8. OPERATIONAL DESCRIPTION - MODEL Axcera-6U4AD

8.1 General Description

The 6U4AD is a complete 5000-watt UHF solid-state, digital television transmitter. It operates at a nominal output power of 5000 watts average.

8.2 Technical Specifications

Type of Emission 6M00K1D

Frequency Range .... 722 MHz to 728 MHz

Output Power........ 5000 watts average

8.3 Performance Specifications

Operating Frequency Range .... 722 MHz to 728 MHz

RF output - Nominal:
- Power .... 5000 watts average
- Impedance .... 50 ohms
- Connector ....1-5/8" EIA

Regulation of Output 3%
Signal-to-Noise Ratio (SNR) .... 30 dB or better
Carrier Frequency Stability .... ±1000 Hz

Data Interface:
Input Rate........ 19.39 Mbps, 6 MHz Channel
Input Interface........ SMPTE 310M (ASI optional)

<u>Electrical Requirements</u>

Power Line Voltage ....358-528 volts, 3 Phase, 50/60 Hz
Power Consumption........ 25,000 watts

<u>Environmental</u>

Maximum Altitude .... 8,500 feet
Operational Temperature Range .... 0°C to +50°C

Mechanical

Dimensions:
- Width .... 24.00”
- Height .... 79.00”
- Depth .... 50.00”
- Weight... 940 lbs

8.4. System Overview

The 6U4AD is made up of the trays/assemblies listed in Table 8-1.

Table 8-1. 6U4AD Major Trays and Assemblies

MAJOR ASSEMBLY DESIGNATOR	TRAY/ASSEMBLY NAME
A1	Axciter Digital Modulator
A2	Exciter/Driver Tray
A3	Power Amplifier Tray
A4	Power Amplifier Tray
A5	Power Amplifier Tray
A6	Power Amplifier Tray
A7	Power Supply
A8	Power Supply

8.4.1 Axciter Digital Modulator

The Axciter 8-VSB modulator accepts an ASTC transport stream in SMPTE 310 Format input and outputs an 8-VSB IF signal centered at 44 MHz.

The 44 MHz IF signal is upconverted to the desired channel by the upconverter located in the upconverter tray or, in a sled-based system, as an upconverter sled mounted in the driver/amplifier chassis assembly.

The signal generation function of the Axciter is also referred to as the “forward signal path” in this manual. There is also a “reverse signal path” that is used for automatic adaptive equalization.

Two transmitter output samples are taken from directional couplers located before and after the channel mask filter and are applied to the upconverter tray or the external Relay. The upconverter tray also contains a downconverter that converts the RF sample to an IF output. In a sled-based system, the downconverter sled is mounted in the driver/amplifier chassis assembly.

The downconverted IF transmitter sample is digitized by the Axciter modulator. It is then 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.

8.4.2 Exciter/Driver Tray

The Transmitter Driver provides an On Channel output signal at 1800 Watts.

8.4.2.1 Frequency Agile Upconverter Board (1309695)

The board takes a 44 MHz or 36 MHz IF signal and converts it to a TV channel in the range of 54-860 MHz. The IF input signal, (≈-8dBm level), is connected to J6 on the board. The IF first passes through a frequency response pre-corrector, consisting of R145, C188, R 146 and C189. The pre-corrector circuit compensates for any response variation in the ceramic filter used to pick the appropriate conversion sideband. The pre-corrected signal is then converted to a second IF centered at 1044 MHz using U16, U18 and associated components. The signal is next applied to a second mixer, U15, where it is converted to the final RF channel frequency. The signal is then sent to a low pass filter that removes unwanted conversion products above 1 GHz, amplified by U21 passed to another low pass filter that removes unwanted conversion products above 1 GHz, amplified by U20 and connected to J7 the RF output jack for the board (≈-3dBm level).

The upconverter has two local oscillators, LO1 and LO2. The LO1 oscillator consists of U1, U2, U5, U6 and amplifiers U3 and U4. The LO1 oscillator operates at 1 GHz for 44 MHz IF inputs and is used to convert the signal to 1044 MHz. In 36 MHz IF systems, this oscillator circuit operates at 1.008 GHz. The Red LED DS4 will light if the PLL for the LO1 oscillator is not locked.

