

OPERATIONAL DESCRIPTION OF THE UTX2.5K ULTRA



V -- THEORY OF OPERATION (Page 1 of 5)

A. INTRODUCTION

The UTX2.5K ULTRA 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 UTX2.5K ULTRA 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.

This transmitter was designed for Analog (NTSC) transmission with provisions and options available to convert to Digital Service at a later date if necessary.

Refer to the UTX2.5K ULTRA block diagram in 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.

SEE SECTION VI.A FOR PARTS LIST AND BLOCK DIAGRAM.

B. ACDIS2 AC & DC DISTRIBUTION

The ACDIS2 is the primary AC power inlet module. The UTX2.5K ULTRA 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 -230 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 ACDIS2 performs the following functions:

1. Provides a primary AC power breaker point to shutdown the transmitter
2. Provides 208 VAC power to each of the 2 KW DC power supplies with individual breaker points for added safety.
3. Provides 110 VAC circuits for Modulator, ADP500, ABS (as necessary) 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.

SEE SECTION VI.B FOR SCHEMATIC AND PARTS LIST

C. AC2008 2KW POWER SUPPLY MODULE

The UTX2.5K ULTRA 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) TWR18004 (PTI Part # AC2008) power modules mounted into one (1) main frame assembly (PTI Part # AC2009) which are capable of managing three (3) 2 KW modules each.



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The power modules are "HOT PLUGGABLE" and can be removed or installed without turning off the transmitter.

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 MODEL # TWRI6004 PROVIDED WITH THE UTX2.5K ULTRA.

D. ADP500 AND PAS3 PERFORMANCE MONITOR

The ADP500 AND PAS3 Performance Monitor provides the following functions:

1. Monitors FORWARD AND REFLECTED POWER to the antenna and presents it as a percentage of power rating. The transmitter comes set to 100% P-Sync power based on the ratings of the transmitter.
2. Monitors Aural Power as a percentage of P-Sync rating (5% typical).
3. Provides a HIGH ANTENNA VSWR MONITOR in the event of an antenna or coax failure where the reflected power exceeds 25% the transmitter will shut down. The front panel LED will change from green to red in case of a fault.
4. Provides current monitoring of all the pallets used in the three (3) PA1K power amplifier assemblies. The current levels can be read directly from the multi-meter on the front panel. Individual pallets are selectable on the ADP500 and the PA assemblies are selected using the PAS3. In normal operation, a PA FAULT is indicated by going from green to red. RED indicates that the current level is below 500 ma and a transistor may have failed. To read the actual current, select the appropriate PA Bank using the PAS3. The ADP500 will display status of each pallet in that PA. The multi-meter will read the actual current.
5. 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.
6. An RF MONITOR port (BNC) is available to connect a spectrum analyzer for monitoring the output signal.
7. METER SELECTION SWITCHES

The PAS3 is used to select the appropriate PA module (PA1K) for performance display on the ADP500. PA designations are PA1 starting from the top row left (there is no PA located in the top row right position) with PA3 and 4 located on the bottom row left to right.

The rotary switch on the ADP500 is the detail selector for the multi-meter. The various positions are defined as follows:

PA1 thru PA5.....Reads PA Pallet currents as selected
Typical reading in INHIBIT MODE 1.5 to 2.5 A
Typical reading SMPTE BARS 5-7 A for PA1 thru PA4 with normal picture
Typical reading SMPTE BARS 2-3 A for PA5 with normal picture



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7. METER SELECTION SWITCHES (Continued)

| | |
|--------------------|---|
| PA6..... | No Connection |
| PS VOLTS..... | Reads DC voltage applied to PA stages Typical reading would be +29 to 33 VDC |
| P FWRD..... | Reads PA output power in P-Sync percentage of rating Full power reading would be 100% |
| P RFLD..... | Reads PA output power being returned from the load and displayed as a percentage of forward power. Typical reading would be < 5% indicated. |
| P AURAL..... | Reads the AURAL POWER component as a percentage of forward power. Typical reading would be 5% |
| AUX 1 & AUX 2..... | Not used in this configuration. |

REFER TO SECTION VI.H FOR SCHEMATICS AND PARTS LIST

E. RC8 REMOTE MONITOR AND CONTROL WITH ABS

This equipment is OPTIONAL and can be used to satisfy FCC remote control requirements.

The Remote Monitor is used to monitor the operational status of the transmitter and will allow the operator to turn RF on or off and adjust power levels remotely. The following items are monitored or controlled:

1. Transmitter on/off function
2. Power output level monitor and adjust
3. AC Line Voltage status - With ABS you can be notified if there is a power failure at the site.
4. Various other custom options are available. Specify these at the time the transmitter is purchased and they will be included if possible.

