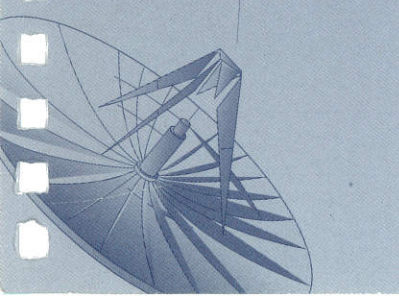


**OPERATION AND INSTALLATION MANUAL
XTRD-500, XTRD-700, AND XTRD-750
RACK-MOUNT TWT POWER AMPLIFIERS**



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XTRD-500, XTRD-700, AND XTRD-750
RACK-MOUNT TWT POWER AMPLIFIERS**

**Document No. 802-0114-001
Revision D
May 1999**

xicom
TECHNOLOGY

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Printing History

Edition	Date	Document Number
Edition 4	5/03/99	802-0114-001 Rev. D
Edition 3	12/15/98	802-0114-001 Rev. C
Edition 2	9/23/98	802-0114-001 Rev. B
Edition 1	6/12/98	802-0114-001 Rev. A

High Voltage Hazards

This amplifier uses 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

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

Safety Summary

Equipment of this nature has inherent hazards. Operator or service technicians should have training on Xicom Technology's rack-mount TWT 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.

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Related Documentation

802-0008-002, *User Guide, Xicom Technology Digital M&C System*
802-0103-001, *Command Set & Protocol Manual High Power Amplifiers
& Controllers*

CHAPTER 1: GENERAL DESCRIPTION

Overview

Xicom Technology's programmable, microprocessor controlled XTRD-500, XTRD-700, and XTRD-750 power amplifiers are designed to be rack or bench mounted. Each amplifier consists of a Traveling Wave Tube (TWT), a solid state amplifier, filtering to reduce the level of harmonics and noise power in the receive band, a power monitor, a TWT power supply, a programmable Monitor and Control (M&C) system, dual remote control interfaces (COM1 and COM2), and an internal forced air cooling system.

(For power amplifier operating instructions, refer to Document No. 802-0008-002, User Guide, Xicom Technology Digital M&C System.)

For a brief description and typical block diagram, see the table and figure below.

Table 1-1. Models Available

Model Name	Frequency Range	Band	Rated Power @ HPA Flange
XTRD-500DBS	17.3-18.5 GHz	DBS-Band	415 Watts (17.3-18.1 GHz) 380 Watts (18.1-18.4 GHz)
XTRD-500X	7.9-8.4 GHz	X-Band	500 Watts
XTRD-700X	7.9-8.4 GHz	X-Band	625 Watts
XTRD-750C	5.85-6.425 GHz	C-Band	650 Watts
XTRD-750K	13.75-14.5 GHz	Ku-Band	650 Watts

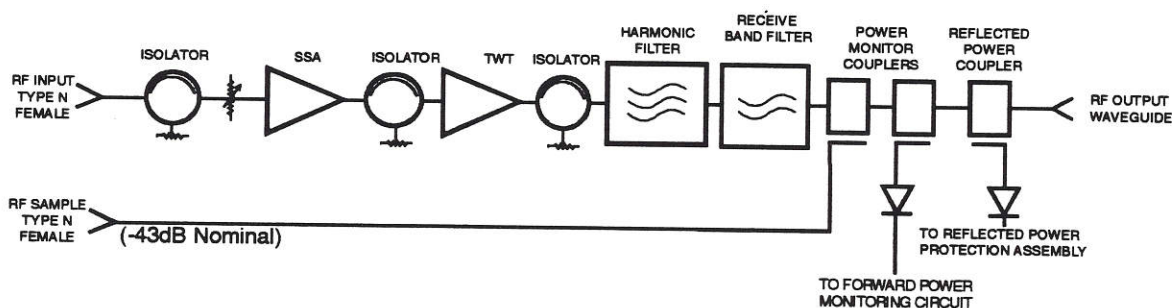


Figure 1-1. TWT Block Diagram

Control and Status Interface

The amplifier is controlled from the Front Panel (Local Control) or via a Remote Control Interface connector. The controls, monitors, and status indicators available for Remote Control operation are described in Chapter 2. Table 1-2 summarizes the interface specifications.

Table 1-2. Interface Specifications

Parameter	Specifications
PRIME POWER, STANDARD	180-260 VAC, 1Ø 47 to 63 Hz 2450 VA Maximum 0.95 Minimum Power Factor
CONTROLS <i>Local</i>	Programmable via Keypad Manual RF Gain HV ON/OFF
<i>Remote</i>	Programmable via Serial Interface (COM1 and COM2) RF Inhibit (Summary Fault Connector) External Interlock (Summary Fault Connector)
STATUS INDICATORS <i>LED</i>	<i>Local</i> Power, AC Filament Time Delay (FTD) High Voltage State Heater Standby (STBY) Local Mode Remote Mode Summary Fault
<i>Local Digital</i>	Multi-line Digital Display, All relevant M&C parameters
<i>Remote</i>	All relevant M&C parameters via digital serial interface. Auxiliary Interface 1 (Auxiliary Interface Connector) Auxiliary Interface 2 (Auxiliary Interface Connector)
MONITOR, Analog (Local and Remote)	+15 VDC (Auxiliary Interface Connector)
OUTPUT VOLTAGES	+24 VDC (Auxiliary Interface Connector)
RF SAMPLE PORT* (Type N Jack)	-43 dB Nominal -40 dB Nominal (XTRD-500DBS only)

*Located on amplifier front panel. An option is available to locate this connector on the amplifier rear panel.

Performance Specifications

Performance specifications are summarized in Tables 1-3, 1-4, and 1-5. Tables 1-6 and 1-7 summarize the physical characteristics and environmental specifications, respectively.

