

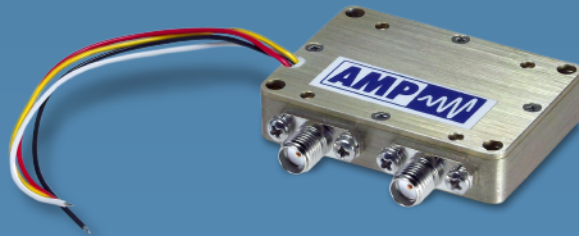
Operation Manual

H Series *Analog FM Power Amplifiers*

HSF1 Power Amplifier



HSP1 Power Amplifier



HHA1 High Power Amplifier



Advanced Microwave Products
PO Box 1437
2465 Old Highway 40 West, Suite 200
Verdi, NV 89439

www.advmw.com
engineering@advmw.com
(775) 345-9933

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1. INTRODUCTION

Thank you for choosing this AMP Power Amplifier. Every effort has been made to design and manufacture a quality product that will meet your needs for many years. Please visit our website (www.advmw.com) for information on other products and for datasheets, quick start guides, model number builders, operation manuals, and other related materials.

If you have any questions regarding this product or if you require technical assistance, please feel free to contact us at (775) 345-9933.

1.1. Purpose and Function

H Series Power Amplifiers are developed and manufactured by Advanced Microwave Products (AMP).

H Series Power Amplifiers are best operated with AMP's V, P, E, or F series transmitters (as noted by the specific amplifier) but are compatible with many other analog FM transmitters on the market.

1.2. Capabilities

AMP Power Amplifiers are designed for harsh environments and feature robust packaging and connectors. Compact package sizes provide versatility in unit placement and system applications.

AMP Power Amplifiers require no tuning or adjustments. Power can be derived from batteries, simple power supplies, or vehicle power.

Whip or "rubber duck" antennas are adequate for most applications.

1.3. Environmental Requirements

AMP Power Amplifiers are designed for indoor or outdoor use. Precautions should be taken when exposing the products to the elements. Do not expose to 100% humidity.

Power Amplifiers should be located in areas where the ambient temperature does not exceed the maximum operating temperature indicated in the specifications. Placement in confined locations with minimal airflow, in direct sunlight in areas of temperature extremes, or in proximity to other devices that generate heat, such as power supplies, heating systems, etc., should be avoided. Temperatures exceeding +75°C may cause permanent damage to the equipment.

When not used for extended periods of time, external connections, including power cable, and antenna, should be removed and the units covered, boxed, or crated and stored in a clean, dry place.

2. HHA1 HIGH POWER AMPLIFIER

2.1. HHA1 Specifications

RF Characteristics

Frequency Range (Specify):	UHF:	340.0-399.9 MHz
(Other Ranges Available)	433 ISM:	433.0-434.8 MHz
	868 ISM:	868.0-870.0 MHz
	915 ISM:	902.0-928.0 MHz
	Lower L-Band:	1435-1535 MHz
	Upper L-Band:	1700-1850 MHz
	Lower S-Band:	2200-2399 MHz
	Upper S-Band:	2400-2499 MHz
	Full S-Band:	2200-2499 MHz
	Lower C-Band:	4400-4900 MHz
	Upper C-Band:	4900-4999 MHz
	Full C-Band:	4400-4999 MHz
Output Power (Specify):	2W, 5W, or 10W, Nominal	
Output Power, PA Disabled:	< +10 dBm	
Input Power (Specify):	250 mW (+/- 1dB), 500 mW (+/- 1dB), 1W (+/- 1dB), 2W (+/- 1dB)	
Power Modes (Specify):	One (Fixed), Two (Specify), or Three (Specify), MDM-9P Pins 7 & 8, Open (10 k Ω pull up to 3.3 Vdc) = High, Ground (or <0.6 Vdc) = Low, see chart below for configuration	
Output Impedance:	50 Ω Nominal, VSWR 2:1 Maximum	
Output Protection:	UHF:	None – 20:1 VSWR Indefinitely
	L/S/C:	Internal Isolator - Open/Short Indefinitely
Spurious Output:	-13 dBm Maximum	

