OPERATION MANUAL
MODEL AR-20
RF BOOSTER AMPLIFIER

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SECTION I
GENERAL INFORMATION

1.1 Introduction

This manual supports the **Model AR-20,** a 20W 30 to 512 MHz Multi-Band Automatic Band Switching Power Amplifier with built in switchable SATCOM low noise amplifier (LNA). The manual provides general information, installation instructions, and operating instructions.

The envelope dimensions of the Model AR-20 are shown in SECTION IV DRAWING.

The Model AR-20 is self-contained and is intended to operate from a single external MIL-STD XX90 type 28V battery, or a 12-35.5V vehicle DC supply.

The AR-20 Man-pack Kit comes with a broadband 30-512 MHz antenna. The kit includes matching Antenna and Amplifier vest mounting pouches, two interconnecting RF coax cables and a DC power cable. All you need to provide is a DC voltage supply capable of at least 3.2A at 24V DC; such as a military 28V DC vehicle supply or an XX90 primary or secondary (rechargeable) battery.

Unit identification is located on the Serial Number Label attached to the bottom of the amplifier.

1.2 Agency Approval

Not applicable.

1.3 Equipment Required

The Model AR-20 is for use with military communication devices to extend the range of communication. External DC power must be provided to operate this unit and it can come from either a 28 Volt battery system or a DC power supply capable of 12-35.5V DC.

1.4 Safety Considerations

There are no safety concerns in operating this unit.

1.5 Recommended Tools and Equipment

Other than standard installation tools, used to mount the amplifier in a vehicle, no special tools or equipment are required.

1.6 Description

The Model AR-20 is a portable, lightweight, waterproof 20W MULTI-BAND Automatic Band Switching Power Amplifier for multi-band VHF/UHF tactical radio equipment employing legacy, proprietary and emerging Networking waveforms in the 30-512MHz frequency range. The amplifier has a built in switchable Low Noise Amplifier system that covers the UHF SATCOM band and provides approximately 12dB of filtered gain in the receive path.

The unit is capable of carrying but not limited to AM, FM, PM, SINCGARS, SATCOM DAMA and IW, SRW, ANW2C and WNW waveforms. Six harmonic low pass filters are automatically selected at high speed in all modes to assure low harmonic distortion levels and minimize “friendly interference” in hopping modes.

The rated output power is a nominal 20W into a 50-Ohm load from 30-512 MHz. No tuning, switching or adjustments are required to operate this unit. Protection is provided against overheating, excessive VSWR and inadvertent DC polarity reversal. The amplifier will be bypassed automatically in case of an over temperature condition, loss of DC supply voltage, or in the sleep condition. The amplifier includes RF sensing, T/R switching, Automatic Level Control (ALC), transient protection, and automatic band switching.

The amplifier is made to operate in a rugged, man-pack or man-portable environment and is designed to meet or exceed applicable sections of MIL-STD-810F for humidity, shock and vibration. The amplifier is submersible and will not be adversely affected by immersion in water for up to 20 minutes at 1 meter. Its rugged construction and its ability to operate without any operator intervention or need to reset functionality makes it ideal for many operational environments such as, man portable, ground vehicles of all types, UAV’s, remote aircraft, or boat installations.

The amplifier comprises a watertight machined aluminum case with 4 threaded bolt holes for bolting to a flat surface. Cooling is by natural convection.

1.7 Shipping and Handling Precautions

The AR-20 amplifier is ruggedly constructed of cast aluminum and will withstand general ground or air transportation shock and vibration without adversely affecting the mechanical and electrical performance when commercially accepted packaging practices and materials are employed. No special precautions are required.

Typical packaging consists of:

- 4-Mil plastic bag or wrap to cover the amplifier.
- A strong shipping box of 90 lb.-test, corrugated cardboard.
- ½” of shock-absorbing material surrounding the amplifier to prevent movement and provide cushioning.
- Appropriate shipping labels.

1.8 Storage

The power amplifier must be stored in a clean and dry environment. The following environmental limits must be observed in both storage and shipment.

- Temperature: -40 °C. to 70 °C.
- Humidity: <95% relative

SECTION II
INSTALLATION

2.1 Introduction

This section provides information to unpack and prepare the power amplifier for use.

2.2 Unpack and Inspect

Inspect the shipping box for damage. If the shipping box has serious damage, notify the courier and AR Modular RF Customer Service. If possible, photograph the unopened box for possible insurance claims. Retain the damaged shipping box and all internal cushioning material for inspection until after the amplifier condition and performance have been examined. The shipping box should contain:

- 1 ea. AR-20, 20W30-512MHz Multi-Band Automatic Switching Power Amplifier

2.3 Preparation for Use

The Model AR-20 is designed to operate on 12-35.5VDC military power supplies. The DC power is applied via the power connector. Pin assignments are shown in Table 2-2 below. This unit is designed to operate from a SINGLE MIL-STD XX90 type battery pack, connected in the 24V DC configuration.