Table 1-3. XTRD-500DBS, Performance Specifications

Parameter	XTRD-500DBS, DBS-Band Specifications
FREQUENCY RANGE	17.3 to 18.4 GHz
OUTPUT POWER, TWT @ Amplifier Flange	500W(17.3-18.1); 450W(18.1-18.4) 415W(17.3-18.1); 380W(18.1-18.4)
GAIN Small Signal, Minimum Large Signal, Minimum Attenuator Range (continuous) Maximum SSG Variation Over Any Narrow Band Full Band Slope, Maximum Stability, 24 Hr Maximum Stability, Temperature	70 dB 65 dB 25 dB 1.0 dB per 80 MHz band 4.0 dB ± 0.04 dB/MHz ± 0.25 dB ± 1.0 dB maximum over operating temperature range at any frequency
INTERMODULATION	-16 dBc maximum with two equal carriers at 4 dB total output backoff
HARMONIC OUTPUT, Maximum	-60 dBc
AM to PM CONVERSION, Maximum	2.5° dB at 6 dB below rated power
NOISE POWER, Maximum Transmit Band Receive Band	-70 dBw/4 KHz -150 dBw/4 KHz 12.20 to 12.75 GHz
GROUP DELAY, Maximum Bandwidth Linear Parabolic Ripple	Any 80 MHz 0.01 nsec/MHz 0.005 nsec/MHz ² 0.5 nsec 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
PHASE NOISE, Maximum	10 dB below IESS phase noise profile AC fundamental -50 dBc Sum of all spurs -47 dBc
VSWR, Maximum Input Output	1.3:1 1.3:1

Table 1-4. XTRD-500X and XTRD-700X Performance Specifications

Parameter	Specifications	
	XTRD-500X, X-Band	XTRD-700X, X-Band
FREQUENCY RANGE *extended frequency coverage available	7.9 to 8.4 GHz	7.9 to 8.4 GHz
OUTPUT POWER Traveling Wave Tube Rated Power @ HPA Flange	550 Watts 500 Watts	700 Watts 625 Watts
GAIN Large Signal, minimum Small Signal, minimum Attenuator Range (continuous) Maximum SSG Variation Over: Any Narrow Band Full Band Slope, maximum Stability, 24 Hr maximum	70 dB 75 dB 25 dB 1.0 dB per 40 MHz 3.0 dB ± 0.04 dB/MHz ± 0.25 dB	70 dB 75 dB 25 dB 1.0 dB per 40 MHz 3.0 dB ± 0.04 dB/MHz ± 0.25 dB
GAIN Stability, Temperature	± 1.0 dB maximum over temperature range at any frequency	
INTERMODULATION	-18 dBc maximum with two equal carriers @ 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	
NOISE POWER, maximum Transmit Band Receive Band	-70 dBw/4 KHz -150 dBw/4 KHz 7.25 to 7.75 GHz	-70 dBw/4 KHz -150 dBw/4 KHz 7.25 to 7.75 GHz
GROUP DELAY, maximum Bandwidth Linear Parabolic Ripple	Any 40 MHz 0.01 nS/MHz 0.005 nS/MHz ² 0.5 nS Pk-Pk	Any 40 MHz 0.01 nS/MHz 0.005 nS/MHz ² 0.5 nS Pk-Pk
RESIDUAL AM NOISE, maximum	-50 dBc to 10 KHz -20 (1.5+log _f) 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	
VSWR, maximum Input Output	1.3:1 1.3:1	1.3:1 1.3:1

Table 1-5. XTRD-750C and XTRD-750K Performance Specifications

Parameter	Specifications	
	XTRD-750C, C-Band	XTRD-750K, Ku-Band
FREQUENCY RANGE *extended frequency coverage available	5.850 to 6.425 GHz	13.75 to 14.5 GHz
OUTPUT POWER Traveling Wave Tube Rated Power @ HPA Flange	750 Watts 650 Watts	750 Watts 650 Watts
GAIN Large Signal, minimum Small Signal, minimum Attenuator Range (continuous) Maximum SSG Variation Over: Any Narrow Band Full Band Slope, maximum Stability, 24 Hr maximum	70 dB 75 dB 25 dB 1.0 dB per 40 MHz 2.5 dB ± 0.04 dB/MHz ± 0.25 dB	70 dB 75 dB 25 dB 1.0 dB per 80 MHz 2.5 dB ± 0.04 dB/MHz ± 0.25 dB
GAIN Stability, Temperature	± 1.0 dB maximum over temperature range at any frequency	
INTERMODULATION with two equal signals	-18 dBc maximum with two equal carriers @ 4 dB total output backoff -28 dBc with optional linearizer	
HARMONIC OUTPUT, maximum	-60 dBc	-60 dBc
AM TO PM CONVERSION, maximum	2.5°/dB at 6 dB below rated power	
NOISE POWER, maximum Transmit Band Receive Band	-70 dBw/4 KHz -150 dBw/4 KHz 3.7 to 4.2 GHz	-70 dBw/4 KHz -150 dBw/4 KHz 10.95 to 12.75 GHz
GROUP DELAY, maximum Bandwidth Linear Parabolic Ripple	Any 40 MHz 0.02 nS/MHz 0.005 nS/MHz ² 0.5 nS Pk-Pk	Any 80 MHz 0.01 nS/MHz 0.005 nS/MHz ² 0.5 nS Pk-Pk
RESIDUAL AM NOISE, maximum	-50 dBc to 10 KHz -20 (1.5+log _f) 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	
VSWR, maximum Input Output	1.3:1 1.3:1	1.3:1 1.3:1

Table 1-6. Physical Characteristics

Parameter	Value	
Length (Maximum)	60.96 cm	(24.00 inches)
Width (Less brackets)	43.18 cm	(17.00 inches)
Height (Maximum)	17.78 cm	(7.00 inches)
Unit Weight(Typical)	34.5 kg	(75 pounds)
Shipping Weight (Typical)	39 kg	(85 pounds)
RF Input	Type N	female
RF Output Sample	Type N	female
RF Output	CPRG-112 WR-112 WR-62 CPR-137G WR-75	X-Band X-Band DBS-Band C-Band Ku-Band
Remote Control Connectors (Two)	DB-9	Male
Auxiliary Interface Connector	DB-15	male

Table 1-7. Environmental Specifications

Parameter	Specifications
Non-operating Temperature Range	-50°C to +70°C
Operating Temperature Range	-10°C to +50°C
Humidity	Up to 95% Non-condensing
Altitude	10,000 feet MSL maximum
Shock and Vibration	Normal transportation
Cooling	Forced air 275 CFM (typical)

CHAPTER 2: INSTALLATION

Unpacking and Inspection

Inspect the inside of the shipping container for signs of damage. If any shipping damage is detected, call the shipping carrier and submit a damage report.

