Preliminary Instruction Manual

Innovator, LX Series

Digital VHF High Band Driver/Transmitter w/Axciter Modulator

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Chapter 1
Introduction

1.1: Manual Overview

This manual explains the installation, setup, alignment, and maintenance procedures for the LX Series modular Digital VHF High Band driver/transmitter. If your transmitter contains external power amplifier assemblies, then information and drawings on the external amplifier assemblies are contained in Volume 2. **NOTE:** Information on the Axciter Modulator, the Upconverter Sled and the Downconverter Sled are contained in the separate Axciter Manual.

This instruction manual is divided into five chapters and supporting appendix. **Chapter 1**, Introduction, contains information on the assembly numbering system used in the manual, safety, maintenance, return procedures, and warranties. **Chapter 2**, system description, maintenance and remote control connections, describes the transmitter and includes discussions on system control and status indicators, maintenance and remote control connections. **Chapter 3**, site considerations, installation and setup procedures, explains how to unpack, install, setup, and operate the transmitter. **Chapter 4**, circuit descriptions, contains circuit-level descriptions for boards and board-level components in the transmitter. **Chapter 5,** Detailed Alignment Procedures, provides information on adjusting the system assemblies for optimal operation. **Appendix A** contains drawings and parts lists.

1.2: Assembly Designators

Axcera has assigned assembly numbers, Ax designations such as A1, where x=1,2,3…etc, to all assemblies, modules, and boards in the system. These designations are referenced in the text of this manual and shown on the block diagrams and interconnect drawings provided in the appendices. The Block Diagrams, Interconnects, Schematics, Assembly Drawings and Parts Lists are arranged in increasing numerical order in the appendices. Section titles in the text for assembly or module descriptions or alignment procedures contain the associated part number(s) and the relevant appendix that contains the drawings for that item.

The cables that connect between the boards within a tray or assembly and that connect between the trays, racks and cabinets are labeled using Brady markers. Figure 1-1 is an example of a Brady marked cable. There may be as few as two or as many as four Markers on any one cable. These Brady markers are read starting furthest from the connector. If there are four Brady Markers, this marker is the transmitter number such as transmitter 1 or transmitter 2. The next or the furthest Brady Marker is the rack or cabinet number on an interconnect cable or the board number within a tray. The next number on an interconnect cable is the Tray location or number. The Brady marker closest to the connector is the jack or connector number on an interconnect cable or the jack or connector number on the board within a tray.

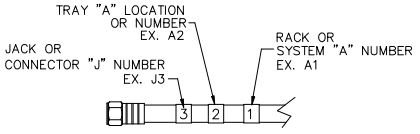


Figure 1-1: Brady Marker Identification Drawing

1.3: Safety

The VHF transmitter systems manufactured by Axcera are designed to be easy to use and repair while providing protection from electrical and mechanical hazards. Please review the following warnings and familiarize yourself with the operation and servicing procedures before working on the transmitter system.

Read All safety Instructions – All of the safety instructions should be read and understood before operating this equipment.

Retain Manuals – The manuals for the transmitter should be retained at the transmitter site for future reference. Axcera provides two sets of manuals for this purpose; one set can be left at the office while one set can be kept at the site.

Heed all Notes, Warnings, and Cautions – All of the notes, warnings, and cautions listed in this safety section and throughout the manual must be followed.

Follow Operating Instructions – All of the operating and use instructions for the transmitter should be followed.

Cleaning – Unplug or otherwise disconnect all power from the equipment before cleaning. Do not use liquid or aerosol cleaners. Use a damp cloth for cleaning.

Ventilation – Openings in the cabinet and module front panels are provided for ventilation. To ensure the reliable operation of the driver/transmitter, and to protect the unit from overheating, these openings must not be blocked.

Servicing – Do not attempt to service this product yourself until becoming familiar with the equipment. If in doubt, refer all servicing questions to qualified Axcera service personnel.

Replacement Parts – When replacement parts are used, be sure that the parts have the same functional and performance characteristics as the original part. Unauthorized substitutions may result in fire, electric shock, or other hazards. Please contact the Axcera Technical Service Department if you have any questions regarding service or replacement parts.

1.4: Contact Information

The Axcera Field Service Department can be contacted by phone at **(724) 873-8100** or by fax at **(724) 873-8105**.

Before calling Axcera, please be prepared to supply the Axcera technician with answers to the following questions. This will save time and help ensure the most direct resolution to the problem.

1. What are the Customers' Name and call letters?
2. What are the model number and type of transmitter?
3. Is the transmitter digital or analog?
4. How long has the transmitter been on the air? (Approximately when was the transmitter installed.)
5. What are the symptoms being exhibited by the transmitter? Include the current control/power supply LCD readings and the status of LEDs on the front panels of the modules. If possible, include the control/power supply LCD readings before the problem occurred.

1.5: Return Material Procedure

To insure the efficient handling of equipment or components that have been returned for repair, Axcera requests that each returned item be accompanied by a Return Material Authorization Number (RMA#).

The RMA# can be obtained from any Axcera Field Service Engineer by contacting the Axcera Field Service Department at (724) 873-8100 or by fax at (724) 873-8105. This procedure applies to all items sent to the Field Service Department regardless of whether the item was originally manufactured by Axcera.

When equipment is sent to the field on loan, an RMA# is included with the unit. The RMA# is intended to be used when the unit is returned to Axcera. In addition, all shipping material should be retained for the return of the unit to Axcera.

Replacement assemblies are also sent with an RMA# to allow for the proper routing of the exchanged hardware. Failure to close out this type of RMA# will normally result in the customer being invoiced for the value of the loaner item or the exchanged assembly.

When shipping an item to Axcera, please include the RMA# on the packing list and on the shipping container. The packing slip should also include contact information and a brief description of why the unit is being returned.

Please forward all RMA items to:

AXCERA, LLC
103 Freedom Drive
P.O. Box 525
Lawrence, PA 15055-0525 USA

For more information concerning this procedure, call the Axcera Field Service Department @ (724) 873-8100. Axcera can also be contacted through e-mail at **info@axcera.com** and on the Web at **www.axcera.com.**

1.6: Limited One Year Warranty for Axcera Products

Axcera warrants each new product that it has manufactured and sold against defects in material and workmanship under normal use and service for a period of one (1) year from the date of shipment from Axcera's plant, when operated in accordance with Axcera's operating instructions. This warranty shall not apply to tubes, fuses, batteries, bulbs or LEDs.

Warranties are valid only when and if (a) Axcera receives prompt written notice of breach within the period of warranty, (b) the defective product is properly packed and returned by the buyer (transportation and insurance prepaid), and (c) Axcera determines, in its sole judgment, that the product is defective and not subject to any misuse, neglect, improper installation, negligence, accident, or (unless authorized in writing by Axcera) repair or alteration. Axcera's exclusive liability for any personal and/or property damage (including direct, consequential, or incidental) caused by the breach of any or all warranties, shall be limited to the following: (a) repairing or replacing (in Axcera's sole discretion) any defective parts free of charge (F.O.B. Axcera's plant) and/or (b) crediting (in Axcera's sole discretion) all or a portion of the purchase price to the buyer.

Equipment furnished by Axcera, but not bearing its trade name, shall bear no warranties other than the special hours-of-use or other warranties extended by or enforceable against the manufacturer at the time of delivery to the buyer.

NO WARRANTIES, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, AND NO WARRANTIES OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR FREEDOM FROM INFRINGEMENT, OR THE LIKE, OTHER THAN AS SPECIFIED IN PATENT LIABILITY ARTICLES, AND IN THIS ARTICLE, SHALL APPLY TO THE EQUIPMENT FURNISHED HEREUNDER.

☞ WARNING!!!

≺ HIGH VOLTAGE ≻

DO NOT ATTEMPT TO REPAIR OR TROUBLESHOOT THIS EQUIPMENT UNLESS YOU ARE FAMILIAR WITH ITS OPERATION AND EXPERIENCED IN SERVICING HIGH VOLTAGE EQUIPMENT. LETHAL VOLTAGES ARE PRESENT WHEN POWER IS APPLIED TO THIS SYSTEM. IF POSSIBLE, TURN OFF POWER BEFORE MAKING ADJUSTMENTS TO THE SYSTEM.

★ RADIO FREQUENCY RADIATION HAZARD ★

MICROWAVE, RF AMPLIFIERS AND TUBES GENERATE HAZARDOUS RF RADIATION THAT CAN CAUSE SEVERE INJURY INCLUDING CATARACTS, WHICH CAN RESULT IN BLINDNESS. SOME CARDIAC PACEMAKERS MAY BE AFFECTED BY THE RF ENERGY EMITTED BY RF AND MICROWAVE AMPLIFIERS. NEVER OPERATE THE TRANSMITTER SYSTEM WITHOUT A PROPERLY MATCHED RF ENERGY ABSORBING LOAD ATTACHED. KEEP PERSONNEL AWAY FROM OPEN WAVEGUIDES AND ANTENNAS. NEVER LOOK INTO AN OPEN WAVEGUIDE OR ANTENNA. MONITOR ALL PARTS OF THE RF SYSTEM FOR RADIATION LEAKAGE AT REGULAR INTERVALS.

EMERGENCY FIRST AID INSTRUCTIONS

Personnel engaged in the installation, operation, or maintenance of this equipment are urged to become familiar with the following rules both in theory and practice. It is the duty of all operating personnel to be prepared to give adequate Emergency First Aid and thereby prevent avoidable loss of life.

RESCUE BREATHING

1. Find out if the person is breathing.

You must find out if the person has stopped breathing. If you think he is not breathing, place him flat on his back. Put your ear close to his mouth and look at his chest. If he is breathing you can feel the air on your cheek. You can see his chest move up and down. If you do not feel the air or see the chest move, he is not breathing.

2. If he is not breathing, open the airway by tilting his head backwards.

Lift up his neck with one hand and push down on his forehead with the other. This opens the airway. Sometimes doing this will let the person breathe again by himself.

3. If he is still not breathing, begin rescue breathing.

-Keep his head tilted backward. Pinch nose shut.
-Put your mouth tightly over his mouth.
-Blow into his mouth once every five seconds
-DO NOT STOP rescue breathing until help arrives.

LOOSEN CLOTHING - KEEP WARM

Do this when the victim is breathing by himself or help is available. Keep him as quiet as possible and from becoming chilled. Otherwise treat him for shock.

BURNS

SKIN REDDENED: Apply ice cold water to burned area to prevent burn from going deeper into skin tissue. Cover area with a clean sheet or cloth to keep away air. Consult a physician.

SKIN BLISTERED OR FLESH CHARRED: Apply ice cold water to burned area to prevent burn from going deeper into skin tissue. Cover area with clean sheet or cloth to keep away air. Treat victim for shock and take to hospital.

EXTENSIVE BURN - SKIN BROKEN: Cover area with clean sheet or cloth to keep away air. Treat victim for shock and take to hospital.

dBm, dBw, dBmV, dBmV, & VOLTAGE EXPRESSED IN WATTS

50 Ohm System

WATTS	PREFIX	dBm	dBw	dBmV	dBµV	VOLTAGE
1,000,000,000,000	1 TERAWATT	+150	+120			
100,000,000,000	100 GIGAWATTS	+140	+110			
10,000,000,000	10 GIGAWATTS	+130	+100			
1,000,000,000	1 GIGAWATT	+120	+ 99			
100,000,000	100 MEGAWATTS	+110	+ 80			
10,000,000	10 MEGAWATTS	+100	+ 70			
1,000,000	1 MEGAWATT	+ 90	+ 60			
100,000	100 KILOWATTS	+ 80	+ 50			
10,000	10 KILOWATTS	+ 70	+ 40			
1,000	1 KILOWATT	+ 60	+ 30			
100	1 HECTROWATT	+ 50	+ 20			
50		+ 47	+ 17			
20		+ 43	+ 13			
10	1 DECAWATT	+ 40	+ 10			
1	1 WATT	+ 30	0	+ 77	+137	7.07V
0.1	1 DECIWATT	+ 20	- 10	+ 67	+127	2.24V
0.01	1 CENTIWATT	+ 10	- 20	+ 57	+117	0.707V
0.001	1 MILLIWATT	0	- 30	+ 47	+107	224mV
0.0001	100 MICROWATTS	- 10	- 40			
0.00001	10 MICROWATTS	- 20	- 50			
0.000001	1 MICROWATT	- 30	- 60			
0.0000001	100 NANOWATTS	- 40	- 70			
0.00000001	10 NANOWATTS	- 50	- 80			
0.000000001	1 NANOWATT	- 60	- 90			
0.0000000001	100 PICOWATTS	- 70	-100			
0.00000000001	10 PICOWATTS	- 80	-110			
0.000000000001	1 PICOWATT	- 90	-120			

TEMPERATURE CONVERSION

°F = 32 + [(9/5) °C]

°C = [(5/9) (°F - 32)]

USEFUL CONVERSION FACTORS

TO CONVERT FROM	TO	MULTIPLY BY
mile (US statute)	kilometer (km)	1.609347
inch (in)	millimeter (mm)	25.4
inch (in)	centimeter (cm)	2.54
inch (in)	meter (m)	0.0254
foot (ft)	meter (m)	0.3048
yard (yd)	meter (m)	0.9144
mile per hour (mph)	kilometer per hour(km/hr)	1.60934
mile per hour (mph)	meter per second (m/s)	0.44704
pound (lb)	kilogram (kg)	0.4535924
gallon (gal) U.S. liquid	liter	3.7854118
(One U.S. gallon equals 0.8327 Canadian gallon)		
fluid ounce (fl oz)	milliliters (ml)	29.57353
British Thermal Unit	watt (W)	0.2930711 per hour (Btu/hr)
horsepower (hp)	watt (W)	746

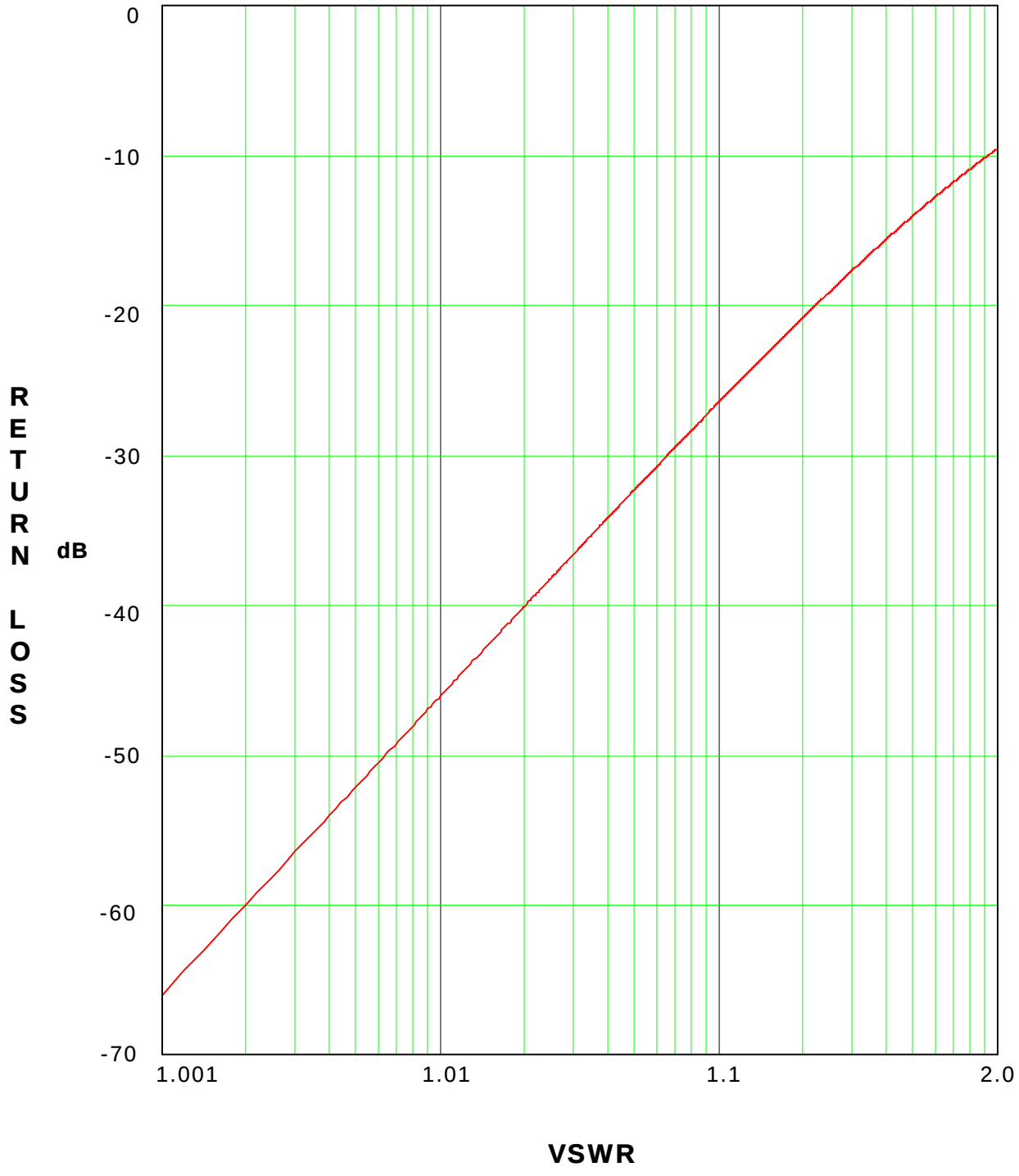
NOMENCLATURE OF FREQUENCY BANDS

FREQUENCY RANGE	DESIGNATION
3 to 30 kHz	VLF - Very Low Frequency
30 to 300 kHz	LF - Low Frequency
300 to 3000 kHz	MF - Medium Frequency
3 to 30 MHz	HF - High Frequency
30 to 300 MHz	VHF - Very High Frequency
300 to 3000 MHz	UHF - Ultrahigh Frequency
3 to 30 GHz	SHF - Superhigh Frequency
30 to 300 GHz	EHF - Extremely High Frequency

