INSTALLATION AND OPERATING MANUAL

100 W Ku-BAND RACK-MOUNT

SOLID STATE POWER AMPLIFIER

ARMA-K100-CRM

PM 101-632650-140 REV. 2

WARRANTY

This ADVANTECH Advanced Microwave Technologies, Inc. product is warranted against defects in material and workmanship for a period of 2 years from date of shipment. During the warranty period, ADVANTECH Advanced Microwave Technologies, Inc. will, at its option, either repair or replace products that will prove to be defective.

To return a product for warranty or repair service, you must first request a Return Material Authorization (RMA) number by contacting ADVANTECH at:

Phone:	(514) 420-0045	or	Fax: (514) 420-0073
Website:	www.AdvantechAMT.com	or	e-mail: Support@AdvantechAMT.com

The unit should be shipped to the following address, in original shipping container (box), with shipping charges prepaid.

ADVANTECH Advanced Microwave Technologies, Inc.
657 Orly Avenue
Dorval, Quebec
H9P 1G1
CANADA

Please indicate the RMA number on all shipping documentation.

Units shipped without prior issued RMA, or shipped not in original packing, may be subject of rejection and returned at sender's own expense.

LIMITATIONS OF WARRANTY

ADVANTECH Advanced Microwave Technologies, Inc. warrants this product to be free of materials and workmanship defects.

The foregoing warranty shall not apply to defects resulting from improper handling or abuse by the Buyer, unauthorized modification, operation outside of the environmental specifications for the product, or improper installation or maintenance.

ADVANTECH Advanced Microwave Technologies, Inc. shall not be liable for any direct, indirect, special, incidental or consequential damages.

CONTENTS

FIGURES

TABLES

1. SAFETY

In addition to this section, included by reference are the following pertinent sections of the International Standard IEC-215, 'Safety requirements for radio transmitting equipment':

Appendix D, 'GUIDANCE ON ASSESSING THE COMPETENCE OF PERSONNEL FOR DESIGNATION AS SKILLED' and also Sub-clause 3.1 of the Standard.

Appendix E, 'GUIDANCE ON SAFETY PRECAUTIONS TO BE OBSERVED BY PERSONNEL WORKING ON RADIO TRANSMITTING EQUIPMENT', also Sub-clauses 3.2, 3.7 and 22.1 of the Standard.

To prevent the risk of personal injury or loss related to equipment malfunction Advantech uses the following symbols for safety related information. For your own safety, please read the information carefully BEFORE operating the equipment.

Symbols used in manual:

WARNING: This indicates a hazardous procedure that could result in serious injury or death if not performed properly.

CAUTION: This indicates a hazardous and dangerous procedure that could result in light-to-severe injury or loss related to equipment malfunction, if proper precautions are not taken.

---------- **WARNING** ----------

When supplying power to this equipment, use the 3-pin connector provided, to connect to a **grounded power outlet**. If power is supplied without grounding to the equipment, there is a risk of receiving a severe or fatal electric shock.

In the context of this document any voltage that is lethal is viewed as 'High Voltage'. Therefore, even prime power (90 to 264 V AC) is dangerous because prime power potentials have been known to cause death or injury.

---------- **WARNING** ----------

The operator cannot repair this equipment. DO NOT attempt to remove the equipment cover or to disassemble internal components. Only qualified service technicians should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury to untrained personnel. In addition, there is a risk of damage to precision components.

---------- **WARNING** ----------

ALWAYS TERMINATE THE OUTPUT WAVEGUIDE OF THE AMPLIFIER WITH AN RF LOAD CAPABLE OF DISSIPATING FULL CW RF POWER. SIMILARLY TERMINATE THE INPUT TO AVOID THE POSSIBILITY OF THE AMPLIFIER BEING DRIVEN BY STRAY LEAKAGE SIGNALS. Incorporate the termination prior to applying prime power to the amplifier. This procedure prevents self-oscillation and irradiation of the local environment. Even if a source is not connected to the amplifier you are working with, there are situations where the amplifier can go into a self-induced mode and generate high levels of RF energy. Destruction caused under excessive load voltage standing wave ratio (VSWR) will void the warranty. Although the equipment has internal protection for VSWR higher than 3:1 and will automatically go in shutdown (with a delay of 1 second), still it is a safe procedure to avoid unwanted effects.

---------- **WARNING** ----------

DO NOT LOOK INTO THE OUTPUT PORT OF THE POWERED RF AMPLIFIER.
Treat the powered amplifier with extreme care. Keep in mind that levels of microwave radiation that do not induce immediate physical discomfort in most individuals can be sufficiently high to induce longer-term effects. Your eyes are particularly vulnerable parts of your body.

The permissible levels of exposure are quite low compared to the power levels of the amplifiers built by Advantech (e.g. less than 10 mW versus 20 to 500 W delivered by various units). The permissible levels are currently being studied by a number of organizations. In the past the U.S. safety Code established a dosage rate of 10 mW/cm^2. Currently there is consideration being given to reducing the permissible level to 1 mW/cm^2 in the United States, as has been the case for several European countries.

2. GENERAL INFORMATION

2.1 INTRODUCTION

This manual contains information required to install and operate the 100 W, Ku-Band Rack-mount Solid State Power Amplifier model ARMA-K100-CRM.

2.2 DESCRIPTION

The ARMA-K100-CRM is a Ku-Band 100 W solid-state power amplifier (SSPA) intended for rack-mount (indoor) installation. It incorporates a DC main power supply and a forced air cooling system. The SSPA product outline is shown in **Figure 1** at page 12 **& Figure 2** at page 13. A block diagram for one unit is shown in **Figure 3** at page 14. A redundant system block diagram is shown in **Figure 4** at page 15. Back panel connectors are shown in **Figure 5** at page 22. Full monitor and control capabilities are available from either the front panel or with the RS-485 serial interface.

2.2.1 POWER SUPPLY

The main power supply provides a single output, DC high current to the HPA (High Power Amplifier), the secondary power supply and a filtered, low current supply for operation of the fans. The secondary power supply has multiple outputs for operation of the Monitor and Control Assembly and the front panel display. The main power supply is configured for operation from 90-264 V AC. The fans are configured for 48V DC.

2.2.2 HPA ASSEMBLY

The HPA Assembly amplifies the RF input signal to a level sufficient for transmission. Integral to this module are low noise and power amplifier sections as well as variable attenuation sections that are used for temperature compensation and gain control. Other functionality includes internal power conditioning, temperature monitoring & high temperature shutdown.

2.2.3 MONITOR AND CONTROL ASSEMBLY

The MCA (Monitor and Control Assembly) monitors all the important operating parameters of the system, and communicates externally via serial and discrete interfaces as well as the front panel controls and display.

2.3 PACKING LIST

Item	Quantity	Description	Part #
1.	2	Installation and Operating Manual	101-632650-140, Rev.2
2.	2	Ku-Band, 100 Watt Amplifier, model ARMA-K100-CRM	100-632650-140
3.	1	Serial Communications Software (on 3½" diskette)	380-100796-001, Rev. 1.4
4.	1	Converter RS-485 to RS-232 PC Keyboard powered	510-000485-001
5.	2	Connector D-Sub 25 Back Shell, with thumb screws	631-000250-001
6.	2	Connector D-Sub 25 Sold Cup Plug	631-871380-001
7.	2	Connector D-Sub 9 Back Shell	631-925380-001
8.	2	Connector D-Sub 9 Sold Cup Plug	631-871380-003
9.	2	IEC-320 (F) Standard Sheet C-19 (Connector for J5)	634-113800-002
10.	12	#6-32 x 1/2" Hex Screws	802-632090-001
11.	12	#6 Lock Washers	803-600100-001
12.	2	Waterproof O-ring gasket WR-75 for WG flange	820-075000-001
13.	1	RMR-K400A Redundancy Kit (see next table)	190-330600-020

RMR-K400A Redundancy Kit (P/N 190-330600-020)

Item	Quantity	Description	Part #
1.	1	W/G WR75 Switch Assembly	240-330600-A01
2.	2	Ground Cable	260-100014-001
3.	1	Serial Interface Bus Cable Assembly	260-310402-001
4.	1	Semi-rigid Cable Assembly Upper	260-130602-601
5.	1	Semi-rigid Cable Assembly Lower	260-130600-701
6.	1	Local Bus Cable Assembly (Redundancy Cable)	260-310803-001
7.	1	Ku-Band Splitter Assembly (for rack-mount)	290-530400-001
8.	1	Connector Plate	330-153639-001
9.	1	Support	330-153895-001
10.	1	Plate	330-153896-001
11.	2	Pin ¼-20	330-153897-001
12.	1	“A” Decal	780-000220-001
13.	1	“B” Decal	780-000230-001
14.	4	10-32 Hex Nut 18-8 Stainless Steel SS	801-103210-001
15.	2	¼-20 Hex Nut 18-8 SS	801-140010-001
16.	4	8-32 Hex Nut 18-8 SS	801-832010-001
17.	2	6-32x5/16 Mach Screw Socket Cap 18-8 SS	802-632030-001
18.	8	6-32x5/8” Mach Screw Hex Socket Cap 18-8 SS	802-632030-011
19.	4	8-32x3/4” Mach Screw Phil Pan Head 18-8 SS	802-832010-003
20.	2	#10 Split Washer 18-8 SS	803-100100-001
21.	2	#10 Flat Washer 7/16 OD X.20 OD X.031 Thk 18-8 SS	803-100200-001
22.	2	¼ Split Washer 18-8 SS High Collar	803-140100-002
23.	2	¼ Flat Washer 18-8 SS	803-140200-001
24.	10	#6 Split Washer 18-8 SS	803-600100-001
25.	8	#6 Flat Washer Sml 0.312”Od 0.155”ID 0.035”Thk 18-8 SS	803-600200-002
26.	4	Split Washer 18-8 SS	803-800100-001
27.	8	#8 Flat Washer 3/8”OD 0.170”ID 0.031”Thk 18-8 SS Gould Fasteners	803-800200-001
28.	2	WR75 O-Ring Half Gasket	820-075000-001