Unpacking

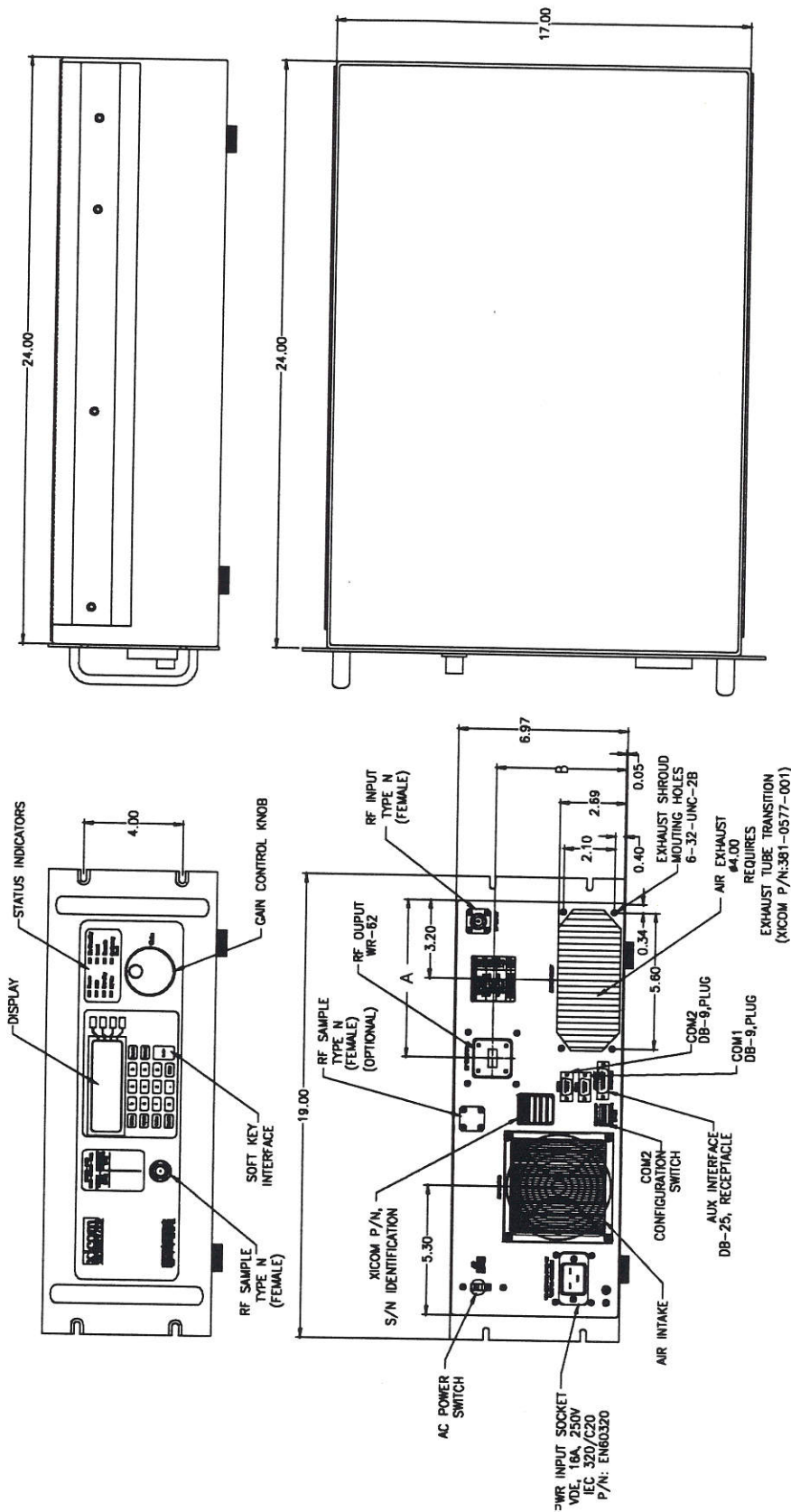
Compare the packing list to the contents of the container to be certain that all enclosed material has been received. Save all data sheets. They will be useful during any maintenance actions. Save the packing material and use it if you need to reship the unit.

Inspection

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 amplifier can be rack or bench mounted. Removable rubber feet are attached to the bottom to support the unit on any flat surface. Since the unit is relatively light, drawer slides are not required. For rack installations, the unit is mounted on angle brackets. Removable angle brackets are included with the unit to mount the amplifier in a standard 19-inch rack.



Frequency Band	Dimensions (Inches)	
	A	B
DBS-Band	6.48	5.34
X-Band	6.00	4.80
C-Band	6.00	4.80
Ku-Band	6.00	4.80

Figure 2-1. Amplifier Outline Drawing

Cabinet Slide Assembly Installation

The amplifier is equipped with a pair of 22 inch drawer slides (Figure 2-2). These slides mate with a pair of cabinet slide assemblies mounted in a standard 19 inch rack (cabinet).

