User MANUAL
888-2715-001
Maxiva ULX ATSC Series
Digital Transmitter

Maxiva ULX ATSC Series
Digital Transmitter

T.M. No. 888-2715-001

February 19, 2010

Rev: **A**

Technical Assistance

Technical and troubleshooting assistance for HARRIS Transmission products is available from HARRIS Field Service (factory location: Quincy, Illinois, USA) during normal business hours (8:00 AM - 5:00 PM Central Time). Telephone ***+1-217-222-8200*** to contact the Field Service Department; FAX ***+1-217-221-7086***; or E-mail questions to ***tsupport@harris.com.***

Emergency service is available 24 hours a day, seven days a week, *by telephone only*.

On-line assistance, including technical manuals, white papers, software downloads, and service bulletins, is available at ***http://support.broadcast.harris.com/eservice_enu.***

Address written correspondence to Field Service Department, HARRIS Broadcast Communications Division, P.O. Box 4290, Quincy, Illinois 62305-4290, USA. For other global service contact information, please visit: ***http://www.broadcast.harris.com/contact***.

NOTE: For all service and parts correspondence, you will need to provide the Sales Order number, as well as the Serial Number for the transmitter or part in question. For future reference, record those numbers here: _____/_____

Please provide these numbers for any written request, or have these numbers ready in the event you choose to call regarding any Service, or Parts requests. For warranty claims it will be required, and for out of warranty products, this will help us to best identify what specific hardware was shipped.

Replaceable Parts Service

Replacement parts are available from HARRIS Service Parts Department from 7:00 AM to 11:00 PM Central Time, seven days a week. Telephone ***+1-217-222-8200*** or email ***servicepartsreq@harris.com*** to contact the Service Parts Department.

Emergency replacement parts are available *by telephone only*, 24 hours a day, seven days a week by calling +1-217-222-8200.

Unpacking

Carefully unpack the equipment and preform a visual inspection to determine if any apparent damage was incurred during shipment. Retain the shipping materials until it has been verified that all equipment has been received undamaged. Locate and retain all PACKING CHECK LISTs. Use the PACKING CHECK LIST to help locate and identify any components or assemblies which are removed for shipping and must be reinstalled. Also remove any shipping supports, straps, and packing materials prior to initial turn on.

Returns And Exchanges

No equipment can be returned unless written approval and a Return Authorization is received from HARRIS Broadcast Communications Division. Special shipping instructions and coding will be provided to assure proper handling. Complete details regarding circumstances and reasons for return are to be included in the request for return. Custom equipment or special order equipment is not returnable. In those instances where return or exchange of equipment is at the request of the customer, or convenience of the customer, a restocking fee will be charged. All returns will be sent freight prepaid and properly insured by the customer. When communicating with HARRIS Broadcast Communications Division, specify the HARRIS Order Number or Invoice Number.

Manual Revision History

Maxiva ULX ATSC Series Digital Transmitter User Manual

REV.	DATE	ECN	Pages Affected
A	FEB 2010	-	Created

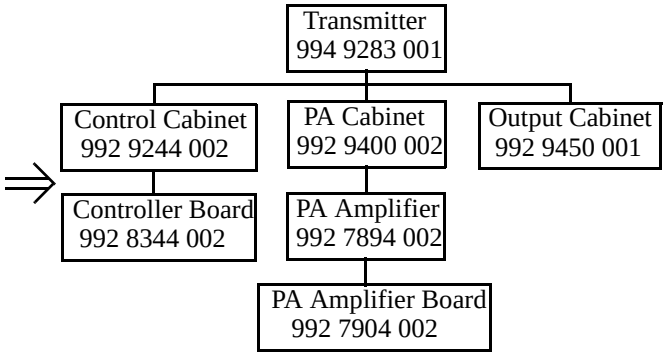
WARNING: Disconnect primary power prior to servicing.

Guide to Using Harris Parts List Information

The Harris Replaceable Parts List Index portrays a tree structure with the major items being leftmost in the index. The example below shows the Transmitter as the highest item in the tree structure. If you were to look at the bill of materials table for the Transmitter you would find the Control Cabinet, the PA Cabinet, and the Output Cabinet. In the Replaceable Parts List Index the Control Cabinet, PA Cabinet, and Output Cabinet show up one indentation level below the Transmitter and implies that they are used in the Transmitter. The Controller Board is indented one level below the Control Cabinet so it will show up in the bill of material for the Control Cabinet. The tree structure of this same index is shown to the right of the table and shows indentation level versus tree structure level.

Example of Replaceable Parts List Index and equivalent tree structure:

Replaceable Parts List Index	Part Number	Page
Table 7-1. Transmitter	994 9283 001	7-2
Table 7-2. Control Cabinet	992 9244 002	7-3
Table 7-3. Controller Board	992 8344 002	7-6
Table 7-4. PA Cabinet	992 9400 002	7-7
Table 7-5. PA Amplifier	994 7894 002	7-9
Table 7-6. PA Amplifier Board	992 7904 002	7-10
Table 7-7. Output Cabinet	992 9450 001	7-12



The part number of the item is shown to the right of the description as is the page in the manual where the bill for that part number starts. Inside the actual tables, four main headings are used:

- Table #-#. ITEM NAME - HARRIS PART NUMBER - this line gives the information that corresponds to the Replaceable Parts List Index entry;
- HARRIS P/N column gives the ten digit Harris part number (usually in ascending order);
- DESCRIPTION column gives a 25 character or less description of the part number;
- REF. SYMBOLS/EXPLANATIONS column 1) gives the reference designators for the item (i.e., C001, R102, etc.) that corresponds to the number found in the schematics (C001 in a bill of material is equivalent to C1 on the schematic) or 2) gives added information or further explanation (i.e., “Used for 208V operation only,” or “Used for HT 10LS only,” etc.).

NOTE: Inside the individual tables some standard conventions are used:

- A # symbol in front of a component such as #C001 under the REF. SYMBOLS/EXPLANATIONS column means that this item is used on or with C001 and is not the actual part number for C001.
- In the ten digit part numbers, if the last three numbers are 000, the item is a part that Harris has purchased and has not manufactured or modified. If the last three numbers are other than 000, the item is either manufactured by Harris or is purchased from a vendor and modified for use in the Harris product.
- The first three digits of the ten digit part number tell which family the part number belongs to - for example, all electrolytic (can) capacitors will be in the same family (524 xxxx 000). If an electrolytic (can) capacitor is found to have a 9xx xxxx xxx part number (a number outside of the normal family of numbers), it has probably been modified in some manner at the Harris factory and will therefore show up farther down into the individual parts list (because each table is normally sorted in ascending order). Most Harris made or modified assemblies will have 9xx xxxx xxx numbers associated with them.

The term “SEE HIGHER LEVEL BILL” in the description column implies that the reference designated part number will show up in a bill that is higher in the tree structure. This is often the case for components that may be frequency determinant or voltage determinant and are called out in a higher level bill structure that is more customer dependent than the bill at a lower level.

HARRIS Broadcast Systems Division
P.O. Box 4290, QUINCY, IL 62305

PARTS ORDER FORM

HARRIS PHONE: 217-222-8200
HARRIS FAX: 217-221-7096

BILLING INFORMATION

CUSTOMER NAME: _____

ADDRESS: _____

_____

_____

_____

TELEPHONE NUMBER: _____

FAX NUMBER: _____

PREFERRED PAYMENT METHOD: _____

SHIPPING INFORMATION

SHIP TO: _____
(if different from billing information)

ADDRESS: _____

_____

_____

_____

TELEPHONE NUMBER: _____

FAX NUMBER: _____

SHIPPING METHOD PREFERRED: _____

FREQUENCY (If required): _____

EQUIPMENT NAME: _____

EQUIPMENT PART NUMBER: _____

EQUIPMENT SERIAL NUMBER: _____

GUIDE FOR ORDERING PARTS

Please use the following parts order form, filling is as much information as possible. The complete informaiton will allow double checking the part number for correctness or locating a substitude if the part is not available.
The equipment name, part number, and serial number will be found on the metal ID plate on the back of the unit. The serial number MUST be included for any parts ordered under warranty.
Describe the part using the description in the parts list if possible. Include the schematic information, schematic number, or number of next higher assembly. The next higher assembly is usually a 992-xxxx-00x type.

ITEM #	QTY ORD	HARRIS PART NUMBER	DESCRIPTION OF PART (PART'S NAME, DESCRIPTION, SPECIFICATION FROM PARTS LIST IF AVAILABLE)	SCHEMATIC REFERENCE REFERENCE NAME (e.g. C001, R100, etc)	ITEM USED ON (NEXT HIGHER ASSEMBLY IF KNOWN) (e.g. C001 used on 992 8025 001, SCHEMATIC 839 8099 991)	COMMENTS

WARNING:
TTHE CURRENTS AND VOLTAGES IN THIS EQUIPMENT ARE DANGEROUS. PERSONNEL MUST AT ALL TIMES OBSERVE SAFETY WARNINGS, INSTRUCTIONS AND REGULATIONS.

This manual is intended as a general guide for trained and qualified personnel who are aware of the dangers inherent in handling potentially hazardous electrical/electronic circuits. It is not intended to contain a complete statement of all safety precautions which should be observed by personnel in using this or other electronic equipment.

The installation, operation, maintenance and service of this equipment involves risks both to personnel and equipment, and must be performed only by qualified personnel exercising due care. HARRIS CORPORATION shall not be responsible for injury or damage resulting from improper procedures or from the use of improperly trained or inexperienced personnel performing such tasks. During installation and operation of this equipment, local building codes and fire protection standards must be observed.

The following National Fire Protection Association (NFPA) standards are recommended as reference:

- Automatic Fire Detectors, No. 72E
- Installation, Maintenance, and Use of Portable Fire Extinguishers, No. 10
- Halogenated Fire Extinguishing Agent Systems, No. 12A

WARNING:
ALWAYS DISCONNECT POWER BEFORE OPENING COVERS, DOORS, ENCLOSURES, GATES, PANELS OR SHIELDS. ALWAYS USE GROUNDING STICKS AND SHORT OUT HIGH VOLTAGE POINTS BEFORE SERVICING. NEVER MAKE INTERNAL ADJUSTMENTS, PERFORM MAINTENANCE OR SERVICE WHEN ALONE OR WHEN FATIGUED.

Do not remove, short-circuit or tamper with interlock switches on access covers, doors, enclosures, gates, panels or shields. Keep away from live circuits, know your equipment and don’t take chances.

WARNING:
IN CASE OF EMERGENCY ENSURE THAT POWER HAS BEEN DISCONNECTED.

WARNING:
IF OIL FILLED OR ELECTROLYTIC CAPACITORS ARE UTILIZED IN YOUR EQUIPMENT, AND IF A LEAK OR BULGE IS APPARENT ON THE CAPACITOR CASE WHEN THE UNIT IS OPENED FOR SERVICE OR MAINTENANCE, ALLOW THE UNIT TO COOL DOWN BEFORE ATTEMPTING TO REMOVE THE DEFECTIVE CAPACITOR. DO NOT ATTEMPT TO SERVICE A DEFECTIVE CAPACITOR WHILE IT IS HOT DWHILE IT IS HOT DUE TO THE POSSIBILITY OF A CASE RUPTURE AND SUBSEQUENT INJURY.

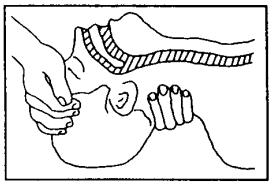
TREATMENT OF ELECTRICAL SHOCK

1. IF VICTIM IS NOT RESPONSIVE FOLLOW THE A-B-CS OF BASIC LIFE SUPPORT.

PLACE VICTIM FLAT ON HIS BACK ON A HARD SURFACE

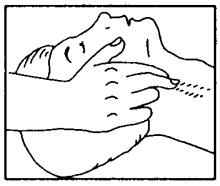
(A) AIRWAY

IF UNCONSCIOUS,
OPEN AIRWAY



LIFT UP NECK
PUSH FOREHEAD BACK
CLEAR OUT MOUTH IF NECESSARY
OBSERVE FOR BREATHING

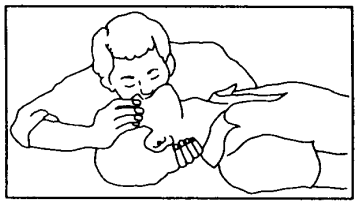
CHECK
CAROTID PULSE



IF PULSE ABSENT,
BEGIN ARTIFICIAL
CIRCULATION

(B) BREATHING

IF NOT BREATHING,
BEGIN ARTIFICIAL BREATHING



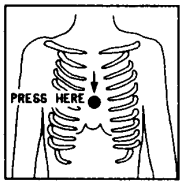
TILT HEAD
PINCH NOSTRILS
MAKE AIRTIGHT SEAL

4 QUICK FULL BREATHS

REMEMBER MOUTH TO MOUTH
RESUSCITATION MUST BE
COMMENCED AS SOON AS POSSIBLE

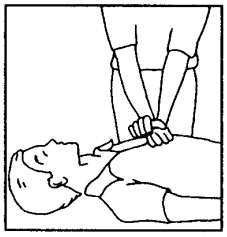
(C) CIRCULATION

DEPRESS STERNUM 1 1/2 TO 2 INCHES



APPROX. RATE OF COMPRESSIONS --80 PER MINUTE
- ONE RESCUER
- 15 COMPRESSIONS
- 2 QUICK BREATHS

APPROX. RATE OF COMPRESSIONS --60 PER MINUTE
- TWO RESCUERS
- 5 COMPRESSIONS
- 1 BREATH



NOTE: DO NOT INTERRUPT RHYTHM OF COMPRESSIONS
WHEN SECOND PERSON IS GIVING BREATH

CALL FOR MEDICAL ASSISTANCE AS SOON AS POSSIBLE.

2. IF VICTIM IS RESPONSIVE.

A. KEEP THEM WARM
B. KEEP THEM AS QUIET AS POSSIBLE
C. LOOSEN THEIR CLOTHING
D. A RECLINING POSITION IS RECOMMENDED

WARNING: Disconnect primary power prior to servicing.

FIRST-AID

Personnel engaged in the installation, operation, maintenance or servicing of this equipment are urged to become familiar with first-aid theory and practices. The following information is not intended to be complete first-aid procedures, it is a brief and is only to be used as a reference. It is the duty of all personnel using the equipment to be prepared to give adequate Emergency First Aid and there by prevent avoidable loss of life.

Treatment of Electrical Burns

1. Extensive burned and broken skin
    a. Cover area with clean sheet or cloth. (Cleanest available cloth article.)
    b. Do not break blisters, remove tissue, remove adhered particles of clothing, or apply any salve or ointment.
    c. Treat victim for shock as required.
    d. Arrange transportation to a hospital as quickly as possible.
    e. If arms or legs are affected keep them elevated.

NOTE:
If medical help will not be available within an hour and the victim is conscious and not vomiting, give him a weak solution of salt and soda: 1 level teaspoonful of salt and 1/2 level teaspoonful of baking soda to each quart of water (neither hot or cold). Allow victim to sip slowly about 4 ounces (a half of glass) over a period of 15 minutes. Discontinue fluid if vomiting occurs. (Do not give alcohol.)

2. Less severe burns - (1st & 2nd degree)
    a. Apply cool (not ice cold) compresses using the cleanest available cloth article.
    b. Do not break blisters, remove tissue, remove adhered particles of clothing, or apply salve or ointment.
    c. Apply clean dry dressing if necessary.
    d. Treat victim for shock as required.
    e. Arrange transportation to a hospital as quickly as possible.
    f. If arms or legs are affected keep them elevated.

REFERENCE:
ILLINOIS HEART ASSOCIATION
AMERICAN RED CROSS STANDARD FIRST AID AND PERSONAL SAFETY MANUAL (SECOND EDITION)

Table of Contents

Section 1
Introduction

Section 2
Operation

Section 3
Diagnostics

Table of Contents

Section 1 Introduction

1

1.1 Purpose of This Manual

This user manual contains the information pertaining to the Maxiva ULX Series, solid-state, UHF, ATSC digital TV transmitter. The various sections of this technical manual provide the following types of information.

- Section 1, Introduction, provides general manual layout, photos, equipment description, block diagram and general specifications.
- Section 2, Operation, provides operation and navigation information for the Graphical User Interface or GUI as well as identification and functions of all external panel controls and indicators.
- Section 3, Diagnostics, provides detailed fault information and diagnostic procedures to the board level.

WARNING: Disconnect primary power prior to servicing.

1.2 General Description

This section contains a general description of the Maxiva ULX Series ATSC digital television transmitters. Included in this section will be descriptions of the Control System, Power Amplifier, block diagrams of the different models and system specifications.

