

THE *General Radio* EXPERIMENTER

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ELECTRICAL MEASUREMENTS AND THEIR INDUSTRIAL APPLICATIONS

A CONVENIENT AMPLIFIER AND NULL DETECTOR

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● MOST BRIDGE MEASUREMENTS and various other laboratory procedures require the use of an amplifier to obtain sufficient sensitivity. The TYPE 814-A Amplifier has for years been a popular item in the General Radio line and has been widely used with audio-frequency bridges.

Recent developments in tubes and circuits have prompted the design of a new model, retaining all the advantages of the old, but with several distinct improvements.

The TYPE 1231-A Amplifier and Null Detector consists of a high-gain resistance-coupled amplifier, using the new miniature-type tubes, mounted on a shock-absorbing suspension.

FIGURE 1. Panel view of the TYPE 1231-A Amplifier and Null Detector.



IET LABS, INC in the GenRad tradition

534 Main Street, Westbury, NY 11590

www.ietlabs.com

TEL: (516) 334-5959 • (800) 899-8438 • FAX: (516) 334-5988

middle of the audio-frequency range is approximately 90 db, and the instrument is usable over the range from 20 cycles to 100 kc.

A most important feature of the new instrument is the built-in null-indicator circuit, which is essentially a semi-logarithmic vacuum-tube voltmeter, utilizing a single multi-section tube as an a-c amplifier, diode voltmeter, and d-c amplifier, thus allowing a high degree of sensitivity. The voltage developed by the diode is applied as a gain-controlling grid bias to the preceding a-c amplifier section of the tube producing the semi-logarithmic response. No additional indicating devices are necessary, therefore, to use the new instrument as a bridge null indicator, although a pair of phones can be plugged into the output if desired.

The amplifier and null detector may also be made selective with regard to frequency by plugging in the TYPE 814-P Tuned Circuits. The TYPE 814-P2 operates at either 400 or 1000 cycles, and the TYPE 814-P3 at 60 cycles. Other types of tuned circuits or filters can also be used with the instrument.

The new amplifier and null detector is unusually compact and convenient to operate. Normally, the instrument is enclosed in a small walnut case, matching other General Radio equipment, and

is operated from internal batteries which will have a long life because of the low current drain. It is also possible where desirable to operate the instrument from the 60-cycle lines by use of the TYPE 1261-A Power Supply unit. This is the same power supply that is used for operating the General Radio Sound-Level Meters and other battery instruments.

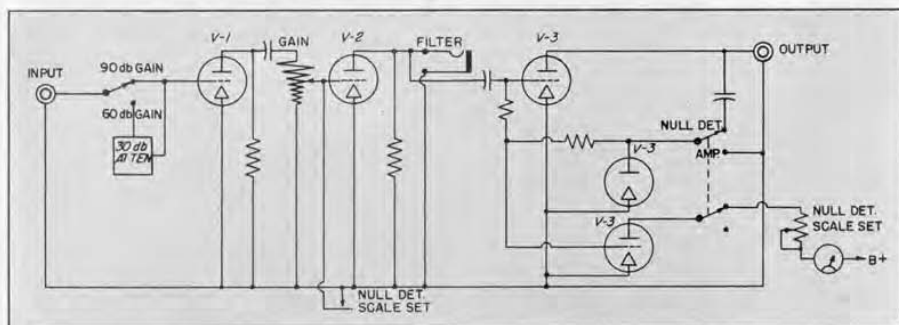
For relay-rack mounting, a panel extension can be provided which mounts the two standard TYPE 814-P Filters also, thus providing a complete unit assembly.

The main gain control of the amplifier is a high-grade, wire-wound unit, which will last indefinitely with normal use. Push buttons are provided to reduce the input voltage and gain for high-level signals and for selecting operation as a straight amplifier or as a null detector with the semi-logarithmic features. Other push buttons allow checking of the battery voltage and exact setting of the null point for critical bridge measurements.

