INSTALLATION AND OPERATING MANUAL

P25 Series UHF CONTINUOUS DUTY POWER AMPLIFIER

Crescend Technologies

140 E. State Parkway

Schaumburg, IL 60173

Tel: 847-908-5400

Fax: 847-908-5408

sales@crescendtech.com

www.crescendtech.com

040003A010 Rev A

1 GENERAL DESCRIPTION

1.1 INTRODUCTION

This manual contains installation and operating information for the Crescend High Power 406-420 MHz Power Amplifier. The manual is organized into multiple sections as follows:

1.2 PRODUCT DESCRIPTION

The Crescend Technologies High Power UHF RF power amplifier is designed for paging and other applications that use a single carrier constant envelope waveform. The amplifier is designed to be powered from either an external +48 VDC source or an optional internal AC power supply. Model

GA amplifiers cover the 406-420 MHz band without retuning. Model HA amplifiers cover the 450-470MHz band without retuning. Amplifier specifications are shown in Table 1-1. There are seven input ranges available as shown in Table 1-2. Closed loop power control is used to maintain a constant output power under varying voltage, signal input level, frequency and output load conditions. Several design features work to protect the amplifier under adverse conditions.

The amplifier is designed to fit into 5.25 inches (3RU) of vertical 19-inch rack space. The front panel includes LED indicators for monitoring status and alarm conditions. This information is also accessible via a monitor connector on the rear of the amplifier. The fan assembly draws ambient air in from the front and blows the air across the heat sink fins out the back of the amplifier.

NOTE: The manufacturer's rated output power of this equipment (see Table 1-1) is specified for single carrier operation using constant-envelope modulation. This equipment is NOT designed for multiple-carrier operation, nor is it intended to be used with non-constant envelope modulation waveforms.

Table 1-1 Amplifier Specifications

Specification	Value
Instantaneous Bandwidth	406-420 MHz (GA models), 450-470MHz (HA models)
Output Power Range	25 W - 250 W
Input Impedance	50 Ohms
Output Impedance	50 Ohms

Table 1-2 Amplifier Input Power Ranges

Input Power Designator Code	Input Power Range	Nominal Gain (250W Output)
R2GA, R2HA	0.2 - 0.5 W	28.5 dB
R5GA, R5HA	0.5 - 1 W	25.0 dB
1GA. 1HA	1 - 2 W	22.0 dB
2GA, 2HA	2- 5 W	18.5 dB
5GA, 5HA	5 - 10 W	15.0 dB
10GA, 10HA	10 - 20 W	12.0 dB
20GA, 20HA	30 - 40 W	8.5 dB

2 INSTALLATION

2.1 INSTALLATION INSTRUCTIONS

The amplifier is designed for installation in a rack that permits access to the rear of the unit for connection of RF and monitor/control cables, and DC power cables or AC line cord if the unit incorporates the internal AC power supply option. The amplifier must have a minimum of 3 inches of open space in front and to the rear of the chassis to allow adequate air flow and ventilation. If installed in a closed or multi-unit rack, the operating ambient temperature within the rack environment may be greater than the room ambient. The equipment installation must be compatible with the +60°C maximum temperature rating of the amplifier. Caution should be exercised when rack mounting the amplifier to avoid creation of a hazardous condition due to uneven mechanical loading. Avoid "top-heavy" or cantilever installations which may cause the equipment rack to become unbalanced. Consideration should be given to the connection of the equipment to the AC or DC supply circuit and the effect that overloading of the circuits might have on overcurrent protection and supply wiring. Consideration of the appropriate current rating (10A for 110-125VAC operation, 20A for +48VDC operation) should be used in addressing this concern. Caution should be exercised with supply connections which are not direct connections to the branch circuit (e.g. use of power outlet strips). Reliable grounding of rack-mounted equipment should always be maintained.

To install the amplifier, proceed as follows:

1. Mount the amplifier in equipment rack and secure in place.
2. Connect a properly sized 50 Ohm cable and load (antenna) to the RF OUT connector on rear of amplifier.
3. Connect the transceiver/exciter output to RF IN connector on rear of amplifier.
4. If monitoring of PA is desired, connect alarm cable to MONITOR connector on rear of amplifier module. See section 3 for more details about monitor pins.
5. Connect a ground cable to the rear panel stud of the amplifier. A UL Listed ground bonding conductor assembly is recommended, such as Harger p/n UBC61411/4KIT5, UBC61811/4KIT5, or UBC63211/4KIT5. These ground cable interfaces consist of Harger p/n 6-6R1 ring tongue lugs crimped to various lengths of Harger p/n 6XLPE133G/YS #6 AWG ground cable.
6. If the unit is the 48 VDC version, measure the DC output voltage of the external power supply. DC voltage should be +48 +/- 0.5VDC. Turn off the DC voltage.

NOTE:

- Make sure power supply DC is well filtered and well behaved with minimal voltage overshoot.
- Keep DC cables as short as possible (recommend no greater than 2 feet) to minimize inductive voltage transients.
- Size DC cables properly to handle the load current to minimize voltage drop during times of transmission when current draw is highest.

