



XPA-200

Solid-State High Power Amplifier
Installation and Operation Manual



Errata A

Comtech EFData Documentation Update

Subject: Various Changes

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Document: XPA200-7984-I-OPT1, X-Band SSPA Installation and Operation Manual, Rev. 2

Part Number:

Collating Instructions: Attach these pages at the beginning of the manual.

Comments:

The following changes provide updated information. This information will be incorporated into the next revision.

Change Specifics:

1. Section 3.3.2.1 should be amended to include (amendments or changes in bold):

```
. . .
EXT  mute on from external J4 control (see section 1)
ON   muted by M&C control or via remote control
```

2. Section 5.8.2.2 should be amended to include (amendments or changes in bold):

```
. . .
Confirmation:      >DEV/MUT_XXX'cr'lf']
```

Note: On Status queries, the 'MUT' command may also return **EXT** (mute on from external J4 control) or **INH** (mute on or inhibited by Mitec 2723B via J5).

3. Section 5.8.3.1 should be amended to include (amendments or changes in bold):

```
. . .
TX_nnn'cr'          Transmit - ON/OFF/EXT/INH
. . .
```

4. Section 5.8.3.5 should be amended to include (amendments or changes in bold):

```

. . .
+10_2_xx'cr'          +10 PS#2 Fault
SHTD_xx'cr'        Thermal Shutdown
. . .

```

Note: A temperature fault is indicated if the unit is less than -20C or more than 85 degrees C. This creates a summary fault and will cause the unit to mute itself and switchover to the back-up unit. However, the 10V supply to the FET transistors will remain on until the unit reaches the thermal shutdown temperature of 90 degrees C or above. For protection reasons, the unit will shutdown the 10V supply to the power transistors at temperatures at or above 90 degrees C.

5. Section 5.8.3.8 should be amended to include (amendments or changes in bold):

```

. . .
Confirmation:          >DEV/PACRCS_aabcde'cr''lf']

```

where: aa = # of 0.25 dB steps in HEX above 0dB (0to120)
 b = 1 if Amplifier ON, 0 if OFF
 c = 1 if Tx ON, 0 if OFF, **2 if external mute command, 3 if external inhibit command**
 d = 1 if unit ONLINE, 0 if OFFLINE
 e = **1 if Auto Recovery enabled, else 0**

6. Section 5.8.3.9 should be amended to include (amendments or changes in bold):

```

. . .
iii = RF forward pwr, .1 dBm steps above 26.0 dBm in Hex
jjj = RF reverse pwr, .1 dBm steps above 19.0 dBm in Hex

```

7. Section 5.8.3.12 should be amended to include (amendments or changes in bold):

```

. . .
Confirmation:          >DEV/PACRAS_abcdefghijkl'cr''lf']

```

```

. . .

```

```

g = 1 if +10 PS#2 Fault, else 0
h = 1 if TEMP Fault, else 0
i = 1 if Thermal Shutdown, else 0
j = 1 if FAN 1 Fault, else 0
k = 1 if FAN 2 Fault, else 0
l = 1 if PROC Fault, else 0

```



Note: A temperature fault is indicated if the unit is less than -20C or more than 85 degrees C. This creates a summary fault and will cause the unit to mute itself and switchover to the back-up unit. However, the 10V supply to the FET transistors will remain on until the unit reaches the thermal shutdown temperature of 90 degrees C or above. For protection reasons, the unit will shutdown the 10V supply to the power transistors at temperatures at or above 90 degrees C.

POLICY

WARRANTY

This COMTECH Product is warranted against defects in material and workmanship for a period of one year from the date of shipment. During the warranty period, COMTECH will, at it's option, repair or replace products which prove to be defective. For warranty service, the product must be returned to COMTECH, all shipping charges prepaid by the buyer. COMTECH will pay shipping charges to return repaired, or replaced, products shipped by normal surface delivery within the continental U.S..

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Preface

Manual

This manual describes the installation, operation and maintenance for the XPA200-7984-I 200 watt X-Band Solid State High Power Amplifier (SSPA).

Intended Users

This is a technical document intended for satellite earth station engineers, technicians and operators responsible for the installation, operation and maintenance of the XPA200-7984-I X-Band SSPA.

Organization of Manual

This manual includes the following chapters:

- Section 1 - describes the purpose, function, description, options and systems specifications of this product.
- Section 2 - describes the unpacking, installation and and brief operating instructions for use with the Mitec 2723B Variable Phase Combiner and Redundancy Switching System.
- Section 3 - describes the system operation.
- Section 4 - describes the redundant system operation.
- Section 5 - describes the remote control operation.
- Section 6 - describes the maintenance and troubleshooting procedures.

Manual Revision Numbering Scheme

The following table identifies the revision numbering scheme utilized for the COMTECH Operation and Maintenance Manuals, Addenda and Supplements:

Part Number	Description
XPA200-7984-I-OPT1, REV.2	2nd edition of the Manual.

Reporting Comments or Suggestions Concerning This Manual

Comments and suggestions regarding the contents and design of this manual will be appreciated. To submit your Comments, please contact the **COMTECH Customer Service Representative, 1-(480)333-4357.**

Safety Notice

This equipment has been designed to minimize exposure of personnel to hazards. The operators and technicians must:

- **NEVER TURN ON THE UNIT WITHOUT PROPER RF TERMINATIONS.**
- Know how to work around, with and on high voltage and high RF power level equipment.
- Exercise every precaution to ensure personnel safety.
- **Exercise extreme care when working near high voltages/high RF power level equipment.**
- Be familiar with the warning presented in this manual.
- **CAUTION** - Disconnect the power supply cord before servicing the SSPA.
- **Lithium Battery Replacement - CAUTION:** There is a danger that the Lithium battery on the M&C assembly

will explode if the battery is incorrectly replaced. Replace only with the same or equivalent type battery recommended by the manufacturer. Dispose of used batteries according to the Lithium battery manufacturer's instructions.

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1. Request a Return Material Authorization (RMA) number from the COMTECH Customer Service Representative, 1-(480) 333-4357, FAX 1-(480) 333-2500.
2. Provide the Customer Service Representative with the following information:
 - a. Model number.
 - b. Serial number.
 - c. Description of the problem.
 - d. Description of action taken to identify the problem.
 - e. Name and telephone number of the company contact.
3. The product being shipped should be packed in it's original shipping container with proper packing material to prevent possible shipping damage.

4. Ship the product, prepaid, to COMTECH. Provide the following address on the shipping label, with the **RMA** number clearly **marked** on the **label** and the **shipping container**:

COMTECH EF Data Corp.
2114 W. 7th Street
Tempe, Arizona 85281 U.S.A.
Attention: Customer Service Department, **RMA Number:**

For more information regarding the COMTECH warranty policy, please refer to the policy page located on the back of the title page.

Product Application, Upgrading or Training Information

To obtain product application, upgrade or training information, Please contact the Customer Service Representative at the numbers above.

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Section 1

Introduction

1.1 Scope

This manual provides instructions on the installation, operation and maintenance of the XPA200-7984-I X-Band Solid State High Power Amplifier manufactured by COMTECH COMMUNICATIONS Corp.

1.2 Functional Description

The XPA200-7984-I X-Band High Power Amplifier (SSPA) is designed for use in communication systems, or in satellite up-link data systems. The SSPA operates over the RF input frequency range of 7900 to 8400 MHz. The RF power output is 53.0 dBm minimum at 1 dB compression. A functional block diagram is shown in Figure 1-1.

The SSPA is designed to be hard mounted in a standard 19-inch rack or cabinet, or to be rack mounted using COMTECH slide mechanisms provided with the SSPA to allow it to be serviced without its removal from the rack. Two internally mounted exhaust fans are mounted on the chassis for cooling. An AC power connector, with an on/off switch, is located on the rear on the chassis.

All operator controls, indicators and displays for local and remote operation as well as the RF Input and Output sample test ports are located on the front panel of the SSPA. Connectors for the external interface connections are located on the rear of the SSPA chassis.

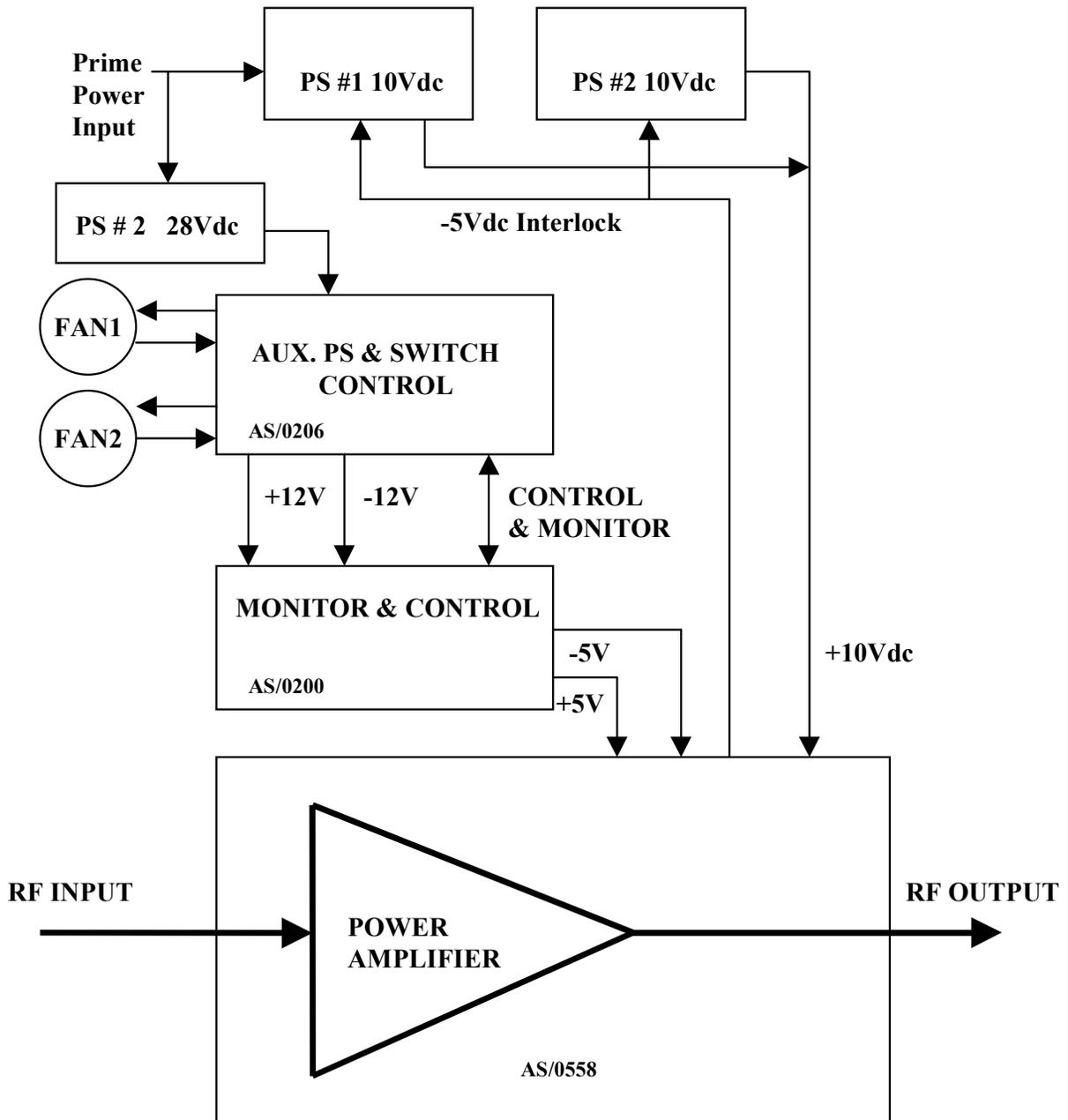


Figure 1.1 FUNCTIONAL BLOCK DIAGRAM

1.3 Specifications

The following are the design, operating and environmental specifications for the XPA200-7984-I X-Band Solid State High Power Amplifier (SSPA).

Output		Front Panel	
Frequency	7.900-8.400 GHz	Display	24 x 2 LCD
Power	53.0dBm min. @ 1dB Comp. (see Note 1)	Data Entry	Cursor Control Keypad
Mute	-80dB	Output Sample	Type N, 50 Ohms, -40dBc
VSWR	1.25:1 Max.	Input Sample	Type N, 50 Ohms, -20dBc
Connector	CPR-112G Waveguide Flange		
Gain		Remote Control	
Linear	62dB min, 67dB typ.	Comm Port	RS-485 or RS-232C
Adjust	20dB in 0.25dB Steps	Protocol	Comtech ASCII or Emul.
Per 500MHz	\pm .75dB		
Per 40 MHz	\pm .25dB		
+0 - +50C	+0.50dB @ center Freq. \pm 1.00dB @ full band		
Third Order Intermod.		Alarms	
Intercept	+60.5dBm Min., +62.0dBm Typ.	Summary Fault	Form C
Products	-30dBc typ., -25dBc max @ 3 dB total back off (two tones, $\Delta f = 1\text{MHz}$)		
AM to PM Conversion		LED	
	2.0 degrees typ., 3.0 max @ rated output	Power	Green
		Fault	Red
		Stored Fault	Red
		Tx ON	Yellow
		Online	Yellow
		Remote	Yellow
Group Delay		Mechanical	
Linear	\pm 0.03ns/MHZ	Height	12.25 inches
Parabolic	\pm 0.003ns/MHZ ²	Width	19 inches
Ripple	1.0ns Peak-to-Peak	Depth	24 inches
		Weight	100 lbs.
Spurious		Environmental	
Carrier Related	-65dBc	Temperature	0 to +50C Operation (See Note 1)
Line Related	-50dBc	Humidity	-40 to +70C Storage 10-95% Noncond. Oper. 0-100% Noncond. Stor.
		Shock	Normal Commercial Shipping & Handling
Input		Power Requirements	
Impedance	50 Ohms		115 VAC, 47-63 Hz, 2600 VA
Noise Figure	10dB Typ., 15dB Max.		
VSWR	1.25:1 Max.		
Connector	Type N		

Note 1: P1dB only guaranteed 0 to 40C. Operation above 40C not recommended.

1.4 Prime Power Input

The power input requirements for the XPA200-7984-I X-Band SSPA are as follows:

- 115 volts AC.
 - 47 to 63 Hz.
 - 2600 VA (approx. 1800W) nominal
-

1.5 Physical Dimensions

- Width: 19 inches.
 - Height: 12.25 inches.
 - Depth: 24 inches.
 - Weight: 100 lbs.
-

1.6 Environmental Specifications

- Temperature: 0 to +50 degrees C operating.
(Note: P1dB guaranteed only 0 to 40C.
Operation above 40C not recommended).
 - Humidity: 10 to 95% noncondensing operation.
-

1.7 Front Panel Controls

The front panel contains a User Interface Key-Pad which is used by a local operator to input commands to the SSPA. The key-pad is used to select the configuration for operating and monitoring the status of the SSPA. In conjunction with the front panel two line, twenty four character, LCD display, the key-pad allows the operator to select one of five configurations. The configuration functions are "Configuration Menu", "Monitor Status Menu", "Currents Faults Menu", "Stored Faults Menu" and "Utility Functions Menu".

1.7 Front Panel Controls (Continued)

The key-pad has six keys: Enter, Clear, Right Arrow, Left Arrow, Up Arrow and Down Arrow. Each key has a logical function:

- Enter Key: (ENT)

Used to select a display function, or to execute a command to change the configuration of the SSPA.

- Clear Key: (CLR)

Used to cancel a selection, or to cancel a configuration change which has not been executed using the "Enter" key. After pressing the "Clear" key the display will return to the previous selection.

- Right and Left Arrow Keys:  / 

These keys are used to select or change an operating mode within a function, or to input or change the configuration input data (numbers).

- Up and Down Arrow Key:  / 

These keys are used to move to the next operation mode, or to move the cursor to select a specific parameter or digit within an operating mode selected.

1.8 Front Panel Indicators

There are six LED indicator lights on the front panel which indicate the status of the SSPA and provide summary fault information. The indicators are defined as follows:

1.8 Front Panel Indicators (continued)

Faults:

- **Fault (Red):**
Indicates that a fault condition exists when the LED light is on.
- **Stored Fault (Red):**
Indicates that the fault has been logged and stored when the LED light is on. The fault may, or may not, be active.

