Instruction Manual

6X Series,

Liquid-Cooled
Transmitter

Axcera, LLC
103 Freedom Drive, P.O. Box 525 Lawrence, PA 15055-0525 USA
PHONE: 1-724-873-8100 • FAX 1-724-873-8105
www.axcera.com • info@axcera.com

Table of Contents

Chapter 1
Introduction

1.1 Manual Overview

This instruction manual is divided into five chapters and supporting appendices. **Chapter 1**, Introduction, contains information on safety, material return procedures, and warranties. **Chapter 2,** System Description, contains the system and assembly descriptions. **Chapter 3**, Installation and Set Up Procedures, describes the installation procedure, set up procedure and the operation of the transmitter. **Chapter 4,** Circuit Descriptions, contains the detailed circuit descriptions of the boards and subassemblies that are contained in the transmitter. **Chapter 5**, Maintenance, describes the periodic maintenance procedures for the transmitter. **Appendix A** contains the System, Assemblies, Subassemblies and Boards drawings and parts lists.

1.2 Assembly Designators

Axcera has assigned assembly numbers, Ax designations, where x=1,2,3 etc, example A1, to all assemblies, modules, and boards in the system. These designations are referenced in the text of this manual and shown on the block diagrams and interconnect drawings provided in the appendices. The Block Diagrams, Interconnects, Schematics, Assembly Drawings and Parts Lists are arranged in increasing numerical order in the appendices. Section titles in the text for assembly or module descriptions or alignment procedures contain the associated part number(s) and the relevant appendix that contains the drawings for that item.

The cables that connect between the boards within a tray or assembly and that connect between the trays, racks and cabinets are labeled using markers. Figure 1-1 is an example of a marked cable. There may be as few as two or as many as four Markers on any one cable. These markers are read starting farthest from the connector. If there are four Markers, the marker farthest from the connector is the system number such as system 1 or translator 2. The next or the farthest Marker is the rack or cabinet “A” number on an interconnect cable or the board “A” number when the cable is within a tray. The next number on an interconnect cable is the Tray location or Board “A” number. The marker closest to the connector is the jack or connector “J” number on an interconnect cable or the jack or connector “J” number on the board when the cable is within a tray.

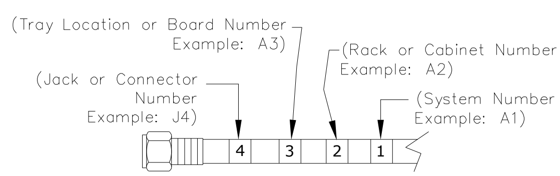


Figure 1-1: Marker Identification

1.3 Safety

It is important that any user of this equipment read all of the instructions, especially the safety information in this chapter, before operating the transmitter. Products manufactured by Axcera are designed to be easy to use and repair while providing protection from electrical and mechanical hazards. Listed throughout the manual are notes, cautions, and warnings concerning possible safety hazards that may be encountered while operating or servicing the product. Please review these warnings and

familiarize yourself with the operation and servicing procedures before working on the product.
Hazardous Accessibility – Axcera has made attempts to provide appropriate connectors, wiring and shields to minimize hazardous accessibility.

Circuit Breakers and Wiring – All circuit breakers and wire are UL and CE certified and are rated for maximum operating conditions.

Single Point Breaker or Disconnect - The customer should provide a single point breaker or disconnect at the breaker box for the main AC input connection to the transmitter.

Transmitter Ratings - The transmitter ratings are provided in the text of this manual along with voltage and current values for the equipment.

Protective Earthing Terminal – A main protective earthing terminal is provided for equipment required to have protective earthing.

Read All Instructions – All of the operating and safety instructions should be read and understood before operating this equipment.

Retain Manuals – The manuals for the equipment should be retained at the site in which the equipment is operating for future reference. We provide two manuals for this purpose; one manual can be left at the office while the other manual can be kept at the site.

Heed all Notes, Warnings, and Cautions – All of the notes, warnings, and cautions listed in this safety section and throughout the manual must be followed.

Follow Instructions – All of the operating and use instructions for the product should be followed.

Cleaning – Unplug or otherwise disconnect all power from the equipment before cleaning. Do not use liquid or aerosol cleaners. Use a damp cloth for cleaning.

Ventilation – Openings in the cabinet and module front panels are provided for ventilation. To ensure the reliable operation of the transmitter, and to protect the unit from overheating, these openings must not be blocked.

Servicing – Do not attempt to service this product yourself until becoming familiar with the equipment. If in doubt, refer all servicing questions to qualified Axcera service personnel.

Replacement Parts – When replacement parts are needed, be sure that the parts have the same functional and performance characteristics as the original part. Unauthorized substitutions may result in fire, electric shock, or other hazards. Please contact the Axcera Technical Service Department if you have any questions regarding service or replacement parts.

1.4 Contact Information

The Axcera Field Service Department can be contacted by phone at **1-724-873-8100** or by fax at **1-724-873-8105**.

Before calling Axcera, please be prepared to supply the Axcera technician with answers to the following questions. This will save time and help insure the most direct resolution to the problem.

1. What are the Customers' Name and call letters?
2. What are the model number and type of transmitter?
3. Is the transmitter digital or analog?
4. How long has the transmitter been on the air? (Approximately, when was the transmitter installed?)
5. What are the symptoms being exhibited by the transmitter? Include the current LCD and/or touch screen readings. Also the status of LEDs on the front panels of the trays or modules. If possible, include the LED, LCD and/or touch screen readings before the problem occurred.

1.5 Material Return Procedure

To insure the efficient handling of equipment or components that have been returned for repair, Axcera requests that each returned item be accompanied by a Return Material Authorization Number (RMA#). The RMA# can be obtained from any Axcera Service Engineer by contacting the Axcera Technical Service Department by Phone at 724-873-8100 or by Fax at 724-873-8105. This procedure applies to all items sent to the Technical Service Department regardless of whether the item was originally manufactured by Axcera.

When equipment is sent to the field on loan, the RMA# is included with the unit. The RMA# is intended to be used when the unit is returned to Axcera. In addition, all shipping material should be retained for the return of the unit to Axcera. Replacement assemblies are also sent with the RMA# to allow for the proper routing of the exchanged hardware. Failure to close out this type of RMA# will normally result in the customer being invoiced for the value of the loaner item or the exchange assembly.

When shipping an item to Axcera, please include the RMA# on the packing list and on the Axcera-provided shipping container. The packing slip should also include contact information and a brief description of why the unit is being returned.

Please forward all RMA items to:

Axcera
Customer Service Department
103 Freedom Drive
P.O. Box 525
Lawrence, PA 15055-0525 USA

For more information, concerning this procedure, call the Axcera Customer Service Department.

Axcera can also be contacted through e-mail at **service@axcera.com** and on the Web at **www.axcera.com.**

1.6 Limited One-Year Warranty for Axcera Products

Axcera warrants each new product that it has manufactured and sold against defects in material and workmanship under normal use and service for a period of one (1) year from the date of shipment from Axcera's plant, when operated in accordance with

Axcera's operating instructions. This warranty shall not apply to tubes, fuses, batteries, or bulbs.

Warranties are valid only when and if (a) Axcera receives prompt written notice of breach within the period of warranty, (b) the defective product is properly packed and returned by the buyer (transportation and insurance prepaid), and (c) Axcera determines, in its sole judgment, that the product is defective and not subject to any misuse, neglect, improper installation, negligence, accident, or (unless authorized in writing by Axcera) repair or alteration. Axcera's exclusive liability for any personal and/or property damage (including direct, consequential, or incidental) caused by the breach of any or all warranties, shall be limited to the following: (a) repairing or replacing (in Axcera's sole discretion) any defective parts free of charge (F.O.B. Axcera’s plant) and/or (b) crediting (in Axcera's sole discretion) all or a portion of the purchase price to the buyer.

Equipment furnished by Axcera, but not bearing its trade name, shall bear no warranties other than the special hours-of-use or other warranties extended by or enforceable against the manufacturer at the time of delivery to the buyer.

NO WARRANTIES, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, AND NO WARRANTIES OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR FREEDOM FROM INFRINGEMENT, OR THE LIKE, OTHER THAN AS SPECIFIED IN PATENT LIABILITY ARTICLES, AND IN THIS ARTICLE, SHALL APPLY TO THE EQUIPMENT FURNISHED HEREUNDER.

☞ WARNING!!!

≺ HIGH VOLTAGE ≻

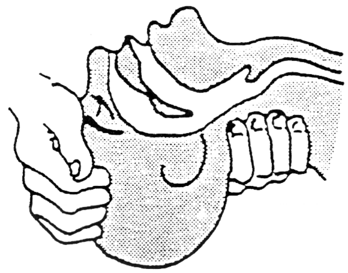
DO NOT ATTEMPT TO REPAIR OR TROUBLESHOOT THIS EQUIPMENT UNLESS YOU ARE FAMILIAR WITH ITS OPERATION AND EXPERIENCED IN SERVICING HIGH VOLTAGE EQUIPMENT. LETHAL VOLTAGES ARE PRESENT WHEN POWER IS APPLIED TO THIS SYSTEM. IF POSSIBLE, TURN OFF POWER BEFORE MAKING ADJUSTMENTS TO THE SYSTEM.

★ RADIO FREQUENCY RADIATION HAZARD ★

MICROWAVE, RF AMPLIFIERS AND TUBES GENERATE HAZARDOUS RF RADIATION THAT CAN CAUSE SEVERE INJURY INCLUDING CATARACTS, WHICH CAN RESULT IN BLINDNESS. SOME CARDIAC PACEMAKERS MAY BE AFFECTED BY THE RF ENERGY EMITTED BY RF AND MICROWAVE AMPLIFIERS. NEVER OPERATE THE TRANSMITTER SYSTEM WITHOUT A PROPERLY MATCHED RF ENERGY ABSORBING LOAD ATTACHED. KEEP PERSONNEL AWAY FROM OPEN WAVEGUIDES AND ANTENNAS. NEVER LOOK INTO AN OPEN WAVEGUIDE OR ANTENNA. MONITOR ALL PARTS OF THE RF SYSTEM FOR RADIATION LEAKAGE AT REGULAR INTERVALS.