WARNING:

- Turn off external primary DC power before connecting DC power cables.
- Connect positive primary power wire (+48VDC) to terminal marked +48VDC and

negative primary power wire to GND terminal next to it on rear of amplifier.

7. Check your work before applying DC voltage to the system. Make certain all connections are tight and the DC wires are going to the correct terminals.
8. If the unit has the optional internal AC power supply: Connect an unpowered AC cord to AC plug on rear of amplifier.
9. Refer to Section 2.2 for initial start-up procedures.

2.2 INITIAL STARTUP

To perform the initial start-up, proceed as follows:

1. Check to ensure that all input and output cables are properly connected and tightened.

NOTE: Use high quality coaxial cable and connectors. Properly install all connectors for reliability.

CAUTION: Before applying power, make sure that the input and output of the amplifier are properly terminated in 50 ohms. Do not operate the amplifier without a load attached. Refer to Table 1-2 for input power requirements. Excessive input power will damage the amplifier.

NOTE: The output coaxial cable between the amplifier and antenna must be 50 Ohm cable and adequately sized to handle the rated power level with additional stresses from high VSWR taken into account. The shield of the 50 Ohm coaxial cable must be connected to ground at the entrance of the building in which the equipment is installed. This should be done in accordance with applicable national electrical installation codes. In the U.S., this is required by Section 820.93 of the National Electrical Code, ANSI/NFPA 70.

2. Apply 48 VDC from your power supply or AC mains power (depending on whether amplifier has the optional internal AC power supply) to the amplifier with the supplied line cord. After a short delay, the fans will power on. Check that all fans are running.
3. Visually check the indicators on the front of the amplifier and verify the following:
    a. The PWR ON indicator (green) is on.
    b. All other LED indicators (red and yellow) are off.
4. Set the external exciter power level so that it is within the specified input power range and apply the RF signal to the amplifier input port. The amplifier will deliver nominally 250W at the output connector. The green exciter drive status LED will illuminate when the RF drive is detected. This LED is meant to give the user a general indication that the exciter is active and is delivering output power when troubleshooting an alarm condition. However, it does not indicate that the minimum input power level has necessarily been reached.
5. Remove the RF input signal. The output power will drop to zero. Only the Power On indicator will be illuminated. The amplifier is ready to use.

3 OPERATING INFORMATION

3.1 INTRODUCTION

This section contains general amplifier operating information

3.2 STATUS INDICATORS AND MONITOR CONNECTOR

The amplifier status indicators and alarms are described in Table 3-1 and Table 3-2.

Table 3-1 High Power UHF Amplifier Status LED Indicators

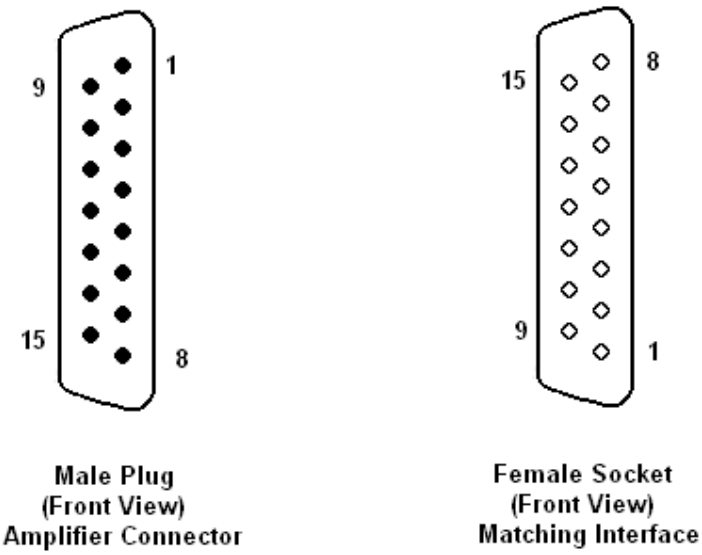
STATUS LED	FUNCTION
PWR ON	Green LED. Illumination indicates unit is powered on
EXCITER DRIVE	Green LED. Illumination indicates RF input power has been applied
CHECK FAN	Red LED. Illumination indicates low fan speed or a locked rotor
HIGH TEMP	Red LED. Activates when the amplifier exceeds a safe operating temperature. Unit shuts down until safe operating temperature returns
HIGH VSWR	Red LED. Activates when load VSWR > 3:1. Amplifier shuts down. Alarm active until RF input removed and reapplied
HIGH INPUT	Yellow LED. Illumination indicates RF input power exceeds safe level (~125%) of rated input power. Alarm active until RF input removed
LOW OUTPUT	Yellow LED. Can activate if power drops due to low gain or minimum specified input level is not applied