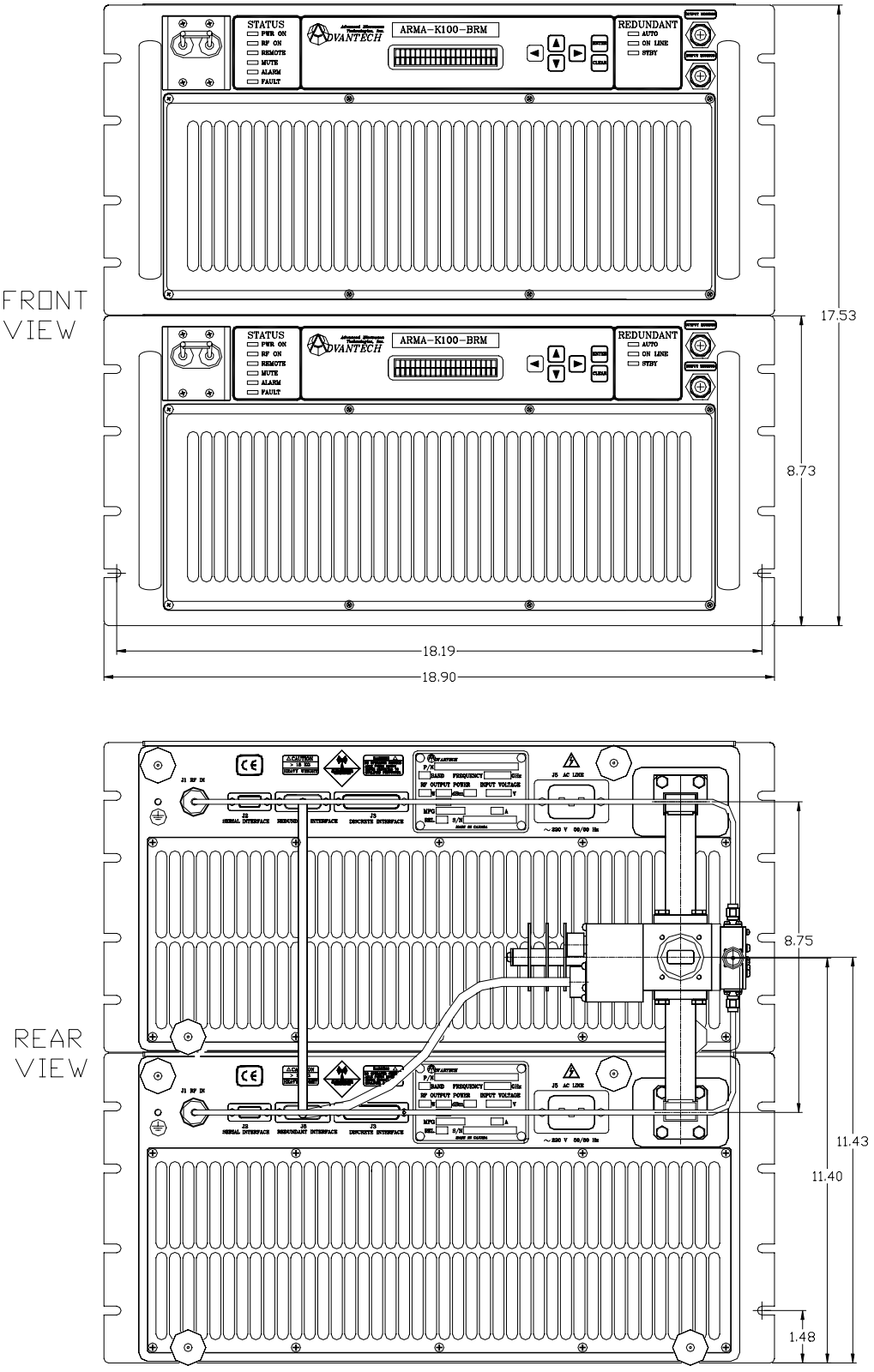


Figure 1: Product Outline (redundant system)

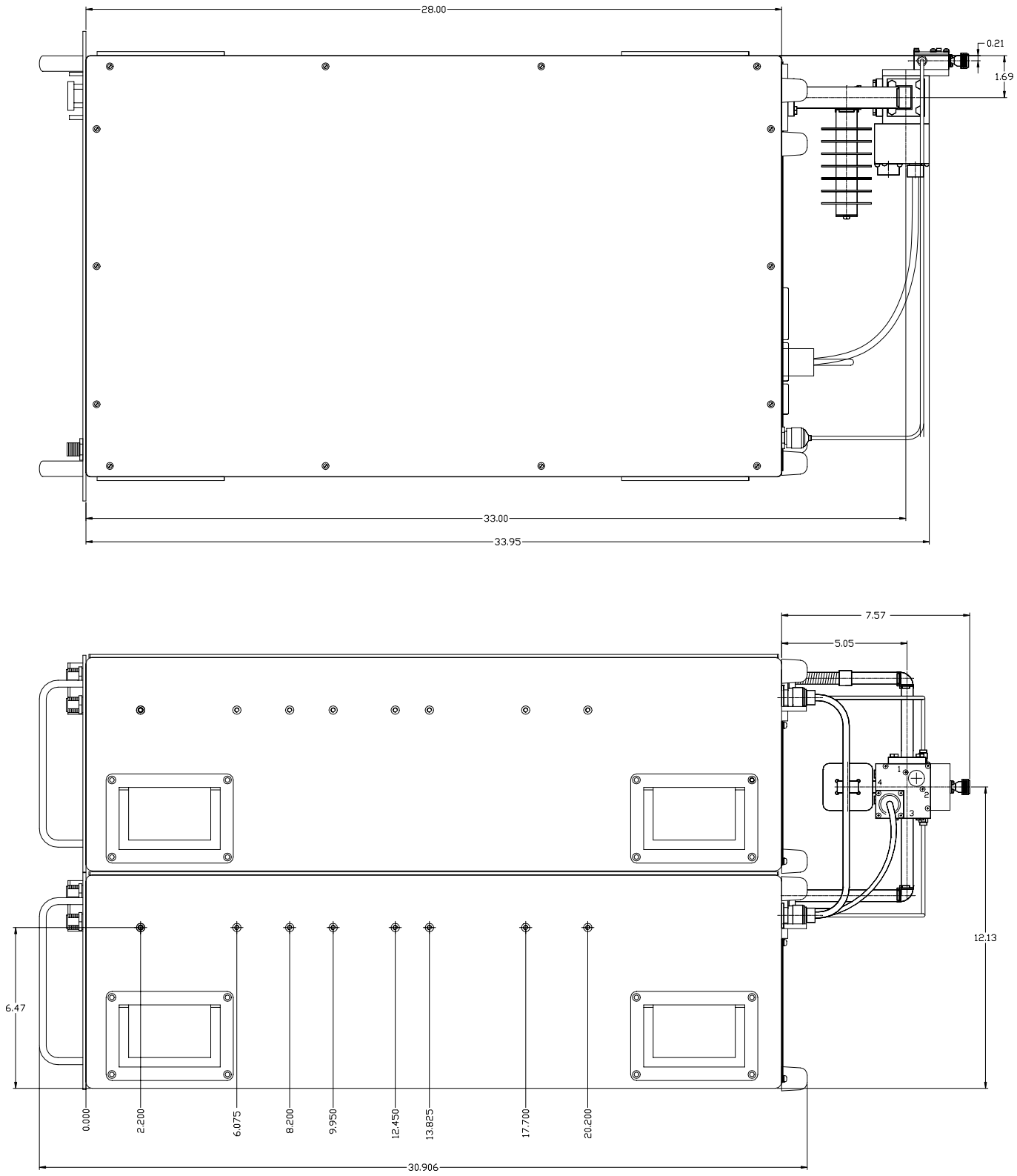


Figure 2: Waveguide Connections (Top view & side view)