The input and output connections will take either General Radio TYPE 774-E Coaxial Connectors or the usual TYPE 274-M Plugs.

Figure 3 shows the frequency characteristics of the amplifier and complete specifications are appended to this article. The instrument was purposely designed for maximum gain in the

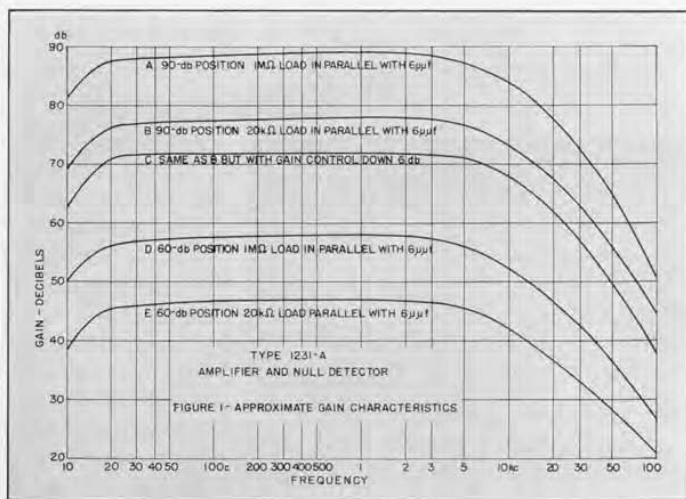
FIGURE 2. Schematic circuit diagram of the TYPE 1231-A Amplifier and Null Detector.



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FIGURE 3. Approximate gain characteristics as a function of frequency.



important audio-frequency range, but, for operation as a bridge null detector, it will provide substantial gain well beyond this range.

It is expected that the TYPE 1231-A

Amplifier and Null Detector, because of its small size, high sensitivity, and general convenience, will meet a real need in most communications laboratories.

—H. H. SCOTT, W. F. BYERS

SPECIFICATIONS

Input Impedance: 1 megohm in parallel with 50 micromicrofarads.

Maximum Gain: 90 db with 1 megohm load — down 6 db at 12 and 11,000 cycles — 24 db down at 50 kc.

Null Detector Sensitivity: Less than 100 microvolts input is required to give 10% indication on the meter at 1 kc.

Output Impedance: Approximately 50,000 ohms.

Output Voltage: 5 volts into 20,000 ohms; 20 volts into 1 megohm.

Battery Life: Between 200 and 250 hours at 8 hours per day.

Frequency Response: See curves.

Noise Level: Less than 0.5 volt at full gain with battery operation; less than 1.0 volt at full gain with a-c power supply.

Tubes: The instrument requires two TYPE

11A and one TYPE 1D8GT Tubes which are supplied in the instrument.

Power Supply: Burgess TYPE 6TA60 (Signal Corps BA48) Battery Pack is supplied in place in the instrument. When a-c supply is desired, TYPE 1261-A Power Supply can be used.

Accessories Available: TYPE 814-P2 (400 and 1000 cycles) and TYPE 814-P3 (60 cycles) Tuned Circuits are available for providing selectivity. These were described in Catalog K, first (page 112) and second (page 90) editions. For facilitating connections to the input and output, two TYPE 274-M Plugs are supplied. TYPE 274-NC or TYPE 274-NE Shielded Connectors may be used. Where complete shielding is required, TYPE 774 Coaxial Connectors are recommended.

Dimensions: 12¼ x 8 x 10¾ inches, overall.

Net Weight: 23¼ pounds, including batteries.

Type	Code Word	Price
1231-A	VALID	\$160.00

DECIBELS

We have received through the courtesy of the author, Mr. V. V. Rao of Madras, India, a copy of his recent book, entitled "The Decibel Notation," a comprehensive treatise covering the history, details, and application of the decibel concept. This book is a welcome addition

to the communications engineer's library, since it embraces, in convenient form, a considerable fund of information on a subject that is usually treated only briefly in engineering texts. Detailed reviews have appeared in many of the electronic periodicals.