Table 3-2 Monitor Connector Description

PIN NO	NAME	DESCRIPTION
1	**POWER CTL**	Output Power Level Control. POWER CTL signal is pulled up internally to 10V and pulled down by POWER SET potentiometer located on front panel. To ensure the full adjustment range of output power from 250W to 25W with POWER CTL signal, make sure POWER SET is turned fully clock wise (refer to section 3.5 for details). Both POWER CTL analog input and POWER SET potentiometer can be disabled by digital communication interface if either “PS=***\r” or “PM=***\r” command is sent to the amplifier (refer to Table 3-7 in section 0 for details).
2	**REV PWR**	Reverse Power Voltage
3	**GND**	Ground Return
4	**HI TEMP**	Alarm - High Temperature Amplifier Shutdown
5	**RXD**	RS232 Interface Received Data
6	**GND**	Ground Return

PIN NO	NAME	DESCRIPTION
7	HI INPUT	Alarm - RF Input Power Above Maximum Rating
8	CHECK FAN	Alarm - Low fan speed or locked rotor detected
9	PA FAULT	Alarm - Low Output Power, RF Input Power Above Maximum Rating, High Temperature Amplifier Shutdown, High VSWR or No Power Supply Voltage
10	FWD PWR	Forward Power Voltage
11	HI VSWR	Alarm - High VSWR
12	RF DRIVE	Minimum RF Input Drive Indicator
13	TXD	RS232 Interface Transmitted Data
14	GND	NOT FOR EXTERNAL CONNECTION - DO NOT USE
15	LOW PWR	Alarm - Low Output Power

Figure 3-1 DSUB-15 Connector Pin Numbers



Male Plug
(Front View)
Amplifier Connector

Female Socket
(Front View)
Matching Interface

3.3 DETAILED STATUS INDICATOR AND MONITOR CONNECTOR INFORMATION

The detailed amplifier status indicators, alarm truth table and monitor connector information is described in detail in Table 3-3 through Table 3-5.

Table 3-3 Amplifier Status Indicators

LED NAME	FUNCTION	INDICATION	CONDITION	RECOVERY
PWR ON	DC Power Up Indicator	Green Light	Power is turned on	Power source is active
		Off	Power is turned off	
EXCITER DRIVE	RF Input Power Indicator	Green Light	RF input power is at or above threshold. If no other alarms present, the amplifier is placed into transmit mode	Set RF input power above threshold
		Off	RF power at input is below the activation threshold. Amplifier is in standby mode	
CHECK FAN	Alarm - Fan Failure or Service Required	Red Light	Alarm - Low fan speed or locked rotor detected. May require cleaning or replacement	To reset the alarm, it is necessary to perform fan maintenance procedure
		Off	Normal operation	
HI TEMP	Alarm - High Temperature Amplifier Shutdown	Red Light	Alarm – Temperature has exceeded maximum operation threshold. The amplifier output is shutdown	To reset the alarm, it is necessary for the amplifier to cool down to below the maximum safe operation threshold
		Off	Normal operation	
HI VSWR	Alarm - High VSWR at Amplifier Output	Red Light	Alarm > 3:1VSWR at the amplifier output was detected. The amplifier output is shutdown	To reset the alarm, it is necessary to remove the high VSWR from the amplifier output and reapply RF input power (The alarm will remain illuminated after RF input power is removed)
		Off	Normal operation	
HI INPUT	Alarm - RF Input Power Above Maximum Rating	Yellow Light	Alarm - RF power at input exceeds maximum threshold level	To reset the alarm, it is necessary to reduce RF drive signal level and reapply RF input power (The alarm will remain illuminated after RF input power is removed)
		Off	Normal operation	
LOW OUTPUT	Alarm - Low Output Power	Yellow Light	Alarm – the analog control loop is open. Amplifier is no longer able to adjust the output power	Alarm is turned off only when the analog control loop is closed. Check if input signal level is within normal limits. If RF input is within range, and all other conditions are normal, this indicates a potential PA failure
		Off	Normal operation	

Table 3-4 Alarm Truth Table

Alarm	LED Color	Amplifier Shutdown	PA Fault	Recovery
CHECK FAN	Red	No	High	Clean fans, replace if defective
HI TEMP	Red	Yes	High	Reduce PA temperature below 65°C
HI VSWR	Red	Yes	High	Input Re-Key
HI INPUT	Yellow	No	High	Input Re-Key
LOW OUTPUT	Yellow	No	High	Set input drive above minimum threshold

Table 3-5 Monitor Connector Description

PIN NO	NAME	SIGNAL TYPE	DESCRIPTION	SIGNAL STATES	CONDITION	APPROPRIATE LOAD
1.	**POWER CTL**	Analog Input	Output Power Level Control (refer to section 0 and 3.5 for limitations)	Open	Maximum output power	Signal is pulled up internally to 10V. Pull down signal with appropriate circuitry.
				0-10V	Adjusts output power setting	
2.	**REV PWR**	Analog Output	Reverse Power Voltage	0-10V	Uncalibrated analog voltage that is proportional to the reflected power detected at the amplifier output	> 100 kOhm, < 100pF
3.	**GND**				Ground return	
4.	**HI TEMP**	Digital Output	Alarm - High Temperature Amplifier Shutdown	<0.8V	Alarm – Temperature has exceeded maximum operation threshold. The amplifier output is shutdown. To reset the alarm, it is necessary for the amplifier to cool to a temperature below the maximum safe operation threshold	> 100 kOhm, < 100pF
				>3.3V	Normal operation	
5.	**RXD**	Digital Input	Received data	RS232 voltages	RS232 communication interface	
6.	**GND**				Ground return	

