Broadcast Electronics
4100 North 24th Street, Quincy, Illinois 62305 USA • Phone (217) 224-9600 • Fax (217) 224-9607 • www.bdcast.com • bdcast@bdcast.com


# STXe 2 STXe 3
# 2kW and 3kW
# FM Transmitter
## Technical Manual

597-6303
Revision D
Sept 30, 2023

# STXe 2 / STXe 3 – 2 & 3 kW FM Transmitters

## Technical Manual



## Proprietary Notice



## Trademarks



## Copyright



## Broadcast Electronics Product Warranty

Broadcast Electronics hereby warrants all new products manufactured by Broadcast Electronics against any defects in material or workmanship at the time of delivery thereof, or that develop under normal use within the period from the date of shipment.

Broadcast Electronics reserves the right to repair equipment under warranty with new or refurbished equipment or parts. Broadcast Electronics' 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 Broadcast Electronics' 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 Broadcast Electronics 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. Broadcast Electronics 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 their new condition.

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

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 Broadcast Electronics 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 Broadcast Electronics, or if not installed according to Broadcast Electronics’ 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 Broadcast Electronics’ 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. Broadcast Electronics shall not be liable for any expense of any nature whatsoever incurred 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 BROADCAST ELECTRONICS, 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.

## 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. Do not return any merchandise without first contacting Broadcast Electronics and receiving prior written approval and a 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 the circumstances and reasons when requesting return of merchandise. 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. We can assume no liability for inbound damage, and necessary repairs become the obligation of the shipper. All returned merchandise must be sent freight prepaid and properly insured by the customer

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 (see next page.)

## RF TECHNICAL SERVICES

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

## PARTS

Telephone: +1 (217) 224-9617
E-Mail: parts@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) 481-7018
General E-Mail: bdcast@bdcast.com
Web Site: www.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.

# CERTIFICATIONS

**BEI Electronics, LLC  Model STXe**
FCC ID:  DDE-STXE
IC: 131A-STXE

**Support: 217.224.9617 bdcast.com/support**

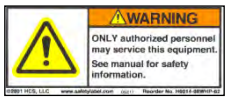
# SAFETY PRECAUTIONS

## PLEASE READ AND OBSERVE ALL SAFETY PRECAUTIONS

**ALL PERSONS WHO WORK WITH OR ARE EXPOSED TO POWER TUBES, POWER TRANSISTORS, OR EQUIPMENT THAT 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

Personnel should always break the primary AC Power when accessing the inside of the transmitter. Mains voltage is high enough to kill through electrocution. In tube transmitters, the mains voltage is stepped up to much higher voltages. When provided, always use safety devices such as “Lock Out & Tag Out”.

## RF 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/cm2 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/cm2 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.

# Table of Contents

# Figures



# Tables

# 1 Specifications

**Table 1 – Specifications: STXe 3**

## RF Specifications

### Output Power:

750 to ~3000 Refer to Brochure for 2kW, 3kW and HD power output details.

### Efficiency:

70% typical AC to RF (FM Only)

### Modulation Type:

Direct-to-channel digitally generated FM (no analog up-conversion); FM only, HD Radio only, or HD Radio + FM, DRM+

### Capabilities:

Up to 300KHz

### Audio Inputs:

AES, L&R analog, composite, SCA/RBDS/RDS external generator in, SCA audio inputs (2)

### Asynchronous AM S/N Ratio:

Better than -65dB (-70dB Typical) referenced to average peak-to-peak carrier amplitude. 75uSec de-emphasis

### Synchronous AM S/N Ratio:

Better than 60dB referenced to average peak-to-peak carrier amplitude. 75kHz deviation @400Hz

### Spurious and Harmonic:

85dB or better, low pass filter standard

## Audio Specifications

### Amplitude Response:

Composite/ AES: +/-0.03dB, 30 Hz to 53 kHz; +/- -0.1dB, 53kHz to 100kHz

Analog L&R: +/-0.25, 30Hz to 53kHz90 to 264VAC; 47-63Hz

### Total Harmonic Distortion + Noise:

Composite: 0.005% or less @400Hz, 10-22kHz bandwidth, 75uSec deemphasis. AES/ Analog L/R Stereo: -0.01 typical @400 Hz, 10-22kHz bandwidth 75uSec deemphasis

### Composite Intermodulation Distortion + Noise:

0.13% SMPTE (60/7000 Hz, 1:1 ratio), DIM-B: 0.008% (14kHz)

### S/N Ratio:

Composite: 85dB below 100& modulation @400 Hz. AES/ Analog L&R Stereo: 80dB below 100% modulation @400Hz. Analog L/R: -70dB, 30Hz to 15kHz

### Stereo Separation:

AES: -74dB below 100% modulation @400Hz. Analog L/R: -70dB, 30Hz to 15kHz

## Mechanical / Physical

### Dimensions:

- 19”W x 6.97” (4RU) H x 28.33” D
- (48.3 cm W x 17.7 cm H x 72 cm D)

### Weight:

- 58lbs (26.3 kg)

### RF Output Connector:

- 7/16 Female DIN

# 2 Installation & Initial Set Up

## 2.1 Overview

The circled areas shown in the front and rear views below will be referenced in the following Section "Installation and Initial Set Up". If you are not currently familiar with the STXe or STX Series, please refer to the detailed information provided in Sections 4 & 5 of this manual for addition installation and product information.


Figure 1 – STXe 3 Front Panel User Interface


Figure 2 – STXe 3 Rear AC, GPIO & Interface Connections

## 2.2 Broadcast Electronics–Interface active stub

The activation stub is required for operation. If the stub was removed for shipment, connect it to the BE Interface located just below the GPIO connector as shown in Figure 3-B. Secure the two jackscrews with a small flat screwdriver.

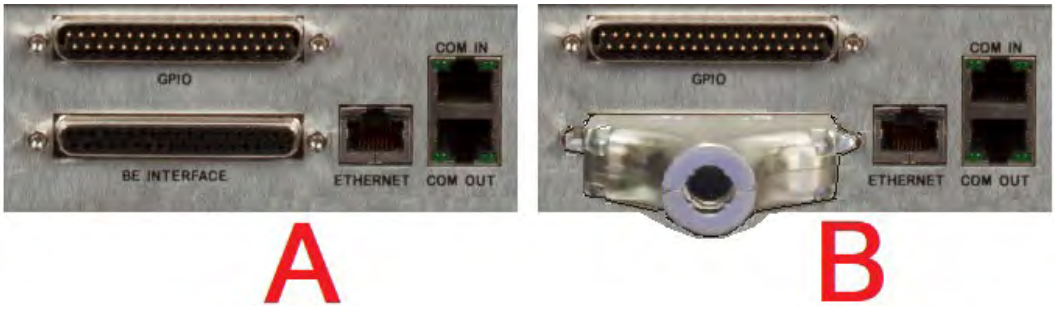



**Figure 3 – BE Activation Stub**

If the STXe 3 was purchased with other system options such as the VPe signal generator that utilize this connection, save this stub for servicing or bench testing.

## 2.3 GPIO Remote Station Interface

For General Purpose Input/Output wiring connections, use the supplied 37PIN female D-Subminiature connector 418-0283 and it's D-Sub Shell 417-0284 for this solder pot connector.
Refer to Table 2 located in section 4.1 GPIO, for the pin out information for connection to a sites remote control system.
All installations require unmute/failsafe to be activated at a minimum. If this is the only site requirements, follow these steps for setup.

1. Connect unmute/failsafe pin 2 to pin 19 through a failsafe relay.
2. If no transmitter failsafe circuitry exists, or for bench testing, substitute a wire jumper as shown in Figure 4.

**Figure 4 – GPIO Fail Safe Jumper**

3. Insert the connector on one of the shell halves.
4. Place the other shell half on top and set the nuts in place as indicated in the figure 5.

**Figure 5 – D-Sub Shell Whole and Nuts**

5. Plug the assembly on the GPIO connection and secure the screws.

## 2.4 AC Connection

**ENSURE AC MAIN IS DISCONNECTED AND LOCKED OUT BEFORE INTERACTING WITH ANY AC CONNECTIONS**

1. Insert AC wiring into the rear connector as shown in Figure 6

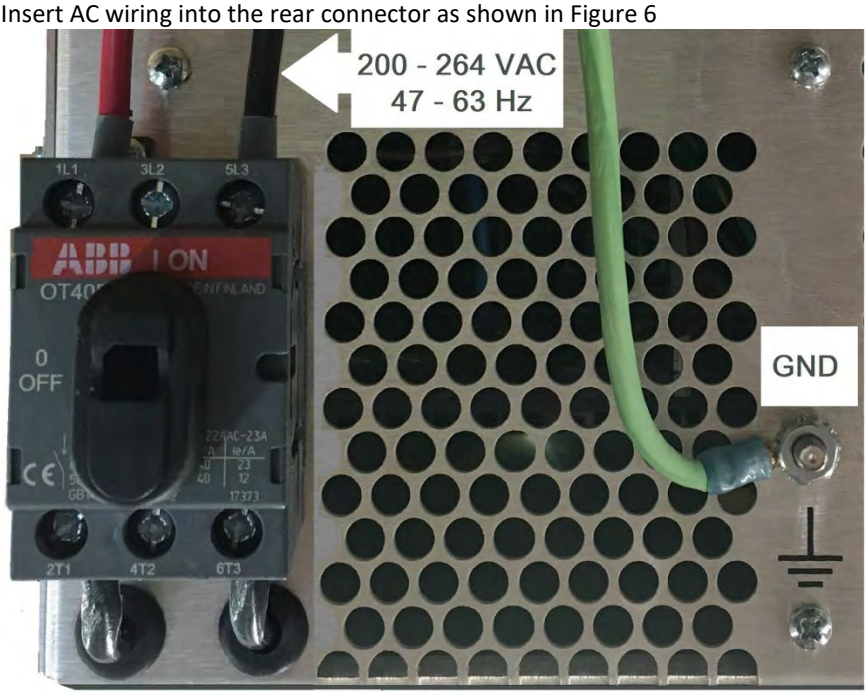



**Figure 6 – AC Input**

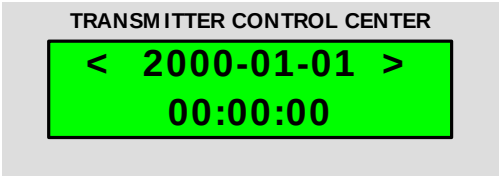
## 2.5 Turn on AC

1. Unlock AC main breaker on the service line and turn the STXe switch to the on position.

## 2.6 Set Time and Date

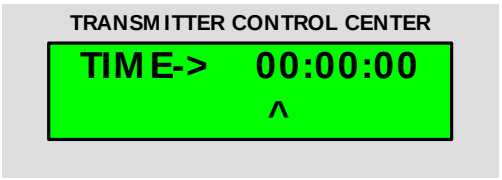
The internal real time clock holds the current time and date for use in the event log. This is a rudimentary device that supports 24-hour format and does not adjust for daylight saving. If installing during summer in a daylight saving region, following standard non-daylight time is recommended instead (the internal real time clock does not automatically compensate for any daylight saving).

1. From the main screen on the transmitter control center on the front panel of the main assembly, press up or down to navigate to the Date and Time menu. Press enter to continue.



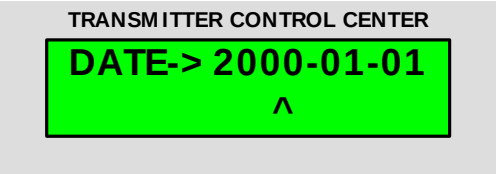

2. Press up or down to select the time editing screen.


3. Set the local (24 hour non-daylight saving) time. Press left or right to move the cursor and press up or down to increment or decrement the number.




4. Press enter when finished editing for the setting to take effect in the system, save, and start keeping time.
5. Enter the date and time menu again. Press up or down to navigate to the date editing screen.


6. Set the current date. Press left or right to move the cursor and press up or down to increment or decrement the number.

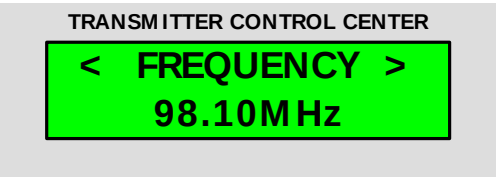



7. Press enter when finished editing for the setting to take effect in the system, save, and keep time.

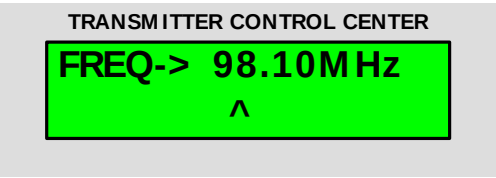
## 2.7 Frequency

STXe 3 is built around frequency agile exciter and PA hardware. The frequency can be changed directly from the front panel – no hardware modifications or tuning procedure is required when the carrier frequency is changed.
If the STXe RF output is on ("TX ON") when the frequency is changed, the system will momentarily turn the RF output off, change the frequency, and immediately turn RF back on again with the new frequency

1. From the main screen on the transmitter control center on the front panel of the main assembly, press up or down to navigate to the FREQUENCY menu. Press enter to continue.




2. Press left or right to move the cursor between frequency digits. Press up or down on each digit to increment or decrement the number.




3. Press enter when finished editing for the frequency change to take effect.

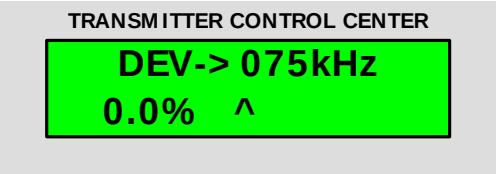
## 2.8 100% peak modulation

The STXe defaults to 100% modulation being +/- 75 kHz. This section only applies if the STXe is being used in an installation where 100% modulation is not +/- 75 kHz.

1. From the main screen on the transmitter control center on the front panel of the main assembly, press up or down to navigate to the AUDIO LEVEL menu. Press enter to continue.


2. Press up or down to select DEV, the FM deviation control setting. Press enter to continue.

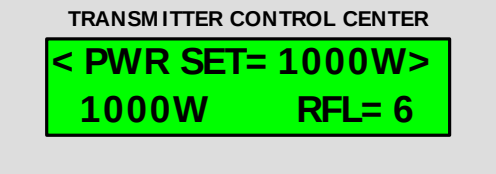

3. Press left or right to move the cursor between frequency digits. Press up or down on each digit to increment or decrement the number. This change takes effect immediately in the system without saving the setting to allow for active tuning.




4. Press enter when finished editing to save the deviation control setting.

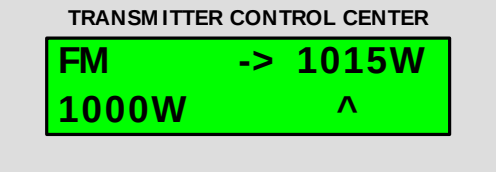
## 2.9 Power set point

1. From the main screen on the transmitter control center on the front panel of the main assembly, press up or down to navigate to the PWR SET menu. Press enter to continue.




2. Press up or down to select the power set point for the FM operation mode, which should display as active. Note that digital, FM+digital, and hybrid HD sideband settings require an optional VPe system. Press enter to continue.


3. Press left or right to move the cursor between digits. Press up or down on each digit to increment or decrement the number. Current output forward power measurements are displayed in the lower left of the screen.




4. Press enter when finished editing for the new power set point to take effect.

## 2.10 Primary Audio Source

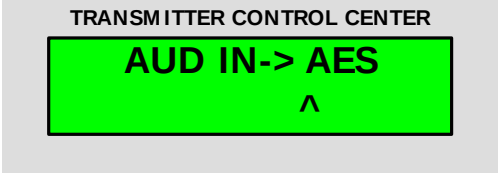
The STXe provides built-in injection of one primary audio source: AES, Composite, or Analog L/R. Secondary audio sources SCA1, SCA2, and RDS can be enabled and used in any on/off combination with these primary audio sources.

### 2.10.1 AES

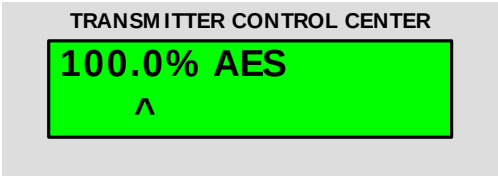
The STXe supports standard AES audio as well as 192 kHz Composite over AES. The 192 kHz Composite over AES operates with various brand name systems including Wheatstone, Omnia and Orban audio processors.
To operate Composite over AES, follow the steps below, but select “AES COMP” rather than “AES” as the input

1. Connect an XLR cable from the desired AES audio source.
2. From the main screen on the transmitter control center on the front panel of the main assembly, press up or down to navigate to the AUDIO INPUT menu. Press enter to continue.


3. Press up or down to select AES as the primary audio source. Press enter to continue.




4. The screen will display the injection percentage allocated to AES. This setting allows the customer to budget the modulation when supplementary services are present. Leave this at 100% if there are no supplementary services in use. If supplementary services are present, set the total modulation percentage associated with AES. This can be adjusted from 70% to 100%. Use the left and right arrows to move the cursor. Press up or down buttons for each digit to increment or decrement the number.