Remote monitoring requires a phone line connection. Information can be accessed via a PC Terminal.

The Auxiliary power unit requires a battery connection. A common car battery (12 VDC) can be used with a charger as an ABS. This will run the Monitor and provide access to transmitter status for several hours.

A manual for this equipment is provided by the Manufacturer and is included in the UTX2.5K ULTRA package shipped with the transmitter. The manual is only included if this option was purchased for delivery with the transmitter.

REFER TO INSTRUCTION MANUAL PROVIDED WITH THIS PACKAGE.



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7. METER SELECTION SWITCHES (Continued)

| | |
|--------------------|---|
| PA6..... | No Connection |
| PS VOLTS..... | Reads DC voltage applied to PA stages Typical reading would be +30 to 33 VDC |
| P FWRD..... | Reads PA output power in P-Sync percentage of rating Full power reading would be 100% |
| P RFLD..... | Reads PA output power being returned from the load and displayed as a percentage of forward power. Typical reading would be < 5% indicated. |
| P AURAL..... | Reads the AURAL POWER component as a percentage of forward power. Typical reading would be 5% |
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1. Transmitter on/off function
2. Power output level monitor and adjust
3. AC Line Voltage status - With ABS you can be notified if there is a power failure at the site.
4. Various other custom options are available. Specify these at the time the transmitter is purchased and they will be included if possible.

Remote monitoring requires a phone line connection. Information can be accessed via a PC Terminal or via an optional "VOICE COMMAND LINE".

The Auxiliary power unit requires a battery connection. A common car battery (12 VDC) can be used with a charger as an ABS. This will run the Monitor and provide access to transmitter status for several hours.

A manual for this equipment is provided by the Manufacturer and is included in the UTX3K ULTRA package shipped with the transmitter. The manual is only included if this option was purchased for delivery with the transmitter.

REFER TO INSTRUCTION MANUAL PROVIDED WITH THIS PACKAGE.



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F. MA5000 MODULATOR

The heart of any TV Transmitter is the MODULATOR. This equipment receives the video and audio signals as well as any control signals needed. The base band signals are converted to RF with an output on the desired operating channel.

Detail operation of the Modulator with schematics and parts list are provided by the equipment manufacturer and included in the UTX2.5K ULTRA package shipped with the transmitter.

REFER TO INSTRUCTION MANUAL PROVIDED WITH THIS PACKAGE.

G. UDR100AC 100 WATT DRIVER AMPLIFIER

The RF output from the MA1000 modulator is accepted by the UDR100AC DRIVER AMPLIFIER. This amplifier increases the drive level to that required for each of the PAK1 power amplifiers to make rated power. The UDR100AC is powered by 110 VAC.

H. US200-3 3-WAY SPLITTER

The US200-3 3-Way Splitter receives the output from the UDR100AC Driver Amplifier and splits it into 3 parts with phase and power levels equal. This unit is an isolated in-phase splitter and will provide some isolation in the event one PA fails.

SEE SECTION VI.F FOR PARTS LIST

I. MFA2PA POWER AMPLIFIER HOUSING

The MFA2PA is the main RF Power Amplifier housing which accommodates two (2) PA1K Amplifiers. The housing includes the following:

- 2 each 330 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 AC Filtered inlet for cooling fans

SEE SECTION VI.D FOR SCHEMATICS AND PARTS LIST

I-1. PA1K POWER AMPLIFIER

The PA1K is the main RF Power Amplifier Assembly used in the UTX2.5K ULTRA. Each amplifier assembly is made up of one (1) U250LD power pallet and two (2) U500LDA power pallets. 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.



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Each PA1K amplifier assembly includes the following:

- 1 each U250LD power pallets
- 2 each U500LDA power pallets
- 1 each Phase and gain matching circuit
- 1 each 2-Way gain & 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 DIN 7/16 Panel mounted RF Output port

SEE SECTION VI.E. FOR SCHEMATICS AND PARTS LIST

J. UC2KW3NDC COMBINER/ DIRECTIONAL COUPLER

The UC2KW3NDC is a 3-Way in-phase combiner. The combiner is specifically designed for the channel designated transmitter frequency. This is a closed unit and cannot be serviced.

SEE SECTION VI.G. FOR PARTS LIST

K. BPU3KW UHF BAND PASS FILTER

This Band Pass filter was designed to meet FCC Certification requirements with minimum loss of RF Power. The BPU3KW comes tuned and tested to the operating frequency of the transmitter and should no be adjusted without proper equipment. Replacement filters are available as P/N BPUKW UHF (+CHANNEL NUMBER).