INSTRUCTION MANUAL

DT325B

350 Watt Digital VHF
Low Band Transmitter

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Chapter 1
Introduction

This manual explains the installation, setup, alignment, and maintenance procedures for the DT325B 350-watt digital VHF low band transmitter. It is important that you read all of the instructions, especially the safety information in this chapter, before you begin to install or operate the unit.

1.1 Manual Overview

This instruction manual is divided into five chapters and supporting appendices. **Chapter 1**, Introduction, contains information on safety, the Axcera method of assigning assembly designation numbers, maintenance, return procedures, and warranties. **Chapter 2** describes the transmitter and its system control and status indicators and remote control connections. **Chapter 3** explains how to unpack, install, set up, and operate the transmitter. **Chapter 4**, Circuit Descriptions, describes the circuits that make up the trays and assemblies in the transmitter. **Chapter 5**, Detailed Alignment Procedures, provides information on adjusting the system assemblies for optimal operation. **Appendix A** contains the system specifications sheet. **Appendix B** contains the system drawings and parts lists. **Appendix C** contains the assembly and subassembly drawings and parts lists for the exciter/driver chassis and modules. **Appendix D** contains the drawings and parts lists for the VHF Low Band Amplifier Tray and the assemblies and subassemblies that make up the tray.

1.2 Assembly Designation Numbers

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.

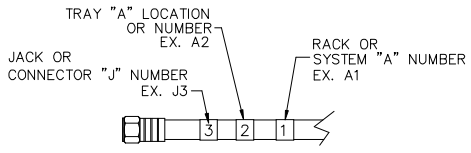


Figure 1-1 Brady Marker Identification Drawing

1.3 Safety

The DT325B transmitters manufactured by Axcera are designed to be easy to use

and repair while providing protection from electrical and mechanical hazards. Listed throughout the manual are notes, cautions, and warnings concerning possible safety hazards that may be encountered while operating or servicing the transmitter. Please review these warnings and familiarize yourself with the operation and servicing procedures before working on the transmitter.

Read All Instructions – All of the operating and 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. We provide 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 Notes, Warnings, and Cautions – All of the notes, warnings, and cautions listed in this safety section and throughout the manual must be followed.

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

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

Ventilation – Openings in the cabinets and tray front panels are provided for ventilation. To ensure reliable operation, and to protect the unit from overheating, these openings must not be blocked.

Servicing – Do not attempt to service this product 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 **1-724-873-8100** or by fax at **1-724-873-8105**.

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 front panel meter readings and the status of LEDs on the front panels of the trays. If possible, include the meter readings before the problem occurred.

1.5 Material Return 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 calling the Axcera Field Service Department at 1-724-873-8100. 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, the RMA# is included with the unit. The RMA# is intended to be used for the return of the unit to Axcera. In addition, all shipping material should be retained for the return of the unit to Axcera. Replacement assemblies are also sent with the 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 exchange assembly.

When shipping an item to Axcera, please include the RMA# on the packing list and on the Axcera-provided 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
103 Freedom Drive
P.O. Box 525
Lawrence, PA 15055-0525 USA

For more information concerning this procedure, call Axcera Field Service at **1-724-873-8100** or by fax at **1-724-873-8105**.

Axcera can also be contacted through e-mail at info@axcera.com and on the Web at www.axcera.com**.**

1.6 Warranty for Axcera Products – Limited One-Year Warranty

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, or bulbs.

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

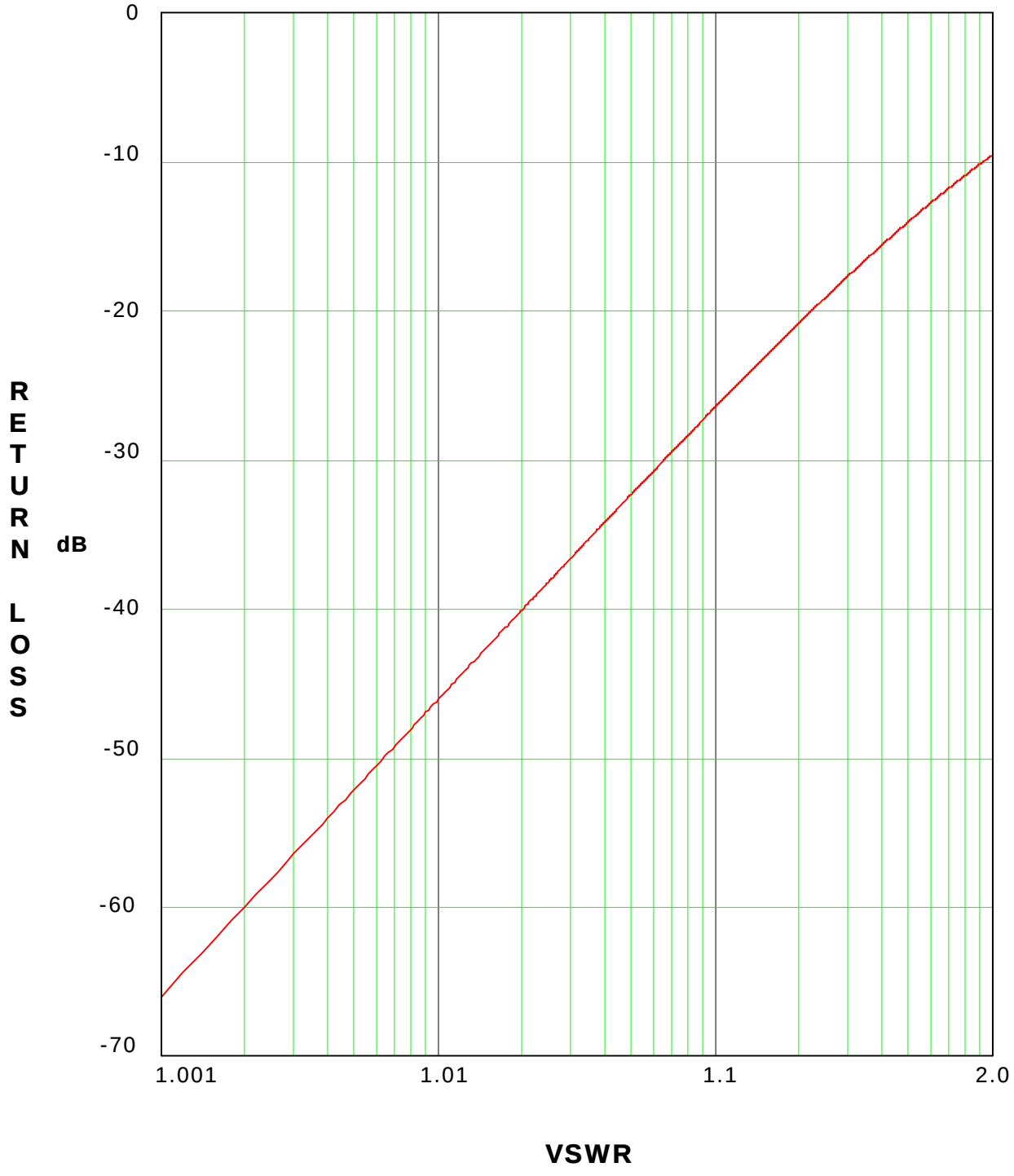
NOMENCLATURE OF FREQUENCY BANDS

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
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
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

Chapter 2
System Description, Maintenance and Remote Control Connections

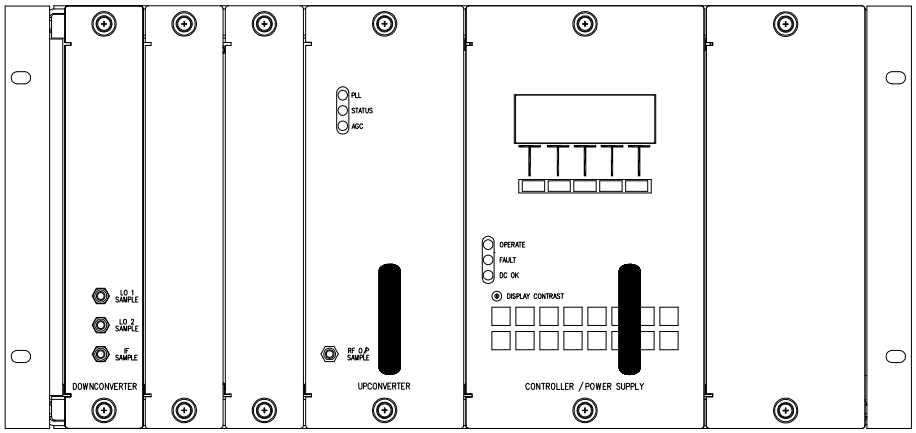


Figure 2-1: Driver/Amplifier Chassis Assembly

Table 2-1: DT325B Major Assemblies and Trays

ASSEMBLY DESIGNATION	TRAY / ASSEMBLY NAME	ASSEMBLY NUMBER
A24	Axciter Modulator	1305842
A2	Driver/Amplifier Chassis Assembly	1310206
A2-A11	Backplane Board	1310080
A2-A1	Downconverter Module	1311157
A2-A5	Upconverter Module	1310226
A2-A4	Control/Power Supply Module	1310835 (220 VAC)
A3	VHF Low Band Amplifier Tray	1304363

2.1 System Overview

The DT325B is a complete VHF low band solid-state digital television transmitter that operates at a nominal average output power of 350 watts.

The transmitter needs an AC input line of 220 VAC at 40 amps that connects to the AC Distribution Panel which distributes the AC through AC power cords to the VHF exciter/driver chassis and the VHF amplifier tray.

The DT325B consists of (A24) an Axciter Modulator Tray, (A2) a Driver/Amplifier Chassis Assembly and (A3) a VHF Low Band Amplifier Tray. The assemblies and trays are listed in Table 2-1.

2.2: Exciter Driver Chassis Assembly, LXB, 220 VAC (1310206; Appendix C)

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 (1310080) provides module to module interconnection as well as interconnection to remote command and control connectors.

NOTE: Information and drawings on the Axciter Modulator Tray (1305842) and the Upconverter Module (1310226) and Downconverter Module (1311157) are found in the separate Axciter Manual.