PIN NO	NAME	SIGNAL TYPE	DESCRIPTION	SIGNAL STATES	CONDITION	APPROPRIATE LOAD
7	**HI INPUT**	Dig	Alarm – High Input Power Detected at Amplifier Input	<0.8V	Alarm – RF input power exceeds maximum power threshold level. To reset the alarm, it is necessary to reduce RF drive signal level and reapply RF input power (The alarm will remain illuminated after RF input power is removed)	
				>3.3V	Normal Operation	
8.	**CHECK FAN**	Dig	Digital Output	<0.8V	Alarm – Low fan speed or locked rotor detected. May require fan maintenance or replacement if defective.	> 100 kOhm, < 100pF
				>3.3V	Normal operation	
9.	**PA FAULT**	Digital Output	Open Collector (External Pull-Up Resistor Required)	Open	Fault - CHECK FAN, HI TEMP, HI VSWR, HI INPUT, LOW OUPUT, No Supply Power	
10.	**FWD PWR**	Analog Output	Forward Power Voltage	0-10V	Uncalibrated analog voltage that is proportional to the forward power detected at the amplifier output	> 100 kOhm, < 100pF
11.	**HI VSWR**	Digital Output	Alarm - High VSWR Detected at Amplifier Output	<0.8V	Alarm – > 3:1 VSWR at the amplifier output was detected. Amplifier output is shutdown. To reset the alarm, it is necessary to remove the high VSWR from the amplifier output and reapply RF input power (the alarm LED will remain illuminated after RF input power is removed)	> 100 kOhm, < 100pF
				>3.3V	Normal operation	
12.	**EXCITER DRIVE**	Digital Output	Minimum RF Input Power Indicator	<0.8V	Minimum RF power on input is present. With no alarms amplifier is set into transmit mode	> 100 kOhm, < 100pF
				>3.3V	RF power at input is below an activation threshold. Amplifier is in standby mode	
13.	**TXD**	Digital Output	Transmitted data	RS232 voltages	RS232 communication interface	
14.	**GND**				Ground return (Caution: Not for external connection, do not use)	14.

PIN NO	NAME	SIGNAL TYPE	DESCRIPTION	SIGNAL STATES	CONDITION	APPROPRIATE LOAD
15.	**LOW PWR**	Digital Output	Alarm - Low Output Power	<0.8V	Alarm – the analog control loop is open and unable to adjust the output power level. Alarm is turned off only when the analog control loop is closed. Check if drive level is within normal limits. If RF input is within range, and all other conditions are normal, this may indicate a potential PA failure.	> 100 kOhm, < 100pF
				>3.3V	Normal operation	

3.4 DIGITAL COMMUNICATION INTERFACE (RS232)

The amplifier is supplied with a RS232 digital communication interface that provides status and alarm information. The communications interface settings are described in detail in Table 3-6.

Table 3-6 Digital Communication Interface Settings

Voltage Level	RS232 voltage levels
Transmission Bit Rates	38.4 Kbps
No of Data Bits	8
Stop Bits	1
Parity	No parity
Flow Control	No flow control

The digital communication interface uses readable ASCII characters. Characters are sent by the amplifier only in response to commands. Commands and responses are terminated by a carriage return ("\r").

If characters are sent to the amplifier before the carriage return ("\r") and do not match a legal command, the amplifier ignores the characters and sends no response. The amplifier will respond to lower case version of commands (e.g. "sn?\r" or "Rt?\r").

Digital communication commands are described in detail in Table 3-7

Table 3-7 Digital Communication Interface Commands

COMMAND	RETURNED ANSWER	NOTES
"CN?\r"	"CN=*********\r" Example: "CN=151238614\r"	Return Crescend serial number.
"SV?\r"	"SV=****\r" Example: "SV=0001\r"	Return software version.
"PN?\r"	"PN=**********\r" Example: "PN=P25-20GA3-PS1-C8-001\r"	Return part number.
"RN?\r"	"RN=****\r" Example: "RN=O\r"	Return revision number.

