

Operating and Service Manual

MODEL

10W1000B

PART NUMBER

1007550-501

SERIAL NUMBER

20125



Souderton, PA 18964-9990 USA
TEL 215-723-8181 TWX 510-661-6094 FAX 215-723-5688

EC Declaration of Conformity

We; Amplifier Research
160 School House Road
Souderton, Pa. 18964

declare that our product;

the Model 10W1000B, 10W1000BM1 RF amplifiers

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

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

The CE marking is affixed on the device according to article 10 of the EC Directive 89/336/EEC.



Donald R. Shepherd
President

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.

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. This symbol is indicated in the Table of Contents to assist in locating pertinent 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.

SAFETY GROUND

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

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.

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SECTION I

GENERAL INFORMATION

1.1 GENERAL DESCRIPTION

The Model 10W1000B Amplifier is a self-contained, broadband unit designed for laboratory applications where instantaneous bandwidth, high gain, and moderate power output are required. A gain control is located on the front panel which can be used to decrease the amplifier gain by 10dB or more. Solid state technology is used exclusively to offer significant advantages in reliability and cost. A Model 10W1000B used with a frequency swept signal source will provide 10 watts of linear swept power output from .5 to 1000MHz. 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 magnetic resonance imaging studies.

1.2 POWER SUPPLIES

The 10W1000B has a self contained switching power supply. The input voltage range to this supply is 90-132 VAC and 180-264 VAC, 50/60 Hz. Universal or selected automatically. the operator does not have to switch or change anything on the 10W1000B when changing the input voltage. The power consumption is a nominal 500 watts. Primary circuit fusing is provided.