Power Requirements

Input Voltage:	+11 to +16 Vdc, Reverse Polarity Protected
Current Draw (12V Typical):	900mA for 2W, 1.5A for 5W, and 2.5A for 10W
PA Enable Control:	Open = On, Ground (or <1.5 Vdc) = Off

Mechanical

Material:	CNC Machined T6061-T6 Aluminum	
Finish (Specify):	Nickel Plated or Gold Iridite	
Dimensions:	2.50" W x 3.50" L x 0.375" H	
Weight:	<3.5 oz.	
Connectors:	RF Input:	SMA Female
	RF Output:	SMA Female
	DC Supply, Power Select, PA Enable: MDM-9P	

Environmental

Temperature (Operating):	-20°C to +60°C
Acceleration:	100 g, 3 Axes
Altitude:	Unlimited
Humidity:	Up to 95% @ Any Temperature Forming Frost or Condensation

**HHA1 SERIES
UHF,L,S,C-BAND
10W POWER AMPLIFIER**
(for P,V,E,F-SERIES TRANSMITTERS)

MDM-9P:
1: VDC IN
2: GROUND
3: GROUND
4: GROUND
5: ENABLE
6: GROUND
7: PWR SELECT 1
8: PWR SELECT 2
9: GROUND

SMA FEMALE
RF INPUT

SMA FEMALE
RF OUTPUT

Dimensions:

- Overall Width: 0.375 [9.5]
- Pin Pitch: 0.094 [2.4]
- Mounting Hole Diameter: 4X Ø0.128 [Ø3.3]
- Distance from Left Edge to Mounting Hole Center: 2.500 [63.5] (to top hole), 2.300 [58.4] (to bottom hole)
- Distance from Top Edge to Bottom Mounting Hole Center: 3.500 [88.9]
- Distance from Bottom Edge to Top Mounting Hole Center: 3.300 [83.8]

- (1) HHA1 High Power Amplifier (configured as ordered)
- (1) CBLRF50-SSS20 - 2" SMA/SMA Coax (for use with EST1 or PMT1) or CBLRF50-SSS30 - 3" SMA/SMA Coax (for use with VST1, PST1, or FMT1)

- WHSMDM9-SSLH0 - MDM-9S (Socket) DC Power Cable
- SNK3535-S12B0 - 5 Watt Heatsink
- SNK6335-S12B0- 10 Watt Heatsink

- Antenna, Type SMA Plug (Male) Connector
- Analog FM Transmitter
- Heatsink

3. HSP1 POWER AMPLIFIER

3.1. HSP1 Specifications

RF Characteristics

Frequency Range (Specify):	UHF:	340.0-399.9 MHz
(Other Ranges Available)	Lower L-Band:	1435-1535 MHz
	Upper L-Band:	1700-1850 MHz
	Lower S-Band:	2200-2399 MHz
	Upper S-Band:	2400-2499 MHz
	Full S-Band:	2200-2499 MHz
	Lower C-Band:	4400-4900 MHz
	Upper C-Band:	4900-4999 MHz
	Full C-Band:	4400-4999 MHz
Output Power (Specify):	250 mW, 500 mW, 1 Watt, or 2 Watts, Nominal	
Output Power, PA Disabled:	< +10 dBm	
Input Power (Specify):	20mW (+13 dBm) +2/-1 dB or 250mW (+24 dBm) +2/-1 dB	
Power Modes (Specify):	One (Fixed) or Two (Specify), Flying Lead, Open (10 k Ω pull up to 3.3 Vdc) = High, Ground (or <0.6 Vdc) = Low	
Output Impedance:	50 Ω Nominal, VSWR 2:1 Maximum	
Output Protection:	Internal Isolator (Most Bands) - Open/Short Indefinitely	
Spurious Output:	-13 dBm Maximum	

