

THEORY OF OPERATION

A. INTRODUCTION

The DTXPRO-2.3KU transmitter was designed to meet or exceed all FCC applicable specifications for TV broadcast equipment. Special attention was given to the selection of sub-assemblies and components to achieve maximum reliability and minimum down time. The construction of the DTXPRO-2.3KU is BASIC and MODULAR with most components field replaceable. Special emphasis was placed on "KEEPING IT SIMPLE" and returning to more traditional transmitter layouts and instrumentation. Refer to the DTXPRO-2.3KU block diagram for an overview of the transmitter architecture. This will give the technician basic information needed to understand the operation of the transmitter and the function of each subassembly.

B. ACDIS4 AC & DC DISTRIBUTION

The ACDIS4 is the primary AC power inlet module. The DTXPRO-2.3KU transmitter was designed to accept 208 to 240 VAC Split Phase using a four (4) wire connection. The four wires are:

- 2 wires for 208 -240 VAC Split Phase L-L, 120 VAC L-N
- 1 wire for neutral connection
- 1 wire for safety ground connection

CAUTION: Connection to the AC Primary source must be made using all four wires listed above. Follow the wiring instruction given in TRANSMITTER INSTALLATION Section III.3. If not followed, severe damage to the transmitter and, or, electrical shock could result.

The ACDIS4 performs the following functions:

1. Provides a primary AC power breaker point to shutdown the transmitter
2. Provides 208-240 VAC power to each of the 2.2 KWDC power supplies with individual breaker points for added safety.
3. Provides 110 VAC circuits for Exciter, ADP500, and AUX Power where needed.
4. Analog metering is provided to monitor the Power Supply voltage and current being applied to the RF Amplifier stages.
5. Power supply current sharing test points are provided for checking current sharing between power supply modules.

V -- THEORY OF OPERATION (Continued)**C. PS12KW 12 KW POWER SUPPLY ASSEMBLY**

The DTXPRO-2.3KU transmitter is designed with over 12 kW of DC power. To achieve this level, the power supply in each transmitter rack is made up of six (6) AC2050 power modules mounted into two (2) main frame assemblies, AC2009, which is capable of managing each 2.2 kW modules.

The power modules are "HOT PLUGGABLE" and can be removed or installed without turning off the transmitter. Although the transmitter output power may need to be reduced to operate while the DC power level is reduced.

Each power supply module has OVER VOLTAGE, OVER CURRENT AND OVER TEMPERATURE protection as well as a fault signal in the event of a failure.

REFER TO MANUFACTURER'S MANUAL FOR THE RRSI SERIES POWER SUPPLY PROVIDED WITH THIS DTXPRO-2.3KU USER MANUAL.

D. ADP500 PERFORMANCE MONITOR

The ADP500 Performance Monitor and associated PAS6 provides the following functions:

1. Provides device current monitoring of all the pallets used in the six (6) PA1KU-50 power amplifier assemblies. The current levels can be read directly from the multi-meter on the front panel. Individual PA's and pallets are selectable on the ADP500 and the PA assemblies are selected using the PAS6. In normal operation, a PA FAULT is indicated when the LED goes from green to red. RED indicates that the current level is below 500 mA and a transistor device may have failed. To read the actual current, select the appropriate Power Amplifier (i.e.: PA1, PA2) using the PAS6 rotary switch. Then, using the rotary switch on the ADP500, rotate through the 5 PA positions to measure the drain current on each transistor device for the selected power amplifier module. The multi-meter will read the actual current.
2. A PA INHIBIT switch is provided for failure diagnostic purposes. When activated, this switch allows the technician to monitor the bias currents for each pallet. These readings were recorded at the factory and are found on the Transmitter Test Report, DC Test Report Section. This is the best way to troubleshoot possible transistor problems. When in the PA INHIBIT mode, the RF PWR OFF LED will change from green to red indicating that the "SHUTDOWN LINE" is at TTL 0 state and the output power has been reduced to near zero.
3. The PA designations on the ADP500 are PA5 (Driver Amp) then PA1 and PA2, indicating the devices on the left side DX500UA-50 Pallet. PA3 and PA4 indicate the current through the devices on the right side DX500UA-50 Pallet.

V -- THEORY OF OPERATION (Continued)

The rotary switch on the ADP1000 is the detail selector for the multi-meter. The various positions are defined as follows:

| | |
|---------------|---|
| PA5 | Reads PA Driver device currents as selected Typical reading in INHIBIT MODE 1.5 to 2.5 A. Typical reading in normal transmitter operation approximately 1 to 2 amps. |
| PA1 to 4 | Reads the individual drain currents on each device located on the pallets located on the left and right side of the Power Amp selected. Typical reading in normal transmitter operation is approximately 7 to 14 amps. |
| PA6 | Not used |
| PS VOLTS | Reads DC voltage applied to PA stages Typical reading for 50 VDC would be the center of the meter, in the green zone. |
| P FWRD | Not Used (See Exciter) |
| P RFLD | Not Used (See Exciter) |
| AUX 1 & AUX 2 | Not used in this configuration. |

E. DXDPRO-10U EXCITER

The heart of any TV Transmitter is the Exciter. This equipment receives the ASI (or SMPTE) digital stream from the source, changes the format to ATSC 8VSB and up converts the IF signal to the specific "on-channel" RF broadcast frequency.