Status:

- **Power (Green):**
Indicates that power is applied to the SSPA when the LED light is on.
- **Tx ON (Yellow):**

Indicates that the transmit function of the SSPA is on when the LED light is on. The indicator light reflects the actual condition of the transmit function.
- **On Line (Yellow):**
Indicates that the SSPA is operating on-line to transmit data.
- **Remote (Yellow):**
Indicates that the SSPA is being operated in the remote control mode where commands and data are transferred via an RS-485 (RS-232C is optional) serial communications link.

1.9 Front Panel Display

The front panel display is a two line by twenty-four character, LCD display. Each configuration function, or operating mode, is shown on the display when the operator enters a command into the key-pad on the front panel.

1.10 Front Panel Test Point Samples

Two test point connections are located on the front panel for monitoring the RF input and the RF output. A type N female connector is provided for the RF sample test points.

1.11 Rear Panel Connections

The following is a list of the connectors on the rear panel:

- Connector J1: SSPA RF Input (RF in).
- Connector J2: SSPA RF Output (RF output).
- Connector J3: AC Prime Power Input (AC in).
- Connector J4: Cust. Discrete Control (Discrete Control).
- Connector J5: Combiner Interface.
- Connector J6: COM1 Port (RS-232C/RS-485) (COM1).
- AC Power On / Off Switch.

1.11.1 RS-485/RS-232C Interface (COM1), Connector J6

The RS-485/RS-232C Interface connector, J6, is a 9 pin "D" type DB9F connector socket. The pin-out specifications are contained in Table 1-1. The mating connector is a DB9M.

Table 1-1.
J6, COM1 connector Pin-Out

Pin #	RS-232C	RS-485 4-Wire	RS-485 2-Wire
1	no connect	GND; Ground	GND; Ground
2	TD; Transmit Data	no connect	no connect
3	RD; Receive Data	no connect	no connect
4	no connect	+TX; Signal	+RX/TX; Signal
5	GND; Ground	-TX; Signal Complement	-RX/TX; Signal Complement
6	DSR; Unit Ready - always high.	no connect	no connect
7	RTS; Request to Send. Looped to CTS	no connect	no connect
8	CTS; Clear to Send	+RX; Signal	+RX/TX; Signal
9	no connect	-RX; Signal Complement	-RX/TX; Signal Complement

1.11.2 Customer Discrete Control, Connector J4

The Customer Discrete Control connector, J4, is a 19 pin circular connector, type MS3112E14-19S. The pin-out specifications is contained in Table 1-2. The mating connector is a MS3116F14-19P.

Table 1-2.
J4, Customer Discrete Control Connector Pin-Out

Pin	Signal Name	Description
A	External Mute Cmd	External Mute Command. TTL input "high" mutes the unit.
B	External Mute Common	External Mute Common.
G	Local Online Common	Local Online Status Common.
H	Local Online NO	Tied to pin G when Online, else open.
N	Summary Fault Common	Summary Fault Status Common.
P	Summary fault NO	Open when Faulted, else tied to Pin N.

Note: All other pins are unused.

1.11.3 Combiner Interface, Connector J5

The Redundant Loop interface connector, J5, is a 19 pin circular connector, type MS3112E14-19S. The pin-out specifications is contained in Table 1-3. The mating connector is a MS3116F14-19P.

Table 1-3.

J5, Combiner Interface Connector Pin-Out

Pin #	Description	Pin #	Description
A	Inhibit Command	L	not used
B	VPC A+B->Antenna	M	not used
C	not used	N	not used
D	not used	P	not used
E	VPC Output Common	R	not used
F	VPC A(B) ->Antenna	S	Local SumFlt Common
G	not used	T	Local SumFlt NO
H	Inhibit Common	U	not used
J	not used	V	not used
K	not used		

1.11.4 AC Prime Power Input Connector, J3

The AC prime power input connector, J3, is a 3 pin circular connector, type CA3102E20-19PB FMLB A. The ground connector, pin A, is of the first make, last break type. The pin-out specifications are contained in Table 1-4. A mating connector of type CA3106E20-19SB is included for the customer.

Table 1-4.

J3, AC Prime Power Input Connector

Pin #	Description
A	Ground
B	Neutral
C	Line

1.12 Prime Power Switch

The on/off prime power switch is located on the rear of the chassis adjacent to the prime power input connector. The circuit breaker is rated for 40 Amps.

Section 2

Installation/Operation with Mitec 2723B Variable Phase Combiner and Redundant Switching System

2.1 Unpacking and Inspection

This section is intended to give a brief explanation on how to setup and operate two Comtech XPA200 SSPAs with the Mitec 2723B Variable Phase Combiner and Redundant Switching System. More detailed explanations on operation of the SSPA are contained in later sections of this manual. More detailed operating instructions for the Mitec Combiner and redundant switching system can be found in it's associated manual.

Inspect the shipping container for damage. The shipping container and packing materials should be retained for possible re-shipment. Check to determine that all parts, materials and documentation have been shipped with the SSPA. The SSPA should be inspected for possible damage, and then tested for proper operation.

If the shipment is incomplete, or there is mechanical damage, or the SSPA does not operate properly, notify the COMTECH Customer Service representative immediately. If there is damage to the shipping container, notify the carrier, and retain all shipping materials for inspection by the carrier.

2.2 Rack Mount Installation

2.2.1 XPA200 Installation

The XPA200-7984-I X-Band SSPA is designed for installation to mount in a standard 19 inch rack cabinet or enclosure. The SSPA chassis requires 12.25 (7RU) inches of panel height space.

Adequate air ventilation should be provided to the rack mounted equipment. Cool air is taken in through the front panel and

exhausted out the rear panel. **Locate the unit so the input and output airflow paths are not obstructed or restricted.** This will minimize the amplifier operating temperature, and provide years of reliable operation.

If the SSPA is to be mounted on slides, the slides must be the COMTECH rack slides provided with the SSPA. Mount the slides on the sides of the SSPA chassis with the mounting hardware provided. Then, install the slide rails in the rack cabinet enclosure.

Secure the SSPA to the rack cabinet with four screws inserted through the SSPA front panel slotted holes.

2.2.2 Combined/Redundant Amplifier Installation and Cabling

For the complete combined/redundant amplifier system, it is most common to install the Mitec 2723B combiner in the top position of the rack, followed by SSPA B, with SSPA A in the bottom position. (See the outline drawing at the end of this section.)

Connect the Comtech supplied inter-unit control cable, CA/8981, between the Mitec Combiner ports P1,P2,P3 and to each J5 of SSPA A and SSPA B as indicated by the labels on the cable. (Note that this cable is setup for the bottom SSPA be SSPA A.)

Attach the supplied waveguide termination to the load port of the Mitec 2723B such that the termination resides above the unit. (See outline drawing.)

Attach user supplied coaxial cables and waveguide between the Mitec 2723B and each XPA200. Refer to Figure 2.3 of the Mitec manual. A waveguide pressure window has also been supplied and can be attached according to customer preference.

(Note that CA/8981 has been constructed for SSPA A to be in the bottom position. The coaxial cables and waveguides should be connected accordingly. In case of conflict, it will be necessary to modify either CA/8981 or the coaxial cables and waveguides.)

CAUTION!

Before applying AC power to the units, make sure the waveguide output of the amplifiers and the antenna and load ports of the combiner are properly terminated. Failure to do so could lead to equipment damage and excessive RF radiation levels.

Attach power cords to the units. Two standard power cords are supplied with the Mitec 2723B. Each XPA200 is supplied with a mating connector to enable the user to fabricate a power cord. See sections 1.4 and 1.11.4.

2.2.3 Some Notes on Establishing Remote Communications

1. The Mitec 2723B combiner was set at the Comtech factory to RS-232 operation per customer request, on address 00 (30H) through P4. However, the Mitec 2723B has a non-standard pin-out on this I/O connector. Connections should be made as shown below:

Common PC 9-Pin Serial Port	Mitec 2723B Remote Serial Access Port, P4 (9-pin)
Pin 2 (Rd)	Pin 3
Pin 3 (Td)	Pin 4
Pin 5 (Gnd)	Pin 5

Table 2.1 Typical RS-232 Connection to Mitec P4

2. Physical remote cabling information for each Comtech SSPA is described in section 5.3 of this manual. It is recommended to set SSPA A to address 001 and SSPA B to address 002. These and other communication parameters can be set via the front panel of each SSPA, as described in section 3 and section 5.

3. A special Windows-compatible program has been included on a floppy disk in this manual to assist in communicating with the Combined/Redundant Amplifier system. Refer to the file "Notes.txt" for operating instructions.

2.3 Notes on Combined/Redundant System Operation and Setup

The following paragraphs are intended to give a brief explanation of system operation of the Comtech XPA200 SSPAs with the Mitec 2723 Variable Phase Combining and Redundant Switching System. More detailed information can be found in each unit's respective operating manual. A review of the operation of a Variable Phase Combiner is shown in Table 2.2 below.

(Note: The Load Overheat function mentioned in the Mitec 2723B manual is not operational. The Mitec factory explained that this was an option for another project that is not available to Comtech. However, this should not cause any concern because the load is rated for 1000W (convection cooling) and the maximum power possible into the load is approximately 525W.)

VPC Function	VPC Pos.	Applied Power	Power Observed at Load (less I.L.)	Power Observed at Antenna (less I.L.)
A to Antenna	1	A and B	Full Power of B	Full Power of A
A + B to Antenna	2	A only	Half Power of A	Half Power of A
		B only	Half Power of B	Half Power of B
		A & B not phase adjusted	Partial Power of A & B	Partial Power of A & B
		A & B phase adjusted*	Negligible Power	Full Combined Power of A & B
B to Antenna	3	A and B	Full Power of A	Full Power of B
A + B to Load	4	A only	Half Power of A	Half Power of A
		B only	Half Power of B	Half Power of B
		A & B not phase adjusted	Partial Power of A & B	Partial Power of A & B
		A & B phase adjusted*	Full Combined Power of A & B	Negligible Power

* A & B must have equal carrier magnitude and frequency.

Table 2.2 Variable Phase Combiner Operation

2.3.1 Redundant Operation and Setup

The system can operate in a standard 1:1 redundant configuration by choosing VPC position 1 (SSPA A to antenna) or 3 (SSPA B to antenna) on the Mitec 2723B. For example, if the Mitec 2723B was set to run in Automatic mode and SSPA A was normally operating to the antenna (VPC position 1), a fault on SSPA A would cause the system to immediately switch to position 3, or SSPA B to antenna.

Each SSPA may have slightly different gain values. A procedure to equalize gain and output power between SSPA A and SSPA B for redundancy operation is described below. The output powers from SSPAs A and B are first equalized by measurements at the load port before switching power to the antenna port.

- A. To set the output power of SSPA A:
 1. Mute SSPA B via remote or front panel controls. (To prevent unwanted power from SSPA B going to antenna.)
 2. Set VPC to position 3 (B to antenna, A to load).
 3. Connect a power meter to the Mitec calibrated load measuring port (see 2723B test data for exact calibration data). Adjust output power of SSPA A to desired level by adjusting input RF power or by using the SSPA A attenuation setting.

- B. To set the output power of SSPA B:
 1. Mute SSPA A via remote or front panel controls. (To prevent unwanted power from SSPA A going to antenna.)
 2. Set VPC to position 1 (A to antenna, B to load).
 3. Connect a power meter to the Mitec calibrated load measuring port (see 2723B test data for exact calibration data). Adjust output power of SSPA B to desired level (usually the same as A) by adjusting input RF power or by using the SSPA B attenuation setting.

- C. Choose the unit desired to be on-line.
 1. Mute both units to prevent unwanted power from going to the antenna.
 2. Choose SSPA A (position 1) or SSPA B (position 3) for operation to the antenna. The other unit will be sent to the load.
 3. Set the Mitec unit in Automatic mode and un-mute the SSPAs.
 4. Verify proper output power going to antenna by connecting a power meter to the Mitec Antenna Forward power measuring port (see Mitec test data for calibration factor).