EMERGENCY FIRST AID INSTRUCTIONS

Personnel engaged in the installation, operation, or maintenance of this equipment are urged to become familiar with the following rules both in theory and practice. It is the duty of all operating personnel to be prepared to give adequate Emergency First Aid and thereby prevent avoidable loss of life.



RESCUE BREATHING

1. Find out if the person is breathing.

You must find out if the person has stopped breathing. If you think he is not breathing, place him flat on his back. Put your ear close to his mouth and look at his chest. If he is breathing you can feel the air on your cheek. You can see his chest move up and down. If you do not feel the air or see the chest move, he is not breathing.

2. If he is not breathing, open the airway by tilting his head backwards.

Lift up his neck with one hand and push down on his forehead with the other. This opens the airway. Sometimes doing this will let the person breathe again by himself.

3. If he is still not breathing, begin rescue breathing.

-Keep his head tilted backward. Pinch nose shut.
-Put your mouth tightly over his mouth.
-Blow into his mouth once every five seconds
-DO NOT STOP rescue breathing until help arrives.

LOOSEN CLOTHING - KEEP WARM

Do this when the victim is breathing by himself or help is available. Keep him as quiet as possible and from becoming chilled. Otherwise treat him for shock.

BURNS

SKIN REDDENED: Apply ice cold water to burned area to prevent burn from going deeper into skin tissue. Cover area with a clean sheet or cloth to keep away air. Consult a physician.

SKIN BLISTERED OR FLESH CHARRED: Apply ice cold water to burned area to prevent burn from going deeper into skin tissue.

Cover area with clean sheet or cloth to keep away air. Treat victim for shock and take to hospital.

EXTENSIVE BURN - SKIN BROKEN: Cover area with clean sheet or cloth to keep away air. Treat victim for shock and take to hospital.

dBm, dBw, dBmV, dBμV, & VOLTAGE EXPRESSED IN WATTS

50 Ohm System

WATTS	PREFIX	dBm	dBw	dBmV	dBμV	VOLTAGE
1,000,000,000,000	1 TERAWATT	+150	+120			
100,000,000,000	100 GIGAWATTS	+140	+110			
10,000,000,000	10 GIGAWATTS	+130	+100			
1,000,000,000	1 GIGAWATT	+120	+ 99			
100,000,000	100 MEGAWATTS	+110	+ 80			
10,000,000	10 MEGAWATTS	+100	+ 70			
1,000,000	1 MEGAWATT	+ 90	+ 60			
100,000	100 KILOWATTS	+ 80	+ 50			
10,000	10 KILOWATTS	+ 70	+ 40			
1,000	1 KILOWATT	+ 60	+ 30			
100	1 HECTROWATT	+ 50	+ 20			
50		+ 47	+ 17			
20		+ 43	+ 13			
10	1 DECAWATT	+ 40	+ 10			
1	1 WATT	+ 30	0	+ 77	+137	7.07V
0.1	1 DECIWATT	+ 20	- 10	+ 67	+127	2.24V
0.01	1 CENTIWATT	+ 10	- 20	+ 57	+117	0.707V
0.001	1 MILLIWATT	0	- 30	+ 47	+107	224mV
0.0001	100 MICROWATTS	- 10	- 40			
0.00001	10 MICROWATTS	- 20	- 50			
0.000001	1 MICROWATT	- 30	- 60			
0.0000001	100 NANOWATTS	- 40	- 70			
0.00000001	10 NANOWATTS	- 50	- 80			
0.000000001	1 NANOWATT	- 60	- 90			
0.0000000001	100 PICOWATTS	- 70	-100			
0.00000000001	10 PICOWATTS	- 80	-110			
0.000000000001	1 PICOWATT	- 90	-120			

TEMPERATURE CONVERSION

°F = 32 + [(9/5) °C]

°C = [(5/9) (°F - 32)]

USEFUL CONVERSION FACTORS

To Convert From	To	Multiply By
mile (US statute)	kilometer (km)	1.609347
inch (in)	millimeter (mm)	25.4
inch (in)	centimeter (cm)	2.54
inch (in)	meter (m)	0.0254
foot (ft)	meter (m)	0.3048
yard (yd)	meter (m)	0.9144
mile per hour (mph)	kilometer per hour(km/hr)	1.60934
mile per hour (mph)	meter per second (m/s)	0.44704
pound (lb)	kilogram (kg)	0.4535924
gallon (gal) U.S. liquid (One U.S. gallon equals 0.8327 Canadian gallon)	liter	3.7854118
fluid ounce (fl oz)	milliliters (ml)	29.57353
British Thermal Unit	watt (W)	0.2930711 per hour (Btu/hr)
horsepower (hp)	watt (W)	746

NOMENCLATURE OF FREQUENCY BANDS

Frequency Range	Designation
3 to 30 kHz	VLF - Very Low Frequency
30 to 300 kHz	LF - Low Frequency
300 to 3000 kHz	MF - Medium Frequency
3 to 30 MHz	HF - High Frequency
30 to 300 MHz	VHF - Very High Frequency
300 to 3000 MHz	UHF - Ultra High Frequency
3 to 30 GHz	SHF - Super High Frequency
30 to 300 GHz	EHF - Extremely High Frequency

LETTER DESIGNATIONS FOR UPPER FREQUENCY BANDS

Letter	Freq. Band
L	1000 - 2000 MHz
S	2000 - 4000 MHz
C	4000 - 8000 MHz
X	8000 - 12000 MHz
Ku	12 - 18 GHz
K	18 - 27 GHz
Ka	27 - 40 GHz
V	40 - 75 GHz
W	75 - 110 GHz

ABBREVIATIONS/ACRONYMS

AC Alternating Current

AFC Automatic Frequency Control

AGC Automatic Gain Control

ALC Automatic Level Control

AM Amplitude modulation

ASI Asynchronous Digital Interface

ATSC Advanced Television Systems Committee (Digital)

AWG American wire gauge

BER Bit Error Rate

BW Bandwidth

CE Product has met EU consumer safety, health or environmental requirements.

COFDM Coded Orthogonal Frequency Division Multiplexing modulation scheme

DC Direct Current

D/A Digital to analog

DSP Digital Signal Processing

DTV Digital Television

DVB Digital Video Broadcasting

dB Decibel

dBm Decibel referenced to 1 milliwatt

dBmV Decibel referenced to 1 millivolt

dBw Decibel referenced to 1 watt

FCC Federal Communications Commission

FEC Forward Error Correction

FM Frequency modulation

FPGA Field Programmable Gate Array

HXB High Power Transmitter, B-line

Hz Hertz

ICPM Incidental Carrier Phase Modulation

I/P Input

IF Intermediate Frequency

LED Light emitting diode

LSB Lower Sideband

LDMOS Lateral Diffused Metal Oxide Semiconductor Field Effect Transistor

MPEG Motion Pictures Expert Group

NTSC National Television Systems Committee (Analog)

O/P Output

PLL Phase Locked Loop

PCB Printed circuit board

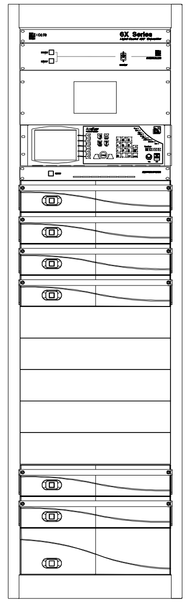
QAM Quadrature Amplitude Modulation

SMPTE Society of Motion Picture and Television Engineers

SNMP Simple Network Management Protocol

VSB Vestigial Side Band

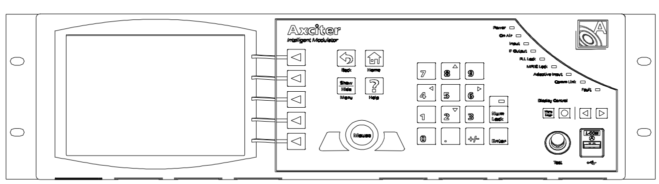
Chapter 2
System Description



The 6X Series Liquid-Cooled Transmitter is made up of a frequency agile exciter and a multi tray power amplifier system. The 6X Series is a state-of-the-art liquid cooled transmitter which uses our frequency agile exciter and the latest LDMOS devices for broadband operation across the entire UHF band. The power amplifier system operates at the highest power density available, reducing floor space requirements. The 6X Series transmitter is available in power levels up to 40kW ATSC in a very small footprint.

The very compact and completely modular design uses parallel amplifier and power supply modules which can be removed and replaced while the transmitter is on the air. This allows users to minimize spare parts stock and also enables simple and inexpensive channel changes. Additionally, the modular construction provides a clear upgrade path, allowing broadcasters to begin with a low power transmitter and add modules and combiners to achieve any power level desired.

2.1: Digital Modulator



The Axciter adaptive digital television modulator utilizes a patented VSB modulation technique, which makes it possible to generate a virtually perfect 8VSB IF signal. Since the Axciter is a completely reprogrammable digital television exciter, it can be easily upgraded in the field with new software versions through the convenient front panel USB port. Critical parameters can be set and queried directly on the color LCD screen or through an interface to a personal computer.

The DSP circuitry also handles frequency offsets allowing an unlimited number of user selectable offsets. In addition, asynchronous resampling techniques compensate for errors in the SMPTE-310M input sample rate, ensuring the best possible signal generation.

Non-volatile operation is achieved through flash-RAM (random access memory), which instantaneously stores all digital settings for the entire exciter-modulator system. This ensures that in case of power loss, the system will return to the previously selected settings when power is restored, saving time by eliminating the need to re-enter operating parameters.

Standard with all Axciters, Axcera Adaptive Correction Technology (AXACT™) provides dynamic digital pre-correction that automatically tracks and corrects for distortions, both linear and non-linear, in the complete transmitter system. All adaptive operations are performed in the high-speed processor, which is capable of equalizing a complete transmitter system in just sixty seconds, and completing a full system optimization in about two minutes.

To obtain the necessary data, AXACT continuously samples the transmitter system output, both before and after the mask filter, this is done through a down converter located in the upconverter/driver tray. The modulator processes the data and the necessary digital pre-correction is applied to the modulator output signal, resulting in consistent transmitter system performance, independent of environmental changes.