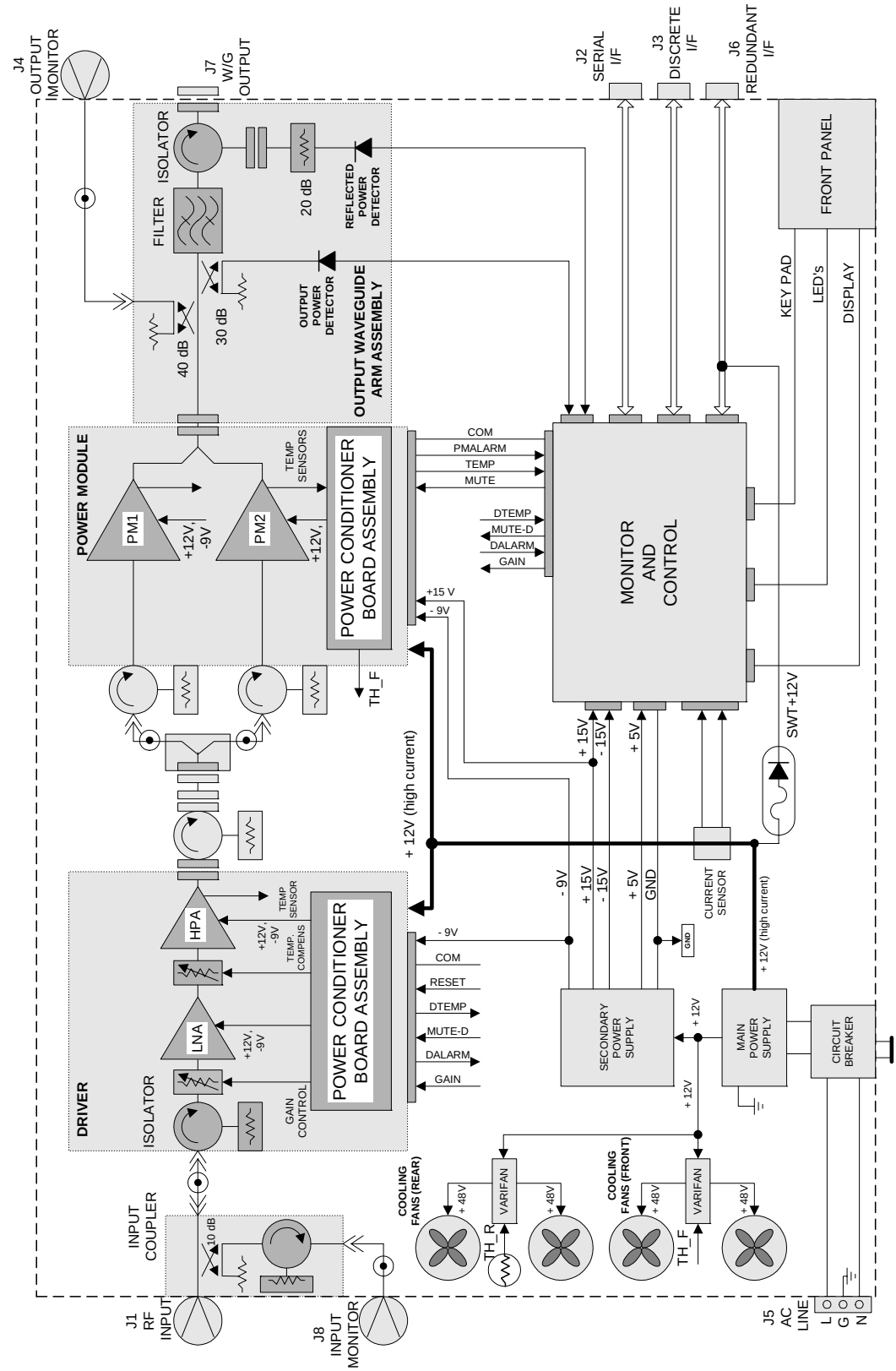


Figure 3: Block Diagram (one unit)

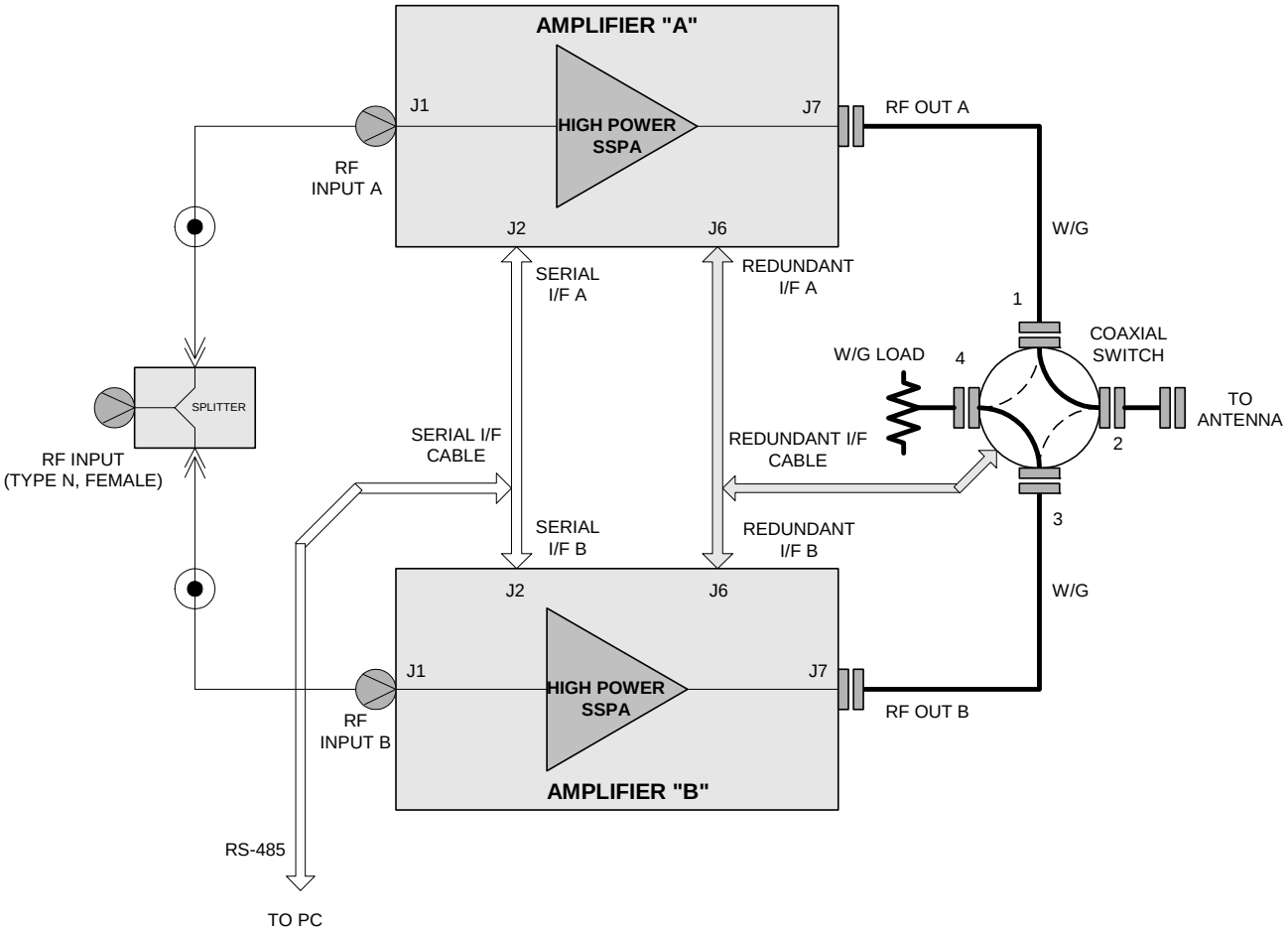


Figure 4: Redundant System Block Diagram

2.4 SPECIFICATIONS

The SSPA specified herein is capable of meeting or exceeding the performance specifications listed in the following table over frequency range, operating temperature and line voltage variation unless otherwise specified. The SSPA will meet all RF performance specifications within thirty minutes of application of prime power.

TABLE 1: ELECTRICAL SPECIFICATIONS (each unit)		
Frequency Range	14.000 - 14.500 GHz	
Power Output (P1dB)	+ 49 dBm, min	
Gain @ rated power	60 dB, min	
Gain Flatness (at room temperature)	2.0 dB p-p, max, over 500 MHz 0.6 dB, max, over 40 MHz	
Gain Variation	± 0.50 dB, max (0°C to +25°C) ± 1.50 dB, max (0°C to +50°C)	
Gain Stability over 24 hours	± 0.25 dB, max @ 25°C ambient	
Variable output attenuation	18 dB, min	
Accuracy of attenuation setting	± 1.0 dB, over frequency and temperature range	
Input Return Loss (Power on)	18 dB, max	
Output Return Loss (Power off)	20 dB, max	
Noise Figure @ maximum gain	10 dB, max	
Spurious at rated power	- 65 dBc, max	
Harmonics at rated power	- 65 dBc, max	
AM/PM Conversion at rated power	3°/dB, typ.	
Third Order Intermodulation (Two equal tones 5 MHz apart)	- 33 dBc, max. @ 7 dB back-off total power - 25 dBc, max. @ 3 dB back-off total power	
Group Delay Linear Parabolic Ripple	0.02 ns/MHz, max 0.003 ns/MHz^2, max 1 ns p-p, typical	
Residual AM (F* = Frequency in kHz)	- 45 dBc - 20 (1+ log F*) dBc - 80 dBc	(0 - 10 kHz) (10 kHz - 500 kHz) (500 kHz - 1 MHz)
Phase Noise	Meets IESS-308/309	

TABLE 2: MECHANICAL SPECIFICATIONS	
Physical Dimensions	See product outline in **Figure 1** at page 12 **& Figure 2** at page 13
Approximate Weight	50 lbs (23 kg) each unit
Mounting Requirements	See product outline in **Figure 1** at page 12 **& Figure 2** at page 13

TABLE 3: POWER REQUIREMENTS	
Power Requirements	90 – 264 V AC, 47-63 Hz, single phase
Power Consumption	10A typical @ 220V AC
Power Factor Correction	95% min.

