ZX SERIES ™
ZX500, ZX1000, ZX2000 & ZX3500

FM BROADCAST TRANSMITTER
888-2594-001

Revision I
May 12, 2014

Manual Revision History

ZX Series FM Transmitter

REV.	DATE	ECN	Pages Affected
A	6/29/2006		Printed
B	9/13/2006	53549	Title pages, MRH1/MRH2, chapter 2.
B1	3/14/2007		Added Appendix a
B2	3/21/2007		Replaced page a-15, added ZX Troubleshooting Remote chart on pages a-24/a-25
C	7/10/2007	55052	Updated entire manual
C1	11/28/2007	FS Request	Upated Parts List in Section 7
C2	2/8/2008	FS Request	Updated Section 2 to add Module Locator
C3	8/18/2008	KAM	Updated Parts List to Include 500, 2000, and 3500 Series
C4	1/8/2009	KAM	Updated 5.4.3.a part numbers.
D	12/18/2009	58545	Updated title page, MRH-1, and page a-19. (by BEA)
E	11/18/10	59700	Corrected Section 4.1.2.4.3
F	11/22/10	59710	Added Appenix B.
H	07/24/2012	61874	Revised Title Page, MRH-1, and Pages a1 & b1
I	05/12/2014	63713	Rebranded

Technical Assistance

Technical and troubleshooting assistance for GatesAir products is available from the field service department during normal business hours 8:00AM to 5:00PM CST.

Telephone *+1-217-222-8200*, FAX *+1-217-221-7086*, email *tsupport@gatesair.com*.

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

Online assistance, including technical manuals, software downloads, and service bulletins, is available at our Customer Portal http://support.gatesair.com.

For Global Technical Support Information please visit:

http://www.gatesair.com/services/technical-support.aspx

Europe, Middle East and Africa:
24/7 Technical Support+1 217 222 8200
Email tsupport.europe@gatesair.com

Asia:
24/7 Technical Support+1 217 222 8200
Email tsupport.asia@gatesair.com

Address written correspondence to

GatesAir
Field Service Department
3200 Wismann Lane
Quincy, IL 62305, USA.

NOTE: For all service and parts correspondence, please provide the sales order number, as well as the serial number for the transmitter or part in question. Record those numbers here:

_____/_____

Please provide these numbers for any written request, or have these numbers ready in the event you choose to call regarding any service or parts requests. All warranty claims require a serial number to be provided. For out of warranty products, this will help us identify what hardware shipped.

Replaceable Parts Service

The service parts department is available from 8:00AM to 5:00 PM CST Monday - Friday,
and 8:00AM to 12:00PM CST on Saturday.

Telephone *+1-217-221-7500* or email service*partsreq@gatesair.com*.

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 which were removed for shipping and must be reinstalled. Also remove any shipping supports, straps, and packing materials prior to initial turn on.

Returns And Exchanges

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

Safety

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

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

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

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

WARNING:
DO NOT REMOVE, SHORT-CIRCUIT OR TAMPER WITH INTERLOCK SWITCHES ON ACCESS COVERS, DOORS, ENCLOSURES, GATES, PANELS OR SHIELDS. KEEP AWAY FROM LIVE CIRCUITS, KNOW YOUR EQUIPMENT AND DON'T TAKE CHANCES.

WARNING:

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

First Aid for Electrical Shock

Faulty switches, frayed flexes and defective appliances can all be causes of electrical shock. Even a shock from a domestic current - the type used in the home or the workplace - can cause serious injury or even result in a fatality.

Water is a very efficient conductor of electricity and presents an additional risk. Handling otherwise safe electrical equipment with wet hands, or when standing on a wet floor, greatly increases the risk of electrical shock.

Treatment for Electrical Shock

Before doing anything else, remember that the first priority is personal safety. Do not touch a victim if they are still in contact with the appliance that has caused the shock. If they are still in contact with the electrical source, they will be 'live' and you risk electrocution to yourself.

Turn off the source of the electricity, if possible, to break contact between the victim and the electrical supply. Switch off the supply at the mains or meter point if possible, otherwise remove the plug or wrench the cable free.

Alternatively, you can move the source of the shock away from you and the victim. Stand on some dry, insulating material such as a wooden box, plastic mat or telephone directory. Using a wooden pole or broom, push the casualty's limb away from the electrical source or push the source away from them.

If it is not possible to break the contact using a wooden pole or broom, loop a length of rope around the casualty's ankles or under their arms. Take great care not to touch them while you are doing this. Once you have looped the rope around them, use this to pull them away from the source of the electrical current.

Once you have broken the contact between the victim and the source of the shock, conduct the primary survey - response, airway, circulation, breathing - and treat any urgent condition found. Call immediately for emergency services.

Post as much information as possible at the transmitter site. Posters such as Figure 0-1 on the next page should be prominently displayed near the transmitter. Emergency contact phone numbers and directions to the transmitter site with landmarks in the area should be posted near the transmitter and telephone.

References

It is very important to have a safety plan in place and available personnel that are trained and certified in first aid and CPR. Please refer to the following web sites for more information:

American Red Cross - www.redcross.org

Occupational Safety and Health Administration (OSHA) - www.osha.gov

For countries other than USA, contact health and safety agencies in your area for more information

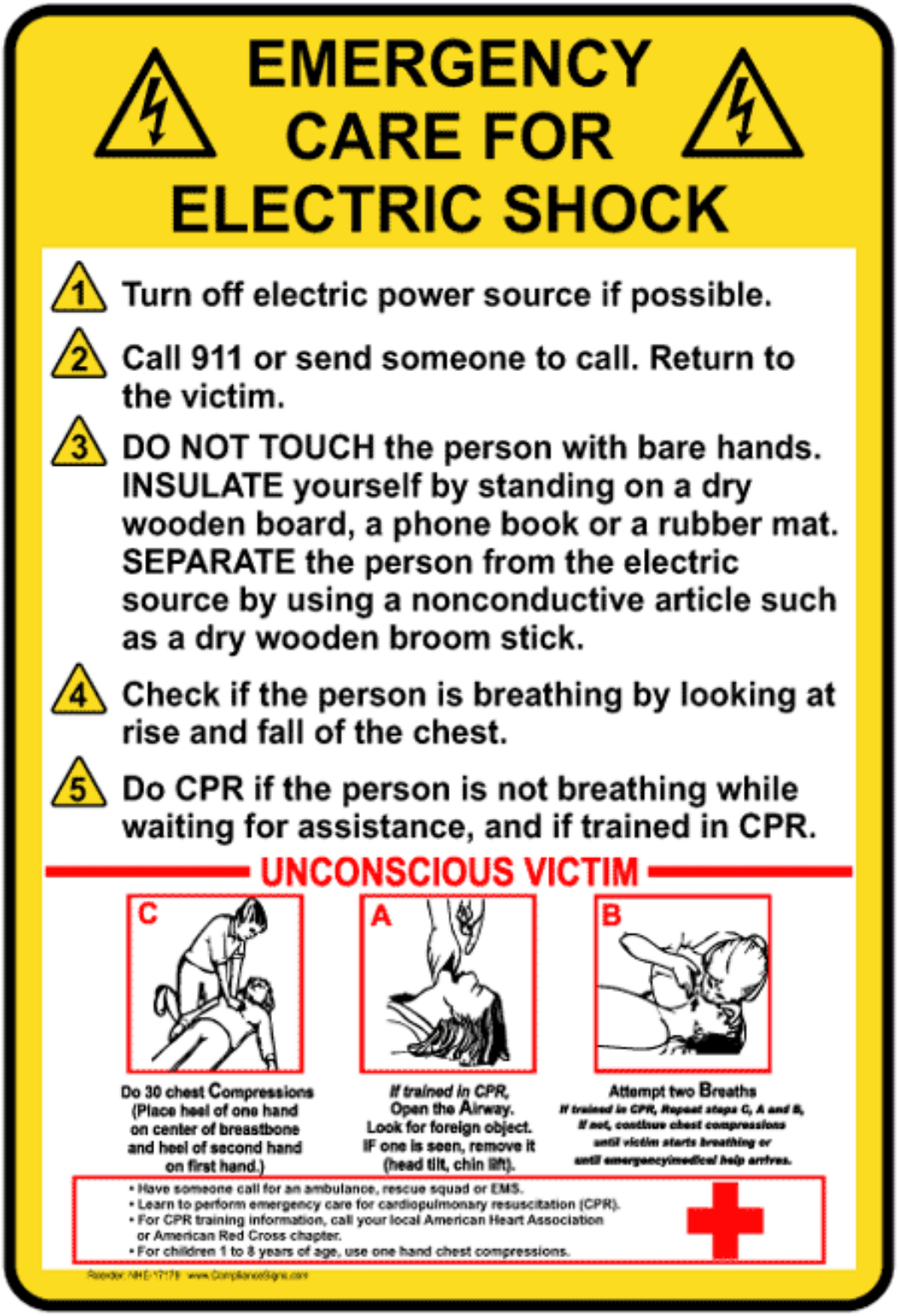

Figure 0-1 Electrical Shock First Aid Poster (Example)

Glossary

AIB - Analog Input Board, An optional circuit card for the modulator section of the low power unit (LPU). It provides the necessary interface to allow the modulator to accept analog video and audio inputs according to the PAL, NTSC, or SECAM standards. Not available in all models.

ADC - Analog to Digital Converter

ASI - Asynchronous Serial Interface, A streaming format used to carry the MPEG transport stream from the network origination point to the transmitter for modulation onto the RF carrier(s).

ATSC - Advanced Television Subcommittee, a digital television standard featuring a single, vestigial-sideband carrier and an 8-VSB modulation constellation. The transport stream format may be either SMPTE310 or ASI. The data rate before forward error correction is 19.392658 Mbit/s. The transmitted data rate with error correction is 32.28 Mbit/s.

Back Porch - The portion of the analog video horizontal line waveform following the sync pulse but before the start of active video. Only used in models that are capable of analog modulation.

Band III - The VHF radio frequency band from 168 MHz to 242 MHz.

Band IV - The UHF radio frequency band from 470 MHz to 860 MHz.

BPF - Band Pass Filter. May also be called a mask filter or critical mask filer. A high power filter centered about the desired channel bandwidth and located at the transmitter output port to eliminate out-of-band intermodulation products arising from the power amplification process.

BTSC - Broadcast Television Systems Committee

CAN - Controller Area Network (CAN or CAN-bus) is a serial communications standard designed to allow micro controllers and devices to communicate with each other.

COFDM - Coded Orthogonal Frequency Division Multiplex. A transmission technique in which the information content of a complete ensemble (multiplex) is divided and modulated onto a multitude of closely neighboring RF carriers within a channel bandwidth (frequency block). The division of the information payload among a large number of RF carriers ensures that each individual RF carrier has a very low data rate (symbol rate). The long symbol period of the individual RF carriers allows the receiver to wait until all delayed signal reflections have arrived and been added to the direct signal (...during a guard interval to be discarded). This permits recovery a stable signal in difficult reception conditions, especially during mobile reception.

CPLD - Complex programmable logic device.

CRC - Cyclic Redundancy Checksum is a procedure for error detection in digital signals. Before distribution to the transmitter, a CRC is computed for the transport stream signal. This CRC is sent in the transport stream. Upon reception at the transmitter site, another CRC is computed from the received transport stream and compared to the transmitted value. If the CRCs are identical, no error has occurred during the distribution to the transmitter site.

DAB Mode - Digital Audio Broadcast is a A digital radio/multimedia standard for transmitting multiple programs within a 1.5 MHz RF frequency block. The original DAB standard has been extended by two different enhancements to the encoding layer: DAB-Plus and DMB. All three standards use the original DAB modulation format in the transmitter (changes are upstream in the encoder). Four different DAB modes exist. VAX model transmitters use DAB mode I.

DAC - Digital Analog Converter refers to a circuit that converts digital values inside the processing stages of the LPU modulator into analog RF waveforms for amplification and transmission by the transmitter.

dBm - Decibels above a milliwatt refers to a logarithmic signal power measurement scale referenced to 1 mW. 0 dBm is equivalent to 1 mW. 10dBm = 10mW, 20dBm = 100mW, 30dBm = 1000mW.

DMB - Digital Multimedia Broadcasting is a modification of the basic DAB system according to ETSI standard (TS 102 427 and TS 102 428) using MPEG-4 (H.264) and BSAC/HE-AAC V2 compression to permit sending of multimedia information (radio, TV, and data casting) to mobile devices such as mobile phones. Originally developed in South Korea.

DNS - The Domain Name System (DNS) is a naming system for computers connected to the Internet or a network. It translates user domain names to the assigned numerical IP addresses.

DUC **-** Digital Upconverter is a circuit in the LPU modulator section that converts the digital modulated baseband signal to the 140 MHz digital intermediate frequency.

Dynamic Delay **-** Refers to a processing function provided in the modulator section to compensate for different delays of the program data stream in the data distribution network between the network origination point and various transmitter sites. A time-stamp contained in the transport stream serves as a reference. The present time is delivered by a GPS receiver at the transmitter (1pps signal, rising slope). Comparing these two sources, the dynamic delay function is able to synchronize the program input to all transmitters over a one-second correction range.

Ensemble **-** The complete information payload being received and processed by the transmitter, typically when transmitting according to the DAB standard. In general, the ensemble includes audio programs, data services, and possibly video content.

ETI **-** Ensemble Transport Interface refers to the transport stream format for DAB/DMB broadcasting (2.048 Mbit/s, G.703) used to send program material from the ensemble provider to all DAB transmitters in a network. The ETI format has two varieties: ETI-NA and ETI-NI.

ETI (NA) **-** Ensemble Transport Interface, Network Adapted Layer, is a protocol suited for transmitting the ETI signal via telecom networks. It has a frame structure that complies with G.704 specifications and contains error protection information (Reed Solomon Code). The bit clock frequency is 2.048 MBit/s.

ETI (NI) **-** Ensemble Transport Interface, Network Independent Layer, is a protocol is suited for transmission with connections that have a low error rate and a constant signal delay. It does not contain any error protection information. The bit clock frequency is 2.048 MBit/s.

EIB **-** ETI Input Board is an optional circuit card for the modulator section of the low power unit (LPU). It provides the necessary interface to allow the modulator to accept ETI transport streams according to the DAB digital transmission standard.

Ethernet **-** Physical interface by which a device may be connected to a LAN and/or the Internet to provide web-based supervision. It generally employs an RJ45 connector.

EVM **-** Error Vector Magnitude is a measure used to quantify the performance of the quality the digital being transmitted. A signal sent by an ideal transmitter would have all constellation points precisely at the ideal locations. However, various imperfections in the signal path cause the actual constellation points to deviate from the ideal locations by finite error vectors. Generally associated with the ATSC modulation standard. Analogous to the modulation error ration (MER) used for the DVB, DAB and other modulation

FEF- Future Extension Frames

FFT- Fast Fourier Transform

FPGA - Field Programmable Gate Array, is an integrated circuit designed to be configured by the customer or designer after manufacturing. FPGAs perform many of the intensive digital processing steps used to synthesize the transmitted RF signal in the LPU modulator section.

GPSS - Global Positioning Satellite System is satellite-based navigation system commonly used for determining position and navigating. In a single frequency network context, it delivers an extremely precise time reference (UTC... universal time coordinated) that is used to synchronize all transmitters.

GUI - Graphical User Interface is a type of user interface that allows users to interact with electronic devices via images rather than text commands. In this application, the user interface provided by a touch screen in dual drive systems or the web-based remote interface served over the Ethernet interface.

Hierarchical Mode - A transmission technique whereby the transmitted data payload is divided into a lower data rate high priority (HP) stream and a higher data rate low priority (LP) stream. Those receivers with difficult reception conditions decode only the more robust HP data stream, while receivers with good reception conditions receive both data streams.

Hot-pluggable - Term to denote that the device in question can be removed while transmitter is operating without suffering damage or causing damage to other devices.

HPF - High Power Filter also referred to as mask filter or critical filter.

HTML - HyperText Markup Language is the predominant markup language for web pages. HTML is the basic building block of web pages.

IP - Internet Protocol

IP Address - Internet Protocol Address is a numerical label assigned to each device (e.g., computer, printer) participating in a computer network that uses the Internet Protocol (IP) for communication. An IP address serves two principal functions: host or network interface identification and location addressing.

ISP - In-System Programming refers to a GatesAir utility used to update transmitter software.

LCD - Liquid Crystal Display is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals to display text and images. Often used to refer to the blue display screen on the front panel of LPU (low power unit).

LPF - Low Pass Filter. Typically installed close to the transmitter output port. It is used to attenuate out of band emissions at the signal harmonic frequencies arising from the high power amplification process. It may also be referred to as a harmonic filter.

LPU - Low Power Unit. Device that contains modulator (exciter) and amplifier sections. There are several different versions of LPU.

LVDS - Low-Voltage Differential Signalling

Mask Filter - Filter designed to pass a specified frequency band.

MCM - Master Control Module is a circuit board in the TCU (transmitter control unit). TCUs are used in some versions of GatesAir transmitters. Later model transmitters use the MSC2 as a transmitter control device.

MER - Modulation Error Ratio is a measure used to quantify the quality of the digital being transmitted. A signal sent by an ideal transmitter would have all constellation points precisely at the ideal locations. However various imperfections in the signal path cause the actual constellation points to deviate from the ideal locations by finite error vectors. The modulation error ratio quantifies the ratio of the desired signal to the undesired error vectors. MER is typically associated with COFDM modulation formats such as DVB or DAB.

MFS - Mega Frame Sync

MIB - Management Information Base

MIP - Mega frame Initialization Packet

NICAM - Near Instantaneous Companded Audio Multiplex; early form of lossy compression for digital audio.

NIT - Network Information Table

PA - Power Amplifier is an electronic circuit that accepts a low level RF signal and outputs an amplified replica.

PAB - Power Amplifier Block refers to a high power amplifier stage. May refer to the LPU power amplifier section or one or more high power amplification stages external to the LPU. PABs are typically numbered from 1…n with PAB 1 being the highest in the rack.

PC - Personal Computer

PCB - Printed Circuit Board in the transmitter.

PCM - Processor Control Module is a circuit card in the transmitter control unit (TCU). The MCM card provides most of the core control functions, whereas the PCM card controls the user remote & GUI interface. Later model transmitters use the MSC2 instead of the TCU.

PFRU - Precise Frequency Reference Unit is a circuit sub-assembly inside the LPU modulator section responsible for supplying the various high-stability oscillator signals required to synthesize the RF waveform that will be transmitted.

PLL - Phase Locked Loop

PRBS - Pseudo Random Binary Sequence is an endless series of random numbers typically used for transmitter test purposes, often when a valid transport stream does not exist.

PS - Power Supply is a device that supplies DC electrical energy to one or more electric loads, typically via the rectification of an AC mains electrical input.

RF - Radio Frequency refers to an electrical oscillation at the frequency of radio waves in the range of 3 kHz to 300 GHz. In this application, typically a signal in the 168 MHz to 242 MHz frequency range of the VAX transmitter.

RS-485 - TIA/EIA standard for serial multipoint communications lines, also known as EIA-485 and TIA/EIA-485, is a standard defining the electrical characteristics of drivers and receivers for use in balanced digital multipoint systems. The standard is published by the Telecommunications Industry Association/Electronic Industries Alliance (TIA/EIA).

RTAC*TM* - Real Time Adaptive Correction is a signal processing technique applied in the modulator signal generation stage which seeks to correct distortions produced in the high power amplification and filtering stages by means of pre-distortion.

RU - Is an abbreviation for rack unit. One rack unit equals 1.75" (44.45mm). The rack unit is used to describe the height of components that will be placed in racks.

SFN - Single Frequency Network is a type of transmission network in which all transmitters are synchronized in frequency and phase (symbol). This transmission technique offers high frequency economy, as a single frequency can be used in a large geographic area.

SMA - SMA connector - consists of a 0.250x36 thread. The male is equipped with a .312 inch (7.925mm) hex nut.

SMPTE 310 - A transport stream format sometimes employed with the ATSC digital television standard. Refers to the set of cooperating standards that label individual frames of video or film with a time code defined by the Society of Motion Picture and Television Engineers.

Static Delay - A delay function provided by the exciter over a manually settable range of 0 to 1000 ms to compensate for differences in signal processing delays or local propagation conditions for individual transmitters in a single frequency network.

Sync (Sync pulse) - Term used in analog broadcasting that refers to the horizontal synchronization pulse in the video waveform which, when transmitted, creates the highest level of peak envelope power in the transmitter.

TCO - Total Cost of Operation

TII - Transmitter Identification Information is a data field transmitted during the null in the DAB RF frame containing transmitter identification information for use by the receiver. Each transmitter in a single frequency network has its own unique TII identifier.

Time Stamps - Data fields in the transmission protocol (e.g. in the ETI signal) containing timing information for the purposes of signal monitoring and synchronization.

TS - Transport Stream refers to a standard format for transmission and storage of audio, video, and data for broadcast systems such as DVB and ATSC. The transport stream specifies a container format encapsulating packetized elementary streams, with error correction and stream synchronization features for maintaining transmission integrity when the signal is degraded. Depending on the digital transmission standard, the transport stream may be in the SMPTE310, ASI, or ETI format.

TPO - Transmitter Power Output refers to the transmitter forward output power level.

TSP - Transport Stream Packet

UDC - Up-Down Converter refers to a circuit in the LPU modulator section that converts an 140 MHz intermediate frequency signal to the final desired VHF RF channel frequency (upconversion) or vice versa (down conversion)

UPS - Uninterruptable Power Supply is a battery-based system designed to provide power during an AC mains failure event.

VGA - Video Graphics Array is a video display standard used by the personal computer industry based on a 640 x 480 pixel resolution. The standard used by the TCU touchscreen in dual drive systems.

VHF - Very High Frequency is the radio frequency range of 30 MHz to 300 MHz. In this application, the 168 MHz to 242 MHz frequency band covered by a VAX transmitter.

WEB - A system of Internet servers that support HTML formatted documents. A device or interface that uses HTML formatted documents transmitted according to the IP protocol, typically over LAN/WAN/Internet servers, but also locally via 1:1 communications.

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Section I Introduction

1

1.1 General Product Description

The ZX family of solid state transmitters is designed to synthesize and amplify radio frequency signals in the FM broadcast band (87.5MHz -108MHz). The full ZX family is composed of multiple transmitter models with FM output powers ranging from 125W to 3850W. This manual addresses the medium power members of the ZX transmitter family: the ZX500, ZX1000, ZX2000, and ZX3500

The complete ZX transmitter consists of two major assemblies: an exciter and the ZX amplifier chassis.

Figure 1-1 ZX1000 Shown

WARNING: Disconnect primary power prior to servicing.

1.1.1 Exciter

The exciter accepts an audio signal in either analog or digital format and modulates it onto an FM carrier. Depending on the format of modulation, digital HD Radio® or traditional FM, the exciter may be any one of these exciters manufactured by GatesAir:

- Superciter FM – FM exciter with analog audio input
- Micromax - FM exciter with analog or digital input
- Digit CD – digitally synthesized FM exciter
- FlexStar HDx-FM - tri-mode exciter capable of either traditional FM, digital HD transmissions, or both

® HD radio is a registered trademark of Ibiquity Digital Corp.

Older vintage GatesAir exciters or exciters manufactured by third parties may also be used, provided that they are capable of producing sufficient RF drive power. The approximate drive level required per model to achieve full nameplate FM power is as follows:

ZX500: 15 watts max.

ZX1000: 30 watts max.

ZX2000: 15 watts max.

ZX3500: 25 watts max.

NOTE:
All ZX transmitters are shipped with IBOC-compatible “class AB” modules installed as standard. Older “class C” ZFM modules may be used for FM-only service if necessary with the simple change of a jumper position. In such cases, the required exciter drive power will need to be increased by approximately 70%, and ***all* PA modules must be the same type** (IPA module, if applicable, can be either IBOC or Class-C type). Contact GatesAir for additional information.

1.1.2 Amplifier

The amplifier chassis accepts a low level on-channel RF signal from the exciter and amplifies it to the desired output level for transmission. This manual chiefly addresses the ZX amplifier chassis and the operation of the transmitter as a whole. A manual dedicated to the exciter is provided separately.

1.2 Transmitter Nomenclature.

The complete ZX transmitter is named according to the particular combination of exciter and amplifier chassis being employed. The number following the ZX prefix indicates the full nominal FM power level. A suffix of FM, CD, or HD+ is assigned according to the FM exciter type. For example:

- ZX1000FM = 1000W transmitter with Superciter
- ZX1000MX = 1000W transmitter with Micromax exciter
- ZX1000CD = 1000W transmitter with DigitCD exciter
- ZX1000FLX = 1000W transmitter with analog FlexStar exciter
- ZX1000HD+ = 1000W transmitter with digital FlexStar exciter
- ZX1000 = 1000W transmitter only, with exciter sold separately (no suffix)

1.2.1 Tri-mode Operation

All ZX transmitters are designed to operate in any one of three different modes:

1. FM mode = traditional FM modulation
2. FM+HD mode = hybrid mode with analog and digital simulcast
3. HD mode = digital HD Radio modulation

The determination of operating mode is made by the exciter. To transmit a digital HD Radio signal, an HD Radio exciter, such as the FlexStar exciter is required. The ZX amplifier can switch on-the-fly between all three operating modes, as commanded by the exciter through an exciter interface cable.

1.3 ZX Transmitter General Construction

The ZX transmitter features all solid-state construction and utilizes a series of FET-based power amplifier (PA) modules to amplify the RF signal. In addition to RF drive power from the exciter, these PA modules utilize DC power supplied by switchmode power supplies (PS) modules. Both the PA and PS modules are hot-pluggable and may be inserted and removed from the transmitter while it is on the air.

The number of PA and PS modules, size, weight, and other important parameters vary according to the transmitter model and desired power level. Information on the number of PA and PS modules as a function of transmitter model is given below.

Table 1-1

Model	PA Modules	PS Modules	Cooling Fans
ZX3500	**6 (+1 IPA)**	**6**	**4**
ZX2000	**4 (+1 IPA)**	**4**	**4**
ZX1000	**2**	**2**	**2**
ZX500	**1**	**1**	**1**

Additional information on important transmitter parameters, such as size, weight, and power consumption, may be found in drawing 839-8464-031 OUTLINE DRAWING, ZX TRANSMITTERS in the drawing package accompanying this manual.

Section II Installation and Initial Turn-On

2

2.1 Introduction

This section contains information concerning the installation and check out of the ZX transmitter.

2.2 Unpacking

Upon receipt of the transmitter shipment, carefully unpack the transmitter and perform a visual inspection to ensure that no apparent damage was incurred during shipment. Retain the shipping materials until it has been determined that the unit is not damaged. The contents of the shipment should be as indicated on the packing list. If the contents are incomplete or if the unit is damaged electrically or mechanically, notify the carrier and GatesAir.

2.3 Returns and Exchanges

Damaged or undamaged equipment should not be returned unless written approval and a Return Authorization is received from GatesAir. Special shipping instructions and coding will be provided to assure proper handling. Complete details regarding circumstances and reasons for return are to be included in the request for return. Custom equipment or special order equipment is not returnable. In those instances where return or exchange of equipment is at the request of the customer, or convenience of the customer, a restocking fee will be charged. All returns will be sent freight prepaid and properly insured by the customer. When communicating with GatesAir, specify the GatesAir Order Number or Invoice Number.

2.4 Transmitter Documentation

Prior to installation, this technical manual and the appropriate exciter technical manuals should be carefully studied to obtain a thorough understanding of the principles of operation, circuitry, and nomenclature. This will facilitate proper installation and initial checkout.

CAUTION:
ALL CONNECTIONS REFERRED TO IN THIS INSTALLATION PROCEDURE SHOULD BE VERIFIED USING THE SCHEMATICS SUPPLIED WITH THE TRANSMITTER. THE SCHEMATICS SHOULD BE CONSIDERED THE MOST ACCURATE IN CASE OF A DISCREPANCY.

2.5 Air Cooling Requirements

GatesAir ZX transmitters are designed to operate in an unobstructed environment with a maximum inlet air temperature of either 45°C or 50°C, depending on the mode of operation. (FM + HD mode = 45°C. Refer to the Outline Drawing 839-8464-031 in the accompanying schematic package for information on intake and exhaust air flows.

Air input is from the transmitter front with hot air exhaust at the rear of the transmitter chassis. Accordingly, the areas immediately in front of and behind the ZX amplifier chassis should be free of obstructions. As a general rule, six inches (15cm) rear clearance is sufficient, thereby allowing use of a standard 30" EIA rack if the rack has a vented door or sufficient venting at its top surface. Careful attention must be paid to the other pieces of equipment mounted in the same rack as the exhaust air from the ZX amplifier will typically be 10-15 degrees C above the ambient temperature. If rack circulation is poor, this level could be as high as 25 degrees C above ambient. Accordingly, the air flow patterns and operating temperature range of auxillary equipments may necessitate the removal of the rack rear door in certain scenarios.

“Clean” air is required. No salt air, polluted air, or sulfuric air can be tolerated. A closed air system is recommended in these environments. That is, an air conditioned system that recirculates and properly filters the room air, with no outside air brought into the transmitter room.

2.6 AC Input Requirements.

The AC mains input for the transmitter varies according to transmitter model:

2.6.1 Single Phase

ZX500: single phase, 90V–260V, 50/60Hz

ZX1000: single phase, 190-260V, 50/60Hz
(Also available as 90–260V, 50/60Hz: twist-lock receptacle)

ZX2000: single phase, 190-260V, 50/60Hz

ZX3500: single phase, 190-260V, 50/60Hz

2.6.2 Three Phase

ZX2000-3D: three phase, delta or wye, 190-260V, 50/60Hz

ZX3500-3D: three phase, delta or wye, 190-260V, 50/60Hz

ZX2000-3Y: three phase, wye only, 330–450V, 50/60Hz

ZX3500-3Y: three phase, wye only, 330–450V, 50/60Hz

A customer supplied external circuit breaker or fused disconnect is required.

Consult Outline Drawing 839-8464-031 (or 839-8464-186 depending on model) for proper breaker/fuse and wiring sizing. Whenever possible, use of separate AC circuits for the exciter and amplifier chassis is strongly recommended.

The AC input wiring should be in agreement with local electrical codes and capable of supplying the transmitter power requirements. See AC Wiring Diagram 839-8464-184 or 839-8464-185 for details.

If using metal conduit, install the AC mains wiring in a separate conduit from all exciter input cables and small signal lines.

2.6.3 Three Phase AC Connection

ZX2000 AND ZX3500 THREE PHASE MODELS

All ZX2000 and ZX3500 transmitters can be wired for single phase operation or in a three phase configuration. This section contains additional information concerning three phase operation.

2.6.3.1 Information concerning 208/240 volt delta systems

GatesAir strongly discourages the use of so-called “open delta” configurations. The unequal impedance between legs in an open delta system makes it especially susceptible to voltage transients that could damage the transmitter. Use of a “closed delta” configuration is recommended.

2.6.3.2 Information concerning 208/220 volt WYE systems

The NEUTRAL connection is NOT required for 208/220VAC 4-wire WYE source voltage and should not be run to the transmitter. There is no connection in the transmitter for the neutral connection (for this application) and it should not be connected to chassis ground. In this application, the "delta" model transmitter is used and the neutral wire is simply not connected.

2.6.3.3 Information concerning all 380/415 volt WYE systems

The neutral connection is extremely important in 380/415VAC 4-wire WYE applications. By virtue of the single phase loads within the transmitter, the system is not entirely balanced, requiring neutral current to maintain proper phase to neutral voltages. A poor neutral connection could cause damage to the transmitter.

2.6.3.4 Information concerning *some* 380/415 volt WYE systems

The ZX500 and ZX1000 transmitters are equipped with MOVs (metallic oxide varistors) to provide a measure of protection against incoming overvoltage transients. However, the selection of some of the MOVs relies upon knowing the approximate voltage from each AC phase to ground. Unfortunately, a few AC power systems around the world do not have a direct connection to earth ground, thereby making it impossible to predict the phase-to-earth ground voltage.

In a typical 380 volt system with a connection to earth ground, each AC phase will measure about 220 volts to ground. The phase-to-phase, and phase-to-ground voltages should be balanced within a few percent. However, in a system which has no direct connection to earth ground, each AC phase will measure a voltage which follows no particular pattern. In such a case, the MOV protection may need to be modified. Please consult with an electrician if this applies to your installation. If applicable, the phase-to-earth 275 volt MOVs in the RV1-RV4, RV11-RV12, and RV15-RV16 positions on PC board 901-0203-121 may be replaced with 510 volt MOVs (GatesAir part number 5600042000).

For safety reasons, you also must install a 4 pole disconnect device if your neutral line is not connected to earth ground.

2.7 Ground Requirements

Two separate ground connections are required for the ZX transmitter.

1. ***An AC safety ground*** to prevent an electrocution hazard should a dangerous potential from inside the unit accidentally come in contact with the metal chassis. This connection is automatically made via the AC input twist lock connector via the green or green/yellow wire in the AC mains connection. The AC safety ground wire should be grounded at the AC mains entrance/distribution panel.
2. ***An RF ground*** to prevent damage to the equipment during lightning induced transients and reduce RF interference to low level circuits in general. An RF ground strap/wire attachment point is located at upper left rear of the ZX amplifier chassis near the AC input connector. Use this connection when utilizing a single point grounding system, attaching your ground strap to the equipment rack and the rack, in turn, to a common grounding plate.

2.7.1 Overview of RF Grounding Practices

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 only a brief overview.

Lightning and transient energy via the power line or tower connections can impose serious threats to your personal safety as well as damage the equipment. For these reasons, you should have a good protective earthing system to divert these forms of energy to earth ground.

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. A low impedance will help carry lightning current directly into the ground instead of into your building. Additionally, coax 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 coax into your building.

For coaxial cables, a single point of entry into the building is best, with all connected to a common grounding plate (or bulkhead panel) having a low impedance connection to the building perimeter ground. Wide copper straps should be used for making the connection from the common grounding plate to earth ground.

A common grounding plate is also the best location for coaxial surge protectors for sensitive equipment such as an STL receiver. Ideally, this plate should also be the entry point for all signal lines, and serve as a single point ground for AC power surge protection.

A good 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.

Good grounding and shielding will help keep stray RF current to a minimum. RF interference usually shows up in one of several ways, intermittent problems with digital or remote control circuits, audio feedback, or high pitched noise. Even a small amount of non-shielded wire makes a very efficient antenna for RF and transient energy. If RF is allowed into the audio equipment, it can be rectified and may show up as noise or feedback. Wire and cable shields should normally be connected at both ends to the equipment chassis.

2.8 Initial Hook-up and Turn-On Procedure.

This subsection provides a step-by-step procedure for installing and commissioning your new ZX transmitter.