The Axciter also performs over fifteen safety tests upon each adaptive correction run to confirm that the new correction values are appropriate before applying them to the on-air signal. This ensures that the signal will not be negatively affected by a failure of an RF component in the sample path, such as an RF coupler, connector, relay or cable.

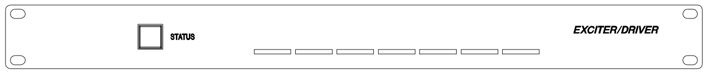
DTVision™ Digital Signal Analysis and Test System is available as an option to the Axciter. This system samples the transmitter output and measures critical transmitter performance parameters. The information is then displayed in high-resolution graphical format on the modulator's front panel display. Available performance parameters include, digital SNR, error vector magnitude (EVM), eye diagram, graphs of adaptive equalizer performance and RF spectrum, constellation diagram, and more.

The Axciter employs dual processors to ensure on-air reliability. The low-level control computer is a simple, highly reliable processor that is dedicated to running the modulator hardware, thereby generating the ATSC signal. This processor uses a highly reliable real-time operating system based on uC/OS for the mission critical 8VSB signal generation.

A second computer is dedicated to providing the adaptive processing, user interface, diagnostics and graphics, using the very stable and reliable Linux operating system. This high performance computer handles the processor intensive functions of performing all adaptive correction and processing the data for the optional DTVision signal analysis measurement and display, all without negatively affecting the critical on-air signal path. In the unlikely event of a failure of this computer, the Axciter remains on the air with a fully corrected ATSC signal. The Linux computer may even be rebooted with no interruption of the on-air signal, and the Axciter is capable of a cold start without the Linux computer.

All ATSC Axciters are field upgradeable to new operating modes, such as ATSC M/H Mobile DTV, DTx slave, Watermark, or other yet to be adopted ATSC enhancements. A dual exciter system is an option for the 6X transmitter.

2.2: Exciter, Upconverter, Driver Tray



The exciter, upconverter, driver tray accepts the digital IF from the Axciter modulator tray and converts it to any UHF channel using a very low phase noise dual-conversion synthesized oscillator that is fully compliant with ATSC recommendations. The output channel is easily selected through the front panel of the system controller for a truly frequency agile exciter/driver chassis.

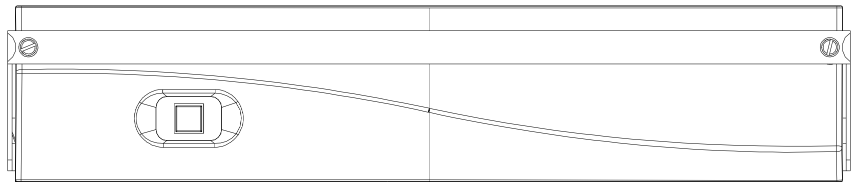
The Exciter, Upconverter, Driver Tray (1312871) contains a Frequency Agile Upconverter Board (1309695), an Exciter Controller Board (1312413), a Downconverter Board (1311103), Pre-Driver Exciter Assembly, 6X (1313190), and a Button Board (1311306).

The 44 MHz digital IF input to the exciter, upconverter, driver tray connects through the IF input jack located on the rear panel to the Frequency Agile Upconverter board. The IF is converted to a second IF of 1044 MHz by an image rejection mixer mounted on the Frequency Agile Upconverter board. A filter selects the appropriate conversion product, which is then amplified to a level of approximately –8 dBm. The 1 GHz local oscillator (LO) frequency is generated on the board and is applied to a high pass and low pass filter designed to eliminate any other interfering signals that might be coupled into the 1 GHz LO. The LO is connected to an ALC circuit that maintains the LO level to each mixer of +13 dBm over a wide range of 1 GHz LO input levels. The LO sample is also sent to the Downconverter board.

This second IF signal is then applied to a second mixer mounted on the Frequency Agile Upconverter board that downconverts it to a broadcast channel (2-69) by a LO that operates in 1.0 MHz steps between 1.1-1.9 GHz depending on the channel selected. The LO frequency equals the Channel center frequency plus 1044 MHz. (As an example CH: 14: Center Frequency is 473.00 MHz therefore the LO2 is 473 + 1044, which equals 1517.00 MHz.)

The output of the mixer is connected to a 900 MHz Low pass filter to remove unwanted conversion products. The resulting signal is amplified and wired to a Pin Diode Attenuator which adjusts the gain of the tray that is controlled by an Automatic Gain Control circuit, which maintains a constant power out of the upconverter, and also the transmitter. The gain controlled output of the pin diode circuit is connected to the output of the Tray.

2.3: Power Amplifiers



The Axcera 6X Series transmitter is comprised of highly reliable broadband amplifier modules operating in a parallel configuration. Each module uses the latest LDMOS transistors, providing very efficient and linear operation and the highest power density available today. For convenience, each amplifier module operates independently, allowing easy removal and replacement while the transmitter is on the air. All power amplifier modules are interchangeable. The extensive correction capability of Axcera's digital exciter allows all stages of the final amplifiers to operate in the very efficient class AB mode, minimizing system power consumption.

The broadband amplifier design allows all modules to operate over the entire operating band without any retuning, helping to minimize spare parts stock for multiple station operators. This also provides for simplified channel changes, requiring only replacement of channelized filters.

The fan power supply board and the amplifier pallets operate using +42 VDC from the buss bar assembly through 30 Amp fuses. Two spare 30 Amp fuses are mounted on the Fan Power Supply Board.

2.4: Combiners

Each Axcera 6X transmitter employs progressive combiners, to combine the power amplifier modules. This design is very low loss, for optimal overall system efficiency, and utilizes liquid-cooled reject loads to minimize size. The progressive combiner design is very modular, allowing for systems to be configured for lower power levels and easily upgraded with additional sections for future migration to higher power. The combiner system is mounted in the rear of the amplifier cabinet, immediately behind the amplifier modules and adjacent to the cooling plenum, minimizing required cabling.

2.5: Liquid Cooling System

The liquid cooling system is made up of three primary systems:

1) PA Cabinet Distribution – Cooling liquid is distributed equally to all power amplifiers and power supplies within the power amplifier cabinet through a water manifold located in the rear of the cabinet. Each amplifier module and power supply plugs directly into the manifold through two drip-less blind-mate connectors, one input and one output. This minimizes the plumbing required within each power amplifier cabinet.

2) Control and Pump Rack – This rack houses the cooling system controller, dual pump system (n+1 configuration optional), cooling liquid reservoir, bleeder valves, and debris filters. The control system monitors temperature in various places throughout the transmitter system and maintains consistent temperatures, independent of ambient temperature changes, in order to reduce

stress on system components, maximizing component life. The control and pump rack is typically mounted indoors, but is also available in an outdoor version, if required.

3) Fan and Heat Exchanger System – The heat exchanger is a very compact, high-efficiency unit, manufactured by Gunter USA.

These primary cooling systems are interconnected using Gates Premo-Flex Hose, or equivalent, and barbed hose fittings, providing high reliability while simplifying installation and maintenance.

2.6: Protection Circuits

To ensure that the 6X Series transmitter will provide reliable service in challenging environments, a high degree of protection is provided in each amplifier chassis, including overdrive, VSWR and overtemperature protection.

Axcera's Intelligent VSWR Protection™ (IVP) is designed to recognize the cause of VSWR and react appropriately in order to protect the entire transmission system while ensuring minimal loss of signal coverage. IVP determines whether the high VSWR is caused by a catastrophic problem like a transmission line arc, or if it is a temporary problem such as antenna icing. In the catastrophic case a typical transmitter may continue to produce power, resulting in expensive antenna, transmission line or RF system repairs. But IVP is designed to quickly remove drive to the final amplifier, avoiding further damage to the system components. For a temporary VSWR condition like antenna icing, the system is designed to remain on the air at a reduced power level until the VSWR returns to a normal level, ensuring minimal coverage loss during the VSWR condition.

AGC around the system ensures that the transmitter output remains stable. An output bandpass and trap filter is included to provide out of band rejection. This RF network also adds lightning protection through the DC short circuit of the band pass filter.

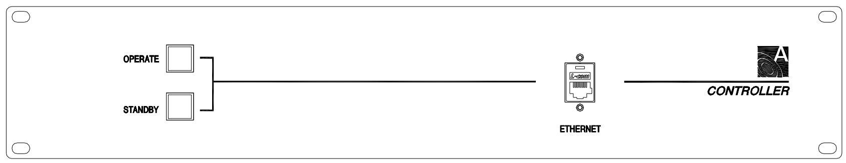
2.7: GUI and Problem Identification System

The GUI has a pre-set group of graphical screens that can be navigated by the standard touch screen included in the system. These are somewhat auto-configuring depending on what hardware is found in the system at any given point in time. The GUI system allows the reading of all significant parameters of the transmitter. It also enables and disables the transmitter, controls different modes the transmitter can be placed, and enables or disables the remote control.

Most major components of the transmitter system have a button on the front panel. This is a pushbutton with a three color LED mounted in it, Red, Blue and Green. The standard operation of this button is that it stays blue whenever the system is operating normally, which is all parameters are within acceptable limits. If a problem occurs, the color changes to RED. When the button is pressed, that subsystem is brought to the foreground on the controller touch screen, and if the button was red when pushed, indicating a problem in that module, the touch screen will show the details of the problem. Pushing these buttons will have no effect on any operating mode of the transmitter, you can push them anytime and nothing will change other than what parameters the GUI displays.

The GUI also contains operation and help screens for the transmitter. Any touch area on the screen that can affect the on-air operation of the transmitter is colored RED, no matter what the function. You can touch anything, anywhere on the touch screen without worry of its effect on the transmitter EXCEPT those that are Red. Touching any Red function on the touch screen may have an effect on the on-air status and performance of the transmitter.

2.8: Local Control & Monitoring



6X System Controller Tray

The 6X controller tray provides manual push buttons for Operate and Standby control of the Transmitter. All local transmitter control and monitoring functions are available through the front panel touch screen VGA display, mounted under the 6X System Controller Tray. The LCD display provides a detailed look into the operation of the transmitter system. Parameters such as forward and reflected power, transistor currents, power supply voltages, module temperatures, system mode, and much more can be viewed directly on the LCD display.