LETTER DESIGNATIONS FOR UPPER FREQUENCY BANDS

LETTER	FREQ. BAND
L	1000 - 2000 MHz
S	2000 - 4000 MHz
C	4000 - 8000 MHz
X	8000 - 12000 MHz
Ku	12 - 18 GHz
K	18 - 27 GHz
Ka	27 - 40 GHz
V	40 - 75 GHz
W	75 - 110 GHz

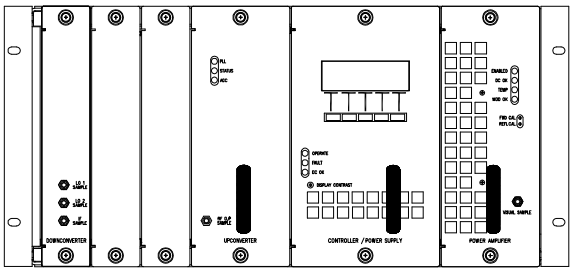
RETURN LOSS VS. VSWR



ABBREVIATIONS/ACRONYMS

AC	Alternating Current
AFC	Automatic Frequency Control
ALC	Automatic Level Control
AM	Amplitude modulation
AGC	Automatic Gain Control
AWG	American wire gauge
BER	Bit Error Rate
BW	Bandwidth
DC	Direct Current
D/A	Digital to analog
DSP	Digital Signal Processing
DTV	Digital Television
dB	Decibel
dBm	Decibel referenced to 1 milliwatt
dBmV	Decibel referenced to 1 millivolt
dBw	Decibel referenced to 1 watt
FEC	Forward Error Correction
FM	Frequency modulation
FPGA	Field Programmable Gate Array
Hz	Hertz
ICPM	Incidental Carrier Phase Modulation
I/P	Input
IF	Intermediate Frequency
LED	Light emitting diode
LSB	Lower Sideband
MPEG	Motion Pictures Expert Group
O/P	Output
PLL	Phase Locked Loop
PCB	Printed circuit board
QAM	Quadrature Amplitude Modulation
SMPTE	Society of Motion Picture and Television Engineers
VSB	Vestigial Side Band

Chapter 2
System Description & Remote Control Connections



A1 **A5** **A4** **A6**

Figure 2-1: Driver/Amplifier Chassis Assembly w/external Axciter Front View Modules

Table 2-1: Digital Driver/Amplifier Chassis Modules w/external Axciter

ASSEMBLY DESIGNATOR	MODULE/ASSEMBLY NAME	PART NUMBER
	Chassis Assembly, HX-E	1307716 (220 VAC)
A1	Axciter Downconverter Module	1306852
A4	Control & Monitoring/Power Supply Module	1303229 (220 VAC)
A5	Axciter Upconverter Module	1306850
A6	Driver Amplifier Module, VHF (Used with High Power transmitter)	1305822
Or A6	Power Amplifier Module, VHF (Used with LHV50/60ATD)	1309218
A11	Backplane Board, HX Series	1307307

2.0: System Overview

The LX Series systems are complete Digital VHF modular television transmitters that operate at an average output power of 5 Watts to 60 Watts, but they can also be used as a driver. When used as a driver, it operates at the needed drive level to produce the desired output power level of the external PA Assembly or Assemblies.

The model number scheme for a Innovator LX Series transmitter is as follows (where #### = power in watts):

LHV####ATD - LX Series VHF Digital Xmtr
(Example): LHV50ATD is a 50 Watt Digital VHF High Band Xmtr

The LX Series digital transmitter is made up of the modules and assemblies as listed in Table 2-1 and shown in Figure 2-1.

2.1: Exciter Amplifier Chassis Assembly, HX-E, 220 VAC (1307716; Appendix A)

The chassis assembly is factory set for operation using 220 VAC. All of the modules, except the power amplifier module and the power supply section of the Control & Monitoring/Power Supply Module, plug directly into a backplane board. The backplane board (1307307) provides module to module interconnection as well as interconnection to remote command and control connectors.

NOTE: Description of the Axciter Downconverter Module, Upconverter Module and Axciter Modulator Tray are found in the separate Axciter Manual.

2.1.1: (A4) Control & Monitoring/ Power Supply Module Assembly, 220VAC (1303229; Appendix A)

The (A4) Control & Monitoring/Power Supply Assembly is made up of a Control Board (1302021), a Power Protection Board (1302837) and a Switch Board (1527-1406). The Assembly also contains a switching power supply that provides ±12 VDC to the rest of the modules in the chassis and +32 VDC to the Power Amplifier module.

The Assembly provides all transmitter control and monitoring functions. The Front panel LCD allows monitoring of system parameters, including forward and reflected power, transistor currents, module temperatures and power supply voltages.

Table 2-2: Controller/Power Supply Display

DISPLAY	FUNCTION
LCD	A 4 x 20 display providing a four-line readout of the internal functions, external inputs, and status. See Chapter 3, Controller/Power Supply Display Screens, for a listing of displays.

Table 2-3: Controller/Power Supply Status Indicator

LED	FUNCTION
OPERATE (green)	When lit it indicates that the transmitter is in the Operate Mode. If transmitter is Muted the Operate LED will stay lit, the transmitter will remain in Operate, until the input signal is returned.
FAULT (red or green)	Red indicates that a problem has occurred in the transmitter. The transmitter will be Muted or placed in Standby until the problem is corrected.
DC OK (red or green)	Green indicates that the switchable fuse protected DC outputs that connect to the modules in the transmitter are OK.

Table 2-4: Controller/Power Supply Control Adjustments

POTENTIOMETERS	DESCRIPTION
DISPLAY CONTRAST	Adjusts the contrast of the display for desired viewing of screen.

2.1.2: (A6) Driver Power Amplifier Module Assembly, VHF, DTV (1305822; Appendix A)

NOTE: The 1305822 Driver PA Assembly is used as a driver for high power transmitters. Refer to the 1309218 PA Assembly, which follows in the next section, for the PA used in the LHV50ATD & LHV60ATD transmitters.

The (A6) Power Amplifier Module Assembly is made up of a VHF Coupler Board Assembly (1308258), an Amplifier Control Board (1308260), a Delta RF 25 Watt VHF Driver Assembly (1305820) and a Delta RF 200 Watt VHF Amplifier Assembly (1300167).

The Power Amplifier Module contains Broadband LDMOS amplifiers that cover the VHF High Band with no tuning required. They amplify the RF to the output power of the transmitter.

The Power Amplifier is used to amplify the RF output of the Upconverter module. A jumper cable, located on the rear chassis, connects the RF output from the LO/Upconverter at J23 to J24 the RF input to the PA Assembly.

The Power Amplifier module contains an amplifier control and monitoring board. This board monitors the RF output power, RF reflected power, the current draw of amplifier sections, the supply voltage, and the temperature of the PA heat sink. The Control and monitoring lines to the Power Amplifier module are routed through the floating blind-mate connector of the Control & Monitoring/Power Supply module.

The RF power detector circuit outputs vary with operating frequency. These circuits must be calibrated at their intended operating frequency. Front panel adjustment potentiometers, R201 for Reflected Power and R202 for Forward Power, are used for calibration.

The Aural power of the Power Amplifier assembly is not reported by the system Control Monitoring module. Additionally the Visual power of the amplifier is reported as Forward Power.

The Forward Power of the Power Amplifier module is routed to the Upconverter module as AGC #1. A system over-drive condition is detected when this value rises above 1.6 VDC on the Axciter's Upconverter Screen. When an over-drive condition is detected, the Upconverter module reduces its RF output level. For values less than 1.6 VDC, the Upconverter uses this voltage for automatic gain.

Table 2-5: Power Amplifier Status Indicator

LED	FUNCTION
ENABLED (Green)	When lit Green, it indicates that the PA is in the Operate Mode. If a Mute occurs, the PA will remain Enabled, until the input signal is returned.
DC OK (Green)	When lit Green, it indicates that the fuse protected DC inputs to the PA module are OK.
TEMP (GREEN)	When lit Green, it indicates that the temperature of the heatsink assembly in the module is below 78°C.
MOD OK (Green)	When lit Green, it indicates that the PA Module is operating and has no faults.
MOD OK (RED)	If the Module OK LED is Red and blinking a fault is present. The meaning of the blinking LED is as follows. **1 Blink** indicates Amplifier Current Fault. **2 Blinks** indicate Temperature Fault. **3 Blinks** indicate +32V Power Supply Over Voltage Fault. **4 Blinks** indicate +32V Power Supply Under Voltage Fault. **5 Blinks** indicate Reflected Power Fault. **6 Blinks** indicate +12V or –12V Power Supply Fault
MOD OK (Amber)	A blinking Amber Mod OK LED indicates the power output of the amplifier module is below 65%. (**NOTE**: Only in Amplifier Code Versions 3.7A or later & System Controller Code Versions 3.9C or later.)

Table 2-6: Power Amplifier Control Adjustments

POTENTIOMETERS	DESCRIPTION
RFL CAL	Adjusts the gain of the Reflected Power monitoring circuit
FORWARD CAL	Adjusts the gain of the Forward Power monitoring circuit
AURAL CAL	(NOT USED) Adjusts the gain of the Aural Power monitoring circuit
AURAL NULL	(NOT USED) Adjusts the offset of the Forward Power monitoring circuit based on the Aural signal level..

Table 2-7: Power Amplifier Sample

DISPLAY	FUNCTION
FWD SAMPLE	RF sample of the amplified signal being sent out the module on J25.

2.1.2.1: (A6) Power Amplifier Assembly, DTV/DVB, VHF (1309218; Appendix A)

NOTE: The 1309218 PA Assembly is used in the LHV50ATD & LHV60ATD Transmitters. Refer to the 1305822 Driver PA Assembly, which is in the previous section, for the driver PA used in high power transmitters.

The (A6) Power Amplifier Module Assembly is made up of a VHF HB Coupler Board Assembly (1308258), an Amplifier Control Board (1309216), a Delta RF 25 Watt VHF Driver Assembly (1305820) and a Delta RF 200 Watt VHF Amplifier Assembly (1300167).

The Power Amplifier Module contains Broadband LDMOS amplifiers that cover the VHF High Band with no tuning required. They amplify the RF to the output power of the transmitter.

The Power Amplifier is used to amplify the RF output of the Upconverter module. A jumper cable, located on the rear chassis, connects the RF output from the LO/Upconverter at J23 to J24 the RF input to the PA Assembly.

The Power Amplifier module contains an amplifier control and monitoring board. This board monitors the RF output power, RF reflected power, the current draw of amplifier sections, the supply voltage, and the temperature of the PA heat sink. The Control and monitoring lines to the Power Amplifier module are routed through the floating blind-mate connector of the Control & Monitoring/Power Supply module.

The RF power detector circuit outputs vary with operating frequency. These circuits must be calibrated at their intended operating frequency. Front panel adjustment potentiometers, R201 for Reflected Power and R202 for Forward Power, are used for calibration.

The Aural power of the Power Amplifier assembly is not reported by the system Control Monitoring module. Additionally the Visual power of the amplifier is reported as Forward Power.

The Forward Power of the Power Amplifier module is routed to the Upconverter module as AGC #1. A system over-drive condition is detected when this value rises above 1.6 VDC on the Axciter's Upconverter Screen. When an over-drive condition is detected, the Upconverter module reduces its RF output level. For values less than 1.6 VDC, the Upconverter uses this voltage for automatic gain.

Table 2-8: Power Amplifier Status Indicator

LED	FUNCTION
ENABLED (Green)	When lit Green, it indicates that the PA is in the Operate Mode. If a Mute occurs, the PA will remain Enabled, until the input signal is returned.
DC OK (Green)	When lit Green, it indicates that the fuse protected DC inputs to the PA module are OK.
TEMP (GREEN)	When lit Green, it indicates that the temperature of the heatsink assembly in the module is below 78°C.
MOD OK (Green)	When lit Green, it indicates that the PA Module is operating and has no faults.
MOD OK (RED)	If the Module OK LED is Red and blinking a fault is present. The meaning of the blinking LED is as follows. **1 Blink** indicates Amplifier Current Fault. **2 Blinks** indicate Temperature Fault. **3 Blinks** indicate +32V Power Supply Over Voltage Fault. **4 Blinks** indicate +32V Power Supply Under Voltage Fault. **5 Blinks** indicate Reflected Power Fault. **6 Blinks** indicate +12V or –12V Power Supply Fault
MOD OK (Amber)	A blinking Amber Mod OK LED indicates the power output of the amplifier module is below 65%. (**NOTE**: Only in Amplifier Code Versions 3.7A or later & System Controller Code Versions 3.9C or later.)

Table 2-9: Power Amplifier Control Adjustments

POTENTIOMETERS	DESCRIPTION
RFL CAL	Adjusts the gain of the Reflected Power monitoring circuit
FORWARD CAL	Adjusts the gain of the Forward Power monitoring circuit
AURAL CAL	(NOT USED) Adjusts the gain of the Aural Power monitoring circuit
AURAL NULL	(NOT USED) Adjusts the offset of the Forward Power monitoring circuit based on the Aural signal level..

Table 2-10: Power Amplifier Sample

DISPLAY	FUNCTION
FWD SAMPLE	RF sample of the amplified signal being sent out the module on J25.

2.2: RF Output Assemblies

The driver/power amplifier RF output jack is at an "N" connector J25, PA RF Output. The RF output of the driver/amplifier chassis assembly is connected to the input of the (A6) circulator and then to the (A7) pre-filter coupler assembly.

The pre-filter coupler supplies a forward, pre-filter power sample at J3, Non-Linear Distortion, which is cabled to J1 on (K2) the Axciter relay mounted on the left side toward the rear of the cabinet. The output of the pre-filter coupler connects to the (A10) low pass filter and then to J1, the RF input jack, on (A8) the DTV bandpass filter. The low pass and bandpass filtered output connects to the (A9) coupler and then to (A11) the post-filter coupler assembly.