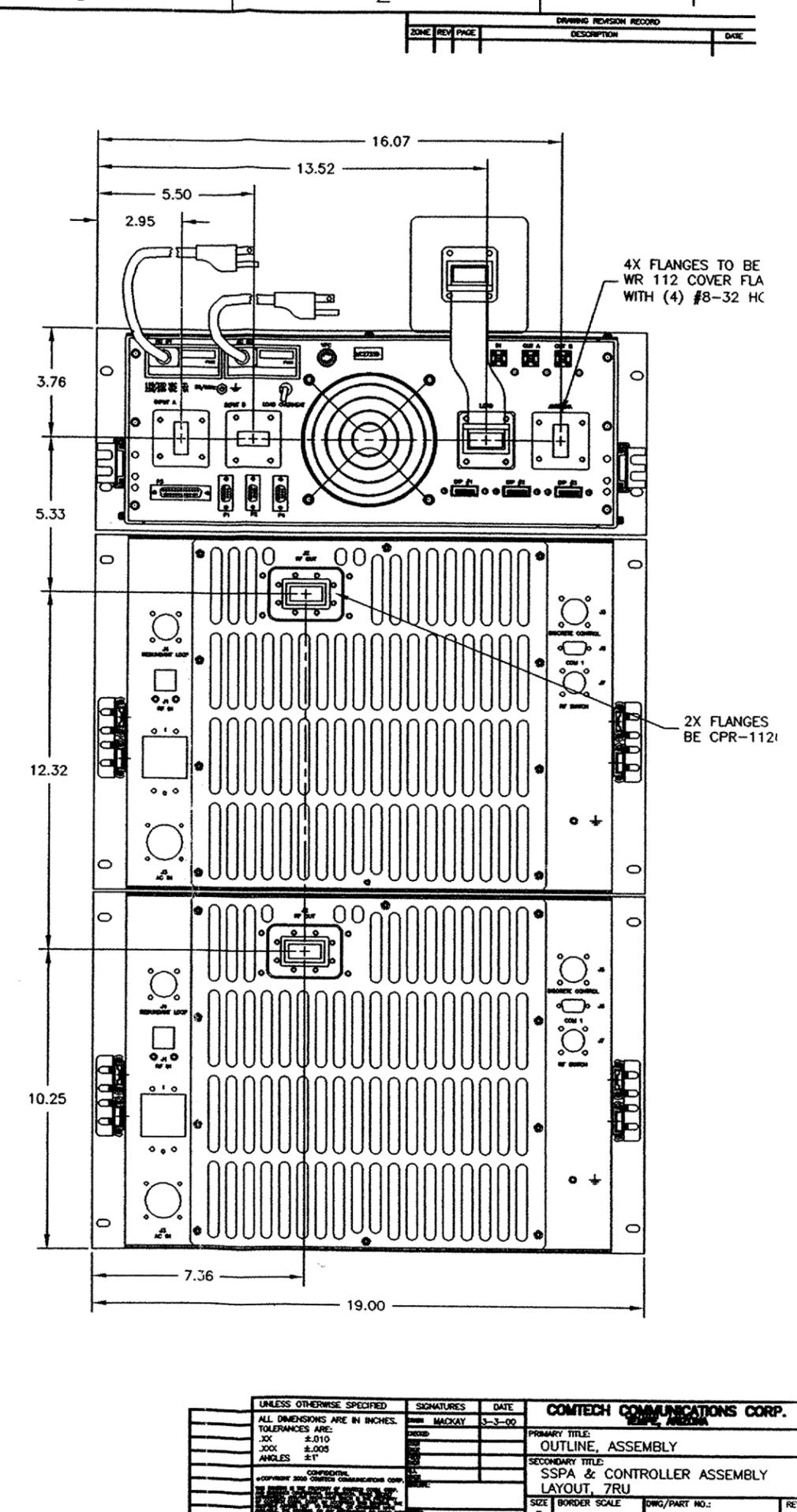
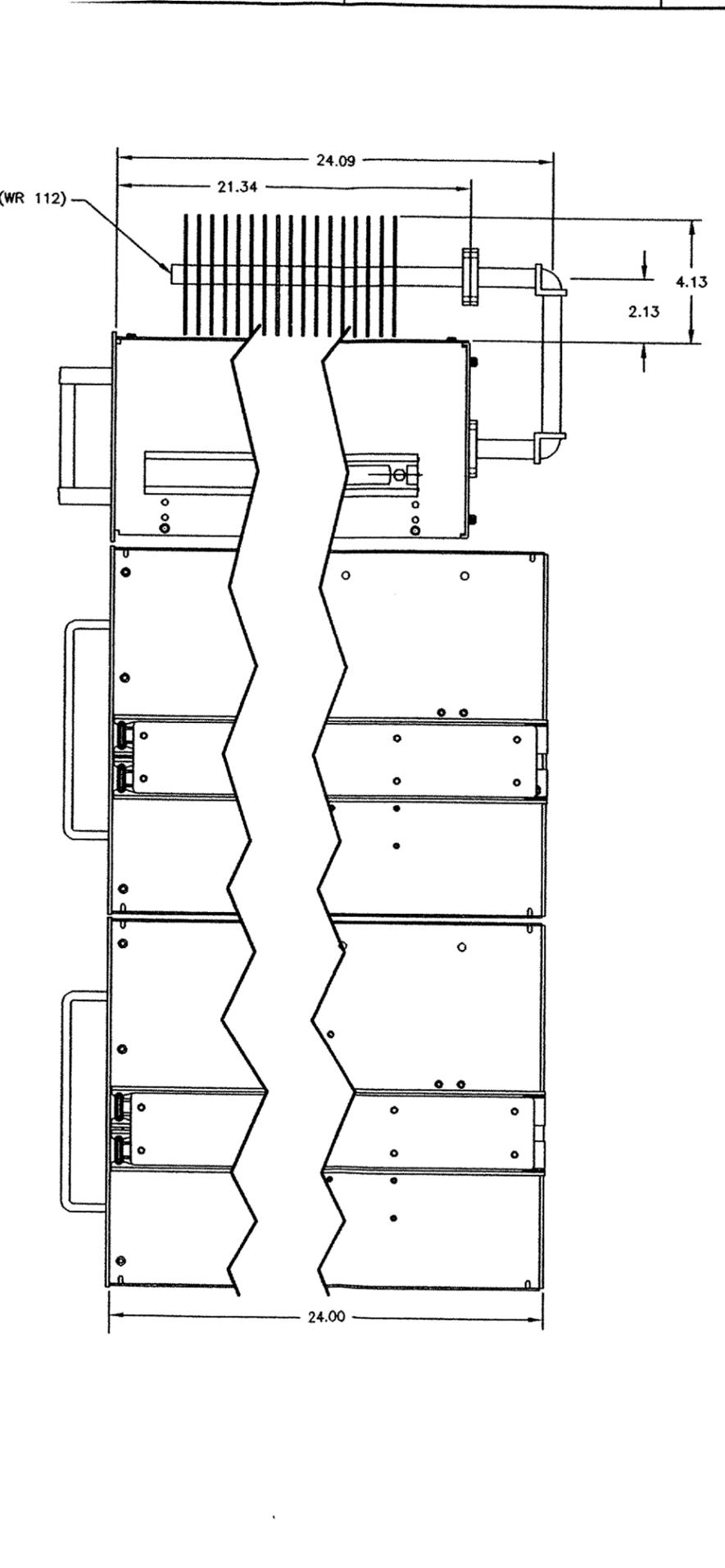
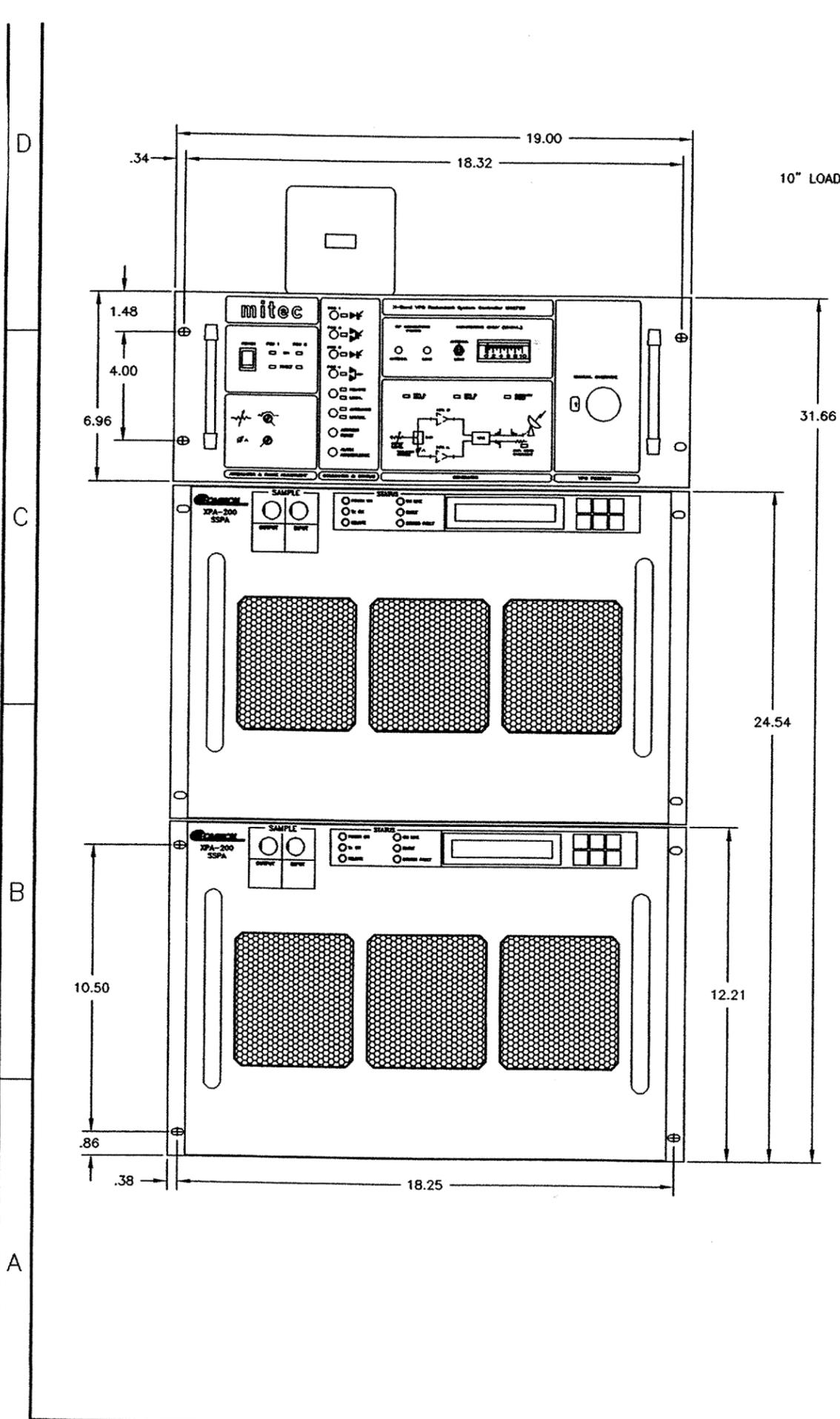
2.3.2 Combined (SSPA A and SSPA B) Operation and Setup

The full powers of SSPAs A and B can be phase combined for increased system power output. Maximum output is obtained only if the signals of SSPA A and B have equal or close carrier magnitude and frequency, and the relative phase between them is adjusted. Phase adjustment of the input signals for maximum output power is accomplished via the screw adjustment on the front panel of the Mitec 2723B.

A procedure to maximize output power by phase combining the outputs of SSPA A and B is given below. The procedure first optimizes the power off-line by using the load port, and then switches the maximized power on-line through the antenna port.

(Note of Caution: During the phase adjustment period, it is possible to send a significant signal level to the antenna port even though the combiner is directed to the load. Therefore, it is recommended to perform the phase combining adjustment at low power levels or activate any maintenance switches which may keep unwanted signal from the actual antenna.)

1. Connect a power meter to the Mitec calibrated load measuring port (see 2723B test data for exact calibration data).
2. Select VPC position 1, (A to Antenna, B to Load). Adjust SSPA B input signal level and attenuation to achieve desired output power level from SSPA B. For example, 40.0 dBm.
3. Select VPC position 3, (B to Antenna, A to Load). Adjust SSPA A input signal level and attenuation to achieve an output power level within +/- .3 dB of that obtained from SSPA B in step 2 above. (It may be necessary to repeat step 2 and increase attenuation level of SSPA B if SSPA B has more gain than SSPA A.)
4. Select VPC position 4, A&B to load. Adjust the phase trimmer on the Mitec 2723B front panel until maximum power is reached, typically 2.7-2.95 dB above the single unit output power level. For this example, 42.7-42.95.
5. Select VPC position 2, A&B to load, to go on-line and route power to the antenna port.
6. Monitor the output power through the Antenna Forward measuring port on the Mitec unit (see 2723B test data for exact calibration data). Perform any minor trimming of the phase shifter to maximize output power.
7. Note: Whenever a significant change in signal frequency occurs, it will be necessary to re-adjust the phase shifter.



UNLESS OTHERWISE SPECIFIED		SIGNATURES	DATE	COMTECH COMMUNICATIONS CORP.
ALL DIMENSIONS ARE IN INCHES.		DAVID MACKAY	5-3-00	
TOLERANCES ARE:				PRIMARY TITLE:
XXX ±.010				OUTLINE, ASSEMBLY
XXX ±.005				SECONDARY TITLE:
ANGLES ±1°				SSPA & CONTROLLER ASSEMBLY
				LAYOUT, 7RU
				SIZE BORDER SCALE DWG/PART NO.:
				D
				SCALE: 1/1 DO NOT SCALE DRAWING SHEET 1 OF 1

Section 3

System Operation

3.1 General

This section contains instructions for operating the solid state high power amplifier (SSPA). The front panel of the SSPA has a key-pad for operator input commands, an LCD Display, LED status indicators, and connector test sample ports to monitor the RF input and output signals. Table 3-1 is provided to show the control and operating functions of the SSPA.

3.2 Switching Power On

Before turning the Prime Power Switch to the "on" position, check to ensure that the installation is complete, and verify that the SSPA is connected to the proper prime power source, RF input and RF output.

Switch the ON/OFF Prime Power Switch on the rear panel to ON. Verify that the cooling fans are operating, and that the POWER ON LED STATUS indicator light is on.

After the prime power is switched on, the STATUS indicators should be as follows:

- POWER ON: Indicator ON.
- TRANSMIT: Indicator OFF.
- REMOTE: Indicator ON.
- ON LINE: Indicator ON.
- FAULT: Indicator OFF.
- STORED FAULT: Indicator OFF.

After the AC power is switched on and before pressing the buttons on the key-pad, the LCD display message should be similar to:

```
XPA200-7984-I  
SW VER X.XX SN7984XXXX
```

Table 3-1. Operating Functions - Front Panel

Item	Functional Description	Reference Designation
Key-Pad; ENT key	Enters commands into the converter.	ENT
Key-Pad; CLR key	Clears commands and data selected and not entered.	CLR
Key-Pad; Right Arrow key	Selects functions and the menu operating data.	Right Arrow
Key-Pad; Left Arrow key	Selects functions and the menu operating data.	Left Arrow
Key-Pad; Up Arrow key	Selects the operating menu and data values.	Up Arrow
Key-Pad; Down Arrow key	Selects the operating menu and data values.	Down Arrow
LCD Display	Displays commands and data entered into the key-pad.	
STATUS Indicator, Green	Prime power is applied when the light is on.	POWER ON
STATUS Indicator, yellow	Transmit function operating when the light is on.	TRANSMIT ON
STATUS Indicator, yellow	In Remote Control Mode when the light is on.	REMOTE
STATUS Indicator, yellow	Operating on-line to receive data when the light is on.	ON LINE
STATUS Indicator, Red	Fault condition exists when the light is on.	FAULT
STATUS Indicator, Red	Faults stored and logged when the light is on.	STORED FAULT
INPUT SAMPLE	Type N connector test point to sample RF input.	SAMPLE INPUT
OUTPUT SAMPLE	Type N connector test point to sample RF output.	SAMPLE OUTPUT

3.3 Operation

Local operation of the 200 watt, X-Band SSPA is controlled by operator input commands initiated through the six button key-pad on the front panel. The key-pad is the local operator's interface to control, configure and monitor the status of the SSPA. Operator inputs and commands entered into the key-pad are displayed by the front panel twenty-four character, two line, LCD display. See Section 5.0 for Remote Control Operation.

There are five operating command functions: Configuration, Monitor Status, Currents Faults, Stored Faults and Utility Functions. A flow chart for selecting the commands, operating menus, and data inputs is shown in Figures 3-1 through 3-6.