2.9: Remote Control & Monitoring

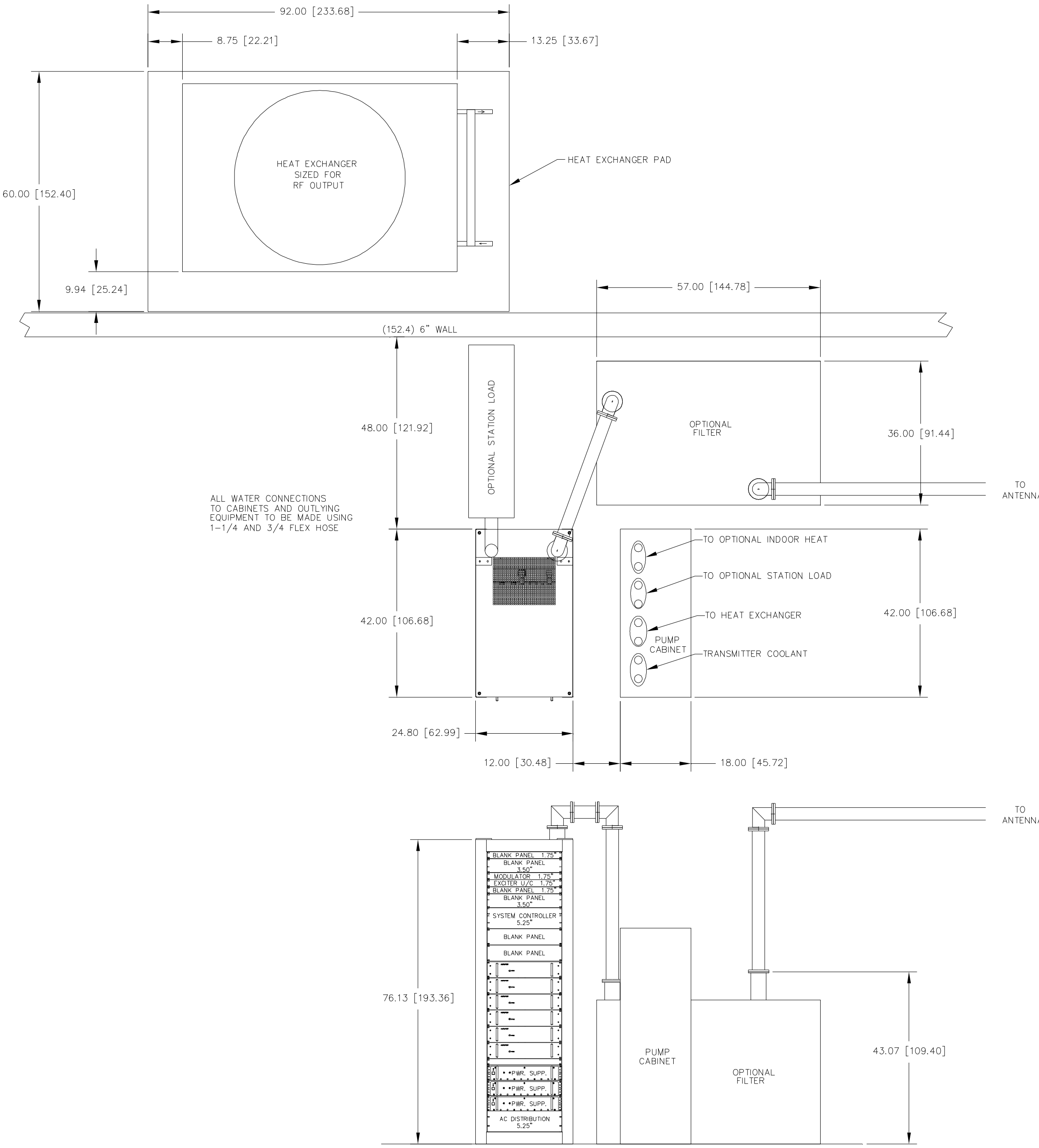
Systems can be remotely monitored and controlled through a Web browser or available SNMP client. An Ethernet connection jack is provided on the front panel of the 6X system controller tray.

The Web browser option allows real-time remote control of the transmitter system from any Internet connection and a standard PC with a Web browser, such as Microsoft Explorer.

Systems are available with a SNMP client, which have the ability to communicate with higher-level network management systems that support simple network management protocol, SNMP.

Chapter 3
Installation and Setup Procedures

As part of the installation of the 6X transmitter, it will be necessary to plan for mechanical, electrical, and plumbing issues. It is a good idea to spend the time to review the site drawing, the RF system requirements, the racking plan of the transmitter cabinets, the plumbing diagram which includes the pump package, and the heat exchanger, before installing this equipment. Site drawings should have been generated for the particular transmitter and the site that it is to be installed that will help in the positioning of the equipment.



6X Typical System Floor Plan

3.1: Unpacking and Installation of the Cabinets

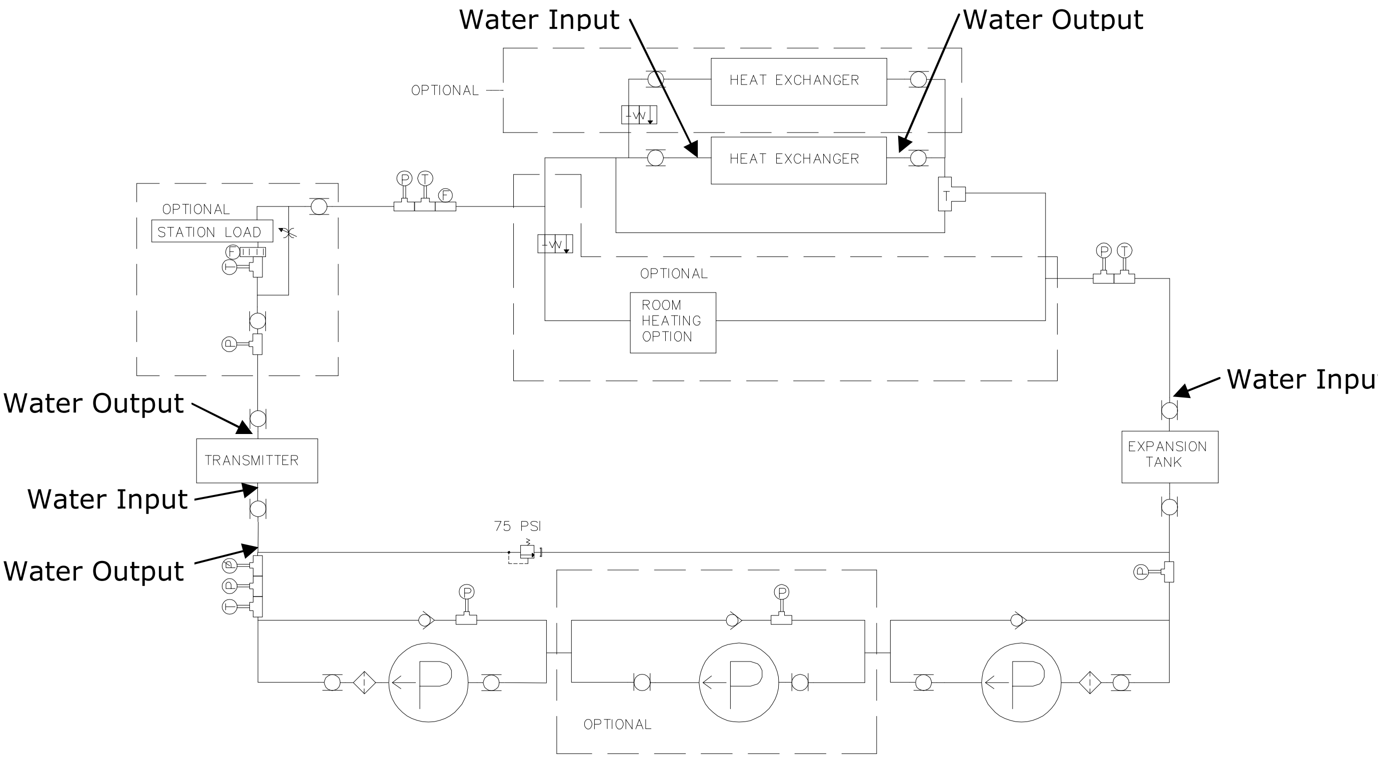
Locate the driver/amplifier cabinet, which contains the Axciter, exciter/driver, amplifier, controller and power supply trays, the pump cabinet assembly and the heat exchanger. Remove the driver/amplifier cabinet, the pump cabinet assembly, the heat exchanger and any installation material from the crates and boxes. Remove the straps that hold the cabinets to the shipping skids and slide the cabinets from the skids. Remove the plastic wrap and foam protection from around the cabinets. Do not remove any labeling or tags from any hoses, cables or connectors; these are identification markers that make assembly of the transmitter system much easier. Open the rear door and carefully remove any packing material. The Axciter, exciter/driver, controller and power supply trays are mounted in the cabinet using Chassis Trak cabinet slides. Slowly slide each tray in and out to verify that they do not rub against each other and have no restrictions to free movement. Adjustments may be necessary. The adjustments are accomplished by loosening the cabinet slide mounting bolts that hold the front of the slide to the mounting frame of the cabinet and moving the tray up or down as needed. Inspect the trays for any loose hardware or connectors, tightening where required. Open the rear door to the cabinet and inspect the interior for packing material and carefully remove any material that is found. The cabinet should be positioned with consideration for adequate ventilation and access to the front of the exciter/amplifier cabinet for the installation and removal of the trays and the opening of the rear door. Locate the pump cabinet assembly and the heat exchanger and position according to the Site drawing. Refer to the 6X Typical System Floor Plan drawing for an idea as to the installation of the transmitter.