2.2.1: (A4) Exciter Control / Power Supply Assembly, LXB, 220VAC (1310835; Appendix C)

The (A4) Control/Power Supply Assembly is made up of a System Controller Board (1310089), a Power Protection Board (1302837) and a LCD w/Switches Board (1307977). 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 if needed.

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

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

2.2.2: (A5) Upconverter Module (1310226) and (A1) Downconverter Module (1311157)

NOTE: More information and the drawings on the Axciter Modulator Tray (1305842) and the Upconverter Module (1310226) and Downconverter Module (1311157) are found in the separate Axciter Manual.

The output from the Axciter modulator, which is an 8-VSB IF signal centered at 44 MHz. that is -6 dBm in level, is cabled to J68 on the rear panel of the Driver/Amplifier Chassis Assembly. The IF input is connected to the upconverter module assembly through the backplane board in the chassis assembly. The 44 MHz IF signal is upconverted to the desired channel frequency by the upconverter module. The resulting RF signal is amplified and wired to a Pin Diode Attenuator which adjusts the gain of the module that is controlled by an Automatic Gain Control circuit. The AGC maintains a constant power out of the upconverter, and also the transmitter, that connects to the power amplifier module. The gain controlled output of the

pin diode circuit is connected to the output of the Upconverter Module, approximately +10 dBm in level, at J23, on the rear panel of the Driver/Amplifier Chassis Assembly. This output is cabled to the (A10) splitter and then the VHF amplifier tray in the system.

2.2.3: Adaptive Equalization Circuits

The adaptive equalization circuits for the system are contained in the Axciter Modulator which controls the K2 relay whose output connects to the downconverter module mounted in the Driver/Amplifier Chassis Assembly. Two transmitter output samples are taken from directional couplers located before, pre-filter, and after the channel mask filter, post-filter, that are applied to the external K2 Relay. The switching of the relay between the pre and post filter samples is controlled by the Axciter Modulator through J7 on the rear panel of the tray.

The pre or post filter sample is connected to J12 the Downconverter RF input jack located on the on the rear panel of the Driver/Amplifier Chassis Assembly. The downconverted IF transmitter sample output of the downconverter module at J13, on the rear panel of the Driver/Amplifier Chassis Assembly, is cabled to J2 on the Axciter Modulator.

The signal is digitized by the Axciter modulator and demodulated in non-real time software. The result is analyzed to calculate linear and nonlinear adaptive equalizers to improve the transmitted signal quality by compensating for the nonlinear compression of the power amplifier, and the linear distortions (mostly group delay effects) of the channel filter.

When a linear adaptive equalizer is being calculated, the transmitter sample is taken after the channel mask filter so that its linear distortions can be “seen.”

When a nonlinear adaptive equalizer is being calculated, the transmitter sample is taken before the channel mask filter, so that the distortion sidebands being generated by the power amplifier can be seen (the channel filter would remove the out-of-band sidebands).

The Axciter modulator contains a standard Personal Computer. The PC performs user interface functions and the numerical processing necessary for the adaptive linear and nonlinear equalization. The PC is not in the forward signal path; if it fails the exciter will continue to generate a signal with the most recently calculated equalization.

2.3: VHF Low Band Amplifier Tray (1304363; Appendix D)

The tray provides approximately 54 dB of gain. The tray contains (A1-A1) the phase shifter board 1198-1602 and (A1-A2) the Filter/amplifier board 1198-1606, which are mounted in the (A1) RF enclosure assembly. The (A2-A1) VHF low band amplifier board 1198-1605, the (A2-A2) Overdrive protection board 1198-1601 and the (A2-A3) 3-way splitter board 1198-1608, which are mounted in the (A2) RF enclosure assembly. The (A3-A1, A3-A2 and A3-A3) low band VHF amplifier pallets, P400-VHF-L-18, 1304348 which are mounted in the (A3) RF enclosure assembly. The (A4-A1) 3-way combiner board 1198-1626 and the (A4-A2 & A4-A3) Low pass filter boards 1198-1628, which are mounted in the (A4) 3 way combiner enclosure. The tray also contains the (A5) AGC control board 1306482, the (A8) Current metering board 1304362 and (A10) the +30 VDC switching power supply assembly PM3329B-5-1-R-2-E, 1301504.

The On Channel RF signal (0 to +10 dBm), enters the rear of the Tray at the "BNC" Jack J1. The RF connects to a phase shifter board that provides a phase shift adjustment of the RF Signal that is needed to produce the maximum output during the combining of multiple Amplifier Trays in an Amplifier Array. The output of the phase shifter is cabled to the filter/amplifier board. The gain of the tray

is controlled by an external bias voltage that connects to the AGC Control Board and adjusts the AGC Pin Attenuator Bias Voltage which is applied to the Filter/Amplifier Board. The RF output of the Filter/Amplifier Board is amplified by the LB Amplifier Board and connected to the Overdrive Protection Board. The overdrive protection board provides a trip point, 110%, for over power conditions which will cut back the output power of the Tray.

The RF Output of the Overdrive Protection Board connects to the 3 Way Splitter Board. The three RF outputs connect to the three Low Band Output Amplifier Pallets. Each amplifier pallet provides approximately 18 dB gain. The RF signal inputs to the Output Amplifier Boards (+33.3 dBm) are amplified to +51.3 dBm outputs at J2, which are connected to the 3 Way Combiner Assembly. The 3 Way Combiner takes the three +51.3 dBm combined inputs and combines them to form the ~ 375 Watt RF Output at J4 of the Combiner which soldered to J2, the RF Output Jack of the Tray.

The 3 Way Combiner Board provides a Forward Power Sample and a Reflected Output Power Sample that connect thru low pass filters to the AGC Control Board. The AGC Control Board provides detected outputs that are used for front panel and remote meter Indications of the forward and reflected output power levels, AGC Detector Voltage Level and also the VSWR Cutback protection if the Reflected Power level increases above the preset level.

Two voltages, +28 VDC from the internal switching power supply and +12 VDC from the Driver/Amplifier Assembly are needed for operation of the Tray. The +12 VDC is connected to a +5 VDC Regulator IC which supplies the +5 VDC needed for operation of the front panel mounted LEDs. The (A10) +28 VDC Switching Power Supply provides the +28 VDC to the Current Metering Board. The Current Metering Board distributes the voltages through fuses to the Amplifier Devices on the Filter/Amplifier, Low Band Driver Board and the three Final Low Band Amplifier Boards.

The Current Metering Board also supplies sample outputs of the operating currents of the amplifier devices in the Tray to the front panel Current Meter. The Meter in the (I_1) position reads the current for the (A3-A1) Low Band Output Amplifier Board, (I_2) for the (A3-A2) Low Band Output Amplifier Board and (I_3) for the (A3-A3) Low Band Output Amplifier Board. To read the desired current; switch S2 to the proper position checking that S1 is in the Current position. These current readings can be used when setting up the Idling Currents, no RF Drive applied, for the devices. (I_1, I_2 & I_3) are set for 3 Amps max.

Table 2-5: VHF Amplifier Tray Control Adjustments

ADJUSTMENT	DESCRIPTION
R2 – A7 Phase	Adjusts the phase of the RF output by approximately 70°.
R3 – A6 Gain	Adjusts the gain of the RF output when the amplifier control board is in the AGC mode.

Table 2-6: VHF Amplifier Tray Sample

SAMPLE	DESCRIPTION
J5 RF Front Panel Sample	Forward power sample of the tray from the AGC control board.

Table 2-7: VHF Amplifier Tray Switches

SWITCH	FUNCTION	
CB1 On/Off Circuit Breaker	Switches 220 VAC through a 15-amp circuit breaker-type protection device. The switch lights if AC is present. The AC is applied to the switching power supply in the tray.	
S1 Switch, Meter	Selects the desired % Forward Output Power, % Reflected Power reading, AGC Voltage, Power Supply Voltage, or Current	
	With Switch S1 in Position	*Display*
	% Forward	Reads the % Forward Output Power of the tray (100% = 375 watts DTV)
	% Refl (Reflected)	Reads the % Reflected Output Power (<5%)
	AGC Voltage	Reads the AGC level of the tray (1 to 3 VDC)
	Power Supply	Reads the voltage from the switching power supply (+28 VDC)
	Current	Uses Switch S2 to indicate the current of transistor devices
S2 Switch, Meter	Selects the current of the transistor devices on the low band amplifier boards. S1 must be in the Current position.	
	With Switch S2 in Position	***Display***
	I_1	Reads the current of (A3-A1) the low band amplifier board (idling current=1.8 amps and operating current=12-13 amps, black picture)
	I_2	Reads the current of (A3-A2) the low band amplifier board (idling current=1.8 amps and operating current=12-13 amps, black picture)
	I_3	Reads the current of (A3-A3) the low band amplifier board (idling current=1.8 amps and operating current=12-13 amps, black picture)
	I_D	Reads the current of (A2-A1) the low band amplifier board (idling current=3 amps and operating current=3 amps, black picture)

Table 2-8: VHF Amplifier Tray Fault Indicators

INDICATOR	DESCRIPTION
DS1 Overdrive	Indicates that the level of drive is too high. The protection circuit will limit the drive level to the set threshold. The fault is generated on the overdrive protection board.
DS2 Enable	Indicates that the Enable supplied by the driver/amplifier chassis assembly is present
DS3 Module Status	Indicates that the forward power sample level is lower than the set reference level
DS4 VSWR Cutback	Indicates that the reflected level of the tray has increased above 20%; this will automatically cut back the output power of the tray. The fault is generated on the AGC control board.
DS5 Overtemperature	Indicates that the temperature of (A13, A14 or A15) one of the thermal switches is above 175° F. When this fault occurs, the Enable to the switching power supply is immediately removed.

2.4: Control and Status

The control and status of the exciter/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.

2.4.1: Front Panel Display Screen

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

2.5: 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 should also be green. The enable and DC OK indicators on the PA Module will also be turned to green.

When the transmitter is in standby, the IF Processor will be disabled and the mute indicator on the front panel will be red. Also, 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. Also check that a jumper or external closed interlock is connected from J30-5 to J30-15 on the rear of the exciter/deriver chassis assembly.

