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**OPERATION AND INSTALLATION MANUAL**  
**XT-50, XT-80 AND XT-100**  
**ANTENNA MOUNT TWT POWER AMPLIFIERS**

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XT-50, XT-80, AND XT-100  
ANTENNA-MOUNT TWT POWER AMPLIFIERS**

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### **High Voltage Hazards**

This amplifier utilizes high voltage that can be lethal if contacted. The amplifier should not be operated without its cover unless you are thoroughly familiar with its operation and are experienced with high voltage.

### **RF Radiation Hazards**

Prior to operation of the TWTA, ensure that all microwave connections are securely fastened. Check that there is no microwave leakage from them. Never operate the amplifier with an open waveguide. This amplifier is capable of generating high power microwave radiation, which can cause bodily harm.

### **Safety Summary**

Equipment of this nature has inherent hazards. Operator or service technicians should have training on the XT-50, XT-80, or XT-100 power amplifiers. When the amplifier's cover is removed, the high voltage power supply for the TWT has multiple exposed high voltage points. Use extreme care when operating the amplifier with its cover removed.

## CHAPTER 1: GENERAL DESCRIPTION

### Overview

This operation manual discusses Xicom Technology antenna-mount power amplifiers with power levels ranging from 50 Watts to 170 Watts. These antenna-mount units are designed for outdoor mounting directly to an antenna structure. The standard components of each amplifier include: a Traveling Wave Tube (TWT), an integral high voltage power supply, and a forced air cooling system. For a brief product description and typical block diagram, see the table and figure below.

Model Name	Frequency Range	Band	Rated Power @ HPA Flange
XT-50C	5.85 to 6.425 GHz	C-Band	50 Watts
XT-100C	5.85 to 6.425 GHz	C-Band	140 Watts
XT-50X	7.9 to 8.4 GHz	X-Band	50 Watts
XT-100X	7.9 to 8.4 GHz	X-Band	125 Watts
XT-50K	14.0 to 14.5 GHz	Ku-Band	50 Watts
XT-80K	14.0 to 14.5 GHz	Ku-Band	70 Watts
XT-100K	13.75 to 14.5 GHz	Ku-Band	100 Watts

Table 1-1 Models Available

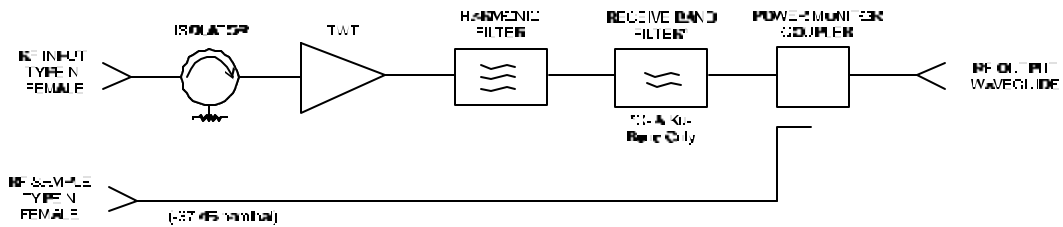


Figure 1-1 TWT Block Diagram

## **Control and Status Interface**

The XT-50, XT-80, and XT-100 amplifiers are externally controlled. These amplifiers do not include any control switches or status indicators for operator use. The external control and status indicator interfaces are detailed in Chapter 2 of this manual.

## **Performance Specifications**

The performance specifications of the C-Band, X-Band, and Ku-Band models are shown in Tables 1-2, 1-3, and 1-4 respectively. Environmental specifications for all models are summarized in Table 1-5. Interface specifications are shown in Table 1-6.



**Table 1-2** C-Band Performance Specifications

<b>Parameter</b>	<b>XT-50C Specifications</b>	<b>XT-100C Specifications</b>
FREQUENCY RANGE	5.850 GHz to 6.425 GHz	5.850 GHz to 6.425 GHz
OUTPUT POWER TWT @ Amplifier Flange	55 Watts 50 Watts	170 Watts 140 Watts
GAIN, Small Signal, Minimum	45 dB	46 dB
GAIN, Large Signal, Minimum	40 dB	40 dB
GAIN VARIATION, SSG Narrow Band, Maximum Full Band, Maximum	1.5 dB over any 40 MHz band 2.5 dB	1.0 dB over any 40 MHz band 2.5 dB
GAIN SLOPE, Maximum	±0.04 dB/MHz	±0.04 dB/MHz
GAIN STABILITY IN ANY 24 HOUR PERIOD, Maximum	±0.25 dB	±0.25 dB
GAIN STABILITY OVER TEMPERATURE	±1.0 dB maximum over operating temperature range at any frequency	±1.0 dB maximum over operating temperature range at any frequency
INTERMODULATION WITH TWO EQUAL SIGNALS	-18 dBc maximum with two equal carriers at 4 dB total output backoff	-18 dBc maximum with two equal carriers at 4 dB total output backoff
HARMONIC OUTPUT, Maximum	-60 dBc	-60 dBc
AM TO PM CONVERSION, Maximum	2.5°/dB at 6 dB below rated power	2.5°/dB at 6 dB below rated power
NOISE POWER Transmit Band, Maximum Receive Band, Maximum	-70 dBw/4 KHz -150 dBw/4 KHz 3.7 GHz to 4.2 GHz	-80 dBw/4 KHz -160 dBw/4 KHz 3.7 GHz to 4.2 GHz
GROUP DELAY, Maximum Bandwidth Linear Parabolic Ripple	Any 40 MHz 0.01 nS/MHz 0.005 nS/MHz <sup>2</sup> 0.5 nS/Pk-Pk	Any 40 MHz 0.01 nS/MHz 0.005 nS/MHz <sup>2</sup> 0.5 nS/Pk-Pk
RESIDUAL AM NOISE, Maximum	-50 dBc to 10 KHz -20 (1.5+log <sub>f</sub> ) dBc 10 to 500 KHz -85 dBc above 500 KHz	-50 dBc to 10 KHz -20 (1.5+log <sub>f</sub> ) dBc 10 to 500 KHz -85 dBc above 500 KHz
PHASE NOISE, Maximum	10 dB below IESS phase noise profile AC fundamental -50 dBc Sum of all spurs -47 dBc	10 dB below IESS phase noise profile AC fundamental -50 dBc Sum of all spurs -47 dBc
VSWR, Maximum Input Output	1.3:1 2.2:1	1.3:1 2.2:1

**Table 1-3** X-Band Performance Specifications

<b>Parameter</b>	<b>XT-50X Specifications</b>	<b>XT-100X Specifications</b>
FREQUENCY RANGE	7.90 GHz to 8.40 GHz	7.90 GHz to 8.40 GHz
OUTPUT POWER, TWT @ Amplifier Flange	55 Watts 50 Watts	140 Watts 125 Watts
GAIN, Small Signal, Minimum	53 dB	46 dB
GAIN, Large Signal, Minimum	49 dB	40 dB
GAIN VARIATION, SSG Narrow Band, Maximum Full Band, Maximum	1.3 dB over any 40 MHz band 2.5 dB	1.0 dB over any 40 MHz band 2.5 dB
GAIN SLOPE, Maximum	±0.04 dB/MHz	±0.04 dB/MHz
GAIN STABILITY IN ANY 24 HOUR PERIOD, Maximum	±0.25 dB	±0.25 dB
GAIN STABILITY OVER TEMPERATURE	±1.0 dB maximum over operating temperature range at any frequency	±1.0 dB maximum over operating temperature range at any frequency
INTERMODULATION WITH TWO EQUAL SIGNALS	-18 dBc maximum with two equal carriers at 4 dB total output backoff	-18 dBc maximum with two equal carriers at 4 dB total output backoff
HARMONIC OUTPUT, Maximum	-60 dBc	-60 dBc
AM TO PM CONVERSION, Maximum	2.5°/dB at 6 dB below rated power	2.5°/dB at 6 dB below rated power
NOISE POWER Transmit Band, Maximum Receive Band, Maximum	-70 dBw/4 KHz -70 dBw/4 KHz 7.25 - 7.75 GHz	-80 dBw/4 KHz -80 dBw/4 KHz 7.25 - 7.75 GHz
GROUP DELAY, Maximum Bandwidth Linear Parabolic Ripple	Any 40 MHz 0.01 nS/MHz 0.005 nS/MHz <sup>2</sup> 0.5 nS/Pk-Pk	Any 40 MHz 0.01 nS/MHz 0.005 nS/MHz <sup>2</sup> 0.5 nS/Pk-Pk
RESIDUAL AM NOISE, Maximum	-50 dBc to 10 KHz -20 (1.5+logf) dBc 10 to 500 KHz -85 dBc above 500 KHz	-50 dBc to 10 KHz -20 (1.5+logf) dBc 10 to 500 KHz -85 dBc above 500 KHz
PHASE NOISE, Maximum	10 dB below IESS phase noise profile AC fundamental -50 dBc Sum of all spurs -47 dBc	10 dB below IESS phase noise profile AC fundamental -50 dBc Sum of all spurs -47 dBc
VSWR, Maximum Input Output	1.3:1 2.2:1	1.3:1 2.2:1