The post-filter coupler supplies a forward sample, Linear Distortion, which is cabled to J2 on the (K2) Axciter relay.

The RF output of the post-filter coupler assembly at the J2 "N" connector, connects to the antenna for your system.

2.2.1: Pre-Filter Sample (Non-Linear Distortion) and Post-Filter Sample (Linear Distortion)

A forward power sample, pre-filtering, (Non-Linear Distortion), of the output of the power amplifier assembly, from (A7) the pre-filter coupler connects to J1, on the K2 relay. (-10 to 0 dBm, Typical level –5 dBm but must be within .5 dB of the J2 sample level.)

A forward power sample, post-filtering (Linear Distortion), of the output of the transmitter is provided from (A11) the post-filter coupler. The post-filter sample connects to J2, on the K2 relay. (-10 to 0 dBm, Typical level –5 dBm but must be within .5 dB of the J1 sample level.)

The switching of the relay between the two samples is controlled by the Axciter Modulator tray through J7. The selected output of the relay at J3, either the Pre or Post filter sample, connects to the rear of the driver/ amplifier chassis assembly at the SMA Jack J41. This sample is connected to the downconverter module, which is part of the Axciter system for use in the adaptive equalization process.

2.3: Control and Status

The control and status of the driver/ amplifier chassis assembly is found by operating the front panel display screen on the assembly. Detailed information on the use of the screen is found in Chapter 3 of this manual.

2.3.1: Front Panel Display Screen

A 4 x 20 display located on the front of the Control & Monitoring/Power Supply Module is used in the LX Series transmitter for control of the operation and display of the operating parameters of the transmitter.

2.4: System Operation

When the transmitter is in operate, as set by the menu screen located on the Control & Monitoring Module. The +32 VDC stage of the Power Supply in the Control & Monitoring Module is enabled, the operate indicator on the front panel is lit and the DC OK on the front panel is green. The enable and DC OK indicators on the PA Module will also be turned to green.

When the transmitter is in standby, the +32 VDC stage of the Power Supply in the Control & Monitoring Module is disabled, the operate indicator on the front panel will be extinguished and the DC OK on the front panel should remain green. The enable and indicator on the PA Module is also extinguished.

If the transmitter does not switch to Operate when the operate menu is switched to Operate, check that all faults are cleared and that the remote control terminal block stand-by signal is not active.

2.4.1: Principles of Operation

Operating Modes

This transmitter is either operating or in standby mode. The sections below discuss the characteristics of each of these modes.

Operate Mode

Operate mode is the normal mode for the transmitter when it is providing RF power output.

Entering Operate Mode

Entering the operate mode can be initiated a few different ways by the transmitter control board. A list of the actions that cause the operate mode to be entered is given below:

- A low on the Remote Transmitter Operate line.
- User selects "OPR" using switches and menus of the front panel.
- Receipt of an “Operate CMD” over the serial interface.

There are several fault or interlock conditions that may exist in the transmitter that will prevent the transmitter from entering the operate mode. These conditions are:

- Power Amplifier heat sink temperature greater than 78°C.
- Power Amplifier Interlock is high indicating that the amplifier is not installed.

Standby Mode

The standby mode in the transmitter indicates that the transmitters output amplifier is disabled.

Entering Standby Mode

Similar to the operate mode, the standby mode is entered various different ways. These are:

- A low on the Remote Transmitter Stand-By line.
- Depressing the “STB” key on selected front panel menus.
- Receipt of a “Standby CMD” over the serial interface.

RF System Interlock

A RF System Interlock signal is provided through TB30-5. When this signal's circuit is completed to ground such as through a wire between TB30-5 and TB30-15, the transmitter is allowed to operate. If this circuit is opened, the transmitter switches to a Mute condition. This circuit may be completed through coax relay contacts and reject load contact closures to assure the RF output system is available to receive the transmitter's output RF signal. This feature is implemented in transmitter software version 1.4 and above.

Operating Frequency

The transmitter controller is designed to operate on VHF frequencies. The exact output frequency of the transmitter can be set to one of the standard VHF frequencies, or to a custom frequency using the software channel set-up menu on the Controller Module. Since RF performance of the transmitter requires different hardware for different frequency bands, not all frequency configurations are valid for a specific transmitter. The Power detectors in the transmitter are frequency dependent, therefore detectors of power amplifiers are calibrated at their frequency of use. The detectors for System RF monitoring are also calibrated at the desired frequency of use.

2.5: Maintenance

The Innovator LX Series Driver/ Transmitter is designed with components that require little or no periodic maintenance except for the routine cleaning of the fans and the front panels of the modules and the periodic check of general tightness of hardware.

It is recommended that periodically, the time interval depends on the amount of movement the cabinet receives, all mounting hardware holding tray slides, shelving and mounting plates inside the cabinet are checked for tightness. All screws and bolts that are accessible should be tightened initially when the transmitter is received and periodically thereafter if the transmitter is moved by vehicle. All coaxial connectors, hard-line connections and hardware holding combiners, splitters, or any other mounted items should be checked and tightened. Check the front panel thumbscrews that hold the Exciter/Driver Sleds, Amplifier Module and Power Supply Sleds in place are tight. This is

especially important after the transmitter has been transported

The amount of time between cleanings depends on the conditions within the transmitter room. While the electronics have been designed to function even if covered with dust, a heavy buildup of dust, dirt, or insects will affect the cooling of the components. This could lead to a thermal shutdown or the premature failure of the affected modules.

When the front panels of the modules become dust covered, the top covers should be taken off and any accumulated foreign material should be removed. A vacuum cleaner, utilizing a small, wand-type attachment, is an excellent way to suction out the dirt. Alcohol and other cleaning agents should not be used unless you are certain that the solvents will not damage components or the silk-screened markings on the modules and boards. Water-based cleaners can be used, but do not saturate the components. The fans and heatsinks should be cleaned of all dust or dirt to permit the free flow of air for cooling purposes.

It is recommended that the operating parameters of the amplifier assembly and transmitter be recorded from the LEDs on the modules and the LCD system metering on the control/monitoring module at least once a month. It is suggested that this data be retained in a rugged folder or envelope.

2.6: Customer Remote Connections

The remote monitoring and operation of the transmitter is provided through jack TB30 located on the rear of the chassis assembly. If remote connections are made to the transmitter, they must be made through the plug TB30 at the positions noted on the transmitter interconnect drawing and Table 2-11. TB30 is an 18 position terminal block that is removable from its sockets to make connections easier. Just grasp and pull the connector straight out. After connections are made, replace the connector and push firmly to seat the connector in the socket.

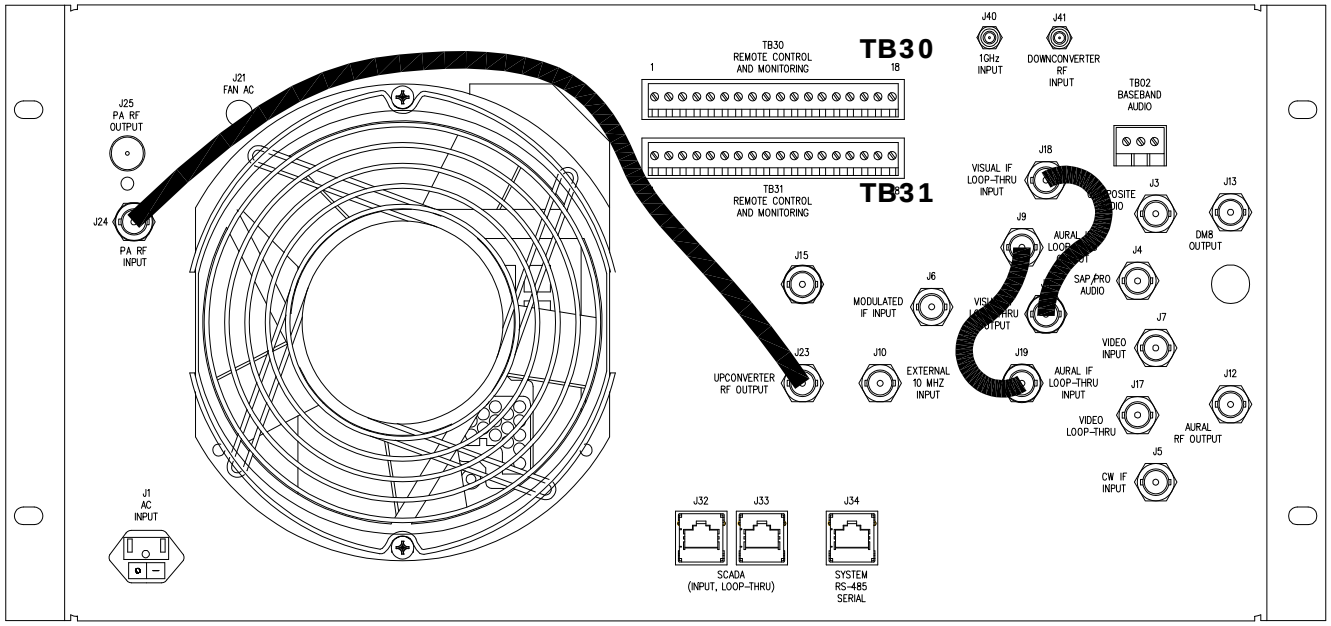


Figure 2-2: Rear View LX Series Chassis Assembly

Table 2-11: LX Series Chassis Assembly Hard Wired Remote Interface Connections to TB30 or TB31, 18 pos. Terminal Blocks Located on the Rear of the Assembly

Signal Name	Pin Designations	Signal Type / Description
RMT Transmitter State	TB30-1	Discrete Open Collector Output - A low indicates that the transmitter is in the operate mode.
RMT Transmitter Interlock	TB30-2	Discrete Open Collector Output - A low indicated the transmitter is OK or completes a interlock daisy chain. When the transmitter is not faulted, the interlock circuit is completed.
RMT Transmitter Interlock Isolated Return	TB30-3	Ground - Configurable ground return which can be either jumpered directly to ground or it can be the "source" pin of a FET so that the transmitter interlock can be daisy chained with other transmitters. This signal does not directly interface to the microcontroller.
RMT AUX IO 1	TB30-4	Discrete Open Collector Inputs, Discrete Open Drain Outputs, or 0 - 5 VDC Analog Input - When used as an output, this line is pulled to +5 VDC with a 1.0 kO resistor for logic high and pulled to ground for a low. A diode allows this line to be pulled up to 12 VDC. When used as a digital input, this line considers all values over 2 Volts as high and those under 1 volt as low. As an analog input, this line is protected by a 5.1 Zener diode.
RMT RF System Interlock	TB30-5	When this signal's circuit is completed to ground such as through a wire between TB30-5 and TB30-15, the transmitter is allowed to operate. If this circuit is opened, the transmitter switches to a Mute condition. Implemented in transmitter software version 1.4 and above.
RMT Transmitter Operate Command	TB30-6	Discrete Open Collector Input - A pull down to ground on this line indicates that the transmitter is to be placed into the operate mode.
RMT Transmitter Stand-By Command	TB30-7	Discrete Open Collector Input - A pull down to ground on this line indicates that the transmitter is to be placed into the standby mode.
RMT Power Raise Command	TB30-8	Discrete Open Collector Input - A pull down to ground on this line indicates that the transmitter power is to be raised.
RMT Power Lower Command	TB30-9	Discrete Open Collector Input - A pull down to ground on this line indicates that the transmitter power is to be lowered.
RMT System Reflect Power	TB30-10	Analog Output - 0 to 4.0 V- This is a buffered loop through of the calibrated "System Reflected Power " and indicates the transmitter's reflected output power. The scale factor is 25 % / 3.2V.
RMT System Forward Power	TB30-11	Analog Output - 0 to 4.0 V- This is a buffered loop through of the calibrated "System Average Power ". Indicates the transmitter's Average power. Scale factor is 100 % / 3.2V.

Signal Name	Pin Designations	Signal Type / Description
RMT Spare 1	TB30-13	Remote connection to spare module - Use is TBD.
RMT Spare 2	TB30-14	Remote connection to spare module - Use is TBD.
RMT +12 VDC	TB30-16	+12 VDC available through Remote w/ 2 Amp re-settable fuse
RMT -12 VDC	TB30-18	-12 VDC available through Remote w/ 2 Amp re-settable fuse
RMT Ground	TB30-15, and 17	Ground pins available through Remote

Chapter 3
Site Considerations, Installation and Setup Procedures

Table 3-1: LX Series Digital Transmitters/Drivers AC Input and Current Requirements.

Transmitter/ Driver	Voltage	Current
5 Watt	117/220 VAC	5 Amps
50/60 Watt	117/220 VAC	10 Amps
125 Watt	220 VAC	10 Amps to the Exciter/Amplifier Cabinet
250 Watt	220 VAC	15 Amps to the Exciter/Amplifier Cabinet
500 Watt	220 VAC	25 Amps to the Exciter/Amplifier Cabinet
1000 Watt	220 VAC	45 Amps to the Exciter/Amplifier Cabinet
1500 Watt	220 VAC	65 Amps to the Exciter/Amplifier Cabinet
2000 Watt	220 VAC	45 Amps to the Exciter/Amplifier Cabinet
	220 VAC	40 Amps to the Amplifier Cabinet
2500 Watt	220 VAC	45 Amps to the Exciter/Amplifier Cabinet
	220 VAC	60 Amps to the Amplifier Cabinet
3000 Watt	220 VAC	65 Amp to the Exciter/Amplifier Cabinet
	220 VAC	60 Amps to the Amplifier Cabinet

3.1: Site Considerations

There are special considerations that need to be taken into account before the LX Series digital driver/transmitter can be installed. For example, if the installation is completed during cool weather, a heat-related problem may not surface for many months, suddenly appearing during the heat of summer. This section provides planning information for the installation and set up of the transmitter.

The AC input and current requirements for LX Series digital transmitter/drivers are shown in Table 3-1.

NOTES: The transmitter is factory set for either 110 VAC or 220 VAC operation as directed by customer. Transmitters above 125 Watts use 220 VAC Input only.

Transmitters 2000 Watts and above require two 220 VAC Inputs, one to each cabinet.

The LX Series Digital Transmitters are designed and built to provide long life with a minimum of maintenance. The environment in which they are placed is important and certain precautions must be taken. The three greatest dangers to the transmitter are heat, dirt, and moisture. Heat is usually the greatest problem, followed by dirt, and then moisture. Over-temperature can cause heat-related problems such as thermal runaway and component failure. Each amplifier module in the transmitter contains a thermal interlock protection circuit that will shut down that module until the temperature drops to an acceptable level.

A suitable environment for the transmitter can enhance the overall performance and reliability of the transmitter and maximize revenues by minimizing downtime. A properly designed facility will have an adequate supply of cool, clean air, free of airborne particulates of any kind, and no excessive humidity. An ideal environment will require temperature in the range of 40° F to 70° F throughout the year, reasonably low humidity, and a dust-free room. It should be noted that this is rarely if ever attainable in the real world. However, the closer the environment is

to this design, the greater the operating capacity of the transmitter.

The fans are designed and built into the transmitter will remove the heat from within the modules, but additional means are required for removing this heat from the building. To achieve this, a few issues need to be resolved. The first step is to determine the amount of heat to be removed from the transmitter room. There are generally three sources of heat that must be considered. The first and most obvious is the heat from the transmitter itself. This amount can be determined for a 50W digital transmitter by subtracting the average power to the antenna (50 watts) from the AC input power (650 watts) and taking this number in watts (600) and then multiplying it by 3.41. This gives a result of 2,046, the BTUs to be removed every hour. 12,000 BTUs per hour equals one ton. Therefore, a 1/4-ton air conditioner will easily cool a 50W digital transmitter.

The second source of heat is other equipment in the same room. This number is calculated in the same way as the equation for BTUs. The third source of heat is equally obvious but not as simple to calculate. This is the heat coming through the walls, roof, and windows on a hot summer day. Unless the underside is exposed, the floor is usually not a problem. Determining this number is usually best left up to a qualified HVAC technician. There are far too many variables to even estimate this number without reviewing the detailed drawings of the site that show all of the construction details. The sum of these three sources is the bulk of the heat that must be removed. There may be other sources of heat, such as personnel, and all should be taken into account.