2.5.1: 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. To provide RF power to the output, the transmitter will not be in mute. Mute is a special case of the operate mode where the power supply's 32 VDC section is enabled but there is no RF output power, because of a fault condition that causes the firmware to

hold the IF Processor module in a mute state.

Operate Mode with Mute Condition

The transmitter will remain in operate mode but will be placed in mute when the following fault conditions exists in the transmitter.

- Upconverter is unlocked
- Upconverter module is not present
- IF Processor module is not present

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.
- Transmitter is Muted due to conditions listed above.
- Power Amplifier Interlock is high indicating that the amplifier is not installed.

Standby Mode

The standby mode in the transmitter indicates that the output amplifier of the transmitter 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.

Auto Standby Mode

The FCC requires that certain transmitters automatically switch to standby operation on loss of input. The transmitter incorporates this feature as a user configurable setting. When Auto Stand-By On Modulation Loss is selected in the set-up menus, the transmitter temporarily switches to standby after ten seconds of modulation loss. When the modulated signal as reported by the IF Processor module is again present, the transmitter automatically returns to Operate mode.

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 or reject load contact closures to assure the RF output system is available to receive the transmitter's output RF signal.

Operating Frequency

The transmitter controller is designed to operate on UHF frequencies. The exact output frequency of the transmitter can be set to one of the standard UHF 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 the detectors of the power amplifiers are calibrated at their frequency of use. The detectors for System RF monitoring are also calibrated at the desired frequency of use.

2.6: Maintenance

The 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.

2.6.1: Module Replacement

Module replacement on the products is a relatively simple process. All modules plug directly into the backplane board except for the power amplifier module, and in higher power units, the power supply and power amplifier modules, which 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 the Controller/Power Supply can then be gently pulled from the unit. 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 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 are placed in the unit from left to right; (1) Downconverter, (2) Blank panel, (3) Blank panel, (4) Upconverter, (5) the Controller/Power Supply and (6) a Blank panel.

2.7: Customer Remote Connections

The remote monitoring and operation of the transmitter is provided through jacks TB30 and TB31 located on the rear of the chassis assembly. If remote connections are made to the transmitter, they must be made through plugs TB30 and TB31 at positions noted on the transmitter interconnect drawing and Table 2-9. TB30 and TB31 are 18 position terminal blocks that are removable from their sockets to make connections easier. Just grasp and pull connector straight out. After connections are made, replace the connector and push firmly to seat the connector in the socket.

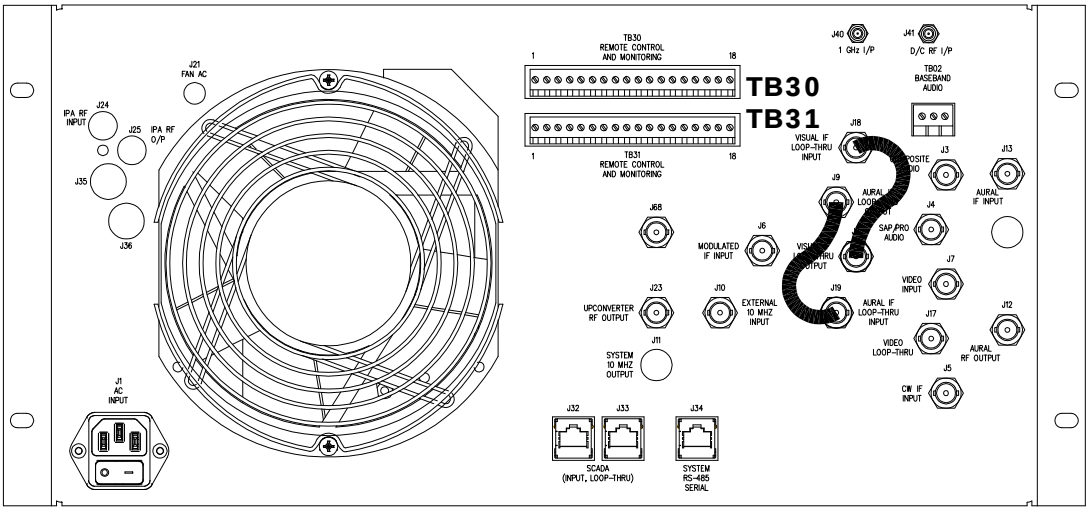


Figure 2-2: Rear View Driver/Amplifier Chassis Assembly

Table 2-9: Driver/Amplifier Chassis Assembly Hard Wired Remote Interface Connections to TB30 or TB31, 18 pos. Terminal Blocks Located on the Rear of the Chassis Assembly

Signal Name	Pin Designations	Signal Type / Description
RMT Transmitter State	TB30-1	**(Connects to isolation relay board.)** 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 an FET so that the transmitter interlock can be daisy chained with other transmitters. This signal does not directly interface to the microcontroller.

Signal Name	Pin Designations	Signal Type / Description
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 the transmitter is allowed to operate. Typically, a jumper is connected from TB30-5 and TB30-15. If this circuit is opened, the transmitter switches to a Mute condition. **(See note at end of table)**
RMT Transmitter Operate	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	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	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	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.
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.
Interlock Rtn	TB30-15	Typically connected to TB30-5, which allows the transmitter to operate.
+12 VDC	TB30-16	**(Connects to triple peak detector board, the isolation relay board, and the VHF amplifier tray.)** +12 VDC w/ 2 Amp re-settable fuse
Rtn	TB30-17	**(Connects to the VHF amplifier tray.)** Rtn
-12 VDC	TB30-18	**(Connects to isolation relay board.)** -12 VDC w/ 2 Amp re-settable fuse.
Power Lower	TB30-19	Discrete Open Collector Input - A pull down to ground on this line indicates that the transmitter power is to be lowered.
Rtn	TB31-1,2,6-11	Rtn
RTN Ground	TB31-12	**(Connects to triple peak detector board.)** Ground
System Reflect Power	TB31-13	**(Connects to triple peak detector board.)** Analog Input - 0 to 1.00 V- This is the input of the “System Reflected Power ” indicating the transmitter's reflected output power. The scale factor is 25 % / 0.80V.

Signal Name	Pin Designations	Signal Type / Description
System Forward Power	TB31-14	**(Connects to triple peak detector board.)** Analog Input - 0 to 1.00 V- This is the input of the "System Forward Power " indicating the transmitter's Forward output power. The scale factor is 100 % / 0.80V.

NOTE: The RMT RF System Interlock, at TB30-5, provides the customer with a means of connecting the transmitter to protection circuits, for the loads, thermal switches, combiners, or the antenna, in the output of your system, that will Mute the transmitter if the protection circuit opens. If the interlock is not used in the system, a jumper from TB30-5 to TB30-15, which is ground, needs to be connected to TB30. This jumper provides the RF System Interlock, which allows the transmitter to go to operate. Without the jumper, the transmitter will remain Muted.

Chapter 3
Installation and Setup Procedures

There are special considerations that need to be taken into account before the DT325B 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.

3.1 Site Considerations

The transmitter requires an AC input line of 220 VAC with a rating of 30 amps connected to the AC input box on the cabinet. Make sure that the proposed site for the transmitter has the voltage requirements that are needed.

The DT325B is designed and built to provide long life with a minimum of maintenance. The environment in which it is 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 tray in the transmitter contains a thermal interlock protection circuit that will shut down that tray 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 down time. A properly designed facility will have an adequate supply of cool, clean air, free of airborne particulates of any kind, and without 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. This is rarely attainable in the real world. However, the closer the environment is to this design, the greater the operating capacity of the transmitter.

The first source of heat in the building is the transmitter itself. The fans designed and built into the transmitter will remove the heat from within the trays and cabinets, but additional means are required for removing this heat from the building. Two blowers, one mounted on the roof of each cabinet, are designed to achieve this.

The second source of heat is other equipment in the same room. 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 detailed drawings of the site showing all construction details. The sum of these three sources is the total amount of 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 be kept at a reasonable level. In addition, the air stream must be adequately

filtered to ensure that no airborne particulate 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 operation of air conditioning and ventilation simultaneously is not recommended. This can cause condensation in transmitters. For tube type transmitters, this can be especially serious if the condensation forms in the tube cavity and creates damaging arcs.

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. With the desired conditioned room temperature under 80° F, the unit must be derated, possibly by a substantial amount.

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

3. Do not isolate 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 isolate the front from the rear will adversely affect the cooling air flow.

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 the ingress of dirt.

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" 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 adequate 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 applies 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 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. Tube transmitters should not rely on the internal blower to exhaust cooling air at elevations above 4000 feet. For external venting, the air vent on the cabinet top must be increased to an 8" diameter for a 50-W, 100-W and 1-kW transmitter and to 10" for 5-kW and 10-kW transmitters. An equivalent rectangular duct may be used but, in all cases, the outlet must be increased in area by 50% through the outlet screen.

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

In calculating the blower requirements, filter size, and exhaust size, if the total load is known in watts, 2000 CFM into 1/2" of water will be required for each 5000 watts. If the load is known in BTUs, 2000 CFM into 1/2" 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 1-724-873-8100.