**Table 1-4** Ku-Band Performance Specifications

<b>Parameter</b>	<b>XT-50K</b>	<b>XT-80K</b>	<b>XT-100K</b>
FREQUENCY RANGE	14.0 GHz to 14.5 GHz	14.0 GHz to 14.5 GHz	13.75 GHz to 14.5 GHz
OUTPUT POWER, TWT @ Amplifier Flange	55 Watts 50 Watts	80 Watts 70 Watts	125 Watts 100 Watts
GAIN, Small Signal, Minimum	53 dB	50 dB	46 dB
GAIN, Large Signal, Minimum	49 dB	46 dB	40 dB
GAIN VARIATION, SSG Narrow Band, Maximum Full Band, Maximum	1.3 dB per 80 MHz 2.5 dB	1.3 dB per 80 MHz 2.5 dB	1.0 dB per 80 MHz 2.5 dB
GAIN SLOPE, Maximum	±0.04 dB/MHz	±0.04 dB/MHz	±0.04 dB/MHz
GAIN STABILITY IN ANY 24 HOUR PERIOD, Maximum	±0.25 dB	±0.25 dB	±0.25 dB
GAIN STABILITY OVER TEMPERATURE	±1.0 dB maximum over operating temperature range at any frequency	±1.0 dB maximum over operating temperature range at any frequency	±1.0 dB maximum over operating temperature range at any frequency
INTERMODULATION WITH TWO EQUAL SIGNALS	-18 dBc maximum with two equal carriers at 4 dB total output backoff	-18 dBc maximum with two equal carriers at 4 dB total output backoff	-18 dBc maximum with two equal carriers at 4 dB total output backoff
HARMONIC OUTPUT, Maximum	-60 dBc	-60 dBc	-60 dBc
AM TO PM CONVERSION Maximum	2.5°/dB at 6 dB below rated power	2.5°/dB at 6 dB below rated power	2.5°/dB at 6 dB below rated power
NOISE POWER Transmit Band, Maximum Receive Band, Maximum	-70 dBw/4 KHz -150 dBw/4 KHz 10.95 GHz to 12.75 GHz	-70 dBw/4 KHz -150 dBw/4 KHz 10.95 GHz to 12.75 GHz	-80 dBw/4 KHz -160 dBw/4 KHz 10.95 GHz to 12.75 GHz
GROUP DELAY, Maximum Bandwidth Linear Parabolic Ripple	Any 80 MHz 0.01 nS/MHz 0.005 nS/MHz <sup>2</sup> 0.5 nS/Pk-Pk	Any 80 MHz 0.01 nS/MHz 0.005 nS/MHz <sup>2</sup> 0.5 nS/Pk-Pk	Any 80 MHz 0.01 nS/MHz 0.005 nS/MHz <sup>2</sup> 0.5 nS/Pk-Pk
RESIDUAL AM NOISE, Maximum	-50 dBc to 10 KHz -20 (1.5+log <sub>f</sub> ) dBc 10 to 500 KHz -85 dBc above 500 KHz	-50 dBc to 10 KHz -20 (1.5+log <sub>f</sub> ) dBc 10 to 500 KHz -85 dBc above 500 KHz	-50 dBc to 10 KHz -20 (1.5+log <sub>f</sub> ) dBc 10 to 500 KHz -85 dBc above 500 KHz
PHASE NOISE, Maximum	10 dB below IESS phase noise profile AC fundamental -50 dBc Sum of all spurs -47 dBc	10 dB below IESS phase noise profile AC fundamental -50 dBc Sum of all spurs -47 dBc	10 dB below IESS phase noise profile AC fundamental -50 dBc Sum of all spurs -47 dBc
VSWR, Maximum Input Output	1.3:1 2.2:1	1.3:1 2.2:1	1.3:1 2.2:1

**Table 1-5** Environmental Specifications, All Models

Parameter	Specifications
NON-OPERATING TEMPERATURE RANGE	-50°C to + 70°C
OPERATING TEMPERATURE RANGE	-40°C to + 50°C
HUMIDITY	Up to 100% condensing
ALTITUDE	10,000 feet MSL maximum
SHOCK AND VIBRATION	Normal transportation
COOLING	Forced air

**Table 1-6** Interface Specifications, All Models

Parameter	Specifications
PRIME POWER, STANDARD  XT-50, maximum value XT-80, maximum value XT-100 maximum value	100-260 VAC 47 Hz to 63 Hz 400 VA Maximum/.95 Minimum Power Factor 525 VA Maximum/.95 Minimum Power Factor 675 VA Maximum/.96 Minimum Power Factor
CONTROLS	High Voltage ON/OFF Fault Reset Heater Standby
MONITOR, DIGITAL	High Voltage ON Filament Time Delay Standby Summary Fault Helix Current/Arc Fault Helix Latched Fault Temperature Fault High Voltage Fault Fan Fault
MONITOR, ANALOG	Helix Current (2 mA/V) Cathode Voltage (1000:1 V/V) TWT Temperature RF Output Power (Optional)
AUXILIARY VOLTAGES	+ 15 VDC (100 mA max) +24 VDC (100 mA max)

\*Heater standby reduces the TWT heater voltage for situations where the high voltage is off for extended periods.

## CHAPTER 2: INSTALLATION

### Introduction

This chapter describes the procedures for unpacking, inspecting, and installing the XT-50, XT-80, and XT-100 amplifiers.

### Unpacking and Inspection

Upon receiving the amplifier, inspect both the inside and outside of the shipping container for signs of damage. If any shipping damage is detected, call the shipping carrier and submit a damage report.

Compare the packing list to the contents of the container to be certain that all material has been received. Save all data sheets. They will be useful during any maintenance actions. Save the packing material and use it if you need to reship the unit.

Inspect all items for any damage received during shipment. If shipping damage is detected, submit a damage report to the shipping carrier. Failure to submit a report may invalidate any future claims.

### Mechanical Installation

The power amplifier can be mounted any place that is convenient for the user, subject to the conditions noted later in this section for unobstructed intake and exhaust air flow. Standard mounting brackets come with the unit. Alternative mounting brackets can be designed using the mounting dimensions shown in Figure 2-1.