Now that the amount of heat that must be removed is known, the next step is to determine how to accomplish this. The options are air conditioning, ventilation, or a combination of the two. Air conditioning is always the preferred method and is the only way to create anything close to an ideal environment.

Ventilation will work quite well if the ambient air temperature is below 100° F, or about 38° C, and the humidity is kept at a reasonable level. In addition, the air stream must be adequately filtered to ensure that no airborne particulates of any kind will be carried into the transmitter. The combination of air conditioning for summer and ventilation during the cooler months is acceptable when the proper cooling cannot be obtained through the use of ventilation alone and using air conditioning throughout the year is not feasible.

Caution: The use of air conditioning and ventilation simultaneously is not recommended. This can cause condensation in the transmitters.

The following precautions should be observed regarding air conditioning systems:

1. Air conditioners have an ARI nominal cooling capacity rating. In selecting an air conditioner, do not assume that this number can be equated to the requirements of the site. Make certain that the contractor uses the actual conditions that are to be maintained at the site in determining the size of the air conditioning unit.

2. Do not have the air conditioner blowing directly onto the transmitter. Under certain conditions, condensation may occur on, or worse in, the transmitter.

3. Do not separate the front of the transmitter from the back with the thought of air conditioning only the front of the unit. Cooling air is drawn in at the front of all transmitters and in the front and back of others. Any attempt to

separate the front of the transmitter from the rear of the unit will adversely affect the flow of cooling air.

4. Interlocking the transmitter with the air conditioner is recommended to keep the transmitter from operating without the necessary cooling.

5. The periodic cleaning of all filters is a must.

When using ventilation alone, the following general statements apply:

1. The blower, with attendant filters, should be on the inlet, thereby pressurizing the room and preventing dirt from entering the transmitter.

2. The inlet and outlet vents should be on the same side of the building, preferably the leeward side. As a result, the pressure differential created by wind will be minimized. Only the outlet vent may be released through the roof.

3. The inlet and outlet vents should be screened with 1/8-inch hardware cloth (preferred) or galvanized hardware cloth (acceptable).

4. Cooling air should enter the room as low as practical but in no case higher than four feet above the floor. The inlet must be located where dirt, leaves, snow, etc., will not be carried in with the cooling air.

5. The exhaust should be located as high as possible. Some ducting is usually required to insure the complete flushing of heated air with no stagnant areas.

6. The filter area must be large enough to insure a maximum air velocity of 300 feet per minute through the filter. This is not a conservative number but a never-exceed number. In a dusty or remote location, this number should be reduced to 150 CFM.

7. The inlet and outlet(s) must have automatic dampers that close any time the ventilation blower is off.

8. In those cases in which transmitters are regularly off for a portion of each day, a temperature-differential sensor that controls a small heater must be installed. This sensor will monitor inside and outside temperatures simultaneously. If the inside temperature falls to within 5° F of the outside temperature, the heater will come on. This will prevent condensation when the ventilation blower comes on and should be used even in the summer.

9. A controlled-air bypass system must be installed to prevent the temperature in the room from falling below 40° F during transmitter operation.

10. The blower should have two speeds, which are thermostatically controlled, and be interlocked with the transmitter.

11. The blower on high speed must be capable of moving the required volume of air into a half inch of water pressure at the required elevation. The free air delivery method must not be used.

12. Regular maintenance of the filters, if used, can not be overemphasized.

13. Above 4000 feet, for external venting, the air vent on the cabinet top must be increased to an 8-inch diameter for a 1-kW

transmitter and to a 10-inch diameter for 5-kW and 6-kW transmitters. An equivalent rectangular duct may be used but, in all cases, the outlet must be increased by 50% through the outlet screen.

14. It is recommended that a site plan be submitted to Axcera for comments before installation begins.

In calculating the blower requirements, filter size, and exhaust size, if the total load is known in watts, 2000 CFM into ½ inch of water will be required for each 5000 watts. If the load is known in BTUs, 2000 CFM into ½ inch of water will be required for each 17,000 BTUs. The inlet filter must be a minimum of seven square feet, larger for dusty and remote locations, for each 5000 watts or 17,000 BTUs. The exhaust must be at least four square feet at the exhaust screen for each 5000 watts or 17,000 BTUs.

The information presented in this section is intended to serve only as a general guide and may need to be modified for unusually severe conditions. A combination of air conditioning and ventilation should not be difficult to design (see Figure 3-1).

System interlocking and thermostat settings should be reviewed with Axcera. As with any equipment installation, it is always good practice to consult the manufacturer when questions arise. Axcera can be contacted at (724) 873-8100.

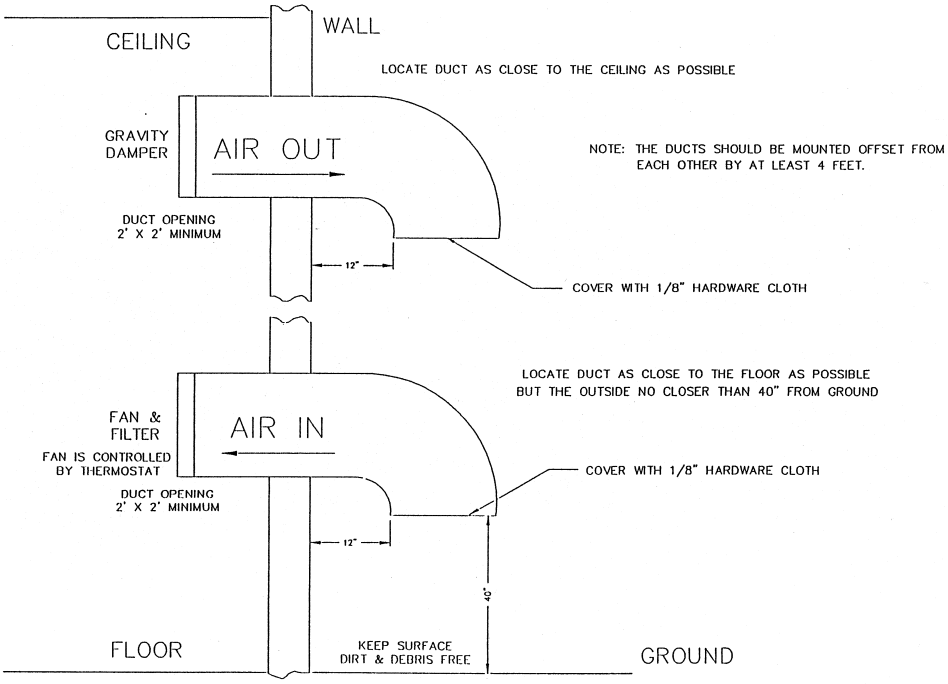


Figure 3-1: 500 Watt Minimum Ventilation Configuration

3.2: Unpacking the Chassis w/ modules, circulator, low pass filter, Digital Mask filter and coupler assemblies

Thoroughly inspect the chassis with modules and all other materials upon their arrival. Axcera certifies that upon leaving our facility the equipment was undamaged and in proper working order. The shipping containers should be inspected for obvious damage that indicates rough handling.

Remove the chassis and modules, the circulator, low pass and digital mask filters and the directional couplers from the crates and boxes.

Check for dents and scratches or broken connectors, switches or display. Any claims against in-transit damage should be directed to the carrier. Inform Axcera as to the extent of any damage as soon as possible.

The modules are mounted to the chassis assembly with slides that are on the top and the bottom of the modules. There are two thumb screws on the front panel that hold each of the modules in place. The chassis assembly is mounted in the cabinet using Chassis Trak cabinet slides. The tray slides are on the side of the assembly. Inspect the assembly for any loose hardware or connectors, tightening where needed.

3.3: Installing the Chassis w/ modules, circulator, low pass filter, Digital Mask filter, and pre and post filter coupler assemblies

The chassis assembly is made to mount in a standard 19" rack. The chassis assembly mounts using the four #10 clearance mounting holes on the ends. The chassis should be positioned to provide the following: adequate air intake into the front and the air exhaust of the fan in the rear; the ability to slide the modules out for replacement purposes; the installation of the circulator, low pass and digital mask filters, the pre and post filter couplers and the output transmission line. The chassis or cabinet in which it is mounted should be grounded using copper strapping material.

NOTE: To remove the driver/power amplifier module, mounted in the exciter/driver assembly, the input and output cables must be removed from the rear of the module and also a 6/32" x ½" Philips screw, mounted between the two connectors, needs to be removed before the module will pull out. After removal of the screw, which is used to hold the module in place during shipping, it does not need to be replaced.

Check that the (A6) circulator, the (A7) pre-filter coupler, the low pass and digital mask filters, and the (A9) post-filter coupler assembly are connected to the output of the power amplifier assembly.

Connect the transmission line for the antenna system to the "N" jack at the output of the (A11) post-filter coupler. Check that J3 the SMA forward sample jack of the (A7) pre-filter coupler is connected to J1 on the K2 Axciter Relay. Check that the forward SMA jack of the (A11) post-filter coupler is connected to J2 on the K2 Axciter Relay.

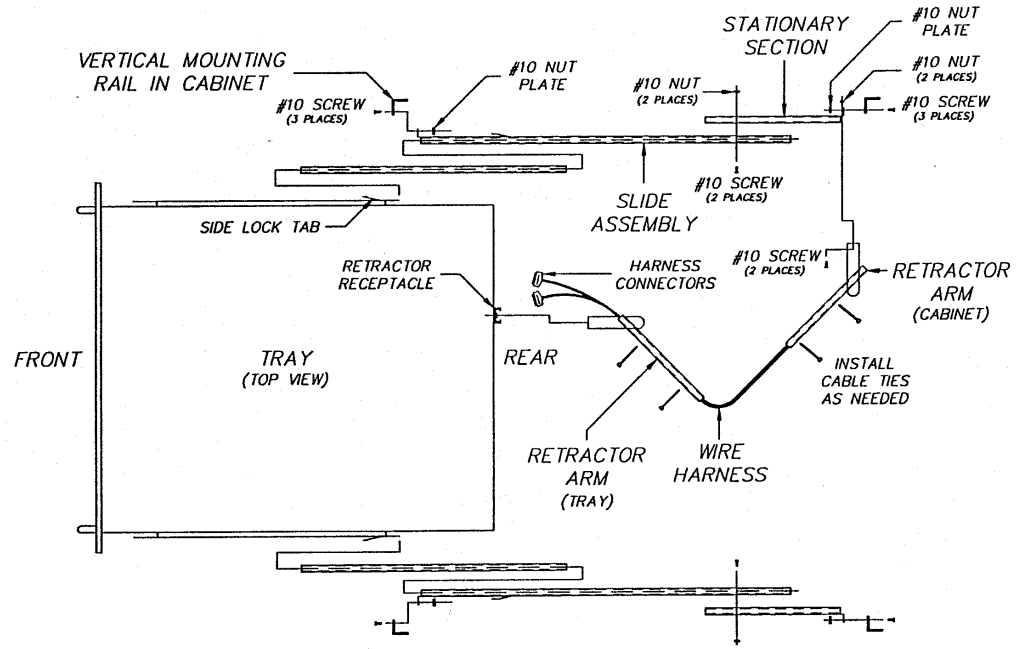


Figure 3-2: Tray Slides Cabinet Mounting Diagram

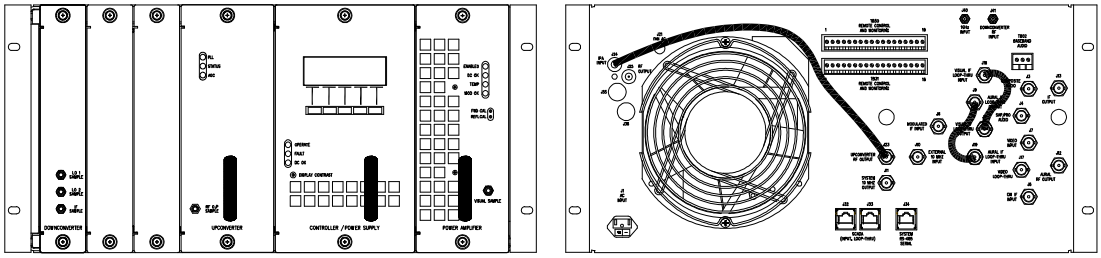


Figure 3-3: Front and Rear View Reconnection Drawing

3.4: AC Input

Once the chassis and output connections are in place, connect the AC power cord from the chassis assembly of the 5W or 60W digital transmitter/driver to an AC outlet

The AC input and current requirements for LX Series digital transmitter/drivers are indicated in the Table 3-1 located at the beginning of this chapter.

NOTES: 1) The transmitter is factory set for either 110 VAC or 220 VAC operation as directed by customer.

2) Transmitters above 125 Watts use 220 VAC Input only.

3) Transmitters 2000 Watts and above require two 220 VAC Inputs, one to each cabinet.

The AC Input to the high power transmitter connects to the terminal block mounted in the AC input box located toward the rear, right side near the top of the cabinet. Connect the AC Input Line 1 to Line 1 on the terminal block, the AC Input Line 2 to Line 2 on the terminal block and the AC Input Ground to Ground on the terminal block. See Figure 3-4.

Figure 3-4: AC Input Box Assembly

NOTE: An AC On/Off Circuit Breaker is located on the rear of the Exciter/Driver Chassis Assembly, near the AC input jack. In high power transmitters, there is one On/Off Circuit Breaker, located on the rear of the Power Amplifier Assembly, for each power supply assembly.

This completes the unpacking and installation of the LX Series VHF television transmitter. Refer to the setup and operation procedures that follow before applying power to the transmitter.

3.5: Set Up and Operation

Initially, the transmitter should be turned on with the RF output at the coupler assembly terminated into a dummy load of a value dependent on the power rating of the transmitter. If a load is not available, check that the output of the coupler assembly is connected to the antenna for your system.

3.5.1: Input Connections

The input connections to the transmitter are made to jacks mounted on the rear of the driver/amplifier chassis assembly.

The Axciter System accepts an SMPTE MPEG-2 transport stream input that connects to J27 on the rear of the Axciter Modulator. The external 10 MHz reference, if used, connects to J9 on the Axciter modulator tray. The IF output of the Axciter modulator tray at J40 is cabled to J15, the Digital IF input jack, located on the rear of the Driver/Amplifier Chassis Assembly. Check that J2 on the Axciter connects to J13 on the Driver/Amplifier Chassis. Check that J15 on the Axciter connects to J40 on the Driver/Amplifier Chassis. Check that J12 on the Axciter connects to J10 on the Driver/Amplifier Chassis.

Refer to the table 3-2 that follows for detailed information.