The DXDPRO-10U provides adaptive linear and non-linear correction and consists of a ProTV core modulator assembly and a 15 VDC power supply. In addition, the DXDPRO-10U Exciter has an internal 10W driver, Automatic Level Control, Power Detector and Logical Measurement and Control.

The DXDPRO-10U has provision for accepting a pre mask filter RF monitoring sample and a post mask filter RF monitoring sample. These samples are used by the internal modulator assembly to make linear and non-linear corrections on-the-fly.

The DXDPRO-10U has provision for accepting a transmitter forward output power sample and reflected output power sample. These values can be read on the exciter front panel as a percent of specified operating power levels.

V -- THEORY OF OPERATION (Continued)

The DXDPRO-10U has a built-in ALC circuit. This circuit receives a sample of output transmitter power and automatically adjusts exciter output power to provide for consistent and constant power in the output.

Additional information on the functions and applications of the DXDPRO-10U Exciter can be found in the transmitter User Manual.

F. S6 6-WAY SPLITTER

The S6 6-Way Splitter receives the output from the DXDPRO-10U Modulator/Driver and splits it into 6 parts each in of phase. Each output is fed to each of the PA1KU-50 power amplifiers. The S6 splitter is a UHF splitter. This unit should not require servicing and if necessary any servicing should be done by the factory.

G. MFA2PU-50 POWER AMPLIFIER HOUSING MAINFRAME

The MFA2PU-50 is the main RF Power Amplifier housing which accommodates up to two (2) PA1KU-50 Amplifiers. The housing includes the following:

- 2 each 470 CFM cooling fans
- 2 each Air filter assemblies
- 2 each Front panel status PC boards
- 1 each Main chassis
- 2 each Mechanical slide assemblies
- 1 each 220 VAC Filtered inlet for operating the cooling fans

There are three (3) MFA2PU-50 mainframe assembly in the DTXPRO-2.3KU transmitter rack for six (6) each PA1KU-50 Power Amplifiers.

I. PA1KU-50 POWER AMPLIFIER

The PA1KU-50 is the main RF Power Amplifier Assembly used in the DTXPRO-2.3KU. Each amplifier assembly is made up of one (1) DX25A-50 driver amp pallet and two (2) DX500UA-50 power pallets operating in parallel. These amplifiers are operated in Class A/AB or sometimes referred to as "HARD AB". This refers to the bias levels to achieve best linearity.

Each PA1KU-50 amplifier assembly includes the following:

- 1 each DX25U-50 driver amp pallet
- 2 each DX500UA-50 power pallets

V -- THEORY OF OPERATION (Continued)

1 each Phase and gain matching circuit
1 each 2-Way in-phase splitter
1 each 2-Way in-phase combiner
1 each Circulator
1 each Power distribution module (1A0025)
2 each Thermal sensors
1 each Remote monitor port (DB9)
1 each Front panel status port (Molex)
1 each Filtered DC input port
1 each Type N Panel mounted RF Input port
1 each 7-16 DIN Panel mounted RF Output port

J. UC6KWN 6-WAY COMBINER

The UC6KWN is a 6-Way In-Phase Combiner. The cables from each PA1KU-50 assembly to each input port on the combiner must be exactly the same length. This combiner is a closed unit and generally does not require servicing.

K. DC5KC-1 DIRECTIONAL COUPLER

There are two (2) DC5KC-1 Directional Couplers provided with this transmitter. One directional coupler (DC) is placed before (pre) the mask filter and one is placed after (post) the mask filter.

1. The pre directional coupler has four monitor probes of which two are used by the transmitter. One probe monitors the forward power which is sent by RG-223 cable to the back of the modulator and used for non-linear correction. The other DC probe monitors the reflected transmitter power and is also sent to the back of the modulator by RG-223 cable. This provides a HIGH ANTENNA VSWR MONITOR in the event of an antenna or antenna transmission line failure. Should the reflected power exceed 25% the transmitter will shut down.
2. The post directional coupler also has four monitor probes of which two are used by the transmitter. One probe monitors forward power and is sent by RG-223 cable to the back of the modulator and used for linear correction. The other DC probe monitors the transmitter forward output power and is also sent to the back of the modulator by RG-223 cable. Monitors FORWARD POWER to the antenna and presents it as a percentage of power rating. The transmitter comes set to 25% Forward Power and the customers engineer turns the power up to 100% for 2.3 kW RMS transmitter output power after the mask filter.

V -- THEORY OF OPERATION (Continued)

The remaining spare DC probe positions are available for customer use.

L. BPUD2.5K6S158-J UHF ATSC COMPLIANT MASK FILTER

This mask filter was designed to meet FCC Certification requirements with minimum loss of RF Power. The BPUD2.5K6S158 comes tuned and tested to the operating frequency of the transmitter and should not be adjusted without proper equipment and experience. It is recommended that, should adjustment become necessary, the filter be returned to the factory.

M. BLP5KU-FF HARMONIC FILTER

Harmonic filters are used to reduce harmonic output signals from the transmitter. At least one harmonic filter is used in the output of all the Pineapple Technology UHF transmitters. In the case where the transmitter channel 2nd or 3rd harmonics could fall into the protected GPS band then three (3) harmonic filters are used in order to comply with FCC 74.794.