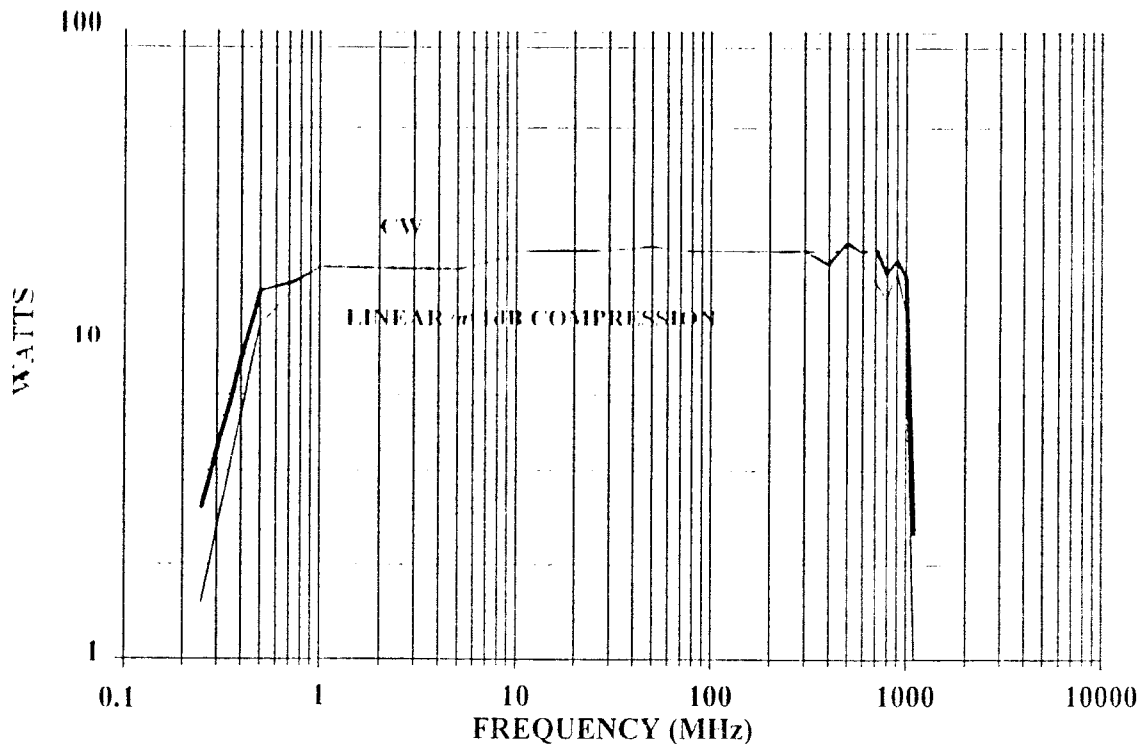
1.3 SPECIFICATIONS

Refer to the "Amplifier Research Data Sheet" on the following page for detailed specifications.

The Model 10W1000B is a solid state, self-contained, air-cooled, broadband amplifier designed for applications where instantaneous bandwidth and high gain are required. Push-pull circuitry is utilized in the high power stages to lower distortion and improve stability. The 10W1000B, when used with an RF sweep generator, will provide a minimum of 10 watts of swept power. Included is a front panel gain control which permits the operator to conveniently set the desired output level. The 10W1000B is protected from RF input overdrive by limiting diodes and an RF input leveling circuit which controls the RF input level to the RF amplifier first stage when the RF input level is increased above 0 dBm. The RF Amplifier stages are protected from over temperature by removing the DC voltage to them if an over temperature condition occurs due to cooling blockage or fan failure. There is a fault lamp on the rear panel to indicate an over temperature condition or power supply fault has occurred. The unit can be returned to operate when the fault condition has been cleared.

The 10W1000B 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.

10W1000B TYPICAL POWER OUTPUT



SPECIFICATIONS
Model 10W1000B

POWER OUTPUT, CW	
<i>Nominal</i>	<i>18 watts</i>
<i>Minimum</i>	<i>10 watts</i>
<i>Linear @ 1dB compression</i>	<i>10 watts minimum</i>
FLATNESS	± 1.0 dB typical ± 1.5 dB maximum
FREQUENCY RESPONSE	<i>500 kHz-1000 MHz instantaneously</i>
INPUT FOR RATED OUTPUT	<i>1.0 milliwatt maximum</i>
GAIN (at maximum setting)	<i>40 dB minimum</i>
GAIN ADJUSTMENT (Continuous Range)	<i>10 dB minimum</i>
INPUT IMPEDANCE	<i>50 ohms, VSWR 2.0:1 maximum</i>
OUTPUT IMPEDANCE	<i>50 ohms, nominal</i>
MISMATCH TOLERANCE *	<i>100% of rated power without foldback. Will operate without damage or oscillation with any magnitude and phase of source and load impedance.</i>
MODULATION CAPABILITY	<i>Will faithfully reproduce AM, FM, or pulse modulation appearing on the input signal</i>
HARMONIC DISTORTION	<i>Minus 20 dBc maximum at 10 watts</i>
THIRD ORDER INTERCEPT POINT	<i>50 dBm typical</i>
PRIMARY POWER (selected automatically)	<i>90-135/180-270 VAC 50/60 Hz, single phase 300 watts maximum</i>
CONNECTORS	<i>Type N female on front panel</i>
COOLING	<i>Forced air (self contained fans)</i>
WEIGHT	<i>16.0 kg (35 lb)</i>
SIZE (WxHxD)	<i>50.3 x 15.5 x 30.0 cm 19.8 x 6.1 x 11.8 in</i>

* See Application Note #27

SECTION II

OPERATING INSTRUCTIONS

2.1 GENERAL

Operation of the Model 10W1000B broadband amplifier is quite simple. The input signal, whether swept or fixed in frequency, is fed into 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. 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 10W1000B 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, WITHOUT DAMAGE, RF INPUT POWER UP TO TWENTY (20) TIMES ITS RATED INPUT OF 1mW. HOWEVER, SIGNAL LEVELS HIGHER THAN 20mW OR TRANSIENTS WITH HIGH PEAK VOLTAGES CAN DAMAGE THE AMPLIFIER. ALSO, ACCIDENTAL CONNECTION OF THE 10W1000B OUTPUT TO THE INPUT CAUSES OSCILLATIONS WHICH WILL PERMANENTLY DAMAGE THE INPUT CIRCUITRY.