5. Press enter when finished editing for the setting to take effect in the system and save.

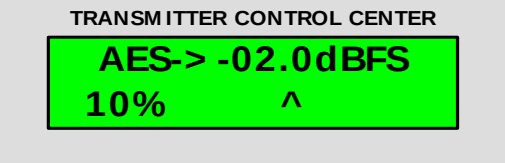
6. AES audio levels are expressed in terms relative to Full Scale of the digital signal path selected.

7. From the main screen on the transmitter control center on the front panel of the main assembly, press up or down to navigate to the AUDIO LEVEL menu. Press enter to continue.


8. Press up or down to select “AES”. Press enter to continue.


9. The display will show the current peak modulation attributable to the AES input. The level can be adjusted by changing the associated dBFS setting. This has a range of -28.0 dBFS to +0.0 dBFS in 0.1 dB steps. This represents the AES level that will generate the percentage modulation shown on the screen

10. Press left or right to move the cursor. Press up or down on each digit to increment or decrement the number and take effect in the system. This has immediate effect. Do this until the displayed left channel peak hold is the desired value – typically 100%.



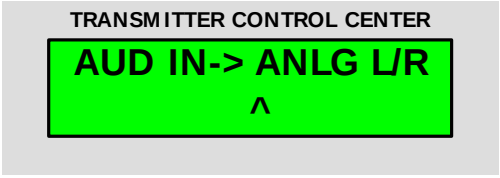

11. Press enter when finished editing to exit the sub-menu.

### 2.10.2 Analog L/R

1. Connect XLR cables from the desired Analog Left and Right audio sources. Activate the source with constant level tones or typical level real audio on each channel.

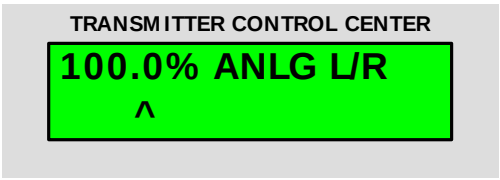
2. From the main screen on the transmitter control center on the front panel of the main assembly, press up or down to navigate to the AUDIO INPUT menu. Press enter to continue.


3. Press up or down to select ANLG L/R as the primary audio source. Press enter to continue.




4. Set the stereo injection reduction (to allocate injection budget for secondary services). Leave this at 100% if there are no secondary services.

5. Press left or right to move the cursor. Press up or down on each digit to increment or decrement the number.



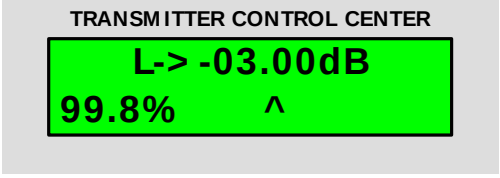

6. Press enter when finished editing for the setting to take effect in the system and save.

7. From the main screen on the transmitter control center on the front panel of the main assembly, press up or down to navigate to the AUDIO LEVEL menu. Press enter to continue.


8. Press up or down to select L. Press enter to continue.

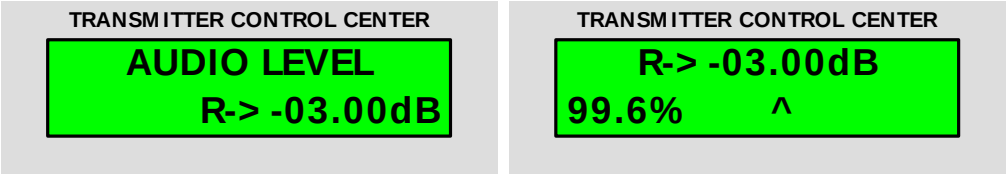

9. The display will show the current peak modulation attributable to the Left input. The level can be adjusted by changing the associated gain/attenuation. This has a range of -96.0 dB to +22.0 dB in 0.25 dB steps. Press left or right to move the cursor.

10. Press up or down on each digit to increment or decrement the number and take effect in the system. This has immediate effect. Do this until the displayed left channel peak hold is the desired value – typically 100%.




11. Press enter when finished editing to save the L calibration setting.

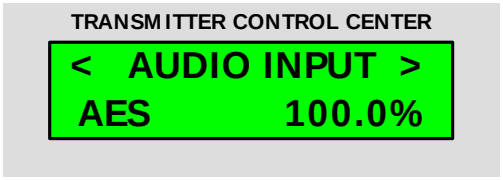
12. Repeat these steps 7 – 11 for R.



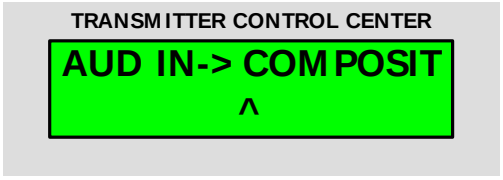

## 2.10.3 Composite

1. Connect a BNC cable from the desired unbalanced composite audio source. Activate the source with a constant level tone or typical level real audio.

2. From the main screen on the transmitter control center on the front panel of the main assembly, press up or down to navigate to the AUDIO INPUT menu. Press enter to continue.




3. Press up or down to select COMPOSIT as the primary audio source. Press enter to continue.

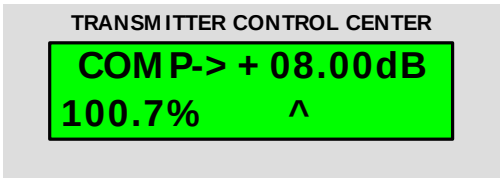



4. From the main screen on the transmitter control center on the front panel of the main assembly, press up or down to navigate to the AUDIO LEVEL menu. Press enter to continue.


5. Press up or down to select COMP. Press enter to continue.

6. The display will show the current peak modulation attributable to the Composite input. The level can be adjusted by changing the associated gain/attenuation. This has a range of -96.0 dB to +22.0 dB in 0.25 dB steps. Press left or right to move the cursor. Press up or down on each digit to increment or decrement the number. This has immediate effect. Do this until the displayed peak hold is the desired value – typically 100%.

7. Note: The Composite input is summed with the supplementary sources SCA1, SCA2, and RDS. When calibrating the Composite input, the supplementary sources should be turned off.

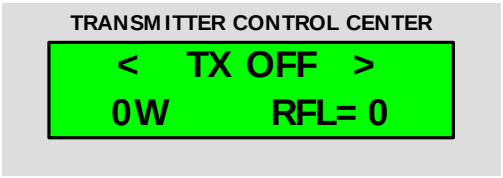



8. Press enter when finished editing to save the Composite calibration setting.

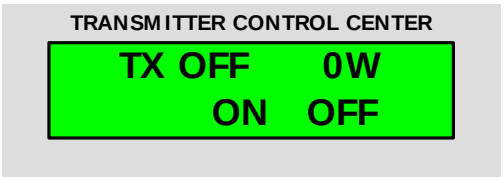
## 2.11 Turn RF Transmission On

If all setup steps have been completed, including desired optional features in the next section, the system should be ready for operation.

1. At the main screen on the transmitter control center, press the return button.




2. Press the button under “ON” to power up the transmitter.



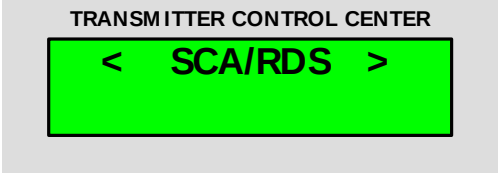
# 3 Optional Installation Steps

## 3.1 Additional Program Services

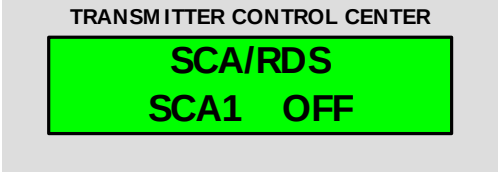
The STXe 3 allows operation of three supplementary audio services. These are labeled SCA1, SCA2 and RDS. It is expected that these will be generated by an external system, modulating the audio at the proper frequency between 57 kHz and 100 kHz.
The setup of these audio input sources all follow the same pattern as one another Repeat these steps below to utilize any of these inputs.

1. Connect a BNC cable from the external signal generator source to the secondary program input. Activate the source with a constant level tone or typical level real audio.

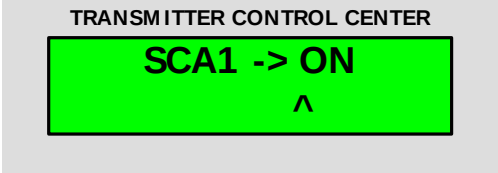
2. From the main screen on the transmitter control center on the front panel of the main assembly, press up or down to navigate to the SCA/RDS menu. Press enter to continue.




3. Press up or down to select the desired SCA/RDS input.




4. Press up or down to change the setting to ON.




5. Press enter for the on/off setting to save and take effect in the system.

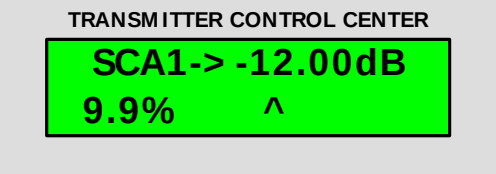
6. From the main screen on the transmitter control center on the front panel of the main assembly, press up or down to navigate to the AUDIO LEVEL menu. Press enter to continue.

7. Press up or down to select the desired input and press enter to continue.


8. Press left or right to move the cursor. Press up or down on each digit to increment or decrement the number and take effect in the system. Do this until the displayed composite peak hold is within a few percent of 100%.

9. Note: SCA1, SCA2, and RDS input signals (that are enabled) also contribute to this composite peak hold value. These sources should be turned off before attempting this calibration.

10. Adjust until the displayed composite peak hold is approximately 10%. Note that enabled SCA1, SCA2, RDS, and composite input signals all contribute to this peak hold value. Other sources should be turned off for calibration of each individual channel.



## 3.2 Ethernet/IP Network

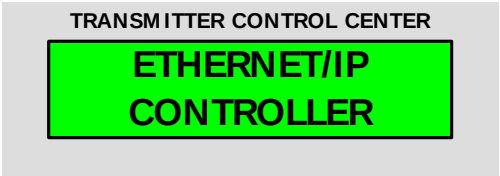
IP network features are entirely optional. System setup sections below contain procedures based on the LCD interface on the front panel of the main assembly, but there is alternative user interfacing for control of all of these setup parameters in both the web and SNMP interfaces.
The currently used configuration, such as IP address, can be observed in front panel menus. The actual configuration of the system may be determined by DHCP rather than the static settings. Configuration should be made to match whatever network setup is installed.
Consult your network manager or internet service provider to ensure that the correct IP settings are used.
For any network type, connect an Ethernet cable from the ETHERNET port to networking equipment (such as a switch or gateway).

### 3.2.1 Static IP

Use either this simple static IP setup or dynamic host control setup.

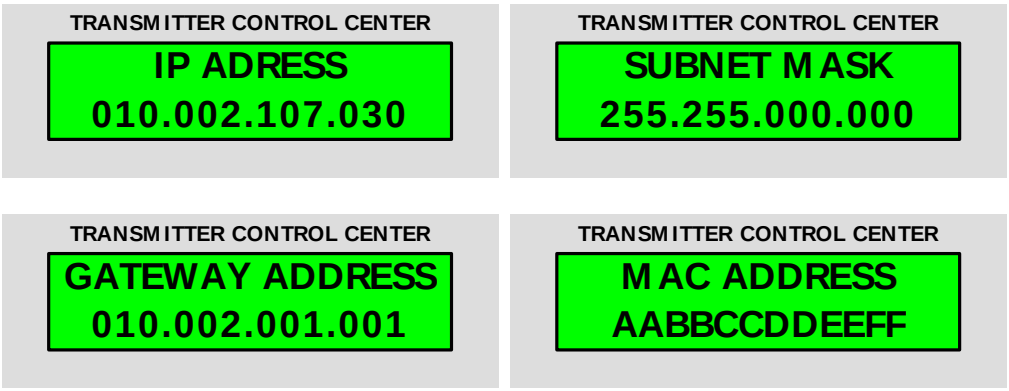
1. From the main screen on the transmitter control center on the front panel of the main assembly, press up or down to navigate to the ETHERNET/IP menu. Press enter to continue.


2. Press up or down to select the port to be set up. CONTROLLER is the ETHERNET port on the STX. Exgine is the ETHERNET DATA port on the optional VPeXG system. VPe is the ETHERNET VPE port on the optional VPeXG system. Press enter to continue.

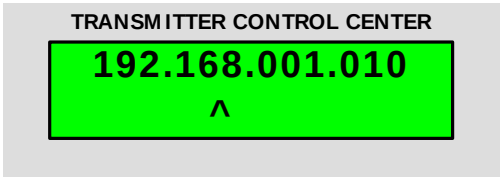



3. Press up or down to select the IP parameter to be observed or changed. Press enter to continue.

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 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.



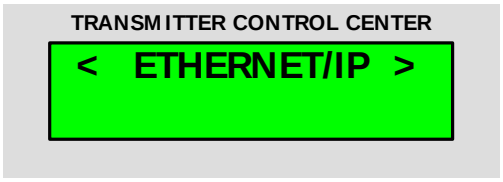

6. Verify that the settings active by connecting to the port.

### 3.2.2 Dynamic Host Control

Dynamic IP setup using DHCP is appropriate for more sophisticated and secure network setups. Ethernet will not function when DHCP is enabled and a DHCP-based host controller (typically an internet gateway) is missing from the network setup.

Use either this dynamic host control setup or static IP setup.

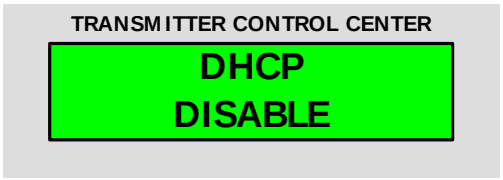
1. From the main screen on the transmitter control center on the front panel of the main assembly, navigate to the ETHERNET/IP menu. Press enter to continue.



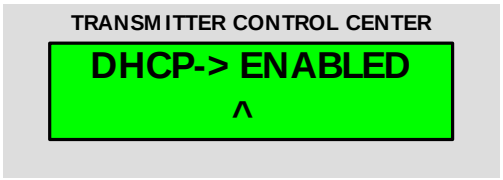

2. Press up or down to navigate to the ETHERNET/IP CONTROLLER. Press enter to continue.


3. Once in the menus, press up or down to select CONTROLLER DHCP and press enter.


4. Once in the menu, press up or down to select DHCP and press enter.




5. Press up or down to change the selection to ENABLED and press enter.

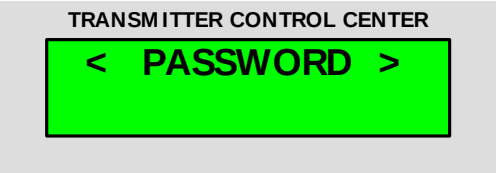



6. Verify that the host control function is active by connecting to the IP port with a web browser. Connect through the managed switch/gateway. Alternatively, view the IP ADDRESS status in these menus to retrieve the current host and access the port through a different local switch.

## 3.3 Password

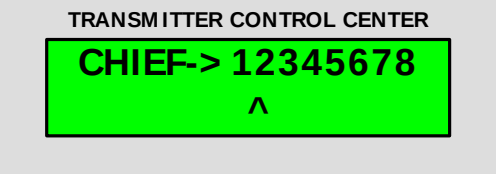
The default password is invalid for control access. One or more of the passwords (operator, user, or chief) must be set at the Front Control Center first, to allow control the of system through any IP interfaces and the STX HTML and GUI programs.

1. From the main screen on the transmitter control center on the front panel of the main assembly, press up or down to navigate to the PASSWORD menu. Press enter to continue.




2. Press up or down to select the password to be set. Press enter to continue.


3. Press left or right to move the cursor between password digits. Press up or down on each digit to increment or decrement the number password.

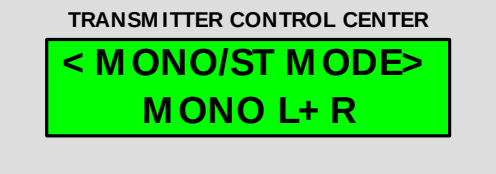



4. Press enter when finished editing for the password to take effect in the system.

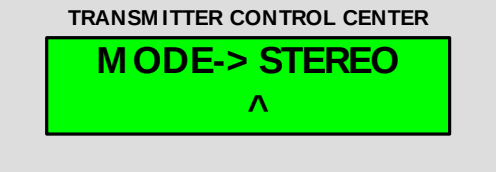
## 3.4 Stereo Generation and Stereo Pilot Injection

Internal stereo generation utilizing the AES or Analog L/R audio input channels is optional.

1. From the main screen on the transmitter control center on the front panel of the main assembly, press up or down to navigate to the MONO/ST MODE menu. Press enter to continue.



