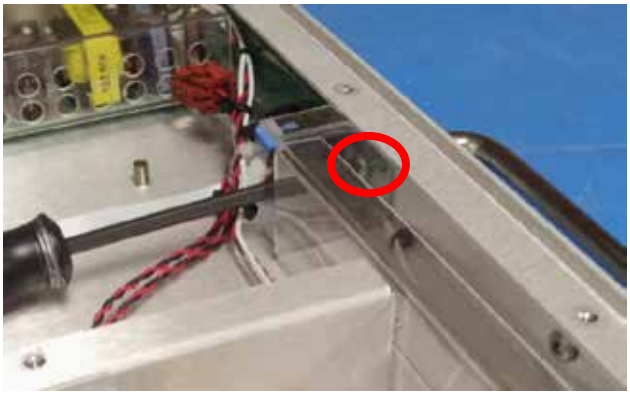


Figure 55 – Handle Screw

3. Disconnect the fan cable harness by disengaging the latch and pulling the connectors apart.

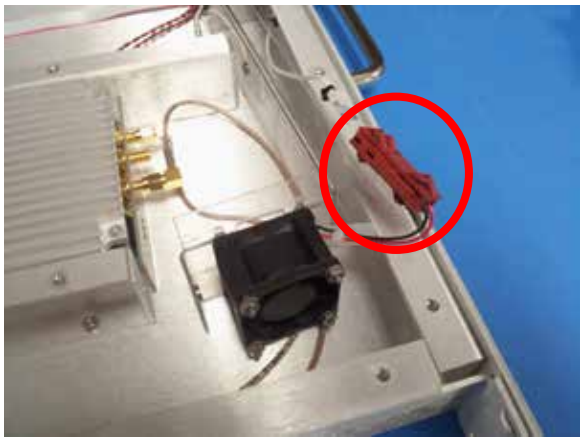


Figure 56 – Fan Harness

4. Hold up the polycarbonate chassis section and use a Phillips screwdriver to disconnect the fan.

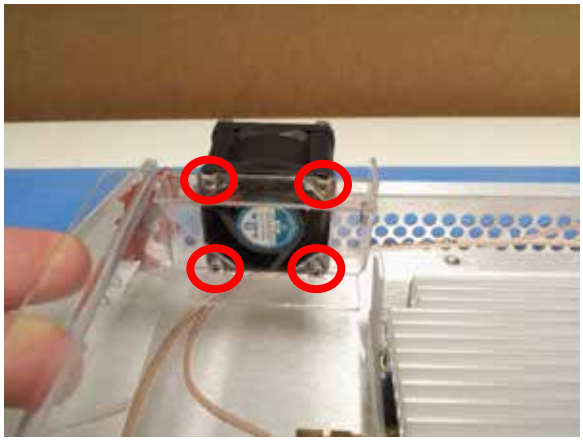


Figure 57 – Fan Screws

5. Repeat these removal steps in reverse to re-install the fan assembly. When placing the chassis section, ensure cabling is in the appropriate grooves.

Figure 58 – Cable Placement

11.6 VPe

Figure 59 – VPe Assembly

☐ 809-2090-010 1 VPe – Digital In RF Out Version
☐ Phillips Screwdriver (long shaft recommended)

6. Remove the two SMA cables from the VPe assembly.

Figure 60 – VPe Cables

7. Use a Phillips screwdriver to unscrew the two screws. Once completely unscrewed, the screws can be lifted out in a later step (with the board assembly).

