



VAX-OP, UAX-OP Series TV Broadcast Transmitters



User manual

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Publication Information

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Use of Symbols

The following symbol conventions are used in this manual to signal the presence of certain hazards or to alert the user to important information:

 NOTE	Indicates information considered important, but not hazard-related.
 CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor injury or damage to the equipment.
 WARNING	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

Additionally, these symbols may be used to signal the presence of certain hazards or to recommend certain precautions.

	A danger of electric shock exists.		Use lockout-tagout safety protocols to prevent accidental reapplication of power
	A general hazard exists. Consult accompanying product documentation for more information.		Use a filtered breathing apparatus to protect against toxic dust/fumes.
	A risk of hazardous electromagnetic radiation exists. Ensure that all covers and RF shields are in place.		Use protective gloves.
	Observe proper precautions against electrostatic discharge when handling components.		Wash hands after completing work.
	Exercise caution when handling a toxic substance.		Use safety goggles to protect eyes.

	A mechanical pinch or crush hazard could cause bodily injury.		Electronic waste. Do not dispose of with household refuse.
	A hot surface could cause burns.		The item in question can be recycled.
	A heavy object has the potential to cause bodily injury.		A heavy object requires a two person lift.

Table 1: Use of symbols

General Safety Practices

Regardless of how well electrical equipment is designed, personnel can be exposed to dangerous electrical shocks when protective covers are removed for maintenance or other activities. Therefore, it is incumbent on the user to ensure that all safety precautions are consistently observed and that all individuals assigned to the equipment have a clear understanding of the first aid procedures related to electrical shocks (see next pages).

In addition, these safety practices must be followed:

- Do not attempt to adjust unprotected circuit controls or to dress leads with power on.
- Always avoid placing parts of the body in series between ground and circuit points.
- To avoid burns, do not touch heavily loaded or overheated components without precautions.
- Do not assume that all danger of electrical shock is removed when the power is off. Charged capacitors can retain dangerous voltages for a long time after power is turned off. These capacitors should be discharged through a suitable resistor before any circuit points are touched.
- Don't take chances. Be fully trained. GatesAir equipment should be operated and maintained by fully qualified personnel.
- Do not perform service work alone and do not perform internal adjustments of this unit unless another person capable of rendering first aid and resuscitation is present.

Consult Appendix A of this manual for additional safety guidelines according to international standard IEC 60125.

 NOTE	<p>This section is not intended to contain a complete statement of all safety precautions that should be observed by personnel while using this electronic equipment or others.</p> <p>GatesAir shall not be responsible for injury or damage resulting from improper procedures or from equipment use by improperly trained or inexperienced personnel.</p>
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Table 2 contains a summary listing of the principal safety risks involved with operating and servicing VAX/UAX-OP transmitters. In most cases, more detailed safety instructions on specific risks are provided on product warning labels affixed to the product or in the relevant sections of this manual.

	<ul style="list-style-type: none"> - AC mains voltage potentially lethal if touched. - +50V DC supply can supply high current if short-circuited.
	<ul style="list-style-type: none"> - BeO ceramic insulators toxic in dust form.
	<ul style="list-style-type: none"> - PA modules can pinch fingers upon insertion.
	<ul style="list-style-type: none"> - PA modules or reject loads can be hot after continued operation. - Transmission line components could have localized hot spots.
	<ul style="list-style-type: none"> - PA modules heavy, require 2-person lift.
	<ul style="list-style-type: none"> - Risk of RF exposure if transmitter operated with shields or covers removed.

Table 2: Summary table of product hazards, VAX/UAX-OP transmitters

First Aid Procedures

Personnel engaged in the installation, use and maintenance of the equipment must be familiar with the theory and practice of first aid.

First aid in case of electric shock

A muscle spasm or unconsciousness may render a victim unable to free himself from the source of the electric shock. If a person seems unable to free himself while receiving an electric shock, disconnect the power before attempting to help.

If power cannot be turned off immediately, very carefully loop a length of dry non-conducting material (such as a rope, insulating material, or clothing) around the victim and pull him free of the power source. Carefully avoid touching him or his clothing until he is completely free of the power source.

Emergency Resuscitation Technique



Step 1

Check the victim for unresponsiveness. If there is no response, **immediately call for medical assistance** and then return to the person.



Step 2

Position the person flat on their back. Kneel by their side and place one hand on their forehead and the other under their chin. Tilt their head back and lift their chin until their teeth almost touch. Look and listen for breathing.



Step 3

If they are not breathing normally, pinch their nose and cover their mouth with yours. Give two full breaths. The person's chest will rise if you are giving enough air.



Step 4

Put the fingertips of your hand on the victim's Adam's apple; slide them into the groove next to the windpipe. Feel for a pulse. If you cannot feel a pulse or are unsure, move on to the next step.



Step 5

Position your hands in the center of the chest between the nipples. Place one hand on top of the other.



Step 6

Push down firmly two inches. Push on their chest 15 times.

CONTINUE WITH TWO BREATHS AND 15 PUMPS UNTIL HELP ARRIVES.

 WARNING	Do not touch a shock victim or their clothing before power is disconnected, or you can also become a shock victim. 
---	---

Treatment for extensive burns and broken skin

- Cover area with clean sheet or a clean cloth.
- Do not break blisters, remove tissue, remove any clothing that is stuck to the skin, or apply an ointment.
- Treat victim according to the type of accident.
- Arrange transportation to a hospital as quickly as possible.
- If arms or legs are affected, keep them elevated.
- If medical help is not available within an hour and victim is conscious and not vomiting, give a solution of salt and baking soda: 1 teaspoon of salt and half of baking soda for every 250 ml of water.
- Make victim slowly drink half a glass of solution four times during a period of 15 minutes.
- Stop administering solution if vomiting occurs.

Do not administer alcoholic beverages

Treatment for less severe burns

- Apply cold gauze compresses (not iced) using a cloth that is as clean as possible.
- Do not break blisters, remove tissue, remove any clothing that is stuck to the skin, or apply an ointment.
- If necessary, put on clean, dry clothes.
- Treat victim according to the type of accident.
- Arrange transportation to a hospital as quickly as possible.
- If arms or legs are affected, keep them elevated.

Acronyms and Abbreviations

AC	Alternating Current
ASI	Asynchronous Serial Interface
ATSC	Advanced Television Systems Committee
BER	Bit Error Rate
COTS	Commercial Off The Shelf
EIA	Electronic Industries Alliance
ESD	Electrostatic discharge
FCC	Federal Communications Commission
FET	Field Effect Transistor
GNSS	Global Navigation Satellite System
GPIO	General-Purpose Input/Output
GPS	Global Positioning System
GUI	Graphical User Interface
LAN	Local Area Network
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LNB	Low-Noise Block Downconverter
LPU	Low Power Unit
MER	Modulation Error Rate
MIB	Management Information Base
MOS	Metal Oxide Semiconductor
MPEG	Moving Picture Experts Group
PCB	Printed Circuit Board
PSU	Power Supply Unit
PVC	Polyvinyl Chloride
RF	Radio-Frequency
RMS	Root Mean Square
SFN	Single Frequency Network
SNMP	Simple Network Management Protocol
TLC	Telecommand (remote control command)
TLS	Telesignalling (remote control status)
TS	Transport Stream
TSOIP	Transport Stream Over IP
UHF	Ultra-High Frequency
USB	Universal Serial Bus
VA	Volt-amperes
VAC	Volts Alternating Current
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio

Table 3: Acronyms and abbreviations

RED Supplier Declaration of Conformity (SDoC)



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RED Declaration of Conformity (DOC)

We, GatesAir S.r.l., at 17 Via G. Di Vittorio, 25125, Brescia, Italy, declare under our sole responsibility for the equipment:

Maxiva UAX-OP

UAX-OPG2D-[800/1100/1400]
UAX-OPG2E-[1000/1300/1750], UAX-OPG2E6-1300
UAX-OP-[2P6D/2P7D/3P6D/3P7D/4P6D/4P7D]-R36
UAX-OP-[2P6E/2P7E/3P6E/3P7E/4P6E/4P7E]-R36

Maxiva VAX-OP

VAX-OPG2-[1100/1400/1800/1200-DA/1500-DA/1900-DA]
VAX-OP-[2P6/2P7/3P6/3P7/4P6/4P7/6P7/8P7]-[R36/DA]
VAX-OPG2-[900L/1200L/1350L/1500L]
VAX-OP-[2P7L/4P7L]-R36
VAX-OP-[6P7L/8P7L]-R42
VAXTE-2L, VAXTE-3L, VAXTE-4L, VAXTE-6L, VAXTE-8L, VAXTE-12L, VAXTE-16L, VAXTE-24L

That the equipment is in conformity with the following relevant Union harmonisation legislation:

Directive 2014/53/EU on radio equipment
Directive 2014/30/EU relating to Electromagnetic Compatibility
Directive 2014/35/EU relating to electrical equipment designed for used within certain voltage limits
Commission Delegated Directive [EU] 2015/863 of 31 March 2015 amending Annex II to Directive 2011/65/EU of the European Parliament and of the Council as regards the list of restricted substances (RoHS III)

Conformity to the essential requirements of the legislation(s) have been demonstrated by using the following standards:

Health and Safety [Art. 3(1) (a) Directive 2014/53/EU]:

ETSI EN 60215:1989+A1:92+A2:94 Safety Requirements for radio transmitting equipment

EMC [Art.3(1) (b) Directive 2014/53/EU and Art.6 Directive 2014/30/EU]:

ETSI EN 301 489-1 V2.2.0 EMC standard for radio equipment and services – Common requirements
ETSI EN 301 489-53 V1.1.1 EMC standard for radio equipment and services – TSB/DTVB

Spectrum [Art.3(2) Directive 2014/53/EU]:

ETSI EN 302 296 V2.1.1 Digital Terrestrial TV Transmitters
ETSI EN 302 077 V2.3.1 Transmitting equipment for the Digital Audio Broadcasting (DAB) service

RoHS 3 [Directive 2015/863/EU]:

EN IEC 63000:2018 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Based on the above test and inspections, we hereby declare this equipment compliant.

Signed for and on behalf of: GatesAir S.r.l.
Place and date of issue: Brescia, Italy, 26/01/2023
Name, function: Giovanni Andrea Luca Saleri, Managing Director

Signature:




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1 Introduction

1.1 Purpose of Manual

This technical manual contains information concerning the Maxiva VAX/UAX-OP series of solid-state broadcast transmitters. The various sections of this technical manual provide the following types of information:

- **Section 1: Introduction** identifies the versions of the product available and the possible purchase options.
- **Section 2: Installation** details the procedures to receive, install and commission the transmitter for use, including an initial start-up procedure.
- **Section 3: Operation** describes the operation of the equipment and is intended to be the primary section referenced by operating personnel.
- **Section 4: Theory of Operation** is included to help service personnel understand the inner workings of the transmitter.
- **Section 5: Maintenance** lists and explains the alignments and adjustments that could be required to maintain the transmitter.
- **Section 6: Troubleshooting** is included as a service aid to be used along with Sections 4 and 5 by qualified service personnel to identify and correct an equipment malfunction.
- **Section 7: Parts Lists** provides a listing of the components that may be replaced in the field.

 NOTE	If a "customer-special" manual is included with a custom-built transmitter, the information in that manual supersedes the information contained in this manual.
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1.2 General Description

The VAX/UAX-OP Series is a complete range of air-cooled broadcast transmitters operating in VHF Band I or III or UHF Band IV/V. All three frequency ranges are covered by this manual. A listing of all the models offered in the VAX/UAX-OP product family is provided later in this section.

The transmitters are housed in an EIA-310 standard 19" rack cabinet and are composed of one or two low power units (LPUs) in a single or dual drive configuration and a suitable number of RF power amplifiers (1 to 4 per rack) operating in parallel.

Larger, multi-PA systems also include rack integration, with RF splitters to feed the RF amplifiers, RF combiners and ballast loads to combine the output power of the RF amplifiers, AC mains energy distribution to the various system subassemblies and a transmitter logic control unit to serve as a universal point of control.

Smaller, single-PA systems are often supplied without rack integration and feature the LPU(s) connected directly to the single PA module. All control and monitoring of the transmitter is via direct connection to the LPU(s).

The LPU is housed in a standard one (1) rack unit 19" chassis and is compatible with many different worldwide modulation standards, such as DVB-T, DVB-T2, ISDB-Tb, ATSC1, ATSC3, DAB and DAB+. It features adaptive linear and non-linear pre-correction for excellent transmitted signal quality at all times. It also houses a high-stability GPS/GNSS receiver to allow an "all-in-one" solution for the implementation of an SFN network. For additional and operational information about the LPU, please refer to its user manual.

In larger multi-PA models, the LPU(s) is (are) directly connected to the transmitter logic control unit, which embeds the automatic change-over function for dual drive configurations. The RF drive signal from the selected LPU drives a series of air-cooled final amplifiers operating in parallel to achieve the desired RF output level. In smaller, single-PA models, the dual drive automatic change-over functionality is embedded in the front end of the single PA module.

When present, the transmitter control unit manages all the devices in the system, provides RF output power readings and is used to configure the main output parameters of the transmitter. It provides an intuitive front panel LCD screen display, as well as a front panel 8-port Fast-Ethernet switch. An embedded automatic switchover function allows the connection of two different LPUs in a dual drive configuration without the need for an external exciter switcher unit.

Each final RF amplifier module is housed in a standard 19" rack chassis and contains multiple RF amplification pallets, RF splitting and combining circuits, RF measuring circuits and one or more switching power supply modules. While the type of RF amplifier pallet varies according to the model and frequency band, all final amplifiers use the Doherty technique for optimized efficiency.

The equipment can be remotely controlled through SNMP protocol and/or its built-in web GUI interface. Dry relay contacts and photo-coupled opto-isolators are available to provide compatibility with existing remote control systems.

The physical disposition of the major transmitter system subassemblies is shown in Figure 1.

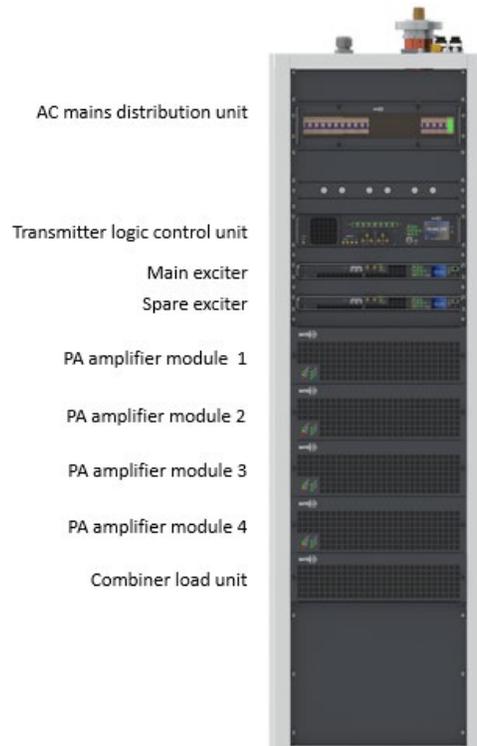


Figure 1: VAX/UAX-OP transmitter – front view

Additionally, the following subassemblies may also be present in the complete transmitter system.

- Coaxial Low Pass Filter (LPF) - to attenuate RF harmonic frequency content generated during the amplification process.
- Channel Band Pass Filter (BPF) - to attenuate RF intermodulation products falling in the immediately adjacent channels.
- Coaxial directional coupler(s) - to provide an RF sample of the transmitted signal.
- Multi-cabinet combiners with reject loads - to combine the outputs of multiple amplifier cabinets in high power systems.
- Patch panel, coaxial switch, or switchless combiner - to steer the output of the transmitter system to the antenna or system test load.
- System test load: to test the transmitter system during off-air maintenance periods.

1.3 Simplified Block Diagram

A simplified block diagram of a basic dual-drive transmitter system is provided in Figure 2.

Dual drive switchover circuits select one of the two LPU (drivers) to drive the subsequent high power amplifier stages. In the case of smaller single-PA systems, the switchover circuitry is embedded in the front end of the PA module, whereas in the case of larger multi-PA systems, the switchover circuitry is embedded in the transmitter logic control unit.

One or more final power amplifiers following the LPUs amplify the on-channel RF signal to the final desired power level. The final transmitter system forward and reflected power levels are detected by means of RF

samples taken from after the high power stage and measured by detectors internal to the transmitter control unit. RF samples taken from after the high power stage provide feedback on amplifier nonlinearities for the RTAC automatic correction system found in the LPU modulators. Additional RF samples from the final system output provide feedback to the RTAC correction system to correct linear distortions in frequency response and group delay arising in the channel mask filter.

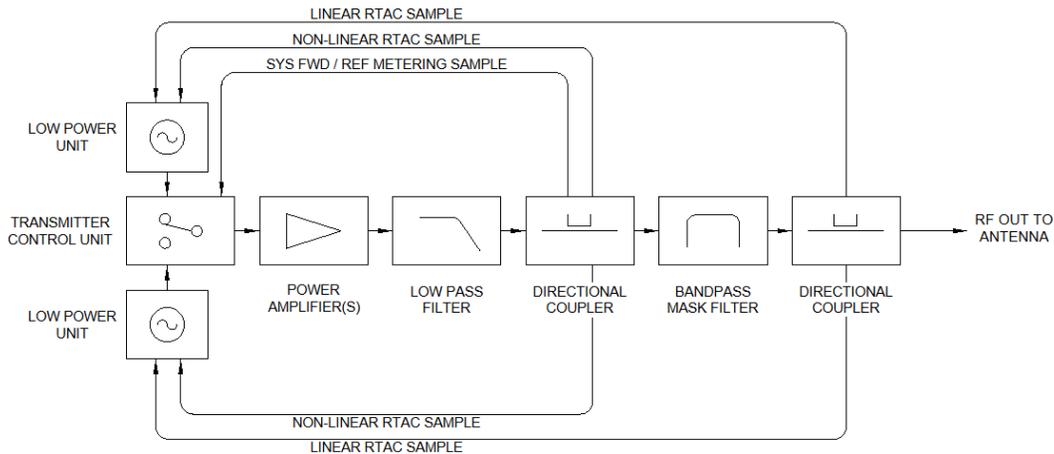


Figure 2: Simplified block diagram – dual drive

1.4 Transmitter Models

 NOTE	<p>The available model tables presented in this section are provided for reference purposes only and are subject to change without notice. For the most current information please consult the product family brochure on the GatesAir website at www.gatesair.com.</p>
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As of this printing, the following models are presently available in the VAX/UAX-OP transmitter family:

 NOTE	<p>COFDM in the following tables refers to the following modulation formats: DVB, DVB-T2, DAB, DMB, ISDB-T, ATSC 3.0.</p> <p>8-VSB refers to ATSC 1.0.</p> <p>Analog refers to PAL and NTSC.</p>
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Mid- to High-Power Digital TV Transmitter Model	COFDM Broadband Power Before Filter (r.m.s. W)	COFDM Wideband (120MHz) Power Before Filter (r.m.s. W)	8VSB Broadband Power Before Filter (r.m.s. W)	8VSB Wideband (120MHz) Power Before Filter (r.m.s. W)	Total # of PAs	Configuration / Rack Style	# of Tx Racks
UHF Band IV & V							
UAX-OPG2D-200	200		300		1	2+1 RU	Option
UAX-OPG2D-350-3U	350		400		1	2+1 RU	Option
UAX-OPG2D-350-4U	350		600		1	3+1 RU	Option
UAX-OPG2D-600	600		750		1	3+1 RU	Option
UAX-OPG2E-250	250	300	350	400	1	2+1 RU	Option
UAX-OPG2E-400-3U	400	400	400	400	1	2+1 RU	Option
UAX-OPG2E-250-4U	250	300	350	400	1	3+1 RU	Option
UAX-OPG2E-450	450	550	700	800	1	3+1 RU	Option
UAX-OPG2E-550	550	550	700	800	1	3+1 RU	Option
UAX-OPG2E-700	700	750	900	1,000	1	3+1 RU	Option
UAX-OPG2D-800	800		1,100		1	3.5+1 RU	Option
UAX-OPG2D-1100	1,100		1,500		1	3.5+1 RU	Option
UAX-OPG2D-1400	1,400		2,000		1	3.5+1 RU	1
UAX-OPG2E-1000	1,000	1,100	1,300	1,400	1	3.5+1 RU	1
UAX-OPG2E-1300	1,300	1,500	2,000	2,000	1	3.5+1 RU	1
UAX-OPG2E6-1300	1,300	1,500	2,000	2,000	1	3.5+1 RU	1
UAX-OPG2E-1750	1,750	2,000	2,000	2,000	1	3.5+1 RU	1
UAX-OP-2P2D-2R36	750		1,000		2	36 RU	1
UAX-OP-2P2D-3R36	750		1,000		2	36 RU	1
UAX-OP-2P3D-R36	1,200		1,400		2	36 RU	1
UAX-OP-2P6D-R36	2,200		3,000		2	36 RU	1
UAX-OP-2P7D-R36	2,500		3,400		2	36 RU	1
UAX-OP-3P6D-R36	3,300		4,500		3	36 RU	1
UAX-OP-3P7D-R36	3,750		5,400		3	36 RU	1
UAX-OP-4P6D-R36	4,400		6,000		4	36 RU	1
UAX-OP-4P7D-R36	5,000		6,800		4	36 RU	1
UAX-OP-2P2E-R42	1,000	1,000	1,100	1,100	2	42 RU	1
UAX-OP-2P6E-R36	2,600	3,000	4,000	4,000	2	36 RU	1
UAX-OP-2P7E-R36	3,000	3,500	4,000	4,000	2	36 RU	1
UAX-OP-3P6E-R36	3,900	4,500	6,000	6,000	3	36 RU	1
UAX-OP-3P7E-R36	4,500	5,250	6,000	6,000	3	36 RU	1
UAX-OP-4P2E-R42	2,000	2,000	2,200	2,200	4	42 RU	1
UAX-OP-4P6E-R36	5,200	6,000	8,000	8,000	4	36 RU	1
UAX-OP-4P7E-R36	6,000	7,000	8,000	8,000	4	36 RU	1

Table 4: UHF Band IV/V digital output power levels

Mid- to High-Power Digital TV Transmitter Model	COFDM Broadband Power Before Filter (r.m.s. W)	8VSB Broadband Power Before Filter (r.m.s. W)	Total # of PAs	Configuration / Rack Style	# of Tx Racks
VHF Band III TV Models					
VAX-OPG2-250	250	350	1	2+1 RU	Option
VAX-OPG2-450	450	450	1	2+1 RU	Option
VAX-OPG2-500	500	700	1	3+1 RU	Option
VAX-OPG2-700	700	900	1	3+1 RU	Option
VAX-OPG2-1100	1,100	1,400	1	3.5+1 RU	Option
VAX-OPG2-1400	1,400	1,800	1	3.5+1 RU	Option
VAX-OPG2-1800	1,800	2,400	1	3.5+1 RU	Option
VAX-OP-2P6-R36	2,800	3,600	2	36 RU	1
VAX-OP-3P6-R36	4,200	5,400	3	36 RU	1
VAX-OP-4P6-R36	5600	7200	4	36 RU	1
VAX-OP-2P7-R36	3200	4100	2	36 RU	1
VAX-OP-3P7-R36	4800	6150	3	36 RU	1
VAX-OP-4P7-R36	6400	8200	4	36 RU	1
VAX-OP-6P7-R36	9600	12300	6	36 RU	2
VAX-OP-8P7-R36	12,800	16,400	8	36 RU	2
VHF Band I Models					
	<i>Power COFDM (Wideband I L&H)</i>	<i>Power ATSC (Wideband I L&H)</i>			
VAX-OPG2-900L	900	1200	1	3.5+1RU	Option
VAX-OPG2-1200L	1,200	1,600	1	3.5+1 RU	Option
VAX-OPG2-1350L	1,350	1,750	1	3.5+1 RU	Option
VAX-OPG2-1500L	1,500	2,000	1	3.5+1 RU	Option
VAX-OP-2P7L-R36	2700	3500	2	36 RU	1
VAX-OP-4P7L-R36	5400	7000	4	36 RU	1
VAX-OP-6P7L-R42	8100	10500	6	42 RU	1
VAX-OP-8P7L-R42	10800	14000	8	42 RU	1
<i>Note: For higher-power level Band I transmitters, refer to Maxiva VAXTE Brochure</i>					

Table 5: VHF Band I/III digital output power levels

Mid- and High-Power TV Transmitter Model	Power Before Filter (p.s. W)	Total Number of PA's	Configuration / Rack Style	Number of Tx Racks
UHF Band IV & V Models				
UAX-OPG2D-A-600	600	1	2+1 RU	Option
UAX-OPG2E-A-600	600	1	2+1 RU	Option
UAX-OPG2D-A-1200	1,200	1	3+1 RU	Option
UAX-OPG2E-A-1200	1,200	1	3+1 RU	Option
UAX-OPG2D-A-2500	2,500	1	3+1 RU	Option
UAX-OPG2E-A-2500	2,500	1	3+1 RU	Option
UAX-OPG2D-A-3000	3,000	1	3.5 + 1 RU	Option
UAX-OPG2D-A-3500	3,500	1	3.5 + 1 RU	Option
UAX-OPG2E-A-3500	3,500	1	3.5 + 1 RU	Option
UAX-OP-A-2P6D-R36	6,000	2	36 RU	1
UAX-OP-A-2P6E-R36	6,500	2	36 RU	1
UAX-OP-A-2P7D-R36	7,000	2	36 RU	1
UAX-OP-A-3P6D-R36	9,000	3	36 RU	1
UAX-OP-A-3P7D-R36	10,500	3	36 RU	1
UAX-OP-A-3P7E-R36	10,500	3	36 RU	1
UAX-OP-A-4P6D-R36	12,000	4	36 RU	1
UAX-OP-A-4P6E-R36	13,000	4	36 RU	1
UAX-OP-A-4P7D-R36	14,000	4	36 RU	1
UAX-OP-A-4P7E-R37	14,000	4	36 RU	1
VHF Band III Models				
VAX-OPG2-A-600	600	1	2+1 RU	Option
VAX-OPG2-A-1200	1,200	1	3+1 RU	Option
VAX-OPG2-A-1500	1,500	1	3+1 RU	Option
VAX-OPG2-A-2500	2,500	1	3+1 RU	Option
VAX-OPG2-A-3000	3,000	1	3.5+1 RU	Option
VAX-OPG2-A-4000	4,000	1	3.5+1 RU	Option
VAX-OP-A-2P6-R36	6,000	2	36 RU	1
VAX-OP-A-3P6-R36	9,000	2	36 RU	1
VAX-OP-A-4P6-R36	12,000	3	36 RU	1
VAX-OP-A-2P7-R36	7,000	3	36 RU	1
VAX-OP-A-3P7-R36	10,500	4	36 RU	1
VAX-OP-A-4P7-R36	14,000	4	36 RU	1
VAX-OP-A-6P7-R36	21,000	6	36 RU	2
VAX-OP-A-8P7-R36	28,000	8	36 RU	2
VHF Band I Models				
VAX-OPG2-A-2500L	2,500	1	3.5+1 RU	Option
VAX-OPG2-A-3000L	3,000	1	3.5+1 RU	Option
VAX-OPG2-A-3500L	3,500	1	3.5+1 RU	Option
VAX-OP-A-2P7L-R36	7,000	2	36 RU	1
VAX-OP-A-4P7L-R36	14,000	4	36 RU	1
VAX-OP-A-6P7L-R42	21,000	6	42 RU	1
VAX-OP-A-8P7L-R42	28,000	8	42 RU	1

Table 6: Analog output power levels

The transmitter model naming system is explained below for several typical transmitter models:

e.g. **VAX-OPG2-1800**

- V = VHF
- A = Air cooled
- X = UC series LPU
- OP = One Power, the high-power product family legacy name
- G2 = Second generation with HTML web GUI
- 1800 = 1800 watts COFDM pre-filter nominal power

e.g. **UAX-OPG2E-1000**

- U = UHF
- A = Air cooled
- X = UC series LPU
- OP = One Power, the high-power product family legacy name
- G2 = Second generation with HTML web GUI
- E = BLF888E final amplifier FET
- 1000 = 1000 watts COFDM pre-filter nominal power

e.g. **VAX-OP-A-4P7L-R36**

- V = VHF
- A = Air cooled
- X = UC series LPU
- OP = One Power, the high-power product family legacy name
- A = Analog television version (PAL/NTSC)
- 4 = Total number of PA modules
- P7 = The number of amplifier pallets per PA module
- L = VHF low band (Band 1)
- R36 = 36 RU rack cabinet.

1.5 Technical Specifications



NOTE

The specifications given in this section are provided for reference purposes only and are subject to change without notice. For the most current information please consult the product family brochure on the GatesAir website at www.gatesair.com.

Parameter	Specification
Working frequency band	UHF Band IV/V, VHF Band I, or VHF Band III
Frequency resolution	1 Hz
Available configurations	Single or dual drive
Exciter(s)	UAXT-UC series or VAXT-UC series
Pre-correction	Adaptive
Signal quality	COFDM, ATSC: 38 dB MER typ. DAB: 26 dB MER typ., 33dB MER typ. as option PAL, NTSC: -60dB IMD typ.
RF output connector	DIN 7-16 (f), 7/8" EIA (f), 1-5/8" EIA (f), 3-1/8" EIA (f), or 4-1/16" EIA (f) 50 Ohm (according to output power)
VSWR	Full power up to 1.3:1
Operating temperature range	-5°C ... +45°C
Storage temperature range	-10°C ... +60°C
Maximum relative humidity	90%, non-condensing
Maximum operating altitude	2500 m (8200 ft) above sea level, >2500 m (8200 ft) optional
Management	LCD screen, Web GUI, SNMP, GPIO
Firmware upgrade	USB, LAN
Power supply	380-400 VAC Wye, 50/60 Hz 208-240 VAC Delta, 50/60 Hz 208-240 VAC Monophase, 50/60 Hz
Power efficiency	Up to 40% when operating in digital
Rack	36U rack 19" (-R36 models) 42U rack 19" (-R42 models) Others on request
Width	600 mm [23.6"] per rack
Height	1800 mm [70.9"] (-R36 models) 2070 mm [81.5"] (-R42 models)
Depth	1000 mm [39.4"] connectors included (UHF models) 1200 mm [47.2"] connectors included (VHF models)

Table 7: General specifications

2 Installation

This section includes information necessary for the installation and commissioning of a VAX/UAX-OP broadcast transmitter.

2.1 Documentation

The first step in the installation process is to locate and review all technical documents supplied with the transmitter. In certain cases, hard copy documentation may not be supplied. In these instances, the referenced documents can be downloaded from the GatesAir Customer Portal. Access the portal via www.gatesair.com and select the CUSTOMER LOGIN option.

The transmitter document package typically includes the following items:

- This technical manual (DOCX-00031)
- The technical manual for the low power unit (exciter) (DOCX-00014)
- One or more interconnect drawings with system level schematics for the transmitter model in question
 - System Interconnect (839-9363-286, -287, -288, -289)
 - Mechanical Outline (839-9363-290)
 - AC Distribution (839-9363-831, -832, -835, -836, -837, -838, -840, -841)
- A factory test data report
- Application notes and manuals for ancillary equipment that may be packed individually with those system components

Review the technical manual and drawing package to become familiar with installation and planning information provided there. Save all documentation in a secure location for future reference.



NOTE

In case of discrepancy between the connections listed in drawings/schematics versus information given in this installation section, the wiring information in the drawings should be considered the most accurate.

All connections listed in this section should be verified with the drawings/schematics before initial turn on.

2.2 Building Preparation

Certain steps must be taken to prepare the transmitter site before the transmitter delivery can take place.

- Designate a suitable space for taking delivery of and unpacking the equipment. See Section 2.3 for more details.
- Develop a plan for handling the equipment including finding suitable locations to use a jack, lift and/or hoist, if needed.
- Designate a suitable space for the placement of the transmitter cabinet(s). The selection of a proper installation location is essential for equipment longevity and reliability. Do not install the transmitter in places where it may be exposed to mechanical shocks, excessive vibration, dust, water, salty air, or acidic gas. The ambient temperature and relative humidity should always range between the following limits: 0 to +45 degrees C (de-rate 2 degrees C per 300m AMSL), with a relative humidity of 0 to 95% non-condensing. See Section 2.4.
- Install a suitable mains electrical service to the transmitter cabinet(s) based on the information provided by GatesAir in the TED sheet or AC mains interconnect drawing. See Section 2.2.1 for more details.

2.2.1 AC mains service installation

The customer is responsible for the installation of a suitable AC mains service to provide power to the transmitter. The required connections are typically detailed in an AC mains interconnect drawing and/or TED sheet provided by GatesAir.

Circuit protection delay curves

The transmitter system can have instantaneous in-rush currents of approximately 5-10 times nominal when AC mains power is first applied. Unless otherwise specified, GatesAir recommends the use of fused disconnects or circuit breakers with 'Type C' trip delay curves.

AC mains safety ground

An AC mains safety ground connection is provided via the third prong of each IEC-style mains cord. This safety ground connection prevents an electrocution hazard should a dangerous potential from inside a unit accidentally contact its metal chassis by providing a secure, uninterrupted path for any wayward electrical current to return to the source. Accordingly, care must be taken to ensure that the green/green-yellow wire inside each IEC-style mains cord has a clear path back to a PE (physical earth) ground terminal at the building AC mains distribution system.

In larger systems, the mains distribution unit has a physical earth (PE) terminal at its mains input terminal block. The green/yellow wires coming from each major transmitter subassembly already connect to this terminal. The green/yellow physical earth (PE) connection from the incoming AC mains service is thus connected to the PE terminal of the AC distribution chassis to complete the safety ground connection.

Voltage regulator

An external voltage regulator is not typically required unless mains voltage variations exceeding +/- 10% are anticipated.

Surge suppressor

GatesAir strongly recommends the use of surge protection devices on the incoming AC mains lines. These devices protect against damages due to transients arising from both natural and man-made sources. (e.g. lightning and inductive load switching). Clear preference is to be given to "series" type surge protection devices - featuring protection by both a series inductance / shunt capacitor filter and shunt threshold device -- over simple shunt-only clamping devices. The surge protector must be sized to handle the full amperage of the load it is protecting (plus a safety margin) and be connected to the building ground system by short, direct connections. In the case where the shunt protection elements are protected by a fuse, it is necessary to periodically check the integrity of the fuse to ensure continued transient protection.

2.3 Unpacking

Carefully unpack the equipment and perform a visual inspection to determine if any 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 that were removed for shipping and must be reinstalled. Also remove any shipping supports, straps and packing materials prior to initial turn on.

In the case of a larger, multi-PA transmitter, the shipment should contain:

- Pre-cabled 19" rack(s) including all necessary interconnection cables, RF splitters, combiners, directional couplers. Depending on the transmitter model, the items listed immediately below may arrive already installed in the main rack or separately in individual shipping boxes:
 - (qty. 1 or 2) LPUs, depending on whether a single- or dual-drive configuration has been ordered.
 - (qty. 1) transmitter control unit.
 - (qty. 1) AC mains distribution unit.
- (qty. 2 to qty. 4) RF power amplifier drawers per rack, depending on the transmitter model.
- Various external RF system components if purchased at time of order:
 - RF channel bandpass filter.
 - RF system test load.
 - RF coaxial switch or patch panel.
 - Rigid transmission line components for interconnection.
- General mechanical installation materials may also be supplied:
 - "All-thread" threaded rod.
 - "Unistrut" channel strut.
 - Assorted hose clamps and transmission line hangers.
- One CD or USB drive with user manual and MIB (SNMP).

Please refer to the image on the following page to visually identify the components of the system (location of each unit can vary according to the specific model).

 <p>NOTE</p>	<p>Smaller, single-PA system shipments will/may contain many of the same items, but these items are typically shipped in separate boxes and final rack integration is the responsibility of the customer on-site.</p>
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 NOTE	<p>It is recommended to save at least one (1) PA module shipping box and one (1) LPU shipping box for future use, should it become necessary to send these units to GatesAir for factory servicing.</p>
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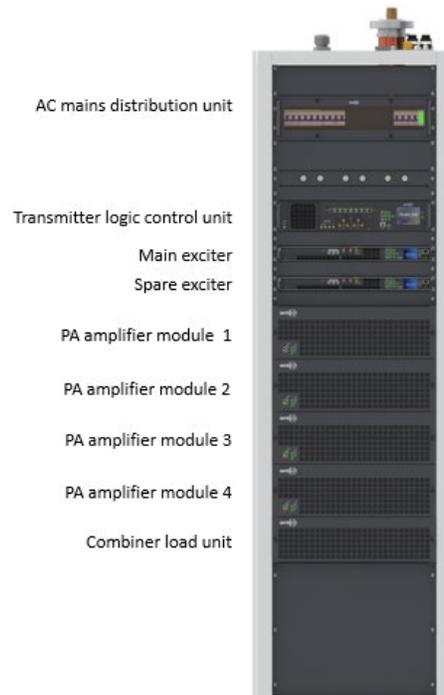


Figure 3: Transmitter cabinet with major subassemblies

2.4 Cabinet Positioning

During the installation, plan to physically place the transmitter rack(s) first, next the output transmission lines, then any cooling system ductwork as required, and finally the electrical conduit runs. The reason for this installation order is that rigid coax transmission lines need to be installed with the minimum number of elbows possible to obtain the best performance. Installation of RF lines is more complicated if obstacles like conduit, tubing and cable trays are already in place.

 WARNING	<p>All lifting equipment must be rated for 1 ton or more. Failure of lifting equipment can result in personal injury.</p>
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- Position the rack cabinet in a dry location.
- Ensure the floor is flat and level. The cabinet must be perfectly vertical.

- Ensure that enough clearance is provided both in front of and behind the rack to extract the various modular assemblies and to perform any maintenance activities. Suggested clearance is: 90 cm (35.4") at the front, 60 cm (23.6") at the rear and 60 cm (23.6") above.
- Verify that the air intake apertures for the power supply modules are unobstructed.
- If the rack cabinet has optional wheels, lock the wheels to avoid any movement once rack placement has been finalized.

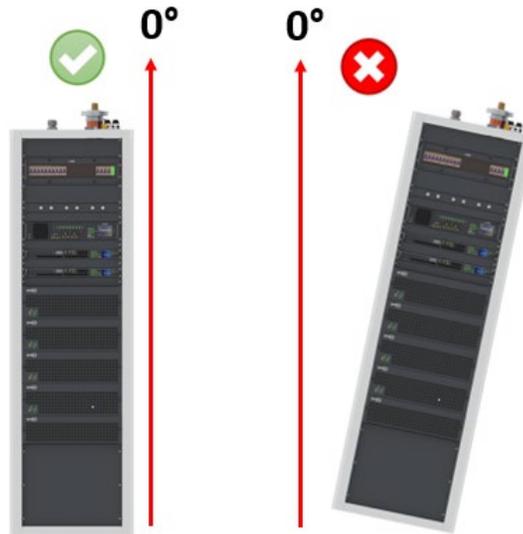


Figure 4: Placement of rack cabinet in upright position

- STEP 1: Remove bolts or straps holding transmitter rack cabinet to wooden shipping pallet.
- STEP 2: Remove rear door and side panels to facilitate moving and manipulating rack(s). Set aside any removed items in a safe place for remainder of installation process.
- STEP 3: Use a hoist to lift rack cabinet into an upright position. Rack cabinet has a provision for lifting hooks on its roof - install lifting hooks if not already in place. A minimum 3 meter (120") height clearance will be required to upright rack cabinet from its shipping pallet. If using a chain hoist, cover rack cabinet with moving blankets to protect paint finish from scratches from hoist chain.
- STEP 4: Place rack into position and carefully align. Use leveling shims or adjustment legs under rack, as required, to ensure that transmitter is level, stable and does not rock.
- STEP 5: Bolt rack cabinet to the floor or other bracing system if required by local building codes. (seismically active regions)
- STEP 6: Reinstall any rack components removed in previous steps.
- STEP 7: In multi-cabinet systems, bolt cabinets together using supplied metal plates and hardware.
- STEP 8: End of procedure.

2.5 RF Amplifier Installation

The final RF amplifiers are usually shipped outside of the rack to avoid damage during shipment. The following procedure discusses the installation of the RF amplifier modules into the rack.

 WARNING	<p>The RF power amplifier modules are heavy and require <u>two people</u> for proper installation.</p> <div style="display: flex; justify-content: space-around;">   </div>
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 CAUTION	<p>Be careful not to pinch or crush fingers when inserting or removing a power amplifier module from the transmitter rack.</p> <div style="text-align: center;">  </div>
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The VAX/UAX-OP transmitter family employs four different PA module styles, according to the final RF power level desired. Unless otherwise indicated, the procedure provided here applies to all four PA module styles.



Figure 5: PA amplifier module types

 CAUTION	<p>The 3.5 RU style PA modules can be field-configured for 3-phase wye, 3-phase delta, or single-phase operation. Double check all PA module labeling to verify that the PA modules supplied with the transmitter correspond to the AC mains configuration/voltage to be used. Should a discrepancy be found, please consult Section 4.2.2 for more information.</p>
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STEP 1: Insert both rack slides into cabinet.

STEP 2: Verify that rack slides are completely inserted.



Figure 6: Sliding guides insertion

STEP 3: With help from another person, hold power amplifier module (one person on left side, one person on right side) and insert its guides into rack slides.

STEP 4: Verify that guides are correctly inserted in rack slides on both sides of power amplifier module.



Figure 7: Sliding guides check

STEP 5: Once guides are inserted, slowly push power amplifier module into rack cabinet until resistance is felt.

STEP 6: Push power amplifier module firmly into cabinet to ensure proper mating of all electrical and RF connections if PA module is 3.5 RU hot plug style. If PA module is a different style, re-establish AC mains, control and RF connections by hand after module has been inserted, as detailed in Figure 9.



Figure 8: RF amplifier installation, final steps

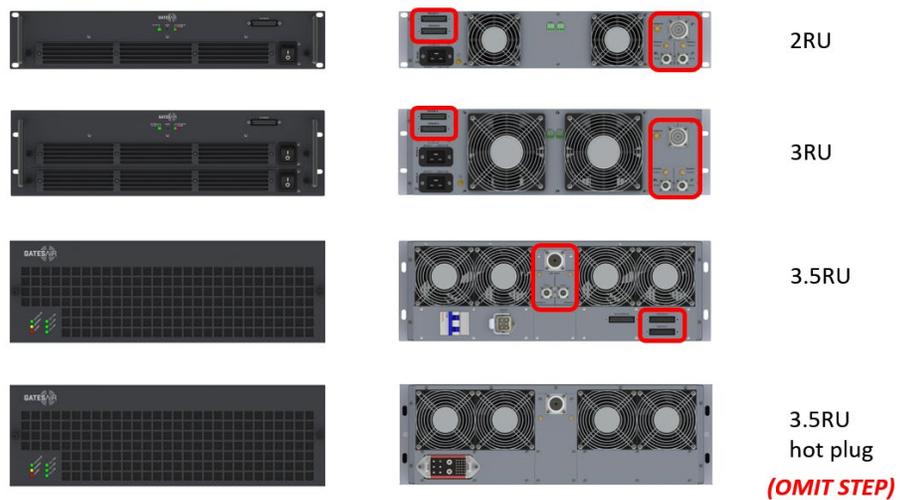


Figure 9: Manually make connections at rear panel

STEP 7: Verify that power amplifier module is completely inserted.

 CAUTION	<p>If a module does not seat fully with moderate pressure, remove the module and check for mechanical interference. Do not force a module into the rack, as this may cause damage to the connectors on the back of the module or in the rack.</p> <p>At no time should any module be slammed into its rack slot.</p>
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STEP 8: Install and tighten rack screws to fix power amplifier module to rack rails.

STEP 9: Install cosmetic air filter cover using its built-in thumbscrews, where applicable. (3.5 RU PA modules)

STEP 10: End of procedure.

2.6 RF System Installation

The transmitter is designed to operate into a 50 ohm RF impedance. High-quality 50 ohm transmission line or RF cable should be used throughout for all RF interconnections. The RF system layout should be designed to minimize wherever possible the number of elbows and/or cable bends.

 NOTE	<p>The discussion that follows pertains to only the very highest power systems employing rigid transmission line. In the case lower power systems employing flexible transmission line, this section can be skipped.</p>
--	--

In general, the following tools and other items are required to construct the RF output system using the flangeless transmission line components typically supplied with the transmitter shipment:

- Tubing cutter
- Deburring tool
- Synthetic fiber scouring pad, Scotch Brite or equivalent
- Bubble level
- Plumb bob
- 25-ft (8 m) tape measure
- Chalk line
- Wrench set
- Sawhorses or cutting table
- Chain hoist (come-along)
- Rope
- Ladders
- Rubber mallet
- Safety glasses
- Work gloves
- Threaded rod (all-thread)

- Tubing clamps and hangers
- Angle iron and/or channel strut

When installing rigid transmission line, ensure that the line is properly supported along its entire length and is not subject to any residual mechanical tension. Any section of transmission line 1m (3 ft) or longer must have at least one mechanical support. The line should not be mechanically supported by RF components, such as filters, patch panels, or loads; the line should be supported by clamps and/or hangers so that these RF components can be removed and/or replaced easily for servicing. Lines that run along walls should be fastened with channel strut and clamps.

All pieces of rigid transmission line should be free of burrs, dents, or other localized deformities.

When cutting rigid transmission line to the correct length, a square, smooth cut is required. Using a tubing cutter to make the cut is the best method, provided that the cutting wheel is fresh and sharp. When spinning the tubing cutter around the circumference of the rigid line, use light pressure and ensure that the cutting wheel doesn't "walk" along the length of the tube but instead tracks along same groove over and over until the cut is finalized. Using a dull tubing cutter or applying too much pressure too quickly will result in a crimped/pinched cut, which is to be avoided.

Once the cut is finalized, the circumference of the cut should be deburred with a deburring tool, as show in Figure 10. After deburring, the area surrounding the cut should be cleaned/shined with a dry synthetic fiber scouring pad (Scotch Brite).



Figure 10: Cut and deburr transmission line

When measuring and cutting rigid coaxial transmission line, always keep in mind that the inner must be shorter than the outer to accommodate a step in the diameter of the anchor connector (bullet). In Figure 11, it can be easily seen that the inner must be shorter than the outer by a length of "2A".

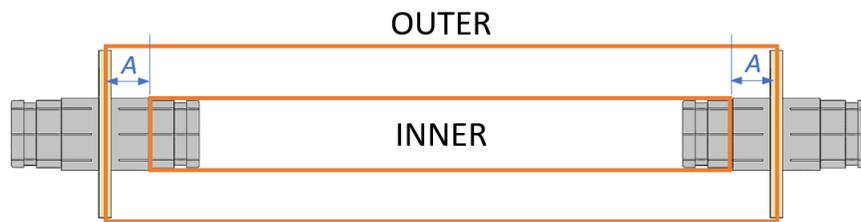


Figure 11: Inner cutback relative to outer

When installing RF cable, make sure that the manufacturer's bend radius specification is always respected.

Before the RF system is connected to the transmitter output, the RF system should be checked for low VSWR at the transmitter operational channel using a vector network analyzer or similar piece of professional test equipment. The filter in the system should be swept and plotted with the correct markers for the modulation type. The filter(s) insertion loss should be measured and verified to meet GatesAir specifications.

The following minimum levels of VSWR performance are recommended for the RF output system:

- Antenna system < 1.2:1 (-20 dB return loss or better)
- Channel filter < 1.1:1 (-26 dB return loss or better)
- Test load < 1.05:1 (-32 dB return loss or better)

2.7 Mains Power Connection

Proceed to connect AC mains power to the transmitter.

In larger, multi-PA systems, the AC mains connection is made to the mains distribution unit.

In smaller, single-PA systems, the AC mains connections are via single-phase line cords connected directly to the LPU(s) and PA module. See Section 3.1 for more information on the connection points and acceptable voltage ranges.

 <p>WARNING</p>	<p>Switch off and lock out all power sources before working on high voltage.</p> <p>This equipment contains potentially lethal voltages when energized. Always observe proper safety precautions.</p>  
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 NOTE	<p>The discussion that follows pertains to only higher power systems employing a mains distribution unit. For lower power systems without a mains distribution unit, this section can be skipped.</p>
--	---

STEP 1: Before attempting connection, ensure that proposed AC mains power source is suitable by its voltage with an AC voltmeter.

- If the transmitter was ordered for 380V wye/star operation, the voltage should measure 380V/400V phase-to-phase and 220V/230V phase-to-neutral for all three phases.
- If the transmitter was ordered for 208V/240V delta operation, the voltage should measure 208V/240V phase-to-phase and no neutral terminal should be present.
- If the transmitter was ordered for 208V/240V single-phase operation, there should be only two connection terminals with 208V/240V between them.

STEP 2: Switch off and lock out AC mains power before coming to contact with any mains connection points.

STEP 3: Connect transmitter to building AC mains power source by means of a suitable cable to large terminal block on rear panel of mains distribution unit. Ensure that wire diameter is sufficient for expected amperage in accordance with prevailing local electrical codes.

R / L1	BROWN WIRE
S / L2	BLACK WIRE
T / L3	GREY WIRE
NEUTRAL	BLUE WIRE
GROUND	GREEN YELLOW WIRE

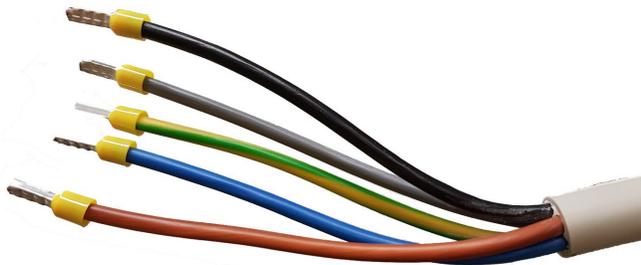


Figure 12: AC mains power cord

When supplied with the transmitter, the AC mains power cord is colored according to IEC 60446 international color standard, as shown in Figure 12.

 NOTE	<p>The connection scheme shown here is for wye/star {R,S,T,N} or delta [R,S,T] operation. In the case of monophas (single-phase) operation, the input terminals are ganged in pairs {R-S, T-N} to handle the increased current load. In such a case, special labeling on the AC mains input terminal block indicates the modified connection scheme.</p>
--	--

 CAUTION	<p>When stranded wires are installed in screw-clamp terminal blocks and tightened, the wire will relax (flow) over time and result in a loose connection as the wire strands conform to the profile of the terminal. To minimize this effect, gently move the wire side to side and back and forth while torquing the lug. This will accelerate the "flow" of the strands in the conductor. Repeat this process until the terminal holds torque and no longer loosens. All AC wire connections should be checked periodically for tightness during routine maintenance sessions.</p>
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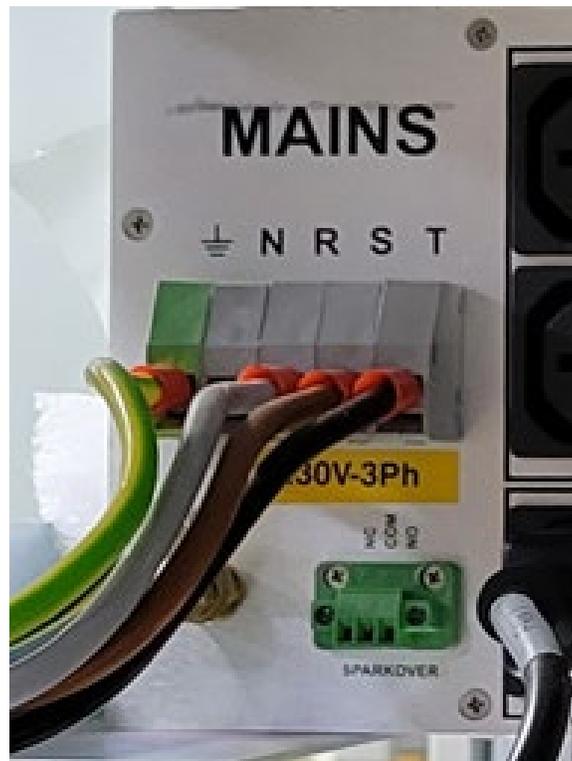


Figure 13: Typical AC mains connection (230V delta)

STEP 1: End of procedure.

2.8 Emergency Circuit Breaker Connection (optional)

In certain cases, an optional red emergency pushbutton is located on the front panel of the unit. Since safety norms vary between countries and the connection possibilities are many, the emergency pushbutton is left disconnected at delivery to give the customer maximum flexibility. The drawing below shows a suggested connection scheme for the emergency pushbutton to allow it to disconnect AC mains power quickly in the case of an emergency.