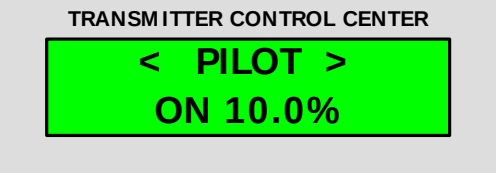

2. Press up or down to select STEREO.



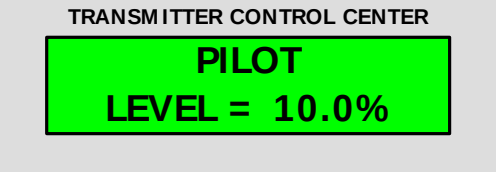

3. Press enter for the selected mono/stereo mode to save and take effect in the system.

4. Note that if changing from any mono mode to stereo, the internally generated 19 kHz stereo pilot will automatically turn on at the previously set level. Change back to mono from stereo automatically turns the stereo pilot off.

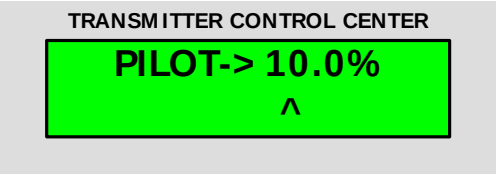
5. To change the injection of the 19kHz stereo pilot: from the main screen on the transmitter control center on the front panel of the main assembly, press up or down to navigate to the PILOT menu. Press enter to continue.




6. Press up or down to select LEVEL.



7. Set the injection level of the pilot in the stereo signal (% peak injection is multiplicative to stereo AES or Analog L/R reduction factors). Press left or right to move the cursor. Press up or down to increment or decrement the number.



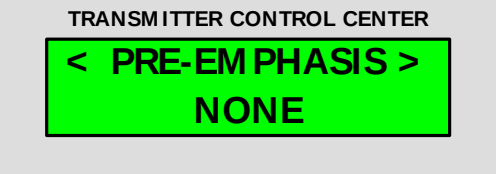

8. Press enter for the pilot level to save and take effect in the system.

The Pilot has two modes of operation: 1) On, or 2) Stereo. When the On mode is selected, the 19 kHz pilot will always be present. If in Stereo mode, the Pilot will only be present if the STXe is in Stereo mode.

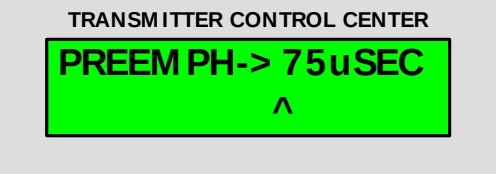
## 3.5 Pre-Emphasis

Internal pre-emphasis filtering on the AES and Analog L/R audio inputs is another standard option feature tied to internal stereo generation. North American receivers are typically compatible with 75 microsecond filters while European receivers typically utilize 50 µs.

1. From the main screen on the transmitter control center on the front panel of the main assembly, press up or down to navigate to the pre-emphasis menu. Press enter to continue.




2. Press up or down to select the desired filter type.




3. Press enter for the filter change to save and take effect in the system.

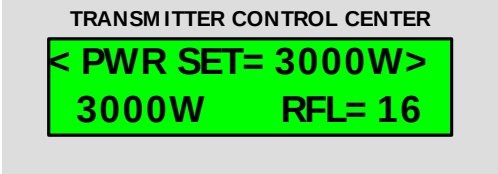
## 3.6 Tuning Digital Mode RF Amplifier Linearity

Some VPe XG option setup conditions (frequency, loads, etc.) require PA digital operation tuning to successfully transmit Digital-only or FM+Digital waveforms. This is typically accomplished by increasing PAV to linearize, or by decreasing PAV to add efficiency and keep power amplifiers as cool as possible.
If PAs are ever excessively hot during this process, immediately restore voltages to default on all PAs, reduce system power (total or side-band power in hybrid modes) until within limits, and contact RF Technical Services.

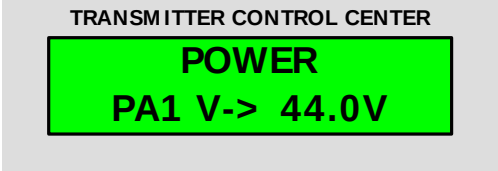
**THIS PROCESS CARRIES A RISK OF AMPLIFIER PART FAILURE DUE TO EXCESSIVE TEMPERATURES. PROCEED WITH CAUTION.**

Open a PA web page on a local PC to see all power and temperature statuses at once.

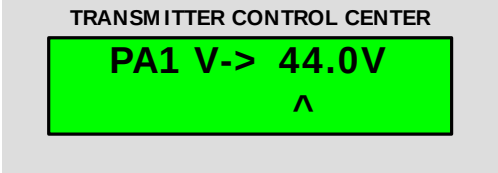
1. Navigate to the power settings menu on the transmitter control center front panel interface.




2. Press down/up to one of the PA# V screens. There is a screen for each PA in the system, where # is the PA number 1, 2, 3, 4 and 5.




3. 1kW systems: increase PAV by 1.0 V at a time and continue to the next step.
4. In combined systems, look at the forward power out of each PA. Select the PA that has the lowest power compared to the rest. Increase Voltage in small increments and check the power of all PAs in the system. Note that if power does not increase, the PA is already operating as linear as possible. Do not continue to increase voltage in a linear PA. It will reduce efficiency with no added benefit to the system and can do this to the point of thermal failure. Also note that other PAs will reduce power to maintain total output power. Repeat this step for other PAs in the system.



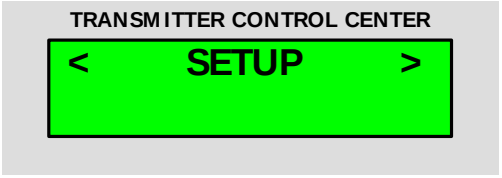

5. After giving VPe adequate time to adapt to the new system characteristics, observe the spectrum and check for sufficient spectral improvement.
6. Verify all PA heat sink temperatures at least remain below ambient air temperature plus 50 degrees C, or about 74 degrees C total when the transmitter is operating in a comfortable room temperature.

To increase efficiency in systems operating below nominal power levels, follow a similar process to reduce voltage in a PA until PA output power starts to reduce. In combined systems, this process should start with the highest temperature PAs.

## 3.7 Secondary Audio and Silence Timeout

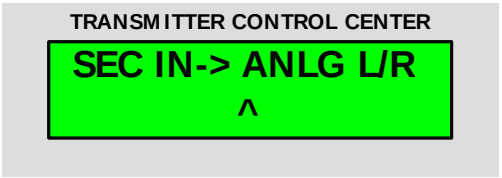
The SECONDARY AUDIO feature allows switching to an alternate source after the PRIMARY AUDIO is absent for the time entered in the SILENCE TIMEOUT setting.

1. From the main screen on the transmitter control center on the front panel of the main assembly, press up or down to navigate to the SETUP menu. Press enter to continue.



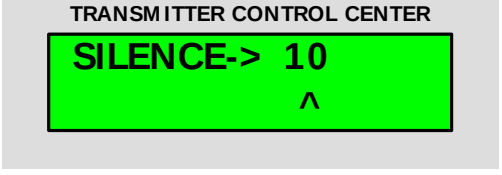

2. Press up or down to select the secondary audio to be set. Press enter to continue.


3. Press up or down to select one of the 4 inputs; Composite, Analog L/R, AES, AES Composite, or None if secondary audio isn't used. Injection level setup for Secondary Audio will be same as outlined in section 2.10.




4. Press enter when finished with selection for the secondary audio source to take effect in the system.
5. Press SET UP again.
6. Press up or down to select SILENCE TIMEOUT and press enter to continue.


7. Press up or down, left or right to enter a timeout in seconds.




8. Press enter when finished for the time out setting to take effect in the system.

# 4 Rear Panel Features & Connections

The reference designator box number corresponds to the sub-section number in this section.
For example, Box 4.1 corresponds to details in 4.1 of this section

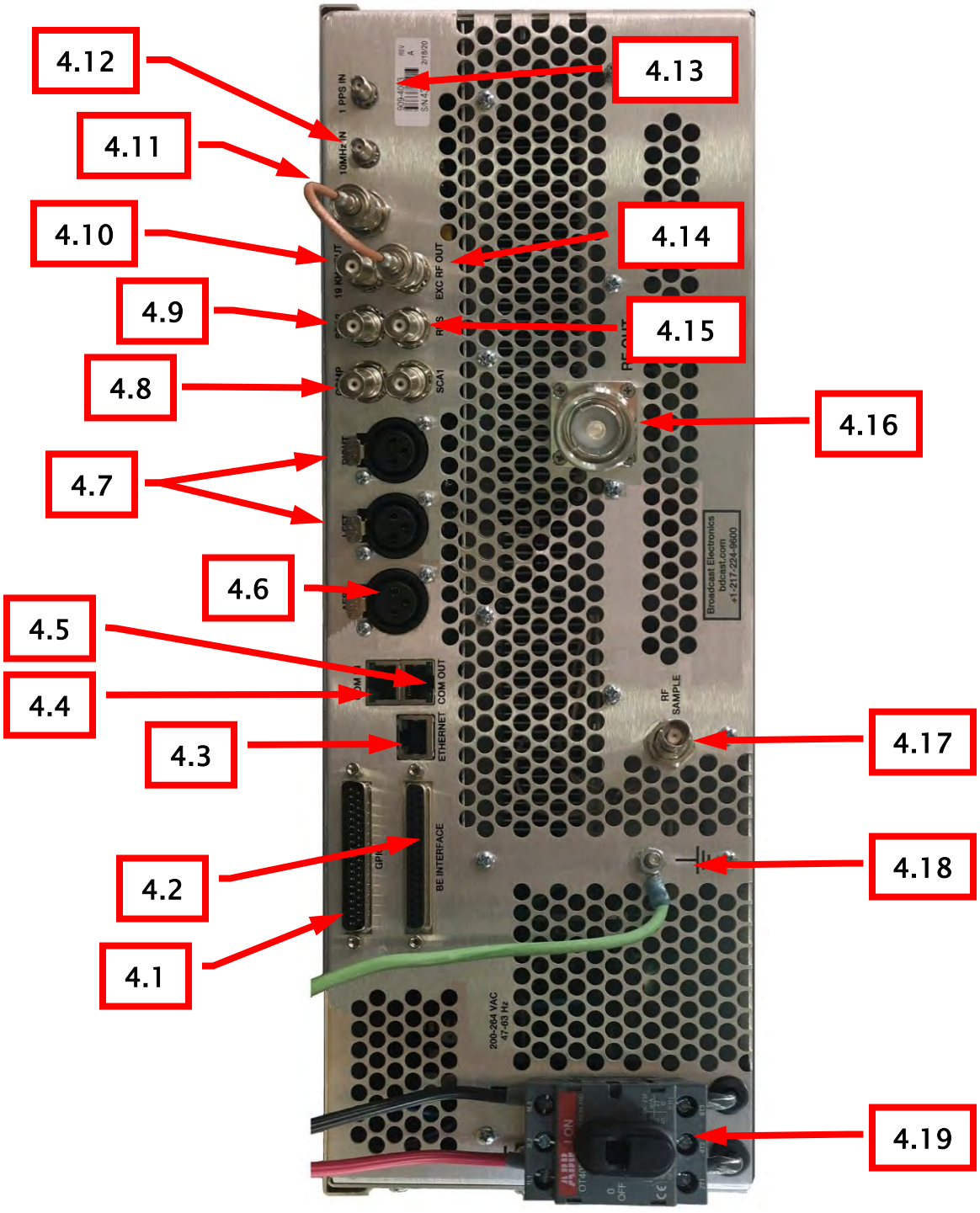



Figure 7 – Feature / Connector Location REAR

## 4.1 GPIO

General Purpose Input/Output, “GPIO” connector. This D-Sub 37 male connector is used in remote station interface control and other machine interfacing. Pin descriptions are described in detail in Table 2.

In the context of TTL interfaces in GPIO and BE-Interface connections, logic low refers to a connection to within 0.8V of isolated ground. Logic high inputs are internally pulled up through 2kOhms to isolated +5V (referenced to GPIO pin 32). Inactive inputs should be open/floating, and not driven. Active edge refers to a transition from the inactive state to the active state. Active low refers to 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 input pulse such as this should be approximately 100ms in duration to ensure capture of the event.

**Table 2 – GPIO Pins**

| Pin | Direction | Name | Description |
|---|---|---|---|
| 1 | Input | Fault Reset | Resets all the transmitter faults with an active low edge. |
| 2 | Input | Failsafe | Transmitter failsafe input. Requires a sustained low to run RF in the system. |
| 3 | Input | Transmitter On | Turns RF power on with an active low edge. |
| 4 | Input | Transmitter Off | Turns RF power off with an active low edge. |
| 5 | Input | Mute | Mutes RF while the input is held low. This essentially performs the function of “Transmitter Off” with a low edge and “Transmitter On” with a high edge. |
| 6 | Input | Raise Transmitter Power | Raises the system power 10 Watts every second that this input is held low. |
| 7 | Input | Lower Transmitter Power | Lowers the system power 10 Watts for every second that this input is held low. |
| 8 | Input | Reserved | Reserved |
| 9 | Input | Controller Reset | Forces hardware reset on the system controller and exciter when active. Hold this line low for up to 5 seconds and release to enable RF output once again. Note: this input is not intended to be used during normal operation of the system and should only be used in extreme circumstances. |
| 10 | Input | Reserved | Reserved |
| 11 | Input | Reserved | Reserved |
| 12 | Input | Ground | Alternative isolated ground pin internally connected to pin 19, see below for details. |
| 13 | Input | Reserved | Reserved |
| 14 | Input | VPe System Present | Indicates the presence of a VPe system in the setup. Checked at system boot for a held low level. |
| 15 | Output | Reflected Power | DC voltage for total reflected power at the system RF output. Varies linearly from 0V = 0W to 5V = 100 * Model W (100W for 1kW, 200W for 2kW, etc.). |
| 16 | Output | Selected PA Total Current | DC voltage for total RF power supply current for a PA module (select via pin 18). Varies linearly from 0 = 0A to 5 V = 50A. |

| Pin | Direction | Name | Description |
|---|---|---|---|
| 17 | Output | Selected PA Temperature | DC voltage for heat sink temperature reading for a PA module (select via pin 18). Varies linearly from 0V = 0 degrees C to 5V = 100 degrees C. |
| 18 | Input | PA Module Select | Controls which PA is being monitored by other output pins. Each active low edge cycles through selections. The end of the selectable PAs is indicated by all outputs being ~0V. Reserved in 1kW systems. |
| 19 | N/A | Ground | Isolated ground intended to be used for safe remote input logic connections on this interface. Jumper J9 allows this to be wired to a system-wide chassis ground. Pin 12 provides an alternate connection. |
| 20 | Output | General Fault | Low when any fault is active in the system. |
| 21 | Output | VSWR Fault | Low when the affected part of the system is shut down due to reflected power above safe levels or VSWR greater than 2.0:1 |
| 22 | Output | Transmitter On | Low when system RF output power is on. |
| 23 | Output | Transmitter Off | Low when system RF output power is off. |
| 24 | Output | Mute Status | Low when the transmitter is muted via input pin 5. |
| 25 | Output | AFC Lock | Low when the internal exciter is locked onto the set frequency. |
| 26 | Output | Power Supply Fault | Low when a power supply fault is detected in any RF power supply. |
| 27 | Output | Reserved | Reserved |
| 28 | Output | PA Fault | Low when any fault is detected in any PA module. |
| 29 | Output | PA Forward Power | DC voltage for PA forward power (select via pin 18). Varies linearly from 0V = 0W to 5V = 1250 W. |
| 30 | Output | PA Reflected Power | DC voltage for PA reflected power (select via pin 18). Varies linearly from 0V = 0W to 5V = 100 W. |
| 31 | Input | Reserved | Reserved |
| 32 | Output | +5V | Low power logic voltage supply for remote interface logic on this interface. Jumper J26 allows this to be wired for fused or isolated power supply. Isolated current limit is 7.5mA. Fused current limit is 0.5A. |
| 33 | Output | Forward Power | DC voltage for system forward output power. Varies linearly from 0V = 0W to 5V = 1100 * Model Watts (1100W for 1kW, 2200W for 2kW, etc.). |
| 34 | Output | PA Voltage | DC voltage representing the variable RF power supply in a PA (select via pin 18). Linear from 0V = 0V to 5V = 50 V. |
| 35 | Output | Reserved | Reserved |
| 36 | Output | Reserved | Reserved |
| 37 | N/A | Ground | Chassis ground |

## 4.2 BE INTERFACE

Broadcast Electronics machine interface. This D-Sub 37 female connector provides conduits for many exciting new product options including a standby system control and exciter, digital radio generators, and much more.

**Table 3 – BEI Pins**

| Pin | Direction | Name | Description |
|---|---|---|---|
| 2 | N/A | Ground | Chassis Ground |
| 4 | Input | Active/Standby | Tie to ground to activate this CPE, open for standby |
| Other | | Reserved | Reserved |

## 4.3 ETHERNET

Ethernet is provided on a standard 10/100 Mbps RJ45 connector. Connect to a local area network switch and/or to a gateway using Cat5E cable for access through the network. This interface automatically negotiates speed and hardware interfacing; a crossover cable is not required. Direct connections to a PC or other network controller can be made with either a crossover or straight Ethernet cable.