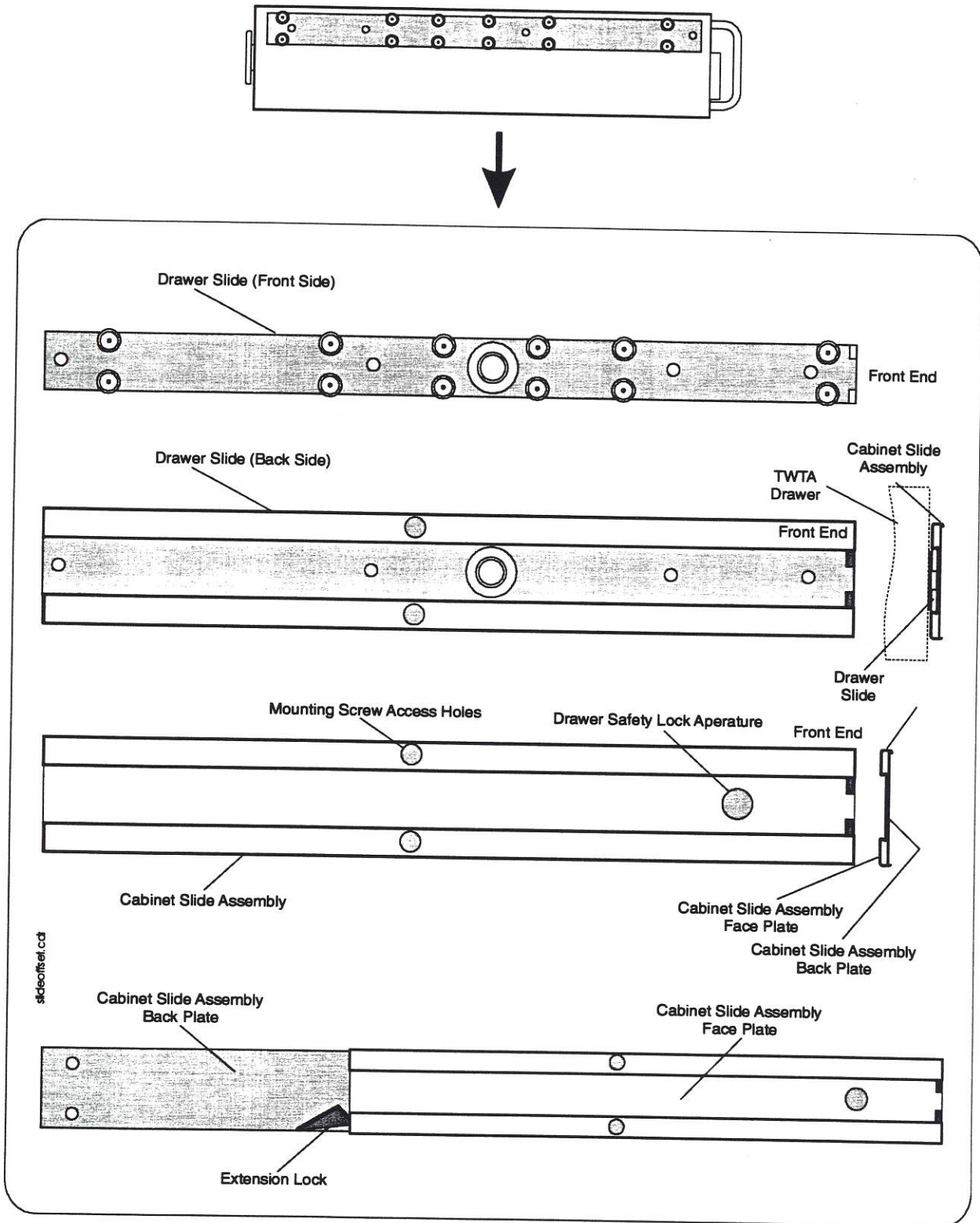


Figure 2-2. Slide Assemblies

The chassis slide assemblies are mounted to the cabinet with adjustable mounting brackets as illustrated in Figure 2-3.

NOTE

Two chassis slide assemblies, four mounting brackets, four nutplates, and mounting screws are supplied with the amplifier.

The specific installation details are dependent upon the cabinet design. Two front mounting brackets (three inches long) and two back mounting brackets (nine inches long) are supplied.

If the front bracket is mounted on the face of the cabinet mounting rail, the combination of the bracket and the bracket mounting screw will not allow the drawer front panel to be flush with the cabinet mounting rail. Therefore, it is preferable to locate the front mounting bracket to the front rail in a way that does not interfere with the drawer front panel.

The right and left cabinet slide assemblies are identical. These assemblies are equipped with an extension lock. When installed the extension lock will be on the bottom edge of the right side cabinet slide assembly and the top edge of the left side assembly. The extension locks, which are mounted on the cabinet slide assembly back plate, must be held against the edge of the cabinet slide assembly backplate to allow the faceplate to move past the lock. To facilitate one-handed release of the locks, it is recommended that the left cabinet slide assembly be offset 3/8 inches toward the cabinet back from the position of the right side cabinet slide assembly (see Figure 2-3).

The following procedures assume installation in a standard cabinet assembly.

1. Verify that the cabinet will accept the TWTA drawer assembly. Refer to Figure 2-1 for mounting dimensions.
2. Verify that any equipment directly beneath the TWTA will not subject the bottom of the TWTA chassis to significant heating above the temperature of the local ambient air.
3. Define a front bracket mounting method.
4. The front end of the cabinet slide assembly is the end with the large hole in the center of the face plate. Attach front and back cabinet slide assembly bracket to each cabinet slide assembly. Do not tighten the mounting screws (two at each end) at this time. The short leg of the mounting brackets points away from the cabinet slide assembly back plate.
5. Install the adjustable rack slide assemblies in the desired location on the rack. The longer of the two mounting brackets should be located at the rear of the rack to minimize the distance from the front of the rack to the extension lock.
6. Tighten the mounting bracket screws.
7. Insert the amplifier slides into the center channel of the rack slide assembly and secure the amplifier to the rack with rack mounting screws and washers. (Front panel mounting screws and washers are not supplied with the unit.)