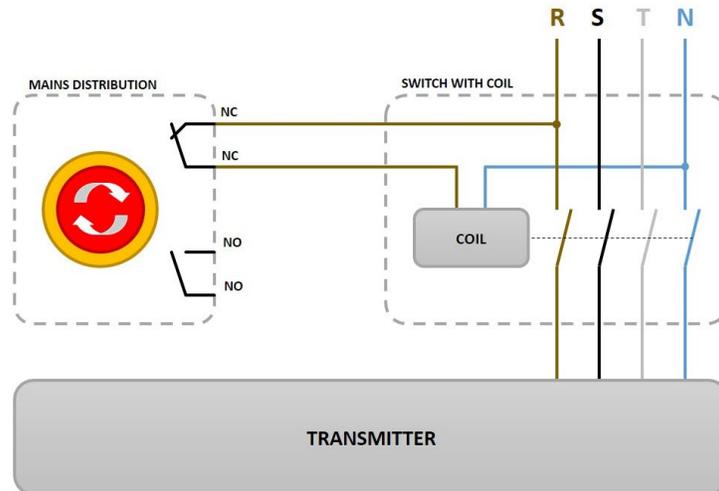


Figure 14: Suggested emergency breaker connection

 NOTE	<p>The red emergency pushbutton has two poles. As a safety precaution, the transmitter may arrive from the factory with one pole connected to the RF mute interlock circuit to provide a minimum degree of transmitter emergency shutdown should the pushbutton remain unconnected to an external disconnect device.</p>
--	--

2.9 Site Grounding Connection

A proper RF earth ground is required to prevent damage to the equipment during lightning induced transients by providing a low impedance path for lightning to return to the earth. An RF ground strap/wire attachment point is located at the bottom of the transmitter rack cabinet. This connection is suitable for use in a single-point grounding system, with the ground strap attached to the equipment rack and the rack, in turn, to a common grounding plate. A strap with a minimum width of 5 cm should be used to connect the equipment rack to the building earth ground system.

The rack cabinet must be properly grounded to ensure safe operation and to prevent damage during lightning strikes. This should ideally be via a wide copper strap from the rack to a common grounding point for the entire transmitter site. The transmitter rack(s) and **all** ancillary equipment should connect to ground **exclusively** through this common point to prevent voltage gradients between devices during a transient lightning event. A second path to ground not passing through this common point (e.g. transmitter rack cabinet bolted to metal structure in floor) would give lightning an alternative path to ground, thus causing it to pass through the transmitter on its way to ground and potentially causing damage. Note that all AC mains safety grounds (green/yellow wire) and RF transmission lines ground (coaxial line outer) should also have a sound connection to the common site ground point.

 CAUTION	The copper ground strap must be a continuous path, no equipment shall bridge that path. It is NOT acceptable to use any equipment such as a heat exchanger, pump module, transmitter, etc. as a portion of the ground strap. All devices must branch from the strap, not be a part of its path.
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Discussion of RF grounding system

The importance of a good RF grounding system and lightning protection cannot be overemphasized for reasons of personnel safety, protection of the equipment and equipment performance. The following is a brief overview.

Lightning and transient energy via the power line or tower connections can impose serious threats to personnel safety, as well as damage the equipment. For these reasons, a good protective grounding system to divert these forms of energy to earth ground is imperative. The energy in a lightning strike has a very fast rise time and can have frequency components up to the megahertz range. For this reason, it is always preferred to use straight, direct runs of large, flat conductors to minimize inductance and allow the free passage of transient energy to earth. Note that the small cross-section and non-direct path to ground of the green/yellow wire of the AC safety ground make it an unsuitable means for safely diverting the transient energy present during a lightning strike.

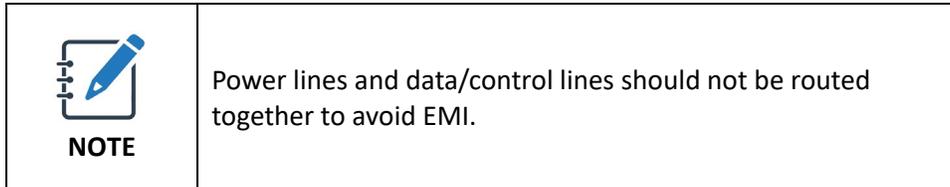
A good grounding system should include substantial grounding at the tower base using copper ground rods and/or a buried copper ground screen, with copper strap used to connect the tower base to earth ground. Coaxial cable shield(s) should be electrically connected to and exit the tower as near to the bottom as practical to minimize the lightning voltage potential carried by the cable back to the transmitter building.

A ground system should include perimeter grounding of the transmitter building using copper ground rods and copper strap. There should also be a copper strap running from tower ground to the building perimeter ground.

Ideally, a common grounding plate (bulkhead panel) with a low impedance connection to building earth ground should be the entry point for all signal lines, including AC mains. It should serve as a single-point ground for all coaxial and mains surge protection devices. Wide copper straps should be used for making the connection from the common grounding plate to earth ground. During a lightning strike, the large surge of current flowing through the very low -- but never completely zero -- impedance of the common point down into the ground may cause its voltage to float up from ground as the energy passes. If all equipment inside the building is tied to this same common point, and no other paths from the equipment to ground exist except via the common point, they will all rise and fall in voltage together, dangerous potential gradients will be avoided, and little or no fault current will flow in the equipment.

2.10 Signal Lines Installation

Proceed to connect the following signal lines:



- **Transport stream:** Connect the transport stream to the appropriate connector(s) on the front panel of the LPU or the PA module/transmitter control unit input switch matrix, in the case of a dual drive system. The digital TS input connectors are typically BNC or RJ-45/Ethernet, depending on which type of transport stream is being supplied to the transmitter.
- **GPS (GNSS):** Connect a GPS receiving antenna, if required, to the appropriate connector on the rear panel of the LPU(s). It is strongly recommended to install a proper surge arrester between the antenna cable and GPS antenna input of the transmitter. For dual drive systems, a second antenna or a GPS splitter is required.
- **Precise reference:** connect a 10 MHz or 1 PPS precise reference signal, if required, to the appropriate connector on the rear panel of the LPU(s). The selection of the correct reference signal input will likely require setup in the LPU web GUI. Refer to Section 3 of the LPU manual for further details.
- **RTAC feedback samples:** Connect the provided post-filter and pre-filter RF sample cables to the appropriate directional couplers in the RF system, as detailed in the system interconnect drawing supplied by GatesAir. Take note of any RF attenuator pads called out in the drawings or already attached to the designated directional coupler ports. Attenuator pads on the RTAC sample lines are typically required to achieve the desired sample level at the exciter.
- **Interlock loops:** Establish interlock loop connections to those external system components that require interlock protection – typically reject loads, patch panels, mask filters, system test loads. All interlock connections are made to the INTERLOCK connector on the rear panel of the transmitter control unit or to a flying cable lead originating from that connector. Navigate to the **Home > Remote > Interlock** page in the transmitter control unit web GUI to program the pin polarity of the various interlock connections.
- **Cross cabinet lines:** In larger, multi-cabinet systems, additional cross-connection of logic signal lines between the cabinets is required. The cables to be reconnected will be temporarily tied off in the rack cabinets and labeled to indicate their intended destination.

2.11 Transmitter Initial Switch On

Once the installation of the transmitter is complete, proceed to switch the system on for the first time.

- STEP 1: Verify transmitter output is connected to a 50-ohm RF termination, such as a suitable antenna or dummy load, before switching on RF power.
- STEP 2: Log into transmitter web GUI as per procedure in Section 3.3.
- STEP 3: Navigate to **Home > Config > General** in web GUI and set **Output Power (dBm)** value to 10 dBm lower than normal.

STEP 4: Switch transmitter on via web GUI **On** button. Transmitter should start producing RF output power at a level of 10% (-10 dB) of normal.

STEP 5: Check all transmitter readings for normal operation.

- All PA currents, PSU currents and PA temperatures should be roughly balanced for modules operating in parallel.
- Event log should be free of any yellow or red fault messages. (...except “power low” alarms or warnings)
- Reflected power level should be less than 4% of forward power level...ideally less than 1%.

STEP 6: Verify that transmitter self-protects when interlock circuits are exercised. See Section 5.4.1 for further details.

STEP 7: Once transmitter performance has stabilized and proper operation of interlocks has been verified, increase **Output Power (dBm)** value in web GUI by gradual steps until full power operation is achieved.

STEP 8: Set any needed modulator configurations in LPU web GUI. Refer also to LPU manual DOCX-00014 as needed.

STEP 9: Navigate to **Home > RTAC** page in LPU GUI and verify that **Non-Linear Feedback Level** is approximately -10 dBm and that no **Linear Prec. Feedback Alarm** is active.

STEP 10: Check transmitter signal performance using professional test equipment. (e.g. spectrum analyzer, modulation analyzer)

STEP 11: Compare transmitter readings and signal performance to levels recorded in factory test data supplied by GatesAir.

STEP 12: Take a set of transmitter readings for future reference. Store transmitter and LPU configurations from their respective web GUIs for future reference. See Section 3.3.15 - Configuration for further details.

STEP 13: End of procedure.

2.12 Remote Control Installation

After the transmitter has been operating properly for several hours or days, proceed to install any remote control connections.

2.12.1 Parallel I/O remote control

The 15-pin D sub connector labeled TX REMOTE on the rear panel of the transmitter control unit provides some basic parallel remote control functions in larger, multi-PA systems. The pinout for this connector is user-configurable and is discussed further in Section 3.3.23.

A simplified schematic of the parallel remote control pin circuits is shown below in Figure 15.

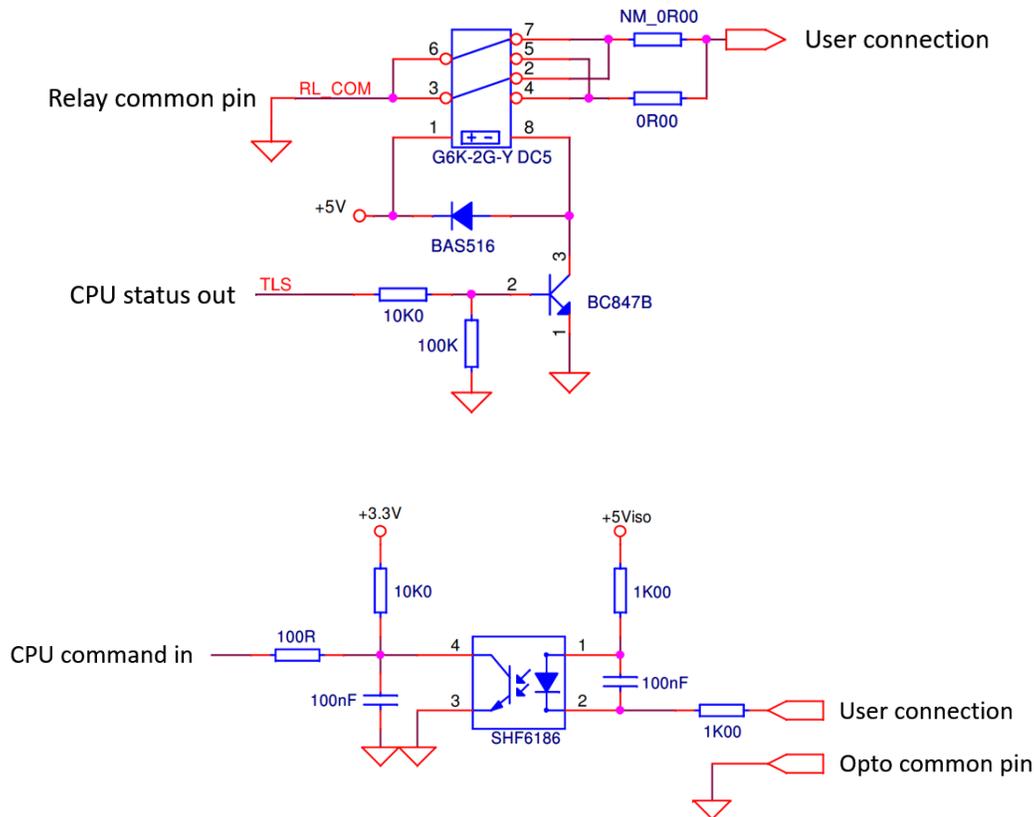


Figure 15: Simplified remote control pin circuits

2.12.2 SNMP remote control

The transmitter can be remotely controlled via SNMP (Simple Network Management Protocol), as desired.

The transmitter has an embedded SNMP agent that can be used to connect to a Network Management System (NMS). The transmitter comes with one or more MIBs (Management Information Base), which contain a listing of all available status and control variables. The MIBs are available for download by navigating to the **Home > Menu > Setup > Network > SNMP > MIB Config** screen on the web GUI. These files can then be imported to the NMS application for correct system configuration. Other screens in the **Home > Setup > Network > SNMP** area of the web GUI allow the SNMP behavior of the transmitter system to be tailored as desired.

The procedure below provides a means to establish basic SNMP control using a free SNMP browser from IReasoning. Once this basic level of control has been achieved, the procedure can be adapted to suit other SNMP-enabled remote control platforms.

**NOTE**

The procedure that follows pertains only to multiple-PA systems employing a transmitter control unit. In the case of single-PA systems, consult the LPU manual DOCX-00014 for more information on connecting to the LPU via SNMP.

STEP 1: Download and install free iReasoning SNMP Browser from this address:

<https://ireasoning.com/mibbrowser.shtml>

STEP 2: Navigate to **Home > Setup > Network > SNMP > MIB Config button** on web GUI and press **Download** button(s) to download all available MIBs.

STEP 3: Select **File > Load MIBs** on IReasoning SNMP browser and follow resulting prompts to upload MIBs into browser.

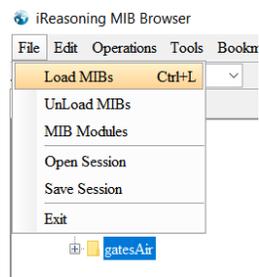


Figure 16: Load MIBs

STEP 4: Select **Tools > Options > Agents > Add button** to create a new profile with transmitter IP address, port number, SNMP version level and read/write communities, as determined on transmitter web GUI **Home > Setup > Network > SNMP** page.

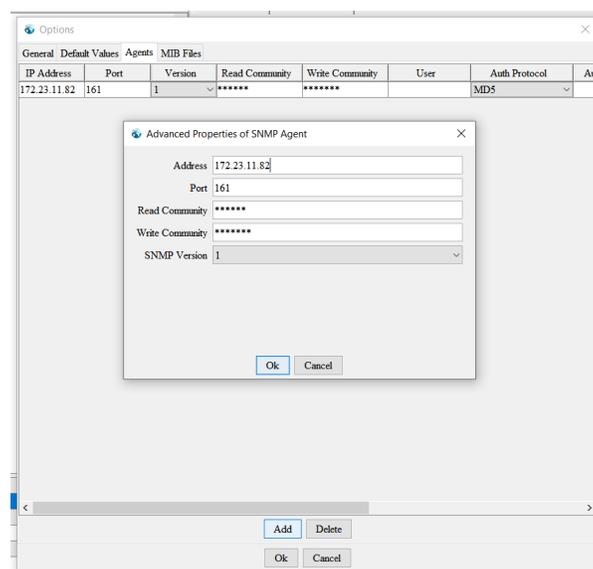


Figure 17: Add new SNMP agent

STEP 5: Navigate MIB tree in SNMP browser to gain access to **logicBaseMIB** subsection. Consult Table 8 for a listing of several useful Base MIB OIDs.

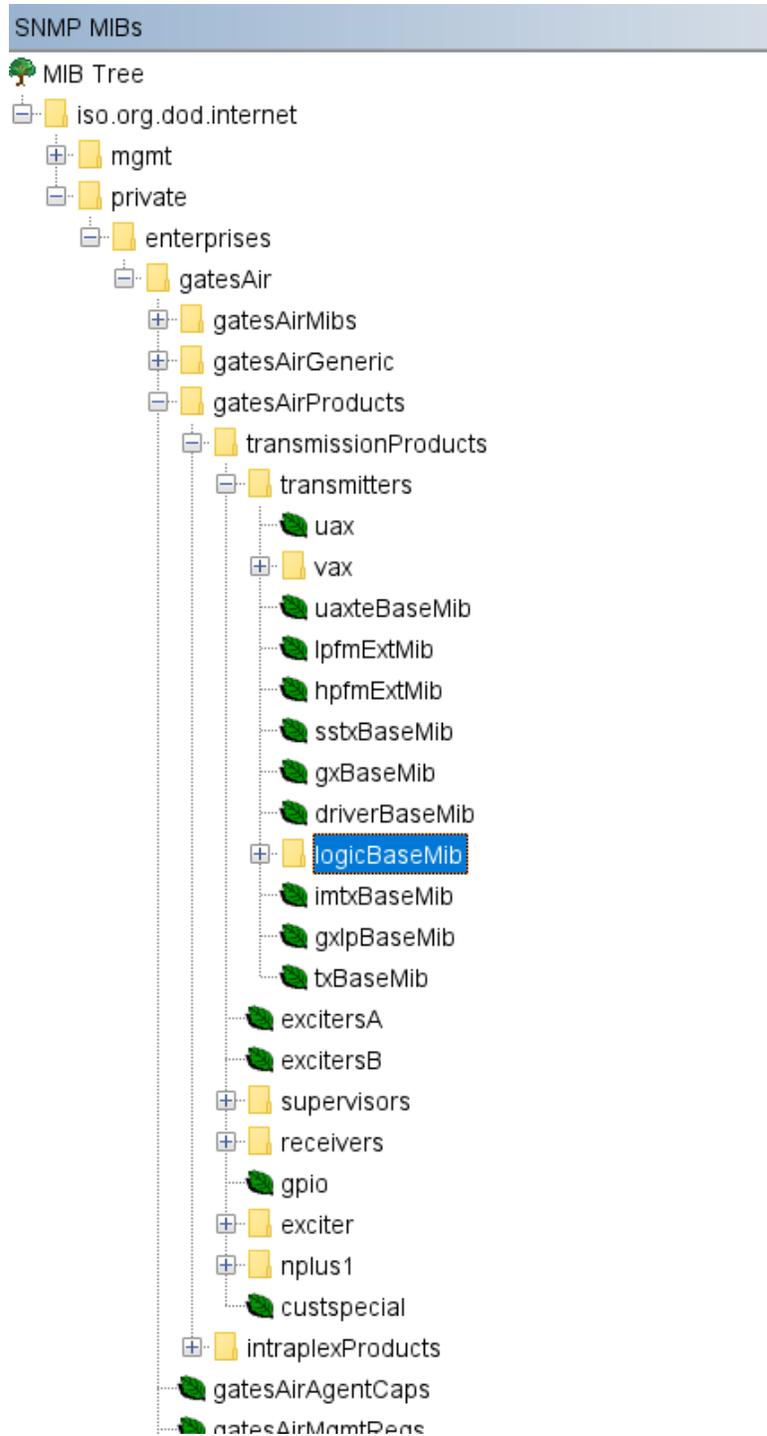


Figure 18: Navigate MIB tree

SNMP datapoint name (OID)	Description
logicBaseMib > logicObjects > logicGeneral > logicStationName (.1.3.6.1.4.1.43768.3.1.1.9.2.3.3)	Returns the user-assigned station name, as set on the web GUI Home > Setup > Service page.
logicBaseMib > logicObjects > logicGeneral > logicModelNumber (.1.3.6.1.4.1.43768.3.1.1.9.2.3.4)	Returns the user-assigned model number, as set on the web GUI Home > Setup > Service page.
logicBaseMib > logicObjects > logicGeneral > logicOpMode (.1.3.6.1.4.1.43768.3.1.1.9.2.3.1)	Returns the on-off status of the transmitter. Switches the transmitter on-off based on the value written with a SET to this OID.
logicBaseMib > logicObjects > logicGeneral > logicStatus (.1.3.6.1.4.1.43768.3.1.1.9.2.3.2)	Returns the overall status of the transmitter.
logicBaseMib > logicObjects > logicSystem > logicSystem Status > logicSysStatusForwardPower (.1.3.6.1.4.1.43768.3.1.1.9.2.5.2.1)	Returns the output forward power level in watts x 1000. e.g. 1900 watts = "1900000"
logicBaseMib > logicObjects > logicSystem > logicSystem Status > logicSysStatusReflectedPower (.1.3.6.1.4.1.43768.3.1.1.9.2.5.2.3)	Returns the output reflected power level in watts x 1000. e.g. 50 watts = "50000"
logicBaseMib > logicObjects > logicSystem > logicSystemConfig > logicSysConfigOutputPower (.1.3.6.1.4.1.43768.3.1.1.9.2.5.1.4)	Returns the current output power APC setting in dBm x 10 format. e.g. 61.0 dBm = "610". A new value may be written with a SET to this OID to change the transmitter power level.
logicBaseMib > logicObjects > logicSystem > logicSystemAlarm > logicSystemAlarmGeneral > logicSystemAlarmForwardLow (.1.3.6.1.4.1.43768.3.1.1.9.2.5.4.1.2)	Returns whether there is a low output power warning or fault currently active.
logicBaseMib > logicObjects > logicSystem > logicSystemConfig > logicSysConfigReset (.1.3.6.1.4.1.43768.3.1.1.9.2.5.1.5)	Performs a general system reset when a value of 1 is written with a SET to this OID.
logicBaseMib > logicObjects > logicSystem > logicSystemConfig > logicSysConfigLowPowerModeEnable (.1.3.6.1.4.1.43768.3.1.1.9.2.5.1.7)	Returns whether low power mode is currently enabled. Low power mode can be enabled/disabled by writing a SET to this OID.
logicBaseMib > logicObjects > logicSystem > logicSystemConfig > logicSysConfigDriverToUse (.1.3.6.1.4.1.43768.3.1.1.9.2.5.1.2)	Returns which LPU is currently active. The active LPU selection can be changed by writing a SET to this OID.
logicBaseMib > logicObjects > logicSystem > logicSystemConfig > logicSysConfigSwitchMode (.1.3.6.1.4.1.43768.3.1.1.9.2.5.1.1)	Returns the current LPU switchover mode. The LPU switchover mode can be changed by writing a SET to this OID.

Table 8: Selected useful OIDs in Base MIB

STEP 6: Right click on **logicBaseMib > logicObjects > logicGeneral > logicStationName** and select **GET**. Verify that a useful result is returned in **Result Table** of SNMP browser.

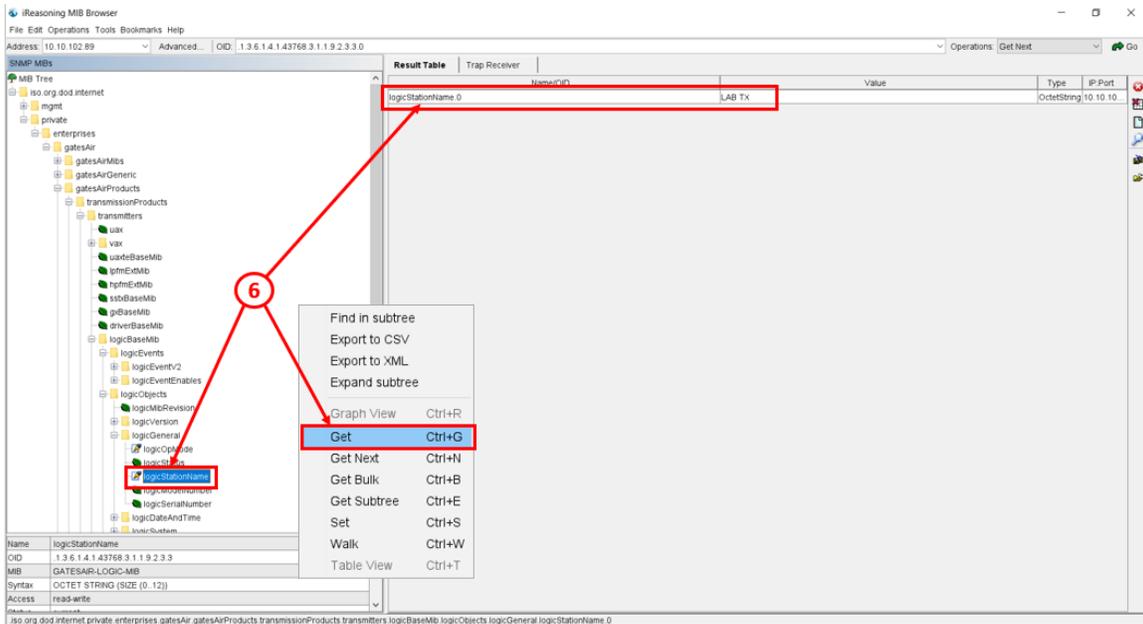


Figure 19: Execute an SNMP GET

STEP 7: Right click on same **logicBaseMib > logicObjects > logicGeneral > logicStationName**, select **SET**, and enter a new transmitter name in pop-up dialog box. Issue a fresh **GET** and verify that a correct, updated result is returned in **Result Table** of SNMP browser.

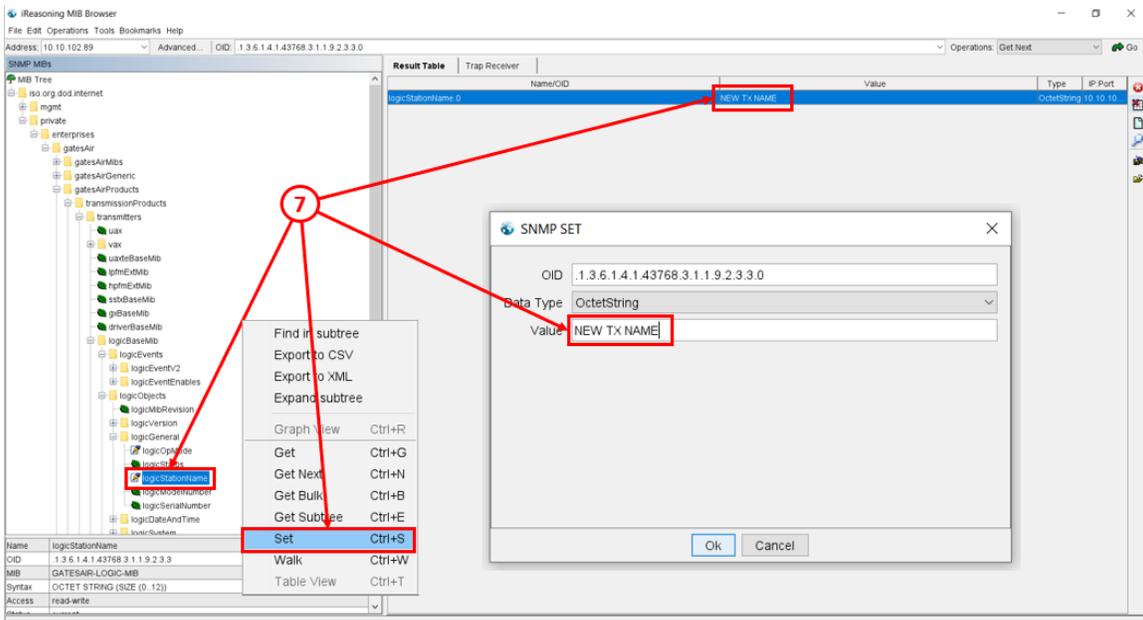


Figure 20: Execute an SNMP SET

STEP 11: End of procedure.



NOTE

This procedure addresses SNMP connection to the transmitter only. Additional data items are available from the individual LPU/drivers at their respective IP addresses. Consult the LPU manual DOCX-00014 for more information on SNMP connection to those units.

3 Operation

This section contains detailed information on the LCD, Web GUI and front/rear panel interfaces to aid in the proper operation of the VAX/UAX-OP transmitter.

3.1 Controls and Indicators

This subsection provides information on the front and rear panel elements of the various subassembly drawers that make up the complete transmitter system.

Special attention is required when dealing with the final power amplifier, as there are multiple amplifier types in the VAX/UAX-OP product family, depending mainly on the operating power level. These are shown in the figure below.



Figure 23: Power amplifier types in VAX/UAX-OP product family

All amplifier types feature essentially the same connections and controls, although their physical locations may vary.

One notable exception is the 3.5RU hot plug amplifier used in the highest power transmitter models. Since these models use the transmitter logic control unit for exciter management, the 3.5RU hot plug amplifier has none of the exciter interface features found in the other amplifier types.

Each power amplifier type is discussed separately in the following pages.

3.1.1 RF power amplifier (2 RU)

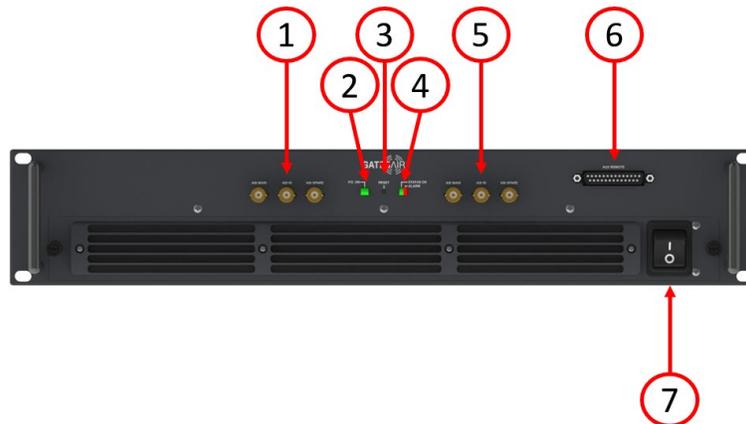


Figure 24: RF power amplifier front panel (2 RU)

Ref.	Description
1	<p>BNC(f) 75 ohms connectors, ASI/video switch to both exciters in dual drive systems. ASI is sent to the currently active exciter.</p> <p>ASI MAIN: switched ASI output to Driver A input.</p> <p>ASI SPARE: switched ASI output to Driver B input.</p> <p>ASI IN: ASI input to system from network headend.</p>
2	<p>P.S. OK: This LED indicates the status of the power supply module:</p> <p>LED ON: The PSU module is switched ON and the amplifier is in operation.</p> <p>LED blinking: The PSU module is switched ON, but the amplifier is in stand-by.</p> <p>LED OFF: The PSU module is switched OFF or the amplifier is in alarm condition.</p>
3	<p>RESET pushbutton resets and restarts the amplifier.</p>
4	<p>Status OK and Alarm: These LEDs indicate the status of the RF amplifier:</p> <p>Status OK LED ON: The RF amplifier is switched ON.</p> <p>Status OK LED blinking: The RF amplifier is switched OFF by means of the web GUI or it is in alarm condition.</p> <p>Alarm LED OFF: no alarm is present.</p> <p>Alarm LED blinking: The RF amplifier is in alarm condition, but still in operation. (e.g. a single fan alarm or voltage/current alarm in just one of the PSU)</p> <p>Alarm LED ON: The RF amplifier is OFF because of an alarm condition.</p>
5	<p>BNC(f) 75 ohms connectors, ASI/video switch to both exciters in dual drive systems. ASI is sent to the currently active exciter.</p> <p>ASI MAIN: switched ASI output to Driver A input.</p> <p>ASI SPARE: switched ASI output to Driver B input.</p> <p>ASI IN: ASI input to system from network headend.</p>
6	<p>D Sub 25 connector for remote control and monitoring.</p>
7	<p>Power Supply AC mains switch.</p>

Table 9: RF power amplifier front panel (2 RU)

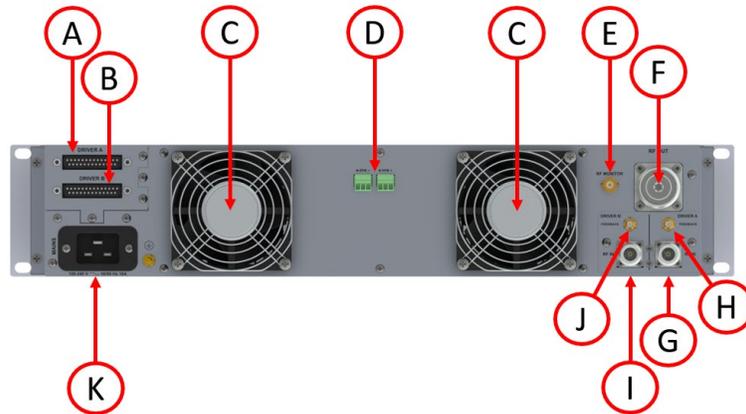


Figure 25: RF power amplifier rear panel (2 RU)

Ref.	Description
A	Driver A: D sub 25 connector to the main LPU to allow control and monitoring of the RF amplifier by the web GUI and SNMP interfaces in LPU A.
B	Driver B: D sub 25 connector to the spare LPU to allow control and monitoring of the RF amplifier by the Web GUI and SNMP interfaces in the LPU B.
C	DC cooling fans.
D	Power connection for DC cooling fans.
E	BNC(f) connector, RF Monitor.
F	DIN 7-16(f) connector, final RF output of the system, to be connected to the external RF band-pass filter.
G	N(f) connector, RF input coming from LPU A.
H	SMA(f) connector, feedback output; to be connected to the non-linear feedback input of LPU A.
I	N(f) connector, RF input coming from LPU B.
J	SMA(f) connector, feedback output; to be connected to the non-linear feedback input of LPU B.
K	IEC320 C20 Plug, AC mains power input. 208-240 VAC, 50/60 Hz, single-phase.

Table 10: RF power amplifier rear panel (2 RU)

3.1.2 RF power amplifier (3 RU)

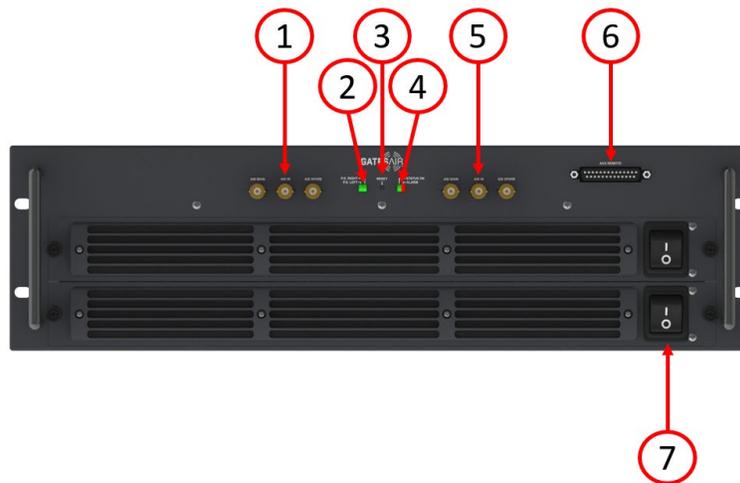


Figure 26: RF power amplifier front panel (3 RU)

Ref.	Description
1	<p>BNC(f) 75 ohms connectors, ASI/video switch to both exciters in dual drive systems. ASI is sent to the currently active LPU.</p> <p>ASI MAIN: switched ASI output to LPU A input.</p> <p>ASI SPARE: switched ASI output to LPU B input.</p> <p>ASI IN: ASI input to system from network headend.</p>
2	<p>P.S. LED ON: The PSU module is switched ON and the amplifier is operational.</p> <p>P.S. LED blinking: The PSU module is switched ON, but the amplifier is in stand-by.</p> <p>P.S. LED OFF: The PSU module is switched OFF or the amplifier is in alarm condition.</p>
3	<p>RESET pushbutton resets and restarts the amplifier.</p>
4	<p>Status OK LED ON: The RF amplifier is switched ON.</p> <p>Status OK LED blinking: The RF amplifier is switched OFF by means web GUI or it is in alarm condition.</p> <p>Alarm LED OFF: no alarm is present.</p> <p>Alarm LED blinking: The RF amplifier is in alarm condition, but still in operation. (e.g. a single fan alarm or voltage/current alarm in just one of the PSU)</p> <p>Alarm LED ON: The RF amplifier is OFF because of an alarm condition.</p>
5	<p>BNC(f) 75 ohms connectors, ASI/video switch to both LPUs in dual drive systems. ASI is sent to the currently active LPU.</p> <p>ASI MAIN: switched ASI output to LPU A input.</p> <p>ASI SPARE: switched ASI output to LPU B input.</p> <p>ASI IN: ASI input to system from network headend.</p>
6	<p>D sub 25 connector for remote control and monitoring.</p>
7	<p>Power Supply (PSU1, PSU2) AC mains switch.</p>

Table 11: RF power amplifier front panel (3 RU)

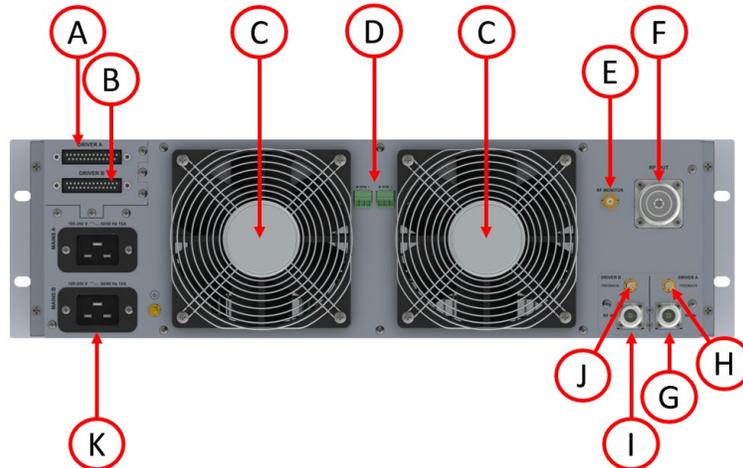


Figure 27: RF power amplifier rear panel (3 RU)

Ref.	Description
A	Driver A: D sub 25 connector to the main LPU to allow control and monitoring of the RF amplifier by the web GUI and SNMP interfaces in LPU A.
B	Driver B: D sub 25 connector to the spare exciter to allow control and monitoring of the RF amplifier by the web GUI and SNMP interfaces in LPU B.
C	DC cooling fans.
D	Power connection for DC cooling fans.
E	BNC(f) connector, RF Monitor.
F	DIN 7-16(f) connector, final RF output of the system, to be connected to the external RF band-pass filter.
G	N(f) connector, RF input coming from LPU A.
H	SMA(f) connector, feedback output; to be connected to the non-linear feedback input of LPU A.
I	N(f) connector, RF input, coming from LPU B.
J	SMA(f) connector, feedback output; to be connected to the non-linear feedback input of LPU B.
K	IEC320 C20 Plug, AC mains power inputs (PS1, PS2). 208-240 VAC, 50/60 Hz, single-phase.

Table 12: RF power amplifier rear panel (3 RU)

3.1.3 RF power amplifier (3.5 RU)

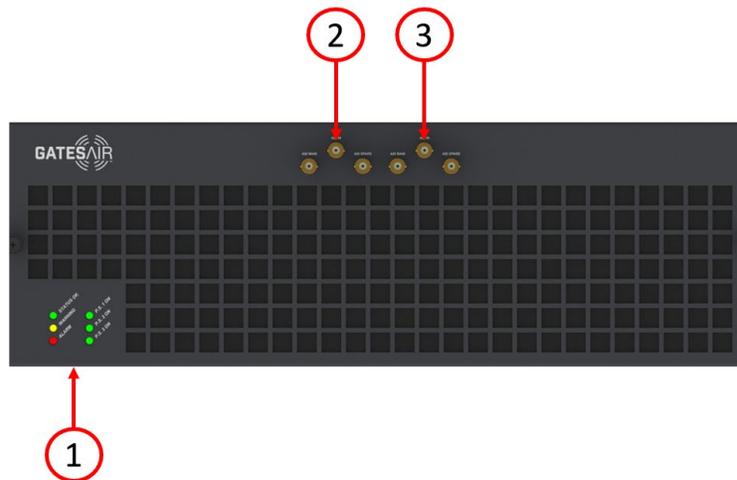


Figure 28: RF power amplifier front panel (3.5 RU)

Ref.	Description
1	<p>Status OK and Alarm: These LEDs indicate the status of the RF amplifier:</p> <p>Status OK LED ON: The RF amplifier is switched ON.</p> <p>Status OK LED blinking: The RF amplifier is switched OFF by means of the web GUI or it is in alarm condition.</p> <p>Alarm LED OFF: no alarm is present.</p> <p>Alarm LED blinking: The RF amplifier is in alarm condition, but still in operation. (e.g. a single fan alarm or voltage/current alarm in just one of the PSU)</p> <p>Alarm LED ON: The RF amplifier is OFF because of an alarm condition.</p> <p>PS1, PS2, PS3 OK: These LEDs indicate the status of the power supply modules:</p> <p>PS LED ON: The PSU module is switched ON and the amplifier is operational.</p> <p>PS LED blinking: The PSU module is switched ON, but the amplifier is in stand-by.</p> <p>PS LED OFF: The PSU module is switched OFF or the amplifier is in alarm condition.</p>
2	<p>BNC(f) 75 ohms connectors, ASI/video switch to both exciters in dual drive systems. ASI is sent to the currently active LPU.</p> <p>ASI MAIN: switched ASI output to LPU A input.</p> <p>ASI SPARE: switched ASI output to LPU B input.</p> <p>ASI IN: ASI input to system from network headend.</p>
3	<p>BNC(f) 75 ohms connectors, ASI/video switch to both LPUs in dual drive systems. ASI is sent to the currently active LPU.</p> <p>ASI MAIN: switched ASI output to LPU A input.</p> <p>ASI SPARE: switched ASI output to LPU B input.</p> <p>ASI IN: ASI input to system from network headend.</p>

Table 13: RF power amplifier front panel (3.5 RU)

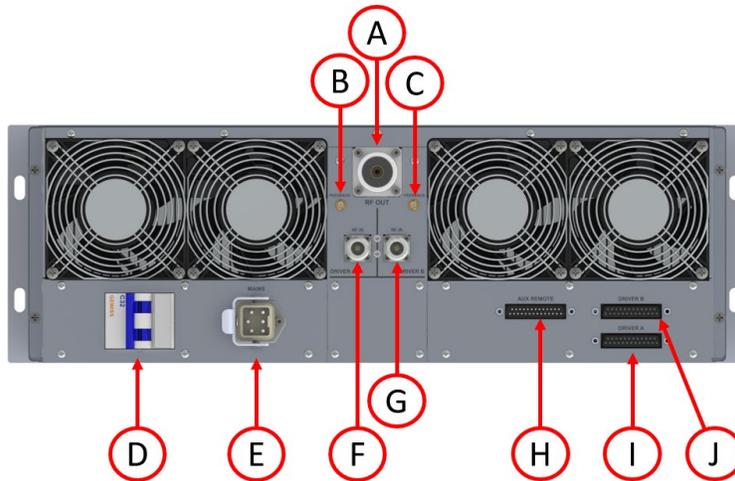


Figure 29: RF power amplifier rear panel (3.5 RU)

Ref.	Description
1	DIN 7-16(f) connector, final RF output of the system, to be connected to the external RF band-pass filter.
2	SMA(f) connector, feedback output; to be connected to the non-linear feedback input of LPU A.
3	SMA(f) connector, feedback output; to be connected to the non-linear feedback input of LPU B.
4	Circuit breaker, 220V 3-phase 20A
5	AC mains power input plug.
6	N(f) connector, RF input coming from LPU A.
7	N(f) connector, RF input, coming from LPU B.
8	D sub 25 connector for remote control and monitoring.
9	Driver A: D sub 25 connector to the main LPU to allow control and monitoring of the RF amplifier by the web GUI and SNMP interfaces in LPU A.
10	Driver B: D sub 25 connector to the spare LPU to allow control and monitoring of the RF amplifier by the web GUI and SNMP interfaces in LPU B.
11	DC cooling fans.

Table 14: RF power amplifier rear panel (3.5 RU)

PINS	COLOUR	380V 3 ϕ 4 WIRE + GROUND	220V 3 ϕ 3 WIRE + GROUND	220V 1 ϕ +GROUND (PINS 2-5, 1-3 ARE IN PARALLEL)
1	BLUE	NEUT	NC	NEUT
2	BROWN	L1	L1	L1
3	GREY	L2	L2	NEUT
4	NC	NC	NC	NC
5	BLACK	L3	L3	L1
EARTH	YEL/GRN	GROUND	GROUND	GROUND

DETAIL 'A'

Table 15: RF power amplifier (3.5 RU) AC mains connection

 CAUTION	<p>The selection of delta (3-wire), wye (4-wire), or single-phase (monophase) AC mains operation is also determined by jumper/fuse settings internal to the amplifier drawer. See Section 4.2.2 for more information.</p>
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3.1.4 RF power amplifier (3.5 RU hot plug)

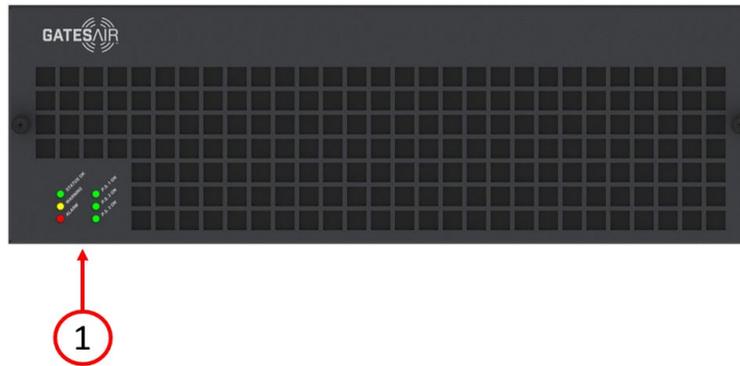


Figure 30: RF power amplifier front panel (3.5 RU hot plug)

Ref.	Description
1	<p>Status OK and Alarm: These LEDs indicate the status of the RF amplifier:</p> <p>Status OK LED ON: The RF amplifier is switched ON.</p> <p>Status OK LED blinking: The RF amplifier is switched OFF by means of the web GUI or it is in alarm condition.</p> <p>Alarm LED OFF: no alarm is present.</p> <p>Alarm LED blinking: The RF amplifier is in alarm condition, but still in operation. (e.g. a single fan alarm or voltage/current alarm in just one of the PSU)</p> <p>Alarm LED ON: The RF amplifier is OFF because of an alarm condition.</p> <p>PS1, PS2, PS3 OK: These LEDs indicate the status of the power supply modules:</p> <p>PS LED ON: The PSU module is switched ON and the amplifier is operational.</p> <p>PS LED blinking: The PSU module is switched ON, but the amplifier is in stand-by.</p> <p>PS LED OFF: The PSU module is switched OFF or the amplifier is in alarm condition.</p>

Table 16: RF power amplifier front panel (3.5 RU hot plug)

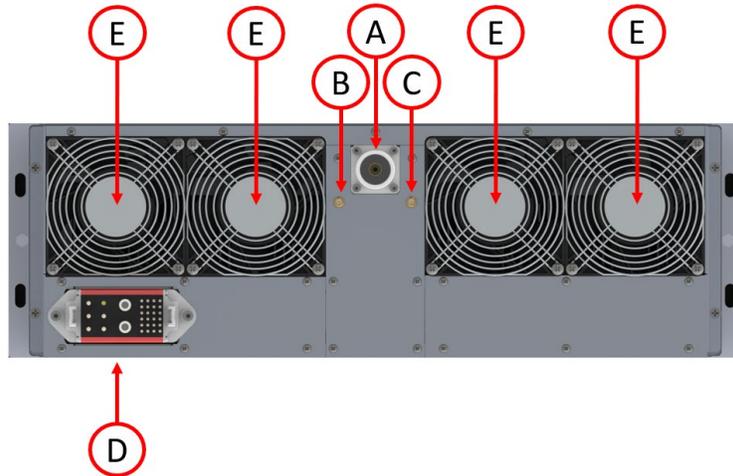


Figure 31: RF power amplifier rear panel (3.5 RU hot plug)

Ref.	Description
A	DIN 7-16(f) connector, final RF output of the system, to be connected to the external RF band-pass filter.
B	SMA(f) connector, not used.
C	SMA(f) connector, not used.
D	Multi-pin connector. See connections detail on following page.
E	DC cooling fans.

Table 17: RF power amplifier rear panel (3.5 RU hot plug)

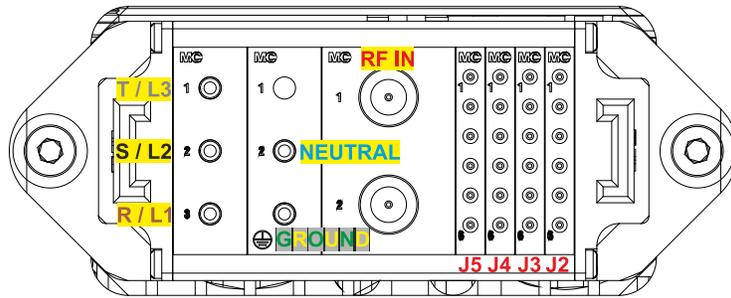


Figure 32: Multicontact connector located on RF amplifier rear panel

For AC mains power and RF connections, refer to the above figure. For other connections, please refer to the table below.

Ref	Description
J2-1	Not used
J2-2	RS 485 TX-
J2-3	RS 485 RX-
J2-4	Not used
J2-5	Not used
J2-6	Opto IN - RF OFF
J3-1	RS 232 RX (factory use only, debug mode)
J3-2	RS 485 TX+
J3-3	RS 485 RX+
J3-4	RS 485 address assignment pin 2
J3-5	Not used
J3-6	+28V input (to feed internal controller module)
J4-1	RS 232 TX (factory use only, debug mode)
J4-2	COM Relay 1 (Reset command from Control Unit)
J4-3	Not used
J4-4	Not used
J4-5	Relay 1 (Reset command from Control Unit), NC
J4-6	RS 485 address assignment pin 1
J5-1	Not used
J5-2	Not used
J5-3	GND Opto (common)
J5-4	Opto IN - Alarm Reset
J5-5	Opto IN - Remote stand-by
J5-6	RS 485 address assignment pin 0

Table 18: Multicontact connector pinout

3.1.5 Transmitter control unit

The front panel of the transmitter logic control unit provides some operational information and features connections for RF monitoring, LAN IP connectivity and management. It is found only in those transmitter models with two or more power amplifiers.

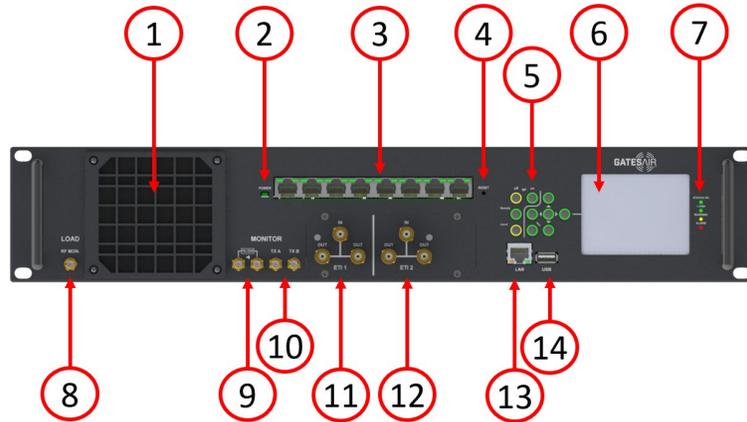


Figure 33: Transmitter control unit front panel

Ref.	Description
1	Air grid for internal exciter / LPU load cooling (if present).
2	Equipment status Power On light indicator.
3	Fast Ethernet switch 8 or 16 ports (according to the model).
4	RESET pushbutton for the Ethernet switch.
5	Front panel push buttons: RF On/Off, Remote/Local, GUI display functions
6	GUI display screen
7	<p>Status OK LED [on] = the transmitter is switched on and functioning normally.</p> <p>Status OK LED [blinking] = the transmitter is not transmitting RF, either because it was switched off or because of an alarm condition.</p> <p>Warning LED [on] = a warning condition exists in the system.</p> <p>Alarm LED [on] = a fault condition exists in the system.</p>
8	SMA(f) 50 Ohm connector, internal exciter load RF monitor out, -20 dBm...0 dBm nominal.
9	SMA(f) 50 Ohm connectors, RF monitor after and before band-pass filter, -20 dBm...0 dBm nominal.
10	SMA(f) 50 Ohm connector, half-system RF monitor, TXA or TXB (only used in larger systems). -20 dBm...0 dBm nominal.
11	BNC(f) 75 Ohm connectors, ASI 1 or video CVBS switching matrix input and outputs.
12	BNC(f) 75 Ohm connectors, ASI 2 switching matrix input and outputs.
13	RJ-45 connector, Ethernet 10/100 BaseT for remote management.
14	USB connector for firmware upgrade.