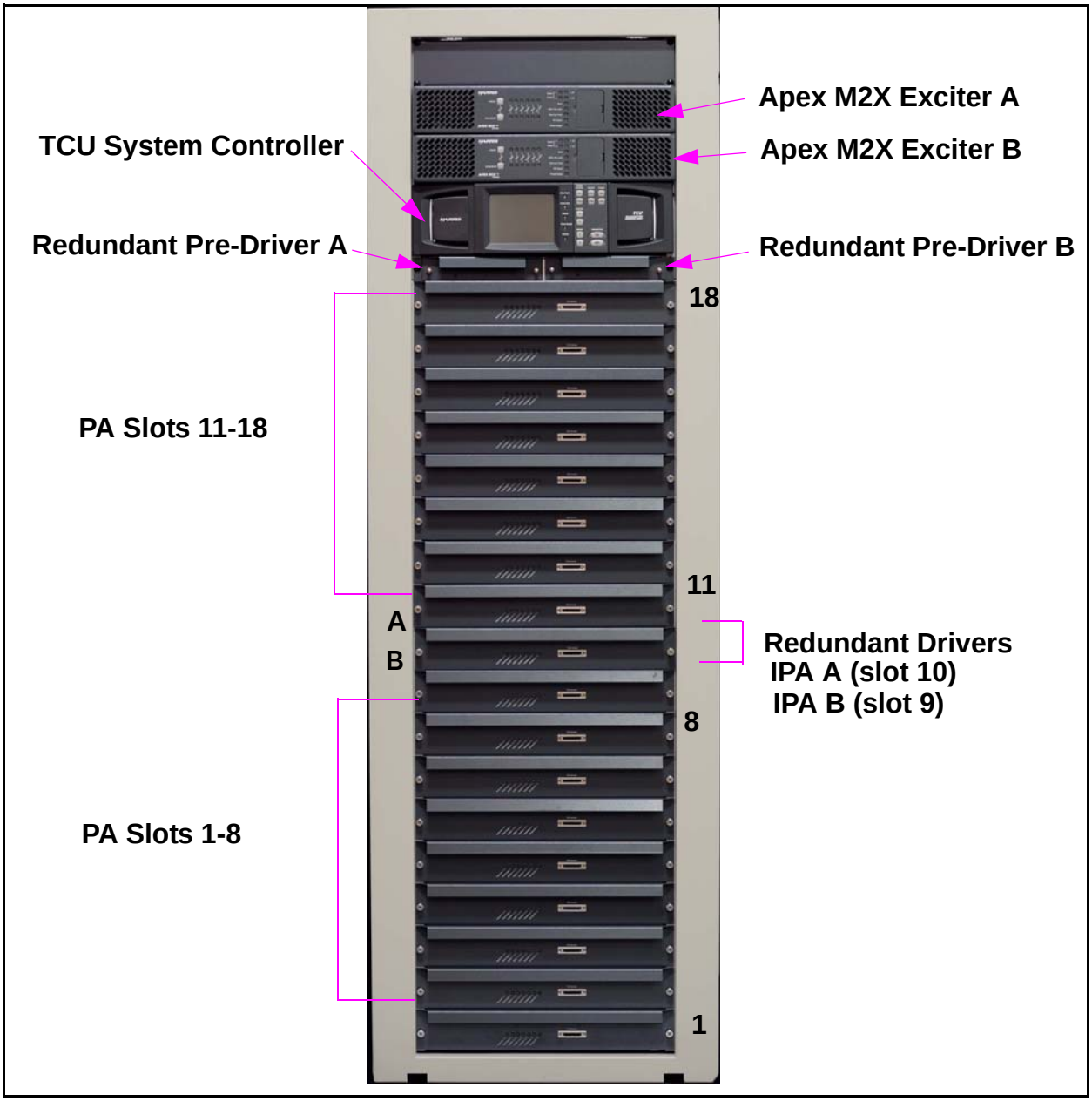


Figure 1-1 ULX-12300AT Front View

WARNING: Disconnect primary power prior to servicing.

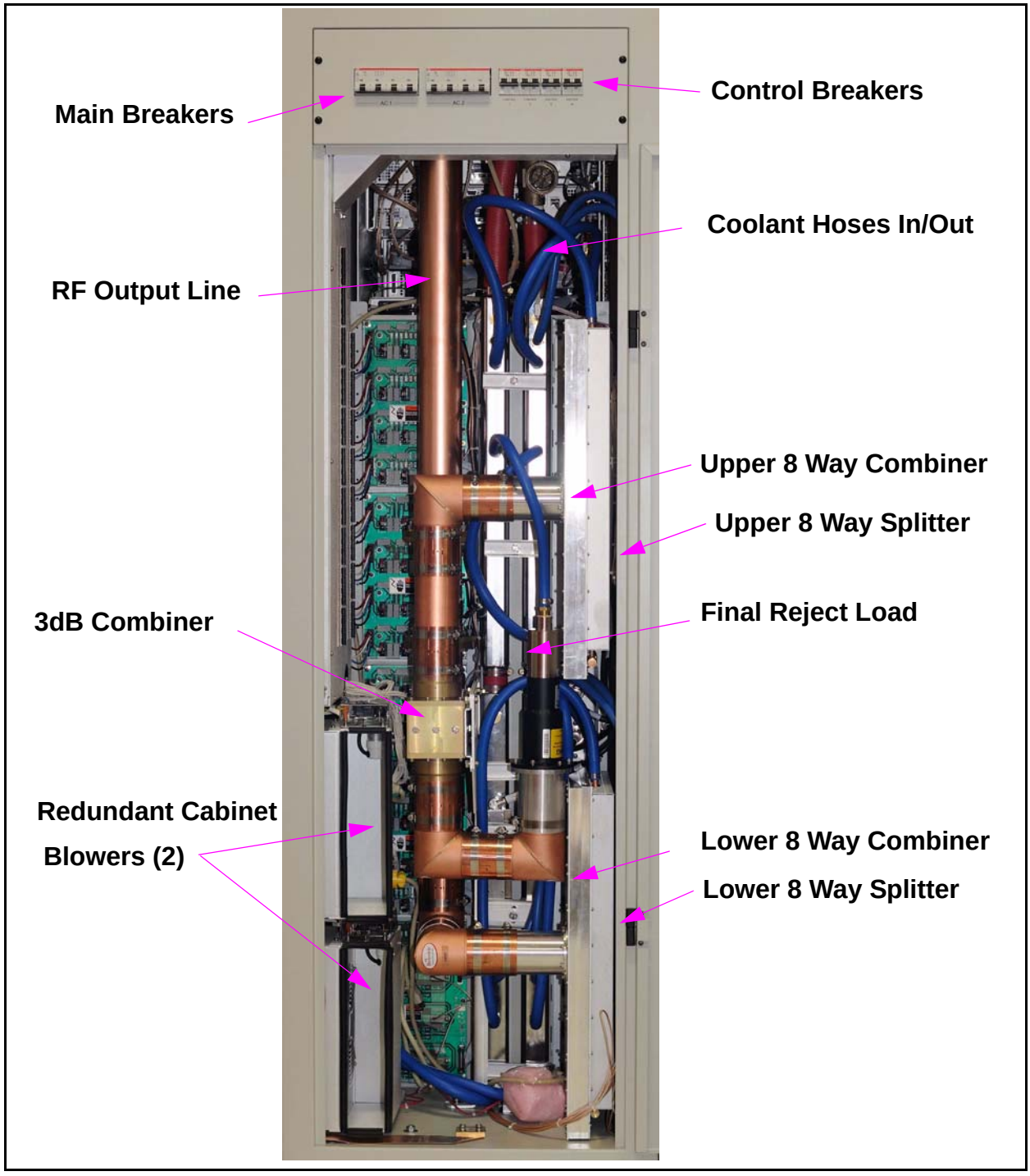


Figure 1-2 ULX 12300AT Rear View

WARNING: Disconnect primary power prior to servicing.

1.2.1 Maxiva ATSC Series Transmitter Models

The Maxiva ULX Series ATSC transmitter is available in 13 liquid cooled power levels. The models are listed below in Table 1-1

Table 1-1 Maxiva ATSC Series Transmitter Models

Tx Models	Cabinets	PA Modules	Output Power	Primary Cooling
ULX1600AT	1	2	1600W	LIQUID
ULX-2400AT	1	3	2400W	LIQUID
ULX-3200AT	1	4	3200W	LIQUID
ULX-4700AT	1	6	4700W	LIQUID
ULX-6300AT	1	8	6300W	LIQUID
ULX-7600AT	1	10	7600W	LIQUID
ULX-9200AT	1	12	9200W	LIQUID
ULX-12300AT	1	16	12.3 kW	LIQUID
ULX-13400AT	2	18(12+6)	13.4 kW	LIQUID
ULX-17800AT	2	24(12+12)	17.8 kW	LIQUID
ULX24600AT	2	32(16+16)	24.6 kW	LIQUID
ULX-25800AT	3	36(12+12+12)	25.8 kW	LIQUID
ULX-36900AT	3	48(16+16+16)	36.9 kW	LIQUID
NOTE: All power levels given in average output power before the bandpass filter.				

1.2.2 System Block Diagram

Figure 1-3 on page 1-5 contains a system block diagram showing the basic signal flow and configuration for a Model ULX-12300AT Maxiva ATSC transmitter. The block diagram shows the 12.3 kW single cabinet, liquid cooled system with 2 pre-amp modules, 2 driver modules and 16 PA modules. Note that the predriver and driver modules are redundant.

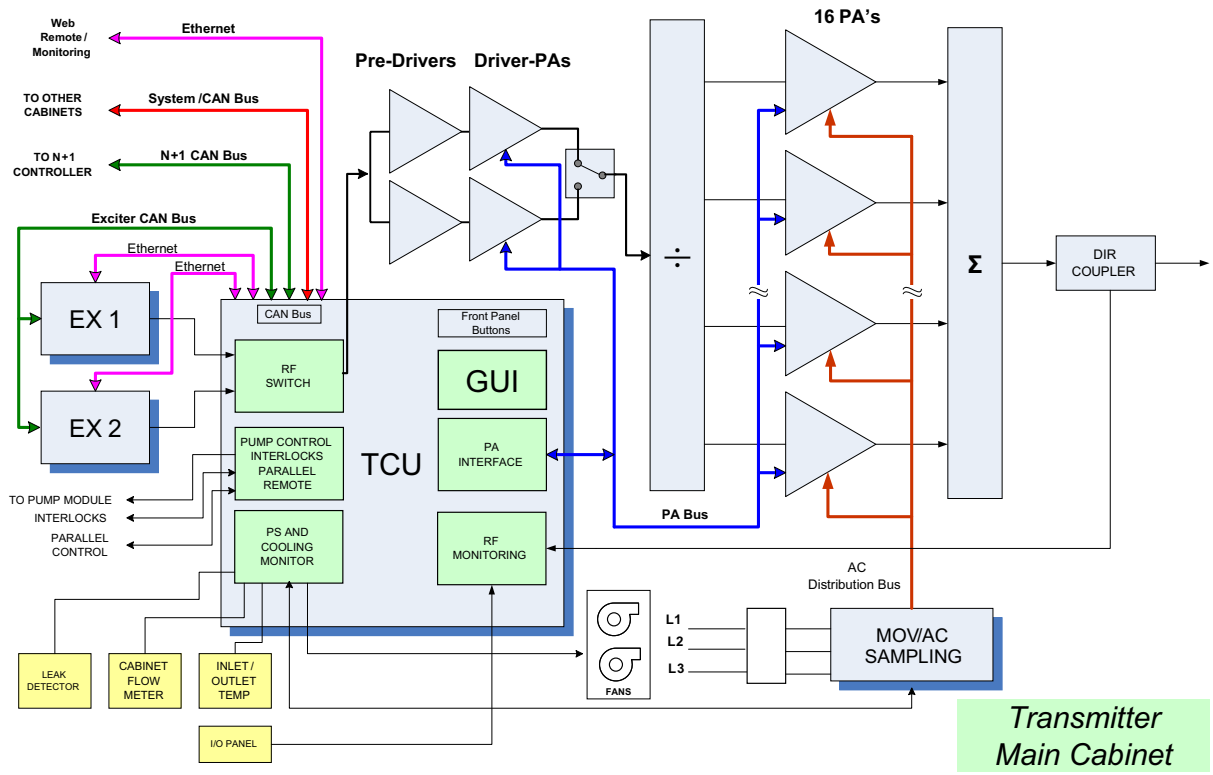


Figure 1-3 Maxiva ULX-12300AT ATSC Block Diagram

1.2.3 Transmitter Control System

The Maxiva ATSC transmitter uses a simplified control system that minimizes the number of microprocessors. Each transmitter sub-system is responsible for its own monitoring and protection and simply reports back to the TCU (transmitter control unit) for display on the GUI (Graphical User Interface) or to a remote interface. In multi-cabinet systems the TCU in cabinet 1 functions as the main controller while the TCU in each amplifier cabinet acts as a slave controller. The cabinet 1 TCU will contain the GUI display for the transmitter. Additional PA cabinets do not contain GUI screens.

The *system bus* originates in MCM (master controller module) inside the cabinet 1 TCU and goes to the TCU located in each amplifier cabinet. The system bus is used to transfer telemetry information in between the TCU's.

The *cabinet bus* is similar to the *system bus* but it connects the cabinet TCU (MCM card) to all of the nodes inside each individual cabinet. If *system bus* communications with the master TCU (in cabinet 1) are interrupted the *cabinet bus* allows each cabinet to operate independently.

The heart of the control system is the TCU which is responsible for control, monitoring and protection. The TCU contains the MCM (master controller module) which controls all critical transmitter functions and the PCM (processor control module) which provides enhanced monitoring and control, exciter and cabinet data collection, fault logs and web remote connectivity. In addition to the MCM and PCM the Maxiva ATSC main TCU contains six modular cards for the following sub-systems:

- PA Interface -Provides interface between TCU, IPA (driver) and PA backplane boards. The interface features 40 digital outputs/inputs and 24 ATSC outputs and inputs. A fully populated cabinet will require two PA interface cards, one card per eight PA modules. The PA interface card sends the ON/OFF commands to the PA modules and receives fault information and status from them.
- RF Detector/Pump Control/ Interlocks - Consists of a main board and a daughter card. It features 7 RMS detectors with adjustable trip points (via EPOTS). It has pump control and interlocks on one D25 pin connector.
- Customer I/O - Provides parallel remote control, status and meter outputs. Connector A has all inputs and Connector B has all outputs.
- Exciter Switch - Contains PWB relay, 2 RMS detectors with adjustable trips (via EPOTs) for power monitoring and a control/status interface for Exciters A and B.
- PS Monitor - Monitors AC lines for phase imbalance and high or low voltage, coolant inlet/outlet temperature, coolant flow, leaks, combiner temperature and cabinet fans.

TCU's also contain the following components:

- Base-Plane - provides a common bus for custom plug-in cards
- Power Supply Modules - two redundant internal power supply modules.
- Standard Master Control Module (MCM) - FPGA based controller used for all critical transmitter control functions.
- LED's - standard front LED mimic display panel.
- Processor Control Module (PCM) - Coldfire based micro module running embedded Linux OS. It provides a touch screen for enhanced monitoring and control, exciter and multi-cabinet data collection, fault logs and web remote connectivity.
- Graphical User Interface (GUI) front panel - 5.25" color 1/4 VGA touch screen that is present only in the main TCU (cabinet 1 in multi cabinet systems).

In multi-cabinet systems, there is a TCU in every cabinet. Each TCU will always contain an MCM but PA cabinet TCU's don't require all TCU cards. The TCU in the first PA cabinet will assume the role of master controller for the system. The TCU's in the remaining PA cabinets will be slaves.

1.2.4 Transmitter RF Power Control

The PA modules operate in open loop mode (no gain or level adjustment). The transmitter RF power control is done via the Phase and Gain Board located in the predriver modules. The predrivers are the only components in the drive chain (besides the exciter) capable of adjusting their RF power based on commands from the TCU.

Each cabinet can also be placed in the "Manual Power Control Mode". In this mode the automatic level control is disabled.

1.2.4.1 Graphical User Interface

The TCU front panel (in the control PA cabinet on multi-cabinet transmitters) contains the graphical user interface which is a 5.25" 1/4 VGA, LCD touchscreen display. The touchscreen display uses software buttons to monitor and control the transmitter. Hardware buttons for the primary transmitter functions such as ON, OFF, RAISE and LOWER are provided on the overlay panel next to the display.

TCU's in additional PA cabinets will not be equipped with GUI screens.

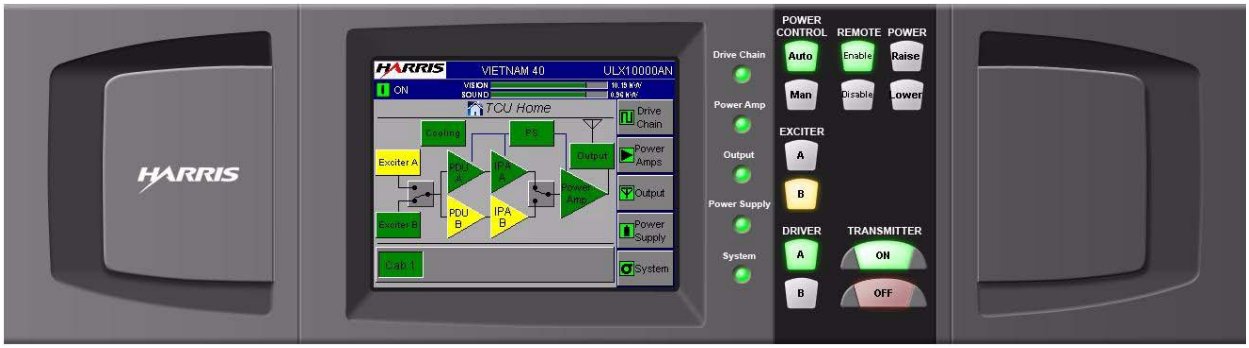


Figure 1-4 TCU Front Control Panel

1.2.5 Control System Communications

The control system uses a serial communications system called a CAN bus. CAN stands for Controller Area Network. The CAN bus is a closed loop serial network controlled by the main TCU. The CAN bus connects the main TCU with TCU's in other cabinets. Each TCU board connected to the CAN bus is considered a node and therefore has a specific address. This allows the master TCU to use the system bus to gather information from all parts of the transmitter and display it on the GUI. One big

advantage of the CAN bus is that it requires only 2 wires of the system control bus ribbon cable, eliminating a large amount of discrete wiring which would otherwise be required.

The system bus ties TCU's in each cabinet together. The cabinet bus is for the most part a duplicate of the system bus but intended to connect nodes within each individual cabinet. The cabinet bus originates in the MCM module within each TCU. The cabinet bus is designed to keep the PA cabinets operating even if the communications with the master cabinet TCU is lost.

1.2.5.1 Software Updates

The use of the CAN bus for communication between the various Micro Modules in the transmitter also allows updating of the software used in each transmitter sub-system via a serial port connection to an external computer.

NOTE:
Software does not need to be loaded into the transmitter unless new components are installed or an update is sent from Harris. The transmitter, as shipped from the factory, is preloaded and ready to run.

1.2.5.2 Remote Control

The Maxiva Series ATSC transmitter has the basic discrete wired parallel remote control with the standard connections for control, status and analog monitoring located on the customer I/O card inside the main TCU(cabinet 1).

Maxiva transmitters include Web enabled remote GUI interface that provides comprehensive remote control and monitoring of data points within the transmitter. It includes an SNMP (Simple Network Management Protocol) manager which allows integration with most Control Systems via the Internet or LAN.

1.2.6 PA Module

The Maxiva ULX Series PA Module utilizes LDMOS (laterally diffused metal oxide semi-conductor) amplifiers to produce up to 800 W average power output. Each module weighs approximately 22kg and can be removed while the transmitter is running. A single cabinet Maxiva Series transmitter can have 2, 3, 4, 6, 8, 10, 12, or 16 PA modules to achieve the various power levels shown in Table 1-1 page1-4. A simplified block diagram of the PA module is shown in Figure 1-5 on page 1-9.

The amplifier and driver modules are interchangeable and do not contain microcontrollers but instead use a CPLD based monitor board in each PA to report faults to the TCU and to take appropriate self-protective action if needed.