IP-based interfaces such as the built-in website and SNMP require this to be connected and the network parameters set up through the front panel interface. There is no explicit limit on the number of concurrent users that can be connected to the STXe; however an excessive number of connections will cause a decrease in performance.

## 4.4 COM IN

System communications bus input. This RJ45 jack is intended to be used in the backup main unit in redundant internal exciter configurations. In this case, a communications cable must be connected from COM OUT on the primary main unit to this input on the standby unit.

This output is not used in typical 1kW configurations. Connecting to this jack improperly may cause internal system communications failures.

## 4.5 COM OUT

System communications bus output. This RJ45 jack is used to wire the communications bus to the rest of the system. For main/backup systems, this connects to the standby unit. The second main assembly in a 2kW system setup connects to the combiner. For all other configurations, this must connect to the next add-on PA in the chain.

This output is not used in typical 1kW configurations. Connecting to this jack improperly may cause internal system communications failures.

## 4.6 AES

AES/EBU audio input connector. This XLR connector is used for inputting digital audio to the standard stereo generator in the internal exciter. Select AES as the primary audio source to modulate RF with this audio.

Supported bitrates include 32, 44.1, 48, 96, and 192 ksps.

## 4.7 LEFT and RIGHT

Left and Right balanced analog audio input connectors. These XLR connectors input audio into the standard stereo generator system in the internal exciter. Set Analog L/R as the primary audio source in order to modulate RF with this audio.
An internal hardware jumper allows these inputs to be switched to 10k Ohm impedance.

## 4.8 COMP

Unbalanced composite audio input connector. This BNC connector allows input of baseband audio up to 100 kHz into the internal exciter. Setting Composite as the primary audio source modulates RF with this signal.

## 4.9 SCA1 and SCA2

Subsidiary Communications Authorization audio input connectors. These BNC connectors allow subcarrier programs up to 100 kHz generated by external devices to be injected in the internal exciter. These inputs are enabled and disabled independently.

## 4.10 19kHz OUT

19 kHz stereo pilot output connector. This BNC connector is used to output the pilot signal for optional use in external synchronization equipment. The output wave form is a constant 1 V peak-to-peak sinusoid when connected to a high impedance termination.

## 4.11 PA RF IN

Power Amplifier RF Input BNC connector. This is connected to the EXC RF OUT for FM operation. It is connected to the optional VPe/XG if in a Digital mode, (e.g. HD radio or Digital Radio Mondiale).

## 4.12 10MHz IN

10 MHz clock input connector. This BNC synchronizes the exciter's internal clocking to a connected sinusoidal clock signal. To lower the chances of drift, connect high precision clock generators such as GPS receiver modules or digital radio signal generators.

## 4.13 1 PPS IN

The one pulse-per-second BNC input connector synchronizes stereo pilot signals such that rising zero-crossing point in the pilot signal corresponds to the rising edge of this logic clock. A high precision clock generator such as a GPS receiver module or a digital radio signal generator is recommended.

## 4.14 EXC RF OUT

Internal Exciter RF output connector. This BNC connector outputs the internally generated exciter power level RF signal. For 1kW systems this should be jumped to PA RF IN using a coaxial connector. For all other system types this should be connected to the RF SPLT IN on the combiner module.

## 4.15 RDS

Radio Data System input connector. This BNC connector allows input of an externally generated RDS standard signal to broadcast time, station identification, and program service information. This input is enabled and disabled independently.

## 4.16 RF OUT

The final power amplifier output. This 7/16 Female DIN connector carries the amplified RF output to the connection of a 50 Ohm antenna or RF system.

## 4.17 RF SAMPLE

Power amplifier RF sample connector. This BNC carries a coupled RF signal from the PA section. This is intended to be used for optional monitoring of RF output.
Nominally generates about 19 dBm at full PA output power. The output level scales with total output power of the PA module.

## 4.18 Ground

Ground bolt that should be used to connect chassis ground to equipment rack or station ground.

## 4.19 AC Input & Power Switch

AC power switch. This hand operated switch turns on or off power service to the device. Complete power-down of the module may take a few seconds.

# 5 Front Panel Features & Controls

The front assembly provides the transmitter control center and contains LED indicators for the system controller, internal exciter, internal power amplifier, and an LCD user interface. The reference designator box number corresponds to same sub-section number in this section. For example, Box 5.1 corresponds to details in 5.1 of this Section

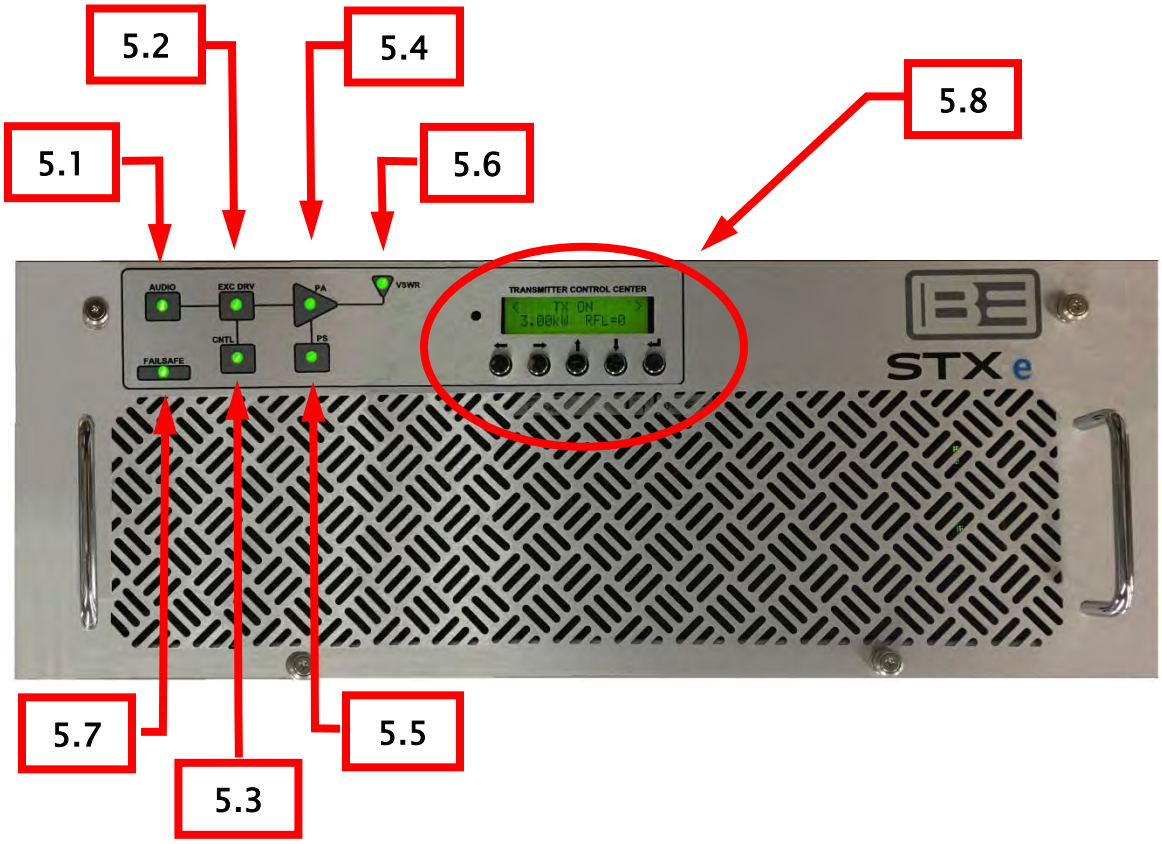



**Figure 8 – Control and Feature Locations – FRONT**

## 5.1 AUDIO LED

The audio LED indicates the status of the current primary audio source and remains green until a fault is detected. If an audio peak is detected, this LED turns red and also during a silence condition when no secondary audio is setup. If a secondary audio source is setup, the LED will turn orange after the primary silence timeout. The LED will return to green when the fault is cleared and the exciter switches back to primary. Check the exciter diagnostics for details on what alarms or faults may be active.

## 5.2 EXC DRV LED

The exciter drive LED indicates the status of any alarms or faults related to the exciter or exciter drive in an internal PA. Green indicates that the exciter has settled into normal operating conditions. Orange indicates an alarm condition. Red shows when the exciter has a fault condition. See Table 8 – Exciter Diagnostics Details in section 10.5 for more information.
Note that there is overlap between internal exciter and internal PA status for drive detection. An exciter drive alarm indication may originate in measurements within the PA.

## 5.3 CNTL LED

The system control LED shows the status of the system controller. Green indicates normal control operation. Red indicates a loss of monitoring and control communication between controller units. This could be between the system controller and the front panel display, any PA controller, or the combiner controller.

## 5.4 PA LED

The power amplifier LED shows status of the internal PA. Green indicates normal operation. Orange indicates an alarm condition. Red indicates a fault and PA shutdown condition. See Table 9 – PA Diagnostics Details in section 10.6 for details on what alarms or faults may be active.

## 5.5 PS LED

The power supply LED shows the status of the RF power supply module. Green indicates normal operation. Orange indicates a self-reported alarm. Red indicates a determined fault. Check PA diagnostics for details on what alarms or faults may be active in the supply connected to the PA.
Note that these power supplies are on the same communications node as the PA they are paired with. A communication fault will illuminate red on both the PA and the PS LEDs.

## 5.6 VSWR LED

The voltage standing wave ratio LED shows the status of the internal PA output in terms of measured reflected power. Green indicates normal operation into an acceptable load. Orange indicates active foldback protection. Red indicates a fault and shutdown condition.

## 5.7 FAILSAFE LED

The failsafe LED is coupled to the failsafe input on the back panel when running transmitter modes. Green indicates the failsafe is connected for normal operation. If red the failsafe is not connected and RF power will not turn on. In exciter setups this LED is turned off.

## 5.8 TRANSMITTER CONTROL CENTER

This front panel LCD interface can be used for control and monitoring of all features in the system. Use the five buttons below the screen to navigate and make modifications. Refer to Figure 9 and the sub sections for details on how to use this interface

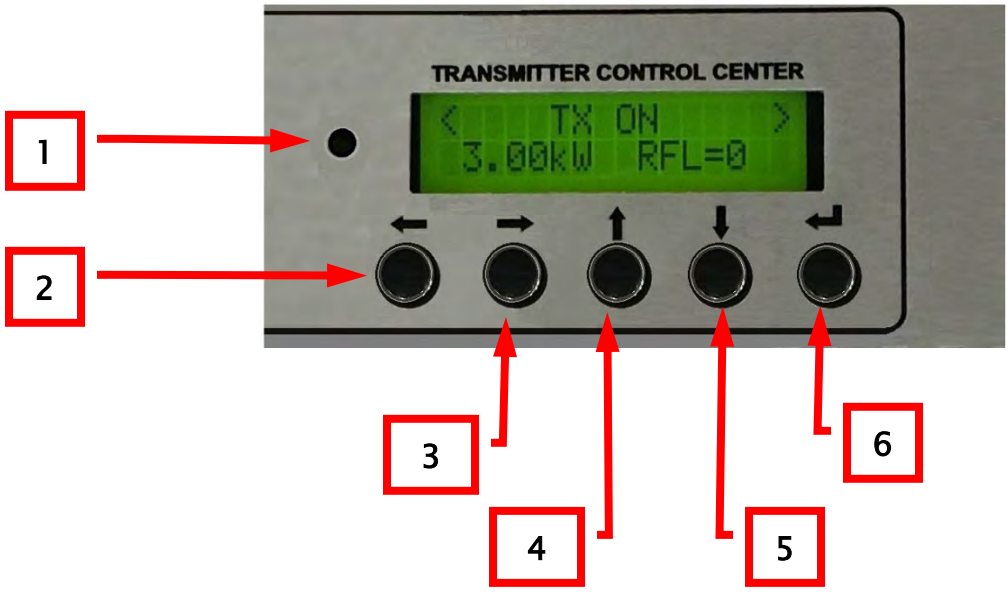



**Figure 9 – Transmitter Control Center**

### 5.8.1 Contrast Control

A potentiometer tuning tool can be used to adjust the contrast on the LCD screen if desired. Turning the potentiometer clockwise reduces contrast, and turning it counter-clockwise increases contrast.

### 5.8.2 Left Button

The context dependent left button performs two primary functions. When navigating between screens it allows a return to the main screen from any other navigation screen. When an editing screen is entered this button moves the cursor one space to the left.

### 5.8.3 Right Button

The context dependent right button performs two primary functions. When navigating between screens it allows a return to the first screen of the submenu tree. When an editing screen is entered this button moves the cursor one space to the right.

### 5.8.4 Up Button

The context dependent up button performs various functions. When navigating between screens through the trunk it selects a new submenu tree. After entering a submenu screen it either selects different branches or cycles through options. When an editing screen is entered this button modifies the object located at the cursor.

### 5.8.5 Down Button

The context dependent down button performs various functions. When navigating between screens through the trunk it selects a new submenu tree (in the opposite direction as the up button). After entering a submenu screen it either selects different branches or cycles through options. When an editing screen is entered this button modifies the object located at the cursor.

### 5.8.6 Return Button

The context dependent down button performs two primary functions. When navigating between screens through the trunk it enters the next level in the menu. This can lead to submenu screens, options selection, or field editing. Once an editing function has been made this saves the field and returns to the first screen in the submenu tree.

# 6 Theory of Operation

Broadcast Electronics STX & STXe FM transmission systems are equipped with a system controller and exciter platform. The exciter sub-system routes audio and other program service data through digital signal processing, digital up conversion, a numerically controlled oscillator, RF digital to analog conversion, and low-power RF analog signal output. This signal path generates a frequency modulated carrier waveform centered within the traditional FM band.

A micro-controller provides user interfacing (including IP), regulates all signal path stages in the exciter, and negotiates control and monitoring with PA controller and front panel interface controller peripheral micro-control modules through controller area network CAN communications.

STXe systems include numerous built-in safety features. Hardware failsafe can be used to reliably disable RF with external automated or manual controls. Automatic RF power fold-back, and system shutdown mechanisms protect power amplification in events of DC over-currents, excessive reflected RF power, or dangerously high internal temperatures. Dedicated circuits immediately mitigate unsafe conditions while micro-controllers self-determine system problems, take action as necessary, report faults/alarms, and log issues for troubleshooting.

In standard setups, exciter RF is routed from lower power exciter RF output back into the system in order to drive RF power amplification. Operating mode setup parameters determines the definition of this interface, which is described in following paragraphs.

Systems come standard equipped to run either of two standard modes of power amplification. FM-only mode utilizes a fixed exciter RF drive level. Variable final amplifier voltages compress the RF signal in class C amplifier operation, effectively controlling system gain to maximize power efficiency. FM+Digital and Digital-Only modes utilize fixed gain while operating class AB amplifiers for minimal signal distortions. The exciter drive level then varies to control system output power level.

Power in a digital RF mode exciter system setup is controlled by a higher power transmitter through a 4-state input with these states; mute, lower, hold, and raise. The duty cycle on this input determines system response.

Standalone transmitter and FM-only exciter setups utilize internal digital closed power control based on system forward output. Forward power approaches the active system set-point. The exciter is included in this loop when running digital power modes. FM-only closed loop is entirely contained within a PA microcontroller.

Fans are two-speed and fully turn on through active hardware logic. This logic is coupled to un-inhibit logic between the PA controller and DC power regulation circuitry.

Standard AC mains supply electrical power. An AC throw switch is included. A main power supply module converts AC to fixed DC power for use throughout the system. Power regulation systems input fixed DC and supply various lower level static and variable voltage levels to all circuitry and RF amplifiers. A fan power supply provides dedicated DC to fan(s).

There are two DB-37 connectors and a DB-25 connector to allow the STXe to interface with other equipment. This includes transmitters, remote monitoring and control, and signal generation options.