Table 19: Transmitter control unit front panel

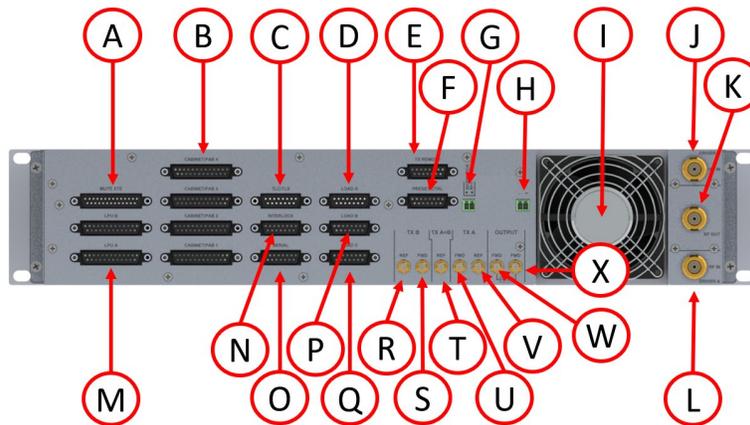


Figure 34: Transmitter control unit rear panel

Ref.	Description																																													
A	D sub 25 connector for communication with external automatic switching units managing N+1 or N+2 systems.																																													
B	D sub 25 connectors, Cabinet/PAB 1...4, serial communication with RF amplifiers and 28V input.																																													
C	D sub 15 connector for remote controls and signaling, not used in this application.																																													
D	D sub 15 connector for RF combiners load A control.																																													
E	D Sub 15 connector, parallel remote control interface. See GUI user interface Home > Remote > TX Remote screen for more information. <table border="1" style="margin-left: 20px;"> <tbody> <tr><td>1</td><td>RF OFF</td><td>Command input</td></tr> <tr><td>2</td><td>RF ON</td><td>Command input</td></tr> <tr><td>3</td><td>INPUT ALARM</td><td>Status output</td></tr> <tr><td>4</td><td>LOCAL/REMOTE</td><td>Status output</td></tr> <tr><td>5</td><td>Not used</td><td></td></tr> <tr><td>6</td><td>RF LOW -7dB</td><td>Status output</td></tr> <tr><td>7</td><td>RF LOW -3dB</td><td>Status output</td></tr> <tr><td>8</td><td>CUSTOM 1</td><td>Command input</td></tr> <tr><td>9</td><td>RX ALARM</td><td>Status output</td></tr> <tr><td>10</td><td>Not used</td><td></td></tr> <tr><td>11</td><td>CUSTOM 2</td><td>Command input</td></tr> <tr><td>12</td><td>RF OFF</td><td>Status output</td></tr> <tr><td>13</td><td>GENERIC ALARM</td><td>Status output</td></tr> <tr><td>14</td><td>Not used</td><td></td></tr> <tr><td>15</td><td>CUSTOM 3</td><td>Command input</td></tr> </tbody> </table>	1	RF OFF	Command input	2	RF ON	Command input	3	INPUT ALARM	Status output	4	LOCAL/REMOTE	Status output	5	Not used		6	RF LOW -7dB	Status output	7	RF LOW -3dB	Status output	8	CUSTOM 1	Command input	9	RX ALARM	Status output	10	Not used		11	CUSTOM 2	Command input	12	RF OFF	Status output	13	GENERIC ALARM	Status output	14	Not used		15	CUSTOM 3	Command input
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13	GENERIC ALARM	Status output																																												
14	Not used																																													
15	CUSTOM 3	Command input																																												
F	D Sub 15 connector, remote control of user-defined preset operating modes. See GUI user interface Home > Remote > Freq. Control screen for more information. <table border="1" style="margin-left: 20px;"> <tbody> <tr><td>1</td><td>GND</td><td></td></tr> <tr><td>2</td><td>GND</td><td></td></tr> <tr><td>3</td><td>GND</td><td></td></tr> <tr><td>4</td><td>Preset 6 selected</td><td>Status output</td></tr> <tr><td>5</td><td>Preset 5 selected</td><td>Status output</td></tr> </tbody> </table>	1	GND		2	GND		3	GND		4	Preset 6 selected	Status output	5	Preset 5 selected	Status output																														
1	GND																																													
2	GND																																													
3	GND																																													
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5	Preset 5 selected	Status output																																												

	<table border="1"> <tr><td>6</td><td>Preset 4 selected</td><td>Status output</td></tr> <tr><td>7</td><td>Select preset 6</td><td>Command input</td></tr> <tr><td>8</td><td>Select preset 5</td><td>Command input</td></tr> <tr><td>9</td><td>Select preset 4</td><td>Command input</td></tr> <tr><td>10</td><td>Select preset 3</td><td>Command input</td></tr> <tr><td>11</td><td>Select preset 2</td><td>Command input</td></tr> <tr><td>12</td><td>Select preset 1</td><td>Command input</td></tr> <tr><td>13</td><td>Preset 3 selected</td><td>Status output</td></tr> <tr><td>14</td><td>Preset 2 selected</td><td>Status output</td></tr> <tr><td>15</td><td>Preset 1 selected</td><td>Status output</td></tr> </table>	6	Preset 4 selected	Status output	7	Select preset 6	Command input	8	Select preset 5	Command input	9	Select preset 4	Command input	10	Select preset 3	Command input	11	Select preset 2	Command input	12	Select preset 1	Command input	13	Preset 3 selected	Status output	14	Preset 2 selected	Status output	15	Preset 1 selected	Status output
6	Preset 4 selected	Status output																													
7	Select preset 6	Command input																													
8	Select preset 5	Command input																													
9	Select preset 4	Command input																													
10	Select preset 3	Command input																													
11	Select preset 2	Command input																													
12	Select preset 1	Command input																													
13	Preset 3 selected	Status output																													
14	Preset 2 selected	Status output																													
15	Preset 1 selected	Status output																													
G	External interlock/safety loop connection, 2 pin socket.																														
H	Power connection for DC cooling fan.																														
I	DC cooling fan.																														
J	Driver B RF In: N(f) 50 Ohm connector, RF input from LPU B. 0-50W typical, model dependent.																														
K	RF Out: N(f) 50 Ohm connector, RF output to feed RF amplifier modules.																														
L	Driver A RF In: N(f) 50 Ohm connector, RF input from LPU A. 0-50W typical, model dependent.																														
M	D sub 25 connectors for serial communication with exciter/LPU A and B and 28V DC input.																														
N	<p>D sub 15 connector, user-definable interlock loop connections. See GUI user interface Home > Remote > Interlock screen for more information.</p> <table border="1"> <tr><td>1</td><td>GND</td></tr> <tr><td>2</td><td>Relay Common</td></tr> <tr><td>3</td><td>Relay Common</td></tr> <tr><td>4</td><td>Relay Common</td></tr> <tr><td>5</td><td>Relay 1</td></tr> <tr><td>6</td><td>Relay 2</td></tr> <tr><td>7</td><td>Relay 3</td></tr> <tr><td>8</td><td>Relay 4</td></tr> <tr><td>9</td><td>GND</td></tr> <tr><td>10</td><td>Relay Common</td></tr> <tr><td>11</td><td>Relay 5</td></tr> <tr><td>12</td><td>Relay 6</td></tr> <tr><td>13</td><td>Relay 7</td></tr> <tr><td>14</td><td>Relay 8</td></tr> <tr><td>15</td><td>Relay Common</td></tr> </table>	1	GND	2	Relay Common	3	Relay Common	4	Relay Common	5	Relay 1	6	Relay 2	7	Relay 3	8	Relay 4	9	GND	10	Relay Common	11	Relay 5	12	Relay 6	13	Relay 7	14	Relay 8	15	Relay Common
1	GND																														
2	Relay Common																														
3	Relay Common																														
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6	Relay 2																														
7	Relay 3																														
8	Relay 4																														
9	GND																														
10	Relay Common																														
11	Relay 5																														
12	Relay 6																														
13	Relay 7																														
14	Relay 8																														
15	Relay Common																														
O	D sub 15 connector-used for debugging.																														
P	D sub 15 connector for RF combiners load B control.																														
Q	D sub 15 connector for RF combiners load C control.																														
R	TX B REF: SMA(f) 50 Ohm connector, feedback input for return loss for amplifiers in bank B (only used in systems with more than 4 RF amplifiers). -20 dBm...0 dBm nominal.																														
S	TX B FWD: SMA(f) 50 Ohm connector, feedback input for forward RF power output for amplifiers in bank B (only used in systems with more than 4 RF amplifiers). -20 dBm...0 dBm nominal.																														
T	TX A+B REF: SMA(f) 50 Ohm connector, feedback input for total return loss. -20 dBm...0 dBm nominal.																														
U	TX A FWD: SMA(f) 50 Ohm connector, feedback input for forward RF power output for amplifiers in bank A (only used in systems with more than 4 RF amplifiers). -20 dBm...0 dBm nominal.																														

V	TX A REF: SMA(f) 50 Ohm connector, feedback input for return loss for amplifiers in bank A (only used in systems with more than 4 RF amplifiers). -20 dBm...0 dBm nominal.
W	OUTPUT FWD: SMA(f) 50 Ohm connector, RF monitor input pre bandpass filter (the input connector pre bandpass filter is used to control power output level). -20 dBm...0 dBm nominal.
X	OUTPUT FWD: SMA(f) 50 Ohm connector, RF monitor input post bandpass filter. -20 dBm...0 dBm nominal.

Table 20: Transmitter control unit rear panel

3.1.6 RF combiner loads assembly

The rear panel of the RF combiner loads assembly features RF and control connections for certain transmitter models with two, three, or four RF amplifier drawers per rack.

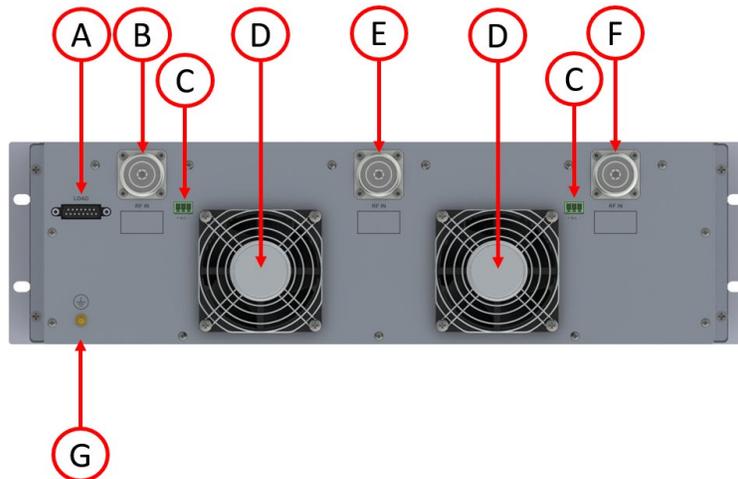


Figure 35: RF combiner loads assembly rear panel

Ref.	Description																								
A	D sub 15 connector for RF combiners load monitoring by transmitter control unit.																								
	<table border="1"> <tr><td>1</td><td>GND</td></tr> <tr><td>2</td><td>GND</td></tr> <tr><td>3</td><td>Analog voltage, detector on load 3</td></tr> <tr><td>4</td><td>Analog voltage, detector on load 1</td></tr> <tr><td>5</td><td>+28V</td></tr> <tr><td>6</td><td>+28V</td></tr> <tr><td>7</td><td>+28V</td></tr> <tr><td>8</td><td>+28V</td></tr> <tr><td>9</td><td>GND</td></tr> <tr><td>10</td><td>+5V Detector</td></tr> <tr><td>11</td><td>Analog voltage, detector on load 2</td></tr> <tr><td>12</td><td>+28V</td></tr> </table>	1	GND	2	GND	3	Analog voltage, detector on load 3	4	Analog voltage, detector on load 1	5	+28V	6	+28V	7	+28V	8	+28V	9	GND	10	+5V Detector	11	Analog voltage, detector on load 2	12	+28V
1	GND																								
2	GND																								
3	Analog voltage, detector on load 3																								
4	Analog voltage, detector on load 1																								
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6	+28V																								
7	+28V																								
8	+28V																								
9	GND																								
10	+5V Detector																								
11	Analog voltage, detector on load 2																								
12	+28V																								

	<table border="1"> <tr> <td>13</td> <td>+28V</td> </tr> <tr> <td>14</td> <td>+28V</td> </tr> <tr> <td>15</td> <td>+28V</td> </tr> </table>	13	+28V	14	+28V	15	+28V
13	+28V						
14	+28V						
15	+28V						
B	DIN 7-16 50 Ohm female connector, load A input.						
C	<p>Three-pin socket for cooling fan power supply.</p> <table border="1"> <tr> <td>1</td> <td>GND</td> </tr> <tr> <td>2</td> <td>Not connected</td> </tr> <tr> <td>3</td> <td>+28V</td> </tr> </table>	1	GND	2	Not connected	3	+28V
1	GND						
2	Not connected						
3	+28V						
D	Cooling fan.						
E	DIN 7-16 50 Ohm female connector, load B input.						
F	DIN 7-16 50 Ohm female connector, load C input.						
G	Grounding screw.						

Table 21: RF combiner loads assembly rear panel

3.1.7 Mains distribution unit

The front panel of the mains distribution unit provides some basic operational information features mains breakers for the whole system in larger transmitters with multiple power amplifier modules.

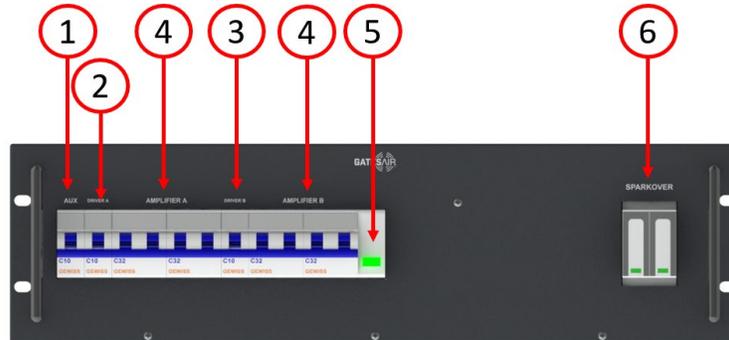


Figure 36: Mains distribution unit front panel

Ref.	Description
1	Aux: Circuit breaker 20A to Auxiliary IEC C-13 receptacles
2	Driver A: Circuit breaker 10A to LPU A (Main)
3	Driver B: Circuit breaker 10A to LPU B (Spare)
4	Amplifier: Circuit breaker 20A to RF amplifier(s) 1 thru 8
5	LED: Indicates phase presence OK
6	Sparkover: Indicates surge protection device is active

Table 22: Mains distribution unit front panel

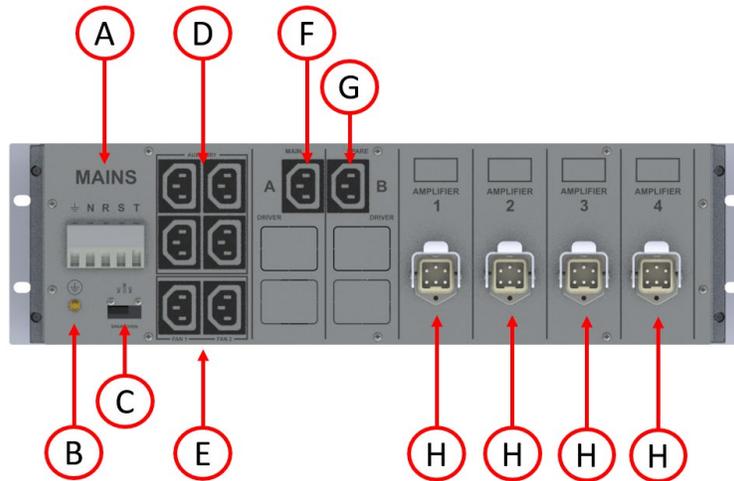


Figure 37: Mains distribution unit rear panel

Ref.	Description
1	MAINS: R-S-T-N ≡ AC mains input, 380-400V 3∅~, 50/60 Hz or 220V 3∅~, 50/60 Hz or 220-240V 1∅~, 50/60 Hz (according to the model).
2	Ground: System ground connection
3	Spark Over: NO Com NO
4	Auxiliary: auxiliary 20A mains circuits
5	Auxiliary Fan 1/2: Rack Cabinet 1 and 2 IEC C-13 receptacle
6	Main: Driver A: AC main distribution to LPU A (10A) IEC C-13 receptacle
7	Spare: Driver B: AC main distribution to LPU B (10A) IEC C-13 receptacle
8	Amplifier (1-8): AC main distribution to PA amplifier(s) 1-4 (20A)

Table 23: Mains distribution unit rear panel

3.1.8 Low power unit (LPU)

 NOTE	<p>The functioning of the LPU (driver) is discussed more extensively in GatesAir manual DOCX-00014. Please consult manual DOCX-00014 for additional information.</p>
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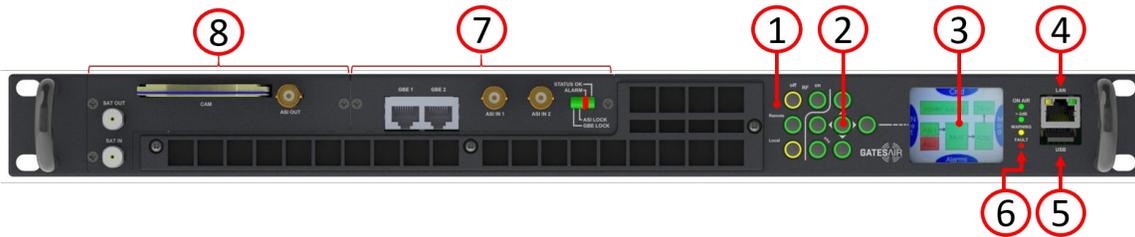


Figure 38: LPU front panel

Ref	Description
1	On-Off and Local-Remote pushbuttons.
2	LCD display navigation buttons.
3	LCD display screen.
4	Ethernet management connector (10/100).
5	USB connector for firmware upgrade.
6	Summary status LEDs: [ON AIR] = unit is transmitting [>-3dB] = output power is below -3dB threshold [WARNING] = a warning condition exists [FAULT] = an alarm condition exists
7	Right input board slot.
8	Left input board slot.

Table 24: LPU front panel

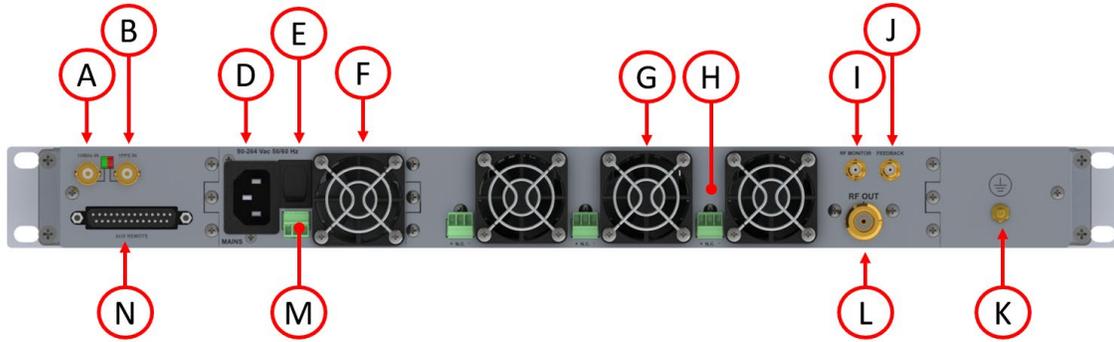


Figure 39: LPU rear panel

Ref	Description																																
A	BNC female connector, 10 MHz reference signal input or output. (5 Vpp TTL)																																
B	BNC female connector, 1 PPS reference signal input or output. (5 Vpp TTL, 100µs)																																
C	N female connector, GPS antenna input. Switchable antenna power (5V @ 100mA max.)																																
D	IEC320 plug, AC mains input. 110-240 VAC, 50/60 Hz, single-phase.																																
E	AC mains power supply switch.																																
F	Cooling fan of the power supply module.																																
G	Cooling fans of the RF amplifier module.																																
H	RF amplifier module (removable) (1RU only).																																
I	SMA female connector, 50 Ohm, RF monitor output. (0 dBm typical)																																
J	SMA female connector, 50 Ohm, external RF feedback input. (0 dBm...-20 dBm)																																
K	Chassis grounding post.																																
L	N female connector, RF output.																																
M	Switching power supply module (removable) (1RU only).																																
N	DB25 connector for auxiliary remote control and monitoring. <i>OPTOs: close to pin 5 issue command or satisfy interlock</i> <i>ALARMS: relay closure pins A-to-B = alarm</i> <table border="1" style="width: 100%; margin-top: 10px;"> <thead> <tr> <th>Pin</th> <th>Signal</th> <th>Pin</th> <th>Signal</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>GND</td> <td>14</td> <td>GND</td> </tr> <tr> <td>2</td> <td>OPTO Dummy Load Interlock</td> <td>15</td> <td>NOT USED</td> </tr> <tr> <td>3</td> <td>OPTO Reset Modulator</td> <td>16</td> <td>NOT USED</td> </tr> <tr> <td>4</td> <td>OPTO Reboot Equipment</td> <td>17</td> <td>ALARM TS Input A</td> </tr> <tr> <td>5</td> <td>GND OPTO</td> <td>18</td> <td>ALARM TS Input B</td> </tr> <tr> <td>6</td> <td>NOT USED</td> <td>19</td> <td>ALARM RF Output A</td> </tr> <tr> <td>7</td> <td>485 TX+</td> <td>20</td> <td>ALARM RF Output B</td> </tr> </tbody> </table>	Pin	Signal	Pin	Signal	1	GND	14	GND	2	OPTO Dummy Load Interlock	15	NOT USED	3	OPTO Reset Modulator	16	NOT USED	4	OPTO Reboot Equipment	17	ALARM TS Input A	5	GND OPTO	18	ALARM TS Input B	6	NOT USED	19	ALARM RF Output A	7	485 TX+	20	ALARM RF Output B
Pin	Signal	Pin	Signal																														
1	GND	14	GND																														
2	OPTO Dummy Load Interlock	15	NOT USED																														
3	OPTO Reset Modulator	16	NOT USED																														
4	OPTO Reboot Equipment	17	ALARM TS Input A																														
5	GND OPTO	18	ALARM TS Input B																														
6	NOT USED	19	ALARM RF Output A																														
7	485 TX+	20	ALARM RF Output B																														

Ref	Description	
8	485 TX-	21 ALARM Power Supply A
9	485 RX+	22 ALARM Power Supply B
10	485 RX-	23 ALARM GPS A
11	NOT USED	24 ALARM GPS B
12	OPTO Standby Interlock	25 +28 V
13	+28V	

Table 25: LPU rear panel

3.2 LCD User Interface

The front panel LCD screen on the transmitter control unit provides a summary display of important operational parameters. It also provides an easy means of determining the IP address of the web GUI interface discussed in Section 3.3.

 NOTE	<p>This section discusses the front-panel LCD user interface as found on the transmitter control unit in systems with two or more PA modules. For smaller systems without a transmitter control unit, consult manual DOCX-00014 for information on the LCD user interface found on the front of the LPU(s).</p>
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Navigation among the various screens in the LCD menu carousel is via the left and right navigation buttons found immediately to the left of the screen, as detailed in Figure 40.

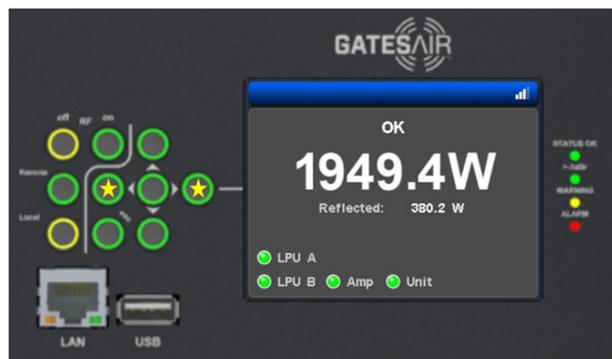


Figure 40: LCD menu navigation

In addition, certain parameters can be modified directly from the front panel by pressing the center button while in local control mode. The setting to be modified highlights in yellow, as shown in Figure 41.

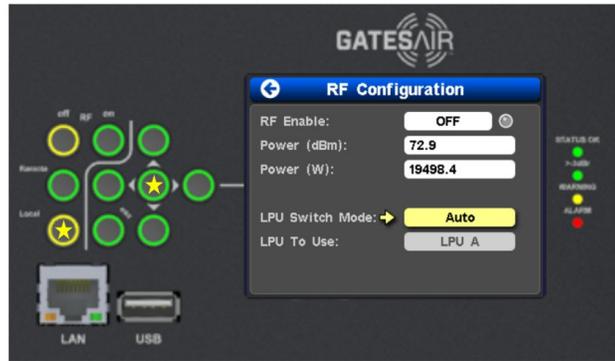


Figure 41: Edit LCD menu items

The remainder of this section provides information on the contents of the various LCD menus. Note that the screen content will vary slightly to what is shown here according to the transmitter model.

3.2.1 LCD navigation tree

The graphic below provides a quick reference to the navigational tree structure of the transmitter control unit LCD menus. The LCD menus detailed in this section are presented according to their order in the LCD navigation tree from left-to-right, top-to-bottom.

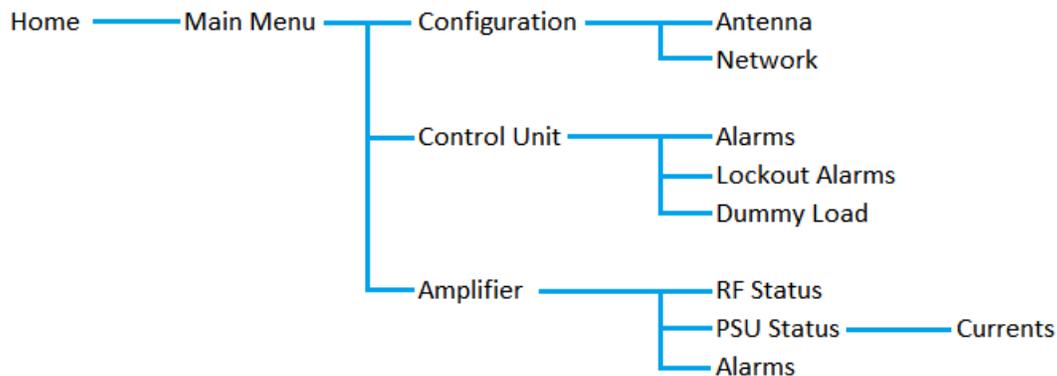


Figure 42: LCD navigation tree

3.2.2 LCD Home menu



Figure 43: LCD Home menu

Item	Function
Ascending bars display	Animates to show the system is currently transmitting.
Status display	Indicates the operational status of the entire transmitter system. [OK] = The system is switched on and transmitting normally. [Power Off] = The system is switched off. [Power Low] = The system is switched on, but the output power is low. [Alarm] = The system has one or more alarms active.
Forward power display	Displays the forward power level at the transmitter output in watts.
Reflected power display	Displays the reflected power level at the transmitter output in watts.
Status LEDs	Indicates the operation status of various parameters. [Green] = normal operation, no abnormal conditions reported. [Yellow] = a warning condition exists. [Red] = a fault condition exists. [Gray X] = does not apply to this transmitter system.
LPU A	Indicates the operational status of LPU A.
LPU B	Indicates the operational status of LPU B.
Amp	Indicates the operational status of the RF amplifiers.
Unit	Indicates the operational status of the transmitter control unit.

Table 26: LCD Home menu

3.2.3 LCD Home > Main Menu



Figure 44: LCD Home > Main Menu

Item	Function
Configuration	Navigates to the Configuration menu.
Control Unit	Navigates to the Control Unit menu.
Amplifier	Navigates to the Amplifier menu.

Table 27: LCD Home > Main Menu

3.2.4 LCD Home > Main Menu > Configuration menu

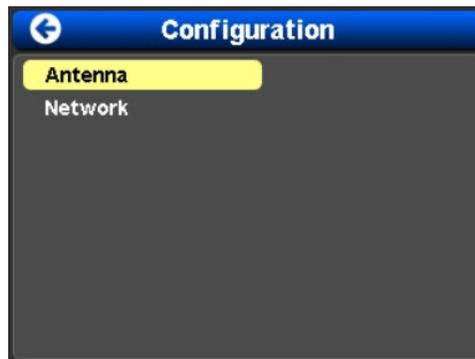


Figure 45: LCD Home > Main Menu > Configuration menu

Item	Function
Antenna	Navigates to the Antenna/RF Configuration menu.
Network	Navigates to the Network-Front Configuration menu.

Table 28: LCD Home > Main Menu > Configuration menu

3.2.5 LCD Home > Main Menu > Configuration > Antenna menu

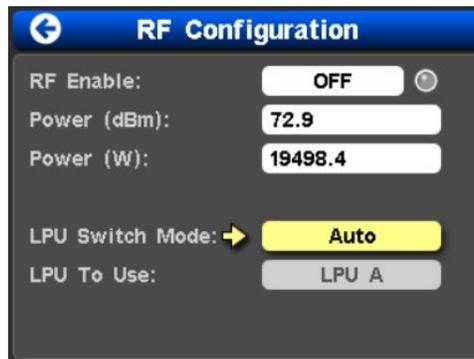


Figure 46: LCD Home > Main Menu > Configuration > Antenna menu

Item	Function
RF Enable	Switches the transmitter system on or off. [OFF, gray LED] = transmitter is switched off. [ON, green LED] = transmitter is switched on.
Power (dBm)	Sets, displays the target forward power level in dBm.
Power (W)	Sets, displays the target forward power level in watts.
LPU Switch Mode	Sets, displays the LPU switchover mode for redundancy purposes. [Auto] = control system switches automatically to the alternate LPU if the first LPU reports a fault condition. [Manual] = control system will not switch automatically to the alternate LPU if the first LPU reports a fault condition.
LPU To Use	Forces a switchover to the designated LPU when in MANUAL for LPU Switch Mode. [LPU A] = manually select LPU A to drive transmitter. [LPU B] = manually select LPU B to drive transmitter.

Table 29: LCD Home > Main Menu > Configuration > Antenna menu

3.2.6 LCD Home > Main Menu > Configuration > Network menu

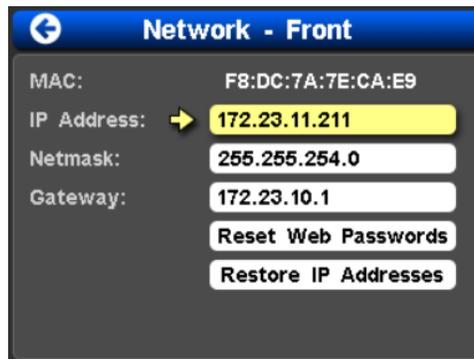


Figure 47: LCD Home > Main Menu > Configuration > Network menu

Item	Function
MAC	Displays the factory-set MAC address for the transmitter control unit IP interface port.
IP Address	Sets, displays the IP address of the IP port.
Netmask	Sets, displays the netmask of the IP port.
Gateway	Sets, displays the gateway for the IP port.
Reset Web Passwords	Deletes all passwords and sets the login for the Admin user to: user: admin password: admin
Restore IP Addresses	Resets the IP address to the factory defaults: IP Address = 192.168.117.88 Netmask = 255.255.255.0 Gateway = 192.168.117.1

Table 30: LCD Home > Main Menu > Configuration > Network menu

3.2.7 LCD Home > Main Menu > Control Unit menu



Figure 48: LCD Home > Main Menu > Control Unit menu

Item	Function
Alarms	Navigates to the Control Unit Logic Alarms menu
Lockout Alarms	Navigates to the Control Unit Reset Lockout Alarms menu
Dummy Load	Navigates to the Control Unit Dummy Load menu

Table 31: LCD Home > Main Menu > Control Unit menu

3.2.8 LCD Home > Main Menu > Control Unit > Alarms menu

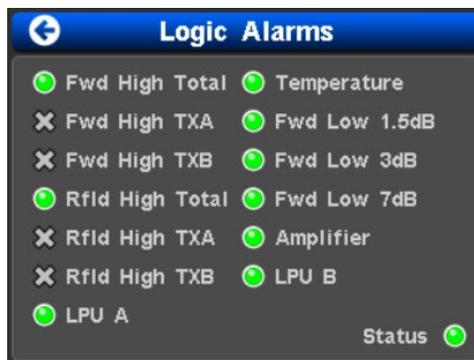


Figure 49: LCD Home > Main Menu > Control Unit > Alarms menu

Item	Function
Status LEDs	Indicates the operation status of various parameters. [Green] = normal operation, no abnormal conditions reported. [Yellow] = a warning condition exists.

	[Red] = a fault condition exists. [Gray X] = does not apply to this transmitter system.
Fwd High Total	Indicates whether the forward output power of the entire system is within the desired limits.
Fwd High TXA	Indicates whether the forward output power of the TX A half-system is within the desired limits in larger/dual transmitter systems.
Fwd High TXB	Indicates whether the forward output power of the TX B half-system is within the desired limits in larger/dual transmitter systems.
Rfld High Total	Indicates whether the reflected output power of the entire system is within the desired limits.
Rfld High TXA	Indicates whether the reflected output power of the TX A half-system is within the desired limits in larger/dual transmitter systems.
Rfld High TXB	Indicates whether the reflected output power of the TX B half-system is within the desired limits in larger/dual transmitter systems.
LPU A	Indicates the internal status of LPU A, as reported by the LPU.
Temperature	Indicates whether the temperature of the transmitter control unit is within the desired limits.
Fwd Low 1.5dB	Indicates whether the forward output power level has dropped 1.5 dB below the nominal output power level.
Fwd Low 3dB	Indicates whether the forward output power level has dropped 3 dB below the nominal output power level.
Fwd Low 7dB	Indicates whether the forward output power level has dropped 7 dB below the nominal output power level.
Amplifier	Indicates the internal status of RF amplifiers, as reported by the amplifier modules.
LPU B	Indicates the internal status of LPU B, as reported by the LPU.
Status	Indicates the global status of the entire system.

Table 32: LCD Home > Main Menu > Control Unit > Alarms menu

3.2.9 LCD Home > Main Menu > Control Unit > Lockout Alarms menu



Figure 50: LCD Home > Main Menu > Control Unit > Lockout Alarms menu

Item	Function
Alarms Total	Resets all latching alarms for the complete transmitter system.
Alarms TX A	Resets all latching alarms for the TX-A half-system in larger/dual transmitter systems.
Alarms TX B	Resets all latching alarms for the TX-B half-system in larger/dual transmitter systems.

Table 33: LCD Home > Main Menu > Control Unit > Lockout Alarms menu

3.2.10 LCD Home > Main Menu > Control Unit > Dummy Load menu



Figure 51: LCD Home > Main Menu > Control Unit > Dummy Load menu

Item	Function
Port 1,2,3 (W)	<p>Displays the power absorbed by the various final combiner dummy loads in watts. Note that each combiner loads assembly has three ports.</p> <p>Typically:</p> <p>Port 1 = (PA1 - PA2) combiner reject power</p> <p>Port 2 = (PA1 + 2) – (PA3 + 4) combiner reject power</p> <p>Port 3 = (PA3 - PA4) combiner reject power</p>

Table 34: LCD Home > Main Menu > Control Unit > Dummy Load menu

3.2.11 LCD Home > Main Menu > Amplifier menu

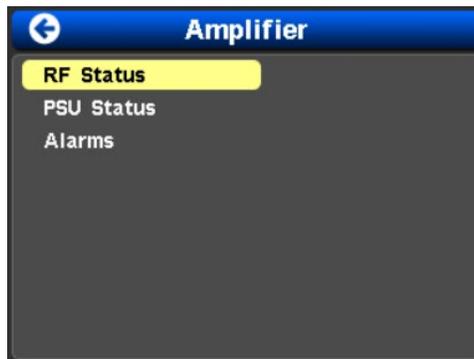


Figure 52: LCD Home > Main Menu > Amplifier menu

Item	Function
RF Status	Navigates to the Amplifier Status menus.
PSU Status	Navigates to the Amplifier PSU Status menus.
Alarms	Navigates to the Amplifier Alarms menu.

Table 35: LCD Home > Main Menu > Amplifier menu

3.2.12 LCD Home > Main Menu > Amplifier > RF Status menu

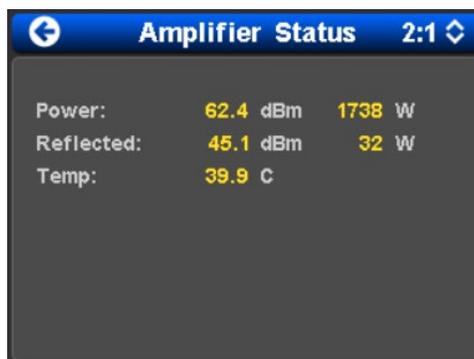
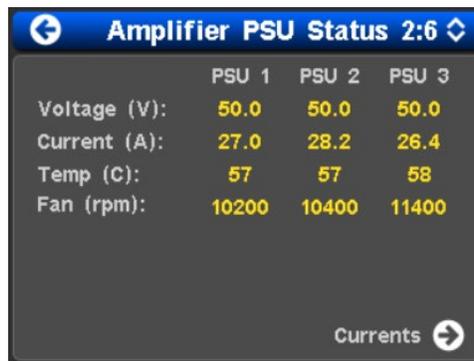


Figure 53: LCD Home > Main Menu > Amplifier > RF Status menu

Item	Function
Cabinet/PA display (2:1)	Displays the cabinet:module number of the amplifier module currently on display. The amplifier selection can be changed by means of the up and down navigation buttons.
Power	Displays the forward output power of the selected RF amplifier module in dBm and watts.
Reflected	Displays the reflected output power of the selected RF amplifier module in dBm and watts.
Temp	Displays the temperature of the selected RF amplifier module in degrees centigrade.

Table 36: LCD Home > Main Menu > Amplifier > RF Status menu

3.2.13 LCD Home > Main Menu > Amplifier > PSU Status menu



	PSU 1	PSU 2	PSU 3
Voltage (V):	50.0	50.0	50.0
Current (A):	27.0	28.2	26.4
Temp (C):	57	57	58
Fan (rpm):	10200	10400	11400

Currents →

Figure 54: LCD Home > Main Menu > Amplifier > PSU Status menu

Item	Function
Cabinet/PA display (2:1)	Displays the cabinet:module number of the amplifier module currently on display. The amplifier selection can be changed by means of the up and down navigation buttons.
Voltage (V)	Displays the voltage being supplied by the selected power supply module.
Current (A)	Displays the current being supplied by the selected power supply module.
Temp (C)	Displays the internal temperature being reported by the selected power supply module.
Fan (rpm)	Displays the fan speed in revolutions per minute of the fan inside the selected power supply module.

Table 37: LCD Home > Main Menu > Amplifier > PSU Status menu

3.2.14 LCD Home > Main Menu > Amplifier > PSU Status > Currents menu



Figure 55: LCD Home > Main Menu > Amplifier > PSU Status > Currents menu

Item	Function
L1...4	Displays the current in amperes of the amplifier pallets on the left-hand side of the power amplifier module.
R1...4	Displays the current in amperes of the amplifier pallets on the right-hand side of the power amplifier module.

Table 38: LCD Home > Main Menu > Amplifier > PSU Status > Currents menu

3.2.15 LCD Home > Main Menu > Amplifier > Alarms menu

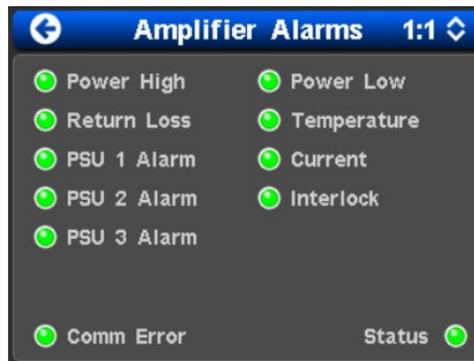


Figure 56: LCD Home > Main Menu > Amplifier > Alarms menu

Item	Function
Status LEDs	Indicates the operation status of various parameters: [Green] = normal operation, no abnormal conditions reported. [Yellow] = a warning condition exists. [Red] = a fault condition exists. [Gray X] = does not apply to this transmitter system.
Power High	Indicates whether the forward output power for the selected PA module has exceeded the factory-set threshold.
Return Loss	Indicates whether the reflected output power for the selected PA module has exceeded the factory-set threshold.
PSU 1...3 Alarm	Indicates whether a power supply module inside the selected PA module has reported an internal alarm.
Power Low	Indicates whether the forward output power for the selected PA module has dropped below the factory-set threshold.
Temperature	Indicates whether the operating temperature for the selected PA module has exceeded the factory-set threshold.
Current	Indicates whether the current for one or more amplifier pallets inside the selected PA module has exceeded the user-defined threshold.
Interlock	Indicates whether the selected PA module is not properly seated in its socket in the transmitter rack.
Comm Error	Indicates whether the transmitter control unit is able to communicate with the selected PA module.
Status	Provides a summary status of the selected PA module.

Table 39: LCD Home > Main Menu > Amplifier > Alarms menu

3.3 Web GUI Interface

All models are equipped with a web-based GUI (Graphic User Interface) for simple and intuitive monitoring and configuration via an RJ-45 connector available on the front panel of the transmitter control unit.

 NOTE	<p>The web GUI discussion in this manual deals only with transmitter system control. To change LPU-specific settings, such as modulation parameters, please connect to the LPU GUI and consult LPU manual DOCX-00014 for further information.</p>
--	---

 NOTE	<p>This section discusses the web GUI served from the transmitter control unit in systems with two or more PA modules. For smaller systems without a transmitter control unit, consult manual DOCX-00014 for information on the web GUI served from the LPU(s).</p>
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3.3.1 Login window

Four levels of GUI access are available on the web interface home page by pressing the blue Login button at the upper left:

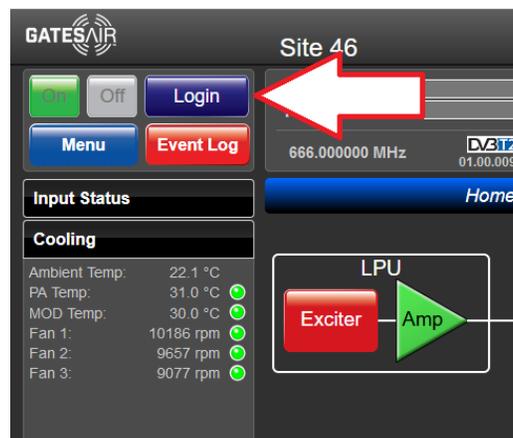


Figure 57: Login button

Pressing the Login button invokes a pop-up box to enter login credentials.

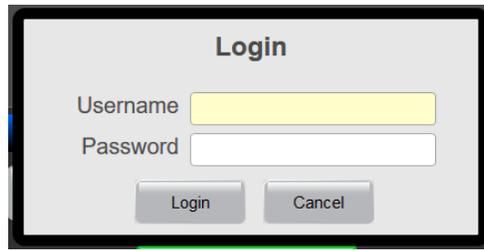


Figure 58: Login popup box

Each level of GUI access has its default username and password.

Username	Default Password	Authorizations
admin	admin	User account management only
eng	eng	Read/Write access
super	super	Read/Write access with additional Advanced Service settings. See Section 0.
guest (not logged in)	----	Read only access

Table 40: Default passwords

The administration (admin) login option leads to a special series of pages for the sole purpose of user account management. See Section 3.3.27 for more details.

3.3.2 GUI navigation tree

Navigation through the tree structure of various sub-pages is either via the blue **Menu** button pulldown or graphically by clicking on any of the home screen block diagram elements.

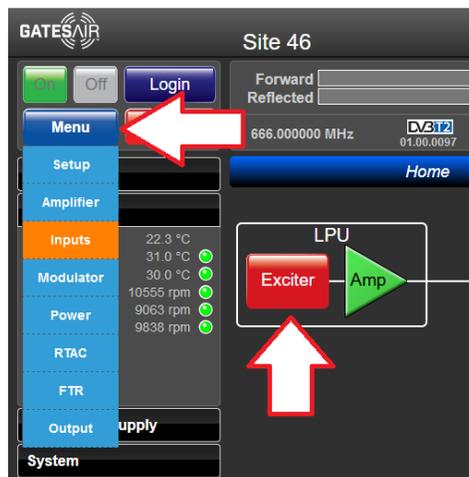


Figure 59: Web GUI navigation pulldown menu

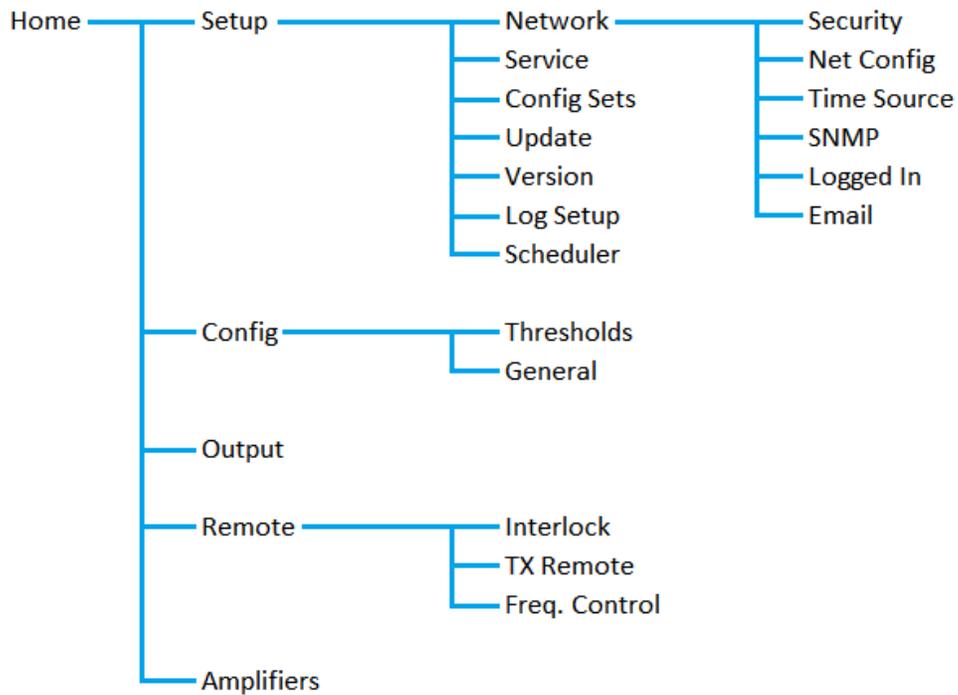


Figure 60: Web GUI navigation tree

 NOTE	<p>GUI contents will change according to equipment configuration options.</p>
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The remainder of this section provides information on the contents of the various GUI screens. Note that the screen content will vary slightly according to the transmitter model and fitted options.

The pages detailed in this section are presented in the order in which they appear in the blue **Menu** button navigation tree.

3.3.3 GUI Home screen

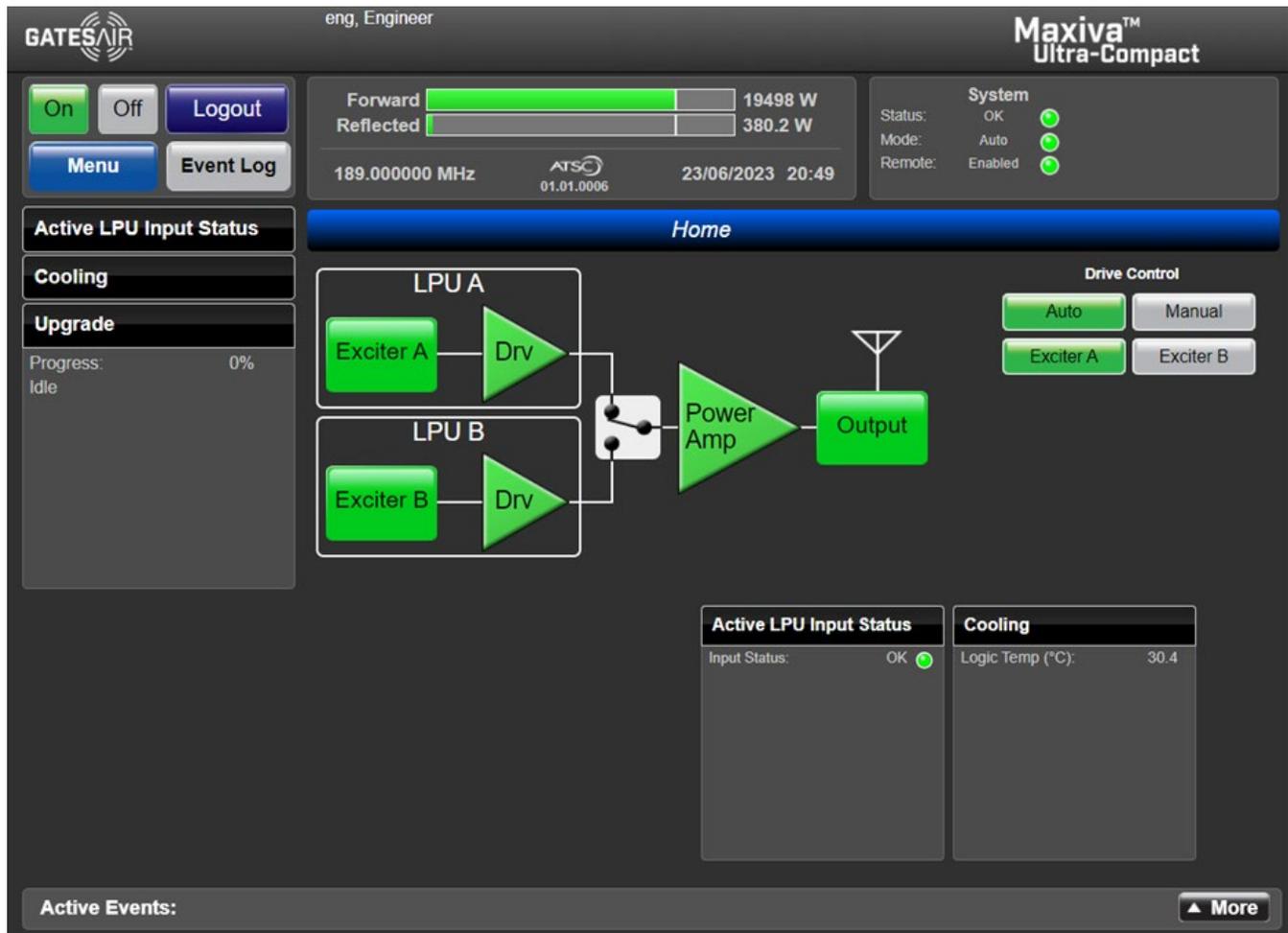


Figure 61: GUI Home screen

Name	Function
On button	Switches the unit on to begin transmitting. [green] = the unit is switched on. [gray] = the unit is not switched on.
Off button	Switches the unit off to stop transmitting. [red] = the unit is switched off. [gray] = the unit is not switched off.
Login/Logout button	Manages the user's login status. [Logout] = The user is currently logged in. Pressing this button logs the user out. [Login] = The user is currently not logged in. Pressing this button launches a dialogue window to enter login credentials.

Name	Function
Menu/Home button	Launches a navigational tree menu to provide easy access to various GUI pages.
Event Log button	Opens a log of recently recorded events.
Forward power bargraph	Displays the output forward power in watts.
Reflected power bargraph	Displays the output reflected power in watts.
Frequency display	Displays the channel center frequency in MHz.
Modulation type display	Displays the modulation format. [ATSC, DVB, ISDBT, etc.]
Date/time display	Displays the current date and time.
<i>System</i>	
Status	<p>Indicates the summary operational status of the complete transmitter system.</p> <p>[OK, green] = system is ok and is transmitting RF power. [Alarm, red] = system has switched off due to an alarm. [Power Off, red] = system is switched off. [Power Low, yellow] = system is transmitter, but the output power level is low.</p>
Mode	<p>Indicates the currently active LPU switchover mode.</p> <p>[Auto, green] = The control system switches to the alternate LPU in the case of an alarm in the currently selected LPU. [Manual, red] = The LPU in use is manually selected by the user.</p>
Remote	<p>Indicates whether the unit is in remote or local control mode, as determined by the front panel Local/Remote pushbuttons.</p> <p>[Enabled, green] = commands can be issued remotely via the GUI, SNMP, or the parallel TX REMOTE port. [Disabled, yellow] = commands cannot be issued remotely via the GUI, SNMP, or the parallel TX REMOTE port.</p>
<i>Active LPU Input Status</i>	
Input Status	<p>Indicates the operational status of the transport stream input(s) to the currently active/selected LPU.</p> <p>[OK, green] = all incoming transport streams are valid, present. [Warning, yellow] = One or more inputs has a warning condition. [Fault, red] = One or more inputs has an alarm condition. [UNDEF, gray] = The input status is unknown.</p>
<i>Cooling</i>	
Logic Temp (deg C)	Displays the internal temperature of the transmitter control unit.