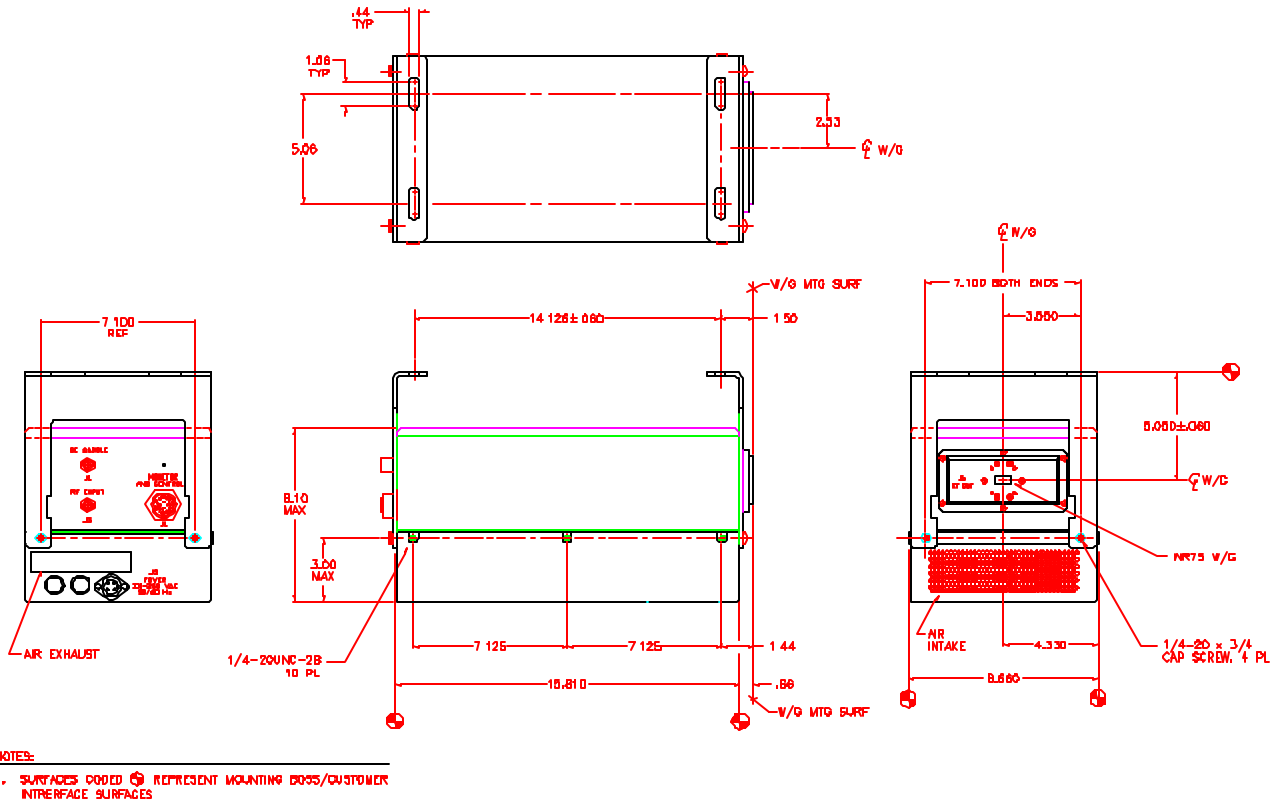
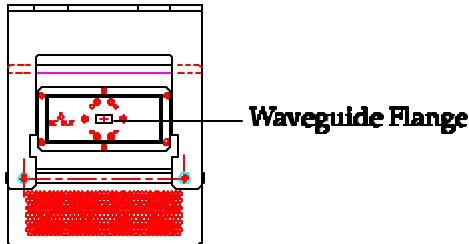


Figure 2-1. Amplifier Outline Drawing

## Waveguide Connection

The RF output waveguide port (C-Band and X-Band CPR-137G, or Ku-Band WR-75) is located on the “output end” of the amplifier as shown in Figure 2-2.



**Figure 2-2.** “Output End”

Proceed as follows:

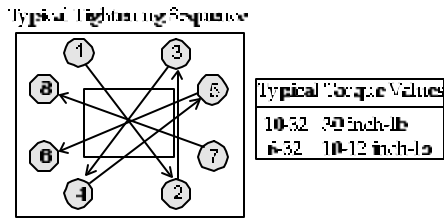
1. Ensure that the proper matching waveguide flange and gaskets are used to connect the RF output to the feed system or antenna.
2. Position the interconnecting waveguide flange parallel to the output waveguide flange. Make sure that the flanges can be mated without strain or torsion.
3. If the two flanges cannot be properly aligned or if the installation is subject to vibration, a flexible waveguide section should be utilized to eliminate potential strain on the waveguide connection.
4. Insert any necessary gasket and/or window between the two flanges.

*If the connecting waveguide is to be pressurized at greater than 5 psi, a waveguide window must be installed at the output flange of the amplifier.*

5. Install and hand tighten all mounting screws (#6-32 for Ku-Band and #10-32 for C-Band and X-Band).

*Do not overtighten the waveguide mounting screws.  
Overtightening may strip the threads in the waveguide flange.*

6. Tighten all mounting screws to the torque values shown in Figure 2-3. A typical sequence is indicated by the numbers in the grayed areas of Figure 2-3. Proceed as follows:
  - a. Partially tighten one of the screws (#1).
  - b. Move the tool to the screw that is diagonally opposite to the screw tightened in step 1 (#2) and partially tighten that screw.
  - c. Move clockwise to the next screw to be tightened (#3) and partially tighten that screw.
  - d. Move to the screw diagonally opposite screw #3 and partially tighten that screw (#4).
  - e. Repeat this process for the remaining screws (#5-#6, #7-#8).
  - f. When you reach the first screw tightened in step a (#1) increase the torque on the screw and repeat the process of steps (1) through (5) until the screws have all been tightened to the torque levels included in Figure 2-3.



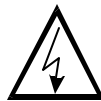
**Figure 2-3.** Typical Tightening Pattern

### Air Ducting

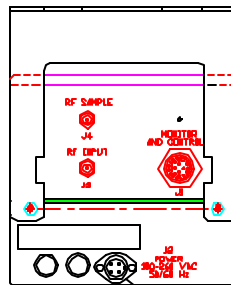
The location of the air inlet and exhaust ports were shown in Figure 2-1. A minimum clearance of two inches is required for the air inlets and exhaust ports. If the amplifier is mounted in an enclosed chamber, duct the exhaust air to the outside of the chamber. Do not recirculate the exhaust air back into the amplifier. Use an exhaust duct that is not smaller than the exhaust port of the amplifier and one that has smooth bends and transitions.

### Prime Power Connections

The location of the prime power input connector is shown in Figure 2-4.



WHEN THE CONTROLLER IS DISCONNECTED OR SET TO AC OFF, PRIME POWER IS STILL PRESENT IN THE INTERIOR OF THE TWTA. DISCONNECT PRIME POWER BEFORE SERVICING THE UNIT.

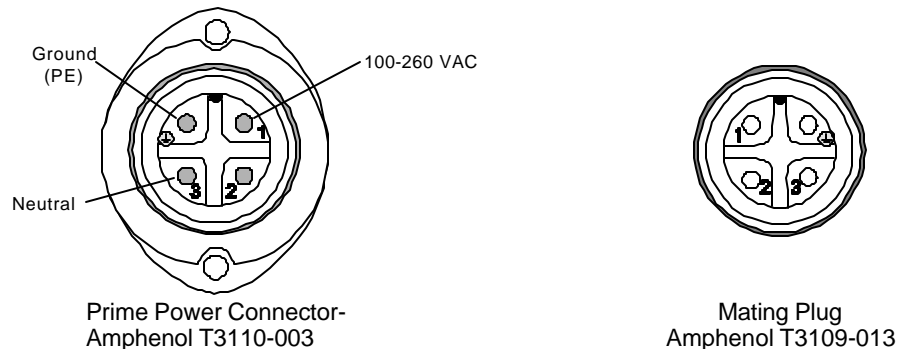


**Prime Power Connector**

**Figure 2-4.** Location of Prime Power Connector

### AC Prime Power, 100 to 260 VAC, Single Phase

The HPA will operate over the entire range of 100 to 260 VAC, 47 Hz to 63 Hz. Connector J2 pinouts are shown in Figure 2-5.



**Figure 2-5.** Connector J2 AC Pinouts



THE AMPLIFIER SHOULD BE SECURELY GROUNDED FOR PERSONNEL AND EQUIPMENT SAFETY. BE CERTAIN THAT THE AC VOLTAGE CABLE HAS THREE WIRES WHERE THE THIRD WIRE IS A SAFETY GROUND.

## Fuses

Input AC power fuses are 13" AGC type related at 8 amperes. They are replaceable through the screw-on sealing caps next to the prime power connector.

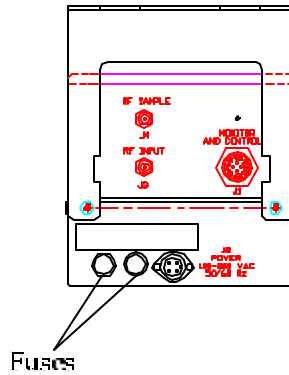


Figure 2-6. Location of Fuses

## Controller Connections

Connector J1 (Figure 2-6) on the "Input End" of the amplifier connects to the external controller. A description of the functions of this connector follows Figure 2-6. The standard connecting cable and the controller end of the cable are described in the paragraphs following the description of connector J1.