Figure 3-5: Rear View of Exciter Driver Chassis Assembly

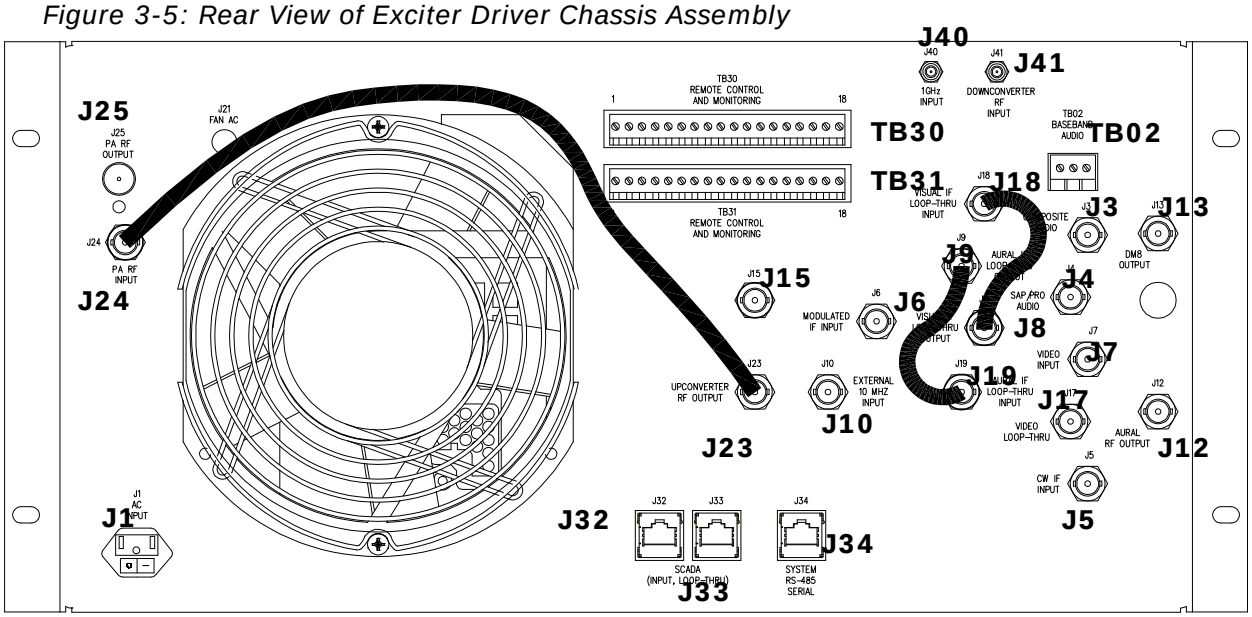


Table 3-2: Rear Chassis Connections for the LX Series Digital Driver/Amplifier.

Port	Type	Function	Impedance
J1	**IEC**	**AC Input**	**N/A**
TB02	Term	(NOT USED) Base Band Audio Input	600O
J3	BNC	(NOT USED) Composite Audio Input	75O
J4	BNC	(NOT USED) SAP / PRO Audio Input	50O
J5	BNC	(NOT USED) CW IF Input	50O
J6	BNC	(NOT USED) Digital IF Input	50O
J7	BNC	(NOT USED) Video Input (Isolated)	75O
J8	BNC	(NOT USED) Visual IF Loop-Thru Output	50O
J9	BNC	(NOT USED) Aural IF Loop-Thru Output	50O
J10	**BNC**	**Ext. 10 MHz Reference Input (From Axciter J12)**	50O
J12	BNC	(NOT USED) MPEG Input	50O
J13	**BNC**	**Downconverter IF Output (To Axciter J2)**	**50O**
J15	**BNC**	**Digital IF I/P (From Axciter J40)**	**50O**
J17	BNC	(NOT USED) Video Loop-Thru (Isolated)	75O
J18	BNC	(NOT USED) Visual IF Loop-Thru Input	50O
J19	BNC	(NOT USED) Aural IF Loop-Thru Input	50O
J23	**BNC**	**Upconverter RF Output (Jumpered to J24)**	**50O**
J24	**BNC**	**PA RF Input (Jumpered from J23)**	**50O**
J25	**N**	**PA RF Output**	**50O**
J32	RJ-45	SCADA (Input / Loop-Thru)	CAT5
J33	RJ-45	SCADA (Input / Loop-Thru)	CAT5
J34	**RJ-45**	**System RS-485 Serial (From/To Axciter J4)**	**CAT5**
J40	**SMA**	**1GHz Input (From Axciter J15)**	**50O**
J41	**SMA**	**Downconverter RF Input (From K2 Relay J3)**	**50O**
TB30	**Termination**	**Remote Control & Monitoring**	**N/A**
TB31	**Termination**	**Remote Control & Monitoring**	**N/A**

3.5.2: Initial Turn On

Once the unit has been installed and all connections have been made, the process of turning on the equipment can begin. First, verify that AC power is present and connected to the transmitter. Verify all cables are properly connected and are the correct type. Once things are completed, the unit is ready to be turned on following the procedures below.

Turn on the main AC power source that supplies the AC to the transmitter. Check that the AC power plug is connected to the AC Input jack on the back of the assembly and that the On/Off circuit breaker located on the rear chassis is On. In high power transmitters, check that the On/Off circuit breaker located on the rear of each Power Amplifier Assembly is On.

3.5.2.1: Axciter Upconverter Sled Module LEDs on Front Panel

Status Indicators:

PLL: This illuminates Green when the phase lock loop circuit is closed, Red if unlocked.

STATUS: This illuminates Green if no faults, Red when a fault has occurred in the upconverter.

AGC: This illuminates Green when in Auto, Amber when in Manual.

3.5.2.2: Controller Module LEDs on Front Panel

Status Indicators:

OPERATE - This illuminates Green when transmitter is in operate.

FAULT - This illuminates Red when a fault has occurred in the transmitter.

DC OK - This illuminates Green when the DC outputs that connect to the modules in the transmitter are present.

3.5.2.3: Driver Power Amplifier Module LEDs on Front Panel

NOTE: Both the IPA Module and PA Module have the same front panel LEDs.

Status Indicators:

ENABLED - This illuminates Green when the PA is in operate.

DC OK - This illuminates Green when the DC inputs to the PA module are present.

TEMP - This illuminates Green when the temperature of the heatsink in the PA is below 78°C.

MOD OK - This illuminates Green when the PA module is operating and has no faults.

If the Module OK LED is Red and blinking, a fault is present. The meaning of the blinking LED is as follows.

1 Blink indicates Amplifier Current Fault.
2 Blinks indicate Temperature Fault.
3 Blinks indicate +32V Power Supply Over Voltage Fault.
4 Blinks indicate +32V Power Supply Under Voltage Fault.
5 Blinks indicate Reflected Power Fault.
6 Blinks indicate +12V or –12V Power Supply Fault

If the Module OK LED is Amber and blinking, it indicates the power output of the amplifier has dropped below 65%. (**NOTE:** Only in Amplifier Code Versions 3.7A or later and System Controller Code Versions 3.9C or later.).

3.5.3: Front Panel Screens for the Driver/Amplifier Chassis Assembly

A 4 x 20 display located on the front of the Control & Monitoring/Power Supply Module is used in the LX Series exciter for control of the operation and display of the operating parameters of the transmitter. Below are the display screens for the system. The ↑ and ↓ characters are special characters used to navigate up or down through the menu screens. Display text flashes on discrete fault conditions for all screens that display a fault condition. When the transmitter is in operate mode, the STB menu appears. When the transmitter is in standby mode, the OPR menu appears.

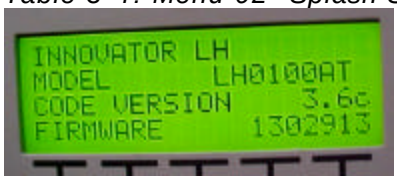
NOTE: The following screens are typical and may be different from the screens in your system.

Display Menu Screens for the LX Series Driver/Amplifier

Table 3-3: Menu 01 - Splash Screen #1

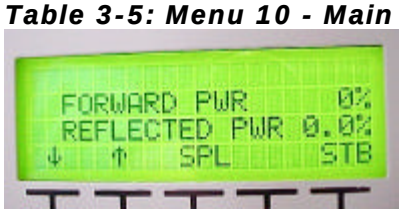
This is the first of the two transmitter splash screens that is shown for the first few seconds after reset or after pushing the SPL button on the Main Screen. This screen will automatically switch to the second splash screen.

Table 3-4: Menu 02- Splash Screen #2



This is the second of the two transmitter splash screens. This screen will automatically switch to the Main Screen. The Model Number, Code Version Number and Firmware Number for your system are displayed on this screen. Make note of these two numbers when conferring with Axcera on software problems.

Table 3-5: Menu 10 - Main Screen:



This is the default main screen of the transmitter. When the transmitter is in Standby, the 'OPR' characters appear in the lower right. By pushing the right most button located under the display, the operator will place the Transmitter in Operate. When the transmitter is in Operate the 'SBY' characters are displayed, the “OFF” is replaced with 'ON' and the forward power values are displayed. Pushing the SPL button will display the two splash screens.

If the ↓ key is activated the display changes to Menu 11, the System Error List Access Screen. If the ↑ key is activated the display changes to Menu 13, the Transmitter Configurations Access Screen.

Table 3-6: Menu 11 - Error List Access Screen

This screen of the transmitter shows the current number of errors, displayed in upper, right of screen (0), and provides operator access to view Menu 20, the error list screens, by pushing the ENT button. When ENT is pushed, Menu 20, the Error List Display Screen is displayed. If the ↓ key is pushed the display changes to Menu 12, Table 3-7, the Transmitter Device Data Access Screen. If the ↑ key is activated the display returns to Menu 10, the Main Screen.

Table 3-7: Menu 12 - Transmitter Device Data Access Screen

This screen of the transmitter allows access to various parameters of the transmitter system. This is the entry point to Menu 30, the System Details Screens, by pausing the ENT button. When the ENT button is pushed, Menu 30 is accessed. Go to Menu 30, Table 3-12 for set up details. Before pushing the ENT button: if the ↓ key is activated the display changes to Menu 13, Transmitter Configurations Access Screen. If the ↑ key is activated the display returns to Menu 11, the Error List Access Screen.

Table 3-8: Menu 13 - Transmitter Configuration Access Screen

This screen of the transmitter allows access to various software settings of the transmitter system. If ENT is pushed, go to Menu 40, Table 3-13, the access to transmitter configuration and set up. Before pushing the ENT button: if the ↓ key is activated the display returns to Menu 10, Main Screen. If the ↑ key is activated the display returns to Menu 12, the Transmitter Device Data Access Screen.

Table 3-9: Menu 20 - Error List Display Screen

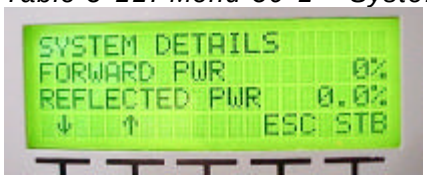
This screen of the transmitter allows access to the system faults screens. Fault logging is stored in non-volatile memory. The transmitter's operating state can not be changed in this screen. The 'CLR' switch is used to clear previously detected faults that are no longer active. The ↑ key and ↓ key allow an operator to scroll through the list of errors that have occurred. The ESC button is used to leave this screen and return to Menu 11, Table 3-6, the Error List Access Screen. **NOTE:** Shown is example of a typical screen.

Menu 30 is entered by selecting ENT at Menu 12, Table 3-7.

Table 3-10: Menu 30 - Transmitter Device Details Screen

This screen allows access to the transmitter parameters of installed devices. The system is configured to know which devices are present. Current values for all installed devices are shown. If a module is not installed, only a "MODULE NOT PRESENT" message will be displayed. The first screen displayed is Menu 30-1, Table 3-11, the System Details Screen.

Table 3-11: Menu 30-1 – System Details Screen



This is first screen of the details screens. The ↓ and ↑ arrows allow you to scroll through the different parameters of each device as shown in **Table 3-12**. Each System Component is a different screen. The proper modules will be programmed for your system.

Table 3-12: Transmitter Device Parameters Detail Screens

System Component	Parameter	Normal	Faulted (Blinking)
Axciter Details	D/C PIN ATTEN VOLTAGE	~ .6V	N/A
	OVERDRIVE FAULT	~ 1.6V	N/A
	AGC MODE	AUTOMATIC	N/A
	ADAPTIVE EQUALIZATION STATUS	RUNNING	N/A
	MEASURED SIGNAL TO NOISE	~ 32.6dB	N/A
	PLL STATUS	LOCKED	N/A
	SMTE310 INPUT STATUS	OK	N/A
	DEMOD FUNCTION STATUS	OK	N/A
	FX VERSION	~ 1.013	N/A
	NB VERSION	~ 0.029	N/A
Upconverter Details	D/C PIN ATTEN VOLTAGE	~ 0.0	N/A
	U/C PIN ATTEN VOLTAGE	~ 1.6V	N/A
	AFC 1 LEVEL	~ 0.06V	N/A
	INPUT STATUS	OK	N/A
	OUTPUT STATUS	ON	N/A
	AGC 1 LEVEL	~ 0.32V	N/A
	AGC 2 LEVEL	~ 0.00V	N/A
	PLL	XXXMHz	N/A
	PLL STATUS	OK	FAULT
	OVERDRIVE LEVEL STATUS	OK	FAULT
	CODE VERSION	1.6h or higher	N/A
System Control Details	SUPPLY ENABLED FOR	xxx HOURS	N/A
Driver or PA Details	POWER SUPPLY STATE, 32V	~ 32 VDC	N/A
	±12V SUPPLY	OK	FAULT
	FORWARD POWER	xxx%	N/A
	REFL POWER	xxx%	N/A
	AMP 1 CURRENT	xx.xA	N/A
	AMP 2 CURRENT	xx.xA	N/A
	TEMPERATURE	xxC	N/A
	CODE VERSION	3.6x	N/A
	PA HAS OPERATED FOR	x.x HRS	N/A

Pushing the ↓ Down Arrow, after scrolling through all of the detail screens, will put you back to Menu 30, Table 3-10. Push the ESC button to exit the Transmitter Device Parameter Screens to Menu 12, Table 3-7, the Transmitter Device Parameter Access Screen.

Menu 40 (Table 3-13) is entered by selecting ENT at Menu 13.

Table 3-13: Menu 40 - Authorized Personnel Screen

This screen of the transmitter notifies an operator that they are only to proceed if they are authorized to make changes to the transmitter's operation. Changes made within the following set-up screens can affect the transmitters output power level, output frequency,

and the general behavior of the transmitter. Please do not make changes within the transmitter's set-up screens unless you are familiar with the operation of the transmitter. This screen is implemented in transmitter software version 1.4 and above.

Pressing ENT will put you into the Transmitter Set Up Screens for Menu 40.

A safeguard is added to the Set Up Menus in software version 2.5 and above. If a change is made to a screen within the Set Up Menus, when you go to the next menu, a new screen asks if you accept the change or want to return to the previous menu to reconsider the changes made.

To accept the changes, the two buttons located under ACCEPT must be pushed simultaneously.

To return to the previous Menu to make corrections, the two buttons located under the RETURN must be pushed simultaneously.
Upon returning to the previous Menu the correct input must be entered and the above procedure repeated, this time accepting the changes

Accept or Return to previous Menu Screen

Pushing these two buttons Simultaneously will accept the change.

Pushing these two buttons Simultaneously will return you to the previous Menu.

Typical Set Up Screens are shown in Table 3-14 Menu 40-1 through Table 3-22 Menu 40-19 that follow.

Table 3-14: Menu 40-1 - Transmitter Set-up: Power Control Screen

This screen of the transmitter is the first of several that allows access to transmitter set-up parameters. When + is selected, the Power will increase. When - is selected, the Power will decrease.

Table 3-15: Menu 40-3 - Transmitter Set-up: Model Select Screen

This screen is used to specify which components are expected to be part of the system. By specifying the model number, the transmitter control firmware knows which components should be installed and it will be able to display faults for components that are not properly responding to system commands.

Table 3-16: Menu 40-5 - Transmitter Set-up: Serial Address Screen

This screen allows the user to set the serial address of the transmitter. The default address is 5. This value and all other set-up parameters are stored in non-volatile memory.

Table 3-17: Menu 40-6 - Transmitter Set-up: System Forward Power Calibration

This screen is used to adjust the calibration of the system's forward power. A symbol placed under the '6' character is used to show major changes in the calibration value. When the calibration value is at full value, the character will be full black. As the value decreases, the character pixels are gradually turned off. The calibration value is a value between 0 and 255 but the calibration value symbol only has 40 pixels. Therefore small changes in actual calibration value may not affect the symbol's appearance.

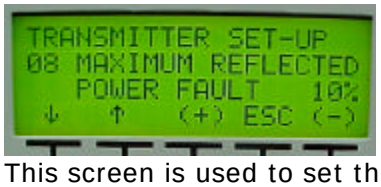
Table 3-18: Menu 40-9 - Transmitter Set-up: System Reflected Power Calibration

This screen is used to adjust the calibration of the system's reflected power. Again a calibration value symbol is used for this screen as on the previous screens.