Power Requirements

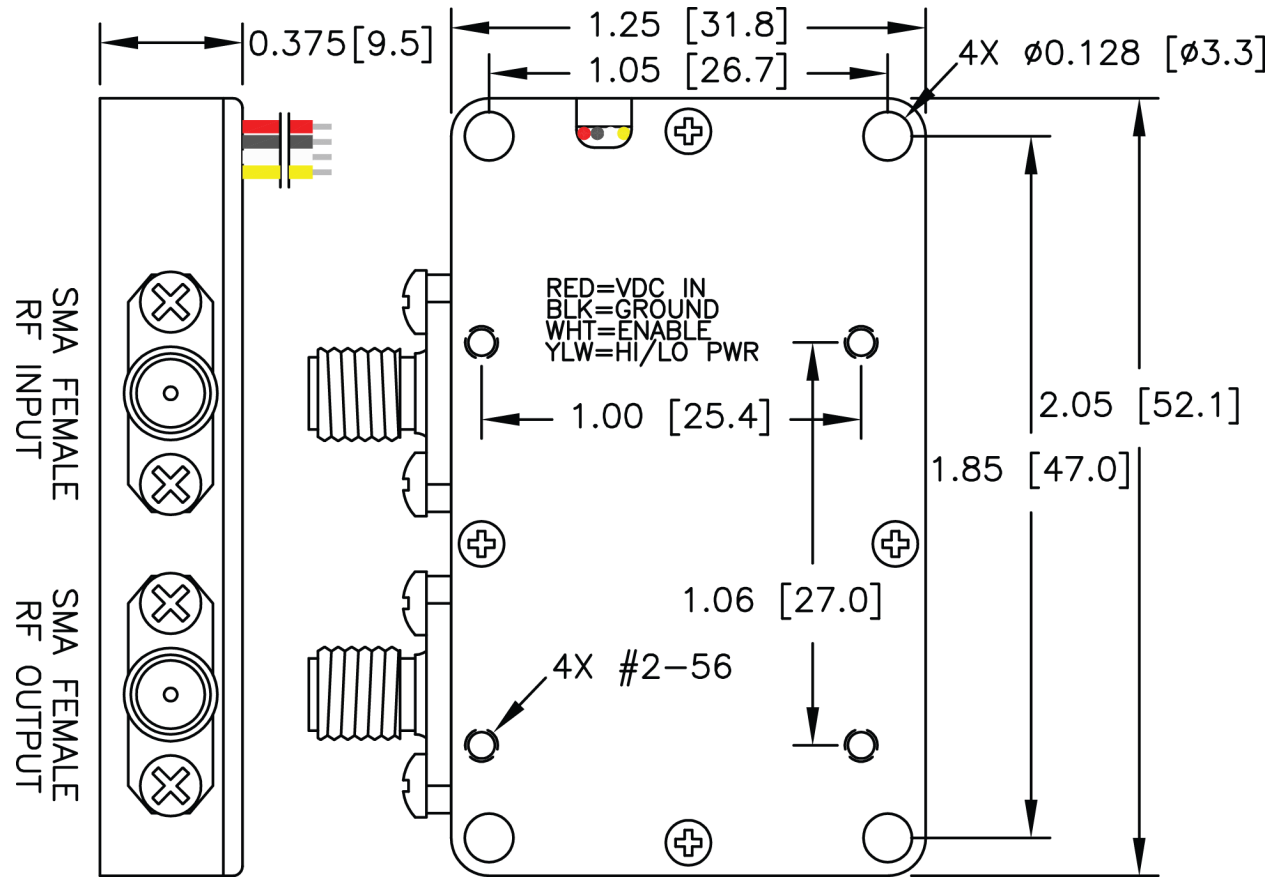
Input Voltage:	+11 to +16 Vdc, Reverse Polarity Protected
Current Draw (12V Typical):	175mA for 250mW, 275mA for 500mW, 375mA for 1W, or 625mA for 2W
PA Enable Control:	Open = On, Ground (or <1.5 Vdc) = Off

Mechanical

Material:	CNC Machined T6061-T6 Aluminum	
Finish (Specify):	Nickel Plated or Gold Iridite	
Dimensions:	1.25" W x 2.05" L x 0.375" H	
Weight:	<1.2 oz.	
Connectors:	RF Input:	SMA Female
	RF Output:	SMA Female
	DC Supply, PA Enable, High/Low Power:	Flying Leads