TABLE 4: ENVIRONMENTAL CONDITIONS	
Temperature: Non operating (continuous exposure) Operating (ambient)	 - 40°C to + 85°C 0°C to + 50°C
Relative humidity	95 % non condensing
Altitude	10,000 feet AMSL, derated 2ºC/1,000 feet from AMSL

TABLE 5: FRONT PANEL DISPLAY AND CONTROLS	
Display	**Keypad**
20 characters x 2 rows alphanumeric	6 keys: **[↑]**, **[↓]**, **[←]**, **[→]**, **[Enter]** & **[Clear]**

TABLE 6: CONNECTORS			
Conn.	**Function**	**Description**	**Mating Connector**
(J1)	RF Input	N - Type (F)	N - Type (M)
(J2)	Serial Interface	DE - 9S (F)	DE - 9P (M)
(J3)	Discrete Interface	DB - 25S (F)	DB - 25P (M)
(J4)	RF Output Monitor	N - Type (F)	N - Type (M)
(J5)	AC Line	IEC - 320 (M) standard sheets C-20 contact style 6.3 mm QD tabs	IEC - 320 (F) standard sheets C-19 (connector is provided)
(J6)	Redundant Interface	DA - 15S (F)	DA - 15P (M)
(J7)	RF Output	WR-75 (Flat)	WR-75 (Grooved)
(J8)	RF Input Monitor	N - Type (F)	N - Type (M)

TABLE 7: RS-485 INTERFACE	
Baud rate	9600 (default factory setting)
Data Bits	7
Stop Bit	1
Parity	EVEN

TABLE 8: SERIAL INTERFACE (J2) – PINS ASSIGNMENTS			
Name	**Type**	**Pin #**	**Active condition**
TX485_H	Serial port (output)	6	Serial transmit port, RS-485 TX + levels.
TX485_L	Serial port (output return)	4	Serial transmit port, RS-485 TX - levels.
RX485_H	Serial port (input)	9	Serial receive port, RS-485 RX + levels.
RX485_L	Serial port (input return)	3	Serial receive port, RS-485 RX - levels.
RS485_C	Serial port (common)	5	System common.
RS485_G	Serial port (ground)	1	Shield ground / safety ground

TABLE 9: DISCRETE INTERFACE (J3) – PINS ASSIGNMENTS			
Name	**Type**	**Pin #**	**Active condition**
PWRON_S	output (active closed)	1	Indicates controller power is on.
RFMUT_S	output (active closed)	2	Indicates RF output is muted (i.e. off).
ALARM_S	output (active open)	3	Indicates operation with degraded performance. Caused by: base plate temperature > 70°C but < 80°C, or internally detected alarms.
FAULT_S	output (active open)	4	Indicates major failure, operation is not possible. Amplifier drain voltages are automatically turned off. Caused by: base plate temperature > 80°C, drain voltage > 13V or < 9V, drain current > maximum rated + 20%, load VSWR > 3.0:1, or internally detected faults.
RFOUT_S	output (active closed)	5	Indicates RF output power greater than 30 dBm.
REMOT_S	output (active closed)	6	Indicates system control is via the remote Computer I/F (CIF).
DISOU_C	output (common)	7	System output common.
RFENA_A	input (active closed)	8	Enables amplifier when connected to pin 15.
CIFRC_A	input (active open)	9	Enables remote Computer I/F (CIF).
GAIUP_A	input (momentary closed)	10	To decrease attenuator setting, momentarily connect to pin 15.
GAIDW_A	input (momentary closed)	11	To increase attenuator setting, momentarily connect to pin 15.
AUTOS_A	input (active open)	12 *	Enables automatic switch over to standby unit upon fault detection. Alternate position is manual mode for servicing.
SWTWG_A	input (momentary closed)	13 *	Waveguide switch toggle action to connect either unit A or unit B to antenna port.
DISIN_C	input (common)	15	System input common.
SWTU1_S	output (active closed)	16 *	Normally closed, Form - C contact, when unit A is connected to the antenna port.
SWTU2_S	output (active open)	17 *	Normally open, Form - C contact, when unit A is connected to the antenna port, in manual mode.
SWTUS_R	output (return)	18 *	Form - C relay common.
STDBY_S	output (active closed)	19 *	Handshake signal indicating that the unit is in a stand-by state. This implies that there are no faults or alarms and that the unit is in auto mode.

Notes:

1. All outputs are open-collector NPN transistors that either are turned on (active closed) or are turned-off (active open). These NPN transistors have the following characteristics:

   V_{ce} max. = 24 VDC

   V_{ce}, sat = 0.8 VDC @ I_c = 50 mA

   I_{ceo} = 100 μA @ V_{ce} = 12 VDC

   Maximum sinking current = 50 mA

2. All inputs are one terminal of a voltage comparator with internal protection resistor and diodes. These inputs are pulled up to the internal +12V DC and have these characteristics:

   Maximum input voltage < 24 VDC

   Open state, input resistance > 50 kΩ

   Close state, input source impedance < 1kΩ

   Close state, required sink current < 1 mA

   The input is active in close state when it is connected to circuit common J3-15 through a conducted transistor or contact closure of a relay.

   For momentarily-closed input, the input pulse width must be more than 10 ms minimum. The longer pulse width will allow the attenuation to change by more than 0.1 dB.

3. Remote operation: Once the remote control mode is selected from the front panel of a rack-mount amplifier, two remote control interfaces are available for operation: discrete interface J3 and serial interface J2. At anytime during the operation only one remote control interface is active (i.e. ready to accept input command) and the control of redundant switch is ignored if the optional redundant switch software is not installed.

   The selection of remote control interface is via the discrete input J3-9. The active-open input at J3-9 will enable the commands from the serial interface to be acknowledged and carried out and the active-closed input (i.e. grounding) will enable the discrete remote. The monitoring outputs are always active (valid) at either remote interface.

4. * = Pins 12, 13, 16, 17, 18 and 19 are active for Redundant option only.

TABLE 10: REDUNDANT INTERFACE (J6) – PINS ASSIGNMENTS			
Pin #	**Signal Name**	**Type**	**Description**
1	STBY-OK-OUT	Output, Active Low	Indicates this amp is in standby with no fault and in auto mode.
2	GND	Output Common	At Ground potential
3	SW-POS-ONLINE	Input, Relay contact	Closure to ground indicates this amplifier is on line.
4	GND	Input Common	At Ground potential
5	STBY-OK-IN	Input, Active Low	Closure to ground indicates the other amplifier is in standby and auto mode.
6	GND	Input Common	At Ground potential
7	Amp-A-ONLINE	Input, Relay Contact	Closure to J6-9 indicates amplifier 'A' is online.
8	Amp-B-ONLINE	Input, Relay Contact	Closure to J6-9 indicates amplifier 'B' is online.
9	Common	Relay Common	This Form-C relay contact from W/G switch is for discrete remote interface.
10	POS-A-DRIVE	Output, Momentarily Low	Closure to +12V DC return for 0.1 sec at 3.5A typical
11	POS-B-DRIVE	Output, Momentarily Low	Closure to +12V DC return for 0.1 sec at 3.5A typical
12	SW-POWER	Voltage Source	Connected to +12V DC supply through a steering diode
13			Not used.
14			Not used.
15			Not used.

TABLE 11: STATUS INDICATORS		
Function	**Description of ON condition**	**Display**
Power On	AC power supplied	LED, Green
RF On	RF output signal detected	LED, Green
Remote	Remote amplifier control is enabled Front panel control of some functions is disabled.	LED, Green
Mute	RF output disabled by operator	LED, Amber
Alarm	Thermal, Low output or incorrect WG position detected	LED, Amber
Fault	Fault condition detected	LED, Red

TABLE 12: REDUNDANT INDICATORS		
Function	**Description of ON condition**	**Display**
Auto	For redundant only (Automatic Switching is enabled)	LED, Green
On-Line	For redundant only (Amplifier connected to antenna)	LED, Green
Stand-by	For redundant only (Amplifier terminated to load)	LED, Amber

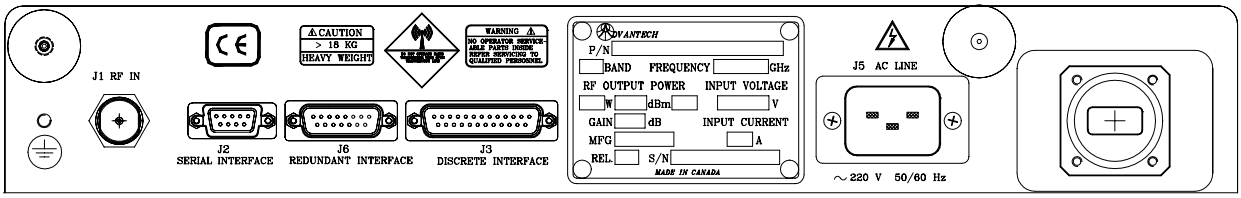


Figure 5: Back Panel Connectors

3. INSTALLATION

3.1 MOUNTING CONSIDERATIONS

The unit is designed for installation in a standard 19" equipment rack and fixed in place at the front panel

3.2 INSTALLATION PROCEDURE

1. Mount the unit in the desired location, ensuring that there is a clearance of at least 1 foot (30 cm) between the air intakes, exhaust and any surface which may obstruct air flow.

2. Connect the waveguide output of the SSPA using gasket, screws #6-32 x 1/2" and #6 lock-washers.

3. Connect the RF source to the RF input, see **Figure 1** at page 12 **&** **Figure 2** at page 13.

4. Connect the AC power source to the AC socket at the rear of the amplifier.

5. Proceed to **Section 4** at page 24 for OPERATION and CONFIGURATION INSTRUCTIONS.

6. In case of use of pressurized output waveguide system, it is mandatory to install pressure window in order to protect Amplifier from high pressure

NOTE: The rotating speed of cooling fans is temperature dependent.

4. OPERATION

4.1 INTRODUCTION

The amplifier may be operated via the RS-485 serial interface, discrete interface or the front panel controls and display. Each method provides full access to the unit's functions including system monitoring of all key operating parameters, control of output attenuation and amplifier's operational status.

In LOCAL mode, with the aid of the keypad and the LCD display, the operator can navigate through a series of menus on the front panel which allow the setting of key parameters and digital display of critical performance indicators. A series of LED indicators provides a summary of the operational status of the amplifier, see **TABLE 11** at page 22 & **TABLE 12** at page 22. In REMOTE mode, using the software supplied with this product or a similar communications software, the same monitor and control functions can be accessed via the RS-485 interface, see **Section 5.4**, *Select Local Control Mode* at page 35 for more information.

4.2 FRONT PANEL CONTROLS

Per **TABLE 5** at page 17**,** six keys on the front panel provide access to the various display functions and allow local control of the amplifier. The display functions via a menu system that provides quick access to all available monitor and control features.

Generally, the **[↑]** and **[↓]** keys are the primary means by which the operator moves between different displays and menu options. The **[Enter]** key is used to select a menu item and to confirm changes made to operating parameters. The **[Clear]** key is used to reset the FAULT status on an amplifier once the condition that caused the fault has been corrected. For specific instructions on the functionality of each sub-menu refer to the appropriate section of this manual.