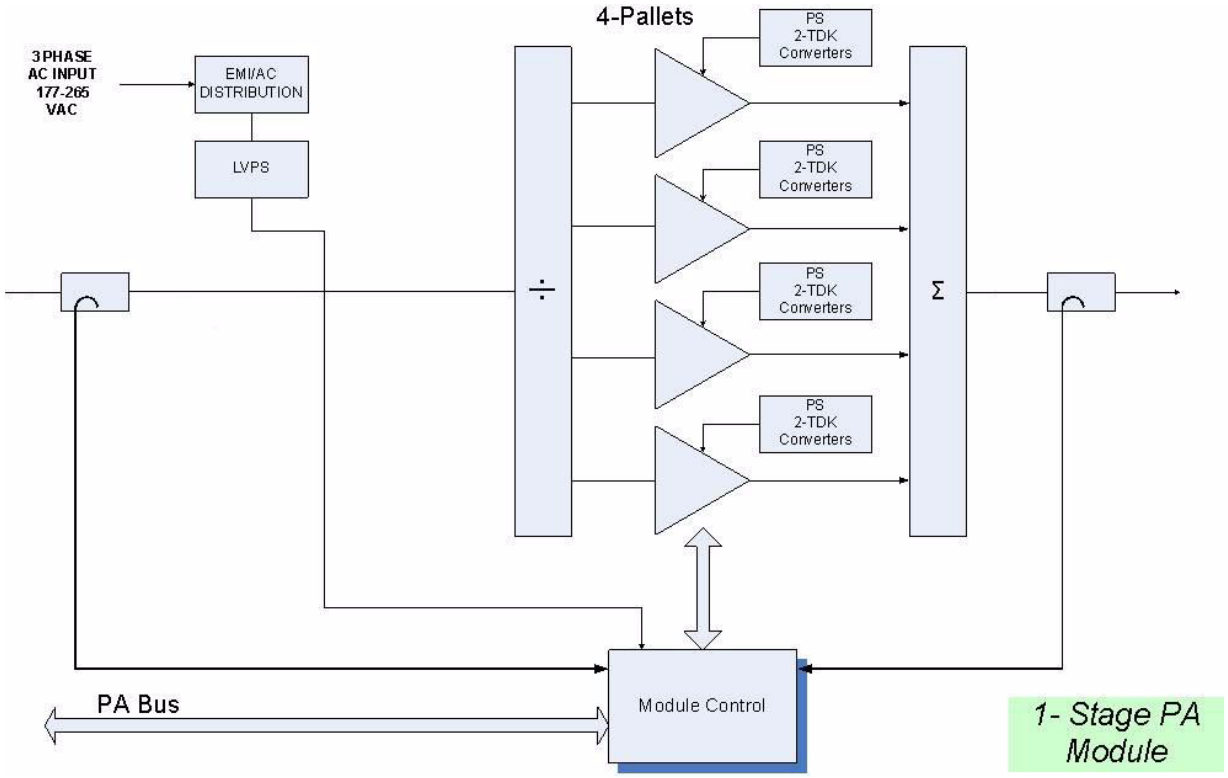


Figure 1-5 PA Module Simplified Block Diagram

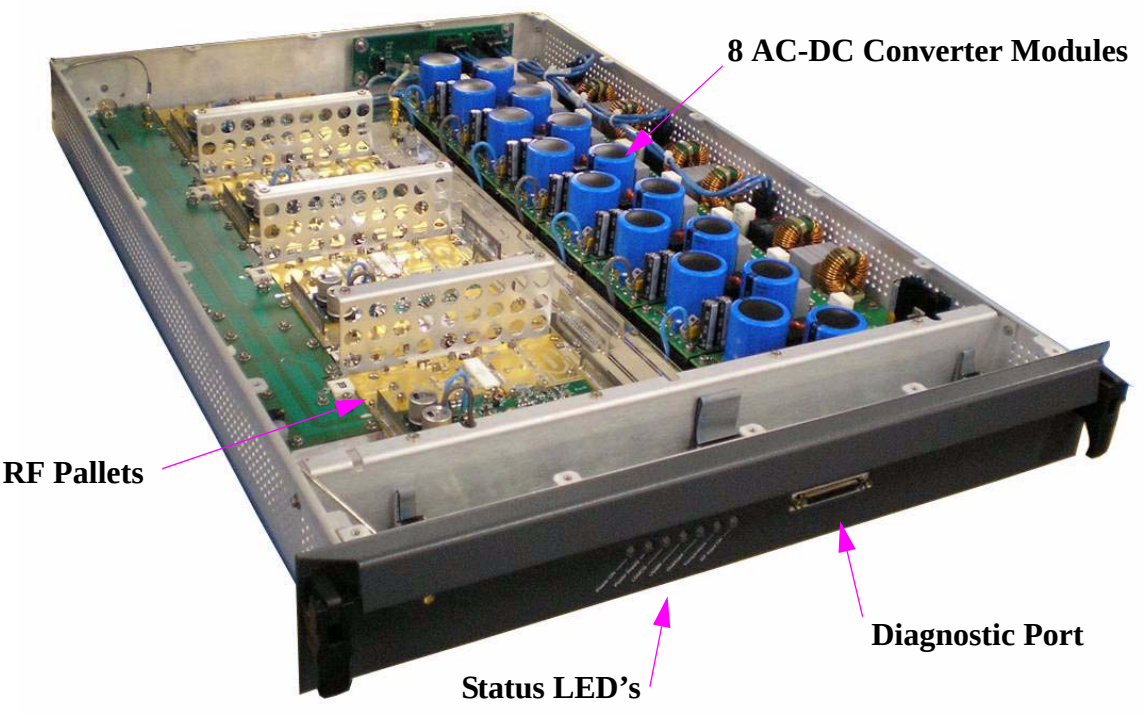


Figure 1-6 Maxiva PA Module (cover removed)

The diagnostic port shown in Figure 1-6 allows the operator to connect directly to the PA module with a handheld device and obtain PS voltages, fault status, FWD and REF RF power levels and internal temperatures. The diagnostic port can also be used to reprogram the CPLD as required.

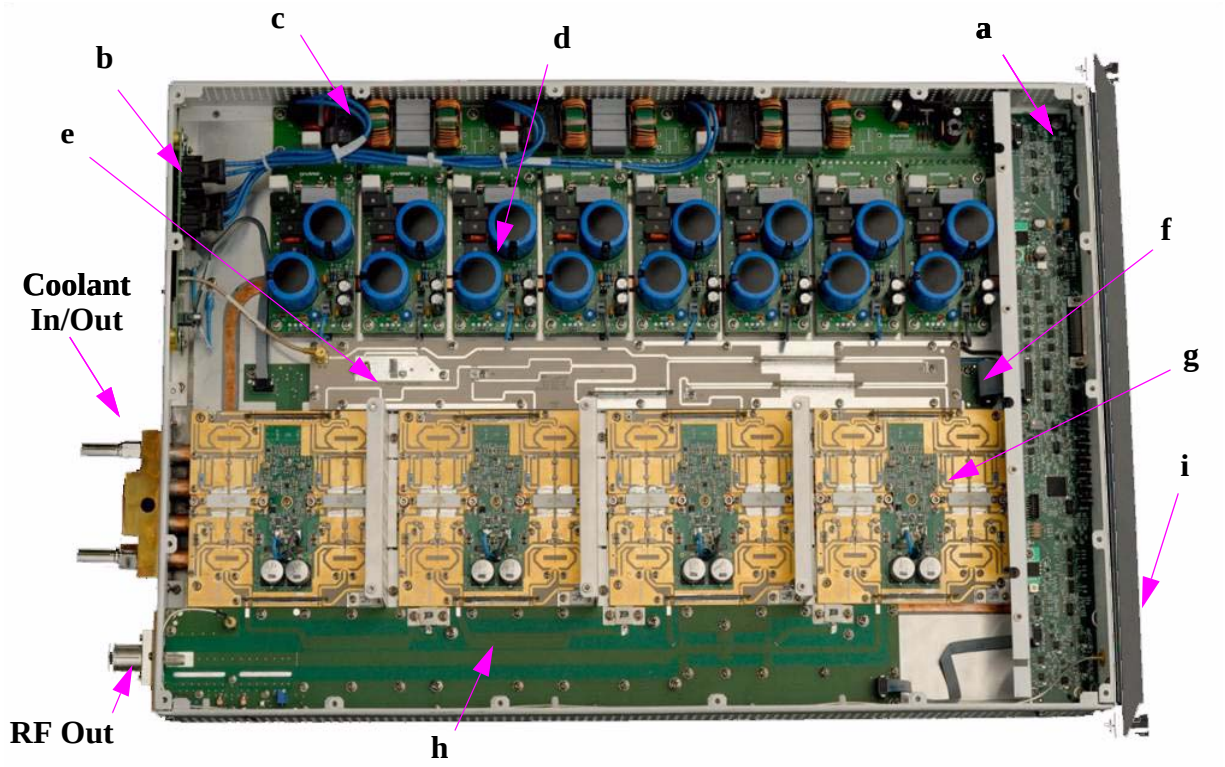


Figure 1-7 Maxiva ULX PA Module (top view, cover removed)

Each PA module consists of the following components:

a. Monitor Board - Responsible for all monitoring and protection of the module. Reports to the transmitter TCU via the parallel control lines.

b. Connector I/O Board -I/O Connector Board provides interface connections between PA Module and transmitter back plane. The board includes a single hybrid connector on one side and five (5) connectors on the other side. The large hybrid connector interfaces with mating connector on the back plane board. It contains seven (7) AC contacts, twenty four (24) small signal contacts, and a single RF coaxial connector.

c. AC Distribution Board - The AC distribution board provides three phase AC to the eight power supply boards. It also provides AC line filtering, step-start function and transient protection for the module.

d. Power Supply Boards - The eight (8) AC/DC power supplies provide 44VDC to 50VDC power to each pair of FET's on the four (4) PA pallets. Voltage varies with modulation type and channel.

e. Splitter Board - The splitter board equally divides the RF signal between four (4) power amplifier pallets. The splitter is broadband (covers TV band IV/V). The splitter board also delivers a detected RF sample to the monitor board to indicate input power level and provide protection from excessive input drive power.

f. Signal Distribution Board - Signal Distribution Board serves to route analog and digital control and monitoring data between four (4) PA module board subassemblies, monitor board, PA pallets, connector I/O board, and 4-way splitter board.

g. LDMOS Amplifier Pallets - There are four (4) single stage amplifier pallets operating in parallel in the PA module. When combined, they provide up to 800 watts of average power at the output of the module.

h. Combiner Board - The board combines the RF outputs of the four (4) amplifier pallets, and delivers the combined signal to the output port. The combiner is broadband (covers the entire TV Band IV/V) and requires no tuning. The combining of the signals is accomplished using hybrid combiners in series. The first stage is a 2-way 3dB hybrid, the second stage a 2-way 4.77dB hybrid, and the 3rd stage is a 2-way 6dB hybrid. The use of reject loads in conjunction with the hybrids allows continuous operation of the PA Module in the event of a PA Pallet failure. The combiner contains Forward and Reflected signal directional couplers at its output. Detector circuits deliver the forward and reflected output samples to the Monitor Board, which indicates the forward power level in dBm and uses the reflected signal for VSWR monitoring and VSWR fault protection for the module. Another directional coupler provides an attenuated sample of output RF signal to an optional coaxial port at the front of the PA module.

Each Maxiva ATSC PA Module is a self-contained 800W transmitter including the power supply with its own internal control, monitoring and protection. The modules only receive basic On/Off, Mute, & Restart commands from the transmitter control system. This means that each module will protect itself without relying on the TCU.

1.2.6.1 Module Control

The primary method for control and monitoring of the PA Modules is via the individual 50 conductor ribbon cable bus to one of the two TCU assembly PA Interface boards. These busses are called Drive A (for preamp A and IPA A), Drive B (for preamp B and IPA B), and BP 1 through BP 4 (for PA backplanes A5, A6, A8, and A9 respectively). Each module contains a CPLD based monitor board that is responsible for reporting faults back to the TCU and for taking action when the ON/STBY command is issued from the TCU. The cabinet bus connects to each PA and IPA Module backplane, but it is only used for the PA_voltage_select line, which sets the DC output voltage of each of the eight AC to DC converters in the IPA and PA modules. The output can be switched between 44, 46, 48, or 50 VDC, depending on the operating frequency.

1.2.7 Transmitter Power Supplies

Three phase AC mains must be supplied to the cabinets via circuit breaker CB23 and CB24 on the AC mains input assembly (A15). The transmitter can accept 208-240VAC (Delta or WYE) or 380-415VAC (WYE) by changing jumpers in three areas:

- Terminal boards TB1 and TB2
- Parallel MOV boards (A15A1 & A15A2)
- IPA (driver) and PA backplane boards

If properly jumpered there will be three phase 208-240V AC inputs supplied to each driver and PA module.

CAUTION:
THREE PHASE 440-480VAC AC MAINS CAN ALSO BE USED BUT ONLY WITH AN EXTERNAL TRANSFORMER WHICH CAN BE ORDERED SEPARATELY FROM HARRIS.

The 208 to 240VAC is supplied to each PA module's connector I/O board and then to the modules AC distribution board. There it is applied to eight AC/DC converters (two per pallet). Depending on the operating frequency, the AC/DC converter output can be switched between 44, 46, 48, or 50 VDC, which is supplied to each of the eight FET's in the module. There are two FET's on each of the four pallets in each module.

The control system in the transmitter is powered by two low voltage power supply (LVPS) modules in the TCU.

1.2.8 Cooling System

The Maxiva ATSC transmitter uses a 50/50 glycol/water cooling system to remove the majority of the heat away from the transmitter but also has cabinet flushing fans to remove residual cabinet heat. A simplified block diagram of the liquid cooling system is shown in Figure 1-8 on page 1-14. A simplified diagram of the liquid cooling system inside the transmitter cabinet is shown in Figure 1-12 on page 1-21. The cooling system basically consists of:

a. Cooling System Control Panel/Pump Module & /Heat Exchanger Unit
b. Air purger located at the highest point in the cooling system.
c. Coolant strainer.

d. Supply and return line hose and fittings.

e. PCI (pump control interface) located in the TCU

f. Transmitter PA Module, Splitter and Combiner Cold Plates

The liquid cooling system is an efficient closed loop, pressurized system. Prior to operation the cooling system must be properly prepared for operation and bled to remove trapped air. Instructions for cooling system preparation can be found in the ULX technical manual.

The heat exchanger & pump module units operates on either 208-240 VAC, 50/60 Hz or 380-415 VAC 50/60 Hz. The operating voltages and frequencies should be provided at time of order. The number of heat exchanger fans will vary with model number.

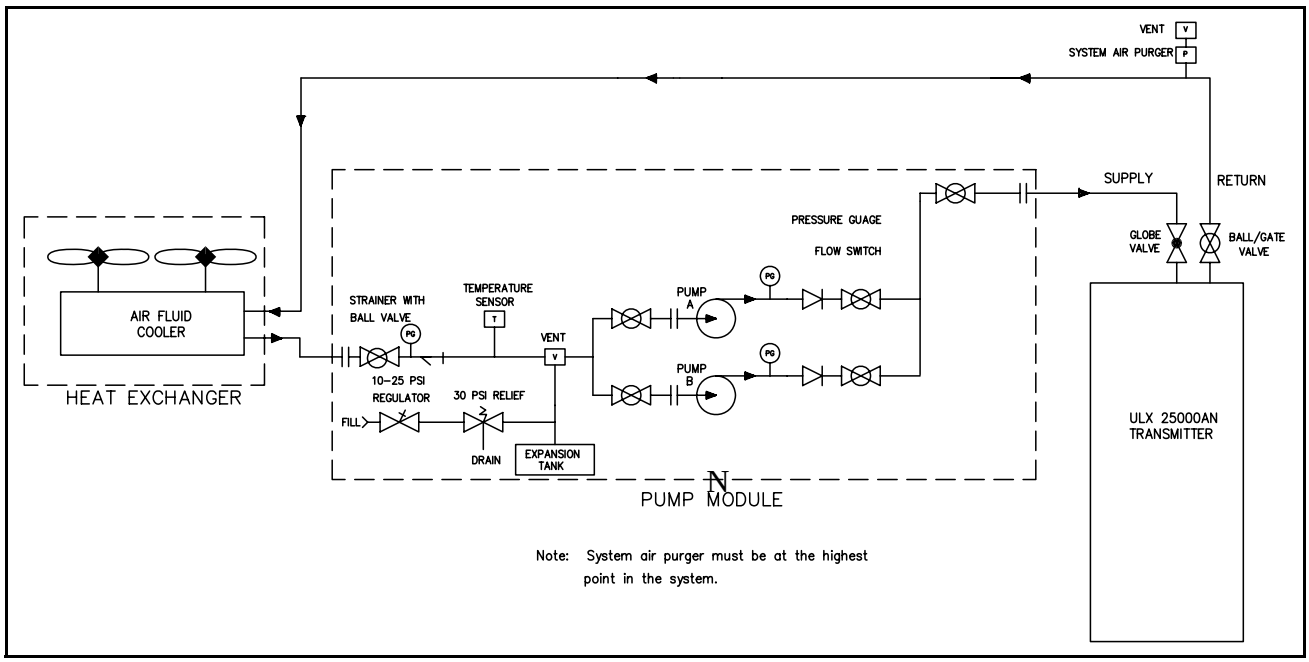


Figure 1-8 Simplified Liquid Cooling System Block Diagram

CAUTION:
SOME MAXIVA ULX SERIES TRANSMITTERS WILL NOT SUPPORT A WATER COOLED TEST LOAD. AN AIR COOLED LOAD SHOULD BE USED WITH ULX SERIES TRANSMITTERS.

1.2.8.1 Cooling System Control Panel

The cooling system control panel controls the operation of the pump module/heat exchanger, and sends fault and status information to the TCU. The cooling system control connects to the RF Detector/Pump Control/Interlocks card in the TCU for monitoring and control.

NOTE:
The control panel and pump module is designed for indoor use only.

The pump control signals are described below:

+12 Vdc - Voltage supplied by Pump Control Unit.

PUMP_INTLK - Output, active high. When high, the transmitter's RF output is muted and the pumps are forced to OFF regardless of the LOCAL/ REMOTE setting in the pump cooling control panel. If this interlock is active, the pumps can't be turned ON (even locally). This interlock is driven by the transmitter or PA cabinet leak detector. If a leak is detected, this interlock goes to high.

PUMP RUN - Output, active high to turn on selected pump.

SWITCH PUMP - Output, pulsed active high to switch between Pump A and Pump B.