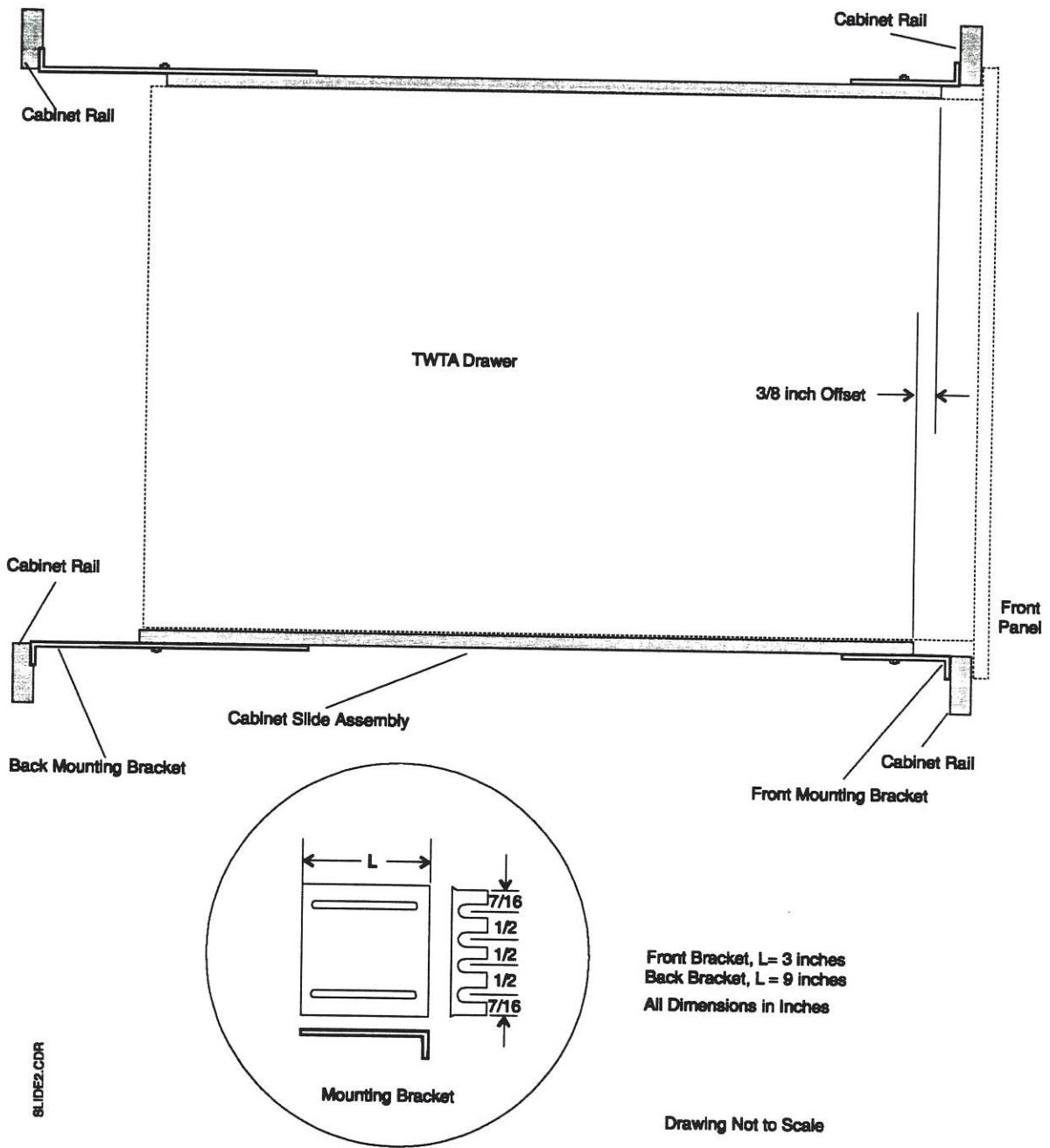


Figure 2-3. Cabinet Slide Assembly Mounting Details

Waveguide Connection

The RF output waveguide port is located on the rear panel of the amplifier. Ensure that the proper matching waveguide flange is used to connect the amplifier output to the RF load.

Position the interconnecting waveguide flange with the amplifier waveguide flange. Make sure that the flanges can be mated without strain or torsion.

1. 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.
2. Insert any necessary gaskets and windows between the two flanges.

NOTE

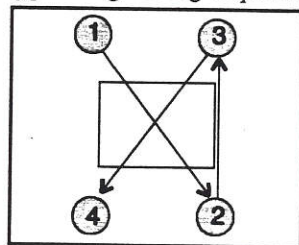
If the connecting waveguide is to be pressurized at greater than 5 psi, a waveguide window must be installed at the output flange of the amplifier. Use an absorptive-type gasket to preclude radiation leakage.

3. Tighten all mounting screws with the appropriate size Allen wrench. A typical sequence is indicated by the numbers in the grayed areas of Figure 2-4. 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. When you reach the first screw tightened in step A (#1) increase the torque on the screw and repeat the process of steps (B) through (D) until the screws have all been tightened to the desired torque. Typical torque levels are included in Figure 2-4.

CAUTION

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

Typical Tightening Sequence



Typical Torque Values

10-32	30 inch-lb
6-32	8.5 inch-lb

Figure 2-4. Typical Tightening Pattern

Air Ducting

The TWTA is cooled with an internal fan. Heated exhaust air should not be recirculated into the TWTA. The air intake and exhaust ports are located on the rear panel of the amplifier (Figure 2-5). A clearance of six to eight inches is recommended to allow the heated exhaust air to clear the TWTA.

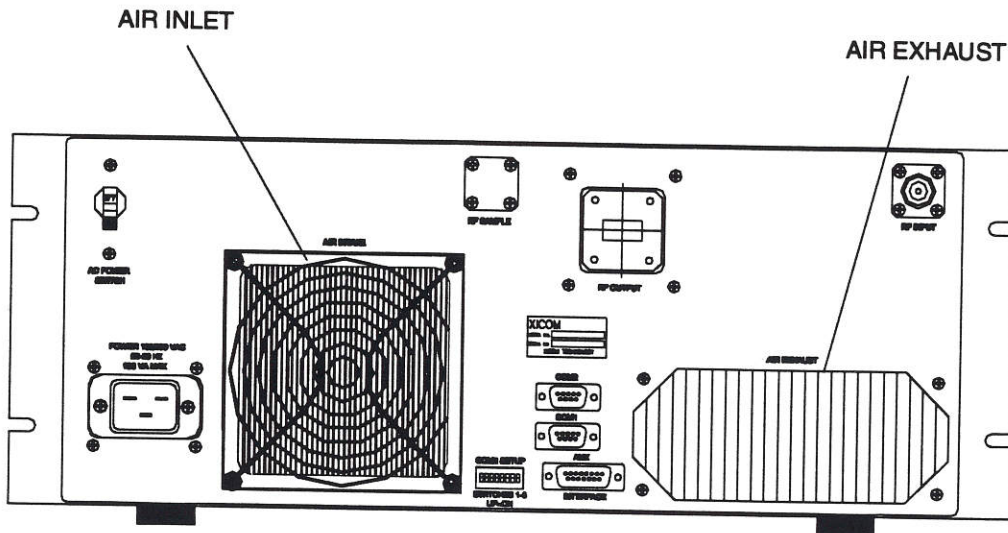


Figure 2-5. Amplifier Rear Panel

If the unit is installed in a closed cabinet or in a configuration that would tend to divert or block the exhaust air, provisions should be made to isolate the exhaust air from the intake air supply.

The Exhaust Port Guard can be removed (four screws) and replaced with a four inch air duct to carry the exhaust away from the TWTA. This air duct, which is part number 381-0571-001, is available from Xicom Technology.

Prime Power Connections

The AC Prime Power receptacle is located on the amplifier rear panel (Figure 2-6). Nominal line voltage required is 180 to 260 VAC, 47-63 Hz, single phase. Use an IEC 320, C-19 cable plug for the AC Power cable that connects the power amplifier to prime power.