COMMAND	RETURNED ANSWER	NOTES
“RT?\r”	“RT=***C” Examples: “RT=095C”, “RT=-09C”	Return active stage temperature.
“RV?\r”	“RV=**.***V\r” Example: RV=47.985V	Return DC supply voltage.
“RC?\r”	“RC=**.***A\r” Example: “RC=09.233A\r”	Return DC supply current. Current does not include fan current.
“EX=1\r”	“EX=1\r”	Enable the external control of output power level. With the external control enabled, the power level can be controlled through POWER SET potentiometer and POWER CTL analog input. The command changes registers in the nonvolatile memory. The external control of output power level will remain enabled after the amplifier is powered down. The external control of output power level is set by default at the factory.
"PS=***W\r" Example: “PS=250W\r”	"PS=***W\r" Example: “PS=250W\r”	Set power level. The value range is from 050 to 250 with step 010. The controller will round any numbers that do not meet this criterion. The command does not change registers in the nonvolatile memory. If the external control of output power level is enabled prior the command is send, it will remain enabled after power down.
"PM=***W\r" Example: “PM=250W\r”	"PM=***W\r" Example: “PM=250W\r”	Set power level and save into the nonvolatile memory. The value range is from 050 to 250 with step 010. The controller will round any numbers that do not meet this criterion. The digital control of output power level will remain enabled after amplifier power down.
"PS?\r"	"PS=***W\r" Example: “PS=250W\r” “PS=EX\r”	Return power level that is set in the volatile memory. If the external control of output power level is enabled, the amplifier returns “EX” value.

COMMAND	RETURNED ANSWER	NOTES
"PM?\r"	"PM=***W\r" Example: “PM=250W\r” “PM=EX\r”	Return power level that is saved in nonvolatile memory. If the external control of output power level is enabled, the amplifier returns “EX” value.
"CF?\r"	“CF=1\r”	Return CHECK FAN alarm status. (0 - alarm; 1 - normal operation)
"F1?\r"	“F1=*****RPM\r” Example: “F1=03450RPM\r”	Return fan 1 speed.
"F2?\r"	“F2=*****RPM\r” Example: “F2=03500RPM\r”	Return fan 2 speed.
"FT?\r"	“FT=*****RPM\r” Example: “FT=03500RPM\r”	Return CHECK FAN alarm speed threshold.
“PF?\r”	“PF=*\r” Example: “PF=1\r”	Return PA FAULT alarm sate. (0 - alarm; 1 - normal operation)
“LO?\r”	“LO=*\r” Example: “LO=1\r”	Return LOW OUTPUT alarm state. (0 - alarm; 1 - normal operation)
“HT?\r”	“HT=*\r” Example: “HT=1\r”	Return HI TEMP alarm state. (0 - alarm; 1 - normal operation)
“HI?\r”	“HI=*\r” Example: “HI=1\r”	Return HI INPUT alarm state. (0 - alarm; 1 - normal operation)
“HR?\r”	“HR=*\r” Example: “HR=1\r”	Return HI VSWR alarm state. (0 - alarm; 1 - normal operation)

COMMAND	RETURNED ANSWER	NOTES
“ED?\r”	“ED=*\r” Example: “ED=0\r”	Return EXCITER DRIVE condition state. (0 - RF input signal present; 1 - no RF signal at PA input)

* - represents a single char

3.5 POWER SET CONTROL

The amplifier is equipped with a single turn POWER SET potentiometer located on the front panel. The potentiometer allows the user to adjust the amplifier output power from 250W down to 25W. Turning the potentiometer fully clockwise sets the amplifier to the maximum output power level.

POWER SET potentiometer pulls down the POWER CTL signal located in the Monitor connector (section 3.2 and 3.3). To ensure the full output power adjustment range from 250W to 25W with POWER SET potentiometer, make sure that POWER CTL analog output is either left open or connected to a 10V source.

Both POWER SET and POWER CTL can be disabled by the digital communication interface if either “PS=***W\r” or PM=***W\r” command is sent to the amplifier (refer to Table 3-7 section 0 for details).

4 TROUBLESHOOTING

4.1 INTRODUCTION

This section contains a list of potential problems and suggested actions to be taken. If the suggested corrective action does not eliminate the problem, please contact the Crescend factory for further instructions.

NOTE: Do not break the seals on equipment under warranty or the warranty will be null and void. Do not return equipment for warranty or repair service until obtaining RMA and proper shipping instructions from the factory.

4.2 TROUBLESHOOTING

Refer to Table 4-1 for troubleshooting suggestions.

Table 4-1 Troubleshooting Guide

PWR ON	EXCITER DRIVE	OUTPUT POWER STATUS	PA FAULT	CHECK FAN	HI TEMP	HI VSWR	HI INPUT	LOW OUTPUT	OTHER SYMPTOMS	POSSIBLE CAUSE	SUGGESTED ACTIONS
ON	ON	Full power	Low							Amplifier is in transmit mode.	No action is required.
ON	OFF	No power	Low							Amplifier remains in standby mode.	Apply RF input signal to amplifier.
										Input power is below activation threshold.	Verify exciter signal level.
ON			High	ON						Low fan speed due to dirt.	Clean dirt from fans and vents
										Low fan speed due to aging.	Obtain RMA to have amplifier checked at factory.
										Fan rotor locked.	Obtain RMA to have amplifier checked at factory.
ON	ON	Low or no power	High					ON		Input power is above activation threshold but lower than minimum specified value.	Verify exciter signal level.
										Input signal frequency is out of amplifier operation band.	Verify exciter signal frequency.