1. Unpack unit and carefully inspect for damage. Power supplies (PS) and power amplifier (PA) modules come in separate boxes from the main chassis.
2. Mount empty amplifier chassis in EIA rack. (ZX500 and ZX1000 have optional rack slides. Mount these rack slides as applicable). Ensure adequate vent room behind transmitter chassis. As a general rule, six inches (15cm) clearance is sufficient.
3. Connect RF output cable to amplifier chassis. Allow sufficient bend radius according to cable manufacturer's recommendations. Install an elbow as necessary.
4. Mount exciter in rack above amplifier chassis. Consult exciter manual to determine steps for proper installation and set up of exciter.
5. Install PA modules and PS modules. Modules should fully seat in transmitter chassis with only light to moderate force. Stop procedure and inspect chassis connectors for obstruction or damage if significant mechanical resistance is detected during module insertion. All PA modules are identical and symmetrical; they can be inserted with either side facing up and cannot be inserted improperly.

NOTE:
The factory test data sheet shipped with the transmitter contains the serial numbers of each of the PA modules and their slot locations within the transmitter during factory testing. While it is not critical to operation, the transmitter readings may be closer to the data sheet if the PA modules are placed in the same positions used during factory testing. To correctly duplicate factory conditions, the module

serial number tag should be on the left-hand side of the module when inserted into the transmitter.

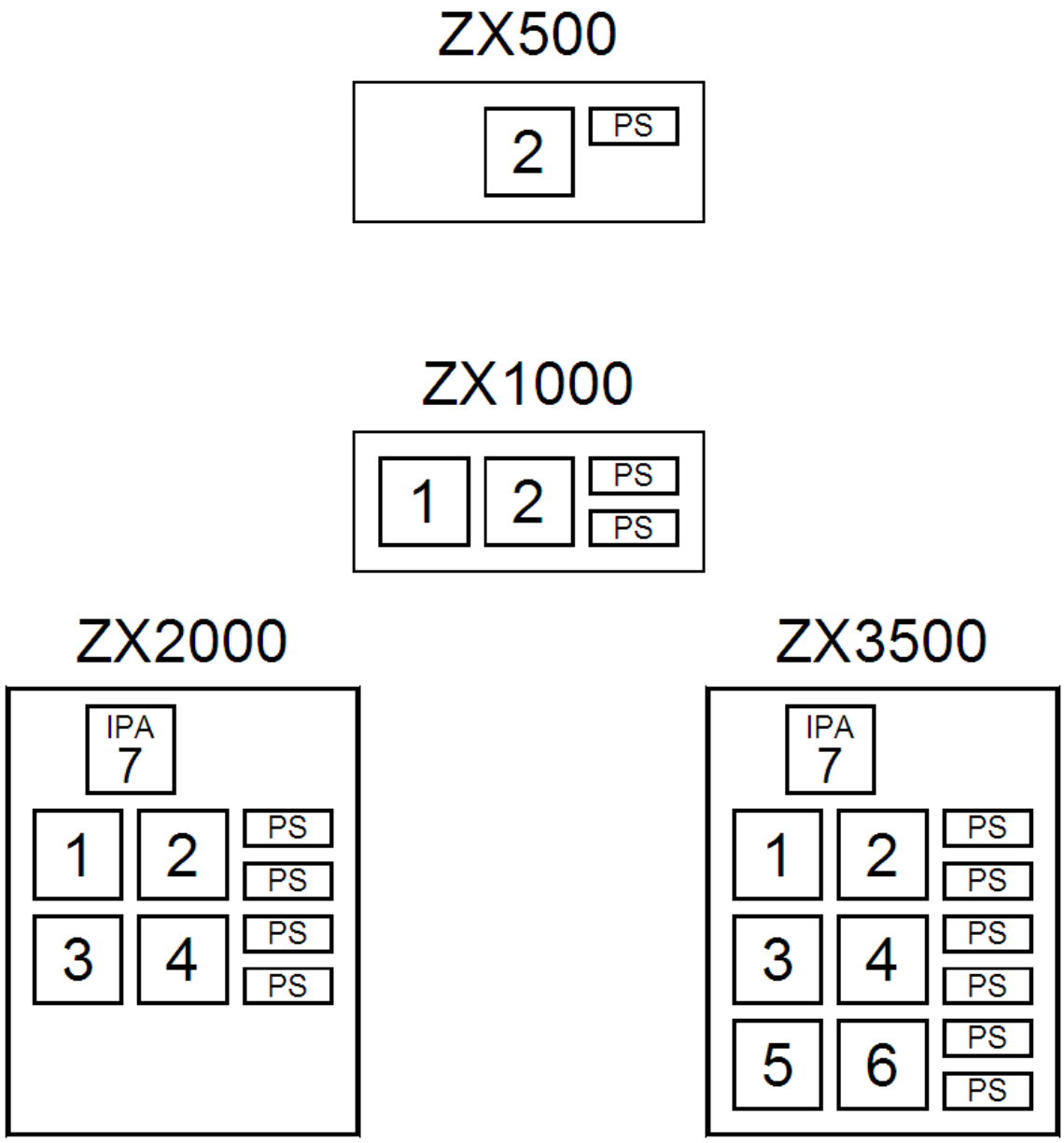


Figure 2-1 Module Locator

CAUTION:
EACH MODULE HAS TWO CAPTIVE THUMBSCREWS WHICH MUST BE TIGHTENED TO ASSURE PROPER MODULE OPERATION. THEY SHOULD BE FINGER TIGHT. IF A SMALL SCREWDRIVER IS USED, BE SURE NOT TO OVERTIGHTEN.

6. **TWIST-LOCK RECEPTACLE TYPE:**
   Attach supplied twist-lock plug to AC mains feed cable. *Do not connect this cable/connector to transmitter chassis until instructed to do so.* Consult AC-DC INTERCONNECT drawing in accompanying drawing package for determination of correct twist-lock connector pinout.
   -or-
   IEC-C19 RECEPTACLE(s) TYPE:
   Attach supplied plug(s) to AC mains feed cable. *Do not connect to transmitter chassis until instructed to do so.* Consult AC MAINS drawing in accompanying drawing package for determination of correct receptacle connector pinout.

CAUTION:
AN EXTERNAL CIRCUIT BREAKER OR FUSED DISCONNECT IS REQUIRED. CONSULT DRAWING 839-8464-031 OUTLINE DRAWING, ZX TRANSMITTERS FOR PROPER BREAKER/FUSE AND WIRING SIZING.

7. Engage external disconnect to apply AC voltage to plug.
8. Measure AC volts with voltmeter between blades of the connector to verify AC mains voltage phase-to-phase is between 190V-260V for ZX500/ ZX1000/ZX2000/ZX3500 models (or 90V-260V for ZX1000 with twist-lock connector type).
9. Open external disconnect to remove AC power.
10. Insert connector into chassis AC inlet and secure.
11. Reapply AC power. Fans internal to PS modules should start.
12. Loosen front panel thumbscrews and open front door.
13. Verify +5, +15, -15V voltage with three green voltage present LEDs on transmitter controller board. DS28 (5V), DS30 (+15V), DS29 (-15V). Note that the "-15V" voltage will be closer to -17.5V in practice.
14. Measure +5V, +15V, -15V with voltmeter between test points TP4 (+5V), TP5 (+15V), and TP6 (-15V) and metal chassis. +15V should be within +/- .25V. +5V should be within +/- .5V, -15V should measure -18V within -1V, +0.5V.
15. Locate external interlock plug (4 pin white connector) in interconnect cable kit and install in failsafe/interlock jack at rear of chassis.
16. Verify interlock plug has wire jumper installed between pins 3 and 4.
17. Turn transmitter on by pressing front panel ON button. Large DC fans at rear of chassis should start and module status red LEDs on front panel should extinguish.

18. Turn transmitter off.
19. Connect exciter drive cable and exciter interface cable between exciter and amplifier chassis.
20. Connect transmitter output to station antenna or dummy load.
21. Set exciter drive power level at minimum.
22. Turn on transmitter. Exciter should un-mute.

NOTE:
Exciter should be set to mute its RF output when a ground potential is NOT present at pin 4 of the exciter interface cable (at transmitter end... pin 9 at exciter end). This configuration will already have been performed for any exciter supplied with the transmitter.

23. Raise exciter drive power to level indicated in factory test data. PA status LEDs should glow green as a function of PA module current draw. LED intensity should be balanced between all PA modules.

NOTE:
LEDs may glow very dimly or not all for very low power levels.

24. Proceed to set APC power level as necessary per procedure in section 5 of this manual.

NOTE:
Each transmitter is thoroughly checked out during factory final test, but adjustment may be required during installation due to shipping, variations in primary power, antenna systems, or transmission line differences.

25. Verify all meter readings closely match those recorded on the factory test data sheet. Meter calibration should not normally be necessary. All meters have been calibrated in the factory.
26. Proceed to install any remote control or station interlock connection once proper transmitter operation has been verified. Remote control pinout information is provided later in this section.
27. Procedure complete.

2.8.1 Additional Steps for Connection to FlexStar HDx-FM Exciter

In addition to the exciter interface and RF drive cables, an RF sample of the transmitter output for the RTAC correction system must also be installed. This procedure assumes

that the transmitter is already operating at full power in the HD or FM+HD modes. Consult drawing 839-8464-048 for more information.

1. Locate 2-way RF splitter in interconnect cable kit.
2. Mount RF splitter to rear rack rail behind amplifier chassis or other suitable location. Splitter can be removed from angle bracket and reversed as necessary to facilitate mounting.
3. Locate BNC-BNC cable in interconnect cable kit and install between amplifier chassis RF monitor output and splitter input.
4. Locate 20dB SMA attenuator in interconnect kit and install on FlexStar "transmitter" RTAC sample input.
5. Locate BNC-SMA cable in interconnect cable kit and install between splitter output and 20dB attenuator installed in previous step.
6. Connect other output of splitter to modulation monitor, spectrum analyzer, other monitoring device, or terminate with a 50 ohm BNC load (1W rating or greater).
7. Activate RTAC correction system via exciter screen as per instructions in exciter manual.
8. Verify RTAC correction system has properly suppressed out-of-band IMD emissions with spectrum analyzer or other monitoring device.
9. Procedure complete.

2.9 Transmitter Interface Information

This subsection contains information on connecting the ZX transmitter to remote control and other external circuits. All user connections are found on the rear face of the transmitter chassis.

2.9.1 Rear Panel Connectors

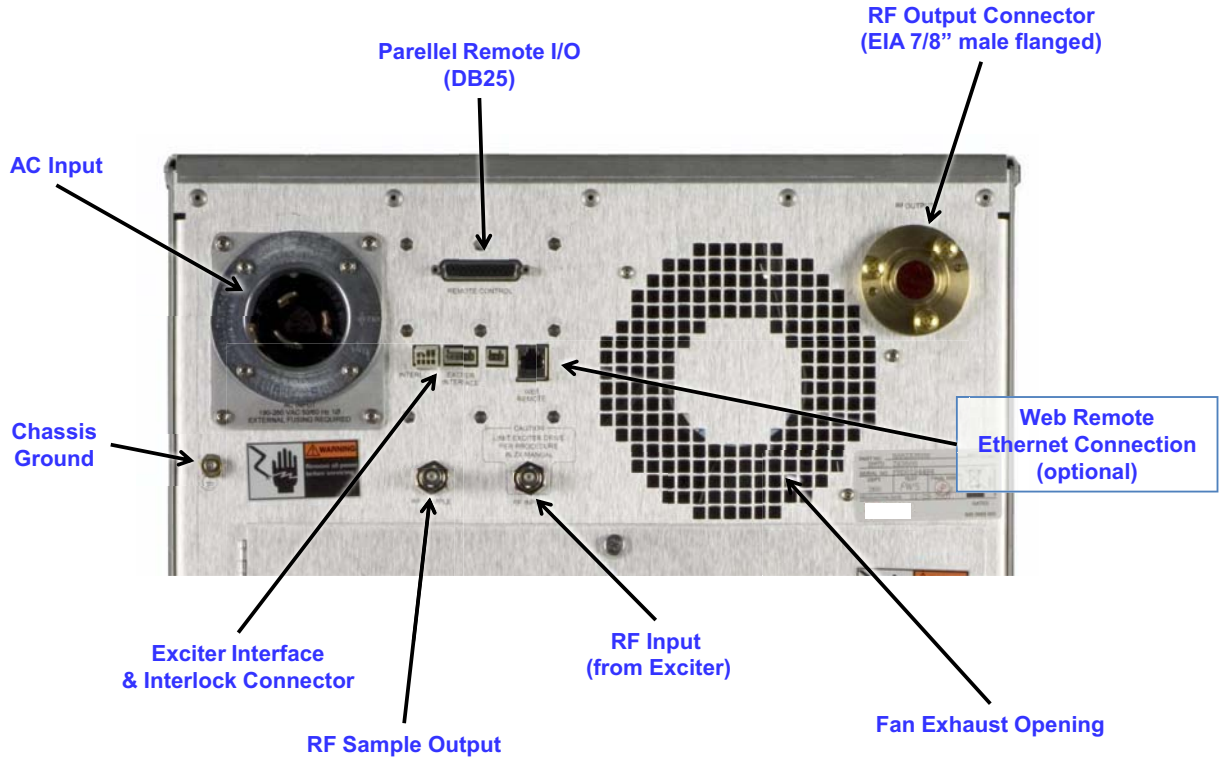


Figure 2-2 Rear panel of an early ZX3500 with Twist-lock AC receptacle

Table 2-1 Rear Connectors Types

Function	Connector
Parallel Remote Control	DB25 female
Secondary Control (not shown above)	DB25 female (see Appendix A on optional Web Remote)
Failsafe / Interlock	4 pin Wago
Web Remote	RJ45
Unused (prior 6/2007)	3 pin Wago
Exciter Interface	6 pin Wago
RF Monitor BNC	+20dBm / 2Vrms nominal
RF Input BNC	0 - 30W typical (model dependent)
RF Output	N female(ZX500, ZX1000) or 7/8" EIA flange (ZX2000, ZX3500)

2.9.2 Remote Control Pinout

NOTE:
The command functions associated with the connector are enabled/disabled via switch S6 on the Transmitter Controller PCB..

Pin	Function	Comment
1	Ground	Common return
2	TX ON/Reset command	Ground to activate (10 mA).
3	TX OFF command	Ground to activate (10 mA).
4	Power RAISE command	Ground to activate (10 mA).
5	Power LOWER command	Ground to activate (10 mA).
6	Disable foldback command or Temp reduction active *	Ground to disable (30 mA) (non-latching). or Open collector, 24V @ 100mA max. Low = transmitter power lowered to reduce stress to combiner ballast loads
7	Future use or Remote disabled status *	Future use or Open collector, 24V @ 100mA max. Low = transmitter remote control disabled by local/ remote switch on reverse side of controller card. For use with external light/alarm
8	Forward power metering	4V = 100% FM power, 2k source impedance
9	Reverse power metering	4V = 10% FM power, 2k source impedance
10	PA volts metering	4V = 52.5V, 2k source impedance
11	PA amps metering	4V = 100% nominal current per model, 2k source impedance
12	Raw max temp metering	4V = 99C, 2k source impedance. Consult conversion table to convert voltage to centigrade or Fahrenheit scales.
13	TX mode status	2k source impedance 0V = TX off 1V = FM mode on 2V = HD mode on 3V = FM + HD mode on
14	Gain low fault	Open collector, 100mA max. Low = fault Transmitter has dropped out of APC due to a failure or insufficient exciter power

15	VSWR foldback active	Open collector, 24V @ 100mA max. Low = foldback active
16	PA current foldback active	Open collector, 24V @ 100mA max. Low = foldback active
17	PS current foldback active	Open collector, 24V @ 100mA max. Low = foldback active
18	PA temperature foldback active	Open collector, 24V @ 100mA max. Low = foldback active
19	External mute active	Open collector, 24V @ 100mA max. Low = mute active
20	PA 1 current metering	4V = 20A, 2k source impedance
21	PA 2 current metering	4V = 20A, 2k source impedance
22	PA 3 current metering	4V = 20A, 2k source impedance
23	PA 4 current metering	4V = 20A, 2k source impedance
24	PA 5 current metering	4V = 20A, 2k source impedance
25	PA 6 current metering	4V = 20A, 2k source impedance

* The alternate entries for pins 6 and 7 apply to transmitters with controller card with artwork 8010203063 revC or higher (produced afer June 2007).

2.9.3 Failsafe/Interlock Connector Pinout

Pin	Function	Comment
1	Remote mute (+)	Connect (+) and (-) pins to force output power to zero. Momentary. Does not turn transmitter power supplies off.
2	Remote mute (-/GND)	
3	External interlock (+)	Connect (+) and (-) pins to NOT issue an OFF command to the transmitter. Transmitter latches in the OFF condition, requiring an ON command to restart after the connection is re-established.
4	External interlock (-/GND)	

2.9.4 Temperature Conversion Table

Max PA Tempera-ture (deg. C)	Remote Voltage (V)
25	0.274
30	0.333
35	0.407
40	0.498
45	0.609
50	0.743
55	0.904
60	1.09
65	1.32
70	1.58
75	1.88
80	2.23
85	2.63
90	3.1
95	3.62
100	4.03

2.9.5 Exciter Interface Connector Pinout

When purchased as a complete transmitter, a ready-made exciter interface cable kit is provided to connect the amplifier chassis and exciter together. This cable kit comes in two varieties:

P/N 952-9232-022 for connection to Digit / Superciter / Micromax exciters.

P/N 952-9232-029 for connection to the FlexStar HDx-FM exciter.

When the amplifier chassis is supplied without an exciter, the end-user must fashion a cable to provide the necessary interconnection. The table below provides pinout information for the transmitter end of the cable.

Table 2-2 Exciter Interface Connector Pinout

Pin	Function	Comment
1	GND	Common return.
2	FM_ON_STATUS	Held low by the FlexStar HDx-FM exciter to indicate that FM carriers are being transmitted. In FM-only applications, this line should be permanently tied to ground (pin 1) to force the power amplifier chassis into FM MODE at all times.
3	HD_ON_STATUS	Held low by the FlexStar HDx-FM exciter to indicate that HD carriers are being transmitted. In FM-only applications, this line should be left disconnected.
4	MUTE	Used to mute the exciter whenever the power amplifier is switched off or has lost AC power. This prevents the exciter from dissipating its RF output power in the amplifier chassis while the amplifier fans are not running. The amplifier chassis holds this line high (open) when it wishes the exciter output to mute. The amplifier shorts this line to ground via an open collector when it wishes the exciter to supply power. The open collector is rated for 24V @ 100mA. The splitter RF loads in the amplifier chassis are capable of dissipating the typical exciter drive power in still air, but this is not a generally recommended practice. When a non-standard exciter is used, jumpers internal to the exciter may need to be modified to allow it operate in a HIGH = MUTE fashion. In some cases, it may be necessary to use a 10K pull-up resistor and auxiliary power supply voltage to create the logic high condition.
5	EXC_APC	Used to control the power output level of the exciter in External APC mode. This is typically only used with the FlexStar HDx-FM exciter and can be left disconnected in FM-only applications.
6	EXC_READY	Held low via an open collector in the exciter when it is ready to supply drive power. The FlexStar HDx-FM exciter temporarily holds this line high/open while switching modes to force the amplifier chassis to mute during the changeover. In FM-only applications, this pin should be permanently connected to ground (pin 1).

The Wago connectors used for interconnect have two small bumps or "keys" to prevent the connector from being inserted incorrectly. One of these keys will be slightly offset

from the corner of the connector to indicate the location of pin number 1. See Figure 2-2 below.

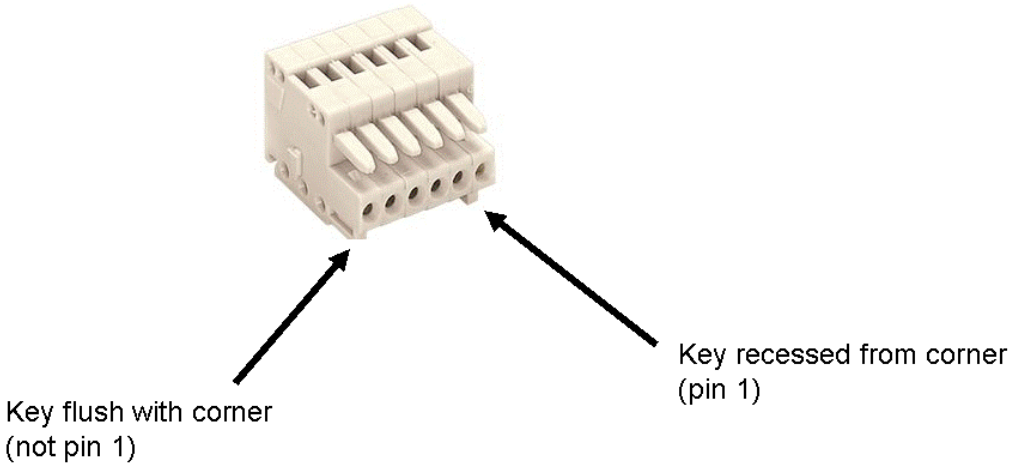


Figure 2-3 Location of pin 1 on Wago connectors

WARNING: Disconnect primary power prior to servicing.

Section III Operation

3

3.1 Introduction

This section contains information concerning operation of the transmitter and its front panel controls, indicators, and adjustments.

3.1.1 Front Panel

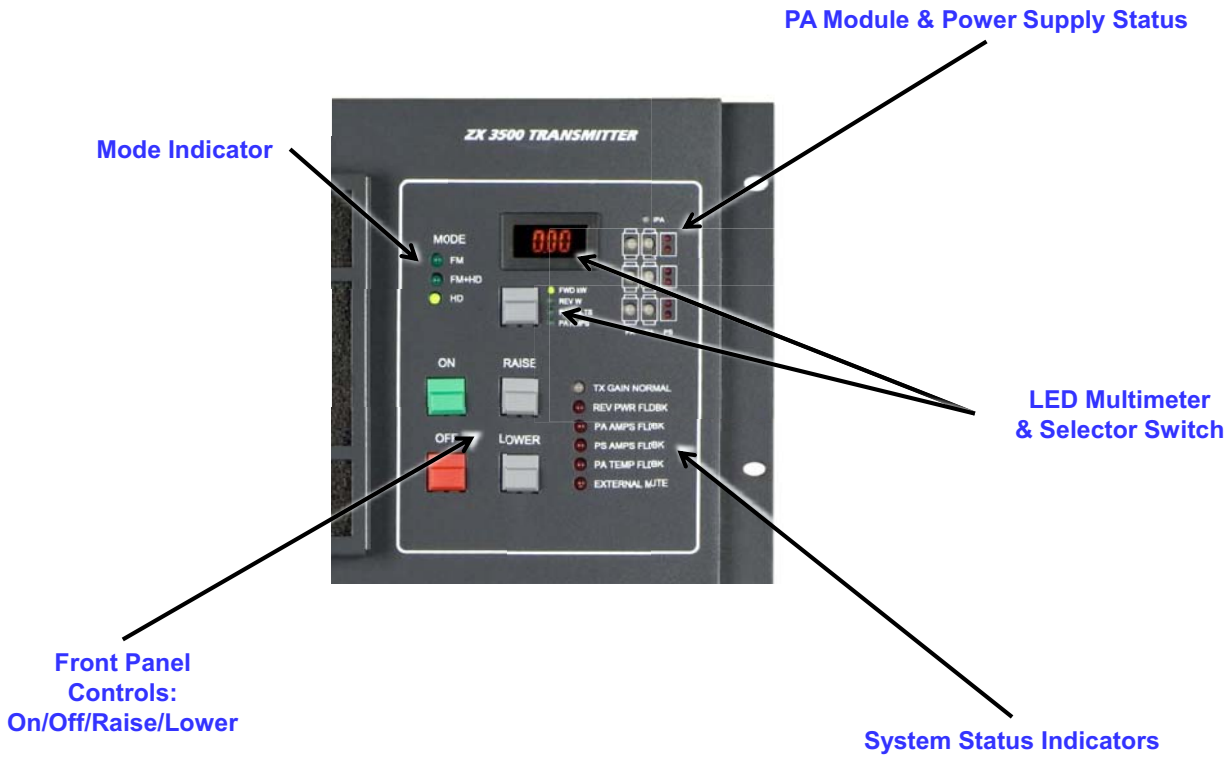


Figure 3-1 ZX3500 Front Panel

WARNING: Disconnect primary power prior to servicing.

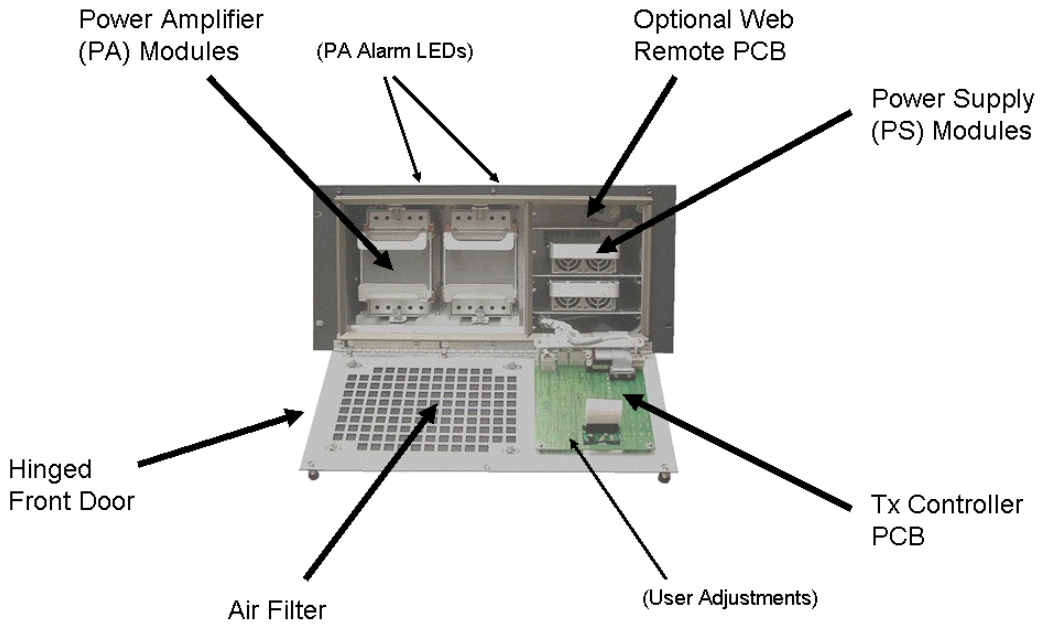


Figure 3-2 ZX1000 Inside front panel

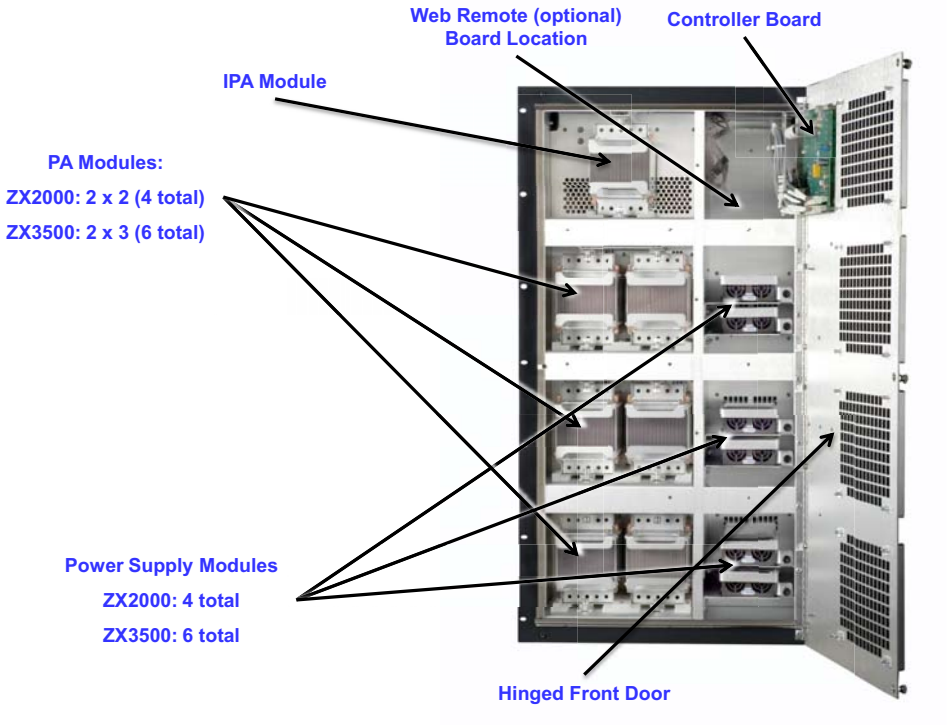


Figure 3-3 ZX3500 Inside front panel

WARNING: Disconnect primary power prior to servicing.

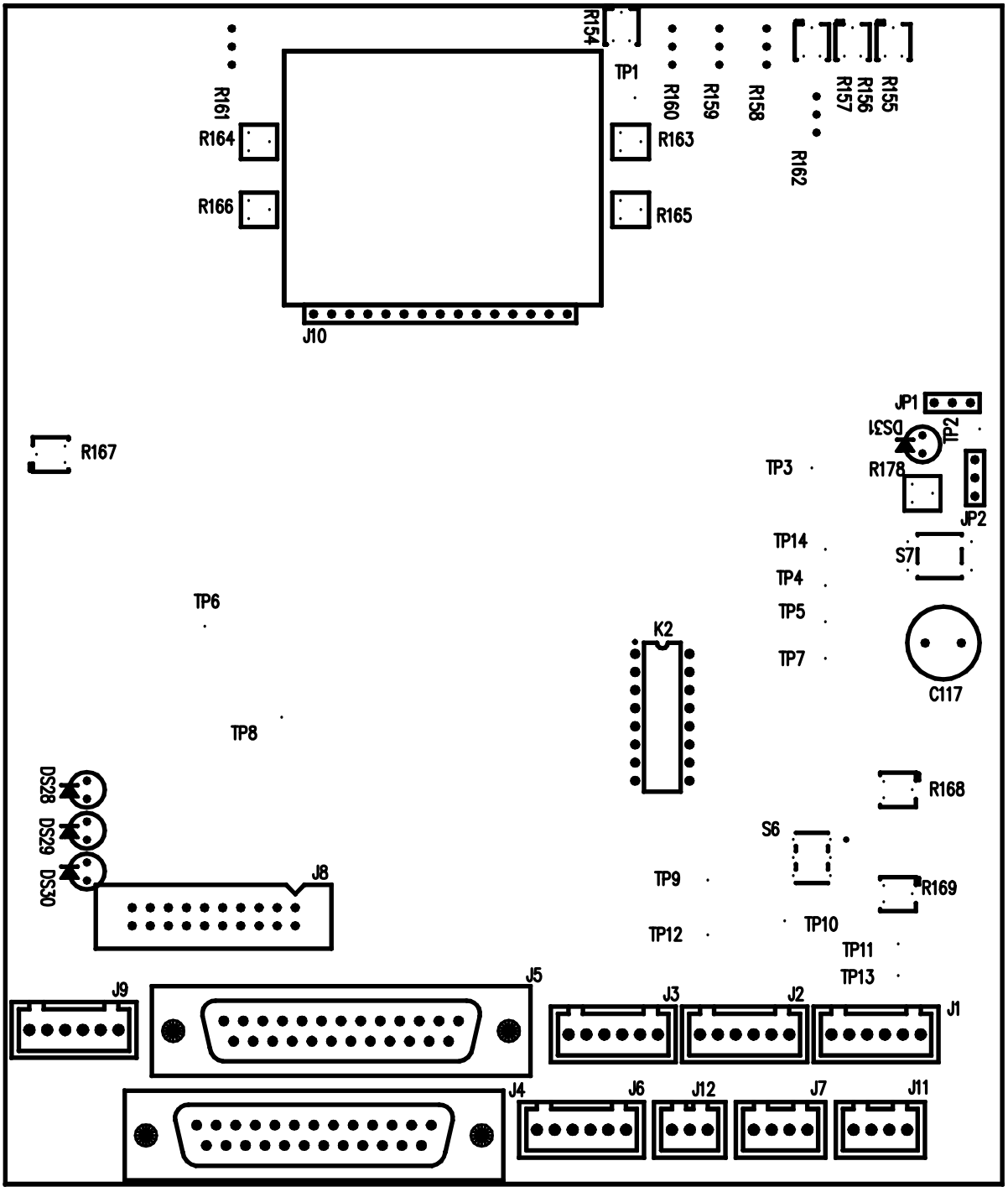


Figure 3-4 Transmitter Control Card

WARNING: Disconnect primary power prior to servicing.

Table 3-1 Transmitter Control Adjustments

The adjustments listed in this table may require user adjustment under certain circumstances. Information on the proper adjustment of these controls is provided in Section 5 of this manual.

Parameter	Control	Notes
FM APC power set	R158	Sets top of power adjustment range when operating in FM mode.
FM+HD APC power set	R159	Sets top of power adjustment range when operating in FM+HD mode.
HD APC power set	R160	Sets top of power adjustment range when operating in HD mode.
Max. exciter limit	R162	Set maximum APC voltage fed back to exciter when operating in external (exciter) APC mode. Reserved for use with HD exciters not equipped with internal power limit settings.
Reverse power foldback threshold	R161	Sets threshold of automatic power reduction due to high reflected power at transmitter output.
Remote control disable switch	S6	Disables remote control ON, OFF, RAISE, LOWER commands during transmitter maintenance periods.
APC mode: internal vs. external	JP1 and JP3 *	1-2 both jumpers = internal control of power via PA bias voltage. 2-3 both jumpers = external control of power via exciter RF drive level.
Module version	JP2	2-3 IBOC "class AB" modules (standard), 1-2 FM only "class C" modules.
Temp reduction controls **	S7 and R178	S7 forces activation of the temperature reduction circuit so that reduction percentage may be set by potentiometer R178
* Transmitters with controller card with artwork 8010203063 rev C or higher (produced after June 2007) do not have JP3		
** Only present on transmitters with controler card with artwork 8010203063 rev C or higher (produced after June 2007)		

Table 3-2 Factory Adjustments

The adjustments listed in this table are typically set at the factory and do not require user adjustment. In many cases, the adjustment controls are sealed at the factory before transmitter shipment.