Figure 61 – VPe Screws

8. Disconnect the polycarbonate chassis section housing the fan. Refer to the left picture in Figure 54.

9. Slide the entire VPe assembly sideways just enough to disengage the edge connector.

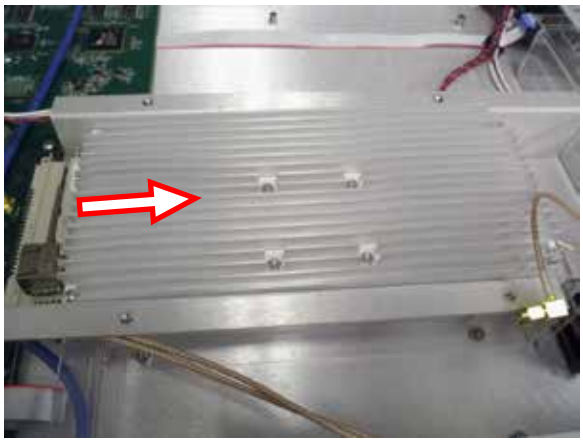


Figure 62 – Unseating the VPe Assembly

10. Pivot the edge connector end of the assembly up and to lift the assembly out of the chassis.

Figure 63 – VPe Assembly Removal

11. Remove the polycarbonate air barrier from the assembly by sliding it off the connectors.

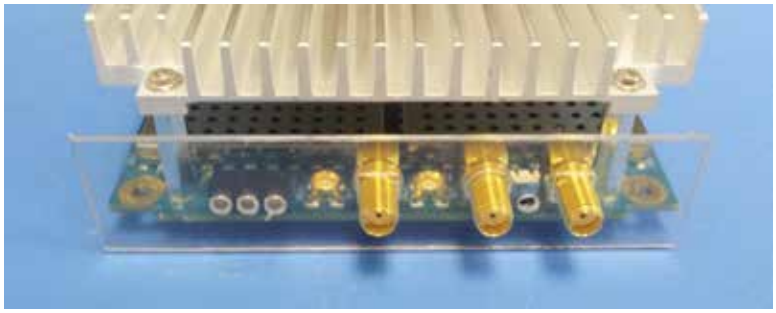


Figure 64 – VPe Air Dam

12. Repeat these removal steps in reverse to re-install the VPe assembly.

    Note: the two SMA cables have different lengths to provide distinction. The longer cable should loop back and attach to the left while the shorter cable dresses across it to the right as shown here.

Figure 65 – VPe Coaxial Cables Detail

11.7 Gateway Controller

Figure 66 – VPe Gateway Controller

☐ 919-6101	1	VPe XG Gateway Control PCB Assembly
☐ 3/16” Nut Driver		
☐ Phillips Screwdriver		
☐ 9/16” Wrench		

1. Use a 3/16” nut driver to remove the two D-Subminiature jack screws and split-lock washers securing the BE-Interface jack to the main chassis.

Figure 67 – BE Interface Jack Screws

2. Remove the Exgine Input and Output terminal blocks by pulling the plastic block housing. Take note of block placement, and ensure that these blocks and their attached cable sets do not get unintentionally swapped later.

Figure 68 – Exgine Terminal Blocks

3. Use a Phillips screwdriver to remove the XLR screws.

Figure 69 – XLR Screws

4. Use a 9/16” wrench to remove all BNC jack nuts and lock washers.

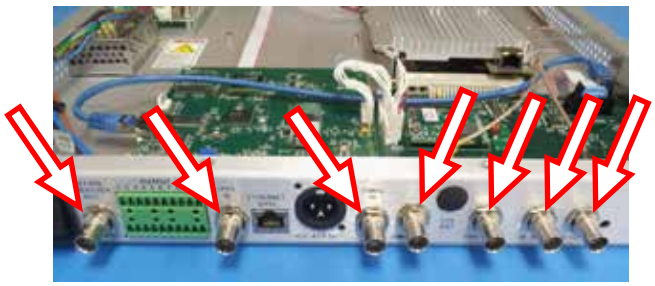


Figure 70 – BNC Nuts

5. Unscrew the bottom and two side screws that secure the back panel chassis section to the main chassis.

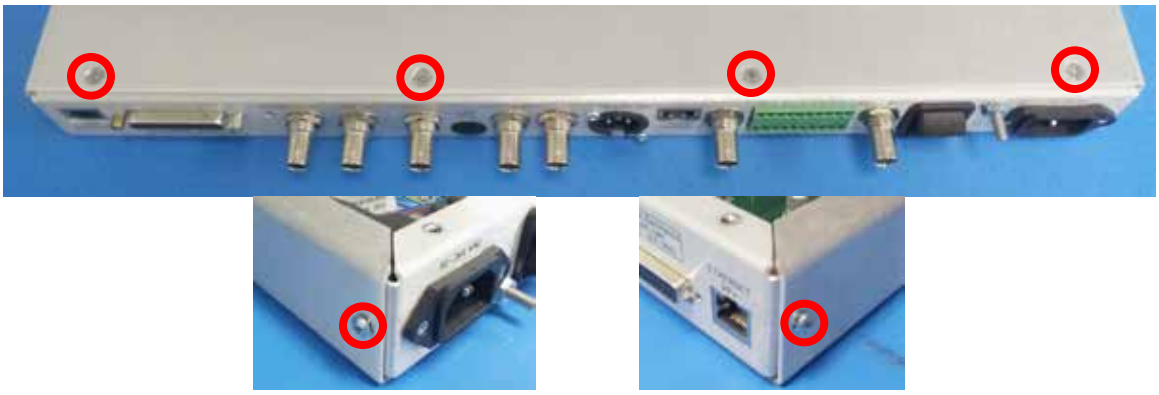


Figure 71 – Back Panel Screws

6. Slide the chassis section off of connectors and angle it aside as shown.

Figure 72 – Displaced Back Panel

7. Use a Phillips screwdriver to remove the screws securing the board assembly.

Figure 73 – Gateway Controller Board Screws

8. Disconnect all cables from the board assembly; unscrew the two SMA connectors, unlatch the front panel display ribbon cable, and pull all other connectors straight up. The RJ45 connector is accessible on a later step.