The unit may also be operated from civilian 12 Volt or 28 Volt Military vehicle systems. Connection cables should be suitably fused and taken back to the supply source for best results using cable suitably sized to prevent excessive voltage drop.

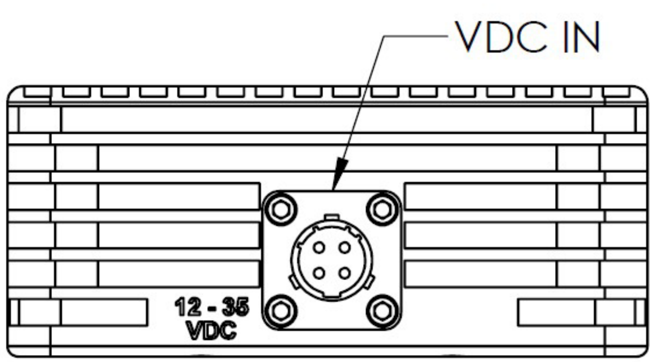


Figure 2-1, DC Input Power Connector

PIN NUMBER	FUNCTION	SUGGESTED WIRING
A	BATTERY POSITIVE + (12-35 VDC)	RED 20 AWG
B	BATTERY POSITIVE + (12-35 VDC)	RED 20 AWG
C	BATTERY NEGATIVE – (GROUND)	BLACK 20AWG
D	BATTERY NEGATIVE – (GROUND)	BLACK 20AWG

Figure 2-2, Table DC Power Connector Pin Functions

There is a front panel power switch on the unit, once connected to a power source with the mode switch in the “CENTER ON” position the system is ready to be used and is in its “sleep mode”. A microprocessor system monitors the RF input line constantly and if there is no input for a period of time the unit goes into a “sleep mode” reducing the current consumption to approximately 35mA. In the active standby mode, between transmissions and before “sleep mode”, current draw is approximately 275mA.

2.4 Input / Output Connections

Connections to the amplifier signal input and output connectors require 50-Ohm coaxial cable. RG400 or equivalent is suitable for the input. Output coax cable type should be chosen based on the length of cable required for each application. Short cables of less than 6ft can use RG-400 or equivalent, longer runs require a lower loss cable such as Times LMR-400. TNC male coaxial connectors are required to connect to the amplifier.

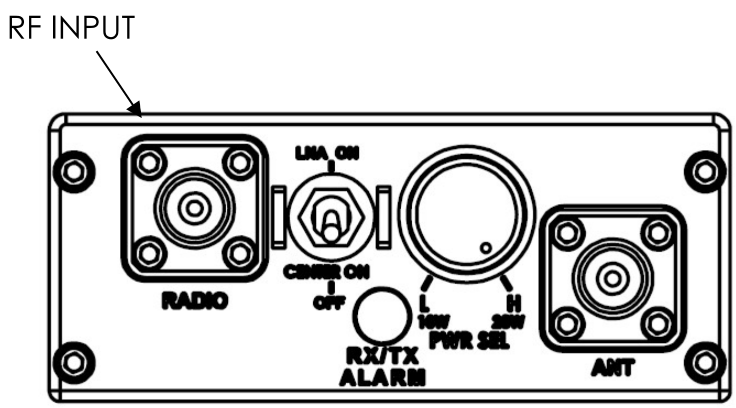


Figure 2-3, RF Input Output connectors

NOTE: Take care not to transpose the input and output cables. Transmitting into the RF Out will not cause damage but will not allow proper operation.

2.5 Positioning the Amplifier

The AR-20 is designed to be either worn on one's person or permanently installed in a communications base or vehicle. There are four threaded mounting holes on the bottom of the amplifier housing, and these are used to directly attach the unit to a base plate. An optional vest pouch is available individually or as part of the AR-20 Man-pack Kit.

The Amplifier is convection-cooled. Therefore, for most efficient cooling it should be placed in a position where the integral heat sink fins are vertical, unless there is forced airflow in a different direction.

SECTION III
OPERATION

3.1 Introduction

Operation of the **MODEL AR-20 MULTI-BAND AUTOMATIC BAND-SWITCHING POWER AMPLIFIER** requires no special skills and is limited to the description given below.