Table 3-19: Menu 40-13 - Transmitter Set-up: Minimum Forward Power Fault Threshold Screen

This screen is used to set the minimum forward power fault threshold. When the transmitter is operating, it must operate above this value otherwise the system will shut down with fault for 5 minutes. If after five minutes the fault is not fixed, the transmitter will enable, measure the power and if less than this value it will again shut down for five minutes.

Table 3-20: Menu 40-14 - Transmitter Set-up: Maximum Reflected Power Fault Threshold



This screen is used to set the maximum reflected power fault threshold. When the transmitter is operating, it must not operate above this value otherwise the system will slowly begin to reduce the forward output power. If the system's reflected output power exceeds the maximum reflected power threshold by five percent or more, the transmitter will shut down with fault for 5 minutes. If after five minutes the fault is not fixed, the

transmitter will enable, measure power and if above this value plus five percent it will again shut down for five minutes. If the system's reflected output power exceeds the maximum reflected power threshold due to some condition like the formation of ice on an antenna, the transmitter reduces visual forward power to a level where the reflected power is less than this threshold. The transmitter will automatically increase its output power to normal operation when the cause of higher than normal reflected power is corrected.

Table 3-21: Menu 40-19 - Transmitter Set-up: Amplifier Output Power Warning

This screen is used to set up the Amplifier Output Power level at which a warning will be sent out if the power output of the amplifier drops below this setting. The warning indication is the blinking of the Module OK LED colored Amber, located on the front of the amplifier module. (**NOTE:** Only in Amplifier Code Versions 3.7A or later and System Controller Code Versions 3.9C or later.)

Table 3-22: Menu 40-19 - Transmitter Set-up: Remote Commands Control

This screen is used to allow or deny the use of remote control commands. When disabled, remote commands are not used. Remote commands are commands received either through the rear terminal blocks or through serial messages.

Push the ESC button to exit the Transmitter Set Up Screens to Menu 13, Table 3-8, the Transmitter Configuration Access Screen.

This completes the description of the menu screens for the LX Series driver/amplifier chassis assembly.

3.5.4: Operation Procedure

If necessary, connect to the transmitter to the antenna. Check that the output is 100% and if needed adjust the ALC Gain adjust pot on the front panel of the IF Processor to attain 100%. The power raise / lower settings, in the menus, are only to be used for temporary reductions in power.

The power set-back values do not directly correspond to the output power of the transmitter.

This completes the Installation, Set Up and Turn On of the Driver/Transmitter.

If a problem occurred during the setup and operation procedures, refer to Chapter 5, Detailed Alignment Procedures, of this manual for more information.

Chapter 4
Circuit Descriptions

NOTE: Information and drawings on the Axciter Modulator Tray and the Upconverter Module and Downconverter Module are contained in the separate Axciter Manual.

4.1: (A4) Control Monitoring/Power Supply Module, 220VAC (1303229; Appendix A)

The Control Monitoring/Power Supply Module Assembly contains (A1) a Power Protection Board (1302837), (A2) a 600 Watt Switching Power Supply, (A3) a Control Board (1302021), (A4) a Switch Board (1527-1406) and (A5) a LCD Display.

AC Input to the Driver/Amplifier Chassis Assembly

The AC input to the LX Series Driver/Amplifier Chassis Assembly is connected from J1, part of a fused entry module, located on the rear of the chassis assembly to J50 on the Control Monitoring/Power Supply Module. J50-10 is line #1 input, J50-8 is earth ground and J50-9 is line #2 input. The input AC connects to J1 on the Power Protection Board where it is fuse protected and connected back to J50, at J50-11 AC Line #1 and J50-12 AC Line #2, for distribution to the cooling Fan.

4.1.1: (A1) Power Protection Board (1302837; Appendix A)

The input AC connects through J1 to two 10 Amp AC fuses F1 and F2. The AC line #1 input connects from J1-1 to the F1 fuse. The AC line #1 input after the F1 fuse is split with one line connected back to Jack J1 Pin 4, which becomes the AC Line #1 to the Fan. The other line of the split connects to J4. The AC line #2 input connects from J1-3 to the F2 fuse. The AC line #2 input after the F2 fuse is split with one line connected back to Jack J1 at Pin 5, which becomes the AC Line #2 to the Fan. The other line of the split connects to J2. J1-2 is the earth ground input for the AC and connects to J3.

Three 150-VAC, for 115 VAC input, or three 275-VAC, for 230 VAC input, MOVs are connected to the input AC for protection. One connects from each AC line to ground and one connects across the two lines. VR1 connects from J4 to J2, VR2 connects from J4 to J3 and VR3 connects from J2 to J3.

+12 VDC Circuits

+12 VDC from the Switching Power Supply Assembly connects to J6 on the board. The +12 VDC is divided into four separate circuits each with a 3 amp self resetting fuse, PS3, PS4, PS5 and PS6.

The polyswitch resettable fuses may open on a current as low as 2.43 Amps at 50°C, 3 Amps at 25°C or 3.3 Amps at 0°C. They definitely will open when the current is 4.86 Amps at 50°C, 6 Amps at 25°C or 6.6 Amps at 0°C.

PS3 protects the +12 VDC 2 Amp circuits for the System Controller, the Amplifier Controller and the Spare Slot through J62 pins 7, 8, 9 and 10. If this circuit is operational, the Green LED DS3, mounted on the board, will be lit.

PS4 protects the +12 VDC 2 Amp circuits for the Modulator and the IF Processor through J62 pins 13, 14, 15 and 16. If this circuit is operational, the Green LED DS4, mounted on the board, will be lit

PS5 protects the +12 VDC 2 Amp circuits for the Upconverter through J62 pins 17, 18, 19 and 20. If this circuit is operational, the Green LED DS5, mounted on the board, will be lit

PS6 protects the +12 VDC 2 Amp circuits for the Remote through J63 pins 17, 18, 19 and 20. If this circuit is operational, the Green LED DS6, mounted on the board, will be lit

-12 VDC Circuits

-12 VDC from the Switching Power Supply Assembly connects to J5 on the board. The -12 VDC is divided into two separate circuits each with a 3 amp self resetting fuse, PS1 and PS2.

PS1 protects the -12 VDC 2 Amp circuits for the System through J63 pins 1, 2, 3 and 4. If this circuit is operational, the Green LED DS1, mounted on the board, will be lit

PS2 protects the -12 VDC 2 Amp circuits for the Remote through J62 pins 1, 2, 3 and 4. If this circuit is operational, the Green LED DS2, mounted on the board, will be lit

The connections from J62 and J63 of the Power Protection Board are wired to J62 and J63 on the Control Board.

4.1.2: (A3) Control Board (1302021; Appendix A)

In this transmitter, control monitoring functions and front panel operator interfaces are found on the Control Board. Front panel operator interfaces are brought to the control board using a 26 position conductor ribbon cable that plugs into J60. The control board controls and monitors the Power Supply and Power Amplifier module through a 16 position connector J61 and two 20 position connectors J62 & J63.

4.1.2.1: Schematic Page 1

U1 is an 8-bit RISC microcontroller that is in circuit programmed or programmed using the serial programming port J4 on the board. When the microcontroller, U1, is held in reset, low on pin 20, by either the programming port or the external watchdog IC (U2), a FET Q1 inverts the reset signal to a high that connects to the control lines of U5, an analog switch. The closed contacts of U5 connects the serial programming lines from J4 to U1. LED DS10 will be lit when programming port J4 is used.

U2 is a watchdog IC used to hold the microcontroller in reset, if the supply voltage is less the 4.21 VDC; (1.25 VDC < Pin 4 (IN) < Pin 2 (Vcc). The watchdog momentarily resets the microcontroller, if Pin 6 (ST) is not clocked every second. A manual reset switch S1 is provided but should not be needed.

Diodes DS1 through DS8 are used for display of auto test results. A test board is used to execute self-test routines. When the test board is installed, Auto_Test_1 is held low and Auto_Test_2 is allowed to float at 5 VDC. This is the signal to start the auto test routines.

U3 and U4 are used to selectively enable various input and output ICs found on pages 2 & 3 of the schematic.

U1 has two serial ports available. In this application, one port is used to communicate with transmitter system components where U1 is the master of a RS-485 serial bus. The other serial port is used to provide serial data I/O where U1 is not the master of the data port. A dual RS-232 port driver IC and a RS-485 Port driver is also in the second serial data I/O system. The serial ports are wired such that serial data input can come through one of the three serial port channels. Data output is sent out through each of the three serial port channels.

Switch SW1, transmitter operation select, is used to select either transmitter operation or exciter/driver operation. When the contacts of SW1 are closed, transmitter operation is selected and the power monitoring lines of the transmitter's power amplifier are routed to the system power monitoring lines.

4.1.2.2: Schematic Page 2

U9 is a non-inverting transceiver IC that provides 2 way asynchronous communication between data busses. The IC is used as an input buffer to allow the microcontroller to monitor various digital input values.

Digital output latch circuits are used to control system devices. Remote output circuits are implemented using open drain FETs, Q13, Q14, Q16, and Q17, with greater than 60 Volt drain to source voltage ratings.

Remote digital inputs are diode protected, using CR6, CR7, CR8 and CR9 with a 1 kO pull-up resistor, to +5 VDC. If the remote input voltage is greater than about 2 Volts or floating, the FET is turned on and a logic low is applied to the digital input buffer, U9. If the remote input voltage is less than the turn on threshold of the FET (about 2 VDC), a logic high is applied to the digital input buffer, U9.

Four of the circuits on page two of the schematic, which include Q2, Q9, Q19 and Q21, are auxiliary I/O connections wired for future use. They are wired similar to the remote digital inputs but include a FET, Q5, Q12, Q20 and Q22, for digital output operations. To operate these signals as inputs, the associated output FET must be turned off. The FETs are controlled by U10 and U12, analog input multiplexer ICs.

4.1.2.3: Schematic Page 3

U13, U14, U15, U16, U17 and U18 are 3 state non-inverting transceiver ICs that provide 2 way asynchronous communication between data busses. The ICs are used as input buffers to allow the microcontroller to monitor various digital input values. The digital inputs to the ICs utilize a 10 kO pull-up resistor. The buffer IC, U18, used for data transfer to the display is wired for read and write control.

4.1.2.4: Schematic Page 4

U19 and U20 are digitally controlled analog switches that provide samples back to the microprocessor. Each analog input is expected to be between 0 and 5 VDC. If a signal exceeds 5.1 VDC, a 5.1 Volt zener diode clamps the signals voltage, to prevent damage to the IC. Most signals are calibrated at their source, however two dual serial potentiometers ICs are used to calibrate four signals, System Visual/Average Power, System Aural Power, System Reflected Power and the Spare AIN 1. For these four circuits, the input value is divided in half before it is applied to an op-amp. The serial potentiometer is used to adjust the output signal level to between 80 and 120% of the input signal level. Serial data, serial clock and serial pot enables are supplied by the microprocessor to the dual serial potentiometer ICs. J62 and J63 are two 20 position connectors that provide the +12 VDC and –12 VDC power through the Power Protection Board. The ±12 VDC generated by the switching power supply connects to J62 and J63 after being fuse protected on the Power Protection Board.

4.1.2.5: Schematic Page 5

There are three dual element, red/green, common cathode LED indicators mounted on the front panel of the sled assembly: DC OK, Operate and Fault.

There are three, the fourth is a spare, identical circuits that drive the front panel mounted LED indicators. The levels on the 1, 2, 3 and 4 LED Control Lines, for both the red and green LEDs, are generated by the IC U11 as controlled by the DATABUS from the microprocessor U1.

Each LED controller circuit consists of an N-Channel MOSFET w/internal diode that controls the base of an N-P-N transistor in an emitter follower configuration. The emitter of the transistor connects the LED.

With the LED control line LOW, the MOSFET is Off, which causes the base of

the transistor to increase towards +12 VDC, forward biasing the transistor. With the transistor forward biased, current will flow from ground through the LED, the transistor and the current limiting resistors in the collector to the +12 VDC source. The effected LED will light.

With the LED control line HIGH, the MOSFET is On, which causes the base of the transistor go toward ground potential, reverse biasing the transistor. With the transistor reverse biased, no current through the transistor and LED, therefore the effected LED will not light.

A third color, amber, can also be generated by having both transistors conducting, both control lines LOW. The amber color is produced because the current applied to the green element is slightly greater than the red element. This occurs because the current limiting resistors have a smaller ohm value in the green circuit.

There are four voltage regulators, three for +5 VDC and one for +7 VDC, which are used to power the Control Board. +12 VDC is applied to U25 the +7 VDC regulator that produces the +7V, which is applied to the LEDs mounted on the board. The +7V is also connected to the input of U26 a precision +5.0 Volt regulator. The +5.0Vdc regulator output is used to power the analog circuits and as the microcontroller analog reference voltage. Another two +5 Volt regulator circuits U27, +5V, and U8, +5 Vserial, are used for most other board circuits.

4.1.3: (A4) Switch Board (1527-1406; Appendix A)

The switch board provides five front-panel momentary contact switches for user control and interface with the front-panel LCD menu selections. The switches, SW1 to SW5, complete the circuit through connector J1 to connector J2 that connects to J1 on (A5) the 20 Character by 4 line LCD Display. J1 on the switch board is also cabled to the Control Board. When a switch is closed, it connects a logic low to the control board that supplies the information from the selected source to the display. By pushing the button again, a different source is selected. This occurs for each push button. Refer to Chapter 3 Section 3.5.3, for more information on the Display Menu Screens.

4.1.4: (A2) Switching Power Supply Assembly

The power supply module contains a switching power supply, an eight position terminal block for distributing the DC voltages, a three position terminal block to which the AC Input connects, Jacks J1, V1 and V2. Jack J1 connects to the Control Board and supplies DC OK, at J1-4 & 3, and AC OK, at J1-2 & 1, status to the control board. A Power Supply enable connects from the control board to the power supply at V1-6 & 7. The power supply is configured for three output voltages +12V, -12V, at the 8 position terminal block, and a main output power of +32 VDC at J50 pin A (+) and J50 pin B (Rtn). The power supply is power factor corrected to .98 for optimum efficiency and decrease in energy consumption. For safety purposes all outputs are over voltage and over current protected. This supply accepts input voltages from 85 to 264 volts AC, but the power entry module, for the exciter/amplifier chassis, must be switched to the proper input voltage setting, for the transmitter to operate.

4.2: (A4) Driver Power Amplifier Assembly, VHF, DTV (1305822; Appendix A)

NOTE: The 1305822 Driver PA Assembly is used as a driver for high power transmitters. Refer to the 1309218 PA Assembly, which follows in the next section, for the PA used in the LHV50ATD & LHV60ATD transmitters.

The Power Amplifier Module Assembly contains (A5) an Amplifier Control Board (1308260), (A4) a Coupler Board (1308258), (A2) a 25 Watt VHF Driver Module (1305820), and (A3) a 200 Watt Power Amplifier Assembly (1300167).

The RF input (-2 dBm) to the PA assembly from the Upconverter Module Assembly connects from the Upconverter RF Output BNC Jack J23 to the PA RF Input BNC Jack J24, located on the rear of the driver/amplifier chassis assembly.

4.2.1: (A2) 25 Watt VHF Driver Pallet (1305820; Appendix A)

The RF input at a level of -2 dBm connects to the RF input jack on the (A2) 25 Watt VHF Amplifier Assembly. The assembly is manufactured by Delta RF and has a gain of approximately +30dB. Refer to the Delta RF data sheet (PA25-VHF-H) located in Appendix A for more information on the assembly. The RF output (+32 dBm), connects to the RF input jack on (A3) the 200 Watt power amplifier assembly.

The +30 VDC bias voltage connects from the amplifier control board at TB18 to the feed thru capacitor FL2 on the module assembly that is wired to the $+V_{dd}$ input on the 25 Watt VHF Amplifier Assembly.