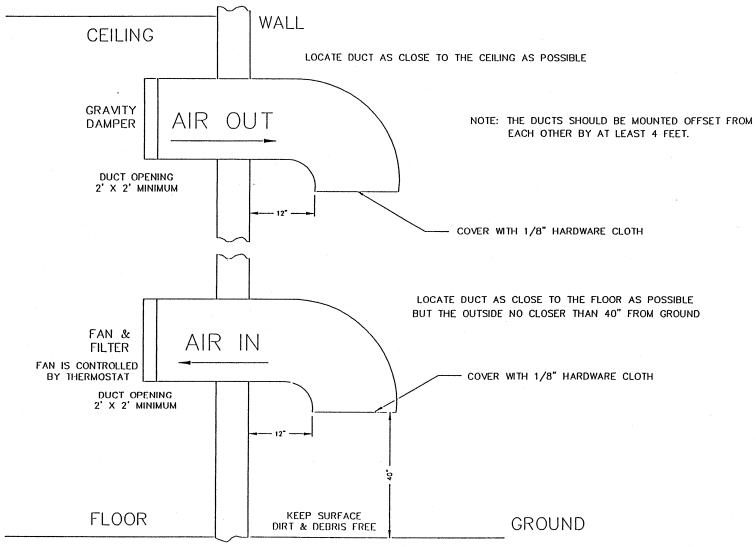


Figure 3-1: Typical 1 kW Minimum Ventilation Configuration

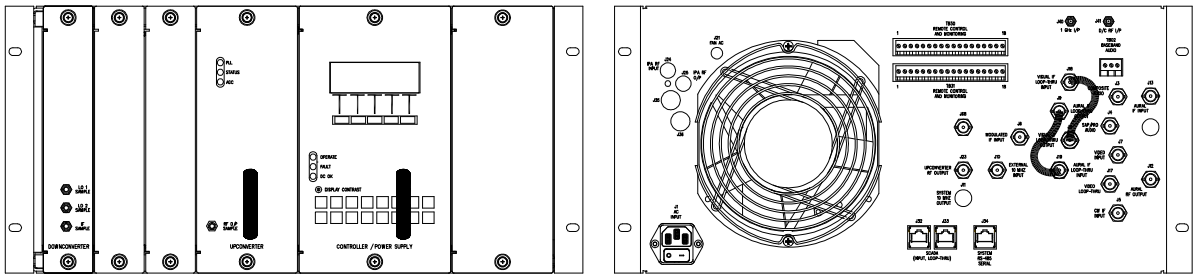


Figure 3-2: Front and Rear View of the Driver/Amplifier Reconnection Drawing

3.2 Unpacking and Installation of the Cabinet and Trays

Thoroughly inspect the cabinet, the trays 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 is indicative of rough handling. Check for dents and scratches or broken switches, meters, or connectors. 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.

Remove the cabinet with the Axciter system, driver/amplifier chassis and VHF amplifier tray, also the harmonic filter, bandpass filter, couplers and the installation material from the crates and boxes. Remove the straps that hold the cabinets to the shipping skids and slide the cabinet from the skid. Remove the plastic wrap and foam protection from around the cabinets. Do not remove any labeling or tags from any cables or connectors; these are identification markers that make assembly of the transmitter much easier.

If the trays are shipped in the cabinet, remove the L-brackets, mounted on the front panel rails, which hold the trays in place during shipment. The trays are mounted in the cabinet using Chassis Trak cabinet slides. The slides are on the sides of the VHF amplifier and the Axciter modulator trays. Inspect the trays for any loose hardware or connectors, tightening where needed. Open the rear door of the cabinet and inspect the interior for packing material, carefully removing any that is found. Slowly slide each tray in and out to verify that they

do not rub against each other and have no restrictions to free movement.

Adjustments to the position of the trays may be necessary. To accomplish this, loosen the cabinet slide mounting bolts that hold the front of the slide to the mounting frame of the cabinet and move the tray up or down as needed to correct for the rubbing.

The air intake to the transmitter is intended for room air only. The cabinet should be positioned with consideration given to adequate air intake and exhaust, the opening of the rear door, access to the trays (including sliding them out for testing), the main AC hookup, and the installation of the output transmission line. The cabinet should be grounded using copper strapping material and should also be permanently mounted to the floor of the site using the holes in the bottom of the cabinet.

3.3 Input and Output Connections to the Transmitter

3.3.1 Main AC Connection to the Transmitter System

Once the cabinet is in place, the connection of the Main AC to the cabinet is ready to be made.

Caution: Before connecting the transmitter to the AC voltage, make certain that all of the circuit breakers associated with the transmitter are switched off.

The main AC input circuit to the DT325B is a 30-amp, 220-VAC line, using AWG 6 wire, inside of 1-1/4-inch conduits to each cabinet assembly. The 220 VAC input connections are made to the terminal block TB1, which is part of the AC junction box, mounted near the upper right-hand, rear portion of the cabinet: terminals 1 and 2 (220 VAC) and terminal 3 (chassis ground). See Figure 3-3.

Figure 3-3: AC Input Box Assembly

Check that the AC power cords from the Driver/Amplifier Chassis Assembly and the Axciter Modulator Tray connect directly to the UPS or to the AC outlet assembly connected to the UPS in the Cabinet. Check that the AC power cord from the VHF Amplifier Tray connects to the AC outlet assembly not connected to the UPS in the Cabinet.

3.3.2 Input Connections to the Transmitter System

Connect the SMPTE 310 input to J27 located on the rear panel of the (A24) Axciter Modulator Tray. If an external 10 MHz reference is used, connect it to J9 located on the rear panel of the (A24) Axciter Modulator Tray. If the external 10MHz is not used an internally generated 10MHz is produced by the Axciter Modulator for use in the transmitter. Check that the DTV output of the Axciter at J40 connects to J68, the IF Input jack, on the rear panel of the Driver/Amplifier Chassis Assembly. Check that the 1GHz output of the Axciter at J15 connects to J40 on the rear panel of the Driver/Amplifier Chassis Assembly.

Check that the forward power sample, pre-filtering, of the VHF amplifier tray, from the (A16) pre-filter coupler connects to J1, on the K2 relay. Check that the forward power sample, post-filtering, of the output of the transmitter from the (A11) post-filter coupler connects to J2, on the K2 relay. Check that the selected output of the K2 relay at J3 connects to the rear of the driver/amplifier chassis assembly at the SMA Jack J41. This sample is used by the Axciter system in the adaptive equalization process.

Figure 3-4: Rear View of Driver/Amplifier Chassis Assembly

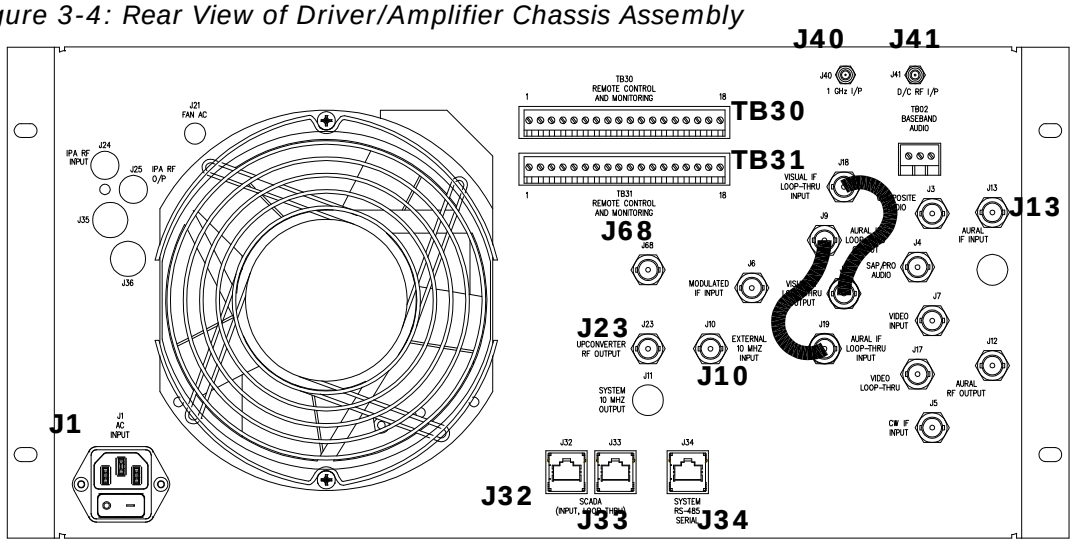


Table 3-1: Rear Chassis Connections for the Digital Driver/Amplifier Chassis Assembly.

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**	**External 10 MHz Reference Input (From Axciter)**	50O
J12	BNC	(NOT USED) MPEG Input	50O
J13	**BNC**	**Downconverter IF Output (To Axciter)**	**50O**
J68 / J15	**BNC**	**Digital IF I/P (From Axciter)**	**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 (To Splitter)**	**50O**
J24	BNC	IPA RF Input (Jumpered from J23)	50O
J25	N	IPA 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**	**CAT5**
J40	**SMA**	**1GHz Input (From Axciter)**	**50O**
J41	**SMA**	**Downconverter RF Input (From K2 Relay)**	**50O**
TB30	**Termination**	**Remote Control & Monitoring**	**N/A**
TB31	**Termination**	**Remote Control & Monitoring**	**N/A**

3.4 Setup and Operation Procedures

The transmitter should initially be turned on with the RF output of the coaxial switch terminated into a dummy load of at least 350W. If a load is not available, check that the output is connected to the antenna.

Check that the circuit breaker mounted on the rear panel near the AC input jack of driver/amplifier chassis assembly is On. Check that the circuit breaker, located on the front of the VHF amplifier tray, is On.

On the driver/amplifier, switch the Operate/Standby switch to Operate. The VHF amplifier tray should go to operate. Observe the power supply reading on the front panel of the VHF amplifier tray. It should be +28 VDC.

NOTE: If the transmitter does not switch to Operate when the selected On Air exciter is placed in Operate, check that the protection interlock is present, normally by jumpering TB30-5 to TB30-15. The interlock or the jumper provides the remote interlock needed by the transmitter to allow it to switch to Operate.

On the LCD screen in the driver/amplifier chassis assembly, look at the % Output Power indication, it should read near to the level as stated on the final test data sheet for your transmitter. If necessary, adjust the output power of the transmitter using the Driver/ Amplifier LCD display while viewing the Power Control Screen in the Set Up Menu and increase or decrease the level as needed to attain 100% output power of the transmitter. As the output power level is being checked, observe the LCD screen reading in the % Reflected Power position. If the % Reflected Power is very high, above 10%, a problem may exist with the output coaxial lines and they will need to be checked. A center bullet missing from the coax lines or loose bolts is a probable cause. Repair as needed to attain a <5% reflected reading.

The gain and phase control on the front panel of the VHF amplifier tray was adjusted at the factory to obtain an output of 100% for the transmitter and should not need to be readjusted. Refer to the Test Data Sheet for the transmitter to compare the final readings from the factory with the readings on the tray after the setup. They should be very similar. If a reading is off by a significant amount, refer to the power adjustment procedure for the VHF amplifier tray in Chapter 5, Detailed Alignment Procedures, of this manual before trying to make any adjustments.