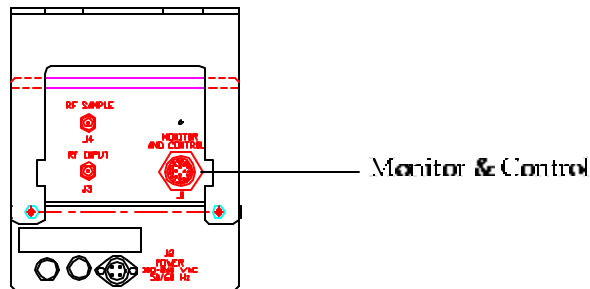


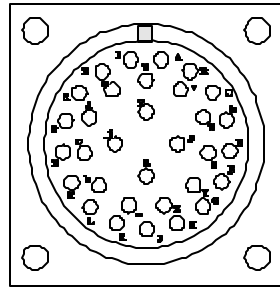
Figure 2-7. Location of Controller Interface Connector J1



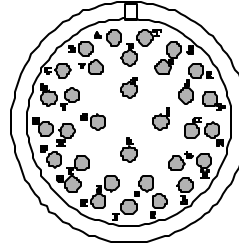
## Control and Monitor Interfaces

The control interface connector (J1) pinouts are shown in Figure 2-8. There are five classes of interfaces:

- Controls
- Digital Status
- External Voltage
- Analog Signals
- DC Bias Voltages



**I/O Interface Connector  
J1-Receptacle  
Bordix No. PTC2E-1B-328**



**I/O Mating Connector  
J1-Plug  
Bordix No. PTC0E-1B-32P(SR)**

Item	Pin	Functions
Controls (Commands)	a	AC Power ON
	F	High Voltage ON
	J	Heater Standby
	X	Fault Reset
	Z	AC Command Return
All circuits active low	A	Helix/Arc Fault Latched
	C	Helix/Arc /Fault
	G	Heater Timer Complete
	H	TWT Temperature Fault
	K	High Voltage ON
	M	Fan ON
	R	High Voltage Fault
	S	Fan ON High
	T	Summary Fault
	U	Fan Lock
	W	Control/Status Return
Signals, Analog	b	RF Output Power
	D	Helix Current
	L	High Voltage Monitor
	N	Analog Signal Return
	P	TWT Temperature
Output Voltages	E	+15 VDC (100 mA maximum)
	V	+24 VDC (100 mA maximum)
External Voltage	Y	External Supply (+5/15 VDC)

**Figure 2-8.** Interface Connector Pinouts

## Control Interface

There are five control inputs as follows:

- **AC Power ON (Pin a).** Connect *Pin a* to ground (*Pin Z*) to enable operation of the TWTA and turn the TWT's heater on.
- **High Voltage ON (Pin F).** Connect *Pin F* to ground (*Pin W*) to turn high voltage on.
- **Heater Standby (Pin J).** Connect *Pin J* to ground (*Pin W*) to reduce the voltage applied to the TWT's heater. This feature is provided to extend the life of the TWT when the amplifier is the back-up unit in a redundant configuration. The High Voltage ON overrides the Heater Standby command and returns the TWT's heater voltage to its normal operating value.
- **Fault Reset (Pin X).** Momentarily connect *Pin X* to ground (*Pin W*) to reset the high voltage fault and helix current fault.

*Turning the High Voltage OFF will also clear these faults.*

- **AC Command Return (Pin Z).** Common return.

## Operation Without a Controller

To implement operation without a controller, the following jumper connections need to be made. These connections can be made in the control connector mate: PT06E 18-32P.

1. Connect Pin a to Pin Z
2. Connect Pin F to Pin W
3. Connect Pin E to Pin Y

With these connections, the amplifier will be operational within 3 minutes of applying AC Power. If the amplifier has a Latching Type Fault, it can be reset by momentarily turning off the AC Power.

Bias for the external control inputs need to be implemented with either the internal +15 VDC of the amplifier or from an external DC supply. Both configurations are described in the following paragraphs.

**Using the Internal +15 VDC for Control (Connect E to Y):** The control circuits for systems that use the internal +15 VDC supply of the power amplifier are shown in Figure 2- 9.

**Using an External DC Supply for Control into Pin Y:** The control circuits for systems that use an external +10 to +15 VDC supply are shown in Figure 2- 10.

These figures include the pinouts (a., b., c., etc.) of power amplifier connector J1. The equivalent "D" connector pinouts for interconnect cable 350-0017-XXX, which is normally used to connect the power amplifier to a TWTA controller are shown later in this chapter in Figure 2-14. The operation of either configuration is the same. The control system connections are fail-safe. Removal of the interconnect cable inhibits operation of the power amplifier.