Name	Function
<i>Upgrade</i>	
Progress	<p>Indicates the status of the upgrade process.</p> <p>[Waiting] = information is being gathered on the current software versions. [Checking] = the software versions are being checked to determine if an upgrade is required. [Upgrading] = an upgrade is being applied. [Idle] = no upgrade is taking place presently.</p>
<i>Block Diagram</i>	
LPU A/LPU B	<p>Displays the operational status of the LPU/drivers.</p> <p>[green] = status ok. [yellow] = the LPU has an internal warning condition. [red] = the LPU has an internal alarm condition.</p> <p>When clicked on, launches a separate browser tab with the web remote interface from the individual LPU.</p>
Power Amp	<p>Displays the operational status of the high power amplifier stage.</p> <p>[green] = status ok. [yellow] = a PA module has an internal warning condition. [red] = a PA module has an internal alarm condition.</p> <p>When clicked on, navigates to the Amplifiers web page.</p>
Output	<p>Displays the operational status of the output power level at the system final output.</p> <p>[green] = status ok, the output power is within the desired limits. [yellow] = warning condition, the output power is outside the warning limits. [red] = alarm condition, the output power is outside the alarm limits.</p> <p>When clicked on, navigates to the Output/Configuration web page.</p>
<i>Drive Control</i>	
Auto button	<p>Selects automatic LPU switchover mode when pressed. When lit green, indicates that automatic LPU switchover mode is currently selected. The control system will switch to the alternate LPU if the on-air LPU has internal alarms.</p>
Manual button	<p>Selects manual LPU switchover mode when pressed. When lit red indicates that manual LPU switchover mode is currently selected. The control system will not switch to the alternate LPU if the on-air LPU has internal alarms.</p>
Exciter A button	<p>Forces the selection of exciter/LPU A when in manual switchover mode.</p>
Exciter B button	<p>Forces the selection of exciter/LPU B when in manual switchover mode.</p>
<i>Event Log status bar</i>	

Name	Function
Active Events	Displays any active faults or warning messages. Changes color to yellow or red depending on the severity of the condition. Only the highest priority message is displayed.
More button	Opens a pop-up display to list all active fault and warning messages.

Table 41: GUI Home screen

3.3.4 Home > Setup > Network > Security

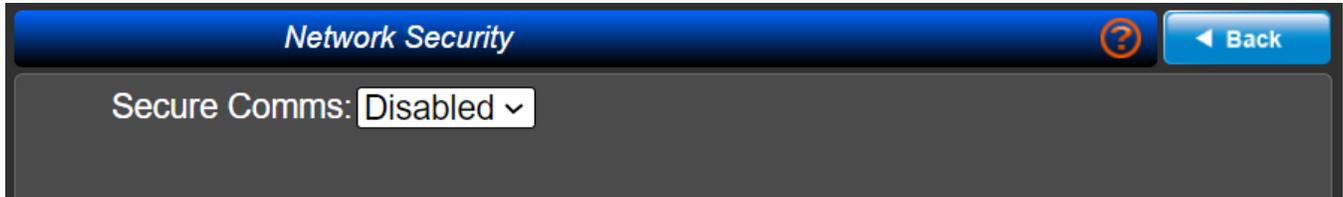


Figure 62: Home > Setup > Network > Security

Name	Function
Secure Comms	<p>Sets whether a secure communications protocol (https with self-signed GatesAir certificate) is to be used between the transmitter and the remote web client.</p> <p>[Disabled] = do not use https protocol. [Enabled] = use https protocol.</p>

Table 42: Home > Setup > Network > Security

3.3.5 Home > Setup > Network > Net Config

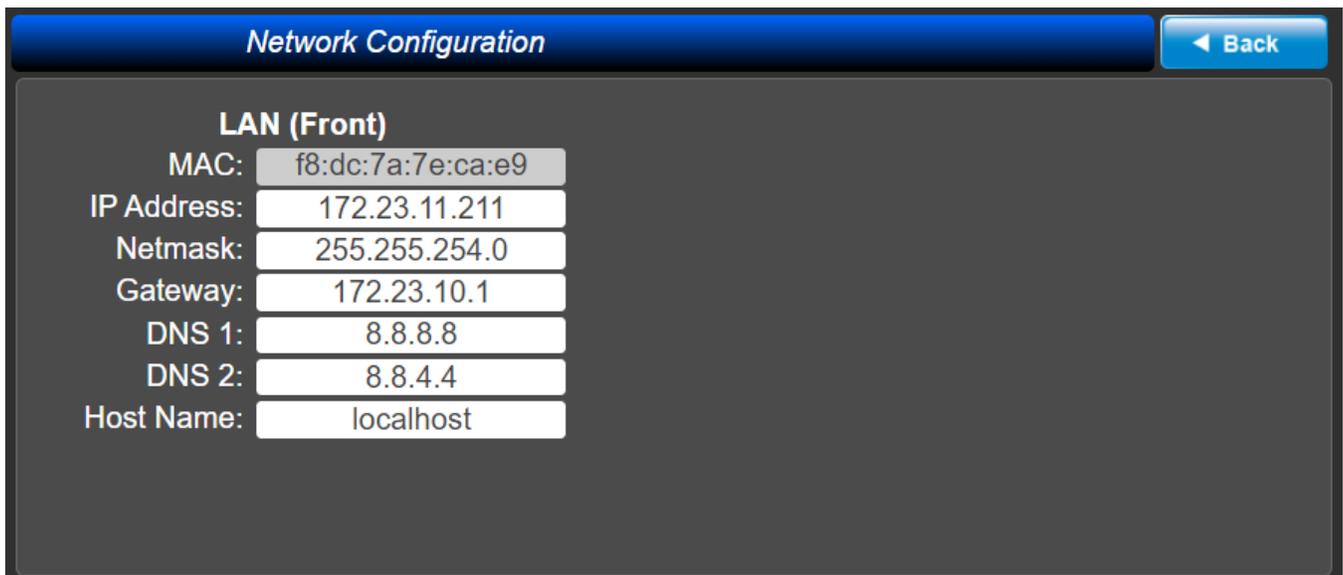


Figure 63: Home > Setup > Network > Net Config

Name	Function
<i>LAN (Front)</i>	
MAC	Displays the MAC address of the front IP port.
IP Address	Sets the IP address of the front IP port.
Netmask	Sets the netmask of the front IP port.
Gateway	Sets the gateway of the front IP port.
DNS 1	Sets the address for the main DNS server for the front IP port.
DNS 2	Sets the address for the alternate DNS server for the front IP port.
Host Name	Sets the host name of the front IP port.

Table 43: Home > Setup > Network > Net Config

3.3.6 Home > Setup > Network > Time Source

The screenshot shows the 'Event Log Time Source' configuration interface. At the top, there is a title bar with a question mark icon and a 'Back' button. Below the title bar, there are several input fields for configuration:

- Time Source: NTP (selected from a dropdown)
- NTP Server 1: 193.204.114.232
- NTP Server 2: 1.it.pool.ntp.org
- NTP Server 3: 0.it.pool.ntp.org
- NTP Server 4: 193.204.114.233
- NTP Server 5: 3.it.pool.ntp.org
- Date & Time: 23/06/2023 20:52

To the right of these fields is a box titled 'NTP Result:' containing the text: 'NTP is in Normal Synchronized state! refid=193.204.114.232,'.

Below the configuration fields is a table with the following data:

Remote	Ref ID	Stratum	Type	When	Poll	Reach	Delay	Offset	Jitter
*193.204.114.232	.CTD.	1	u	161	512	377	137.478	1.213	8.310
+193.204.114.233	.CTD.	1	u	330	512	377	136.199	0.380	37.332
-212.45.144.3	193.204.114.232	2	u	400	512	377	119.355	-1.203	1.155
-80.88.90.14	193.204.114.232	2	u	396	512	377	125.976	2.909	0.569
+37.247.53.178	195.176.26.206	2	u	373	512	377	118.367	1.252	1.278

Figure 64: Home > Setup > Network > Time Source

Name	Function
Time Source	Determines the source for system time calibration, if any. [Disabled] = allow the system time to free run. [NTP] = set the system time via an NTP server.
NTP Server 1...5	Sets the address for an NTP server for system time calibration.
Date & Time	Displays the current system time.

NTP Result	Provides feedback on NTP time synchronization status.
NTP sources table	Displays telemetry information for the various NTP sources.

Table 44: Home > Setup > Network > Time Source

3.3.7 Home > Setup > Network > SNMP

Figure 65: Home > Setup > Network > SNMP

Name	Function
MIB Config button	Navigates to the SNMP MIB Selection page.
Traps button	Navigates to the SNMP Traps/Informs page.
Port	Selects the port number to be used. [161, 8170...8179]. Port 161 is the default.
SNMP Version	Selects the SNMP version. [v1, v2c, v3]
<i>Community Names, SNMP User 1,2</i>	
Read-Only 1,2	Sets a password that allows an SNMP GET to be performed. Default is <i>public</i> .
Read-Write 1,2	Sets a password that allows an SNMP SET to be performed. Default is <i>private</i> .

Name	Function
<i>MIB-2 System Group</i>	
System Contact	Sets the name of the person responsible for the equipment.
System Name	Sets the name of the equipment.
System Location	Sets the location of the equipment.
<i>SNMPv3 User 1,2</i>	
User Name	Sets the SNMPv3 username.
Security Level	<p>Sets the SNMPv3 Authentication and Privacy security level.</p> <p>[NoAuthNoPriv] = No v3 authentication and no v3 privacy. [AuthNoPriv] = v3 authentication but no v3 privacy. [AuthPriv] = v3 authentication and v3 privacy.</p>
Auth Password	Sets the SNMPv3 authentication password.
Auth Protocol	Selects the SNMPv3 authentication protocol. [None, MD5, SHA, 128-SHA/224, 192-SHA/256, 256-SHA/384, 384-SHA/512]
Priv Password	Sets the SNMPv3 privacy password.
Priv Protocol	Sets the SNMPv3 privacy protocol. [None, DES, AES128]

Table 45: Home > Setup > Network > SNMP

3.3.8 Home > System > Network > SNMP > MIB Config

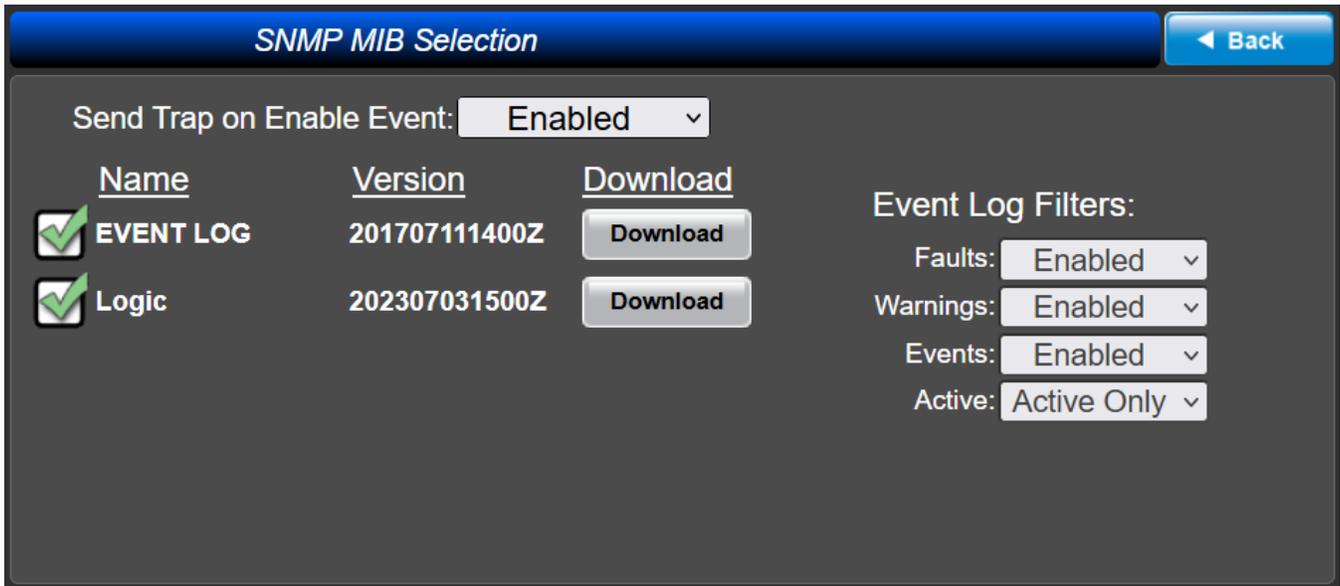


Figure 66: Home > System > Network > SNMP > MIB Config

Name	Function
Send Trap on Enable Event	Determines whether a burst of all SNMP traps will be sent as a test whenever a new MIB is enabled. [Disabled] = do not send all traps. [Enabled] = send all traps.
Name	Lists the names of the available MIBs.
Version	Lists the version number of the available MIBs.
Download	Allows the MIB to be downloaded for inspection, loading into an NMS.

Table 46: Home > System > Network > SNMP > MIB Config

3.3.9 Home > System > Network > SNMP > Traps

Figure 67: Home > System > Network > SNMP > Traps

Name	Function
Host 1,2,3	Provides trap/inform sending to up to three different destinations.
Address	Sets the target IP address for traps/informs being sent out from the unit.
Port	Sets the port on the trap/inform target IP address. Default is port 162.
SNMP Version	Sets the SNMP version. [v1, v2c, v3]
SNMP User Name	Sets the SNMPv3 username.
Security Level	Sets the SNMPv3 Authentication and Privacy security level. [NoAuthNoPriv] = No v3 authentication and no v3 privacy. [AuthNoPriv] = v3 authentication but no v3 privacy.

Name	Function
	[AuthPriv] = v3 authentication and v3 privacy.
Auth Password	Sets the SNMPv3 authentication password.
Auth Protocol	Selects the SNMPv3 authentication protocol. [None, MD5, SHA, 128-SHA/224, 192-SHA/256, 256-SHA/384, 384-SHA/512]
Priv Password	Sets the SNMPv3 privacy password.
Priv Protocol	Sets the SNMPv3 privacy protocol. [None, DES, AES128]
Type	Sets the SNMP notifications as being either traps or informs. [Trap, Inform]
Retries Interval	Sets the number of minutes the unit will wait before re-sending an unacknowledged inform.
Retries Times	Sets the number of times the unit will attempt to re-send an unacknowledged inform.
Max Outstanding PDUs	Sets the number of unacknowledged informs the unit will hold its buffer and keep trying to resend.
Pending	Displays how many informs are in the buffer waiting to be acknowledged.
Timeouts	Displays how many times an inform went unacknowledged from the receiving end.
Overflow	Displays how many informs were lost because the buffer overflowed with unacknowledged informs.
Max Pending	Provides a read out the highest number of informs that were ever parked in the buffer at one time since the system was last rebooted.

Table 47: [Home](#) > [System](#) > [Network](#) > [SNMP](#) > [Traps](#)

3.3.10 Home > Setup > Network > Logged In

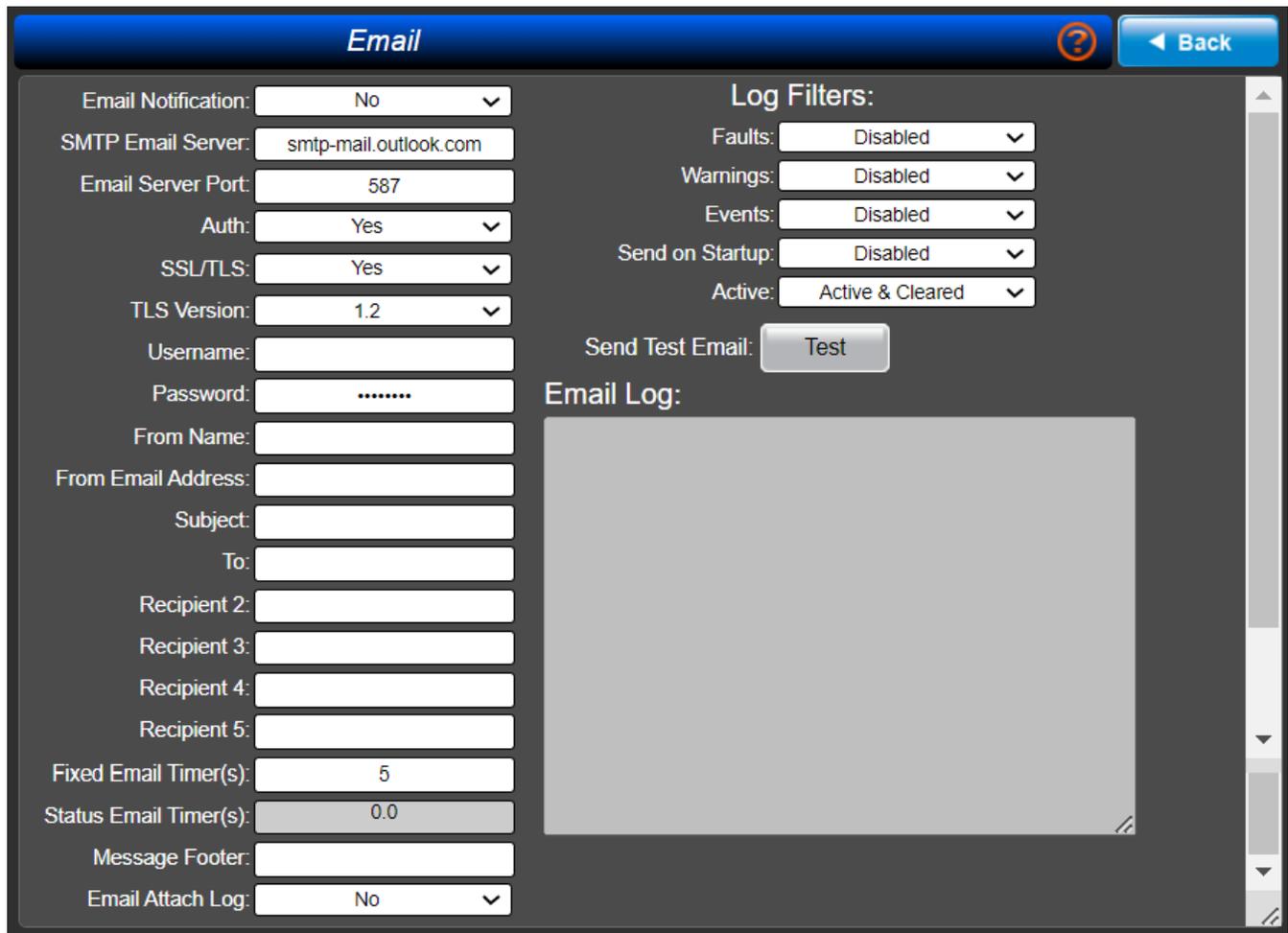


Figure 68: Home > Setup > Network > Logged In

Name	Function
Number of Open Browser Sessions	Displays how many remote browser sessions are currently in contact with the unit at the present time.
<i>Logged on users table</i>	
Logged On User	Displays the account username.
IP Address	Lists any users who are actively logged in at the present time.
Logged In	Displays whether the user is fully logged in. [Yes] = user has logged is as <i>User</i> or <i>Admin</i> . [No] = user has <i>Guest</i> -level read-only access.
Logged in Time	Displays the login time and date for all logged in users.

Table 48: Home > Setup > Network > Logged In

3.3.11 Home > Setup > Network > Email



Email ? Back

Email Notification:

SMTP Email Server:

Email Server Port:

Auth:

SSL/TLS:

TLS Version:

Username:

Password:

From Name:

From Email Address:

Subject:

To:

Recipient 2:

Recipient 3:

Recipient 4:

Recipient 5:

Fixed Email Timer(s):

Status Email Timer(s):

Message Footer:

Email Attach Log:

Log Filters:

Faults:

Warnings:

Events:

Send on Startup:

Active:

Send Test Email:

Email Log:

Figure 69: Home > Setup > Network > Email

Name	Function
Email Notification	Activates user remote notification via e-mail. [Yes, No]
SMTP Email Server	Sets the address of the SMTP server used to send e-mails.
Email Server Port	Sets the port on the designated SMTP server. [1...65535]
Auth	Sets whether the SMTP server is expecting authentication. [Yes, No]
SSL/TLS	Sets whether SSL/TLS security features are to be used. [Yes, No]
TLS Version	Sets the TLS version level, when applicable. [1.0, 1.2]
Username	Sets the username for contacting the designated SMTP server.
Password	Sets the password for contacting the designated SMTP server.
From Name	Sets the name to be used in the FROM field of any generated e-mails.
From Email Address	Sets the return address to be displayed in the FROM field of any generated e-mails.
Subject	Sets the information to be included in the SUBJECT field of any generated e-mails.

Name	Function
To	Sets the address of the principal recipient of any generated e-mails.
Recipient 2...5	Sets the address of alternate recipients of any generated e-mails.
Fixed Email Timer(s)	Sets whether e-mails will be event-triggered or sent on a fixed schedule. [0] = a value of zero causes e-mails to be event-triggered. An e-mail is sent five seconds after the last event recorded. New incoming events cause the send timer to reset to zero. [1...3600] = e-mails are sent at a fixed intervals of n seconds. This could be useful to prevent repetitive e-mails caused by a rapidly toggling event.
Status Email Timer(s)	Displays the timer countdown until sending of next e-mail.
Message Footer	Allows input of a text message to be included as a footer in any generated e-mails.
Email Attach Log	Sets whether a copy of the event log is attached to the body of any generated e-mails. [Yes, No]
<i>Log Filters</i>	
Faults	Sets whether an e-mail is sent whenever a fault is recorded. [Disabled, Enabled]
Warnings	Sets whether an e-mail is sent whenever a warning is recorded. [Disabled, Enabled]
Events	Sets whether an e-mail is sent whenever a log event is recorded. [Disabled, Enabled]
Send on Startup	Sets whether an e-mail is sent each time the transmitter has AC mains power recycled. [Disabled, Enabled]
Active	Sets whether an e-mail is sent at the end of an alarm/warning/event. [Active Only] = send an e-mail only at the start of an alarm/warning/event. [Active & Cleared] = send an e-mail at both the start and end of an alarm/warning/event.
Send Test Email button	Forces the system to send a test email to all designated recipients.
Email log	Provides a readout of recent email sending activity.

Table 49: Home > Setup > Network > Email

3.3.12 Home > Setup > Service



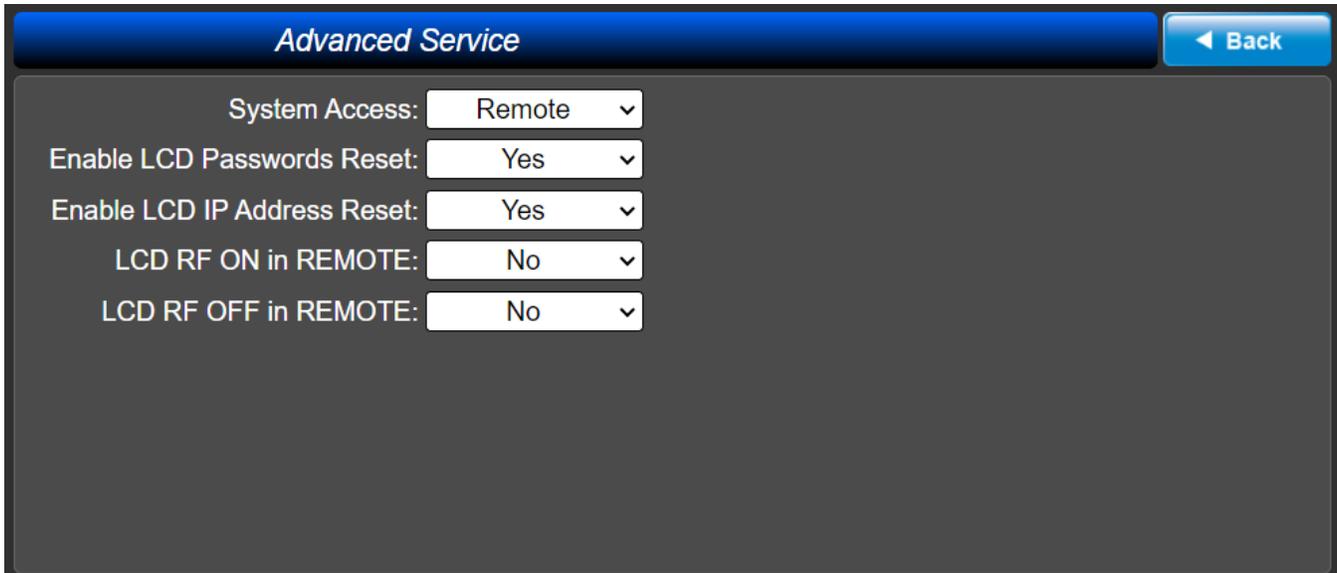
Figure 70: Home > Setup > Service

Name	Function
Station Name	Sets the site name.
Model Number	Sets the equipment model or identifier.
Serial Number	Lists the unit's serial number.
Display Format	Sets the date format based on a 24-hour clock. [MM/DD/YYYY, DD/MM/YYYY, YYYY/MM/DD]
Time Zone	Sets the local time zone to automatically determine the offset from universal time coordinated (UTC).
Offset from UTC	Sets the offset hours relative to universal time (UTC, also referred to as GMT) when a time zone has not already been selected. [-12:00 ... +13:00]
Date (MM/DD/YYYY)	Displays the current date in the selected format. The date can be set here if NTP/GPS as an external time source is disabled.
Time (24 Hour)	Displays the current time. The current time can be set here if NTP/GPS as an external time source is disabled.
Set Time button	Saves the date and time settings after being manually changed. NTP/GPS as an external time source must be disabled to set the time manually.

Table 50: Home > Setup > Service

3.3.13 Home > Setup > Service > Advanced (“Super” user login only)

A series of special configuration settings are found on an Advanced Service page that is only accessible when logged in as a “Super” class user.



The screenshot shows the 'Advanced Service' configuration page. At the top, there is a blue header with the text 'Advanced Service' and a 'Back' button. Below the header, there are five configuration items, each with a label and a dropdown menu:

- System Access: Remote
- Enable LCD Passwords Reset: Yes
- Enable LCD IP Address Reset: Yes
- LCD RF ON in REMOTE: No
- LCD RF OFF in REMOTE: No

Figure 71: Home > Setup > Service > Advanced (Super user only)

Name	Function
System Access	Allows the super user to force the transmitter into local or remote control mode from a remote location. This can be especially useful if the transmitter was inadvertently left in local control mode (i.e. remote control disabled) before leaving the transmitter site. [Remote] = allow the equipment to be controlled remotely. [Local] = prevent the equipment from being controlled remotely.
Enable LCD Passwords Reset	Determines whether the user login passwords can be reset via the front panel LCD screen. This could potentially allow a casual user to corrupt user login credentials. [Yes, No]
Enable LCD IP Address Reset	Determines whether the IP address can be reset via the front panel LCD screen. This could potentially allow a casual user to corrupt IP connectivity. [Yes, No]
LCD RF ON in REMOTE	Determines whether the transmitter can be switched on locally via the front panel LCD screen when in remote enabled mode.
LCD RF OFF in REMOTE	Determines whether the transmitter can be switched on locally via the front panel LCD screen when in remote enabled mode.

Table 51: Home > Setup > Service > Advanced (Super user only)

3.3.14 Home > Setup > Config Sets

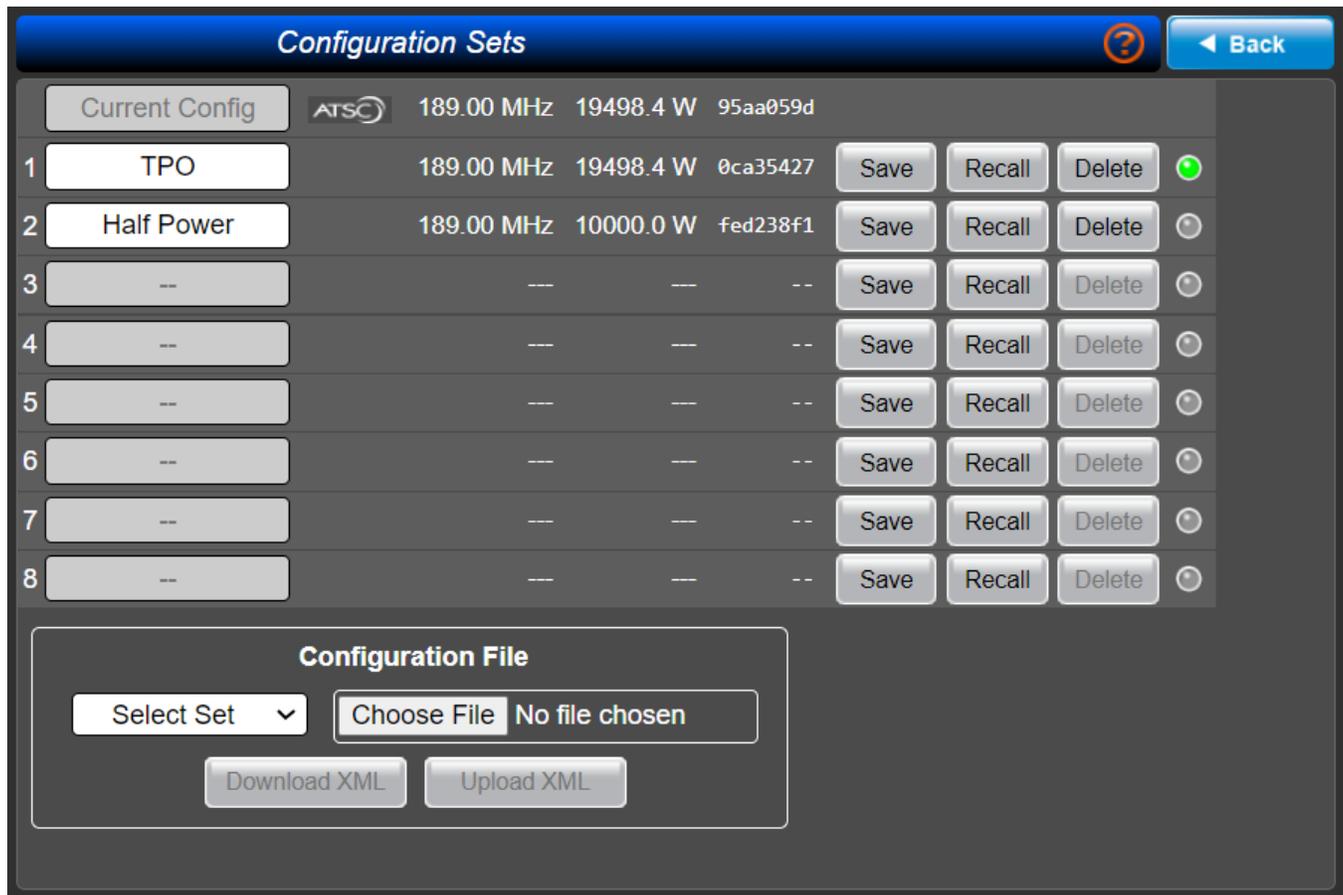


Figure 72: Home > Setup > Config Sets

Name	Function
Current Config	Displays the parameters of the currently invoked configuration.
Configuration sets 1...8	Displays the parameters of up to eight saved configuration sets. Information displayed includes modulation format (logo), channel frequency in MHz, RF power in watts and a unique identifier code for the configuration. [green] = this configuration is currently active. [gray] = the configuration is in reserve.
Save	Saves the current operating parameters to memory as a configuration set. Remember to save any changes before changing to a different configuration!!
Recall	Recalls and invokes a stored configuration set.
Delete	Deletes a stored configuration set from memory.
<i>Configuration File</i>	
Select Set	Determines into which configuration set location a file can uploaded or downloaded to/from the hard disk. [Config Set 1...8]

Name	Function
Browse button	Launches a dialog box to specify a location on the hard disk to upload or download a configuration file.
Download XML button	Downloads the configuration set as an xml file. The file can be reviewed with a text editor such as Notepad.exe.
Upload XML button	Uploads an xml configuration file into the specified configuration set location.

Table 52: Home > Setup > Config Sets

3.3.15 Home > Setup > Update

Software Management ← Back

Software
Upload
Reset
Configuration
Backup
Force Upgrade

Current Version: VLXTE_01.01.0006

Status	Name	Version	Software P/N	Size	Notes	Activate	Delete
Active	VLXTE	01.01.0006	861-1172-017 A	30,004k	View		

Software Management ← Back

Software
Upload
Reset
Configuration
Backup
Force Upgrade

Upload

Browse

Uploading: 0%

Status

Software Management ← Back

Software
Upload
Reset
Configuration
Backup
Force Upgrade

Restart: Perform a soft-reset to restart the software (approx 2-5 seconds).

Reboot: Perform a hard-reset to additionally re-initialize hardware (approx 10-20 seconds).

Restart
Reboot

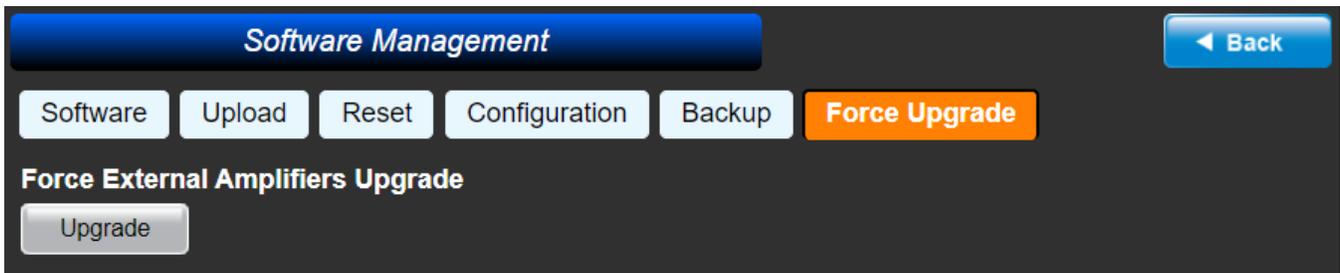
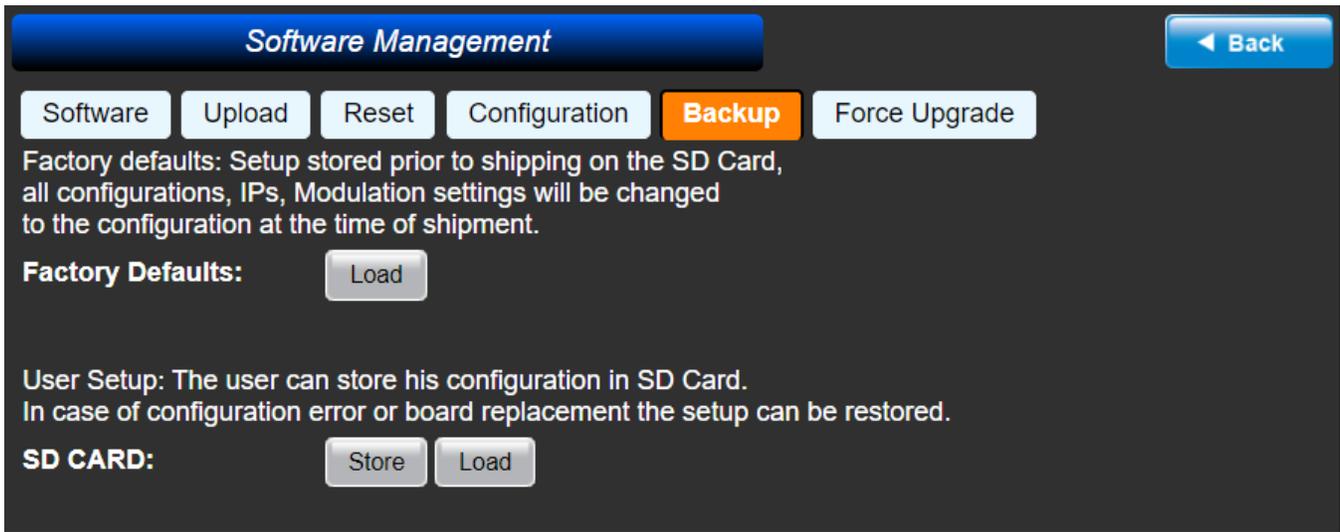
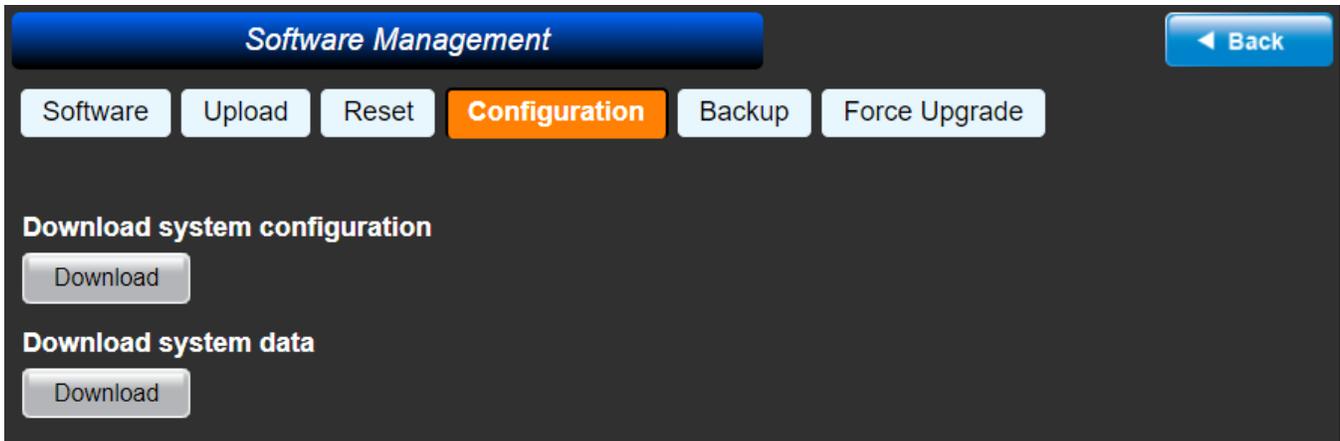


Figure 73: Home > Setup > Update

Name	Function
Software button	Navigates to the main Software Management page.
Upload button	Navigates to the Software Upload page.
Reset button	Navigates to the Software Reset page.
Configuration	Navigates to the Software Configuration page.
Backup button	Navigates to the Software Backup page.
Force Upgrade button	Navigates to the Software Force Upgrade page.

Name	Function
<i>Software</i>	
Current Version	Displays which version of software is currently running in the transmitter control unit.
Status	Displays the status of different versions of software. [Active] = this version is currently active/running. [Not Active] = this version had been loaded on board but is currently in reserve/not running.
Name	Displays the name of the software.
Version	Displays the version number of the software.
Software P/N	Displays the part number of the software.
Size	Displays the size of the software.
Notes	Launches a pop-up window with a display of release notes.
Activate	Activates the software and deactivates any other versions.
Delete	Deletes the software version from the transmitter control unit.
<i>Upload</i>	
Upload button	Launches the file uploading process.
Browse button	Launches a dialog box to select a file to upload on the local PC.
Upload progress bar	Provides a bar graph display of the uploading process.
Status	Provides a textual readout of the uploading process.
<i>Reset</i>	
Restart button	Performs a soft reset to restart the software. (approx. 2-5 seconds of interruption)
Reboot button	Performs a hard reset to reinitialize both the hardware and software. (approx. 10-20 seconds of interruption)
<i>Configuration</i>	
Download system configuration button	Downloads an xml file containing information on the current system configuration.
Download system data button	Downloads an xml file with a complete data set of transmitter telemetry.
<i>Backup</i>	
Load factory defaults button	Loads the original factory-defined configuration from when the transmitter system was originally shipped/installed.
Store/Load SD card buttons	Stores/loads a user-defined configuration onto/from the SD card located in the transmitter control unit.
<i>Force Upgrade</i>	
Force External Amplifiers Upgrade button	Pushes the latest software revision to all PA modules currently running older software versions.

Table 53: Home > Setup > Update

3.3.16 Home > Setup > Version

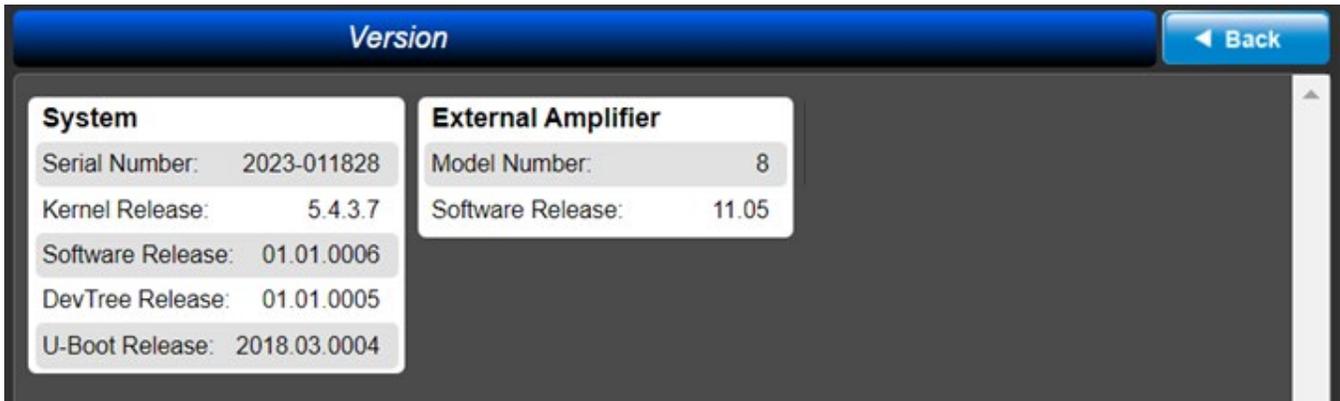


Figure 74: Home > Setup > Version

Name	Function
System	Displays the revision level for various components in the transmitter control unit.
External Amplifier	Displays the revision level for various components in the RF amplifier modules.

Table 54: Home > Setup > Version

3.3.17 Home > Setup > Log Setup

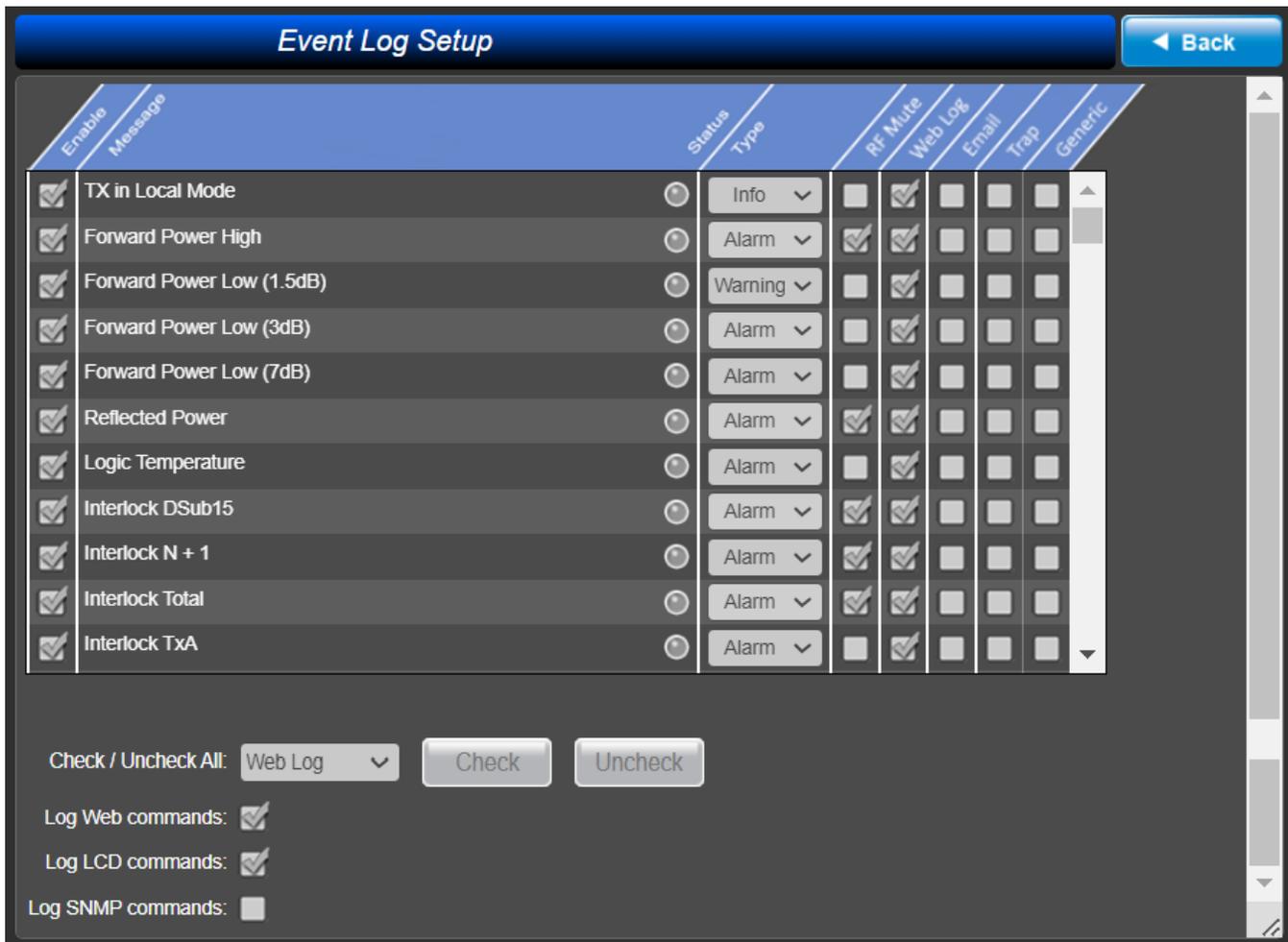


Figure 75: Home > Setup > Log Setup

Name	Function
Enable	Suppresses an event when unchecked.
Message	Describes the event in question.
Status	Indicates that the event is currently active when lit.
Type	Sets the priority of the event. [Alarm] = red/high priority. [Warning] = yellow/medium priority. [Info] = none/low priority.
RF Mute	Sets whether the event triggers a mute of the RF output.
Web Log	Sets whether the event will appear in the web GUI event log.
Email	Sets whether the event will trigger an email to be sent each time it occurs.

Name	Function
Trap	Sets whether the event triggers the sending of an SNMP trap/inform.
Generic	Sets whether the event will trigger a switchover to the reserve transmitter in redundant transmitter systems. i.e. whether a fault is serious enough to switch away from this transmitter to the reserve transmitter.
Check/Uncheck All buttons	Allows the user to quickly check or uncheck the same attribute in all events. [Enable, RF Mute, Web Log, Email, Trap, Generic]
Log Web commands	Causes commands originating from web GUI to be recorded in the event log when checked.
Log LCD commands	Causes commands originating from the LCD front panel to be recorded in the event log when checked.
Log SNMP commands	Causes commands originating from SNMP to be recorded in the event log when checked.

Table 55: Home > Setup > Log Setup

3.3.18 Home > Setup > Scheduler



The screenshot shows the 'System Scheduler' interface with a 'Back' button. The table below represents the data shown in the interface.

Date	Time (24) H:M:S	Category	Cmd	Repeat	Confirm	Enabled	Edit
23/06/2023	21:11:03	—	—	—	—	NO	
23/06/2023	21:11:03	—	—	—	—	NO	
23/06/2023	21:11:03	—	—	—	—	NO	
23/06/2023	21:11:03	—	—	—	—	NO	
23/06/2023	21:11:03	—	—	—	—	NO	
23/06/2023	21:11:03	—	—	—	—	NO	
23/06/2023	21:11:03	—	—	—	—	NO	
23/06/2023	21:11:03	—	—	—	—	NO	
23/06/2023	21:11:03	—	—	—	—	NO	
23/06/2023	21:11:03	—	—	—	—	NO	

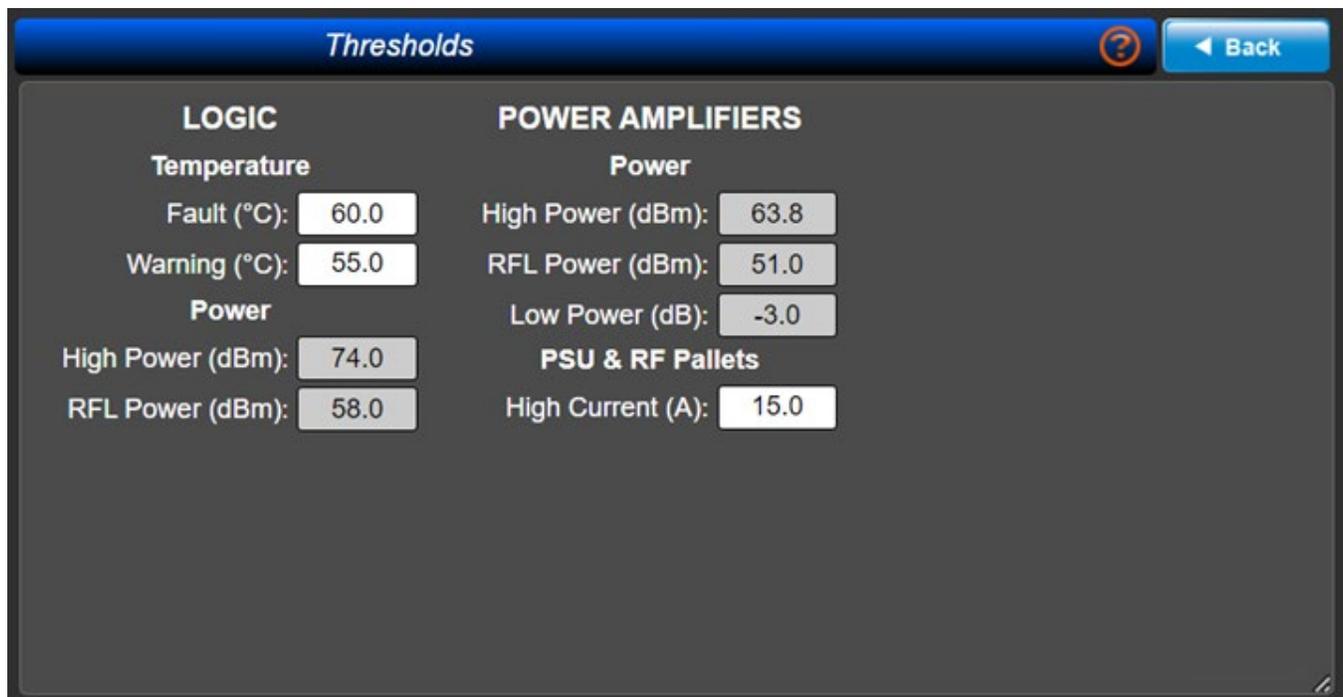
Figure 76: Home > Setup > Scheduler

Name	Function
Date	Displays the date for the scheduled action.
Time (24) HMS	Displays the time of day for the scheduled action in 24-hour hours:minutes:seconds format.
Category	Displays the category of the scheduled action. [RF Control, Load Config Set, Switch Power Profile]
Cmd	Displays the command associated with the scheduled action. [On, Off], [1...8], [Normal Power, Low Power]

Name	Function
Repeat	Indicates whether the scheduled action is to repeat periodically. [Never, Daily, Weekly, Bi-Weekly, Monthly]
Confirm	Indicates whether a confirmation will be sent via SNMP each time the scheduled action executes. [Yes, No]
Enabled	Indicates whether the intended action is currently scheduled to execute. [Yes, No]
Edit	Launches a dialog to allow the addition/editing of scheduled actions.

Table 56: Home > Setup > Scheduler

3.3.19 Home > Config > Thresholds



LOGIC		POWER AMPLIFIERS	
Temperature		Power	
Fault (°C):	60.0	High Power (dBm):	63.8
Warning (°C):	55.0	RFL Power (dBm):	51.0
Power		PSU & RF Pallets	
High Power (dBm):	74.0	Low Power (dB):	-3.0
RFL Power (dBm):	58.0	High Current (A):	15.0

Figure 77: Home > Config > Thresholds

Name	Function
<i>LOGIC</i>	
Temperature Fault (deg C)	Sets, displays the alarm threshold in degrees centigrade for the internal board temperature for the transmitter control unit. [20...80]
Temperature Warning (deg C)	Sets, displays the warning threshold in degrees centigrade for the internal board temperature for the transmitter control unit. [20...80]
High Power (dBm)	Displays the threshold in dBm for the forward power over-power alarm for the entire transmitter system.
RFL Power (dBm)	Displays the threshold in dBm for the reflected power over-power alarm for the entire transmitter system.