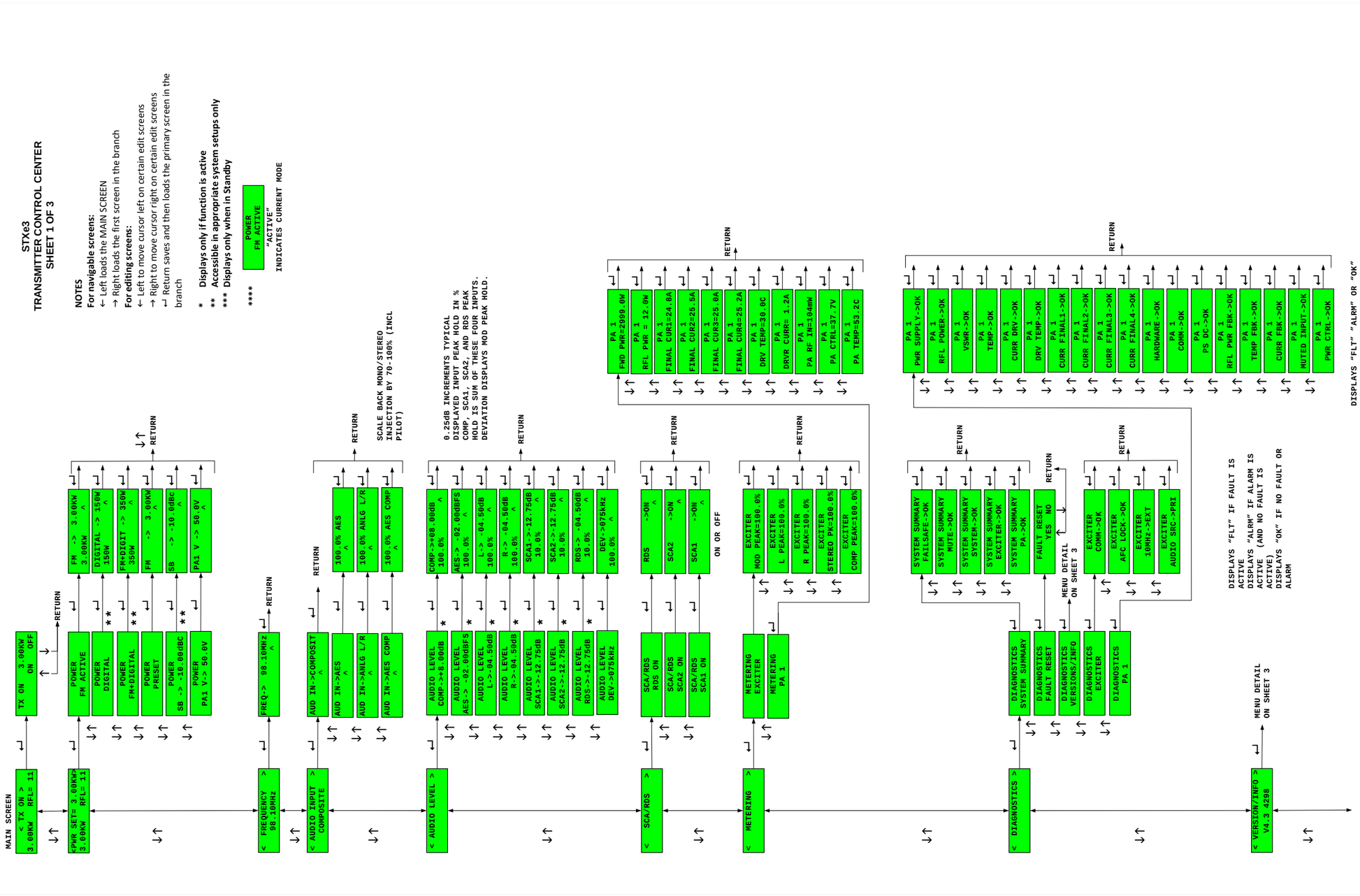



Figure 10 – Transmitter Control Center Menus Sheet 1

**STXe3**
**TRANSMITTER CONTROL CENTER**
**SHEET 2 OF 3**

**NOTES**
**For navigable screens:**
← Left loads the MAIN SCREEN
→ Right loads the first screen in the branch
**For editing screens:**
← Left to move cursor left on certain edit screens
→ Right to move cursor right on certain edit screens
↵ Return saves and then loads the primary screen in the branch

* **Displays only if function is active**
** **Accessible in appropriate system setups only**
*** **Displays only when in Standby**

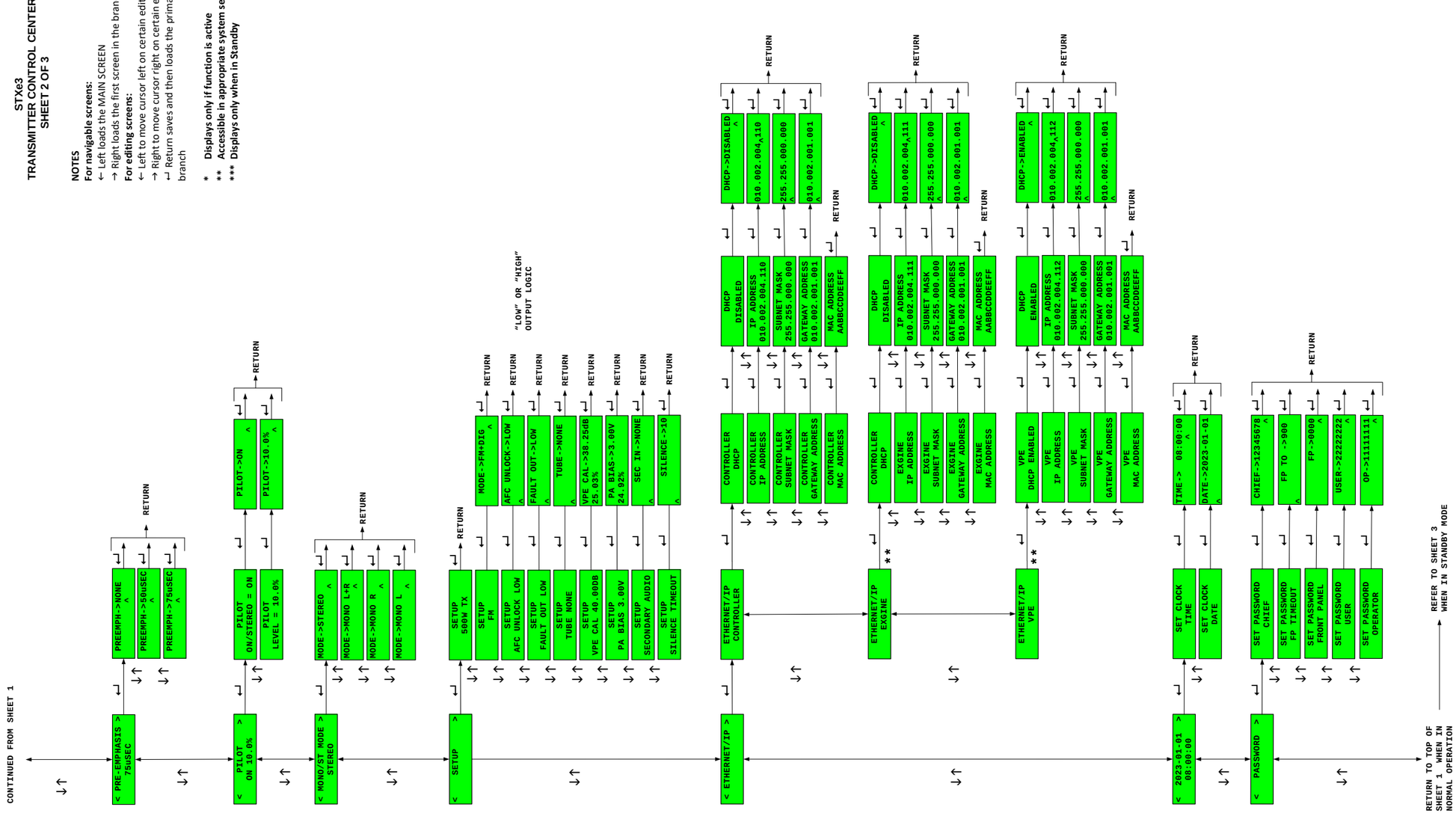



Figure 11 – Transmitter Control Center Menus Sheet 2

STXe3
TRANSMITTER CONTROL CENTER
SHEET 3 OF 3

Sheet 3 of 3
NOTES

*  Displays only if function is active
**  Accessible in appropriate system setups only
***  Displays only when in Standby

The first level window displays and their sub-menus on this sheet are the only displays that cycle in STANDBY MODE.

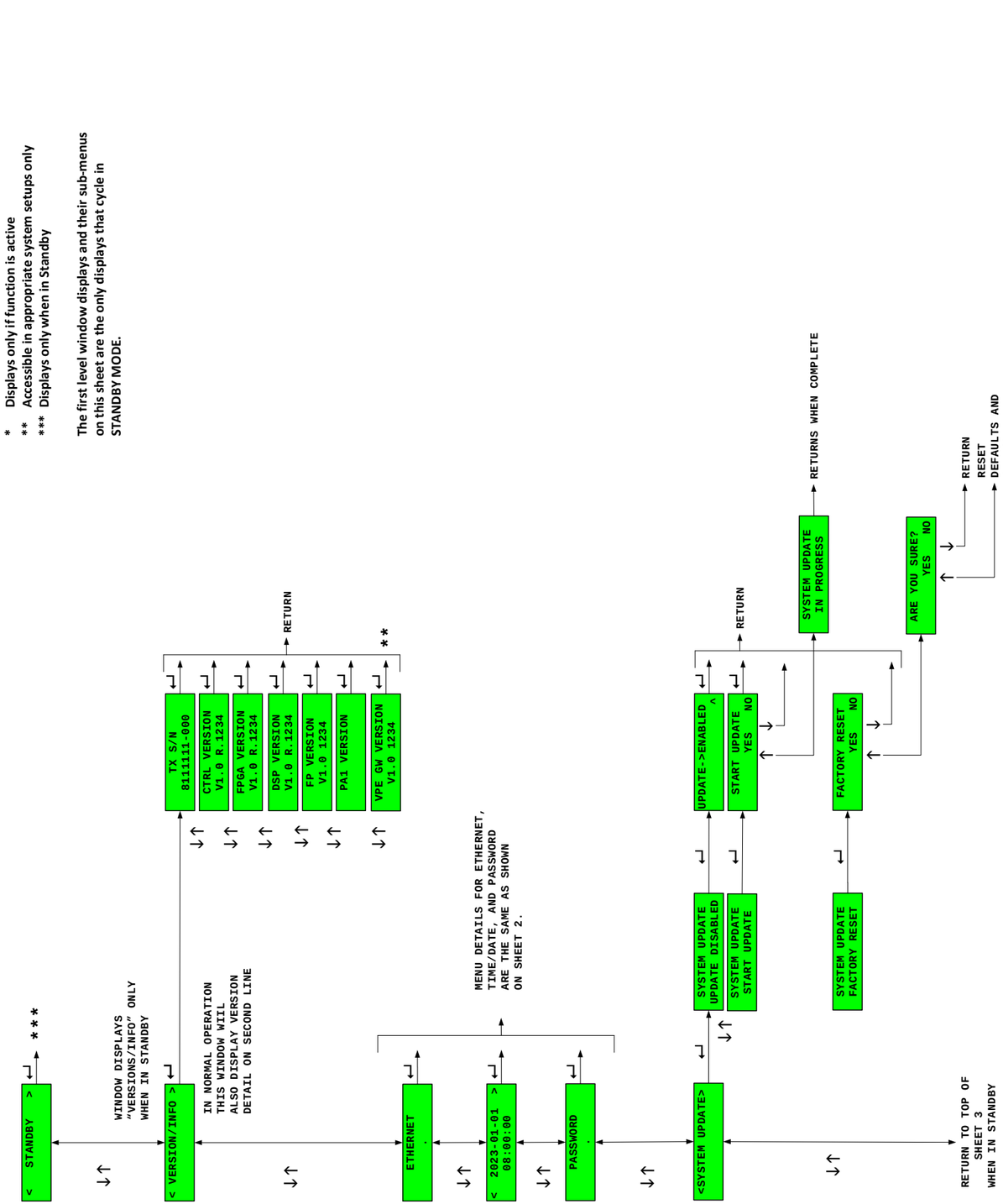



Figure 12 – Transmitter Control Center Menus Sheet 3

# 7 Basic HTML Web Pages

The STXe comes with a built in HTTP web server monitoring and control interface. To load this page, direct a standard web browser to the IP assigned to the Ethernet port on the system.

Below is the Main Page displayed on the browser tab. Note that addition tabs can be opened to display other pages or even the Enhanced GUI screens.

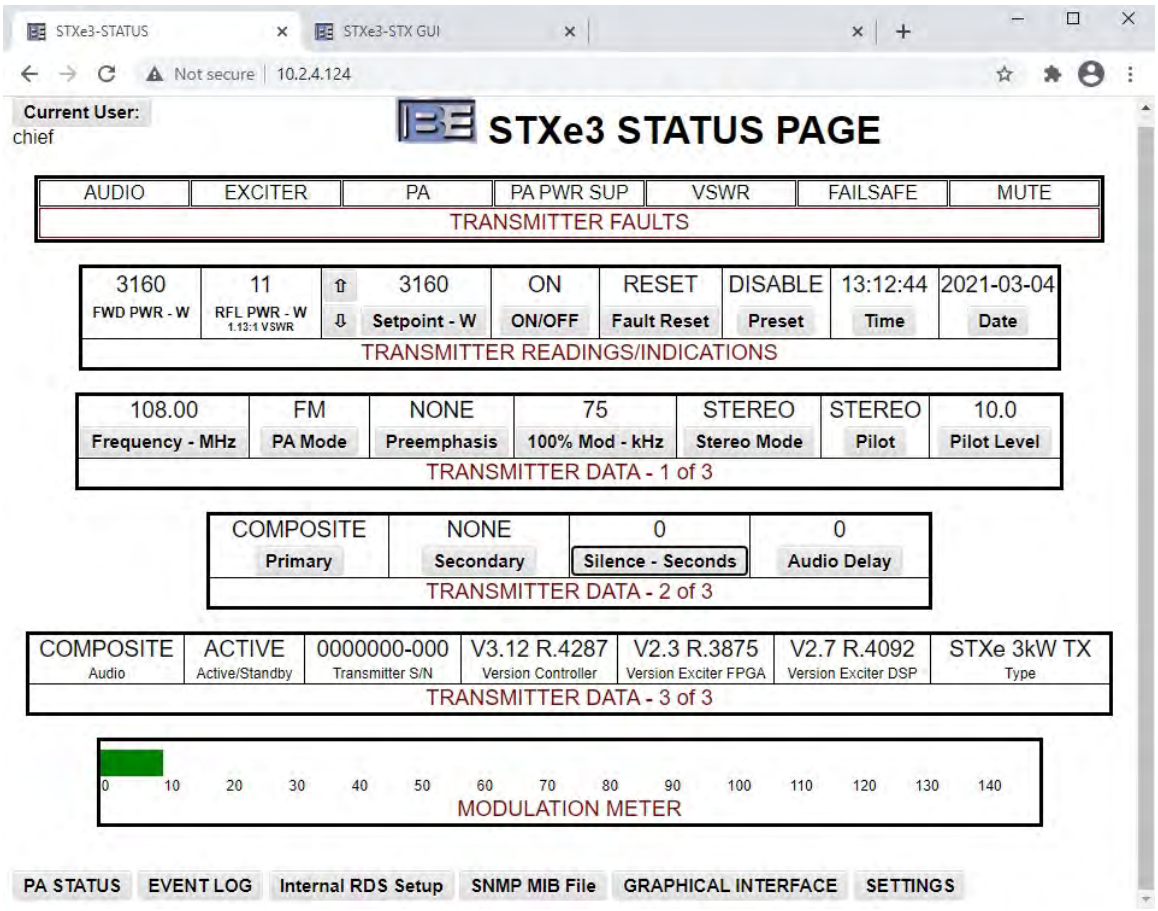



**Figure 13 – Web Interface Main Page**

Many of the fields displayed on the Main Page have link buttons in Bold to allow further monitoring detail or the entering / posting of setup data. In these setup fields, a correct user profile and password is required to make changes or to enter the field. Sections 7.2 and 7.3 will detail the user profile and set up details.

You can also navigate to additional status, monitoring information, and other settings, by clicking on the link buttons located on the bottom of the Main Page.

To check the current web page version, simply point a web browser to [IP Address]/rev.htm

## 7.1 Login Profiles – Basic Web Page

Posting settings to the exciter or other transmitter settings in **bold** requires an appropriate login profle. If the text is not in **bold**, it is for monitoring only or it is disabled for user profiles that do not have permission to modify the setting

To switch user profiles, such as" Chief" or "Operator", click the "Current User" link in the upper left. of the screen and will see the Authentication dialog box pop up, as shown Figure 14. Enter the user profile name that is required and it's 8-digit numerical password and hit OK to save the setting.