The second LO, LO2, consists of two VCOs, U26 and U31, that are used to generate the second LO. One VCO operates from 1.1-1.5 GHz and the second from 1.5-1.9 GHz. The Red LED DS2 will light if the PLL for the LO2 oscillator is not locked.

Both of the LOs, LO1 and LO2, are locked to an on board 10 MHz VCXO. The 10 MHz VCXO circuit consists of U36, U39, the VCTCXO Y1 and associated components. When an external 10 MHz signal is applied to J10 on the board, the internal VCXO is locked to the external 10 MHz, otherwise, it is free-running. The Red LED DS6 will light if an

8.4.2.2 Downconverter Board (1311103)

A sample of the transmitter's RF output is applied to J6 on the downconverter board at an input level of –10 to +10 dBm. The signal is fed through a matching network and connected to the pin diode attenuator circuit consisting of DS1, DS2 and associated circuitry which allows the operator to adjust the gain of the downconversion path using R1. The RF is then amplified by U2 and converted to the first conversion IF of 1044 MHz by the mixer U4 and the filter IC U5. Also connected to the U4 mixer is the variable LO, 1.5 to 1.9 GHz for UHF, which is generated on the external frequency agile upconverter board that mixes with the output RF frequency to produce the 1044 MHz first conversion IF output at J9, typically -25 dBm.

A 1 GHz LO1 signal, typically -15 dBm, which is generated externally on the Frequency Agile Upconverter Board is connected to the downconverter board at J12. The 1 GHz LO is amplified by U9 and applied to a high pass filter, amplified by J10 and connected to a low pass filter. The filters are designed to eliminate any other interfering signals that might be coupled into the 1 GHz LO. The LO1 is split with one part connected to the LO input on the U11 mixer. The other part of the LO1 signal is connected to the LO1 sample jack J13. Also connected to the U11 mixer is the first conversion IF of 1044 MHz. The output of the U11 mixer is the 44 MHz second IF signal. This 44 MHz second IF signal is then applied to a low pass filter to remove any out of band energy, amplified by U12 and U15 and connected to a frequency response correction circuit intended to compensate for any linear distortions in the downconversion path. Adjustments R50-R52 and C79-C81 are used to control the frequency response of the downconverter. The resulting signal is then amplified by U14 and applied to a cascaded high pass low pass filter, which removes any out of band products that are generated in the demodulation process. The filtered output is connected through U16 a coupler to J15 the IF output jack of the board. Typical level is -6 dBm. The coupler provides a sample that is split. One sample output, -20 dBm, is connected to J16 the output sample Jack of the board. The other sample output connects to a detector IC U17 that provides a detected output level that is used in the Mute circuitry of the tray.

8.4.2.3 Button Board (1311306)

The Button Board provides the front panel accessed push button switch which is illuminated by multicolored LEDs. The switch lit Blue indicates normal operation. When the switch is lit Red, it indicates a malfunction has occurred. Pushing the button will cause the front panel LCD on the system controller tray to display the operating parameters of the selected power controller and/or the malfunction which has occurred.

8.4.2.4 Pre-Driver Amplifier Board, Exciter, 6X (1313190)

The Pre-Driver Amplifier Board provides up to 22 dB of gain. The RF output of the upconverter board, ≈-3dBm in level, connects to J1 the RF input jack on the pre-driver board. The RF is connected to DS1 and DS2 and associated components which make up a pin diode attenuator circuit that controls the output level of the board. A gain adjust voltage, from the Exciter Controller Board, connects though L3 to the pin diodes and increases or decreases the level through the circuit and therefore the output drive level of the exciter, upconverter, driver tray. The output of the pin diode level control circuit is amplified by U3 and connected to the IC U2 which is a 1 Watt driver amplifier with approximately 17 dB of gain. The amplified output of U2 is connected through a directional coupler IC U5 to the RF output jack J2 of the board. The RF output, ≈19 dBm maximum, is cabled to the RF output jack, J2, mounted on the rear panel of the exciter, upconverter, driver tray. A sample of the RF from the coupler connects to U6 that generates a DC output level based on the RF level, which is amplified by the IC U1B and fed, output level, to the Exciter Controller Board, for metering and level control.