PUMP A SELECTED - Input, connect to open drain or relay contacts. Active when input is LOW.

PUMP B SELECTED - Input, connect to open drain or relay contacts. Active LOW.

LOCAL STATUS - Input, connect to open drain or relay contacts. Remote = HIGH, Local = LOW

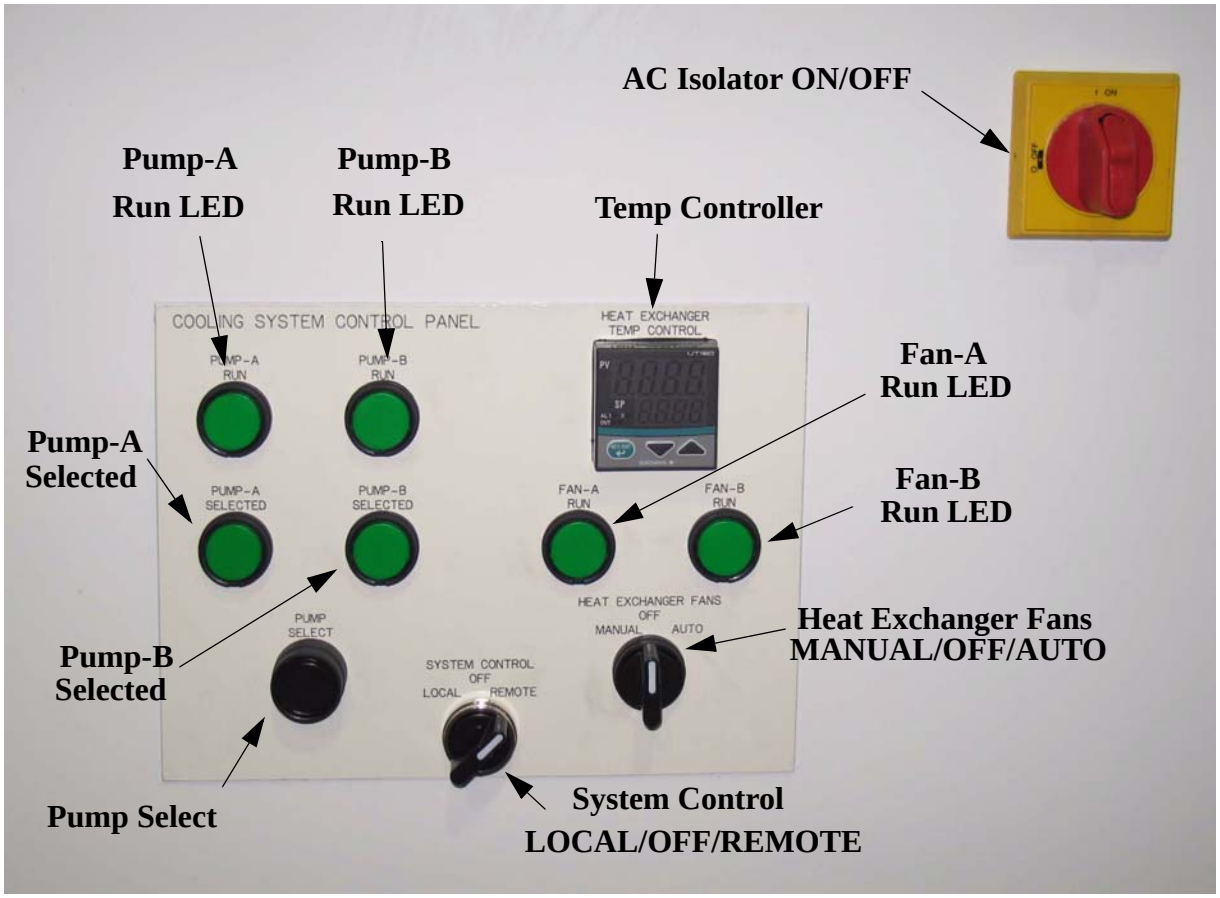


Figure 1-9 Cooling System Control Panel

a. ISOLATOR - ON/OFF

b. HEAT EXCHANGER FANS - Manual, OFF, or Remote

c. PUMP SELECT - A or B pump is selected when pressed

d. TEMP CONTROL - Sets fan cycle temps. Factory settings are fan 1 turns on at 23.9^{o} C. (75^{o}F.) and fan 2 turns on at 26.7^{o}C. (80^{o}F.). These can be adjusted in the field to more suitable levels. Fan 1 turn on at 32^{o}C and Fan 2 turn on at 37^{o}C would be typical.

e. SYSTEM CONTROL - LOCAL/REMOTE - Allows local control or remote control via transmitter.

f. HEAT EXCHANGER TEMP CONTROL - PLC controller used to set fan ON and OFF temperatures.

The control panel also has the following status indicators:

g. PUMP - A RUN (ON = Green)

h. PUMP - B RUN (ON = Green)
i. FAN - A RUN (ON = Green)
j. FAN - B RUN (ON = Green)
k. PUMP - A SELECTED (ON = Green)
l. PUMP - B SELECTED (ON = Green)
m. PLC STATUS INDICATOR

When System Control is in Remote mode, see Figure 1-9, the transmitter is responsible for control of the cooling system, including ON/OFF, manual pump selection and automatic pump switching in the case of a failure. Placing the control panel in Local mode allows manual switching of the pumps.

The red selector at the top of the control panel (labeled ON/OFF) is the AC isolation switch which disconnects AC power from the pump module as well as the control circuitry in the control panel itself.

In the local mode, with the AC isolation switch set to ON, one of the two pumps will be energized unless the Pump Interlock is active. To deenergize the pumps, when in the local mode, set the AC isolation switch to OFF.

1.2.8.2 Pump Module/Heat Exchanger

The control panel/pump module and heat exchanger are separate units each in a rack. The control panel and pump module are self-contained in one rack and include a PLC (programmable logic controller), an expansion tank, air purger, pressure gauges, a strainer and dual pumps operating in main/standby mode. The control panel/pump module is designed for indoor operation and should be located near the transmitter if possible. The heat exchanger assembly is designed for outdoor mounting.

Pump Module Front

Pump Module Side

Figure 1-10 Pump Module & Control Panel

WARNING: Disconnect primary power prior to servicing.

Figure 1-11 Heat Exchanger (before installation)

NOTE:
The heat exchanger shown in Figure 1-11 is a 2 fan unit. It is shown on a shipping pallet. The two fans that are shown pull air up through the cooling coil/fins (not visible in the photo) if unit if mounted horizontally (as shown). This unit can be mounted horizontally or vertically depending on how the legs are attached to the heat exchanger. Smaller transmitters may use only one fan.

1.2.8.2.1 Heat Exchanger Fan Control

Units with two fans offer redundancy. In multi-cabinet transmitters there will be one heat exchanger and control panel/pump module per PA cabinet. The fans are controlled electronically. The fans are enabled whenever the pump module is activated, but the controller temperature set point, in degrees C, and the proportional band setting, in degrees C, determines when the fans will actually start. With the controller temperature set point at 32^{o}C and the proportional band setting at 5^{o}C, the first fan will turn on when the coolant discharge temperature reaches 32^{o}C, with the second fan turning on at 37^{o}C. As the coolant discharge temperature drops the fans will be turned off.

1.2.8.2.2 Pump Operation/Control Logic

Pump operation is automatically controlled using a programmable interface device controller (PID). There are two modes of pump operation, "LOCAL" and "REMOTE". The PID controller interfaces with the pump control interface (PCI) located in the TCU. The PLC controller receives and sends signals to the transmitter PCI. With "LOCAL"

selected a status signal is sent to the PCI reporting the mode selection. Loss of flow for more than 5 seconds in an active pump will cause activation of the standby pump. Loss of flow for more than 15 seconds will cause both pumps to shut down.

1.2.8.3 PA Module and Combiner Cold Plates

Each PA Module has a liquid cooled cold plate which connects to the cooling system with quick release connectors. There are also cold plates inside the combiner and the splitter to which all of the internal combiner reject loads are attached. See Figure 1-12 for cabinet coolant routing and module slot numbering.

NOTE:
The module slot numbering should not be confused with the IPA and PA module numbering. Module numbering and slot locations will vary depending on model number. See the outline drawing to identify which PA modules go in which slot locations dependent on model.

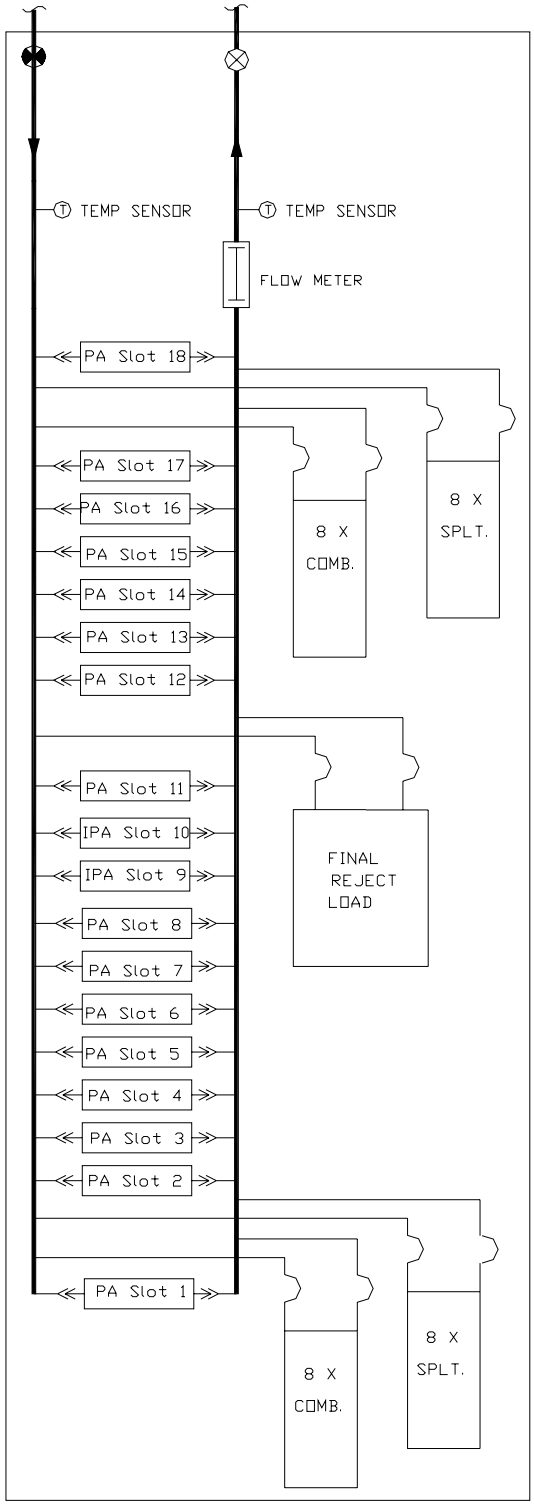


Figure 1-12 ULX 12300AT Liquid Cooling System (Internal)

WARNING: Disconnect primary power prior to servicing.

1.2.9 M2X Multimedia Exciter

The M2X exciter is used with the Maxiva ULX Series transmitter. This exciter is described in a separate instruction book. A second hot standby exciter, and drive chain switcher is available as an option. The exciter is controlled by the transmitter using an internal CAN bus or Ethernet connection. Configuration, editing, diagnostics and monitoring are possible using the front panel on the TCU display, or via Ethernet ports provided with the exciter.

Figure 1-13 M2X Exciter Front

A single exciter unit drives the Maxiva ULX transmitter. The excellent quality and stability of ATSC UHF signal output maximizes the TV transmitter efficiency, improving performance and helping to reduce operating costs.

Universal Exciter Platform

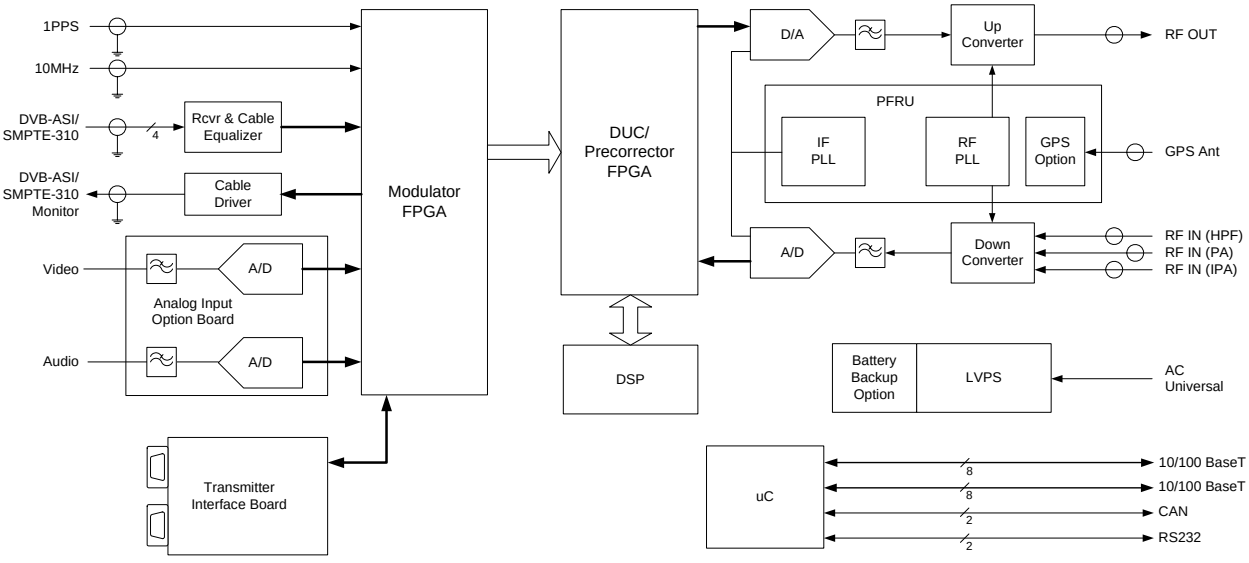


Figure 1-14 M2X Exciter Block Diagram

WARNING: Disconnect primary power prior to servicing.

1.3 General Specifications

NOTE:
Specifications subject to change without notice. Unless otherwise noted specifications apply at the output of the Harris supplied mask filter.

General				
Frequency Range	Mhz	Any specified FCC Channel 14-69		470-860
DTV Channel Bandwidth	Mhz	ATSC, 8-VSB DTV standard		6MHz
Cabinet Output Power (before mask filter)	kW	At 37 dB shoulders (measured +/-3.25 MHz from center of channel)	**Configuration**	**Power**
			1 Cab / 2 PA's	1.6
			1 Cab / 3 PA's	2.4
			1 Cab / 6 PA's	4.7
			1 Cab / 12 PA's	9.2
			1 Cab / 16 PA's	12.3
			2 Cab / 18 PA's	
			2 Cab / 32 PA's	24.0
			3 Cab / 48 PA's	36.0
			4 Cab / 64 PA's	48.0
System Output Power (after mask filter)	kW	At 37 dB shoulders (measured +/-3.25 MHz from center of channel)	**Configuration**	**Power**
			1 Cab / 2 PA's	1.4
			1 Cab / 3 PA's	2.1
			1 Cab / 6 PA's	4.5
			1 Cab / 12 PA's	8.8
			1 Cab / 16 PA's	11.7
			2 Cab / 18 PA's	
			2 Cab / 32 PA's	TBD
			3 Cab / 48 PA's	TBD
			4 Cab / 64 PA's	TBD
RF Load Impedance	Ohms			50
RF Load VSWR		Measured on any 6 Mhz channel		1.1:1
Output Connector		Cabinet Output	Size determined by power level	1-5/8", 3-1/8", 4-1/16"
Data Input				
Input Rate	b/s		SMPTE-310M Standard	19,392,658.46
Impedance	Ohms			75
Standard			ATSC A/53 standard	SMPTE 310M
Connector				BNC Female
External Frequency Reference Input				
Frequency	Mhz			10 Mhz
Impedance	Ohms			50 Ohms
Level	dBm			0 to +10 dBm
Connector				BNC Female
Performance				
Signal to Noise Ratio	dB	Within the 10 degree C performance temp window		27dB, or better
EVM, Error Vector Magnitude	%	Within the 10 degree C performance temp window		4.2% or Less
Pilot Frequency Stability (without external reference)	Hz			Less than +/-200 Hz / month
Pilot Frequency Stability (with external reference)	Hz			Less than +/- 3 Hz
Stability of Output Power in 10 degree C window:	%			+/-2%, or less
Sideband Performance		Measured with Tektronix RFA300A ATSC Modulation Analyzer		Meets mask requirements specified in FCC 5th & 6th Report & Order.

Specifications continue on following pages.

Item	Units	Conditions	Notes	Transmitter Published Specification Value
Spurious Radiation				
Harmonics and Spurious Emissions		After System Mask Filter		Per FCC Title 47, CFR 73.622
AC Line				
AC Line Voltage	VAC	3-phase		208, 220, 240 or 380, 400, 415 (select at time of order)
AC Power Source Type				WYE or Delta for 208-240V range WYE for 380-415V range
AC Line Voltage Variation	%		Investigate if +10 / -15% can be met	+10, -10
AC Line Frequency	Hz			50, 60
AC Line Frequency Variation	%			+5, -5
Phase imbalance	%	Voltage variance bewteen highest and lowest phase-phase level		3
Power Factor		At rated RF output power		> 0.9
Overall Efficiency (Typical/Max)	%	AC Power to Average RF Power	Transmitter only, does not include cooling system	TBD
Environmental				
Operational Temperature Range	°C		Derate 2 degree C per 300m AMSL	0-45
Operational Relative Humidity	%	non-condensing		0 - 90
Altitude	meters	AMSL	Derate 2 degree C per 300m AMSL	0-4000
Cooling Method (primary)	%	Liquid	Propylene (or Ethylene) Glycol / Water	50/50
Acoustic Noise	dBA	Measured 1m from front of cabinet and 1.5m up from floor	does not include cooling pump module and heat exchanger	≤ 65
Residual Heat transferred to room	kW	Maximum per transmitter cabinet with 8PAs	Measured at full power	< 2.5
Physical				
Dimensions	mm		**Model**	**Size**
		Single Cabinet Transmitter		
Weight	Kg	Weight includes all options	**Model**	**Weight**
Safety and EMC Standards				
Safety				EN 60215
EMC				EN 301-489-1
FCC Part 73				Yes
UL				No
RoHS/Wee				Yes

WARNING: Disconnect primary power prior to servicing.

WARNING: Disconnect primary power prior to servicing.