If a dummy load is connected to the transmitter, switch the main on/off circuit breaker, for the system, Off. Remove the dummy load and make all of the connections needed to connect the transmitter to the antenna. Switch the main on/off circuit breaker On and the Operate/Standby switch to operate. If needed, adjust the output power, using the Axciter LCD screen in the Upconverter menu screen, to attain 100% output of the transmitter.

If the transmitter is already connected to the antenna, check that the output is 100%. If necessary, adjust the output power, using the Axciter LCD screen in the Upconverter menu screen, to attain 100% output of the transmitter.

3.4.1 Driver/Amplifier Chassis Modules front panel LEDs

The following LED descriptions are typical of the operating On Air Exciter.

3.4.1.1: 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 present, Red when a fault has occurred in the upconverter.

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

3.4.1.2: 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.

3.4.2: Front Panel LCD Screen 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 Driver/Amplifier Chassis Assembly 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.

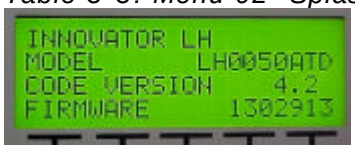
NOTE: The following screens are typical of an operating Exciter but may be different from the screens in your system.

Display Menu Screens for the Driver/Amplifier Chassis Assembly

Table 3-2: 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 3-3: 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 3-4: 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 3-5: 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 3-6, the Transmitter Device Data Access Screen. If the ↑ key is activated the display returns to Menu 10, the Main Screen.

Table 3-6: 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 3-11 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 3-7: 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 3-12, 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 3-8: 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 3-5, the Error List Access Screen. **NOTE:** Shown is example of a typical screen.

Menu 30 is entered by selecting ENT at Menu 12, Table 3-6.

Table 3-9: 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 3-10, the System Details Screen.

Table 3-10: 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 3-11**. Each System Component is a different screen. The proper modules will be programmed for your system.

Table 3-11: 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

Pushing the ↓ Down Arrow, after scrolling through all of the detail screens, will put you back to Menu 30, Table 3-9. Push the ESC button to exit the Transmitter Device Parameter Screens to Menu 12, Table 3-6, the Transmitter Device Parameter Access Screen.

Menu 40 (Table 3-12) is entered by selecting ENT at Menu 13.

Table 3-12: 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.

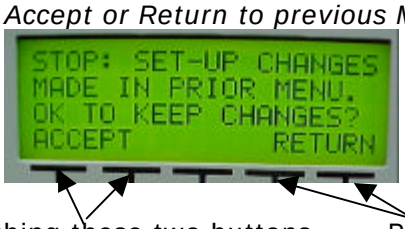
Pressing ENT will put you into the Transmitter Set Up Screens for Menu 40.

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 3-13 Menu 40-1 through Table 3-21 Menu 40-19 that follow.

Table 3-13: 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 3-14: Menu 40-2 - 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 3-15: Menu 40-3 - Transmitter Set-up: Upconverter Channel Select Screen

The choices of this screen are to the standard UHF / VHF channels. The + and – buttons change the desired channel of the transmitter. The PLL frequency is set for custom Offsets within the upconverter frequency. Any change to the channel is immediately set to the Upconverter Frequency Synthesizer PLL circuit.

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: 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.

The same previous screens will be displayed by the back up exciter if it is switched to become the On Air Exciter.

This completes the description of the menu screens for the Driver/Amplifier Chassis Assembly and the Setup and Operation Procedures for the DT325B.

Chapter 4
Circuit Descriptions

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

4.1 (A4) Control Monitoring/Power Supply Module, 220VAC (1310835; Appendix C)

The Control Monitoring/Power Supply Module Assembly contains (A1) a Power Protection Board (1302837), (A2) a 790 Watt Switching Power Supply, (A3) a System Controller Board (1310089), (A4) a LCD w/Switches Board (1307977) and (A5) a LCD Display.

AC Input to the Amplifier/Driver Chassis Assembly

The AC input to the Amplifier/Driver 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 C)

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) System Controller Board (1310089; Appendix C)

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 Sheet 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 Sheet 2

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 Sheet 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.

RB1 is the connector to a Rabbit Semiconductor RCM4300. This Ethernet enabled controller polls the U1 microcontroller on the same serial lines as a remote computer. The controller only gets data and sets conditions through the serial communications port.

Table 4-1: Innovator DIP Switch Settings for SW2 located on the Exciter Controller Board (1310089) in the Power Supply/Controller Assembly

Switch Position	Function
SW2-1	0 = No Modulator in a translator configured transmitter 1 = Modulator present in a translator configured transmitter
SW2-2	0 = Normal 1 = Aural Upconverter not to be installed
SW2-3	0 = Normal 1 = IP Processor not to be installed
SW2-4	0 = Normal 1 = Modulator not to be installed
SW2-5	0 = Normal 1 = Visual Upconverter not to be installed
SW2-6	Reserved
SW2-7	Reserved
SW2-8	Reserved

NOTE: These switch positions are factory set and should not be changed.

4.1.2.4 Schematic Sheet 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 potentiometer ICs are used to calibrate four signals, System 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. Serial data to the

second serial potentiometer is transferred through the first IC. The wiper position of the digital potentiometer circuit is used to set the gain of the op-amp. Lower digital values for the wiper settings increases the gain of the op-amp. If N=0 then Gain=6.0 and if N=255 then Gain=3.00. If the Vin=1.0 at spare_Ain_1 and N=128 then U21A out=4.0V with gain=4. 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 Sheet 5

There are three dual element, red/green, common cathode LED indicators mounted on the front panel of the sled assembly that are used. The fourth is a spare. The used LEDs are DC OK, Operate and Fault.

There are four identical circuits, one of which is a spare, 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, shown on sheet 2, as controlled by the DATABUS from the microprocessor U1, shown on sheet 1.

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, U26, U27 & U28, and one for +7 VDC, U25, 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 (+5Vdc). Another two +5 Volt regulator circuits U27, (+5V), and U8, (+5Vserial), are used for most other board circuits.

4.1.3 (A4) LCD w/Switches Board (1307977; Appendix C)

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 J3 to connector J2 that connects to J1 on (A5) the 20 Character by 4 line LCD Display. J3 on the switch board is also cabled to the (A3) System Controller Board. When a switch is closed, it connects a logic low to the system controller 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 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, a terminal blocks, V1, V2 & V3, for distributing the DC voltages, and a 3 position terminal block to which the AC Input connects. 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 V1B-6 & 7. The power supply is configured for three output voltages +12V, -12V, at the 10 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.

4.1.5 RF Output of Driver/Amplifier Chassis Assembly

The RF output from the upconverter at the upconverter RF output jack J23, a BNC connector. The RF is cabled to the "S" input Jack on the (A10) 2 Way Splitter. One output of the splitter connects to the VHF Amplifier Tray. The other output of the splitter connects to the triple peak detector board for metering, ALC and monitoring purposes.

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

This completes the description for the Driver/Amplifier chassis assembly.

4.2 (A3) VHF Low Band Amplifier Tray (1304363; Appendix D)

The VHF low band amplifier tray is adjusted at the factory for use as a digital RF amplifier tray. The tray has approximately 55 dB of gain at the frequency of the VHF low band channel and will take the typical +4 dBm DTV input and amplify it to an output level of approximately +55.8 dBm. As a DTV amplifier, the tray is calibrated for 350 watts average power that is equal to a 100% meter reading. The tray is made up of the boards and assemblies listed in Table 4-1.

Table 4-1: VHF Low Band Amplifier Tray Boards and Assemblies

MAJOR ASSEMBLY DESIGNATOR	BOARD/ASSEMBLY NAME	DRAWING NUMBER
A1-A1	Phase shifter board (mounted in [A1] an RF enclosure assembly)	1198-1602
A1-A2	Filter/amplifier board (mounted in [A1] an RF enclosure assembly)	1198-1606
A2-A1	VHF low band amplifier board (mounted in [A2] an RF enclosure assembly)	1198-1605
A2-A2	Overdrive protection board (mounted in [A2] an RF enclosure assembly)	1198-1601

A2-A3	3-way splitter board (mounted in [A2] an RF enclosure assembly)	1198-1608
A3-A1, A3-A2 and A3-A3	Three low band VHF amplifier pallets (mounted in [A3] an RF enclosure assembly)	P400-VHF-L-18 1304348
A4-A1	3-way combiner board (mounted on [A4] the 3 way combiner enclosure)	1198-1626
A4-A2 & A4-A3	Low pass filter board (mounted on [A4] the 3 way combiner enclosure)	1198-1628
A5	AGC control board	1306482
A8	Current metering board	1304362
A10	+30 VDC switching power supply assembly	PM3329B-5-1-R-2-E 1301504

4.2.1 (A1-A1) Phase Shifter Board (1198-1602; Appendix D)

The On Channel RF signal (+4dBm), enters the rear of the Tray at the "BNC" Jack J1 and is fed to J1 of the (A1) Enclosure Assembly which contains the phase shifter board and the filter amplifier board. The input is cabled to to J1 of (A1-A1) the Phase Shifter Board (1198-1602).

The Board provides a Phase Shift adjustment of the RF Signal that is needed to provide maximum output during the combining of multiple Amplifier Trays in an Amplifier Array. A front panel mounted Phase Shift Potentiometer, R2 (A7), which connects to J3 of the Board, controls the Phase of the RF Signal.

If the Input Signal level to the Phase Shifter Board falls below a preset level, a High, which is an Input Fault, connects from J5 of the board to J14 on the AGC Control Board. When an Input Fault occurs, the AGC Control Board generates a Fault Output at J1, which is connected to J4 on the Filter/Amplifier Board. The Fault cuts back the RF Signal level using the Pin Diode Attenuator Circuit located on the Filter/Amplifier Board.

The output at J2 of the Phase Shifter Board is directed to J7 the input jack on (A1-A2) on the filter/amplifier board.

