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rf/microwave instrumentation

Operating and Service Manual

25A250AM6
Model

10007635
Part Number

0328563
Serial Number

160 School House Road, Souderton, PA 18964 • 215-723-8181 • Fax 215-723-5688 • www.ar-worldwide.com

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rf/microwave instrumentation

EC Declaration of Conformity

We; AR Worldwide
160 School House Road
Souderton, Pa. 18964

declare that our product(s);

the Model 25A250A series amplifiers

to which this declaration relates is in compliance with the requirements of the EEC EMC Directive (89/336/EEC) and Low Voltage Directive (73/23/EEC) in accordance with the relative standards listed below:

EMC:

EN 50082-2 : 1995
Electromagnetic compatibility - Generic immunity standard
Part 2: Industrial environment

EN 55011 : 1991
Electromagnetic emissions requirements for Industrial, Scientific and Medical (ISM) Equipment
Group 1, Class A

Safety:

IEC 61010-1 : 2001

The CE marking is affixed on the device according to the EC Directives.

Donald R. Shepherd
President

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INSTRUCTIONS FOR SAFE OPERATION

BEFORE APPLYING POWER

Review this manual and become familiar with all safety markings and instructions.

Verify that the equipment line voltage selection is compatible with the main power source.

Protection provided by the equipment may be impaired if used in a manner not specified by Amplifier Research.

INTENDED PURPOSES

This equipment is intended for general laboratory use in a wide variety of industrial and scientific applications. It is designed to be used in the process of generating, controlling, and measuring high levels of electromagnetic Radio Frequency (RF) energy. Therefore, the output of the amplifier must be connected to an appropriate load such as an antenna or field-generating device. It is the responsibility of the user to assure that the device is operated in a location which will control the radiated energy such that it will not cause injury and will not violate regulatory levels of electromagnetic interference.

HAZARDOUS RF VOLTAGES

The RF voltages on the center pin of the RF output connector can be hazardous. The RF output connector should be connected to a load before AC power is applied to the amplifier. Do not come into contact with the center pin of the RF output connector or accessories connected to it. Place the equipment in a non-operating condition before disconnecting or connecting the load to the RF output connector.

SAFETY GROUND

This equipment is provided with a protective earth terminal. The main power source to the equipment must supply an uninterrupted safety ground of sufficient size to the input wiring terminals, power cord, or supplied power cord set. The equipment **MUST NOT BE USED** if this protection is impaired.

PHYSICAL DAMAGE

The RF amplifier should not be operated if there is physical damage, missing hardware, or missing panels.

MAINTENANCE CAUTION

Adjustment, maintenance, or repair of the equipment must be performed only by qualified personnel. Hazardous energy may be present while protective covers are removed from the equipment even if disconnected from the power source. Contact may result in personal injury. Replacement fuses are required to be of specific type and current rating.

SAFETY SYMBOLS



This symbol is marked on the equipment when it is necessary for the user to refer to the manual for important safety information.



Dangerous voltages are present. Use extreme care.

CAUTION: The caution symbol denotes a potential hazard. Attention must be given to the statement to prevent damage, destruction, or harm.



Indicates protective earth terminal.

RANGE OF ENVIRONMENTAL CONDITIONS

This equipment is designed to be safe under the following environmental conditions:

- Indoor use
- Altitude up to 2000M
- Temperature of 5°C to 40°C
- Maximum relative humidity 80% for temperatures up to 31°C. Decreasing linearly to 50% at 40°C.
- Main supply voltage fluctuations not to exceed ± 10% of the nominal voltage or minimum and maximum autoranging values.
- Pollution degree 2: Normally non-conductive with occasional condensation. While the equipment will not cause hazardous condition over this environmental range, its performance may vary.

COOLING AIR

Care should be exercised not to block the cooling air inlets or outlets. Cooling air blockage can result in damage to the RF amplifier or intermittent shut-downs.

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1. GENERAL INFORMATION

1.1 GENERAL INFORMATION

The Model 25A250A Amplifier is a self-contained broadband unit designed for laboratory applications where instantaneous bandwidth, high gain and moderate power output are required. Solid state technology is used exclusively to offer significant advantages in reliability and cost. A valuable feature is the amplifier gain over a 18 dB range to meet specific output power requirements by means of a simple front panel control.

Typical applications include antenna and component testing, wattmeter calibration, EMI susceptibility testing, use as a driver for frequency multipliers and high power amplifiers and as an RF source for nuclear magnetic resonance imaging studies.

1.2 POWER SUPPLIES

The 25A250A has a self-contained switching power supply. The input voltage range to this supply is 90-132 VAC or 180-264 VAC, 50/60 Hz, universal or selected automatically. The operator does not have to switch or change anything when changing the input line voltage.

The power consumption is a nominal 100 watts (200 watts maximum). Primary circuit fusing is provided.