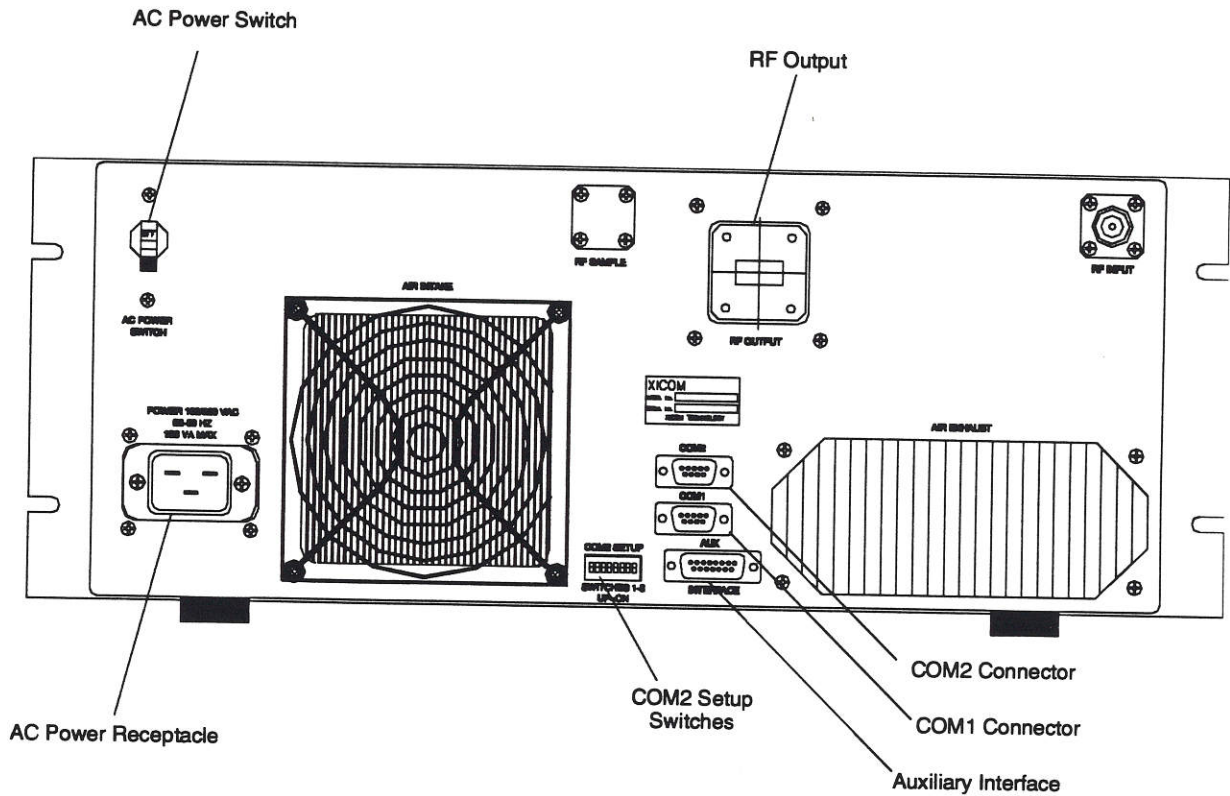


Figure 2-6. Prime Power Connections

Serial Interface Ports

Dual serial interface connectors (COM1 and COM2), located on the rear panel of the amplifier are available for remote control operation (Figure 2-9). Both serial interface ports are always enabled. The amplifier will respond to commands from either interface. The last command received has precedence.

COM1 is an RS-232 only serial interface. Pinouts for COM1 are shown in Figure 2-9. No switch settings are required for COM1.

COM2 can be configured (with the set of dip switches on the rear panel) as an RS-485 2-wire serial interface or as an RS-485 4-wire serial interface. Pinouts for COM2 are shown in Figure 2-10 (RS-485).

The COM2 Setup Switches (Figure 2-6) are used to configure the COM2 serial interface. Switches 1, 3, and 4 are used for COM2 setup. Switches 2, 5, 6, 7, and 8 are not used.

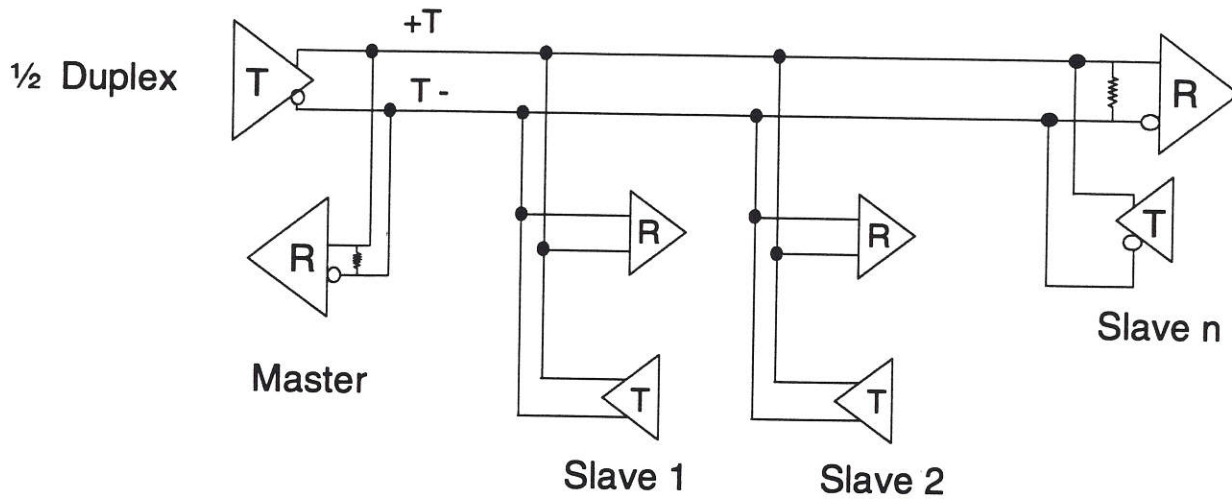
Table 2-1 lists the settings for the COM2 Setup Switches.

Table 2-1. COM2 Switch Settings

Switch Number	Function
1	Termination for RS-485/422 BUS
2	Not used
3	Sets Two Wire Mode for RS-485/422*
4	Sets Four Wire Mode for RS-485/422*
5	Not used
6	Not used
7	Not used
8	Not used

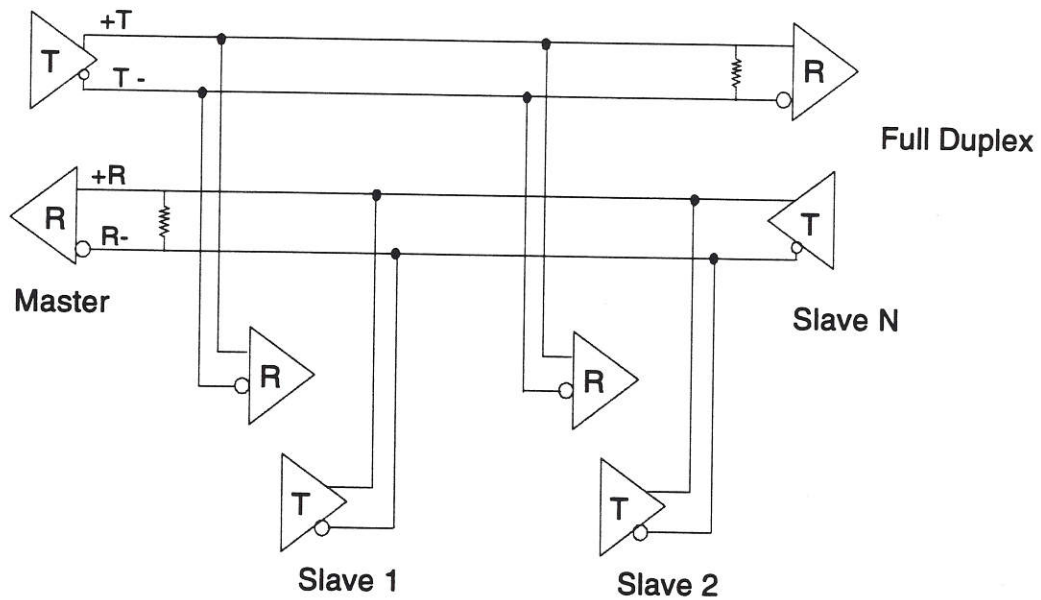
* NEVER SWITCH #3 & #4 ON AT THE SAME TIME

RS-485/422 Theory of Operation



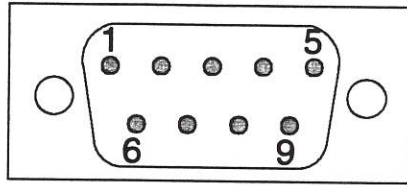
First and last device on chain should be terminated.