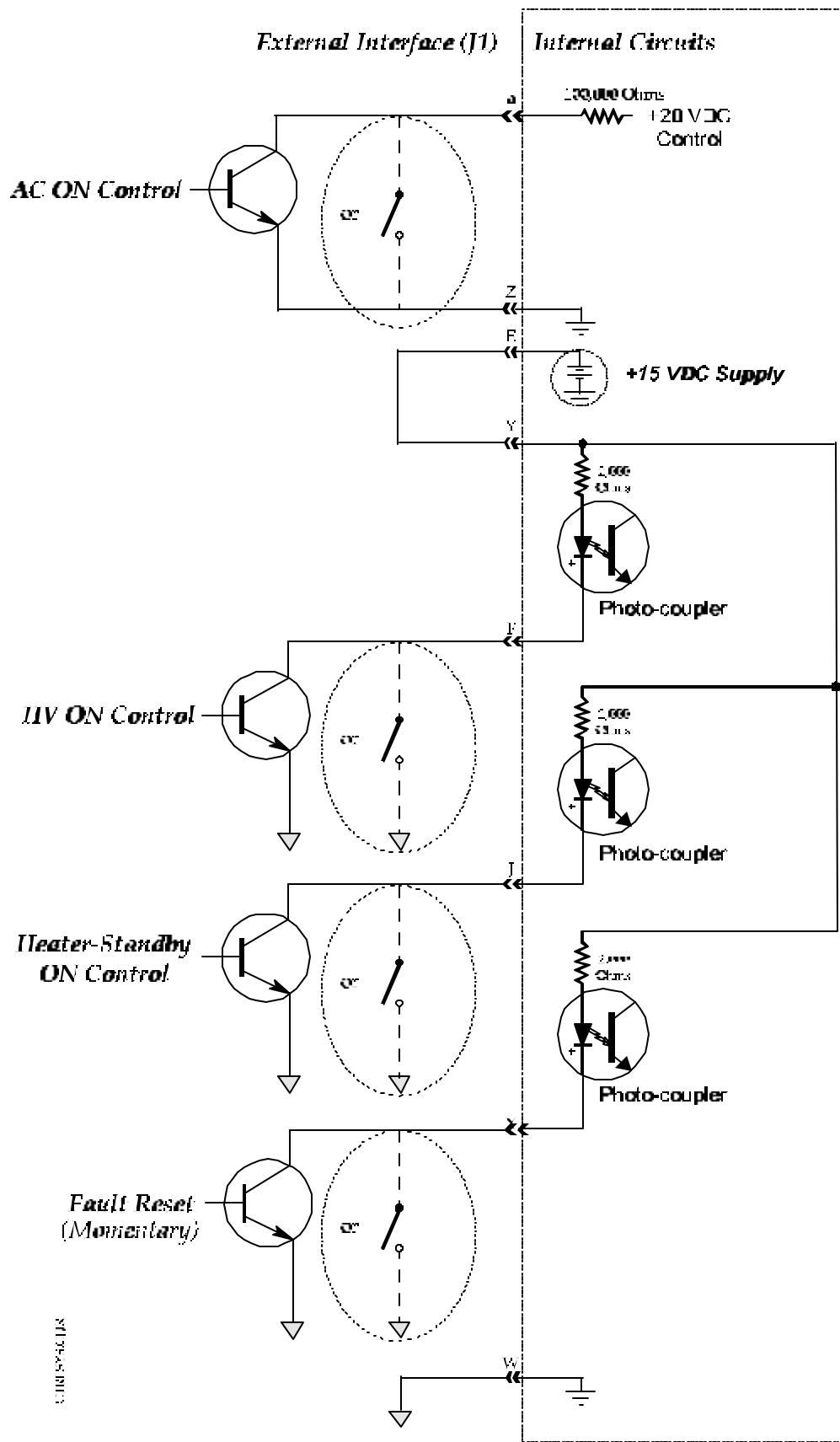


Figure 2-9. Internal Supply Control Circuits

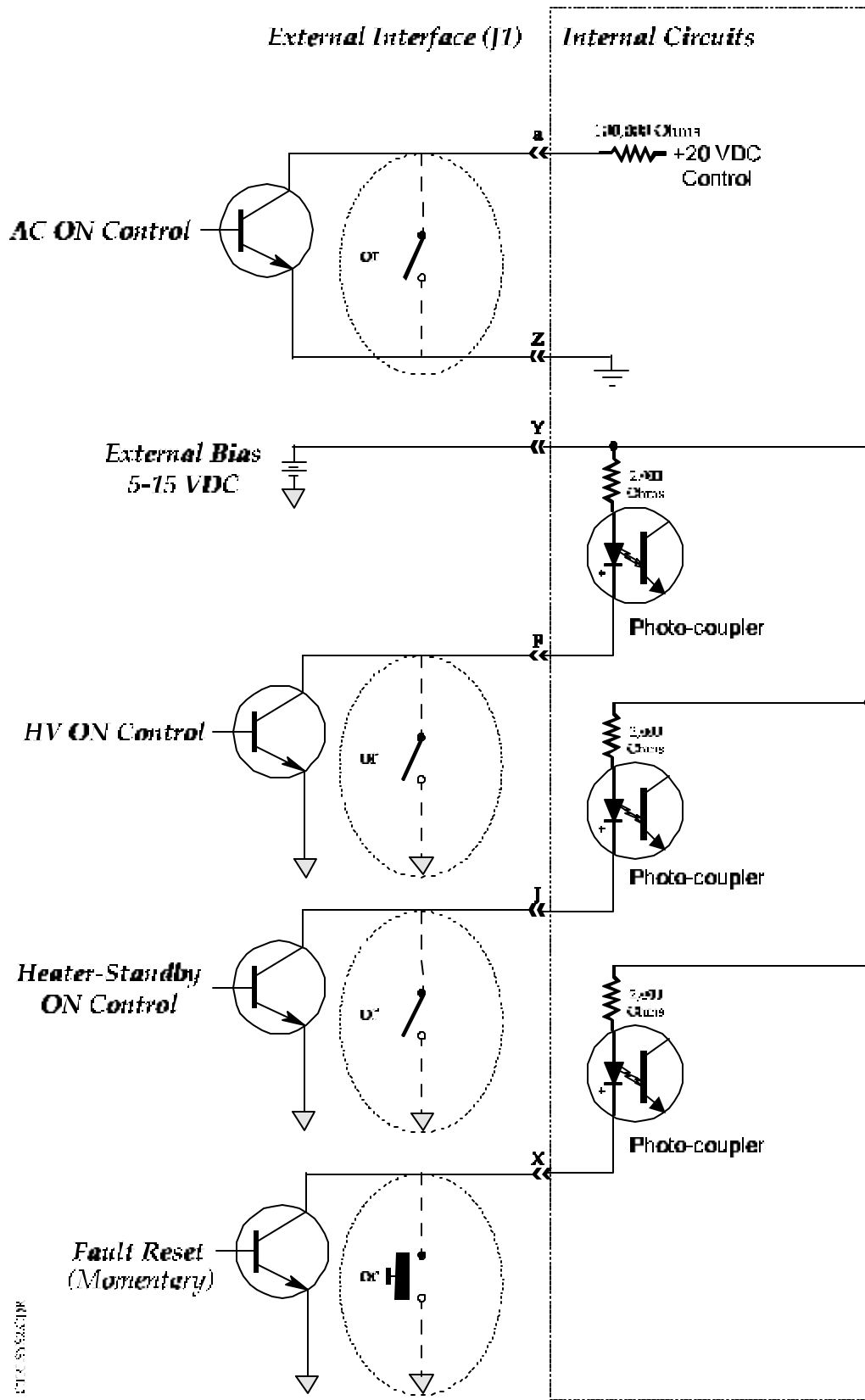


Figure 2-10. External Supply Control Circuits

The control functions shown in Figures 2-9 and 2-10 are:

**AC ON Control:** This circuit inhibits operation of the power amplifier power supply when pin J1-a is high. When pin J1-a is connected to pin J1-Z, power supply operation is enabled.

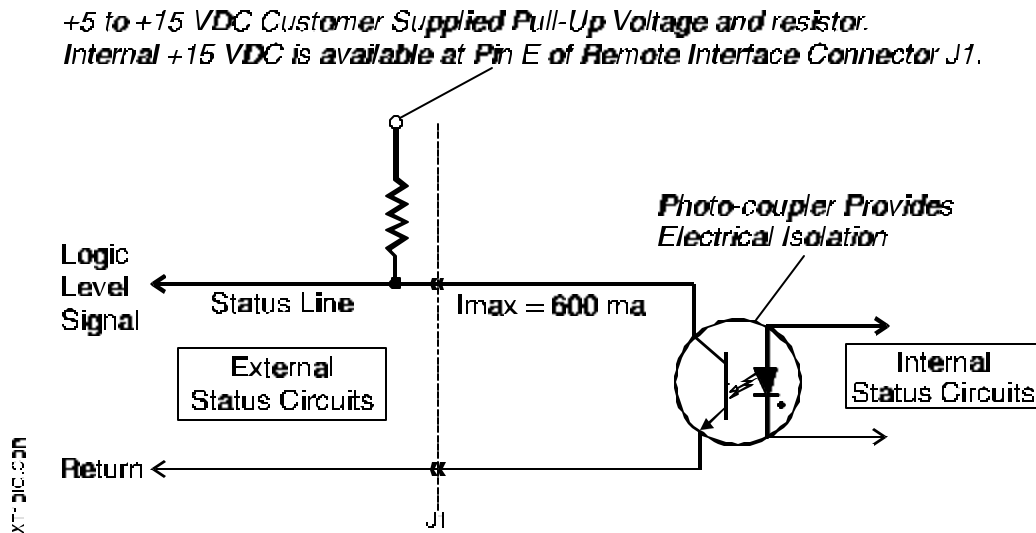


**WARNING:** THE AC CONTROL CIRCUIT DOES NOT AFFECT THE CONNECTION OF THE POWER AMPLIFIER TO PRIME POWER. DISCONNECT PRIME POWER WHEN YOU SERVICE THE POWER AMPLIFIER.

*High Voltage ON, Heater Standby ON and Fault Reset Control:* These circuits are isolated from the internal circuits of the power amplifier. The operation of all three control circuits is the same. When pins F, J, or X are pulled to the power amplifier ground (pin J1-W), the control function is enabled. **Fault Reset** should be implemented with a momentary circuit or switch.

### Digital Status Circuits

The digital status interface circuits are isolated outputs as shown in Figure 2-11. The internal +15 VDC supply (100 mA max) or an external supply can be used to bias the digital status indicator circuits. Refer to Figure 2-8 for indicator circuit pinout designations and the text following Figure 2-11 for indicator circuit descriptions.



**Figure 2-11.** Digital Status Circuit Isolation

- **Helix/Arc Fault Latched (Pin A).** (Active = low) When active, indicates there have been 3 successive Helix over current/arc faults within the amplifier and the amplifier is now turned off. *Pin A* is now shorted by open collector to ground (*Pin W*). Maximum open voltage is 20 volts and maximum switched current is 3 mA. The switch is an isolated photo-coupler. After three successive helix/arc faults, the automatic cycle is terminated and this line is active (low).
- **Helix/Arc Fault (Pin C).** (Active = low) When active, indicates there is a helix/arc fault within the amplifier when *Pin C (+)* is connected by open collector to ground (*Pin W*). Maximum open voltage is 20 volts and maximum switched current is 3 mA. The switch is an isolated photo-coupler.