PWR ON	EXCITER DRIVE	OUTPUT POWER STATUS	PA FAULT	CHECK FAN	HI TEMP	HI VSWR	HI INPUT	LOW OUTPUT	OTHER SYMPTOMS	POSSIBLE CAUSE	SUGGESTED ACTIONS
										Amplifier failure.	Verify exciter signal frequency and level. Obtain RMA to have amplifier checked at factory.
ON	ON	Full power	High				ON			High power input signal level has been detected.	Turn off input drive. Verify exciter signal level.
OFF	OFF	No power	High							Fuse failure	Disconnect AC cord. Check fuse and replace if necessary.
										No AC power is applied to amplifier.	Verify AC power source.
										Power Supply failure	Obtain RMA to have amplifier checked at factory.
OFF	OFF	No power	High						Fans operate	Amplifier failure	Obtain RMA to have amplifier checked at factory.
ON	ON	No power	High		ON					Ambient temperature is above 60C.	Turn off input drive. Allow amplifier to cool down. Verify cabinet ventilation and room air temperature.
										Air circulation is blocked.	Turn off input drive. Allow amplifier to cool. Disconnect AC cord. Clean up air vents. Remove any obstacles from air inlet and outlet.

PWR ON	EXCITER DRIVE	OUTPUT POWER STATUS	PA FAULT	CHECK FAN	HI TEMP	HI VSWR	HI INPUT	LOW OUTPUT	OTHER SYMPTOMS	POSSIBLE CAUSE	SUGGESTED ACTIONS
ON	ON	No power	High		ON				One or more inactive fans	Fan failure	Turn off input drive. Allow amplifier to cool. Disconnect AC cord. Try removing any obstacles from fan blades if present. Obtain RMA to have amplifier checked at factory.
ON	ON	No power	High			ON				Output load VSWR is above 3:1.	Turn off input drive. Check output connections and cables for integrity and tightness. Check antenna, combiner, etc. for proper return loss.
ON	OFF	No power	Low			ON				Output load VSWR higher than 3:1 was detected before RF input signal was removed.	
ON	ON	Low power	Low							Low signal is applied to POWER CTL pin.	Remove any voltage or short attached to POWER CTL pin.
										POWER SET potentiometer is turned counter clockwise.	Turn POWER SET potentiometer fully clockwise.

4.3 RETURN FOR SERVICE PROCEDURES

When returning products for service to Crescend, please follow the procedures below.

4.3.1 OBTAINING RMA

A Return Material Authorization (RMA) number must be obtained prior to returning equipment to the factory for service. Please contact our Customer Service Department at 800-872-6233 to obtain this number. Failure to obtain this RMA number may result in considerable delays in receiving repair service.

4.3.2 REPACKAGING FOR SHIPMENT

To ensure safe shipment of the amplifier, it is recommended to use the packaging designed for the amplifier. The original packaging material is reusable. If it is not available, contact Crescend Customer Service Department for packing materials and information.

5 MAINTENANCE

5.1 INTRODUCTION

This section contains periodic maintenance requirements for reliable amplifier operation.

5.2 PERIODIC MAINTENANCE

Periodic maintenance requirements are listed in Table 5-1. Table 5-1 also lists the intervals at which the tasks should be performed.

Table 5-1 Periodic Maintenance

TASK	INTERVAL	ACTION
Clean Air Vents/Check Fan	30 Days	Inspect and clean per paragraph 5-3. Verify fans are working properly.
Inspect Cables and Connectors and General Site Conditions	6 Months	Inspect signal and power cables for frayed insulation and proper attachment. Check RF connectors to make sure that they are tight. Inspect the lightning protection system and ground at the site.

5.3 CLEANING AIR INLETS/OUTLETS

The air inlets and outlets should be checked every 30 days and cleaned if necessary. If the equipment is operated in a severe dust environment, it should be checked and cleaned more often. If dust and dirt are allowed to accumulate, the cooling efficiency will be diminished. Using either compressed air or a brush with soft bristles, loosen and remove accumulated dust and dirt from the air inlet panels.

Check that the fans are running smoothly. A slow running or noisy fan may indicate an imminent fan failure. Heat is one of the biggest factors in reducing the reliability of the amplifier. Ensure the fan has access to cool and clean airflow within the rack.

6 RF ENERGY EXPOSURE

6.1 RF ENERGY EXPOSURE AWARENESS, CONTROL INFORMATION, AND OPERATIONAL INSTRUCTIONS FOR COMPLIANCE WITH FCC RF EXPOSURE LIMITS

NOTE: This power amplifier product is intended for use in environments in which personnel have full knowledge of their exposure and can exercise control over their exposure to meet FCC limits. This power amplifier is NOT authorized for use by the general population, consumer, or for use under conditions where unintended or accidental exposure may occur.