3.2: Unpacking and Installation of the RF System and Cooling System

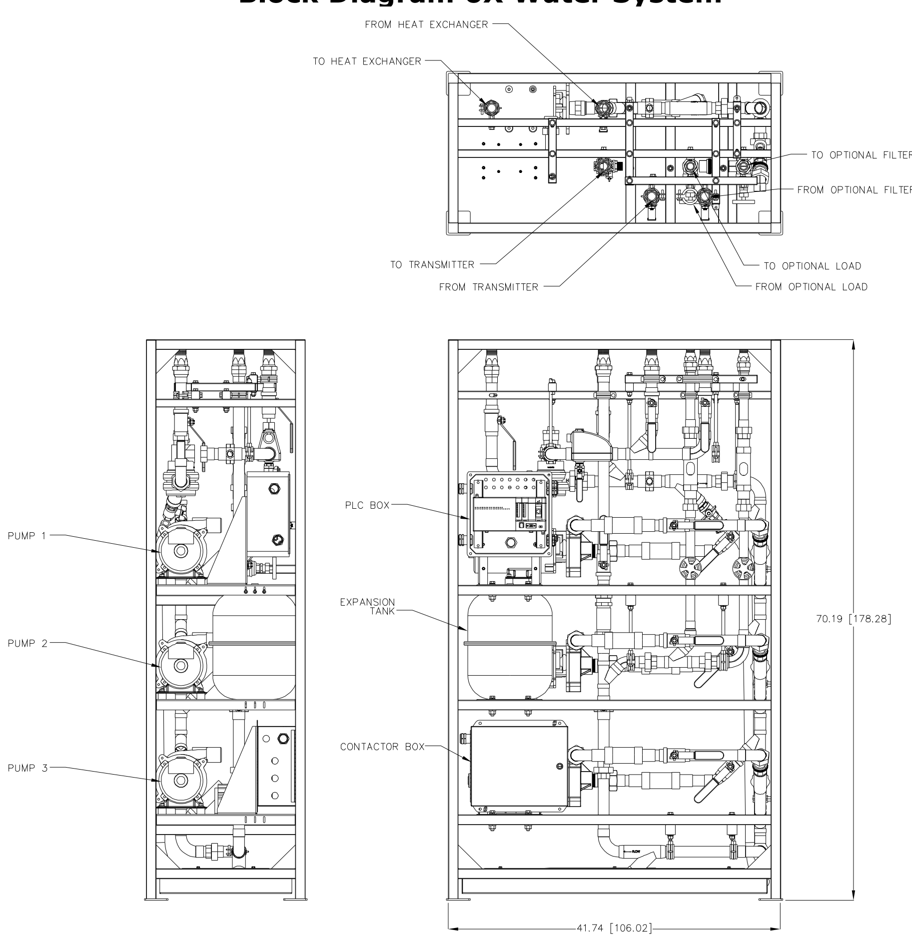
The RF System for your transmitter will vary in size and configuration, depending on the frequency and manufacturer of the RF system. The RF System may be dropped shipped directly to the site or included with the transmitter material. Locate and inventory the RF System checking that all items are accounted for. The preparation and the actual installation of the RF system may take a full week to complete, so allow time for the installation. Install the RF System according to the floor plan drawings for your site.

The Cooling System for the transmitter will vary in size and configuration, depending on the power rating of the transmitter and location of the heat exchanger and pump cabinet assembly. The Exciter/Amplifier cabinet and heat exchanger each have two Hose Barb Connectors, one for the input and one for the output of the water, to which the 1-1/4" hoses connect. The pump rack has four Hose Barb connections, one to and one from the heat exchanger and one to and one from the Transmitter. Refer to the 6X Water Cooling System Block Diagram, the Pump Rack drawing, and heat exchanger drawing for the connection locations. Connect the 1-1/4" hoses to the barb connectors and fix each connection in place with a hose clamp.

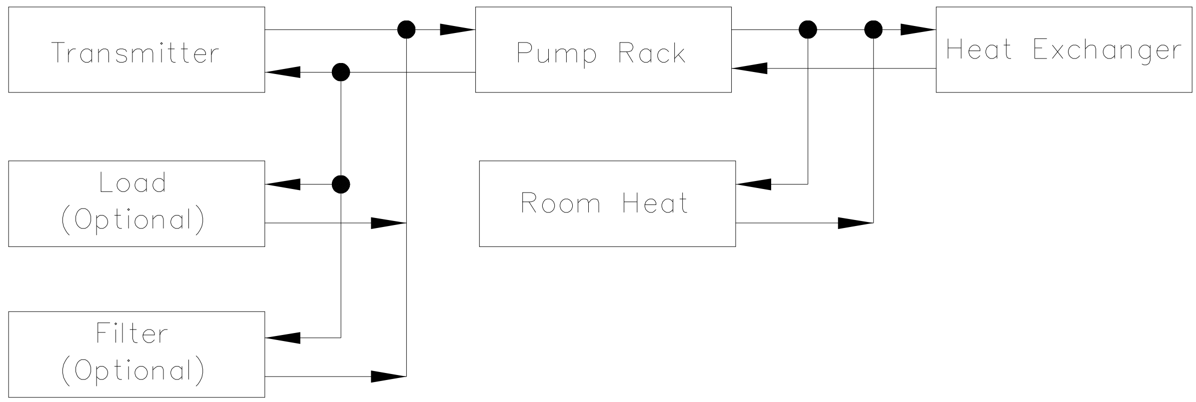
NOTE: Use Gates Premo-Flex Hose or equivalent only. **NOTE:** Refer to the detailed system drawings for the site into which the transmitter is to be installed for the exact location of the exciter/amplifier cabinet, pump rack assembly, and heat exchanger**.**



Block Diagram 6X Water System



Pump Rack



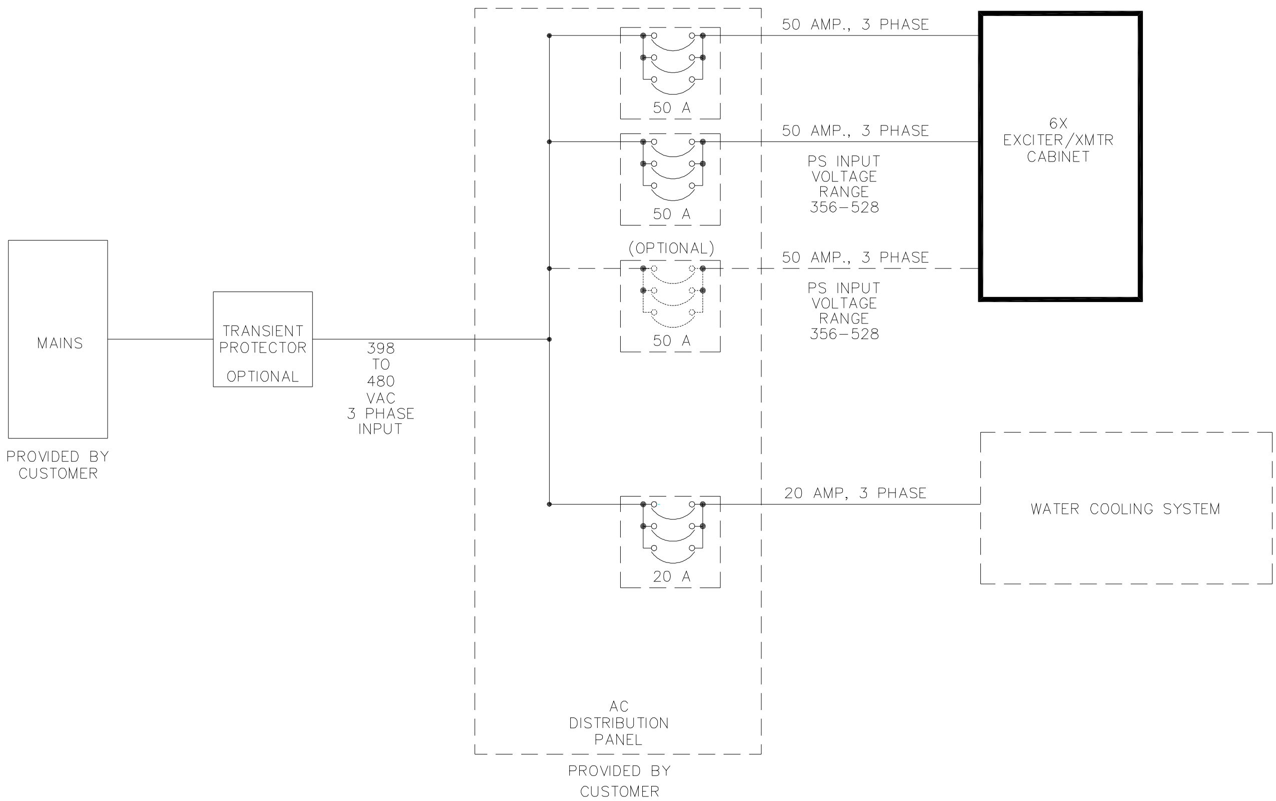
6X Typical Cooling System Block Diagram

3.2.1: Ethylene Glycol/Distilled Water Cooling System

3.2.1.1: Initial Filling the Water Cooled System

A positive displacement pull must be used to fill and charge the coolant system. During the filling process, check for leaks through-out the system.

1. Check and tighten all fittings.
2. Open all air vent valves
3. Locate the pressure gauge on the pump
4. Locate the fill port (GHT) and install hose.
5. Open the fill valve.
6. Operate the fill pump to a pre-charge of 30psi.
7. Turn off the fill pump and close the fill valve.
8. Apply main AC power to the pump rack.
9. Move the PLC mode switch to RUN.
10. Locate the Auto/Man switch and place in Man, the pumps will start.
11. Run the system for 3 to 5 minutes.
12. Place the Auto/Man switch to Auto, the pumps will turn off.
13. Repeat Steps 5 through 12 until the pressure gauge maintains 30psi.



6X Typical Electrical System

3.3: Main AC Connections

The Electrician should install the Main AC and the control & monitoring conduit for the transmitter site to meet all NEC regulations and also according to the electrical system transmitter site drawing. Use conduit, in the size needed for running the wires, as called out on the Electrical drawing for your site and as required by NEC regulations.

NOTE: Site grounding is required as recommended by Axcera on the typical electrical system drawing.