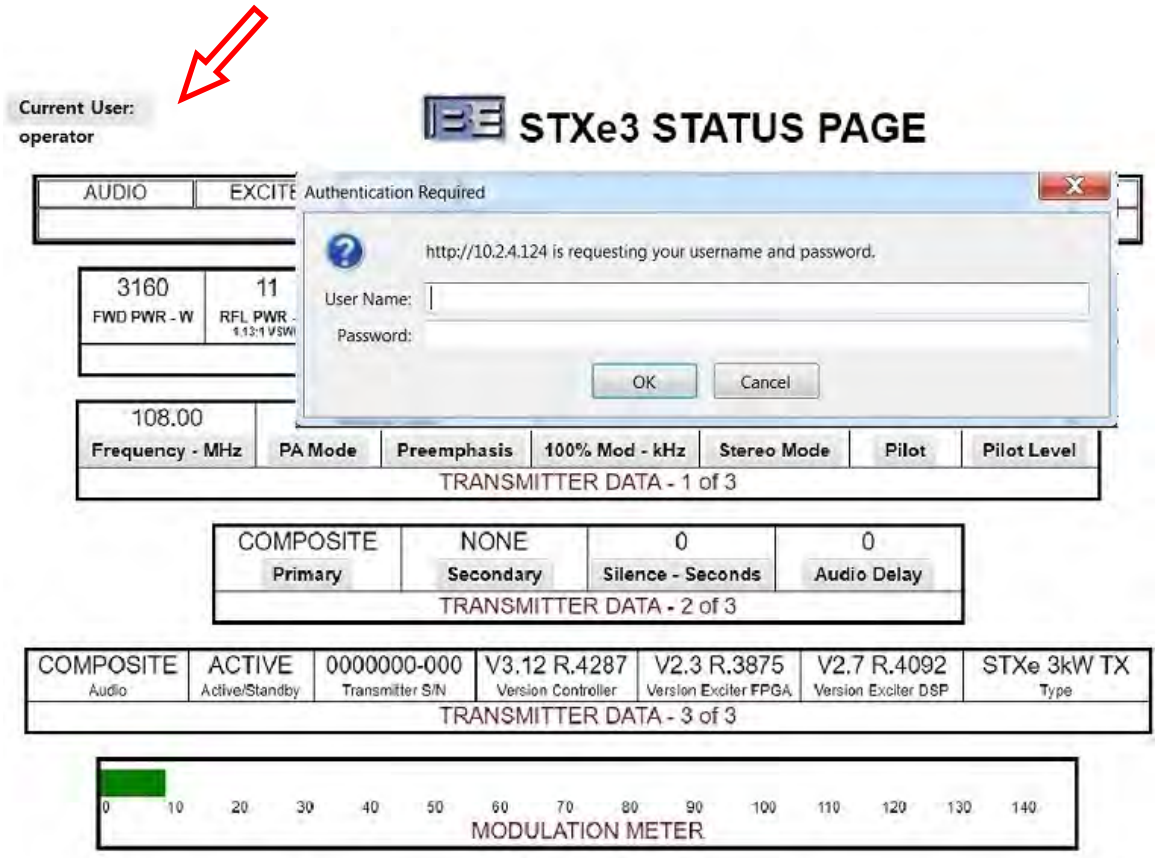



**Figure 14 – Web Interface Authentication**

**NOTE**: The transmitter is shipped with both of the passwords set to a default of "00000000". However, as a security measure, the password "00000000" is not accepted as valid by the transmitter. The customer must change the password to something other than "00000000" before remote operation is allowed. The password can only be changed at the front panel.
Refer to Section 3.3 regarding setting the passwords.

## 7.2 Posting Setup and Operating Data

Posting transmitter setup and operating data can be made in the individual fields of the Transmitter Data lines. Depending on what field button is selected, either a Data Entry Window will open as shown Figure 15, or the field will expand and list the selection options available for that filed as shown in Figure 16.

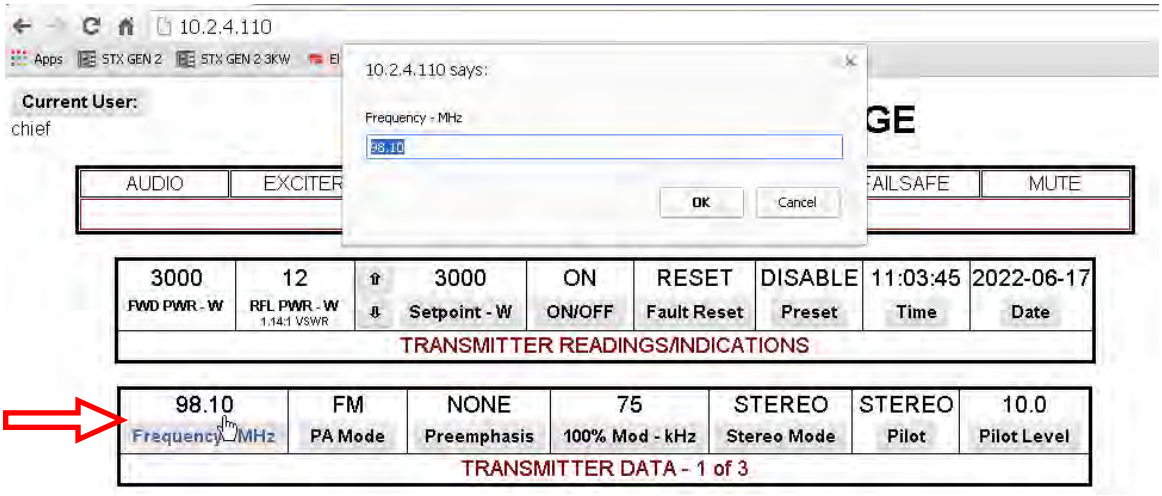



**Figure 15 – Data Entry Windows**

In the Figure 15 example, the Frequency button has been selected and a data entry window will open and display the current operating status or data. Enter the new data and click OK to save and make the change.

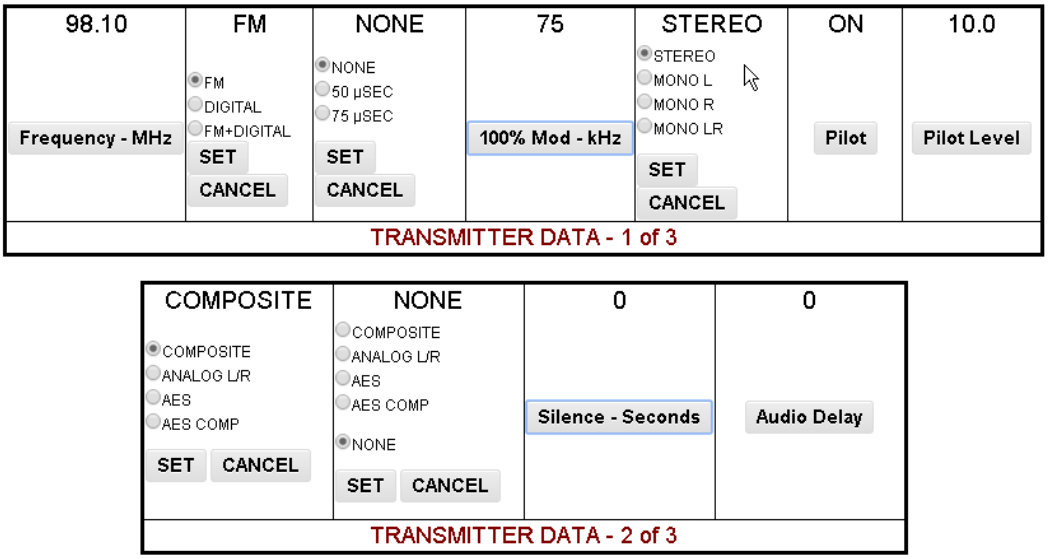



**Figure 16 – Expanded Views of Data Fields**

In the fields requiring a predefined operating parameter to be selected, the entire Transmitter Data line will expand and the selection options will be listed for that field button that is clicked on.

Note that Figure 16 was edited for this instruction manual to show all of these predefined fields and their options. Normally, when the field button is clicked, only that field's options are displayed.

For example, in TRANSMITTER DATA 1 or 3, if you click on the PA MODE button, the options will expand for PA Mode only, along with the SET & CANCEL buttons

If you click on the Preemphisis button, the options for Preemphisis will expand only

If you click on the STEREO MODE, the options for Stereo will expand for Stereo only

Expanded fields exist for the Primary and Secondary Audio buttons in TRANSMITTER DATA 2 of 3.

After you select the option required, click on the SET button to capture, save and exist from the expanded view of the field.

The fields that are titled; Frequency, 100% Mod, Pilot, Pilot Level, Silence Seconds, and Audio Delay will all display a data entry window when that button is clicked. Additional setup information for Audio Delay are provided in section 7.5

If the correct user profile is not listed in "Current User", the Authentication widow will pop up first and after the profile is changed to the correct profile; the field's data entry window or options will be active to continue making the entry.

## 7.3 PA Status and Event Logs

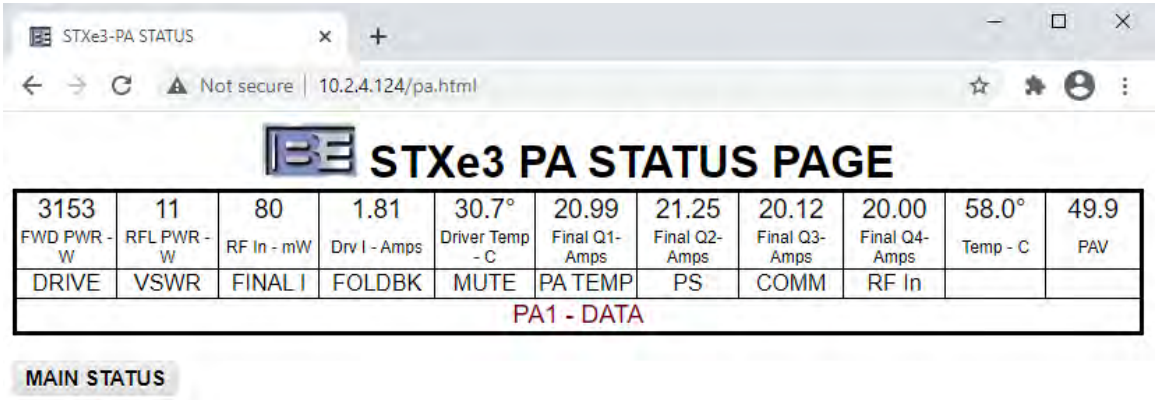



**Figure 17 – Web Interface PA Status Page**

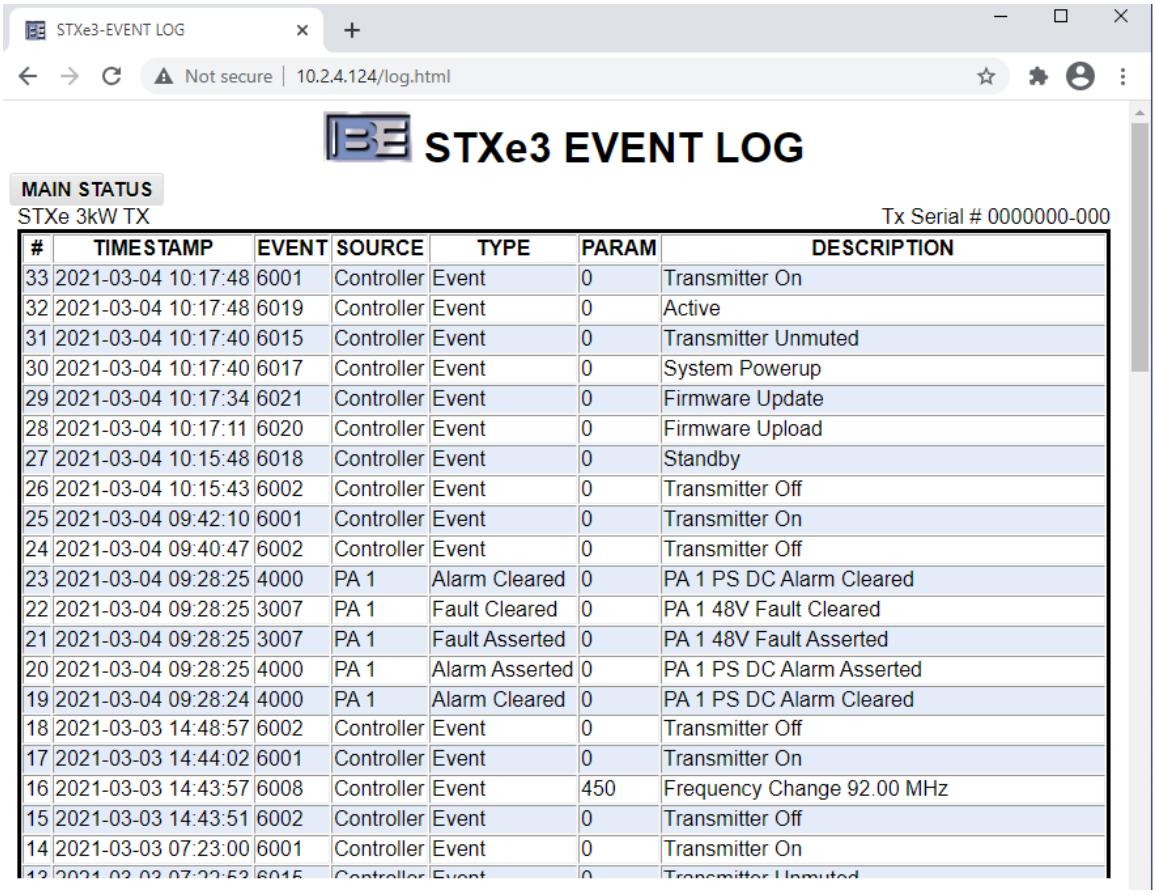



**Figure 18 – Web Interface Events Page**

## 7.4 RDS and FSK Setup

To enter static RDS information or FSK ID data such as Translator Identification, use the “Internal RDS Setup” link in the bottom of the Basic Web page, to access the RDS Setup Page.

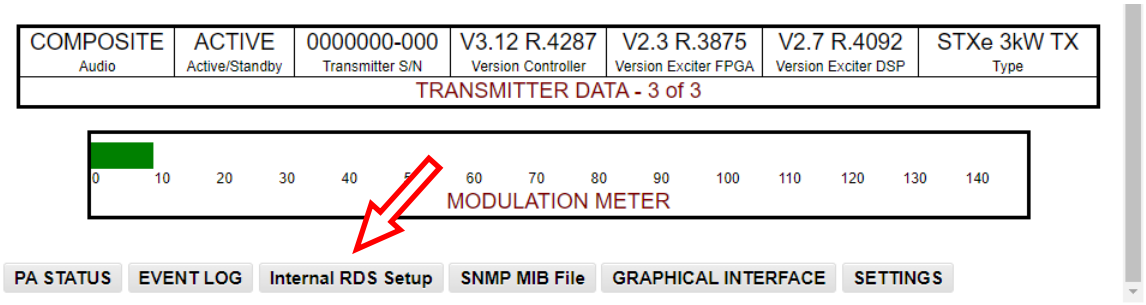



**Figure 19 – Internal RDS Setup Link**

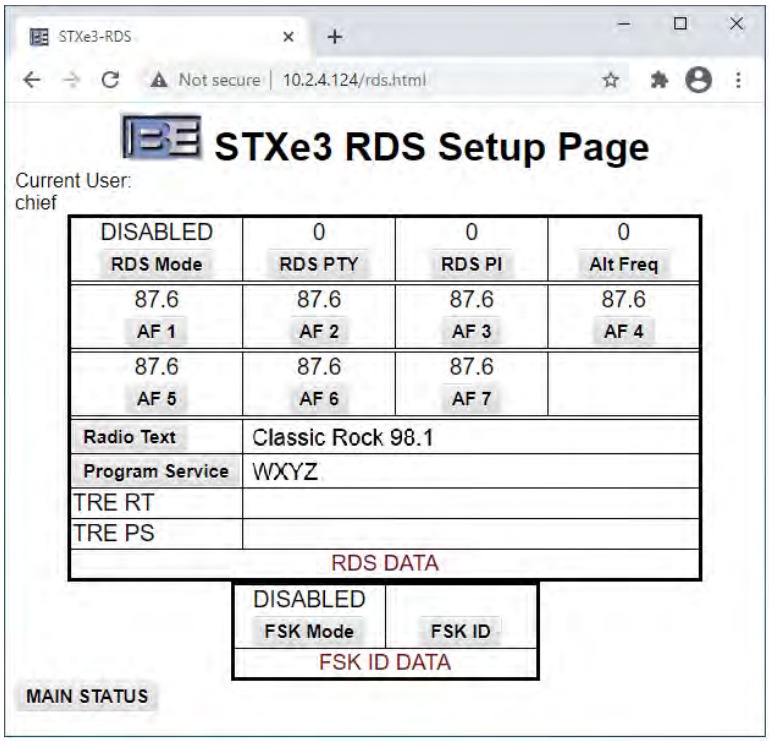
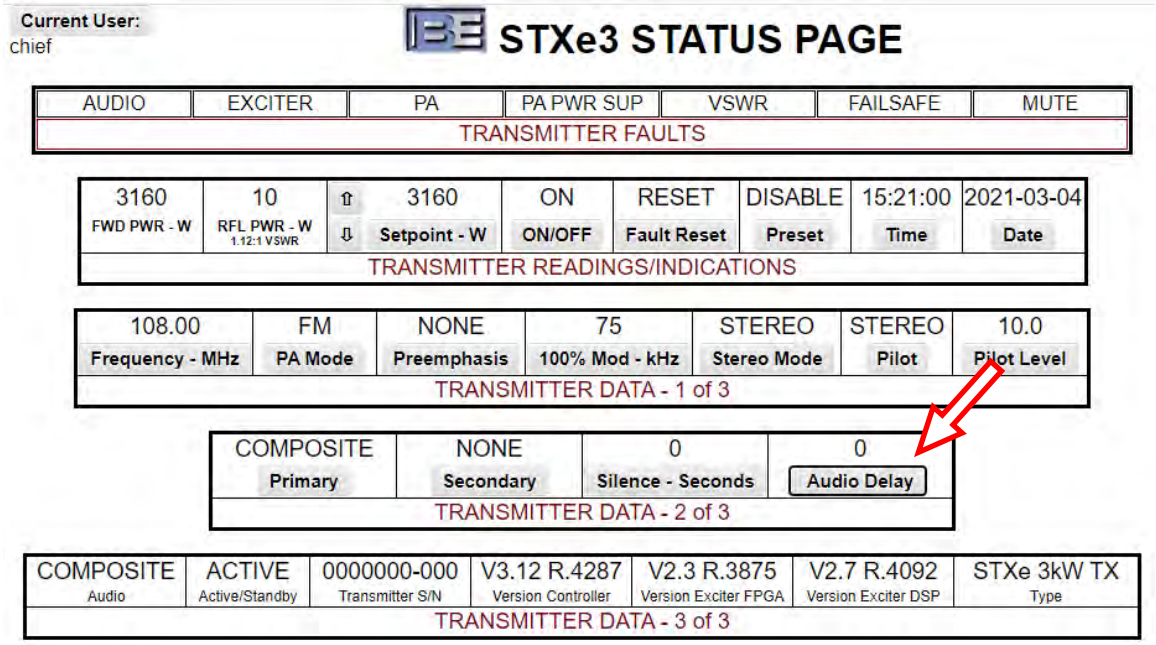



**Figure 20 – RDS Setup Page**

## 7.5 Audio Delay Setup

This is an adjustable audio delay to help set up a single-frequency network, or a repeater station by getting the delays of the system in sync.