3.2 Operation

A) The amplifier must be connected to the DC power source as described in SECTION II, INSTALLATION, and the mode switch placed into the “CENTER ON” position

Note! Take care not to transpose the input and output cables. Transmitting into the RF Out will not cause damage but will not allow proper operation.

B) The system output must be connected via suitable low loss coaxial cable to a transceiver radio using the RADIO (input) TNC connector, and the ANT (output) TNC connector to a suitable load or antenna. The AR-20 Man-pack Kit comes with a broadband 30-512 MHz antenna and the interconnecting coax cables. DC voltage supply must be capable of at least 3.2 amps at 24v DC; such as a military 28V DC vehicle supply or an XX90 primary or secondary (rechargeable) battery.

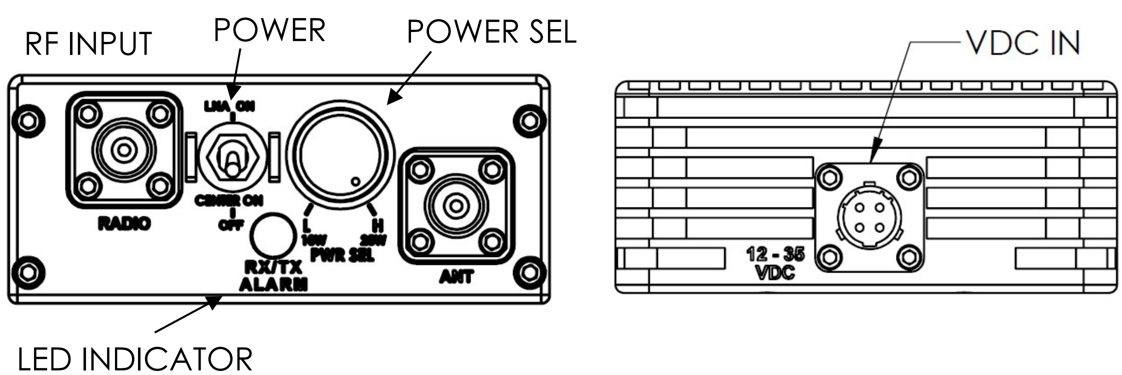


Figure 3-1, LED, Control and Connector locations

The unit is designed for RF inputs from a tactical transceiver that has an RF output in the range 1W to 5W. Normal operation requires only an RF input drive of typically 1.5W to 2.5W. Exceeding 2W will at some point cause the RF output to fold back to protect the amplifier. RF input detection threshold is typically 500mW CW.

C) Line Of Sight operation:
Mode switch to be in the CENTER ON position

D) SATCOM operation:
Mode switch in the LNA ON position will activate a 12dB gain LOW NOISE AMPLIFIER. The use of this amplifier will improve the receive signal of low angle satellites. When this LNA is switched 'ON', all other non-SATCOM receive frequencies will be heavily attenuated. If LOS operation is then needed the operator will have to move the MODE switch to CENTER ON position in order to receive LOS signals correctly. If by mistake the operator goes back to transmitting on LOS frequencies and forgets to switch back to the CENTER ON position (LOS or SATCOM with no LNA mode) on the amplifier, then the LNA will automatically be switch out of circuit to allow LOS communications to take place.

E) Simply apply a nominal 2W input in either the LOS or SATCOM modes, and the unit auto tunes the correct harmonic filter.

F) It is essential that natural convection cooling be not impeded so that operation of the individual components is within their ratings. This is dependent upon the free flow of air along the fins of the amplifier housing.

3.3 LED Indicator

The **MODEL AR-20** is equipped with a triple-state LED in between the RF input and output connectors to indicate the working status of the unit as shown in figure 3.

A) **Green LED Activated:**

The green LED is lit when the unit is connected to the DC power, this is the active receive state. After a period of about 3 minutes of no-transmission the unit will go into "sleep" mode at which point the green LED is turned off and the unit goes into bypass mode. The unit automatically wakes up at the beginning of the next transmission.

B) **Amber LED Activated**:

The amber LED will be active when an RF transmission is detected.

C) **Flashing Red LED Activated**:

The red LED will flash when the internal case temperature is higher than 85˚C ±3˚C. The unit will switch to receiving mode (By-pass) under this condition until the temperature drops to 75˚C. This function is fully automatic no operator intervention is required.

3.4 Controls

There are only two controls on the AR-20 that can be adjusted by the operator. The mode switch is used for turning the unit off/on or LNA on. The Power Select, “PWR SEL”, controls the level of output power generated by the amplifier.

