

THEORY OF OPERATION

A. INTRODUCTION

The DTXPRO-800U 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-800U 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-800VH 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. ACDIS1 AC & DC DISTRIBUTION

The ACDIS1 is the primary AC power inlet module. The DTXPRO-800U transmitter was designed to accept 208 to 240 VAC Single Phase using a four (4) wire connection. The four wires are:

- 2 wires for 208 -240 VAC Single Phase
- 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 ACDIS1 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 KWDC power supplies with individual breaker points for added safety.
3. Provides 110 VAC circuits for Exciter, ADP1000, and AUX Power where needed.
4. Analog metering is provided to monitor the Power Supply voltage and current being applied to the RF Amplifier states.
5. Power supply current sharing test points are provided for checking current sharing between power supply modules.

V -- THEORY OF OPERATION (Continued)**C. PS4KW 4 KW POWER SUPPLY ASSEMBLY**

The DTXPRO-800U transmitter is designed with over 4 kW of DC power. To achieve this level, the power supply in each transmitter rack is made up of two (2) AC2050 power modules mounted into one (1) main frame assembly, AC2009, which is capable of managing both 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 would need to be reduced below the level of power from one PS module. A third power supply module can be purchased for added redundancy.

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-800U USER MANUAL.

D. ADP1000 PERFORMANCE MONITOR

The ADP1000 Performance Monitor provides the following functions:

1. Provides device current monitoring of all the pallets used in the two (2) 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 ADP1000. 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 push button switch. Then, using the rotary switch on the ADP1000, 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 ADP1000 are PA5 (inhibited in this transmitter) 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. USH2C 2-WAY HYBRID SPLITTER

The USH2C 2-Way Hybrid Splitter receives the output from the DXDPRO-10U Modulator/Driver and splits it into 2 parts each 90 degrees out of phase. Each output is fed to each of the PA1KU-50 power amplifiers. The USH2C splitter is not a frequency sensitive assembly. It is a closed unit and cannot be opened for repair or maintenance.

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 is one (1) MFA2PU-50 mainframe assembly in the DTXPRO-800U transmitter rack for two (2) each PA1KU-50 Power Amplifiers.

I. PA1KU-50 POWER AMPLIFIER

The PA1KU-50 is the main RF Power Amplifier Assembly used in the DTXPRO-800U. 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)
- 3 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. UCH2KU PHASED 2-WAY HYBRID MULTICOUPLER

The UCH2KU is a 2-Way Hybrid Combiner. This combiner accepts the 90 degrees out of phase output power from each of the two (2) PA1KU-50 Power Amplifiers and combines them into an output power level slightly higher than the rated transmitter output power in order to compensate for the filter insertion loss. This is a closed unit and generally does not require servicing.

K. DC2KC-2 DIRECTIONAL COUPLER

There are two (2) DC2KC-2 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 800W 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. BPUD1K-1 UHF ATSC COMPLIANT MASK FILTER

This mask filter was designed to meet FCC Certification requirements with minimum loss of RF Power. The BPUD1K-1 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. BLP2KU-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.