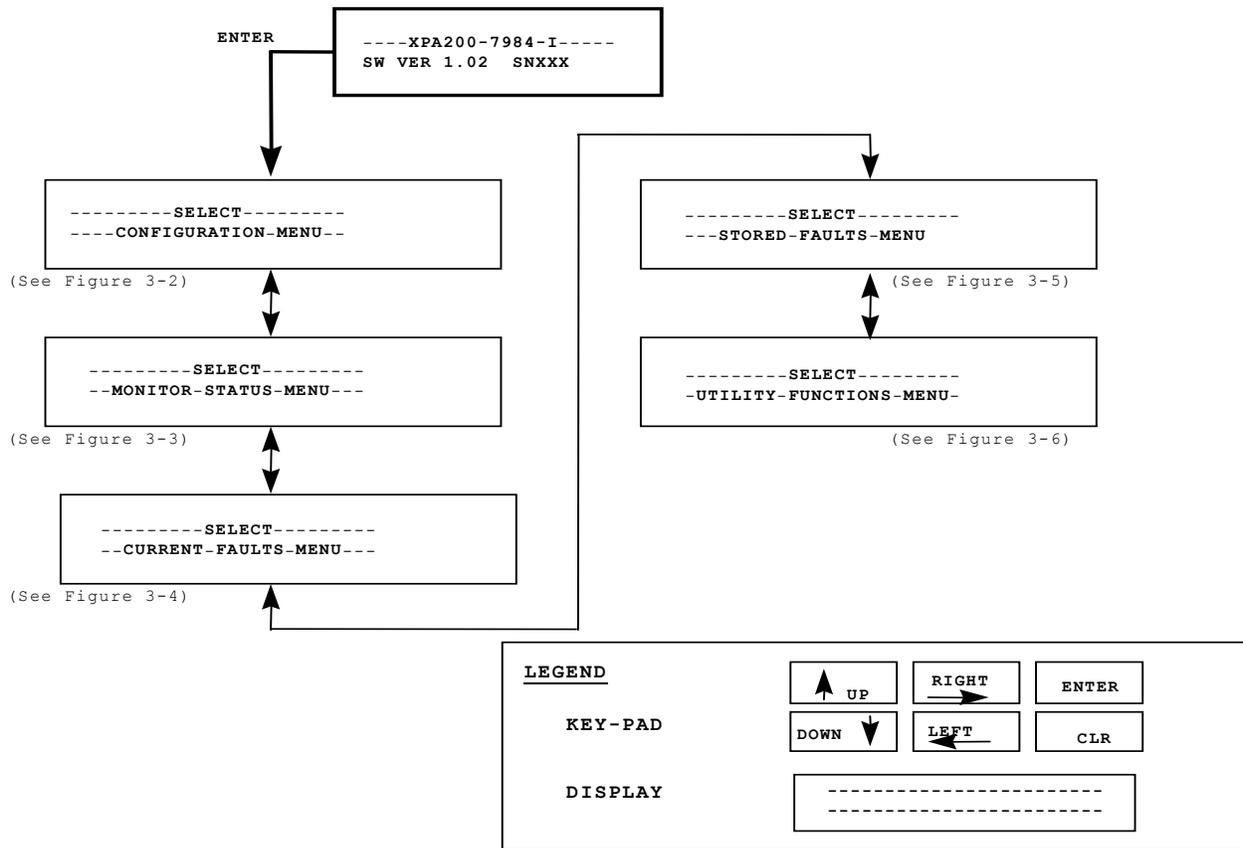


Figure 3-1. SSPA Operating Command Functions

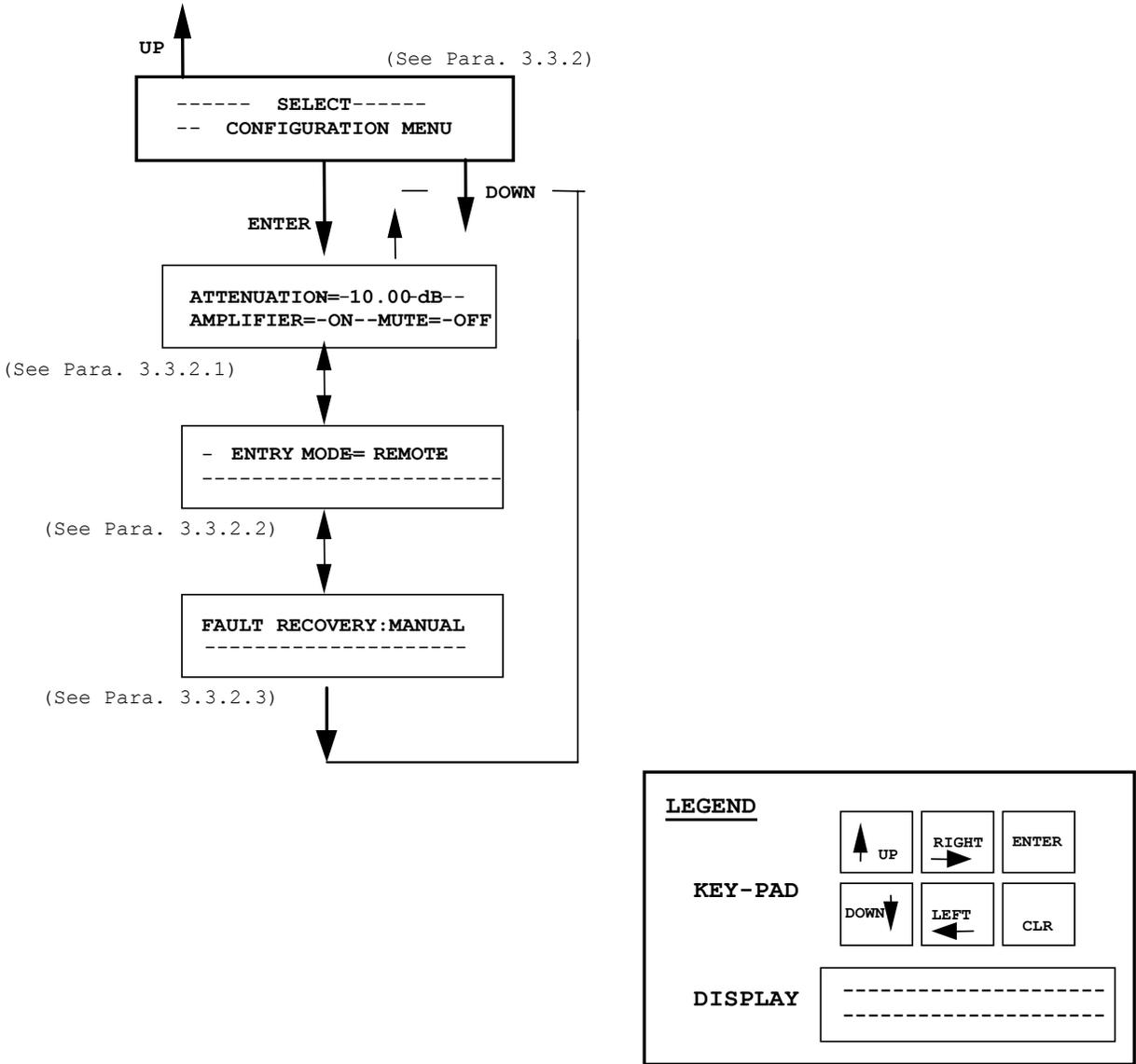


Figure 3-2. Configuration Menu Commands.

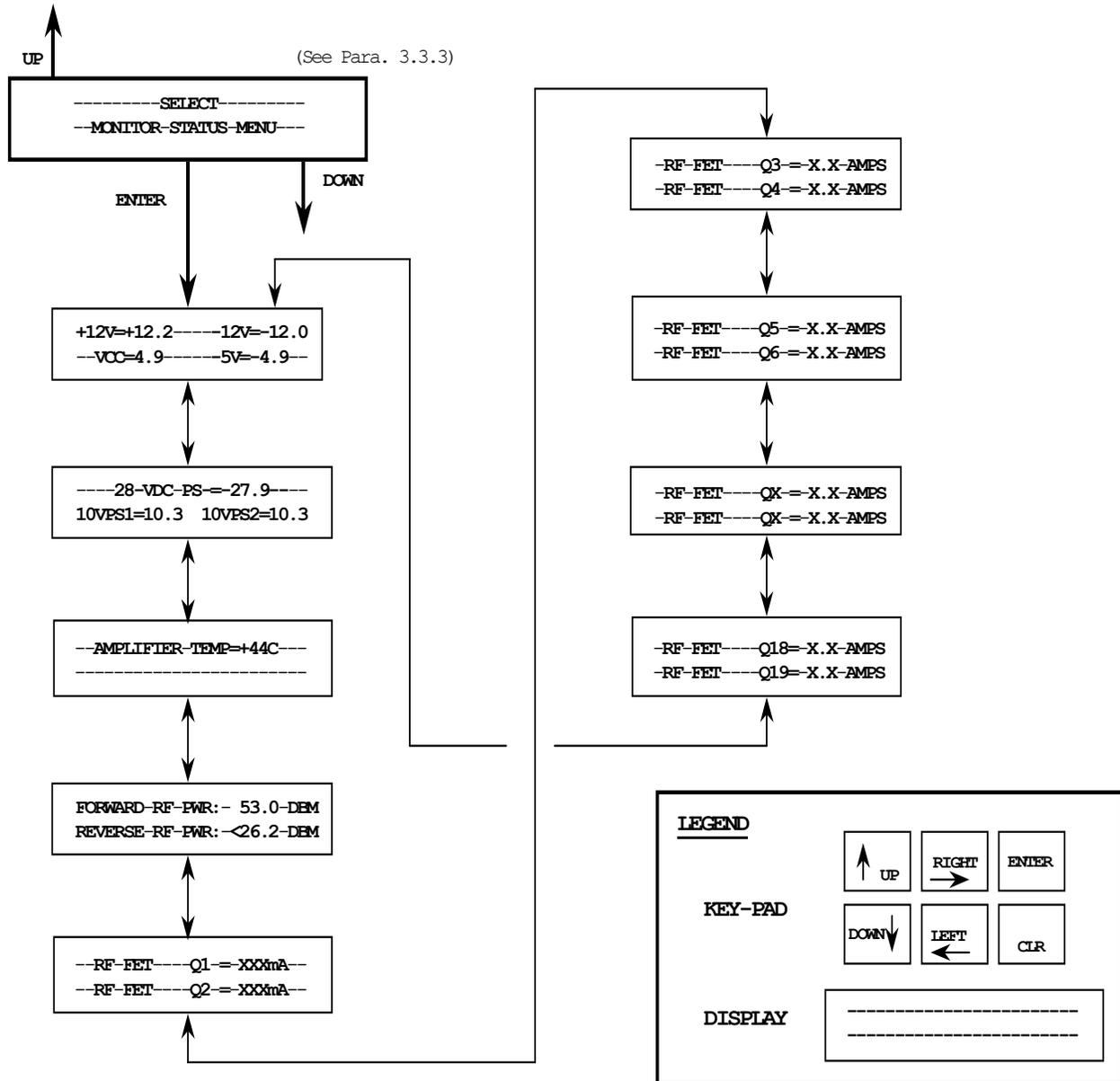


Figure 3-3. Monitor Status Menu Commands

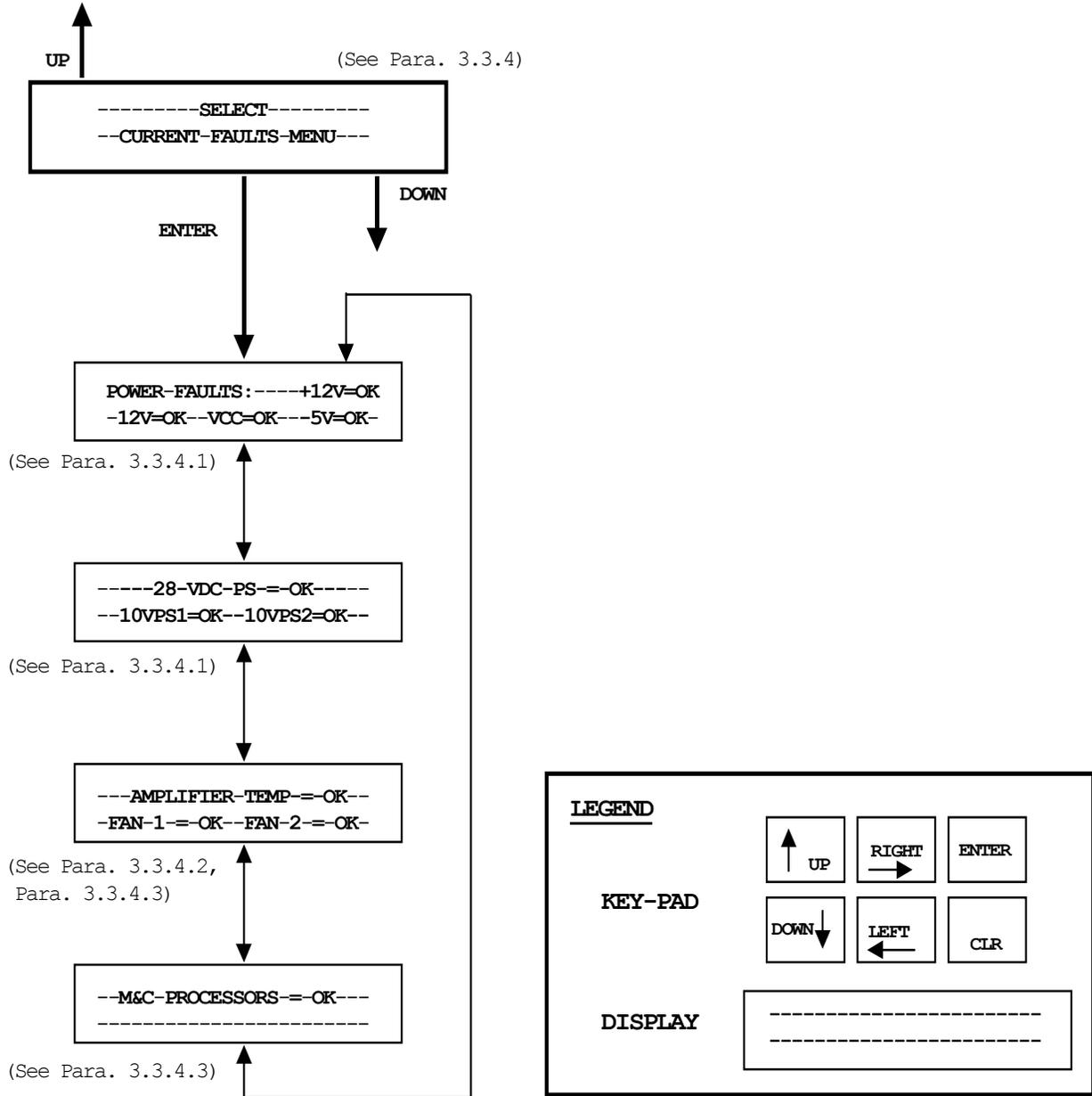


Figure 3-4. Currents Faults Menu Commands

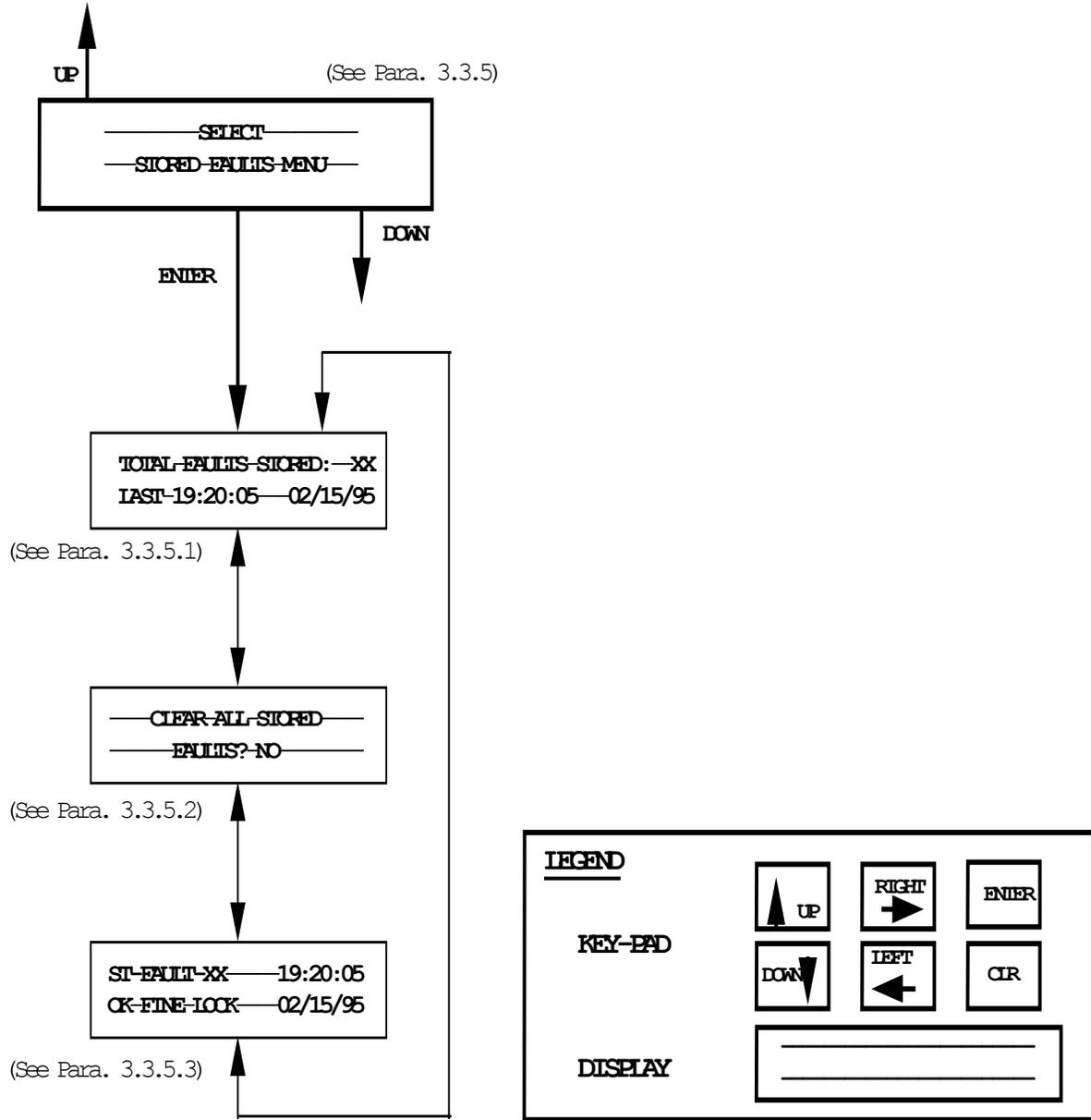


Figure 3-5. Stored Faults Menu Command

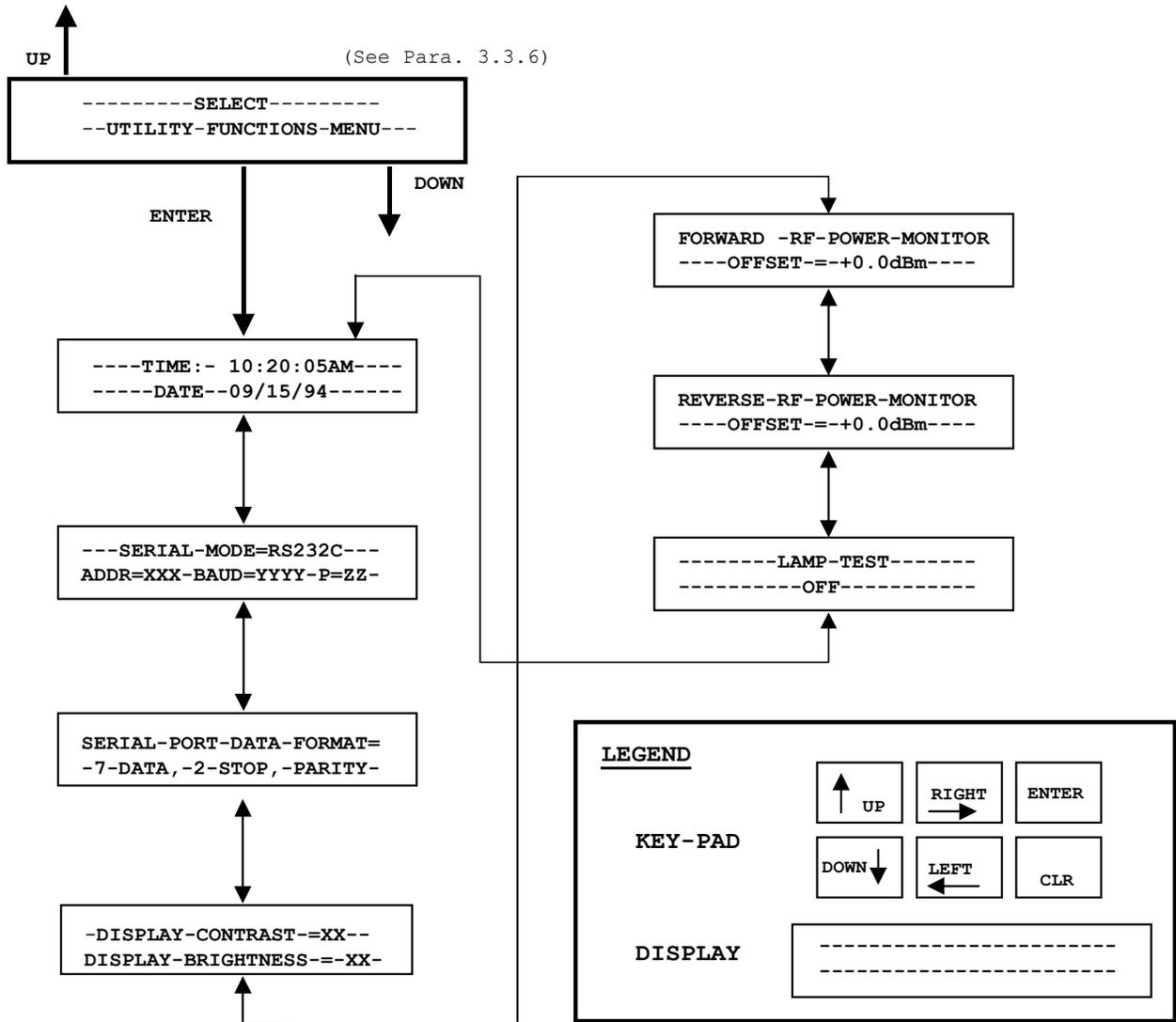


Figure 3-6. Utility Functions Menu Commands

3.3.1 SSPA commands

The SSPA commands are in a tree structured menu format designed for access and execution of all control functions, and to prevent the execution of an invalid entry by the operator. When the prime power is turned on, the LCD display will contain a message indicating the SSPA model number and the version number of the firmware installed in the SSPA.