Parameter	Control	Purpose
FM forward power meter cal	R155	Adjusts forward power reading on both local meter and at remote interface when in FM mode.
FM+HD forward power meter cal	R156	Adjusts forward power reading on both local meter and at remote interface when in FM+HD mode.
HD forward power meter cal	R157	Adjusts forward power reading on both local meter and at remote interface when in HD mode.
Reverse power meter cal	R154	Adjusts reverse power reading on both local meter and at remote interface when in any mode.
PA volts meter cal	R166	Adjusts PA volts reading on both local meter and at remote interface when in any mode.
PA amps meter cal	R167	Adjusts PA amps reading on both local meter and at remote interface when in any mode.
Forward meter zero	R168	Zeroes forward power reading when transmitter is off.
Reverse meter zero	R169	Zeroes reverse power reading when transmitter is off.
Forward power coarse meter scale	R165	Adjusts forward power reading on local meter only. Establishes correct relationship between remote reading and front panel meter.
Reverse power coarse meter scale	R163	Adjusts reverse power reading on local meter only. Establishes correct relationship between remote reading and front panel meter.
PA amps coarse meter scale	R164	Adjusts PA amps reading on local meter only. Establishes correct relationship between remote reading and front panel meter.

3.1.1.1 Indicators in PA Module Bay (one for each PA module)

These indicators are visible when the front door to the transmitter is open. They serve to identify which individual PA module is creating a foldback condition when a foldback is reported on the transmitter control panel.

Left: PA reverse power foldback active (…this module) (DS5)

Center: PA current foldback active (…this module) (DS3)

Right: PA temperature foldback active (…this module) (DS4)

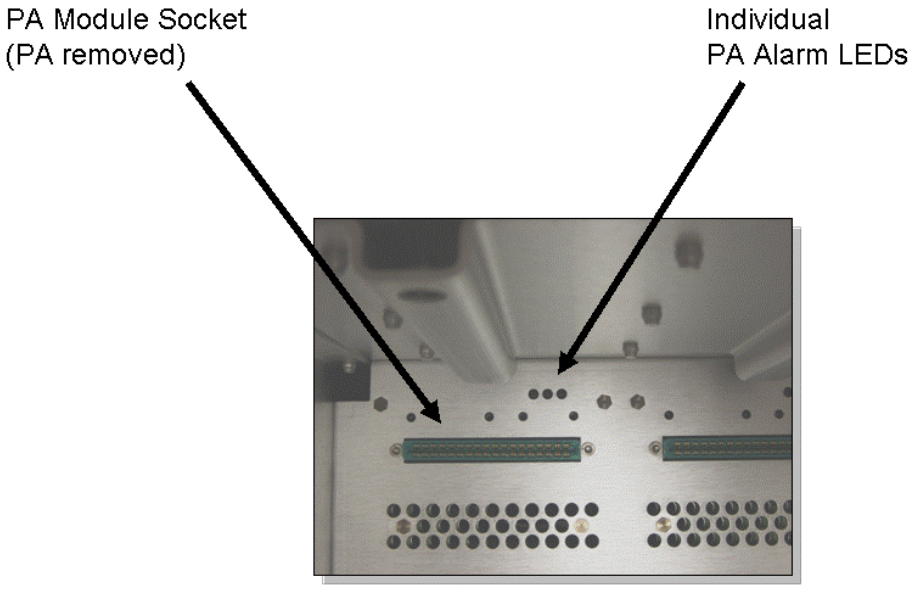


Figure 3-5 Individual PA alarm LEDs

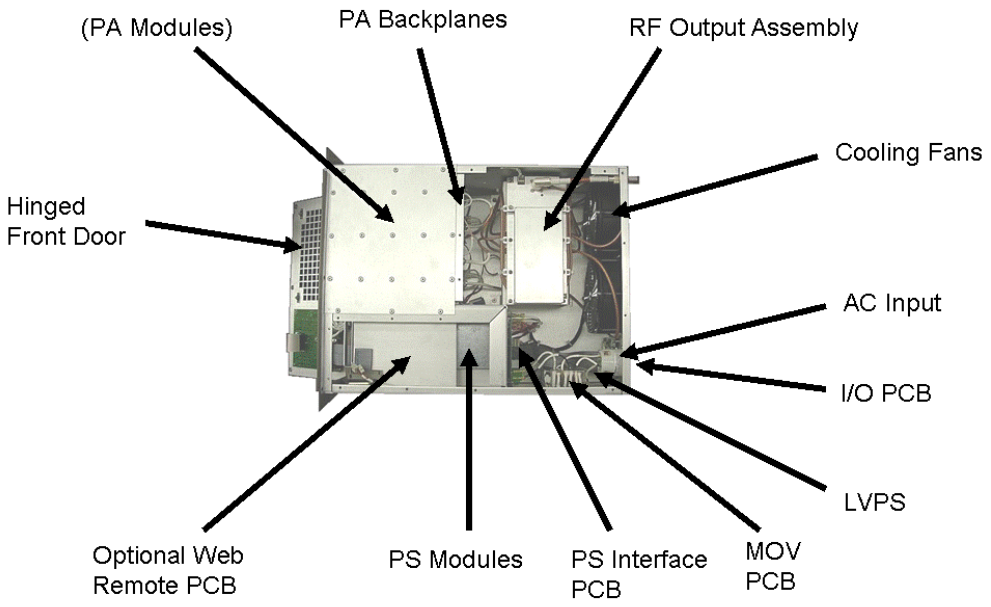


Figure 3-6 Major subassembly locator, ZX500/ZX1000 chassis

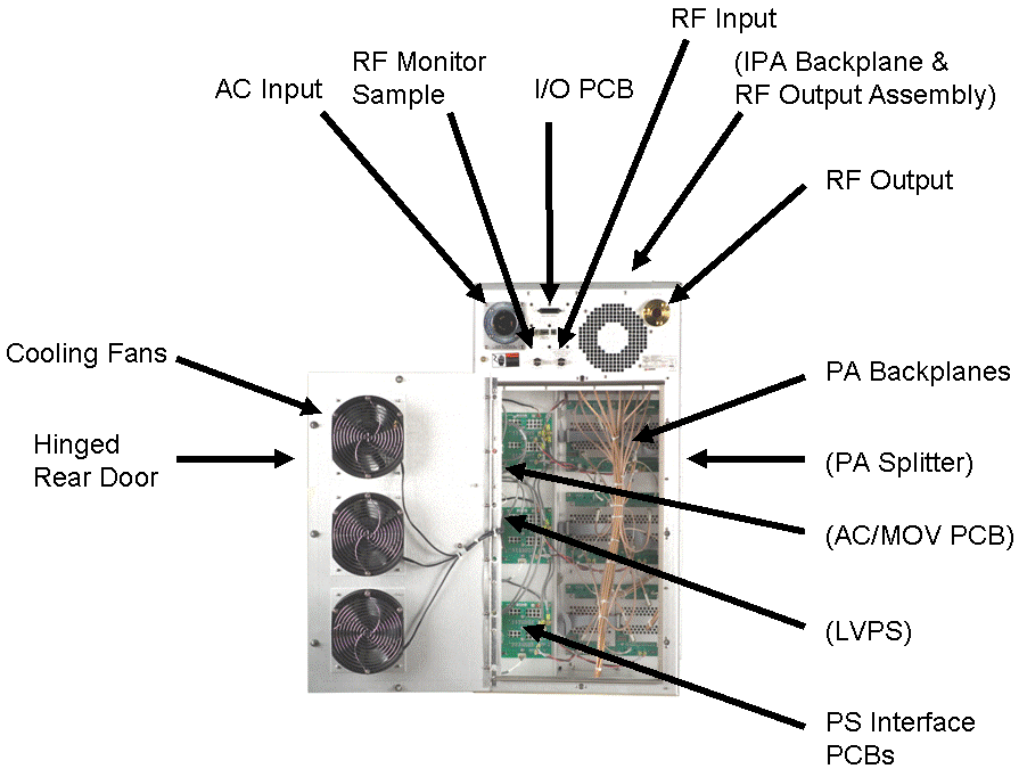


Figure 3-7 Major subassembly locator, ZX2000/ZX3500 chassis

WARNING: Disconnect primary power prior to servicing.

3.1.2 BASIC OPERATIONAL PROCEDURES

This section contains the basic procedures for daily operation of the transmitter.

3.1.2.1 ON/OFF Procedure

1. Power supply internal fans operate whenever AC is applied.
2. Press front panel ON button.
3. PA power supplies output 50V DC and fans at rear of chassis start.
4. PA and PS status LED(s) of front panel change from red to off.
5. RF power is ramped up from zero.
6. PA module status LED(s) change from off to green with a variable intensity that increases according to PA module current draw.
7. Consult front panel meter to verify correct power output level.
8. Inspect PA status LEDs for balanced intensity among all PA modules.
9. Procedure complete.

3.1.2.2 Power Raise/Lower Procedure

1. Select forward power metering position on front panel meter via meter select pushbutton.
2. Adjust output power using front panel RAISE or LOWER pushbuttons.
3. With transmitter gain control circuits properly adjusted, it should be possible to vary power from <10% to 110% power.
4. Procedure complete.

NOTE:
The TX GAIN NORMAL light should always remain green. If the TX GAIN NORMAL light turns red or orange at the high end of the power range (and all PA and PS modules are operating correctly), the exciter drive power is insufficient. Compare exciter power against original factory data or station log and adjust exciter as necessary. Also consult the APC setup procedure contained in the maintenance section of this manual for more details on properly setting exciter power.

3.1.2.3 Switch Operating Mode Procedure (HDx-FM Exciter)

1. Access mode selection fields on user screen **[Home>Setup>Output>Next]** of FlexStar HDx-FM exciter.
2. Command exciter to switch to desired mode (FM, FM+HD, HD) by setting **Primary mode: Main** parameter.
3. ZX transmitter (amplifier chassis) registers EXTERNAL MUTE alarm and transmitter power drops to zero.
4. Transmitter MODE LED changes on amplifier front panel to reflect new mode selection.
5. EXTERNAL MUTE alarm clears and power ramps up from zero to new power level.
6. Adjust front panel RAISE or LOWER pushbuttons as necessary to adjust power level.
7. Procedure complete.

NOTE:
The front panel RAISE/LOWER power setting is preserved while switching transmitter modes. For example; if the transmitter were operating at 65% of the maximum FM setting in FM mode, it would transmit at 65% of the maximum HD setting after switching to HD mode.

Section IV Overall System Theory

4

4.1 Introduction

This section provides a more in-depth discussion of the operation of the ZX transmitter.

4.1.1 RF Flow Diagram

Consult appropriate drawing based on your transmitter model

ZX500 = 839-8464-024

ZX1000 = 839-8464-006
-or-
ZX1000 = 839-8464-005

ZX2000 = 839-8464-017

ZX3500 = 839-8464-020

4.1.1.1 RF Splitter

ZX500/ZX1000: RF power from the exciter passes through a Wilkinson power splitter to the RF input connectors on each PA backplane. The input splitter features isolation between its outputs to keep the drive to each PA module constant as other PA modules are plugged in and pulled out. A 90 degree offset in every other output cable ensures that reflections are absorbed by the splitter absorption loads as PA modules are unplugged.

ZX2000/ZX3500: The RF power from the exciter first passes through an additional PA module acting as an intermediate power amplifier (IPA) before being supplied to the input splitter as described above.

4.1.1.2 PA Modules

The RF signal is amplified in the PA modules with a nominal gain of 14 – 20 dB, depending on frequency and operating mode. Each PA module utilizes a pair of VHF MOSFETs operating in a push-pull configuration. Consult schematic 843-5569-071 for more details.

4.1.1.3 RF Combiner

The output from the PA modules is passed through the PA backplanes to the RF output assembly. The RF output assembly is a combination Wilkinson power combiner and harmonic filter. The output of the RF output assembly is passed outside the transmitter to the station RF system and antenna. An RF sample derived from a non-directional voltage probe at the transmitter output is available for customer monitor equipment and/or the GatesAir RTAC® adaptive correction system for HD Radio. The RF output sample has a +20dBm nominal level (or approximately 2Vrms into 50 ohms). This high level is required to drive most commercially available modulation monitors, but must be attenuated with a 20dB attenuator for connection to the FlexStar RTAC input.

® RTAC is a registered trademark of GatesAir.

4.1.2 AC-DC Interconnect Diagram

Consult appropriate drawing based on transmitter model

ZX500 = 839-8464-025

ZX1000 = 839-8464-005/6
-or-
ZX1000 = 839-8464-187

ZX2000 = 839-8464-018

ZX3500 = 839-8464-021

For ZX500/ZX1000 models, AC power enters at the transmitter rear and passes through an AC distribution board with built-in MOV protection. For all ZX models, AC is then distributed to a low-voltage power supply, which powers the transmitter logic circuits, and to one or more power supply interface boards. AC power is converted into +50V DC by the PS module(s) plugged into the PS interface board(s).

+50V DC voltage from the PS Interface boards is distributed to DC cooling fans and to one or more PA backplanes. The PA backplane acts as an interface to the PA module, receiving DC power from the power supplies and communicating logic signals to the transmitter controller board.

The transmitter controller also receives power readings from detectors on the RF output assembly to drive the transmitter APC circuits and front panel power meter.

The transmitter controller communicates to the outside world via the I/O Filter PCB. The I/O Filter PCB contains RF filtering and MOV surge suppression devices to prevent externally generated interference and voltage spikes from damaging the transmitter.

4.1.2.1 PA Backplane

Consult drawing 801-0203-051

The PA backplane is toggled between the on and off condition according to the state of bistable latch U2 pins 13-15. A positive pulse on J7-4 from the transmitter controller flips the latch to the on state (positive rail) and enables the PA module by removing the negative voltage through diode CR4 pins 9-8 to the bias drive transistors Q1 and Q2.

When in the on state, the PA module receives the bias voltage supplied by the transmitter controller via J7-3. This bias may be fixed or variable, according to the mode of operation (internal versus external power control).

While in the on state, the output of U2 pin 14 is divided through R24-R25 to provide a +9.5V signal at U2 pin 12. The PA module remains in the on state until a voltage greater than +9.5V is received at U2 pin 13. Such a signal could come from +10V signal (after CR4 diode drops) from any of several sources:

- Via R1 when the PA module is unplugged from its socket, thus breaking a ground connection through the PA module.
- From VSWR detection circuits U1 pins 1-3 and 5-7 whenever a reflected power level of greater than 20W is detected at either PA output.
- From temperature detection circuits U1 pins 8-10 and 12-14 whenever a temperature of greater than 99 degrees Centigrade is detected by either of the PA module onboard thermistors.
- From overvoltage or undervoltage detection circuits U2 pins 1-3 and 8-10 whenever the DC voltage from the power supplies is outside the window of approximately 35V to 60V.

- From the current monitoring circuit U3 whenever the total current draw for the PA module exceeds 22A.

In the case of the PA current, PA temperature, and VSWR detection circuits, samples of the 0-10V signals described above are also passed to the transmitter controller via LEDs DS3-DS5 and ultimately J3-8,10, and 12. The transmitter controller is designed to invoke the transmitter reverse power, PA current, or PA temperature foldback circuits when any of these voltages exceeds approximately 95% of the +10V alarm threshold. As a result, the PA module will only toggle to the off state from VSWR, current, or temperature overloads under the following three conditions:

- A transient alarm so rapid that the foldback control loop on the transmitter controller cannot respond quickly enough to reduce power.
- The transmitter foldback circuits are bypassed via the external remote control interface. (Units produced prior to June 2007)
- The transmitter controller is not functioning correctly.

The action of the transmitter foldback circuits is discussed further in the section dedicated to the transmitter controller theory of operation.

4.1.2.2 IPA Backplane

Consult drawing 801-0203-131 (ZX2000 and ZX3500 models only)

The IPA backplane is essentially the same as the PA backplane discussed earlier. One noticeable difference is that the module in the IPA position will never toggle to the OFF state. In the case of a momentary overload not rectified by the main controller, the IPA controller simply folds back the IPA module using the on-board gate bias voltage. In such cases the IPA status light on the main controller will pass from green to a variable shade of red, depending in the severity of the foldback.

4.1.2.3 PS Interface PCB

Consult drawing 801-0203-101

The PS Interface board provides an interface between the plug-in power supply module and the transmitter chassis. Resistors R1-R4 program the power supply to produce approximately 51.5 VDC.

AC sample circuit T1-CR1 produces a sample of the incoming line voltage. This sample is used by the transmitter controller to mute the transmitter output during under voltage

conditions (<190VAC) in the ZX2000/ZX3500 models, and ZX1000 with IEC-C19 AC receptacle.

4.1.2.4 Transmitter Controller

Consult drawing 801-0203-061

4.1.2.4.1 Forward Power Metering (Page 1)

A forward voltage sample from the output RF assembly passes through RF filter components R180, C150, and is squared by multiplier U22 to create a reading proportional to output power. Potentiometer R168 is preset in the factory to remove any offset and zero the forward power readings.

The forward power sample is amplified by U3 pins 1-3, with gain being determined by trimpots R155, R156, R157 and analog switch U2. The gain of U3 changes with each transmitting mode (FM, FM+HD, HD) to provide accurate power reading regardless of modulation format and peak to average ratio. The forward power readings are calibrated in the factory to provide a nominal 4V output voltage to the remote control at the full nameplate FM power level of the transmitter. The 4V voltage is the divided by resistors R1, R165 to provide the correct reading on the front panel meter.

NOTE:
Trimpot R165 is preset in the factory to establish the "100% power = 4V remote voltage = nnnn Watts meter reading" relationship for a given transmitter model. This adjustment should never be changed once the unit leaves the factory. Fine power calibrations may be performed via trimpots R155, R156, or R157 in the HD, FM+HD, and FM modes respectively.

The scaled forward power reading from R165 passes through meter selector chip U6 to the front panel meter. The front panel meter is internally scaled such that an input voltage of .2000V produces a reading of "2000."

In the ZX2000 and ZX3500 transmitter models, the decimal point after the second digit activates while the forward power position is selected via SPDT switch U9 to provide a reading scaled in kilowatts.

4.1.2.4.2 Reverse Power Metering (Page 1)

A reverse voltage sample from the output RF assembly passes through RF filter components R151, C83, and is squared by multiplier U25 to create a reading

proportional to output reverse power. Potentiometer R169 is preset in the factory to remove any offset and zero the reflected power readings.

The reverse power sample is amplified by U3 pins 5-7, with gain being determined by trimpot R154. There is a single trimpot calibration for all three transmitting modes: FM, FM+HD, HD. This will create an error of up to 20% in the reflected power meter reading when switching modes (FM mode is 20% low when compared to HD). This discrepancy does not have a material impact on the operation reverse power protection circuits in the transmitter.

The reverse power reading is calibrated in the factory to provide a nominal 4V output voltage to the remote control at 10% of the full nameplate FM power level of the transmitter. The 4V voltage is the divided by resistors R2, R163 to provide the correct reading on the front panel meter.

NOTE:
Trimpot R163 is preset in the factory to establish the "10% reverse power = 4V remote voltage = nnnn Watts meter reading" relationship for a given transmitter model. This adjustment should never be changed once the unit leaves the factory. Fine power calibrations may be performed via trimpot R154.

The scaled reverse power reading from R50 passes through meter selector chip U6 to the front panel meter. The front panel meter is internally scaled such that an input voltage of .2000V produces a reading of "2000."

The decimal point after the third digit activates while the reverse power position is selected via SPDT switch U8 to provide a reading scaled in tenths of a watt. (e.g. 120.2W)

4.1.2.4.3 Automatic Power Control (APC) (Page 2)

The forward power sample at TP13 is also applied to a voltage controlled amplifier formed by U3 pins 12-14 and U20. U20 is a digital 100k ohm potentiometer controlled by the power RAISE and LOWER buttons. Because the U3 is inside the negative feedback APC loop, increasing its gain increases the relative strength of the output sample and forces the APC to lower the transmitter power to compensate. Accordingly, the minimum resistance setting of U20 corresponds to the maximum gain of U3 and minimum transmitter output power. U20 has 64 different attenuator steps, corresponding to a power control step of approximately 1%. The power control steps are logarithmically weighted, with finer steps near the top end of the power adjustment range.

The output of U3 pins 12-14 is applied to a variable gain amplifier U3 pins 8-10, the gain of which is selected according to transmitting mode via potentiometers R158, R159, R160, and analog switch U1.

NOTE:
Potentiometers R158, R159, R160 determine what constitutes full power in each mode, while the U3/U20 raise/lower circuit moves from 0% to 100% within this pre-determined range.

Under normal circumstances and 100% output power, the voltage at U3 pin 8 is approximately +7.5V. It passes through optoisolator U18 and voltage divider R57, R58 to drive pin 2 of U12 with approximately +2.65V. Here, it is compared to a fixed reference voltage of +2.65V at pin 3 of U12. If the output sample is greater than the fixed reference, the output power is too high and the output of U12 pin 1 drops to reduce output power. If the output sample is lower than the fixed reference, the output of U12 pin 1 rises to increase output power.

The U21 APC comparator is normally controlled by a sample of the forward output power passing through the diode OR ladder formed by U18, U21, and U24. This causes the APC to track the forward power and stabilize the transmitter gain against changes in temperature or other environmental conditions. In overload conditions, such as excessive reverse power, high temperature, or over drive (over current), other signals take control of the diode OR ladder and force the APC comparator to reduce power until a new equilibrium is reached at 2.65V. The optoisolator (diode) in conduction lights its corresponding front panel status LED to indicate which signal is currently controlling power.

If the forward power sample is too low compared to the 2.65V reference, and no overload conditions exist, a “low gain” (LREF) reference voltage, derived from U26 pins 5-7, takes control of the OR circuit and lights the red half of the APC normal LED. Since the LREF signal is always below the 2.65V reference at U12 pin 2, the APC control output at U12 pin 1 is always at the maximum boost level (positive rail) whenever the APC NORMAL LED is red.

The output of U12 pin 1 is sent to one of two places according to the setting of jumpers JP1 and JP3. (JP3 not present on units produced after June 2007)

Position 1-2 (internal APC): the power control voltage is sent to the PA modules in the form of a variable bias voltage. This option is typically used when the transmitter is operating in an FM–only mode.

Position 2-3 (external APC): the power control voltage passes through an R-C ramp circuit and ultimately to the exciter as 0-5V analog control voltage. A maximum limit on this voltage can be set by trimpot R162. Use of external APC is required for HD and FM+HD mode operation, but is also used for FM mode when the transmitter is configured for tri-mode operation.

When internal APC is not used, the PA modules receive a fixed bias voltage via jumper JP1 position 2-3. When this bias voltage is very positive (+15V), a saturated FET with grounded drain on the individual PA backplanes sends a 0V bias to the PA modules. This corresponds to class AB linear amplification in the PA module. When the transmitter is operating in FM mode, optoisolator switch U13 modifies this bias voltage to send a more negative voltage to the PA modules to increase efficiency.

Jumper JP2 modifies the bias circuit to supply zero volt bias to the modules in FM mode. This is indicated whenever older vintage “class C” platinum Z modules are used (992-9992-002 or 992-9992-902).

NOTE:
All new ZX amplifiers are supplied with HD-compatible “IBOC” modules.

CAUTION:
THE “CLASS C” ZFM AND Z-IBOC PA MODULES ARE NOT COMPATIBLE AND CANNOT BE USED SIMULTANEOUSLY IN THE SAME TRANSMITTER. BE SURE TO CHANGE THE POSITIONS OF JUMPER JP2 IF CHANGING FROM ONE MODULE TYPE TO ANOTHER. NO OTHER ADJUSTMENTS ARE REQUIRED. CLASS C ZFM MODULES ARE ONLY SUITABLE FOR EMERGENCY FM-ONLY OPERATION. AN INCREASE IN REQUIRED EXCITER DRIVE WILL BE NOTED WHEN CHANGING FROM Z-IBOC TO ZFM MODULES.

4.1.2.4.4 System Reverse Power Foldback (Page 1)

The reflected power sample at TP11 is also amplified by U17 pins 12-14, with gain determined by user-adjustable trimpot R161, and applied to optoisolator U21 to create a reverse power foldback proportional to the average reflected power appearing at the system output.

This control voltage is ORed with the reverse power sample coming from the individual PA backplanes. Accordingly, the front panel REV PWR FLDBK LED will light if high reverse power is detected at either the main output or any PA output. However, in the case of PA module reflected power, a red LED in the amplifier module bay, mounted just above the PA module, will indicate which PA is affected. and the front panel reverse power reading will be very low. If no LEDs are lit in the PA module bay and the front panel reverse power reading is abnormally high, the problem is determined to be high reflected power at the main transmitter output.

4.1.2.4.5 Load Temperature Foldback (Page 2)

A DC sample voltage proportional to the maximum load temperature on the output combiner enters a J12 and is OR'ed with the maximum PA temperature sample passed from the individual PA modules. This sample voltage forces a power foldback whenever any combiner load exceeds approximately 100 degrees C. This sample voltage is developed from thermistors screwed directly to the load mounting flanges.

4.1.2.4.6 Meter Select Circuit (Page 1)

The front panel meter is capable is displaying four operating parameters: forward output power, reverse output power, PA stage voltage, and total PA stage current. The determination as to which parameter is displayed is made by 4-by-1 analog switch U6, which is controlled by four-position ring counter U10. Pushbutton S1 causes counter U10 to increase one count each time it is pressed. Resistor R35 and C17 provide switch debouncing. The four possible output lines control the configuration of analog switch U6 and the on/off state of front panel indicator LEDs DS13, DS15, DS19, and DS21 via driver transistors Q4, Q5, Q6, and Q8, respectively.

When appropriate, decimal point scaling is provided by SPDT switches U8 and U9. Switch U8 activates the third digit decimal point for 1/10 unit reading precision whenever the reverse power, PA volts, or PA current metering options are selected. Switch U9 activates the second digit decimal point for a kilowatts reading (1/1000 scale) whenever the forward power metering option is selected in the ZX2000 and ZX3500 transmitter models (i.e. 2.00 kW). Resistors R47-R48 form a resistive divider to drop the 15V nominal output of U27 to the 5V nominal signal required to drive U4 and U5.

4.1.2.4.7 ON/OFF Control (Page 3)

The transmitter on/off state is held in memory by latching relay K2. When K2 is in the transmitter off position the following occurs:

- The enable pin(s) of the PA power supply(ies) is (are) held low to remove +50V DC power from the PA stage.
- The TX_MODE status line is pulled to zero volts to provide a remote control indication that the transmitter is in the OFF state.
- An APC MUTE voltage is applied to the transmitter APC circuits to force the transmitter output power to zero.
- The gate signal to exciter mute transistor Q12 is removed, thereby un-grounding the exciter mute line and forcing the exciter to mute its output.

NOTE:
The input RF circuit has load resistors capable of safely dissipating the nominal exciter input power when the transmitter is off and the fans are deactivated. However, whenever possible, it is highly recommended the exciter mute function be implemented as a safety precaution.

ON/OFF relay K2 is moved to the on position by a +15V signal generated by any one of the following actions:

- Front panel ON pushbutton S2 is pressed.
- The REM_ON_CMD command line is held low at pin 2 of the parallel remote control interface J4 and remote enable switch S6 is in the enabled position, thereby causing optoisolator U23 and driver transistor Q11 to conduct.
- The REM_ON_CMD command line is held low by the optional web control PCB at pin 2 of J5 and remote enable switch S6 is in the enabled position, thereby causing optoisolator U23 and driver transistor Q11 to conduct.

These actions also send a positive pulse to the PA modules via connector J8 pin 4 to turn them on. This will re-activate any PA modules that have shut themselves down due to a previous fault condition.

NOTE:
The on command provided via the front panel pushbutton or remote control interface MUST be momentary (pulsed). Do not hold the ON button in for extended periods of time. Ensure that any external remote control system is programmed to send a momentary (non-latched ON command).

ON/OFF relay K2 is moved to the off position by a -15V signal generated by any one of the following actions:

- Front panel OFF pushbutton S4 is pressed.
- The REM_OFF_CMD command line is held low at pin 3 of the parallel remote control interface J4 and remote enable switch S6 is in the enabled position, thereby causing optoisolator U23 and driver transistor Q10 to conduct.
- The REM_OFF_CMD command line is held low by the optional web control PCB at pin 3 of J5 and remote enable switch S6 is in the enabled position, thereby causing optoisolator U23 and driver transistor Q10 to conduct.
- The EXT_INTLK line is NOT held low at pin 3 of J7, thereby causing optoisolator U27 and driver transistor Q13 to conduct. The external interlock line a J7-3 is held low when the station interlock loop back to J7-4 is closed.

These actions also send a -15V pulse to the PA modules via connector J8 pin 5 to turn them off.

The purpose of the auto restart circuit is to send an ON command to restart PA modules that may have shut off during a transient event such as a brief AC power outage. The auto restart circuit is triggered whenever the transmitter is in a latched ON state (K2) and all PAs are off. Comparator U17 pins 1-3 produces a high output when all PA modules are off, thereby activating timer U16, which sends periodic ON commands to the PA_ON bus until the condition is eliminated (i.e. at least one PA turns on).

4.1.2.4.8 Power Control Clock Circuit (Page 3)

Timer U15 generates a square wave with an approximate 4Hz frequency. This signal is used as the clock for the power/raise lower electronic potentiometer U20. The setting of U20 moves four counts for every second the power RAISE or LOWER pushbuttons are pressed.

4.1.2.4.9 Power Supply Current Foldback (Page 3)

A maximum current monitoring sample from the PS modules is taken from pin 2 of J1, J2, or J3. The PS current is already diode ORed by diodes located on the PS Interface PCB. The maximum PS current sample is amplified by U26 pins 1-3, which is set such that a voltage of +7.5V is obtained when the corresponding power supply output is approximately 85% of its nominal rating. This +7.5V signal causes optoisolator U24 to conduct in the APC foldback ladder circuit on page 2. Therefore, when a PA power supply reaches 85% of its nominal current rating, it takes control of the APC circuit, initiates a PS CURRENT fold back, and lights the front panel PS CURRENT LED.

Because all PA power supplies share a common DC bus in transmitter models with multiple supplies, the PS CURRENT fold back circuit often engages when one power supply is removed. The current from the remaining supply(ies) increases until 85% of their nominal rating is reached. The RF power output is then reduced via the PS CURRENT fold back circuit until equilibrium is reached. The PS CURRENT foldback circuit allows PA power supplies to be removed in a hot-plug fashion while ensuring that the remaining supplies continue to operate within their safe operating range.

4.1.2.4.10 Power Supply NOK LEDs (Page 2)

Each of up to six PA power supply modules provides a DC Not OK indication to drive front panel red LEDs DS1, DS2, and DS3, etc.

4.1.2.4.11 AC Low Voltage Mute (Page3)

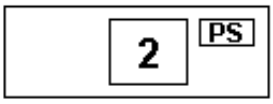
Comparator U26 pins 8-10 receives a DC sample proportional to the incoming AC line voltage via pins 3 on J1, J2, and J3 (where applicable). This sample is diode OR-ed among multiple PS Interface boards for greater redundancy (where applicable). The output of U26 pin 8 goes high whenever the AC input voltage drops below 190VAC, enabling the transmitter external mute via Q21. This muting prevents the transmitter from tripping the external circuit breaker if it has not been rated for operation below 190VAC.

NOTE:
Resistor jumper R153 is removed in ZX500 and ZX1000 transmitters to allow them to operate at 120VAC.

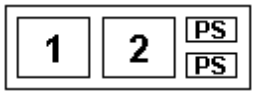
4.1.2.4.12 PA Module Status LEDs (Page 4)

The PA module status lines for module positions 1-7 arrive from the PA modules at pins 14 through 20 of J8. Up to six PA modules may be accommodated in positions 1 through 6. A PA module in the IPA position occupies position 7 (ZX2000 & ZX3500). Depending on the transmitter model, only some of the PA module positions may be occupied. The physical positions of the PA modules according to transmitter model number are shown below.

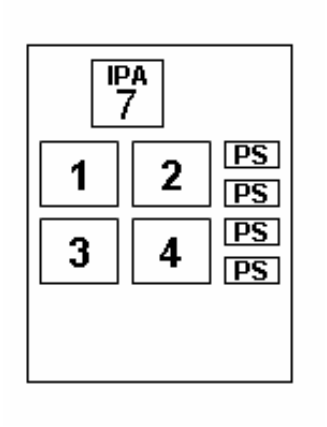
ZX500



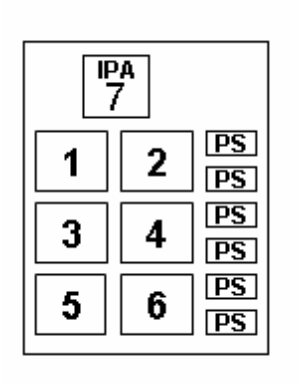
ZX1000



ZX2000



ZX3500



Each PA module status line for positions 1 through 6 will carry one of two possible signals:

- A positive 0V to +4V signal equivalent to the PA module DC current draw in amperes divided by 5. (i.e. 4V = 20A)
- A negative voltage indicating that the module is in the OFF state.

PA status line 7 carries a positive signal when the corresponding IPA is active. This voltage becomes progressively more negative if the IPA experiences a severe foldback condition. See sections on PA and IPA backplane for more details.

The PA status lines for PA module positions 1 through 6 are buffered by U11 and U4. The outputs of U11 and U4 drive bipolar LEDs DS18, DS17, DS11, etc. to provide a front panel indication of the status of each module. The bipolar LEDs provide either a variable intensity green illumination to indicate the relative current draw of each module or a steady full red illumination to indicate that the PA module has turned off. This allows a rapid, at-a-glance assessment of the operating status of all PA modules.

In addition to driving the status LEDs, the outputs of U11 and U4 are also used to provide a remote PA current sample. Diodes CR2, CR1, CR6, etc. prevent a negative voltage from being applied to the remote control interface when the modules are in the OFF state.

The PA module current samples are also passed through summing resistor network R65, R70, R73, etc. to U26 pins 8-10. A reading of the total PA current is initially inverted in polarity by the summing amplifier, but is de-inverted by a subsequent stage, also implemented in U11. The amplitude of the resulting total PA stage current reading is adjusted via potentiometer R167.

4.1.2.4.13 Remote RAISE/LOWER Circuit (Page 2)

Holding low the REM_RAISE line at pin 4 of remote interfaces J4 or J5 while the remote enable switch S6 is in the enabled position causes optocouplers U13 and U14 to conduct, thereby holding low the CS line to electronic potentiometer U20 in the automatic power control circuit. U14 also applies a +5V to signal to the U/~D line to U20. U20 changes its resistance one step each time its clock is strobed while the CS line is held low.

Holding low the REM_LOWER line at pin 5 of remote interfaces J4 or J5 while the remote enable switch S6 is in the enabled position causes optocoupler U13 to conduct, thereby holding low both the CS and U/~D lines and changing the resistance of U20 in the opposite direction, thus lowering the transmitter output power.

4.1.2.4.14 Transmitting Mode Select Circuit (Page 2)

The transmitter is capable of operating in any one of three modes based on incoming command lines from the exciter. The transmitter determines its operating state via the FM_ON_STATUS and HD_ON_STATUS lines available at the transmitter interface connector of the GatesAir FlexStar HDx-FM exciter. These lines are pulled low by the exciter when the FM carrier or HD carriers are present at the exciter output.