Name	Function
<i>POWER AMPLIFIERS</i>	
High Power (dBm)	Displays the threshold in dBm for the forward power over-power alarm for the individual PA modules.
RFL Power (dBm)	Displays the threshold in dBm for the reflected power over-power alarm for the individual PA modules.
Low Power (dB)	Displays the threshold in dBm for the forward power under-power alarm for the individual PA modules.
High Current (A)	Sets, displays the threshold in amperes for the over-current alarm for the individual RF pallets inside the PA modules. [0...30]

Table 57: Home > Config > Thresholds

3.3.20 Home > Config > General

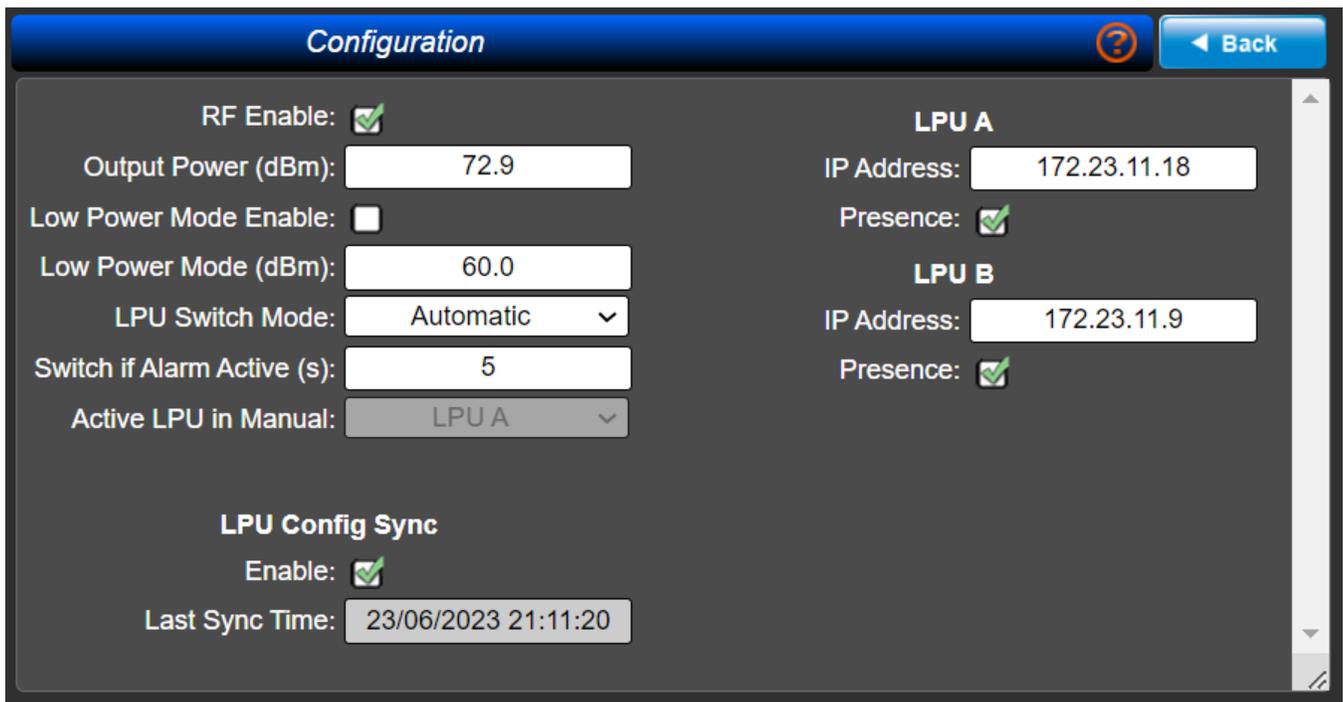


Figure 78: Home > Config > General

Name	Function
RF Enable	When checked, switches on the RF transmission.
Output Power (dBm)	Sets the desired output forward power in dBm.
Low Power Mode Enable	When checked, temporarily lowers the output forward power to a level specified in the field immediately below.
Low Power Mode (dBm)	Sets the desired output forward power in dBm when operating in the special low power mode.

Name	Function
LPU Switch Mode	<p>Sets the LPU/driver switchover mode for redundancy purposes.</p> <p>[Automatic] = the control system will automatically switch over to the alternate LPU in the case of a problem in the on-air LPU.</p> <p>[Manual] = the LPU selected in the Active LPU in Manual field is used to drive the transmitter high power stages.</p>
Switch if Alarm Active (s)	Sets the time delay in seconds before the control systems switches away from an LPU with internal alarms when in LPU Switch Mode is Automatic.
Active LPU in Manual	Sets which LPU is selected to drive the transmitter when in manual LPU switchover mode.
RF on Load Enable	When checked, allows the LPU is the reserve position to transmit power to the small dummy load internal to the transmitter control unit.
<i>LPU Config Sync</i>	
Enable	When checked, forces the periodic synchronization of certain settings between both LPUs. The settings from the currently selected/on-air LPU are copied to the reserve/standby LPU.
Last Sync Time	Displays when the last LPU synchronization occurred.
<i>LPU A/B</i>	
IP Address	Sets the IP address of the LPU in question.
Presence	Sets whether the LPU is installed in the system.

Table 58: Home > Config > General

3.3.21 Home > Output

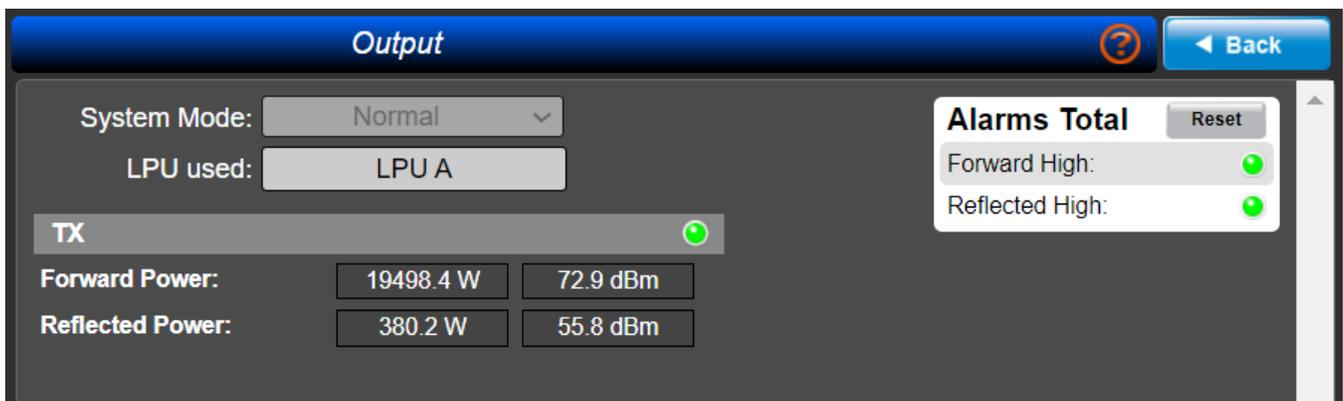


Figure 79: Home > Output

Name	Function
System Mode	Sets, displays the current system configuration for redundancy purposes in larger systems.

Name	Function
	<p>[Normal] = system is single-ended with no dual/main-alt functionality.</p> <p>[Patch Panel] = system has a patch panel to manually connect one half of the system to the antenna.</p> <p>[Relays] = system has a coaxial relay to electronically connect one half of the system to the antenna.</p> <p>[Seamless] = system has a switchless combiner to electronically connect one half of the system to the antenna without interrupting transmission.</p>
LPU used	Indicates which LPU is currently selected to drive the transmitter high power stages.
TX status LED	<p>Indicates the summary operational status of the complete transmitter system.</p> <p>[green] = system is switched on.</p> <p>[gray] = system is switched off.</p>
Forward Power	Displays the output forward power in watts and dBm.
Reflected Power	Displays the output reflected power in watts and dBm.
<i>Alarms Total</i>	
Reset button	Forces a reset of the latched alarms discussed below.
Forward High	<p>Indicates whether the output forward power for the transmitter system is below the high alarm threshold.</p> <p>[green] = system operating normally, high power threshold has not been exceeded.</p> <p>[red] = high power threshold has been exceeded. The system switches off and makes three retries to turn on. If it fails all three times, the system remains off with this alarm active. To reset the alarm after the three retries, the "Reset button" above must be pressed.</p>
Reflected High	<p>Indicates whether the output reflected power for the transmitter system is below the high alarm threshold.</p> <p>[green] = system operating normally, high power threshold has not been exceeded.</p> <p>[red] = reflected power threshold has been exceeded. The system switches off and makes three retries to turn on. If it fails all three times, the system remains off with this alarm active. To reset the alarm after the three retries, the "Reset button" above must be pressed.</p>

Table 59: Home > Output

3.3.22 Home > Remote > Interlock



Figure 80: Home > Remote > Interlock

Name	Function
TX Remote button	Navigates to the TX Remote page.
Freq Control button	Navigates to the Frequency Control page.
<i>Interlock D Sub 15</i>	
Pin #	Displays the pin number on the rear panel D Sub 15 INTERLOCK port. [1...15] and sets the pin polarity. [Disabled] = the interlock is disabled, not checked by the logic control system. [Active Open] = the interlock is satisfied whenever the pin is NOT connected to the RLY COMMON pin. [Active Closed] = the interlock is satisfied whenever the pin is connected to the RLY COMMON pin.
Name	Sets a user-defined name for the interlock function.
Status LED	Indicates the logical status of the relevant interlock.

Name	Function
	<p>[green, not active] = the interlock has been satisfied.</p> <p>[red, active] = the interlock is open/not satisfied.</p> <p>[gray, N/A] = the interlock is currently disabled.</p>
<i>Interlock N+1</i>	
Pin	<p>Sets the pin polarity for the rear panel N+1 INTERLOCK connector.</p> <p>[Disabled] = the interlock is disabled, not checked by the logic control system.</p> <p>[Active Open] = the interlock is satisfied whenever the two pins of the connector are NOT connected together.</p> <p>[Active Closed] = the interlock is satisfied whenever the two pins of the connector ARE connected together.</p>
Name	Sets a user-defined name for the interlock function.
Status LED	<p>Indicates the logical status of the N+1 interlock.</p> <p>[green, not active] = the interlock has been satisfied.</p> <p>[red, active] = the interlock is open/not satisfied.</p> <p>[gray, N/A] = the interlock is currently disabled.</p>

Table 60: Home > Remote > Interlock

3.3.23 Home > Remote > TX Remote

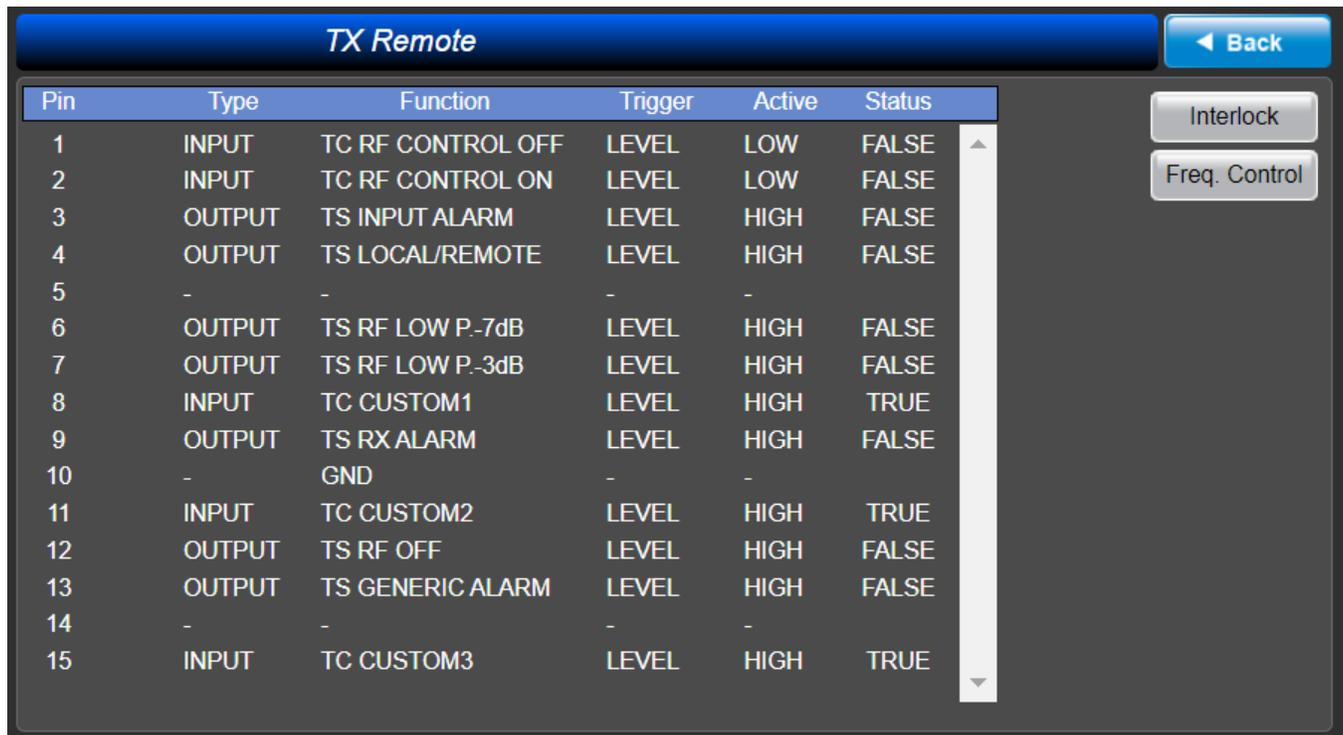


Figure 81: Home > Remote > TX Remote

Name	Function
Interlock button	Navigates to the Interlock page.
Freq Control button	Navigates to the Frequency Control page.
<i>TX Remote pinout table</i>	
Pin	Displays the pin on the rear panel D Sub 15 TX REMOTE port. [1...15]
Type	Displays the direction/function of the pin. [Input] = remote control command in. [Output] = remote control status out.
Function	Displays the remote control function assigned to the pin.
Trigger	Indicates the transitional behavior of this pin. [LEVEL] = the logic state toggles with steady-state changes in level. [EDGE] = the logic state toggles with high-low transitions. [---] = does not apply to this pin.
Active	Displays the polarity of this pin. [LOW] = the logic state is true when this pin is connected to its common pin.

Name	Function
	[HIGH] = the logic state is true when this pin is not connected to its common pin.
Status	Displays the current steady-state logic state on this pin. [NA] = does not apply to this pin. [FALSE] = the logic state of the pin is currently false. [TRUE] = the logic state of the pin is currently true.

Table 61: Home > Remote > TX Remote

3.3.24 Home > Remote > Freq Control

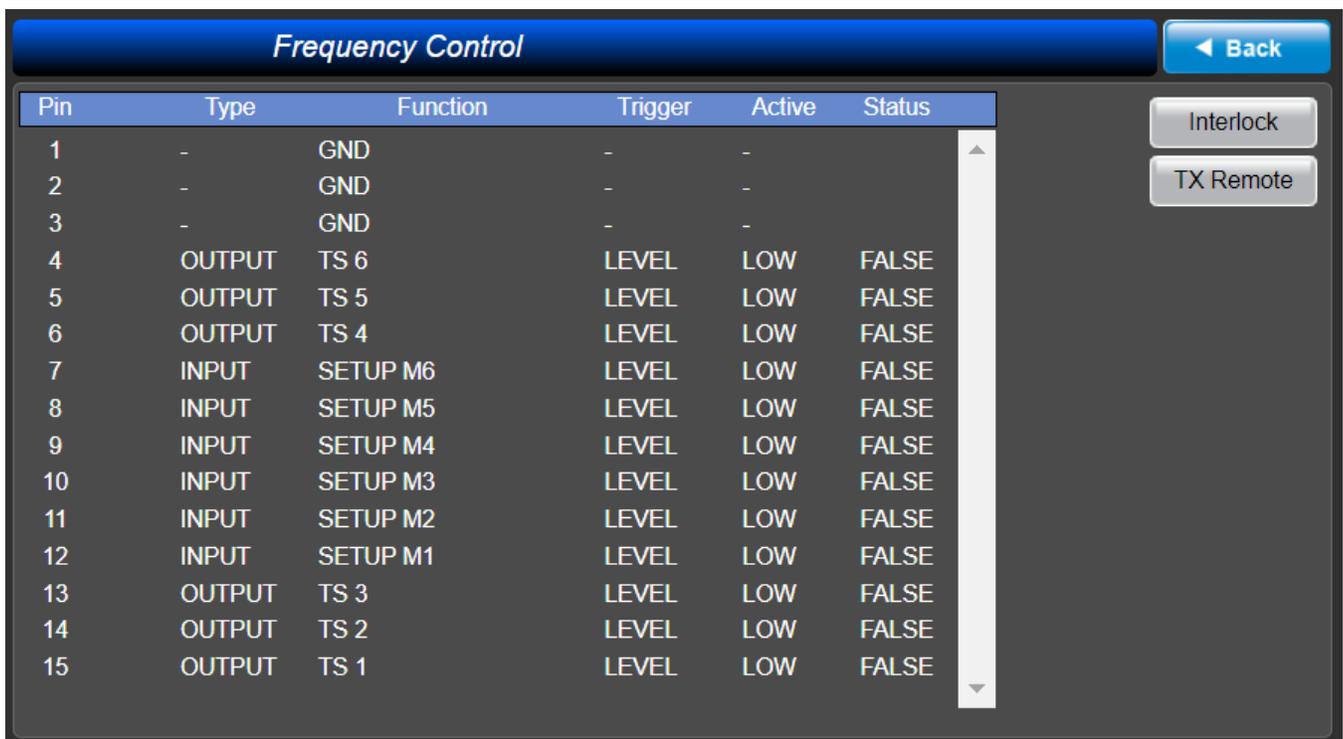


Figure 82: Home > Remote > Freq Control

Name	Function
Interlock button	Navigates to the Interlock page.
TX Remote button	Navigates to the TX Remote page.
<i>Frequency Control pinout table</i>	
Pin	Displays the pin on the rear panel D Sub 15 PRESET CTRL port. [1...15]
Type	Displays the direction/function of the pin. [Input] = remote control command in. [Output] = remote control status out.

Name	Function
Function	Displays the remote control function assigned to the pin.
Trigger	<p>Indicates the transitional behavior of this pin.</p> <p>[LEVEL] = the logic state toggles with steady-state changes in level. [EDGE] = the logic state toggles with high-low transitions. [---] = does not apply to this pin.</p>
Active	<p>Displays the polarity of this pin.</p> <p>[LOW] = the logic state is true when this pin is connected to its common pin. [HIGH] = the logic state is true when this pin is not connected to its common pin.</p>
Status	<p>Displays the current steady-state logic state on this pin.</p> <p>[NA] = does not apply to this pin. [FALSE] = the logic state of the pin is currently false. [TRUE] = the logic state of the pin is currently true.</p>

Table 62: Home > Remote > Freq Control

3.3.25 Home > Amplifiers



Figure 83: Home > Amplifiers

Name	Function
Prev/Next buttons	Navigates to additional pages of amplifier telemetry in larger, multi-cabinet systems.
Amp 1...6 buttons	Identifies the display column for a particular PA module, up to eight PA modules in a cabinet. When pressed, buttons lead to Ext Amplifier page(s) providing more extensive metering information for an individual PA module. [green] = the PA module is ok. [yellow] = a warning condition exists inside the PA module. [red] = a fault condition exists inside the PA module. [gray] = the PA module is not enabled in the system.
<i>Meters</i>	
Fwd Power (W)	Displays the forward power level in watts for the PA module in question.
Rfld Power (W)	Displays the reflected power level in watts for the PA module in question.
Temperature (deg C)	Displays the internal temperature in degrees centigrade for the PA module in question.
Comm Status	Indicates the state of serial communications between the PA module in question and the transmitter logic control unit. [OK] = all communications are normal. [ERROR] = communications to the PA module have been lost.

Name	Function
	[N/A] = comm status is unknown, not available.
<i>Alarms</i>	
Forward High	<p>Indicates whether the output forward power for the PA module in question is within the desired limits.</p> <p>[OK] = the forward power from the PA module is within the prescribed limits. [N/A] = no information available from the PA module. (comm error) [ERROR] = the output power is above the high output power threshold.</p>
Forward Low	<p>Indicates whether the output forward power for the PA module in question is within the desired limits.</p> <p>[OK] = the forward power from the PA module is within the prescribed limits. [N/A] = no information available from the PA module. (comm error) [ERROR] = the output power is under the low output power threshold.</p>
Reflected	<p>Indicates whether the output reflected power for the PA module in question is within the desired limits.</p> <p>[OK] = the reflected power from the PA module is within the prescribed limits. [N/A] = no information available from the PA module. (comm error) [ERROR] = the output reflected power is over the reflected output power threshold.</p>
Temperature	<p>Indicates whether the internal temperature for the PA module in question is within the desired limits.</p> <p>[OK] = the internal temperature of the PA module is within the prescribed limits. [N/A] = no information available from the PA module. (comm error) [WARNING] = the internal temperature of the PA module is over the warning threshold. [ERROR] = the internal temperature of the PA module is over the alarm threshold.</p>

Table 63: Home > Amplifiers

3.3.26 Home > Amplifiers > AMP n



Figure 84: Home > Amplifiers > AMP n

Name	Function
Prev/Next buttons	Navigates to additional pages of amplifier telemetry in larger, multi-PA systems.
<i>Amplifier Status</i>	
RF	Indicates whether the PA module in question has been switched on and is producing RF power. [green] = the PA module is switched on and is producing RF power. [red] = the PA module is switched off. [gray] = data not available (comm error).
Power	Displays the forward power of the PA module in question in dBm and watts.
Reflected	Displays the reflected power of the PA module in question in dBm and watts.

Name	Function
Temp	Displays the internal temperature of the PA module in question in degrees centigrade.
<i>PSU Status</i>	
Presence	Indicates the presence of the PSU module in its socket. [green] = the PSU is correctly installed in its socket. [red] = the PSU is missing. [gray] = data not available (comm error).
Started	Indicates that the PSU in question is switched on. [green] = the PSU is switched on and producing voltage. [gray] = the PSU is switched off.
Fault	Indicates the operational status of the PSU in question. [green] = the PSU is ok, no abnormal internal conditions reported. [red] = an alarm for the PSU has been detected. [gray] = data not available (comm error).
Voltage (V)	Displays the DC voltage level being supplied by the PSU in volts.
Current (A)	Displays the DC current level being supplied by the PSU in amperes.
Temp (deg C)	Displays the internal temperature of the PSU in degrees centigrade.
Fan (rpm)	Displays the fan speed in revolutions per minute of the fan internal to the PSU.
<i>Module Currents</i>	
PA L1,2,3,4	Displays the current for the individual amplifier pallets on the left-hand side of the PA module.
PA R1,2,3,4	Displays the current for the individual amplifier pallets on the right-hand side of the PA module.
IPA 1,2	Displays the current for the pre-amplifier pallets in the PA module.
<i>Alarms</i>	
Alarms LEDs	Indicates the operational status of various parameters: [Green] = normal operation, no abnormal conditions reported. [Yellow] = a warning condition exists. [Red] = a fault condition exists. [Gray] = data not available (comm error).
Temperature (deg C)	Indicates whether the temperature detected inside the PA module is within the desired limits.
RF Forward High	Indicates whether the forward power for the PA module has exceeded the alarm threshold.
RF Forward Low	Indicates whether the forward power for the PA module has fallen below the alarm threshold.
RF Reflected High	Indicates whether the reflected power for the PA module has exceeded the alarm threshold.
Current	Indicates whether the current consumption for any of the amplifier pallets has exceeded the alarm threshold.

Name	Function
RS485 Comms	Indicates the status of the RS-485 serial communications between the PA module and the transmitter control unit.
PSU 1,2,3 Status	Indicates the operational status of the three PSU modules installed in the PA module.
Interlock	Indicates whether the PA module in question is properly seated in its socket in the transmitter cabinet.
HW Reset button	Performs a general hardware reset of the PA module in question.

Table 64: Home > Amplifiers > AMP n

3.3.27 Administrator Login

Logging in with the special administrator level login leads to a special page for the management of user accounts and passwords.

Username	Permission Group	Max Logins	Idle Timeout	New User	
admin	Admin	0	0	Edit	
eng	Engineer	0	0	Edit	Delete
operator	Operator	0	0	Edit	Delete
super	Super	0	0	Edit	Delete

Figure 85: Administrator login, user account management

Name	Function
Username	Displays the account username.
Permission Group	<p>Displays the account permission group.</p> <p>[Admin] = used for making changes to user account settings, but no operational control is available.</p> <p>[Engineer] = used for operational control, but no access to user account settings is available.</p> <p>[Operator] = used for operational monitoring only; no settings changes or commands are available.</p> <p>[Super] = similar permissions to Engineer level login but with some additional advanced settings available. See Section 0 for more information.</p>
Max Logins	Displays the maximum number of simultaneous logins permitted for the account.
Idle Timeout	Displays the amount of time a session using this account can remain idle before it is automatically logged out. Setting this value to zero allows the account to remain logged in indefinitely.
New User	Opens a new screen where a new user account can be configured.
Edit	Opens a new screen where the current user account can be modified.
Delete	Deletes the user account.

Table 65: Administrator Login

3.3.28 Administrator Login > Edit User Information

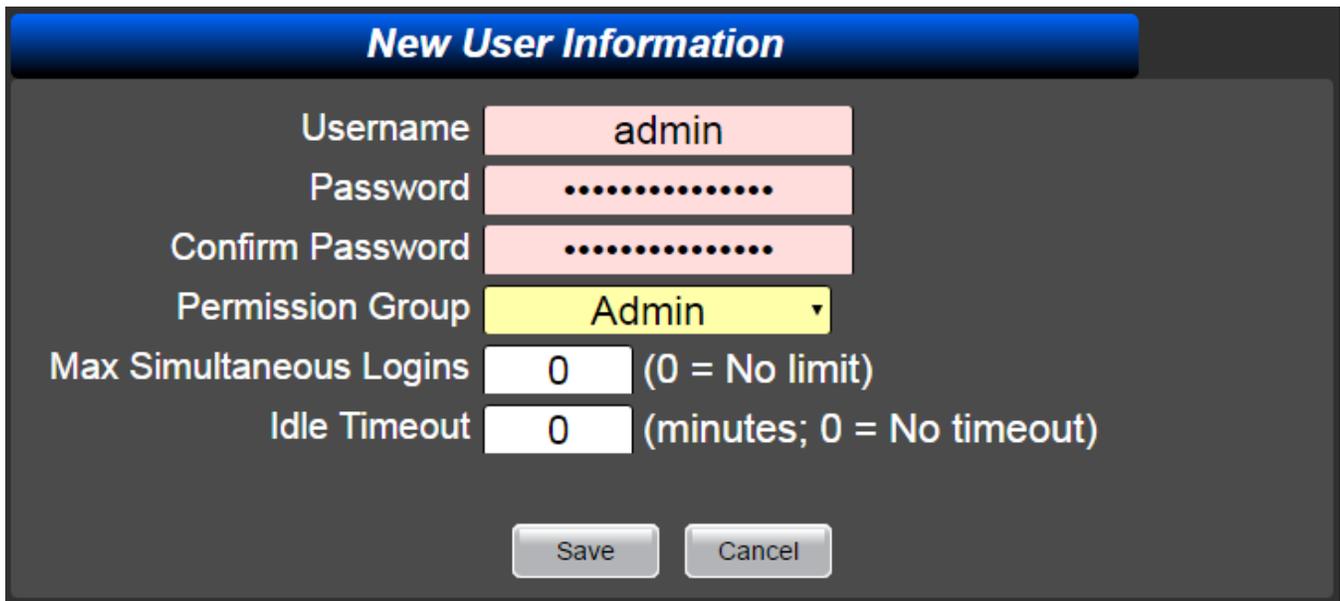


Figure 86: Administrator Login > Edit User Information

Name	Function
Username	Sets the account username.
Password	Sets the account password.
Confirm Password	Input box to confirm the account password.
Permission Group	<p>Sets the account permission group.</p> <p>[Admin] = used for making changes to user account settings, but no operational control is available.</p> <p>[Engineer] = used for system control, but no access to user account settings is available.</p> <p>[Operator] = used for system monitoring, no operational commands nor access to user account settings are available.</p>
Max Simultaneous Logins	Sets the maximum number of simultaneous logins permitted for the account.
Idle Timeout	Sets the amount of time a session using this account can remain idle before it is automatically logged out. Setting this value to zero allows the account to remain logged in indefinitely.
Save	Saves the proposed changes.
Cancel	Discards the proposed changes.

Table 66: Administrator Login > Edit User Information

4 Theory of Operation

4.1 General Description

Transmitter models in the VAX/UAX-OP product family fall into two general categories:

- Multiple PA systems where a transmitter logic control unit serves as the principal point of control.
- Single PA systems where no transmitter control unit is present and the LPU(s) are connected directly to the PA module.

4.1.1 General description – single PA systems.

Please consult Figure 87 and Figure 88.

In dual drive systems, one or two incoming transport streams are applied to an optional transport stream matrix in the shared PA module. The switch matrix sends the transport stream(s) to the currently selected LPU. The standby LPU does not receive a transport stream in this configuration. In single drive systems, the transport stream(s) is (are) connected directly to the LPU input and the input switch matrix is not employed.

The LPU selects one of the transport stream inputs and outputs an on-channel modulated RF signal at a level of approximately 0-10 watts, which is then passed to the PA module. In dual drive systems, an RF drive switch matrix at the PA module input selects the LPU drive to be used to excite the final amplifier.

All system control is via the LPU(s) and their user interfaces. The LPU(s) control the PA module via a D sub 25 cable connection. PA module control and telemetry show up on extra web pages in the web GUI [of the LPU](#).

A series of RF samples from the system output provide feedback for the RTAC precorrection system in the LPU. RF samples taken from internal directional couplers at the PA output stage are used for non-linear precorrection (linearity and incidental phase errors), while RF samples taken from after the output channel filter are used for linear precorrection (frequency response and group delay errors).

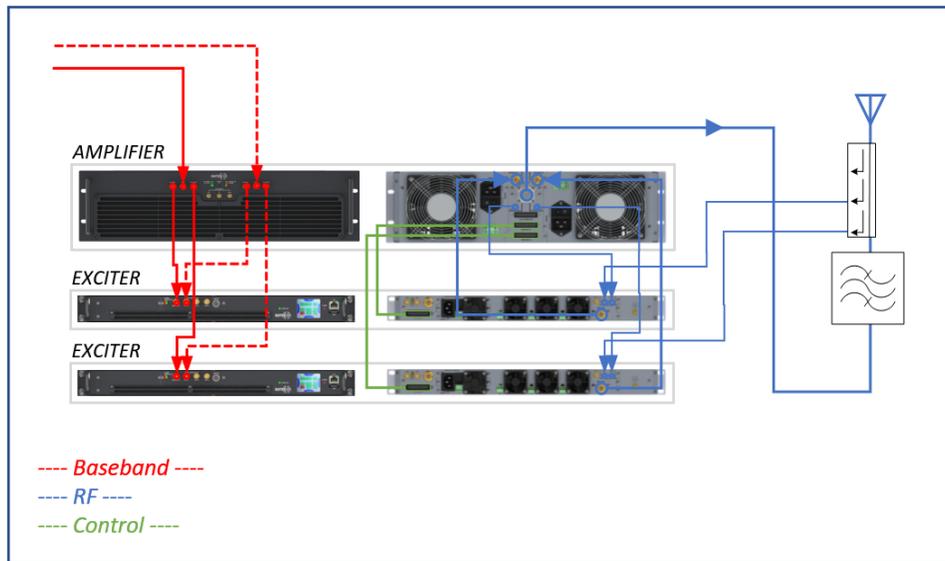


Figure 87: Interconnect diagram, typical 1-PA system

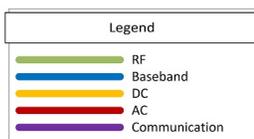
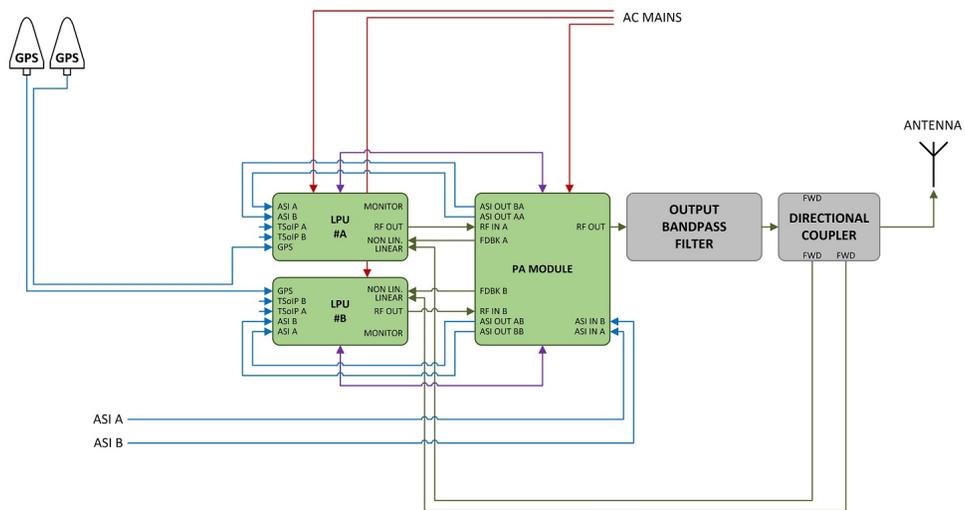


Figure 88: Interconnect diagram, typical 1-PA system, alternate view

4.1.2 General description – multiple PA systems.

Please consult Figure 89 through Figure 92.

 NOTE	For the sake of brevity, information is provided here for a 4-PA system, but the structure of a 2-PA and 3-PA system is easily deduced by removing one or two PA modules and their associated interconnections.
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In dual drive systems, one or two incoming transport streams are applied to an optional transport stream matrix in the transmitter control unit. The switch matrix sends the transport stream(s) to the currently selected LPU. The standby LPU does not receive a transport stream in this configuration. In single drive systems, the transport stream(s) is (are) connected directly to the LPU input and the input switch matrix is not employed.

The RF output of both LPUs goes to the transmitter logic control unit, which selects one LPU to drive the subsequent high power amplification stages. The other LPU remains in a reserve position, to be used if the selected LPU should develop a failure.

The drive signal from the selected LPU is divided by a series of RF splitters and is applied to multiple power amplifier modules connected in parallel. The RF output from the PA modules is combined in a series of hybrid combiners to form the final, high power output. An air cooled combiner loads assembly provides up to three ballast loads to safely dissipate any power rejected by the final combiner system due to imbalanced or improperly phased signals from the PA modules.

The combined output signal is passed through a series of directional couplers for system metering and to provide feedback to the RTAC adaptive correction system in the LPU modulator. A lowpass filter attenuates harmonic byproducts naturally arising from the high-efficiency amplification process.

The LPUs are commanded by the transmitter logic control unit by means of both IP over a LAN and a hardware mute line connected to their remote control interface. The hardware mute line ensures a rapid, reliable muting action, even if the LAN traffic should become latent, irregular. A fast Ethernet switch in the transmitter control unit provides the interconnection and routing of all IP LAN traffic.

Automatic power control (APC) to maintain a constant output power is accomplished in the transmitter logic control unit. The actual RF power level, as measured by detector circuits connected to an RF sample from the system output, is compared to the desired/target output level. The transmitter control unit then commands the active LPU to increase or decrease its output power to compensate for any error.

The mains distribution unit distributes AC mains power to the power amplifier modules and LPUs. In some cases, rack cooling fans may also be present.

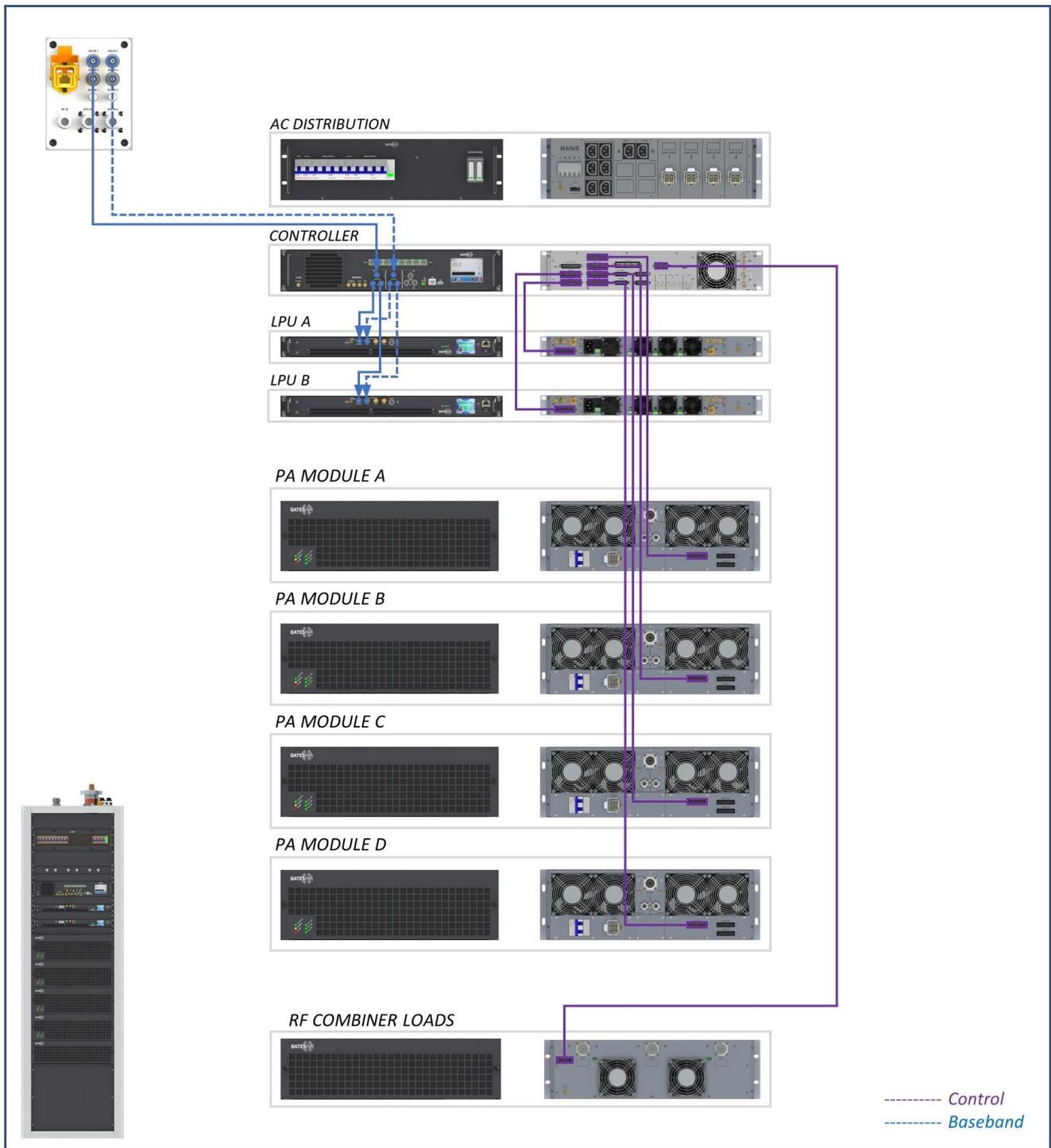


Figure 89: Interconnect diagram, typical 4-PA system (1 of 3)

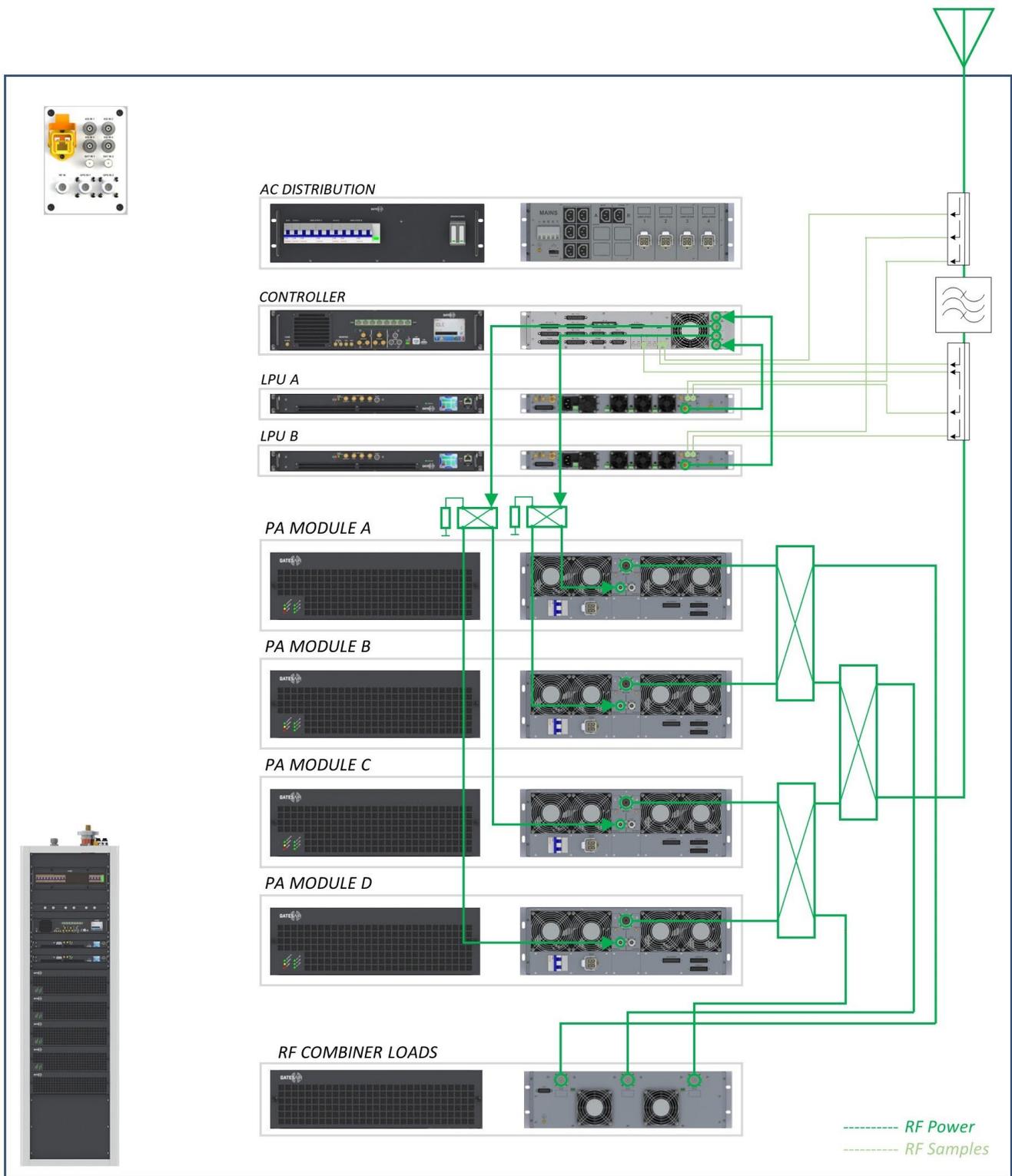


Figure 90: Interconnect diagram, typical 4-PA system (2 of 3)

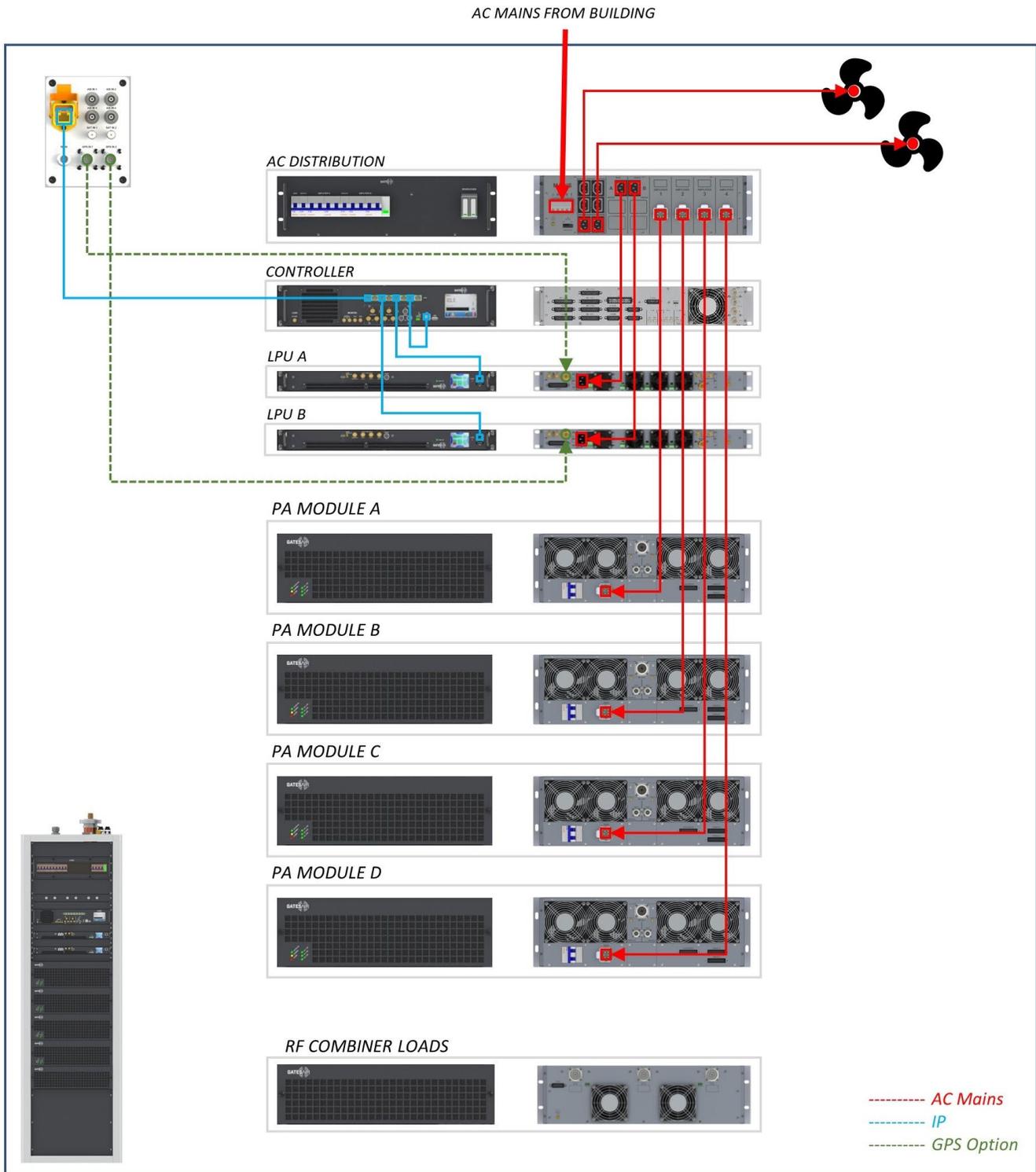


Figure 91: Interconnect diagram, typical 4-PA system (3 of 3)

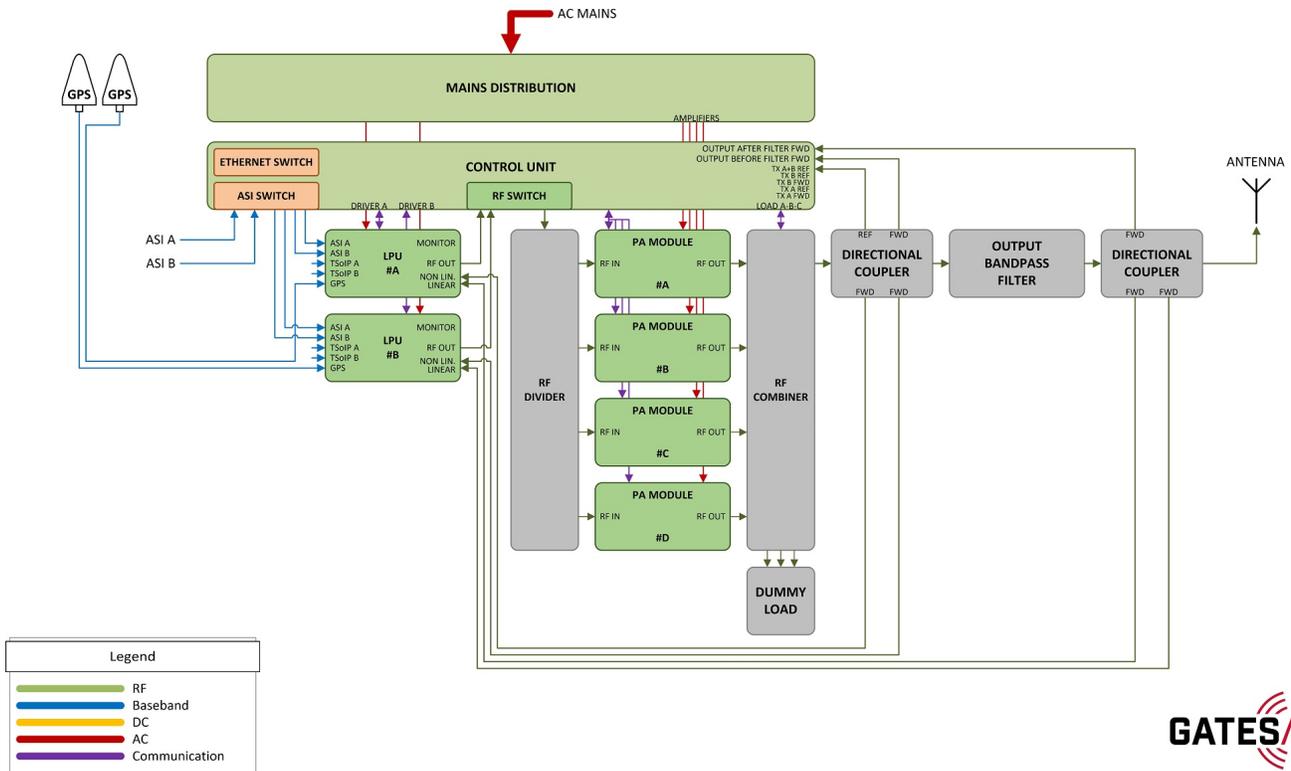


Figure 92: Interconnect diagram, typical 4-PA system, alternate view

4.2 PA Module

There are multiple PA module types used in the VAX/UAX-OP product family. All power amplifier modules employ one or more RF amplifier pallets operating in parallel to achieve the desired output power level. All the final stage amplifier pallets employ Doherty amplification for increased efficiency. In certain models, a preamplifier pallet in series uses a class AB amplification for improved linearity performance.

The various PA modules in the product family can be generally classified by their rack unit height (2 RU, 3 RU, 3.5 RU) and the quantity of RF pallets they contain. The available PA module types are identified in Table 68.

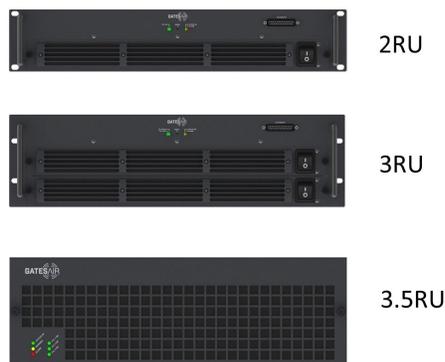


Table 67: PA module types – general appearance

Description	VHF Band 1	VHF Band 3	UHF Band IV/V
2 RU – 1 pallet		VAX-OA-PA-250	UAX-OA-PA-200-D <i>-or-</i> UAX-OA-PA-300-E
2 RU – 2 pallet		VAX-OP-PA-450	UAX-OA-PA-350-D2U <i>-or-</i> UAX-OA-PA-400-E-2U
3 RU – 2 pallet		VAX-OP-PA-500	UAX-OA-PA-350-D3U <i>-or-</i> UAX-OP-550-E
3 RU – 3 pallet		VAX-OP-PA-700	UAX-OA-PA-600-D <i>-or-</i> UAX-OA-PA-750-E
3.5 RU – 4 pallet	VAX-OP-PA-900L	VAX-OP-PA-1100	UAX-OA-PA-800-D <i>-or-</i> UAX-OA-PA-1100-E
3.5 RU – 6 pallet	VAX-OP-PA-1200L	VAX-OP-PA-1400	UAX-OA-PA-1100-D <i>-or-</i> UAX-OP-PA-1500-E
3.5 RU – 6+1 pallet		VAX-OP-PA-1500-DA	UAX-OP-PA1-1500E
3.5 RU – 7+1 pallet	VAX-OP-PA-1350L	VAX-OP-PA-1600	UAX-OA-PA-1250-D <i>-or-</i> UAX-OP-PA-1750-E
3.5 RU – 8 pallet	VAX-OP-PA-1500L	VAX-OP-PA-1800	UAX-OA-PA-1400-D <i>-or-</i> UAX-OA-PA-2000-E

Table 68: PA module types – part numbers

 NOTE	<p>Two major categories of UHF PA modules exist: those ending in D utilize the BLF888D FET as their final device, whereas those ending in E utilize the BLF888E FET as their final device. Each FET type (D vs. E) offers certain tradeoffs in bandwidth, efficiency and power handling.</p>
--	--

4.2.1 2 RU and 3 RU PA modules

Please refer to Figure 93 through Figure 96.