1.3 SPECIFICATIONS

Refer to AR Worldwide Data Sheet at the end of this section for detailed specifications.

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AMPLIFIER RESEARCH
160 School House Road, Souderton, PA 18964-9990 USA
Phone 215-723-8181•FAX 215-723-5688

MODEL 25A250AM6
25 WATTS CW
1 – 300 MHz

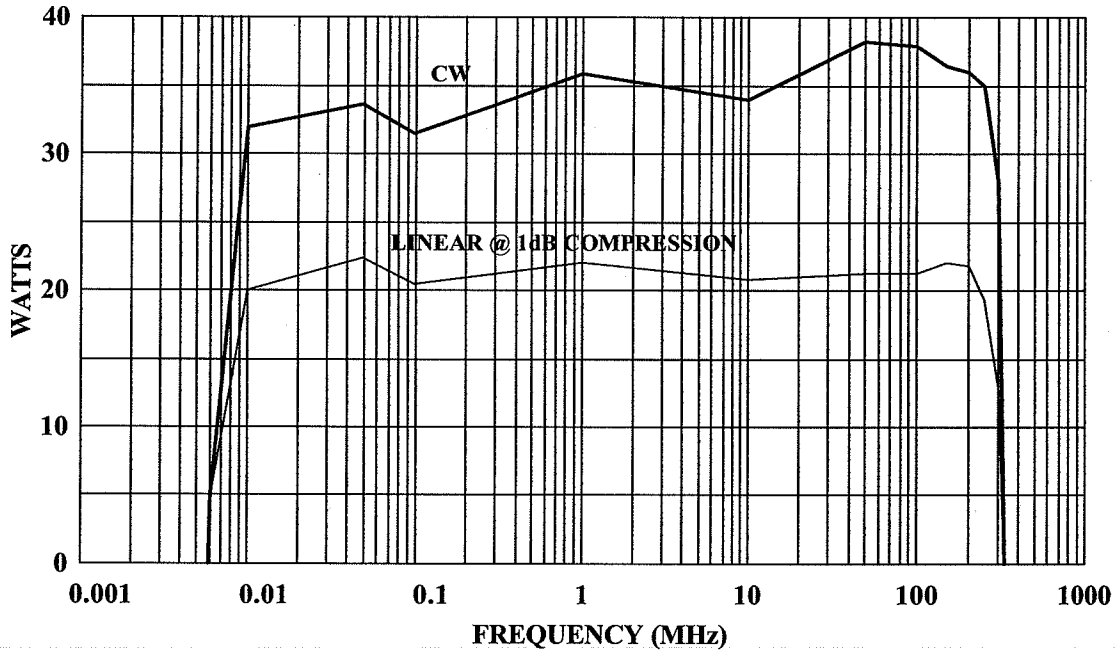
The Model 25A250AM6 amplifier is a self-contained, broadband unit designed for laboratory applications where instantaneous bandwidth, high gain and moderate power output are required. Utilization of push-pull MOSFET circuitry lowers distortion, improves stability and allows operation into any load impedance without damage. The Model 25A250AM6, when used with an RF sweep generator, will provide a minimum of 25 watts of swept power.

The Model 25A250AM6 includes a front panel control which permits the operator to conveniently set the amplifier's desired output level. Designed for rack mounting, the Model 25A250AM6 provides readily available RF power for typical applications such as RF susceptibility testing, antenna and component testing, watt meter calibration, and use as a driver for higher power amplifiers.

The 25A250AM6 utilizes a switching power supply with universal and autoranging input which will automatically accept from 90 to 135 VAC or from 180 to 270 VAC at 47 to 63 Hz.

The M6 version of the 25A250A is supplied without an instrument case and exhibits an enhanced frequency response.

25A250AM6 TYPICAL POWER OUTPUT



REV061297

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SPECIFICATIONS
Model 25A250AM6

POWER OUTPUT, CW	
Nominal	***35 watts***
Minimum	***25 watts***
Linear @ 1dB compression	***15 watts minimum (1-250 MHz)*** ***10 watts minimum (250-300 MHz)***
FLATNESS	***± 1.0 dB maximum***
FREQUENCY RESPONSE	***1-300 MHz instantaneously***
INPUT FOR RATED OUTPUT	***1.0 milliwatt maximum***
GAIN (at maximum setting)	***44 dB minimum***
GAIN ADJUSTMENT (continuous range)	***18 dB minimum***
INPUT IMPEDANCE	***50 ohms, VSWR 1.5:1 maximum***
OUTPUT IMPEDANCE	***50 ohms, VSWR 2.0:1 maximum***
MISMATCH TOLERANCE *	***100% of rated power without foldback. Will operate without damage or oscillation with any magnitude and phase of source and load impedance.***
MODULATION CAPABILITY	***Will faithfully reproduce AM, FM, or pulse modulation appearing on the input signal***
NOISE FIGURE (above 1.0 MHz)	***6 dB typical***
HARMONIC DISTORTION	***Minus 20 dBc maximum at 15 watts***
THIRD ORDER INTERCEPT POINT	***54 dBm typical***
PRIMARY POWER	***90-135/180-270 VAC*** ***47 to 63 Hz, single phase 200 watts maximum***
RF CONNECTORS	***Type N female***
COOLING	***Forced air (self contained fans)***
WEIGHT	***10.9 kg (24.0 lb)***
SIZE (WxHxD)	***48.3 x 13.2 x 28.7 cm*** ***19.0 x 5.2 x 11.3 in***