This power amplifier product generates electromagnetic energy in the radio frequency (RF) spectrum to provide communications between users over a distance. RF energy is one specific form of electromagnetic energy. Other forms include, but are not limited to, sunlight and x-rays. RF energy, however, should not be confused with these other forms of electromagnetic energy, which when used improperly, can cause biological damage. Very high levels of x-rays, for example, can damage tissues and genetic material.

Experts in science, engineering, medicine, health, and industry work with organizations to develop standards for safe exposure to RF energy. These standards provide recommended acceptable levels for personnel who may be exposed to RF energy. The RF exposure levels described therein include substantial margins of protection.

When properly installed and used, Crescend power amplifier products meet all government-established RF exposure levels. In addition, Crescend recommends specific operating instructions for users of its power amplifier products. These instructions are important because they inform users about RF energy exposure and provide simple procedures on how to control it.

Please refer to the following Web sites for more information on the nature of RF energy exposure and how to control your exposure to assure compliance with established RF exposure limits.

http://www.fcc.gov/oet/rfsafety/rf-faqs.html

http://www.osha.gov/SLTC/radiofrequencyradiation/index.html

6.2 FEDERAL COMMUNICATION COMMISSION REGULATIONS

The FCC rules require manufacturers to comply with the FCC RF energy exposure limits for communication devices before they can be marketed in the U.S. The FCC further requires users to be fully aware of and able to control their exposure to meet RF energy exposure limits. This document includes operating instructions and information required to control your RF exposure and to satisfy compliance requirements.

6.3 RF EXPOSURE COMPLIANCE, CONTROL GUIDELINES AND OPERATING INSTRUCTIONS

To control exposure to yourself and others and to ensure compliance with the RF exposure limits, always adhere to the following guidelines.

1. Crescend power amplifier products are intended for use in fixed communication locations (e.g. base station sites). The antenna installation must comply with the following requirements to ensure optimum performance and compliance with the RF energy exposure limits required by the FCC.

a. The antenna should be mounted outside the site building on a roof, tower, or other support structure such that its location is inaccessible to personnel within the Minimum Permissible Exposure radius (see below).

b. The licensee must undertake the responsibility to manage the site in accordance with the applicable regulatory requirements. This may include, but is not limited to, providing advisory notices to all personnel who may be exposed to RF energy in the vicinity of the antenna, restricting access to areas adjacent to the antenna, or ceasing use of the power amplifier when RF energy exposure safety cannot be guaranteed.

2. When the power amplifier is operating, a front panel LED will be illuminated. The power amplifier will be generating measurable RF energy exposure when transmitting.

3. The maximum permissible exposure (MPE) radius is unique to each base site installation and is based on several factors such as the transmitter power output level, antenna gain, feed line loss, etc. It is the responsibility of the licensee to determine the MPE for the base site installation.

   a. For frequencies of operation between 300 and 1500MHz, the maximum exposure limit is f/1500 mw/cm^2, where f = frequency in MHz

   b. An example calculation of the MPE radius for a 250 Watt 406 MHz transmitter installation having a 5 dBi gain antenna and 1dB of feedline loss is provided below:

$Po = 250000$ mWatts $\quad f = 406\,MHz$

$dBd = 2.85$ antenna gain in dBd

$G1 = dBd + 2.15$ gain in dBi $\quad S = \frac{f}{1500} = 0.27067 \ \frac{mW}{cm^2}$

$G1 = 5$ dBi $\quad$ See 47 CFR 1.1310

$CL = 1.0$ dB coax loss

$G = G1 - CL$

$Gn = 10^{\frac{G}{10}}$

$Gn = 2.512$ gain (numeric)