The AC feeds for a typical exciter/amplifier cabinet consist of two 50 Amp 480 VAC 3 wire three phase feeds that are connected to terminal blocks mounted in the cabinet. Connect the 480 VAC 3 phase inputs to the exciter/amplifier cabinet. The pump cabinet assembly requires a 20 Amp 480 VAC 3 phase feed. Connect the 480 VAC 3-phase inputs to the terminal block mounted in the pump cabinet assembly.

3.4: Main AC Power Up and Verification

The Electrician must power up the 480 VAC 3 phase Distribution Panel circuit breakers, the primary site power and also verify the operation of the surge suppressor and voltage regulator, if present.

3.5: Initial Turn-On Procedures

After the cabinets and the transmission lines have been connected, the system should first be swept and fine matched through to the Station Load. Then the system should be turned on using the following procedure. During the initial turn-on procedure the system should be tested into a system test load and not the antenna. The transmitter should be operated in this mode until initial testing is completed. After the initial turn-on procedure is completed, the output of the transmitter can be connected to the antenna for normal operation.

NOTE: Check that all installation has been completed before proceeding with the initial turn-on of the transmitter.

Caution: Check that all circuit breakers on the exciter/amplifier, pump cabinet assembly and heat exchanger have been turned off.

Check that the combined RF output of the RF system is terminated into a dummy load with a rating of at least the rated output of the transmitter. Check that all hoses are connected to the exciter/amplifier, pump cabinet assembly and heat exchanger.

Switch on the Main AC circuit to the system. Switch On the circuit breakers on the exciter/amplifier, pump cabinet assembly and heat exchanger. Push the Operate button on exciter/amplifier cabinet, which will indicate Amber until all systems are operating normally. The automatic controls will purge the water system and check for proper water flow throughout the system. When all systems are operating properly, the Operate button will turn Green. Push the Green button to place the transmitter in Operate. **Warning:** Do not operate the exciter/amplifier cabinet assembly with no water flow through the system.

Connect a Digital test signal to the Input jack on the rear panel of the Axciter Modulator Tray.

Slowly adjust the gain pot on the front panel of the Axciter to attain 100% output power on the LCD display on the exciter/amplifier cabinet.

3.6: Setup and Operation Procedures

The exciter/driver was set up at the factory for normal operation and only minor adjustments may be required.

3.6.1: Axciter Set Up Overview

It is one of the features of the Axciter that it has no internal adjustments that are made on its circuitry. There is not even an adjustable pot, capacitor, or coil anywhere on the boards. This is made possible through the use of almost entirely digital electronics that are under software control. Even component aging should not put the unit out of normal operation.

Several system parameters are adjusted through the user interface screens, such as power output, AGC levels, etc. Mostly this is through commands sent from the

Axciter to the upconverter. Proper setting of these parameters is system dependent, and other systems manuals should be referenced for information on their setting.

3.6.2: Transmitter Set Up Procedures

3.6.2.1: Initial Test Set Up

This Exciter Digital transmitter was aligned at the factory and should not require additional adjustments to achieve normal operation.

This section describes the set up of the Axciter Modulator system. The Axciter Modulator takes the SMPTE 310 or optional ASI digital stream input and converts it to a 44MHz intermediate frequency (IF). This IF then feeds the upconverter which converts the signal to the desired On Channel RF Output. The signal then drives the power amplifier section of the transmitter, which produces the system's output power level.

Check that the RF output at the DTV Mask Filter is terminated into a dummy load of at least the rated output of the system or connected to the antenna for your system. While performing the alignment, refer to the Test Data Sheet for the transmitter and compare the final readings from the factory with the readings on each of the modules. The readings should be very similar. If a reading is substantially different from the factory reading, it is likely that there is a problem in that module that should be rectified before proceeding with the transmitter setup.

Switch On the main AC for the system and the individual circuit breakers on the cabinets and assemblies. Check that AC is present to all systems.

This transmitter operates using a SMPTE 310M or optional ASI input that connects to J27 located on the rear panel of the Axciter Modulator Tray. Check that the input is present. If an (Optional) external 10 MHz reference input from a GPS is used, check that it is connected to J9 on the Axciter Modulator.

The check of and the setup of the drive levels are completed using the front panel adjustments located on the Axciter Modulator Tray. The level of the RF output which includes adjustment of the drive level of the Intermediate Power Amplifier and the adjustment of the linearity and phase pre-distortion to compensate for any nonlinear response of the Power Amplifiers are controlled within the Axciter Modulator Tray.

3.6.2.2: Setting Up the Output Power of the Transmitter

The following adjustments are completed using the LCD screen located on the front panel of the Axciter Modulator Tray. On the Axciter Main Screen, push the button next to the Upconverter tab on the right side of the screen. This will open the Upconverter Main Screen. Set the AGC to Manual by selecting 3 on the keyboard entry. The screen will now indicate AGC Manual. Set the transmitter to full power using the front panel screen of the Axciter.

3.6.2.3: Setting up of AGC 1

To set up the AGC, first the AGC must be activated. Locate the 8 position DIP switch SW1 mounted on the Control Board in the Exciter Driver Tray. The Upconverter DIP

Switch Position 6 must be switched ON (0) which allows the user to modify the AGC 1 and AGC 2 gain through the Axciter Modulator.

On the Axciter Upconverter Screen, set AGC 1 to 1.5 Volts, by selecting 4 on the key board entry. This will cause a detail screen to appear prompting you to enter a number value. Monitor the AGC 1 Gain Value on the screen and increase or decrease the value of the number entered until the monitored reading is 1.5 Volts.

3.6.2.4: Setting up of AGC 2

On the Axciter Upconverter Screen, set AGC 2 to 1.7 Volts, by selecting 5 on the keyboard entry. This will cause a detail screen to appear prompting you to enter a number value. Monitor the AGC 2 Gain Value on the screen and increase or decrease the value of the number entered until the monitored reading is 1.7 Volts.

After the setting up of the AGC, the AGC must be de-activated to prevent accidental changes. The Upconverter DIP Switch SW1 Position 6 must be switched OFF (1) which locks the AGC 1 and AGC 2 gain.

3.6.2.5: Setting up of Overdrive Threshold

On the Axciter Upconverter Screen set the Overdrive Threshold to 1.6 Volts, by selecting 7 on the keyboard entry. This will cause a detail screen to appear. Increase or decrease the voltage as needed until the monitored reading is 1.6 Volts.

Place the Transmitter into AGC by pushing the 3 of the keyboard entry on the Axciter Upconverter Screen. This will place the Transmitter AGC into Auto.

3.6.2.6: Axciter Pre and Post Filter Sample Values

Pre and Post RF samples are connected to the rear panel of the Exciter Driver tray. These levels should be measured with a power meter before connecting them. Your installation may require RF attenuators to be placed in line with the samples to get them within the desired range.

J17 on the Exciter Driver Tray is the connection to the Forward power sample of the coupler before the mask filter, Pre-Filter Sample.
The Level into the Relay at J1 or the Upconverter Tray at J17 should be 0 dBm to –10 dBm, –5 dBm typical.

J16 on the Exciter Driver Tray is the connection to the Forward power sample after the mask filter, Post-Filter Sample.
The Level into the Relay at J2 or the Upconverter Tray at J16 should be 0 dBm to –10 dBm. –5 dBm typical, but within .5 dB of the Pre-Filter sample.

3.6.2.7: Exciter Driver Adjustment

On the Axciter Modulator, activate the Upconverter Main screen by selecting Upconverter using the button next to it on the right side of the Axciter Main Screen. Activate the Downconverter Output Gain by pushing 2 on the key board entry. Monitor the DTVision Linear Display by pushing the button next to the DTVision Linear display on the right side of the Axciter Main Screen. At the bottom of the DTVision linear screen, locate the reading next to RMS. If this reading is between –

10 dBm & 0 dBm no adjustment is needed. If it is not, adjust the "Downconverter Gain", then view the RMS value until it is within the –10 dBm to 0 dBm range.

This completes the set up and adjustment of the transmitter using the Axciter Modulator.

If a problem occurred during set up, contact Axcera field service at 1-724-873-8100.