*The amplifier will reset itself immediately after a helix/arc fault, hence will only momentarily activate.*

- **Heater Timer Complete (Pin G).** (Active = low). When active, indicates the heater delay is complete when *Pin G (+)* is connected by open collector to ground (*Pin W*). Maximum open voltage is 20 volts and maximum switched current is 3 mA. The switch is an isolated photo-coupler.
- **TWT Temperature Fault (Pin H).** (Active = low) When active, indicates there is a TWT Temperature fault within the amplifier when *Pin H (+)* is connected by open collector to ground (*Pin W*). Maximum open voltage is 20 volts and maximum switched current is 3 mA. The switch is an isolated photo-coupler. This is not a latched fault. The amplifier will turn itself on once the TWT has cooled to an acceptable temperature.

*A TWT Temperature fault may occur from a number of causes: (1) air intake filter clogged, (2) cooling fins clogged, (3) fan failure, or (4) fan power supply failure.*

- **High Voltage ON (Pin K).** (Active = low) When active, indicates that the amplifier is on when *Pin K (+)* is connected by open collector to ground (*Pin W*). Maximum open voltage is 20 volts and maximum switched current is 3 mA. The switch is an isolated photo-coupler.
- **Fan ON (Pin M).** (Active = low) When active, indicates that the amplifier's main cooling fan is on when *Pin M (+)* is connected by open collector to ground (*Pin W*). Maximum open voltage is 20 volts and maximum switched current is 3 mA. The switch is an isolated photo-coupler. The main cooling fan is controlled by the temperature of the TWT. The fan will cycle on and off in cooler ambient conditions. The fan is typically operated below the manufacturer's nominal design voltage.

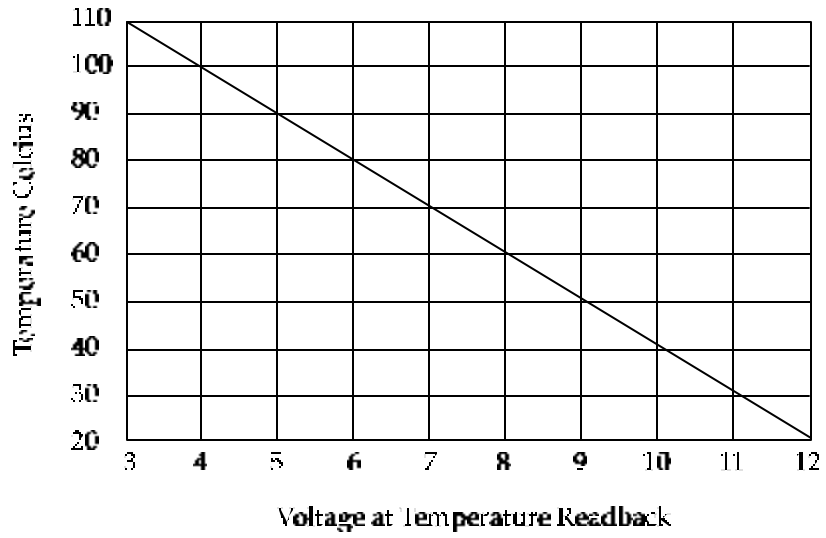
- **High Voltage Fault (Pin R).** (Active = low) When active indicates there is a high voltage fault within the amplifier when *Pin R (+)* is connected by open collector to ground (*Pin W*). Maximum open voltage is 20 volts and maximum switched current is 3 mA. The switch is an isolated photo-coupler. A high voltage fault is typically an indication of a serious power supply failure.
- **Fan ON High (Pin S).** (Active = low) When active, indicates that the TWT has heated up to the point that the fan must run at its manufacturer's rated voltage when *Pin S (+)* is connected by open collector to ground (*Pin W*). Maximum open voltage is 20 volts and maximum switched current is 3 mA. The switch is an isolated photo-coupler.
- **Summary Fault (Pin T).** (Active = low) When active, indicates there is a fault within the amplifier when *Pin T (+)* is connected by open collector to ground (*Pin W*). Maximum open voltage is 20 volts and maximum switched current is 3 mA. The switch is an isolated photo-coupler.
- **Fan Lock (Pin U).** (Active = low) When active indicates that the fan is locked when *Pin U (+)* is connected by open collector to ground (*Pin W*). Maximum open voltage is 20 volts and maximum switched current is 3 mA. The switch is an isolated photo-coupler. A Fan Lock signal is caused by either a fan failure or some object is interfering with the rotation of the fan.
- **Control/Status Return (Pin W).** Common return.

### Analog Status Circuits

- **RF Output Power (Pin b).** This pin is not active on the Multi-Band TWTA.
- **Helix Current (Pin D).** The TWT's helix current may be determined by monitoring the voltage in *Pin D*. There is 2 mA of current for each volt measured.
- **High Voltage Monitor (Pin L).** The high voltage level may be determined by monitoring the voltage in *Pin L*. This output is proportional to the high voltage (1V/1000 VDC).
- **Analog Signal Return (Pin N).** Common return.
- **TWT Temperature (Pin P).** The TWT's collector temperature may be determined by monitoring the voltage on *Pin P* and referring to Figure 2-12.
- **Reflected Power (Pin c).** The detector output is nominally 2VDC for a VSWR of 2.5:1.

### Output Voltage Circuits

- **+15 Volts (Pin E).** Fifteen volts DC at 100 mA is available for external use or for powering the pull-up resistors for the control and status signals (*Pin Y*).
- **+24 Volts (Pin V).** Twenty-four volts DC at 100 mA is available for external use.