Environmental

Temperature (Operating):	-20°C to +60°C
Acceleration:	100 g, 3 Axes
Altitude:	Unlimited
Humidity:	Up to 95% @ Any Temperature Forming Frost or Condensation



3.3. HSP1 List of Items Furnished

- (1) HSP1 Power Amplifier (configured as ordered)
- (1) CBLRF50-SSS10 - 1" SMA/SMA Coax

3.4. HSP1 Optional Accessories

- SNK3520-S05B0 - Heatsink

3.5. HSP1 List of Items Required

- Antenna, Type SMA Plug (Male) Connector
- Analog FM Transmitter
- Heatsink

4. HSF1 Power Amplifier

4.1. HSF1 Specifications

RF Characteristics

Frequency Range (Specify):	433 ISM:	433.0-434.8 MHz
(Other Ranges Available)	868 ISM:	868.0-870.0 MHz
	915 ISM:	902.0-928.0 MHz
	Upper S-Band:	2400-2499 MHz
Output Power (Specify):	250 mW, 500 mW, 1 Watt, or 2 Watts, Nominal	
Output Power, PA Disabled:	<+10 dBm	
Input Power (Specify):	20mW (+13 dBm) +2/-1 dB or 250mW (+24 dBm) +2/-1 dB	
Power Modes (Specify):	One (Fixed), Two (Specify), Three (Specify), or Four (Specify), Flying Lead, Open (10 k Ω pull up to 3.3 Vdc) = High, Ground (or <0.6 Vdc) = Low, see chart below for configuration	
Power Leveling:	Within ± 0.5 dB Over Frequency Band, Nominal	
Output Impedance:	50 Ω Nominal, VSWR 2:1 Maximum	
Output Protection:	Internal Isolator (Most Bands) - Open/Short Indefinitely	
Spurious Output:	-13 dBm Maximum	

Power Requirements

Input Voltage:	+11 to +16 Vdc, Reverse Polarity Protected
Current Draw (12V Typical):	175mA for 250mW, 275mA for 500mW, 375mA for 1W, or 625mA for 2W
PA Enable Control:	Open = On, Ground (or <1.5 Vdc) = Off