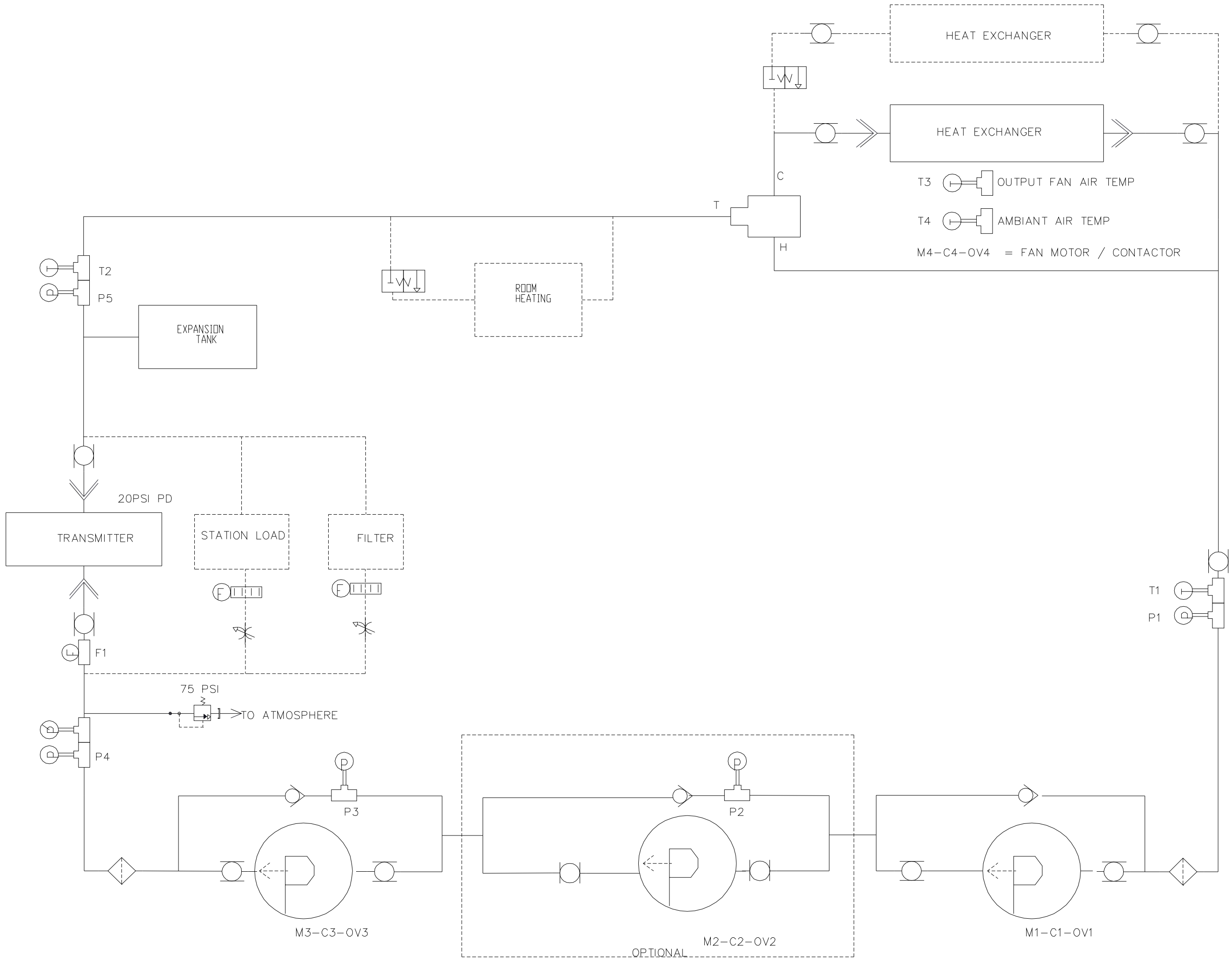
3.7: Problem Identification

3.7.1: Pump Rack Cabinet Assembly

The Programmable Logic Controller, PLC, makes decisions based on inputs from the transmitter and the various sensors throughout the pump rank and outside heat exchanger. To turn the pumps ON the PLC is expecting a high signal from the transmitter controller. Pump 1 will turn ON, after a 20 second delay pump 2 will turn ON. Pump 3 will only turn ON if there is a fault in either pump 1 or 2. If 2 pumps fault the PLC will send an alarm signal to the transmitter controller. The PLC also controls the heat exchanger fan by monitoring the coolant return temperature from the transmitter, optional load and optional filter. When the Coolant reaches 50°C the PLC energizes the fan motor contactor. The PLC issues a warning signal or alarm to the transmitter system controller when one of the following conditions occurs (See Warnings/Alarms Table). The transmitter WILL NOT shut down when issued a warning. The transmitter WILL shut down when an alarm is issued.

Condition	Warning	Alarm
Temperature	50°C<(T1) < 55°C	(T1)>55°C
Heat Exchanger Fan Failure		(T1)>50°C and (X7)low
Pump Failure	(X4) or (X5) or (X6)	(X4) and (X5) or (X4) and (X6) or (X5) and (X6)
Clogged Upper Filter	P1 >high	
Clogged Lower Filter	P4 >high 24> F1<28	
Blown Hose to Transmitter		0<P4>5
Blown Hose from Transmitter		P5=0
Blown Hose to Heat Exchanger		0<P5<8 PSI
Blown Hose from Heat Exchanger		P1=0 ???

Warnings/Alarms Table



Coolant System Schematic

3.8: 6X PLC pump rack control software

3.8.1: Functions

Turn pumps on as required
- Turn pump on at startup request
- Delay start of second pump

Monitor Contactor Overload Relay
- If pump 1 or 2 fails start pump 3 on 3 pump system
- If 2 pumps fail shut down

Monitor and display Flow Meter in integer gallons per minute
Monitor temperature sensors
- Display all temperature readings
- Display delta temperature (T2-T1)
- Display outside ambient temperature
- Calculate and display Heat Exchanger efficiency (T3-T4)

Monitor pressure sensors
- Display all pressure sensor readings
- Monitor pressure sensors to issue alarms (see Warning / Alarm table)

Monitor request to start from transmitter controller
- Must be normally high signal (Low means shut down or lost cable to pump rack)

Control Heat Exchanger
- High signal from contactor overload relay
- Low signal from fan motor temperature switch

This page has intentionally been left blank.

Chapter 4
Circuit Descriptions

4.1 Exciter, Upconverter, Driver Tray Boards

4.1.1 Frequency Agile Upconverter Board (1309695)

The board takes a 44 MHz or 36 MHz IF signal and converts it to a TV channel in the range of 54-860 MHz. The 44 MHz or 36 MHz IF input signal, (≈-8dBm level), is connected to J6 on the board. The IF first passes through a frequency response pre-corrector, consisting of R145, C188, R 146 and C189. The pre-corrector circuit compensates for any response variation in the ceramic filter used to pick the appropriate conversion sideband. The pre-corrected signal is then converted to a second IF centered at 1044 MHz using the mixer U16, the 1.044 GHz filter U18 and associated components. The mixer IC U16 has a 1 GHz LO1 connected to the LO input. The 1.044 GHz signal is next applied to a second mixer, U15, where it is mixed with the LO2 signal and converted to the final RF channel frequency. The RF output is then sent to a low pass filter that removes unwanted conversion products above 1 GHz, amplified by U21 then passed to another low pass filter. The filtered output is amplified by U20 and connected to J7 the RF output jack for the board at ≈-3dBm level.

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

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

Both of the LOs, LO1 and LO2, are locked to an on board 10 MHz VCXO reference signal. The 10 MHz VCXO circuit consists of U36, U39, the VCTCXO Y1 and associated components. When an external 10 MHz reference signal is applied to J10 on the board, the internal VCXO is locked to the external 10 MHz. Otherwise, the internal VCXO is free-running. The Red LED DS6 will light if an External 10 MHz reference is present. The Red LED DS3 will light if the PLL for the 10 MHz oscillator is not locked.

4.1.2 Downconverter Board (1311103)

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

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

4.1.3 Button Board (1311306)

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

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

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

4.2 Power Controller/AC Distribution Assembly, Boards

4.2.1 Button Board (1311306)

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

4.2.2 Power Supply Line Monitoring Board (1311312)

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

4.2.3 Power Supply Control Board (1312059)

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

4.3: Power Amplifier Tray, Boards

4.3.1 (A1) Fan Power Supply Board (1312004)

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

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

The board contains two PIC microprocessors, PIC 1, U7, for Fan 1 and temperature and PIC 2, U9, for Fan 2 and the +32 VDC pre driver power supply, which monitor the power supplies and communicate with the tray on Serial Data Line connections at J5-2, J6-2, J7-2 and J9-1. The system controller for the transmitter monitors these samples and determines if a power supply needs to be shut down. J8 is a programming port which is initially used to program the U7 microcontroller and is not used by the customer. J10 is the programming port which is initially used to program the U9 microcontroller and is not used by the customer.

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

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

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

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

4.3.2 Front Panel Smart Button Board (1310349)

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

4.3.3 (A2) Phase/Gain Board (1312011)

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

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

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

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

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

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

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

4.3.4 (A8) Interface Board (1312562)

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

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

4.3.5 (A5) 4 Way Splitter Board, Top (1312033)

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

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

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

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

4.3.6 (A6) 4 Way Splitter Board, Bottom (1310448)

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

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

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

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

4.3.7 (A7 & A9-A16) 878 Amplifier Pallets, Digital Bias (1310321)

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

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

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

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

The +42 VDC needed to operate the individual pallets is supplied from the Buss Bar Assembly thru 30 Amp fuses to the pallet at FC1. Filtering of the +42VDC is provided by the capacitor network consisting of C24, C30, C64, C75 and C76. There are clips containing two "spare" 30 Amp fuses located on the Fan Power Supply Board. The fuse protected and filtered +42 VDC is applied through the .002Ω resistors R32 and

R33 and the output Balun assemblies to the drains of Q1 and Q2. The +42 VDC is also connected through the 12V Zener diode CR1 to the regulator IC U4 that supplies +3.3 VDC, which is used by the U2, U6 and U7 ICs on the pallet.

4.3.6 (A17) 4 Way Combiner Board, Top (1310305)

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

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

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

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

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

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

4.3.7 (A18) 4 Way Combiner Board, Bottom (1310308)

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

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

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

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

4.3.8 (A19) Power Combiner (1312281)

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

Chapter 5: Maintenance

5.1: Maintenance

The 6X Series Transmitter is designed with components that require little periodic maintenance except for the routine cleaning of the filters and the fans in the amplifier cabinets and trays. For maintenance procedures on vendor items, such as the blower, heat exchanger, motor, contactor, starter, sensor or flow meter, refer to the manufacturers' manuals, included with the item or with the installation material.

The amount of time between cleanings depends on the conditions within the transmitter room. While the electronics have been designed to function even if covered with dust, a heavy buildup of dust, dirt, or insects will affect the cooling of the components. This could lead to a thermal shutdown or a premature failure of the affected tray.

Axcera recommends that the operating parameters of the transmitter be recorded from the touch screen weekly. It is suggested that this data be retained in a rugged folder or envelope.

5.1.1: Exciter/Amplifier Assembly

The individual trays in the exciter/amplifier must also be cleaned. If the front panels become covered with dust, the top covers should be taken off and any foreign material that has accumulated should be removed. A vacuum cleaner, utilizing a small, wand-type attachment, is an excellent way to suction out the dirt. Alcohol and other cleaning agents should not be used unless you are certain that the solvents will not damage any components or the silk-screened markings on the trays and boards. If water-based cleaners are used, be careful that the components do not become saturated. The fans and heat sinks should be cleaned of all dust or dirt to permit the free flow of air for cooling purposes.

5.1.2: Ethylene Glycol/Distilled Water Cooling System

5.1.2.1: Flushing and cleaning of the strainers

The strainers can be cleaned by flushing them out. Begin the flushing process by placing a bucket under the drain and opening the drain valve to the strainer. See Figure 5-1.