4.2.1 FRONT PANEL MENU SYSTEM

MAIN MENU	SUB-MENUS
Utilities, press **[Enter]** to access sub-menu	Display product identification
	Display configuration
	Perform LED and display test
Reflected power display (dBm)	
Output power display (dBm)	
Power amplifier hot spot temperature display (°C)	
Power amplifier shroud temperature display (°C)	
Power supply current display (A)	
Monitor calibration, press **[Enter]** to access sub-menu	Display output monitor coupling loss across frequency range
	Set output power low level threshold
Switch between LOCAL and REMOTE control mode	
Select POWER ON or MUTE (not available in REMOTE control mode)	
Adjust attenuation level (not available in REMOTE control mode)	

4.3 REMOTE INTERFACE

4.3.1 SOFTWARE INSTALLATION AND SET-UP

The communications protocol for the serial interface is RS-485. To use the standard IBM® compatible personal computer (running DOS 3.1 or higher) with an RS-232 serial port, you must use the RS-485/RS-232 adapter, provided as an option. In fact the software can be used to control up to 16 different SSPAs from a single computer.

CAUTION: Direct connection or direct communication from (J2) of SSPA to RS-232 port of PC will cause permanent damage to the controller of SSPA.

The following table provides wiring instructions for proper operation of the user interface.

TABLE 13: SERIAL RS-485 INTERFACE CONNECTION INFORMATION		
Serial Interface (J2), Pin #	**Active condition**	**RS-485/RS-232 Adapter, Pin #**
6	Serial Transmit port, RS-485 TX + levels.	17
4	Serial Transmit port, RS-485 TX - levels.	3
9	Serial Receive port, RS-485 RX + levels.	14
3	Serial Receive port, RS-485 RX - levels.	2
5	System common.	1
1	Shield	

4.3.2 USING THE RS-485 SERIAL INTERFACE

The RS-485 serial interface provides a powerful means of monitoring and controlling key amplifier parameters. A communications program is provided with the unit that will allow full access to all amplifier functions. Note that an RS-232/RS-485 adapter is required to use the program on a PC serial port.

Function key ‘F10’ is reserved to go to the next menu (screen) page. There are three menu (screen) pages.

Function keys ‘F1’ to ‘F9’ are used to control/query the amplifier. All queries display the received packet in full. The header ‘<00A’ should be disregarded as well as the trailer ‘#x’ where ‘x’ is a checksum character.

NOTE: ALT-X to exit the program.

INITIAL MENU (SCREEN) PAGE

When started, the communication program will prompt the user to enter the number of the communication port at the PC used for communication. The following image will be displayed on the display of the PC. The user should introduce the communication-port number (usually 2) and press then <ENTER> key.

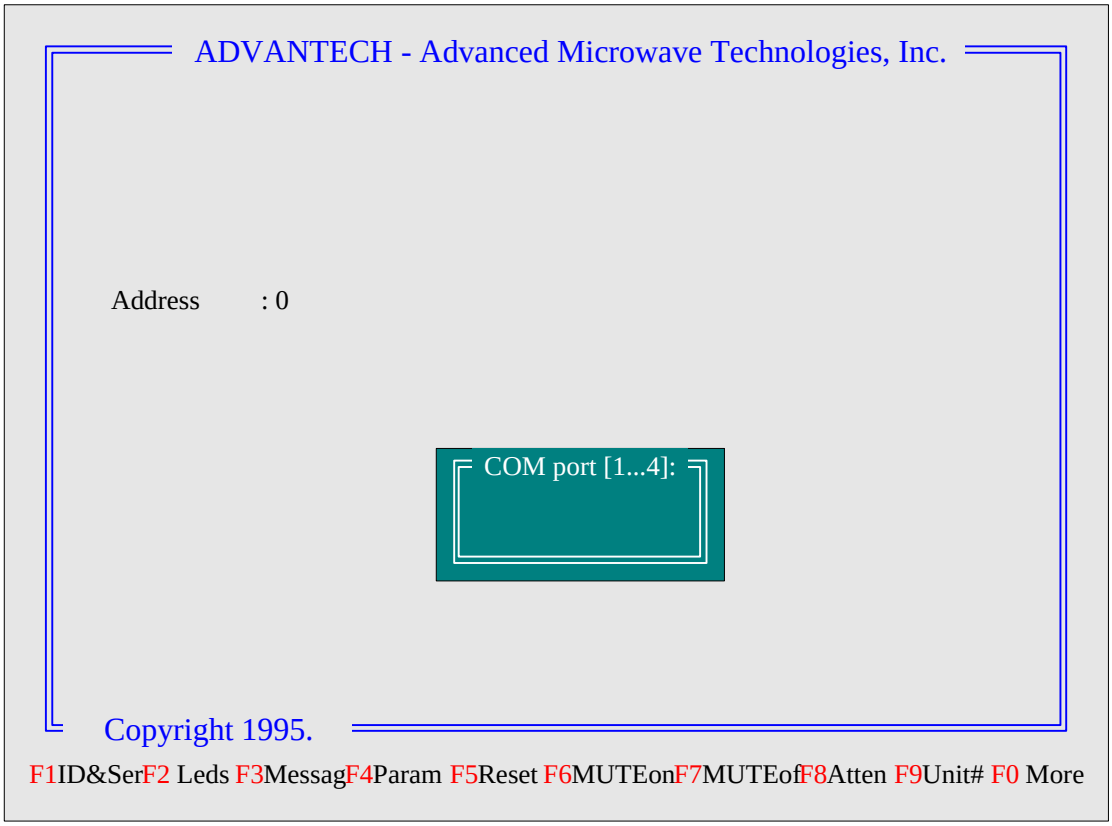


Figure 6: Initial Page of the Communication Program

After entering the communication-port number the next page menu (Page #1) will be displayed on the screen of the PC.

MENU (SCREEN) PAGE #1

NOTE: Commands ‘F5’, ‘F6’, ‘F7’ & ‘F8’ require that the unit to be in REMOTE mode. See key ‘F2’ bytes 9 & 13 below.

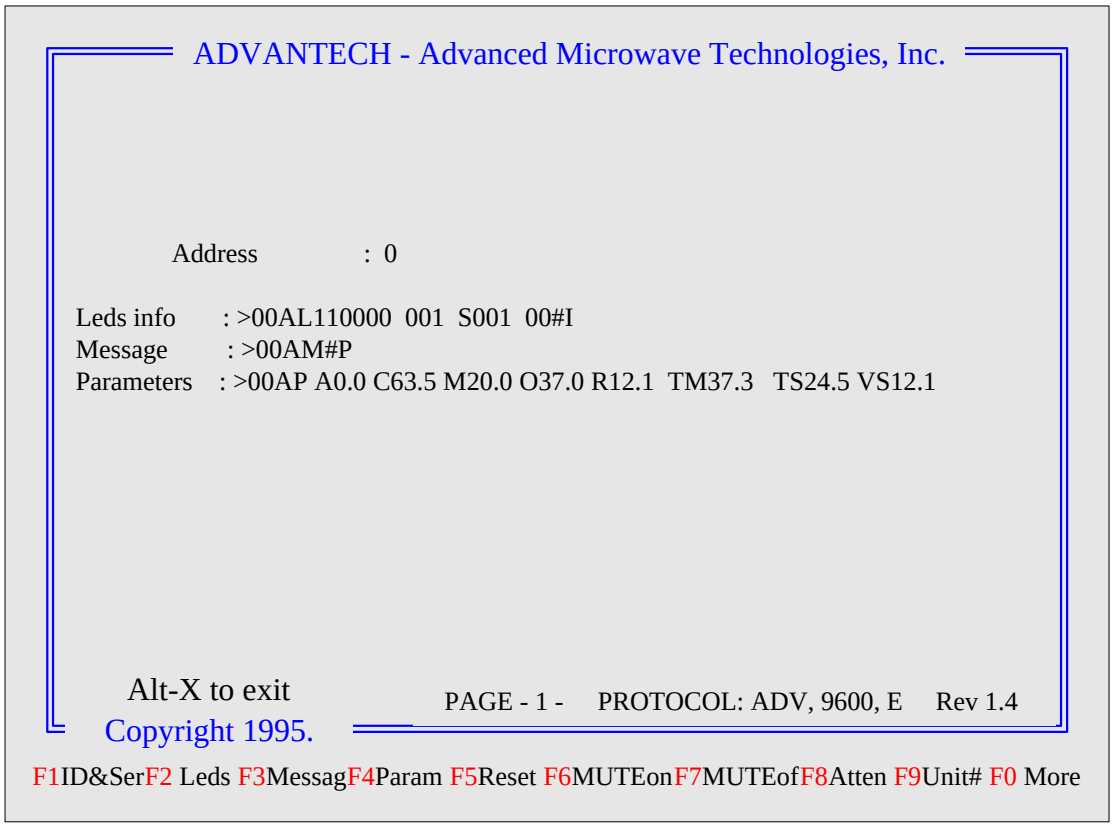


Figure 7: Page #1 of the Communication Program

F1 – ID&Ser: query for the unit ID and serial number.

F2 – Leds: query for LEDs information. These are the digital outputs of the unit, that may be used to light LEDs. After disregarding the header, following the ‘L’ the bytes (‘0’ or ‘1’) represent:

1. ‘1’ - The unit is powered. (Will always be ‘1’)
2. ‘1’ - RF output power detected.
3. ‘1’ - Alarm condition exists
4. ‘1’ - Fault condition exists
5. ‘1’ - This unit is connected to the antenna (ON-LINE)
6. ‘1’ - This unit is connected to an RF load (STDBY)
7. ‘1’ - The unit shutdown by operator (MUTE)
8. - No info
9. ‘1’ - unit under remote control / ‘0’- LOCAL control
10. ‘S’ – the ASCII character S is followed by the next three LED-like bytes:
11. ‘1’ - A message is available / ‘0’- no messages

12. '1' - A request to go LOCAL was issued / '0'- no event
13. '1' - Computer interface in control / '0'- Hardware interface in control (if byte #9 is a '1')

F3 – Messag: request for alarm or fault message. No message bytes are shown if no message is available. See 'F2' response byte 11.