8.4.3 Power Controller/AC Distribution Assembly, Boards

8.4.3.1 Button Board (1311306)

The Button Board provides the front panel accessed push button switch which is illuminated by multicolored LEDs. The switch lit Blue indicates normal operation. When lit Red, indicates a malfunction has occurred. Pushing the button will cause the front panel LCD on the system controller tray to display the operating parameters of the selected power controller and/or the malfunction which has occurred.

8.4.3.2 Power Supply Line Monitoring Board (1311312)

The power supply line monitor board monitors the voltage and current on each of the incoming three phase AC lines from the input power connection. The measured values are connected the power supply control board. The power supply line monitoring board also has a 600V solid state relay mounted on it that drives the coil of the power contactors.

8.4.3.3 Power Supply Control Board (1312059)

The power supply control board is mounted behind the front panel of the power controller/AC distribution assembly. The power supply control board monitors signals that deal with the transmitter's power circuitry. The three incoming AC lines voltage and current are monitored along with signals that pertain to the power supplies. The power contactors are controlled from this board. The board contains a local 5 VDC power supply that powers the logic contained on the board.

8.4.4: Power Amplifier Tray, Boards

8.4.4.1 Fan Power Supply Board (1312004)

The Fan Power Supply Board contains three power supplies, two identical +12 VDC fan power supplies and a +32 VDC pre driver power supply. All three of the power supplies are current mode flyback topology DC-DC type. The power supplies are all short circuit protected. The fan power supply board is connected to the main +42V Buss rail through a 3 Amp fuse. This fuse protected +42 VDC is also wired to the Phase/Gain Board. There are clips containing two "spare" 30 Amp fuses located on the Fan Power Supply Board which can be used to replace the fuses to the amplifier pallets, if needed.

+5 VDC from the phase/gain board connects to the fan power supply board at J9-2. The +5 VDC is connected to a 3.3V regulator IC U11 that takes the +5V input and generates the regulated +3.3VDC labeled +3.3V that connects to rest of the board. The Green LED DS1 is lit if the +3.3VDC is present on the board. The +5 VDC is split on the board and connected out of the board at J6-3, which is cabled to the bottom combiner board, at J5-3, which is cabled to the front panel button board, and at J7-3, which is cabled to the bottom splitter board.

The board contains two PIC microprocessors, PIC 1, U7, for Fan 1 and temperature and PIC 2, U9, for Fan 2 and the +32 VDC pre driver power supply, which monitor the power supplies and communicate with the tray on Serial Data Line connections at

J5-2, J6-2, J7-2 and J9-1. The system controller for the transmitter monitors these samples and determines if a power supply needs to be shut down. J8 is a programming port which is initially used to program the U7 microcontroller and is not used by the customer. J10 is the programming port which is initially used to program the U9 microcontroller and is not used by the customer.

The fan power supply that uses the T1 transformer takes the +42 VDC input and produces the +12 VDC output, which connects to the (A20) F1 Fan through Jack J1-2 & 1. The Fan 1 voltage, current and spin rate (Tach) are sampled and connected to the PIC 1 microcontroller.

The fan power supply using the T2 transformer takes the +42 VDC input and produces the +12 VDC output, that connects to the (A21) F2 Fan through Jack J3-2 & 1. The Fan 2 voltage, current and spin rate (Tach) are sampled and connected to the PIC 2 microcontroller.

The pre driver power supply, that uses the T3 transformer, takes the +42 VDC and produces the +32VDC needed to power the pre driver (Q6) that is located on the Phase/Gain Board. The +32 VDC pre driver power supply voltage is sampled and connected to the PIC 2 microcontroller.