4.2.2: (A3) 200 Watt VHF Amplifier Assembly (1300167; Appendix A)

The RF input at a level of +32 dBm connects to the RF input jack on the (A3) 200 Watt VHF Amplifier Assembly. The assembly is manufactured by Delta RF and has a gain of approximately +16dB. Refer to the Delta RF data sheet (P200-VHF-H) located in Appendix A for more information on the assembly. The RF output (+48.2 dBm) connects to the coupler assembly at J1.

The +30 VDC bias voltage connects from the amplifier control board at TB19 to the feed thru capacitor FL1 on the module assembly that is wired to the $+V_{dd}$ input on the 200 Watt VHF Amplifier Assembly.

4.2.3: (A4) Coupler Board Assembly (1308258; Appendix A)

The coupler board assembly provides forward and reflected power samples of the output to (A5) the amplifier control board where they connect to the metering and overdrive protection circuits in the system.

The RF input to the coupler assembly, from the 200 Watt VHF Power Amplifier module, connects to the SMA jack J1. The RF is connected by a stripline track to the SMA type connector RF Output jack J2. A hybrid-coupler circuit picks off a power sample that is connected to a SMA type connector jack J3 as the forward power sample. Another power sample is taken from the coupler circuit that is connected to the SMA type connector jack J4 as the reflected power sample. The RF output of the coupler at J2 is cabled to the “N” connector J25, which is the RF output jack of the driver/amplifier chassis assembly (+48dBm).

4.2.4: (A5) VHF Amplifier Control Board (1308260; Appendix A)

The amplifier control board provides LED fault and enable indications on the front panel of the module and also performs the following functions: overdrive cutback, when the drive level reaches the amount needed to attain 110% output power; and overtemperature, VSWR, and overdrive faults. The board provides connections to the LCD Display for monitoring the % Reflected Power, % Output Power, and the power supply voltage.

If the Module OK LED, located on the front panel, is Red and blinking, a fault is present. The meaning of the blinking LED is as follows.

1 Blink: Indicates Amplifier Current Fault.
2 Blinks: Indicate Temperature Fault.
3 Blinks: Indicate +32V Power Supply

Over Voltage Fault.
4 Blinks: Indicate +32V Power Supply Under Voltage Fault.
5 Blinks: Indicate Reflected Power Fault.
6 Blinks: Indicate +12V or –12V Power Supply Fault

If the Module OK LED, located on the front panel, is Amber and blinking, it indicates the power output of the amplifier has dropped below 65%. (**NOTE:** Only in Amplifier Code Versions 3.7A or later and System Controller Code Versions 3.9C or later.).

4.2.4.1: Schematic Page 1

U4, located upper center of page, is an in circuit microcontroller. The controller is operated at the frequency of 3.6864 MHz using crystal Y1. Programming of this device is performed through the serial programming port J2. U4 selects the desired analog channel of U3 through the settings of PA0-PA2. PA3 of U4 is a processor operating LED that can be flashed to show continued operation. PF1 is used to monitor the +12VDC supply to the board. PF4 is the selected channel of analog switch U3. PF3 and other selected microcontroller pins are connected to a via for future use.

U2 is serial to RS-485 driver IC. U5 is a watchdog IC used to hold the microprocessor in reset, if the supply voltage is less than 4.21 VDC. U5 momentarily resets the microcontroller if Pin 6 (!ST) is not clocked every second. A manual reset switch, S1, is provided but should not be needed.

In the Upper left corner, U1 is used to determine where the amplifier control board is located. The eight inputs come from the main amp connector J8 and are used to set the SCADA address of the controller. Pull-up resistors set a default condition of logic high.

U6 below U1 is used to control two of the four board's status LEDs and three other circuits that are not allowed to change state during a microcontroller reset. A FET is turned on to shunt current away from the LED to turn it off. U8 below U6 is used to enable different features within the software. Actual use is to be determined.

4.2.4.2: Schematic Page 2

In the lower right corner are voltage regulator circuits. U17 should allow for 0.14 amps of power using its 92 C/W rating if Ta = 60°C max and Tj = 125°C max. 0.26amps can be obtained from U17 if the mounting pad is 0.5 square inches. The controller will not need this much current. U18 and U19 are low drop out +5 VDC voltage regulators with a tolerance greater than or equal to 1%. 100mA of current is available from each device but the controller will not need this much current.

In the upper left section are circuits with U9 and U11. U11 is used to generate a regulated voltage that is about 5 volts less than the +32 VDC supply, approximately +26.25 VDC. When the +32 VDC supply is enabled, the circuitry around U9A is used to provide gate voltage to Q14 that is 5 volts greater than the source pin of this FET. The gate of Q14 can be turned Off by any one of a few different circuits. U10A is used to turn Off the gate of Q14 in the event of high current in amplifier #1. At 1.10 VDC the current to amplifier #1 should be approximately 6.20 Amps. U10B is used to turn off the Q14 FET, if high current is detected in amplifier #2. U12A is used to turn off the Q14 FET, if high current is detected in amplifier #3. With 2.74 VDC at Pin 5 of U10B or Pin 3 of U12A, the voltage output of current sense amplifier U15 or U16 at high current shut down should be greater than 15 Amps. U12B is used to detect high power supply voltage. U13A is used to indicate that the power supply voltage is less than 26 volts. U13B determines if the power supply temperature gets too hot.

4.2.4.3: Schematic Page 2, Current Monitoring Sections of the Board.

The ICs U14, U15 and U16 along with associated components set up the current monitoring sections of the board. R67, R68 and R69 are 0.01O/5W 1% through hole resistors used for monitoring the current through several sections of the amplifier. The voltage developed across these resistors are amplified for current monitoring by U14, U15 or U16. The LT1787HVCS8 precision high side current sense IC amplifier accepts a maximum voltage of 60 VDC. The 43.2 kO resistor from pin 5 to ground sets the gain of the amplifier to about 17.28. This value is not set with much accuracy since the manufacturer internally matches the resistors of this part but their actual resistance value is not closely defined. A trimming resistor is suggested to give a temperature stability of –200 ppm/C, but instead the microcontroller will determine the exact gain of the circuit and use a correction factor for measurements. Circuit loading components are located in the lower portion of each current monitoring circuit.

A6 is a temperature sensor thermistor that is used to monitor the temperature of the external amplifier module's heat sink. The sensor connects to J6 pins 1 & 2 on the board and is wired to the comparator IC U13B. If the temperature increases above 75°C the output will go Low that is used as a temperature fault output, which generates a Fault alert and disables Amplifier #1.

4.2.4.4: Schematic Page 3, Forward and Reflected power detector sections of the board.

A Forward Power Sample enters the board at the SMA Jack J3 and is split. One output connects to CR18, which is the aural portion of the board and is not used in this configuration. The other part connects to J4 on the board that is the SMA Forward Power Sample Jack, located on the front panel of the assembly. The other part of the split forward power sample is detected by CR24 and the DC level amplified by U21B and U21C. The output of U21C at pin 8 is connected to R202, the Visual Power Calibration Adjustment. R202 sets the level to the IC U24A, which amplifies the visual power sample before it is split. A sample of the visual power, Visual/Avg Power, connects back to U3 on Page 1. The other visual power sample connects to amp U24B whose output is level detected by CR29, CR28 and CR30 and then to J9-2. The detected level is used as the power amplifier AGC voltage for Upconverter AGC #1.

A Reflected Power Sample enters the board at the SMA Jack J5 and is detected by CR31 and the DC level amplified by U21D. The output of U21D at pin 14 is connected through the reflected calibration pot R201 to U25A. The output is split with one part connected to the Reflected Pwr connection on Page 1 of the schematic that connects to U3. The other part of the split from U25A connects to the comparator IC U25B that has a reference level connected to Pin 5. If the reflected level increases above the reference level a low Fault output is produced and connected to the Reflected Power Shutdown V circuit on Page 2 at CR14 & CR15. This produces a Reflected Power Fault V that is connected to an output of the board, the Fault Alert circuit and also shuts down the Amplifier.

The Gain of the power measurements is completed through software. Only the Aural Null needs to be completed through front panel pots.

This completes the description of the Power Amplifier Module Assembly.

The RF output from the exciter driver power amplifier (˜ +50 dBm Visual, +40 dBm Aural) is at the RF output jack J25, an “N” connector. The RF is cabled to the input of the external power amplifier.

4.3: (A4) Power Amplifier Assembly, DTV/DVB, VHF (1309218; Appendix A)

NOTE: The 1309218 PA Assembly is used in the LHV50ATD & LHV60ATD Transmitters. Refer to the 1305822 Driver PA Assembly, which is in the previous section, for the driver PA used in high power transmitters.

The Power Amplifier Module Assembly contains (A5) an Amplifier Control Board (1309216), (A4) a Coupler Board (1308258), (A2) a 25 Watt VHF Driver Module (1305820), and (A3) a 200 Watt Power Amplifier Assembly (1300167).

The RF input (-2 dBm) to the PA assembly from the Upconverter Module Assembly connects from the Upconverter RF Output BNC Jack J23 to the PA RF Input BNC Jack J24, located on the rear of the driver/amplifier chassis assembly.

4.3.1: (A2) 25 Watt VHF Driver Pallet (1305820; Appendix A)

The RF input at a level of -2 dBm connects to the RF input jack on the (A2) 25 Watt VHF Amplifier Assembly. The assembly is manufactured by Delta RF and has a gain of approximately +30dB. Refer to the Delta RF data sheet (PA25-VHF-H) located in Appendix A for more information on the assembly. The RF output (+32 dBm), connects to the RF input jack on (A3) the 200 Watt power amplifier assembly.

The +30 VDC bias voltage connects from the amplifier control board at TB18 to the feed thru capacitor FL2 on the module assembly that is wired to the $+V_{dd}$ input on the 25 Watt VHF Amplifier Assembly.

4.3.2: (A3) 200 Watt VHF Amplifier Assembly (1300167; Appendix A)

The RF input at a level of +32 dBm connects to the RF input jack on the (A3) 200 Watt VHF Amplifier Assembly. The assembly is manufactured by Delta RF and has a gain of approximately +16dB. Refer to the Delta RF data sheet (P200-VHF-H) located in Appendix A for more information on the assembly. The RF output (+48.2 dBm) connects to the coupler assembly at J1.

The +30 VDC bias voltage connects from the amplifier control board at TB19 to the feed thru capacitor FL1 on the module assembly that is wired to the $+V_{dd}$ input on the 200 Watt VHF Amplifier Assembly.

4.3.3: (A4) Coupler Board Assembly (1308258; Appendix A)

The coupler board assembly provides forward and reflected power samples of the output to (A5) the amplifier control board where they connect to the metering and overdrive protection circuits in the system.

The RF input to the coupler assembly, from the 200 Watt VHF Power Amplifier module, connects to the SMA jack J1. The RF is connected by a stripline track to the SMA type connector RF Output jack J2. A hybrid-coupler circuit picks off a power sample that is connected to a SMA type connector jack J3 as the forward power sample. Another power sample is taken from the coupler circuit that is connected to the SMA type connector jack J4 as the reflected power sample. The RF output of the coupler at J2 is cabled to the “N” connector J25, which is the RF output jack of the driver/amplifier chassis assembly (+48dBm).

4.3.4: (A5) VHF, DVB Amplifier Control Board (1309216; Appendix A)

The amplifier control board provides LED fault and enable indications on the front panel of the module and also performs the following functions: overdrive cutback, when the drive level reaches the amount needed to attain 110% output power; and overtemperature, VSWR, and overdrive faults. The board provides connections to the LCD Display for monitoring the % Reflected Power, % Output Power, and the power supply voltage.

If the Module OK LED, DS6, located on the front panel, is Red and blinking, a fault is present. The meaning of the blinking LED is as follows.

1 Blink: Indicates Amplifier Current Fault.
2 Blinks: Indicate Temperature Fault.
3 Blinks: Indicate +32V Power Supply Over Voltage Fault.
4 Blinks: Indicate +32V Power Supply Under Voltage Fault.
5 Blinks: Indicate Reflected Power Fault.
6 Blinks: Indicate +12V or –12V Power Supply Fault

If the Module OK LED, located on the front panel, is Amber and blinking, it indicates the power output of the amplifier has dropped below 65%. (**NOTE:** Only in Amplifier Code Versions 3.7A or later and System Controller Code Versions 3.9C or later.).

4.3.4.1: Schematic Page 1

U4, located upper center of page, is an in circuit microcontroller. The controller is operated at the frequency of 3.6864 MHz using crystal Y1. Programming of this device is performed through the serial programming port J2. U4 selects the desired analog channel of U3 through the settings of PA0-PA2. PA3 of U4 is a processor operating LED that can be flashed to show continued operation. PF1 is used to monitor the +12VDC supply to the board. PF4 is the selected channel of analog switch U3. PF3 and other selected microcontroller pins are connected to a via for future use.

U2 is serial to RS-485 driver IC. U5 is a watchdog IC used to hold the microprocessor in reset, if the supply voltage is less than 4.21 VDC. U5 momentarily resets the microcontroller if Pin 6 (!ST) is not clocked every second. A manual reset switch, S1, is provided but should not be needed.

In the Upper left corner, U1 is used to determine where the amplifier control board is located. The eight inputs come from the main amp connector J8 and are used to set the SCADA address of the controller. Pull-up resistors set a default condition of logic high.

U6 below U1 is used to control two of the four board's status LEDs and three other circuits that are not allowed to change state during a microcontroller reset. A FET is turned on to shunt current away from the LED to turn it off. U8 below U6 is used to enable different features within the software. Actual use is to be determined.

4.3.4.2: Schematic Page 2

In the lower right corner are voltage regulator circuits. U17 should allow for 0.14 amps of power using its 92 C/W rating if Ta = 60°C max and Tj = 125°C max. 0.26amps can be obtained from U17 if the mounting pad is 0.5 square inches. The controller will not need this much current. U18 and U19 are low drop out +5 VDC voltage regulators with a tolerance greater than or equal to 1%. 100mA of current is available from each device but the controller will not need this much current.

In the upper left section are circuits with U9 and U11. U11 is used to generate a regulated voltage that is about 5 volts less than the +32 VDC supply, approximately +26.25 VDC. When the +32 VDC supply is enabled, the circuitry around U9A is used to provide gate voltage to Q14 that is 5 volts greater than the source pin of this FET. The gate of Q14 can be turned Off by any one of a few different circuits. U10A is used to turn Off the gate of Q14 in the event of high current in amplifier #1. At 1.10 VDC the current to amplifier #1 should be approximately 6.20 Amps. U10B is used to turn off the Q14 FET, if high current is detected in amplifier #2. U12A is used to turn off the Q14 FET, if high current is detected in amplifier #3. With 2.74 VDC at Pin 5 of U10B or Pin 3 of U12A, the voltage output of current sense

amplifier U15 or U16 at high current shut down should be greater than 15 Amps. U12B is used to detect high power supply voltage. U13A is used to indicate that the power supply voltage is less than 26 volts. U13B determines if the power supply temperature gets too hot.

4.2.4.3: Schematic Page 2, Current Monitoring Sections of the Board.

The ICs U14, U15 and U16 along with associated components set up the current monitoring sections of the board. R67, R68 and R69 are 0.01O/5W 1% through hole resistors used for monitoring the current through several sections of the amplifier. The voltage developed across these resistors are amplified for current monitoring by U14, U15 or U16. The LT1787HVCS8 precision high side current sense IC amplifier accepts a maximum voltage of 60 VDC. The 43.2 kO resistor from pin 5 to ground sets the gain of the amplifier to about 17.28. This value is not set with much accuracy since the manufacturer internally matches the resistors of this part but their actual resistance value is not closely defined. A trimming resistor is suggested to give a temperature stability of –200 ppm/C, but instead the microcontroller will determine the exact gain of the circuit and use a correction factor for measurements. Circuit loading components are located in the lower portion of each current monitoring circuit.

A6, mounted on the module's heat sink, is a temperature sensor thermistor that is used to monitor the temperature of the external amplifier module's heat sink. The sensor connects to J6 pins 1 & 2 on the board and is wired to the comparator IC U13B. If the temperature increases above 75°C the output will go Low that is used as a temperature fault output, which generates a Fault alert and disables Amplifier #1.