$R = \sqrt{\frac{(Po \cdot Gn)}{4\pi \cdot S}}$

$R = 429.7$ distance (cm) required for compliance

$inches = \frac{R}{2.54} \quad inches = 169.2$

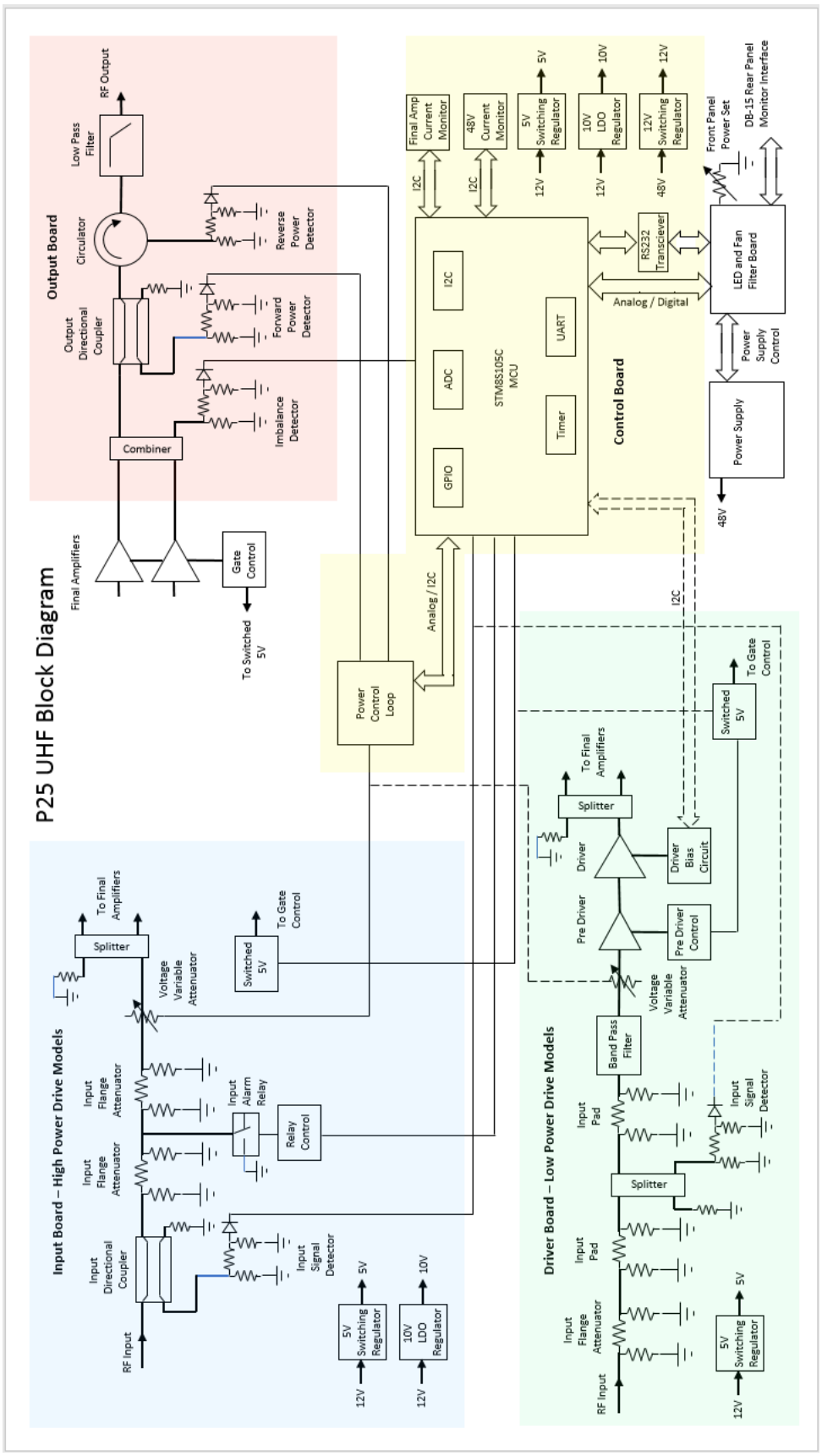
$feet = \frac{inches}{12} \quad feet = 14.1$

4. In instances where the effective antenna gain (antenna gain – feedline loss) differs from the example above, the MPE radius must be calculated by the licensee. Table 4-1 presents the results of calculations of the MPE radius for a 250 Watt 406 MHz transmitter having various effective antenna gain values.

Table 6-1 Calculations of the MPE Radius for a 250 Watt 406 MHz Transmitter

Effective Antenna Gain (dBi)	Minimum Safe Distance (meters)	Minimum Safe Distance (feet)
3.0	3.83	12.6
4.0	4.30	14.1
5.0	4.82	15.8
6.0	5.41	17.7
7.0	6.07	19.9
8.0	6.81	22.3
9.0	7.64	25.1
10.0	8.57	28.1

WARNING: Failure to observe the minimum safe distance radius may result in exposure to RF radiated energy in excess of the FCC Maximum Permissible Exposure (MPE) limit. The licensee is responsible for the safe operation of the base site and must ensure that the Maximum Permissible Exposure limits are observed at all times.


P25 UHF Block Diagram
Output Board
RF Output
Low Pass Filter
Circulator
Reverse Power Detector
Output Directional Coupler
Forward Power Detector
Imbalance Detector
Combiner
Final Amplifiers
Gate Control
To Switched 5V
Final Amp Current Monitor
48V Current Monitor
5V Switching Regulator
10V LDO Regulator
12V Switching Regulator
I2C
Front Panel Power Set
DB-15 Rear Panel Monitor Interface
RS232 Transciever
Analog / Digital
LED and Fan Filter Board
Power Supply Control
Power Supply
48V
Control Board
STM8S105C MCU
I2C
ADC
GPIO
UART
Timer
Power Control Loop
Analog / I2C
Input Board – High Power Drive Models
To Final Amplifiers
Splitter
Voltage Variable Attenuator
Switched 5V
To Gate Control
Input Flange Attenuator
Input Alarm Relay
Relay Control
Input Directional Coupler
Input Signal Detector
RF Input
Driver Board – Low Power Drive Models
Driver
Driver Bias Circuit
Pre Driver
Pre Driver Control
Band Pass Filter
Input Pad