To select a Command Function press the "ENT" button on the key-pad. The LCD display will indicate:

SELECT
CONFIGURATION MENU

This will provide the local operator access to the Command Function Menus, which is the top level structure to start the selection of Command Function Menus to input into the SSPA. To sequence to the next Command Function Menu press a "DOWN" or "UP" arrow button on the key-pad. The SSPA will step to the next Command Function Menu each time a "DOWN" or "UP" arrow button is pressed. The current Command Function Menu will be displayed on the LCD display. The Command Function Menus are shown in Figure 3-1.

To select a specific Command Function Menu press the "ENT" key-pad button. If a function is selected in error, press the clear ("CLR") button which will return the SSPA to the main command menus to allow the selection of another function. Any one of the five Command Function Menus can be selected using this procedure.

Once a Command Function has been selected, use the "RIGHT" or "LEFT" arrow key-pad buttons to sequence through the Operating Mode Commands. Each of the modes will be displayed on the LCD display. A specific operating mode is selected by pressing the "ENT" button. If an mode is selected in error, press the clear ("CLR") button which will return the SSPA to the operating menus to allow the selection of another mode.

3.3.1 **SSPA Commands** (cont.)

When an operating mode is selected, a parameter or a digit within the parameter will be flashing on the LCD display. Use the "RIGHT" and "LEFT" arrows buttons to sequence through the parameters or digits to select the next parameter or digit. A specific parameter or value is selected by pressing the "ENT" button. If a parameter or value is selected in error, press the clear ("CLR") button which will return the SSPA to the original parameter or value to allow another selection.

After selecting a parameter or digit, use the "UP" or "DOWN" arrow buttons to select the next parameter, or to increment or decrement the value of a digit. A specific new parameter or new value is selected by pressing the "ENT" button. If a parameter or value is selected in error, press the clear ("CLR") button which will return the SSPA to the original parameter or value to allow another selection.

Each time the clear ("CLR") button is pressed, the SSPA will return to the menu level prior to the last "ENT" command.

3.3.2 **Configuration Menu**

The Configuration Functions are as follows:

3.3.2.1 Frequency Operating Mode

Attenuation (ATTN):

Input and displays the SSPA attenuation setting which is selected between 0.00 to 20.00 in 0.25 dB steps. The default setting is 10.00 dB.

Amplifier: Control supply voltage to RF FETS. The default mode is ON.

Mute: Provide SSPA mute control. The default is OFF. Other possible modes are:

INH inhibited or muted by the Mitec 2723B
EXT mute on from external J4 control (see section 1).

3.3.2.2 Entry Mode

Mode: The entry mode is Local or Remote. The default is Local.

3.3.2.3 Fault Recovery: Fault Recovery is Manual or Auto. The default is Auto.

3.3.3 Monitor Status Menu

Monitors and displays the status of:

- All SSPA power supplies.
 - SSPA internal temperature.
 - RF output power level.
 - RF FET currents (Q1 through Q19).
-

3.3.4 Current Faults Menu

Displays the status of the current fault conditions. The LCD display will indicate "FT" when a fault condition exists. The display will indicate "OK" when a fault has not occurred.

3.3.4.1 Power Faults

Displays the DC voltage power supply faults. The DC voltages displayed are:

- +12 VDC.
 - -12 VDC.
 - VCC.
 - -5 VDC.
 - +28 VDC
 - +10 VDC, PS1 and PS2
-

3.3.4.2 SSPA Over Temperature Fault

Displays a SSPA temperature fault condition.

3.3.4.3 Fan Faults

Displays status of both FAN #1 and FAN #2.

3.3.5 Stored Faults Menu

The SSPA displays a total of one hundred (100) faults which a date and time stamped and stored in memory as they occur. The stored faults remain in memory until a clear command is entered.

3.3.5.1 Total Stored Faults

Displayed the total number of faults stored. The most recent fault stored is displayed on the LCD display.

3.3.5.2 Clear All Stored Faults

Input command to clear all faults. The command is "YES" or "NO" which is displayed on the LCD display.

3.3.5.3 Display Stored Fault

The local operator can sequence through the stored faults starting with the most recent fault. The Fault number, time, description and date is displayed on the LCD display.

3.3.6 Utility Menu

The local operator can input commands to the following Utility Functions which are displayed on the LCD display:

- TIME. Military time is used in hours, minutes and seconds.
- DATE. The date is displayed in month, day and year.
- Serial MODE (communications link).
 - RS-232C, RS-485-2, RS-485-4.
 - Physical Address. The default address starts from one (001).
 - BAUD (Rate). The default baud rate is 9600.
- SERIAL PORT DATA FORMAT. The default is 7 Data, 2 Stop Bits, with Parity. An optional format is 8 Data, 1 Stop Bit, with No Parity. This can only be changed via the front panel menu system.
- DISPLAY CONTRAST. The default is 15, with values from zero (0) to thirty (30).
- DISPLAY BRIGHTNESS. The default is 15, with values from zero (0) to thirty (30).
- FORWARD RF POWER MONITOR OFFSET. This function allows the operator to calibrate (fine tune) the RF Power Monitor for a specific carrier frequency. The RF Power Monitor is calibrated in the factory at the SSPA center frequency. The operator can adjust (offset) the display level using this function. The range equals -6.0 to +6.0 dBm in 0.1 dBm steps.
- REVERSE RF POWER MONITOR OFFSET. This function allows the operator to calibrate (fine tune) the RF Power Monitor for a specific carrier frequency. The RF Power Monitor is calibrated in the factory at the SSPA center frequency. The operator can adjust (offset) the display level using this function. The range equals -6.0 to +6.0 dBm in 0.1 dBm steps.
- LAMP TEST. The default is OFF

Section 4

Redundant System Operation

4.1 GENERAL

This option or application uses a Mitec variable phase combiner for redundancy use which is totally different than the standard Comtech Communications redundancy operating features.

Section 2 contains the specialized redundancy system features for this option. Also see the Mitec 2723B manual for more detailed information.

Chapter 5

Remote Control

5.1 GENERAL

Each COMTECH X-Band SSPA can be remotely controlled through a serial port. COMTECH's simplified Command/Response protocol is easily invoked by either a monitor and control computer, a non-intelligent ASCII terminal or a laptop computer operating in terminal emulation mode. All SSPA configuration parameters as well as all monitor and status information is available via the remote port.

5.2 ELECTRICAL INTERFACE

The remote control interface supports either 2-wire RS-485, 4-wire RS-485 or RS-232C. The default port is 2-wire RS-485. Selection of the interface type is made via front panel menu selection.

5.2.1 RS-232C

Levels, pulse shapes and impedances conform to EIA standards for asynchronous operation.

5.2.2 RS-485

Levels, pulse shapes and impedances conform to EIA standards.

5.3 PHYSICAL INTERFACE

All three interface types (2-wire RS-485, 4-wire RS-485 and RS-232C) are implemented alternately through the same 9-pin connector.

5.3.1 Connector

The remote control port is a female DB-9 connector located on the rear of the SSPA.

5.3.2 Pin-out

5.3.2.1 RS-232C

PIN	NAME	FUNCTION
2	TD	SSPA Transmit Data
3	RD	SSPA Receive Data
5	GND	Ground
6	DSR	Unit Ready. Always high.
7	RTS	Request to Send. Looped to CTS.
8	CTS	Clear to Send

It should be noted that Comtech SSPA's do not require the hardware handshaking provided by the DSR, RTS and CTS signals. These signals are provided for customers who are using interface terminals that require this handshaking. Most of today's PC's are provided with RS-232C serial ports that do not require the hardware handshaking. In these instances, the interface can be reduced to three (3) signals; TD, RD and GND.

5.3.2.2 RS-485

Both 2-wire and 4-wire applications are supported. The 4-wire interface provides independent signal wires for each of the receive (+RX) signal and its complement (-RX) as well as the transmit (+TX) signal and its complement (-TX). In the 2-wire interface, the receive signal and the transmit signal (+RX/TX) share one wire and likewise the complement signals (-RX/TX) share one wire. Choice of 2-wire versus 4-wire is based on the customers interface equipment and the cabling between this equipment and the SSPA(s).

5.3.2.2.1 RS-485 2-wire

The pinout for the 2-wire interface is provided below. Note that each signal pair (+RX/TX and -RX/TX) is provided on two pins. This is done to provide customers who are using 'solder-cup' type DB-9 connector the ability to more easily daisy chain the signals to multiple devices while maintaining one wire per 'solder-cup'. Customers who use 'IDC Mass Terminated' style DB-9 connectors (Ribbon cable types) need only use three (3) signals.

PIN	NAME	FUNCTION
1	GND	Ground
4	+RX/TX	Signal Loop In
5	-RX/TX	Signal Complement Loop In
8	+RX/TX	Signal Loop Out
9	-RX/TX	Signal Complement Loop Out

5.3.2.2.2 RS-485 4-wire

The pinout for the 4-wire interface is provided below. Note that all five (5) signals are required.

PIN	NAME	FUNCTION
1	GND	Ground
4	+TX	Transmit Signal
5	-TX	Transmit Signal Complement
8	+RX	Receive Signal
9	-RX	Receive Signal Complement

5.3.3 Cables

5.3.3.1 RS-232

The remote control port is configured with pin 2 as the transmit data signal (TD) and pin 3 as the receive data signal. This arrangement allows straight connection (pin 2 to pin 2 and pin 3 to pin 3) between the SSPA and most standard serial ports using any standard RS-232C cable (i.e. no need to swap pins 2 and 3).

5.3.3.2 RS-485

RS-485 cabling can be implemented with a single ribbon cable using 'IDC Mass Terminated' style connectors or with discrete wires using 'solder-cup' style connectors. A sufficient length of ribbon cable must be allowed to reach the system monitor and control computer.

5.4 PROTOCOL

5.4.1 Transmission Mode

The transmission mode is half duplex implemented in Command/Response convention. This method requires the external system monitor and control unit to initiate all communications by command and the SSPA to respond with either confirmation or an error message. The confirmation may contain status information.

5.4.2 Baud Rate

The default serial port Baud Rate is 9600. Baud rates of 4800, 2400, and 1200 and 300 are also supported.

5.4.3 Format

The following parameters are the default character format.

- 1 Start Bit
- 7 Data Bits
- 2 Stop Bits
- 1 Parity Bit

An optional character format that can be selected is:
This can only be selected from the Front Panel Menu.

- 1 Start Bit
- 8 Data Bits
- 1 Stop Bit
- 0 Parity Bits

5.4.4 Character Set

The character set implemented is ASCII.

5.7 Message Structure

The structure of either a Command , Response or Error Message is as follows:

```

Start Character
Device Address
Command or Response
End of Message String

```

5.7.1 Start Character

The Start Character begins each message:

```

Example:      <   Start of a user Command.
              >   Start of a SSPA response.

```

5.7.2 Device Address

The Device Address consists of a Physical Address. For this document DEV is used for the generic case examples.

```

Example:      <10      direct addressing

```

5.7.3 Command

A Command is a variable length character string beginning with a / and containing either an instruction or an instruction and data for a SSPA to act upon. If data is passed by command it is appended to the instruction by an underscore(_). If data is retrieved by command underscore follows the instruction flagging the SSPA to supply data in a response. In this document /COM is used for the generic case examples.

```

Example: <DEV/COM_xxx'cr'   Sends data to a SSPA.
Example: <DEV/COM_'cr'     Requests information from
                          a SSPA.

```

5.7.4 Confirmation Response

A confirmation will change the start character, and echo the Device Address and Command. Any requested data will be appended

to the Command.

Example: >DEV/COM_xxx'cr''lf']

5.7.5 Error Response

If a SSPA cannot execute a Command or detects a protocol violation, an error response is generated. An error is flagged by changing the "/" command designator in the response to a "?". Following the "?" error symbol are two characters which are unique error symbols useful for computer analysis. The two error symbols are followed by a text string explaining the error for the convenience of a human operator. For this document ER is used for the generic case examples response.

Example: >DEV?COM ER Error Message 'cr''lf']

5.7.6 End Of Message

End of message strings were devised in such a way that an orderly screen presentation would result when SSPAs are controlled by simple ASCII terminals.

5.7.6.1 Command Ending

The end of message for a command is a carriage return. For this document 'cr' is used for the carriage return.

Example: <DEV/COM'cr'

5.7.6.2 Response Ending

End of message for a response is a carriage return, line feed and a bracket: 'cr''lf'].

Example: >DEV/COM'cr''lf']

5.8.1.5 Parity Bit

The default parity is even.

```
Set Parity Bit:      <DEV/SPB_XXXX'cr'          xxxx = ODD
Confirmation:      >DEV/SPB_XXXX'cr''lf']    or EVEN
```

```
Retrieve Parity Bit: <DEV/SPB_'cr'
Confirmation:      >DEV/SPB_XXXX'cr''lf']
```

5.8.1.6 LCD Contrast

The default is 15.

```
Set Contrast:      <DEV/CON_xx'cr'          xx = 0 to 30
Confirmation:     >DEV/CON_xx'cr''lf']
```

```
Retrieve Contrast: <DEV/CON_'cr'
Confirmation:     >DEV/CON_xx'cr''lf']
```

5.8.1.7 LCD Brightness

The default is 15.

```
Set Brightness:   <DEV/LCD_xx'cr'          xx = 0 to 30
Confirmation:    >DEV/LCD_xx'cr''lf']
```

```
Retrieve Brightness: <DEV/LCD_'cr'
Confirmation:      >DEV/LCD_xx'cr''lf']
```

5.8.1.8 Lamp Test

The default is off.

```
Test Lamps:      <DEV/LAM_XXX'cr'          XXX = ON or OFF
Confirmation:    >DEV/LAM_XXX'cr''lf']
```

```
Lamp Test Status: <DEV/LAM_'cr'
Confirmation:     >DEV/LAM_XXX'cr''lf']
```

5.8.1.9 Equipment Type

Equipment Type is a command that retrieves the model number and software version of the equipment. The information cannot be changed by command.

```
Retrieve Equipment Type: <DEV/RET_'cr'
Confirmation:           >DEV/RET_##### yyyyy'cr''lf']
```

= Model Number yyyyy = Software Version

```
Example:                >DEV/RET_XPA200-7984-I SW_1.07
```

5.8.1.10 Application Identification

The Application Identification (AID) command allows a free form message to be created. It is intended to identify either the satellite, transponder, beam, destination or other aspects of the application that may be significant to operations. The message length corresponds to capability of the LCD and is 48 characters in total. The second line begins at character 25, therefore, blanks must be used after line 1 information in order to space to line 2. A carriage return ends the command. Trailing blanks will be generated to fill the LCD field. The AID display will alternate with the Equipment type display by use of the clear function key on the front panel. The default is "AID MESSAGE".

```
Application ID:         <DEV/AID_##### ... #####'cr'
Confirmation:          >DEV/AID_'cr'
                        #####'cr'
                        #####'cr''lf']
```

```
Retrieve ID:           <DEV/AID_'cr'
Confirmation:          >DEV/AID_'cr'
                        #####'cr'
                        #####'cr''lf']
```

Note: ##### ... ##### = Your message, maximum 48 characters.