4.2.4.4: Schematic Page 3, Forward and Reflected power detector sections of the board.

A Forward Power Sample enters the board at the SMA Jack J3 and is split. One output connects to CR18, which is the aural portion of the board and is not used in this configuration. The other part connects to J4 on the board that is the SMA Forward Power Sample Jack, located on the front panel of the assembly. The other part of the split forward power sample is detected by CR24 and the DC level amplified by U21B and U21C. The output of U21C at pin 8 is connected to R202, the Forward, Visual Power Calibration Adjustment. R202 sets the level to the IC U24A, which amplifies the forward, visual power sample before it is split. A sample of the forward power, Visual/Average Power, connects back to U3 on Page 1. The other forward, visual power sample connects to amp U24B whose output is level detected by CR29, CR28 and CR30 and then to J9-2. The detected level is used as the power amplifier AGC voltage for Upconverter AGC #1.

A Reflected Power Sample enters the board at the SMA Jack J5 and is detected by CR31 and the DC level amplified by U21D. The output of U21D at pin 14 is connected through the reflected calibration pot R201 to U25A. The output is split with one part connected to the Reflected Pwr connection on Page 1 of the schematic that connects to U3. The other part of the split from U25A connects to the comparator IC U25B that has a reference level connected to Pin 5. If the reflected level increases above the reference level a low Fault output is produced and connected to the Reflected Power Shutdown V circuit on Page 2 at CR14 & CR15. This produces a Reflected Power Fault V that is connected to an output of the board, the Fault Alert circuit and also shuts down the Amplifier.

The Gain of the power measurements is completed through software. Only the Aural Null needs to be completed through front panel pots.

This completes the description of the Power Amplifier Module Assembly.

The RF output from the exciter driver or power amplifier (˜ +50 dBm Visual, +40 dBm Aural or ˜ +47.7 dBm Digital) is at the RF output jack J25, an “N” connector. The RF is cabled to the input of the external power amplifier or to the external circulator.

NOTE: Information and drawings on the Axciter Modulator Tray and the Upconverter Module and Downconverter Module are contained in the separate Axciter Manual

This completes the description of the Power Amplifier Module Assembly and the entire LX Driver/Amplifier assembly.

Chapter 5
Detailed Alignment Procedures

5.1: System Preparation

This transmitter was aligned at the factory and should not require additional adjustments to achieve normal operation.

The driver/amplifier chassis assembly and power amplifier assembly are of a Modular design and when a Module fails that module needs to be changed out with a replacement module. The replacement module can then be sent back to Axcera for repair. Contact Axcera Customer Service Department at 724-873-8100 or fax to 724-873-8105, before sending in any module.

5.1.1: Module Replacement

Module replacement is a relatively simple process. All modules in the driver/amplifier assemblies plug directly into the backplane board except for the power amplifier module, that plug into a blind mating connector. To replace a module, refer to the following procedure.

Loosen the two grip lock connectors, located on the front panel, at the top and bottom of the module, counterclockwise until the module releases. The Downconverter, Upconverter and Controller/Power Supply can then be gently pulled from the unit. To remove the IPA Module in the driver/amplifier chassis assembly, the two cables, Input and Output, connected to the rear of the chassis, must be removed along with a 6/32" x ½" shipping screw, located between the two connectors. After removal of the failed module, slide the replacement module in place and make certain it connects to the backplane board. If the replacement module is an IPA Module, replace the two cables to the rear of the driver/amplifier chassis assembly. The 6/32" x ½" shipping screw does not need to be replaced, it is only used during shipping. If the replacement module does not slide in easily, verify it is properly aligned in the nylon tracks, located on both the top and bottom of the module.

Note: Each Module has an assigned slot and will not fit properly or operate in the incorrect slot. Do not try to place a Module in the wrong slot as this may damage the slot or the connectors on the backplane board. Each module has the name of the module on the front, bottom for identification and correct placement. The Modules in the Driver/Amplifier Chassis Assembly are placed in the unit from left to right; (1) Axciter Downconverter, (2) Blank panel, (3) Blank panel, (4) Axciter Upconverter, (5) Controller/Power Supply and (6) Driver Power Amplifier.

5.2: Initial Test Set Up of the Transmitter

Switch On the main AC for the system and the individual circuit breakers on each assembly. Check that AC is present to the system.

Check that the RF output of the post-filter coupler assembly is terminated into a dummy load of at least the rated output of the system or connected to the antenna for your system. While performing the alignment, refer to the Test Data Sheet for the transmitter and compare the final readings from the factory with the readings on each of the modules. The readings should be very similar. If a reading is way off, the problem is likely to be in that module.

This transmitter operates using a SMPTE 310 input that connects to J27, the MPEG Input Jack, located on the rear of the Axciter Modulator Tray. Check that the MPEG input is present. If used, check

that the 10 MHz input from the GPS is connected to J9 on the Axciter Modulator.

The check of and the setup of the drive level and output power of the transmitter are completed using the LCD Display on the control/power supply module. In the Transmitter Set-Up menu and the Power Control Screen, set the output power to 100% or the drive level needed to attain the desired output power of the transmitter. The transmitter must be in the Manual Gain position when readjusting the Forward Power.

(Example of screen is shown below).

The adjustment of the linearity and phase pre-distortion to compensate for any nonlinear response of the Power Amplifiers are controlled within the Axciter Modulator Tray.

NOTE: Refer to the separate Axciter Instruction Manual for detailed information on the Axciter Modulator and the Downconverter and Upconverter Modules.

5.3: Setting Up the Output Power of the Transmitter using the Axciter Modulator Tray

5.3.1: Adjusting Forward Power Readings

When the transmitter utilizes external amplifier modules, the Forward Power readings for each of the amplifier modules will need to be readjusted to a 100% Forward Power reading when the System is at 100% Forward Power.
NOTE: The transmitter must be in the Manual Gain position when readjusting the Forward Power. These amplifier readings can be found under the Transmitter Details Main Screen, by arrowing down to each Amp Set and then each Module in turn. These adjustments must be completed when the System is at the desired output power level.

(Example of screen is shown below).

5.3.2: Setting up of AGC

NOTE: The following adjustments are completed using the LCD screen located on the front panel of the Axciter Modulator Tray. On the Axciter Main Screen, push the button next to the Upconverter tab on the right side of the screen. This will open the Upconverter Main Screen. See Figure 5-1 that follows. Set the AGC to Manual by selecting 3 on the key board entry. The screen will now indicate AGC Manual. Set the transmitter to full power using the Driver/Amplifier LCD display while viewing the Power Control Screen in the Set Up Menu.

5.3.2.1: Setting up of AGC 1

To set up the AGC, first the AGC must be activated. Locate the 8 position DIP switch SW1 mounted on the Control Board in the Axciter Upconverter Sled, mounted in the Driver/Amplifier Assembly. The Upconverter DIP Switch Position 6 must be switched ON which allows the user to modify the AGC 1 and AGC 2 gain through the Axciter Modulator.

On the Axciter Upconverter/ Downconverter Screen set AGC 1 to 1.5 Volts, by selecting 4 on the key board entry. This will cause a detail screen to appear prompting you to enter a number value. Monitor the AGC 1 Gain Value on the screen and increase or decrease the value of the number entered until the monitored reading is 1.5 Volts.

Figure 5-1: Axciter Upconverter/Downconverter Main Screen

5.3.2.2: Setting up of AGC 2

NOTE: AGC2 is only used in systems with external power amplifiers.

On the Axciter Upconverter/ Downconverter Screen, set AGC 2 to 1.7 Volts, by selecting 5 on the key board entry. This will cause a detail screen to appear prompting you to enter a number value. Monitor the AGC 2 Gain Value on the screen and increase or decrease the value of the number entered until the monitored reading is 1.7 Volts.

After the setting up of the AGC, the AGC must be de-activated to prevent accidental changes. The Upconverter DIP Switch SW1 Position 6 must be switched OFF which locks the AGC 1 and AGC 2 gain.

5.3.3: Setting up of Overdrive Threshold

On the Axciter Upconverter Screen set the Overdrive Threshold to 1.6 Volts, by selecting 7 on the key board entry. This will cause a detail screen to appear. Increase or decrease the voltage as needed until the monitored reading is 1.6 Volts.

Place the Transmitter into AGC Auto by pushing the 3 of the key board entry on the Axciter Upconverter Screen, which will place the Transmitter AGC into Auto.

5.3.4: Axciter Relay Sample Values

RF samples to the Axciter Relay K2: These levels are to be measured with a power meter before connecting them. Your installation may require RF

attenuators to be placed in line with the samples to get them within the desired range.
J1 connection to the FWD power sample of the coupler before the mask filter. Pre-Filter Sample, Non-Linear Distortion. Level into Relay at J1 should be 0 dBm to –10 dBm. –5 dBm typical

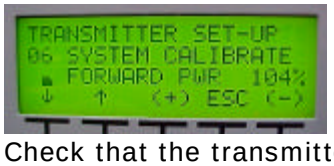
J2 connection to the forward power sample after the mask filter. Post-Filter Sample, Linear Distortion. Level into Relay at J2 should be 0 dBm to –10 dBm. –5 dBm typical, but within .5 dB of the J1 sample level.

5.3.5: Upconverter Downconverter Adjustment

On the Axciter Modulator, activate the Upconverter Main screen by selecting Upconverter, using the button next to Upconverter on the right side of the Axciter Main Screen. Activate the Downconverter Output Gain by pushing 2 on the key board entry pad. Monitor the DTVision Linear Display by pushing the button next to the DTVision Linear display on the right side of the Axciter Main Screen. At the bottom of the DTVision linear screen, locate the reading next to RMS. If this reading is between –10 dBm and 0 dBm no adjustment is needed. If it is not, adjust the "Downconverter Gain", then view the RMS value until it is within the –10 dBm to 0 dBm range.

5.4: System Calibration of Forward and Reflected Powers using the Driver/Amplifier LCD Display

5.4.1: Forward Power Calibration



Check that the transmitter is at 100% output power, as shown on the LCD display on the Driver/Amplifier in the Set Up menus.

Measure with a VOM, TP31-14, Red, and TP31-12, Black, on the terminal block TP31, located on the rear chassis of the Driver/Amplifier Chassis Assembly. Adjust R9, Forward Calibration Adjustment, on the Dual Peak Detector Board (1159965) for a reading of .8VDC on the VOM. Locate the Forward Power Adjust screen on the Driver/Amplifier LCD display in the Set Up menus and adjust the up or down arrow as needed to achieve 100 % output power. This completes the forward power set up.

5.4.2: Reflected Power Calibration

Switch the transmitter to Standby. Remove the connector that is on Jack J2, on the Dual Peak Detector Board (1159965), and replace with the connector now on J1, also inserting a 10 dB pad in series. Switch the transmitter to operate. Then adjust R10, Reflected Calibration Adjustment, on the dual peak detector board (1159965) for a .32VDC reading, at TB31-13 and TB31-12 return, on the terminal block TB31 mounted on the rear of exciter/driver chassis assembly. Switch the transmitter to Standby. Move the connector back to J1 while removing the 10 dB pad. Replace the original connector onto J2.

This completes the detailed alignment procedures for the Digital transmitter.

If a problem occurred during the alignment, help can be found by calling Axcera field support at 724-873-8100.

APPENDIX A

DRAWINGS

Innovator LX Series Digital System
Remote Site System Drawings..... 1309808

NOTE: The Drawings for the Axciter Modulator and the Upconverter Sled and the Downconverter Sled Modules are found in the separate Axciter Manual.

Chassis Assembly, Driver, 220 VAC, HX-E
Interconnect..... 1305554

Backplane Board, Axciter
Schematic..... 1307308

Control/Power Supply Assembly, 220 VAC
Block Diagram..... 1303889
Interconnect..... 1302062

Control Board
Schematic..... 1302023

Power Protection Board
Schematic..... 1302839

Switch Board
Schematic..... 1527-3406

Power Amplifier Assembly, DTV/DVB, VHF
Block Diagram..... 1305824
Interconnect..... 1305823

Amplifier Control Board, VHF, DVB
Schematic..... 1309217

25 Watt VHF Driver Assembly (1305820)
Delta RF Data Sheet..... PA25-VHF-H

200 Watt VHF Amplifier Assembly (1300167)
Delta RF Data Sheet..... P200-VHF-H

APPENDIX B

SPECIFICATIONS SHEET

Low Power ATSC Transmitter 5W – 3kW

LU500ATD Shown

Designed to provide broadcasters with a product that will meet their needs like no other solution on the market, this advanced low to medium power transmitter line uses the latest LDMOS UHF or MOSFET VHF devices for broadband operation across the entire operating band. This allows users to minimize spare parts stock, which is especially important to group owners and networks, and also enables simple and inexpensive channel changes.

The very compact and completely modular design uses a chassis/backplane configuration with parallel amplifier and power supply modules which can be removed and replaced while the transmitter is on the air.

Configurations are available in power levels from 10 watts to 6 kilowatts analog and up to 3 kilowatts DTV, and all are manufactured in the USA by Axcera - *The RF Experts*.

Low Power ATSC Transmitter 5W – 3kW

Performance

Frequency Range[1]	
LLV	54 to 88 MHz
LHV	174 to 216 MHz
LU	470 to 806 MHz
Frequency Stability	±1kHz (max 30 day variation)
w/Precise Frequency Option	±2 Hz
Regulation of RF Output Power	3%
Out of Band - Compliant with FCC Mask[2]	
Channel Edge ±500kHz	-47 dB or better
6 MHz from Channel Edge	-110 dB or better
Signal to Noise (SNR)	33 dB typical
Data Interface	
Input Rate	19.39 Mbps, 6 MHz Channel
Input Interface	SMPTE 310M
Test Signals	Internal PRBS 23 MPEG System

Options

Dual Exciter with Automatic Switcher
AC Surge Protector
Precise Frequency Kit
Stringent Mask Filter
Spare Parts Kit

[1] Other Frequencies - Consult Factory
[2] Measured in 30 KHz RBW, relative to total average power
[3] Above 8,500 feet - Consult Factory

General

Model Number	LU5ATD	LHV10ATD LLV10ATD	LU50ATD LHV50ATD LLV50ATD	LHV60ATD	LU125ATD	LU250ATD	LU500ATD	LU1000ATD
Power Output (average)	5W	10W	50W	60W	125W	250W	500W	1000W
Output Connector								
Simple Mask	N							1 5/8 EIA
Stringent Mask	N/A			N	7/8 EIA			
Power Consumption (watts)	250W	275W	650W	725W	1000W	1700W	3400W	6700W
Input Power								
Line Voltage (volts)	110-260 VAC				195-260 VAC			
Power Requirements	Single Phase, 50 or 60 Hz							
Size (H"x W"x D")	8.75 x 19 x 23 (rackmount)			55 x 22 x 34				76 x 22 x 34
Weight (lbs)	45	45	45	250	340	360	400	550
Operational Temperature Range	0 to +50°C, derate 2°C/1000 ft							
Maximum Altitude[3]	8500 ft (2600 m) AMSL							
Operational Humidity Range	0% to 95% non-condensing							
RF Load Impedance	50Ω							

Model Number	LU1500ATD	LU2000ATD	LU2500ATD	LU3000ATD
Power Output (average)	1500W	2000W	2500W	3000W
Output Connector				
Simple Mask	1 5/8 EIA			
Stringent Mask	7/8 EIA	1 5/8 EIA		
Power Consumption (watts)	10,500W	13,500W	17,000W	20,500W
Input Power				
Line Voltage (volts)	220±10%			
Power Requirements	Single Phase, 50 or 60 Hz			
Size (H"x W"x D")	76 x 22 x 34	76 x 44 x 34		
Weight (lbs)	700	1030	1180	1330
Operational Temperature Range	0 to +50°C, derate 2°C/1000 ft			
Maximum Altitude[3]	8500 ft (2600 m) AMSL			
Operational Humidity Range	0% to 95% non-condensing			
RF Load Impedance	50Ω			

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