The grounding of these two status lines causes one or both halves of optoisolator U7 to conduct and applies +15V logic high signals to 2-bit decoder U5. The four possible

combinations of FM_ON_STATUS and HD_ON_STATUS are mapped to three transmitter operating modes according to the following truth table:

Table 4-1

FM_ON_STATUS	HD_ON_STATUS	FlexStar Mode	TX mode
false (high)	false (high)	Split level Mode	HD Mode
true (low)	false (high)	FM Mode	FM Mode
false (high)	true (low)	HD Mode	HD Mode
true (low)	true (low)	FM + HD Mode	FM+HD Mode

NOTE:
The FlexStar exciter split level mode is mapped to the transmitter HD mode via steering diode CR3. This is done as a safety precaution in case this mode is accidentally selected in the exciter. ZX transmitters are not designed to operate with the special FlexStar "split-level" mode (a hybrid FM+HD mode with a non-standard FM to HD ratio). If long-term operation in a split-level mode is envisioned, the FM+HD mode should be used and the relevant power meters and APC set controls (permanently) adjusted to operate with the new FM/HD ratio.

CAUTION:
CONSULT WITH GATESAIR CUSTOMER SERVICE BEFORE ATTEMPTING TO RECONFIGURE THE ZX TRANSMITTER FOR A NON-STANDARD FM TO HD RATIO. DEPENDING ON THE RATIO SELECTED, CERTAIN DE-RATINGS MAY APPLY.

The transmitter adjusts the forward meter calibration and APC set point according its operating mode via the FM_MODE, FMHD MODE, HD_MODE logic lines to analog switches U1 and U2. These logic lines also activate driver transistors Q1, Q2, and Q3 to activate front panel LEDs DS7, DS9, and DS14 and indicate the current operating mode.

Optoisolator U13 bypasses resistance R44 in the bias control voltage divider R44, R46 to shift the PA module bias level linearly whenever the HD_ON_STATUS line is true (low). This shifts the operating bias point of the PA modules to class AB to amplify linearly the HD digital radio signal.

4.1.2.4.15 Foldback Disable (Page 2)

Applying a ground to pin 6 of J4 or J5 of the remote interface energizes relay K1. This relay removes the REV PWR, PA AMPS, and PS AMPS foldback signals from the APC diode OR ladder, thus temporarily disabling these foldback circuits.

This circuit is not present in transmitters produced after June 2007.

4.1.2.4.16 Remote Control Interface (Page 5)

The transmitter remote interface is composed of two parallel DB25 connectors: J4 for the external parallel remote interface and J5 for the optional web control card. The following types of signal are available for remote control.

- Analog metering voltages for forward power, reverse power, PA stage voltage, PA stage current, and the currents of each PA module, as buffered by amplifiers U20, U23, U24 (page 3), and U26 (page 3). These signals are nominally 4V for a full scale indication.
- Command lines for transmitter ON, transmitter OFF, power RAISE, power LOWER, and foldback disable. These command lines must be momentarily grounded to issue the corresponding command.
- Open collector status lines for low gain alarm, reverse power foldback active, PA current foldback active, PS current foldback active, PA temperature fold back active, and external mute active, as provided by transistors Q13 through Q19. These open collector lines are capable of sinking up to 100mA @ 24V. The open collector is pulled to ground when the correspond fault or condition is true (active).

NOTE:
The optional web control card relies on the logic high drive signal to the open collector transistors to determine transmitter status.

NOTE:
The open collector status outputs do not have hysteresis. This could result in multiple remote control alarm events for overload conditions that are just at the alarm threshold. Classic examples of this are very slowly increasing PA module temperatures due to a clogged air filter or slowly increasing reverse power during antenna icing conditions.

4.1.2.4.17 Temperature Reduction Circuit (Page 2)

Units produced after June 2007 have a special temperature reduction circuit designed to mimize stress on the combiner reject loads during periods of prolonged operation with combiner imbalance in high ambient temperatures. A strong illumination of PA TEMP FLDBK diode DS26 via U24 causes bistable latch U12 pins 8-10 to toggle to the low state, thereby pulling the power control voltage leaving APC comparator U12 pin 1 to a lower value set by adjustable voltage divider R174-R178. This circuit is typically adjusted in the factory to reduce the power by roughly 50% upon activation. The circuit is deactivated when a reset pulse from the front panel or remote control ON command causes U12 to toggle to the high state.

4.1.2.4.18 Arc Elimination Circuit (Page 1)

Units produced after June 2007 have a special arc elimination circuit design to break a continual cycle of arc-restart-arc in case of output transmission line arcing with a well-defined threshold. In such cases, RC network C120-R179 triggers FET Q29 on PA VSWR alarms with a very rapid rise time, thereby causing timer U28 to issue a one-second power lower command via Q28 and logic line CS to power control chip U20. This cycle is repeated for each new arc, thereby allowing the transmitter to progressively lower power and remain on-air at the maximum safe power where no arcing occurs. The REV PWR FLDBK alarm output is also triggered for one second to allow any remote control monitoring devices, such as the optional web remote, to properly latch and log the event.

Section V Maintenance and Alignment

5

5.1 Introduction

This section provides maintenance and adjustment information for qualified technical personnel. The first part of this section provides a general overview of good maintenance practices.

The second part of this section provides these key maintenance procedures:

- Power amplifier module swap
- Power supply module swap
- Air filter replacement
- APC power level set
- Forward power meter calibration
- Reverse power meter calibration
- PA voltage meter calibration
- PA current meter calibration
- VSWR foldback threshold adjust

The third part of this section provides information on what precautions should be taken when replacing major subassemblies.

The fourth part of this section provides a troubleshooting table.

5.1.1 Routine Maintenance

Routine maintenance of the ZX series transmitter basically consists of regular cleaning and monitoring of temperature, currents, voltages and faults.

WARNING: Disconnect primary power prior to servicing.

5.1.1.1 Safety Precautions

It is very dangerous to attempt to make measurements or to replace components with power on. Shut off all power before servicing the transmitter, other than replacement of PA and PS modules. The front door is hinged and can be opened while the transmitter is running for access to the PA and PS modules. The rear door (ZX2000, ZX3500) and top cover require a tool to gain access and should never be opened while the transmitter is operating

5.1.1.2 Record Keeping

The importance of keeping station performance records cannot be over-emphasized.

Logbooks should be maintained for all operation and maintenance activities. These records can provide data for predicting potential problem areas and analyzing equipment malfunctions.

5.1.1.3 Transmitter Logbook

To aid in any future troubleshooting, the transmitter should be monitored (using front panel and/or remote control metering) and the results recorded in the transmitter logbook at least once a day. This provides a baseline of normal operating parameters against which any future abnormal readings might be compared.

5.1.1.4 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

Describe the nature of the malfunction. Include all observable symptoms and performance characteristics.

- CORRECTIVE ACTION

Describe the repair procedure used to correct the malfunction.

- DEFECTIVE PART(S)

List all parts and components replaced or repaired. Include the following details:

a. COMPONENT TIME IN USE

b. COMPONENT PART NUMBER

c. COMPONENT SCHEMATIC NUMBER

d. COMPONENT ASSEMBLY NUMBER

e. COMPONENT REFERENCE DESIGNATOR

- NAME OF REPAIRMAN

Person who made the repair.

- STATION ENGINEER

Indicates chief engineer noted and approved the transmitter repair.

5.1.2 Cleaning

Proper airflow is essential in keeping the transmitter in top working condition. If outside air is brought into the building, it should be well filtered to keep dirt out of the building and the transmitter.

5.1.2.1 Module cleaning

The PA module heatsinks are designed for high efficiency and therefore do not have large openings for airflow. As a result, it is common for the modules to collect dirt over time. The modules should be cleaned with compressed air on a schedule to be determined on site, depending on the air system, filtering, humidity etc... (at least once a year). This determination can be made either by visual inspection or by monitoring the maximum module temperature at pin 12 of the remote interface.

⚠ **WARNING:**
THE PA MODULES ARE DESIGNED TO HANDLE VERY HIGH TEMPERATURES AND MAY BE EXTREMELY HOT. DO NOT TOUCH THE MODULES WITH BARE HANDS AFTER THE TRANSMITTER HAS BEEN RUNNING, ESPECIALLY IN HIGH AMBIENT TEMPERATURE ENVIRONMENTS.

5.1.2.2 Chassis cleaning and inspection

The ZX amplifier chassis should be periodically opened, inspected for dust buildup, and cleaned as necessary. This inspection should also check for signs of progressive damage, such as cracking cables, destroyed MOVs, or evidence of heat stress/burning. In general, this inspection should occur on at least a yearly basis.

5.2 Operator Maintenance Procedures

The maintenance procedures provided in this section may be routinely performed by operators with basic technical skills. No special equipment or training is required.

5.2.1 Power Amplifier (PA) Module Swap Procedure

a. If a failed PA module is suspected, verify failure by looking for these tell-tale signs:

1. Output power has dropped significantly.
2. Front panel TX GAIN NORMAL light has shifted from green to red.
3. One PA status LED extinguished or significantly dimmer than other PA status LEDs (where applicable).

NOTE:
It is conceivable that conditions (1) and (2) may not occur when the transmitter is operating at greatly reduced power levels (due to APC compensation).

b. Open front door by loosening thumb screws on transmitter front panel.

c. Loosen PA module thumb screws immediately above and below affected PA module.

d. Unplug PA module from transmitter. PA status LED of removed module should change to red.

WARNING:
THE PA MODULES ARE DESIGNED TO HANDLE VERY HIGH TEMPERATURES AND MAY BE EXTREMELY HOT. DO NOT TOUCH THE MODULES WITH BARE HANDS AFTER THE TRANSMITTER HAS BEEN RUNNING, ESPECIALLY IN HIGH AMBIENT TEMPERATURE ENVIRONMENTS.

e. Insert replacement PA module.

f. Tighten PA module thumb screws to secure module in place.

g. Close front door and tighten front door thumb screws.

h. Press front panel ON pushbutton to reset module. PA status LED for affected module should change from red to off, and eventually green, as PA current ramps up.

i. Procedure complete.

NOTE:
For transmitters models equipped with an IPA module position, the IPA module slot does not have a latched OFF position. Accordingly, a module installed in the IPA position will switch on as soon as it is firmly installed in the socket. That is, it is not necessary to press the ON pushbutton to reset it.

NOTE:
When a PA module is unplugged or otherwise deactivated, some of the output power is diverted to ballast loads in the output combiner. The ballast loads are sized to safely dissipate this power during the period required to perform a PA module swap. If one or PA modules are left inactive for extended periods of time, a special temperature reduction circuit automatically lowers transmitter power to reduce long-term stress on the ballast loads. The temperature reduction may or may not occur depending on the transmitter model and current output power level. i.e. the temperature reduction circuit may not engage in units operating at low output powers or in very cool environments.

5.2.2 Power Supply (PS) Module Swap Procedure

a. If a failed PS module is suspected, verify failure by looking for these tell-tale signs:

1. Output power has dropped significantly.
2. Front panel TX GAIN NORMAL light has shifted from green to red.
3. TX GAIN NORMAL light is extinguished / dim and PS AMPS FLDBK is lit.
4. One PS status LED is red.

NOTE:
Not all conditions may happen simultaneously depending on transmitter operating power level.

b. Open front door by loosening thumb screws on transmitter front panel.

c. Loosen PS thumb screw at far right of power supply handle.

d. Remove PS module from transmitter. AC fans inside power supply will continue to spin for approximately five seconds after supply has been removed. Avoid touching connector at the rear of the power supply module during this period (i.e. until supply is fully discharged).

e. Insert replacement PS module. AC fan inside power supply starts to spin as soon as connection is made with transmitter chassis. Left-most green LED on power supply face should light to indicate an AC OK condition. Center LED on the power supply face should light to indicate a DC OK condition.

NOTE:
When a fully discharged PS module is installed, it is normal for a momentary sag to occur in the 50V DC voltage due to the current inrush as contact is first made. An audible slowing of the DC fans for a split second will be noticed, and the PA modules will briefly shut off. The transmitter auto restarts and returns to full power in two or three seconds.

f. Tighten PS thumb screw to secure replacement PS module in place.

g. Close front door and tighten thumb screws to secure.

h. Verify that power has returned to desired power level and TX GAIN NORMAL light has returned to green condition.

i. Procedure complete.

5.2.3 Air Filter Replacement Procedure

a. Separate filter retainer frame from front panel by gently pulling at frame corners until spring-retained studs at frame corners release.

b. Remove filter media foam from filter retainer frame.

c. Install replacement media foam in retainer frame.

d. Press retainer frame into mounting holes on front panel until retaining springs engage.

e. Gently wash filter media foam in water until all dust and debris is removed.

f. Allow filter media to dry and save for use as replacement media next time procedure is performed.

g. Procedure complete.

NOTE:
All ZX transmitters are supplied with a spare piece of filter media, so that a new piece may be rotated into service while the first piece is being washed and allowed to dry. Do NOT under any circumstance install a wet or moist filter in the transmitter. Contact GatesAir Service to purchase additional filter media, as necessary. Request part number 943-5567-181.

5.3 Technician Maintenance Procedures

The maintenance procedures in this section should only be performed qualified technicians with a firm understanding of the operating principles of the ZX transmitter and transmitter technology in general. Do not attempt to perform any of the procedures in this section before having thoroughly read and understood the entirety of this technical manual.

WARNING:
NEVER PERFORM THE PROCEDURES DESCRIBED IN THIS SECTION WHILE ALONE AND/OR NOT FULLY ALERT. SERIOUS BODILY INJURY OR DEATH COULD RESULT FROM FAILURE TO OBSERVE PROPER SAFETY PRECAUTIONS.

5.3.1 Set APC Maximum Power Level

(Case 1: Internal transmitter APC control)

Use this procedure when the transmitter power level is being controlled internally via the PA module bias voltage. This is typically the case when the ZX amplifier is being used strictly for FM-only service.

NOTE:
If the type of power control is unknown, check the position of jumper JP1 on the transmitter controller PC board: position 1-2 is internal control; position 2-3 is external (exciter) control. In the case of external control, consult the alternate procedure immediately following this one. The use of external power control is almost exclusively reserved for use with the FlexStar HDx-FM exciter operating in HD, FM+HD, or tri-mode operation.

CAUTION:
IMPROPER ADJUSTMENT OF THIS CIRCUIT COULD RESULT IN DAMAGE TO THE TRANSMITTER. THE TRANSMITTER COMES FROM THE FACTORY WITH THIS ADJUSTMENT ALREADY PERFORMED. USE THIS PROCEDURE ONLY WHEN IT BECOMES NECESSARY TO CHANGE THE MAXIMUM TRANSMITTER OUTPUT POWER LEVEL FROM THAT ESTABLISHED AT THE TIME OF IN-FACTORY TEST. IF THE TRANSMITTER IS UNABLE TO REACH FULL POWER, RULE OUT ALL OTHER CAUSES BEFORE PROCEEDING TO PERFORM THIS ADJUSTMENT.

NOTE:
It is typical for the gain of the PA modules to drop during the first half hour of operation. This procedure should be performed after the transmitter has reached a thermal steady state.

a. Verify current operating mode is FM, based on front panel LED display.

b. Depress front panel RAISE pushbutton repeatedly until power adjustment circuit has clearly reached top of its range.

c. Locate FM APC power set potentiometer R158 on transmitter controller board.

d. Dial potentiometer R158 fully CW. This causes APC to rise to its maximum boost setting. TX GAIN NORMAL light should be red to indicate that transmitter does not have enough gain to achieve current power set level (i.e. APC is out of range).

e. Adjust exciter power to achieve 111% of desired transmitter power level.

f. Adjust potentiometer R158 counter-clockwise until power level drops to 110% of desired full power level. APC NORMAL LED should change in color from red to green just before power starts to drop.

g. Further reduce power to 100% via front panel LOWER pushbutton. Front panel power adjustment from <10% to 110% should now be possible.

h. Note exciter power level on exciter power meter for future reference.

i. Procedure complete.

5.3.1.1 Quick Example Using 1000W Transmitter:

- Press RAISE button until limit reached.
- Dial out APC fully CW.
- Set exciter to achieve 1110W.
- Dial APC CCW to limit power to 1100W.
- Press LOWER button to lower power to 1000W.

5.3.2 Set APC Maximum Power Level

(Case 2: Exciter APC control with FlexStar HDx-FM or BoostPro)

Use this procedure when the transmitter power level is being controlled via an analog voltage fed back to the exciter. This is always the case when operating in FM+HD or HD mode with the FlexStar HDx-FM exciter.

This procedure may also be used in conjunction with the BoostPro amplifier by making the necessary modifications wherever the notation "BoostPro:" is encountered.

CAUTION:
IMPROPER ADJUSTMENT OF THIS CIRCUIT COULD RESULT IN DAMAGE TO THE TRANSMITTER. THE TRANSMITTER COMES FROM THE FACTORY WITH THIS ADJUSTMENT ALREADY PERFORMED. USE THIS PROCEDURE ONLY WHEN IT BECOMES NECESSARY TO CHANGE THE MAXIMUM TRANSMITTER OUTPUT POWER LEVEL FROM THAT ESTABLISHED AT THE TIME OF IN-FACTORY TEST. IF THE TRANSMITTER IS UNABLE TO REACH FULL POWER, RULE OUT ALL OTHER CAUSES BEFORE PROCEEDING TO PERFORM THIS ADJUSTMENT.

NOTE:
It is typical for the gain of the PA modules to drop during the first half hour of operation. This procedure should be performed after the transmitter has reached a thermal steady state.

a. Determine current operating mode based on front panel LED display: FM, FM+HD, HD.

b. Depress front panel RAISE pushbutton repeatedly until power adjustment circuit has clearly reached top of its range.

c. Adjust exciter max power limit via appropriate LIMIT setting in FlexStar **Home>Setup>More Setup>Next** screen (FM:Limit, FM+HD:Limit, or HD:Limit) until power level just starts to drop. This ensures exciter power is properly restrained during next few steps.

   BoostPro: Adjust BoostPro output power limit by utilizing following steps: **Info** > **Control Submenu** > **Enter** > **Config. Unlock > Enter** > **Yes** > **Enter**. Then, **Info** > **Setup Submenu** > **Ext APC Limit** > **Enter** > scroll up or down to limit amount of output power > **Enter**.

d. Dial potentiometer R162 on transmitter controller board fully clockwise to deactivate transmitter APC limit feature. This feature is not required when FlexStar exciter is used.

e. Locate APC power set adjustment for current operating mode on transmitter controller board. Each mode has its own power set potentiometer: FM = R158, FM+HD = R159, HD = R160.

f. Dial APC power set potentiometer for current mode fully CW. This causes APC to rise to its maximum boost setting. TX GAIN NORMAL light should be red to indicate that transmitter does not have enough gain to achieve current power set level (i.e. APC is out of range). Transmitter power does not rise due to exciter limit adjustment performed previously.

g. Slowly raise FlexStar limit setting to achieve 111% of desired transmitter power level.

CAUTION:
NEVER RAISE THE FLEXSTAR LIMIT SETTING MORE THAN 100 UNITS AT A TIME. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN DAMAGE TO THE PA MODULE FROM A SUDDEN DRIVE SPIKE AS THE NEW LIMIT SETTING TAKES EFFECT.

BoostPro: Slowly raise BoostPro Limit setting to achieve 111% power utilizing same key strokes outline in step “c” above

h. Adjust APC power set potentiometer for current operating mode counter-clockwise until power level drops to 110% of desired full power setting. APC NORMAL LED should change in color from red to green just before power starts to drop.

i. Further reduce power to 100% via front panel LOWER pushbutton. Front panel power adjustment from <10% to 110% should now be possible.

j. Note exciter power level on exciter power meter for future reference.

k. Repeat procedure for other operating modes as necessary.

l. Procedure complete.

5.3.3 Forward Power Meter Calibration

Use this procedure to calibrate the transmitter forward power meter with a calibrated attenuator load, through-line wattmeter, or calorimetry. This calibration should be checked at regular intervals.

a. Obtain calibrated reading of transmitter forward power from calibrated attenuator load, through-line wattmeter, or calorimetry.

b. Select forward power reading on front panel meter via meter select pushbutton.

c. Determine operating mode via front panel MODE LEDs (FM, FM+HD, or HD).

d. Open front door and locate forward power calibration potentiometer for current operating mode (R155 = FM mode calibration, R156 = FM+HD mode calibration, R157 = HD mode calibration).

e. Adjust relevant potentiometer until desired reading is obtained on meter.

f. Close front door and tighten thumb screws to secure door in place.

g. Procedure complete.

5.3.4 Reverse Power Meter Calibration

Use this procedure to calibrate the transmitter reverse power meter.

This procedure must be performed while the transmitter is off the air. This procedure should only be performed if the factory calibration has been disturbed.

a. Turn off transmitter via front panel OFF pushbutton.

b. Ensure that exciter has been properly muted is not producing any RF output power.

c. Disconnect exciter drive coax cable from ZX amplifier chassis input.

d. Connect exciter drive coax cable to main RF output of ZX amplifier chassis. An adapter is required to make this connection.

e. Select reverse power meter position on the front panel meter.

f. Turn transmitter on to un-mute exciter.

g. Record exciter output power level in watts, as displayed on exciter power meter.

h. Adjust reverse power meter calibration potentiometer (R154) until reading displayed on transmitter meter matches reading displayed on exciter.

i. Turn off transmitter and restore equipment to original condition.

j. Procedure complete.

NOTE:
Whenever possible, greater accuracy can be achieved by making a calibrated measurement of the exciter output power before attempting to calibrate the transmitter reverse power meter.

5.3.5 PA Volts Meter Calibration

Use this procedure to adjust the transmitter PA voltage reading. This procedure should only be used if the factory calibration has been disturbed.

a. Turn off transmitter via front panel OFF pushbutton.

b. Disconnect RF drive cable between exciter and amplifier chassis.

c. Select PA volts metering position on front panel meter via meter select pushbutton.

d. Open front door and locate potentiometer R166 on transmitter controller board.

e. Gain access to interior of transmitter by removing top cover (ZX500 & ZX1000) or opening rear door (ZX2000 & ZX3500).

f. Using a high impedance voltmeter, clip measurement leads onto quick-disconnect connectors J8 and J9 of any PA backplane PC board.

g. Route voltmeter leads outside chassis and place voltmeter in a stable position outside unit.

h. Replace top cover (ZX500 & ZX1000) or close rear door (ZX2000 & ZX3500).

i. Turn transmitter ON via the front panel ON pushbutton.

j. Measure DC voltage with voltmeter.

WARNING:
HAZARDOUS VOLTAGES PRESENT IN TRANSMITTER INTERIOR. CLOSE ALL DOORS AND REPLACE COVERS BEFORE TURNING TRANSMITTER ON.

k. Adjust potentiometer R166 until correct reading is obtained on front panel meter.

l. Turn transmitter OFF and restore all equipment to original condition.

m. Procedure complete.

5.3.6 PA Current Meter Calibration

Use this procedure to calibrate the transmitter PA current meter. This procedure should only be used if the factory calibration has been disturbed. This procedure is performed with the transmitter operating at full nominal power.

a. Measure and record PA current sample voltages appearing at following pins of DB25 connector at rear of the amplifier chassis using a high impedance voltmeter.

PIN 20 = PA MODULE 1

PIN 21 = PA MODULE 2

PIN 22 = PA MODULE 3

PIN 23 = PA MODULE 4

PIN 24 = PA MODULE 5

PIN 25 = PA MODULE 6

All measurements referenced to chassis ground or PIN 1.

Certain model transmitters may not have all PA modules installed.

b. Sum sample voltages from all measurements taken.

c. Calculate total PA stage current draw in amperes by multiplying number obtained in previous step by 5. For example 4V = 20A, 8V = 40A, 12V = 60A, etc.

d. Select PA current measurement on front panel meter via meter select pushbutton.

e. Open front door and locate potentiometer R167 on transmitter controller board.

f. Adjust potentiometer R167 to obtain correct reading on transmitter meter.

g. Restore all equipment to original condition.

h. Procedure complete.

5.3.7 Set User Reverse Power Foldback Threshold

Use this procedure to set the user-defined reverse power foldback threshold. The user reverse power foldback is designed to reduce power when the average reflected power at the transmitter output exceeds a given level set by the user. This is in contrast to the PA reverse power foldback system, which is peak power sensitive and has a fixed threshold of 20-22W reflected power at any PA output.

This adjustment and the proper operation of the reverse power foldback circuit should be tested at regular intervals.

a. Select reverse power metering position on front panel meter via front panel meter select pushbutton.

b. Press front panel OFF button to turn transmitter off.

c. Open front door to gain access to transmitter controller board.

d. Locate potentiometer R161 on transmitter controller.

e. Disconnect transmission line from transmitter output.

f. Press front panel ON pushbutton to turn transmitter on.

g. Power should increase to level between 0W and approximately 40 x number of PA modules (e.g. ZX1000 = 2 PA modules = 80W approximate PA foldback threshold).

h. Adjust potentiometer R161 to limit forward power to a foldback level of 2.5% of the transmitter FM power nameplate rating.

ZX500 - 12W
ZX1000 - 25W
ZX2000 - 50W
ZX3500 - 88W

i. Turn transmitter off and restore all equipment to original condition.

j. Procedure complete.

NOTE:
ZX transmitters ship from the factory with the R161 threshold set to 2.5% of the transmitter FM nameplate rating (e.g ZX1000 = 25W). It is strongly recommended that this setting be retained unless a compelling reason exists to adjust this threshold to a higher value. Operating the transmitter at higher VSWR levels places additional stress on the PA modules, transmission line, and antenna.

5.4 Special Part Replacement Notes

This section contains a loose collection of notes addressing certain aspects of the replacement of major ZX subassemblies.

5.4.1 PA Module

a. Verify that P/N of new module matches old module.

b. No user adjustments.

c. Modules are hot-pluggable; they can be removed and replaced while the transmitter is running.

d. Modules are symmetrical; they can be inserted into the transmitter with either side facing up (they cannot be inserted wrong).

NOTE:
In the event of an RF power MOSFET failure, field replacement of a single transistor is not practical due to the cost of components, time, and test equipment involved in repair and alignment of phase, gain, and response. This is a highly critical area, and if not done correctly, improper module and transmitter operation will occur. Instead, a single amplifier board (1/2 of module) may be replaced by following the procedure given below.

1. Obtain replacement power amplifier board. Replacement PA board will include thick copper plate under PC board. Do not remove PC board from copper plate.
2. Remove cover of damaged PA board.
3. Remove (only) larger countersunk screws to free copper plate from larger aluminum heatsink.
4. Apply thin, but even, coating of thermal compound to bottom of copper plate of replacement amplifier. Level with a razor blade or other straight-edge as necessary. Coverage should be complete, but so thin as to be transparent / translucent.
5. Attach replacement PA board (copper plate) to aluminum heatsink. Tolerance on screw holes will assure proper alignment on new PA into transmitter chassis.
6. Procedure complete.

When handling damaged PA modules, please observe the following warning regarding beryllium oxide:

WARNING:
PRODUCT AND ENVIRONMENTAL SAFETY-TOXIC MATERIALS. THIS PRODUCT CONTAINS BERYLLIUM OXIDE. THE PRODUCT IS ENTIRELY SAFE PROVIDED THAT THE BEO DISC IS NOT DAMAGED. ALL PERSONS WHO HANDLE, USE OR DISPOSE OF THIS PRODUCT SHOULD BE AWARE OF ITS NATURE AND OF THE NECESSARY SAFETY PRECAUTIONS. AFTER USE, DISPOSE OF AS CHEMICAL OR SPECIAL WASTE ACCORDING TO THE REGULATIONS APPLYING AT THE LOCATION OF THE USER. IT MUST NEVER BE THROWN OUT WITH THE GENERAL OR DOMESTIC WASTE.

5.4.2 PS Module

a. Replacement unit arrives without handle. Transfer handle from old module to new module.

b. No user adjustments.

c. Modules are hot-pluggable; they can be removed and replaced while the transmitter is running.

d. Internal fans will run for approximately five seconds after module is unplugged.

5.4.3 Transmitter Controller PCB

a. Replacement boards should come from GatesAir tuned and tested at nominal power level for transmitter model. Last three digits in board part number indicate version:

-063 tuned and tested to 500W (ZX500)

-064 tuned and tested to 1000W (ZX1000)

-065 tuned and tested to 2000W (ZX2000)

-066 tuned and tested to 3500W (ZX3500)

b. Match all jumper settings on old board before installing replacement.

c. Adjustment of APC set point may be required. Consult APC adjustment procedure elsewhere in this chapter.

d. Fine calibration of meter readings may be required. Consult meter calibration procedures elsewhere in this section.

e. Verify that 15-pin ribbon cable to front panel multimeter is properly aligned before applying power (i.e. not one pin off). Ribbon cable connectors are not keyed and are easy to misalign.

5.4.4 Power Amplifier Backplane PCB

a. (ZX500, ZX1000) Remove RF output assembly to gain access to PA backplane boards.

b. Set dipswitch address to match setting on backplane being replaced.

c. No user calibrations required.

d. Certain mounting screws have a shorter length. Carefully note screw locations while removing PA backplane and shield.

e. Verify push-on (faston) DC connectors make snug contact upon connection. Remove connector and gently press closed with pliers if connection is loose.

5.4.5 Power Supply Interface PCB

a. No user adjustments required.

b. Verify push-on (faston) DC connectors make snug contact upon connection. Remove connector and gently press closed with pliers if connection is loose.

c. Fuse is not required on ZX500 / ZX1000 and can be removed if blown.

5.4.6 RF Output Assembly

a. Entire assembly lifts out of transmitter and can be replaced as a complete “module” at the user’s discretion.

b. Disconnect RF connections at PA backplanes and assembly output before attempting to remove assembly.

c. Recalibration of forward or reverse power readings may be desired. Consult meter calibration procedures elsewhere in this chapter.

NOTE:
It is easiest to check the integrity of the RF combiner loads when RF output assembly is outside of transmitter chassis. The resistance from the load common point (at the center of the loads) to the center conductor of any coax at the board periphery should read 50 divided by N, where N is the number of PA outputs going to the combiner. (e.g. ZX 1000 = 4 PA cables = 50/4 = 12.5 ohms reading). If this reading is not correct, visually inspect loads for damage, and replace faulty components as necessary using procedure below. For the ZX2000 and ZX3500 models, it is necessary to first lift the center conductor of the load island stub cable before making this reading. The stub cable provides a direct connection to ground, which will cause and incorrect reading of zero ohms.

WARNING:
BEWARE OF HOT LOADS IF TRANSMITTER HAS BEEN OPERATING WITH ONE OR MORE PA MODULES REMOVED.

1. Obtain replacement RF power resistor (load).
2. Remove screws holding combiner (upper) board to supports. Combiner board should flip up like hinge once freed from supports.
3. Flip up combiner board to gain access to load (lower) board.
4. Desolder tabs and remove mounting screws, temperature sensor from damaged load.
5. Remove damaged RF load while observe Beryllium Oxide safety considerations (see warning below).
6. Apply thin, but even, coating of thermal compound to mounting flange of replacement load. Level with razor blade or other straight-edge as necessary. Coverage should be complete, but so thin as to be transparent / translucent.
7. Whenever possible, place thermal relief crimp in tabs of replacement load. Copy tab crimping arrangement of load being replaced.
8. Attach replacement load and temperature sensor to output assembly heatsink with mounting screws.
9. Torque mounting screws to 6 inch-lbs for 250W loads in ZX500, ZX1000 or 8 inch-lbs for 400W loads in ZX2000, ZX3500.
10. Solder tabs of replacement load to appropriate traces of load PC board.
11. Verify load integrity with ohmmeter measurement.
12. Reattach combiner PC board to supports.
13. Procedure complete.

When handling damaged RF loads, please observe the following warning regarding beryllium oxide:

WARNING:
PRODUCT AND ENVIRONMENTAL SAFETY-TOXIC MATERIALS. THIS PRODUCT CONTAINS BERYLLIUM OXIDE. THE PRODUCT IS ENTIRELY SAFE PROVIDED THAT THE BEO CHIP IS NOT DAMAGED. ALL PERSONS WHO HANDLE, USE OR DISPOSE OF THIS PRODUCT SHOULD BE AWARE OF ITS NATURE AND OF THE NECESSARY SAFETY PRECAUTIONS. AFTER USE, DISPOSE OF AS CHEMICAL OR SPECIAL WASTE ACCORDING TO THE REGULATIONS APPLYING AT THE LOCATION OF THE USER. IT MUST NEVER BE THROWN OUT WITH THE GENERAL OR DOMESTIC WASTE.

5.4.7 RF Splitter

a. No user adjustments required.

b. RF splitter is hidden under RF output assembly in ZX500 / ZX1000.

c. Beware of hot loads if transmitter has been operating with one or more PA modules removed.

5.4.8 MOV PCB

NOTE:
This section does not apply to ZX2000/ZX3500 models.

a. Visually inspect MOV PC board for signs of exploded MOVs or burning.

b. Replace damaged MOVs to ensure continued protection against incoming AC transients.

c. Verify push-on (faston) DC connectors make snug contact upon connection. Remove connector and gently press closed with pliers if connection is loose.

5.4.9 LV Power Supply

a. The +15V output must be properly set for the transmitter to operate correctly. Measure +15V at test point TP5 of transmitter controller PC board. Adjust trimpot near the bottom of the power supply (the only trimpot on LVPS) to achieve +15V +/- 0.25V reading.

b. It is difficult, but not impossible, to reverse connector polarity when reconnecting supply. Verify correct polarity of connectors while disconnecting old supply.

c. Supply is modified at GatesAir to remove the negative -15V three terminal regulator before being installed in transmitter. This increases the negative voltage available to the transmitter from -15V to approximately -17.5V. Verify that the negative regulator has been removed from supply before attempting to install. The three-pin regulator is typically mounted to on-board heat sink bracket. Do not install an unmodified supply in transmitter

5.4.10 I/O Filter PCB

a. No user adjustments.

b. Inspect chip MOVs on board for signs of damage.

5.4.11 DC Cooling Fans

a. Verify proper airflow direction.

5.4.12 Front Panel Multimeter

a. Verify that 15-pin ribbon cable is properly aligned before applying power (i.e. not one pin off). Ribbon cable connectors are not keyed and are easy to misalign.

5.4.13 Front Panel Filter

a. All ZX transmitters ship with spare filter media.

b. Never install a wet or damp filter in transmitter.

5.5 Troubleshooting Table

The following pages provide a troubleshooting table for all ZX transmitters. In case of difficulties, contact GatesAir Customer Service for additional assistance.