** See Application Note #27*

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2. OPERATING INSTRUCTIONS

2.1 GENERAL

Operation of the Model 25A250A broadband amplifier is quite simple. The input signal, whether swept or fixed in frequency, is applied to the jack marked "INPUT" and the amplifier output signal is taken from the jack labeled "OUTPUT". The unit is turned on by activating the power switch marked "1" / "0". In the event of a unit malfunction, protection is provided by fusing located at the rear of the unit. A polarized, three (3) wire AC power cord is also included with the unit to provide cabinet and chassis grounding to the power mains.



CAUTION:

The Model 25A250A amplifier is not critical in regards to source and load VSWR and will remain unconditionally stable with any magnitude and phase of source and load VSWR. It also has been designed to withstand RF input power up to twenty (2) times its rated input of 1mW. However, signal levels higher then 20 mW or transients with high peak voltages can damage the amplifier. Also, accidental connection of the output to its input causes oscillations which may permanently damage the unit.



CAUTION:

While the Model 25A250A will operate at its rated output power into any load impedance, the amplifier may be damaged if it is simultaneously overdriven with an open or short circuited load. To prevent damage to the amplifier, the following practices are recommended:

- **Do not intentionally overdrive the amplifier at any time. When operating into a mismatched load, take special precautions so that the input cable cannot be inadvertently overdriven.**
- **When connecting and disconnecting cables, turn the power switch off. 25 watts of RF power is sufficient to cause serious electrical shock and/or burns.**
- **Care must be taken to prevent restrictions of the cooling fan air inlet opening on the bottom of the unit. Restriction of the opening for extended periods will cause overheating of the unit and possible premature failure.**

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2.2 AMPLIFIER OPERATION

Figure 2.1 shows the Model 25A250A Amplifier in pictorial form.

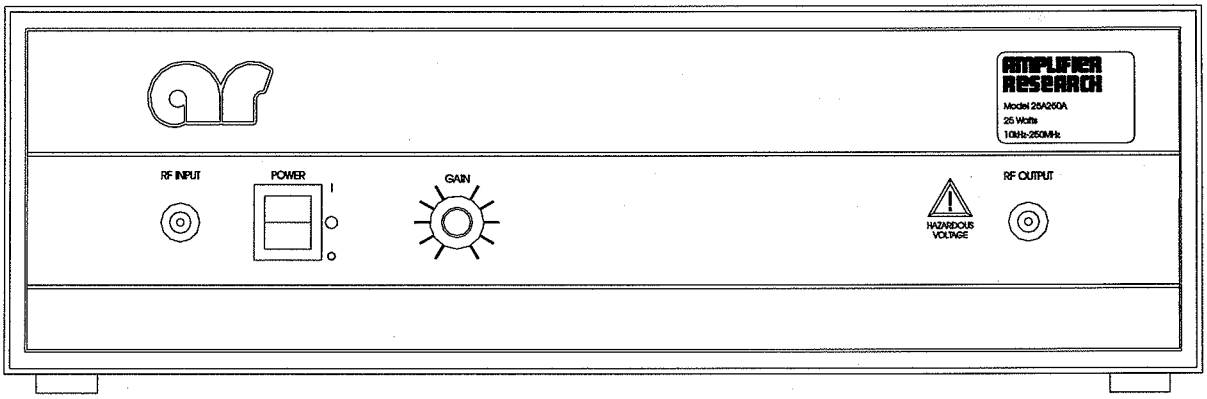


Figure 2-1. Amplifier Operation

1. Connect the AC power to the unit.
2. Connect input signal to INPUT connector.
3. Connect load to OUTPUT connector.
4. Set gain control fully counter clockwise.
5. Activate power switch to on (1) position. A GREEN indicator light mounted on the front panel will light when power is applied.
6. Adjust gain control as required.

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3. THEORY OF OPERATION

3.1 INTRODUCTION

The Model 25A250A Amplifier consists essentially of three (3) cascaded stages followed by a push-pull stage of broadband Mosfet transistor amplifiers. Total power gain of the amplifier is a minimum of 44 dB. Input and output matching networks are utilized to provide optimum power transfer of the RF signal when the amplifier is connected to a source and load impedance of 50 ohms. Inter-stage coupling is accomplished by means of capacitors between the three (3) cascaded stages and transformer coupling between these stages and the push-pull output stage. This provides an overall flat frequency response that is further enhanced by utilizing negative feedback around each transistor stage.