TYPE 1261-A POWER SUPPLY

An a-c operated power supply for instruments which use the Signal Corps BA48 Battery Block (Burgess Type 6TA60)



FIGURE 1. View of the TYPE 1261-A Power Supply.

● **BATTERY OPERATION** of a measuring instrument is necessary if the instrument is to be truly portable and easily used in any location. Many instruments designed primarily for portable use can be and are used in production test set-ups where they are in continuous use. A-c operation for such instruments would eliminate the need for frequent battery replacement, but would limit portability.

The TYPE 759-B Sound-Level Meter is a good example of a portable battery-operated instrument which is often used in production testing. Early in 1942* the TYPE 759-P50 power supply was brought out as an a-c operated power source which was interchangeable both electrically and mechanically with the battery block in the sound-level meter. Thus, the sound-level meter became readily adaptable for either production work or for field use. This power supply could also be used in the older TYPE 759-A Sound-Level Meter.

Other instruments intended for portable use, and hence battery operated,

*See "An A-C Operated Power Supply for the Sound-Level Meter," by H. H. Scott, *General Radio Experimenter*, January 1942, Vol. XVI, No. 8.

have been developed and manufactured since the TYPE 759-P50 Power Supply became available. A number of these instruments use the same battery block as the TYPE 759-B Sound-Level Meter, but differences in plate or filament supply loads and other small details prevented the use of the TYPE 759-P50 Power Supply in these later instruments. For all these instruments, a new power supply, the TYPE 1261-A, has been developed which incorporates the changes required to make a more complete replacement for the BA-48 battery block.

This new supply, by means of suitable selector plugs, can be used in the following General Radio instruments: TYPE 759-A and TYPE 759-B Sound-Level Meters, TYPE 720-A Heterodyne-Frequency Meter, and TYPE 1231-A Audio Amplifier and Null Detector. Octal selector plugs inserted into a socket on the top of the power supply are used to select either a 1.5- or 3.0-volt filament supply and, in cases where the current drain of the instrument to be supplied is less than required for normal operation of the power supply, the plug is used to add load resistors which insure normal operation.

The TYPE 1261-A Power Supply is not limited to use in General Radio instruments. An unwired selector plug, which can be wired by the customer, is available so that the power supply can be used in any battery operated instrument which has plate and filament requirements within its scope. Intended as a general purpose replacement for the BA48 battery block, the power supply is a light and compact unit that fits in the battery compartment, and has a four-





terminal output socket which fits the plug on the battery cable of instruments using the BA48 battery.

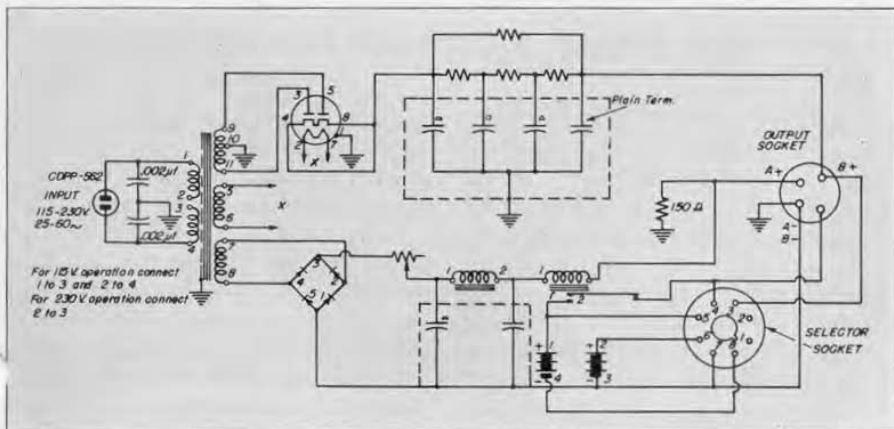
The filament supply, which consists of a selenium rectifier with an L-C filter, has two small flashlight cells connected across the output. These cells are connected in series for 3.0-volt output, and in parallel for 1.5-volt output by means of the selector plug. The cells act as a regulator for the filament supply and also provide an extremely low a-c output impedance. Hum and low-frequency changes in output caused by a-c power line fluctuations are reduced to the point where satisfactory operation of the high-gain amplifiers used in the sound-level meters and in the TYPE 1231-A Audio Amplifier and Null Detector is obtained.