Figure 2-7. Two Wire RS-485 Implementation



First and last device on chain should be terminated.

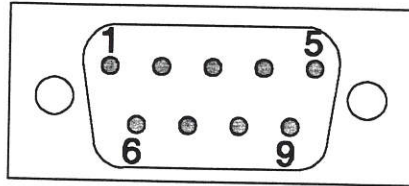
Figure 2-8. Four Wire RS-485 Implementation



DB-9, Male Connector, Front View

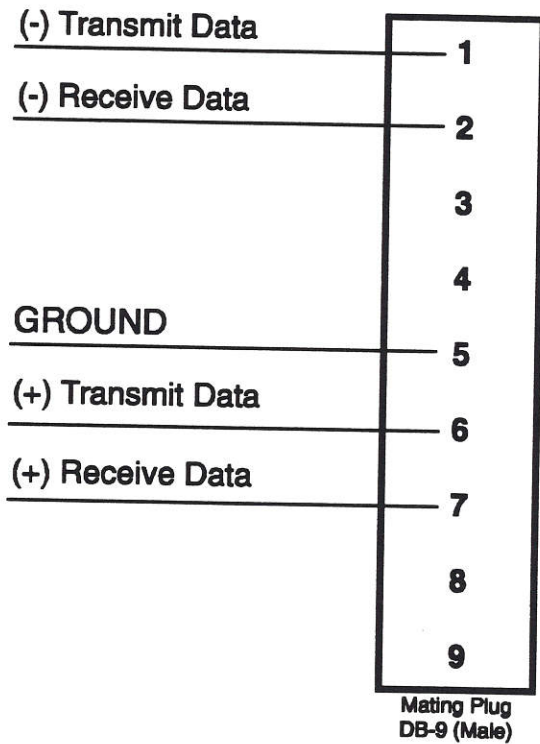
Pin No.	RS-232 Function
1	No Connection
2	RXD—Received Data (from Controller)
3	TXD—Transmitted Data (to Controller)
4	No Connection
5	Ground and Signal Return
6	DSR—Data Send Ready (Controller)
7	RTS—Request to Send (Amplifier)
8	CTS—Clear to Send (Amplifier)
9	No Connection

Figure 2-9. RS-232 Pinouts, COM1

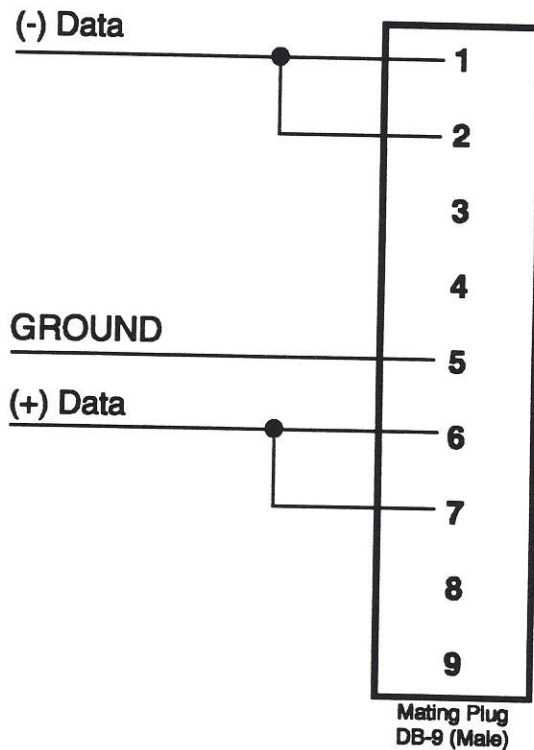


DB-9, Male, Front View

**Mating Plug Connections
for Four-Wire RS-485 System**



**Mating Plug Connections
for Two-Wire RS-485 System**



485FPIN.CDR

Amplifier address for RS-485 operation is entered via the Setup Menu.

Figure 2-10. RS-422/RS-485 Pinouts, COM2 Only

Auxiliary Interface Connector

The Auxiliary Interface provides the following interfaces for the customer's use:

- Two sets of Form 'C' Relay contacts for Summary Fault Indication
- External Interlock Input
- RF Inhibit Input
- 24 VDC @100mA
- ± 15 VDC for monitoring purpose only. The pinout of the Auxiliary Interface connector is shown in Figure 2-11.

External Interlock

The External Interlock (Pin 13) must be shorted to the External Interlock Return (Pin 11) for the amplifier to operate. Removing the short causes an External Interlock fault and turns off High Voltage.

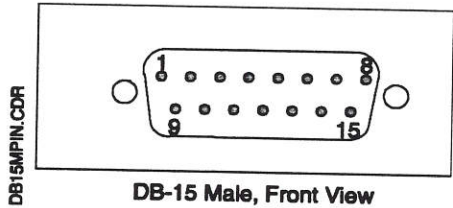
RF Inhibit

In factory default configuration, RF is inhibited when RF Inhibit (Pin 12) is shorted to Ground (Pin 9 or 10). The amplifier inhibits RF by removing the RF drive to the tube. The amplifier can be factory configured, upon customer request, to inhibit when the short to ground is removed. The amplifier can also be factory configured to turn off High Voltage to inhibit RF.

Grounding

WARNING!

The amplifier should be securely grounded for personnel and equipment safety.



Pin No.	Auxiliary Interface Function	Comments
1	(+)24 VDC	Available for external use.
2	(+)24 VDC	Current limit of 100 mA.
3 (Note 1)	Summary Fault 1	Normally Open. Closes when fault occurs.
4	Summary Fault 1	Normally Closed. Opens when fault occurs.
5	Summary Fault 1	Common, Fault 1
6	Summary Fault 2	Common, Fault 2
7 (Note 2)	Summary Fault 2	Normally Open. Closes when fault occurs.
8	Summary Fault 2	Normally Closed. Opens when fault occurs.
9	Ground	
10	Ground	
11	External Interlock Return	Pin 11 must be connected Pin 13 to enable High Voltage ON
12	RF Inhibit	Connect Pin 12 to Pin 9 or 10 to inhibit RF Output,
13	External Interlock	Pin 13 must be connected Pin 11 to enable High Voltage ON
14	+15 VDC	Monitor Only
15	-15 VDC	Monitor Only

Note 1: Pins 3, 4, 5 –Form C contacts. Fault 1, Summary Fault.

