

## Chapter 2

### Amplifier Assembly Description & Remote Control Connections

#### 2.1 LX Series Power Amplifier Assembly Overview

The (A3) power amplifier assembly in the LX Series contains modular television amplifiers that slide into the assembly. There is also needed one external Power Supply Module Assembly for every two PA modules, which also slide into the Power amplifier assembly, under the PA Modules. Four PA modules and two Power Supply modules are the maximum number of modules in a Power Amplifier Assembly. The RF output of the (A2) exciter/driver at the "N" connector J25 connects to the power amplifier assembly at the "N" connector J200. A system serial cable connects from the Power Amplifier Assembly at J232 to J34 on the exciter/driver assembly. If more than two PA modules are used then another serial port J233 is also connected to the

exciter/driver. The output of the amplifier assembly at the "N" connector J205 is cabled to A9 the bandpass filter for the system. The filtered output can connect to (A10) the Optional 1 section or 2 section trap filter that provides even more filtering as needed. The filtered output is connected to A11 a coupler assembly that supplies a forward and reflected sample to the A4 Visual/Aural Metering Board. The Visual/Aural Metering Board supplies reflected, visual and aural output power samples to the exciter/driver for metering purposes. The RF output for the transmitter is at J2 the 7/8" EIA connector on the A11 coupler assembly.

The LX Series power amplifier assembly is made up of the modules and assemblies listed in Table 2-1.

Table 2-1: LX Series Power Amplifier Assemblies

ASSEMBLY DESIGNATOR	ASSEMBLY NAME	PART NUMBER
	Chassis Assembly	CB001274
A3	Power Amplifier Assembly, 250 Watt	1302868
	Power Supply Assembly	1302893
A11	Coupler Assembly	
A4	Visual/Aural Metering Board	1265-1309

##### 2.1.1 Power Amplifier Module Assembly, 250Watt (1302868; Appendix B)

POWER AMPLIFIER MODULE	RF INPUT/OUTPUT:	470 – 860 MHz
	INPUT LEVEL:	+30dBm ±2dB PK SYNC.
	INPUT RETURN LOSS:	–10dB
	OUTPUT LEVEL:	+55dBm (300W PK SYNC)
	POWER REQUIREMENTS:	+32V @ 25A +12V @ 0.2A –12V @ 0.5A

The Power Amplifier Module Assembly is made up of (A6) an Amplifier Control Board (1301962), (A1) a UHF Phase/Gain Board (1303213), (A2) a 150 Watt Driver Pallet Assembly (1303293), (A3 & A4)

two RF Module Pallets, Philips (1300116), and (A5) a 2-Way Combiner Board (1303208).

The Power Amplifier Module contains Broadband LDMOS amplifiers that cover the entire UHF band with no tuning required. Each module amplifies the RF to a nominal 300W output power.

The Power Amplifier assembly is used to amplify the RF output of the Transmitter/Exciter Driver. A cable, located on the rear chassis, connects the RF output from the Exciter/Driver at J25

to J200 the RF input to the PA Assembly. This module contains RF monitoring circuitry for both an analog and a digital system. Control and monitoring lines to the Power Amplifier module are routed through the floating blind-mate connector of the Control & Monitoring/Power Supply module.

The 100 Watt Transmitter/Exciter Driver Power Amplifier module and any External Amplifier modules contain the same control and monitoring board. This board monitors RF output power, RF reflected power, the current draw of amplifier sections, the supply voltage, and the temperature of the PA heat sink.

The RF power detector circuit outputs vary with operating frequency. These circuits must be calibrated at their intended operating frequency. Front panel adjustment potentiometers are used to calibrate the following:

Table 1: Power Amplifier Calibration Adjustments in Analog Systems

R201	Reflected Power Cal
R202	Forward Power Cal
R204	Meter Offset Zero

In analog systems, the Aural power of an Exciter Driver Power Amplifier and the Aural power of any external amplifier will not be reported by the system Control Monitoring module. Additionally the Visual power of these amplifiers, is reported as Forward Power just like in digital systems. In analog

systems, aural and visual power will only be reported for the final system RF output.

In digital systems, the Forward power of an Exciter Driver Power Amplifier and the Forward power of any external amplifier, is reported by the system Control Monitoring module.