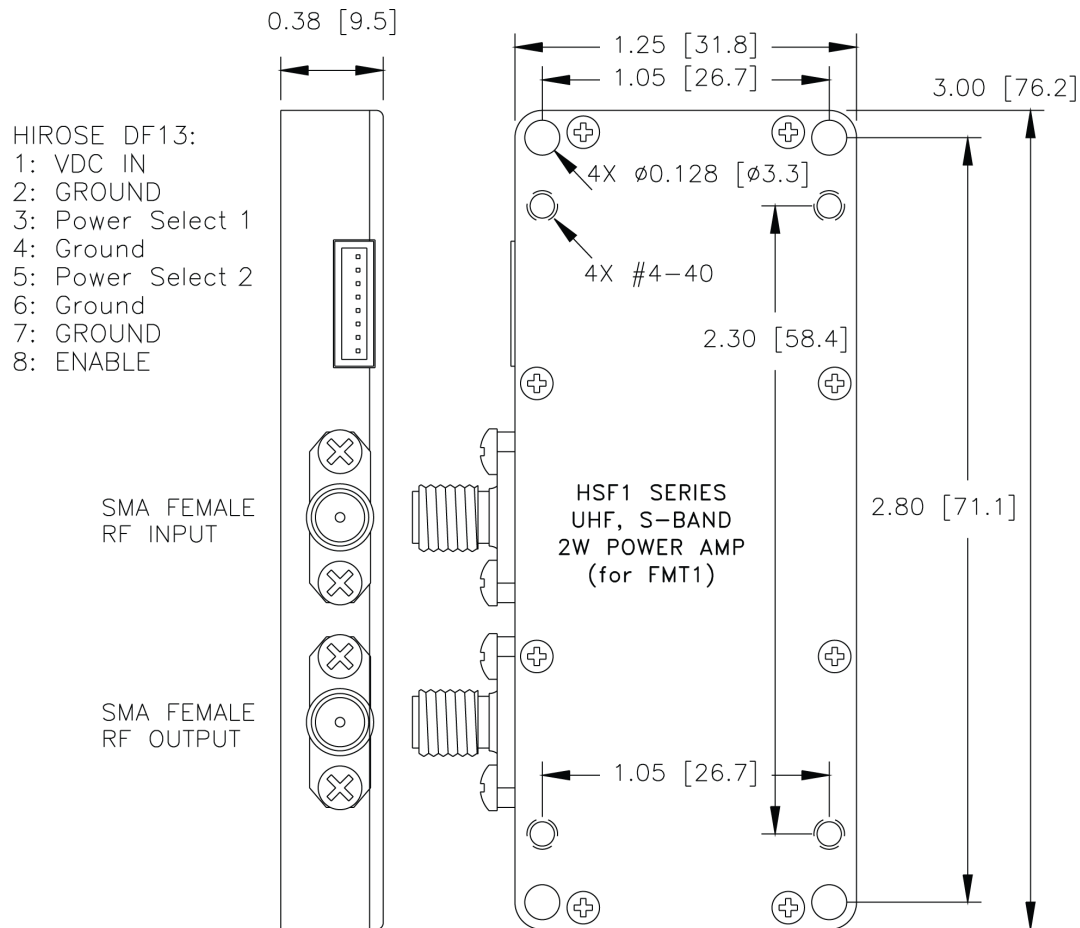
Mechanical

Material:	CNC Machined T6061-T6 Aluminum	
Finish (Specify):	Nickel Plated or Gold Iridite	
Dimensions:	1.25" W x 3.00" L x 0.375" H	
Weight:	<1.5 oz.	
Connectors:	RF Input:	SMA Female
	RF Output:	SMA Female
DC Supply, Power Select, PA Enable: Hirose DF13-8P-1.25DS, Mate Supplied		

Environmental

Temperature (Operating):	-20°C to +60°C
Acceleration:	100 g, 3 Axes
Altitude:	Unlimited
Humidity:	Up to 95% @ Any Temperature Forming Frost or Condensation

4.2. HSF1 Mechanical Drawing and Connector Pin-Outs



4.3. HSF1 List of Items Furnished

- (1) HSF1 Power Amplifier (configured as ordered)
- (1) WSHSF1-S08S0 - Power Mating Connector
- (1) CBLRF50-SSS10 - 1" SMA/SMA Coax

4.4. HSF1 Optional Accessories

- SNK3520-S05B0 – Heatsink

4.5. HSF1 List of Items Required

- Antenna, Type SMA Plug (Male) Connector
- FMT1 Transmitter
- Heatsink

5. SAFETY PRECAUTIONS

Power Amplifiers should be handled with caution like any electrical or electronic device. Do not handle the units or associated cabling with wet hands or materials.

Connections should be made only to previously-tested, active power sources (outlets or batteries) of the correct voltage, and each connector should be inserted only into its designated port. All connections should be checked to ensure they are firmly in place.

WARNING! RF RADIATION HAZARD

In order to keep the RF Exposure within the FCC 1.1310 limit, a safe personal distance from the antenna must be maintained according to the below tables. The first table is for transmitters operating 1500 MHz or higher where the Maximum Permissible Exposure (MPE) is 10 Watts/meter². The second table is for transmitters operating in the 340-400 MHz range where the MPE is 2.27 Watts/meter². See following page for details on calculation of safe personal distances.