5.8.2 Configuration Commands

5.8.2.1 Amplifier ON/OFF

The XPA200-7984-I provides the user direct control of the 10 VDC supply voltage to the solid state RF power FETs. This feature provides the ability to put the SSPA into a low power consumption mode when the unit is offline. The default is on.

```
Amplifier control: <DEV/AMP_xxx'cr'          xxx = ON or OFF
Confirmation:      >DEV/AMP_xxx'cr''lf']
```

```
Retrieve AMP Status: <DEV/AMP_'cr'
Confirmation:       >DEV/AMP_xxx'cr''lf']
```

5.8.2.2 Mute Output

The user is provided output mute control via the remote interface using this command. The default is on.

```
Mute Output:        <DEV/MUT_xxx'cr'          xxx = ON or OFF
Confirmation:       >DEV/MUT_xxx'cr''lf']
```

```
Retrieve Mute Status: <DEV/MUT_'cr'
Confirmation:        >DEV/MUT_xxx'cr''lf']
```

5.8.2.3 Attenuator

The default is 10 dB.

```
Set Attenuator:     <DEV/ATT_ yy.yy'cr'
Confirmation:       >DEV/ATT_ yy.yy'cr''lf']
```

```
Retrieve Attenuator:: <DEV/ATT_'cr'
Confirmation:        >DEV/ATT_ yy.yy'cr''lf']
```

Note: yy.yy = 0.0 to 20.00 dB in 0.25 steps.

5.8.2.4 Auto Fault Recovery

The SSPA output is automatically muted in the event of a detected fault. Auto Fault Recovery, if enabled, will cause the output signal to go active (unmuted) if all faults clear. If disabled, the output will remain muted even after all faults clear until a MUT_OFF command is received (see 5.8.2.2). The default is off.

```
Set Fault Recovery: <DEV/AFR_XXX'cr'           xxx = ON or OFF
Confirmation:      >DEV/AFR_XXX'cr''lf']
```

```
Retrieve Status:   <DEV/AFR_'cr'
Confirmation:     >DEV/AFR_XXX'cr''lf']
```

5.8.3 Status Commands

Status commands retrieve configuration, maintenance and alarm status in summary form.

5.8.3.1 Configuration Status

```
Configuration Status: <DEV/RCS_'cr'
Confirmation:        >DEV/RCS_'cr'

ATT_YY.YY'cr'       Attenuator
AMP_nnn'cr'         Amplifier - ON/OFF
TX_nnn'cr'          Transmit - ON/OFF
ONL_nnn'cr'         Online - ON/OFF
AFR_nnn'cr'         Auto Flt Recovery-ON/OFF
```

5.8.3.2 Maintenance Status

```
Maintenance Status: <DEV/RMS_'cr'
Confirmation:       >DEV/RMS_'cr'

V+28_XX.X'cr'       +28 VDC Supply
V+12_XX.X'cr'       +12 VDC Supply
V-12_XX.X'cr'       -12 VDC Supply
V +5_X.X'cr'        +5 VDC Supply
V -5_X.X'cr'        -5 VDC Supply
V+10_1_XX.X'cr'    10 VDC Supply #1
V+10_2_XX.X'cr'    10 VDC Supply #2
TEMP_XX'cr'         Temperature
FPWR_XX.X'cr'       RF Forward Power (dBm)
RPWR_XX.X'cr''lf'] RF Reflected Power (dBm)
```

5.8.3.3 FET Status

FET Status: <DEV/RFS_'cr'
 Confirmation: >DEV/RFS_'cr'

FET1_xxx'cr'	FET1 current in milliamps
FET2_x.x'cr'	FET2 current in amps
FET3_x.x'cr'	FET3 current in amps
FET4_x.x'cr'	FET4 current in amps
FET5_x.x'cr'	FET5 current in amps
FET6_x.x'cr'	FET6 current in amps
FET7_x.x'cr'	FET7 current in amps
FET8_x.x'cr'	FET8 current in amps
FET9_x.x'cr'	FET9 current in amps
FET10_x.x'cr'	FET10 current in amps
FET11_x.x'cr'	FET11 current in amps
FET12_x.x'cr'	FET12 current in amps
FET13_x.x'cr'	FET13 current in amps
FET14_x.x'cr'	FET14 current in amps
FET15_x.x'cr'	FET15 current in amps
FET16_x.x'cr'	FET16 current in amps
FET17_x.x'cr'	FET17 current in amps
FET18_x.x'cr'	FET18 current in amps
FET19_x.x'cr''lf']	FET19 current in amps

5.8.3.4 Utility Status

Utility Status: <DEV/RUS_'cr'
 Confirmation: >DEV/RUS_'cr'

COMM_aaaaaa'cr'	RS-232 or RS-485
ADD_xxx'cr'	Address (001 to 255)
BR_nnnn'cr'	Baud Rate (300 to 9600)
PAR_nn'cr'	Parity (OD or EV)
CON_xx'cr'	LCD Contrast (0 to 30)
LCD_xx'cr''lf']	LCD Brightness (0 to 30)

5.8.3.5 Alarm Status

```

Alarm Status:      <DEV/RAS_'cr'
Confirmation:      >DEV/RAS_'cr'

+28_xx'cr'        +28 VDC Fault
+12_xx'cr'        +12 VDC Fault
-12_xx'cr'        -12 VDC Fault
+5_xx'cr'         +5 VDC Fault
-5_xx'cr'         -5 VDC Fault
+10_1_xx'cr'      +10 PS#1 Fault
+10_2_xx'cr'      +10 PS#2 Fault
TEMP_xx'cr'       Temperature Fault
FAN1_xx'cr'       Fan 1 Fault
FAN2_xx'cr''lf'] Fan 2 Fault
xx = OK or FT

```

5.8.3.6 Summary Alarm Status

Summary alarm is set to Fault (FT) if any of the items in paragraph 5.8.4.5 are faulted.

```

Summary Alarm:      <DEV/SAS_'cr'           xx = OK or FT
Confirmation:      >DEV/SAS_xx'cr''lf']

```

5.8.3.7 Terminal Status Change

The TSC_ command can be used to determine if the status of the terminal has changed since it was last polled. If any of the parameters listed in the RCS or RUS commands have changed as a result of user operations or if any new fault condition occur the TSC_ command will return YES. The TSC_ command will then continue to return YES until any of the following commands are received: RCS_, RUS_, RAS_, PACRCS_, PACRUS_, or PACRAS.

```

Configuration Status: <DEV/TSC_'cr'
Confirmation:         >DEV/TSC_nnn'cr''lf']  nnn = YES/NO

```

5.8.3.8 Packed Configuration Status

Configuration Status: <DEV/PACRCS_'cr'
 Confirmation: >DEV/PACRCS_aabcdeefg'cr''lf']

where: aa = # of 0.25 dB steps in HEX above 0dB (0to120)
 b = 1 if Amplifier ON, 0 if OFF
 c = 1 if Tx ON, 0 if OFF
 d = 1 if unit ONLINE, 0 if OFFLINE
 ee = SSPA number = BU,01 or 02 (if e = 0, ff = 00)
 f = A if Auto Mode, M if Manual Mode
 g = 1 if Auto Recovery enabled, else 0

5.8.3.9 Packed Maintenance Status

Packed Maintenance Status: <DEV/PACRMS_'cr'
 Confirmation: >DEV/PACRMS_aabbccddeeffgghhhiiijjj'cr''lf']

where:
 aa = +28 supply, 100mV per count above 10.0V in Hex
 bb = +12 supply scaled 100mV per count in Hex
 cc = -12 supply scaled 100mV per count in Hex
 dd = +5 supply scaled 100mV per count in Hex
 ee = -5 supply scaled -100mV per count in Hex
 ff = +10 supply #1 scaled 100mV per count in Hex
 gg = +10 supply #2 scaled 100mV per count in Hex
 hhh = Signed temperature in degrees C (-10 to +95)
 iii = RF forward pwr, .1 dBm steps above 32.0 dBm in Hex
 jjj = RF reverse pwr, .1 dBm steps above 25.0 dBm in Hex

5.8.3.10 Packed FET Status

Packed FET Status: <DEV/PACRFS_'cr'
 Confirmation: >DEV/PACRFS_aabbccddeeff. . rrrs'cr''lf']

where:
 aa = FET1 current in Hex, formula: FET1 = (aa * 3)mAmps
 bb = FET2 current in Hex, scaled 100mA per count
 cc = FET3 current in Hex, scaled 100mA per count
 dd = FET4 current in Hex, scaled 100mA per count
 ee = FET5 current in Hex, scaled 100mA per count
 ff = FET6 current in Hex, scaled 100mA per count
 gg = FET7 current in Hex, scaled 100mA per count

```

hh = FET8 current in Hex, scaled 100mA per count
ii = FET9 current in Hex, scaled 100mA per count
jj = FET10 current in Hex, scaled 100mA per count
kk = FET11 current in Hex, scaled 100mA per count
ll = FET12 current in Hex, scaled 100mA per count
mm = FET13 current in Hex, scaled 100mA per count
nn = FET14 current in Hex, scaled 100mA per count
oo = FET15 current in Hex, scaled 100mA per count
pp = FET16 current in Hex, scaled 100mA per count
qq = FET17 current in Hex, scaled 100mA per count
rr = FET18 current in Hex, scaled 100mA per count
ss = FET19 current in Hex, scaled 100mA per count

```

5.8.3.11 Packed Utility Status

```

Packed Utility Status: <DEV/PACRUS_'cr'
Confirmation:          >DEV/PACRUS_abbcddeeff'cr''lf']

```

```

where:  a = com1 mode; 0=RS-232, 1=RS-485-2, 2=RS-485-4
        bb = Address in hex (01 to FF)
        c = 0 if Baud Rate 9600
          = 1 if Baud rate 4800
          = 2 if Baud rate 2400
          = 3 if Baud rate 1200
          = 4 if Baud rate 300
        d = 0 if Parity Even, 1 if Parity Odd
        ee = LCD Contrast (0 to 30)
        ff = LCD Brightness (0 to 30)

```

5.8.3.12 Packed Alarm Status

```

Packed Alarm Status: <DEV/PACRAS_'cr'
Confirmation:        >DEV/PACRAS_abcdefghijkl'cr''lf']

```

```

where:  a = 1 if +28 Fault, else 0
        b = 1 if +12 Fault, else 0
        c = 1 if -12 Fault, else 0
        d = 1 if +5 Fault, else 0
        e = 1 if -5 Fault, else 0
        f = 1 if +10 PS#1 Fault, else 0
        g = 1 if +10 PS#2 Fault, else 0
        h = 1 if TEMP Fault, else 0
        i = 1 if FAN 1 Fault, else 0
        j = 1 if FAN 2 Fault, else 0
        k = 1 if PROC Fault, else 0

```

5.8.4 Stored Alarm

The 100 alarms are date/time stamped and stored in memory as they occur. The alarm entry is also updated with its date/time of clearance. The entry remains in memory until it is removed by command.

5.8.4.1 Total Stored Alarms

This command retrieves the total number of stored alarms and the time and date of the most recent alarm.

```
Retrieve Total Alarms: <DEV/TSA_'cr'
Confirmation:         >DEV/TSA_TOTAL:nnn'cr'
                     LAST:hh:mm:ss mm/dd/yy'cr''lf']
```

5.8.4.2 Clear All Stored Alarms

```
Clear Alarms:        <DEV/CAA_YES'cr'
Confirmation:        >DEV/CAA_CLEARED'cr''lf']
```

5.8.4.3 List All Alarms

```
List All Alarms: <DEV/LAA_'cr'
Confirmation:   >DEV/LAA_'cr'
               xxx yyyyyyyyyyy hh:mm:ss mm/dd/yy'cr'
               xxx yyyyyyyyyyy hh:mm:ss mm/dd/yy'cr'
               xxx yyyyyyyyyyy hh:mm:ss mm/dd/yy'cr'
               "      "      "      "
               "      "      "      "
               xxx yyyyyyyyyyy hh:mm:ss mm/dd/yy'cr''lf']
```

Where: xxx = stored fault number
 yyyyyyyyyyy = fault description
 hh:mm:ss = fault time
 mm/dd/yy = fault date

5.9 ERROR PROCESSING

5.9.1 General Errors

The following Error Responses may be generated by any command instead of a confirmation:

```
>DEV?COM CU COMMAND UNRECOGNIZED'cr''lf']  
>DEV?COM IP INVALID PARAMETER'cr''lf']  
>DEV?COM PE PARITY ERROR'cr''lf']
```

5.9.2 Configuration Errors

The following Error Responses may be generated by configuration commands:

```
>DEV?COM LO DEVICE IN LOCAL MODE'cr''lf']
```

5.9.3 Time-Outs

A time-out should be assumed if there is no response in 1.0 seconds. The station monitor and control computer should try at least three times. Possible sources of timeouts are as follows.

1. Incorrect Device Address
2. Faulty Cable
3. Faulty Connector
4. I/O fault on remote interface
5. I/O fault on monitor and control computer

XPA200-7984-I-OPT1 Remote Command Summary

Utility Commands		Paragraph
Set Time	<DEV/TIM_hh:mm:ss' cr'	5.8.1.1
Set Date	<DEV/DAT_mm/dd/yy' cr'	5.8.1.2
Set Physical Address	<DEV/SPA_xxx' cr'	5.8.1.3
Set Baud Rate	<DEV/SBR_xxxx' cr'	5.8.1.4
Set Parity Rate	<DEV/SPB_xxxx' cr'	5.8.1.5
Set LCD Contrast	<DEV/CON_xx' cr'	5.8.1.6
Set LCD Brightness	<DEV/LCD_xx' cr'	5.8.1.7
Retrieve Equipment Type	<DEV/RET_' cr'	5.8.1.8
Set Application ID Message	<DEV/AID_xxx...xxx' cr'	5.8.1.9
Configuration Commands		Paragraph
Set Amplifier ON/OFF	<DEV/AMP_xxx' cr'	5.8.2.1
Mute/Unmute	<DEV/MUT_xxx' cr'	5.8.2.2
Set Attenuation	<DEV/ATT_xx.xx' cr'	5.8.2.3
Select Auto Fault Recovery	<DEV/AFR_xxx' cr'	5.8.2.4
Status Commands		Paragraph
Retrieve Configuration Status	<DEV/RCS_' cr'	5.8.3.1
Retrieve Maintenance	<DEV/RMS_' cr'	5.8.3.2
Retrieve FET Status	<DEV/RFS_' cr'	5.8.3.3
Retrieve Utility Status	<DEV/RUS_' cr'	5.8.3.4
Retrieve Alarm Status	<DEV/RAS_' cr'	5.8.3.5
Summary Alarm Status	<DEV/SAS_' cr'	5.8.3.6
Terminal Status Change	<DEV/TSC_' cr'	5.8.3.7
Packed Configuration Status	<DEV/PACRCS_' cr'	5.8.3.8
Packed Maintenance Status	<DEV/PACRMS_' cr'	5.8.3.9
Packed FET Status	<DEV/PACRFS_' cr'	5.8.3.10
Packed Utility Status	<DEV/PACRUS_' cr'	5.8.3.11
Packed Alarm Status	<DEV/PACRAS_' cr'	5.8.3.12
Stored Alarm Commands		Paragraph
Retrieve Total Stored Alarms	<DEV/TSA_' cr'	5.8.4.1
Clear All Stored Alarms	<DEV/CAA_YES' cr'	5.8.4.2
List All Stored Alarms	<DEV/LAA_' cr'	5.8.4.3

SECTION 6

Maintenance and Troubleshooting

6.1 General

This section is intended to provide procedures to assist operator and maintenance personnel in the checkout, maintenance and troubleshooting of the SSPA. COMTECH recommends that spare replacement SSPA'S be used to replace SSPA'S removed from the system for maintenance. Troubleshooting procedures are provided for fault isolation to the module level.

The input and output signals, the interconnecting cables and The location of the modules are as shown in Figure 6-1.