Table 5-1 ZX Transmitters Troubleshooting Table

Front Panel Alarms LEDs	
Symptom	**Cause and Solution**
TX GAIN NORMAL LED red	System gain or exciter drive not sufficient to achieve power level set by APC trimpot. Check module status LEDs for red modules. Replace faulty module. Check exciter drive against station log readings. Raise exciter power if exciter level found to be below normal as per log readings.
TX GAIN NORMAL LED orange	System gain or exciter drive not sufficient to achieve power level set by APC trimpot. Similar to LED red condition described above, only not as severe. (i.e. LED is still partially green).
TX GAIN NORMAL LED green but power changes as exciter power is raised.	System is at threshold of dropping out of APC due to insufficeint exciter power. There is a small range in power where the APC starts to fail but the TX GAIN NORMAL light does not yet turn orange/red. Increase exciter power 15% or until power level stabilizes. Readjust APC set trimpot necessary to reestablish correct power level.

Table 5-1 ZX Transmitters Troubleshooting Table

TX GAIN NORMAL LED changes to orange/red as power is raised on front panel.	System gain or exciter drive not sufficient to achieve power level set by APC trimpot. Check module status LEDs for red modules. Replace faulty module. Check exciter drive against station log readings. Raise exciter power if exciter level found to be below normal as per log readings.
REF PWR FLDBK LED red.	High reflected power detected at PA output and/or transmitter output. Check reverse power reading on front panel multimeter to determine if excessive reflected power is being reported at transmitter output. If so, inspect output transmission line, antenna for damage, hot spots. If front panel reverse power reading is normal, open front door and determine if any PA modules have red LED lit behind module. In the case of a single PA module alarm, open amplifier chassis and inspect RF outputs from affected PA backplane for obvious signs of damage. If a single PA module is reporting a very high reflected power level and this is causing a power foldback to a very low level, some temporary relief may be had by unplugging the affected module from the chassis.
PA AMPS FLDBK LED red.	High PA module current in one or more PA modules, typically due to exciter overdrive or an RF splitter malfunction. Open front door and determine which PA modules have a red LED lit behind module. In the case of exciter overdrive, all modules typically have their individual LEDs lit to varying degrees. In the case of a splitter failure, only one or some LEDs will be lit and the green module status LEDs may have an unequal intensity. Reduce exciter drive/Tx power level or open chassis and repair splitter as necessary.
PS AMPS FLDBK LED red.	One or more PS modules has reached 1000W output limit. This typically occurs when one or more PS modules is unplugged during hot plug operations and the load is redistributed to the remaining PS modules. Foldback should disappear automatically once all PS modules are installed and operating normally. If all PS modules are installed, 50V DC voltage bus to PA modules may be partially shorted. Measuring PA volts on front panel multimeter and determine if PA voltage has dropped from normal 50V - 52V level. Unplug individual PA modules and/or PS modules to locate short. Open amplifier chassis and inspect DC wiring for short circuit. Unplug individual fans from PS interface board(s) to locate shorted fan.

Table 5-1 ZX Transmitters Troubleshooting Table

PA TEMP FLDBK LED red.	One or more PA modules has reached 95 degrees C temperature limit. Check cooling fans for failure(s). Check front panel air filter for obvious signs of contamination or obstruction. Replace fan(s) or air filter as necessary. Open front door and determine which PA modules have red LED lit behind module. If single PA module has red LED lit and all others are completely extinguished, unplug affected PA and see if alarm disappears. (BEWARE OF HOT MODULES). If alarm disappears, measure thermistor resistance between pins N and P of edge connector on PA backplane PCB. Reading should be between 3800 ohms (@ 99 degrees C) and 50,000 ohms (@ 25 degrees C). If reading is zero, replace thermistor or locate short circuit. If no modules have red LED lit, temperature overload may be coming from RF output assembly heat sink. This would most likely occur if a single amplifier (1/2 PA module) had failed and the transmitter is operating in high ambient temperature environment. If so, transmitter will automatically fold back power to a safe level until faulty PA module is replaced. If no modules have red LED lit, and no PA modules are missing or have failed amplifiers (all green status LEDs equally illuminated), a temperature sensor may be faulty on the Load PCB. Open chassis and with power off measure resistance of temperature probes where they attach to the Load PCB on the lower level of the RF output assembly. Resistance should be between 50 and 200 ohms at ambient room temperature.
PA TEMP FLDBK LED lit and power fluctuates wildly, oscillates slowly between high and low power.	Temperature overload, possibly due to sudden fan failure or large piece of debris (sheet of paper) becoming stuck to input filter. Temperature foldback circuit and output power will oscillate over tens of seconds if a sudden severe overload occurs. Lower transmitter power to stop oscillation and stabilize power. This alarm condition may be observed when one or more PA modules are removed, especially in ZX2000/ZX3500 transmitters operating in high ambient temperature conditions. Transmitters produced after June 2007 have a special temperature reduction circuit to automatically rectify this situation by reducing transmitter power to a safe level until the faulty modules can be replaced and/or the ON button is pressed. In transmitters produced before this date, it is necessary to manually reduce power to pevent this condition from occurring.
All front panel LEDs blink repeatedly.	Probable short-circuit of LVPS output. Overcurrent protection in LVPS manifests itself as on-off-on oscillation of voltage output. Selectively disconnect DC/logic cables to PA backplanes, output assembly, panel multimeter, web remote, etc. until blinking stops to localize fault. Eliminate short circuit.

Table 5-1 ZX Transmitters Troubleshooting Table

EXTERNAL MUTE LED red.	Transmitter output has been muted due to one of three possible reasons: 1. Customer "failsafe" mute line is being held low (pin 1 of FAILSAFE/ INTERLOCK connector at ransmitter rear). 2. An AC brownout condition has dropped the AC mains to below 190V in any ZX model transmitter, except the ZX1000 with a twist-lock AC receptacle. 3. The "exciter ready" ground signal has disappeared from exciter (FlexStar HDx-FM only) or the exciter interface cable is unplugged. (pin 6 of exciter interface cable). Locate origin of mute and rectify.
Modules shut down with no alarms whatsoever.	Possible transient alarm conditon so rapid that modules shut down before foldback circuit can reduce power. When this occurs and all modules shut down, auto restart will ramp power back up slowly, thereby giving foldback circuit time to engage and report cause of foldback (alarm). If no satisfactory alarm reporting occurs, lower power to zero and ramp up power very slowly using front panel RAISE button while observing alarm LEDs. Possible incorrect setting of JP1 and JP3. Ensure that JP1 and JP3 are not in external APC mode (2-3 position on both) while exciter is in internal APC mode (i.e. not accepting outside power control). In such cases, the foldback circuit and front panel LEDs will not work properly. The shutdown circuits on the individual PA backplanes will function normally, but will give no advanced warning as the shutdown threshold is approached. Note that JP3 is not present in transmitters produced after June 2007.

Transmitter on / off control

Symptom	Cause and Solution
Transmitter has shut down spontaneously. No front panel alarm lights. Multimeter reads all zeroes.	Possible external interlock open circuit. The external interlock circuit sends a latched OFF command to the transmitter whenever pin 3 of the FAILSAFE/INTERLOCK connector at transmitter rear is NOT grounded.
Transmitter has shut down spontaneously. No front panel alarm lights. Multimeter appears dead.	Possible failure of low voltage power supply. Possible AC mains failure (external disconnect open). Verify AC presence by status of fans inside PS modules. If PS module fans are operating, suspect low voltage power supply and check DC presence LEDs on reverse side of transmitter controller board (open front door). If fans are inoperative, suspect AC mains failure. Reset external fuse/breaker or replace low voltage power supply as necessary.

Table 5-1 ZX Transmitters Troubleshooting Table

Transmitter will not turn on. Does not respond to front panel ON button.	Possible external interlock open circuit. The external interlock circuit send a latched OFF comand to the transmitter whenever pin 3 of the FAILSAFE/ INTERLOCK connector at transmitter rear is NOT grounded. Listen for tiny audible click of controller board relay K1 as ON/OFF buttons are pressed. If no click is heard, suspect an external interlock problem. If a click is head but the main fans do not start up, suspect a possible low AC condition. PS modules will not turn on if an AC undervoltage condition is detected.
Transmitter returns to less than full power after extended AC mains outage.	This is normal. Transmitter retains front panel power setting during brief AC mains outages. After several minutes without AC power, transmitter power control reverts to a safe-mode level - typically 75% of full power.
Transmitter returns to less than full power after sudden VSWR/ arc event.	This is normal. Units produced after June 2007 have a special arc reduction circuit that actuates the power LOWER control each time the transmitter auro restarts following an sudden VSWR overload (arc). This causes the transmitter to progressively lower power until the cycle of arc-restart-arc is broken.
PS and PA modules	
Symptom	**Cause and Solution**
Single PA module status LED extinguished or glowing dimly (while others lit green at full brightness).	Possible damaged FETs on PA module. Swap PA modules and verify problem follows module. If so, replace PA module. If problem remains with slot position, troubleshoot and replace PA backplane board and/or swap drive cables to verify drive splitter operation.
Single PS module status LED glowing red (while others extinguished).	Possible failed power supply module. Swap PS modules and verify problem follows module.
Power drops momentarily upon insertion of power supply module.	Temporary voltage drop due to inrush current to energize supply. This is normal. The transmittershould automatically recover and return to full power in a few seconds.
PA module spontaneously turns on upon insertion.	This is normal under two conditions; Module is the last remaining PA in transmitter. Auto restart circuits senses all PA as being off and issues repeated on commands until at least one PA reports being on. Module is in IPA position in ZX2000 or ZX3500 transmitter. Module in IPA position folds back but never turns off.

Table 5-1 ZX Transmitters Troubleshooting Table

Poor performance, alarms after installation of replacement PA module.	Possible incompatible PA module. Verify part number of replacement PA module matches original module. Although the ZX amplifier can accept both class C (orignal ZFM) and class AB ("IBOC") PA modules (...with the change of certain jumper settings), it cannot do so simultaneously. That is, it is not possible to "mix" module types. Modules must be all of one type or the other.
Single PA reports reflected power foldback when a different module is unplugged.	Poor output combiner isolation due to failed combiner RF load. Consult procedure on checking load integrity and load replacement (Chapter 5 of manual).
Reverse power foldback LED light remains lit in certain PA position, even after corresponding PA module has shut down/been removed.	Poor output combiner isolation due to failed combiner RF load. PA socket reverse power detector remains active even after PA module is removed. PA socket is receiving excessive power due to power crossing over from active PAs and poor combiner isolation. Consult procedure on checking load integrity and load replacement (Chapter 5 of manual).
PA module status LEDs glow dimly in HD mode.	This is normal. Module status LEDs glow dimly because current draw in HD mode is considerably lower that in FM or FM+HD modes.
Red module status LEDs "wink" (dim momentarily) several second lafter transmitter turned off.	This is normal.

Metering and Remote Control

Symptom	Cause and Solution
Slowly increasing PA temperature reading at remote control interface.	Front panel air filter becoming progressively clogged. Replace air filter with spare filter media provided with transmitter. Filter retainer frame disengages from transmitter front panel for easy filter media replacement. Wash dirty filter with water. Never install a wet or moist filter in the transmitter.

Table 5-1 ZX Transmitters Troubleshooting Table

Sudden increase in PA temperature reading at remote control interface.	Possible fan failure. Check air flow exiting at transmitter rear for signs of fan failure. Replace faulty fan as necessary. It may be difficult to detect a fan failure by visual inspection alone, as the the pressure from the remaining fans may cause the failed fan to spin backwards. Verify correct air flow by laying paper currency note (e.g. dollar bill, euro note, etc) over fan opening at transmitter rear panel. Paper should deflect noticeably outward. If paper becomes stuck to fan opening, fan has failed and is spinning backwards.
Forward power or reverse power reading does not go to zero.	Possible misadjustment of meter offset potentiometer R168 (forward) or R169 (reverse). Potentiometers should be set be dialing in positive (offset) reading on meter while transmitter is off and slowly reducing reading until 000 is just reached (do not overshoot). This is not a routine adjustment. Perform adjustment only if meter offset is clearly incorrect.
Poor metering linearity, especially at low end of power range.	Possible misadjustment of meter offset potentiometer R168 (forward) or R169 (reverse). Potentiometers should be set be dialing in positive (offset) reading on meter while transmitter is off and slowly reducing reading until 000 is just reached (do not overshoot). This is not a routine adjustment. Perform adjustment only if meter offset is clearly incorrect.

Section VI
Parts List

6

6.1 Replaceable Parts List Index

Replaceable Parts List Index

WARNING: Disconnect primary power prior to servicing.

Table 6-1 XMTR, ZX 1000, CONFIGURABLE - 995 0035 001 (H)

GatesAir PN	Description	Qty UM	Reference Designators
817 2311 006	DWG, FAMILY TREE ZX 1000	0 DWG	
952 9232 022	EXC INTERFACE CABLES, ZX TO DIGIT/SUPERCITER/MICROMAX	0 EA	
952 9232 029	EXC INTERFACE CABLE KIT, ZX TO FLEXSTAR	0 EA	
952 9232 031	KIT, ZX STANDALONE	0 EA	
971 0023 009	KIT, ZX RACK RAIL	0 EA	
971 0027 006	FLEXSTAR BOOST AMP	0 EA	
981 0090 001	ASSY, AMPLIFIER, ZX 1000	1 EA	
990 1202 001	*KIT, MODULE SPARES	0 EA	
990 1203 001	KIT, BOARD SPARES, ZX1000	0 EA	
990 1242 001	KIT, BASIC, SPARE PARTS	0 EA	
994 9410 005	! EXCITER, DIGIT CD	0 EA	
994 9678 002	! EXCITER, SUPERCITER	0 EA	
995 0013 001	FLEXSTAR FM EXCITER	0 EA	
995 0015 001	FLEXSTAR FM HD EXCITER	0 EA	
995 0061 001	*CARD, WEB REMOTE INTERFACE	0 EA	A9

Table 6-2 ASSY, AMPLIFIER, ZX 1000 - 981 0090 001 (G)

GatesAir PN	Description	Qty UM	Reference Designators
430 0291 000	FAN, 48VDC 280CFM, 6" DIA	2 EA	B1,B2
430 0292 000	FAN GUARD, 6.14" DIA.	2 EA	#B1,#B2
609 0008 000	RECP, 3C 250VAC 30AMP	1 EA	#J1
609 0011 000	INLET/MALE, 3C 250VAC 30AMP	1 EA	J1
646 0665 000	LABEL, INSPECTION	1 EA	
646 1353 000	NAMEPLATE, XMTR EQUIPMENT	1 EA	
736 0445 000	PSU, 48VDC 1200W 90-264VAC	2 EA	A40,A41
839 8464 005	WIRING DIAGRAM, RF INTERCONNECT, ZX1000	0 DWG	
839 8464 006	WIRING DIAGRAM, AC-DC INTERCONNECT, ZX1000	0 DWG	
901 0203 041	PWA, 4X SPLITTER	1 EA	A4
901 0203 051	PWA, PA BACKPLANE	2 EA	A10,A11
901 0203 064	PWA, TX CONTROLLER, ZX1000	1 EA	A1
917 2558 080	PATENT LABEL - FM XMTRS	1 EA	
943 5567 163	DOOR, FRONT	1 EA	
943 5567 173	SHIELD, PA INTERFACE,	2 EA	
943 5567 179	HANDLE, P.S.	2 EA	#A40,#A41
952 9232 019	CABLE, AMP, INTERNAL CABLES, ZX1000	1 EA	
971 0023 001	ASSY, BASIC, ZX LP	1 EA	
971 0023 002	ASSY, RF OUTPUT, ZX1000	1 EA	A5
988 2594 002	DP, ZX1000 TRANSMITTER	1 EA	
992 9992 041	MODULE, DUAL PA, IBOC	2 EA	A20,A21

Table 6-3 PWA, PA BACKPLANE - 901 0203 051 (F)

GatesAir PN	Description	Qty UM	Reference Designators
384 0780 000	LED, RED T1 VERT	3 EA	DS3,DS4,DS5
542 1603 000	RES, 0.01 OHM, 3W 1%	1 EA	R16
610 1066 000	CONN, .25 FASTON PC MOUNT	2 EA	J8,J9
610 1585 020	HDR, 20C 2ROW VERTICAL	1 EA	J7
612 1347 000	JACK, SMA STRAIGHT PCB	2 EA	J1,J2
612 1488 000	CONN, EDGECARD 18POS 2ROW	2 EA	J5,J6
620 1677 000	JACK, BNC STRAIGHT PCB	2 EA	J3,J4
801 0203 051	SCH, PA BACKPLANE	0 DWG	
901 0203 052	PWA, PA BACKPLANE, SMT	1 EA	

Table 6-4 PWA, TX CONTROLLER, ZX1000 - 901 0203 064 (A)

GatesAir PN	Description	Qty UM	Reference Designators
901 0203 061	PWA, XMTR CONTROLLER	1 EA	

Table 6-5 PWA, XMTR CONTROLLER - 901 0203 061 (H)

GatesAir PN	Description	Qty UM	Reference Designators
358 2751 000	SPACER, LED MOUNT .150 LG	14 EA	
384 0610 000	LED, GRN T1-3/4 VERT	3 EA	DS32,DS33,DS34
384 0611 000	LED, RED T1-3/4 VERT	5 EA	DS23,DS24,DS25,DS26,DS27
384 0780 000	LED, RED T1 VERT	6 EA	DS3,DS6,DS8,DS12,DS16,DS20
384 0806 000	LED, RED/GRN T1-3/4 VERT	6 EA	DS4,DS5,DS10,DS11,DS17,DS18
384 0808 000	LED, RED/GRN T1-3/4 VERT	1 EA	DS22
384 0904 000	LED, GRN T1 VERT	8 EA	DS13,DS15,DS19,DS21,DS28,DS29,DS30,DS31
389 0046 000	LED, GRN/RED T1 VERT	1 EA	DS1
409 0004 000	SPACER, LED MOUNT	11 EA	
409 0006 000	SPACER, LED T1-3/4 TRI	1 EA	
522 0590 000	CAP 470UF 25V 20%	1 EA	C117
550 0983 000	TRIMPOT 200K OHM 1/2W 10%	5 EA	R158,R159,R160,R161,R162
574 0485 000	RELAY 2PDT 12VDC 2A LATCHING	1 EA	K2
604 1111 000	SW PB GRAY MOM W/O LED	3 EA	S1,S3,S5
604 1119 000	SW PB RED MOM W/O LED	1 EA	S4
604 1152 000	SW PB GRN MOM W/O LED	1 EA	S2
604 1201 000	SW, TGL DPDT SMT	1 EA	S6
610 0900 000	HDR, 3C VERT 1ROW UNSHR	2 EA	JP1,JP2
610 0935 000	HDR, 15C VERT 1ROW UNSHR	1 EA	J10
610 1423 003	HDR, 3C 1ROW VERTICAL	1 EA	J12
610 1423 004	HDR, 4C 1ROW VERTICAL	2 EA	J7,J11
610 1423 006	HDR, 6C 1ROW VERTICAL	5 EA	J1,J2,J3,J6,J9
610 1585 020	HDR, 20C 2ROW VERTICAL	1 EA	J8
612 1184 000	JUMPER SHUNT, 2C, 0.1'' PITCH	2 EA	1/JP1,1/JP2
612 2139 003	RECP, D STRT 25C PCB	2 EA	J4,J5
801 0203 061	SCH, XMTR CONTROLLER	0 DWG	
901 0203 062	PWA, XMTR CONTROLLER, SMT	1 EA	

Table 6-6 ASSY, BASIC, ZX LP - 971 0023 001 (U)

GatesAir PN	Description	Qty UM	Reference Designators
026 6010 003	GROMMET STRIP, 0.125	1 FT	
256 0031 000	CABLE ASSY, FFC, 15C 3" LG	1 EA	
2960350000A	*TUBING, ZIPPER PVC 5/8" BLK	0.500 FT	
358 2589 000	MOUNT, RIBBON CABLE, 2''	1 EA	
358 2628 000	CABLE PUSH MOUNT	7 EA	
358 2847 000	BALL STUD, FAMALE 6-32 X 0.289	4 EA	
358 3734 000	SCREWLOCK KIT, DSUB 4-40 HEX	6 EA	
408 0397 000	GASKET,EMI,11.8MM X 10.7MM, V	55 IN	
410 0481 000	STANDOFF, 1/4 M/F 4-40 X 1-1/4	2 EA	
424 0023 000	GROMMET 1.000 GROOVE DIA	1 EA	
448 0623 000	SPRING CATCH	4 EA	
620 0208 000	ADAPTER, N-TYPE JACK-JACK	1 EA	J4
620 0455 000	ADAPTER, BNC JACK-JACK	2 EA	J2,J3
632 1201 000	PNL MTG, DIGITAL VOLTMETER	1 EA	A8
901 0203 071	PWA, I/O FILTER	1 EA	A3
901 0203 081	PWA, MOV	1 EA	A7
901 0203 101	PWA, PS INTERFACE	1 EA	A30
943 5567 126	FRONT PANEL,	1 EA	
943 5567 127	HINGE LEAF,	1 EA	
943 5567 130	FRAME, FRONT PANEL,	1 EA	

943 5567 131	FILTER RETAINER,	1 EA
943 5567 132	BULKHEAD, CHASSIS	1 EA
943 5567 138	PANEL, REAR,	1 EA
943 5567 139	SLIDE, MODULE	2 EA
943 5567 140	SLIDE, MIDDLE, MODULE	1 EA
943 5567 141	PLATE, MODULE,	1 EA
943 5567 143	COVER, MODULE,	1 EA
943 5567 144	COVER, REMOVABLE,	1 EA
943 5567 145	COVER, AC BD,	1 EA
943 5567 148	BRACKET, MODULE,	1 EA
943 5567 149	SHELF, PCB,	1 EA
943 5567 161	PS SHIELD,	1 EA
943 5567 162	CHASSIS,	1 EA
943 5567 164	SHELF, PS	2 EA
943 5567 165	GUIDE, PS	4 EA
943 5567 181	ZX AIR FILTER MEDIA, PRE-CUT	2 EA
943 5567 273	ROD, CABLE MTG	1 EA
971 0023 007	MODIFIED, PSU, SWITCHING, TRIPLE OUTPUT	1 EA

Table 6-7 PWA, I/O FILTER - 901 0203 071 (B)

GatesAir PN	Description	Qty UM	Reference Designators
610 1423 004	HDR, 4C 1ROW VERTICAL	2 EA	J9,J10
610 1423 006	HDR, 6C 1ROW VERTICAL	2 EA	J7,J8
612 1589 000	JACK, RJ45 SHIELDED VERT	2 EA	J1,J2
612 2139 003	RECP, D STRT 25C PCB	4 EA	J3,J4,J5,J6
801 0203 071	SCH, I/O FILTER	0 DWG	
901 0203 072	PWA, I/O FILTER,SMT	1 EA	

Table 6-8 PWA, MOV - 901 0203 081 (A)

GatesAir PN	Description	Qty UM	Reference Designators
2960345000A	*TUBING, SHRINKABLE 3/4	1 FT	
560 0111 000	MOV, 275WVAC, 140J, 20MM DISC	6 EA	RV1,RV2,RV3,RV4,RV5,RV6
610 1066 000	CONN, .25 FASTON PC MOUNT	6 EA	J1_1,J1_2,J1_3,J2_1,J2_2,J2_3
801 0203 081	SCHEMATIC, MOV	0 DWG	
801 0203 083	PWB, MOV	1 EA	

Table 6-9 PWA, PS INTERFACE - 901 0203 101 (G)

GatesAir PN	Description	Qty UM	Reference Designators
300 1579 000	SCR, 10-32 X 3/4	2 EA	E1,E2
304 0023 000	NUT, HEX 10-32	4 EA	
308 0007 000	10 FLAT WASHER BRASS	4 EA	
312 0049 000	WASHER, SPLIT-LOCK 10	4 EA	
384 0663 000	RECT BRIDGE 1A 200V DIP ESD	1 EA	CR1
398 0495 000	FUSE, CART 5X20MM 0.2A SLOW	1 EA	F1
402 0198 000	CLIP, FUSE 5MM DIA FUSE	2 EA	#(2) F1
472 1793 000	XFMR, STEPDOWN	1 EA	T1
522 0561 000	*CAP 100UF 63V 20% (10X12.5)	1 EA	C1
609 0015 000	RECP, POWER/SIGNAL, 3ACP+24S+2P	2 EA	J3,J4
610 1066 000	CONN, .25 FASTON PC MOUNT	6 EA	J1,J2,J6,J7,J8,J9
610 1334 000	HDR, 3C VERT 1ROW 1-WALL	2 EA	J10,J11
610 1423 006	HDR, 6C 1ROW VERTICAL	1 EA	J5
801 0203 101	SCH, PS INTERFACE	0 DWG	
901 0203 102	PWA, PS INTERFACE, SMT	1 EA	

Table 6-10 ASSY, RF OUTPUT, ZX1000 - 971 0023 002 (G)

GatesAir PN	Description	Qty UM	Reference Designators
296 0310 000	TUBING TEFLON 20 AWG	.25 FT	

544 1655 000	RES 50 OHM 250W 5%	4 EA	
559 0080 000	POSISTOR, 100C OVERHEAT SENSOR	4 EA	R1,R2,R3,R4
646 0665 000	LABEL, INSPECTION	1 EA	
839 8464 009	SCHEMATIC, RF OUTPUT ASSY ZX10000	DWG	
901 0203 031	PWA, 4X COMBINER	1 EA	A5A1
901 0203 091	PWA, 4X LOAD	1 EA	A5A2
943 5567 136	0.125 SHIELD, COMBINER,	1 EA	
943 5567 137	SHIELD, 0.030, COMBINER,	1 EA	
943 5567 155	COIL, 11 TURNS	1 EA	L1
943 5567 156	COIL, 1-1/2 TURNS	1 EA	L2
943 5567 157	COIL, 2-1/2 TURNS	1 EA	L3
943 5567 158	COIL, 1-1/2 TURNS	1 EA	L4
943 5567 159	COIL, 2-1/2 TURNS	1 EA	L5
943 5567 178	COVER, COMBINER	1 EA	
943 5567 647	ASSY., HEATSINK	1 EA	
943 5567 648	CHASSIS, COMBINER	1 EA	
952 9232 017	KIT, COAX CABLE, RF OUTPUT ASSY	1 EA	

Table 6-11 MODULE, DUAL PA, IBOC - 992 9992 041 (C)

GatesAir PN	Description	Qty UM	Reference Designators
302 0051 000	SCR, 4-40 X 3/16	8 EA	
302 0105 000	SCR, 6-32 X 5/16	4 EA	
302 0411 000	SCR, 6-32 X 3/8	16 EA	
314 0003 000	WASHER, SPLIT-LOCK 4	8 EA	
314 0005 000	WASHER, SPLIT-LOCK 6	20 EA	
357 0128 000	BUTTON, GLIDE, NYLON, 0.75 DIA	4 EA	
404 0899 007	PAD, THERMAL INTERFACE	2 EA	
448 1081 000	GASKET, EMI/RFI SHIELDING	0.500 FT	
448 1082 000	GASKET, EMI/RFI SHIELDING,	0.750 FT	
646 0665 000	LABEL, INSPECTION	1 EA	
922 1260 178	SHIELD, PA	2 EA	
939 8168 057	HANDLE, MODULE	2 EA	
943 5467 004	ASSY, MODULE HEATSINK	1 EA	
992 9992 021	PWA, PA, IBOC	2 EA	A1,A2

Table 6-12 PWA, PA, IBOC - 992 9992 021 (G)

GatesAir PN	Description	Qty UM	Reference Designators
055 0100 005	*THERMAL COMPOUND, 8OZ JAR	2 EA	#Q001,#Q002
086 0004 054	SOLDER, SN63/PB37, 0.032"	0 EA	
086 0004 055	SOLDER, SN62/PB36/AG2, 0.032"	0 EA	#C031
254 0002 000	BUS WIRE, 20AWG, SOLID TINNED CU	0 FT	L005
302 0053 000	SCR, 4-40 X 5/16	3 EA	
302 0441 000	SCR, 4-40 X 3/8	4 EA	
310 0003 000	WASHER, FLAT NO. 4	3 EA	
314 0003 000	WASHER, SPLIT-LOCK 4	7 EA	
354 0055 000	SOLDER LUG 6 MTG HOLE	4 EA	
358 3698 000	JUMPER, 0.85" LG, 1/8 HIGH	1 EA	
386 0062 000	*ZENER 1N4753A 36V 5% 1W	1 EA	CR002
500 1231 000	CAP 47PF 10% 500VDC CLAD	1 EA	C020
500 1354 000	CAP 91PF 5% 250VDC CLAD	2 EA	C008,C009
500 1359 000	CAP 150PF 5% 300V	1 EA	C032
500 1379 000	CAP, MICA VAR 8-45PF 175V	1 EA	C001
500 1380 000	CAP 180PF 10% 500VDC CLAD	1 EA	C010
500 1381 000	CAP, MICA VAR 16-100PF 250V	1 EA	C019
516 0417 000	CAP 1000PF 10% 200V X7R CK05	5 EA	C006,C007,C012,C014,C016
516 0484 000	CAP 0.100UF 10% 100V X7R CK06	4 EA	C013,C017,C018,C024
516 0768 000	CAP 18PF 5% 100V C0G	2 EA	C026,C027
522 0545 000	CAP 10UF 100V 20% (6.3X11)	1 EA	C029

540 1600 101	RES 10 OHM 3W 5%	2 EA	R001,R002
540 1600 110	RES 24 OHM 3W 5%	1 EA	R014
544 1652 000	* RES 100 OHM 2W 5%	2 EA	R003,R004
690 0021 000	*INSPECTOR'S LACQUER, RED	0 EA	#C001,#C019
843 5569 070	SPEC, PA, IBOC	0 DWG	
843 5569 071	SCH, PA, IBOC	0 DWG	
917 2435 022	TRANSFORMER, OUTPUT, PA	1 EA	T002
917 2435 026	TRANSFORMER, INPUT, PA	1 EA	T001
917 2435 135	FET, RF, MATCHED PAIR	1 EA	Q001,Q002
922 1085 020	CHOKE, RESISTIVE, 1000OHM	1 EA	L001
922 1085 021	CHOKE, FERRITE, 2500 PERM	1 EA	L002
922 1085 062	FEEDBACK COIL	2 EA	L003,L004
922 1260 005	SPREADER, FM PA	1 EA	
943 5567 180	STRAP, T2	1 EA	
992 9992 061	PWA,PA,IBOC,SMT	1 EA	

Table 6-13 XMTR, ZX 2000, CONFIGURABLE - 995 0035 002 (H)

GatesAir PN	Description	Qty UM	Reference Designators
620 1144 000	OBS, USE FFF 620-2691-000	0 EA	
817 2311 008	DWG, FAMILY TREE ZX2000	0 DWG	
952 9232 022	EXC INTERFACE CABLES, ZX TO DIGIT/SUPERCITER/MICROMAX	0 EA	
952 9232 029	EXC INTERFACE CABLE KIT, ZX TO FLEXSTAR	0 EA	
952 9232 031	KIT, ZX STANDALONE	0 EA	
952 9232 071	KIT, ZX2000/3500, DELTA INPUT	0 EA	
952 9232 072	KIT, ZX2000/3500 WYE INPUT	0 EA	
952 9232 073	KIT, ZX2000 SINGLE PHASE INPUT	0 EA	
971 0027 006	FLEXSTAR BOOST AMP	0 EA	
981 0090 002	ASSY, AMPLIFIER, ZX 2000	1 EA	
990 1202 001	*KIT, MODULE SPARES	0 EA	
990 1223 001	KIT, BOARD SPARES, ZX 2000	0 EA	
990 1262 001	KIT, BASIC, SPARE PARTS	0 EA	
994 9410 005	! EXCITER, DIGIT CD	0 EA	
994 9678 002	! EXCITER, SUPERCITER	0 EA	
995 0013 001	FLEXSTAR FM EXCITER	0 EA	
995 0015 001	FLEXSTAR FM HD EXCITER	0 EA	
995 0061 001	*CARD, WEB REMOTE INTERFACE	0 EA	A9

Table 6-14 ASSY, AMPLIFIER, ZX 2000 - 981 0090 002 (S)

GatesAir PN	Description	Qty UM	Reference Designators
358 2589 000	MOUNT, RIBBON CABLE, 2''	9 EA	
358 3247 000	PLUG, WHITE 1" HOLE	4 EA	
424 0023 000	GROMMET 1.000 GROOVE DIA	10 EA	
646 0665 000	LABEL, INSPECTION	1 EA	
646 1353 000	NAMEPLATE, XMTR EQUIPMENT	1 EA	
736 0445 000	PSU, 48VDC 1200W 90-264VAC	4 EA	A40,A41,A42,A43
901 0203 051	PWA, PA BACKPLANE	4 EA	A10,A11,A12,A13
901 0203 065	PWA, TX CONTROLLER, ZX2000	1 EA	A1
901 0203 101	PWA, PS INTERFACE	2 EA	A30,A31
901 0203 131	PWA, IPA BACKPLANE ZX	1 EA	A50
901 0203 151	PWA, 8X SPLITTER	1 EA	A4
917 2558 080	PATENT LABEL - FM XMTRS	1 EA	
943 5567 139	SLIDE, MODULE	6 EA	
943 5567 140	SLIDE, MIDDLE, MODULE	2 EA	
943 5567 165	GUIDE, PS	8 EA	
943 5567 173	SHIELD, PA INTERFACE,	5 EA	
943 5567 179	HANDLE, P.S.	4 EA	#A40,#A41,#A42,#A43
943 5567 200	SHELF, PS	4 EA	
943 5567 227	PLATE, MODULE, 2KW	1 EA	

943 5567 228	PLATE, FILLER, 2KW PS	1 EA	
943 5567 653	FRONT DOOR	1 EA	
952 9232 020	CABLE, AMP, ZX2000, INTERNAL CABLES	1 EA	
971 0023 003	ASSY, BASIC, ZX MP	1 EA	
971 0023 008	ASSY, RF OUTPUT ZX2000	1 EA	A5
988 2594 003	DP, ZX2000 TRANSMITTER	1 EA	
992 9992 041	MODULE, DUAL PA, IBOC	5 EA	A20,A21,A22,A23,A24

Table 6-15 PWA, TX CONTROLLER, ZX2000 - 901 0203 065 (B)

GatesAir PN	Description	Qty UM	Reference Designators
545 0308 321	RES 6.81K OHM 1% 1/8W 0805	1 EA	R141
901 0203 061	PWA, XMTR CONTROLLER	1 EA	

Table 6-16 ASSY, BASIC, ZX MP - 971 0023 003 (V)