The audio delay sets the amount of time from when the analog/AES/AES-Comp signal arrives at the rear panel until it affects the modulation of the RF signal. The audio delay is settable with an integer number, (steps) from 0 to 8128, where each step is on the order of 5.3 micro-seconds. This correlates to a delay range from 0 to 43.7 milliseconds.




To enter a delay setting, click on the Audio Delay button above, to display the setting window in Figure 21. Enter a number calculated from the 5.3 micro-second step amount. The example below of “20” equals a delay of 106 micro-seconds.

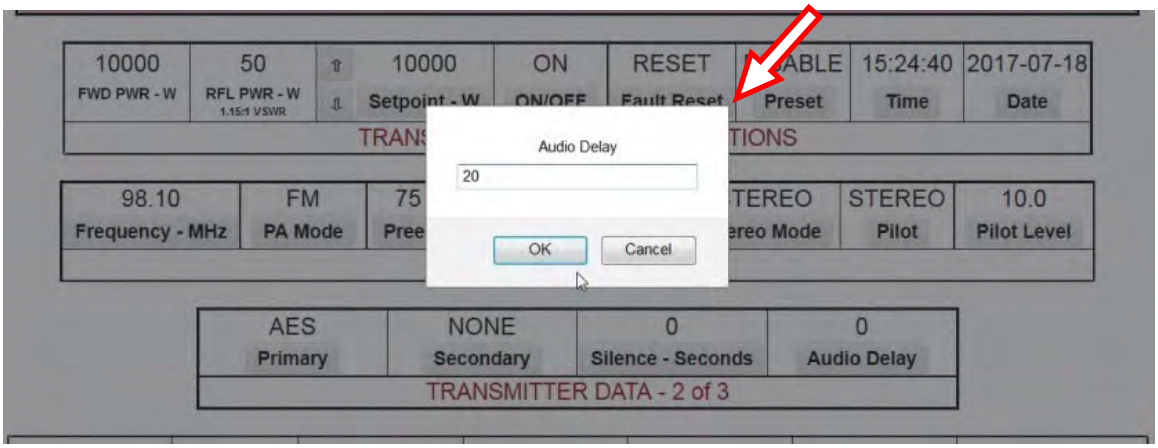



**Figure 21 – Audio Delay Web Interface**

When finished, press OK to save and exit the menu.

# 8 Enhanced Web GUI

STXe systems come standard with an enhanced Web GUI. This provides a more intuitive viewing and control experience than the basic web HTML while still providing all the features and more. To access this page, click the “GRAPHICAL INTERFACE” link at the bottom of the basic HTML web page.

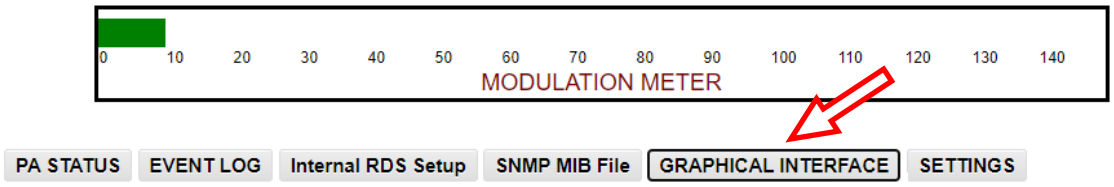



Figure 22 – Link from Basic Web Page to GUI Main Page


Figure 23 – Main GUI Page

Refer to Figure 24 on the following page.

While navigating the screen pages, buttons with banded in Blue are the current settings. When the PC’s mouse pointer icon comes in contact with one these buttons, it will change from the user’s default mouse icon, (Arrow) to either the (Hand/Finger) icon or (Not-Allowed) icon, depending on the Login Profile


Figure 24 – GUI Pointer Icons

## 8.1 Login Profiles – GUI Web Page

The default login profile is “View”. This does not require a password and allows monitoring only. Basic control of system power is allowed with the “Operator” profile. Full control of all settings that can be modified through the web interface requires the “Chief” login profile.

To change the login profile, move cursor into the “view” button and a popup window will display, [click to change Logged in status] as in Figure A. The previous screen being displayed will change to that in Figure B. Move cursor into the desired profile. In this example “Chief” is being selected


Figure 25 – GUI Login Selection

Next, a dialog box will pop up requesting password entry. Change browser settings if this dialog box is being blocked by the browser. Enter the password and press enter or click Save and the process displayed will move to “Pending”, followed by “Logged in”

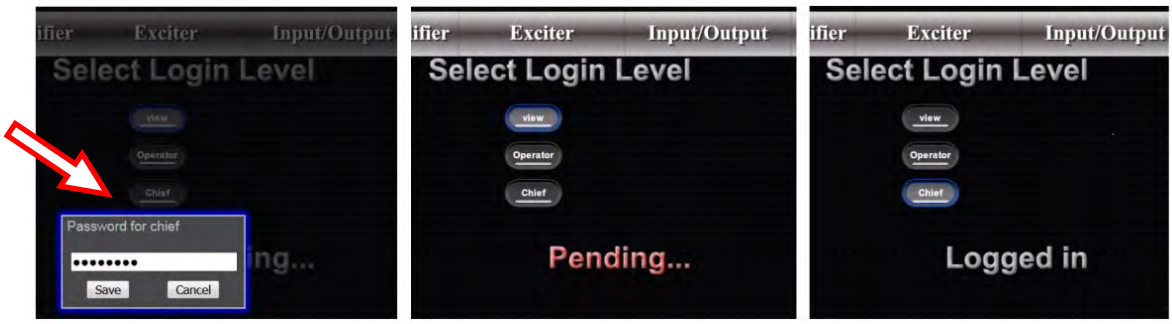



Figure 26 – GUI Login Process

## 8.2 Navigation

The primary screen pages in the GUI can be accessed by clicking on the text in the Navigation Bar near the top of the page in Figure 27.

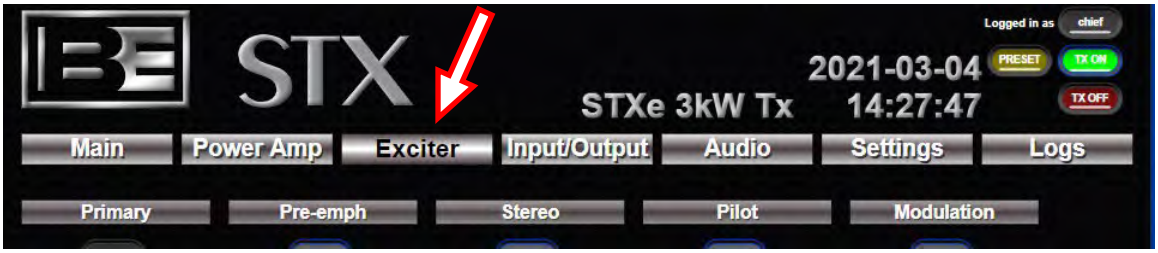



**Figure 27 – GUI Navigation Bar**

### 8.2.1 Features & Items Always-Displayed Items

The Navigation Bar as well the 12 specific items identified in Figure 28 are displayed in all screens

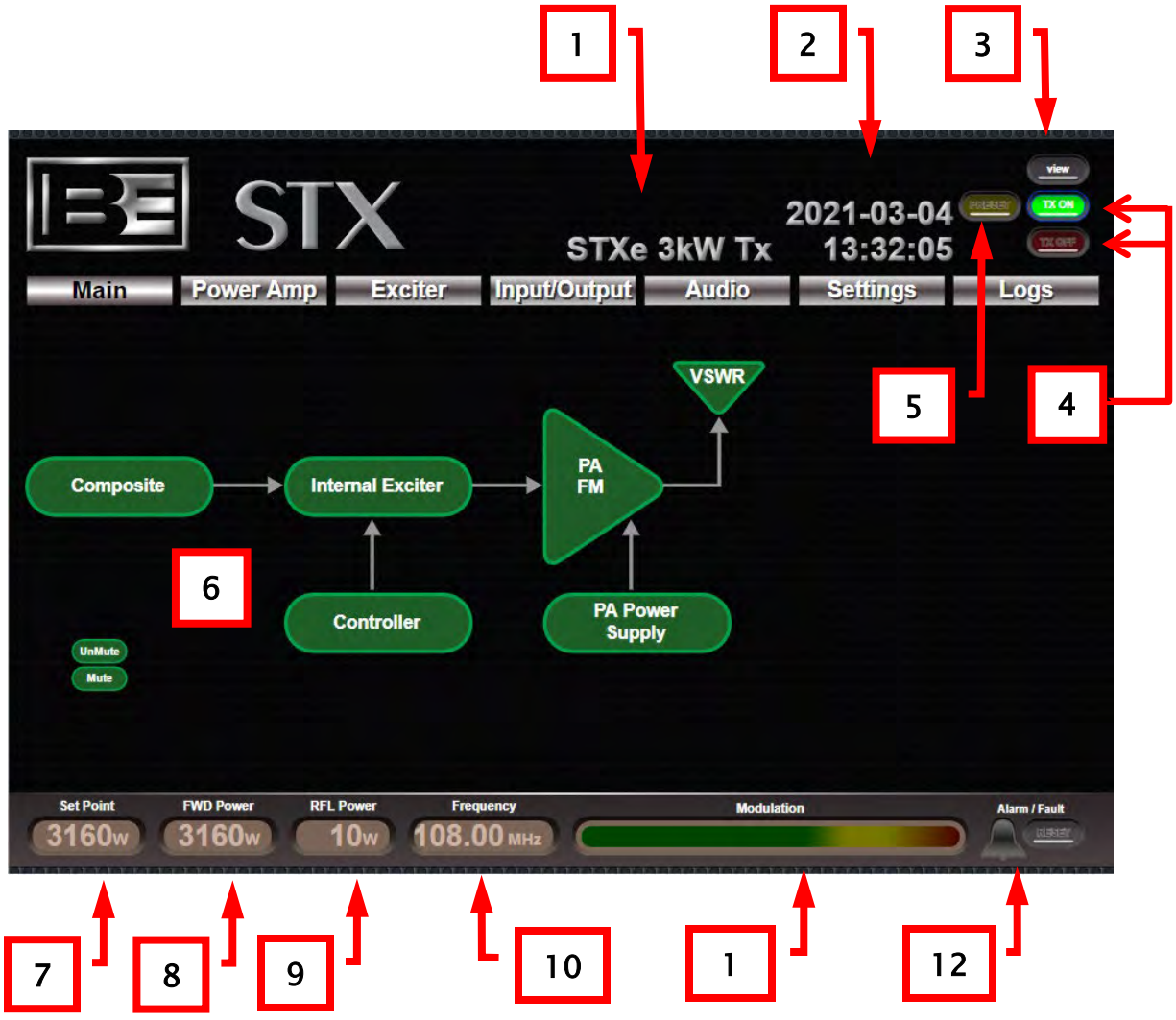


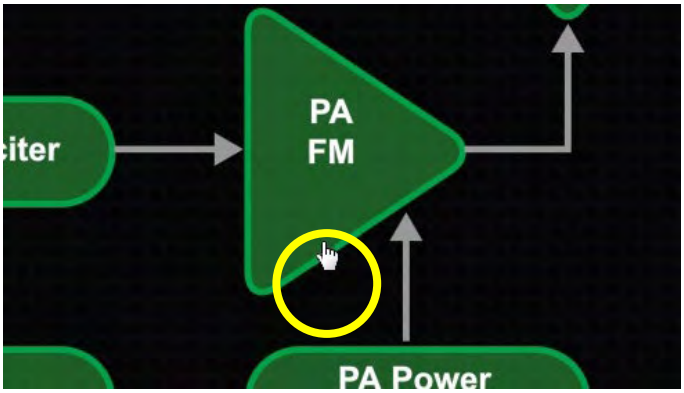

**Figure 28 – Common Features & Items Displayed in all Screens**

**Table 4 – Common Features & Items Displayed in all Screens**

| # | Feature | Description |
|---|---|---|
| 1. | STX System Type | Currently configured hardware setup type. This is determined during initial setup of the system, and might be 1kW, 2kW, or 3kW, TX (transmitter). |
| 2. | Date and Time | Real time clock data configured during setup. |
| 3. | Login Profile | Active login status displayed as View, Operator, or Chief and control button to change profile |
| 4. | Transmitter ON/OFF | ON/OFF status of the final RF output (not just the control status). Transmitter setups allow RF to be turned on and off with sufficient login level. |
| 5. | Preset | Provides a secondary APC setpoint for setting power to a lower power level. When Preset is Enabled the setpoint is for the Preset APC setpoint |
| 6. | System Block Diagram | Overall system status. Green, amber, and red block colors correspond to front panel LED behaviors. See section 5 Front Panel Features for details. |
| 7. | Power Control Set Point | Forward power value that automatic power control attempts to converge to. Note that exciter setups do not rely on this. External power control from a transmitter is utilized instead. |
| 8. | Forward Power | Internally measured system forward RF power output reading. |
| 9. | Reflected Power | Internally measured system reflected RF power reading. |
| 10. | Frequency | FM carrier frequency setting. |
| 11. | Modulation | Internal frequency modulation peak hold as a percentage of peak deviation from nominal frequency. |
| 12. | Fault/Alarm | System faults cause this to display red, and alarms in the system cause this to display amber. Check the Logs page for details. |

## 8.2.2 Block Diagram used for Navigation

In the screens with a System Block Diagram, many of the block figures will also provide navigation to its corresponding screen. Clicking the PA amp block as shown below will take you to the PA Amplifier screen



## 8.3 Power Amplifier

The power amplifier page contains detailed status information for all power amplifiers in the system.