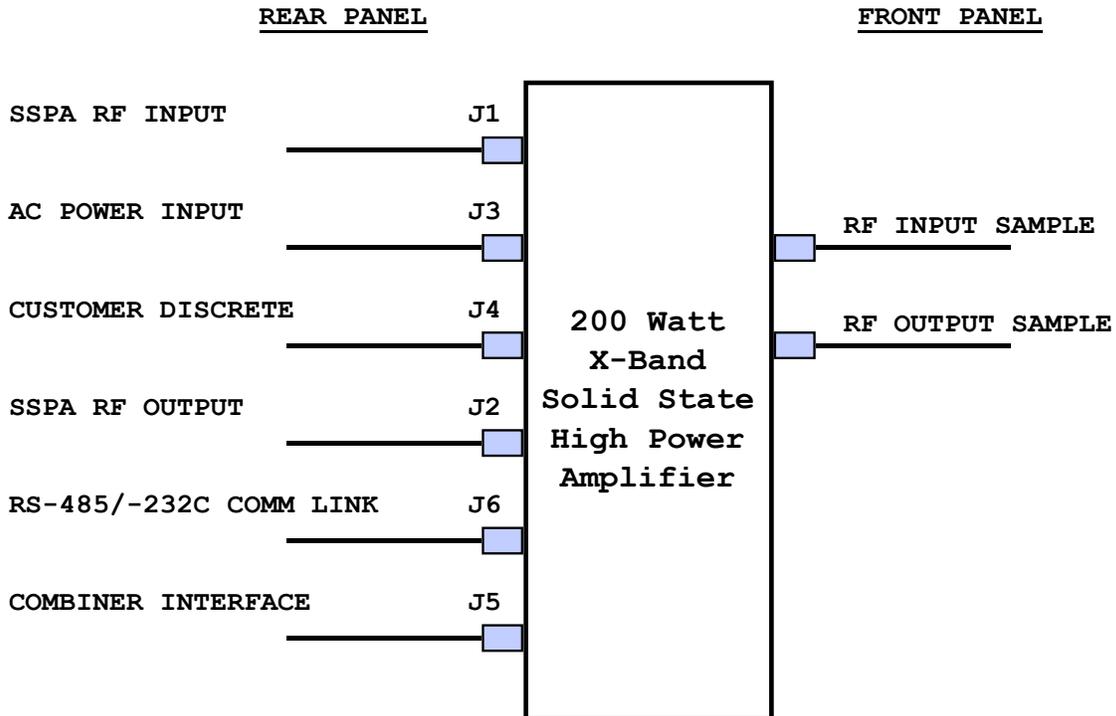


Figure 6-1. SSPA Signal and Interconnecting Cable Diagram

6.2 Maintenance Testing

Use the instructions in Section 2.0 for installing the SSPA for checkout, and the procedures in Section 3.0, System Operation, for operating the SSPA.

The SSPA is a X-Band SSPA with an RF output level of +53.0 minimum dBm at 1 dB compression.

6.2.1 Test Point Samples

The RF input and output can be monitored at the RF Sample Test Points on the front panel. Type N connectors are provided. The sample RF input level is -20 dBc nominal, and the RF output level is -40 dBc nominal. Actual measured data for these sample ports is located on the front panel.

6.3 Troubleshooting

SSPA operating problems can be identified by first observing the status indicators on the front panel. When a fault condition is indicated, the specific fault, or faults, can be identified in the Current Faults Function Menu, Figure 3-4, which is accessed through the local operation key-pad and displayed on the LCD display located on the front panel. The status of SSPA functions is displayed in the Monitor Status Functions Menu, Figure 3-3. Refer to paragraph 3.3, operation, for a description of the SSPA command functions; also, check the status of the mute condition in the configuration menu (i.e.: Mute = "On" means that the amplifier will be muted.)

6.3.1 SSPA Faults

Check the Monitor Status Functions Menu for possible faults, or an indication of a marginal performance tolerance condition.

6.3.1.1 Prime Power

Check the circuit breaker on the rear panel. The required prime power is 115 VAC, at typically 2600 VA (approx 1800W).

6.3.1.2 DC Power Supply Modules

- Power Supply, +10 VDC:

A fault ("FT") indicates a voltage level exceeding +/- 10% of the power supply voltage. Check the output of the DC Power Supply Module. Check all connections to make sure they are secure. If the voltage exceeds +/- 10%, or the fault still exists, return the SSPA to COMTECH for repair.

- Power Supply, +28 VDC:

A fault ("FT") indicates a voltage level exceeding +/- 10% of the power supply voltage. Check the output of the DC Power Supply Module. Check all connections to make sure they are secure. If the voltage exceeds +/- 10%, or the fault still exists, return the SSPA to COMTECH for repair.

- Power Supply, +12 VDC:

A fault ("FT") indicates a voltage level exceeding +/- 10% of the power supply voltage. Check the output of the DC Power Supply Module. Check all connections to make sure they are secure. If the voltage exceeds +/- 10%, or the fault still exists, return the SSPA to COMTECH for repair.

- Power Supply, -12 VDC

A fault ("FT") indicates a voltage level exceeding +/- 10% of the power supply voltage. Check the output of the DC Power Supply Module. Check all connections to make sure they are secure. If the voltage exceeds +/- 10%, or the fault still exists, return the SSPA to COMTECH for repair.

- +5 VDC:

A fault ("FT") indicates a voltage level exceeding +/- 10% of the power supply voltage. Check the output of the +12 VDC Power Supply Module, check for other module faults, and check all connections. If the fault still exists, remove the SSPA and return it to COMTECH for repair.

6.3.1.2 DC Power Supply Modules (continued)

- -5 VDC:

A fault ("FT") indicates a voltage level exceeding +/- 10% of the power supply voltage. Check the output of the -12 VDC Power Supply Module, check for other module faults, and check all connections. If the fault still exists, remove the SSPA and return it to COMTECH for repair.

6.3.1.3 Temperature Fault

- SSPA OVER TEMPERATURE FAULT:

A fault ("FT") indicates that the SSPA is over temperature. Make sure adequate ventilation is supplied to the unit, and that the airflow path is not obstructed. (See installation instructions, Sect. 2). Also, make sure the ambient air is within the 0 - 50 degree C operating limits. If the unit still shows a fault after following these procedures, turn the prime power switch off and return the SSPA to COMTECH for repair.

6.3.1.4 Monitor and Control Board

- Loss of LCD or LED Displays:

Check the 5V LED indicator on the Monitor and Control Board. If the 5V LED indicator is not illuminated, check the SSPA prime power and DC power supply connections to make sure they are

secure. If the fault still exists, remove the SSPA and return it to COMTECH for repair.

- Loss of Serial Communication Interface:

If there is also a DC power supply fault, first check the DC power supply. If there are no DC power supply fault, check the serial communications (COM 1) Connector J6 and cable to make sure they are secure. If the fault still exists, remove the SSPA and return it to COMTECH for repair.

See Section 7 for additional troubleshooting help.

6.4 Returning the SSPA to COMTECH

6.4.1 Return Material Authorization (RMA)

To return an in-warranty or out-of-warranty SSPA to COMTECH for repair or replacement:

1. Request a Return Material Authorization (RMA) number from the COMTECH Customer Service Representative, 1-(480)333-4357.
2. Provide the Customer Service Representative with the following information:
 - a. Model number.
 - b. Serial number.
 - c. Description of the problem.
 - d. Describe action taken to identify the problem.
 - e. Name and telephone number of the company contact.

For more information regarding the COMTECH warranty policy, please refer to the warranty statement located on the back of the title page.

6.4.2 Shipment to COMTECH

The SSPA being shipped should be packed in it's original shipping container with proper packing material to prevent possible shipping damage.

Ship the SSPA, prepaid, to COMTECH. Provide the following address on the shipping label, with the RMA number clearly marked on the label and the shipping container:

COMTECH EF Data Corp.
2114 W. 7th Street
Tempe, Arizona 85281 U.S.A.

Attention: Customer Service Department
RMA Number:

6.5 Product Application, Upgrading or Training Information

To obtain product application, upgrade or training information, Please contract the Customer Service Representative, 1-(480)333-4357.

Addendum

7.1 General

This addendum section contains additional items as listed below:

1. Additional Troubleshooting helps (Table 7.1)
2. Wiring diagram.
3. Top level parts list.

7.2 Additional Troubleshooting Information.

Table 7.1
Additional Troubleshooting Help

SYMPTOM	POSSIBLE CAUSES	SOLUTIONS
Unit does not turn on (no display, no front panel lights, no fans).	Power cord not plugged in. Faulty wiring to 28V power supply. 28V power supply fault.	Check power cord connections. With input power cord removed, check wiring and connections to 28V power supply. Check output of 28Vdc power supply.
Either one or both fans do no turn on.	Faulty wiring, bad	Note: At power-up, the fans are sequenced on. Therefore, in normal operation, the second fan does not turn on until approximately 3 seconds after the first fan. Check AS/0206 to ensure that

SYMPTOM	POSSIBLE CAUSES	SOLUTIONS
	<p>connections.</p> <p>Firmware not properly seated.</p> <p>Faulty 28V power supply.</p> <p>Failed fan, faulty control circuitry.</p>	<p>connections at P4 and P5 are not loose. Also check the cable connection at the fans. There should be approximately 24Vdc between the two pins at the fan. Check cable for continuity. Replace cable wiring if faulty or return to factory for cable repair.</p> <p>The fans are microprocessor controlled and monitored. Therefore, make sure U11 and U12 on AS/0200 are properly seated.</p> <p>Check the output voltage of the 28V power supply. (Either via the front panel "MONITOR" menu or using a voltmeter.)</p> <p>Replace Fan if faulty or return to factory for repair or replacement.</p>
<p>Display not turning on, missing text, incorrect backlighting, etc.</p>	<p>Firmware not properly seated.</p> <p>Faulty wiring, bad connections.</p> <p>Failed display, failed display control card.</p> <p>Failed circuitry on AS/0200 or AS/0206.</p>	<p>Ensure U11 and U12 on AS/0200 are properly seated.</p> <p>Ensure good cable connections from M&C cards AS/0200 and AS/0206 to display card located behind front panel. Check cables for continuity. Replace cable wiring if faulty or return to factory for repair.</p> <p>Return to factory for repair.</p> <p>Return to factory for repair.</p>
<p>No RF output, or output level much less than expected.</p>	<p>Mute function activated.</p>	<p>Check the "CONFIGURATION" menu to determine if the mute function has been activated. "MUTE = ON" means that the unit is muted. Turn the "MUTE" feature to "off" to allow RF amplification of the input signal.</p> <p>The "AMPLIFIER = OFF" feature</p>

SYMPTOM	POSSIBLE CAUSES	SOLUTIONS
	<p>"AMPLIFIER = OFF" feature activated.</p> <p>Large customer attenuation values selected.</p> <p>Input power level not correct, perhaps due to faulty input cable.</p> <p>Faulty input connection from 10V power supplies.</p> <p>Faulty SSPA control cable or connection.</p> <p>Failed SSPA amplifier module.</p>	<p>allows for lower current draw from the prime power source under standby conditions. To obtain RF output, ensure that this feature is set to "AMPLIFIER = ON".</p> <p>Check the "ATTENUATION = XX" setting in the "CONFIGURATION" menu. Lower value to get more gain.</p> <p>Use the input sample port on the front panel to determine that the input power level is as expected.</p> <p>Use the "MONITOR" menu to check the internal level of PS1 and PS2. The levels should be near 10V. If not correct, use a voltmeter to measure the voltage where the #8 wires enter the amplifier unit. WITH UNIT OFF, tighten connections if necessary.</p> <p>Check the 25 pin ribbon cable connections at the amplifier module and at AS/0200.</p> <p>This can usually be determined by using the "MONITOR" menu to check the DC current levels being drawn by each transistor inside the amplifier module. Any transistor (QX) current that is 50 percent more or less than nominal would probably indicate a failure.</p> <p><u>Nominal values:</u> Q1=20mA, Q2,Q3=1.5A,Q4=2A, Q5=4A, Q6-Q11=7.5A, Q12-Q19=9A.</p> <p>There are no user serviceable parts inside the amplifier module. Return to factory for repair.</p>
No remote control communication.	<p>Incorrect cable connections.</p> <p>Improper communication</p>	<p>Make sure cable is wired as described in Section 5.</p> <p>Check settings of SSPA along</p>

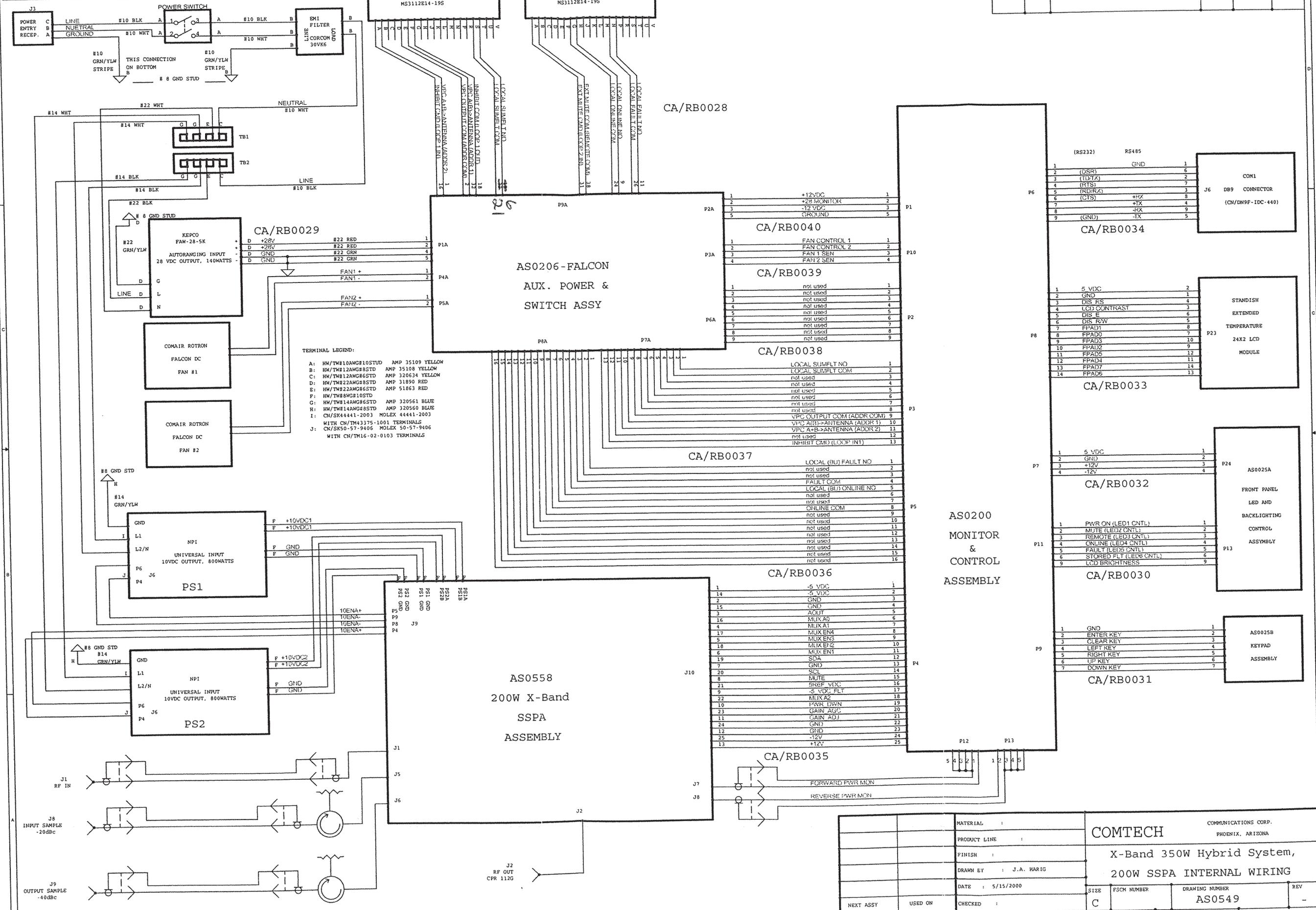
SYMPTOM	POSSIBLE CAUSES	SOLUTIONS
	<p>settings between SSPA and controlling terminal.</p> <p>Entry mode of unit set to "LOCAL".</p>	<p>with remote control terminal software.</p> <p>Change entry mode setting in "CONFIGURATION" menu to "REMOTE".</p>
<p>Amplifier Temperature fault</p>	<p>Operating temperature limits exceeded.</p> <p>Air intake or air exhaust paths obstructed.</p> <p>Fan failure.</p> <p>Defective transistor(s) in amplifier module.</p>	<p>Note: The SSPA module contains an internal temperature monitor that will shut off the unit (i.e. turn off the 10V supplies) if the heatsink temperature becomes excessive. This prevents the transistors from overheating and destruction. After cooling down below the trip point, the unit will automatically restart.</p> <p>Do not exceed 50C ambient input air temperature. (Recommend 40C maximum)</p> <p>Remove obstructions to ensure adequate air flow and proper amplifier cooling.</p> <p>Check fan operation as described earlier in this table. Replace fan(s) if necessary.</p> <p>Use "MONITOR" menu to check transistor currents. Compare readings with nominal values listed earlier. Report excessive readings to manufacturer and return entire unit to manufacturer for repair. There are no user serviceable parts inside the SSPA amplifier module.</p>