Section 2 Operation 2

2.1 Introduction

This section gives detailed operational information for the Maxiva ULX Series Solid-State UHF TV transmitter. Information will pertain mostly to the operation and navigation of the TCU graphical user interface (GUI) touchscreen display.

NOTE:
Operation of the M2X exciter is covered in a separate manuals which ships with the transmitter.

2.2 Transmitter Control Panel

The front panel user interface is a 5.25" 1/4 VGA, LCD touchscreen display. This touchscreen display uses software buttons to monitor the transmitter. Hardware buttons for the primary transmitter functions such as ON/OFF, RAISE/LOWER and Remote Enable/Disable are provided on the overlay panel next to the display as shown in Figure 2-1.

NOTE:
When transmitter is turned off using the OFF button under normal conditions, the pump module pump will continue to operate for approximately 5 minutes and then shut off.

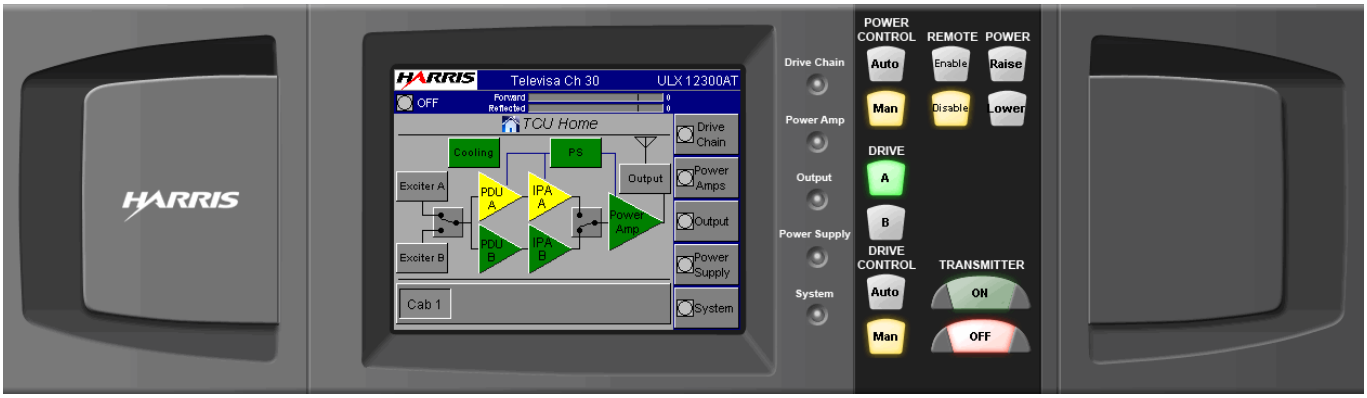
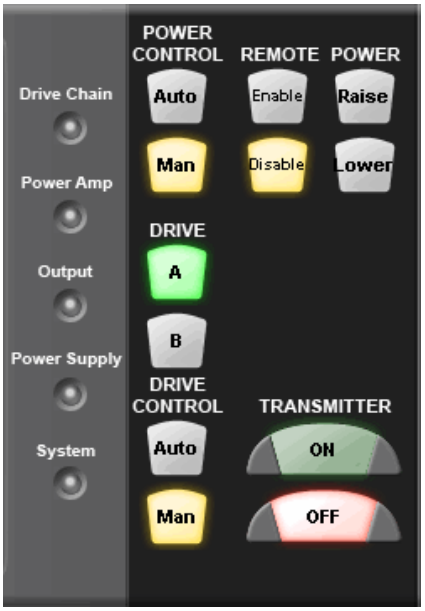


Figure 2-1 Transmitter Control Unit (TCU)

NOTE:
A similar set of GUI screens is available via web browser with an ethernet network connection and the optional eCDi hardware interface.

2.2.1 Hardware Control Buttons



To the right of the touchscreen, there are 6 pairs of hardware control buttons which are part of the front panel overlay. Located to the left of the buttons are Status LED's which are green under normal, no fault conditions. The hardware buttons provide immediate control of 6 main transmitter functions:

a. Power Control - Auto/Manual

b. Remote - Enable/Disable

c. Power - Raise/Lower

d. Exciter - A/B

e. Drive - A/B

f. Transmitter - On/Off

The Status LED's light amber (yellow) for a warning and red for a fault condition in the transmitter subsystems. LED's light green if the sub-system is normal. This provides quick sub-system status information without having to be familiar with a menu structure.

NOTE:
The system control buttons described above will be referred to as hardware control buttons in the following manual text.

Figure 2-2 TCU Front Panel Lowered

Should the GUI screen go gray, i.e., the software buttons or symbols are still visible but have turned shades of gray instead of the usual color scheme, a TCU reset may be required. To reset the TCU, pull down the GUI panel exposing the circuit cards in the TCU chassis as shown in Figure 2-2. The second board from the right is the PCM board. The TCU reset button is located about toward the center of the board and it faces outward toward the user. Use the tip of a pencil or pen to gently depress the small black button.

NOTE:
It will take approximately two minutes for the TCU to reset. If the transmitter is on the air, resetting the TCU will NOT affect transmitter operation.

A TCU reset can also be accomplished by pressing the Local GUI SYSTEM ADMIN screen REBOOT button.The screen and button are shown in Figure 2-19 on page 2-24.

There is another reset button toward the bottom of the MCM board (farthest board to the right). This reset button will also reset the TCU but it will take the transmitter off the air for a short time

Just above the MCM Reset button is a removable memory card containing system software. This card should be installed in any replacement MCM card that is installed.

2.3 Graphical User Interface (GUI)

The GUI ("Gooey") was designed to provide an intuitive interface into the transmitter control system. Once you become familiar with content, finding information is a matter of following the screens to the desired section of the transmitter. Menu Trees of all available screens are given at the end of this section, see "2.10 GUI Menu Structures" on page 2-28

For the most part, all navigation through the GUI screens is via the touchscreen and softkeys (software buttons). The exceptions are the 6 pairs of hardware control buttons mentioned above. The touchscreen display is also divided into an active display area, which will change with each screen selected, and the global areas which are present on all screens.

2.3.1 Global Status and Navigation

The top 2 sections of the touchscreen display (dark blue background) are considered global because they show up on all screens. The top line indicates the transmitter name and model number.

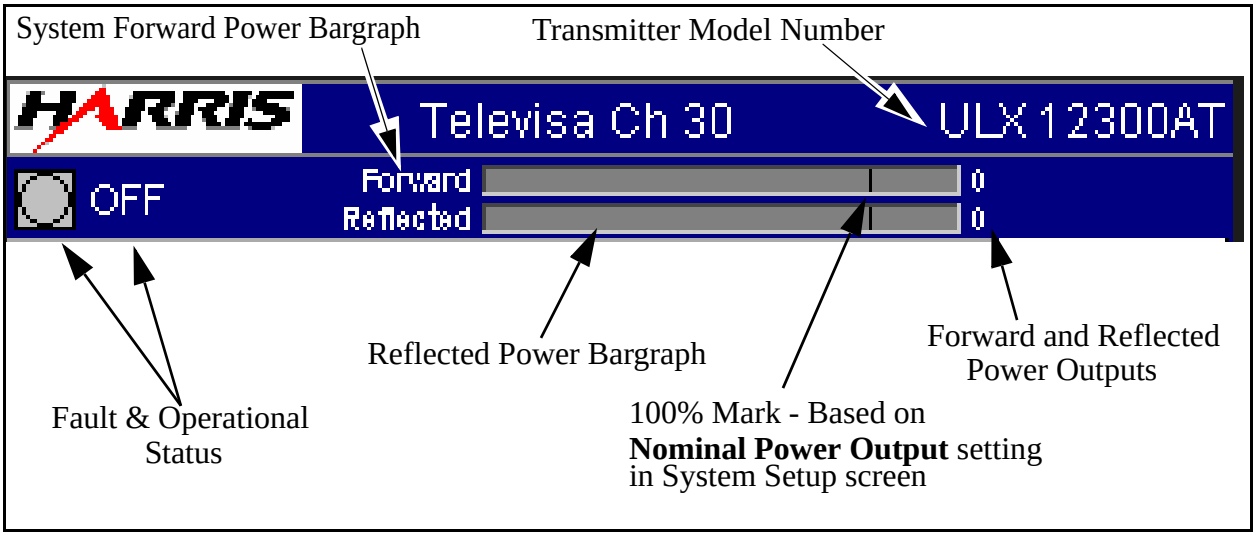


Figure 2-3 Global Display Header

The second line of the display has operational and status information including:

a. **ON**, **Standby**, **Fault OFF**, **ON/FB** (transmitter foldback), **PS MUTE**, and **RF MUTE** status indication.

- **ON:** Normal operating mode
- **Standby:** Transmitter turned off manually or remotely
- **Fault OFF:** Transmitter forced off due to fault condition
- **ON/FB:** Transmitter power folded back. Conditions causing the foldback may by temporary and could possibly be cleared by pressing the ON button. If, after pressing the ON button to reset the foldback, the ON/FB indication resumes the malfunction will need to be determined and the transmitter repaired (see Section 6 for fault log listings).
- **PS MUTE:** A temporary fault condition caused by a power supply related fault. If underlying fault clears, the mute condition will be lifted and the transmitter returned to normal operating mode. If the mute continues, the underlying fault will need to be determined and the transmitter repaired (see Section 6 for fault log listings).
- **RF MUTE:** A temporary fault condition caused by an RF related fault. If underlying fault clears, the mute condition will be lifted and the transmitter returned to normal operating mode. If the mute continues, the underlying fault will need to be determined and the transmitter repaired (see Section 6 for fault log listings).

b. Transmitter Forward power output reading in numerical format (for multiple cabinet transmitters this would be a system power reading and not for a single cabinet). It is important to note that this is the power output after the filter.

c. Transmitter Forward power output reading in a Bargraph format. The 100% mark is based on the nominal power level or TPO (Transmitter Power Output) entered into the configuration screen. The bargraph will also turn yellow if the power level is more than 10% higher **or** lower than the nominal 100% level.

NOTE:
Indications on the global display header in Figure 2-3 should be all green under normal (no fault) operating conditions. A yellow or red symbol or status indication on the global display header should be investigated by the station engineer.

2.4 GUI Home Screen

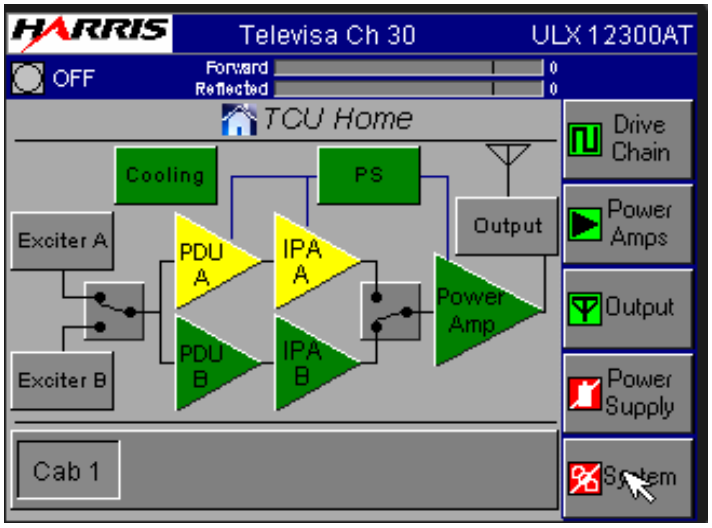
The HOME screen shown in Figure 3-3 is the primary operator screen and the default screen after boot up. The HOME screen contains the most important general operator information such as:

a. Cooling status

b. Power supply status

c. Drive chain selection (pre-driver and IPA status)

d. Amplifier status



To Figure 2-5 on page 2-9

To Figure 2-8 on page 2-13

To Figure 2-10 on page 2-15

To Figure 2-12 on page 2-17

To Figure 2-14 on page 2-19

Figure 2-4 ULX-12300AT Home Screen

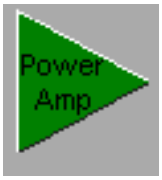
It also has the global status and operation information at the top of the screen which shows the transmitter status, power output and any faults present.

The HOME button (shown to the right) is a software button located in the upper left quadrant of all 5 main menu screens for quick navigation to the HOME screen. If a submenu screen is displayed on the GUI (see Figure 2-4), the lower right-hand button will typically be the BACK (arrow) button; use this back arrow button to go back up a level.

The quickest way to access the HOME screen is to press either the HOME button on a main menu screen or the BACK button arrow on a submenu screen followed by a HOME button press on the main menu screen.

There are five touchscreen navigation buttons on the right side of the GUI Home display. These buttons vary from screen to screen. The software menu buttons can also act as status indicators and turn red if a fault condition is detected.

There is a navigation button (shown to the right) to allow access to information specific to the PA cabinet. Pressing this button will take you to the Power Amp screen shown in Figure 2-8 on page 2-13.



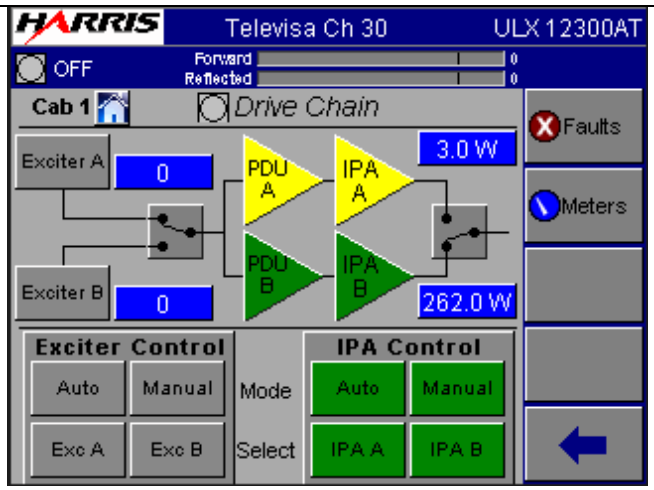
This button is also a status indicator for the PA cabinet as it will change from green to red, if a problem is detected in that cabinet.

NOTE:
To simplify the discussion of GUI navigation, the following sections describe the screens under the 5 main menu buttons located on the right side of the GUI Home page.

Similarly, pressing the exciter, PDU or IPA icons will take you to the main drive chain menu.

2.5 Drive Chain Main Menu

If you press the Drive Chain button on the HOME screen, it will take you to the screen shown in Figure 2-5. The Drive Chain Menu structure is shown in Figure 2-24 on page 2-29.



To Figure 2-6

To Figure 2-7

To Figure 2-4

Figure 2-5 Drive Chain Screen

The Drive Chain screen is basically an exciter, pre-driver and IPA control and monitoring screen. It has a power reading for each exciter and IPA output and allows the operator to select exciters and pre-driver/IPA's. It also allows selection of AUTO or MANUAL switching mode for the drive chain when the optional dual exciter system is installed. Specifically it includes:

a. The operational and on-air status of 1 or 2 exciters (the second exciter is optional) pre-drivers and IPA's.

NOTE:
The standard M2X exciter comes with a main and aux input.

b. The status of Exciters and Drivers A and B. The screen also allows exciter and driver selection.

c. A Dual Exciter Control box (located at the bottom of the screen on the left). This section will be grayed out for single exciter systems. For dual exciter systems this box has two exciter buttons and Auto/Manual buttons:

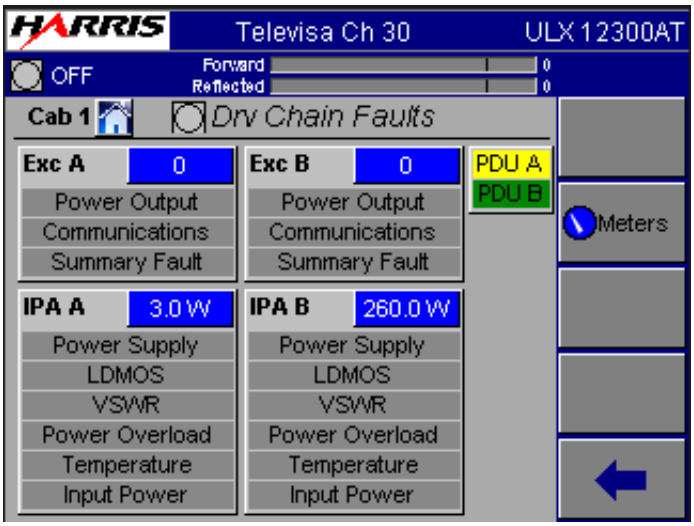
1. Auto/Manual - Auto should be the standard position for normal operation. Placing it in Manual mode prevents an autoswitch to the alternate drive chain. In AUTO mode, if the on-air exciter drops below 50% of nominal power, or if the on-line exciter experiences a fault, the controller will automatically switch to the backup drive chain (if available). Manual mode could be used if an exciter or driver has been removed for service or for any application where an automatic switch to the alternate drive chain is not desired.
2. Exciter A/B - These buttons select operational exciter. To use these buttons, place the Auto/Manual button to Manual, then press the A or B button to select the on-air drive chain.

d. Pre-Driver/IPA Control box (located at the bottom of the screen on the right). This dual driver has 2 switches:

1. Auto/Manual - This toggle button should always be in the Auto position for normal operation. Placing it in Manual mode prevents an autoswitch to the alternate IPA (Preamp/Driver). In AUTO mode, if the on-air predriver/IPA- drops below 50% of nominal power, the controller will automatically switch to the backup pre-driver/IPA. Manual mode could be used if a exciter or driver has been removed for service or for any application where an automatic switch to the alternate IPA(Preamp/Driver) chain is not desired.
2. Pre-driver/IPA A/B - These are the manual selection buttons. To use these buttons, place the Auto/Manual button to Manual, then press A or B to activate the on-air predriver/IPA combination.

2.5.1 Drive Chain Faults

When the "Faults" button in Figure 2-5 is pressed, it will bring up the screen shown in Figure 2-6. This screen is basically a fault display for exciters and pre-driver/IPA's. For more information on these faults and what to do if one should occur, refer to the M2X exciter manual.