Note 2: Pins 5, 6, 7 –Form C contacts. Fault 2, Summary Fault (Used for redundant systems)

Figure 2-11. Auxiliary Interface Connector Pinouts

Optional Rear Panel

An option is available to locate the RF Sample Connector on the amplifier rear panel (standard location is the front panel). The optional configuration is shown in Figure 2-12.

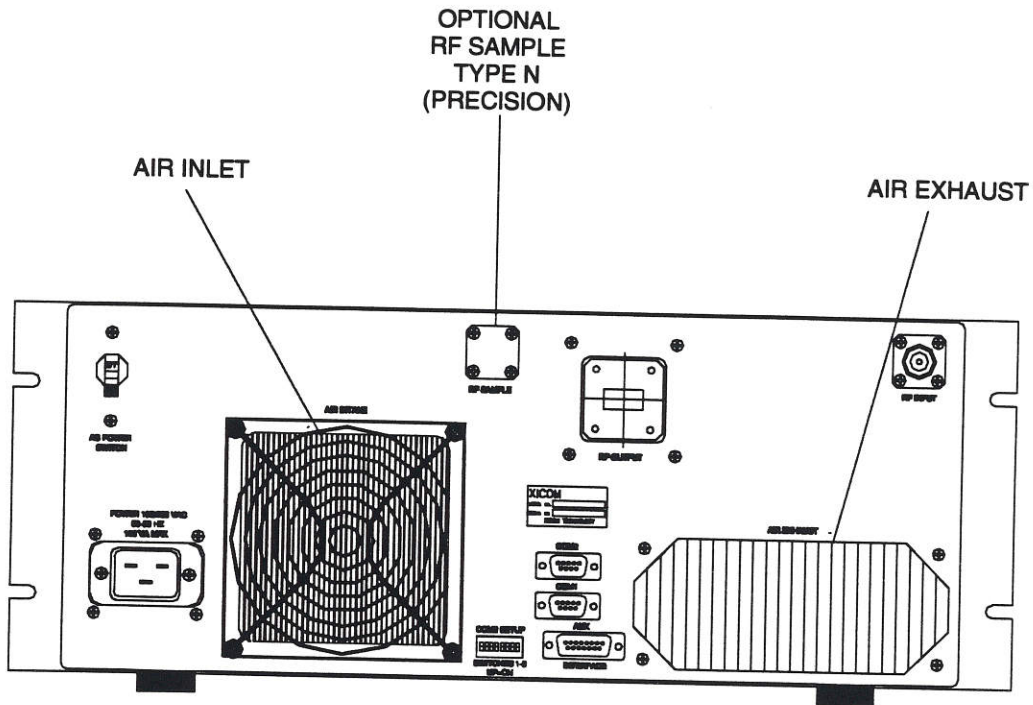


Figure 2-12. Optional Rear Panel

CHAPTER 3: MAINTENANCE AND SERVICE

Preventative Maintenance

When performing periodic preventative maintenance operations, refer to Figure 3-1.

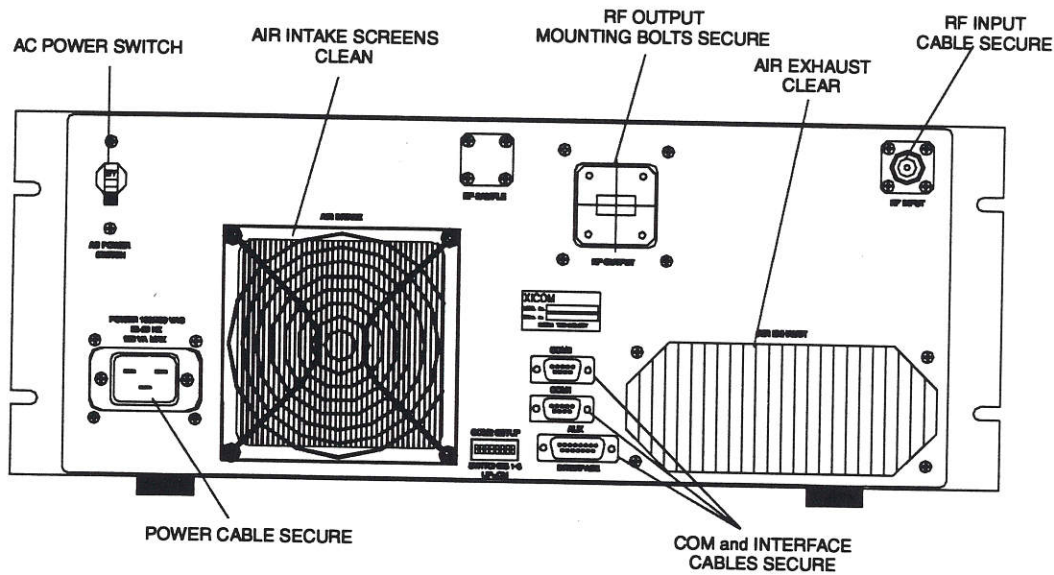


Figure 3-1. Preventative Maintenance Checkpoints

Proceed as follows:

1. Check the integrity of the output waveguide flange mounting bolts. Tighten as necessary.
2. Check the integrity of the RF input cable connected to the Rear Panel.
3. Check the air inlet and exhaust ports for cleanliness. If the air filter is dirty:
 - A. Remove the four screws of the filter guard.
 - B. Remove the air filter.
 - C. Using low pressure air, blow out the dust in the air filter.
 - D. Reinstall the air filter.
 - E. Reinstall the filter guard (four screws).
4. Clean the Front Panel as required with a soft, damp cloth.
5. If a Remote Controller is included in the system, check the integrity of the interconnecting cable and connectors.
6. Check the AC Power Cable for signs of damage and replace as required.

Service and Repair

Special training, procedures, and test equipment are required to service Xicom Technology's rack-mount TWT power amplifier. Do NOT attempt to service the unit unless you are qualified to repair the power amplifier.

Return Authorization

Before returning the amplifier, obtain a Returned Material Authorization (RMA) number by contacting Xicom Technology:

Tel: (408) 481-3000

Fax: (408) 481-3001

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
955 Stewart Drive
Sunnyvale, CA 94086

RMA # _____

Reshipment

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 **FRAGILE, DELICATE INSTRUMENT** in several locations.