SYMPTOM	POSSIBLE CAUSES	SOLUTIONS
10V Power Supply Fault (PS1 or PS2)	<p>Faulty wire or connection.</p> <p>Excessive current draw from transistor inside amplifier module.</p> <p>Faulty Power Supply.</p>	<p>Check cable and connection from both PS1 and PS2 to amplifier module. On outside of module, measure voltage. Expected voltage = 10 +/- .5Vdc.</p> <p>Use "MONITOR" menus to check transistor currents. Record excessive values and return entire unit to manufacturer for repair.</p> <p>Return failed power supply for repair. Replace with new power supply.</p>
Faulty/Improper Redundancy Switch operation	<p>Faulty wiring or connections.</p> <p>Improper settings.</p>	

7.3 WIRING DIAGRAM (next page).

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REVISIONS					
ZONE	REV	DESCRIPTION	BY	DATE	APRVL



TERMINAL LEGEND:

A:	HW/TW#10ANG#10STUD	AMP 35109 YELLOW
B:	HW/TW#12ANG#8STD	AMP 35108 YELLOW
C:	HW/TW#12ANG#6STD	AMP 320634 YELLOW
D:	HW/TW#22ANG#8STD	AMP 31890 RED
E:	HW/TW#22ANG#6STD	AMP 51863 RED
F:	HW/TW#8#8#10STD	AMP 320561 BLUE
G:	HW/TW#14ANG#6STD	AMP 320560 BLUE
H:	HW/TW#14ANG#8STD	AMP 44441-2003
I:	CN/SK44441-2003	MOLEX 44441-2003
J:	WITH CN/TW43375-1001 TERMINALS	
	CN/SR50-57-9406	MOLEX 50-57-9406
	WITH CH/TW16-02-0103 TERMINALS	

MATERIAL :	COMTECH COMMUNICATIONS CORP. PHOENIX, ARIZONA
PRODUCT LINE :	X-Band 350W Hybrid System,
FINISH :	200W SSPA INTERNAL WIRING
DRAWN BY : J.A. HARIG	SIZE : C
DATE : 5/15/2000	FSCM NUMBER : AS0549
CHECKED :	DRAWING NUMBER : AS0549
DATE :	REV : -
APPLICATION :	SCALE: NONE DATE: 5/15/2000 SHEET 1 OF 1

7.4 PARTS LIST (next pages)

Assembly	Assembly Description	Rev	U/M
AS/0549	ASSY, CHASSIS, SSPA, 7RU, XPA200-7984-I		EA

Item	Component	Component Description	Rev	Qty Per Assy	U/M	Obs Date	Eff Date
10	AS/0200	ASSEMBLY, MONITOR & CONTROL	B7	1.00000	EA		
20	AS/0206	ASSEMBLY, POWER & SWITCH	-3	1.00000	EA		
	<u>Reference Designators</u>						
	DEF	FALCON 1.5 OHM RES					
30	AS/0558	ASSEMBLY, RF AMPLIFIER, XPA200-7984-I		1.00000	EA		
40	AS/0546	ASSY.,FRONT PANEL,SSPA,7RU		1.00000	EA		
50	CA/RB0012-02	CA-M&C TO LED PWB (PWR)	B	1.00000	EA		
60	CA/RB0028	CABLE, P9A TO J7, J5 & J4		1.00000	EA		
70	CA/RB0029	CABLE, CCPA 28V P.S. TO AS/0206		1.00000	EA		
80	CA/RB0030	CABLE, SSPA M&C TO LED (CNTL)		1.00000	EA		
90	CA/RB0031	CABLE, SSPA M&C TO KEYPAD PWB		1.00000	EA		
100	CA/RB0032	CABLE, SSPA M&C TO LED (PWR)		1.00000	EA		
110	CA/RB0033	CABLE, SSPA M&C TO LCD MODULE		1.00000	EA		
120	CA/RB0034	CABLE, SSPA M&C TO REMOTE INTF.		1.00000	EA		
130	CA/RB0036	CABLE, SSPA M&C P5 TO AUX PWR P8A		1.00000	EA		
140	CA/RB0037	CABLE, SSPA M&C P3 TO AUX PWR P7A		1.00000	EA		
150	CA/RB0038	CABLE, SSPA M&C P2 TO AUX P6A		1.00000	EA		
160	CA/RB0039	CABLE, SSPA M&C P10 TO AUX PWR P3A		1.00000	EA		

Assembly	Assembly Description	Rev	U/M
AS/0549	ASSY, CHASSIS, SSPA, 7RU, XPA200-7984-I		EA

Item	Component	Component Description	Rev	Qty Per Assy	U/M	Obs Date	Eff Date
170	CA/RB0040	CABLE, SSPA M&C P1 TO AUX PWR P2A		1.00000	EA		
180	CA/RB0041	CABLE, AUX PWR P4, P5 TO FANS		1.00000	EA		
190	CA/RB0042	CABLE, SSPA CONTROL TO 10V PS ENABLE		1.00000	EA		
200	CA/RB0045	CABLE, XPA090-7984-I, M&C CONTROL TO SSPA		1.00000	EA		
210	CA/RF0060	CABLE, PWR MONITOR, FORWARD/REVERSE		2.00000	EA		
220	CA/RF0133	CABLE, SMA, RF IN <J1> TO SSPA		1.00000	EA		
230	CA/RF0134	CABLE, SMA, INPUT SAMPLE		1.00000	EA		
240	CA/RF0135	CABLE, SMA, OUTPUT SAMPLE		1.00000	EA		
250	CA/RF0136	CABLE, DRIVER TO RF		1.00000	EA		
260	CB/PBW92X11240	CKT BRKR, 40A, 2-POLE		1.00000	EA		
270	CN/CA3102E20-19PBF	CN-AC IN, 3 PIN MALE		1.00000	EA		
275	CN/CA3106E20-19SB	CN-3 PIN PLUG, FEMALE		1.00000	EA		
280	CN/CX5319-1	CONN. SMA/M .141 DIA		8.00000	EA		
290	CN/CX5730-2SF	CONN. SMA/MST, RG316		8.00000	EA		
300	CN/DN44M	CN-DB44 MALE SOLDER CUP		1.00000	EA		
310	CN/DN9F-IDC-440	CN-DB9 FEM IDC 4-40		7.00000	EA		

Assembly	Assembly Description	Rev	U/M
AS/0549	ASSY, CHASSIS, SSPA, 7RU, XPA200-7984-I		EA

Item	Component	Component Description	Rev	Qty Per Assy	U/M	Obs Date	Eff Date
320	CN/DN9M-SC	CN-DB9 MALE SLDRCUP		1.00000	EA		
340	CN/MS3112E12-10S	CN - MC12-10S, Box Recept, Solder		1.00000	EA		
350	CN/MS3112E14-19S	CN - MC14-19S, Box Recept, Solder		2.00000	EA		
360	CN/RC13X2	CN-RETAINING CLIP 13 X 2		1.00000	EA		
370	CN/RC5X2	CN-RETAINING CLIP 5 X 2		7.00000	EA		
380	CN/RC7X2	CN-RETAINING CLIP 7 X 2		6.00000	EA		
390	CN/SK2X1-156	CN-SOCKET, 2X1, 0.156		2.00000	EA		
400	CN/SK4X1-04	CN-SOCKET 4X1 POLAR		4.00000	EA		
410	CN/SK5X1-156	CN SOCKET 5X1 0.156 POLAR		2.00000	EA		
420	CN/SK5X2	CN-SOCKET 5X2 POLAR		7.00000	EA		
430	CN/SK7X2	CN-SOCKET 7X2 POLAR		4.00000	EA		
440	CN/SK8X2	CN-SOCKET 8X2 POLAR		2.00000	EA		
450	DI/TDDT7011P	DI-TUNNEL DET, SMA, 7-11 GHZ		2.00000	EA		
460	FN/DC24VFAL	FAN, 24VDC, 1.8 AMP, FALCON		2.00000	EA		
465	FP/AD0015	ADAPTER PLATE,POWER SUPPLY,SSPA	-	1.00000	EA		
470	FP/BR0089	BRACKET,MOUNTING,90 DEGREE,7RU	-	2.00000	EA		

Assembly	Assembly Description	Rev	U/M
AS/0549	ASSY, CHASSIS, SSPA, 7RU, XPA200-7984-I		EA

Item	Component	Component Description	Rev	Qty Per Assy	U/M	Obs Date	Eff Date
480	FP/BR0091	BRACKET,FAN MOUNT,SSPA,7RU	-	1.00000	EA		
500	FP/BR0093	BRACKET,FAN DUCT,BTM.,SSPA	-	1.00000	EA		
510	FP/BR0094	BRACKET,SCREEN RETAINING,SSPA	-	1.00000	EA		
520	FP/BR0035	RETAINING BRACKET, SSPA, FRONT PANEL TO BOTTOM	-	1.00000	EA		
530	FP/BR0045	SLIDE BRACKET FOR SL0004		1.00000	EA		
540	FP/BR0057	BRACKET; ISOLATOR MOUNTING, CPA/XPA	-	1.00000	EA		
545	FP/BR0092	BRACKET,FAN DUCT, TOP, SSPA	-	1.00000	EA		
550	FP/CV0051	COVER, BOTTOM, SSPA, 5U	C	1.00000	EA		
560	FP/CV0052	COVER, TERMINAL BLOCK		1.00000	EA		
570	FP/CV0137	COVER,FAN,HONEYCOMB,S SPA	-	1.00000	EA		
580	FP/CV0075	COVER, TOP, CHASSIS, AR588648-200, 6RU	-	1.00000	EA		
590	FP/CV0135	COVER,HEATSINK,AMPLIFIER		1.00000	EA		
600	FP/CV0136	COVER,SHROUD,AMPLIFIER ,SSPA	-	1.00000	EA		
620	FP/PN0043	PANEL,RIGHT SIDE,7RU,SSPA	-	1.00000	EA		
630	FP/PN0044	PANEL,REAR,SSPA,7RU	-	1.00000	EA		
640	FP/PN0042	PANEL,LEFT SIDE,7RU,SSPA	-	1.00000	EA		

Assembly	Assembly Description	Rev	U/M
AS/0549	ASSY, CHASSIS, SSPA, 7RU, XPA200-7984-I		EA

Item	Component	Component Description	Rev	Qty Per Assy	U/M	Obs Date	Eff Date
650	FP/WG0056	WAVEGUIDE,COMBINER,DU AL LEVEL	-	1.00000	EA		
660	FP/WG0029	WAVEGUIDE, ISO, 7.9-8.4, 200W	-	1.00000	EA		
670	FP/WG0030	WAVEGUIDE, TRIPLE CG COUPLER, WR-112	C	1.00000	EA		
680	GA/0005	O-RING, 2-137, BUTYL, XPA090-7984-I		2.00000	EA		
690	GA/GSKTCPR112HLF	GA-GASKET, CPR112, HLF		2.00000	EA		
700	HS/0048	HEATSINK,CHASSIS,SSPA,7 RU		1.00000	EA		
710	HW/440X1-3/4FHMS	4-40 X 1 - 3/4 FHMS, SS, 100 DEG		1.00000	EA		
715	HW/832X1/2SHCS	8-32 X 1/2 SHCS, SS		3.00000	EA		
717	HW/832X1-3/8SHCS	8-32 X 1 3/8, SHCS, SS		16.00000	EA		
720	HW/832X2-3/8SHCS-BL	8-32 X 2 3/8, SHCS, BLACK ANODIZED		6.00000	EA		
730	HW/HD10944-A-1032-2F	HANDLE,BLACK,OVAL,7RU		2.00000	EA		
740	HW/HNVPH3810	HANDLE, SPRING DETENT, 4 IN., BLACK		2.00000	EA		
750	HW/JMP601RJS12	JUMPER, 12 POLE		1.00000	EA		
760	HW/SO04X1/8M-F	JACK SOCKET, 4-40 X 1/8		2.00000	EA		
770	HW/TBA303104	TERMINAL BLOCK, 4 POLE		2.00000	EA		
772	HW/TW#22AWG-#8STUD	.312 W TERM, # 22 AWG, # 8 STUD		8.00000	EA		

Bill Of Materials with Reference Designators

Assembly	Assembly Description	Rev	U/M
AS/0549	ASSY, CHASSIS, SSPA, 7RU, XPA200-7984-I		EA

Item	Component	Component Description	Rev	Qty Per Assy	U/M	Obs Date	Eff Date
775	HW/TW#12AWG-#8STUD	.375 W TERM, # 12 AWG, # 8 STUD		8.00000	EA		
780	HW/TW#12AWG-#6	.281 W TERM, #12 AWG - #6 STUD		6.00000	EA		
785	HW/TW#10AWG#10ST	.375W TERM,#10 AWG,#10 STUD		4.00000	EA		
787	HW/TW#22AWG-#6STUD	.250 W TERM, # 22 AWG, # 6 STUD		2.00000	EA		
790	HW/TW#8AWG-#10STD	SLDR TERM, #8 WIRE, #10 STUD		12.00000	EA		
820	PS/COVER-FAW28-5K	PS-COVER FOR FAW28-5K		1.00000	EA		
830	PS/FAW28-5K	PS-28VDC, UNIV, INPUT, 150W		1.00000	EA		
850	PS/FLAC-30VK6	PS-EMI FILTER, AC, 30A		1.00000	EA		
855	PS/NPI-3695	PS-10VDC,800W,AUTO INPUT		2.00000	EA		
860	RF/AT-18DH-10	RF-ATTEN, DC-18G, SMA, 10DB		2.00000	EA		
870	RF/IS037665-012	ISO, 7.7 - 8.5, N-F TO SMA-F		1.00000	EA		
880	RF/IS094-037209-003	ISO, 7.7 - 8.5, SMA-M TO SMA-F		3.00000	EA		
890	RS/WWLRW-1R5-5W	RS- 1.5 OHM, 5W, 5% LEADED WW		4.00000	EA		

Reference Designators

R10	1.5 OHM AS/0206
R7	1.5 OHM AS/0206
R8	1.5 OHM AS/0206
R9	1.5 OHM AS/0206

METRIC CONVERSIONS

Units of Length

Unit	Centimeter	Inch	Foot	Yard	Mile	Meter	Kilometer	Millimeter
1 centimeter	—	0.3937	0.03281	0.01094	6.214×10^{-6}	0.01	—	—
1 inch	2.540	—	0.08333	0.2778	1.578×10^{-5}	0.254	—	25.4
1 foot	30.480	12.0	—	0.3333	1.893×10^{-4}	0.3048	—	—
1 yard	91.44	36.0	3.0	—	5.679×10^{-4}	0.9144	—	—
1 meter	100.0	39.37	3.281	1.094	6.214×10^{-4}	—	—	—
1 mile	1.609×10^5	6.336×10^4	5.280×10^3	1.760×10^3	—	1.609×10^3	1.609	—
1 mm	—	0.03937	—	—	—	—	—	—
1 kilometer	—	—	—	—	0.621	—	—	—

Temperature Conversions

Unit	° Fahrenheit	° Centigrade
32° Fahrenheit	—	0 (water freezes)
212° Fahrenheit	—	100 (water boils)
-459.6° Fahrenheit	—	273.1 (absolute 0)

Formulas
$C = (F - 32) * 0.555$
$F = (C * 1.8) + 32$

Units of Weight

Unit	Gram	Ounce Avoirdupois	Ounce Troy	Pound Avoir.	Pound Troy	Kilogram
1 gram	—	0.03527	0.03215	0.002205	0.002679	0.001
1 oz. avoir.	28.35	—	0.9115	0.0625	0.07595	0.02835
1 oz. troy	31.10	1.097	—	0.06857	0.08333	0.03110
1 lb. avoir.	453.6	16.0	14.58	—	1.215	0.4536
1 lb. Troy	373.2	13.17	12.0	0.8229	—	0.3732
1 kilogram	1.0×10^3	35.27	32.15	2.205	2.679	—



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