4.2.2 (A1-A2) Filter/Amplifier Board (1198-1606; Appendix D)

The phase-controlled output (+4 dBm) at J2 of the phase shifter board is directed to J7, the input jack of the (A1—A2) filter amplifier board (1198-1606) that is made up of two circuits. The first circuit is a channel filter that is adjusted for the desired channel frequency and bandwidth. The filtered output (+2 dBm) is connected to the second circuit that contains two amplifiers. The RF connects through a pin-diode circuit to the amplifier IC U1. The voltage applied to J4, which is the external control jack of the board, controls the amplitude of the RF signal through the pin-diode attenuator circuit. Jumper W1 on J5 should be between pins 2 and 3, which provide external control, through J4, of the gain of the board, as well as the output level of the tray. R9 is the manual gain pot that is in the circuit when the jumper W1 is between pins 1 & 2.

The front panel mounted gain pot R3 (A6) connects to the AGC control board and is used to adjust the AGC pin-attenuator bias voltage that connects to J4 on the filter/amplifier board. The RF signal, after the pin-attenuator circuit, is amplified by the second amplifier stage Q1 to about +16.5 dBm; this signal is connected to the output of the board at J2.

The RF output of the filter/amplifier board connects to J2 of (A2) a RF enclosure that contains the VHF low band amplifier board, the overdrive protection board and the 3-way splitter board.

4.2.3 (A2-A1) VHF Low Band Amplifier Board (1198-1605; Appendix D)

The Low Band VHF Amplifier Board takes the +16.5 dBm input signal and amplifies it to approximately +38.5 dBm Output. The board contains a MRF151G Dual FET Amplifier device.

The Input to the board is applied at J1 and is connected through T1 a 9:1 Balun to the Sources of the parallel FETs, which make up Q1. C1 is adjustable for maximum signal to match the impedance of the input to the Push-Pull Transistor Stage. The Bias and collector voltage for the Transistor, +45 VDC, is applied at E1, which is bypassed by C18. The bias voltage is regulated to approximately 20 VDC by Q2 and adjusted by R4 before connecting to Q1. The output of the Q1 push-pull circuit connects to T2 which is a 4:1 Balun that transforms the signal back to a single 50O impedance Output. The Collector Voltage is applied at E1, which is filtered and bypassed by L1, C12 & C14. The Amplifier Stage has roughly 22 dB of gain and draws 5 to 6 Amps of current. The RF output of the board is at J2.

4.2.4 (A2-A2) Overdrive Protection Board (1198-1601; Appendix D)

The RF output of the low band VHF amplifier board at J2 (+38.5 dBm) connects to J4 of (A2-A2) the overdrive protection board (1198-1601). The RF signal is through connected directly to J5, the RF output jack of the board. A sample of the RF on the board is applied to a diode-detector circuit that consists of CR1 and U1A. The gain of amplifier U1D is controlled by detector gain pot R11, which is set to +.4 VDC as measured at TP1. The set output of U1D is connected to the comparator IC U1B. The trip point for the comparator is adjusted by R12, typically set to 110% output power. When the signal reaches that level, the overdrive protection board will cut back the output power of the tray and the red Overdrive LED DS1 located on the board and the red Overdrive LED DS1 mounted on the front panel will be illuminated. Typically, the output power level will bounce down and then up and continue bouncing until the output level is lowered to the normal operating level (100%). The red Overdrive LED DS1, the green Module LED DS3, and the Enable LED DS2 may blink on and off during the bouncing of the output level; this is a normal occurrence. The greater the output level is above 110%, the larger the bounce will be. The RF output of the overdrive protection board (+38.3 dBm) at J5.

4.2.5 (A2-A3)3 Way Splitter Board (1198-1608; Appendix D)

The RF output of the overdrive protection board at J5 connects to J1 on (A2-A3) the 3-way splitter board (1198-1608). The splitter board takes the +38.3 dBm input and provides three +33.3 dBm outputs at J2, J3 and J4 of the board. These three outputs connect to J1, J2 and J3 on the (A3) final amplifier enclosure.

4.2.6 (A3-A1, A2 & A3) VHF LB Output Amplifier Pallets (1304349; Appendix D)

The three RF outputs of the splitter board connect to (A3) the Final Amplifier Enclosure, which contains three (A3-A1, A3-A2 & A3-A3) VHF Low Band Amplifier Pallets (P400-VHF-LB) made by Delta RF Technology. The RF Signals connect to J1 on each of the Low Band Output Amplifier Pallets. Each amplifier pallet provides approximately 18 dB gain.

The RF signal inputs to the Output Amplifier Boards, +33.3 dBm, are amplified to +51.3 dBm outputs at J2,

which are connected to J1, J2 and J3 on (A4-A1) a 3 Way Combiner Board (1198-1626).

4.2.7 (A5-A1) 3 Way Combiner Board (1198-1626; Appendix D)

The 3 Way Combiner takes the three +51.3 dBm combined inputs and combines them to form the approximately 375 Watt (+55.8 dBm) RF Output at J4 of the Combiner which connects to J2, the RF Output Jack of the Tray.

The 3 Way Combiner Board provides a Forward Power Sample at J5 and a Reflected Output Power Sample at J8. The Forward Output Power Sample connects through the (A4-A2) low pass filter board to J4 on (A5) the AGC Control Board. The Reflected Output Power Sample connects through the (A4-A3) low pass filter board to J5 on (A5) the AGC Control Board.

4.2.8 (A5) AGC Control Board (1306482; Appendix D)

The AGC Control Board contains two peak detector networks one for forward and one for reflected power samples. The forward power sample connects through J4 to a detector circuit consisting of CR11 and U3C. The detected forward level is connected through R44 the Forward Power metering level adjustment which controls the gain of the amplifier U3D. The forward peak detected sample output of U3D is split with one output connected to J7-4 which is wired to the front panel meter for monitoring purposes. Another output of U3D connects to the IC U6 and related components which comprise the module fault circuit. The front panel mounted module fault LED DS3, connected to J9-4 & 6, will light if the forward output power drops below a preset level. The final of the split outputs of U3D connects to the IC U3A and related components which comprise the AGC circuit. This level is combined with the AGC reference inputs at J2 and J6-2 which produces the AGC output at J1 which connects to the automatic level control circuit on the Filter/Amplifier Board for the output power of the tray.

The reflected power sample connects through J5 to a detector circuit consisting of CR13 and U5B. The detected reflected level is connected through R53 the Reflected Power metering level adjustment which controls the gain of the amplifier U5D. The reflected peak detected sample output of U5D is split with one output connected to J12-8 which is wired to the front panel meter for monitoring purposes. The other output of U5D connects to the IC U5C and related components which comprise the VSWR Cutback circuit. The front panel mounted VSWR Cutback fault LED DS4, connected to J12-2 & 1, will light if the reflected output power increases above the preset level set by R59. Another output of U5C is detected by CR15 and connected to the IC U3A and related components which comprise the AGC circuit. This level is combined with the AGC reference inputs from the forward power sample and at J2 and J6-2 which produces the AGC output at J1. This output connects to the automatic level control circuit on the Filter/Amplifier Board that controls the output power level of the tray.

Two voltages are applied to the rest of the VHF amplifier tray when the enable is connected to the tray. The voltages are +28 VDC from the internal switching power supply and +12 VDC from the current metering board that connects to J8-2 on the board where it is regulated by U7 and connected to the rest of the board.

The +12 VDC from the Driver/Amplifier is connected to J3-7 & 8 on the rear of the Tray that is wired to J8 Pin 4 & 1 on (A5) the AGC Control Board. The +12 VDC is connected to U8 a +5 VDC Regulator IC, which supplies the +5 VDC needed for operation of the front panel mounted

LEDs. This +12 VDC is supplied to the tray when the Driver/Amplifier is turned on.

4.2.9 (A10) +28 VDC Switching Power Supply Assembly

(A10) The +28 VDC Switching Power Supply uses the 220VAC input through the 15A circuit breaker CB1 and provides the +28 VDC needed for operation of the tray. Two varistors, VR3 and VR4, connect to each leg of the 220 VAC input for overvoltage and surge protection.

The +28 VDC output of the switching power supply assembly connects to (A8) the Current Metering Board at TB1-1 thru TB1-4.

4.2.10 (A8) Current Metering Board (1304362; Appendix D)

The Current Metering Board distributes the voltages through fuses to the Amplifier Devices on the Filter/Amplifier Board, the VHF Low Band Amplifier Board, and the three Final High Band Amplifier Boards. The Fuses F1, F2 & F3 are 20 Amp, F4 is 5 Amp, F6 is 2 Amp and F7 is a 1 Amp Fuse. The F5 fuse is not used in this configuration. There are two Spare Fuses, one 1 Amp and one 20 Amp, located on the top, right rear of the Tray.

Fuse F1 protects (A3-A1) the Low Band Output Amplifier Pallet, Fuse F2 protects (A3-A2) the Low Band Output Amplifier Pallet, Fuse F3 protects (A3-A3) the Low Band Output Amplifier Pallet, Fuse F4 protects (A2-A1) the VHF Low Band Amplifier Board, and Fuse F6 protects (A1-A12 the Filter/Amplifier Board. Fuse F7 supplies +28 VDC to J8 Pin 2 on the AGC Control Board, where it is connected to the Regulator IC U7 that takes the +28 VDC and provides a +12 VDC output. The +12 VDC is used for operation of the AGC Control Board and also the +12 VDC is connected through the Current Metering Board, by the jumper from TB1-5 to TB1-6, to the Phase Shifter Board, the Filter/Amplifier Board and the Overdrive Protection Board. The Current Metering Board also supplies sample outputs of the operating currents of the amplifier devices in the Tray to the front panel Current Meter. The Meter in the (I_1) position reads the current for the (A3-A1) P400 Low Band Output Amplifier Board, (I_2) for the (A3-A2) P400 Low Band Output Amplifier Board and (I_3) for the (A3-A3) P400 Low Band Output Amplifier Board. The (I_D) position reads the current for the (A2-A1) VHF Low Band Amplifier Board. To read the desired current, Switch S2 to the proper position while checking that S1 is in the Current position. These current readings can be used when setting up the Idling Currents, no RF Drive applied, for the devices. Refer to the final Test Data Sheet for your transmitter for the operational and Idling current readings. (**NOTE:** All front panel current readings must be multiplied by 2 to give the actual value.)

