

OPERATING INSTRUCTIONS



HARD

TYPE 1212-A

UNIT NULL DETECTOR

GENERAL RADIO COMPANY

H

OPERATING INSTRUCTIONS

TYPE 1212-A

UNIT NULL DETECTOR

Form 1212-0100-H
January, 1964

GENERAL RADIO COMPANY
WEST CONCORD, MASSACHUSETTS, USA

SPECIFICATIONS

TYPE 1212-A UNIT NULL DETECTOR

Sensitivity: Less than 40 μv input at 1 kc required to deflect meter 1% of full scale.

Voltage Response: See Figure 3.

Power Supply: 325 v dc at 40 ma; 6.3 v ac at 0.9 amp
Type 1203 or 1201 Unit Power Supply recommended.

Frequency Response: See Figure 4.

Hum and Noise Level: Hum, 20 μvolts ; broad-band noise, 30 μvolts .

Accessories Supplied: Type 874 Coaxial Cable Connector, multipoint socket for power supplies other than Unit Power Supplies, and locking strips to attach Unit Power Supply to Null Detector.

Accessories Available: Power supplies (Page 7), Relay-Rack Adaptor Set, Part No. 0480-9986. For special accessories, see below.

Dimensions: Width 10-3/4, height 5-3/4, depth 6-1/4 inches (275 by 150 by 160 mm), over-all.

Weight: 4-3/4 pounds (2.2 kg).

General Radio EXPERIMENTER reference: Vol 27, No. 9, February, 1953.

U.S. Patent Nos 2,548,457 & D187,740

SPECIAL ACCESSORIES AVAILABLE BUT NOT SUPPLIED

TYPE 1212-P1 HIGH-PASS FILTER

Attenuation Characteristics: See Figure 6.

Nominal Load Impedance: One megohm.

Input Voltage Limit: 150 volts maximum.

Terminals: Type 874 at each end.

Dimensions: Diameter 7/8 in., length 4-3/8 in. (22 by 110 mm).

Weight: 3 oz. (85 grams).

General Radio EXPERIMENTER reference: Vol 27, No. 9, February, 1953.

U. S. Patent No. 2,548,457

TYPE 1212-P2 1-MC FILTER

Insertion Gain: When used with Type 716-CS1 Capacitance Bridge and Type 1212-A Unit Null Detector, the insertion gain at 1 Mc varies from 22 db in measurement of 100- $\mu\mu\text{f}$ capacitors to 32 db with 1000 $\mu\mu\text{f}$.

Sensitivity: With Type 1212-A, typically 4 μv (open-circuit voltage behind 50 ohms) for 1% meter deflection.

Second-Harmonic Rejection: At least 39 db.

Maximum Input Voltage: 200 volts.

Terminals: Type 874 at each end.

Dimensions: Diameter 2 in., length 5 in. (51 by 130 mm).

Weight: 9 oz (255 grams).

General Radio EXPERIMENTER reference: Vol 30, No. 8, January, 1956.

U.S. Patent No. 2,548,457

TYPE 1212-P3 RF MIXER

Frequency Range: 3 Mc to 60 Mc. (Can be used up to 150 Mc if care is taken in the selection and identification of local-oscillator frequency.)

Sensitivity: (Open-circuit voltage from 50-ohm source, equivalent to noise level) 10 μ v from 3 Mc to 5 Mc, 6 μ v to 60 Mc (typical).

I-F Output Frequency: 1 Mc.

Bandwidth: 25 kc with TYPE 1212-A Unit Null Detector.

Input Impedance: 200 ohms (approximately).

Output Impedance: 50 kilohms (approximately).

Terminals: TYPE 874 Coaxial Connector

Dimensions: Diameter 2 $\frac{1}{4}$, length 6 $\frac{3}{4}$ inches (58 by 175 mm).

Net Weight: 1 pound (0.5 kg).

General Radio EXPERIMENTER reference: Vol. 37, No. 12, December, 1963.

U.S. Patent No. 2,548,457

TABLE OF CONTENTS

Section 1 INTRODUCTION	1
1.1 Purpose	1
1.2 Description	1
1.3 Accessories	2
Section 2 OPERATING PROCEDURE	3
2.1 Power Supply.	3
2.2 Operation	3
2.3 Use With Filters	4
2.4 Use With RF Mixer.	5
Section 3 SERVICE AND MAINTENANCE	6
3.1 General	6
3.2 Crystal-Diode Replacement	6
3.3 Tube Test Voltages	6
PARTS LIST	10



Figure 1. Type 1212-A Unit Null Detector with Type 1203-B Unit Power Supply.