R108 is a thermistor mounted on the fan power supply board, which generates a voltage reference of the temperature of the board that is connected to the PIC 1 U7 microcontroller. The microcontroller takes this input and the Fan 1 information and supplies a serial data output that is buffered by U8 before it is wired to the Serial Data Line connections at J5-2, J6-2, J7-2 and J9-1.

8.4.4.2 Front Panel Smart Button Board (1310349)

The Button Board provides the front panel accessed push button switch which is illuminated by multicolored LEDs. The switch lit Blue indicates normal operation. When lit Red, indicates a malfunction has occurred. Pushing the button will cause the front panel LCD on the system controller tray to display the operating parameters of the selected power controller and/or the malfunction which has occurred. J3 is the programming port which is used to initially program the microcontroller and is not used by the customer.

8.4.4.3 Phase/Gain Board (1312011)

This board performs a variety of functions. It amplifies the incoming RF signal to the amplifier tray, ≈15mW ATSC, to the level at the output of the board, ≈.6W ATSC, which can drive the output stage of the tray to full power. It adjusts the phase shift through the board so that parallel amplifiers combine correctly. The board also contains protection circuitry to quickly mute RF drive in the event of an overdrive or reflected power fault. It contains circuitry that controls and monitors the amplifier tray. Finally, it contains DC/DC converters that generate various needed power supply voltages for the board.

The RF input to the board at J3-A1, RF_RFIN, ≈15mW ATSC, is connected to the directional coupler U20 which provides a sample of the signal. This sample is used to drive the log amp detector U39 which measures the input level to the board. The main RF signal, RF_U6, is then applied to a PIN diode attenuator consisting of CR9, CR10, CR40, CR41 and U6. This attenuator is used to set the overall output level of the tray. Increasing the voltage at TP2 will increase the gain of the tray.

The output of the PIN attenuator drives a high speed PIN switch consisting of CR7, CR8 and associated components. This switch is used to remove RF drive quickly in the event of a fault. The switch can be controlled by three separate sources, the overdrive protection circuitry, the reflected power protection circuitry, and the Rabbit microcontroller that is controlling and monitoring the amplifier tray. The overdrive protection and reflected power protection circuitry are extremely fast, and will remove the RF drive in a few hundred nanoseconds. Removing the RF drive will also remove the faults, so the output of the comparators U25 and U26 that generate these faults drive a flip flop U41, which latches the faults so the Rabbit microcontroller is able to see them. Once the faults are recorded the Flip Flops are reset and the drive is re-applied.

The output of the PIN switch drives three cascaded phase shifters consisting of U21, U22 and U23 and their associated components. These three phase shifters each have a range of about 135°, giving an overall adjustment range in excess of 360°, allowing the amplifier to adjust the output phase of the tray to any required value. The output of the phase shifters, RF_A, is applied to a MMIC U4 that amplifies the RF signal to overcome any loss which occurred in the previous stages. The output of the MMIC drives an LDMOS amplifier, Q6, which amplifies the RF output signal to an approximate level of 1W average power for ATSC that is applied to the Directional Coupler U31. +32 VDC needed to operate Q6 is generated by the Fan Power Supply Board. The coupler provides a signal to the detector IC U44 which measures the instantaneous output power of the signal. This detected level is used to drive the overdrive detector, U25. This signal, ODVR_LVL, is not filtered so that the protection circuitry can react quickly. The detected level is also applied to a low pass filter consisting of R175 and C145 whose output is used for metering, RF OUT LVL.

The board has mounting, RB1, for a daughter board that contains a Rabbit microcontroller. This microcontroller communicates with the outside world via an Ethernet connection, and also communicates with the other microcontrollers located in the amplifier tray using a one wire serial bus.

The various analog parameters of the board are sampled via U45 which feeds the detected levels of each of its inputs back to the Rabbit. U45 also controls an external multiplexer U54, which extends the number of inputs that can be sampled. The Rabbit also controls the settings of the digital potentiometers U33-U35. These potentiometers generate voltages used to set the Phase, U33, the Gain, U34, and the Overdrive Fault, U35, thresholds for the amplifier tray. There is a fourth digital pot U36 which is not used in this configuration. The U63 microcontroller, U64 buffer amplifier and the J5 programming port are not used in this configuration.