4.2.11 Operation of the VHF Low Band Amplifier Tray

220 VAC is applied through Jack J4 to Terminal Block TB1 in the Tray. When (CB1) the 15 Amp rear panel mounted AC Circuit Breaker is switched On, the 220 VAC is distributed from TB1 to (A11 & A12) two cooling Fans, which will operate, and to (A10) the Switching Power Supply. There are two Surge Suppressors, VR1 and VR2, mounted on TB1 that provide protection from transients or surges on the input AC Line. There are two other Surge Suppressors, VR3 and VR4, mounted at the input to the switching power supply from each AC Line to ground, which provide protection from transients or surges on the AC Line.

The switching power Supply only operates when the Power Supply Enable Control Line, Jack (J3 Pins 9 & 10), located on the rear of the Tray, are shorted. The Enable is generated by the exciter/driver chassis assembly when the

transmitter is switched to Operate. The Enable is applied to (A5) the AGC Control Board (1306482), which, if there is no Thermal Fault, connects the Enable from J10 Pins 6 & 7 to J1-18 & 14 on the Switching Power Supply Assembly. The Green Enable Front Panel LED (DS2) will light, indicating an Enable is present. If the Amplifier Array is in Standby or if a Thermal Fault occurs, the AGC Control Board will not Enable the Switching Power Supply, therefore the +28 VDC will be removed from the Amplifier Modules and the Front Panel Enable LED and Module Status LEDs will be out.

The front panel Meter (A9), by switching (S1) the Front Panel Selector Switch, monitors the AGC Voltage, % Output Reflected Power, % Forward Power and the Switching Power Supply Voltage (+28 VDC). The Meter in the AGC position will typically read anywhere from 1 to 2 Volts. The Meter is calibrated in the Power Supply position using R86, the % Output Power is calibrated using R44 and the % Reflected Power is calibrated using R53, all of the pots located on the AGC Control Board. With S1 in the Current Position, S2 is switched to read the operating currents or the Idling currents, no RF Drive applied, of the High Band Output Amplifier Boards. The idling currents are monitored for the set up of the devices. Refer to the final Test Data Sheet for your Transmitter for the operational and Idling current readings.

The Reflected Power Sample, from the 3 Way Combiner Board, is fed back to the AGC Control Board at J5. On the board the Reflected Sample is connected thru the detector circuit to a VSWR Cutback circuit (U13C). If the Reflected power increases above 20%, the output power of the Tray, as set by R60 (VSWR Cutback) on the AGC Control Board, is cutback to maintain a 20 % Reflected Output level. The Red LED (DS4) VSWR Cutback, located on the front panel, remains lit until the Reflected level drops below 20%.

There are three Thermal Switches mounted in the Tray for overtemperature protection. Two of the Thermal Switches (A13 & A14) are mounted on (A3) the heatsink for the Low Band Amplifier Pallets and the third Thermal Switch (A15) is mounted on the heatsink for the 3 Way Combiner Board. The Thermal Switches close when the heatsink on which it is mounted reaches a temperature of 175° F. The closed Thermal Switch causes the AGC Control Board, to remove the Enable to the Switching Power Supply, eliminating the +28 VDC, and also to light the Red LED Indicator, Overtemperature (DS5), mounted on the front panel. The AGC Control Board also extinguishes the Module Status LED (DS3).

4.3 External Boards

4.3.1 (A4) Triple Peak Detector Board (1159713; Appendix A)

The Triple Peak Detector Board is mounted on the Bottom, Right Side of the Cabinet accessed through the back.

The function of the triple peak detector board is to detect three power samples and generate output voltages that are proportional to the power levels of the sampled signals for use by the control monitoring assembly in the transmitter.

There are three signal paths on the board: one for RF I/P 1, one for RF I/P 2 and one for RF I/P3. The circuits function as described in the following paragraphs. The RF sample input enters the board at the RF I/P 1 SMA jack J1. Resistors R9, R4 and R10 form a 3dB pad. The RF sample is amplified by U3 and connected to a detector circuit made up of R11, R3, CR1, R8, C7, R41, and C6. For digital operation the jumpers, W1 on J4 and W4 on J8, are both between pins 1 & 2. The detected output is buffered by the operational amplifier U1D and then connected to RF I/P 1 power adjust pot R14, which adjusts the gain of U2D. The

output of U2D is connected to J5-1, DC O/P 1.

The second RF sample input enters the board at the RF I/P 2 SMA jack J2. Resistors R22, R17 and R23 form a 50O input impedance matching circuit. The sample is connected to a detector circuit made up of CR3, R24 C8, R42, and C9. For digital operation the jumpers, W2 on J6 and W5 on J9, are both between pins 1 & 2. The detected output is buffered by the operational amplifier U1B and then connected to RF I/P 2 power adjust pot R26, which adjusts the gain of U2B. The output of U2B is split and connected to J5-2 and J5-3, DC O/P 2.

The third RF sample input enters the board at the RF I/P 3 SMA jack J3. Resistors R34, R29 and R35 form a 50O input impedance matching circuit. The sample is connected to a detector circuit made up of CR5, R36, C11, R43, and C13. For digital operation the jumpers, W3 on J7 and W6 on J10, are both between pins 1 & 2. The detected output is buffered by the operational amplifier U1C and then connected to RF I/P 3 power adjust pot R38, which adjusts the gain of U2C. The output of U2C is split and connected to J5-6 and J5-5, DC O/P 3.

The +12 VDC needed for the operation of Op Amps U1 and U2 enters the board at J5-10. The voltage is connected through a filter and isolation circuit consisting of L2, C10, and C15 before it is distributed to the rest of the board.

4.3.2 (K1) Isolation Relay Board (1002-1108; Appendix A)

The Isolation Relay Board is located on the inside right side panel of the cabinet. The Isolation Relay Board when energized supplies the enable to the VHF amplifier tray.

The +12 VDC from the Driver/ Amplifier Chassis Assembly is connected to the board at J1-1, one side of the energizing coil. -12 VDC from the Driver/Amplifier is connected to J2-1 which is the NC contacts of the relay. J2-4 which is the other contact of the NC connection is not used in this configuration.

When the Driver/Amplifier Chassis Assembly is switched to Operate, an Enable, ground, is applied to J1-2, which energizes the relay. The contacts of the relay close which connects J2-2 to J2-1 that applies the -12 VDC, Enable, to the VHF Amplifier Tray. The opposite occurs when the On Air Driver/Amplifier Chassis Assembly is switched to Standby.

This completes the circuit description of the boards that make up the DT325B.

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 Axciter takes the SMPTE 310 digital stream input and converts it to the digital IF output that connects to the driver/amplifier chassis assembly. The driver/amplifier converts it to the desired VHF On Channel RF Output that is amplified by the amplifier tray to produce the systems output power level.

The Driver/Amplifier Chassis Assembly of the transmitter is of a Modular design and when a Module fails that module needs to be changed out with a replacement module. The failed 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.

5.2 Module Replacement

Module replacement in the Driver/Amplifier Chassis Assembly is a relatively simple process. In the Exciter/Driver assembly, the Downconverter, Upconverter and Control/Power Supply Module plug into blind mating connectors located on the Backplane board in the chassis. 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. 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 does not slide in easily, verify it is properly aligned in the nylon tracks, located on both the top and bottom of the module. After positioning, tighten the two grip lock connectors.

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 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) Blank panel.

5.3 (A3) VHF LB Amplifier Tray (134363; Appendix D)

The Tray has been adjusted at the factory to meet all specifications, including Phase Adjustment to match the multiple Trays in an Amplifier Array when combined, and should not need adjusted to attain normal operation. Any adjustment of the Boards should be accomplished in Manual Gain, S1 on (A5) AGC Control Board (1306482) in Manual. The Idling Currents for the amplifier boards are adjusted with no RF Drive applied. For Normal Operation, S1 should be in the Auto AGC position.

Connect a Dummy Load rated of at least 350 Watts to J2 the RF Output Jack of the Tray.

5.3.1 (A13) AGC Control Board (1306482; Appendix C)

Using a calibrated Wattmeter, check that the Tray is operating at rated power.

Remove the Sample Forward Power connection J4 from the board. The Output Power Level should drop to 20 % because of the VSWR Cutback and DS4 should light. The front panel Module Status LED should not be illuminated.

Reconnect J4 and adjust R59 to begin cutting back the Output Power Level when the Reflected Level increases above 20 %. The front panel Meter in the Power Supply Voltage position is calibrated to +32 VDC using R86 located on the AGC Control Board.

5.3.2 (A1-A1) Phase Shifter Board (1198-1602; Appendix D)

This board has no adjustments on it. The Front Panel has adjustments for Phase that are adjusted during the Amplifier Array Set Up Procedure. With +4 dBm input typical output is +4 dBm.

5.3.3 (A1-A2) Filter/Amplifier Board (1198-1606; Appendix D)

This board has a maximum of 15 dB gain. Typically with +4 dBm input an output of +16.5dBm is expected. Tune the channel filter capacitors C20 (input loading) & C29 (output loading), C23 & C26 (center frequency) and C24 (coupling) for best response at J6 the RF output jack of the filter portion of the board. Set the Voltage Adjust Pot R19 for +24 VDC at the Anode of CR5.

The idling current, no RF Drive applied, of the Device Q1 is set for 250 mA. To set the current, remove the RF Drive, measure the voltage across R16, a 1 Ω resistor on the Filter/Amplifier Board, and adjust R13 for .25 Volts. Using Ohms Law: (E = I x R) : (E = 250 mA x 1 Ω) : E = 250 mV.

5.3.4 (A2-A1) VHF Low Band Amplifier Board (1198-1605; Appendix D)

This board has 20 dB of gain and is biased for 3 Amps of Idling Current, no RF Drive applied. To set the Bias, remove RF Drive and switch the front panel Current Meter to the I_D position. Adjust the Bias Adjustment R4 on the Amplifier Board for 3 Amps on the meter.

Connect a Spectrum Analyzer to the Output Jack J2 of the Board and adjust C1 for peak output. Typical output level is +38.5 dBm.

5.3.5 (A2-A2) Overdrive Protection Board (1198-1601; Appendix D)

The RF Input and Output of the board should be approximately +38.5 dBm during normal operation.