When present in dual drive systems, an optional RF input switch matrix accepts the drive signal from both LPUs and determines which drive signal is used to excite the subsequent amplification stages. The RF drive signal is passed through a switchable 3 dB attenuator. The control system will switch in 3 dBs of attenuation to reduce the output power under certain alarm conditions. The drive signal is then passed to a series of preamplification and amplification stages. Directional couplers at the final output stage provide RF samples for metering the forward and reflected power.

 NOTE	<p>All VHF and UHF PA modules have virtually the same architecture. For the sake of brevity, the block diagrams for the VHF versions of each PA module type have not been included here. In each case, the VHF module block diagram is the same as the UHF version, except that the VHF version has a single FET per pallet.</p>
--	--

Modular power supply modules provide both +50 V DC for the final stage FET amplifiers, as well as +24 V DC for the preamplifier stages, control board and rear-panel cooling fans. The 2 RU PA module features a single power supply tray, while the 3 RU PA module has two power supply trays.

UAX-OP-PA-200-D UAX-OP-PA-300-E
AIR COOLED UHF AMPLIFIER

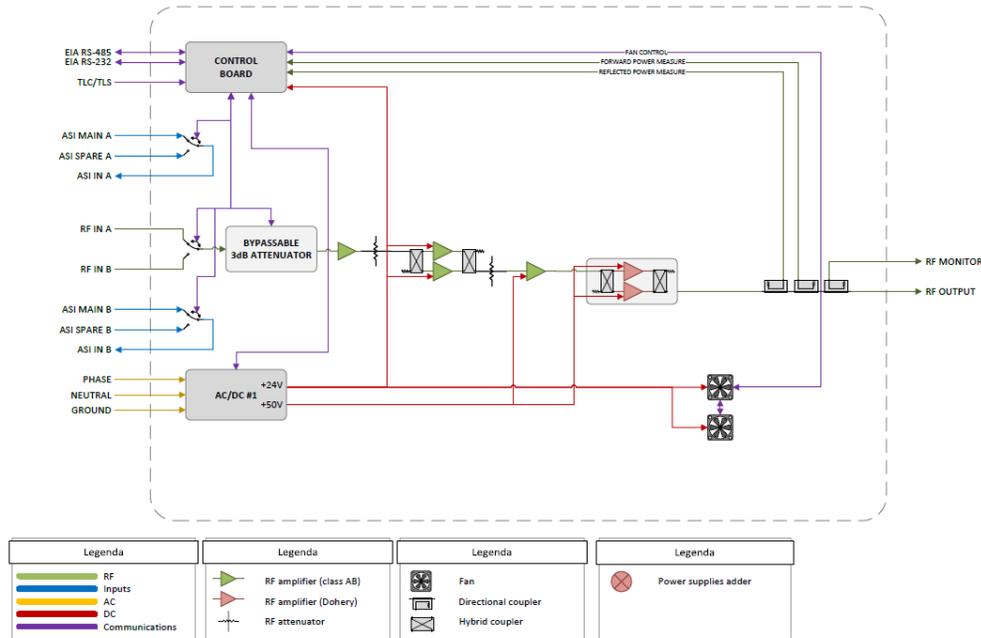


Figure 93: Block diagram – 2 RU, 1-pallet UHF PA module

UAX-OP-PA-350-D2U UAX-OP-PA-400-E-2U
AIR COOLED UHF AMPLIFIER

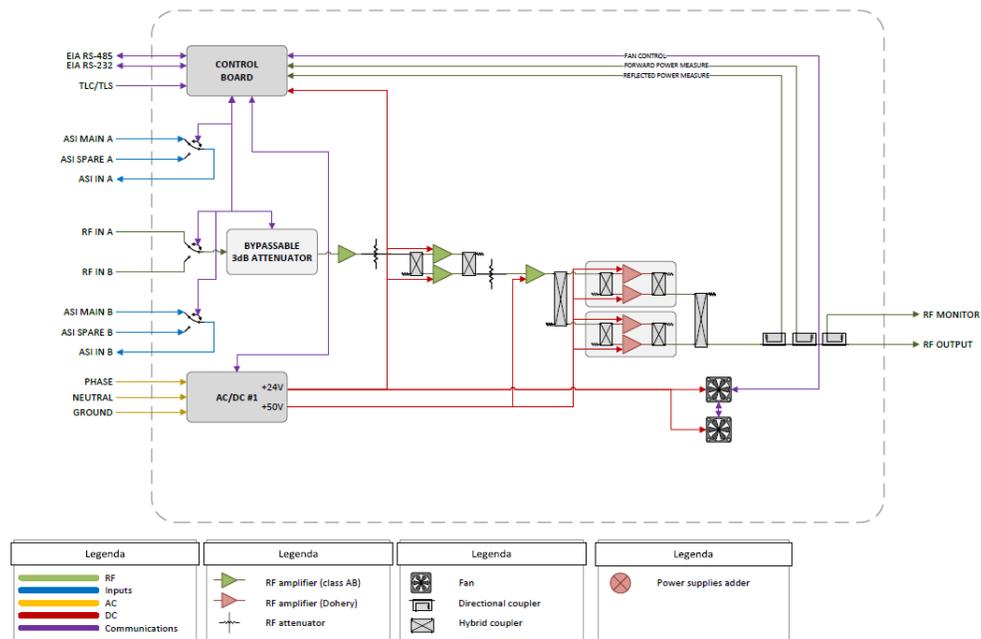


Figure 94: Block diagram – 2 RU, 2-pallet UHF PA module

UAX-OP-PA-350-D3U UAX-OP-PA-550-E
AIR COOLED UHF AMPLIFIER

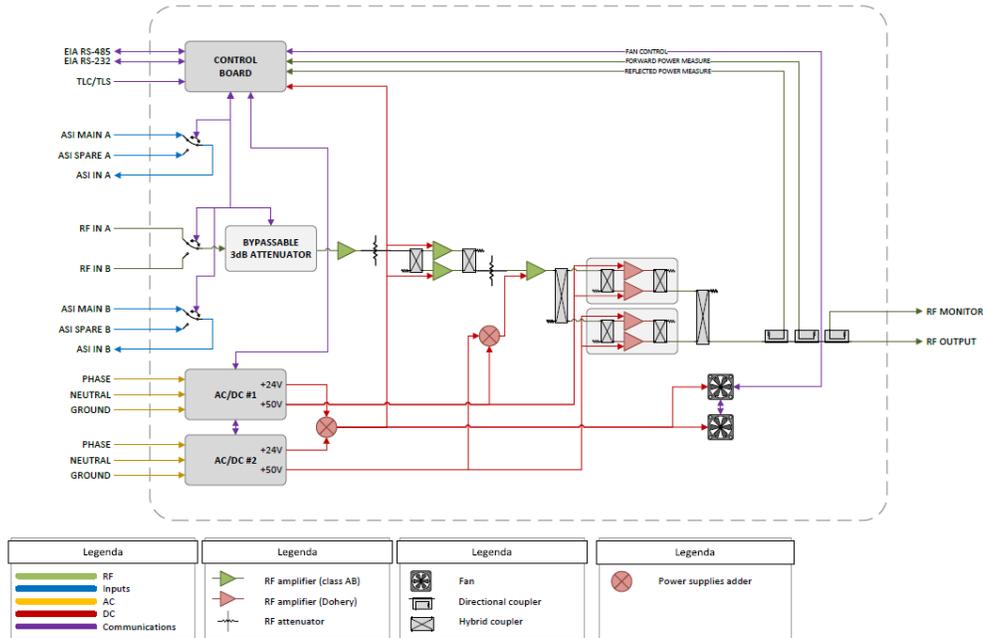


Figure 95: Block diagram – 3 RU, 2-pallet UHF PA module

UAX-OP-PA-600-D UAX-OP-PA-750-E
AIR COOLED UHF AMPLIFIER

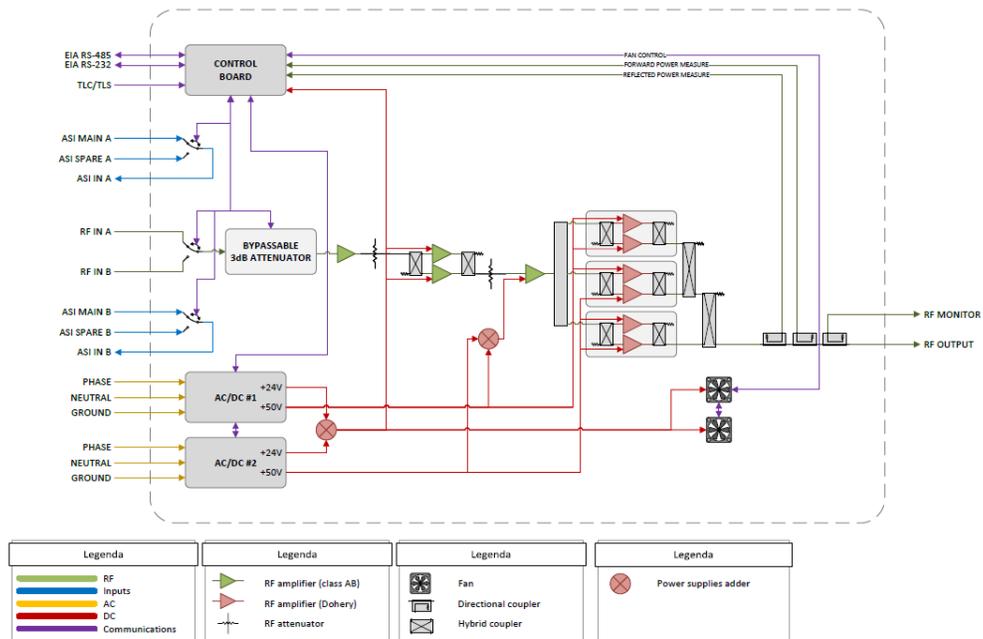


Figure 96: Block diagram – 3 RU, 3-pallet UHF PA module

4.2.2 3.5 RU PA modules

Higher power transmitters employ one or more 3.5 RU PA modules capable of housing up to eight (8) amplifier pallets each. Both hot plug and non-hot plug versions of the 3.5 RU PA module platform exist. The hot plug version features blind-mate DC, control and RF connections that make/break automatically as the PA module is inserted/removed from the transmitter rack, while the non-hot plug version has connections that must be made/broken by hand each time the module requires servicing.

Please refer to Figure 98 through Figure 100.

When present in dual drive systems, an optional RF input switch matrix accepts the drive signal from both LPUs and determines which drive signal is used to excite the subsequent amplification stages. The RF drive signal is passed through a switchable 3 dB attenuator. The control system will switch in 3 dBs of attenuation to reduce the output power under certain alarm conditions. The drive signal is then passed to a series of preamplification and amplification stages. Directional couplers at the final output stage provide RF samples for metering the forward and reflected power.

The amplifier pallets use 50 V DC power supplied by three, hot pluggable AC-DC power supply modules. The AC mains feed to the PA module can be configured to monophasic, delta, or wye power via a series of fuses at the time of purchase, as shown in Figure 97.

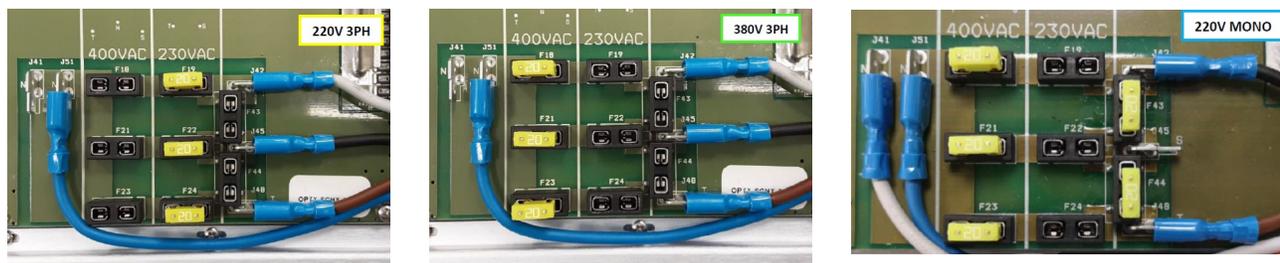


Figure 97: Mains fuses configurations, PA module

The DC outputs of the 50 V DC power supply modules are all bridged (OR-ed) together for increased redundancy. In the case of the failure of a single power supply, the module will continue to output the full power level. In the case of two failed power supplies, the control system internal to the PA module will invoke a 3 dB attenuator at the module input to reduce its power consumption demands.



NOTE

All VHF and UHF PA modules have virtually the same architecture. For the sake of brevity, the block diagrams for the VHF versions of each PA module type have not been included here. In each case, the VHF module block diagram is the same as the UHF version, except that the VHF version has a single FET per pallet. The two DC power lines to each pallet are bridged at the pallet input to accommodate the increased power demands of the single, higher-power VHF FET.

UAX-OA-PA-1100-D / UAX-OA-PA-1500-E
AIR COOLED UHF AMPLIFIER

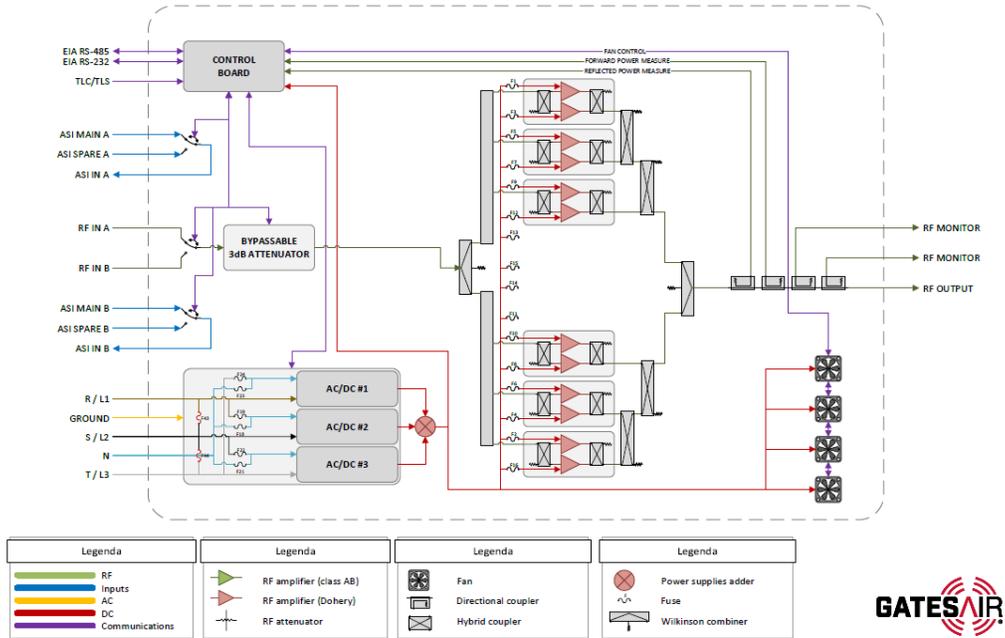


Figure 98: Block diagram – 3.5 RU, 6-pallet UHF PA module

UAX-OA-PA-1250-D / UAX-OA-PA-1750-E
AIR COOLED UHF AMPLIFIER

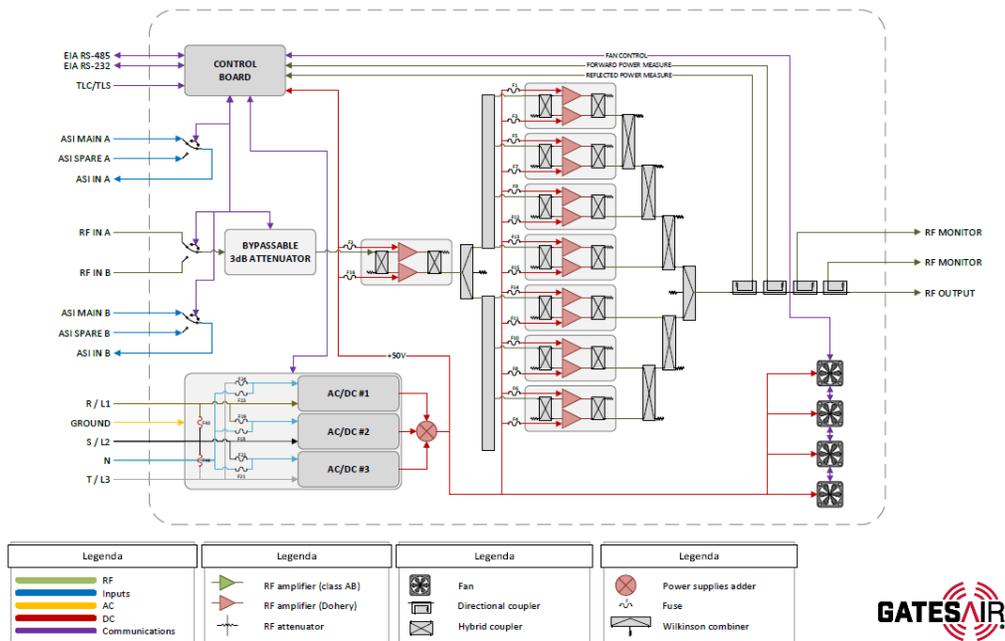


Figure 99: Block diagram – 3.5 RU, 7+1 pallet UHF PA module

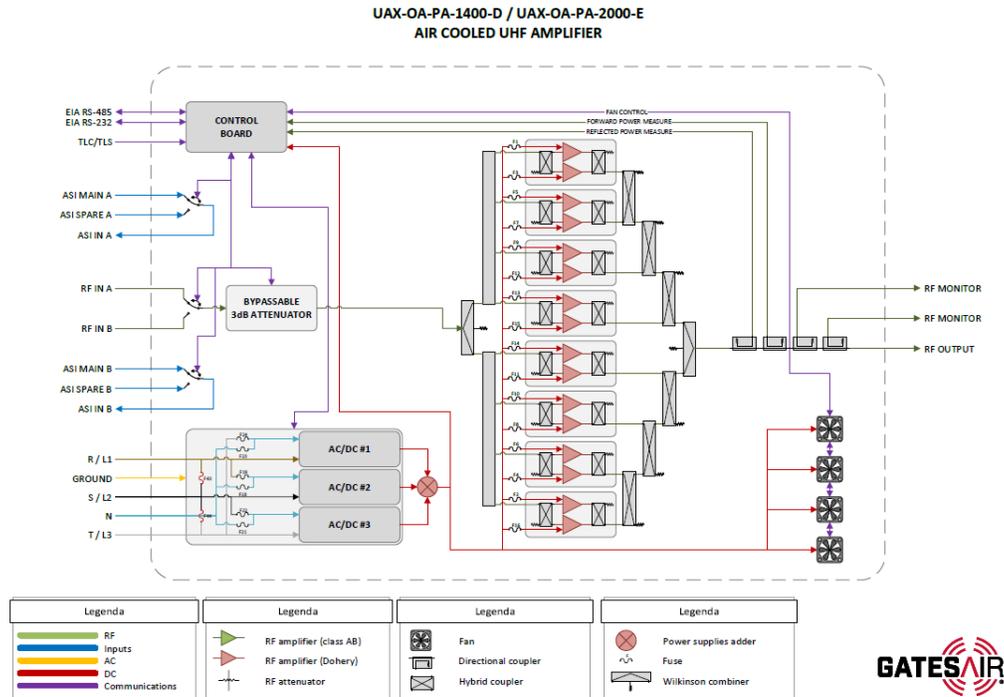


Figure 100: Block diagram – 3.5 RU, 8-pallet UHF PA module

The placement of the major components in a typical 3.5 RU PA module is shown in Figure 101 and Figure 102.

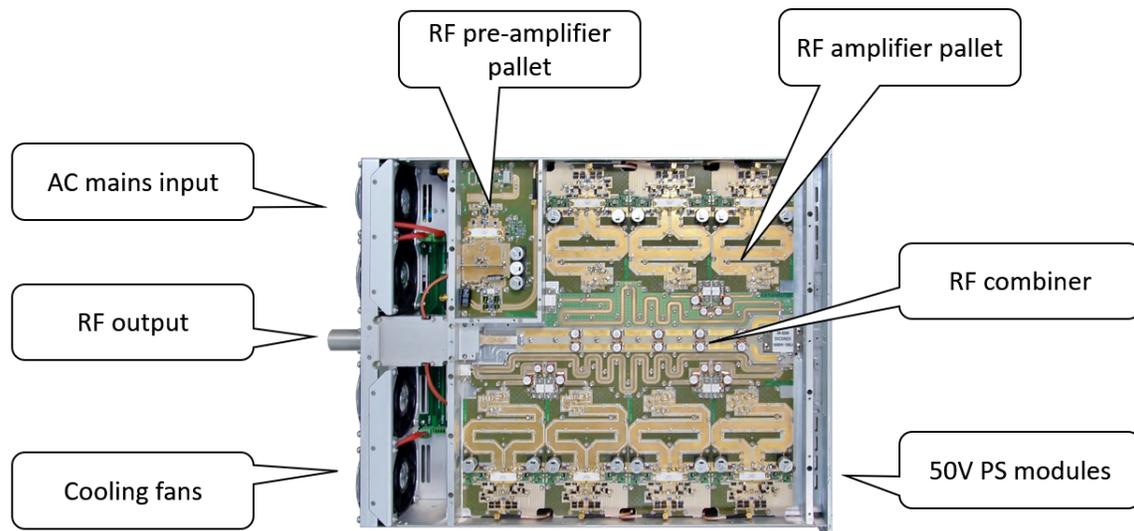


Figure 101: Major subassemblies - 3.5 RU PA module (top)

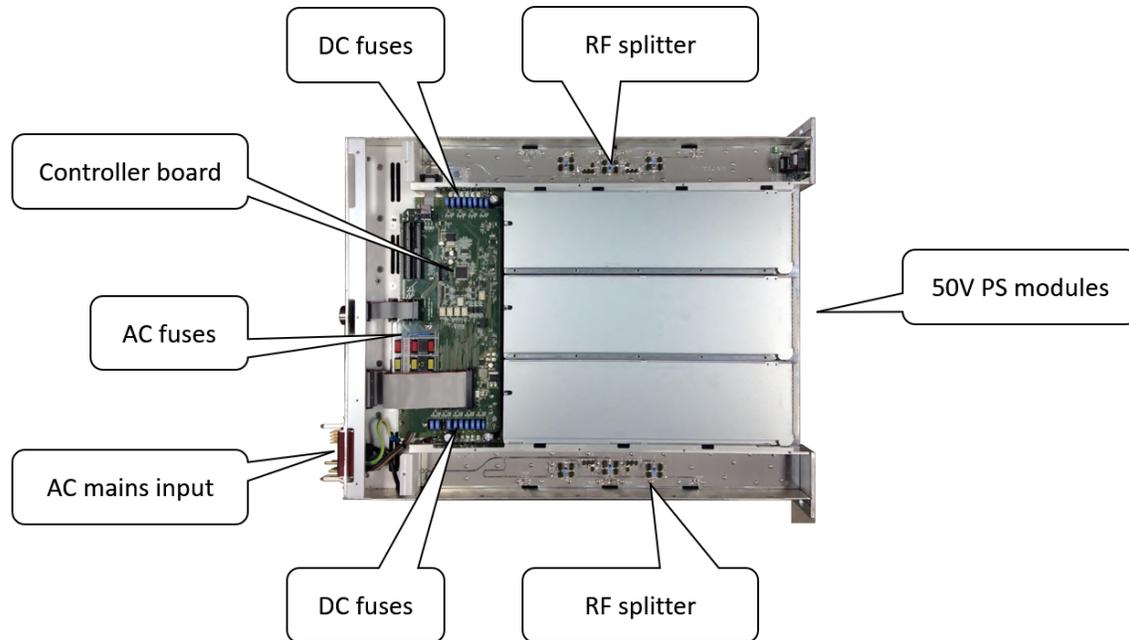


Figure 102: Major subassemblies - 3.5 RU PA module (bottom)

4.3 Transmitter Logic Control Unit

Please refer to Figure 103.

Transmitters with two or more PA modules have a dedicated transmitter control unit that performs the following functions:

- Transport stream (ASI) matrix switching in dual drive systems
- LPU drive switching in dual drive systems
- IP interconnect and routing to various system components (LAN)
- Communications and control of multiple PA modules (IP and RS-485)
- Main interface point for both local users (LCD screen) and remote users (web GUI)

The transmitter control unit is powered by +28 V DC power supplied by the interconnected PA modules. The incoming DC power from up to four (4) PA modules is OR-ed to provide enhanced system redundancy.

The placement of the major components in the transmitter control unit is shown in Figure 104 and Figure 105

LOGIC UNIT

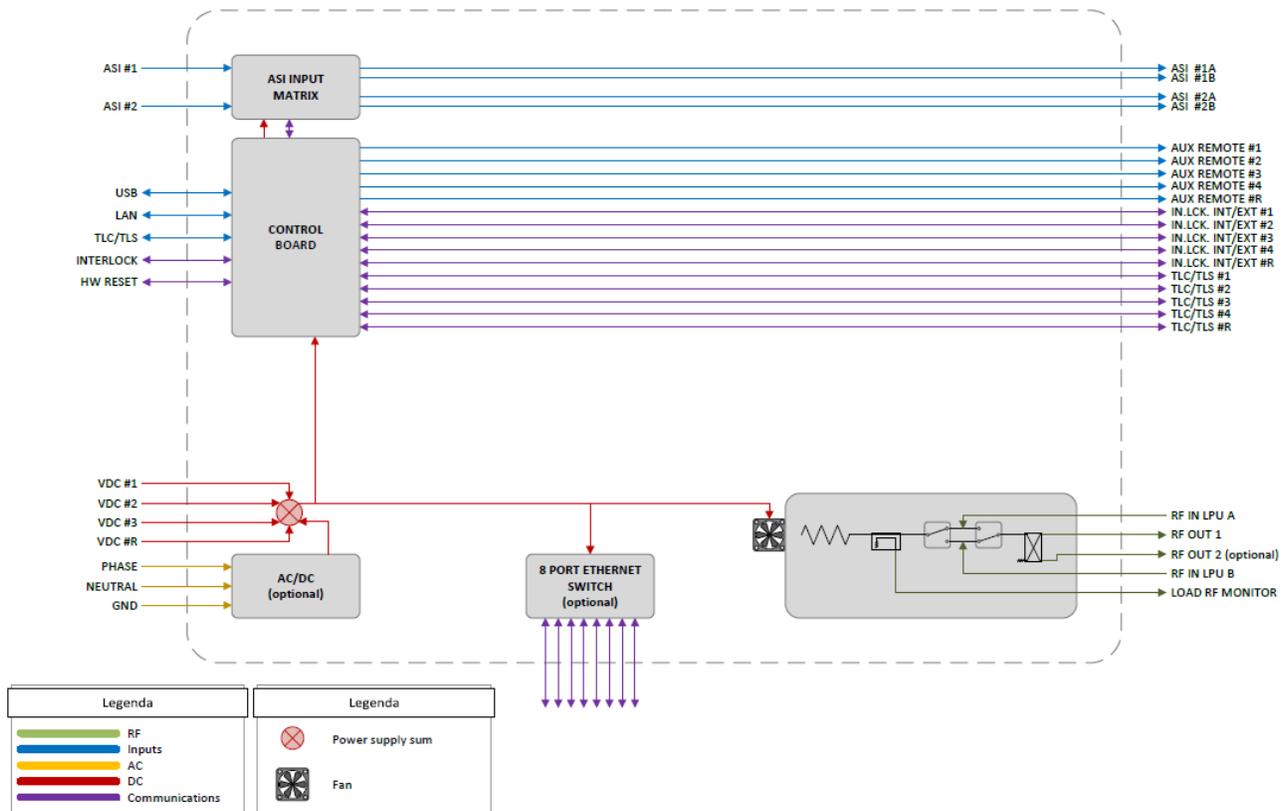


Figure 103: Block diagram – Transmitter control unit

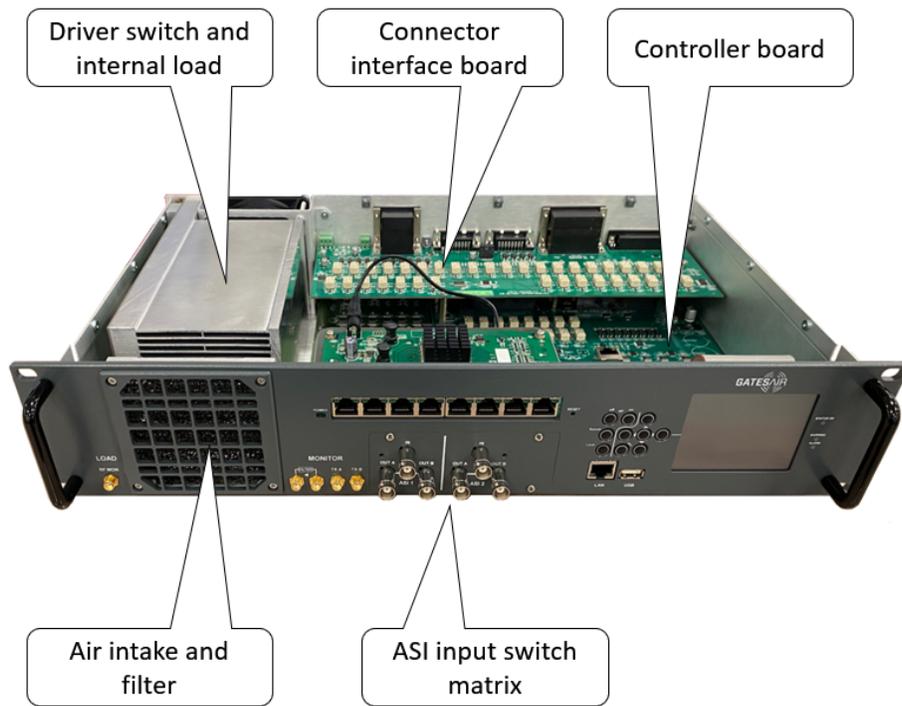


Figure 104: Major subassemblies – Transmitter control unit 1 of 2

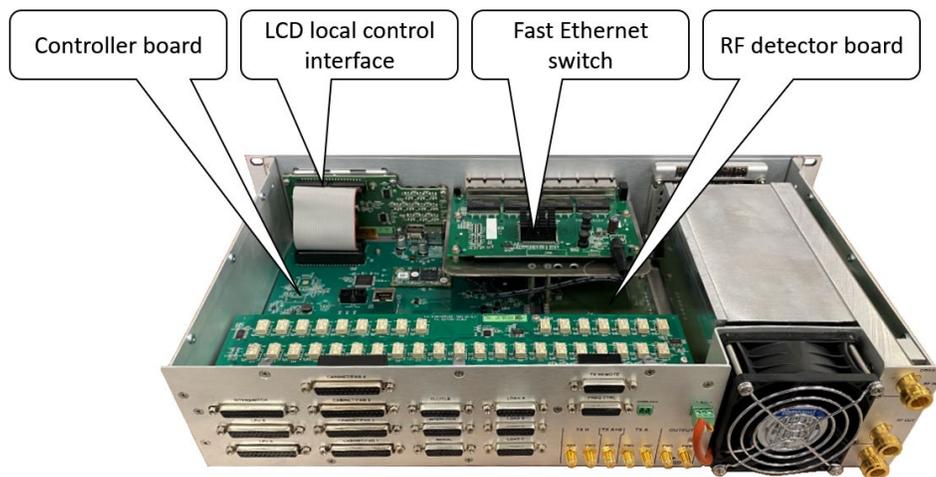


Figure 105: Major subassemblies – Transmitter control unit 2 of 2

5 Maintenance

5.1 Introduction

The VAX/UAX-OP series of transmitters has been designed to require a minimum of maintenance. This section outlines various maintenance interventions required to keep the equipment operating properly and is divided into three principal parts.

The first part provides a general overview of good maintenance practices.

The second part provides maintenance procedures to be performed on routine, periodic basis:

- Clean air filters
- Verify LPU (exciter) switchover
- Check AC mains tightness
- Inspect surge arrestors
- Verify interlocks
- Replace clock battery

The third part provides advanced maintenance procedures to be performed on an exceptional basis, typically in the case of a component failure or other malfunction.

- Change operating power level
- Store/recall configuration
- Update software
- Replace PSU module
- Replace RF amplifier module
- Replace RF amplifier pallet (VHF)
- Replace RF amplifier FET (UHF)
- Replace PA cooling fan
- Replace combiner ballast load
- Replace circuit breaker
- Replace surge arrestor
- Calibrate power readings



WARNING

The service work described in this section must be carried out by trained staff only. Never perform transmitter maintenance while alone and/or not fully alert. Serious bodily injury or death could result from failure to observe proper safety precautions.

5.2 General Maintenance Guidelines

5.2.1 Personnel training

The performance and longevity of a piece of equipment will be maximized if it is properly maintained by a well-trained, technically skilled individual. To this end, GatesAir offers a variety of training classes, both specific to VAX/UAX-OP transmitters and general courses on the fundamentals of RF technology. Contact your GatesAir representative or visit the GatesAir Broadcast website at www.gatesair.com for more information on training offerings.

5.2.2 Recommended tools and equipment

To maximize the effectiveness of maintenance personnel, it is important to have the proper set of tools and test equipment for the job. Below is a list of tools and equipment that should be available on site. Note that not all items are specifically required for the VAX/UAX-OP series transmitter but may be useful in general.

Tools:

- Tool chest with following items:
 - Hex driver set with assorted sizes
 - Allen key set with assorted sizes
 - Flat and Phillips (star) screwdriver set with assorted sizes
 - Drill and drill bit assortment
 - Tap and die set with assorted sizes
 - Adjustable wrench(es)
 - Pipe cutter for rigid transmission line
 - Ratchet wrench with assorted sockets
 - Diagonal cutters
 - Wire strippers
 - Needle-nose pliers
 - General purpose pliers
 - Inspection mirror
 - Fine adjustment screwdriver
- Multimeter with probe leads (ohmmeter, ammeter, voltmeter)
 - Clip lead attachments for multimeter
- Temperature-controlled soldering iron
- Electronics solder (lead free where applicable)
- Isopropyl alcohol for solder cleanup
- Magnifying glass and tweezers if work on SMT components is anticipated
- Clean workshop towels and general cleaning products
- Razor blade, rubber roller, or straight-edge to spread thermal compound.
- Workshop light with clamp, hook
- Air compressor
- Safety goggles
- Work gloves

Test Equipment:

- Modulation analyzer

- Spectrum analyzer
- Station test load capable of dissipating full transmitter power
- Precision power checking means at transmitter output: average power meter and precision directional coupler
- Oscilloscope and probe leads
- Network or transmission line analyzer (optional, but useful)

5.2.3 Spares holding

The ability to resolve any equipment problem quickly is greatly enhanced by maintaining a complement of spare parts on site. GatesAir offers ready-made spares kits for the transmitters addressed by this manual. In general, the following items are useful to have as spares:

- Replacement LPU modules (controller, modulator, LVPS, amplifier pallet, front panel LCD)
- Replacement LPU fan
- Replacement PA module amplifier pallet
- Replacement PA module FET (UHF only)
- Replacement PA module
- Replacement PSU module
- Replacement combiner load resistor
- Replacement air filter foam media
- Replacement fuses for PA module interior power distribution
- Replacement PA module cooling fan
- Replacement circuit breakers in mains distribution unit (multiple sizes)
- Replacement surge arrestor module

Not all these items will be present in all transmitters, depending on the transmitter model. Consult Section 7 - Parts Lists for more specific information and part numbers.

5.2.4 Transmitter logbook

To aid in any future troubleshooting, the transmitter should be monitored using its front panel and/or remote control metering and the results recorded in a transmitter log at least once a day. This may be done either manually or via a computer-based remote control system. This provides a baseline of normal operating parameters against which any future abnormal readings may be compared. A copy of the factory test data report should be kept available to provide additional information for comparison purposes.

5.2.5 Maintenance logbook

The maintenance logbook should contain a complete description of all maintenance activities required to keep the transmitter operational. A list of maintenance information to be recorded and analyzed to provide a database for a failure reporting system is as follows:

- **DISCREPANCY:** Describes the nature of the malfunction. Includes all observable symptoms and performance characteristics.
- **CORRECTIVE ACTION:** Describes the repair procedure used to correct the malfunction.
- **DEFECTIVE PART(S):** Lists all parts and components replaced or repaired. Includes the following details:
 - COMPONENT TIME IN USE
 - COMPONENT PART NUMBER
 - COMPONENT SCHEMATIC NUMBER

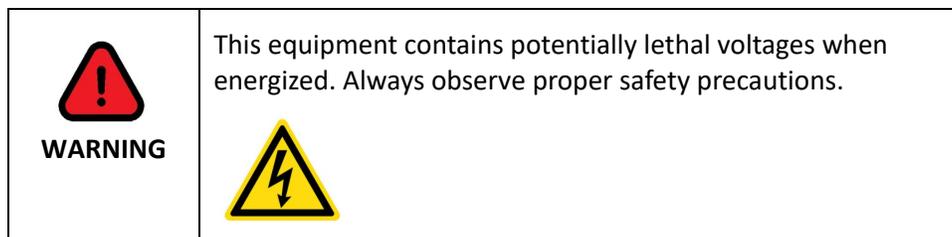
- COMPONENT ASSEMBLY NUMBER
- COMPONENT REFERENCE DESIGNATOR
- NAME OF REPAIRMAN: Lists the name of the technician who made the repair.
- STATION ENGINEER: Indicates that the chief engineer noted and approved the transmitter repair.

5.3 Good Maintenance Practices

Always observe these good maintenance practices when performing maintenance interventions on the equipment.

5.3.1 Remove power before servicing

Many of the procedures discussed in this section require access to restricted areas of the internal workings of the transmitter. In the interest of personnel safety, AC mains power should always be completely removed from the equipment before removing any of its modules or access covers, with the notable exception of hot pluggable PA and PSU modules, which are designed to be inserted/removed while the transmitter continues to operate.



Follow these simple steps for establish the absence of hazardous voltages before starting work:

- Open the main circuit breaker/fuse at the building panelboard to remove all AC mains power. If multiple people are working at the site, observe lock-out, tag-out safety protocols. That is, place a padlock on the circuit interrupt device in the off position to prevent another person from energizing the circuit without your knowledge. Place a tag on the padlock identifying who placed it there and has the key to remove it once the work is complete.
- Switch away from the antenna or ground the antenna line inner conductor if electrical storms are expected in the area.
- Once power has been restored to the system, place the transmitter in local control mode until testing is complete to prevent unexpected operation or modification of settings by remote operators.

5.3.2 Take ESD precautions

Before removing or replacing any PCB assembly within the equipment, ensure that proper precautions are taken against electrostatic discharge (ESD). The icon in Figure 106, when present, indicates the need to take proper ESD precautions to prevent equipment damage. Circuit boards and other sensitive parts shipped from GatesAir typically arrive in conductive ESD-safe bags/package, as shown in Figure 106. Likewise, any sensitive parts returned to GatesAir should be shipped back in ESD-safe bags/package.



Figure 106: ESD caution icon = take ESD precautions

If electronic parts must be touched during installation or repair, the technician performing the work must be equipped with the anti-static protection devices shown below.



Elastic ESD wristband fixed on the technician's wrist.



Flexible ESD cords connected to the elastic wristband and a special plug on the workbench highlighted with the ESD warning label indicating that it is connected to ground to prevent electrostatic charge build-up.

5.3.3 Properly handle Beryllium Oxide

Beryllium in the form of Beryllium Oxide (BeO) is used in the construction of some components contained in this equipment, most notably flanged RF terminations and occasionally other ceramic insulators.

This material, when in the form of fine powder or vapor, can cause respiratory problems if inhaled into the lungs. In its solid form, as used herein, it can be handled quite safely, but it is prudent to avoid conditions that favor the formation of dust due to surface abrasions.

Because of this risk, great care should be taken when removing and disposing of these components. Do not throw them in containers for generic waste material, industrial or domestic, or send via mail. They must be packed separately and clearly identified to show the nature of the risk, then safely disposed of by authorized personnel for toxic waste.

 WARNING	<p>This label is used for components containing beryllium oxide.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;">  </div> <p>Beryllium oxide dust is dangerous if inhaled.</p>
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5.4 Routine Maintenance Procedures

5.4.1 Periodic maintenance

No.	Type	Frequency	Maintenance instructions
1	Clean air filters	Monthly	<p>The air filter on the front panel should be cleaned every month or whenever it is visibly dirty or obstructed. You do not need to switch off the transmitter nor remove the filter to clean it.</p> <ul style="list-style-type: none"> - Vacuum the dust from the air filter on the front panel with a shop-vac type vacuum cleaner. - Use the vacuum cleaner brush nozzle to remove stubborn dust deposits.
2	Verify LPU (exciter) switchover	Monthly	<p>Periodically simulate a fault by removing the AC mains power to the on-air LPU by opening its circuit breaker on the mains distribution unit. Verify that the control system switches to the reserve LPU and the transmitter returns to full power.</p>
3	Check AC mains tightness	Monthly	<p>It is not uncommon for stranded AC mains wires to work themselves loose during the first months of operation as the strands deform under the pressure of the screw terminal.</p> <ul style="list-style-type: none"> - With the transmitter operating at full power, observe all AC mains terminals and wiring for abnormal heating using an IR thermal camera. - With the AC mains power completely removed, check all AC mains terminals for complete tightness.
4	Inspect surge arrestors	Monthly	<p>Visually inspect the surge arrestors on the rear panel of the mains distribution unit. Replace any arrestor that has a red flag in the transparent plastic window. See Section 5.5.11 for more details.</p>
5	Verify interlocks	Yearly	<p>Periodically exercise any external interlock circuits to verify that the system self-protects. Examples of interlocks are temperature switches on dummy loads, mask filters. Since many interlocks are 'closed = satisfied', it is often sufficient to break continuity by disconnecting the interlock connector to create a trip condition.</p>
6	Replace clock battery	Yearly	<p>Replace the time and date battery when the transmitter loses the ability to keep correct time for the event log timestamps. In the case of multiple-PA systems, this intervention requires removing the transmitter control unit from the rack, removing its top cover and removing the fast ethernet</p>

No.	Type	Frequency	Maintenance instructions
			switch board to gain access to the battery on the controller board. In the case of single-PA systems without a transmitter control unit, the time and date battery in the LPU must be replaced, according to the instructions provided in the LPU manual.

Table 69: Routine maintenance procedures

5.5 Exceptional Maintenance Procedures

5.5.1 Change operating power level

To change the operating power level, enter a new value in dBm in the transmitter control unit web GUI.

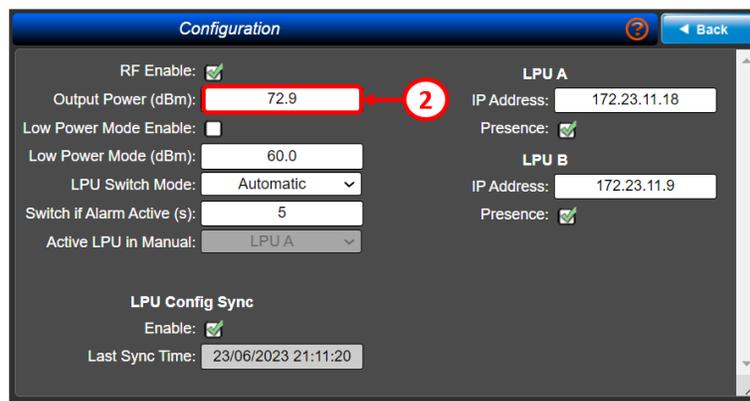


Figure 107: Change operating power level

STEP 1: Navigate to **Home > Config > General** in web GUI interface.

STEP 2: Enter desired operating power level in dBm.

STEP 3: Allow transmitter to slowly adjust to new operating level.

STEP 4: End of procedure.



NOTE

The formula to convert watts to dBm is:

$$dBm = 10 \log (\text{watts} / .001)$$

In the present example: 19500W = 72.9 dBm

5.5.2 Store/recall configuration

The transmitter can store and recall multiple configuration presets. This allows a rapid return to alternate frequency or power levels when needed. In the example below, the user has created a special “half power” preset to operate at reduced power during maintenance periods.

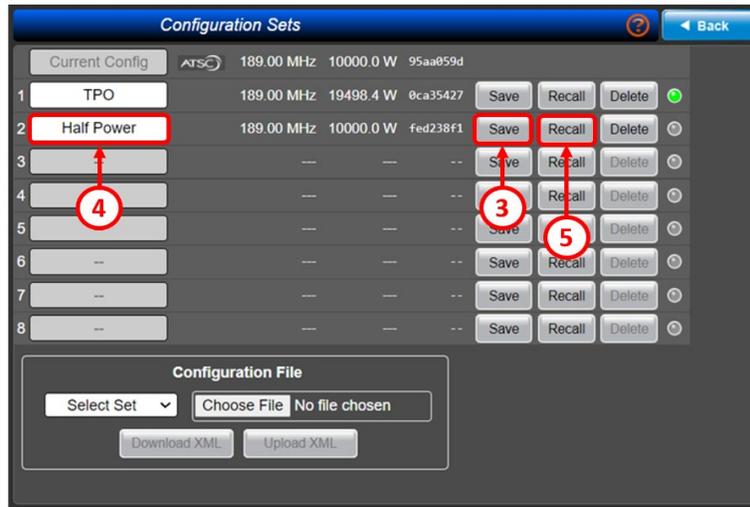


Figure 108: Store/recall configuration

STEP 1: Adjust transmitter to new desired operating point. (output power, frequency, etc.)

STEP 2: Navigate to **Home > Setup > Config Sets** in web GUI interface.

STEP 3: Click **Save** button for next available configuration set.

STEP 4: Give newly created configuration set a recognizable name.

STEP 5: Press **Recall** button for configuration set in question to invoke it at any time.

STEP 6: End of procedure.

5.5.3 Update software

Periodic software updates are generally not required. The software should NOT be updated unless GatesAir has provided specific instructions to do so to correct a shortcoming in its functioning. The update file supplied by GatesAir will have an *imx6* extension.



NOTE

A software update may require up to a 10-minute interruption of transmission.

The user must be logged into a web GUI to perform the steps described in this procedure. The software internal to the transmitter control unit and PA modules is upgraded via the transmitter control unit web GUI, whereas the software internal to the LPU(s) is upgraded via the LPU web GUI(s) at a separate IP address.

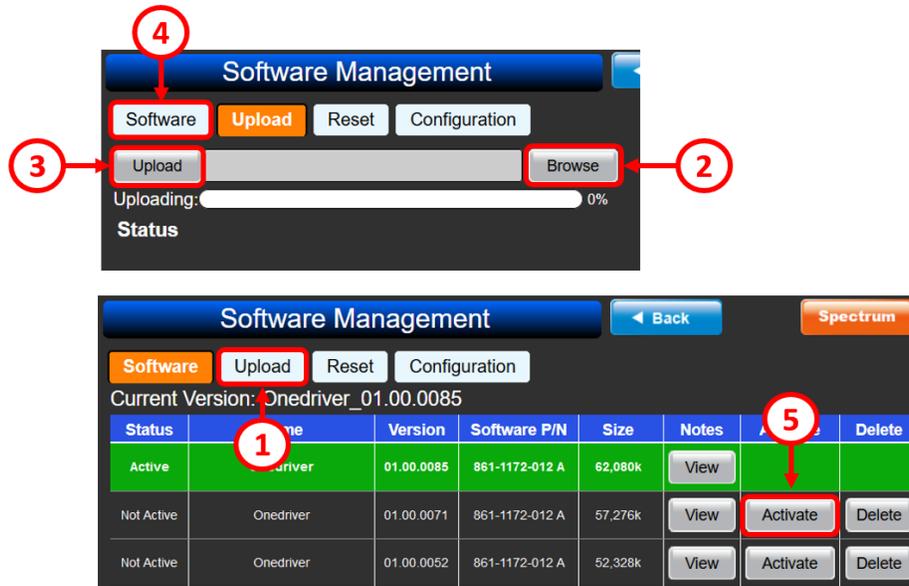


Figure 109: Update software

- STEP 1: Navigate to **Home > Setup > Update** on web GUI. If software package has already been uploaded to memory and is listed in the table of available software versions, skip directly to step 5. Otherwise, press **Upload** button to navigate to software upload page.
- STEP 2: Press **Browse** button and select a suitable upgrade file package on local PC hard drive. An update file supplied by GatesAir will have an *imx6* extension.
- STEP 3: Press **Upload** button to load selected upgrade file into on-board memory.
- STEP 4: Once file has been uploaded, press **Software** button to return to main upgrade page.
- STEP 5: Press **Activate** button for desired software version to put it into effect. Equipment will switch off for several minutes and reboot using new software version.
- STEP 6: End of procedure.

5.5.4 Replace PSU module

The power supply modules in **3.5 RU** style power amplifiers are easily replaced by first removing the PA module front cover, then liberating the plastic cover on the PSU module by means of a spring-loaded lever at its lower corner, then using the cover as an extraction handle to pull the PSU module free of its socket. This operation is detailed in Figure 110.

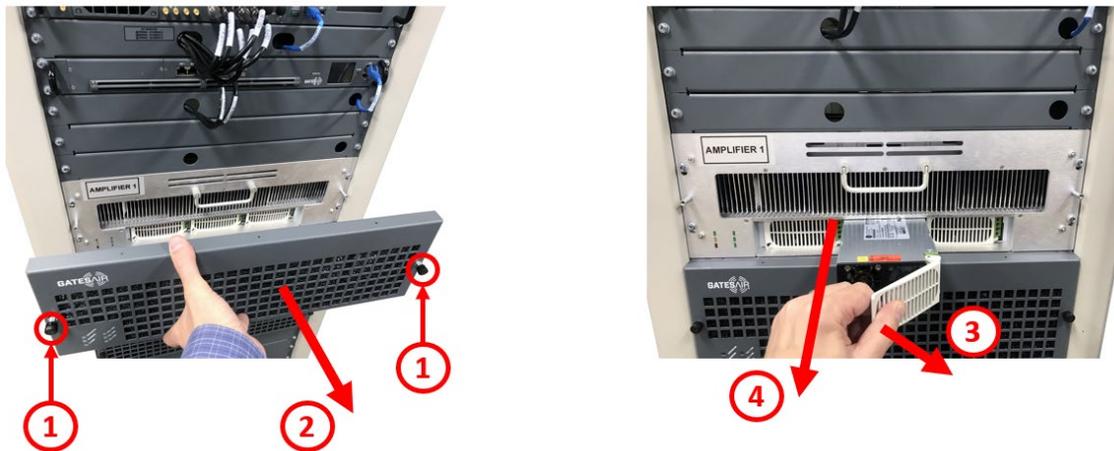


Figure 110: Remove power supply – 3.5 RU PA modules

Snap the plastic cover closed once the replacement power supply module has been fully inserted into its socket.

The power supply modules are fully hot-swappable. It is not necessary to switch the transmitter off nor remove AC mains power to replace a defective unit.

A power supply module in a **2 RU** or **3 RU** style PA module is easily replaced by switching it off via its front panel AC mains switch, loosening the front panel thumbscrews at each end of the module (2 places), then pulling it free of the PA module chassis.

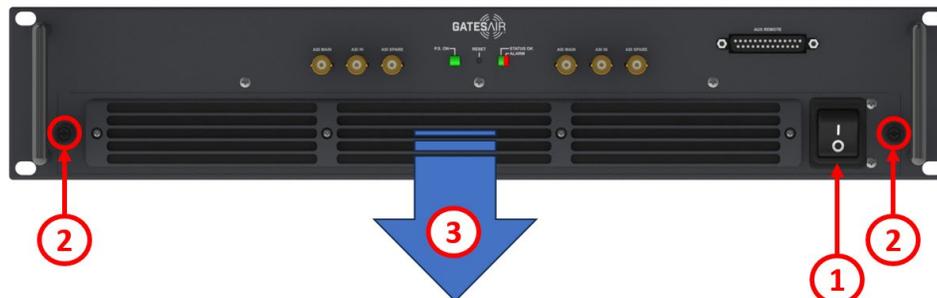


Figure 111: Remove power supply – 2 RU and 3 RU PA modules

The power supply modules used in 3.5 RU style PA modules have no user-serviceable parts. The power supply modules in 2 RU and 3 RU style PA modules, however, can be opened to reveal a series of user-serviceable COTS open-frame switching supplies, as shown in Figure 112.