+32 VDC and +42 VDC needed to operate the board is supplied from the Fan Power Supply Board. The +32 VDC connects through J3-2 and the +42 VDC connects through J3-3. There are three power supplies on the board which are current mode flyback topology DC-DC types that use the +42 VDC as the input voltage. The power supply using the T1 transformer produces the +5VDC labeled +5VR for use by the rest of the board. The power supply using the T2 transformer produces the +12VDC labeled +12V for the rest of the board. The power supply using the T3 transformer produces the +5VDC labeled +5V to the rest of the board. There is also a 3.3V regulator IC U52 that takes the +5V input and generates the regulated +3.3VDC labeled +3.3V that connects to rest of the board. The Green LED DS2 is lit if the +3.3VDC is present on the board. A sample of the +5VDC generated on the board connects out of the board at J3-4 and is cabled to the fan power supply board for use on that board.

8.4.4.4 Interface Board (1312562)

The RF output of the phase/gain board connects to the SMB connector J1 on the interface board. The RF is fed though solder track to J4 the output pad on the board. A wire jumper is soldered from the J4 pad to the J1 input pad, (≈.6Watts ATSC), on the driver pallet assembly. A wire jumper is soldered from the J3 pad to the J3 Data pad on the driver pallet assembly. A wire jumper is soldered from the J5 pad to the J5 Slot location pad on the driver pallet assembly.

Refer to section 4.3.7 for the description of the (A7) 878 Driver Amplifier Pallet.

8.4.4.5 4 Way Splitter Board, Top (1312033)

The Top 4 way splitter board takes the RF from the 878 Amplifier Pallet driver at J1 (≈45Watts ATSC) on the board and connects it to a coupler U2. One output of the coupler is fed to a two way splitter. The other output of the coupler is wired to a Log Amplifier IC U5 which produces a voltage reference of the RF input level to the top splitter board, which connects to the U4 microcontroller. R15 is a thermistor mounted on the heat sink for the splitter, which generates a voltage reference of the temperature of the heat sink that is connected to the U4 microcontroller. The microcontroller takes the inputs and supplies a serial data output that is buffered by U3 before it is wired to the Serial Data Line connections at J6-2 and J7-2. Serial Data is also connected to the amplifier pallets through Jacks J9 to amplifier pallet 1, J10 to amplifier pallet 2, J11 to amplifier pallet 3, and J12 to amplifier pallet 4. J15 is the programming port which is initially used to program the U4 microcontroller and is not used by the customer.

One output of the two way splitter connects to the output jack J8 which is cabled to the input of the bottom 4 Way splitter. The other output of the two way splitter is connected to a four way splitter. The four equal outputs (≈4.5 Watts) connect at J2 to amplifier pallet 1, J3 to amplifier pallet 2, J4 to amplifier pallet 3, and J5 to amplifier pallet 4.

The final amplifier Pallet Slot location identification is achieved using the resistor, each one a different value, connected to J16 for pallet 1, J17 for pallet 2, J18 for pallet 3, and J19 for pallet 4.

+5 VDC is supplied to the top splitter board thru J6-3 & 1 from the bottom splitter board. The +5 VDC connects to U5 on the board and to the 3.3V regulator IC U6. The regulator IC takes the +5 VDC input and generates the regulated +3.3VDC that is used by the ICs U3 and U4. The Green LED DS1 is lit if the +3.3VDC is present on the board.

8.4.4.6 4 Way Splitter Board, Bottom (1310448)

The Bottom 4 way splitter board takes the RF from the top 4 way splitter board at J1 (≈45Watts ATSC) on the board and connects it to a four way splitter. The four equal outputs (≈4.5 Watts) of the splitter connect at J2 to amplifier pallet 5, J3 to amplifier pallet 6, J4 to amplifier pallet 7, and J5 to amplifier pallet 8.