GatesAir PN	Description	Qty UM	Reference Designators
026 6010 003	GROMMET STRIP, 0.125	1 FT	
256 0031 000	CABLE ASSY, FFC, 15C 3" LG	1 EA	
332 0099 000	SCREW, CAPTIVE, PHILIPS HEAD	5 EA	
332 0100 000	RECEPTACLE, SADDLE TYPE, SST	5 EA	
332 0101 000	RETAINER, PUSH NUT, SST	5 EA	
335 0015 000	WASHER NYLON .25 ID	5 EA	
358 2628 000	CABLE PUSH MOUNT	20 EA	
358 2847 000	BALL STUD, FAMALE 6-32 X 0.289	16 EA	
358 3734 000	SCREWLOCK KIT, DSUB 4-40 HEX	6 EA	
408 0397 000	GASKET,EMI,11.8MM X 10.7MM, V	110 IN	
410 0481 000	STANDOFF, 1/4 M/F 4-40 X 1-1/4	2 EA	
430 0291 000	FAN, 48VDC 280CFM, 6" DIA	4 EA	B1,B2,B3,B4
430 0292 000	FAN GUARD, 6.14" DIA.	4 EA	#B1,#B2,#B3,#B4
448 0623 000	SPRING CATCH	16 EA	
620 0455 000	ADAPTER, BNC JACK-JACK	2 EA	J2,J3
632 1201 000	PNL MTG, DIGITAL VOLTMETER	1 EA	A8
901 0203 071	PWA, I/O FILTER	1 EA	A3
901 0203 121	PWA, MOV AC	1 EA	A7
943 5567 131	FILTER RETAINER,	4 EA	
943 5567 181	ZX AIR FILTER MEDIA, PRE-CUT	5 EA	
943 5567 194	CHASSIS, REAR	1 EA	
943 5567 203	SHELF, COMBINER	1 EA	
943 5567 223	COVER, AC BD	1 EA	
943 5567 224	COVER, CHASSIS, REMOVABLE	1 EA	
943 5567 274	PANEL, FRONT	1 EA	
943 5567 276	PLATE, FRONT DOOR	1 EA	
943 5567 277	SHIM, FRONT DOOR	1 EA	
943 5567 278	HINGE, FRONT DOOR	1 EA	
943 5567 279	CHASSIS, FRONT	1 EA	
943 5567 280	CHASSIS, RIGHT SIDE	1 EA	
943 5567 281	CHASSIS, LEFT SIDE	1 EA	
943 5567 282	BULKHEAD,	1 EA	
943 5567 283	SHIELD, PS	1 EA	
943 5567 284	SHELF, BOTTOM MODULES	1 EA	
943 5567 285	SHELF, MODULE	2 EA	
943 5567 286	SHELF, IPA MODULE	1 EA	
943 5567 287	BRACKET, MODULE	3 EA	
943 5567 288	BRACKET, IPA MODULE,	1 EA	
943 5567 292	PLATE, CABLE MTG	1 EA	
943 5567 540	ASSY, DOOR, REAR FAN	1 EA	
971 0023 007	MODIFIED, PSU, SWITCHING, TRIPLE OUTPUT	1 EA	A2
971 0023 049	ASSY, INPUT ATTENUATOR	1 EA	A60

Table 6-17 PWA, MOV AC - 901 0203 121 (D)

GatesAir PN	Description	Qty UM	Reference Designators
2960345000A	*TUBING, SHRINKABLE 3/4	2 FT	
300 1579 000	SCR, 10-32 X 3/4	4 EA	
304 0023 000	NUT, HEX 10-32	8 EA	
308 0007 000	10 FLAT WASHER BRASS	12 EA	
312 0049 000	WASHER, SPLIT-LOCK 10	8 EA	
560 0111 000	MOV, 275WVAC, 140J, 20MM DISC	14 EA	RV1,RV2,RV3,RV4,RV7,RV8,RV9,RV10, RV11,RV12,RV13,RV14,RV15,RV16
610 1066 000	CONN, .25 FASTON PC MOUNT	12 EA	
801 0203 121	SCH, MOV AC	0 DWG	
801 0203 123	PWB, MOV AC	1 EA	

Table 6-18 ASSY, RF OUTPUT ZX2000 - 971 0023 008 (N)

GatesAir PN	Description	Qty UM	Reference Designators
088 0001 063	TAPE, TEFLON 'T', 0.75''W	0 RL	
296 0310 000	TUBING TEFLON 20 AWG	1 FT	
358 1314 000	*HOSE CLAMP, SST, SAE-10	1 EA	
544 1709 000	RES 50 OHM 400W 5% FLANGED	8 EA	
545 0309 208	RES 200 OHM 1% 1/4W 1206	4 EA	R1,R6,R9,R10
559 0080 000	POSISTOR, 100C OVERHEAT SENSOR	8 EA	R2,R3,R4,R5,R7,R8,R11,R12
620 2605 000	CONN, ANCHOR INS 7/8	1 EA	
646 0665 000	LABEL, INSPECTION	1 EA	
839 8464 019	SCH, RF OUTPUT ASSEMBLY ZX2000	0 DWG	
901 0203 141	PWA, 8X COMBINER	1 EA	A5A1
901 0203 161	PWA, LOAD 12X	1 EA	A5A2
943 5567 155	COIL, 11 TURNS	1 EA	L3
943 5567 183	COIL 2, ZX2000	1 EA	L4
943 5567 184	COIL 3, ZX2000	1 EA	L5
943 5567 185	COIL 4, ZX2000	1 EA	L6
943 5567 186	COIL 5, ZX2000	1 EA	L7
943 5567 187	FLANGE, RF CONNECTOR	1 EA	
943 5567 188	INSULATOR	1 EA	
943 5567 189	BULLET, CONNECTOR	1 EA	
943 5567 190	BLOCK, FLANGE MTG.	1 EA	
943 5567 191	BLOCK, FLANGE MTG.	1 EA	
943 5567 211	COVER, RF OUTPUT	1 EA	
943 5567 217	CHASSIS, COMBINER	1 EA	
943 5567 218	ASSY, HEATSINK,	1 EA	
943 5567 221	SHIELD, 0.060, COMBINER	1 EA	
943 5567 222	SHIELD, 0.125, COMBINER	1 EA	
943 5567 240	OUTER CONDUCTOR, 7/8"	1 EA	
943 5567 359	INSULATOR STRIP	1 EA	
952 9232 016	KIT, COAX CABLE, RF OUTPUT ASSY ZX2000	1 EA	

Table 6-19 XMTR, ZX 3500, CONFIGURABLE - 995 0035 003 (D)

GatesAir PN	Description	Qty UM	Reference Designators
620 1144 000	OBS, USE FFF 620-2691-000	0 EA	
817 2311 010	DWG, FAMILY TREE ZX3500	0 DWG	
952 9232 022	EXC INTERFACE CABLES, ZX TO DIGIT/SUPERCITER/MICROMAX	0 EA	
952 9232 029	EXC INTERFACE CABLE KIT, ZX TO FLEXSTAR	0 EA	
952 9232 031	KIT, ZX STANDALONE	0 EA	
952 9232 071	KIT, ZX2000/3500, DELTA INPUT	0 EA	
952 9232 072	KIT, ZX2000/3500 WYE INPUT	0 EA	
952 9232 074	KIT, ZX3500 SINGLE PHASE INPUT	0 EA	
971 0027 006	FLEXSTAR BOOST AMP	0 EA	
981 0090 003	ASSY, AMPLIFIER, ZX 3500	1 EA	

WARNING: Disconnect primary power prior to servicing.

990 1202 001	*KIT, MODULE SPARES	0 EA	
990 1262 001	KIT, BASIC, SPARE PARTS	0 EA	
990 1282 001	KIT, BOARD SPARES, ZX3500	0 EA	
994 9410 005	! EXCITER, DIGIT CD	0 EA	
994 9678 002	! EXCITER, SUPERCITER	0 EA	
995 0013 001	FLEXSTAR FM EXCITER	0 EA	
995 0015 001	FLEXSTAR FM HD EXCITER	0 EA	
995 0061 001	*CARD, WEB REMOTE INTERFACE	0 EA	A9

Table 6-20 ASSY, AMPLIFIER, ZX 3500 - 981 0090 003 (G)

GatesAir PN	Description	Qty UM	Reference Designators
358 2589 000	MOUNT, RIBBON CABLE, 2''	10 EA	
424 0023 000	GROMMET 1.000 GROOVE DIA	14 EA	
646 0665 000	LABEL, INSPECTION	1 EA	
646 1353 000	NAMEPLATE, XMTR EQUIPMENT	1 EA	
736 0445 000	PSU, 48VDC 1200W 90-264VAC	6 EA	A40,A41,A42,A43,A44,A45
901 0203 051	PWA, PA BACKPLANE	6 EA	A10,A11,A12,A13,A14,A15
901 0203 066	PWA, TX CONTROLLER, ZX3500	1 EA	A1
901 0203 101	PWA, PS INTERFACE	3 EA	A30,A31,A32
901 0203 131	PWA, IPA BACKPLANE ZX	1 EA	A50
901 0203 171	PWA, 12X SPLITTER	1 EA	A4
917 2558 080	PATENT LABEL - FM XMTRS	1 EA	
943 5567 139	SLIDE, MODULE	8 EA	
943 5567 140	SLIDE, MIDDLE, MODULE	3 EA	
943 5567 165	GUIDE, PS	12 EA	
943 5567 173	SHIELD, PA INTERFACE,	7 EA	
943 5567 179	HANDLE, P.S.	6 EA	#A40,#A41,#A42,#A43,#A44,#A45
943 5567 200	SHELF, PS	6 EA	
943 5567 360	DOOR, FRONT, ZX 3500	1 EA	
952 9232 053	CABLE KIT, INTERNAL CABLES, ZX3500	1 EA	
971 0023 003	ASSY, BASIC, ZX MP	1 EA	
971 0023 030	RF OUTPUT ASSY, ZX3500	1 EA	A5
988 2594 004	DP, ZX3500 TRANSMITTER	1 EA	
992 9992 041	MODULE, DUAL PA, IBOC	7 EA	A20,A21,A22,A23,A24,A25,A26

Table 6-21 PWA, TX CONTROLLER, ZX3500 - 901 0203 066 (B)

GatesAir PN	Description	Qty UM	Reference Designators
545 0308 318	RES 5.11K OHM 1% 1/8W 0805	1 EA	R141
901 0203 061	PWA, XMTR CONTROLLER	1 EA	

Table 6-22 RF OUTPUT ASSY, ZX3500 - 971 0023 030 (E)

GatesAir PN	Description	Qty UM	Reference Designators
088 0001 063	TAPE, TEFLON 'T', 0.75''W	0 RL	
296 0310 000	TUBING TEFLON 20 AWG	1.250 FT	
358 1314 000	*HOSE CLAMP, SST, SAE-10	1 EA	
544 1709 000	RES 50 OHM 400W 5% FLANGED	12 EA	
559 0080 000	POSISTOR, 100C OVERHEAT SENSOR	12 EA	R1,R2,R3,R4,R5,R6,R7,R8,R9,R10,R11,R12
620 2605 000	CONN, ANCHOR INS 7/8	1 EA	
646 0665 000	LABEL, INSPECTION	1 EA	
839 8464 022	SCH, RF OUTPUT ASSEMBLY ZX3500	1 DWG	
901 0203 161	PWA, LOAD 12X	1 EA	
901 0203 201	PWA, 12X COMBINER	1 EA	
943 5567 155	COIL, 11 TURNS	1 EA	L3
943 5567 187	FLANGE, RF CONNECTOR	1 EA	
943 5567 188	INSULATOR	1 EA	

943 5567 189	BULLET, CONNECTOR	1 EA	
943 5567 190	BLOCK, FLANGE MTG.	1 EA	
943 5567 191	BLOCK, FLANGE MTG.	1 EA	
943 5567 211	COVER, RF OUTPUT	1 EA	
943 5567 217	CHASSIS, COMBINER	1 EA	
943 5567 218	ASSY, HEATSINK,	1 EA	
943 5567 221	SHIELD, 0.060, COMBINER	1 EA	
943 5567 240	OUTER CONDUCTOR, 7/8"	1 EA	
943 5567 299	COIL 2, ZX3500	1 EA	L4
943 5567 300	COIL 3, ZX3500	1 EA	L5
943 5567 301	COIL 4, ZX3500	1 EA	L6
943 5567 302	COIL 5, ZX3500	1 EA	L7
943 5567 317	SHIELD, 0.125, COMBINER, ZX 3500	0 EA	
943 5567 359	INSULATOR STRIP	1 EA	
952 9232 055	KIT, COAX CABLE, RF OUTPUT ASSY, ZX3500	1 EA	

Table 6-23 XMTR, ZX 500, CONFIGURABLE - 995 0035 004 (C)

GatesAir PN	Description	Qty	UM	Reference Designators
952 9232 022	EXC INTERFACE CABLES, ZX TO DIGIT/SUPERCITER/MICROMAX	0	EA	
952 9232 029	EXC INTERFACE CABLE KIT, ZX TO FLEXSTAR	0	EA	
952 9232 031	KIT, ZX STANDALONE	0	EA	
971 0023 009	KIT, ZX RACK RAIL	0	EA	
971 0027 006	FLEXSTAR BOOST AMP	0	EA	
981 0090 004	ASSY, AMPLIFIER, ZX 500	1	EA	
990 1202 001	*KIT, MODULE SPARES	0	EA	
990 1224 001	KIT, BOARD SPARES, ZX 500	0	EA	
994 9410 005	! EXCITER, DIGIT CD	0	EA	
994 9678 002	! EXCITER, SUPERCITER	0	EA	
995 0013 001	FLEXSTAR FM EXCITER	0	EA	
995 0015 001	FLEXSTAR FM HD EXCITER	0	EA	
995 0061 001	*CARD, WEB REMOTE INTERFACE	0	EA	

Table 6-24 ASSY, AMPLIFIER, ZX 500 - 981 0090 004 (D)

GatesAir PN	Description	Qty	UM	Reference Designators
430 0291 000	FAN, 48VDC 280CFM, 6" DIA	1	EA	B1
430 0292 000	FAN GUARD, 6.14" DIA.	1	EA	#B1
609 0008 000	RECP, 3C 250VAC 30AMP	1	EA	#J1
609 0011 000	INLET/MALE, 3C 250VAC 30AMP	1	EA	J1
646 0665 000	LABEL, INSPECTION	1	EA	
646 1353 000	NAMEPLATE, XMTR EQUIPMENT	1	EA	
736 0445 000	PSU, 48VDC 1200W 90-264VAC	1	EA	A40
839 8464 024	WIRING DIAGRAM, RF INTERCONNECT ZX5000	DWG		
839 8464 025	WIRING DIAGRAM AC-DC INTERCONNECT ZX5000	DWG		
901 0203 051	PWA, PA BACKPLANE	1	EA	A10
901 0203 063	PWA, TX CONTROLLER, ZX500	1	EA	A1
901 0203 191	PWA, 2X SPLITTER	1	EA	A4
917 2558 080	PATENT LABEL - FM XMTRS	1	EA	
943 5567 173	SHIELD, PA INTERFACE,	1	EA	
943 5567 179	HANDLE, P.S.	1	EA	#A40
943 5567 294	DOOR, FRONT, ZX 500W	1	EA	
943 5567 362	PLATE, CLOSEOUT, PA MODULE	1	EA	
943 5567 363	PLATE, REAR FAN, ZX 500	1	EA	
952 9232 050	CABLE KIT, AMP, INTERNAL CABLES, ZX500	1	EA	
971 0023 001	ASSY, BASIC, ZX LP	1	EA	
971 0023 029	RF OUTPUT ASSY, ZX500	1	EA	A5
988 2594 001	DP, ZX500 TRANSMITTER	1	EA	
992 9992 041	MODULE, DUAL PA, IBOC	1	EA	A20

WARNING: Disconnect primary power prior to servicing.

Table 6-25 PWA, TX CONTROLLER, ZX500 - 901 0203 063 (B)

GatesAir PN	Description	Qty UM	Reference Designators
545 0308 318	RES 5.11K OHM 1% 1/8W 0805	1 EA	R18
901 0203 061	PWA, XMTR CONTROLLER	1 EA	

Table 6-26 RF OUTPUT ASSY, ZX500 - 971 0023 029 (D)

GatesAir PN	Description	Qty UM	Reference Designators
544 1655 000	RES 50 OHM 250W 5%	2 EA	
545 0309 208	RES 200 OHM 1% 1/4W 1206	2 EA	R2,R4
559 0080 000	POSISTOR, 100C OVERHEAT SENSOR	2 EA	R1,R3
646 0665 000	LABEL, INSPECTION	1 EA	
839 8464 026	SCH, RF OUTPUT ASSY ZX500	0 DWG	
901 0203 091	PWA, 4X LOAD	1 EA	A5A2
901 0203 211	PWA, 2X COMBINER	1 EA	A5A1
943 5567 136	0.125 SHIELD, COMBINER,	1 EA	
943 5567 137	SHIELD, 0.030, COMBINER,	1 EA	
943 5567 155	COIL, 11 TURNS	1 EA	L1
943 5567 178	COVER, COMBINER	1 EA	
943 5567 295	COIL 2, ZX500	1 EA	L2
943 5567 296	COIL 3, ZX500	1 EA	L3
943 5567 297	COIL 4, ZX500	1 EA	L4
943 5567 298	COIL 5, ZX500	1 EA	L5
943 5567 647	ASSY., HEATSINK	1 EA	
943 5567 648	CHASSIS, COMBINER	1 EA	
952 9232 052	KIT, COAX CABLE, ZX500 RF OUTPUT ASSY	1 EA	

Appendix a
Optional Web Remote Control

a

a.1 Introduction

The GATESAIR WEB REMOTE CONTROL is an optional PC card installed in the ZX amplifier chassis that provides remote control of transmitter functions via a LAN or Ethernet connection. This chapter addresses the GATESAIR WEB REMOTE CONTROL as it is employed in ZX transmitters. The GATESAIR WEB REMOTE CONTROL is also available in a stand-alone 1RU chassis, but this model is addressed in a separate technical manual.

NOTE:
The web remote option described in this Appendix was discontinued in January 2011. It was superceded by the 9810090131 kit, ZXA Web Remote option described in Appendix B.

a.2 Installation & Initial Turn On

When ordered with the initial transmitter purchase, the GATESAIR *WEB REMOTE CONTROL* card comes pre-wired and pre-tested with the main transmitter amplifier chassis. The card is installed just behind the main transmitter controller and is accessible by opening the transmitter front door.

The *WEB REMOTE CONTROL* PC card receives +5V via a coaxial connector from the transmitter low voltage power supply and parallel status, metering, and control signals via a DB25 connector from the transmitter controller. Interfacing to the Internet is via an RJ-45 jack, which receives a CAT5 cable coming from the user interface panel at the back of the amplifier chassis.

Should it be necessary to install the GATESAIR *WEB REMOTE CONTROL* in an existing ZX amplifier chassis, the required steps are simply limited to mechanically installing the card on the provided standoffs and establishing the DC, DB-25, and Ethernet connections mentioned above. Pre-wired cables for these connections should be present at the intended card installation location.

NOTE:
Web remote cards being interfaced to ZX Controller cards with artwork 8010203061 rev B or earlier (pre June 2007 approx) must also have installed a type 9010203221 Web Remote Adapter (See Figure a-2 on page a-4 below) at their J2 input (DB25). This adapter re-maps certain pin outs and voltage levels to provide the correct backwards compatibility. The polarity of the 5V power connector to should also be verified. The center pin of the DC coaxial connection should be +5V and the outer ring ground. Certain early units had this polarity inverted.

Figure a-1 ***Web Remote Adapter***

To access to the *WEB REMOTE CONTROL* for the first time, you should employ one of the following connections:

a. A direct connection from the transmitter rear panel RJ45 to a local PC via an Ethernet “crossover” cable (transmit and receive pair interchanged at one end).

b. A connection from the transmitter rear panel to a router via an Ethernet “straight” cable. The local PC connects to the router with another Ethernet straight cable or wirelessly.

NOTE:
The default IP address of the *WEB REMOTE CONTROL* when shipped from the factory is **192.168.1.123**.

To allow the PC to communicate to the *WEB REMOTE CONTROL*, it is necessary to set the IP address of the local PC to **192.168.1.xxx ,** where xxx is a number between 000 and 254, but not 123. The subnet mask should be set to 255.255.255.0.

NOTE:
The IP address settings for Windows-based computers are typically found at **Start > Settings > Network Connections > Local Area Connections > Properties > TCP/IP**. Exact location of the IP address settings may vary with make and model of computer.

A web browser is required to access the *WEB REMOTE CONTROL*. GatesAir recommends either Mozella, Netscape (version 7.0 or greater), or Internet Explorer (version 6.0 or higher) be used. The minimum recommended screen resolution is 1024 x 728. Resolutions less than this will not display the web pages properly.

To connect to the web remote, open the web browser and type in the *WEB REMOTE CONTROL* IP address in the address box on your browser. (i.e. 192.168.1.123). A password prompt will appear. The default administrator username and password are both **"admin."** The default operator username and password are both **"hweb."** The operator password provides access to only the basic web-based monitoring and control functions, while the administrator password also provides access to the internal web server setup parameters described in the WEB SERVER CONFIGURATION section of this chapter.

Once an initial connection is made, the default IP address can be changed by either the supplied IP configuration software (dgdiscvr.exe) or on the internal device server web page at **192.168.1.123/home.htm** under the heading *Configuration> Network.* (requires administrator password). For more information on setting the IP address of the *WEB REMOTE CONTROL*, please consult the WEB SERVER CONFIGURATION section of this chapter.

Connect your network administrator to obtain an appropriate IP address for your LAN/Internet connection. Although the built-in web server provides the option for DHCP (auto IP assignment), a static IP address is recommended so that the *WEB REMOTE CONTROL* will always appear at the same address in your browser. Otherwise, dynamic DNS assignment will be required, which is outside the scope of this manual.

To connect the *WEB REMOTE CONTROL* to the Internet, GatesAir recommends using a router with firewall protection to prevent unauthorized access. The ports necessary for Internet operation are noted in the WEB SERVER CONFIGURATION section in this chapter.

In case of difficulty accessing the *WEB REMOTE CONTROL*, observe the status of the principal indicator lights as the front edge of the card. Perform the following checks:

a. Verify the green Processor Activity LED is flickering. This indicates that the card is receiving +5V and the CPU is working.

b. Verify that the yellow LED on the RJ45 socket is lit. This indicates the card is connected to a valid Ethernet stream.

c. Verify that the green LED on the RJ45 socket is flickering. This indicates the *WEB REMOTE CONTROL* is being accessed. If the yellow LED is lit, but the green LED does not flicker, this is usually an indication that the IP addresses have not been set correctly.

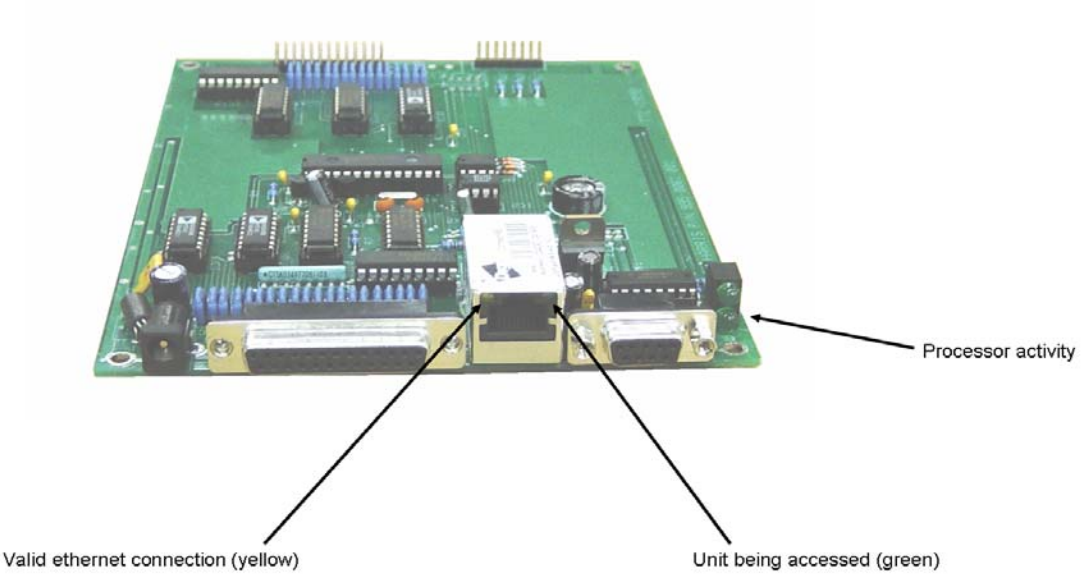


Figure a-2 WEB REMOTE CONTROL indicators

a.3 Interface Connections

The following tables provide an at-a-glance reference listing of the major *WEB REMOTE CONTROL* interconnects.

Function	Type	Description
J1	2.1 mm coaxial	5 VDC input @ < 300 ma. Center pin positive.
J2	DB25 female	Main interface to ZX transmitter. See table below for pin out.
J3	RJ45	Ethernet/LAN connection.
J4	DB9 female	RS-232 connection to set internal clock and log dumps.
J8	26C PCB header	Secondary Control connection.

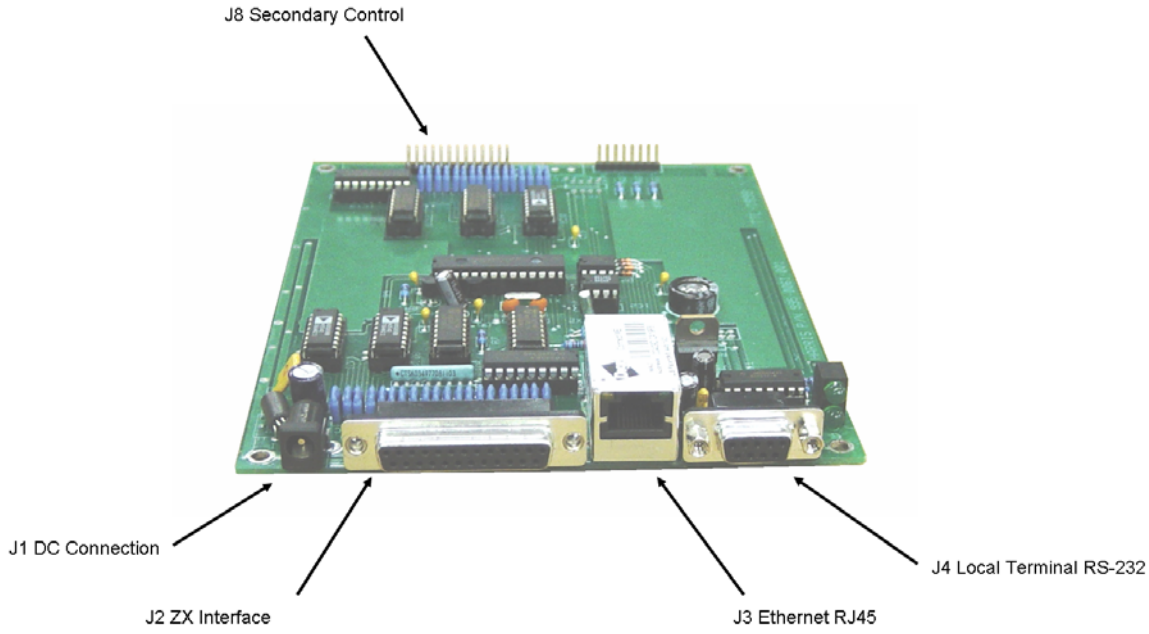


Figure a-3 Connections to WEB REMOTE CONTROL card.

a.3.1 J2 ZX Interface

NOTE:
The control and metering lines (but not status) of connector J2 of the *WEB REMOTE CONTROL* are essentially connected in parallel with the corre-

sponding pins of the DB25 transmitter remote interface at the amplifier chassis rear. Accordingly, the meter readings and/or control behavior of the *WEB REMOTE CONTROL* could become corrupted if improper remote control connections are made to the transmitter remote interface.

Pin	Function	Comment
1	Ground	Common return
2	TX ON/Reset command	Web remote grounds to issue command
3	TX OFF command	Web remote grounds to issue command
4	Power RAISE command	Web remote grounds to issue command
5	Power LOWER command	Web remote grounds to issue command
6	Temp Reduction Active	Tx sends +5V to indicate true condition High = Temp reduction active NOTE: Temp reduction alert not present on ZX transmitter with controller boards 8010203061 revB or earlier.
7	Remote Disable	Tx sends +5V to indicate true condition High = Tx remote control is disabled NOTE: Remote disabled alert not present on ZX transmitter with controller boards 8010203061 revB or earlier.
8	Forward power metering*	Tx sends analog sample voltage 4V = 100% FM power, 2k source impedance
9	Reverse power metering	Tx sends analog sample voltage 4V = 10% FM power, 2k source impedance
10	PA volts metering	Tx sends analog sample voltage 4V = 52.5V, 2k source impedance
11	PA amps metering	Tx sends analog sample voltage 4V = 100% nominal current per model, 2k source impedance
12	Raw max temp metering	Tx sends analog sample voltage (logarithmic) 4V = 99C, 2k source impedance.

13	TX mode status	Tx sends analog sample voltage 2k source impedance 0V = TX off 1V = FM mode on 2V = HD mode on 3V = FM+HD mode on
14	TX out of APC/low gain fault	Tx sends +5V to indicate true condition High = APC fault Transmitter has dropped out of APC due to a module failure or insufficient exciter drive.
15	VSWR foldback active	Tx sends +5V to indicate true condition High = foldback active
16	PA current foldback active	Tx sends +5V to indicate true condition High = foldback active
17	PS current foldback active	Tx sends +5V to indicate true condition High = foldback active
18	PA temperature foldback active	Tx sends +5V to indicate true condition High = foldback active
19	External mute active	Tx sends +5V to indicate true condition High = mute active (also AC< 190V fault in ZX2000/3500)
20	PA 1 current metering	Tx sends analog sample voltage 4V = 20A, 2k source impedance
21	PA 2 current metering	Tx sends analog sample voltage 4V = 20A, 2k source impedance
22	PA 3 current metering	Tx sends analog sample voltage 4V = 20A, 2k source impedance
23	PA 4 current metering	Tx sends analog sample voltage 4V = 20A, 2k source impedance
24	PA 5 current metering	Tx sends analog sample voltage 4V = 20A, 2k source impedance
25	PA 6 current metering	Tx sends analog sample voltage 4V = 20A, 2k source impedance

NOTE:
The analog to digital conversion process internal to the web remote card makes use of a 4.1V precision reference. Accordingly, all metering values monitored by the web remote will experience saturation when the incoming analog voltage exceeds 4.1V. Since all ZX transmitters ship from the factory with a default remote voltage scale of 4V = 100% forward FM power, the for-

ward power reading displayed on the web remote will saturate at approximately 103% of the transmitter nominal FM power level. Depending on the required transmitter power output, it may be desirable to recalibrate the ZX controller to provide a nominal 3V = full scale remote sample and thus provide more metering headroom on the web remote. To make this change, simply recalibrate R155 on the ZX controller to provide 3.0V = 100% FM power at pin 8 of the DB25 user parallel interface, adjust R165 to correct the reading on the front panel multimeter, and adjust R156 & R157 to provide correct meter readings in the FM+HD and HD modes, respectively. The forward power multiplier on the Configuration 1 page must then be adjusted to recalibrate the displayed forward power reading on the Transmitter Control page.

a.3.2 Secondary Control Connector

Although the secondary control function is not implemented on the *WEB REMOTE CONTROL* when installed in a ZX transmitter, it may become desirable at some point to use this feature. This may be done provided that the following precautions are observed:

The **status** inputs are logic levels with an open input (or 3.8 to 5.0 VDC) or a closure (between 0 VDC and 1.5 VDC) to change the status indicator. The status inputs have a built-in pull up. Accordingly, it is only necessary to apply to an external ground to force a status change from the high to low state. That is, no external voltage is required.

The **control** outputs from the *WEB REMOTE CONTROL* are open collector and are rated at a maximum of 24 volts DC at 500 mA each.

The analog **meter** inputs are rated at between 0.000 and 4.1 VDC. This reading and level can be scaled by using the *multiplier* on the “Configuration” pages. Input impedance for the analog inputs is greater than 10 k Ohms.

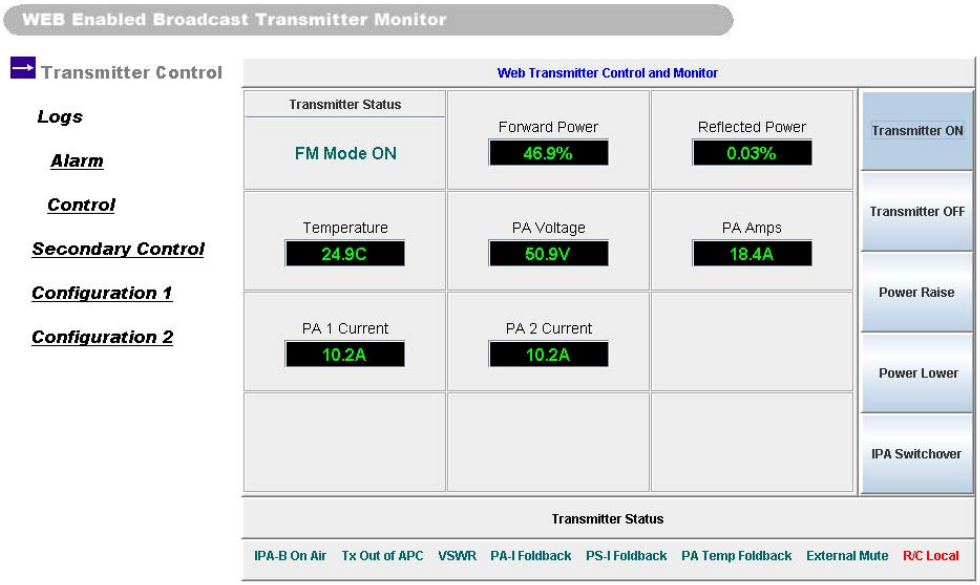
CAUTION:
A VOLTAGE HIGHER THAN +5V ON A STATUS OR METERING INPUT PIN WILL DAMAGE THE WEB REMOTE CONTROL.