To set up the Overdrive circuit, check that the Output Power Level of the Transmitter is at 100 % and adjust R11, on the Board, for a reading of .4 VDC at TP1. Increase the Output power level of the Transmitter to 120 % and adjust R12 until the Output Power begins to Drop Off. Return the Output Power Level of the Transmitter to 100 %.

5.3.6 (A2-A3) 3 Way Splitter Board (1198-1608; Appendix D)

This board contains no tuning adjustments. The board takes the +38.3 dBm input and splits it into three equal +33.3 dBm outputs.

5.3.7 (A3-A1, A2 & A3) VHF LB Output Amplifier Pallets (1304348; Appendix D)

These P400-VHF-LB pallets are supplied by Delta RF Technology, Inc. Refer to the data sheets in the subassembly section of this manual for more information. Each pallet has approximately 18 dB of gain. With +33.3 dBm input an output of +51.3 dBm is typical.

5.3.8 (A4-A1) 3 Way Combiner Board (1198-1626; Appendix D)

There are no adjustments on this board. The three +51.3 dBm Inputs are combined to produce the 375 Watts (+55.8 dBm) Output at J4 that connects to the RF output jack J2 located on the rear panel of the tray.

5.4 Calibration of the Output Power of the VHF Amplifier Tray

Check that a Dummy Load of at least 400 Watts is connected to the Output of the Tray that is to be calibrated. Switch S1 located on the AGC Control Board to the **Manual** position before beginning the set up. Adjust the front panel Meter for 100% Forward Output Power with R5, Manual Gain Adjust, located on the AGC Control Board.

Readjust the Manual Gain Pot for same Spectrum Analyzer Reference Level. Adjust R44 for 100% Forward Power Reading. Calibrate the Front Panel Output Power Meter to 100 % with R44, Forward Power Meter Adjust, located on the AGC Control Board. Lower the Forward Power reading to 80% on the front panel meter using R5, Manual Gain Adjust, located on the AGC Control Board. Adjust R65, AGC Fault Adjust, located on the AGC Control Board until DS3 the Green Module LED mounted on the front panel just lights. Readjust the Forward Power to 100 % using R5. Switch the Tray Off and reverse the J6 and J7 cables located on the 3 Way Combiner Board. Switch the Tray On and adjust the front panel meter in the Reflected Output Power Position to a 100 % reading using R53, Reflected Power Meter Adjust, located on the AGC Control Board. Adjust the Reflected Output Power to a 20 % reading using R5 located on the AGC Control Board. Then adjust R59, VSWR Cutback Adjust, located on the AGC Control Board until DS4 the Red VSWR Cutback LED mounted on the front panel lights. This sets up the VSWR Cutback Circuitry.

Readjust R5 for 100 % on the Meter for 250 Watts Output. Switch the Tray Off and return the J6 and J7 Cables located on the 3 Way Combiner Board back to their original positions. Switch S1 located on the AGC Control Board to the AGC position, which is the normal operating position, after the set up is completed.

There is a spare 1 Amp and 20 Amp Fuse, located on the top, right rear of the Tray, for replacement of the Fuses on the Current Metering Board.

The VHF Low Band Amplifier Tray is aligned and calibrated and ready for normal operation.

5.5 Setting Up the Output Power of the Transmitter

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 Up/Downconverter tab on the right side of the screen. This will open the Upconverter/Downconverter Main Screen. 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 and adjusting the level as needed to attain 100% output power.

5.5.1 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 gain through the Axciter Modulator.

See Figure 5-1 for an example of the Axciter Upconverter/Downconverter

Main Screen. On the Axciter Upconverter 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.

5.5.2 Setting up of the Overdrive Threshold

On the Axciter Upconverter/ Downconverter Screen set the Overdrive Threshold to 1.7 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 1.7 Volts.

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

Figure 5-1: Axciter Upconverter/Downconverter Main Screen

5.5.3 Axciter Relay K2 Sample Values

The K2 Relay is mounted on the Lower, Right Side of the Cabinet, accessed through the back. The RF Sample levels must 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 Pre Filter connection to the FWD power sample of the coupler before the mask filter (Non-Linear Distortion). Level into Relay at J1 should be 0 dBm to –10 dBm. –5 dBm typical

J2 Post Filter connection to the forward power sample after the mask filter (Linear Distortion). The level into the K1 Relay at J2 should be 0 dBm to –10 dBm. –5 dBm typical, but must be within .5 dB of the J1 sample.

5.5.4 Upconverter Down Converter Adjustment

On the Axciter Modulator, activate the Up/Downconverter Main screen by selecting Up/Downconverter using the button next to it on the right side of the Axciter Main Screen. Activate the Downconverter Output Gain by pushing 2 on the key board entry. 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 & 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.

5.6 System Calibration of Forward and Reflected Powers Using the Driver/AmplifierChassis

NOTE: Do not adjust R38 on (A4) the Triple Peak Detector Board (1159713). It is factory set for .7 to .8 VDC typical AGC Reference to the VHF Amplifier Tray and any readjustment may damage the tray.

5.6.1 Forward Power Calibration

Check that transmitter is at 100% output power, as shown on the LCD display on the (A2) Driver/Amplifier in the Set Up menus.

Measure with a VOM, TP31-14, Red, and TP31-12, Black, at the terminal block TP31 located on the rear chassis of the (A2) Driver/Amplifier Chassis Assembly. Adjust R14, Forward Calibration Adjustment, on the (A4) Triple Peak Detector Board, mounted on the lower right side of the cabinet accessed through the rear cabinet door, 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 calibration.

5.6.2 Reflected Power Calibration

Switch the transmitter to Standby. Remove the connector that is on Jack J2, on the (A4) Triple Peak Detector Board (1159713), and replace with the connector now on J1, also inserting a 10 dB pad in series. Switch the transmitter to operate. Monitor the LCD display on the (A2) Driver/Amplifier in the Set Up menus, reflected power screen. Adjust R26, Reflected Calibration Adjustment, on the (A4) Triple Peak Detector Board for a reading of 10% on the display. 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 reflected power calibration.

This completes the set up and adjustment of the DT325B transmitter. If a problem occurred during alignment, contact Axcera field service at 1-724-873-8100.

APPENDIX A

DT325B
SYSTEM SPECIFICATIONS

Low Power VHF DTV Transmitters/Translators 350W - 2.1kW

DT334B/DT434B Pictured

These low power VHF DTV transmitters and translators deliver high quality and performance in a compact and economical package - perfect for broadcasters wishing to get a DTV signal on the air quickly. The time-proven Axcera DT1C modulator or optional DT2B adaptive modulator, generates the ATSC-compliant 8VSB IF signal, which feeds the companion upconverter. The upconverter provides a pre-corrected output directly to the high-gain final power amplifier modules (three PAs in the 1000W unit). The entire package is housed in a single 19 inch rack-mount cabinet.

Designed for high reliability and unattended operation, each power amplifier utilizes a parallel amplifier design with a high level of protection circuitry. Features such as VSWR cutback, overdrive protection and over-temperature protection ensure on-air reliability. Convenient system monitoring is achieved through front panel samples, status indicators and metering, most of which are remote controllable.

Low Power VHF DTV Transmitters/Translators 350W - 2.1kW

Performance

Frequency Range[1]	
Low Band	54 to 88 MHz
High Band	174 to 216 MHz
Output Impedance	50 Ω
Frequency Stability	±250Hz *(Max 30 Day Variation)*
Regulation of RF Output Power	3%
Out of Band -Compliant with FCC Mask[2]	
Channel Edge ±500kHz	-47 dB or better
6MHz from Channel Edge	-110 dB or better
Signal to Noise (SNR)	27 dB or better
Data Interface	
Input Rate	19.39 Mbps. 6MHz channel
Input Interface	SMPTE 310M, Serial Differential ECL and TTL
Test Signals	Staircase, VSB Pilot, Zero Pilot, Average Power Pilot, Nyquist Waveform

Options

Dual Exciter with Automatic Switcher
Adaptive Exciter
AC Surge Protector
Precise Frequency Kit
Spare Parts Kit

General

Model Number	DT325B DT425B	DT330B DT430B	DT334B DT434B	DT335B-1.4 DT435B-1.4	DT335B-1.7 DT435B-1.7	DT335B-2.1 DT435B-2.1
Power Output *(Watts)*	350	500/700[2]	1050	1400	1750	2100
Output Connector	N	N/1 5/8" EA	1 5/8" EIA	3 1/8" EIA	3 1/8" EIA	3 1/8" EIA
Power Consumption *(Watts)*	2250	4250	6250	8250	10,250	12,250
Number of PAs	1	2	3	4	5	6
Input Power						
Line Voltage *(Volts)*[1]	208 or 240 ± 10%					
Power Requirements	Single Phase, 50 or 60 Hz					
Size *(H x W x D)*	69"x22"x34"				69"x44"x34"	
Operational Temperature Range	0 to +50°, derate 2°C/1000 ft.					
Maximum Altitude[1]	8500 feet (2600m) AMSL					
Operational Humidity Range	0% to 95% non-condensing					
RF Load Impedance	50 Ω					

1 Consult factory for other frequencies, altitudes and line voltages
2 Available with 700 W Filter Option

103 Freedom Drive, PO Box 525, Lawrence, PA 15055 t: 724-873-8100 f: 724-873-8105

APPENDIX B

SYSTEM DRAWINGS

DT325B

APPENDIX C

EXCITER/DRIVER CHASSIS ASSEMBLY DRAWINGS

Chassis Assembly, Exciter/Driver, LXB, 220 VAC

Block Diagram 1302139
Interconnect 1310215

Backplane Board, Innovator LX
Schematic 1310081

NOTE: Information and drawings on the Axciter Modulator Tray (1305842) and the Upconverter Module (1310226) and Downconverter Module (1311157) are found in the separate Axciter Manual.

Exciter Control/Power Supply Assembly, LXB, 220 VAC

Block Diagram 1310189
Interconnect 1310190

Power Protection Board
Schematic 1302839

LCD w/Switches Board
Schematic 1307978

System Controller Board, LXB
Schematic 1310090

APPENDIX D

VHF LOW BAND AMPLIFIER TRAY
DRAWINGS

VHF Low Band Amplifier Tray