R15 is a thermistor mounted on the heat sink for the splitter, which generates a voltage reference of the temperature of the heat sink that is connected to the U4 microcontroller. The microcontroller takes this input and supplies a serial data output that is buffered by U3 before it is wired to the Serial Data Line connections at J6-2 and J7-2. Serial Data is also connected to the amplifier pallets through Jacks J9 to amplifier pallet 5, J10 to amplifier pallet 6, J11 to amplifier pallet 7, and J12 to amplifier pallet 8. J15 is the programming port which is initially used to program the U4 microcontroller and is not used by the customer.

The final amplifier Pallet Slot location identification is achieved using the resistor, each one a different value, connected to J16 for the amplifier pallet 5, J17 for the amplifier pallet 6, J18 for the amplifier pallet 7, and J19 for the amplifier pallet 8.

+5 VDC is supplied to the bottom splitter board thru J7-3 & 1 from the Fan Power Supply Board. The +5 VDC connects through rectifier diodes CR2 and CR3 which drop the voltage to +3.3 VDC whose output level is maintained by C7. The +3.3VDC is used by the ICs U3 and U4. The Green LED DS1 is lit if the +3.3VDC is present on the board.

8.4.4.7 878 Amplifier Pallets, Digital Bias (1310321)

There are nine 878 Amplifier Pallets mounted in the amplifier tray. One is used as a driver (A7) and eight are final amplifier pallets (A9-A16). Each of the 878 pallets has approximately +17dB of gain for the UHF frequency range of 470 to 860 MHz. The pallets have dual parallel amplifier circuits, each using a BLF878 LDMOS RF power transistor, which operate Class AB. The driver pallet normally operates with an RF input of .6 Watts ATSC typically produces 30 Watts ATSC output. With an RF input of 4.5 Watts ATSC the output of the final amplifier pallet should be 225 Watts ATSC.

The paralleling network is achieved using an input hybrid splitter and an output hybrid combiner. The RF input is applied to the hybrid splitter that produces two outputs, one at 0° and one at -90°. Each output connects to identical amplifier circuits. Each signal is applied to a Balun assembly that produces two 180° out of phase outputs. The two outputs connect to a dual LDMOS transistor, configured in a push pull arrangement, with approximately 17 dB of gain. The amplified outputs of the transistors connect to a Balun assembly that combines the two 180° out of phase signals into a single output. The output connects to one input of a hybrid combiner circuit. The 0° and the -90° signals from the amplifier circuits are combined by the hybrid combiner circuit and connected to J2 the RF output jack on the board (≈+55 dBm).

U2 and U7 are digital to analog converter ICs that generate the bias voltage for each transistor. U1 and U5 are current sense ICs that monitor the current at the output of the Q1 and Q2 amplifiers and provide a sample to the U6 microcontroller. R24 is a thermistor mounted to the board, which generates a voltage reference of the temperature of the board that is connected to the U6 microcontroller. The microcontroller takes the parameter sample inputs and supplies a serial data output that is buffered by U8 before it is wired to the Serial Data Line connection at J3.

The final amplifier Pallet Slot location identification for the individual amplifier pallets is achieved by connecting the voltage at J5 to one of the resistors, each one a different value located on the top splitter board and the bottom splitter board. Four of the resistors are located on the top splitter board and four are located on the bottom splitter board.

The +42 VDC needed to operate the individual pallets is supplied from the Buss Bar Assembly thru 30 Amp fuses to the pallet at FC1. Filtering of the +42VDC is provided by the capacitor network consisting of C24, C30, C64, C75 and C76. There are clips containing two "spare" 30 Amp fuses located on the Fan Power Supply Board. The fuse protected and filtered +42 VDC is applied through the .002Ω resistors R32 and R33 and the output Balun assemblies to the drains of Q1 and Q2. The +42 VDC is also connected through the 12V Zener diode CR1 to the regulator IC U4 that supplies +3.3 VDC, which is used by the U2, U6 and U7 ICs on the pallet.

8.4.4.8 4 Way Combiner Board, Top (1310305)

The Top 4 way combiner board takes the four RF Inputs at J4, J5, J6 & J7 (≈225Watts ATSC) on the board and combines them into a single output (≈750Watts) at J2 on the board which is cabled to one input of the Power Combiner.