Pin	Function	Comment
1	Ground	Common return
2	Metering Input 1	0-4V analog, >10kohms

3	Metering Input 2	0-4V analog, >10kohms
4	Metering Input 3	0-4V analog, >10kohms
5	Metering Input 4	0-4V analog, >10kohms
6	Metering Input 5	0-4V analog, >10kohms
7	Metering Input 6	0-4V analog, >10kohms
8	Metering Input 7	0-4V analog, >10kohms
9	Metering Input 8	0-4V analog, >10kohms
10	Status Input 1	0-5V TTL or ground = low, open = high.
11	Status Input 2	0-5V TTL or ground = low, open = high.
12	Status Input 3	0-5V TTL or ground = low, open = high.
13	Status Input 4	0-5V TTL or ground = low, open = high.
14	Status Input 5	0-5V TTL or ground = low, open = high.
15	Status Input 6	0-5V TTL or ground = low, open = high.
16	Status Input 7	0-5V TTL or ground = low, open = high.
17	Status Input 8	0-5V TTL or ground = low, open = high.
18	Control Output 1	Open collector, 24V @ 500mA max.
19	Control Output 2	Open collector, 24V @ 500mA max.
20	Control Output 3	Open collector, 24V @ 500mA max.
21	Control Output 4	Open collector, 24V @ 500mA max.
22	Control Output 5	Open collector, 24V @ 500mA max.
23	Control Output 6	Open collector, 24V @ 500mA max.
24	Control Output 7	Open collector, 24V @ 500mA max.
25	Control Output 8	Open collector, 24V @ 500mA max.
26	+5 VDC	Do not use.

a.4 Operational Information: Web Pages

This section provides an explanation of the individual web pages in the order in which they are displayed from the menu bar at the right of the pages.



a.4.1 *TRANSMITTER CONTROL Page*

The first page displayed is the primary control page. This page provides the control and monitoring functions for ZX transmitters. The labels on this page cannot be changed (the Secondary Control page has this capability).

The Transmitter Status cell shows the current operating mode. This display changes between “Transmitter Off”, “FM Mode”, “HD Mode”, and “FM+HD Mode” mode according to the level of the input on pin 13 of the ZX interface connector.

Forward and reflected powers are shown in watts. The transmitter PA stage voltage and current are displayed in their respective cells.

A temperature reading is derived from thermistor sensors on the PA module(s). A special math function is built-in to convert the logarithmic output of the PA thermistors to a direct reading in degrees Celsius. The value reported is the maximum value reported by any single PA module.

Up to six cells for PA current measurement display the individual PA module current levels. Depending on the transmitter model, one or more of these cell may not be present.

Five pushbutton cells at the right of the page provide control outputs. Placing the mouse cursor over one of these buttons and clicking causes the respective output on the *WEB REMOTE CONTROL* to make a closure for about ½ second.

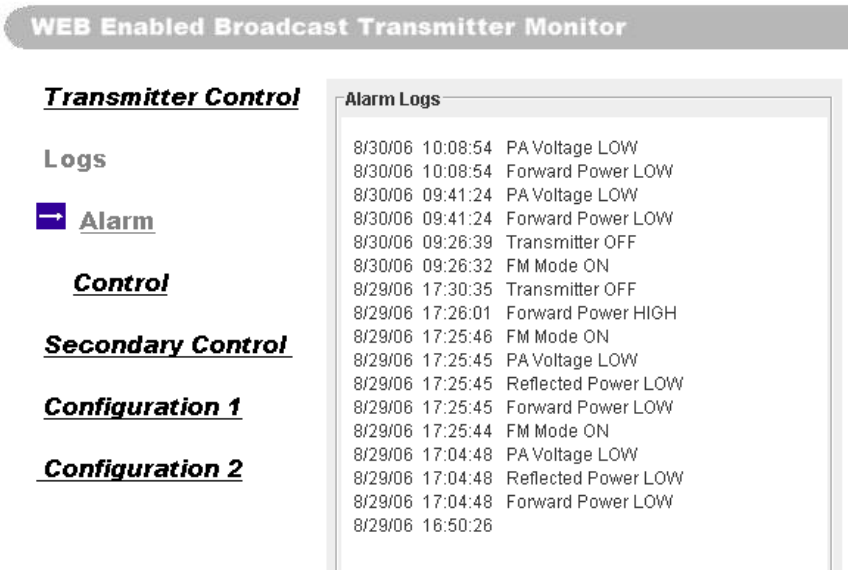
The IPA Switchover button will cause the transmitter on control to stay active (closed) for about 3 seconds.

NOTE:
The IPA Switchover option is not implemented in standard ZX transmitters.

Eight status "lights" at the bottom of the page change color from green to red depending on the status of the respective input (high = red, low = green).

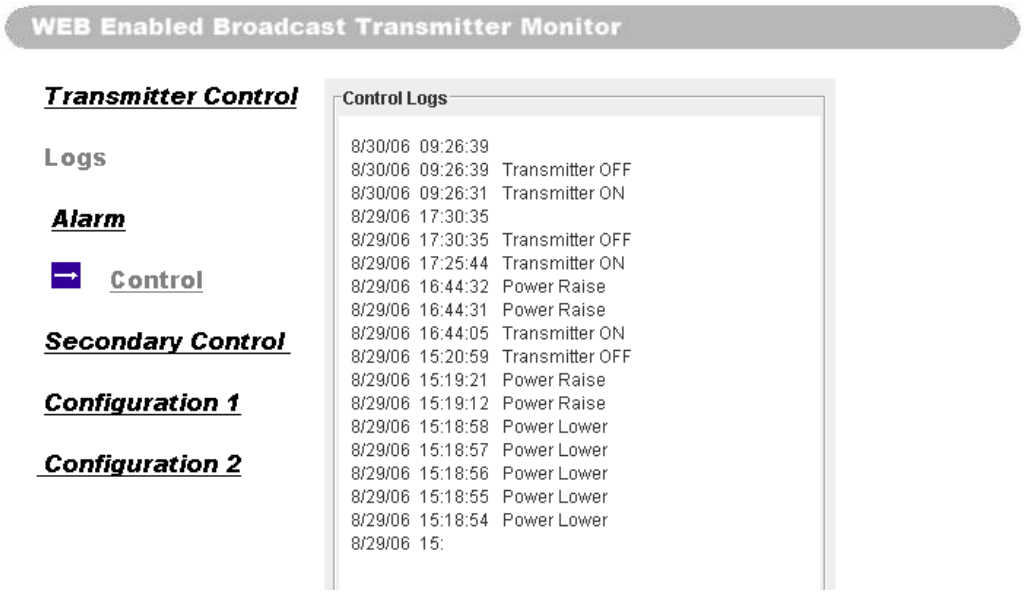
The metering on this page has a unique feature. When the metered reading falls outside of the high or low alarm limits (as set on the Configuration 1 page), the reading changes color from green to red.

When the alarm high limit is set to 0 for the six PA current readings, the affected metering cell will go blank and the label will disappear. This allows customization of the web page according to the ZX transmitter model. Transmitter models with fewer than six PA modules can have the missing PA readings removed front the main control page.



a.4.2 ALARM LOG Page

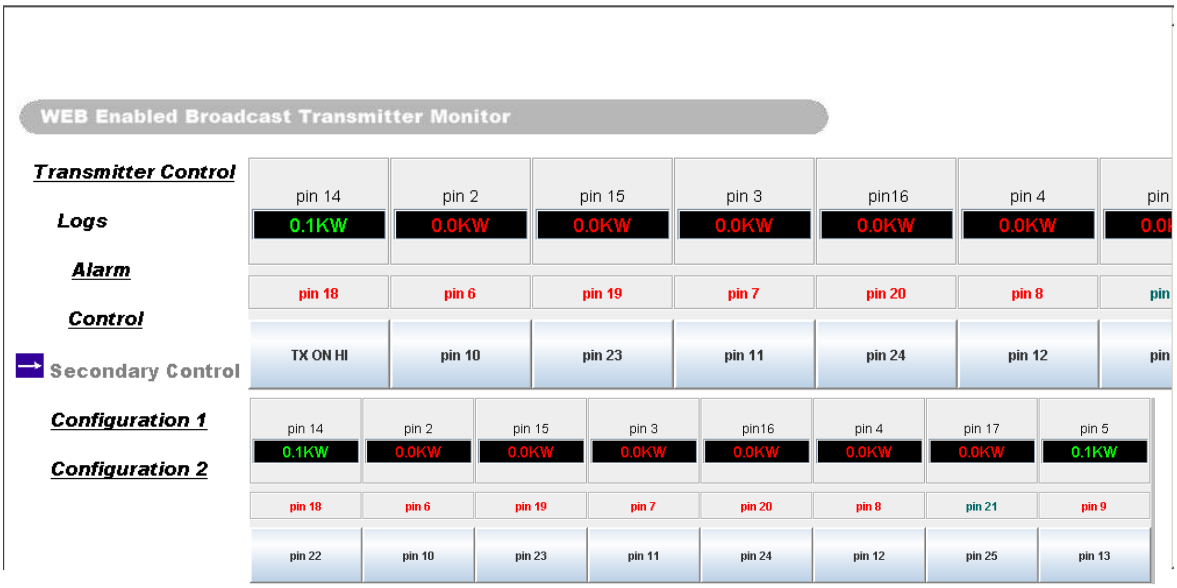
Clicking on the "LOGS – ALARM" button summons a log of the last 25 alarms, with the most recent alarm at the top of the page. The date, time, and alarm name are displayed. If a hard copy print out is desired, a cut-and-paste method can be used to extract the alarm log and paste it into a text editor.



a.4.3 *CONTROL LOG Page*

Clicking on the “LOGS – CONTROL” button summons a log of the last 25 commands issued to the ZX amplifier via the web remote. Note that this log only displays those commands entered via web control. Commands issued locally via the transmitter control panel do not appear in this log.

Commands are displayed on this page starting at the most recent at the top of the page. The date, time, and command name are displayed. If a hard copy print out is desired then a cut-and-paste method can be used to extract the control log and paste it into a text editor.



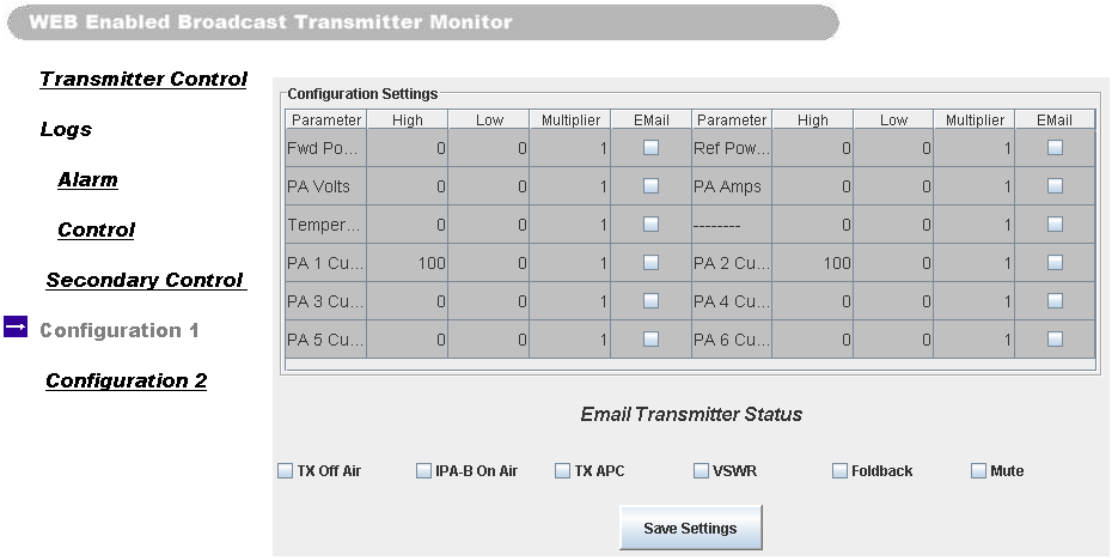
a.4.4 *SECONDARY CONTROL Page*

Clicking on the “SECONDARY CONTROL” button summons the Secondary Control page. This page allows direct access to the secondary I/O connector. Eight metering, status, and control functions are shown on this page. The labels for the metering, the units for the metering, the multiplier for the meter reading, the label for status buttons, and the label for the control buttons are designated on the “Configuration 2” page.

The status labels will change color with a change in the status of their respective inputs. Normal status (TTL low) will have the status label display in green while abnormal status (TTL high) will cause the status label to display in red.

Clicking on a control button will cause the respective control output to “close” for approximately ½ second.

NOTE:
As of this printing, the “Secondary Control” function is not supported in ZX transmitters. The Secondary Control connector is present and functional on the web remote card, but its connections are not wired to the transmitter or outside world.



a.4.5 CONFIGURATION 1 Page

Clicking on the “CONFIGURATION 1” button summons a page in which the alarm and meter scale parameters for the main Transmitter Control page are set.

To set an alarm window, simply type in the value in the high or low column for the function you wish to alarm. The value you type in must be a non-decimal (whole) number. The use of a decimal point may cause one or more readings to become corrupted and display incorrect values. If the “HIGH” value is set to 0, no alarm will be generated. In the case of the six PA current readings, a “HIGH” value set to 0 will cause the affected cell on the Transmitter Control page to disappear. Normally, it is expected that the “HIGH” value will exceed the “LOW” value. A meter reading outside the alarm limits will appear in red lettering on the Transmitter Control page.

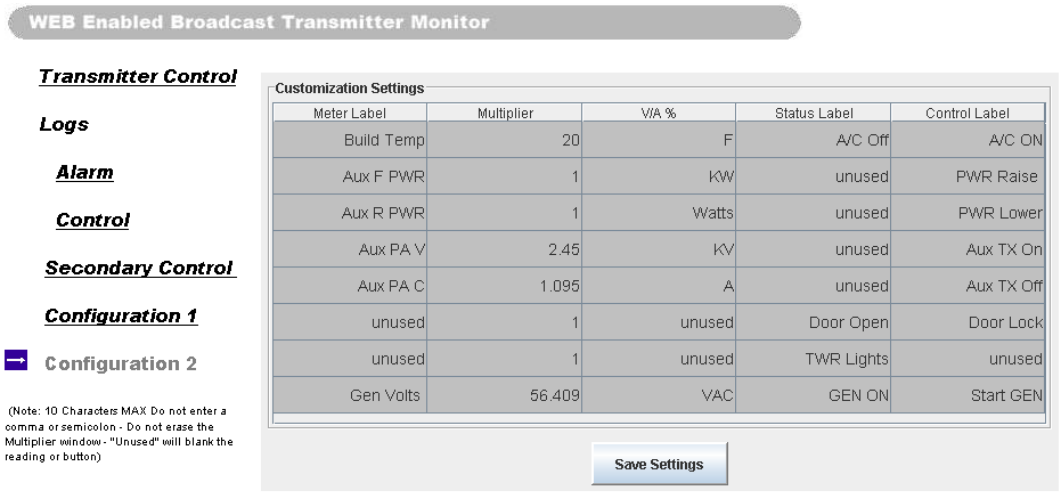
The “MULTIPLIER” column is used to fine-tune the reading displayed on the Transmitter Control page. This can be in decimal format and in a range from 9999.999 to 0.001. There is some rounding off that takes place internally. The multiplier values will have already been set for any ZX transmitter shipped from the factory with the *WEB REMOTE CONTROL* already installed.

The next column is for the email function. If the metered voltage exceeds the window set by the “HIGH” and/or “LOW” limits, an email is generated to notify the user of the alarm condition if this box is checked.

At the bottom of this page are email notification selection boxes for six status conditions. If the status goes from low to high AND the box is checked, an email is sent. (See the WEB SERVER CONFIGURATION section of this chapter for more information on sending email and SNMP notifications).

After the alarm window settings have been made, the “SAVE SETTINGS” button must be pressed. Otherwise, no changes will be recognized or made. These settings are saved in nonvolatile memory.

NOTE:
The SAVE SETTINGS button will not capture changes to a value if the blinking cursor is still in the affected cell. Use the mouse to click on a different cell before attempting to save settings.



a.4.6 CONFIGURATION 2 Page

Clicking on the “CONFIGURATION 2” button summons a page displaying the setup parameters for the Secondary Control page.

The first column sets the metering label for the eight metering functions. Up to ten letters, numbers, or some punctuation can be used for these labels. Exceptions are a comma or semi-colon (“ , “ or “ ; “).

The second column is for the metering multiplier. A direct one to one reading is the default. For example, if 3.565 volts are present on the Secondary I/O metering pin, the value “3.6” will be displayed in the metering window. Changing the multiplier will change the corresponding reading. Making the multiplier 100 will change the reading displayed to “356.5”

NOTE:
DO NOT ERASE THE VALUE IN THE MULTIPLIER WINDOW. A DECIMAL VALUE MUST BE IN THIS WINDOW OR THE SYSTEM WILL HANG UP, THUS REQUIRING A REBOOT!

The next column is for the meter reading descriptor. Any letter or letters (up to ten characters) can be typed into this window to name the corresponding meter reading displayed on the Secondary Control page. Such labels as Amp, Volt, %, etc. are acceptable. Exceptions are a comma or semi-colon (“ , “ or “ ; “).

The fourth column is for the status label for the eight status functions displayed on Secondary Control page. Up to ten letters, numbers, or punctuations can be used for these labels. Exceptions are a comma or semi-colon (“ , “ or “ ; “). This label will change color with a change in status. A status normal (TTL low) will display the label in green lettering. An abnormal status (TTL high) will display the label in red lettering.

The last column is for labeling the eight control buttons used on the Secondary Control page.

After the settings have been made the “SAVE SETTINGS” needs to be clicked. Without saving the settings, no changes will be recognized or made. These settings are saved in nonvolatile memory.

NOTE:
Do not enter a comma (,) or a semicolon (;) in any window.

a.5 Operational Information: Local Terminal

The *WEB REMOTE CONTROL* has the ability to send its alarm and control logs to a local terminal via an RS-232 connection to its on-board DB-9 connector. This connection is also used to set the internal clock for the proper recording of alarm and control events. A terminal emulator program, such as Windows HyperTerminal, may be used to access this information. The setup parameters for this connection are as follows.

Bits per Second = 9600 baud

Data Bits = 8

Parity = No

Stop Bits = 1

Handshake/Flow Control = None

Once a connection is established, the resulting output on the terminal screen should resemble the sample printout below.

```
          WEB Control  Version

Time is now: 14:04:39   Date: 2/13/07

                MENU
 1 Set Clock
 2 Dump Alarm Log
 3 Dump Control Log
 4 Erase Alarm Log
 5 Erase Control Log
 6 Erase Secondary Control Labels
 7 Turn ON/OFF Local Alarm Printout - Printer is now ON
 0 Exit to normal operation

0
Exiting to Normal Operation

 Transmitter OFF            14:04:45   Date: 2/13/07 *
 PA-1 Current LOW           14:04:45   Date: 2/13/07
 Transmitter ON             14:04:49   Date: 2/13/07 *
 HD Mode ON                 14:04:49   Date: 2/13/07 *
 Transmitter APC            14:04:49   Date: 2/13/07
```

Note how the local alarm printout has been activated. (Menu #7) After the menu exits and normal operation is resumed, the terminal output displays new log events with time and date information. The asterisk after the date indicates that an e-mail was also sent for the alarm in question. The ability to selectively send e-mails for certain alarms is covered elsewhere in this chapter.

The menu automatically exits and normal logging resumes after ten seconds with no user activity.

a.6 Web Server Configuration

The GATESAIR *WEB REMOTE CONTROL* uses the DIGI International embedded device server as a means of communicating with the Internet or a LAN. This section describes some of the basic features of this powerful device server.

CAUTION:
ALTERING SOME SETTINGS CAN RESULT IN THE GATESAIR WEB REMOTE CONTROL CEASING TO FUNCTION PROPERLY. DO NOT CHANGE ANY SETTINGS *WITHOUT UNDERSTANDING HOW THESE CHANGES WILL AFFECT PROPER OPERATION OF THIS UNIT.*

NOTE:
If a router is used for Internet connection, ports 80 and 1001 need to be set to forward the data. If not the web remote will not communicate properly. Please consult the documentation for the router used to determine how this is done on the router.

To reach the device server web page in your browser address window, type in the IP address followed by “/home.htm”.

LOGIN: The administrator level username and password are required to make access or make any changes to this portion of the GATESAIR WEB REMOTE CONTROL. The default ADMINISTRATIVE USERNAME for the GATESAIR WEB REMOTE CONTROL series is: “admin” in small letters. The default PASSWORD is “admin” as well.

HOME: The HOME page gives a summary of the IP Address and the MAC address for this device server. Do not attempt to make changes to this page. Selections from this page are Configuration or Administration.

a.6.1 Configuration Functions

Configuration NETWORK: This is a series of three pages selected by clicking on the bottom tab. The IP SETTINGS allow you to select whether you want to force an IP address or use DHCP for the selection. The use of a static IP address for the GATESAIR *WEB REMOTE CONTROL* is recommended.

Configuration NETWORK SERVICE SETTINGS: On this page, you can select which services you desire for the WEB REMOTE CONTROL. The only services actually needed are "Enable Network Management Protocol (SNMP)" and "Enable Web Server (HTTP)". Do not change the port settings as these are the standard ports for these services.

Configuration ADVANCED NETWORK SETTINGS: Do not make changes to this page.

Make sure that the "APPLY" button has been pressed to save any changes!

Configuration SERIAL PORTS: This page allows you to make minor changes to the way the device server handles internal data from the access port. Clicking on the "PORT1" will bring you to the port settings page. The default settings should be maintained. These are "TELNET PORT" enabled (checked) at port number 2001, "RAW TCP ACCESS" enabled (checked) at port number 10001, and "SECURE SOCKET ACCESS" enabled (checked) at port number 2601. Do not change the profile or the TCP client settings from the factory default.

Configuration SERIAL PORTS – BASIC SERIAL SETTINGS: This page should not be changed from the factory settings of 9600 baud, 8/N/1/N. This is an internal serial data bus and is NOT the serial port on the GATESAIR *WEB REMOTE CONTROL!* That serial port is not addressable and is fixed.

Configuration SERIAL PORTS –ADVANCED SERIAL SETTINGS: No changes should be made to this page. All of the settings are unchecked.

Configuration GPIO: This page selects the direction of the internal alarm bus. Each GPIO should be selected for the "IN" mode.

CAUTION:
CHANGING THE GPIO SETTINGS IN THIS AREA WILL RESULT IN DAMAGE TO THE WEB REMOTE CONTROL!

Configuration – ALARMS CONFIGURATION: If you wish to be notified by email and/or SNMP when an alarm occurs, select the "Enable alarm notifications"

check box. Enter the SMTP IP address (the IP address of your email server) and the email "from" address.

Configuration – ALARMS CONDITIONS: This section is where you specifically assign which alarm goes to which email address and with what alarm message.

NOTE:
Be careful when you make changes to the alarm settings. The order of the alarms is specific to how they are internally addressed by the internal circuits of the Web Remote.

Checking the box next to the alarm number will enable that alarm to send email and SNMP alarms. Click on the alarm number and you are presented with the conditions under which the alarm will be sent.

The GPIO trigger states are factory set for the five-bit binary number representing the decimal number of the alarm. Do not change these settings.

"Send Alarm Based on GPIO States" should be checked. "Serial Pattern" should NOT be checked. "Alarm Destinations Send Email" should be checked if you want email notification of a specific alarm. Type in the information for the recipient, the CC recipient, the priority of the email, and the subject line. The subject line is the alarm specific information you want your email recipient to get. For example, "Transmitter Power High" could be a subject. There is no body to the alarm email messages.

Check "Send SNMP trap to following destination when alarm occurs" if you want to enable the SNMP alarm trap for this alarm. The destination address is selected in the "Configuration – Systems" section below.

NOTE:
As of this printing, the SNMP MIBs for the built-in web server may be found at www.digi.com under the heading of product support for the Digi Connect ME product.

Repeat this process for each alarm. **Remember to hit the "APPLY" button to save the settings!**

Configuration – SYSTEM: This brings up the system device settings.

CAUTION:
DO NOT CHANGE THE DEVICE ID. DOING SO WILL MAKE THE WEB REMOTE CONTROL NON-FUNCTIONAL.

Configuration – SYSTEM-Simple Network Management Protocol (SNMP) Settings: This is the area where the SNMP IP address and configuration is set. It is recommended that no client be able to "SET" in the device server. There are no user settable SNMP conditions on this device server.

Configuration – REMOTE MANAGEMENT - CONNECTIONS: There should be nothing checked on this page.

Configuration – REMOTE MANAGEMENT – SECURITY: One nice feature of the GATESAIR *WEB REMOTE CONTROL* is the extensive security features. On this page you can select the level and degree of SSL you wish to incorporate into this unit.

Configuration – REMOTE MANAGEMENT – ADVANCED: Normally, the default settings for this page are sufficient to maintain adequate connections between the *WEB REMOTE CONTROL* and a user.

Configuration – USERS: This area is where you can designate two users for the *WEB REMOTE CONTROL.* Select a user and the level of access that user has to this device server, not the GATESAIR *WEB REMOTE CONTROL!* Normally a system administrator will need access to all of the functions of the device server and should have administrator privileges. A non-administrator user only needs access to the web server part which incorporates the functions of the *WEB REMOTE CONTROL.* Each user has a password and privileges. It is recommended that the administrator have administrator privileges and his/her own username and password and all of the other users share the same username and password.

Remember that no serial configuration is performed on the device server! Do not change any serial settings!

Configuration – Serial Ports: Displays information relative to the internal serial port.

Configuration – Connections: Shows the IP address of the currently connected user.

a.6.2 Administration Functions

Administration – FILE MANAGEMENT: This area is where the device server stores the working pages for the GATESAIR *WEB REMOTE CONTROL.*

CAUTION:
DO NOT CHANGE ANY FILE OR TRY TO UPLOAD ADDITIONAL FILES. DOING SO WILL MAKE THE WEB REMOTE CONTROL NON-FUNCTIONAL.

Administration – BACKUP/RESTORE: No changes to this page are necessary.

Administration – UPDATE FIRMWARE:.

CAUTION:
DO NOT UPDATE THE FIRMWARE! DOING SO WILL MAKE THE WEB REMOTE CONTROL NON-FUNCTIONAL.

Administration – FACTORY DEFAULT SETTINGS:

CAUTION:
DO NOT RESET THE FACTORY DEFAULT SETTINGS! DOING SO WILL MAKE THE WEB REMOTE CONTROL NON-FUNCTIONAL.

Administration – SYSTEM INFORMATION: This is a handy area to see how the device server is working. Within this area, you can see how long the device server has been online and the TCP and IP statistics and packet information.

Administration – REBOOT: Rebooting the device server will not cause damage to the GATESAIR *WEB REMOTE CONTROL*. Note, however, that it only resets the web server portion of the *WEB REMOTE CONTROL* and not the CPU responsible for measuring and digitizing the various metering and status inputs.

ZX Transmitter Web Remote Troubleshooting Table

Symptom	Cause and Solution
Browser returns "website not found" message.	Possible connectivity error. Perform following checks: > Check for presence of +5V supply to card and processor activity (green activity LEDs on card). Cycle DC power to card as necessary. > Check for presence of valid Ethernet connection (yellow LED on RJ45 connector). Reconnect Ethernet cable as necessary. > Check for presence of IP traffic (green LED on RJ45 connector). Verify IP address settings as necessary. See table entry below on "Restore Factory Defaults" for more information on finding a lost IP address.
Web pages open OK with menus at left present, but data area in center is empty.	Java Runtime environment not installed or incompatible version. Web Remote designed to work with Java Runtime versions 5.0.11 or higher. Obtain free upgrade to latest version Java Runtime environment by searching under heading "java runtime" on Internet.
Web pages open OK but all readings black / blank.	Another user is logged into web remote. Other user can be forcibly disconnected in Configuration – Connections page of "home.htm" (Administrator) portion of web remote.
Web browser freezes if AC power removed to web remote card while browser is actively viewing web page.	This is unavoidable with certain browsers in Windows. Browser must be hard shut-down using Ctrl-Alt-Del and Task Manager to recover. Minimize or close web remote window before removing AC power to avoid problem.
Last modified value not saved when changing settings on Configuration page.	Configuration page editor will not save modified value if cursor is still in affected cell when Save Settings button is pressed. Use mouse to move cursor to different cell before pressing Save Settings button.
One or more readings wildly inaccurate. Readings do not agree with multiplier value and measured input voltage.	Possible multiplication error due to presence of decimal point in high or low alarm limits on Configuration page. Use only whole numbers for the high and low alarm limits.
Time / date stamp on alarm logs incorrect.	Incorrect clock programming in web remote. Access web remote RS-232 port to set clock. Connection parameters are 9600/8/N/1/N. Modify clock settings via menu selection 1 of local terminal menu.
Connectivity to web remote lost after accidentally pressing "Restore Factory Defaults" button in "home.htm" (Administrator) section of web remote.	Run provided Digi Device Discovery application (dgdiscvr.exe) to serve new address to unit via DHCP. After running discovery app, new address and login will be: IP address: 169.254.1.70 Subnet Mask: 255.255.255.0 Username: root Password: dbps Connect with browser to address http://169.254.1.70/home.htm and access Configuration – Network page to set IP address to desired value. You can determine the address of equipment by monitoring the Ethernet with a program like Ethereal, running in capture mode on a PC, as you cause the equipment to send out a packet (by using the Digi Device Discovery application for example). Visit website http://www.ethereal.com. ; The program is a free download. If web remote is set to DHCP and has not been served an address by Digi Device Discovery application or a router, it may still have an 0.0.0.0 address.

	Digi Device Discovery application (dgdiscvr.exe) is typically provided on CD ROM with web remote. Contact Harris Customer Service if copy of application cannot be found.
Control log only records commands entered via web remote.	This is normal.
Remote Disable and/or Temp Foldback status fields inactive.	These two status features were not implemented in ZX transmitters produced prior to June 2007.

Appendix b
Web Remote Option (ZXA)

b

b.1 Introduction

This appendix provides information about the 9810090131 kit, ZXA Web Remote option, a purchase option for the ZX series of FM transmitters addressed in this manual.

The ZXA Web Remote replaces an earlier version web remote option: the 7350061000 Web Remote Control card addressed in Appendix A of this manual. The ZXA Web Remote is a fit, form, and functional replacement for the earlier card, with the exception of the "Secondary Control" connector. The ZXA Web Remote does not support the Secondary Control functionality of the 7350061000 Web Remote. However, unlike the earlier card, the ZXA Web Remote *does* provide full SNMP support for GET, SET, and TRAP.

NOTE:
The designation "ZXA" refers to the ZX A series of transmitters (ZX500, ZX1000, ZX2000, ZX3500). The information presented here does not apply to the similar web remote option for the ZX B series of transmitters (ZX2500, ZX3750, ZX5000, ZX7.5, ZX10). Please consult manual 888-2595-001 for information on those model transmitters.

The information is this appendix is organized in a structure that mirrors the larger transmitter manual: there are subsections addressing the following topics:

1. Introduction
2. Installation
3. Operation
4. Theory of Operation
5. Maintenance
6. Troubleshooting
7. USB Flash Drive

b.1.1 General Product Description

The ZXA Web Remote provides extended metering and control of the ZX A series of FM transmitters via a standard web browser and Ethernet/IP connection. This allows the transmitter to be monitored and controlled anywhere in the world via the Internet, including in a mobile environment via handheld Internet appliances and smart phones. The serial IP data stream used to update the main web page may also be used by custom web pages created by the user or a third-party remote control system, when properly programmed to communicate with the correct protocol. Three levels of password protection are provided: "guest" (monitor only), "operator" (monitor and commands), and "expert" (access configuration settings). As of this printing, the web remote has been tested to be compatible with the following popular browsers: Internet Explorer, Firefox, Opera, Safari, Chrome.

In addition to webpage-based control, the web remote also responds to SNMP v1 GET and SET commands. It can be set to send a generic trap and/or e-mail notification when a user-adjusted low power alarm threshold is passed.

The physical implementation of the web remote is a 178mm x 140mm PC board that mounts inside the transmitter chassis and communicates with the transmitter control system via a 25-pin ribbon cable. It receives its power from the transmitter LVPS via a 2.1mm coaxial plug and consumes approximately 150mA at 4V to 5V DC.

Figure b-1 identifies the major components of the ZXA Web Remote.

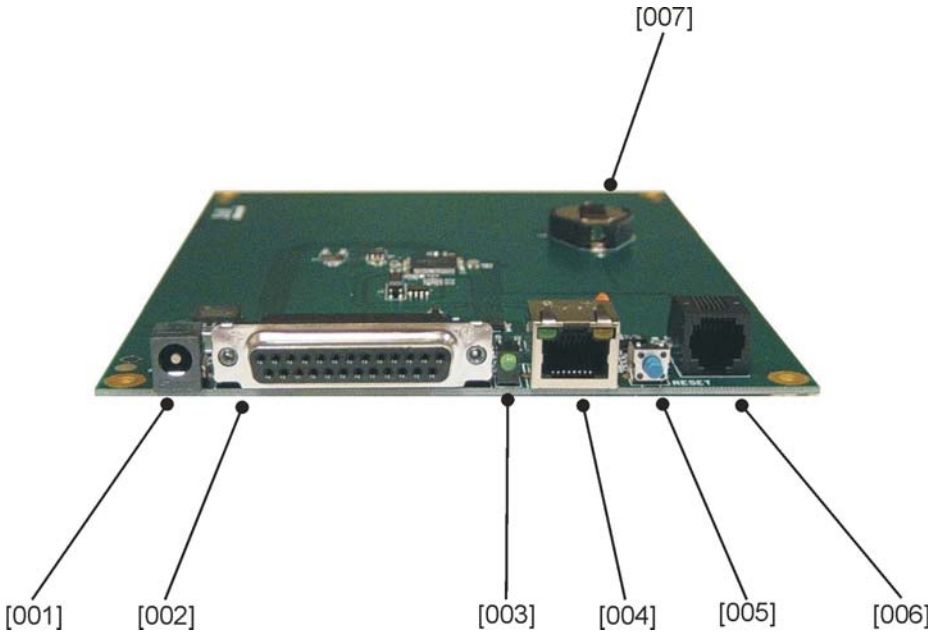


Figure b-1 Physical appearance of ZXA Web Remote Board.

[001] +5VDC power socket

[002] DB25 logic connection from controller

[003] Processor activity LED.

[004] RJ45 Ethernet port with activity and link LEDs.

Link (yellow, right) = valid cable plugged in

Activity (green, left) = unit is communicating

[005] Reset button

[006] RJ11 programming port (factory use)

[007] 3V lithium coin-cell battery for on-board clock (660-0068-000).

WARNING: Disconnect primary power prior to servicing.

b.2 Installation

b.2.1 Internet Security

The ZXA Web Remote is designed for use in a LAN environment. It has a moderate level of password protection but does not employ packet encryption. Accordingly, it should not be hooked directly to the Internet without additional precautions being taken.

A typical application of the web remote is at a remote transmitter site, but as part of a 'virtual LAN' (VPN) with connection via special routers employing encryption chosen by the LAN owner/operator. The web remote remains connected to the router with a fixed IP address and fixed port forwarding. The web remote uses these ports.

- HTTP: 80
- SNMP: 161
- SNMP Trap: 162
- SMTP: 25

The port selections given above are fixed. If two or more web remotes are to be used behind a single firewall, it will be necessary to use a router with port address translation and assign each web remote its own HTTP port (e.g. 8080. 8081, 8082, etc.)