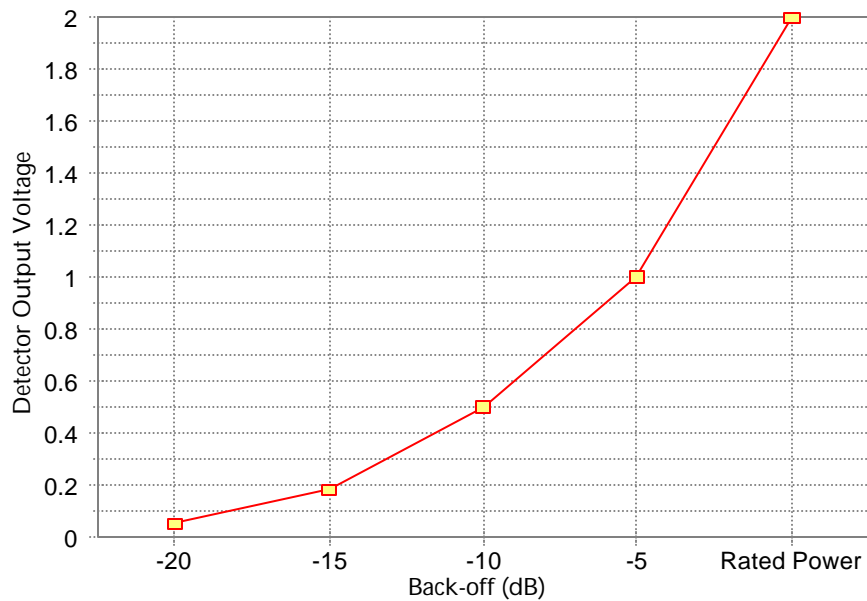


**Figure 2-12.** TWT Temperature: Temperature vs. Voltage



## Detected Power Calibration

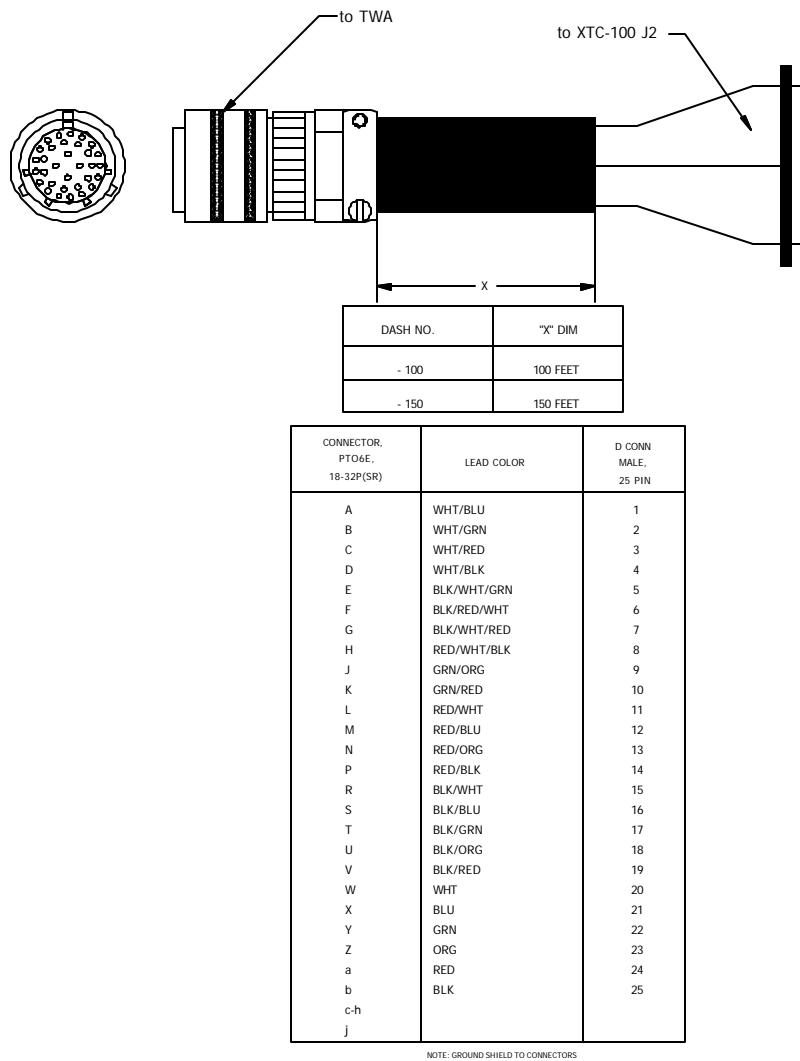
These units incorporate temperature compensated detector diodes. Refer to the chart below to find the backoff reading (in dB).



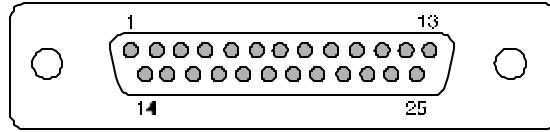
**Figure 2-13.** Detected Power Calibration

## Standard Interconnect Cable

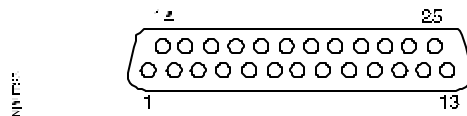
Typically, this cable is used to connect the amplifier to the following XICOM controllers: XTC-100, XTC-100D, XTC-111D, or XTC-122D. The standard interconnect cable is XICOM Technology Part Number. 350-0017-XXX. Refer to Figure 2-13. The XXX portion of the part number designates the length of the cable (in feet). Connect the round connector plug to I/O Interface Connector J1 of the amplifier. Connect the other end of the cable to Connector J2 on the rear panel of the XTC-100 (Female DB-25) or an equivalent controller. Pinouts for the "D" connector end of the interconnect cable are shown in Figure 2-14.



**Figure 2-13.** Interconnect Cable



**TWTA Remote Control Interface Connector  
(Male) DB-25(M)**



**Mating Remote Control Interface Plug  
(Female) DB-25(F)**

Type	Pin	Function	Return Pin**
Control Interfaces (All circuits are active LOW)	2	High Voltage Select ON	4
	3	Control	4
	5	High Voltage Select OFF	4
	6	Control	4
		External Interlock* Fault Reset Control	
Digital Status Circuits (All circuits are active LOW)	8	High Voltage ON Status	7
	10	Indicator	22
	12	Summary Fault Indicator	24
	21	High Voltage Select ON	9
	23	Indicator	11
	25	Standby Status Indicator FTD (Filament Time Delay) Remote/Local Indicator	13
Analog Status Circuits	14	Helix Current Monitor	16
	15	High Voltage Monitor	16
	17	TWT Temperature Monitor	16
Output Voltage Circuits	1	+24 Volts DC	16
	19	+15 Volts DC	16
Ground	4,16	Common Ground (connected)	NA

Pin 4 tied to  
Pin 16

Pins 7, 9, 11, and 22  
tied together.  
May be interchanged

Pin 16 tied to Pin 4

**\*Pin 5 must be connected to Pin 4 with special jumper or external interlock circuit..**

**Figure 2-14.** Interface Cable "D" Connector Pinouts

## **RF Connectors**

### **RF Input Connector J3**

Refer to Figure 2-7 for the location of connector J3. This Type N (Female) Connector is the input for the TWTA.

### **RF Sample Connector J4**

Refer to Figure 2-7 for the location of connector J4. This Type N (Female) Connector is connected to a probe in the output waveguide assembly of the TWTA.

### **RF Output Waveguide Flange J5**

The RF Output flange is:

CPR-137G for C-Band or X-Band

CPR-112 for X-Band

WR-75 for Ku-Band

Details on connection to this waveguide flange were presented in the *Waveguide Connection Section* of this chapter.

## CHAPTER 3: OPERATION

### General

An external control and monitor unit must be used to operate the XT-50 and XT-100 series amplifiers. Control and status signals are accessed via a 32-pin interface connector (J1).

*It is recommended that operating time (standby and beam on), operating conditions (power level) and maintenance actions be recorded in a power amplifier log.*

### Operating Modes

There are five amplifier operating modes:

- Heater Delay (FTD)
- Heater Standby
- Standby
- High Voltage ON
- Fault

#### Heater Delay Mode

When power is first applied to the amplifier, voltage is applied to the TWT's heater. The TWT's heater must be at operating temperature in order for the tube to function properly. The typical warm-up period is three minutes. During this warm-up period, the Timer Complete status line will not be active. When the heater delay is complete, the Timer Complete status line will go active (low).

If there is a power failure, the high voltage will be kept off for a period proportional to the prime power off-time. At the end of this period, the high voltage will be automatically applied (assuming that the High Voltage ON control line is active).

#### Heater Standby Mode

Heater Standby is enabled when the Heater Standby control line is set low. When prime power is first turned on, full heater voltage is applied during the Heater Delay mode. At the end of the Heater Delay mode, the heater voltage is reduced if the high voltage is OFF, and Heater Standby is enabled. The heater voltage reduction feature enhances tube life when the amplifier is the backup unit in a redundant configuration. In this mode, the TWT is ready for high voltage to be applied. Heater voltage will return to normal when High Voltage ON is enabled or Heater Standby is disabled (set high).

#### Standby Mode

In this mode, the TWT is ready for high voltage to be applied. The Timer Complete status line is active (low) and the High Voltage ON status line is not active (high).

### High Voltage ON Mode

When high voltage is ON (applied to the TWT) RF input signals are amplified and the High Voltage ON line is active (low). If the High Voltage ON control line is activated (set low) before the Heater Delay is complete, high voltage will remain off until the delay is complete.

### Fault Mode

This mode exists anytime a condition detrimental to the TWT is detected by the power supply fault detection circuitry. Any of the following conditions trip the fault detection circuitry:

- **Excessive Helix Current Fault.** When the power supply detects a Helix Current fault, it turns OFF high voltage and then tries to turn the high voltage ON. If the fault persists for three OFF-ON cycles, the fault circuit latches and the power supply stops automatically recycling. The Helix/Arc Fault line will remain active (low) at this point. Once the Helix/Arc Fault circuit latches, the Fault Reset control line must be activated briefly or the High Voltage ON control deactivated to clear the fault.
- **High Voltage Fault.** The high voltage fault circuit will latch immediately when a fault occurs. A high voltage fault may be cleared by setting the Fault Reset control line low or by setting the high voltage ON control high.
- **TWT Over-Temperature Fault.** A TWT over-temperature fault will clear itself once the temperature of the TWT's collector is reduced to a safe operating level. High voltage will automatically be enabled when the over-temperature fault clears (if High Voltage ON control signal is active).

*An over-temperature fault should be cause for immediate maintenance action as it is an indication of a fan failure or blocked air passage(s).*

- **Fan Lock Fault.** This fault indicates that fan rotation is restricted or the fan has failed.

A fan lock fault should be cause for an immediate maintenance action as it is an indication of a foreign object jamming the fan or a fan failure.