If the Control Monitoring module is monitoring a 5-50 Watt Digital or 10-100 Watt Analog Transmitter, system power is measured in the Power Amplifier module. The wired connections are transferred through the power supply connector to the backplane board on a five position header. All four positions of control board switch SW1 must be set on to route these lines as the system's RF power signals. In systems of output power greater than 50 Watts digital or 100 Watts aural, system power is monitored by an external module that is connected to TB31 and control board SW1 switches must be set off.

The Forward Power of the Transmitter/Exciter Driver Power Amplifier module is routed to the Upconverter module as AGC #1. A system over-drive condition is detected when this value rises above 0.9 VDC. When an over-drive condition is detected, the Upconverter module reduces its RF output level. For values less than 0.9 VDC, the Upconverter uses this voltage for automatic gain.

Table 2-2. Power Amplifier Status Indicator

LED	FUNCTION
ENABLED (Green)	When lit Green, it indicates that the PA is in the Operate Mode. If a Mute occurs, the PA will remain Enabled, until the input signal is returned.
DC OK (Green)	When lit Green, it indicates that the fuse protected DC inputs to the PA module are OK.
TEMP (Green)	When lit Green, it indicates that the temperature of the heatsink assembly in the module is below 78°C.
MOD OK (Green)	When lit Green, it indicates that the PA Module is operating and has no faults.

Table 2-3. Power Amplifier Control Adjustments

POTENTIOMETERS	DESCRIPTION
RFL CAL	Adjusts the gain of the Reflected Power monitoring circuit
VISUAL CAL	Adjusts the gain of the Visual / Forward Power monitoring circuit
METER ZERO	Adjusts the offset of the Forward Power monitoring circuit

Table 2-4. Power Amplifier Sample

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

### 2.1.2 Power Supply Module Assembly, 1kW LX Series (1302863; Appendix B)

A1 +32V/2000W POWER SUPPLY & A2 +/-12V/40W POWER SUPPLY ASSEMBLIES	AC INPUT: 220 VAC @ 17 AMPS A1 OUTPUT POWER LEVELS: +32V @ 67A A2 OUTPUT POWER LEVELS: +12V @ 1A -12V @ 1A
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The Power Supply Module Assembly is made up of (A1) a +32V/2000W Switching Power Supply and (A2) a ±12V/40W Switching Power Supply.

The power supply module provides the +32 VDC and the +12 VDC and -12 VDC to the power amplifier module assembly.

### 2.1.3 Front Panel Display Screens

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

## 2.2 System Operation

When the transmitter is in operate, as set by the menu screen located on the Control & Monitoring Module in the exciter/driver assembly. The IF Processor will be enabled, the mute indicator on the front panel will be extinguished. 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 green.

When the transmitter is in standby. The IF Processor will be disabled, the mute indicator on the front panel will be red. 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 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.

The transmitter can be controlled by the presence of a modulated input signal. If the input signal to the transmitter is lost, the transmitter will automatically cutback and the input fault indicator on the IF Processor module will light. When the video input signal returns, the transmitter will automatically return to full power and the input fault indicator will be extinguished.

### **2.2.1 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 +32 VDC section of the power supply is enabled but there is no RF output power from the transmitter. This condition is the result 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 the 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

- Modulator (if present) is in Aural/Visual Mute

#### **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 using various means. 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.

### Operating Frequency

The LX Series transmitter controller is designed to operate on UHF and VHF frequencies. The exact output frequency of the transmitter can be set to one of the standard UHF frequencies, or it can be set to a custom frequency using software set-up menus. 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 have frequency dependency,

therefore detectors of power amplifiers are calibrated at their frequency of use. The detectors for System RF monitoring are also calibrated at the desired frequency of use.

### 2.3 Customer Remote Connections

The remote monitoring and operation of the transmitter is provided through terminal blocks TB30 and TB31 located on the rear of the chassis assembly. If remote connections are made to the transmitter, they must be made through terminal blocks TB30 and TB31 at the positions noted on the transmitter interconnect drawing and Table 2-5.