F4 – Param: request for various parameters. After disregarding the header 00A, the ASCII character 'P' (for parameters) is followed by a list of monitored parameters:

'A' is followed by the set attenuation level (in dB)
'C' is followed by supply current (in A)
'M' is followed by the user-set alarm threshold for the output power (in dBm)
'O' is followed by the output power level (in dBm)
'R' is followed by the reflected power level (in dBm)
'TM' is followed by the power module hot spot temperature (in °Celsius)
'TS' is followed by the shroud temperature (in °Celsius)
'VS' is followed by the supply voltage (in VDC)

F5 - Reset: resets faults and restarts the unit for all alarm conditions except over temperature (which restarts by itself when the unit cools down).

F6 – MUTEon: command to MUTE the unit (no RF output power).

F7 – Muteof: command that brings the amplifier back to its RF ON state.

F8 – Atten: Sets the attenuation level. For 0 dB attenuation, enter 0; for 15 dB attenuation, enter 150; for 18 dB attenuation, enter 180 (0.1 dB steps, no decimal point required).

F9 – Unit#: selects the unit with which the PC is communicating. Any value between 0 and 15 (default value: 0)

F10 – More: to go to next menu (screen) page.

MENU (SCREEN) PAGE #2

NOTE: These commands require that the unit be in REMOTE mode with the serial interface in control. See screen (menu) page #1 key 'F2' bytes 9 & 13.

Figure 8: Page #2 of the Communication Program

F1& F2 - N/A (not available)

F3 – ParamS: request for S amplifier parameters (only for 1 to 2 redundant systems).

F4 – Auto: puts the system in AUTO mode (this command is effective only for redundant systems: the switching between the antenna and the dummy load will be performed automatically).

F5 – Manual: puts the system in MANUAL mode (this command is effective only for redundant systems: the switching between the antenna and the dummy load will be controlled by the operator).

F6 – A/Ant: only for redundant systems, sets the switch so that the output of unit A is directed towards the Antenna (the system should be in MANUAL mode, in order that this switching be effective).

F7 – B/Load: only for redundant systems, sets the switch so that output of unit B is directed towards the RF dummy load (the system should be in MANUAL mode).

F9 - Thresh: sets the user-defined threshold. This should be a value from 300 to 500 representing 30.0 to 50.0 dBm. When the output level falls below this level an alarm will be generated.

F10 – More: goes to next menu (screen) page.

MENU (SCREEN) PAGE #3

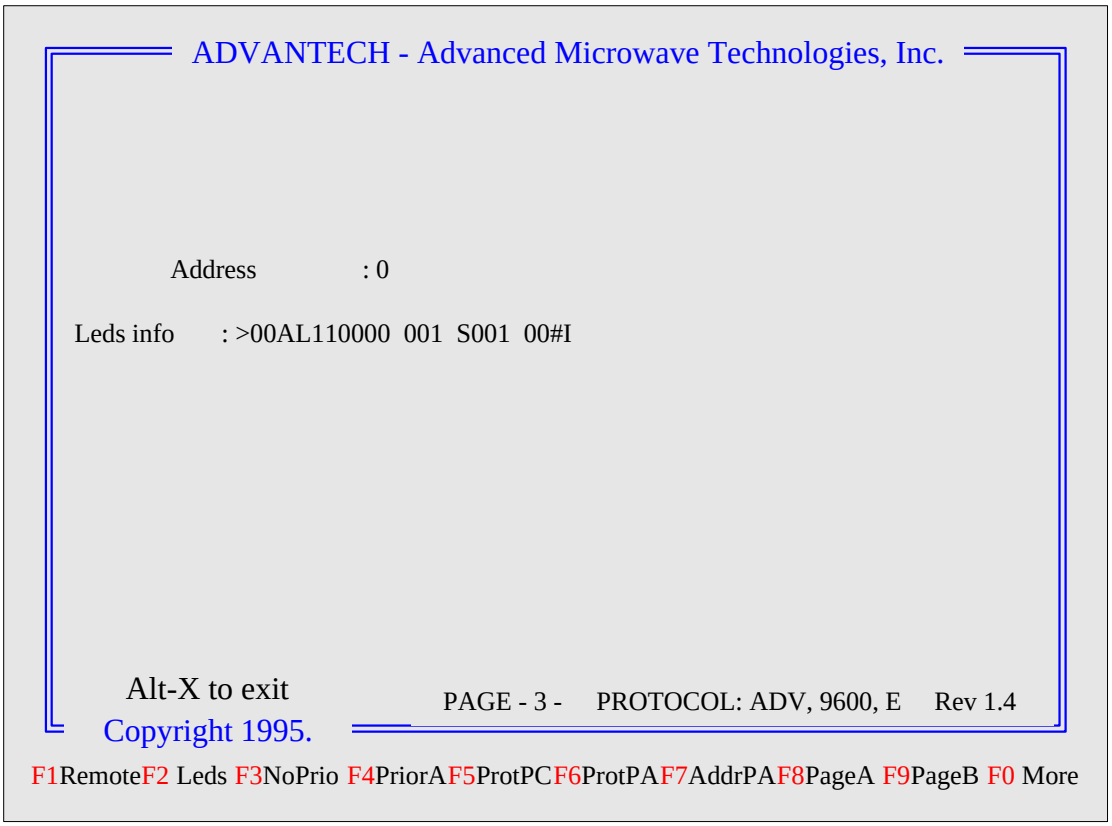


Figure 9: Page #3 of the Communication Program

F1 - Remote: prevents the unit from going to LOCAL mode. This is to be used with rack-mount units when the operator requests to go local and the control room wants to lock out the local operator, not allowing him to take control over the operation of the unit.

F2 - Leds: queries the unit for LEDs information (like in Menu Page #1).

F3 – F6 – Functions not applicable for this unit.

F7 – AddrPA: to change the communication address of the SSPA. This address will take effect after the next power-up of the unit or after performing a Reset command on the unit (use Menu Page #1 function key ‘F5’ for Reset).

F8 – PageA: to load Flash Memory page A (the unit will wait for flash data to be uploaded).

F9 – PageB: to load Flash Memory page B (the unit will wait for flash data to be uploaded).

F10 – More: to return to Menu Page #1.

4.4 DISCRETE INTERFACE

The discrete interface provides all the necessary functions to monitor and control the amplifier. The unit provides open collectors for continuous monitoring alarms, faults, and amplifier status, amplifier enable/disable switching. **Figure 10** provides the detailed circuit information required for utilizing the above features. Pins 12, 13, 16, 17, 18 & 19 are active for redundant option only.

4.4.1 RF ENABLE

Providing a contact between pins 8 & 15 of the Discrete Interface connector permits amplifier operation. When these pins are not in contact, the amplifier is considered to be in hardware shutdown mode and cannot be started by any means.

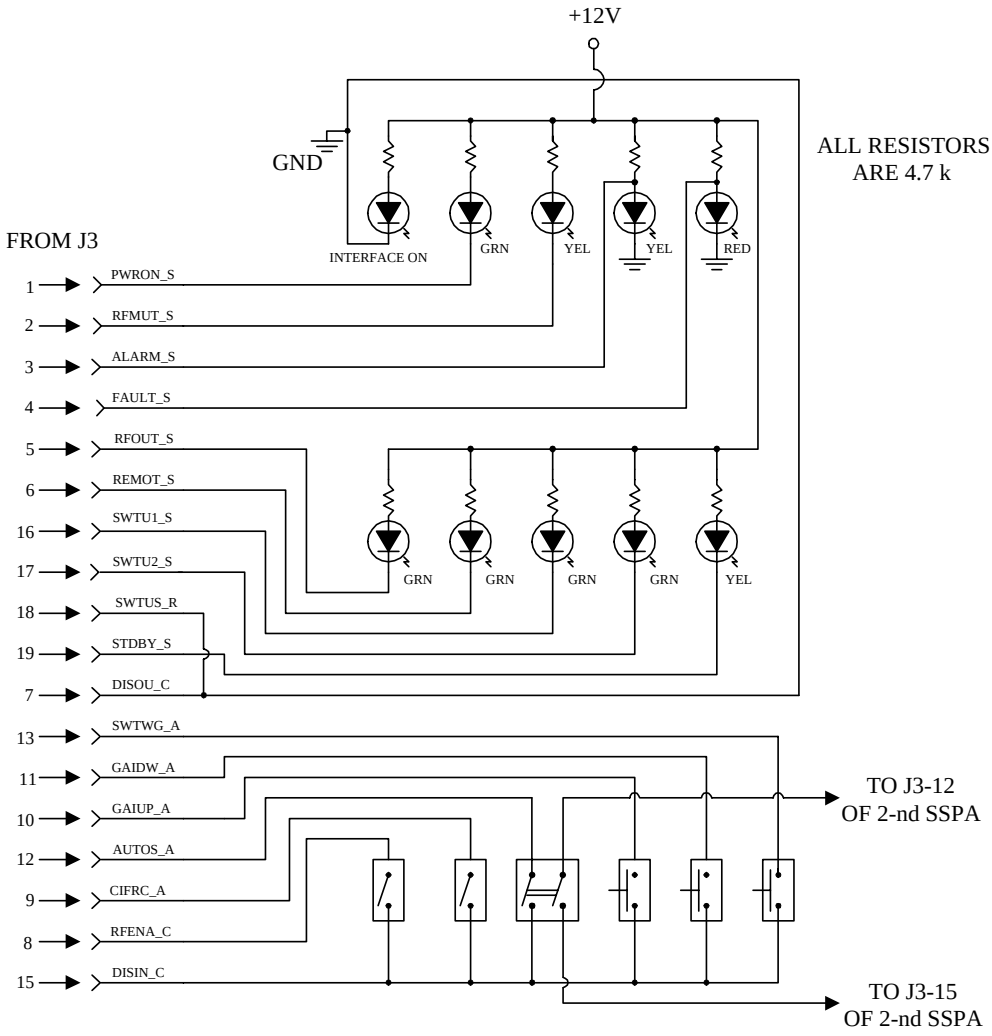


Figure 10: Discrete Interface – Proposed Monitor and Control Circuit

5. CONFIGURATION AND SET-UP

5.1 SOFTWARE CONFIGURATION

Insert the adapter in the desired serial port of the computer and connect the cable leading to the amplifier to the adapter.