To Figure 2-7

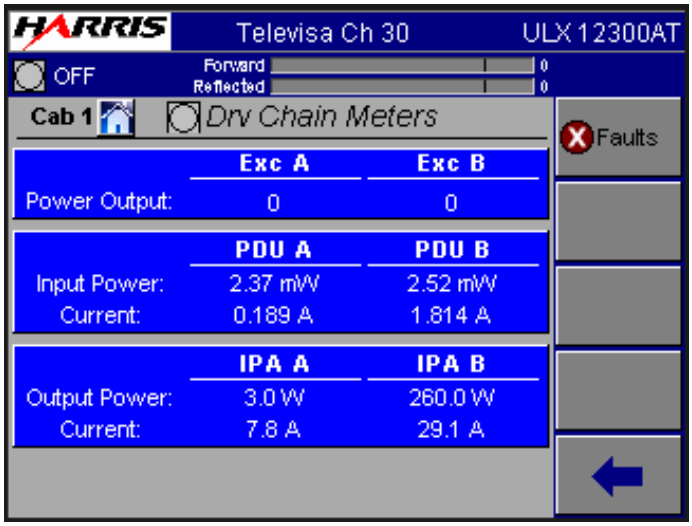
To Figure 2-5

Figure 2-6 Drive Chain Faults Screen

NOTE:
Exciter A is always factory installed as the upper exciter unit. The optional exciter B is installed immediately above the TCU and below the top exciter unit (see layout photo Figure 1-1 on page 1-2).

2.5.2 Drive Chain Meters

When the "Meters" button in Figure 2-6 is pressed, it will bring up the screen shown in Figure 2-6. This screen displays input and output information for exciters and pre-driver/IPA units.Current values for the pre-driver and IPA's are also given.



To Figure 2-6

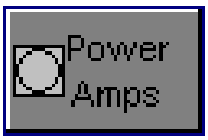
To Figure 2-5

Figure 2-7 Drive Chain Meters Screen

WARNING: Disconnect primary power prior to servicing.

2.6 Power Amp Main Menu

If you press the Power Amps button on the HOME screen, it will take you to the screen shown in Figure 2-8. The Power Amps Menu structure is shown in Figure 2-24 on page 2-29.



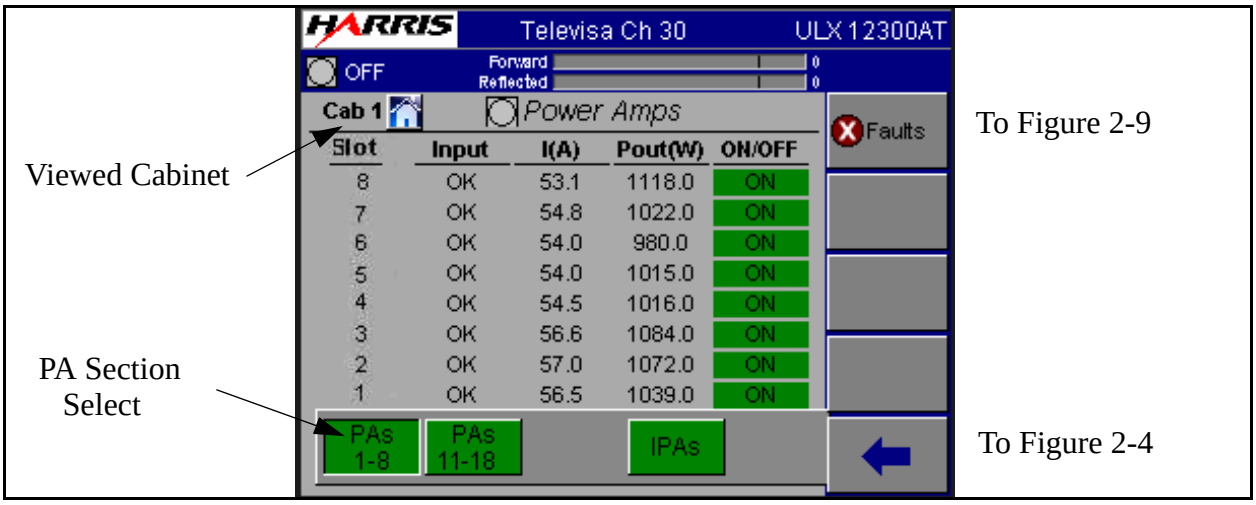


Figure 2-8 Power Amps Screen
(PA Cabinet 1 ULX12300AT shown)

This screen shows the current and forward power for individual PA modules in the indicated cabinet. Additional modules in the same cabinet are viewed by selecting the PA's 1-8 or 11-18 buttons in the lower left portion of the bottom of the screen. The PA, Input and On/Off indications on the screen are also status indicators with 3 possible states indicated:

a. OK - Green background
b. Fault - Red background
c. OFF - The background is gray.

The On/Off field will can be used to toggle individual amplifier modules on or off as needed.

NOTE:
For multi-cabinet Maxiva Series transmitters (ULX13400 - ULX36900) the cabinet select buttons are located to the right on the screen. Selecting "Next Cabinet" will allow viewing of information for the next cabinet. Once the desired cabinet is selected, submenus are navigated in the same way as the others cabinets'.

NOTE:
Always be sure that you are accessing the desired cabinet number. The cabinet being viewed is indicated in the upper left corner of the screen.

To get detailed information on a particular PA Module, press the Faults button on the right section of the screen. The Faults button will take you to the PA Faults screen shown in Figure 2-9.

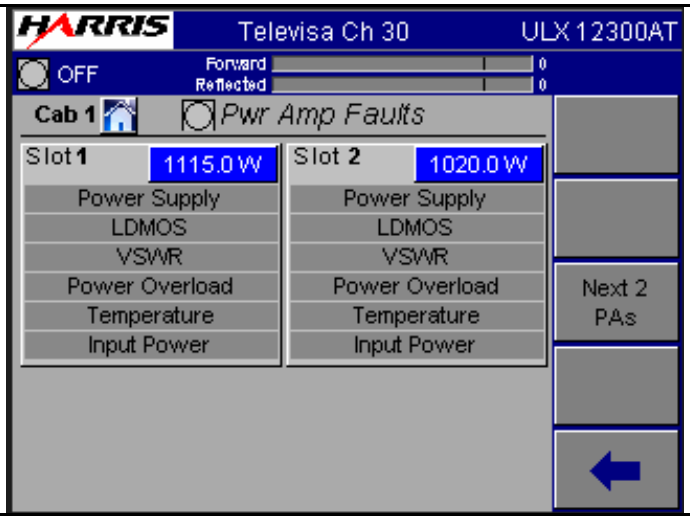
2.6.1 PA Faults

This screen is basically a list of all faults monitored in each PA Module.

- An active fault will be highlighted in RED
- A warning condition will be highlighted in YELLOW.

The PA Faults screen in Figure 2-9, shows that PA Module #1, in PA Cabinet #1 has no faults and 1 temperature warning. It also shows a power supply fault on module 3 and an input power warning on module 4.

NOTE:
For a detailed explanation of all PA Faults in Figure 2-9 refer to Section 6, Diagnostics.



To Figure 2-8

Figure 2-9 PA Faults Screen (PA Module 1 Selected)

PA Modules will fault off at 200W reflected power. Also, it will display a temperature fault at 65° C ambient temperature (measured by a thermistor on the monitor board) or 90° C pallet temperature.

2.7 Output Main Screen

If you press the Output button on the HOME screen, it will take you to the screen shown in Figure 2-10. The Output Menu structure is shown in Figure 2-23 on page 2-27.

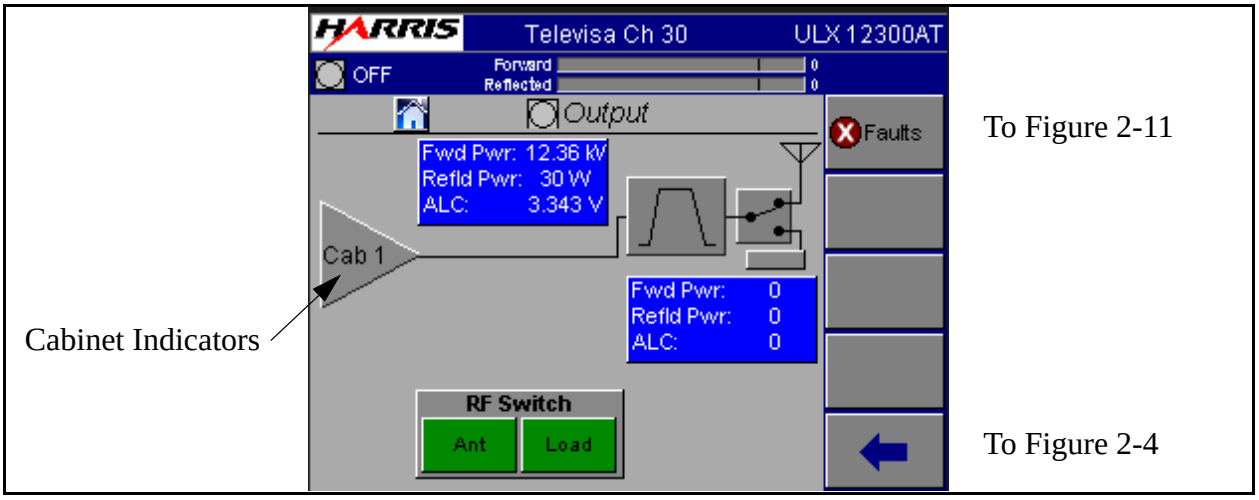


Figure 2-10 Output Screen

The main Output screen is has 3 main areas:

- RF Output System - This panel gives the total system Forward and Reflected power, measured after the filter. It also has a VSWR and Foldback status indications with backgrounds that are red for fault or yellow for warning. A VSWR fault is indicated when the system VSWR is > 1.9:1. Foldback warning is indicated when system VSWR is > 1.4:1

NOTE:
Both VSWR fault and foldback levels are adjustable via software.

- Power Amplifier Cabinet - Amplifier cabinet icons (triangle) give a status indication of OK (green) or Fault (red) along with cabinet Forward and Reflected power (before the filter) for each cabinet.
- Output Control - The control area at the bottom of the screen is used to control an external RF switch so that the transmitter can be switched from Antenna to the Test Load. The diagram indicates the position of the RF switch based on micro-switches located on the switch.

NOTE:
If the load interlock is open and the transmitter is switched to the "Test Load" position, the transmitter output will be muted. If a test load interlock is not used the appropriate connection on the interlock connector on the customer I/O panel must be jumpered. For more information see UAX technical manual section two.

2.7.1 Output Faults

This screen shows faults which are considered Cabinet or System level such as VSWR, Power High, foldback etc....

- An active fault will be highlighted in RED
- A warning condition will be highlighted in YELLOW

A detailed explanation of each of these faults is given in Section 6, Diagnostics.

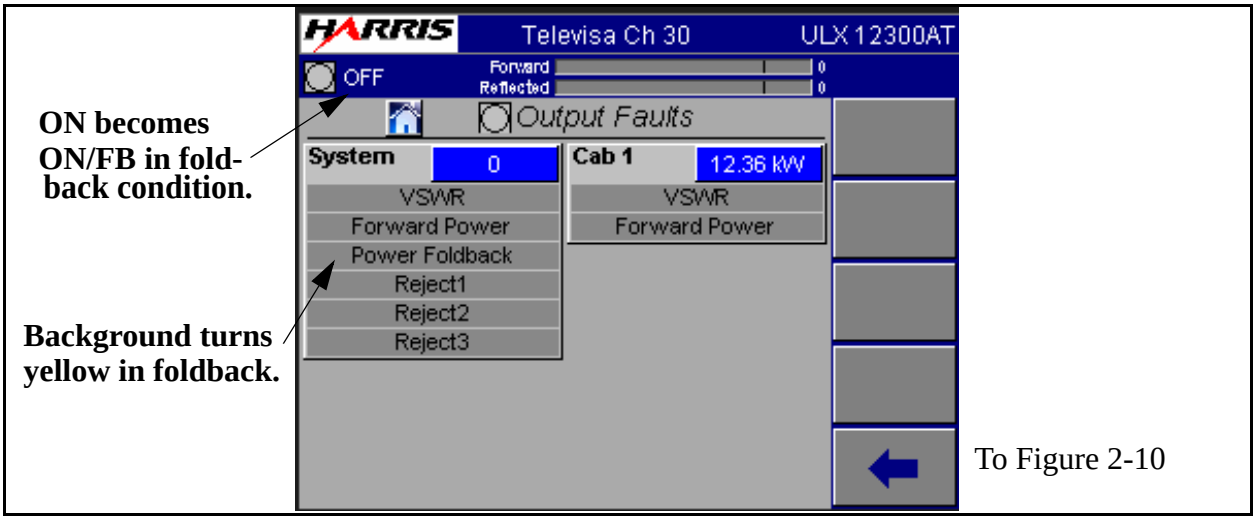


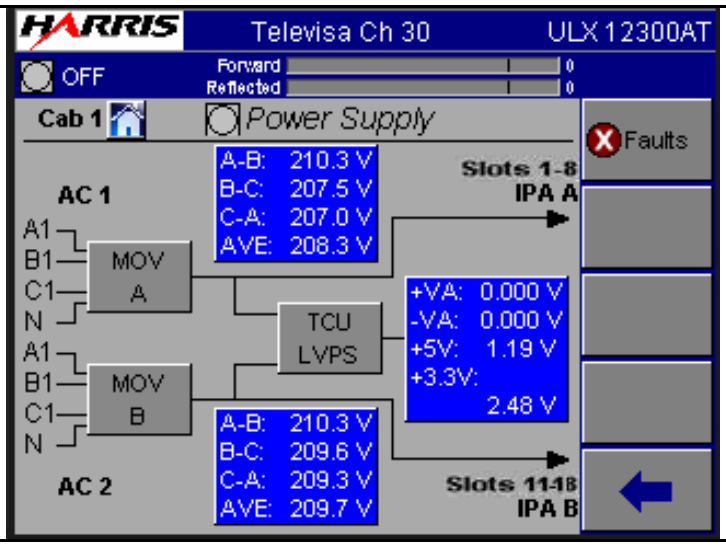
Figure 2-11 Output Faults Screen

2.8 Power Supply Main Menu

If you press the Power Supply button on the GUI screen it will take you to the screen shown in Figure 2-12. The Power Supply Menu structure is shown in Figure 2-24 on page 2-29.

This is the power supply metering screen for both the low voltage power supply units (in the TCU) and the AC Mains. It also allows access to Power Supply Fault screens:

- PS Faults - Fault list and status
- Next Cabinet - Access to PS screens on other cabinets if applicable.



To Figure 2-13

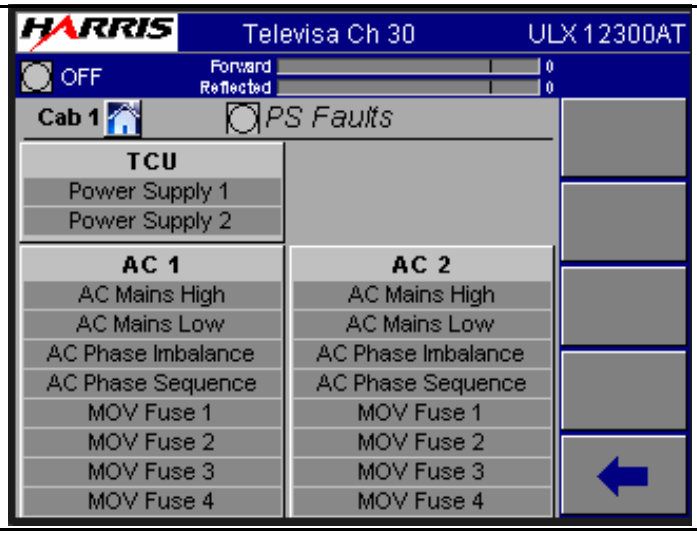
To Figure 2-5

Figure 2-12 Power Supply Screen

WARNING: Disconnect primary power prior to servicing.

2.8.1 PS Faults

This is the PS (power supply) Faults screen which lists of all of the monitored power supply faults for the AC mains and low voltage power supplies. An active fault will be highlighted in RED, while a warning condition will be highlighted in YELLOW. For a detailed explanation of these faults, refer to Section 6, Diagnostics.



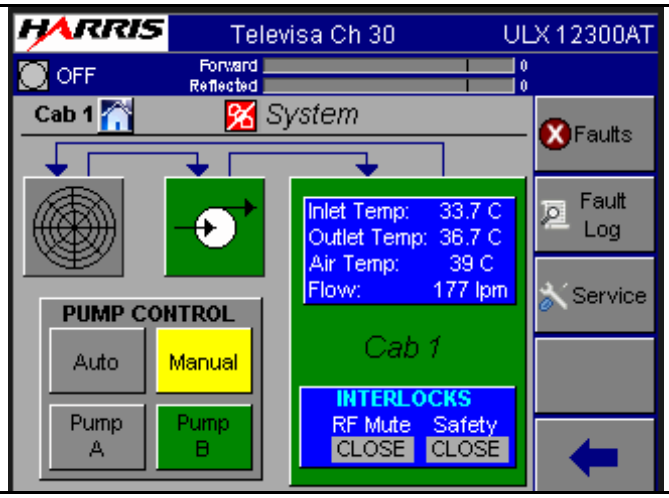
To Figure 2-12

Figure 2-13 PS Faults Screen

WARNING: Disconnect primary power prior to servicing.

2.9 System Main Menu

If you press the System button on the GUI screen, it will take you to the screen shown in Figure 2-14. The System Menu structure is shown in Figure 2-24 on page 2-29.



To Figure 2-15

To Figure 2-16

To Figure 2-17

To Figure 2-4

Figure 2-14 System Main Menu

This screen contains the System Main Menu which gives overall status information and access to additional System screens. This includes:

a. **CAB1 -** Provides coolant temperatures, air temperatures and coolant flow (liters per minute). The CAB1 block also provides the status of the RF Mute and Safety Interlocks. Interlocks can read Open (red background) or Closed (gray background)

b. **Pump Status -** Pump icon has a green background color if no faults are present or a red background color if faults are active. For more information on faults press "Faults"

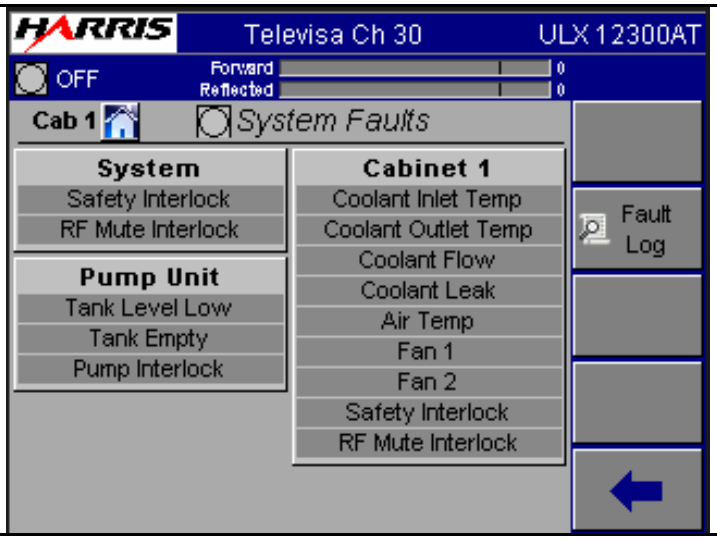
c. **Pump Control -** Pump A & Pump B for dual pump systems are indicated. This panel would be grayed out (inactive) for single pump systems. The active pump will have a green background. Pumps can be switched from this screen, by pressing A or B only if the pump control panel switch is in the REMOTE mode. Placing the pump control panel in LOCAL mode will disable pump selection on the System GUI screen. For additional information on LOCAL operation and the pump control panel see "1.2.8.1 Cooling System Control Panel" on page 1-15. AUTO or MANUAL can also be selected here. Selecting AUTO allows automatic switchover in case of pump failure in dual pump systems. AUTO is the normal operating mode if the system has dual pumps.