Operating Frequency 1500 MHz and Higher (MPE = 10 W/m ²)										
Antenna Gain (dBi)	Transmitter Power 0.25 Watts		Transmitter Power 0.5 Watts		Transmitter Power 1 Watt		Transmitter Power 2 Watts		Transmitter Power 5 Watts	
	EIRP (Watts)	Minimum Distance (Meters)	EIRP (Watts)	Minimum Distance (Meters)	EIRP (Watts)	Minimum Distance (Meters)	EIRP (Watts)	Minimum Distance (Meters)	EIRP (Watts)	Minimum Distance (Meters)
0	0.25	>0.20	0.5	>0.20	1	>0.20	2	>0.20	5	>0.20
2	0.4	>0.20	0.79	>0.20	1.58	>0.20	3.17	>0.20	7.9	0.25
5	0.79	>0.20	1.58	>0.20	3.16	>0.20	6.32	0.22	15.8	0.35
10	2.5	>0.20	5	>0.20	10	0.28	20	0.4	50	0.63
15	7.91	0.25	15.8	0.35	31.6	0.5	63.2	0.71	158.1	1.12
20	25	0.45	50	0.63	100	0.89	200	1.26	500	1.99
25	79.1	0.79	158.1	1.12	316.2	1.59	632.5	2.24	1581.1	3.55
30	250	1.41	500	1.99	1000	2.82	2000	3.99	5000	6.31

Operating Frequency 340 - 400 MHz (MPE = 2.27 W/m ²)												
Antenna Gain (dBi)	Transmitter Power 0.25 Watts		Transmitter Power 0.5 Watts		Transmitter Power 1 Watt		Transmitter Power 2 Watts		Transmitter Power 5 Watts		Transmitter Power 10 Watts	
	EIRP (Watts)	Minimum Distance (Meters)	EIRP (Watts)	Minimum Distance (Meters)	EIRP (Watts)	Minimum Distance (Meters)	EIRP (Watts)	Minimum Distance (Meters)	EIRP (Watts)	Minimum Distance (Meters)	EIRP (Watts)	Minimum Distance (Meters)
0	0.25	>0.20	0.5	>0.20	1	>0.20	2	0.26	5	0.42	10	0.59
2	0.4	>0.20	0.79	>0.20	1.58	0.24	3.17	0.33	7.9	0.53	15.8	0.75
5	0.79	>0.20	1.58	0.24	3.16	0.33	6.32	0.47	15.8	0.74	31.6	1.05
10	2.5	0.3	5	0.42	10	0.59	20	0.84	50	1.32	100	1.87
15	7.91	0.53	15.8	0.74	31.6	1.05	63.2	1.49	158.1	2.35	316.2	3.33
20	25	0.94	50	1.32	100	1.87	200	2.65	500	4.19	1000	5.92
25	79.1	1.66	158.1	2.35	316.2	3.33	632.5	4.71	1581.1	7.45	3162.3	10.53
30	250	2.96	500	4.19	1000	5.92	2000	8.37	5000	13.24	10000	18.72

MAINTAIN A SAFE PERSONAL DISTANCE FROM THE ANTENNA WHILE TRANSMITTER/AMPLIFIER IS OPERATIONAL.

FAILURE TO MAINTAIN A SAFE PERSONAL DISTANCE FROM THE ANTENNA MAY RESULT IN PERSONAL INJURY.

6. PREPARATION FOR USE

6.1. Unpacking

Carefully remove the product from the shipping container and make sure all listed furnished items are included as noted in the respective section. Inspect all items for damage. If any item is omitted from the shipment or appears damaged, contact AMP with detailed description of problem.

6.2. Amplifier Pre-Test

Although each unit is thoroughly tested at the factory for both functional and environmental performance, a minimal amount of pre-testing should be done by the operator before placing the power amplifier into service. The power amplifier, an analog FM link with appropriate input sources and output monitors and DC power supplies are the only components required to perform a functional test of the amplifier.

Set up and test your existing analog FM link and make all necessary adjustments in accordance with that unit's Operation Manuals. The transmit and receive antennas should be situated at a distance of greater than 25 feet apart to prevent serious damage to or destruction of the receiver's front end.

Verify DC power supplies are between +11 and +16 Vdc. For the HHA1 and HSF1, with the DC Power Cable DISCONNECTED from the power amplifier, connect DC power supply to DC Power Cable (Pin1 = positive DC input, Pin2 = negative DC input (ground)). Do not connect DC Power Cable to amplifier until all other connections are complete.