With this type of installation, the router owns the external IP address and a domain name, if desired. The web remote port is simply appended to the router IP address with a colon.

e.g.

- http://myharristransmitter.com:8081
- http://69.234.123.78:8081

NOTE:
The port number may be omitted if it is the default value of 80.

The internal e-mail (SMTP) notification routine does not provide for username/ password authentication to access an SMTP server. If no SMTP server is available, small PC-based SMTP servers are available for approximately US $50. PostCast Server by Gate Comm Software would be a good example. When necessary, the e-

mail notification generated by the web remote may be forwarded by the local SMTP server and/or other intermediate servers in order to add password protection or circumvent a DNS (spam) blacklist for a particularly demanding recipient.

The SNMP implementation is per SNMP v1 with separate read and write communities. In addition the write community, a special user-defined value between 0-255 must be written during the SET operation for the desired command to be issued. This provides an additional level of security. The SNMP GET, SET, and TRAP functions can be disabled via the user configuration page.

b.2.2 Installation Procedure

The ZXA Web Remote is typically installed in the amplifier chassis by factory personnel prior to delivery. However, it is possible that the need may arise to add the web remote as an upgrade to a unit already operating in the field. In such a case, follow the installation procedure below from STEP 1. Otherwise, start at STEP 12.

STEP 1 Remove AC mains power from amplifier chassis.

STEP 2 *(ZX500/ZX1000)* Remove top cover of amplifier chassis. Remove amplifier chassis from rack as required.

(ZX2000/ZX3500) Open front door of amplifier chassis.

STEP 3 Mount ZXA Web Remote card on provided mounting standoffs using #4 hardware.

STEP 4 Locate unused web remote interface cables already present in amplifier chassis:

- 2.1mm coaxial DC cable from LVPS
- DB25 ribbon cable from controller board
- CAT5/RJ45 Ethernet cable from amplifier chassis rear panel
- 26C Secondary Control ribbon cable from amplifier chassis rear panel.

STEP 5 Connect 2.1mm coaxial power plug to provided socket at front edge of card.

STEP 6 Connect DB25 ribbon cable to provided connector at front edge of card.

STEP 7 Connect CAT5 Ethernet cable to RJ45 connector at front edge of card.

STEP 8 Remove or stow as desired 26C ribbon cable (w/ 2-row plastic connector) coming from rear panel Secondary Control connector. This functionality is not supported.

STEP 9 *(ZX500/ZX1000)* Replace top cover of amplifier chassis.

STEP 10 *(ZX2000/ZX3500)* Close amplifier chassis front door.

STEP 11 Apply AC mains power to amplifier chassis.

STEP 12 Connect CAT5 cable to Ethernet port on rear panel of amplifier chassis. If connection is 1:1 to a PC, use a crossover cable. Otherwise, use a straight cable.

STEP 13 Attempt to access configuration page via procedure in section b.5.1 Default password is "expert". Default IP address is 192.168.1.99 unless otherwise indicated.

NOTE:
To access the web remote for the first time, there are two different options:

- 1:1 connection to PC: Use a crossover type cable, and the PC should have its IP address manually set to 192.168.1.xx, where xx is 0-255, but not 99.
- Connection to router: Some router types use a default address of 192.168.1.1. (e.g. LINKSYS) In such a case, the web remote may be connected directly to the router via a straight (non-crossover) cable.

STEP 14 If web remote will not respond to IP address 192.168.1.99, perform an expert reset per procedure in section b.5.3.

STEP 15 On configuration page, set IP address to final desired address. Where indicated, access router configuration page and set port 80 forwarding to web remote IP address. Set other user parameters per information given in Table B-3.

STEP 16 Access main page via procedure in section b.3.1.

STEP 17 Verify web remote properly commands and monitors transmitter.

STEP 18 Change configuration settings as desired until satisfied with all aspects of web remote operation (passwords, SMTP, SNMP, etc).

STEP 19 Record all configuration settings on paper and store in safe place for future reference. (passwords, addresses, etc)

STEP 20 Procedure complete.

b.3 Operation

All monitoring, logging, and commands are on a single, straightforward, main web page. Use this procedure to access the main page.

b.3.1 Access main page

STEP 1 Open web browser on PC.

STEP 2 Enter IP address of web remote on address line and press RETURN. e.g. http://192.168.1.99

STEP 3 An empty page with a "PASSWORD?" prompt should be displayed.

Figure b-2 ***Main page awaiting entry of password key.***

STEP 4 Enter "guest" or "operator" password key in box at upper right. Status bar should change color and readings should instantly display upon successful input of full password. If guest key was used, all command buttons but MAIL will be blanked out. If operator key was used, all command buttons will be operational.

Figure b-3 Main page after successful entry of key.

STEP 5 Erase last letter of key from input box at upper right at any time to pause readings. Restore key to cancel pause and resume operations.

STEP 6 Press command buttons as desired to affect transmitter operation.

STEP 7 Press MAIL button to generate e-mail message pre-populated with current readings.

NOTE:
The automated e-mail feature requires that a valid e-mail client be previously installed and activated on the PC accessing the web remote. This automated e-mail facilitates the tasks of logging transmitter readings by allowing the user to simply archive the populated e-mail in an e-mail folder for future reference. It also provides an easy means to communicate transmitter readings to GatesAir Customer Service personnel.

STEP 8 Procedure complete.

Table b-1 Elements on main page

STATUS BAR	
STATUS BAR (top compartment)	Provides a space to enter password key (right), displays transmitter ID name (center), and changes color to provide at-a-glance assessment of transmitter status. [Green/Yellow/Grey/White] [Green] = transmitter is switched on with no active faults. [Yellow] = transmitter is switched on but has active faults. [Grey] = transmitter is switched off. [White] = web remote is dormant: password or data link is missing

METER READINGS	
PA FWD WATTS	Forward output power of amplifier chassis in watts. Detector is on output assembly inside amplifier chassis.
PA REV WATTS	Reverse output power of amplifier chassis in watts. Detector is on output assembly inside amplifier chassis.
PA VOLTS	Drain voltage of PA modules in volts as reported from PA backplane board(s).
PA AMPS	Total current of PA modules in final stage in amperes, (no IPA, where applicable) as measured on controller board.
STATUS	Operational status of amplifier chassis. [ON/OFF/FAULT/???] [ON] = Transmitter is switched on. [OFF] = Transmitter is switched off. [FAULT] = Transmitter is switched on but has active faults. [???] = Web remote is dormant because password is missing or serial data is stale.
MODE	Transmitting mode of amplifier chassis. [FM/FMHD/HD] [--] = transmitter is switched off. [FM] = analog FM modulation [FMHD] = combined FM+HD mode [HD] = digital HD Radio mode
REMOTE CONTROL	Status of remote control command functionality as set by REMOTE ENABLE / DISABLE switch on transmitter controller board on reverse of front door. [ON/ OFF] [ON] = Transmitter can be commanded remotely either via web remote or parallel remote control interfaces. [OFF] = Transmitter can be commanded via local front panel buttons only. **NOTE:** This will also prevent the SNMP trap and/or e-mail notification from being sent if the transmitter drops below the RF < ALARM THRESHOLD.
PA AMPS (1-6)	PA module currents in amperes, as reported from PA backplane board(s).

MAX PA TEMP	Maximum PA module temperature in degrees centigrade, as reported from PA backplane board(s).

FAULT INDICATIONS	
TX GAIN LOW (AGC)	AGC has come unlocked due to failure of a PA, exciter, or other module.
REV POWER FOLDBACK	Output power is being automatically reduced due to excessive RF reverse power (VSWR) measured at output.
PA AMPS FOLDBACK	Output power is being automatically reduced due to excessive PA module current as reported by one or more PA backplane boards.
PS AMPS FOLDBACK	Output power is being automatically reduced due to excessive PS module current as reported by one or more PS modules.
PA TEMP FOLDBACK	Output power is being automatically reduced due to excessive PA module temperature as reported by one or more PA backplane boards.
EXTERNAL MUTE	Output power is being inhibited by one of these sources: • Closure of external mute pins 1 and 2 on rear panel MUTE/ INTERLOCK interface. • Exciter Ready mute command from Flexstar exciter while changing modes. (ground at pin 6 of exciter interface cable) • An incoming AC mains voltage below approximately 190V. (ZX2000/ ZX3500)
TEMP REDUCTION	Transmitter has temporarily reduced output power to reduce thermal stresses on output combiner ballast loads.

COMMAND BUTTONS	
ON	Switches transmitter on.
OFF	Switches transmitter off.
RAISE	Raises transmitter output power.
LOWER	Lowers transmitter output power.
CLEAR	Erases all log entries.
MAIL	Generates an automated e-mail populated with current transmitter readings and last ten log entries. **NOTE:** requires a valid e-mail application installed on client PC viewing webpage.

EVENT LOG	
SERIAL NUMBER (lower compartment, upper right)	Transmitter serial number, as entered on configuration page. GatesAir Customer Service may ask you for this number if you call for assistance. This helps us locate your records.
EVENT LOG	Readout of transmitter log with entries in chronological order (most recent at top). Entries are in dd mm yy hh mm ss format. e.g. 10 NOV 09 20:10:55 equals 9 November 2010 - 8:10:55 PM A list of all log entries is found below in Table B-2.

Table b-2 List of transmitter log messages

LOG MESSAGES	
RF > OK THRESHOLD	Transmitter RF output power has risen above RF WARN and RF ALARM thresholds as set on configuration page.
RF < WARN THRESHOLD	Transmitter RF output power has fallen below RF WARN threshold as set on configuration page.
RF < ALARM THRESHOLD	Transmitter RF output power has fallen below RF ALARM threshold as set on configuration page. **NOTE:** An SNMP trap and/or e-mail notification is sent (if enabled) when this message appears.
ON COMMAND	Transmitter ON command line was actuated from either this web remote or from parallel REMOTE CONTROL interface on amplifier chassis rear panel. **NOTE:** front-panel ON button presses are not logged.
OFF COMMAND	Transmitter off line was actuated from web remote or parallel remote.
RAISE COMMAND	Transmitter raise line was actuated from web remote or parallel remote.
LOWER COMMAND	Transmitter lower line was actuated from web remote or parallel remote.
LOG ERASED	Transmitter log was cleared via a command from on-screen CLEAR button.
TX GAIN LOW (AGC NOK)	Transmitter automatic power control circuits have dropped out of a locked condition. This may be due to an internal failure or a lack of sufficient exciter drive.
REVERSE POWER FOLDBACK	Output power is being automatically reduced due to excessive RF reverse power (VSWR) measured at output.
PA AMPS FOLDBACK	Output power is being automatically reduced due to excessive PA module current as reported by one or more PA backplane boards.
PS AMPS FOLDBACK	Output power is being automatically reduced due to excessive PS module current as reported by one or more PS modules.

PA TEMPERATURE FOLDBACK	Output power is being automatically reduced due to excessive PA module temperature as reported by one or more PA backplane boards.
EXTERNAL MUTE ACTIVE	Output power is being inhibited by one of these sources: • Closure of external mute pins 1 and 2 on rear panel MUTE/ INTERLOCK interface. • Exciter Ready mute command from Flexstar exciter while changing modes. (ground at pin 6 of exciter interface cable) An incoming AC mains voltage below approximately 190V. (ZX2000/ZX3500)
TEMPERATURE REDUCTION	Transmitter has temporarily reduced output power to reduce thermal stresses on output combiner ballast loads.
REMOTE DISABLED	Amplifier chassis was placed in “local” REMOTE DISABLED mode via switch on reverse side of front door controller board.
REMOTE ENABLED	Amplifier chassis was returned to REMOTE ENABLED mode.
TX SWITCHED OFF	Transmitter was switched off.
FM MODE ON	Transmitter was switched on in FM mode. **NOTE:** When no Flexstar exciter is present, the transmitter is hard-wired permanently into FM mode via shorted pins on the exciter interface cable.
FM+HD MODE ON	Transmitter was switched on in FM+HD mode.
HD MODE ON	Transmitter was switched on in HD mode.

b.4 Theory of Operation

The ZXA Web Remote features a Microchip PIC18F97J60 microcontroller running a modified version of the Microchip V4.02 TCP stack and a custom made application to interface to the ZXA series of transmitters. An on-board real time clock with 3V coin-cell battery maintains the current time, even in the absence of AC mains power. An on-board EEPROM maintains non-volatile storage of the transmitter log and various configuration settings. An on-board RJ11 jack provides for in-circuit programming in the factory. Should a software upgrade be required in the field, the preferred method is to remove the card from the amplifier chassis and plug in a replacement board sent in advance from the GatesAir factory. A small green LED at the front edge of the card blinks once a second when the web remote is operating correctly.

The web remote serves out a main HTML status page that receives updated readings via an AJAX data stream on port 80. This data stream may be also used by customized external pages created by the user or by third-party remote control systems, if suitably programmed. This is addressed in greater detail in files provided on the accompanying USB flash drive (7320514003). The web remote also responds to SNMPv1 GETs and SETs on port 161 and can send a generic trap on port 162. A simple e-mail notification with a text message link pointing back to the web remote IP address can be sent on port 25.

The web remote has only a moderate level of security and is designed to be used in a secure LAN setting or paired with a router to provide a firewall / encryption / security if use over the Internet is envisioned. Because use with a router is envisioned, a reset button at the front edge of the card can forcibly reset the web remote to an IP address of 192.168.1.99 - an address compatible with many popular routers.

b.5 Maintenance

The ZXA Web Remote has no user hardware adjustments and requires no periodic cleaning or replacement of consumable materials.

Several key maintenance procedures are provided below:

- Access configuration page
- Perform simple reset
- Perform expert reset
- Change clock battery
- Calibrate clock speed
- Use Microchip Ethernet Discoverer utility

b.5.1 Access Configuration Page

Purpose: A single configuration page contains all user-adjustable settings. It may be accessed using the "expert" level password.

Special Tools: PC with web browser.

STEP 1 Open web browser on PC.

STEP 2 Enter IP address of web remote on address line with suffix "/config.htm". For example: http://192.168.1.99/config.htm.

STEP 3 Configuration page with password pop-up prompt should display.

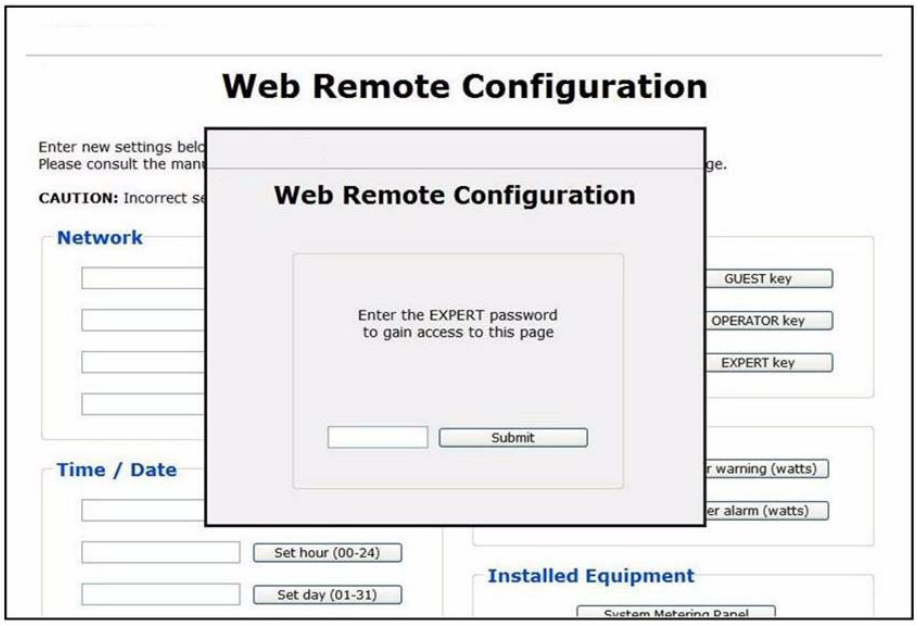


Figure b-4 Configuration page with password prompt.

STEP 4 Enter “expert” level password key in box at center and press SUBMIT button. The default expert level password is "expert".

STEP 5 Pop-up box should disappear, revealing all configuration settings.

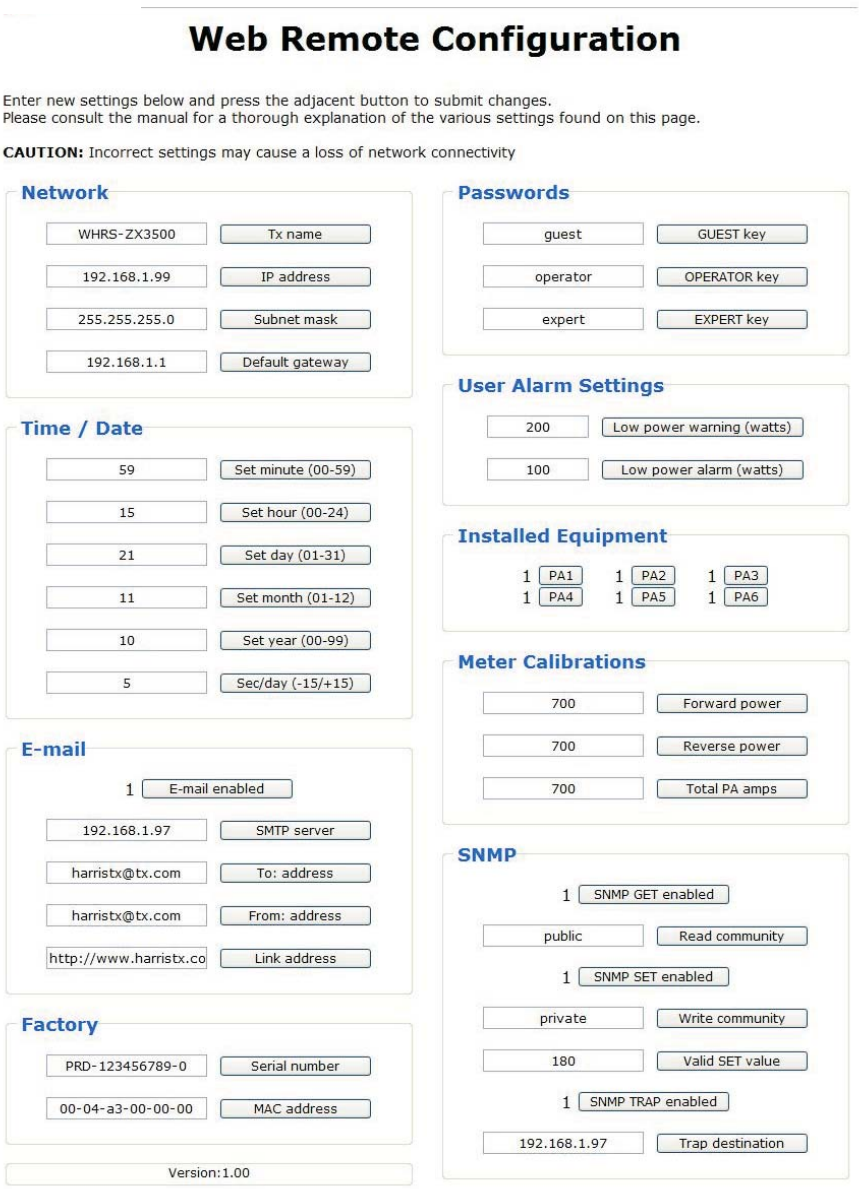


Figure b-5 Configuration page

STEP 6 Change settings, as desired, and press labeled button to right of modified field to submit change for permanent storage in memory.

NOTE:
The corresponding button should be pressed after each field is changed. Otherwise, the changes will not be saved.

NOTE:
Incorrect settings could cause a loss of board connectivity. Carefully read Table b-3 to understand the implications of changing each parameter.

STEP 7 Toggle "E-MAIL Enabled" button off-on to send a test e-mail message, as desired.

STEP 8 Toggle "SNMP Trap Enabled" button off-on to send a test trap, as desired.

STEP 9 Procedure complete.

Table b-3 List of settings on configuration page.

CONFIGURATION SETTINGS	
TX NAME	The identification name for the transmitter. Since this name also doubles as the NETBIOS name for the web remote, it is limited to 15 characters and cannot contain spaces.
IP ADDRESS	The IP address of the web remote. A change of this setting could cause a loss of board connectivity.
SUBNET MASK	The sub net mask of the web remote. A change of this setting could cause a loss of board connectivity.
DEFAULT GATEWAY	The IP address of the PC/router/device through which the web remote sees the rest of the LAN/Internet. A change of this setting could cause a loss of board connectivity.
SET MINUTE, HOUR, DAY, MONTH, YEAR	A means to set the current time for the on-board clock used to time stamp log entries. **NOTE:** the MINUTE button will also reset the seconds to 00 when pressed.
SEC/DAY	The number of seconds added to /subtracted from the clock each day. A means to fine trim the clock speed. See section b.5.5 for an adjustment procedure.
EMAIL ENABLED	Activates the e-mail notification in case of an RF < ALARM THRESHOLD condition. Toggling this setting from 0(off) to 1(on) will cause a test email to be sent.
SMTP SERVER	The IP address of the SMTP server responsible for forwarding the e-mail notification.
TO: ADDRESS	The target e-mail address for the e-mail notification.
FROM: ADDRESS	A from: address to populate the e-mail notification address header. This can be a fictitious address. It is required because some e-mail servers will reject a message with this field left blank. The from: address can be used to identify the sending transmitter. e.g. GatesAir_ZX@Mt_Alto_site.com
LINK ADDRESS	A link to the web remote main page appearing in the body on the e-mail notification. If the full address is written (starting with http://...) the link should appear in the received e-mail as fully “clickable”, thereby allowing the recipient to easily navigate to the main page, especially in small/mobile devices.
SERIAL NUMBER	The transmitter serial number. This is typically entered in the factory and does not require updating in the field. GatesAir Customer Service may ask you for this number if you call for assistance. This helps us locate your records. If the web remote is moved to a new transmitter, be sure to update this field.

MAC ADDRESS	The MAC address of the web remote. This is typically entered in the factory and does not require updating in the field. A change of this setting could cause a loss of board connectivity. **CAUTION:** If you need to ask why a MAC address might need to be modified, you should not modify it!
GUEST KEY	The basic level password. This allows access to main web page, but no transmitter commands. The default guest level password is "guest".
OPERATOR KEY	The main level password. This allows full access to main web page, including the transmitter command buttons. The default operator level password is "operator".
EXPERT KEY	The administrator level password. This allows access to the configuration web page. The default expert level password is "expert".
LOW POWER WARNING	The threshold in watts for the RF < WARN THRESHOLD fault.
LOW POWER ALARM	The threshold in watts for the RF < ALARM THRESHOLD fault. This fault condition will cause an SNMP trap and/or e-mail notification to be sent. (when enabled)
INSTALLED EQUIPMENT	Allows the web remote to be customized to different transmitter models and systems by zeroing out those modules not installed.
FORWARD CAL FACTOR	Converts the nominal 4V full-scale forward power reading for a given model transmitter into the absolute power level in watts. Scaled in an arbitrary 0…1000 unit scale. The approximate cal factors per transmitter model are: • ZX500 = 100 • ZX1000 = 200 • ZX2000 = 400 • ZX3500 = 700
REVERSE CAL FACTOR	Converts the nominal 4V full-scale reverse power reading for a given model transmitter into the absolute power level in watts. Scaled in an arbitrary 0…1000 unit scale. The approximate cal factors per transmitter model are: • ZX500 = 100 • ZX1000 = 200 • ZX2000 = 400 • ZX3500 = 700
AMPS CAL FACTOR	Converts the nominal 4V full-scale PA current reading for a given model transmitter into the absolute current level in amperes. Scaled in an arbitrary 0…1000 unit scale. The approximate cal factors per transmitter model are: • ZX500 = 100 • ZX1000 = 200 • ZX2000 = 400 • ZX3500 = 600

SNMP GET ENABLED	Enables the transmitter to be queried by SNMP GET commands.
READ COMMUNITY	The SNMP READ community for GET commands.
SNMP SET ENABLED	Enables the transmitter to be commanded by SNMP SET commands.
WRITE COMMUNITY	The SNMP WRITE community for SET commands.
VALID SET VALUE	As an added security measure, the value “written” by the SNMP SET must match this value. Otherwise, no command will be issued.
SNMP TRAP ENABLED	Enables alarm notification of an RF < ALARM THRESHOLD fault via a generic SNMP trap. Toggling this setting from 0(off) to 1(on) will cause a test trap to be sent.
SNMP TRAP ADDRESS	The destination IP address of the trap notification.
VERSION	The software version of the web remote.

b.5.2 Perform Simple Reset

Purpose: Issues simple reset of microprocessor. Essentially the same as cycling power to card.

Special Tools: Small plastic screwdriver.

STEP 1 Locate RESET button at front edge of card.

STEP 2 Press button continually with small plastic adjustment tool or similar item for ten seconds. Maintain button depressed continually for full ten seconds.

STEP 3 Web remote processor resets and will resume operation within seconds of button release.

STEP 4 Procedure complete.

b.5.3 Perform Expert Reset

Purpose: To be used if the IP address and/or expert password has been forgotten or connectivity has otherwise been lost.

The expert reset resets restores these key settings to factory default values:

- IP address = 192.168.1.99
- Subnet mask = 255.255.255.0

- Default gateway = 192.168.1.1
- Expert password = "expert"

Additionally, the expert reset primes the on-board EEPROM to be overwritten. If DC power to the card is cycled before any values are modified on the configuration page, all parameters are overwritten with their factory values. To prevent this from happening, access the configuration page immediately after performing an expert reset, and toggle any setting on the page to force a cancellation of this feature.

Special tools: Small plastic screwdriver.

STEP 1 Locate RESET button at front edge of card.

STEP 2 Press button momentarily with small plastic adjustment tool or similar item three times within a five second window.

STEP 3 Web remote memory resets IP address, subnet mask, default gateway, and expert password to values listed above.

STEP 4 Connect to web remote configuration page with PC to http://192.168.1.99/config.htm and change IP address and/or expert password to desired values.

STEP 5 Procedure complete.

b.5.4 Change Clock Battery

Purpose: The on-board 3V Lithium battery has an expected lifetime of over 10 years. If it becomes exhausted, the internal clock will reset to 1 Jan 00 after an AC mains failure.

Special tools: Small screwdriver to pry out battery.

This procedure is ideally performed with the transmitter off air and all mains power removed. Wait until a scheduled maintenance period to perform this procedure. Consult Figure b-2 for a photo of battery location / appearance.

STEP 1 Remove AC mains power to transmitter.

STEP 2 *(ZX500/ZX1000)* Remove amplifier chassis top cover.

(ZX2000/ZX3500) Open amplifier chassis front door.

STEP 3 Locate 3V battery on web remote PC board.

STEP 4 Pry battery loose with small screwdriver.

STEP 5 Insert new battery.

STEP 6 *(ZX500/ZX1000)* Replace amplifier chassis top cover.

(ZX2000/ZX3500) Close amplifier chassis front door.

STEP 7 Reapply AC mains power to amplifier chassis.

STEP 8 Procedure complete.

b.5.5 Calibrate Clock Speed

Purpose: If no special precautions are taken, the on-board clock in the web remote can slip several seconds a day. To prevent this, the user can fine trim the clock speed to add or subtract several seconds a day. This adjustment occurs at midnight each night.

Special tools: High quality clock for comparison purposes.

STEP 1 While accessing main page, issue on command via ON button to create a log entry.

STEP 2 Note log entry time stamp as compared to quality external clock.

STEP 3 Access configuration page and recalibrate on-board time to correct value, as desired.

STEP 4 Repeat steps 1 and 2 several hours or several days later.

STEP 5 Note if on-board clock has lost or gained seconds relative to quality external clock.

STEP 6 Extrapolate rate of gain/loss to 24 hour time period. e.g. 1 sec lost in 12-hour period = +2 second adjustment required per 24-hour period.

STEP 7 Increment/decrement SEC/DAY time adjustment field on configuration page.

STEP 8 Recalibrate on-board time to correct value as desired.

STEP 9 Procedure complete.

b.5.6 Use Microchip Discoverer Utility

Purpose: The USB flash drive supplied with the web remote contains a small application called Microchip Ethernet Discoverer. This program can be useful for locating a web remote with an unknown IP address, but is limited to detecting only web remotes connected to the same subnet. (1:1 PC connection or sharing same router)

Special tools: Microchip Ethernet Discoverer.exe

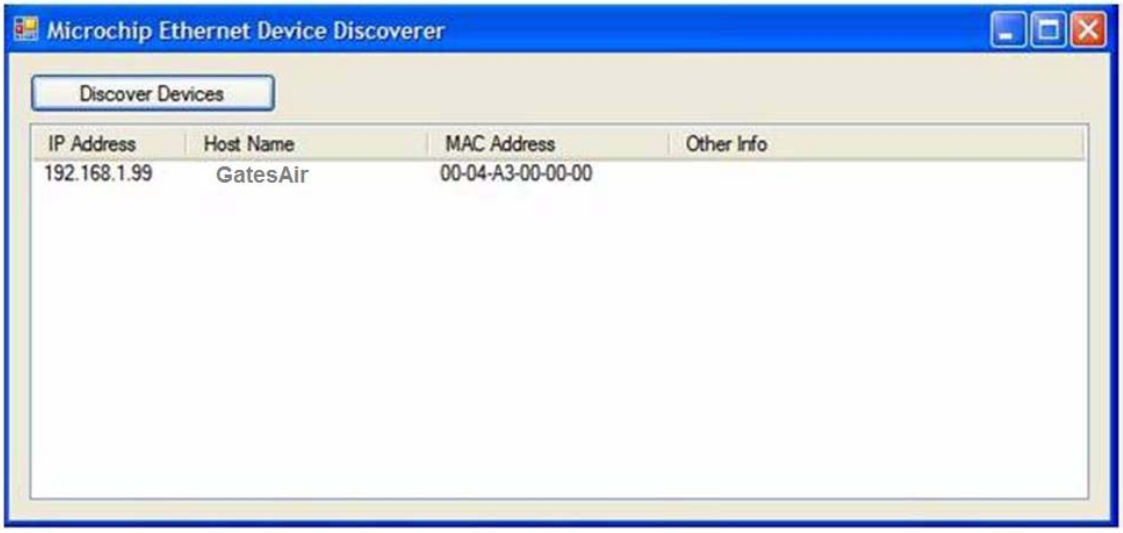


Figure b-6 Web discover results window.

STEP 1 Launch discoverer application on PC installed on same LAN as web remote.

STEP 2 Press Discover Devices button.

STEP 3 Consult results window to determine current IP address of web remote.

STEP 4 Attempt to contact web remote on current IP address or perform an expert reset to change IP address to more convenient value.

STEP 5 Procedure complete.

b.6 Troubleshooting

Table b-4 Web Remote Troubleshooting.

Symptom	Cause and Solution
Cannot connect to web remote. Web browser displays “cannot display page” error message.	Possible incorrect IP address. Enter correct IP address and press F5 to refresh browser page. If IP address cannot be located, perform expert reset of web remote card to reset IP address and password. See section B.5.3 for more information. Possible connectivity problem. Check yellow “link” and green “activity” LEDs on RJ45 connector at front edge of card to verify a valid connection has been established.If connected to router as gateway, check router for activity. Access router configuration page and verify all settings are correct.
Main page remains dark, "-----" is displayed where transmitter name should be, and all readings display '999'.	Incorrect execution of Javascripts on web page or Javascipts have been disabled in web browser settings. Check browser settings and "enable scripts". NOTE: if the web page is a locally stored page (hard drive) as described in the accompanying USB flash drive, this problem can also be caused by no connectivity due to an incorrect web remote IP address or the web remote server on the far end being off-line.
Incorrect time recorded in new log entries.	Possible incorrect setting of on-board clock. Access configuration page and update time information. If on-board clock consistent loses or gains seconds over course of days/weeks, update clock speed trim value via procedure in section b.5.5. Possible extended AC mains failure. It has been noted that the clock accuracy will suffer slightly during extended periods on backup battery power.
Time format is stuck on 24 hour ‘military’ format. e.g. 5:00pm = 17:00	This is normal. Time and date format for log entries is not adjustable.
Cannot send SNMP test trap to NMS manager.	Possible firewall interference. Verify port 162 is not being blocked by an intervening firewall. Possible incorrect trap address. Verify correct IP address of trap destination.
Cannot send test e-mail to target PC.	Possible firewall interference. Verify port 25 is not being blocked by an intervening firewall. Possible DNS (spam) blacklist. Verify IP address of web remote is not being blocked by recipient. Possible authentication required. Verify SMTP server and/or recipient does not require authentication. (username, password). If so, install local SMTP server on LAN to serve as intermediary to pass message on to more demanding server with required credentials.

All Log entries all have 'undefined' and '63' in their fields.	On-board clock has gone into battery backup mode due to sagging DC voltage from chassis. This occurs if main DC voltage to card is less than 125% of battery voltage. Check DC voltage coming into card with voltmeter. Voltage could theoretically sag due to short circuit somewhere on card and current limiting action of PTC resettable fuses. Locate and rectify short circuit condition.
'Service Unavailable' (and nothing else, plain white page) error message returned from web remote in browser window.	Cause unknown. Attempt simple and/or expert reset procedure in sections b.5.2 or b.5.3. Contact GatesAir Service for possible updated troubleshooting strategies.

b.7 USB Flash Drive

A USB flash drive (7320514003) is supplied with the ZXA Web Remote. It contains the following files:

1. Microchip Ethernet Discoverer.exe - a utility that may be useful to determine the IP address of a lost web remote.

2. GATESAIR-TX-ZXA-MIB.mib - a text copy of the SNMP MIB for the web remote in ASN.1 format.

3. International.htm - a special version of the web remote with dual language support. Also included in the folder are dictionary files for various languages such as Spanish and French. This allows the user to choose which languages to display. Instructions on how to set up the International version are included in an accompanying readme file.

4. Large.htm - a special version if the web remote suitable for creating a full screen power meter display. An accompanying readme file provides additional information.

5. Starter.htm - a simplified web remote page that serves as a starting point for those users that wish to create their own customized web remote display. An accompanying readme file provides instructions on how to get started.

6. Protocol.txt - a text file with details on the communication protocol of the web remote for those users who wish to interface it to an external device.

It is anticipated that the contents of the USB flash drive will evolve over time and may include additional files not listed here. The user is encouraged to fully explore the contents of the flash drive to learn about the latest ways to extend the functionality of their GatesAir ZXA Web Remote.

Support Contacts: http://www.gatesair.com/services.aspx
Customer Portal: http://support.gatesair.com

GatesAir has office locations around the world. For locations and contact information see:
http://www.gatesair.com/company/contact-us.aspx