The Mode switch has 3 positions:

A) **OFF**, the system is turned OFF from the DC supply

B) **CENTER ON** is used for LOS communications or for SATCOM communication that DO NOT need the use of the LNA system

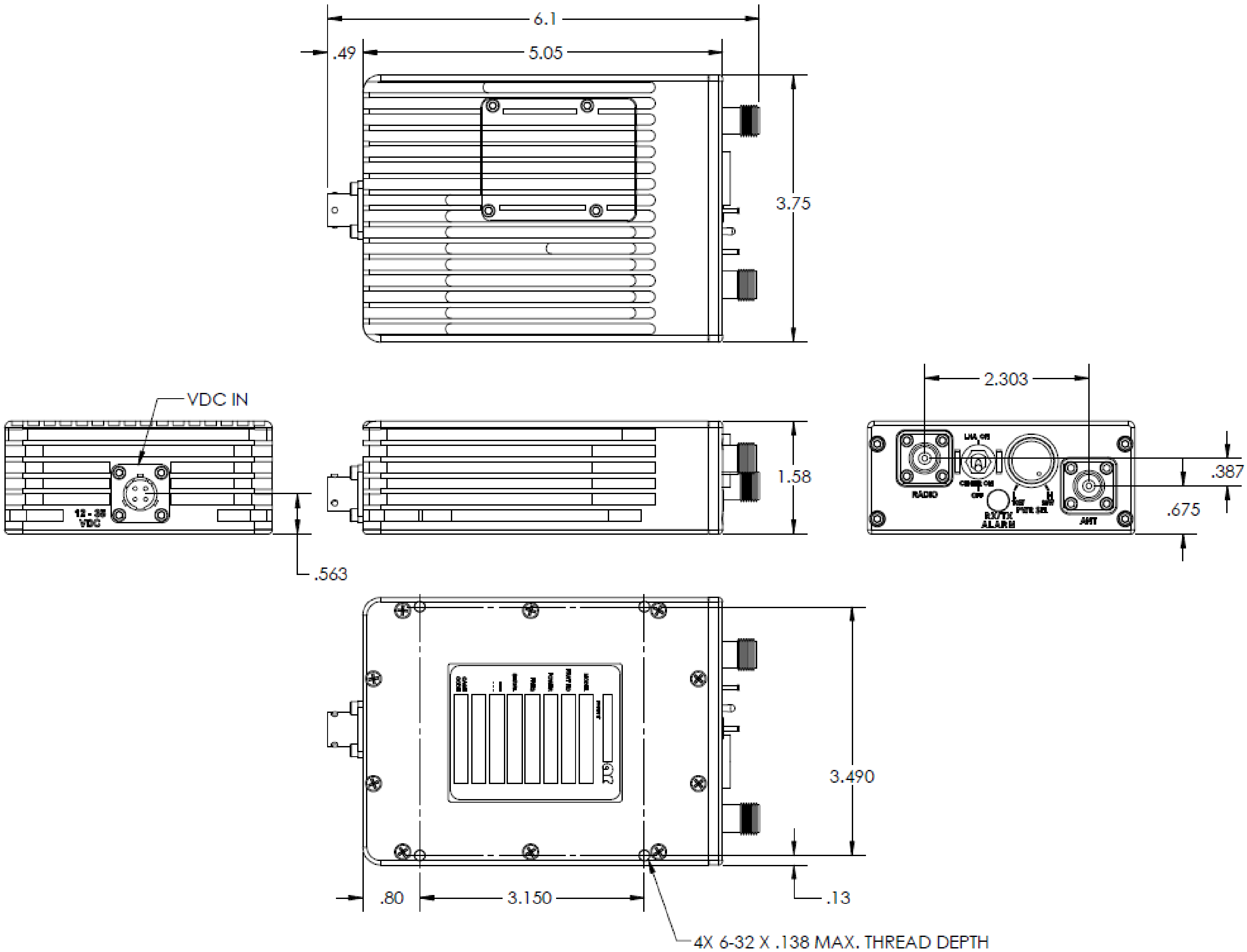
C) **LNA ON**, in this position the system is for SATCOM use only, a low noise filtered gain amplifier is placed in the receive path to improve low angle satellite operation.

The **PWR *SEL*** switch

If necessary, the output power of the system can be reduced, up to 50% down approximately 10 watts, using the control fitted to the front panel. PRESS hard with a finger and rotate the control to a lower or higher position as needed. All units are shipped with this control set at the highest power of 20 Watts.

SECTION IV
DRAWINGS

Drawing is provided to show dimensions and connector location.



SECTION V
CUSTOMER SUPPORT

System can be returned to the factory for repair by contacting Customer Service for a return authorization number (RMA). This RMA number must be clearly visible on the outside of the shipping container

For warranty information please refer to AR MODULAR RF Sales Order Terms and Conditions found on AmetekPDS.com

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