The microcontroller, U2 takes the parameter sample inputs and supplies a serial data output that is buffered by U1 before it is wired to the Serial Data Line connections at J11-2 and J19-2. The Serial Data Line connects to the system controller for the transmitter. U5 is not used in this configuration. R10 is a thermistor mounted to the board, which generates a voltage reference of the temperature of the board that is connected to the U2 microcontroller. The microcontroller generates a bit stream sample of the reflected threshold level system setting that connects to the digital to analog converter IC. The DAC IC generates a DC level that sets the reflected threshold, which connects to the reflected fault comparator IC U10. J8 is a programming port which is initially used to program the U2 microcontroller and is not used by the customer. J12 is a programming port which is initially used to program the U5 microcontroller and is not used by the customer.

The power detector portion of the board provides forward and reflected samples to the U2 microcontroller. A Forward Output Power Sample connects to the board at J15. The sample is split with one output connected to J8, the Forward Power Sample Jack, located on the front panel and the other output filtered and split again. One output of the splitter is connected to the detector IC U8, which produces an average forward power DC level that connects to the microcontroller U2. The other output of the splitter is connected to the detector IC U6, which produces an output that is fed to U7A and U7B and associated circuitry. This circuit generates a peak forward power DC level that connects to the microcontroller U2.

A Reflected Output Power Sample connects to the board at J17. The sample is filtered and connected to the detector IC U9, which produces a reflected power DC level that connects to the microcontroller U2. Another output of U9 is fed to a comparator IC U10 that generates a reflected fault output if the input reflected level exceeds the Fault threshold setting for the tray. The reflected fault output is wired to J18 that is cabled to the phase/gain board where it connects to the fault protection circuitry.

Four 50Ω/120W terminations are mounted on the top combiner board for amplifier pallets 1-4. The termination R34 connects at J14 to pallet 1, R15 at J9 to pallet 2, R23 at J10 to pallet 3 and R27 at J13 to pallet 4. The rest of the circuitry after the terminations on the schematic is not used in this configuration.

+5 VDC is supplied to the top combiner board thru J11-3 & 1 from the bottom combiner board. The regulator IC, U11, takes the +5 VDC input and generates the regulated +3.3VDC that is used by the ICs on the board. The Green LED DS1 is lit if the +3.3VDC is present on the board.

8.4.4.9 4 Way Combiner Board, Bottom (1310308)

The Bottom 4 way combiner board takes the four RF Inputs at J4 from pallet 5, J5 from pallet 6, J6 from pallet 7 and J7 from pallet 8 (≈225Watts ATSC) on the board and combines them into a single output (≈750Watts) at J2 on the board which is cabled to one input of the Power Combiner.

The microcontroller, U5 takes the parameter sample inputs and supplies a serial data output that is buffered by U4 before it is wired to the Serial Data Line connections at J11-2 and J15-2. The Serial Data Line connects to the system controller for the transmitter. R36 is a thermistor mounted to the board, which generates a voltage reference of the temperature of the board that is connected to the U5 microcontroller.

Four 50Ω/120W terminations are mounted on the bottom combiner board for amplifier pallets 5-8. The termination R27 connects at J13 to pallet 5, R23 at J10 to pallet 6, R15 at J9 to pallet 7 and R34 at J14 to pallet 8. The rest of the circuitry after the terminations on the schematic is not used in this configuration.

+5 VDC is supplied to the bottom combiner board thru J11-3 & 1 from the fan power supply board. The +5 VDC is split and one part connected to the top combiner board thru J15-2 & 1. The other +5 VDC connects through rectifier diodes CR5 and CR6 which drop the voltage to +3.3 VDC whose output level is maintained by C14. The +3.3VDC is used by the ICs U4 and U5. The Green LED DS1 is lit if the +3.3VDC is present on the board.

8.4.4.10 Power Combiner (1312281)

The Power Combiner takes the outputs of the top (≈750Watts ATSC) and bottom (≈750Watts ATSC) combiners and combines them to a single output (≈1.5 kW ATSC) which is the output of the power amplifier tray.