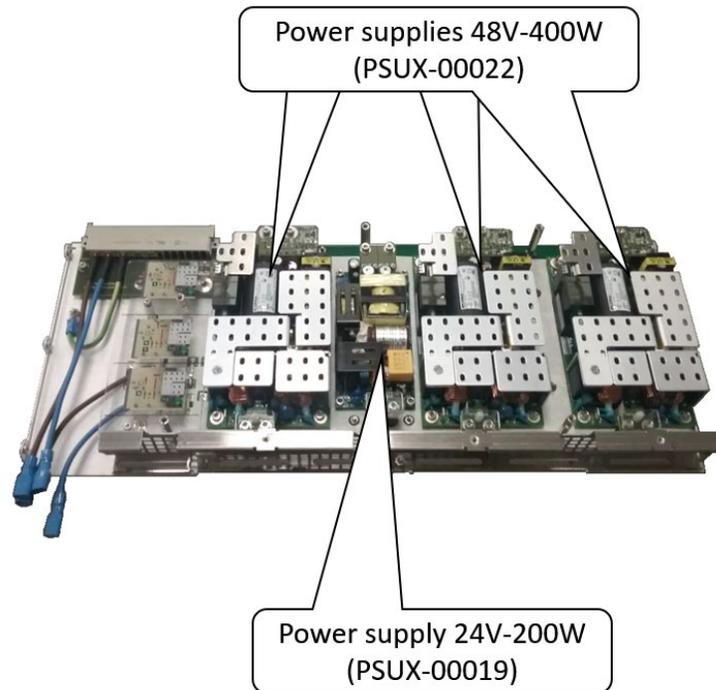


Figure 112: PSUY-00025 power supply tray (covers removed)

5.5.5 Replace PA module cooling fan

The replacement of a PA module cooling fan is relatively straightforward and does not generally require removing the PA module from service to effect the replacement.

For **2 RU** and **3 RU** style PA modules, a cooling fan can be replaced by simply disconnecting the DC power lead to the fan, waiting for the fan blades to stop rotating, mechanically removing the fan and its grille by removing four (4) fixing screws, transferring the grille to the replacement fan, mechanically installing the replacement fan and grille on the PA chassis, and reconnecting the DC power lead.

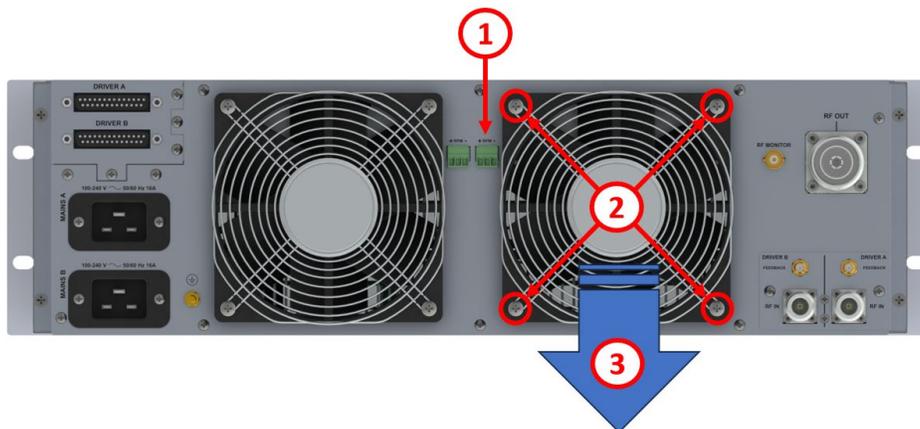


Figure 113: Fan replacement – 3 RU style PA module

For **3.5 RU** style PA modules, the procedure is slightly more complicated because the power connections for the cooling fans are found inside the chassis, behind the cooling fans themselves. This can be seen in Figure 114. This potentially means that a defective fan must be removed for the PA module chassis while it is still receiving DC power. If the fan is still rotating, it may prove difficult to handle because of the flywheel momentum of the rotating blades. Additionally, care must be exercised while handling the protective grille to prevent finger injuries caused by the rotating blades. Accordingly, many customers choose to remove AC mains power to the PA module before proceeding with a fan replacement.

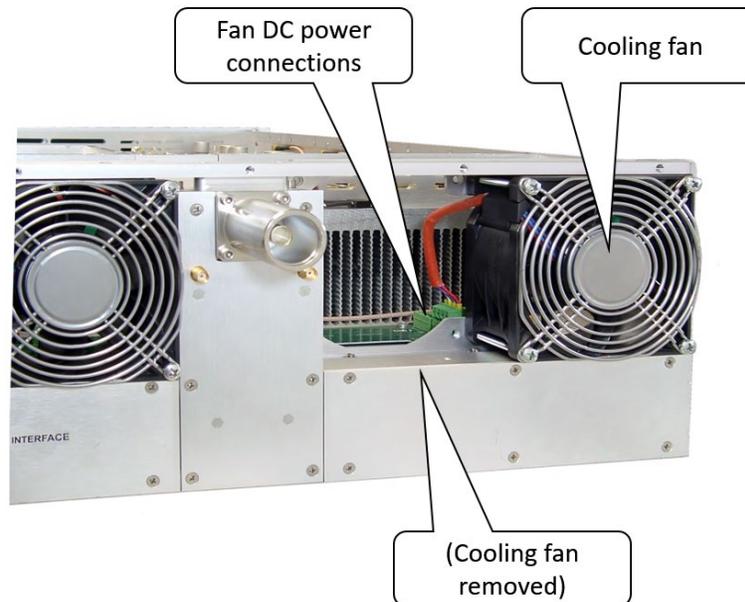


Figure 114: Remove cooling fan – 3.5 RU PA module

5.5.6 Replace RF amplifier module

RF power amplifier replacement can be performed while the transmitter is on-air.

 WARNING	<p>The RF power amplifier modules may be hot after continuous operation. Exercise caution and use protective gloves as required.</p> <div style="display: flex; align-items: center; gap: 10px;">   </div>
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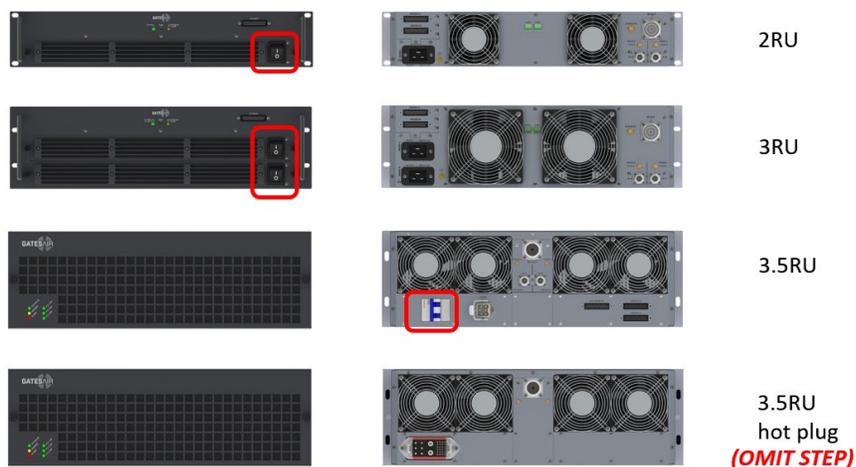
 WARNING	<p>The RF power amplifier modules are heavy and require <u>two people</u> for proper installation.</p> <div style="display: flex; justify-content: center; gap: 10px;"> </div>
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 CAUTION	<p>Be careful not to pinch or crush fingers when inserting or removing a power amplifier module from the transmitter rack.</p> <div style="display: flex; justify-content: center; gap: 10px;"> </div>
--------------------	--

Tools required:

- #1 star (Phillips) screwdriver

STEP 1: Switch off desired amplifier by means of its AC mains switch(es). Switch location will vary according to amplifier type, as shown below. Omit this step for 3.5RU hot plug amplifiers, as AC mains power will automatically be removed as amplifier is pulled free from rack.



Switch off AC mains power

Figure 115: Switch off AC mains power

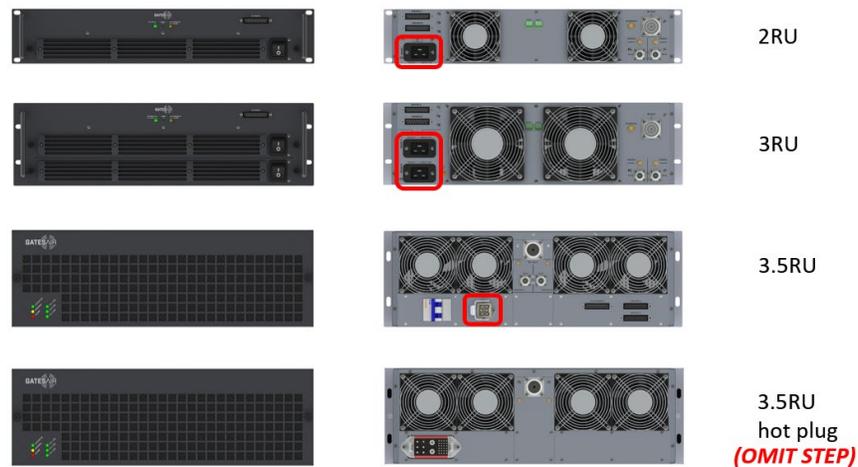
Output power will decrease according to this formula:

$$P_{OUT} = P_{ORIGINAL} \left(\frac{AMPLIFIER_{NUMBER} - FAILED_AMPLIFIER_{NUMBER}}{AMPLIFIER_{NUMBER}} \right)^2$$

For example, the resulting power when 1 module is switched off in a 4-module 6 kW system is given by:

$$P_{OUT} = 6000 W \left(\frac{4 - 1}{4} \right)^2 = 6000 W \left(\frac{9}{16} \right) = 3375 W$$

STEP 2: Break AC mains connection by physically removing AC mains cord. Omit this step for 3.5RU hot plug amplifiers, as AC mains power connection will automatically break as amplifier is pulled free from rack.



Break AC mains connection

Figure 116: Break AC mains connection

STEP 3: Remove four (4) screws fixing amplifier drawer to rack cabinet rails, as shown in Figure 117.

3.5 RU PA modules: remove front panel first by loosening two (2) thumbscrews to gain access to rack fixing screws underneath.

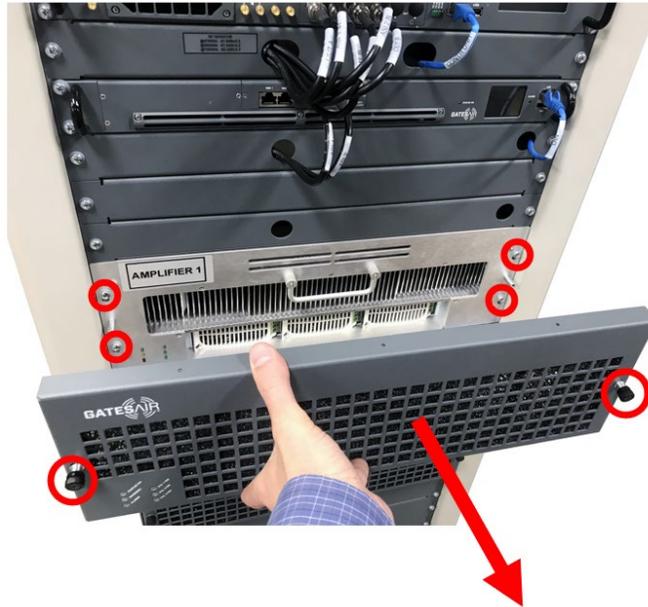
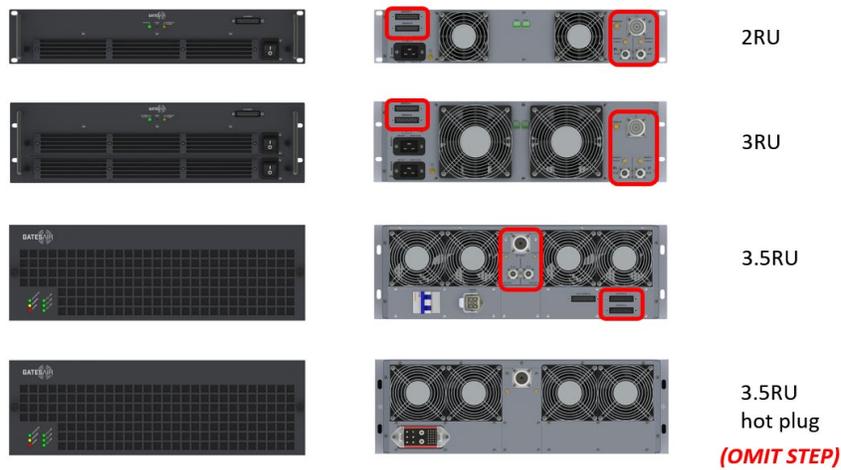


Figure 117: Remove fixing screws

STEP 4: Proceed to manually break all AC mains, control and RF connections at rear panel of module.



Break all other connections

Figure 118: Manually break connections to PA module

STEP 5: Pull hard on amplifier extraction handles to slide it out from rack cabinet until a stop is felt.



Figure 119: Extracting the amplifier

STEP 6: Once stop has been reached with amplifier partially extracted from rack cabinet, unlock both sliding guides by actuating security lock levers on each side of amplifier drawer.

	<p>NOTE With certain slide types, the security lock lever on the right side must be pushed downward and the security lock lever on the left side pulled upward to unlock the slides. With other slide types, the two security lock levers must be pushed inwards to unlock the slides.</p>
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Figure 120: Unlocking sliding guides

STEP 7: Completely remove power amplifier drawer from rack cabinet.

STEP 8: Verify that replacement amplifier part number and AC mains configuration matches those of unit being removed from service.

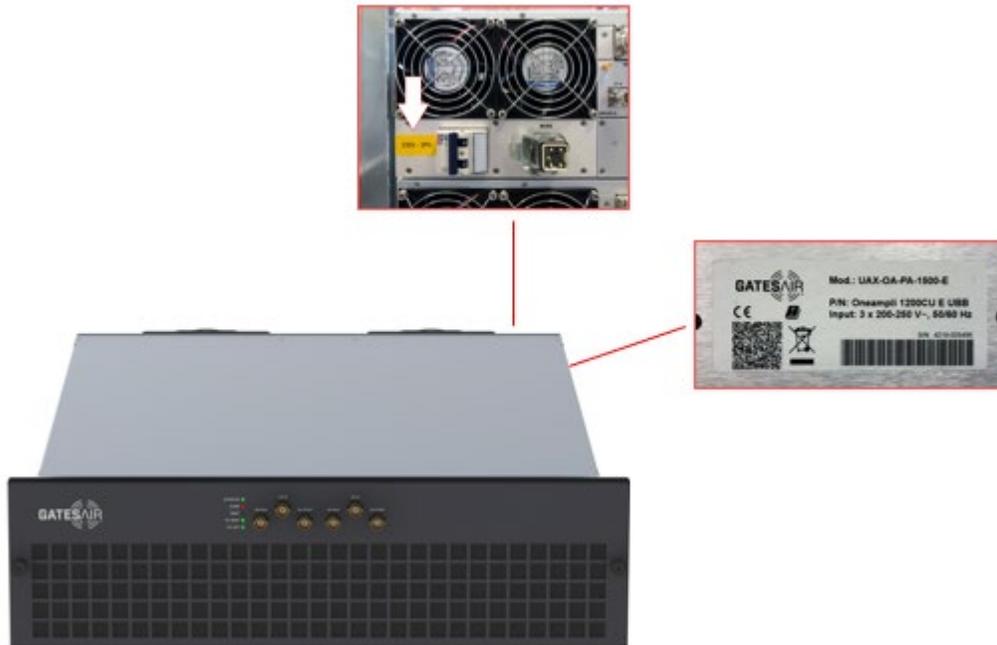


Figure 121: AC mains and ID sticker

 <p>CAUTION</p>	<p>It is imperative that the replacement module match the original module in both part number and AC mains configuration. Otherwise, damage to the PA module and/or transmitter could result. If both items do not match, contact your local GatesAir representative or GatesAir customer service for further instructions.</p>
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STEP 9: Replace failed amplifier with a replacement unit. RF amplifier installation instructions are found in Section 2.5 of this manual.

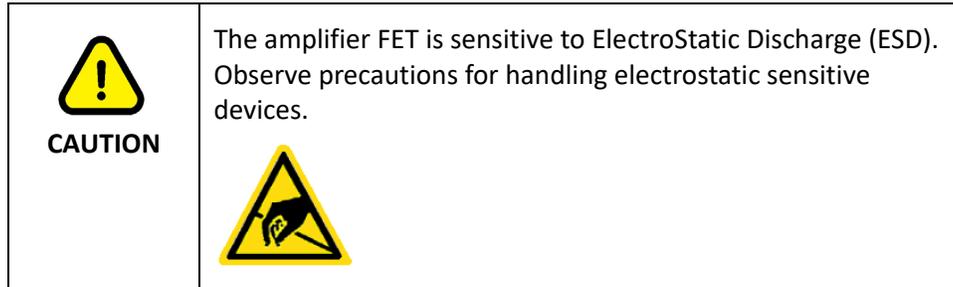
STEP 10: Verify replacement amplifier is fully inserted.

STEP 11: Apply AC mains power to replacement unit.

STEP 12: End of procedure.

5.5.7 Replace RF amplifier pallet (VHF)

Should an RF amplifier pallet develop a failure, it will become necessary to remove the affected PA module from service and replace the defective pallet. The discussion in this section applies to VHF Band 1 and VHF Band 3 amplifiers. UHF Band 4/5 amplifiers are discussed separately in a subsequent section of this manual.



Tools required:

- #1 star (Phillips) screwdriver
- Ohmmeter
- Torque wrench with #2 star (Phillip) or 3 mm hex insert
- Thermal compound (GatesAir MCON-00004 or Wakefield 120-8 or equivalent)
- Ink roller or straight edge for spreading thermal compound
- Soldering iron, solder and solder wick
- "Exacto" razor knife
- Replacement solder tabs (GatesAir 2520420000A or equivalent)
- Replacement solder tabs (GatesAir 2520465000 or equivalent)
- Automotive fuse 15A (GatesAir FUSX-00010 or equivalent)

Before starting work, review the following good engineering practices related to this procedure:

- If possible, use new fasteners when reassembling the module.
- Avoid the use of excessive heat when soldering, which may damage components or boards.
- All leads and pads should be tinned prior to soldering.
- New jumper ribbons should be used at the RF input and output connections.
- Install all fasteners in each subassembly prior to tightening them.

STEP 1: Navigate to **Home > Amplifier > Amp N** in web GUI to identify which amplifier pallet inside PA module is defective, as evidenced by abnormally low current consumption relative to remaining pallets in PA module.

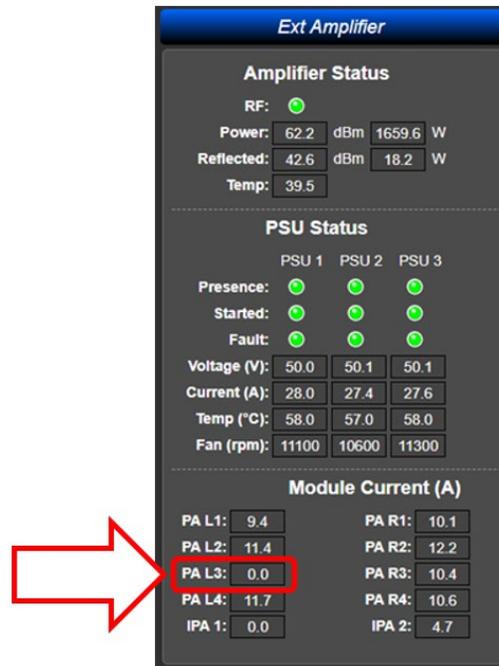


Figure 122: Locate defective pallet

STEP 2: Remove affected PA module from transmitter and allow it to cool down before starting work. See Section 5.5.6 for more detailed instructions on removing a PA module.

STEP 3: Remove top cover of PA module to gain access to RF amplifier pallets.

STEP 4: Carefully inspect inner workings of PA module for any obvious signs of damage. Look for signs of heat stress or burn marks. If a pallet is suspected of being damaged based on a GUI low/zero PA current reading, locate suspect pallet by its ID number in Figure 123.

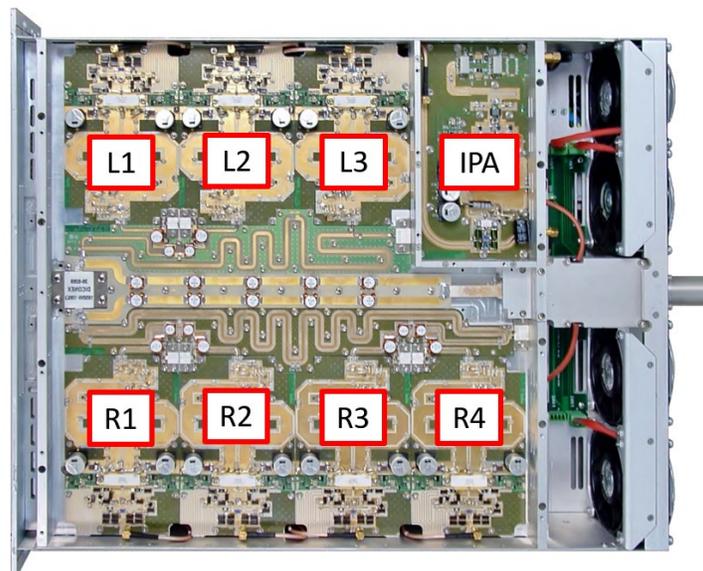


Figure 123: RF amplifier pallet positions, VHF 3.5 RU PA module

STEP 5: Verify failed status of suspect pallet(s) by measuring resistance-to-ground of each FET gate tab (2 places) with an ohmmeter, as shown in Figure 124. In general, a reading of less than 200 ohms on either tab indicates a failed FET, thus requiring a pallet replacement.



Figure 124: FET resistance test

STEP 6: Carefully desolder input and output connections at locations shown in Figure 125. Avoid using excess heat that could damage PC board. Use a solder removal tool as required to remove excess solder and jumpers. Discard old jumpers; it is generally necessary to install new jumpers after a pallet is replaced.

STEP 7: Remove fasteners circled in red in Figure 125. Depending on pallet vintage, fasteners may be M4 machine screws or 3 mm hex screws.

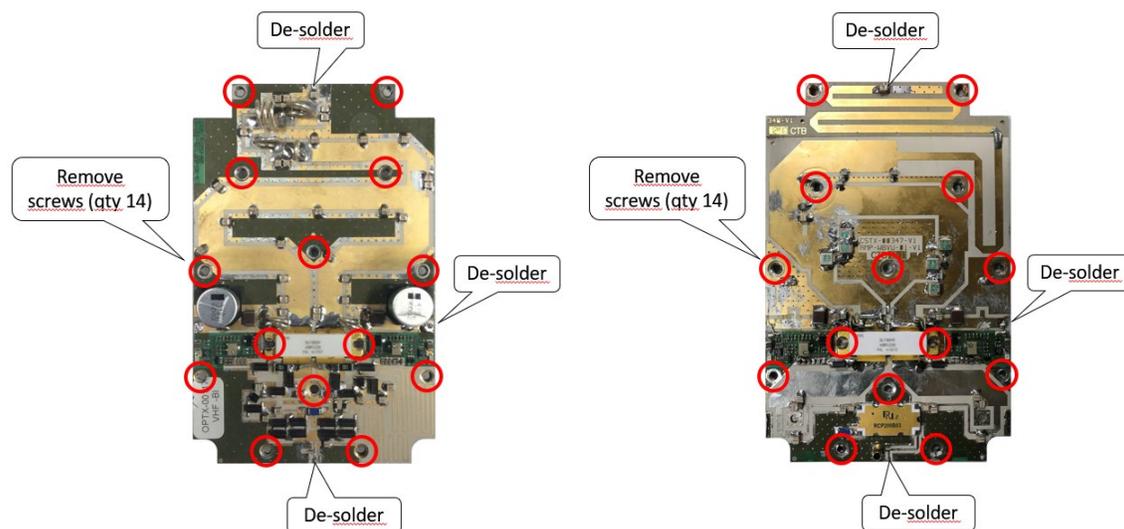


Figure 125: RF pallet removal – Band 1 (left) or Band 3 (right)

STEP 8: See note below, then remove defective pallet and clean up any heat transfer compound remaining on PA module baseplate where pallet was previously attached.

 NOTE	Removal of the pallet may be difficult due to the presence of heat transfer compound under the pallet. Insert a flat blade screwdriver beneath the edge of the pallet baseplate where it meets the aluminum heatsink assembly. Use the screwdriver to gently pry upward without placing stress on adjacent components. Repeat this process along the edges of the pallet in several places until it loosens up. Take care not to scratch the pallet baseplate or heatsink surfaces. The pallet should be lifted straight up off the heatsink to avoid damaging connections coming up from below.
--	--

STEP 9: Apply heat transfer compound to replacement pallet baseplate. Use a small roller (ink roller) or a flat piece of flexible plastic to apply an even, thin coat.

STEP 10: Carefully seat new pallet on heatsink baseplate.

STEP 11: Install pallet hold-down screws, but don't tighten them until all screws are in place.

STEP 12: Tighten pallet hold-down screws to a torque of 1.35 N-m (12 lbs-inch).

STEP 13: Solder two ribbon connections between pallet/splitter and pallet/combiner. Use new jumpers - GatesAir (252-0420-000A) and (252-0465-000) or equivalent.

STEP 14: Solder connection to the 50V DC input pin, as shown at far right of Figure 125.

 NOTE	3.5 RU PA modules: When a pallet fails, its corresponding fuses may also blow open and thus require replacement as well. These fuses are located on the bottom side of the PA module and their replacement requires the removal of the PA module bottom cover, as shown in Figure 126. To remove the bottom cover, remove all screws from the bottom cover face, as well as a series of screws on the PA module side wall around the cover periphery. Use a small flat-blade screwdriver to carefully pry the cover free of the PA module chassis.
--	---

STEP 15: Check affected fuses for continuity with an ohmmeter and replace any open-circuited fuses.

STEP 16: Inspect and clean up all newly soldered connections.

STEP 17: Replace all covers and hardware.

STEP 18: End of procedure.

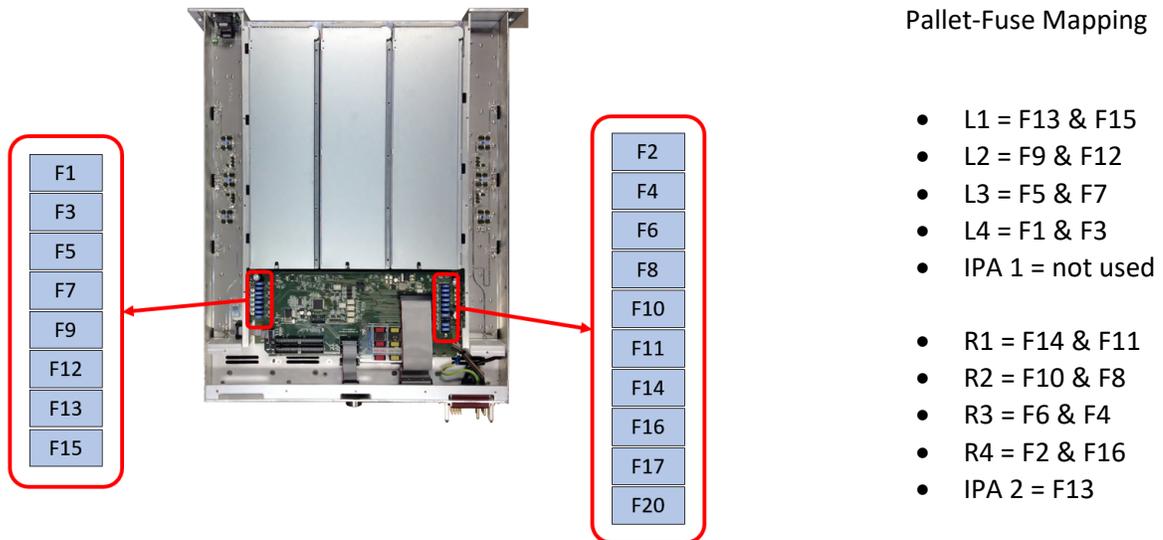


Figure 126: 3.5 RU PA module – bottom view

5.5.8 Replace RF amplifier FET (UHF)

Should an RF amplifier FET develop a failure, it will become necessary to remove the affected PA module from service and replace the defective FET. The discussion in this section applies to UHF Band 4/5 amplifiers. VHF Band 1 and VHF Band 3 amplifiers are discussed separately in a previous section of this manual.

 CAUTION	<p>The amplifier FET is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices.</p> 
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Tools required:

- #1 star (Phillips) screwdriver
- Ohmmeter
- Torque wrench with #2 star (Phillip) or 3 mm hex insert
- Silver conductive thermal grease (Circuit Works CW7100 or equivalent)
- Soldering iron (JBC 120W soldering station with C245741 tip, or equivalent)
- Solder wick (Techspray 1823-10F #4 or equivalent)
- Lead free solder
- Paper towel and isopropyl alcohol
- "Exacto" razor knife
- Automotive fuse 15A (GatesAir FUSX-00010 or equivalent)

Before starting work, review the following good engineering practices related to this procedure:

- Use a soldering iron and tip properly sized for the job. As soldering iron of at least 120 watts with an extra wide tip is recommended.
- Avoid the use of excessive heat when soldering, which may damage components or boards.
- Install all fasteners in each subassembly prior to tightening them.
- Note that the heat transfer compound is electrically conductive grease. Clean up any excess to prevent short circuits.

STEP 1: Navigate to **Home > Amplifier > Amp N** in web GUI to identify which amplifier pallet inside PA module is defective, as evidenced by abnormally low current consumption relative to remaining pallets in PA module.

Current (A)					
PA L1	7.0	4.6	PA R1	6.2	5.3
PA L2	6.1	4.6	PA R2	6.1	5.6
PA L3	4.9	0.0	PA R3	4.6	5.9
PA L4	6.1	6.5	PA R4	5.1	6.6



Figure 127: Locate defective pallet

STEP 2: Remove affected PA module from transmitter and allow it to cool down before starting work. See Section 5.5.6 for more detailed instructions on removing a PA module.

STEP 3: Remove top cover of PA module to gain access to RF amplifier pallets.

STEP 4: Carefully inspect inner workings of PA module for any obvious signs of damage. Look for signs of heat stress or burn marks. If a FET is suspected of being damaged based on a web GUI low/zero PA current reading, locate suspect FET by its ID number in Figure 128.

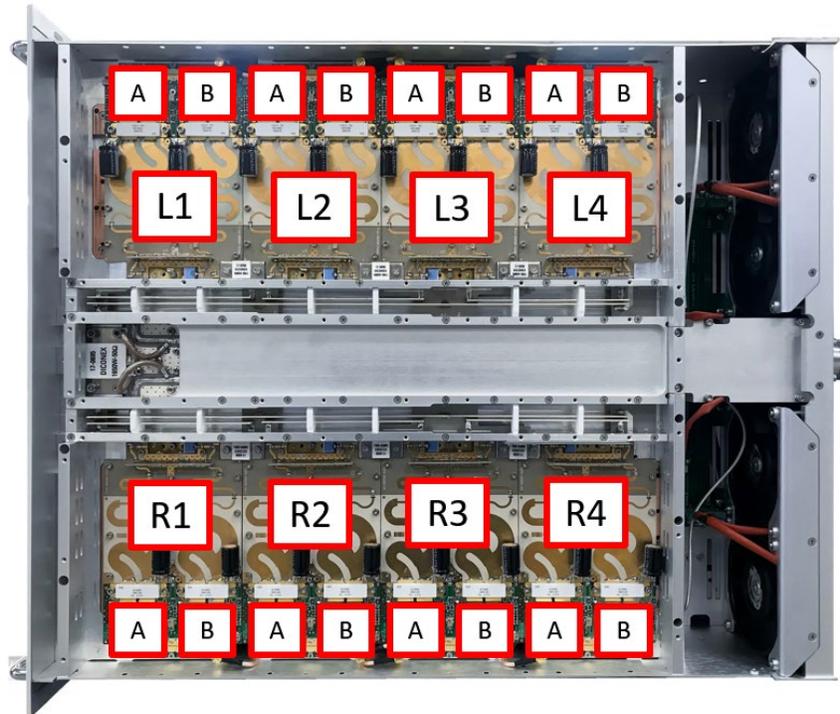


Figure 128: RF amplifier pallet positions, UHF 3.5 RU PA module

STEP 5: Verify failed status of suspect FET(s) by measuring resistance-to-ground of each FET gate tab (2 places) with an ohmmeter, as shown in Figure 129 and Figure 130. Left-side tab should read 16 ohms +/- 3 ohms, while right-side tab should read 295 ohms +/- 10 ohms. A reading outside of these ranges indicates a failed FET, thus requiring a FET replacement.



Figure 129: FET resistance test, left gate tab



Figure 130: FET resistance test, right gate tab

STEP 6: Remove defective FET by unsoldering tabs (4 places) and removing flange mounting bolts (2 places). Optionally remove and set aside drain choke coils highlighted in dashed yellow (2 places). Use solder wick to remove solder from under all four FET tabs, as shown in Figure 132, prior to attempting to pry FET up from heatsink base.

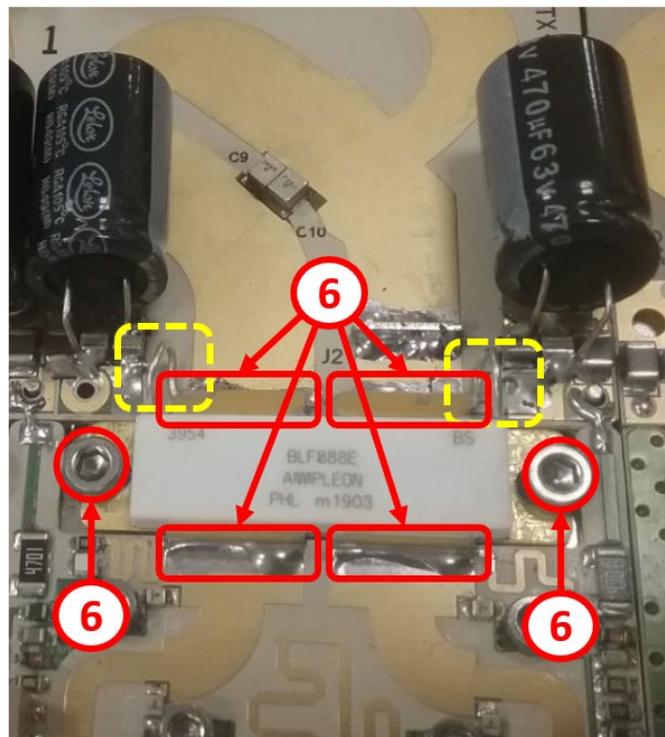


Figure 131: Remove old FET

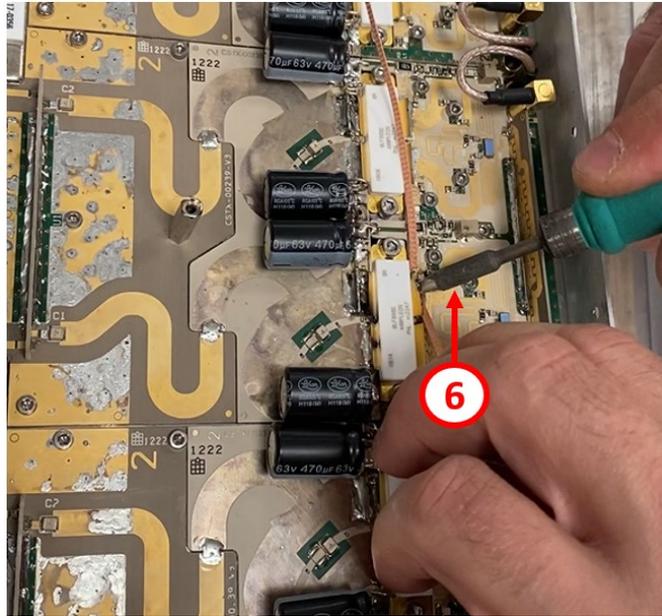


Figure 132: Remove solder from under tabs with solder wick

STEP 7: Use solder wick and a paper towel moistened with alcohol to clean all remaining solder, flux and thermal grease from heat sink baseplate and adjacent circuit traces.

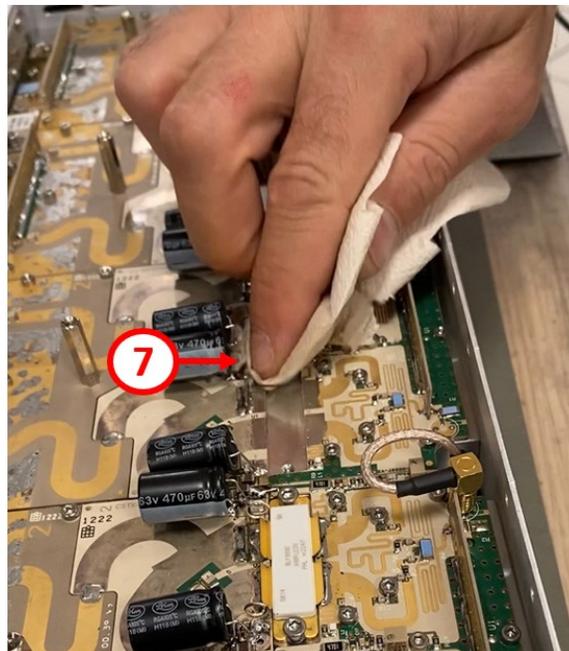


Figure 133: Clean up FET mounting area

STEP 8: Prepare replacement FET by bending its tabs upwards at a 45 angle.

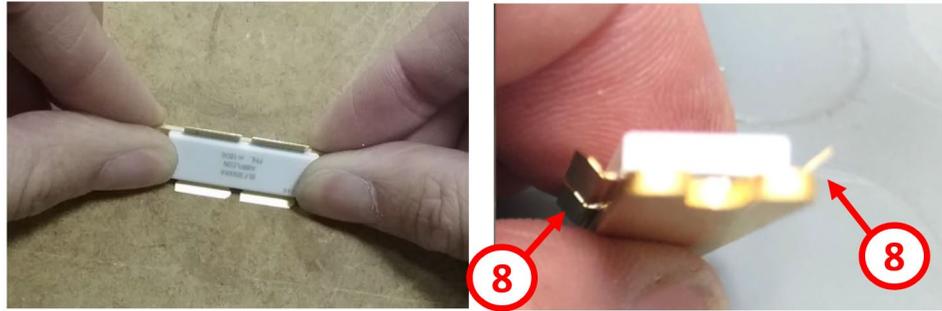


Figure 134: Prepare new FET, bend tabs

STEP 9: Apply a thin coat of thermal grease to underside of replacement FET mounting flange. Use fingertip to spread grease thinly and evenly.

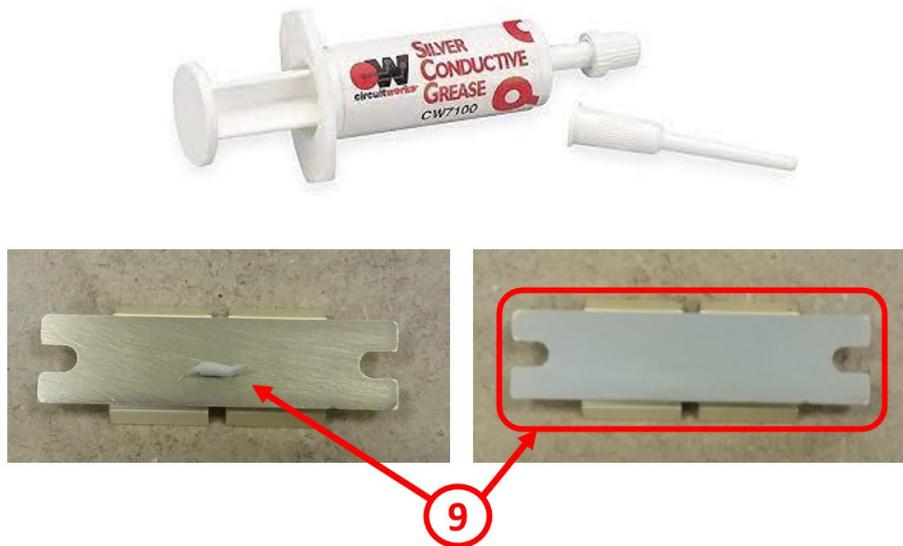


Figure 135: Apply thermal grease

STEP 10: Remove excess thermal grease from sides of mounting flange to keep it far from FET tabs and thus minimize any risk of short circuits.



Figure 136: Remove excess thermal grease

STEP 11: Install replacement FET, observing correct orientation of drain tab notch: Rub transistor mounting flange back and forth laterally across heat sink base to ensure that thermal grease fills all microscopic gaps between flange and heatsink. Then, install flange mounting bolts but do not tighten (2 places). Use a small screwdriver to press FET as far as possible towards output PCB before proceeding to tighten flange mounting bolts. Tighten flange mounting bolts to 0.7 N-m (6 lbs-in) of torque.

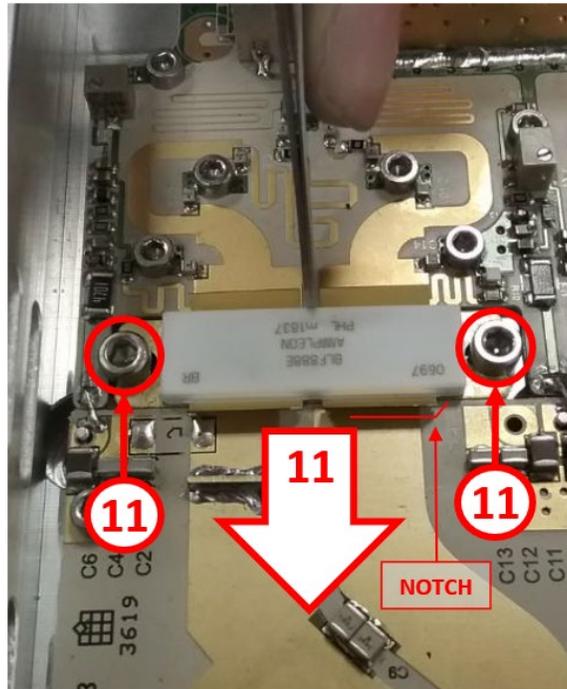


Figure 137: Install new FET

STEP 12: Solder replacement FET tabs to surrounding PC boards. (4 places)

STEP 13: Solder drain choke coils to replacement FET drain tabs (2 places)

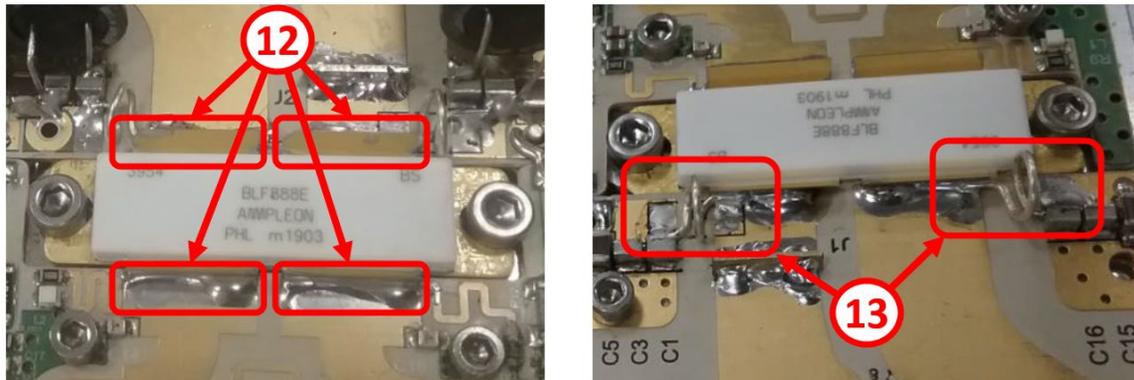


Figure 138: Solder new FET

STEP 14: Perform a final resistance check of newly installed FET. Verify that measured gate resistances are approximately 16/300 ohms and measured drain resistance is greater than 1 kilohm.

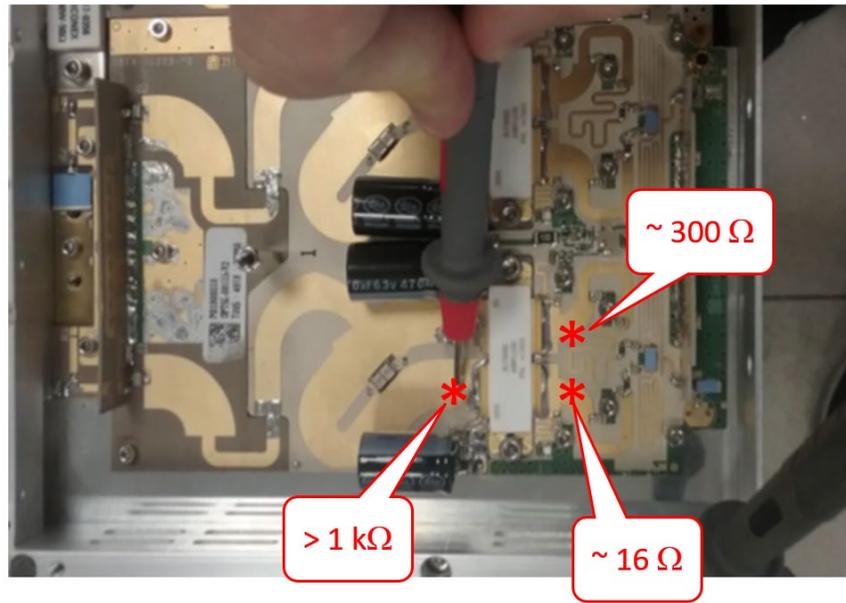


Figure 139: Resistance check, new FET



NOTE

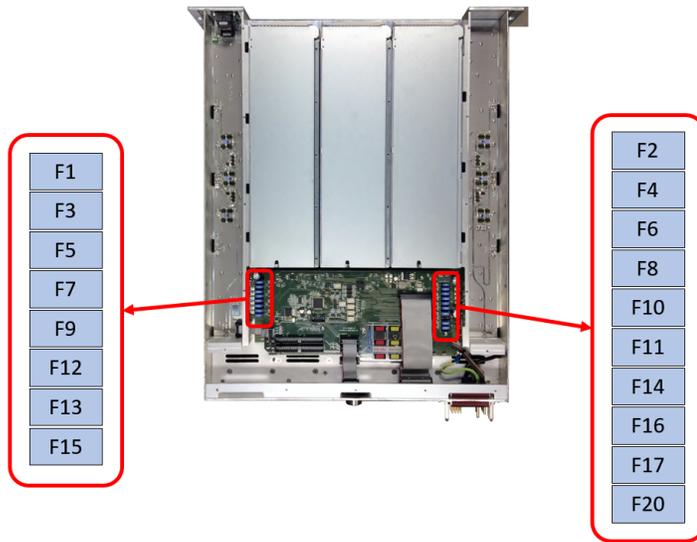
3.5 RU PA modules: When a FET fails, its corresponding fuse may also blow open and thus require replacement as well. The fuse is located on the bottom side of the PA module and its replacement requires the removal of the PA module bottom cover, as shown in Figure 140. To remove the bottom cover, remove all screws from the bottom cover face, as well as a series of screws on the PA module side wall around the cover periphery. Use a small flat-blade screwdriver to carefully pry the cover free of the PA module chassis.

STEP 15: Check affected fuses for continuity with an ohmmeter and replace any open-circuited fuses.

STEP 16: Inspect and clean up all newly soldered connections.

STEP 17: Replace all covers and hardware.

STEP 18: End of procedure.



FET-Fuse Mapping

- L1A = F15
- L1B = F13
- L2A = F12
- L2B = F9
- L3A = F7
- L3B = F5
- L4A = F3
- L4B = F1
- IPA 1 = not used

- R1A = F14
- R1B = F11
- R2A = F10
- R2B = F8
- R3A = F6
- R3B = F4
- R4A = F2
- R4B = F16
- IPA 2 = F17 & F20

Figure 140: 3.5 RU PA module – bottom view

5.5.9 Replace combiner ballast load

A series of combiner ballast loads absorb any rejected power due to amplifier imbalances in the output combiner. When the transmitter is operating normally with all power amplifier modules producing equal power and phased correctly, the ballast loads dissipate virtually no power. For this reason, the failure of a ballast load is an exceedingly rare occurrence. Should a ballast load fail, its failure is most likely to be detected when one or more power amplifiers have switched off or have been removed for servicing. A reflected power alarm in one or more PA modules when a different PA module is switched off is a classic symptom of poor output combiner isolation due to failed combiner ballast loads.

Figure 141 shows the combiner loads assembly removed from the transmitter for servicing purposes.



Figure 141: Combiner loads assembly

The procedure below details the replacement of an individual combiner ballast load.

Tools required:

- #1 star (Phillips) screwdriver
- Ohmmeter
- Torque wrench with #2 star (Phillip) or 3 mm hex insert.
- Diagonal cutters.
- Thermal compound (GatesAir MCON-00004 or Wakefield 120-8 or equivalent)
- Ink roller or straight edge for spreading thermal compound
- Soldering iron, solder and solder wick
- "Exacto" razor knife
- Coarse grit sandpaper (220-250 grit)

Before starting work, review the following good engineering practices related to this procedure:

- Avoid the use of excessive heat when soldering, which may damage components or boards.
- All leads and pads should be tinned prior to soldering.
- Install all fasteners in the load prior to tightening them to the required torque spec.
- Observe safety precautions concerning the possible presence of Beryllium Oxide dust.

 <p>WARNING</p>	<p>Beryllium oxide may be present in the ballast load ceramic. Exercise caution in the presence of any ceramic dust.</p> <div data-bbox="662 567 1149 808"><table border="1"><tr><td></td><td>CAUTION</td></tr><tr><td colspan="2">TOXIC BERYLLIUM</td></tr><tr><td colspan="2">Consult technical manual before handling</td></tr></table></div> <p>Beryllium oxide dust is dangerous if inhaled. Use appropriate PPE as needed.</p> <div data-bbox="544 913 876 1029"></div>		CAUTION	TOXIC BERYLLIUM		Consult technical manual before handling	
	CAUTION						
TOXIC BERYLLIUM							
Consult technical manual before handling							

STEP 1: Gain access to combiner load input port(s) by breaking RF coaxial cable connection(s) at either load assembly input(s) or RF combiner reject output(s).

STEP 2: Measure resistance between inner and outer at each load assembly input port with an ohmmeter. A reading of 25 ohms +/- 3 ohms should be obtained (two 50-ohm loads connected in parallel). A measured value outside this range indicates a ballast load failure.



Figure 142: Measure load port resistance

- STEP 3: Remove combiner loads assembly cover to gain access to individual ballast loads.
- STEP 4: Visually inspect individual ballast loads for obvious signs of damage, such as burning or cracking.
- STEP 5: Gently desolder and pry up tabs to suspected ballast loads to check their resistance to ground individually.
- STEP 6: Remove any ballast load with a resistance other than 50 ohms +/- 3 ohms and proceed with its replacement.
- STEP 7: Check flatness of mounting flange of replacement load by rubbing it in circles across a piece of coarse grit sandpaper, as shown in Figure 143.

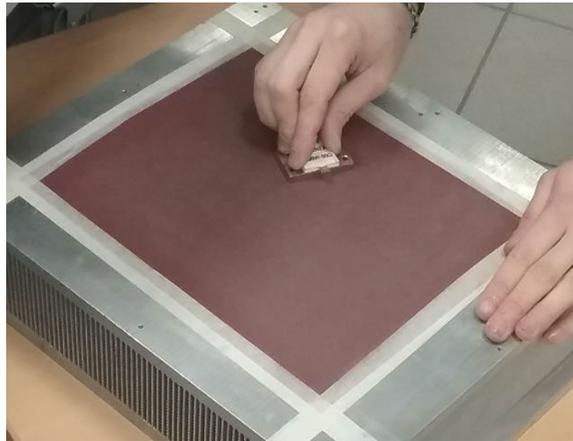


Figure 143: Check load mounting flange flatness

STEP 8: Visually inspect results of sandpaper test. A good flange will have abrasion marks spread equally across its entire bottom surface. A bad flange will have uneven abrasion marks across only a portion of its surface.

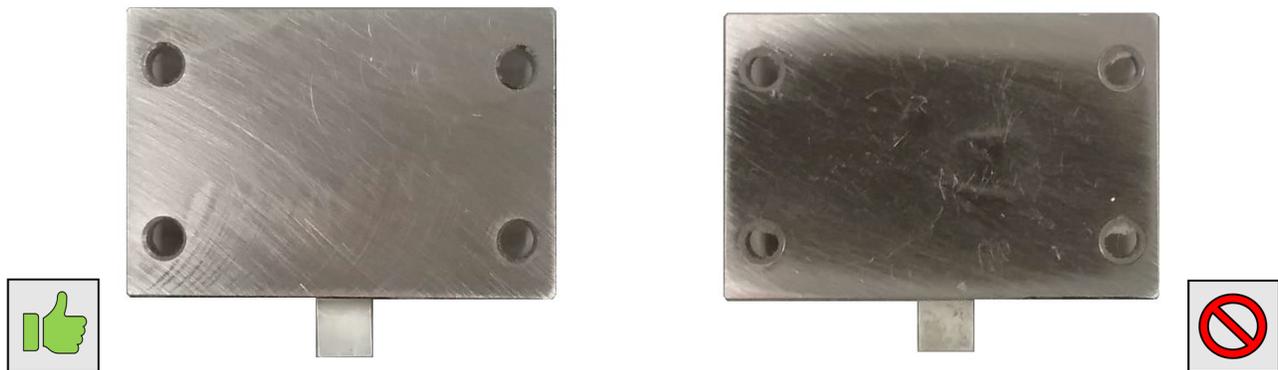


Figure 144: Results of sandpaper test

STEP 9: In the case of poor mounting flange flatness, continue to rub load flange across sandpaper until a satisfactory result is obtained.