A small push button switch, located on top of the power supply, makes it possible to disconnect the cells at any time and to set the output voltage equal to the cell voltage. Under operating conditions, normal line voltage variations cause the cells either to charge or to discharge slightly, and when the instrument is turned off a small relay

opens the circuit so that the cells will not be damaged. These flashlight batteries cost only ten cents apiece and, as used, their life is extremely long. A conventional vacuum-tube rectifier is used to obtain the d-c output voltage for the plate supply. A four section R-C filter attenuates the hum or a-c ripple voltage to an exceptionally low value. The plate supply is not regulated.

The TYPE 1261-A Power Supply replaces the older TYPE 759-P50 for use in the TYPE 759-A and TYPE 759-B Sound-Level Meters, but is not directly interchangeable with it. A modification incorporated in the new power supply to protect the small flashlight cells, used in the filament circuit, requires a simple wiring change in the battery cable of older instruments. This change does not affect battery operation of the instrument and has been made standard wiring for current and future lots of instruments. Complete instructions are furnished with the power supply so that the customer can make the required change in older instruments, and once the change is made the TYPE 1261-A Power Supply is directly interchangeable

FIGURE 2. Schematic circuit diagram of the power supply.





with the BA48 battery block. Similar changes must be made in existing models of the TYPE 720-A Heterodyne Fre-

quency Meter. For instruments shipped in the future, no changes are necessary.

— E. E. GROSS

SPECIFICATIONS

OUTPUT:

Filament Supply: 1.5 volts or 3.0 volts up to 350 ma. Normal current through filter choke to operate relay = 300 ma. Bleeder resistor in selector plug needed for lower current requirements.

Plate Supply:

133 volts open circuit
107 volts at 3 ma
89 volts at 5 ma
72 volts at 7 ma

{ For 115-volt 60-cycle power line with normal filament current of 300 ma.

Maximum output current = 8 ma

Selector Plugs: One of the following is furnished. Please specify type wanted.

Selector Plug 1261-P1— Provides proper voltages for TYPE 759-A Sound-Level Meter. Battery Plate of Sound-Level Meter must be replaced by four-terminal plug to fit output socket of TYPE 1261-A Power Supply. Full sensitivity of instrument cannot be used. Attenuator settings below 50 db on B and C weighting networks and below 40 db on the A weighting network are not recommended.

Selector Plug 1261-P2— Provides proper voltages for TYPE 759-B Sound-Level Meter.

Selector Plug 1261-P3— Provides proper voltages for TYPE 720-A Heterodyne-Frequency Meter.

Selector Plug 1261-P4— Provides proper voltages for TYPE 1231-A Audio Amplifier and Null Detector. On Null Detector use, the plate supply regulation causes the meter to overshoot somewhat upon rapidly approaching a null.

Selector Plug 1261-P5— To be wired by customer to meet his own requirements.

Hum and Noise Level— Sufficiently low, when operated from 60-cycle supply line, to assure satisfactory operation of instruments listed under conditions specified.

Input Voltage: 105–125, or 210–250, volts, 40 to 60 cycles.

Input Power: Less than 10 watts at 115 volts, 60 cycles.

Tube: One TYPE 6H6 is supplied.

Batteries: Two Burgess No. 2 uni-cells which are floated across the output of the Filament Supply are furnished.

Terminals: A four-terminal output socket fits the plug on the battery cable of the TYPE 759-B, TYPE 720-A, and TYPE 1231-A.