WARNING: Disconnect primary power prior to servicing.

2.9.1 System Faults

This screen is accessed by pressing the Faults button on the System screen. An active fault condition is highlighted in RED while a warning condition is highlighted in YELLOW.

For more information on these faults refer to Section 6, Diagnostics.



To Figure 2-14

Figure 2-15 System Faults Screen

2.9.2 System Fault Log

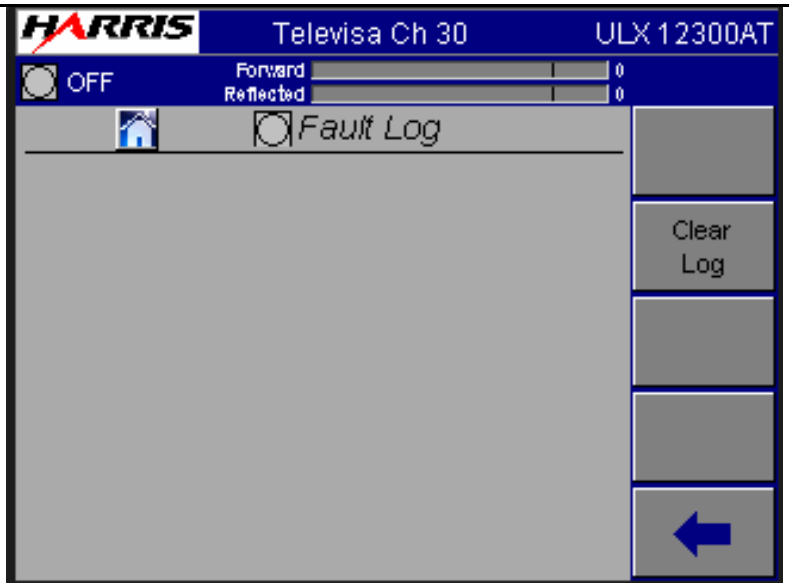
This screen is accessed by pressing the System Fault Log button on the System screen in Figure 2-14 on page 2-19. It is a complete listing of all transmitter and system faults in the order in which they occurred. It can hold up to 99 faults and then becomes a FIFO (First IN - First Out) memory buffer, with the **latest fault entry on top**. *Active* Faults will be highlighted and cannot be reset. All other faults will be cleared when the RESET button is pressed. Use the NEXT and PREVious buttons to view the entire list.

A complete listing of all faults which can show up in this log, along with a brief explanation of each fault, is given in the following tables in Section 6, Diagnostics.

- Table 3-1, “Maxiva Drive Chain Fault List,” on page 3-5
- Table 3-2, “PA and IPA Module Fault List,” on page 3-7
- Table 3-3, “Power Supply Faults List,” on page 3-8

- Table 3-4, “Output Faults List,” on page 3-10
- Table 3-5, “System Faults List,” on page 3-12

These tables are a quick reference list and in most cases is all that is required for advanced user to diagnose the problem. However, detailed information on each of these faults is also given in context with the fault page where it originated, also in Section 6.



Note:
Date format is DD/MM/YY

Press to clear all faults

To Figure 2-14

Figure 2-16 System Fault Log Screen

WARNING: Disconnect primary power prior to servicing.

2.9.3 System Service

This screen provides a way to change 3 pieces of information which are then used throughout the GUI. The System Service screen us shown in Figure 2-17 on page 2-22.

- **Station Name:** This can be up to 24 characters and will appear at the top of every GUI screen
- **Model Number:** This value is entered at the factory. The model number chosen must match the transmitter name plate. It is used to gray out portions of the GUI screens which are not used by some models.
- **Serial Number:** This is entered at the factory. Refer to this number if calling for support.

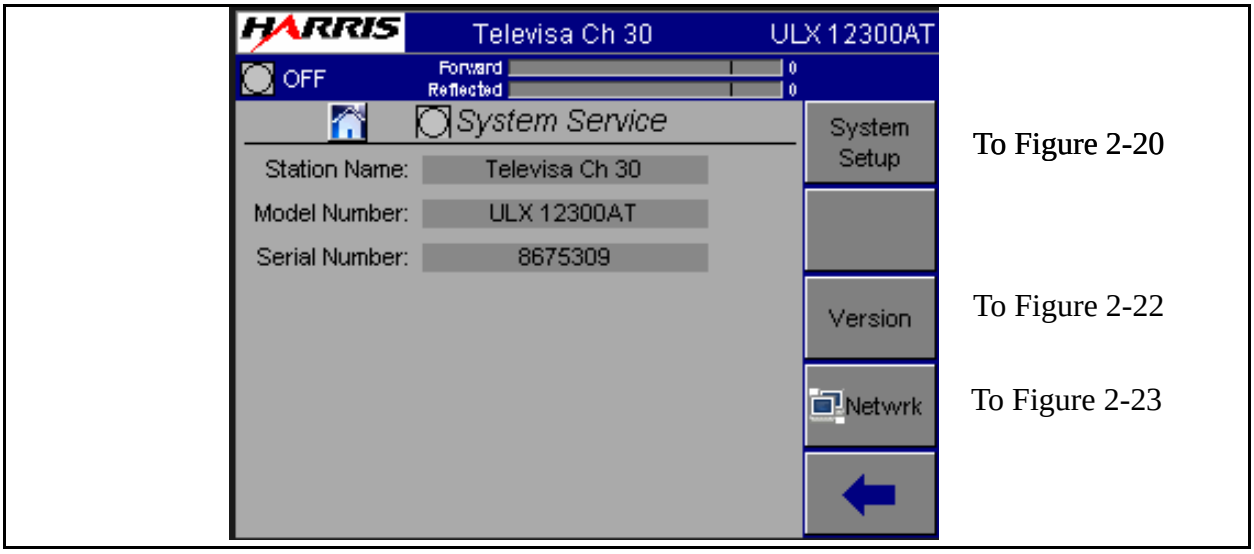


Figure 2-17 System Service Screen (Remote)

The System Service screen varies depending on whether it is viewed on the local GUI screen or remotely via web browser. The local screen shown in Figure 2-18 on page 2-23 contains additional entry windows to allow manual entry of date and time values. The TCU will automatically set date and time values at turn on if it is connected to a network.

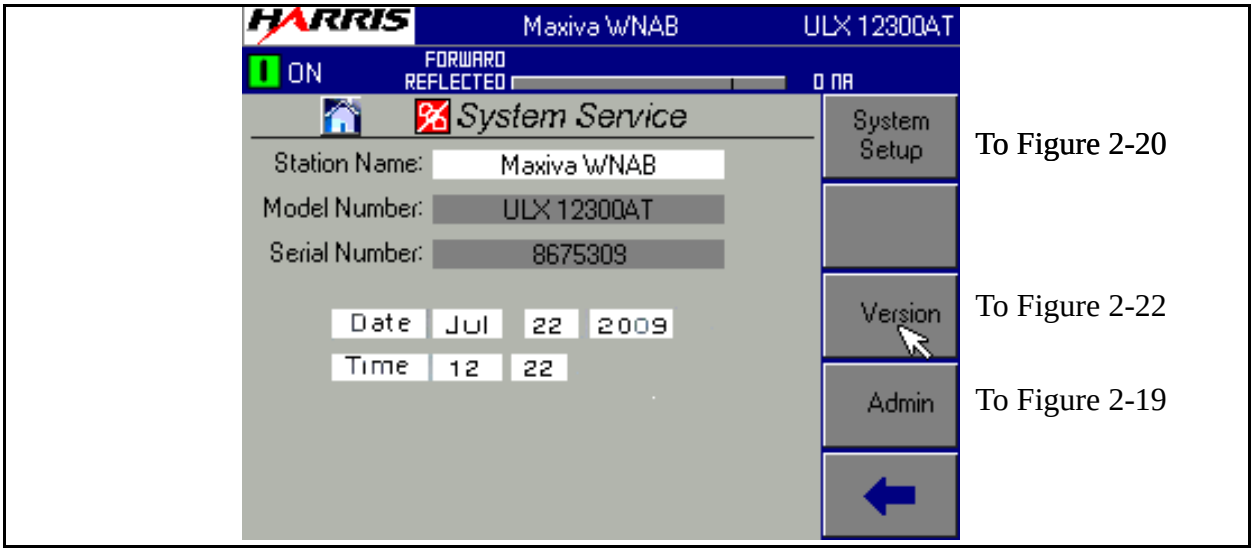
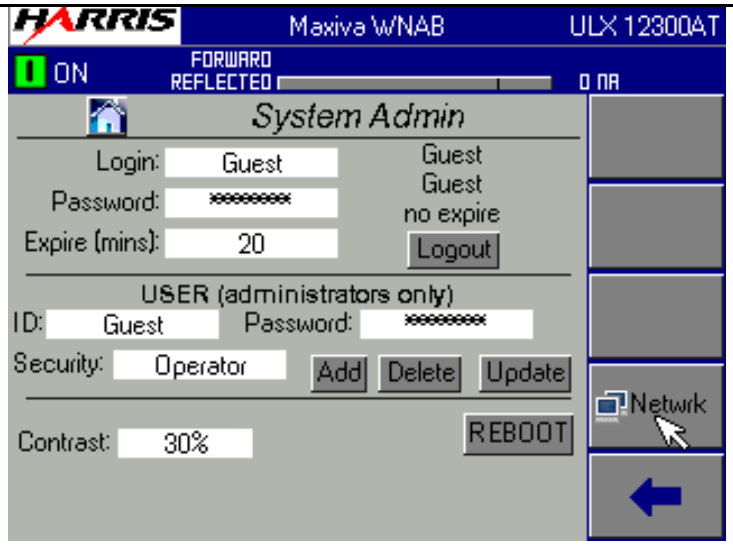


Figure 2-18 System Service Screen (Local)

2.9.3.1 Admin Setup (Local GUI Only)

The Admin screen is accessed by pressing the Admin button shown on the Local GUI System Service screen shown in "Figure 2-18 System Service Screen (Local)" on page 2-23. The following parameters are accessed via the System Service Admin screen.

- Login: Allows access as Guest, Operator or Expert. Guest level allows user to view screens but does not allow adjustments. Operator allows viewing and operational adjustments. Expert allows viewing, operational and maintenance adjustments.
  - Local GUI login is admin. Web browser login is admin.
- **Password:** Allows user password entry. There are different login and passwords for local and web browser GUI usage. The default logins and password from the factory are:
  - Local GUI passwrord is harris. Web browser login is harris2009.
- **Expire:** Sets the expiration time for the user access level.
- **LCD Contrast:** The screen contrast can be adjusted dynamically to allow for different room lighting by change the percentage setting.
- **User (administrators only):** This area is used to enter ID's and passwords for the various user levels.
- **Reboot:** This button will reboot the TCU. The transmitter will stay on the air. Reboot takes about 2 minutes



To Figure 2-20

Figure 2-19 System Admin Screen

2.9.3.2 System Setup

- **Sys Pwr Out (W):** Set this value to the system nominal power output. This value determines the 100% level on the GUI power out bar.
- **Center Freq (MHz):** Enter the center frequency for the desired operational channel. This only sets the transmitter frequency. It doesn't set the exciter frequency.
- **Modulation Type:** Select the system modulation type from the values displayed in the box.
- **AC Line Volt (VAC):** Set this to the nominal AC line voltage at the transmitter site.
- **Number of Exciters:** Set this to either 1 or 2 depending on how many exciters are in the transmitter.
- **Number of Cabinets:** Set this to the number of PA cabinets in the system.
- **System Setup Entry:** Enter a number from 1 to 8 in this field. For example if you want to set up the transmitter for CH29 and store it in entry 3, you enter 3 in the System Setup Entry. This will recall the data for entry 3. If no data is there, defaults will be loaded. Once all the calibrations for channel 29 are done you press SAVE SETUP. This will save the data to entry 3.

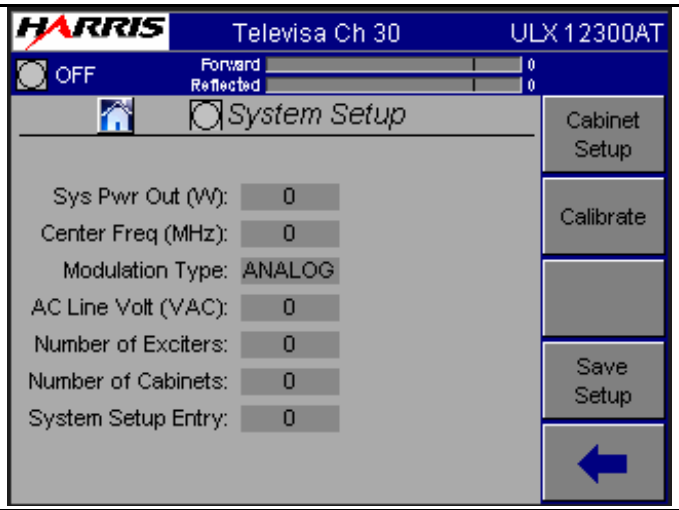
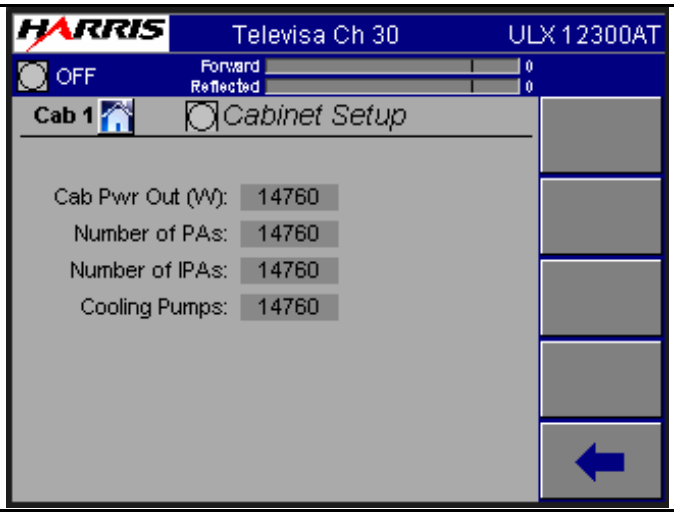


Figure 2-20 System Setup Screen

NOTE:
The Save Setup button allows storage of up to eight setups for the purpose of N+1 operation. All the calibrations for the transmitter are saved in the MCM module. This means the transmitter can change to anyone of 8 channels and be fully calibrated by simply recalling the set up entry. The N+1 controller will send the set up the entry that needs to be recalled, as well as set the exciter frequency.

2.9.3.3 Cabinet Setup

- **Cab Pwr Out (W):** Set cabinet output power here. This is the power out of the cabinet before the combiner or filter. This needs to be set for each cabinet. Sets cabinet nominal power used to set ALC level. Maximum cabinet power is limited to 10% over this value.
- **Number of PA's:** Enter the number of PA modules in the selected cabinet. This needs to be set for each cabinet.
- **Number of IPA's:** Enter the number of IPA modules in the selected cabinet. This needs to be set for each cabinet.
- **Cooling Pumps:** Set this to either 1 or 2 depending on how many pumps are in pump module/heat exchanger for this cabinet. This needs to be set for each cabinet.



To Figure 2-17

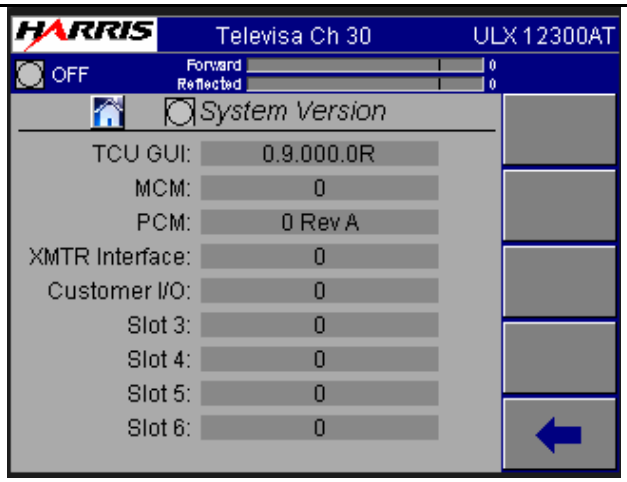
Figure 2-21 Cabinet Setup Screen

2.9.3.4 System and Cabinet Power Calibrate

See the UAX technical manual Section 5 for the procedure that utilizes these screens.

2.9.3.5 System Version Screen

This screen shows the software revision for the TCU controllers. This information should be known before calling for technical support.

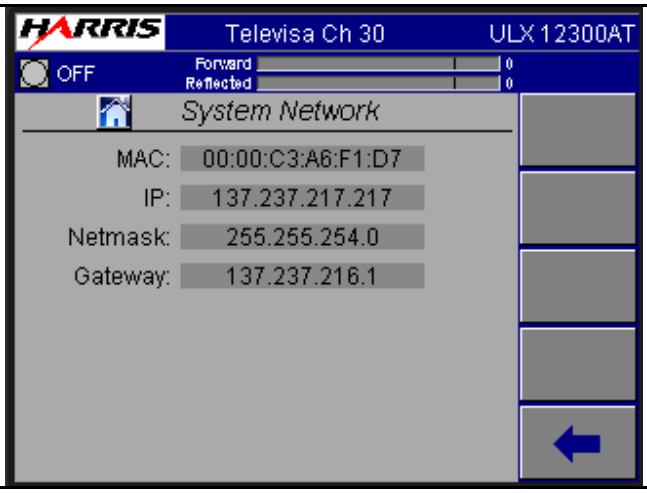


To Figure 2-17

Figure 2-22 System Version Screen

2.9.3.6 System Network Screen

This screen provides information about network settings. MAC, IP, Netmask and Gateway settings are given.