STEP 10: Add thermal compound to replacement load mounting flange and spread to a thin even coat with a straight-edge tool.



Figure 145: Spread thermal compound on mounting flange

- STEP 11: Trim replacement load solder tab with diagonal cutters to match PC board artwork, as necessary.
- STEP 12: Install replacement load in load assembly and tighten 4 hex bolts to 1.8 N-m (16 lbs-in) of torque.
- STEP 13: Solder replacement load solder tab to PC board.
- STEP 14: Verify correct resistance with ohmmeter and reverse previous steps to place repaired load assembly back into service.
- STEP 15: End of procedure.

5.5.10 Replace circuit breaker

Should an individual circuit breaker fail in a larger system with a dedicated AC mains distribution unit, it can be replaced without taking the mains distribution unit out of the transmitter rack.

 <p>WARNING</p>	<p>Dangerous voltages present. Remove all power to the affected cabinet before starting work. Lock out the mains source to the cabinet to eliminate the possibility of an accidental reapplication of power while the work is being performed.</p>  
---	--

Tools required:

- #1 star (Phillips) screwdriver.
- 3 mm flat (slotted) screwdriver.
- Needle nose pliers or forceps.

- STEP 1: Remove all power to affected cabinet and lock out mains disconnect device to prevent an accidental reapplication of power while work is being performed.
- STEP 2: Remove four (4) rack fixing screws from front panel and slide entire chassis forward from rack approximately ten (10) centimeters, or as permitted by available slack in cables connected to unit at rear panel.
- STEP 3: Remove two (2) rack handles from front panel by loosening four (4) fixing machine screws around back side of front panel.
- STEP 4: Remove front panel by removing four (4) machine screws around its periphery, as shown in Figure 146.



Figure 146: Remove front panel

- STEP 5: Loosen screw terminals at top and bottom of defective circuit breaker and pull wires clear of breaker terminals. A pair of needle nose pliers or forceps may prove useful for this step.
- STEP 6: Mechanically release defective circuit breaker from DIN mounting rail by sliding one or two small plastic retaining clips. GEWISS-brand circuit breakers have a pair of orange retaining clips and will pull out horizontally, while ABB-brand circuit breakers have a single black tab and must be rotated upwards for extraction.

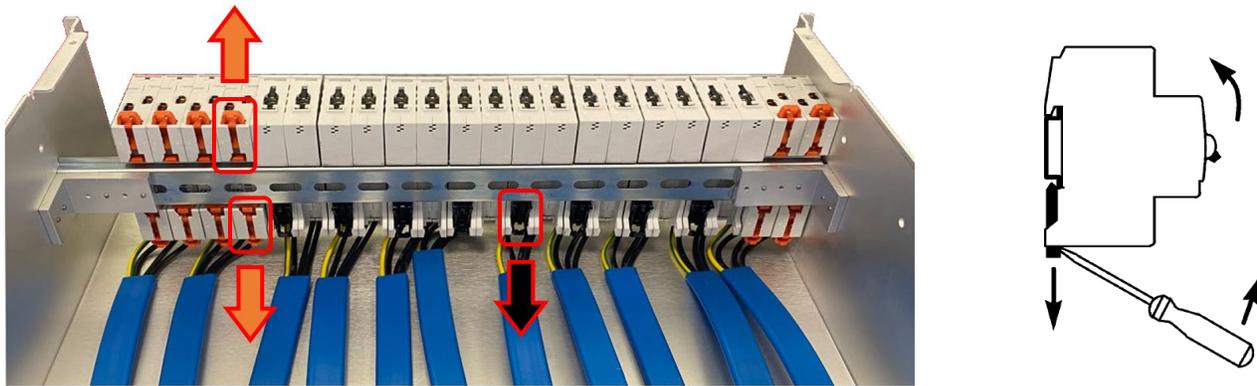


Figure 147: Circuit breaker retaining clips



NOTE

Figure 147 shows a partially disassembled chassis for illustration purposes only. The view shown in Figure 147 will not be present during the circuit breaker replacement procedure.

STEP 7: Mechanically snap replacement circuit breaker onto DIN rail and secure with retaining clips.

STEP 8: Install wires to replacement circuit breaker and tighten screw terminals. A pair of needle nose pliers or forceps may prove useful for this step.

STEP 9: Perform a spot check of wire tightness on all other breakers while chassis is still open.

STEP 10: Execute previous disassembly steps in reverse order to return unit to service.

STEP 11: End of procedure.

5.5.11 Replace surge arrestor

The surge arrestors in the mains distribution unit should be checked regularly to ensure continued protection against incoming AC mains transients. A spent module will have a red indicator in its clear plastic display window, thus indicating that it requires replacement. Surge arrestor modules are hot pluggable – they can be inserted and removed while the transmitter continues to operate.

Replacement surge arrestors are available in complete 4-arrestor block form from GatesAir as part number INTX-00085 or as individual single-phase modules from Lovato as part number SAX00PA320.



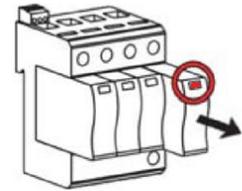
SAX00PA320

Plug-in cartridge, for SA0... Types

Type of product: Spare Parts

Type of spare parts: Plug-in cartridge

Spare parts for: SA0...



Order code	SAX00PA320
Weight [g]	105
Qty. per package	1
Multiple qty. of packs per order	1
Package dimensions [mm]	050X022X052
Volume [cm ³]	57.2
Bar code [EAN13]	8013975191811
HS Code	85365080

Figure 148: Surge arrester module

5.5.12 Calibrate power readings

 CAUTION	<p>The concepts and procedures discussed in this section are reserved for only the most advanced users. A special factory-only permission is required to access the Calibration Data web page discussed below. Contact GatesAir Customer Service for more information.</p>
---	--

 NOTE	<p>The discussion in this section applies only to larger systems with two or more PA modules. For smaller, single-PA systems without a transmitter control unit, please consult the LPU manual DOCX-00014 for more information on calibrating its power meters.</p>
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Power metering calibration information is stored on-board the transmitter control unit. Power measurements are calibrated in the factory over the full power range before shipment. Therefore, it is not necessary to revisit their calibration in the field, even after a power level change.

Nevertheless, component replacement or other factors may create the need to recalibrate the transmitter power readings. A special web GUI page allows the meter calibrations to be updated in the field. Consult Section 5.5.13 for detailed information on the calibration web GUI page discussed in this section.

The power reading calibration data is presented in the form of a lookup table relating the transmitter power (in dBm x 10 format) and the expected RF detector voltage at that power level. This can be seen in Figure 149, below.

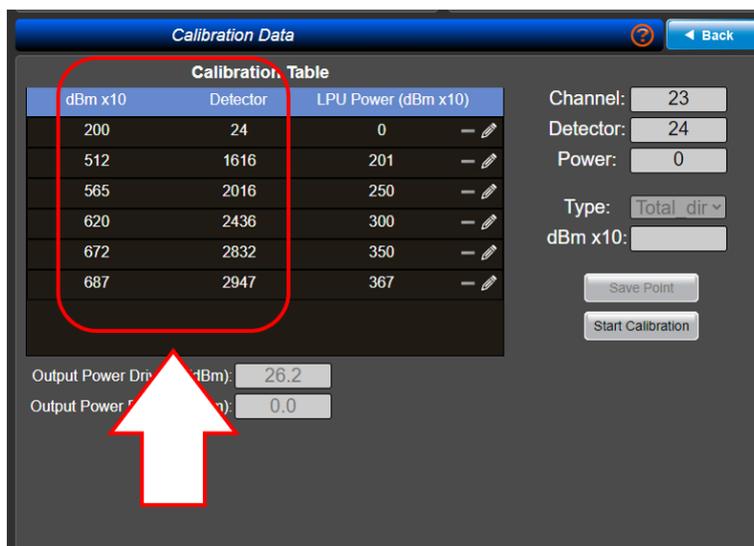


Figure 149: Home > Config > Calibration

Should the system forward power meter calibration be discovered to be slightly in error, the simplest remedy is to slightly “nudge” the data point closest to the desired operating power level in the calibration table. Since most transmitters have a stored data point at the desired transmitter power output (TPO), in practice this means slightly modifying the calibration data point corresponding to full TPO. Clicking on the pencil icon for the affected data point launches a pop-up dialog box in which the measured transmitter power portion of the ‘tx power-vs-detector volts’ data pair can be modified.

In the example shown in Figure 150, the data point corresponding to 67.2 dBm (5250 W) is being modified. Note that since the automatic power control system will always seek to maintain the correct detector voltage, changing the transmitter power paired with that detector voltage will have the *opposite* effect on the true power level measured on an external power meter. In other words, *increasing* the value to 673 (67.3 dBm) in the present example will cause the true transmitter power measured on an external meter to *decrease* after automatic power control compensates. Likewise, *decreasing* the value to 671 (67.1 dBm) will cause the true transmitter power being read on an external meter to *increase*.

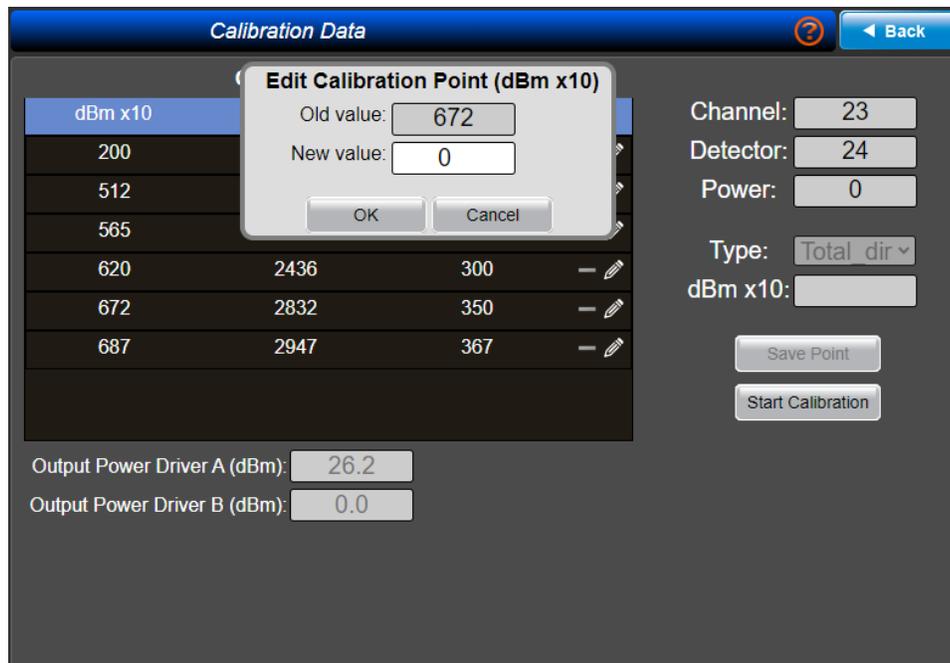


Figure 150: Single point edit of calibration table

The procedure outlined above is useful for minor changes to the power metering calibration. It is also possible to completely erase the calibration table, using the minus sign icons on each line, and rebuild it completely from scratch. GatesAir strongly discourages this approach, except in extreme cases, because the risk of error is high.

To rebuild the entire table, first delete all data points, then press the **Start Calibration** button. This will invoke a special calibration mode in which automatic power control (APC) is disabled and the LPU drive power (and thus transmitter output power) can be commanded manually by entering a suitable value in dBm in the **Output Power Driver A/B** field. Once in the special calibration mode, start at zero and slowly raise the output power level at convenient intervals such as 3 dB or 5 dB until the full desired transmitter output power is reached. Press the **Save Point** button at each step in power to add a new entry to the calibration table.

Note that the highest point in the calibration table sets the upper limit for the value that can be entered as the automatic power control set point at **Home > Config > Output Power (dBm)** in the transmitter web GUI. Adding an additional calibration point at 105% power to the calibration table might prove useful to provide more flexibility when setting/adjusting the transmitter output power level.

The same web GUI page also offers the possibility of adjusting the reflected power meter calibration as an option under the **Type** pulldown menu. GatesAir strongly cautions against changing the reflected power calibration table based on readings obtained from a power meter connected to the reflected port on a directional coupler in the field. All reflected directional couplers will have fixed errors from forward power bleeding over into the reflected port due to imperfect coupler directivity. Thus, the RF sample exiting the reflected port of the directional coupler will be a mix of true reflected power and some forward power bleeding over in error. In a well-tuned RF system, as the true reflected power level approaches zero, the fixed error due to the presence of forward power contaminating the sample becomes proportionally ever larger. Thus, when measuring with a power meter connected to a directional coupler, the lower a reflected power reading is, the less accurate it is. Making calibration decisions based on low reflected power readings can result in some very large calibration errors and should be avoided.

5.5.13 Home > Config > Calibration web page

The screenshot shows the 'Calibration Data' web page. At the top, there is a blue header with the title 'Calibration Data', a help icon, and a 'Back' button. Below the header is the 'Calibration Table' section, which contains a table with three columns: 'dBm x10', 'Detector', and 'LPU Power (dBm x10)'. Each row in the table has a minus sign and a pencil icon to its right. To the right of the table are several input fields: 'Channel' (23), 'Detector' (24), 'Power' (0), 'Type' (Total dir), and 'dBm x10' (empty). Below these fields are 'Save Point' and 'Start Calibration' buttons. At the bottom of the page, there are two more input fields: 'Output Power Driver A (dBm)' (26.2) and 'Output Power Driver B (dBm)' (0.0).

dBm x10	Detector	LPU Power (dBm x10)
200	24	0
512	1616	201
565	2016	250
620	2436	300
672	2832	350
687	2947	367

Figure 151: Home > Config > Calibration

Name	Function
<i>Calibration Table</i>	
dBm x 10	Displays the calibration point (transmitter) power level in dBm x 10 format. e.g. 600 = 60.0 dBm
Detector	Displays the corresponding metering detector voltage at the calibration point power level.
LPU Power (dBm x 10)	Displays the measured LPU power level, reported by the LPU at the calibration point power level in dBm x 10 format. e.g. 300 = 30.0 dBm (1.0 W) LPU power.
minus sign (-)	Deletes the selected line from the calibration table.
pencil icon	Launches a pop-up dialog box to edit a single data point in the calibration table.
Output Power Driver A (dBm)	Displays the power level command in dBm format being sent to LPU A from the transmitter control unit. e.g. 33.0 dBm = LPU is being commanded to output 33 dBm (2W) of drive power. Allows the LPU power level to be set manually whenever the Start Calibration button has been pressed and the special calibration mode has been invoked.
Output Power Driver B (dBm)	Displays the power level command in dBm format being sent to LPU B from the transmitter control unit. e.g. 33.0 dBm = LPU is being commanded to output 33 dBm (2W) of drive power. Allows the LPU power level to be set manually whenever the Start Calibration button has been pressed and the special calibration mode has been invoked.
Channel	Displays the current operating channel.
Detector	Displays the current metering detector voltage.
Power	Displays the current LPU drive level being reported by the active LPU.
Type	Selects the type of power calibration being performed/displayed. [Total_dir] = System forward power. [Total_ref] = System reflected power. [TX A/B_dir] = Forward power for a single transmitter in a dual transmitter system. [TX A/B_ref] = Reflected power for a single transmitter in a dual transmitter system. [LoadN] = Reject load power in a larger multi-cabinet system with load power metering.
dBm x 10	Inputs the power reading in dBm x 10 format for the next calibration point to be added to the calibration table. e.g. 600 = 60.0 dBm
Save Point button	Adds a new data point to the calibration table.
Start/Stop Calibration button	Invokes a special calibration mode in which the LPU power can be commanded manually by entering the desired LPU power level in the Output Power Driver A/B field(s). In this way, the transmitter power can be run up and down manually and the calibration table populated based on readings taken from an external power meter connected to a precision directional coupler.

Table 70: Home > Config > Calibration

6 Troubleshooting

Should problems arise during the operation of the equipment, the first step in troubleshooting is to consult the web GUI **Event Log** for alarms and other messages. **Alarm**, **Warning** and **Info** messages can be either **ACTIVE** for conditions that are still occurring (Item 1 in Figure 152 below) or **CLEARED** for conditions that had a finite duration in the past but have since ended. (Item 2). Note that messages with a status of cleared will provide a double time stamp listing both a start and end time (Item 3), whereas events with a status of active will list no end date because the condition is still occurring (i.e. has not ended). In addition to **Alarm**, **Warning** and **Info** messages, **Event** messages may also be present to indicate when certain user interventions took place (e.g. switch on, switch off, change settings, etc.) (Item 4).

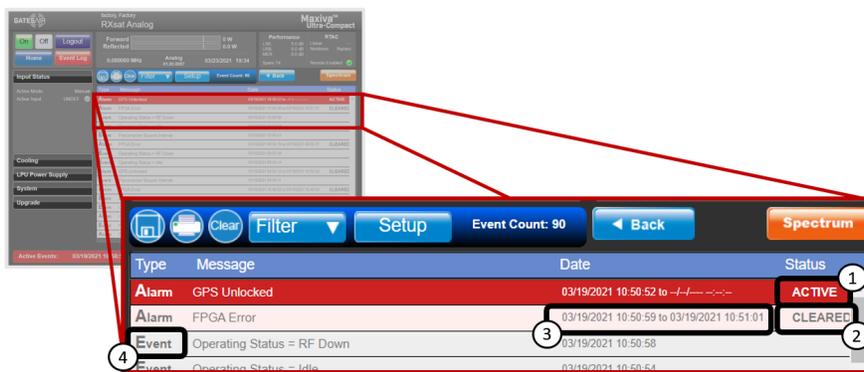


Figure 152: Selected Event Log concepts

Note that some message classes may be missing from the event log if they have been suppressed by the event log filter settings, as accessed by the **Filter** button.

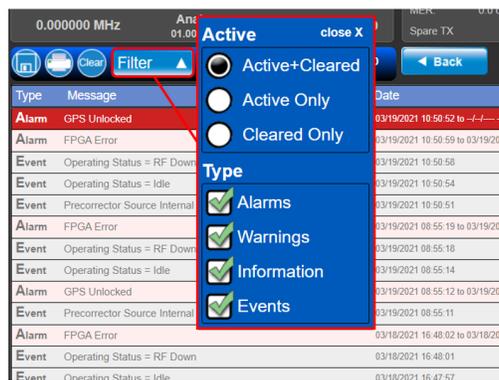


Figure 153: Event Log filtering

To aid in troubleshooting, Table 71 below provides a list of selected Event Log messages and information to aid in their interpretation. Their order follows their order of appearance in the web GUI **Log Setup** screen.

6.1 Index of Event Log Messages

When a fault or warning alarm condition occurs, the **ALARM** or **WARNING** LED on the transmitter control unit front panel will illuminate red or yellow, respectively. To track down the cause of the alarm, open the transmitter log via a web browser and see what events have occurred and in what order. If you are not familiar with web browser navigation, refer to Section 3.3.

The log messages listed in this section are those appearing in the **Event Log** originating in the transmitter control unit. Each LPU will also have its own log available in its own web GUI. Please consult manual DOCX-00014 for more information on the LPU web GUI.

Log Message	Meaning / Suggested Interventions
TX in Local Mode	The transmitter has remote control disabled because a user-intervention via the front panel interface.
Forward Power High	The output power level has exceeded the alarm threshold. Check for an incorrect automatic power control (APC) setting, attenuation pads removed from the drive chain, an incorrect RF level calculation in dBm.
Forward Power Low (1.5dB) Forward Power Low (3dB) Forward Power Low (7dB)	The output power level has dropped below the alarm threshold, typically due to another alarm condition. Check for alarm messages from one or more PA modules and/or the LPU.
Reflected Power	A high reflected power level is present at the transmitter system output, typically due to damage to the antenna, mask filter, or transmission line. Disconnect the antenna and operate into a system test load, if available, to help isolate the problem.
Logic Temperature	A high temperature was sensed internally to the transmitter control unit. Verify that the control unit has proper ventilation. Navigate to Home > Config > Thresholds for more information on the temperature thresholds. Check the for proper operation of the fan located on the rear of the transmitter control unit, as well as the fan mounted on the front panel (if present). Access to the front fan is via the mesh filter on the front panel. Clean or replace the air filter, as necessary. Replacement defective fan, as necessary.
Interlock DSub15 Interlock N + 1 Interlock Total Interlock TxA, TxB	The system has stopped transmitting due to an open interlock circuit. Verify interlock connectivity with an ohmmeter and/or voltmeter. Check the connector plug/wiring at the INTERLOCK receptacle located on the rear panel of the transmitter control unit. Also check the transmitter system's interlock wiring external to the rack.
Logic Temperature Warning	A high temperature was sensed internally to the transmitter control unit. See previous entry on Logic Temperature for more information.
Logic Generic Alarm	A generic malfunction of the transmitter control unit has occurred. If nature of failure is not obvious due to presence of other alarms, proceed to replace transmitter control unit.
Low Power Mode Active	The system is transmitting at a reduced power due to the activation of Low Power Mode by a user intervention. See Home > Config > General page in web GUI.

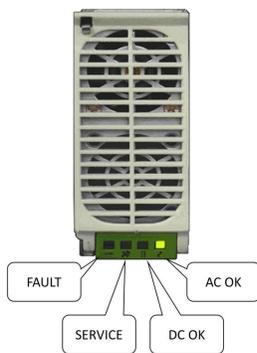
Log Message	Meaning / Suggested Interventions
All LPUs in Generic Alarm	Both LPUs have an alarm condition. Consult the web GUI for the LPU(s) for more information on the alarm condition being reported.
LPU A/B General Alarm	An LPU has an internal alarm condition. Consult the web GUI for the LPU for more information on the alarm condition being reported.
LPU A/B General Warning	An LPU has an internal warning condition. Consult the web GUI for the LPU for more information on the warning condition being reported.
LPU A/B RS485 Communication Error	An LPU has lost RS-485 serial communications to the transmitter control unit. Verify the cabling integrity between the two units.
LPU A/B in Generic Alarm	An LPU has an internal alarm condition. Consult the web GUI for the LPU for more information on the alarm condition being reported.
LPU A/B Ethernet Communication Error	An LPU has lost serial IP communications to the transmitter control unit. Attempt to contact the LPU web GUI directly at its individual IP address to verify that LPU is still capable of LAN communications. Verify the cabling integrity between the two units.
Cab n ExtAmp m General Warning	A PA module is reporting an internal summary warning condition. Navigate to Home > Amplifiers to check for the presence of a warning condition.
Cab n ExtAmp m Communication Error	Serial communications have been lost between the transmitter control unit and a PA module. Remove and re-insert the affected PA module. Replace PA module as necessary.
Cab n ExtAmp m Forward Power High	A PA module is reporting high forward power at its output. Verify that the system is set for the correct output power level and verify the system forward power meter calibration.
Cab n ExtAmp m Forward Power Low	A PA module is reporting low forward power at its output. Navigate to Home > Amplifiers to check for the presence of a failed pallet or other alarm condition.
Cab n ExtAmp m Reflected Power	A PA module is reporting excessive reflected power at its output. If all PA modules have high reflected power, check system reflected power level to determine if problem is downstream from transmitter (both PAs and system reflected high) or within the intra-cabinet combining system (PA high reflected but system low reflected). If system reflected power is low, swap PA module with the module from another position to see if problem follows the module or the slot position. If problem follows slot, suspect a failure of a multi-module combiner or possibly a combiner ballast load.
Cab n ExtAmp m Temperature	A PA module is reporting a high temperature alarm. Verify that the air flow to the module is good (fans ok, no obstructions), that the ambient temperature in the transmitter hall is within an acceptable range (0 deg C – 45 deg C), and that all other PAs are reporting normal temperatures. Swap PA module with the module from another position to see if problem follows the module or the slot position. If it follows the slot position, check for excessive VSWR, drive level, or other abnormality causing the PA module to work harder than normal. If the problem follows the module, re-verify the proper operation of the cooling fans and input air filter. Replace the PA module from spares if no obvious cause can be found.
Cab n ExtAmp m Temperature Warning	A PA module is reporting a high temperature warning. See the previous entry for Cab n ExtAmp m Temperature.

Log Message	Meaning / Suggested Interventions
Cab n ExtAmp m Interlock	A PA module is not installed, fully inserted in its socket. Remove and re-insert PA module. Verify that fixing screws to secure PA module in rack have been installed and tightened.
Cab n ExtAmp m PSU1/2/3 General	A PSU module inside a PA module is reporting an internal alarm condition. Replace the defective PSU module.
Cab n ExtAmp m Current	A PA module is consuming too much DC current. Determine if all PA modules have excessive current or just a single PA module. If all PA modules have high current, verify the system RF output level is correct, not too high, possibly due to incorrect meter calibration. If a single PA module has excessive current, swap PA modules to see if high readings follow the module or the slot position. If it follows the slot position, check for drive splitter imbalances. If it follows the PA, replace PA module and/or check for failed FETs.
Cab n ExtAmp m Upgrade Alarm	A PA module failed to upgrade its software when prompted to do by the transmitter control unit. Reattempt upgrade by navigating to Home > Setup > Upgrade > Force Upgrade > Upgrade button.

Table 71: Index of selected Event Log messages

6.2 Power Supply Diagnostics

Table 72 provides additional information on the status LEDs on the front face of the PSU modules inside the 3.5 RU style power amplifiers. Because there are no user serviceable parts inside the PSU, most faults resulting in a red FAULT LED generally require that the affected PSU be replaced with a new unit from spares. Those fault conditions that result in an incorrect status of the green AC OK or DC OK LEDs can often be resolved by locating the external factors contributing to the fault condition. (e.g. low incoming AC mains, short-circuited load at DC output, etc.)



Condition	AC OK (Green)	DC OK (Green)	SERVICE (Amber)	FAULT (Red)
OK	On	On	Off	Off
Thermal alarm / warning	On	On	On	Off
Thermal shutdown	On	Off	On	On
Defective fan	On	Off	Off	Off
No AC mains < 15 ms	Off	On	Off	Off
AC mains present but out of range	Blinks	Off	Off	Off
AC mains not present	Off	Off	Off	Off
Boost stage failure	On	Off	Off	On
Output over-volts latched shutdown	On	Off	Off	On
Over current at output	On	Blinks	Off	Off
Non-specific internal failure	On	On	Off	On
Standby (waiting for on command from TX)	On	Off	Off	Off
Service request (PMBus mode)	On	On	Blinks	Off
Communications fault (RS-485)	On	On	Off	Blinks

Table 72: Power supply module LEDs

7 Parts Lists

The parts lists in this section are limited to those parts that can be replaced by the user in the field. For a complete parts list or for inquiries concerning a specific part, please contact your GatesAir service representative.



NOTE

The OEM part numbers for selected key components are provided in parentheses and italics. e.g. SURGE ARRESTOR (*LOVATO SA03NA320R*). In many cases, additional information on these components can be found by downloading their OEM datasheets from the Internet.

<i>Mains Distribution Unit</i>	
PWP4A-T-380V-01	POWER DISTR, 3PH 380V 4AMP
PWP8A-T-380V-01	POWER DISTR, 3PH 380V 8AMP
INTX-00038	CIRCUIT BREAKER (1P+N) 10A C-CURVE (<i>GEWISS GW90026</i>)
INTX-00050	CIRCUIT BREAKER (3P+N) 20A C-CURVE (<i>GEWISS GW90088</i>)
INTX-00085	SURGE ARRESTOR (<i>LOVATO SA03NA320R</i>)
FANX-00065	AC FAN 60SQ X 25 (option)

<i>Transmitter Logic Control Unit</i>	
OL-H-2U	ONELOGIC 2U VERS. HTML5
8611172015	S/W, VARISCITE LOGIC APP
FANX-00056	FAN, AXIAL 80MM 24VDC (<i>EBM-PAPST 8214J/2N</i>)
BATX-00002	BATTERY, 3V 0.075AH CR2016 (<i>PANASONIC_CR2016</i>)
PRFX-00039	MEMORY CARD, MICROSD 16GB (<i>SANDISK_SDSQAF3-016G-I</i>)
SCHX-00502-V1	PWA, VARISCITE MOD. DART-6UL
SCHX-00632-V3	PWA, CS-OLH2U-CNTRL-VAR-V3
SCHX-00633-V2	PWA, CS-OLH2U-INTERFACE-V2
SCHX-00133-V3	PWA, CS-OL-DETECTOR
AIRX-00013	AIR FILTER FOR ONE LOGIC 2U
LCDX-00006	DISPLAY, TFT LCD 3.5 RGB AFY320240
SCHX-00506-V3	PWA, CS-LCD3,5-TACT-V3

UC LPU/Driver (see manual DOCX-00014)

2/3 RU RF Amplifier Module (UHF Band IV/V)	
AIRX-00002	AIR FILTER FOR PSUX-00025
FANX-00056	FAN, AXIAL 80MM 24VDC (<i>EBM-PAPST 8214J/2N</i>)
FANX-00029	FAN AXIAL 119MM 24VDC (<i>PAPST_4114N/2H3</i>)
FANX-00029-DE	FAN AXIAL 119MM 24VDC (<i>DELTA AFB1224EHE-CF00</i>)
OPTX-00073-V2	PALLET W/ BLF888D UBB CH 21-69
OPTX-00113-V3	PALLET W/ BLF888E (560-706 MHz)
OPTX-00115-V2	PALLET W/ BLF888E (470-590 MHz)
OPTX-00116-V2	PALLET W/ BLF888E (BROADBAND) - UHF
PSUX-00019	PSU, SWITCHING (<i>MEAN WELL EPP-200-24</i>)
PSUX-00022	PSU, SWITCHING, 400W 48V (<i>MURATA_MVAC400-48AF</i>)
PSUY-00025	PSU. SWITCHING MONOFASE 1U TRAY
R050R-0012	RF LOAD 250W 50 OHM (<i>DICONEX 45-0015Y</i>)
R050R-0019	FLANGED TERMINATION 50 OHM 500W (<i>DICONEX_17-0356</i>)
SCHX-00061-V4	PWA, CS-OC-DIREZ-01-V4
SCHX-00087-V5	PWA, CS-OC-VENT-01-V5
SCHX-00116	PWA, CS-OA-LED-01-V1
SCHX-00179-V2	PWA, CS-OC-MOBO2U-02
SCHX-00182-V5	PWA, CS-AMP-020-V5
SCHX-00224-V2	PWA, CS-AMP-WBHY-213
SCHX-00309-V1	PWA, CS-OA-RELAY_DD-
SCHX-00310-V1	PWA, CS-OA-COMB350W-
SCHX-00338-V4	PWA, CS-PS1400W-DIN-
SCHX-00339-V5	PWA, CS-PS1400W-SHARE-01-V5
SCHX-00340-V3	PWA, CS-PS1400W-SENS
SCHX-00374-V2	PWA, CS-PS1400W-28V-
SCHX-00375-V1	PWA, CS-PS1400W-220V
TRNX-00055	XSTR BLF888DU (NXP)
TRNX-00073	XSTR BLF888EU (AMPLEON)

2/3 RU RF Amplifier Module (VHF Band III)	
AIRX-00002	AIR FILTER FOR PSUX-00025
FANX-00056	FAN, AXIAL 80MM 24VDC (<i>EBM-PAPST 8214J/2N</i>)
FANX-00029	FAN AXIAL 119MM 24VDC (<i>PAPST_4114N/2H3</i>)
FANX-00029-DE	FAN AXIAL 119MM 24VDC (<i>DELTA AFB1224EHE-CF00</i>)

PSUX-00019	PSU, SWITCHING (MEAN WELL EPP-200-24)
PSUX-00022	PSU, SWITCHING, 400W 48V (MURATA_MVAC400-48AF)
PSUY-00025	PSU. SWITCHING MONOPHASE 1U TRAY
R050R-0001	RF TERMINATION, 50 OHM 100W 5%
R050R-0010	TERMINATION 10W 50 OHM (DICONEX_45-0040S)
R050R-0019	FLANGED TERMINATION 50 OHM 500W (DICONEX_17-0356)
SCHX-00061-V4	PWA, CS-OC-DIREZ-01-V4
SCHX-00087-V5	PWA, CS-OC-VENT-01-V5
SCHX-00116	PWA, CS-OA-LED-01-V1
SCHX-00180-V2	PWA, CS-AMP-019-V2
SCHX-00226-V3	PWA, CS-OC-DIREZ600W
SCHX-00309-V1	PWA, CS-OA-RELAY_DD-
SCHX-00338-V4	PWA, CS-PS1400W-DIN-
SCHX-00339-V5	PWA, CS-PS1400W-SHARE-01-V5
SCHX-00340-V3	PWA, CS-PS1400W-SENS
SCHX-00374-V2	PWA, CS-PS1400W-28V-
SCHX-00375-V1	PWA, CS-PS1400W-220V
SCHX-00377-V1	PWA, CS-OC2U-COMB-VHF_HE-V1
SCHX-00534-V1	PWA, CS-VAXT-700-DRI
SCHX-00537-V1	PWA, CS-VAXT-700-COM
SCHX-00656-V1	PWA, VAXT-700-DIVI-V1

3.5 RU RF Amplifier Module (UHF Band IV/V)

AIRX-00003	AIR FILTER FOR ONEAMPLI 3,5U
FANX-00037	FAN, AXIAL 92MM 48VDC (PAPST 3258J/2H3P)
FANX-00037-CEV	FAN, AXIAL 92MM 48VDC (CEV AGB09238B48V)
FANX-00037-MF	FAN, AXIAL 92MM 48VDC (MAXFLOW MFD9238D4-VHBPF)
FANX-00037-SD	FAN, AXIAL 92MM 48VDC (SANYO-DENKI 9GV0948P1H03)
FUSX-00009	FUSE, AUTO 20A YELLOW (LITTELFUSE 0297020.WXNV)
FUSX-00010	FUSE, BLADE-MINI 15A BLUE (LITTELFUSE 0297015.WXNV)
OPTX-00073-V2	PALLET W/ BLF888D UBB CH 21-69
OPTX-00113-V3	PALLET W/ BLF888E (560-706 MHz)
OPTX-00115-V2	PALLET W/ BLF888E (470-590 MHz)
OPTX-00116-V2	PALLET W/ BLF888E (BROADBAND) - UHF
PSUX-00013	PSU, 48VDC 2725W U240VAC 1RU (ABB CP2725AC48TEZ-FB)

R03DB-0002	ATTENUATOR, FIXED, FLANGE, DC (<i>RF LABS 33A702303.00F</i>)
R050R-0012	RF LOAD 250W 50 OHM (<i>DICONEX 45-0015Y</i>)
R050R-0013	FLANGED TERMINATION 50 OHM 1350W (<i>DICONEX 17-0712</i>)
R050R-0015	FLANGED TERMINATION 50 OHM 1650W (<i>DICONEX 17-0695</i>)
R050R-0019	FLANGED TERMINATION 50 OHM 500W (<i>DICONEX 17-0356</i>)
R100R-0002	FLANGED RESISTANCE 100 OHM 100W (<i>IPP RB221-100</i>)
R100R-0015	FLANGED RESISTANCE 100 OHM 10W (<i>DICONEX 45-0068S</i>)
SCHA-00359-V1	PWA, CS-OA
SCHX-00224-V1	PWA, CS-AMP-WBHY-213
SCHX-00224-V2	PWA, CS-AMP-WBHY-213
SCHX-00266-V4	PWA, CS-OAW-MOBOALIM
SCHX-00275-V3	PWA, CS-OAW-LED-01-V
SCHX-00350-V1	PWA, CS-OA 3.5U-D4UH
SCHX-00351-V1	PWA, CS-OA 3.5U-D4UH
SCHX-00353-V5	PWA, CS-OA 3.5U-CONTROL-V5
SCHX-00354-V1	PWA, CS-OA 3.5U-DIRE
SCHX-00355-V2	PWA, CS-OA 3.5U-D2UH
SCHX-00357-V1	PWA, CS-OA 3.5U-VENT
SCHX-00358-V1	PWA, CS-OA 3.5U-ASI-
SCHX-00360-V1	PWA, CS-OA 3.5U-D3UH
SCHX-00361-V1	PWA, CS-OA 3.5U-D3UH
SCHX-00392-V1	PWA, CS-OA 3.5U-V
SCHX-00408-V1	PWA, CS-OA3.5U-REMOT
SCHX-00525-V1	PWA, CS-OA_PA-ASI-V1
SCHX-00618-V1	PWA, CS-OA-D2UHF-SX-V1
SCHX-00619-V1	PWA, CS-OA-D2UHF-DX-V1
TRNX-00055	XSTR BLF888DU (NXP)
TRNX-00073	XSTR BLF888EU (AMPLEON)

3.5 RU RF Amplifier Module (VHF Band III)

AIRX-00003	AIR FILTER FOR ONEAMPLI 3,5U
FANX-00037	FAN, AXIAL 92MM 48VDC (<i>PAPST 3258J/2H3P</i>)
FANX-00037-CEV	FAN, AXIAL 92MM 48VDC (<i>CEV AGB09238B48V</i>)
FANX-00037-MF	FAN, AXIAL 92MM 48VDC (<i>MAXFLOW MFD9238D4-VHBPF</i>)
FANX-00037-SD	FAN, AXIAL 92MM 48VDC (<i>SANYO-DENKI 9GV0948P1H03</i>)

FUSX-00009	FUSE, AUTO 20A YELLOW (<i>LITTELFUSE 0297020.WXNV</i>)
FUSX-00010	FUSE, BLADE-MINI 15A BLUE (<i>LITTELFUSE 0297015.WXNV</i>)
OPTX-00140-V1	PALLET AMPLIFIER BAND 3 300W
PSUX-00013	PSU, 48VDC 2725W U240VAC 1RU (<i>ABB CP2725AC48TEZ-FB</i>)
R050R-0001	RF TERMINATION, 50 OHM 100W 5%
R050R-0013	FLANGED TERMINATION 50 OHM 1350W (<i>DICONEX 17-0712</i>)
R050R-0015	FLANGED TERMINATION 50 OHM 1650W (<i>DICONEX 17-0695</i>)
R050R-0019	FLANGED TERMINATION 50 OHM 500W (<i>DICONEX 17-0356</i>)
SCHA-00359-V1	PWA, CS-OA
SCHX-00266-V4	PWA, CS-OAW-MOBOALIM
SCHX-00275-V3	PWA, CS-OAW-LED-01-V
SCHX-00353-V5	PWA, CS-OA 3.5U-CONTROL-V5
SCHX-00354-V1	PWA, CS-OA 3.5U-DIRE
SCHX-00357-V1	PWA, CS-OA 3.5U-VENT
SCHX-00358-V1	PWA, CS-OA 3.5U-ASI-
SCHX-00389-V2-AC_3	PWA, CS-OA 3.5U-D4BI
SCHX-00390-V2-AC_3	PWA, CS-OA 3.5U-D4BI
SCHX-00391-V1	PWA, CS-OA 3.5U-D2BI
SCHX-00392-V1	PWA, CS-OA 3.5U-V
SCHX-00393-V2	PWA, CS-OA 3.5U-3DBI
SCHX-00394-V3	PWA, CS-OA 3.5U-6DBIII-V3
SCHX-00395-V2	PWA, CS-AMP-DRV-BIII
SCHX-00396-V2	PWA, CS-OA 3.5U-4.77DBIII-V2
SCHX-00408-V1	PWA, CS-OA3.5U-REMOT
SCHX-00525-V1	PWA, CS-OA_PA-ASI-V1
SCHX-00624-V2	PWA, CS-OA-COMB4-VHF-V2
SCHX-00625-V1	PWA, CS-OA-D2VHF-SX-V1
SCHX-00626-V1	PWA, CS-OA-D2VHF-DX-V1

3.5 RU RF Amplifier Module (VHF Band I)	
AIRX-00003	AIR FILTER FOR ONEAMPLI 3,5U
FANX-00037	FAN, AXIAL 92MM 48VDC (<i>PAPST 3258J/2H3P</i>)
FANX-00037-CEV	FAN, AXIAL 92MM 48VDC (<i>CEV AGB09238B48V</i>)
FANX-00037-MF	FAN, AXIAL 92MM 48VDC (<i>MAXFLOW MFD9238D4-VHBPFF</i>)
FANX-00037-SD	FAN, AXIAL 92MM 48VDC (<i>SANYO-DENKI 9GV0948P1H03</i>)

FUSX-00009	FUSE, AUTO 20A YELLOW (<i>LITTELFUSE 0297020.WXNV</i>)
FUSX-00010	FUSE, BLADE-MINI 15A BLUE (<i>LITTELFUSE 0297015.WXNV</i>)
OPTX-00117-V3	PALLET AMPLIFIER CHAN 2,3,4
OPTX-00118-V2	PALLET AMPLIFIER CHAN 5,6
PSUX-00013	PSU, 48VDC 2725W U240VAC 1RU (<i>ABB CP2725AC48TEZ-FB</i>)
R050R-0019	FLANGED TERMINATION 50 OHM 500W (<i>DICONEX 17-0356</i>)
R100R-0015	FLANGED RESISTANCE 100 OHM 10W (<i>DICONEX 45-0068S</i>)
R100R-0017	FLANGED RESISTANCE 100 OHM 1650W (<i>DICONEX 39-0269</i>)
SCHA-00359-V1	PWA, CS-OA
SCHX-00266-V4	PWA, CS-OAW-MOBOALIM
SCHX-00275-V3	PWA, CS-OAW-LED-01-V
SCHX-00353-V5	PWA, CS-OA 3.5U-CONTROL-V5
SCHX-00354-V1	PWA, CS-OA 3.5U-DIRE
SCHX-00357-V1	PWA, CS-OA 3.5U-VENT
SCHX-00392-V1	PWA, CS-OA 3.5U-V
SCHX-00401-V2_234	PWA, CS-OA3.5U-3DBI-
SCHX-00401-V2_56	PWA, CS-OA3.5U-3DBI-
SCHX-00401-V2-B1/1_4	PWA, CS-OA3.5U-3DBI-
SCHX-00401-V2-B1/2_4	PWA, CS-OA3.5U-3DBI-
SCHX-00402-V2-CH_234	PWA, CS-OA3.5U-4.77D
SCHX-00402-V2-CH_5_6	PWA, CS-OA3.5U-4.77D
SCHX-00402-V2-B1/1_4	PWA, CS-OA3.5U-4.77D
SCHX-00402-V2-B1/2_4	PWA, CS-OA3.5U-4.77D
SCHX-00403-V2-B1/1	PWA, CS-OA3.5U-C3DBI
SCHX-00403-V2-B1/2	PWA, CS-OA3.5U-C3DBI
SCHX-00405-V4	PWA, CS-AMP-DRV-BI-V4
SCHX-00406-V2	PWA, CS-OA3.5U-D4BI
SCHX-00406-V2-AC3	PWA, CS-OA3.5U-D4BI_DX-V2-AC3
SCHX-00407-V2	PWA, CS-OA3.5U-D4BI_
SCHX-00407-V3-AC4	PWA, CS-OA3.5U-D4BI_SX-V3-AC4
SCHX-00408-V1	PWA, CS-OA3.5U-REMOT
SCHX-00463-OA-V1	PWA, CS-OP-DIVI_2VIE
SCHX-00525-V1	PWA, CS-OA_PA-ASI-V1
SCHX-00637-V1	PWA, CS-OA-COMB2-B.I-V1
SCHX-00638-V1/1	PWA, CS-OA-COMB4-B.I-V1 CH. 2 - 3 - 4

SCHX-00638-V1/2	PWA, CS-OA-COMB4-B.I-V1 CH. 5 - 6
SCHX-00639-V1	PWA, CS-OA-DIVI2-B.I-SX-V1
SCHX-00640-V1	PWA, CS-OA-DIVI2-B.I-DX-V1

RF System, UHF Band IV/V

RF System, VHF Band III

RF System, VHF Band I

Combiner Loads Assembly

OL-2A-00001	DUMMY LOAD, 3U (2 AMPLI) 875W
OL-3A-00001	DUMMY LOAD, 3U (3 AMPLI) 875W+875W
OL-3A-00002	DUMMY LOAD, 3U (3 AMPLI) 875W+1750W
OL-4A-00001	DUMMY LOAD, 3U (4 AMPLI) 2X875W+1750W
AIRX-00011	AIR FILTER FOR AMPLI 3U
INTX-00044	THERMOSTAT 240V 10A (<i>HONEYWELL 2455R 9082-464 F50C</i>)
FANX-00056	FAN, AXIAL 80MM 24VDC (<i>EBM-PAPST 8214J/2N</i>)
MCON-00004	THERMAL GREASE, WHITE SILICONE
R033R-0003	RESISTOR ACS SERIES 330HM 10W (<i>ARCOL/OHMITE ACS10S33RJ</i>)
R050R-0015	FLANGED TERMINATION 50 OHM 1650W (<i>DICONEX 17-0695</i>)
SCHX-00136-V1	PWA, CS-LOAD-DIREZ-01-V1
SCHX-00264-V2	PWA, CS-LOAD-50OHM-01-V2
SCHX-00320-V2	PWA, CS-LOAD-1.5KW-01-V2

Table 73: List of selected replacement parts

A IEC 60215 Safety Guidelines

Standard IEC 60215 contains useful safety guidelines for working with radio and television transmitters. The text below is reproduced from Annex C of publication IEC 60215:2016.

Guidance on safety precautions to be observed by personnel working on radio transmitting equipment

C.1 Introductory remark

To ensure the safety of personnel working on radio transmitters and associated equipment, a full appreciation of the various hazards involved is required.

The factors covered with respect to such work are as follows:

- general precautions to be taken when using voltages exceeding 72 V peak;
- special precautions to be taken when using high radio-frequency voltages, often much higher than the voltages indicated above;
- the effects of electromagnetic fields existing in the vicinity of antennas and antenna leads which may introduce fire hazards, danger of electric shock, burns to personnel and other harmful physiological effects;
- explosion hazards where flammable gases are present;
- the risk, run by personnel working on structures or buildings, of falls which may be complicated by shock through accidental contact with live conductors.

C.2 Dangerous voltages and currents

Fundamentally, current rather than voltage is the criterion of shock intensity. The passage of even a very small current through a vital part of the human body can cause death. The voltage necessary to produce the fatal current is dependent upon the resistance of the body, the contact conditions, the path through the body, etc. Detailed information on the effect of electric shock is given in IEC 60479.

C.3 Electric shock: first-aid treatment

Electric shock may result in interruption of natural breathing. Immediate action is necessary to restore [the] breathing and it is therefore essential that personnel are familiar with the various methods of artificial respiration and heart massage.

Defibrillators are a useful addition to first aid treatment equipment.

In the case of high-voltage accidents urgent medical aid is needed to treat the effects of poisonous products in the body caused by severe burns.

In all cases, medical assistance shall be called.

It is necessary to check all personnel engaged in the operation and maintenance of transmitting equipment in which dangerous voltages may be present, for their ability to apply artificial resuscitation and to make arrangements for additional first-aid training of such personnel whenever needed.

C.4 Operation of transmitting equipment

The following apply.

- a) The equipment shall be kept constantly in such condition as to comply with the relevant safety requirements.
- b) At regular intervals, the condition of the equipment and the correct functioning of protective and SAFETY DEVICES shall be checked by a SKILLED person approved by the appropriate authority for this duty. Functional checks shall be carried out on interlocking systems of doors, mechanical interlocks, isolating switches, earthing switches, parallel resistances and protective devices against overvoltages and overcurrents. The above checks shall also be carried out after the protective and SAFETY DEVICES have operated under fault conditions. The SAFETY DEVICES shall not be altered or disconnected except for replacement, nor shall the safety circuit be modified without specific approval of the appropriate authority in each case.
- c) All covers giving protection against accidental contact with dangerous voltages shall be kept closed under conditions of normal operation. They shall only be opened for maintenance or repair, when approved by the SKILLED person responsible. Covers which are designed for removal by tool shall not be modified to be operated BY HAND.
- d) All metal ENCLOSURES and covers of electrical and electronic equipment shall be effectively earthed, and care shall be taken to maintain these protective earth connections. For fix screwed cover plates, the usual metal screwed connections or low impedance plug contacts are considered sufficient to ensure continuity, provided that no electrical equipment is attached to them and that there is some part of the panel that has metal-to-metal contact with the frame. If electrical parts are attached to such items, then separate conductors providing suitably low impedance shall be used.
- e) The room occupied by equipment of open construction is to be considered as an ENCLOSURE, within the meaning of 3.1.10.

Definition of enclosure from 3.1.10: *space in which items of the equipment that might be dangerous are located, and access to which is prevented, for example, with locked doors or with cover plates which cannot be removed without using a tool.*

- f) When energizing a radio transmitter, the SKILLED person responsible shall satisfy himself that there is no one at work on the equipment or its associated antenna system, that any work which may have been in progress is sufficiently completed to permit transmission, that no tools, test equipment or hand lamps are left in or on the equipment, and that all test or ancillary apparatus connected for the purpose of testing has been removed.

C.5 Procedure for establishing the absence of voltage

The following procedure applies.

- a) Before starting work on the equipment, it shall be isolated from the mains supply. This disconnection shall always be checked by visual inspection. Further precautions shall be taken to ensure that the mains supply cannot be restored whilst work is being carried out.

After the mains supply has been disconnected, all other lines such as control and interlocking shall be disconnected if they carry dangerous voltages. Moreover, the antenna or the antenna transmission line

shall be disconnected from the antenna terminal device to prevent the introduction of dangerous voltages due to antenna pick-up. When disconnection of the antenna or antenna transmission line is not possible, other suitable precautions shall be taken, for example, earthing, when necessary at several places, to establish absence of voltage. These earthing connections shall be very short compared with the wavelength.

- b) Capacitors which are connected to a circuit isolated from its supply shall be discharged and have their terminals permanently short-circuited and the casing earthed during the whole period of the work.
- c) The electrical charge retained by electrical machinery when stopped may, in certain cases, be sufficient to cause a severe shock. This shall be taken into account when making connections to an apparently "dead" machine. Therefore all machinery shall be discharged and earthed using an adequately insulated lead for this purpose. The discharge operation shall be repeated several times.
- d) Before any maintenance work is carried out on automatic or remote controlled equipment, the remote or automatic switching circuits shall be made inoperative. Precautions shall be taken to ensure that the remote or automatic switching cannot be restored whilst work is being carried out. If appropriate, locking keys should be in the possession of the person carrying out the work.

C.6 Procedure for determination of the absence of voltage

After the equipment has been isolated according to C.5, the absence of voltage shall be determined at the workplace. This may be done by the use of voltage indicators, measuring instruments, glow-discharge lamps for indicating radio-frequency voltages or other suitable means. High-voltage exposed parts shall be earthed through attaching an earthing wand, but this should only be carried out after determination of the absence of voltage by other means.

C.7 Working on live circuits

Work on live circuits with voltages exceeding the limits laid down in 7.1 or work in proximity to such circuits shall be restricted to a minimum. Such work may be performed only if the following conditions are met.

- The work shall be carried out by an authorized person, SKILLED in electrical engineering, watched by at least one other person who has been instructed and is able to switch off voltage without delay and, moreover, has been trained to render first aid by means of artificial respiration and cardiac massage.
- There should be no possibility of hazardous ionizing or non-ionizing radiation.
- The work shall be performed in such a manner that there is no danger from arcing or currents flowing through the body.
- Suitable equipment, test facilities and tools shall be used for the work to be carried out safely.
- Suitable measures shall be taken to indicate the areas of danger.
- The work shall be performed only for compelling reasons; for example, because in the absence of live voltages it would be impossible to do the work or to localize the fault.

NOTE In some countries more stringent rules and/or regulations apply.

C.8 Other hazards

C.8.1 Radio-frequency radiation hazards

The following requirements apply.

- a) The maximum levels of power density in the microwave range and/or the electric and magnetic components of field strength at lower radio frequencies to which personnel may be exposed shall not exceed the national limits of the country concerned. For countries which have not yet adopted a national standard for permissible non-ionizing radiation levels, guidance may be obtained from the ICNIRP

(International Commission on Nonionizing Radiation Protection) *Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz)* (see Annex D).

- b) Personnel shall never make a direct visual examination of any microwave radiator, reflector, waveguide, horn or any concentrated beam radiating system during periods of operation.

C.8.2 Eye protection

Personnel shall never make a direct visual examination of any fibre optic or laser source system during periods of operation.