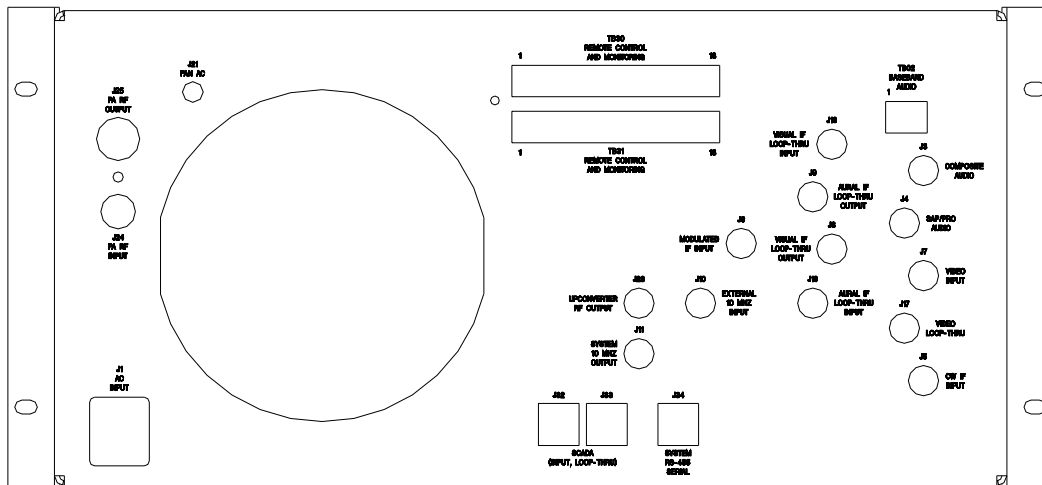


Table 2-5: LX Series Chassis Assembly Hard Wired Remote Interface Connections to TB30 or TB31, 18 pos. Terminal Blocks Located on the Rear of the Assembly

Signal Name	Pin Designations	Signal Type/Description
RMT Transmitter State	TB30-1	Discrete Open Collector Output - A low indicates that the transmitter is in the operate mode.
RMT Transmitter Interlock	TB30-2	Discrete Open Collector Output - A low indicated the transmitter is OK or completes an 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 k $\Omega$ 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 AUX IO 2	TB30-5	
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 Visual/Forward Power	TB30-11	Analog Output - 0 to 4.0 V- This is a buffered loop through of the calibrated "System Visual/Avg. Power ". Indicates the transmitter's Visual / Average power. Scale factor is 100%/3.2V.
RMT System Aural Power	TB30-12	Analog Output - 0 to 4.0 V- This is a buffered loop through of the calibrated "System Aural Power ". Indicates the transmitter's forward Aural output power. The 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.
System Reflect Power	TB31-13	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.
System Visual / Forward Power	TB31-14	Analog Input - 0 to 1.00 V- This is the input of the "System Visual / Forward Power " indicating the transmitter's forward Visual / Forward output power. The scale factor is 100%/0.80V.
System Aural Power	TB31-15	Analog Input - 0 to 1.00 V- This is the input of the "System Aural Power " indicating the transmitter's forward Aural output power. The scale factor is 100%/0.80V.
IF Processor IF Signal Select	TB31-3	Discrete Open Collector Input - A low indicates that the modulator IF source is to be used by the IF Processor module. When floating an analog IP Processor module may use the Modulated IF Input if the IF Processor sled is so configured.

Signal Name	Pin Designations	Signal Type/Description
IF Processor DLC Voltage	TB31-4	Analog Output - 0 to 5.00 V- This is the input of IF Processor module for digital system RF output power control.
UC AGC #2 Voltage	TB31-5	Auxiliary Analog Input - 0 to 1V- This voltage is used by the Upconverter for gain control. Linear signal with display resolution of 0.01 %. Primary signal source is J34-1.
RMT Ground	TB30-15, and 17	Ground pins available through Remote
RMT Ground	TB31-1, 2, 6 to 12, and 17	Ground pins available through Remote
RMT +12 VDC	TB30-16 TB31-16	+12 VDC available through Remote w/ 2 Amp re-settable fuse
RMT -12 VDC	TB30-18 TB31-18	-12 VDC available through Remote w/ 2 Amp re-settable fuse