The HSP1 does not have a power connector, but instead has flying leads. Do not connect the DC power to the HSP1 leads (Red lead = positive DC input, black lead = negative DC input (ground)) until all other connections are made.

Connect the transmit antenna to the amplifier RF output connector (SMA). After confirming the transmitter power output matches the power input range of your power amplifier, connect the RF Input connector to the transmitter RF output with the provided SMA to SMA coax cable.

Configure the output power (if you unit has multiple output powers) as instructed in Section 7.3. Connect DC Power to power amplifier and transmitter. Your analog FM link should be working as intended, if not, refer to Section 8.2 for troubleshooting instructions.

7. INSTALLATION AND OPERATING INSTRUCTIONS

7.1. Use and Function of Connectors

AMP H series products are simple to install, requiring only connection to the antenna, analog FM transmitter, and DC power supply using the appropriate cables and jacks and requiring only connection to the antenna, transmitter, and DC power supply using the appropriate cables and jacks. The use and function of the connectors are in the respective product sections.

7.2. Using the Enable Pin

AMP H series power amps are equipped standard with an enable pin to disable the RF output. When the pin is open the RF output is active, when the pin (or lead in the case of the HSP1) is grounded or connected to <1.5 VDC the RF output is disabled. When the RF output is disabled the power amplifier is still powered, if still connected to a power source.

7.3. Setting Power Output Level

7.3.1. HHA1

The HHA1 power amplifier does not require any configuring unless it includes optional multiple RF power output levels. If included, the power level is set using pin 7 and 8 of the MDM-9P connector shown in Section 2.2. Reference the Output Power Configuration table below to determine whether each wire is to be left open (or driven to 3.3 Vdc by an external device) or grounded (or driven to below 0.6 Vdc by an external device) to command the unit to the desired output level. If the HHA1 power amplifier is commanded to a power level with which the unit is not equipped, the unit will default to standby (disabled) until a valid power level command is applied.

Output Power Configuration		
Power Select 1	Power Select 2	Output Power
Ground	Ground	Standby
Ground	Open	2 W
Open	Ground	5 W
Open	Open	10 W

7.3.2. HSP1

The HSP1 power amplifier does not require any configuring unless it includes optional dual RF power output. If included, the power level is set using the yellow wire shown in Section 3.2. To set the amplifier to the higher output power level, leave the yellow wire open (or driven to 3.3 Vdc by an external device). To set the amplifier to the lower output power level, connect the yellow wire to ground (or driven to below 0.6 Vdc by an external device).

7.3.3. HSF1

The HSF1 power amplifier does not require any configuring unless it includes optional multiple RF power output levels. If included, the power level is set using the green and blue wires shown in Section 4.2. Reference the Output Power Configuration table below to determine whether each wire is to be left open (or driven to 3.3 Vdc by an external device) or grounded (or driven to below 0.6 Vdc by an external device) to command the unit to the desired output level. If the HSF1 power amplifier is commanded to a power level with which the unit is not equipped, the unit will default to standby (disabled) until a valid power level command is applied.

Output Power Configuration		
Power Select 1	Power Select 2	Output Power
Ground	Ground	250 mW
Ground	Open	500 mW
Open	Ground	1 Watt
Open	Open	2 Watts

7.4. Use of Heat Sink

HHA1, HSP1, and HSF1 Power Amplifiers operating at or above 500 mW require the use of a heat sink or must be securely fastened to an adequate heat sinking object or surface. Advanced Microwave Products recommends the appropriate heatsink as noted in the Optional Accessories section for each product.

H Series amplifiers should be fastened to AMP heat sinks using provided pan head or socket head screws with lock washers. Use of thermal grease, such as Wakefield Engineering 120 Series Thermal Compound, to improve thermal conduction between transmitter base plate and heat sinking surface will reduce unit temperature and increase product reliability.

7.5. Shut Down

If the power amplifier is to be shut down only briefly, simply remove DC voltage from the DC Power Cable or disconnect DC Power Cable from amplifier. If the unit is to be shut down for an extended period, all external cabling including the antenna should be removed and the unit should be stored in a container and placed in a clean, dry environment.