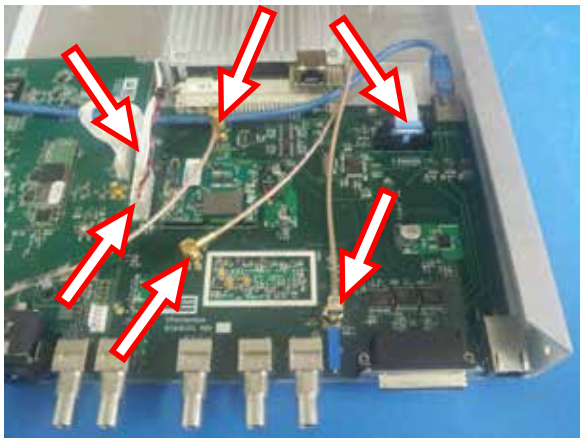


Figure 74 – Gateway Controller Cables

9. Lift the edge of the board, and slide assembly out of the VPe edge connector to remove it. Do not drag the board assembly across chassis standoffs; this may damage components on the bottom of the board assembly.

Figure 75 – Gateway Controller Removal

10. Disconnect the RJ45 cable by unlatching it.

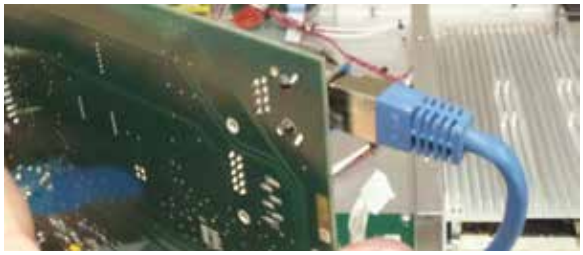


Figure 76 – Gateway Controller RJ45

11. Repeat these removal steps in reverse to re-install the Gateway Controller assembly.

11.8 Exgine

☐ 919-6100	1	Exgine Gen II PCB Assembly
☐ Phillips Screwdriver		
☐ 9/16” Wrench		

1. Remove the Input and Output terminal blocks by pulling the plastic block housing. Take note of block placement, and ensure that these blocks and their attached cable sets do not get unintentionally swapped later. Refer to Figure 68.

2. Use a Phillips screwdriver to remove the XLR screws. Refer to Figure 69.

3. Use a 9/16” wrench to remove the left three BNC jack nuts and lock washers.

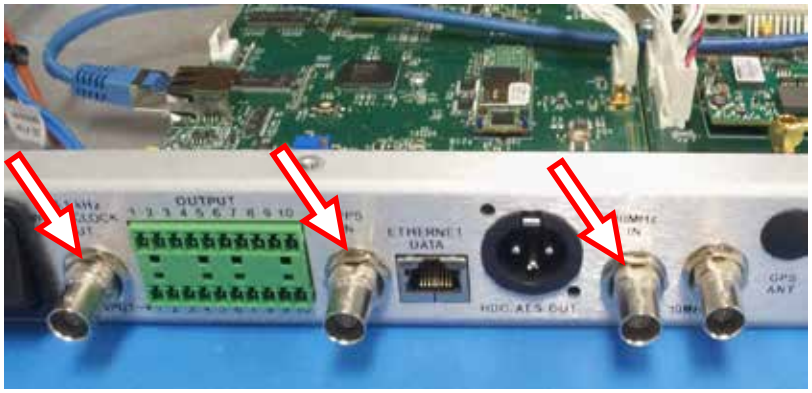


Figure 77 – Exgine BNC Jacks

4. Disconnect all internal cables from the board assembly: unscrew the SMA, unlatch and pull the RJ45, and pull the last connector up.

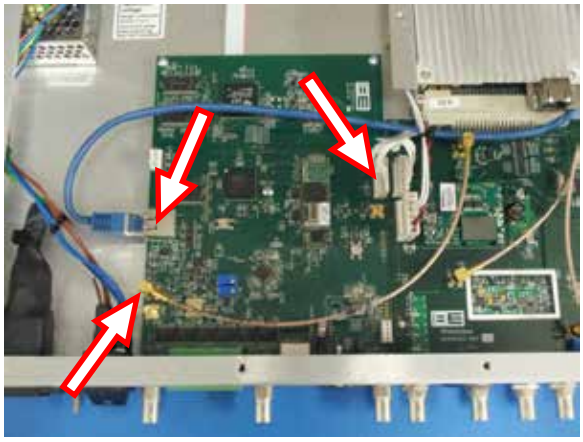


Figure 78 Exgine Cables

5. Unscrew the three screws securing the board assembly.

Figure 79 – Exgine Screws

6. Lift the back of the board and slide the connectors out from the chassis. Do not drag the board assembly across chassis standoffs; this may damage components on the bottom of the board assembly.

Figure 80 – Exgine Removal

7. Repeat these removal steps in reverse to re-install the Exgine assembly.