The self-contained power supply consists of a switching power supply, which features universal input voltage capability, followed by a current limiter circuit which provides over dissipation protection for the amplifier. Gate bias stability is provided by a three (3) terminal regulator set for 15 VDC.

3.2 AMPLIFIER SECTION

Refer to Schematic Diagram No. 10019450.

The input signal to the amplifier is fed through the front panel attenuator to the gate of Q1, which is input level limited by diodes CR2 and CR3. Biasing for Q1 is accomplished by R10 which drives the gate of Q1. Bias voltage for Q2 is adjusted via R6 through R11. Output of Q2 is coupled through C4 to the gate of Q3. Resistor R12 and capacitor C12 provide adjustments for bandpass response. The output of Q3 is coupled to transformer T1 which is utilized to drive push-pull stage Q4 and Q5. Resistor R22 sets bias voltages for both Q4 and Q5, in conjunction with R23 which is used to equalize the bias voltage on gates of Q4 and Q5.

The output of Q4 and Q5 are coupled through matching transformer T2 to coaxial connector on front panel of unit.

Power gain of each of the three (3) cascaded stages is approximately +11 dB and +13 dB for push-pull stage, giving an overall gain of better than +44 dB for the amplifier.

3.3 POWER SUPPLY

Refer to Schematic Diagrams No. 10019449 and 10019322.

The self-contained power supply employs a switching power supply with universal input line voltage capability. Input AC power is fed through RFI filter FL1 before being switched by the main power switch S1. FL1 also contains the line fuses that protect the unit against excessive line current. Power switch S1 supplies power to the switching power supply PS1. The approximately 29 VDC output of PS1 is fed to a current limiter circuit A3. A3 allows the voltage to the amplifier to be adjusted to 28 VDC and also allows the current limit to be set to approximately five (5) amps.

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4. MAINTENANCE

4.1 GENERAL MAINTENANCE INFORMATION

The Model 25A250A should require very little maintenance since it is a relatively simple instrument. It is built with etched circuit wiring and solid state devices which should ensure long, trouble-free life. However, should trouble occur special care must be taken in servicing to avoid damage to the devices or the etched circuit board.

Since the components are soldered in place, substitution of components should not be resorted to unless there is some indication that they are faulty. In addition, take care when troubleshooting not to short voltages across the amplifier. Small bias changed may ruin the amplifier due to excessive dissipation or transients.

Components with AR Worldwide instruments are conservatively operated to provide maximum instrument reliability. In spite of this, parts within an instrument may fail. Usually, the instrument must be immediately repaired with a minimum of "down time". A systematic approach can greatly simplify and thereby speed up the repair.

However, due to the importance of the amplifier's alignment, it is recommended that when failure is caused by breakdown of any of the components in the signal circuits, the amplifier be returned to the factory for part replacement and amplifier realignment. Shipping instructions are as follows:

Ship **PREPAID** via United Parcel Service to:

AR WORLDWIDE

160 SCHOOL HOUSE ROAD

SOUDERTON, PA 18964

See warranty statement at rear of manual.

4.2 COVER AND CIRCUIT BOARD REMOVAL

CAUTION:



Remove power cord from receptacle before servicing.

1. The amplifier can be removed from the housing by removing 4 screws from the front panel and 4 screws from the back panel. The amplifier can then be slid from the housing.

2. The top cover can be removed to gain access to the RF assembly. The bottom cover can be removed to gain access to the power supply assembly.

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4.3 TROUBLESHOOTING

CAUTION:



Extreme caution should be exercised when troubleshooting this unit. Hazardous voltages exist in the unit which could cause serious injury to any personnel performing internal measurements.

A good way to start troubleshooting is to check the supply voltage at the amplifier supply voltage terminal. If it is low or non-existent, check the power supply components starting with the AC line.

The power supply output voltage should be nominally +29.5 VDC. The output voltage of the current regulator assembly should be 28.0 VDC.

Assuming these voltages are correct, the problem may lie in the RF amplification chain. A re-alignment of the RF board should reveal the problem. Contact AR Worldwide for the appropriate alignment/test procedure.

CAUTION:



Beware of voltages applied to the gate of a Mosfet transistor in excess of ±20 V. This will result in transistor gate failure.

4.4 SERVICING ETCHED CIRCUIT BOARDS

When soldering leads, use a hot forty (40) watt or smaller iron. Apply heat sparingly to the leads, not to the printed wiring on the board. Before installing new parts, clean holes to receive new part without forcing. Have new leads tinned to receive solder quickly with a minimum of heat and without residue.

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