Dimensions: (Length) 10 x (width) 2¼ x (depth) 5 inches.

Net Weight: 7¼ pounds.

Type		Code Word	Price
1261-A	Power Supply.....	NUTTY	\$55.00

When ordering, specify type of selector plug desired. See list above in specifications. Also mention type number and serial number of instrument with which it is to be used.

TYPE 1260-A VARIAC RECTIFIER

● DURING THE PAST FEW YEARS selenium rectifiers have come into wide use as a means for obtaining d-c output voltage from a-c supply lines. They are extremely simple, rugged, compact, and efficient, and they have practically unlimited life. Being conservatively rated, they will carry heavy overloads without damage. In most of its applications the selenium rectifier is chosen to do a particular job, wired permanently

into a circuit, and then forgotten. However, there are many cases, especially in standardizing laboratories and in development work, when a continuously variable source of d-c voltage is very useful. Storage batteries are not too convenient and usually require charging just when they are needed. Furthermore, the output voltage of a storage battery is not easily adjustable. The development engineer often needs varied d-c voltage



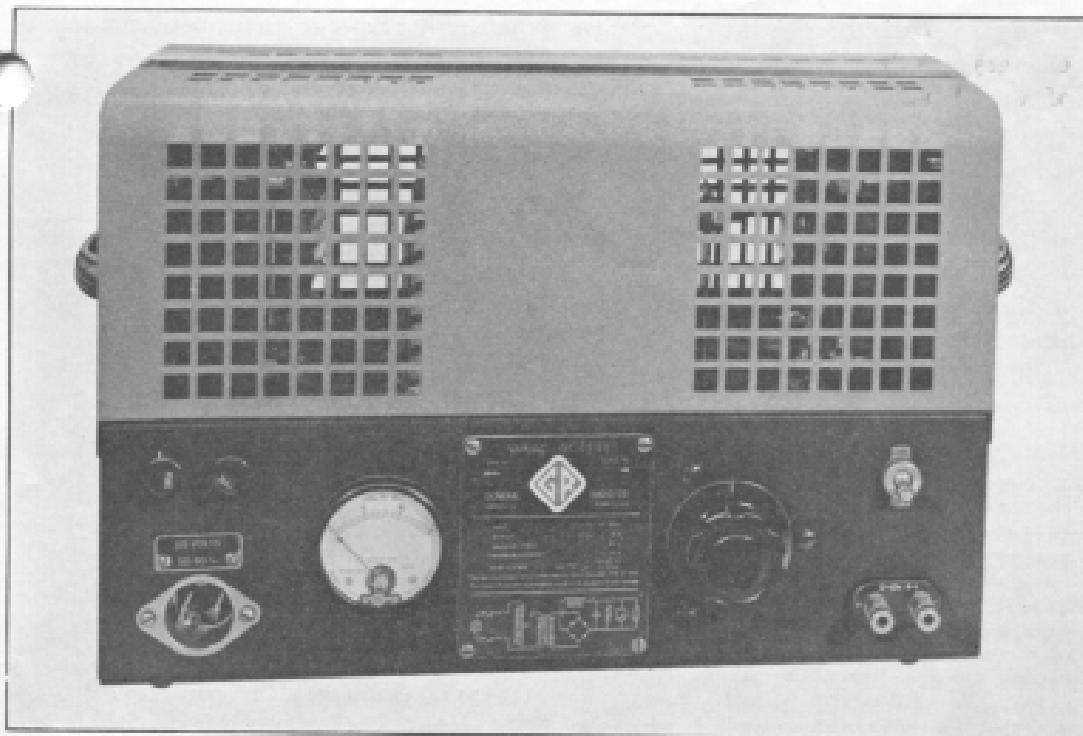


FIGURE 1. View of the TYPE 1260-A Variac Rectifier.

supplies. His requirements may be 1.0 volt at 4.5 amperes filament supply for a power oscillator today, 10.0 volts at 20 ma for a bridge supply tomorrow, 6.0 volts at 5 amperes to test a small d-c constant-speed motor the next day, and so on for a large number of relatively short-time applications, no two of which have the same requirements.