1. The program ADV.EXE is located on the diskette enclosed with this amplifier. To use the software, first copy ADV.EXE to your hard disk.
2. To execute the program, at the DOS prompt type ADV.
3. Connect your serial interface crossed cable to the SSPA.
4. At the prompt, enter the COMM (serial) port number you are using (1, 2, 3 or 4).
   NOTE: The protocol is 9600 baud, 7 bits and even parity, see **TABLE 7** at page 18 and Screen Menu #1.
5. Press the function key 'F10' twice to obtain Screen (menu) #3.
6. Select the 'F7' function key (COMSET) to configure the communications address for the amplifier. This is the number that will be used to identify the specific SSPA for monitor and control purposes.
7. At the prompt, enter a value from 0 through 15. Restart the SSPA, the default value is 0.

From this point on, to access a specific SSPA for monitor or control purposes, use the function key 'F9' on Screen (menu) #1. You will be prompted to enter the communication address of the specific amplifier to be accessed.

Type ALT-X to exit the program.

5.2 RF CONFIGURATION

5.2.1 SAFETY CONSIDERATIONS

The VSWR protection at the output of the amplifier is designed to protect the unit against accidental operation with no load at the RF output connector by causing the SSPA to shutdown automatically.

WARNING: Prolonged operation without a load at the output may cause severe bodily harm, loss of sight, even death. Do not operate amplifier if the output RF connector is not connected to a load.

Please note that failure of the amplifier due to above condition will be attributed to abuse or neglect and is not covered by our standard warranty.

5.3 START-UP

1. Switch the power on (Front Panel). The **POWER ON** LED will light and a message will appear on the screen indicating that the unit is performing self-diagnostics. If everything is OK, a second message will appear identifying the model number of the unit.

NOTE: The Amplifier will be MUTE (see the corresponding LED on the front panel) upon start up. If pins 8 & 15 of discrete interface are not connected, then the RF portion of the amplifier will not be active.

2. The **[🡅]** and **[🡇]** keys serve to move between various displays and menu items. Press **[🡇]** to access the first menu function, UTILITIES.
3. Press **[Enter]** to view the first screen of the UTILITIES sub-menu, which displays the serial number of the unit and the hardware and software version numbers respectively. Press **[🡇]** to display the current system configuration.

CONFIG: Standalone Unit: 0

'Stand Alone' indicates that the unit has not been configured in a 1:1 system. The unit number, which is zero (0) by default, is used to address the unit via the serial interface. Up to 16 different amplifiers may be controlled from a computer via a single serial interface port.

4. Press **[🡇]** to access the LEDS & DISPLAY TEST screen.

LEDS & DISPLAY TEST Set LEDs & DISPL. on

Use the **[🡅]** and **[🡇]** keys to adjust the contrast on the display as desired.

Press **[Enter]** to activate the display and LED test. All indicators should now be lit and the display should appear similar to the following:

Press **[Enter]** to return to the main menu.

5.4 SELECT LOCAL CONTROL MODE

The REMOTE (LOCAL) status of the amplifier determines if the following operations can be performed via the serial interface or at the front panel respectively.

- Setting output attenuation level (gain adjustment)
- Setting fault condition for low output power

When the REMOTE (LOCAL) LED indicator is ON, REMOTE control is selected.

To switch to either LOCAL or REMOTE control mode perform the following steps:

1. From the main menu, press either **[↑]** or **[↓]** successively to select the following display:

STATUS: ____ <ENTER> FOR LOCAL CTL	STATUS: ____ <ENTER> TO GO REMOTE

2. Press **[Enter]** to switch modes. When switching to LOCAL control, the unit will wait 30 seconds before yielding local access. This measure allows a remote operator to cancel the request for local access via the serial interface.

   Note: The normal status of the amplifier is 'REMOTE', therefore a local operator must always change control back to 'REMOTE' after completing SSPA's adjustments.

5.5 SETTING FAULT CONDITION FOR LOW OUTPUT POWER

As the SSPA has a variable gain attenuation feature, the operator can set the minimum output power value (in dBm) below which a fault will be generated.

5.5.1 AT THE FRONT PANEL

1. Verify that the unit is in LOCAL control mode (REMOTE/LOCAL LED indicator is OFF). If not, switch to LOCAL mode as instructed in **Section 5.4**, *Select Local Control Mode* at page 35.
2. In the main menu, use the **[↑]** and **[↓]** keys to select the MONITOR CALIBRATION display.

   STATUS: ____
   MONITOR CALIBRATION

3. Press **[Enter] until** you see the following display:

   STATUS: ____
   OUT POWER THRESHOLD

4. Use the **[↑]** and **[↓]** keys to select the minimum acceptable output power level below which the amplifier shall signal a fault condition. Each press of a button either increases or decreases the output level by 0.1 dB increments. Holding a button will cause the display to increment/decrement automatically at a faster rate.
5. Press **[Enter]** to confirm your selection.

5.5.2 USING THE SERIAL INTERFACE

1. Verify that the unit is in REMOTE control mode (REMOTE/LOCAL LED indicator is ON). If not, switch to REMOTE mode as instructed in **Section 5.4**, *Select Local Control Mode* at page 35.

2. From Screen (menu) #1, use the 'F9' function key to select the SSPA and then from Screen (menu) #2, select 'F9' ('Thresh'). At the prompt, enter minimum output power level, disregarding the decimal point. For example, to request a minimum output power of 30.0 dBm attenuation, enter 300.

5.6 GAIN ADJUSTMENT

The output attenuation of the amplifier will be set to the factory default setting of 10dB or the previous setting stored in memory.

5.6.1 AT THE FRONT PANEL

1. Verify that the unit is in LOCAL control mode (REMOTE/LOCAL LED indicator is OFF), if not, switch to LOCAL mode as instructed in **Section 5.4**, *Select Local Control Mode* at page 35.
2. In the main menu, use the **[🡅]** and **[🡇]** keys to select the ADJUST ATTENUATION display.

STATUS: ____ ADJUST ATTENUATION

3. Use the **[🡄]** and **[🡆]** keys to select the gain attenuation level in dB. Each press of a button either increases or decreases the attenuation by 0.1 dB increments. Holding a button will cause the display to increment or decrement automatically at a faster rate.
4. Press **[Enter]** to confirm your selection.

5.6.2 USING THE SERIAL INTERFACE

1. Verify that the unit is in REMOTE control mode (REMOTE/LOCAL LED indicator is ON). If not, switch to REMOTE mode as instructed in **Section 5.4**, *Select Local Control Mode* at page 35.
2. From Screen (menu) 1, use the 'F9' function key to select the SSPA and then 'F8' ('Atten'). At the prompt, enter attenuation level (from 0 to 20.0 dB), disregarding the decimal point. For example, to request an attenuation of 15.5 dB, enter 155. For an attenuation level of 4.0 dB, enter 40.

5.7 POWERING UP THE AMPLIFIER

To power up the amplifier (i.e. activate the RF portion of the SSPA) after the shutdown, do one of the following:

5.7.1 AT THE FRONT PANEL

1. Verify that the unit is in LOCAL control mode (REMOTE/LOCAL LED indicator is OFF), if not, switch to LOCAL mode as instructed in **Section 5.4**, *Select Local Control Mode* at page 35.
2. In the main menu, use the **[🡅]** and **[🡇]** keys to select the TO POWER PA display.

STATUS: ____ <ENTER> TO POWER PA

3. Press **[Enter]** to confirm your selection.

5.7.2 USING THE SERIAL INTERFACE

1. Verify that the unit is in REMOTE control mode (REMOTE/LOCAL LED indicator is ON). If not, switch to REMOTE mode as instructed in **Section 5.4**, *Select Local Control Mode* at page 35.
2. From Screen (menu) #1, use the 'F9' function key to select the SSPA and then 'F7' ('MUTEoff ').

5.8 STATUS DISPLAY SCREENS

The front panel display allows an operator to view information on a number of critical operating parameters. Use the **[↑]** and **[↓]** keys to move between the various displays and sub-menus.

The following are typical status displays.

STATUS: ____ REFL. PWR <nn.n dBm

STATUS: ____ OUTPUT PWR nn.n dBm

STATUS: ____ PA HOTSPOT nn.n °C

STATUS: ____ PA SHROUD nn.n °C

STATUS: ____ SUPPL CURR nn.n A

5.9 AMPLIFIER SHUTDOWN

Amplifier shuts down due to an alarm or as a result of a hardware or software command.

A software shutdown is performed either from the front panel or by selecting the MUTE ON function key sending the appropriate code via the RS-485 serial interface, see **Section** 4.3.2 at page 26. The amplifier can be restarted in a similar manner provided a hardware shutdown is not in effect. The amplifier can also be restarted by switching power off & on the PA.

When the amplifier resumes operation, the attenuation level will return to its previous setting after about 2 minutes of stable operation. Note however that the amplifier will not restart if a FAULT condition is detected.

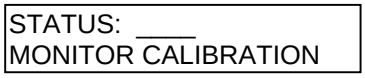
5.10 RF OUTPUT MONITOR PORT

The output monitor port on the front panel provides a means to measure the output signal (in dBm) using appropriate test equipment. The coupling loss normally associated with RF sample, must be added to the power level measured at the sample port in order to obtain the proper value for input or output power level.