NOTE:

ALTHOUGH DESIGNED FOR OVERDRIVE AND LOAD TOLERANCE DESCRIBED ABOVE, SUBJECTING THE AMPLIFIER TO THESE CONDITIONS SIMULTANEOUSLY CAN CAUSE FAILURE OF THE OUTPUT TRANSISTOR. REPEATED FAILURES OF THIS NATURE WILL NOT BE COVERED UNDER WARRANTY.

The 10W1000B Amplifier is protected from input overdrive by limiting diodes across the RF input and a automatic level control circuit which will limit the maximum RF level to the first gain stage (U1) of the RF Amplifier to approximately 0dBm. The 10W1000B RF power transistors are protected from over temperature by sensing the heat sink temperature near the RF output transistors. In the event of a cooling fan failure or an air flow blockage the DC voltage will be removed from the RF stages when the heat sink temperature reaches approximately 70°C. Operation will resume when the heat sink temperature drops below 70°C. The Fault LED on the back panel will light during an over temperature condition. The Fault LED will also light if the output voltage from the DC regulator is low due to a failure or an over current condition elsewhere in the amplifier.

2.2 AMPLIFIER OPERATION

Figure 2-1 shows the Model 10W1000B Amplifier in pictorial form.

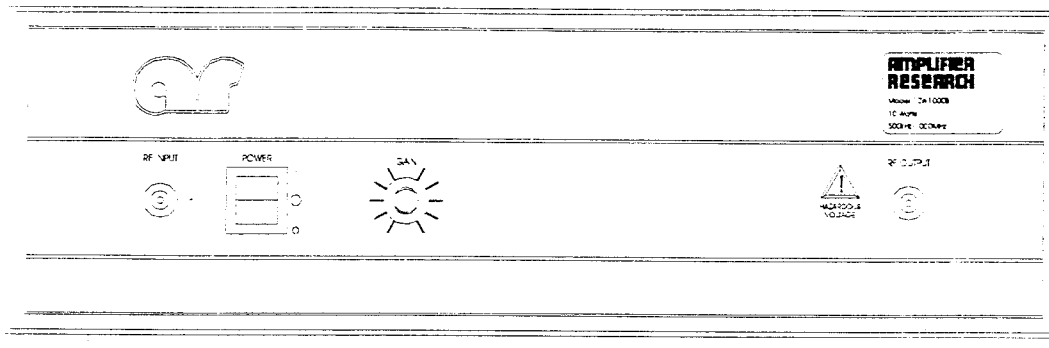


FIGURE 2.1
AMPLIFIER OPERATION

Turn On Sequence:

1. Connect input signal to "INPUT" connector. The input signal level should be 0dBm maximum
2. Connect load to "OUTPUT" connector.
3. Activate power switch to "1" position. A green indicator light mounted on the Front Panel will light when power is applied.

SECTION III

THEORY OF OPERATION

3.1 INTRODUCTION

The Model 10W1000B Amplifier consists essentially of four (+) cascaded stages of broadband transistor amplifiers and 2 push-pull stages which yields a total power gain greater than 40dB minimum. Input and output matching networks are utilized to provide optimum power transfer of the signal to and from the amplifier with a 50 ohm source and load impedance. Intra-stage feedback is used to flatten the frequency response and bias stabilization of the individual stages is provided.

The self-contained power supply consists of a switching power supply with universal input voltage capability, followed by a linear regulator with current limited output

3.2 AMPLIFIER OPERATION

The RF Amplifier consists of the Driver Stages Schematic Diagram Number 1006553 and the Final Amplifier Schematic Number 1006556.