It was to meet these needs that the TYPE 1260-A Variac-Rectifier was developed. This power supply is a combination of a TYPE 200-B Variac, a step-down transformer, a selenium rectifier, a filter, and an output voltmeter arranged electrically as shown in the nameplate wiring diagram (see Figure 1).

By supplying continuously adjustable primary voltage between 0 and 115 volts to the step-down transformer, the TYPE 200-B Variac provides extremely smooth

control of the d-c output voltage from 0-15 volts. A maximum power of 40 watts may be drawn from the power supply between 7 and 10 volts, but the maximum current of 6 amperes should not be exceeded at any voltage. There are many applications where the unfiltered d-c output from the rectifier would be adequate; however, the possible uses of the power supply are increased many fold if the d-c output is filtered so that the a-c ripple is a small part of the output. The output filter of the TYPE 1260-A Variac-Rectifier reduces the ripple or hum voltage to a value low enough for most applications. The d-c internal output impedance of the power supply is approximately 0.6 ohm. This means that there will be an increase in output voltage of about 2.4 volts if a load drawing a current of 4 amperes is removed.



The TYPE 1260-A Variac-Rectifier is a compact and convenient power unit. It is mounted in a sturdily constructed steel case; it is light in weight and easily portable. The various components have been carefully selected to obtain maximum output ratings and yet insure long life and trouble-free operation. Several of these units, built a few years ago, have been used in many ways in our standardizing laboratory and in our

engineering laboratories as replacements for storage batteries. They have been operated for long periods at maximum ratings with no appreciable drift in output voltage. These power supplies were designed to be convenient, useful sources of low-voltage d-c power, and our experience with them over the past few years has proved that the design objectives were well met.

—E. E. Gross

SPECIFICATIONS

Output Range: 4 amperes at 0-10 volts, dc; maximum power, 40 watts; maximum current, 6 amperes; no load voltage, over 15 volts.

Meters: The output voltage is indicated by a voltmeter mounted on the cabinet. A panel knob controls the output voltage.

Power Supply: The unit will operate from a 105- to 125-volt, 50- to 60-cycle line. A suitable power cord is supplied with the instrument.

Power Input: At the full 40-watt load, the power input from the a-c line is about 75 watts.

Hum Voltage: At 10 volts, 4 amperes, the

hum voltage is less than 100 millivolts or 1% of the output voltage when the instrument is operated on a 60-cycle line. At 2 volts, 6 amperes, the hum voltage is less than 60 millivolts or 3% of the output voltage when the instrument is operated on a 50-cycle line. For lower load currents, the hum decreases.

Accessories Supplied: Spare fuses.

Mounting: The instrument is mounted in a metal cabinet suitable for table use.

Dimensions: (Length) 16 x (depth) 7 x (height) 9½ inches, overall.

Net Weight: 26¾ lbs.

Type	Code Word	Price
1260-A Variac-Rectifier.....	VALET	\$90.00

GENERAL RADIO COMPANY

275 MASSACHUSETTS AVENUE

CAMBRIDGE 39

MASSACHUSETTS

TELEPHONE: TROWBRIDGE 4400

BRANCH ENGINEERING OFFICES

NEW YORK 6, NEW YORK
90 WEST STREET
TEL.—WORTH 2-5837



CHICAGO 5, ILLINOIS
920 SOUTH MICHIGAN AVENUE
TEL.—WABASH 3820

LOS ANGELES 38, CALIFORNIA
1000 NORTH SEWARD STREET
TEL.—HOLLYWOOD 6321



IET LABS, INC in the GenRad tradition

534 Main Street, Westbury, NY 11590

www.ietlabs.com

TEL: (516) 334-9959 • (800) 899-8438 • FAX: (516) 334-9988