- **Interlock Fault.** If the amplifier's cover is removed, an interlock will prevent high voltage from being applied.



**WARNING:** EXTREME CAUTION SHOULD BE USED ANY TIME THE COVER IS OFF THE UNIT. A SAFE PRACTICE IS TO ASSUME THE HIGH VOLTAGE IS ALWAYS ON.

## Clearing Faults

Faults can be cleared in two ways:

1. Cycle High Voltage OFF then ON.
2. Momentarily set the Fault Reset control line low.

If the fault condition occurs frequently, maintenance action is required.

## Control and Status Signals

### Control Signals

- **AC Power ON.** Connect *Pin a* to *Pin W* (ground) to turn the power amplifier ON.
- **High Voltage ON/OFF.** This control signal turns the high voltage ON (control line set low) or OFF (control line set high). The High Voltage ON signal enables TWT amplification by turning the TWT electron beam on or off.
- **Heater Standby.** This control signal reduces the voltage applied to the TWT's heater (ON = control line set low). (See Heater Standby Section for details). Turning high voltage on overrides the Heater Standby command and returns the TWT's heater voltage to its normal operating value.
- **Fault Reset.** This control signal resets the High Voltage fault and Helix Current fault (reset = control line momentarily set to low).

*Turning the High Voltage OFF also clears faults.*

### Status, Digital

- **Helix/Arc Fault Latched.** Indicates there is a helix/arc fault within the amplifier. Status line goes low when fault occurs. See Chapter 3, *Fault Mode* for details.
- **Helix/Arc Fault.** Indicates there is a helix/arc fault within the amplifier. Status line goes low when fault occurs.

*The amplifier will try to reset itself in the event of a helix/arc fault. This line will 'blink' during each reset cycle.*

- **Heater Timer Complete.** Indicates Heater Delay status. Status line goes low when heater delay cycle is complete.
- **TWT Temperature Fault.** Indicates there is a TWT Temperature fault within the amplifier. This is not a latched fault. The amplifier turns itself ON when the TWT cools to an acceptable temperature.

📄 *A TWT Temperature fault may be caused by: (1) air intake filter clogged, (2) cooling fins clogged, (3) fan failure, or (4) fan power supply failure.*

- **High Voltage ON.** Indicates amplifier's high voltage system status. Status line goes low when high voltage is ON.
- **Fan ON.** Indicates that the amplifier's main cooling fan is on. The main cooling fan is controlled by the temperature of the TWT. The fan will cycle on and off in cooler ambient conditions. The fan is typically operated below its nominal voltage design in order to maximize fan life. Status line goes low when the fan is on.
- **High Voltage Fault.** Indicates there is a high voltage fault within the amplifier. Status line goes low when fault occurs. A high voltage fault is typically an indication of a serious power supply failure.
- **Fan ON High.** Indicates that the TWT has heated up to the point that the fan must run at its nominal rated voltage. Status line goes low for this condition. This is not a fault condition. The fan is expected to operate on high during elevated ambient temperature conditions.
- **Summary Fault.** Indicates there is a fault within the amplifier. Status line goes low when fault occurs.
- **Fan Lock.** Indicates that the fan is locked. A fan lock signal is caused by either a fan failure or some object interfering with the rotation of the fan. Status line goes low when fault occurs.

### Status, Analog

- **RF Output Power.** This is an amplifier option. The output power of the amplifier may be determined by monitoring this voltage and referring to the chart in Figure 2-7.
- **Helix Current.** The TWT's helix current may be determined by monitoring this voltage. There is 2 mA of helix current for each volt measured.
- **High Voltage Monitor.** The high voltage applied to the TWT may be determined by monitoring this voltage. The high voltage is divided down so that one volt output equals 1,000 volts.
- **TWT Temperature.** The TWT's collector temperature may be determined by monitoring this voltage and referring to the chart in Figure 2-8.

### Initial Turn-On

The check list below should be followed to ensure proper operation of the amplifier and to avoid permanent damage to the amplifier.





Failure to observe any of the following instructions may cause permanent damage to the amplifier and will void the warranty.

### Pre-Power Check

1. The prime power voltage needs to be within the specified limits of the amplifier (Table 1-6).
2. If the amplifier is installed within an enclosure, the exhaust air from the amplifier should be ducted to the outside of the cabinet so that the warm air is not recirculated into the amplifier's air intake.
3. The RF output is terminated with a load capable of dissipating 200 Watts CW. This load has a maximum VSWR of 2.2:1.
4. The RF drive signal is within the frequency range of the amplifier's specification and does not exceed by more than 2 dBm the input power required to the TWT saturation point.



EXCEEDING THE INPUT POWER LIMIT WILL CAUSE A HELIX CURRENT FAULT AND MAY PERMANENTLY DAMAGE THE TWT.

### Turn-On Sequence

The pin numbers referenced in this section apply to connector J1, the interface connector.

1. Connect *Pin a* to ground. This applies prime power to the TWT power supply. Wait until the heater time delay cycle is complete (*Pin G* goes low).
2. Connect *Pin F* to ground. This turns High Voltage ON. The High Voltage ON status line (*Pin K*) goes low.
3. Turn on the test RF signal source. Slowly increase the drive power to the amplifier. Monitor the RF output power through the amplifier's built-in power sampler or through an external coupler.



Driving the TWT by more than 2 dBm beyond the input power required to reach the saturation point may cause permanent TWT damage.

### Turn-Off

There are three shut down modes:

1. **High Voltage OFF, heater at full power.** If the TWTA is to be deactivated for a short time (a few minutes to an hour), turn High Voltage OFF by disconnecting *Pin F* from *Pin W*.

2. **High Voltage OFF, heater in standby mode.** If the TWTA is to be shut down for a few hours and quick turn ON is required, disconnect *Pin F* from *Pin w* and connect *Pin J* to *Pin W*. This places the TWTA is heater standby mode.
3. **TWTA OFF.** If the TWTA is to be shut down for an extended period, disconnect *Pin a* from *Pin W*. This will totally deactivate the TWT and allow the TWT heater to cool.

## CHAPTER 4: MAINTENANCE & SERVICE

### Preventative Maintenance

Periodically the exterior of the amplifier should be inspected and cleaned. The inspection should include:

1. The integrity of the mounting bolts. Tighten as necessary.
2. The integrity of the output waveguide flange mounting bolts. Tighten as necessary.
3. The integrity of the input connections and the interconnecting cables.
4. The air inlet and exhaust ports. Make sure that there is no debris such as insect nests, leaves, straw, etc. that obstruct the air inlet ports. Use high pressure air to blow dust and debris out of the Lower Deck cover.

Depending upon the operating environment, and at least annually, the Lower Deck Cover should be removed per the procedure presented later in this chapter. Inspect the cooling fins for accumulated dirt and debris. Use high pressure air to blow dust and debris out of the Lower Deck cover. After completion of the cleaning operation, check the integrity of the Electrical connections and then replace the Lower Deck cover.

### Remove Lower Deck Cover

Proceed as follows:

- a. Disconnect prime power from the amplifier (Connector J2).
- b. Remove the 12 #6-32 self-locking mounting screws. Save the screws for reuse.
- c. Remove the Lower Deck cover and disconnect the cable from the cover's EMI filter.

### Service and Repair

Special training, procedures, and test equipment are required to service the power amplifiers. Do NOT attempt to service the unit unless you are qualified to repair XICOM TECHNOLOGY XT-50, XT-80, and XT-100 series power amplifiers.

## Return Authorization

Before returning the amplifier, obtain a Returned Material Authorization Number (RMA) by contacting XICOM TECHNOLOGY:

Phone: (408) 213-3000

Fax: (408) 213-3001

In all applicable correspondence, please refer to the amplifier by both its model number and serial number. Please use the following shipping address for all returned products:

**XICOM TECHNOLOGY**

3550 Bassett Street

Santa Clara, CA 95054

RMA # \_\_\_\_\_

## Re-Shipment

It is best to reship the amplifier in its original packing; however, if the original packing is not available, use wooden boxes or double layer corrugated boxes. Make sure that there is adequate packing material between the amplifier and the outside box. Seal the container with heavy packing tape or metal bands. Mark the shipping container with the words *FRAGILE, DELICATE INSTRUMENT*, etc. in several locations.