The RF input signal is fed to the first gain stage (U1) thru the input attenuator made up of diodes CR1, CR2, and CR3.. The output of U1 is fed to a detector diode (CR6) and the second gain stage (U2). Detector diode (CR6) senses the output level of U1, this DC level is fed to U3A which amplifies the signal. The output of U3A is fed to U3B which is a voltage comparator. The voltage comparator output is fed to the input attenuator thru the manual gain control, located on the Front Panel. When the input level to U1 reaches approximately 0dBm the current thru the series attenuator diodes (CR2 & CR3) decreases, maintaining that level at approximately 0dBm. This protects the amplifier from damage which could be caused by input overdrive.

Integrated Circuit U2 further amplifies the RF signal from U1 and drives RF Stage Q4 and Q3 which amplify the signal. Transistors Q1 and Q2 are used to control the collectors current of Q4 and Q3 respectively. The output of Q3 is fed to a gain equalizer which in turn drives the first push-pull stage

The Final RF stage consists of push-pull stages Q3 and Q4. T4 is a phase splitter which provides signals of the correct phase to the input of Q3. T1 is a matching/coupling transformer between the output of Q3 and the input of Q4. T2 is used to match the output of Q4 to 50 ohms. Transistors Q1, Q2, Q5 and Q6 sense and control the current thru the collectors of Q3 and Q4.

3.3 POWER SUPPLY SECTION

The power supply consists of a switching power supply PS1 and a linear voltage regulator with circuit limiting. The AC input is fed through filter FL1 to the power supply switch S1. FL1 also contains the line fuses.

Power switch S1 feeds the switching power supply PS1. PS1 features universal input line voltage capability. Nothing has to be switched or changed when changing from one line voltage to another.

The output of PS1 is fed to the 20 volt regulator thru the 1.2 Ω (R59) Resistor connected from the emitter to the base of the current boost transistor (Q6 located on the RF Heat Sink). The normal load on the regulator is approximately 5.5 amps @ 20VAC. The DC regulator U1 in the power supply conducts approximately .5 amps and the balance of the current (approximately 5 amps) is supplied by the Boost Transistor. The thermal switch located on the heat sink is in series with the Regulator and will turn off the Power Supply above 70°C. Potentiometer R4 is used to adjust the output voltage of the Regulator and R1 is used to set the current limit to approximately 6 amps.

SECTION IV

MAINTENANCE

4.1 GENERAL MAINTENANCE INFORMATION

The Model 10W1000B 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 changes may ruin the amplifier due to excessive dissipation or transients.

Components with Amplifier Research 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:

Amplifier Research Corporation
160 School House Road
Souderton, Pa. 18964

4.2 DISASSEMBLY PROCEDURE

CAUTION:

EXTREME CAUTION SHOULD BE EXERCISED WHEN TROUBLESHOOTING THIS UNIT. PARTICULARLY WHEN MEASURING VOLTAGES IN THE POWER SUPPLY SECTION OF THE UNIT AS HAZARDOUS VOLTAGES DO EXIST IN THE UNIT WHICH COULD CAUSE SERIOUS INJURY TO ANY PERSONNEL PERFORMING THE MEASUREMENTS.

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

4.3 TROUBLESHOOTING

A lit fault LED on the rear panel indicates either an over temperature condition or a low output voltage from the regulator caused by regulator problem or an overload on the output of the regulator. Check the fan for proper operation or for a blockage of the air flow.

The source of low gain or no gain problems can often be determined from DC voltage checks. Check the voltage to the amplifier it should be 20VDC. If the output voltage from the DC regulator is normal compare the voltages on the various stages to the voltages given on the schematics. The currents thru the various stages can be determined by measuring the voltage drops across the low value resistors connected between the 20VDC lines and the collectors. The gain control should be at maximum gain and the input signal less than 0dBm when checking voltages on the amplifier.

Troubleshooting can also be done using signal tracing techniques, using a signal generator and an oscilloscope.

4.4 SERVICING ETCHED CIRCUIT BOARDS

When soldering leads, use a hot forty 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.