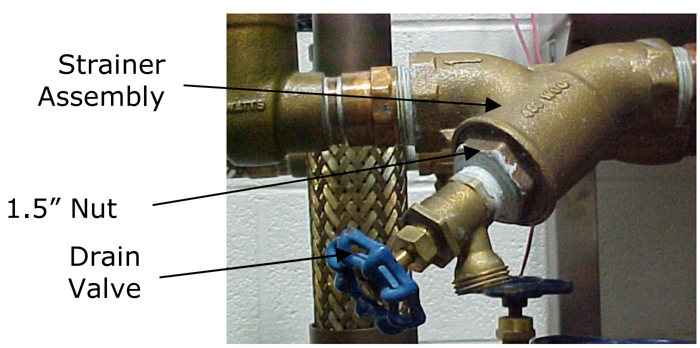


Figure 5-1: Strainer

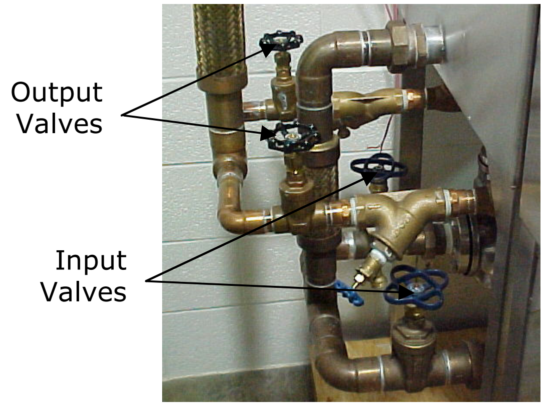


Figure 5-2: Input and Output Valves

Let the water run for approximately 3 seconds. This should clean the strainer. Repeat for the strainer in the other line. Periodically, the strainers should be removed and cleaned. This is accomplished by first isolating the desired pump and strainer by turning off the input and output valves to the pump. See Figure 5-2. Place a bucket under the drain and open the drain valve. Remove the 1.5″ nut from the bottom of the strainer assembly and remove the strainer, noting the orientation of the strainer. Clean the strainer, may need to use a metal brush, and return it to the strainer assembly in the same position as removed. Tighten the 1.5″ nut. Repeat for the strainer in the other line. Turn on the input and output valves to the pump. Also, check and clean the single strainer located in the input line to the reservoir tank in the same manner as described for the output strainers.

If you are doing the initial installation flushing, connect the water lines to the 6X and the Test Load.

5.1.2.2: Checking the glycol concentration level and PH value

It is recommended to use Dow Chemicals' Dowtherm SR-1 at a 50/50 mix with distilled water for cooling the 6X transmitter.

The concentration and condition of the mixture should be checked monthly. This can be done with a hydrometer, if the temperature of the mixture is known. However, a refractometer will indicate the concentration regardless of the temperature of the mixture. To test the coolant mixture for pH and concentration, Axcera recommends the use of a pH-meter supplied by Misco and a refractometer supplied by Misco (7084 VP+ [^{o}F] or 7064 VP+ [^{o}C]). The pH value of the mixture is important. The glycol mixture must be monitored at monthly intervals for the pH value. The desired range of the value is between 8 and 10. If this value falls below 8 and is ignored, the mixture will rapidly become acidic and could damage the 6X amplifier trays. When the pH value of the mixture falls below 8, the entire mixture must be replaced or a small, 50% diluted quantity of sodium hydroxide (very caustic) or potassium hydroxide (less caustic) should be added to the system. This will bring the pH back into the required range. The use of sodium hydroxide or potassium hydroxide can only be repeated three times, after which the whole mixture should be replaced.

If, when the coolant is inspected, the color of the glycol mixture has changed to gray or black, or there is an oily layer, a burnt odor, or any sludge in the mixture, this will indicate a need for the replacement of the entire mixture.

NOTE: Dowtherm SR-1 in the undiluted state should not be stored outside during the summer, because it begins to decompose at temperatures above 100° F. In addition, undiluted SR-1 will freeze at a few degrees under 32° F, but it will recover.

5.1.2.3: Checking and cleaning the Heat Exchanger and back up Pump

The heat exchanger should be checked for weeds, leaves, debris or any other obstructions around the sides of the unit and the heat rejection coils and fins. The coils and fins can be cleaned with compressed air or a commercial coil cleaner, being careful not to distort the fins. During the winter months, be sure to remove any snow accumulation around the sides and top of the system or on the fan blades. Also check for leaks or excessive vibrations in the plumbing and fan. If your system has a back up pump for your cooling system, it will need to be cycled on approximately every 3 months to prevent it from seizing up.

5.2: 6X Transmitter Normal Inspection and Maintenance Schedule

Refer to the chart Table 5-1 that follows for the 6X recommended maintenance schedule.

Table 5-1: 6X Transmitter normal record, inspection and maintenance schedule

6X Transmitter Normal Record, Inspection and Maintenance Schedule						
Type of Record or Inspection Check	***Data Recording or Inspection Interval***					
	Daily	**Weekly**	**Monthly**	**Quarterly**	**Half Year**	**Yearly**
Record a full set of Operating Readings.		X				
Check performance for FCC Compliance.			X			
Carrier Frequency Measurement and Correction			X			
Analysis and Correction of Transmitter Upper and Lower Sideband Response.			X			
Power Measurement and Correction.			X			
Check and Correct Parameters and Settings of the Output Amplifiers.			X			
Check and correct all appropriate protection trip circuits					X	
Verify Local and Remote Metering Calibration.					X	
			X			
Check and Clean or Change Filters			X			
Check Cooling System for Leaks			X			
Check Cooling Fluid Level			X			
Ethylene Glycol/Distilled Water Mixture Concentration Check			X			
Ethylene Glycol/Distilled Water Mixture PH Level Check			X			
Inspection of High Voltage lines					X	
Inspection of Heat Exchangers for Leaks, Corrosion etc.			X			
Inspection of Heat Exchangers Fans and Lubrication.				X		
Visual check of Power Amplifiers condition, including voltage cable forms, resistors and capacitors and miscellaneous hardware					X	
Visual check of sub-systems power supplies					X	
Visual check of all Fans, Blowers and Pumps in the system for normal operation and any signs of wear or overheating				X		
Verify proper operation of all Interlock and Ready Status Switches					X	

6X Transmitter
Normal Record, Inspection and Maintenance Schedule

Type of Maintenance	***Maintenance Interval***					
	Daily	**Weekly**	**Monthly**	**Quarterly**	**Half Year**	**Yearly**
Cycling of the Dual Pumps, Back Up Pump				**X**		
Lubricate the Pumps, both Primary and Back Up Pumps				**X**		
Check & Clean the Strainers in the Pump Assembly & Reservoir				**X**		
Clean the Exciter/Power Amplifier Cabinet					**X**	

Appendix A

6X Drawings

Appendix B

Transmitter Specifications

Liquid-Cooled Solid State ATSC Transmitter

SNMP

atsc
Advanced Television Systems Committee

atsc
MOBILE DTV

With over twenty five years of experience in the design and manufacture of solid state transmitters, Axcera continues to provide the latest technology, enabling our customers to focus on the future. Axcera’s 6X Series liquid-cooled solid state transmitters are available in power levels up to 40 kW ATSC.

These advanced solid state transmitters were designed specifically to meet the needs of today’s broadcaster, offering high levels of reliability, efficiency and performance. The modular construction provides a clear upgrade path, allowing broadcasters to begin with a low power transmitter and easily add modules to achieve any power level desired. With its parallel amplifier design, Axcera’s 6X Series transmitters are perfect for long-term, unattended operation. State-of-the-art design and components achieve industry leading power density resulting in the smallest transmitter footprint available.

Liquid-Cooled Solid State ATSC Transmitter

Performance

Frequency Range[1]	470 to 862 MHz
Standard	ATSC
Frequency Stability	0.2 ppm *(max 30 day variation)*
w/GPS	0.001 ppm
Regulation of RF Output Power	3%
Out of Band Emissions	Compliant with FCC Mask
Signal to Noise (SNR)	30dB or better (typical), 27dB min.
Data Interface	
Input Rate	19.39 Mbps, 6 MHz channel
Input Interface	SMPTE 310M (ASI optional)
Cable Equalization	Automatic
Impedance	75Ω, BNC
Level	800mV±10%

General

Operational Temperature Range	
Indoor	0ºC to +50°C, derate 2°C/1000 ft.
Outdoor	-20ºC to +50ºC
Maximum Altitude[1]	8500 feet *(2600m)* AMSL
Operational Humidity Range	0% to 95% non-condensing
Output Impedance	50 Ω
Line Voltage[1]	358-528 VAC, 3 Phase, 50/60 Hz, Delta or WYE

Options

DTVision Signal Analysis System
Bandwidth Enhancement Technology
Dual Exciter with Automatic Switch
N+1 Power Supply
AC Surge Protector
Spare Parts Kit
GPS Receiver
N+1 Water Pump
SNMP Client

[1] *Other Frequencies, Altitudes & Voltages - Consult Factory*
[2] *Measured after output mask filter.*
[3] *Typical power consumption*

Model Specific Specifications

Model Numbers	6U2AD	6U3AD	6U4AD	6U5AD	6U6AD	6U7AD	6U8AD	6U12AD	6U16AD	6U24AD
Power Output	2.5kW	3.7kW	5kW	6kW	7.5kW	8.5kW	10kW	15kW	19kW	29kW
Power Consumption	13kW	19kW	25kW	32kW	38kW	42kW	50kW	76kW	99kW	150kW
No. of Final PA Modules	2	3	4	5	6	7	8	12	16	24
Dimensions (H x W x D)										
Inches	79 x 24 x 50							79 x 48 x 50		79 x 72 x 50
Centimeters	200 x 60 x 127							200 x 120 x 127		200 x 180 x 127
Weight (lbs/kg)	660/300	715/324	940/426	1000/454	1060/480	1120/509	1200/544	2100/952	2350/1065	3500/1590
Output Connector	1 5/8" EIA			3 1/8" EIA					4 1/16" EIA	

103 Freedom Drive, PO Box 525, Lawrence, PA 15055, USA t:+1 724-873-8100 f:+1 724-873-8105 www.axcera.com