To Figure 2-17

Figure 2-23 System Network Screen

The System Network screen when viewed from the local GUI has an additional button called Save & Restart Network. When a change is made to one of the network parameters (IP address, mask, etc.) the networking system has to be restarted before the

change is implemented. Save & Restart saves the change and restarts the network system so the change is made permanent and the new parameters become active.

2.10 GUI Menu Structures

Figure 2-24 on page 2-29 shows the menus which can be accessed on the GUI. This menu tree may be helpful when learning to navigate the screens. The blocks on the left represent the main menus which can accessed using one of the 5 software buttons on the right side of the GUI HOME Page. Each successive level (to the right) represents software buttons which will show up on the right side of the GUI submenu screens.

NOTE:
Multi-cabinet Maxiva Series transmitters will require an extra button press at the top level menus to select the desired cabinet.

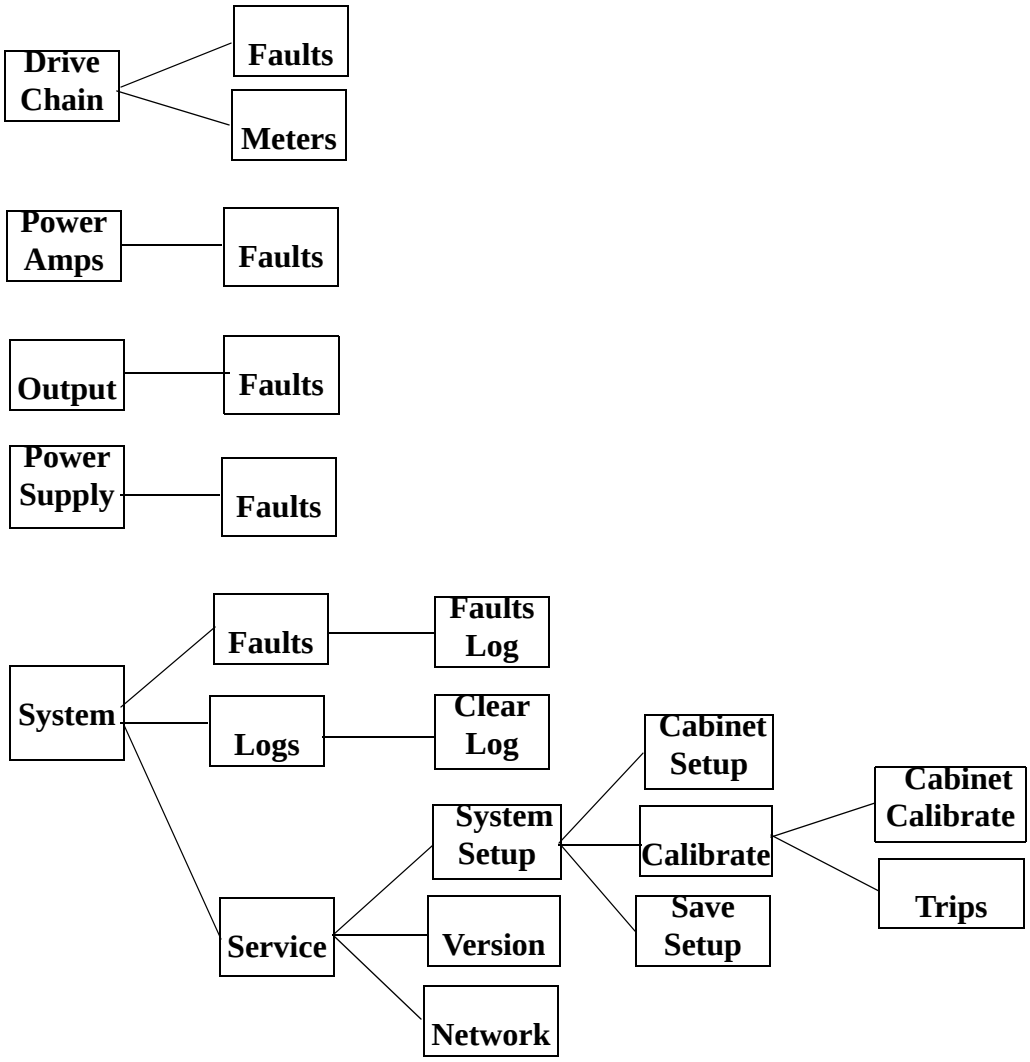


Figure 2-24 GUI Menu Tree

Section 3 Diagnostics 3

3.1 Introduction

This section contains diagnostic and troubleshooting information for the ULX series UHF transmitter. Included is a complete description of all faults which can be displayed via the transmitter front panel TCU display or GUI (Graphical User Interface). Due to the complexity of the transmitter control system and the extensive use of surface mount components, the scope of this diagnostics section is to isolate the problems down to a PC board or module level which can then be easily exchanged.

The GUI buttons and icons use a symbol and color code system. Some examples using the triangle shape are given below. The other shapes operate similarly.

a. Green with a 1 -  - ON and operating normally.

b. Green symbol -  - ON and operating normally.

c. Light Gray -  - "Grayed Out" - Not communicating or not available.

d. Yellow - 

Warning - A non-critical sub-system or parameter is out of tolerance and should be addressed by engineering personnel.

e. Red -  - Critical Fault - This could be a sub-system fault in which the sub-system is muted or shut off (such as a PA Module) or could be a system level fault which could mute or shut the transmitter off.

When a fault occurs one or more of the 5 LED's on the TCU will illuminate RED. To track down the cause of the fault, begin by looking at the TCU Home screen and the

WARNING: Disconnect primary power prior to servicing.

software buttons along the right side as shown in Figure 2-4 on page 2-7 another option is to start by going to the System Log and seeing what faults have occurred and in what order. If you are not familiar with GUI navigation, refer to Section 3.

3.2 GUI System Log

The GUI contains a System Log which is a listing of all faults which have occurred. To see the System Log press SYSTEM then SYSTEM LOG. This will bring up the screen in Figure 3-1. The System Log gives the following information:

a. # - This gives the number of the fault. There can be up to 99 faults in the log, then it is FIFO (First IN, First Out)

b. **Fault Type** - This is simply the name of the fault.

c. **Time and Date** - This gives the exact time and date that the fault occurred.

d. **Active or Inactive** - If the fault is highlighted in red, it is still active and cannot be cleared. If the fault is not highlighted, then the fault is gone and can be cleared if so desired.

Function Buttons:

a. **RESET** - Will erase all inactive faults in the log.

b. **NEXT and PREV -** These buttons allow you to scroll through the entire fault list if necessary.

c. **BACK -** Will take you back to the System main menu.

NOTE:
Tables 6-1 and 6-2 give a complete listing of all possible faults in the Maxiva transmitter. They also give a brief description of each fault, the trip point and the transmitter action taken in response to the fault.

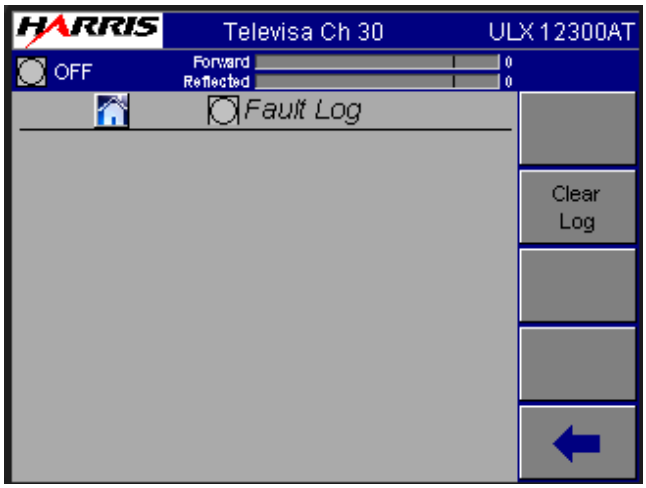


Figure 3-1 Fault Log Screen

3.3 Maxiva Three-Strike Fault Actions

3.3.1 Reflected Power Faults

The TCU monitors reflected power at the Cabinet output and at the System output. When the reflected power level (typically 10% of the rated power or a 1.9:1 VSWR) is exceeded the TCU generates an RF MUTE. If after three attempts to restart (three strikes) subsequent faults occur, the transmitter will turn OFF and operator intervention will be needed to turn it back ON. The three strike counter resets after 30 seconds with no faults.

Reflected power faults that initiate a three strike procedure are:

- Cabinet Reflected Power
- System Reflected Power

3.3.2 Module Faults

Should a module failure occur (say a power glitch) the TCU will initiate a three-strike action. This action will cause a reset of only the PA Module experiencing the fault and not the entire transmitter.

The module three strike policy is:

- The TCU will try to restart the module three times within a 10 second window. After that, if a fault is still present, the module will be turned OFF until it receives the restart command from the Main Controller (ON Command).
- There is a 3 second delay between restart attempts.
- The fault-strike restart process is the same as the system restart command, all of the module faults will be reset.
- During the 10 second three-strike window, any of the nuisance faults will be reported to the Main Controller.

These are the module faults which will be allowed three strikes:

- Over Voltage Pallet
- Under Voltage Pallet
- Over Temperature Module Controller
- Over Current Module Driver
- Over Temperature Pre-driver Heatsink
- Over Drive Module RF Input
- Over Drive Module RF Output
- Under Current Phase and Gain Board
- Over Current Phase and Gain Board
- Over Current Pallet
- Under Current Pre-Driver
- Over Current Pre-Driver
- Over Temperature Power Supply Board
- Low Voltage Output DC Converter
- Short Circuit
- High Module Reflected Power

3.4 Fault Tables

The following tables provide a listing of Maxiva Transmitter faults along with a brief description, the fault level or threshold and the action taken by the transmitter.

Table 3-1 Maxiva Drive Chain Fault List

TYPE	Description	Fault Level or Threshold	Transmitter Action	Three Strike	Available in Life Support
IPA A Fault: Power Supply, LDMOS, VSWR, Power Overload, Temperature, Input Power	The IPA can report up to 6 faults via their parallel control pins	Any one fault active	IPA Switch to alternate IPA if in Auto Mode	YES	YES
IPA B Fault: Power Supply, LDMOS, VSWR, Power Overload, Temperature, Input Power	The IPA can report upto 6 faults via their parallel control pins	Any one fault active	IPA Switch to alternate IPA if in Auto Mode	YES	YES
PDU (Predriver) A Fault	The Predriver current is monitored inside the PDU. A fault is sent if it is below the normal minimum current.	Predriver current is below TBD mA	IPA Switch to alternate IPA if in Auto Mode	NO	YES
PDU Predriver B Fault	The Predriver current is monitored inside the PDU. A fault is sent if it is below the normal minimum current.	Predriver current is below TBD mA	IPA Switch to alternate IPA if in Auto Mode	NO	YES
Exciter A Power Output	Exciter A power level low	Trip point is 50% of nominal. Trip point adjustable by epot	Exciter Switch to alternate Exciter if in Auto Mode	NO	YES

Table 3-1 Maxiva Drive Chain Fault List

TYPE	Description	Fault Level or Threshold	Transmitter Action	Three Strike	Available in Life Support
Exciter B Power Output	Exciter B power level low	Trip point is 50% of nominal. Trip point adjustable by epot	Exciter Switch to alternate Exciter if in Auto Mode	NO	YES
EXCA NO COMMUNICATIONS	Exciter A not communicating with transmitter main controller	No serial communications traffic detected	Exciter Switch to alternate Exciter if in Auto Mode	NO	NO
EXCB NO COMMUNICATIONS	Exciter B not communicating with transmitter main controller	No serial communications traffic detected	Exciter Switch to alternate Exciter if in Auto Mode	NO	NO
EXCA Summary Fault	Exciter A reports a summary fault	Exciter Switch to alternate Exciter if in Auto Mode	NO	YES	
EXCB Summary Fault	Exciter B reports a summary fault	Exciter Switch to alternate Exciter if in Auto Mode	NO	YES	

Table 3-2 PA and IPA Module Fault List

TYPE	Description	Fault Level or Threshold	Transmitter Action	Three Strike	Available in Life Support
Temperature Fault				YES	YES
VSWR Fault				YES	YES
Power Overload (including Input Power Overdrive)				YES	
LD-MOSFET Failure				YES	YES
Input Power Low				YES	YES

Table 3-3 Power Supply Faults List

TYPE	Description	Fault Level or Threshold	Transmitter Action	Three Strike	Available in Life Support
+VA VDC FLT	+15V Voltage Failure	Value is more than +/- 15% of normal reading	WARNING	NO	YES
-VA VDC FLT	-15V Voltage Failure	Value is more than +/- 15% of normal reading	WARNING	NO	YES
+5 VDC FLT	+5V Voltage Failure	Value is more than +/- 15% of normal reading	WARNING	NO	YES
+3.3 VDC FLT	+3.3V Voltage Failure	WARNING	WARNING	NO	YES
AC Mains High	AC Mains voltage has exceeded 10% above nominal	WARNING	NO	YES	
AC Mains Low	AC Mains voltage has exceeded 15% below nominal	Any phase is greater than +/- 5% of the average of all three phases	NO	YES	
AC Phase Imbalance	AC line imbalance phase to phase	Wrong sequence	WARNING	NO	YES
AC Phase Sequence	Wrong Phase sequence detected	FUSE OPEN	RF MUTE, Pump and Heat exchanger turned OFF. Transmitter returns to ON state automatically when fault clears.	NO	YES
MOV Fuse 1	Fuse failed on MOV board	FUSE OPEN	WARNING	NO	YES

Table 3-3 Power Supply Faults List

TYPE	Description	Fault Level or Threshold	Transmitter Action	Three Strike	Available in Life Support
MOV Fuse 2	Fuse failed on MOV board	FUSE OPEN	WARNING	NO	YES
MOV Fuse 3	Fuse failed on MOV board	FUSE OPEN	WARNING	NO	YES
MOV Fuse 4	Fuse failed on MOV board	Value is more than +/- 15% of normal reading	WARNING	NO	YES

Table 3-4 Output Faults List

TYPE	Description	Fault Level or Threshold	Transmitter Action	Three Strike	Available in Life Support
Cabinet VSWR (Reflected Power Fault)	Cabinet Reflected Power has exceeded 10% of rated power	Trip point is set at VSWR = 1.9:1. Trip point adjustable by epot	RF MUTE, Fault OFF after 3-strike. The Time interval between strikes should be about 3 seconds	YES	YES
System VSWR (Reflected Power Fault)	System Reflected Power has exceeded 10% of rated power	Trip point is set at VSWR = 1.9:1 (Foldback starts at 1.4:1). Trip point adjustable by epot. Foldback set point adjustable by soft-ware	RF MUTE, Fault OFF after 3-strike. The Time interval between strikes should be about 3 senconds	YES	YES for trip NO for Fold-back. Fold-back routine requires PCM action
Cabinet For-ward Power Fault (Visual Power in Analog TV)	Cabinet Forward Power has exceeded 10% of rated power	WARNING	NO	YES	YES
Cabinet Aural Power Fault (Ana-log TV only)	Aural Power is below 50% of rated power	WARNING	NO	NO	NO
System For-ward Power Fault	System Forward Power has exceeded 10% of rated power	WARNING	NO	YES	YES
System Aural Power Fault (Analog TV only)	Aural Power is below 50% of rated power	WARNING	NO	NO	NO

Table 3-4 Output Faults List

TYPE	Description	Fault Level or Threshold	Transmitter Action	Three Strike	Available in Life Support
System Power Fold-back	The forward power is folded-back (reduced) to maintain the reflected power below 2.8% of nominal power (1.4:1 VSWR)	Trip point is set at VSWR = 1.4:1. This is a software trip point which depends on the transmitter nominal power	WARNING	NO	NO
Reject 1 Fault	Reject power threshold exceeded	WARNING	NO	YES	YES
Reject 2 Fault	Reject power threshold exceeded	WARNING	NO	YES	YES
Reject 3 Fault	Reject power threshold exceeded	WARNING	NO	YES	YES

Table 3-5 System Faults List

TYPE	Description	Fault Level or Threshold	Transmitter Action	Three Strike	Available in Life Support
Air Temp	Ambient control enclosure air temperature has exceeded 65°C. The source of this temp can be from the temp sensor in the MCM module for instance.	65°C	WARNING	NO	YES
Coolant Flow	Coolant flow is less than the minimum Liters per minute flow rate for the number of PAs present	Depends on transmitter model	RF MUTE followed by pump switchover. If still insufficient flow RF MUTE stays active until proper flow is restored. Transmitter returns to ON state automatically when fault clears.	NO	YES
Coolant Leak	Coolant leak detected inside transmitter cabinet	N/A	Transmitter Fault OFF. A manual turn ON is required for recovery	NO	YES
Coolant Inlet Temperature	Coolant temperature has exceeded 55°C	Warning at 55°C, Fault at 65°C	WARNING. RF MUTE if coolant temperature reaches 65°C. Transmitter returns to ON state automatically when fault clears.	NO	YES

Table 3-5 System Faults List

TYPE	Description	Fault Level or Threshold	Transmitter Action	Three Strike	Available in Life Support
Coolant Outlet Temperature	Coolant temperature has exceeded 55°C	Warning at 55°C, Fault at 68°C	WARNING. RF MUTE if coolant temperature reaches 68°C. Transmitter returns to ON state automatically when fault clears.	NO	YES
Coolant Fault	The tank in the pump module is empty	Open circuit from level detector inside tank	Transmitter Fault OFF. A manual turn ON is required for recovery	NO	YES
Coolant Warning	The coolant in the tank is low	Open circuit from level detector inside tank	WARNING	NO	YES
Fan 1 Fault	Fan AC current too low or too high	Fault levels LOW: 100 mA, HIGH: 800 mA	WARNING	NO	YES
Fan 2 Fault			WARNING	NO	YES
System Safety Interlock		Open circuit	Transmitter Fault OFF. A manual turn ON is required for recovery	NO	YES

Table 3-5 System Faults List

TYPE	Description	Fault Level or Threshold	Transmitter Action	Three Strike	Available in Life Support
System RF Mute Interlock		Open circuit	Transmitter RF MUTE. Transmitter returns to ON state automatically when the interlock is closed.	NO	YES
Cabinet Safety Interlock		Open circuit	Cabinet Fault OFF. A manual turn ON is required for recovery	NO	YES
Cabinet RF Mute Interlock		Open circuit	Cabinet RF MUTE. Cabinet returns to ON state automatically when the interlock is closed.	NO	YES