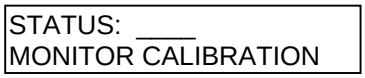
The coupling loss may vary with frequency and the specific characteristics of the RF circuit. Accordingly, a calibration chart is provided via the front panel display for each sample port. The calibration chart for the port identifies the coupling loss at a number of frequencies across the operating range of the amplifier. The loss associated with intermediate frequencies can be obtained by interpolation.

5.10.1 MONITOR CALIBRATION CHART

1. To view the monitor calibration chart for the RF sample port on an amplifier, use the **[🡅]** and **[🡇]** keys on the front panel of the amplifier to access the Monitor Calibration sub-menu.



2. Press **[Enter]** once to view the Output Monitor calibration chart. The display is capable of showing one line of the calibration chart at a time. Use the **[🡆]** and **[🡄]** keys to scan the chart in order to obtain the coupling loss associated with specific frequencies.



3. Example: IF CALFACT for output monitor at 6.150 GHz = - 40.2 dB, and the External Power Meter measurement reads Pm = +6.8 dBm, then the SSPA output power will be calculated as following:

$$P_{out} = Pm + |C| = 6.8 \text{ dBm} + 40.2 \text{ dB} = 47 \text{ dBm}.$$

5.11 RF INPUT MONITOR PORT

Similarly with the RF Output Monitor Port, the RF Input Monitor Port provides an output signal coupled with the input signal. Table charts for this port are also provided in the test data sheets, giving the coupling ratio for different frequencies.

6. ALARMS AND FAULTS

The amplifier monitors all key operating parameters and provides alarm and fault signals both on the front panel and remotely. Two LED indicators on the amplifier identify ALARM or FAULT conditions respectively. Also during a fault condition, a display similar to the following will appear on the front panel:

```
HIST.FAULT: (message)
<CLEAR> to clear
```

An ALARM signals that a fault has been detected that may reduce amplifier's performance or, if allowed to continue uncorrected, may lead to a FAULT condition, see **TABLE 11** at page 22 & **TABLE 12** at page 22. An ALARM will not cause automatic amplifier shutdown. A FAULT condition results when a fault has been detected which has caused, or is likely to cause an amplifier failure. As such, a FAULT may cause automatic amplifier shutdown depending on the nature of the fault.

6.1 THERMAL ALARMS AND FAULTS

The amplifier continually monitors internal temperature and current consumption and includes an automatic shutdown feature to prevent operation at excessive temperatures.

An alarm will be triggered when the internal temperature of the amplifier exceeds 70°C. Amplifier will continue to operate in this condition. When the base plate temperature exceeds 80°C or current consumption exceeds a threshold value, a fault will be triggered and the amplifier will shutdown. The amplifier will automatically restart when its internal temperature cools to 65°C. If a fault has been caused by any other condition, then the status of the SSPA must be reset (i.e. to NO FAULT) and the source of the problem should be corrected before the unit can resume operation (see RESETTING THE SSPA below).

A thermal alarm can be caused by any of the following conditions:

- high ambient temperature (the unit is designed to operate between 0°C and +50°C ambient)
- blockage at air intake or exhaust
- cooling fan failure

6.2 RESETTING THE SSPA

After a fault condition has been detected on the amplifier and the source of the problem remedied, the fault must be cleared in order for the unit to resume operation. Similarly, unforeseen circumstances might require default parameters to be reset. Thermal alarm will be cleared after temperature drops below 65°C.

6.2.1 USING THE SERIAL INTERFACE

From Screen (menu) #1, use the function key 'F9' to select the desired SSPA, then press 'F5' to reset the unit.

6.2.2 AT THE FRONT PANEL

Press **Clear]** at the front panel.

7. MAINTENANCE

7.1 CLEANING

In order to ensure adequate cooling of the amplifier, it is recommended to inspect the unit weekly to verify that the air intake and exhaust are free of any obstruction. Clean the air intake filter with a soft bristle as nessesary. Filter can be cleaned while the unit is in service (power on).

7.2 PRECAUTIONS

7.2.1 CONNECTION TO LINE VOLTAGE

Ensure that correct voltage (90-264 V AC) is used for this rack-mount unit, see **TABLE 3** at page 17 **& TABLE 6** at page 18.

7.2.2 RF RADIATION HAZARD

To prevent bodily harm and dammage to equipment, ensure that the input and output RF ports are terminated and properly fastened before connecting the amplifier to the line voltage. Note that this amplifier has sufficient gain & power to cause destructive oscillation if the above precaution is not taken.

7.2.3 NON USER-SERVICEABLE MODULES

The rack-mount amplifier is serviceable at the module level only. Local service is limitted to replacement of defective modules with maintenance spares. The repairs of separate modules must be done at the factory or at a regional repair center.

7.3 FUSES AND CIRCUIT BREAKERS

7.3.1 FUSES

There is no user serviceable fuse in this rack-mount amplifier unit.

7.3.2 CIRCUIT BREAKERS

The front panel power switch also acts as the main line circuit breaker. The breaker will trip only under a major power supply fault.

7.4 MAIN FAULT DIAGNOSIS

Description of Problem	Probable Cause	Refer to Section
Power is On but Power On LED is off.	No line voltage at the AC input. The secondary power supply has failed. Circuit breaker has failed	7.5.1 7.5.5 7.5.1
RF is On but RF On Led is off.	The RF output level is below set threshold. The attenuation setting is too high. The amplifier is muted.	7.8.1, 7.8.2 7.8.2 7.6.4, 7.6.5
Alarm LED is on.	The RF output level is too low. The amplifier has overheated but not shutdown	7.6.1- 7.6.3
Fault LED is on.	The amplifier has overheated & is in thermal shutdown. The Power Amplifier has failed. The Main Power Supply has failed. The Controller has failed	7.7 7.10 7.5.3, 7.5.4 7.10
HIGH TEMP is displayed.	The amplifier internal temperature has exceeded 70° C.	7.7
LOW CURR is displayed.	The Power Amplifier has failed.	7.10
HIGH CURR is displayed.	The Power Amplifier has failed.	7.10
LOW VOLT is displayed.	The Power Amplifier has failed. The Main Power Supply has failed. The Secondary Power Supply has failed.	7.10 7.5.4 7.5.5
HIGH VOLT is displayed.	The Main Power Supply has failed.	7.5.4
The fan non-functional.	The fan has failed, see Note per 2.2.	7.10
Mute LED is on but not from the front panel.	The Discrete Interface RF Mute line is high or the U-link is not installed.	7.6.5
The unit cannot be controlled from the front panel.	The unit is set for Remote operation.	5.4

7.5 POWER SYSTEM FAULT DIAGNOSIS

1. Verify AC power feed.
2. Verify power on led is on.
3. Verify fan operation.
4. Verify voltage on main power supply: +12V ± 0.5V. Refer to **Section 7.10** at page 43 for replacement.
5. Verify voltage on secondary power supply:
   P12-2 to P12-1 is +15V ± 0.5V.
   P12-2 to P12-3 is -15V ± 0.5V.
   P12-2 to P12-4 is +5V ± 0.15V.
   Refer to **Section 7.10** at page 43 for replacement.

7.6 SSPA FAULT DIAGNOSIS

1. Verify RF input level.
2. Verify attenuation setting on front panel. Refer to **Section 5.6** at page 37.
3. Verify output power reading on front panel.
4. Verify MUTE on/off.
5. Verify U-link on discrete interface connector.

7.7 TEMPERATURE FAULT DIAGNOSIS

Refer to **Section 6.1** at page 40 for alarm conditions

1. Verify ambient temperature.
2. Verify air exhaust and intake obstruction.
3. Verify fan operation. Refer to **Section 7.10** at page 43 for replacement.

7.8 LOW OUTPUT POWER FAULT DIAGNOSIS

1. Verify RF input level.
2. Verify attenuation setting on front panel.

7.9 HIGH REFLECTED POWER FAULT DIAGNOSIS

Verify waveguide leading to antenna.

7.10 MODULE REPLACEMENT

Module	Part #
Input Coupler	**100-000330-041**
SSPA (Driver module)	**200-630600-002**
SSPA (Power module)	**200-132600-003**
WR75 W/G Arm Assembly	**240-330600-701**
Main Power Supply	**505-743320-001**
Secondary Power Supply	**210-450256-001**
48 V Varifan Power Supply (3)	**210-450794-011**
Current Sensor	**230-500600-001**
Waveguide Arm Assembly	**240-330600-502**
Fan Assembly (4)	**290-100600-001**
Monitor and Control Assembly	**210-250754-212**

8. APPENDIX A: SAFETY AND EMC COMPLIANCE

Advantech Products are compliant with following standards:

SAFETY: IEC 950 (1992)
CAN/CSA-C22.2 No. 950 –92/ UL 1950

EMC: EN 55022: 1995 / CISPR22:1993 – Class A Conducted and Radiated Emission.
Conducted: 0.150-30 MHz,
Radiated: 30-1000 MHz.

EN 50082-1: 1998 Electrical Fast Transient Burst.
0.5kV Signal Lines, 1 kV Power Lines / IEC 1000-4-4

EN 50082-1: 1998 Electrostatic Discharge (contact and air discharge).
4kV CD, 8 kV AD / IEC 1000-4-2

EN 50082-1: 1998 Surge Immunity (AC ports).
1kV, 0.5 kV / IEC 1000-4-5

EN 50082-1: 1998 Power Line Quality Testing.
70%, 40%, 0% AC Port Dips / IEC 1000-4-11

EN 61000-4-3: Radiated Immunity.
80-1000 MHz @ 3 V/m 80% AM @ 1 kHz.

SUPPLEMENTARY INFORMATION:

The products herewith comply with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and may carry the CE-marking accordingly.