8. MAINTENANCE INSTRUCTIONS

8.1. Cleaning

AMP Power Amplifiers should be periodically wiped off with a clean, damp cloth. For more thorough cleaning, dampen a clean cloth with glass cleaner and wipe off unit. Ensure units are completely disconnected from their power sources before cleaning.

8.2. Troubleshooting

To avoid poor performance, ensure all mating connectors are tightly fastened, clean, and have no pins bent or damaged.

If poor or no operation is observed, ensure the external DC voltage supply is between +11 and +16 Vdc with correct polarity. All AMP Power Amplifiers have over-voltage and reverse polarity protection circuits. If the input voltage is over +16 Vdc, remove the DC Power Cable from the unit, reduce the DC voltage to between +11 and +16 Vdc, and reconnect the DC Power. If the input voltage is negative polarity, remove the DC Power Cable from the unit, reverse the connections between the DC voltage supply and DC Power Cable, and reconnect the DC Power Cable.

If poor or no operation is still observed, verify that your enable pin (see Section 7.2) and power output level (see Section 7.3) are set properly for your Power Amplifier and that the output power of your transmitter matches the acceptable power input range for your Power Amplifier configuration.

If these efforts fail, do not attempt to repair the unit. Please contact AMP with a detailed description of the problem. Depending on the nature of the problem, AMP may provide further troubleshooting assistance or advise the entire system be returned for repair and retest.

Caution: Removal of the cover constitutes breaking the seal and VOIDS PRODUCT WARRANTY.

8.3. Preparation for Reshipment

If the power amplifier, and/or any other purchased item(s) are to be shipped to another location or returned for repair or realignment, use the original packaging or a sturdy box with sufficient protective material to avoid damage from movement or exposure during transit. Remove all external connections (cables, antenna, etc.) prior to shipping.

8.4. Returning an Item

Please contact AMP customer service at (775) 345-9933 for a Return Authorization Number before returning an item. The AMP ship-to address is listed below. When returning an item, always include a contact name and phone number and a detailed description of the problem with your shipment.

Advanced Microwave Products

Advanced Microwave Products
PO Box 1437
2465 Old Highway 40 West, Suite 200
Verdi, NV 89439

9. WARRANTY STATEMENT

Advanced Microwave Products (AMP) warrants these products to be free from defects in material and workmanship for a period of one year from date of original shipment. AMP shall, at its option, either repair or replace products which prove to be defective.

No products may be returned to AMP without the permission of AMP. BUYER, after obtaining a return authorization from AMP, shall return the equipment to AMP accompanied by a report stating as completely as possible the reason for return, the defects, and the conditions under which they occurred. BUYER shall pay all shipping charges, duties, and fees for the return of products to AMP. All warranty services will be carried out at AMP's facility. AMP will pay for the return of products to the BUYER.

All articles are to be properly and carefully inspected by BUYER upon receipt. Shipping container damage may indicate equipment damage. All shipping damage must be promptly reported to the carrier. AMP is not liable for shipping damage.

Limitation of Warranty: The above warranty does not apply to defects of, or resulting from the following:

- 1) End items included as part of a system, but not designed by, AMP are subject only to warranty as may be obtained from the original manufacturers. Such items include, but are not limited to, batteries, cameras, monitors, cabling, etc.,
- 2) Operation outside of the environmental specifications of the product,
- 3) Unauthorized modifications, misuse, or mishandling,
- 4) Improper or inadequate maintenance by BUYER,
- 5) Improper or inadequate heat sinking by BUYER,
- 6) Improper installation or improper testing,
- 7) Malfunction of connected hardware.

THIS WARRANTY IS EXCLUSIVE AND NO OTHER WARRANTY, WHETHER WRITTEN OR ORAL, IS EXPRESSED OR IMPLIED. AMP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

The remedies set forth above are the purchaser's sole and exclusive remedies. In no circumstances shall AMP assume liability for loss, damage, or consequential expense (including loss of profits) whether based on contract, tort, or any other legal theory, arising directly or indirectly from the use of its equipment separately or in combination with other equipment.