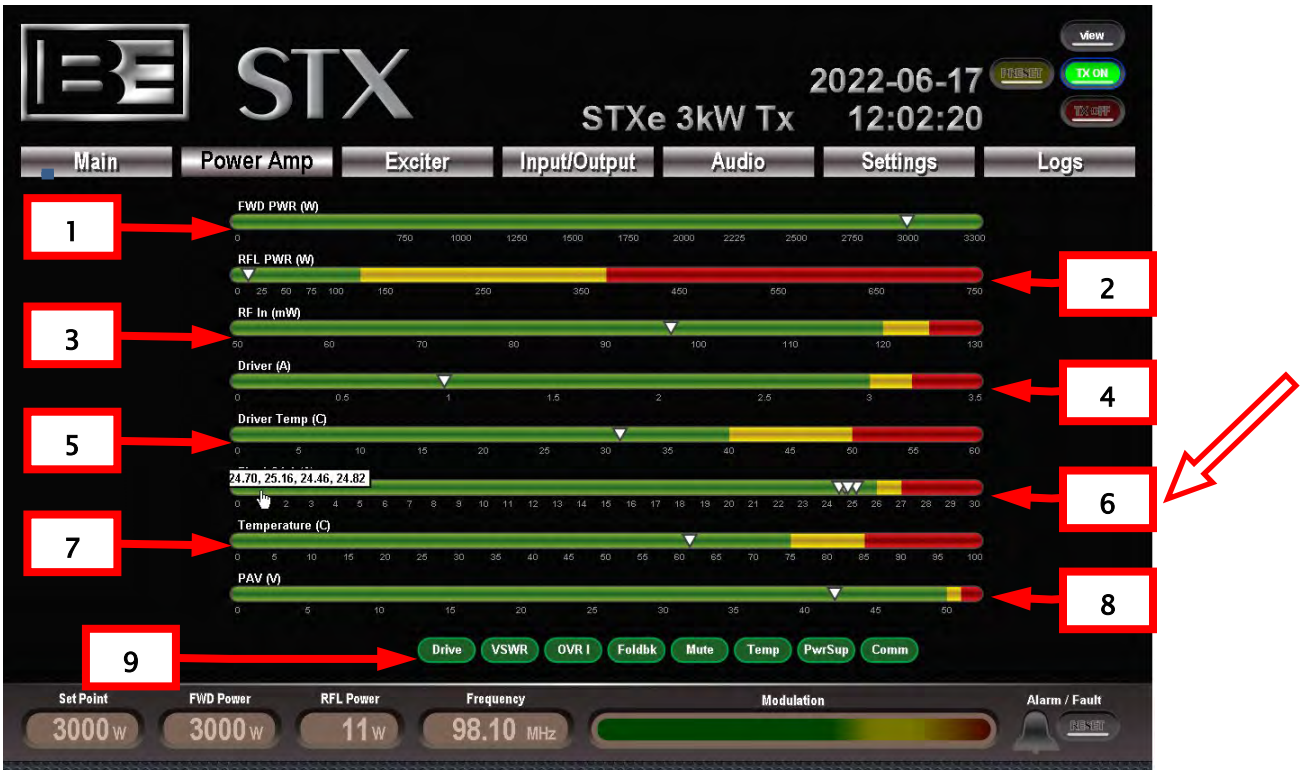



**Figure 29 – Power Amplifier Display**

**Table 5 – Power Amplifier Display Features**

| # | Feature | Description |
|---|---|---|
| 1. | Forward Power<br>FWD PWR (W) | PA forward RF power output reading. This is also the system forward output power in 1kW systems. |
| 2. | Reflected Power<br>RFL PWR (W) | PA reflected RF power reading. This is also the system reflected power in single-PA 1kW systems. |
| 3. | RF Input Power<br>RF In (mW) | PA RF drive input power reading in mili-Watts. |
| 4. | Driver Current<br>Driver (A) | Current in Amperes for the driver stage RF power amplifier. |
| 5. | Driver Temperature<br>Temperature (C) | Internal heat sink temperature measurement of the RF driver stage. |
| 6. | Final Currents<br>Final (A) | The current of each RF pallet used in the final PA Stage is measured in Amperes. By clicking on this bar, the 4 current readings will be displayed. |
| 7. | Temperature<br>Temperature (C) | Internal heat sink temperature measurement of final PA stage. |
| 8. | PAV<br>PAV (V) | Final amplifier drain voltage. This variable voltage supply is sourced from the PA power supply. |
| 9. | Status Balloons | Fault and alarm indications for the PA. These will be red, yellow or green depending on the status of each item |

## 8.4 Exciter


**Figure 30 – Exciter Display Details**

**Table 6 – Exciter Page Features**

| # | Feature | Description |
|---|---|---|
| 1. | Primary | Primary audio input source selection. Choose one of the listed options. Composite ignores stereo generation settings. |
| 2. | Pre-emph | Pre-emphasis setting for internal stereo generation. |
| 3. | Stereo | Mono/stereo setting for stereo generation. |
| 4. | Pilot | 19 kHz pilot on/off and level controls. This automatically updates with changes to the mono/stereo setting. Can be controlled independently. |
| 5. | Modulation | Frequency deviation amount in kilohertz from nominal carrier frequency. This setting represents 100% peak frequency modulation. |
| 6. | Secondary | Secondary Audio input source selections. Choose one of the listed options. |
| 7. | Transmitter Power | Automatic power control set point. Transmitter mode setups attempt to regulate total system forward output power to this value. |
| 8. | Frequency | Nominal FM carrier frequency. |
| 9. | Silence Timeout | Time allowed before loss of primary audio source switches to secondary audio source. |

## 8.5 Input/Output


**Figure 31 – I/O Display Details**

The Input/Output page contains information for connections on the GPIO connector pins, shown in the left columns. These connections may be used for machine interfaces with remote station controllers/monitors or with other transmission system equipment. Refer to section 4.1 for detailed function descriptions.

## 8.6 Audio


Figure 32 – Audio Display Details

Table 7 – Audio Page Features

| # | Feature | Description |
|---|---|---|
| 1. | Source | Audio input source selection. Choose one of the listed options. This duplicates function in the Exciter page. |
| 2. | Gain | Gain settings for hardware amplification/attenuation. AES gain is a digital scale factor. |
| 3. | Stereo Injection Scale | Allows the stereo composite to be scaled down to balance modulation budget without changing gain calibration setup. This also scales pilot when in stereo. |
| 4. | Modulation | Peak holds for inputs displayed as effective % of peak modulation. Composite Mod includes Unbalanced Composite, SCA1, SCA2, and RDS inputs. |
| 5. | SCA 1,and SCA 2 | Allows on/off control and input hardware amplification/attenuation adjustment. |
| 6. | RDS | Allows on/off for an external RDS or mode control of the internal RDS, (Static vs From TRE) |

## 8.7 Logs


**Figure 33 – Logs Display Details**

| # | Feature | Description |
|---|---|---|
| 1. | Event # | Event index number. Initially (or after a clear) this starts at 0 and increments for every event. If the log fills, half of the current entries are deleted and numbering resumes. When 65535 entries are created, the log clears itself. |
| 2. | Time Stamp | Date and time of the event based on the system's internal real time clock and calendar. |
| 3. | Type Code | Unique event type identification number. |
| 4. | Source | Controller node from which the entry was triggered. |
| 5. | Type | Type category identification in a readable format. |
| 6. | Parameter | Event-specific value for logging some changes. |
| 7. | Full Description | Log entry details in a readable format. |
| 8. | Scroll | Click the up and down arrows to scroll through the log. |
| 9. | Clear | Wipes all log entries from memory forever.<br>NOTE: Only displays when in the "Chief" login profile. |
| 10. | Serial Number | Displays BE serial number and controller Ethernet MAC. |
| 11. | Software Versions | Listing of all viewable software versions in the system. |

## 8.8 Other Features – VSWR vs Reflected Power

The GUI now allows the choice to either display Reflected Power or VSWR as shown in Figure 34. The display can be toggled to either mode by clicking the text and having the proper login profile.

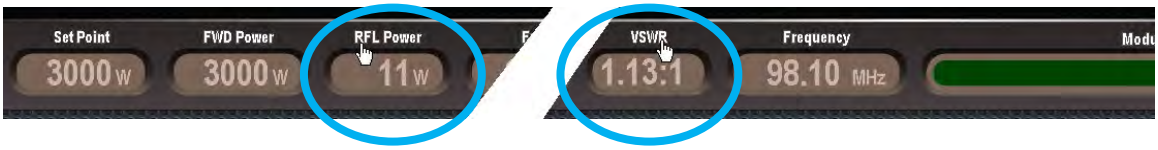



**Figure 34 – VSWR or Reflected Power Display**

On many of the bar graph displays such as the ones used in the Power Amp screen a triangle maker is used to mark the reading measured in the transmitter as in the circled examples on the right in Figure 34. If you click on a bar, then the actual reading is displayed as circled on the left of Figure 35.

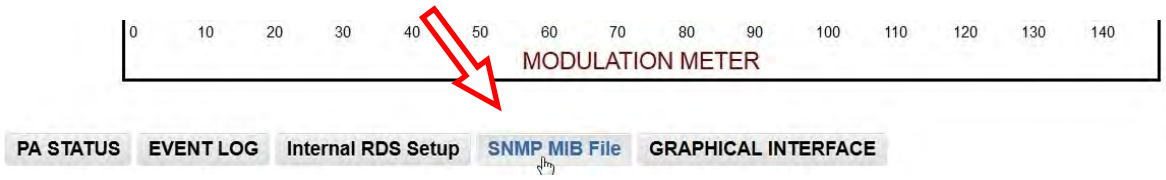

**Figure 35 – Bar Graph Options**

# 9 SNMP

Simple Network Management Protocol is a member of the Internet Protocol standard communications suite. The STXe comes with a built-in SNMP agent (SNMP version 2c) for handling all request types included in the protocol – GET, SET, GETNEXT, and GETBULK. The appropriate MIB for the version of SNMP agent installed on the transmitter must be downloaded from the transmitter itself. As with any MIB, this ASCII text file completely defines the data structure within the agent. The MIB also provides textual descriptions for every accessible object.

**SNMP IS FOR ADVANCED APPLICATION INTEGRATION. THIRD PARTY APPLICATIONS THAT UTILIZE THE SNMP INTERFACE ARE NOT SUPPORTED BY BE.**

To download the file access the web interface using a standard web browser. Right click on the link titled "SNMP MIB File" and then "Save link as…", a local copy of the MIB file wherever desired for use in an SNMP manager application. Alternatively, click the link and navigate to the file in the browser. Right click anywhere in the viewing space and click "Save as…" Simply remove the .txt extension (leaving only the .mib extension) and save at the desired location.




An SNMP manager application must be utilized in order to access the interface. Integrating a manager into custom station automation programs provides countless possibilities. Alternatively, various third party MIB browser GUI applications are available for free download; however Broadcast Electronics does not endorse any specific application. Simply direct the manager to the Ethernet port for communication across a network.

## 9.1 Authentication

Data is accessible by using the correct community strings for the desired login level. The formula for these strings is a combination of the login type – chief, user, or operator –, a delimitating '+' character, and the 8 digit numerical password associated with that login type. For example, "chief+12345678" in both the read community and write community passes authentication and allows read and write to essentially every object in the MIB with the appropriate max-access type. User and Operator login types provide more strict control over what settings can be modified and commands issued in the system.

## 9.2 Objects

The SNMP interface utilizes tables wherever it makes sense to communicate data in an indexed fashion. To accommodate a scalable transmitter product design, for example, almost all PA data is structured as tables by using the PA number as the index. This works by appending ".#" to the object where # is the PA number. Note that a normal "leaf" node is accessed by appending ".0" as in …38118.2.2.2.0, the object for system forward power.

# 10 Troubleshooting

Some basic information and troubleshooting steps are included below. If problems persist after basic troubleshooting steps are taken, please contact RF Technical Services. Contact information is located on our website at www.bdcast.com and on page iii in the front of this manual.

A fault in any part of the system indicates a complete disruption in normal operation of at least one part of the transmitter system. Once the problem has been identified, a fault reset command should always be issued through diagnostics in any user interface to attempt to recover from fault conditions. If the reset is not successful or a condition that caused a fault still remains, the fault will re-assert.

An alarm typically indicates an abnormal condition that represents a disruption that may resolve itself. Alarms in unexpected situations could indicate serious conditions. Alarms that persist for long periods of time or unexpectedly appear on a regular basis should not be ignored. To get a good feel for what alarms are expended under which conditions, see the alarm details in the sections that follow.

## 10.1 Event Log

The system event log can be accessed through the web interface log page or in its raw form through the event Log tree in SNMP. An event is defined by its index starting with the first saved event at index 1, a timestamp from the system's internal real time clock, an event identification number, and the sub-system where the event triggered. Some events also have context-based parameters that are embedded in the description of the event.

## 10.2 Standby

The STXe series comes with built-in functionality for a standby mode of the controller and exciter. Standby mode is used in Main/Alternate, (M/A) or Combined, (Dual) transmitter systems and HD operation with the Vpe Generator. Standby mode is not intended for normal operation for the STXe3 in a single system. In these M/A and Dual systems, the control and exciter setups should have no more than one unit active at a time.

If a system is stuck in standby mode, this typically indicates a setup problem. Single system controller and exciter setups require a stub 949-4130 that activates the transmitter. This must be attached to the BE Interface jack, see Section 2.2. The M/A & Dual system controller and exciter setups require a switcher that connects to both STXe assemblies through this interface. The switcher must be operated to activate one controller/exciter.

## 10.3 Failsafe

An asserted failsafe input on the remote station interface is required for operation of the system. The intended usage of this input is to make a loop that passes through safety relays in all critical transmission system components. When any part of the transmission system becomes unsafe, the circuit should open and de-assert the failsafe on the transmitter. When a failsafe condition is active, check all systems that are wired into the failsafe circuit.

## 10.4 Mute

A mute generally refers to a lack of an RF source in some part of the system, and the affected part depends on the context of the notification. Mute indications can happen at various stages for different reasons, and details in system sections listed here should be considered.

Transmitter mute conditions typically refer to the FM exciter. In internal exciters this commonly occurs when:

- There is no power to the exciter
- The transmitter is turned off
- The mute GPIO input pin on the remote station interface is asserted
- Unmute/Failsafe GPIO input is not asserted
- The BE Interface active input is not asserted
- VPeXG setup presence GPIO input is active when no VPeXG is in the system, or is not activated when it is in the system.

## 10.5 Internal Exciter Diagnostics

**Table 8 – Exciter Diagnostics Details**

| Fault/Alarm | Description |
|---|---|
| Communication Fault | This fault occurs when communication between the system controller and the internal exciter is nonfunctional. |
| AFC Unlock Alarm | Automatic frequency control system does not yet have lock. |
| 10MHz Status | Displays INT when exciter is on the Internal reference or EXT for when an External reference is used. |
| Audio SCR Status | Secondary (SCR) Audio displays PRI for primary audio or SEC for secondary audio |

## 10.6 Power Amplifier Diagnostics

**Table 9 – PA Diagnostics Details**

| Fault/Alarm | Description |
|---|---|
| RF Power Supply Fault | This fault activates when a power source failure is detected. |
| Reflected Power Fault | This fault activates when a sudden increase in reflected power is detected by hardware in the power amplifier. |
| VSWR Fault | This fault activates when the measured VSWR is greater than the maximum VSWR rating of the system at any power level. |
| Temperature Fault | This fault activates when the measured internal heat sink temperature exceeds the safe limit. |
| Current Fault | There is current monitoring on the final stage RF amplifiers. The PA shuts down when measured current on any of these solid state amplifiers exceeds the safe limit. |
| Hardware Fault | This is an internal self-report of problems in PA control hardware. |
| Communication Fault | This fault occurs when communication between the system controller and the PA is lost. |
| Power Supply DC Alarm | This alarm is asserted when there is a fault with the DC power regulator. It will occur if any of the regulated DC voltages are outside acceptable levels. This alarm will not occur when the PA is turned off for any reason, e.g. when the transmitter RF is off. |

| Fault/Alarm | Description |
|---|---|
| Reflected Power Foldback Alarm | During FM only operation, the PA attempts to lower its output power when reflected power approaches dangerous levels. This keeps the transmitter running at reduced power in order to prevent a reflected power fault. |
| Temperature Foldback Alarm | During FM only operation, the PA attempts to lower its output power when the internal heat sink temperature approaches dangerous levels. This keeps the transmitter running at reduced power in order to prevent a temperature fault. |
| Current Foldback Alarm | During FM only operation, the PA attempts to lower its output power when the worst case final power transistor current approaches dangerous levels. This keeps the transmitter running at reduced power in order to prevent a current fault. |
| Muted Input Alarm | This alarm is asserted when in FM-only mode and the RF power from the Exciter to the PA is below the minimum threshold for safe operation. This alarm is not reported when the PA is turned off for any reason. |
| Railed Alarm | During FM-only operation this indicates a condition where automatic power control has reached its highest or lowest possible control value indicating that the transmitter cannot reach the RF power set-point. The power control system automatically leaves this state if the condition is resolved. |

# 11 Appendix

## 11.1 Website

For electronic copies of these and other Broadcast Electronics technical documentation please visit http://www.bdcast.com/information-center/. In addition to this main manual, check the web site for Application Guides such as the STX CPE Software Update Application Guide 597-4200 for software and firmware update details.

## 11.2 Default Operation & Settings

In the absence of specific customer settings or when a reset to factory defaults command is issued on the front panel user interface, the following default settings are used:

Transmitter RF On/Off – Off
Frequency – 98.1 MHz
Operating Mode – FM Only
FM-only Power Set point – 3000W
Digital-only Power Set point – 1020W
FM+Digital Power Set point – 2310W
Sideband power level – -20 dBc
Digital PAV – 44.0V
Emergency Output Power – 0 W (disabled)
100% Modulation – 75 kHz
Pre-emphasis – None
Pilot Injection – On, 10%
Mono/Stereo Mode - Stereo
Audio Input – Composite
AES – -2dBFS input level
AES Stereo injection – 100%
Analog L – -2.5 dB input gain
Analog R – -2.5 dB input gain
Analog L/R Stereo injection – 100%
Composite – +8.0 dB input gain
SCA1
- Off
- -12.0 dB input gain

SCA2
- Off
- -12.0 dB input gain

RDS – Off, -12.0 dB input gain
- Off
- -12.0 dB input gain

Real Time Clock – shipped with Quincy, IL time, factory reset does not affect this
Note: The internal real time clock is likely to have stopped keeping time and reset to 2000-01-01 00:00:00 during shipping or any other time when the system is unpowered for days