Section 1

INTRODUCTION

1.1 PURPOSE. The Type 1212-A Unit Null Detector (Figure 1) is a logarithmic amplifier used primarily as a balance indicator for ac bridge measurements from 50 cps to 5 megacycles. With suitable input filters, the Unit Null Detector can be used with the Type 716-C Capacitance Bridge, Type 1661-A Vacuum-Tube Bridge, Type 916-AL R-F Bridge, Type 716-CS1 Capacitance Bridge, and up to 5 Mc with the Type 1606-A R-F Bridge. Frequency coverage can be extended to 60 Mc and sensitivity substantially improved by the use of the Type 1212-P3 RF Mixer ahead of the null detector. In addition, the mixer permits use of the Type 1212-A with the Type 1602-B Admittance Meter and Type 1607-A Transfer Function and Imittance Bridge.

1.2 DESCRIPTION.

1.2.1 GENERAL. The Unit Null Detector is a three-stage, wide-band, pentode amplifier with a maximum gain of about 70 db. As shown in the elementary schematic diagram (Figure 2), a pair of germanium crystal diodes are connected back-to-back in the output of each stage to obtain a quasilogarithmic input-output characteristic. When the voltage on a pair of diodes is low the impedance is high and the gain of the associated stage is at maximum. Three of these stages are cascaded to produce the quasilogarithmic response over a wide

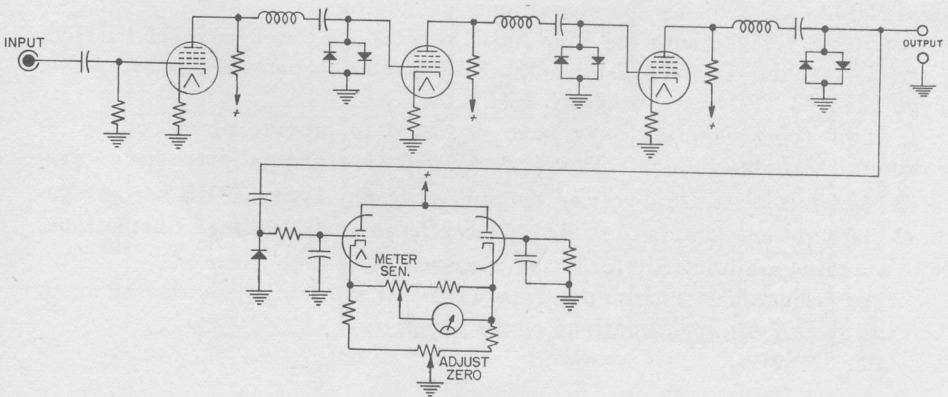


Figure 2. Elementary Schematic Diagram.

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range of input voltages. At fairly low input voltages the third-stage diodes begin to reduce the gain of the amplifier. As the input voltage is increased, the second-stage and first-stage diodes also begin to reduce over-all gain. When the input voltage is increased beyond a few volts, the first stage draws grid current. This puts negative bias on the first tube, further reducing the over-all gain.

Because of the crystal diodes, the second and third stages can never draw grid current.

The output is usually distorted because of the clipping action of the crystal diodes. At low signal levels the distortion is negligible, but at high signal levels the output is approximately a square wave.

Direct current is used on the filament on the first 6AK5 to reduce internal pickup of power-line frequencies. Regulated plate and screen voltages throughout reduce effects of line-voltage variation.

1.2.2 CONTROLS. The front-panel controls are the ADJUST ZERO control, a potentiometer which establishes electrical zero on the meter, the METER SENSITIVITY screw-driver adjustment, used to establish a full-scale reference with maximum voltage applied, and the mechanical zero adjustment for the meter.

1.2.3 CONNECTORS. On the front panel of the Unit Null Detector is a Type 874 coaxial locking-type input connector. A jack-top binding post directly below the coaxial connector permits input connection by means of either the Type 874 Coaxial Connector supplied or a Type 274 Double Plug. At the rear of the instrument, a pair of Type 274 Jacks permit connection to headphones for aural null indication. The power input connector is on the left side of the instrument, and the Null Detector and companion Unit Power Supply can be attached to each other directly, without the need of intermediate cable.

1.3 ACCESSORIES. Supplied with the Type 1212-A Unit Null Detector are a multipoint connector matching the power input connector and a Type 874 Coaxial Cable Connector for the signal input connection.

Available for use with the Unit Null Detector are the Type 1212-P1 High-Pass Filter, the Type 1212-P2 1-Mc Filter (refer to paragraph 2.3) and the Type 1212-P3 RF Mixer (paragraph 2.4).

Two fixed supplies have been designed to provide plate and heater power for Unit instruments. The Type 1203-B is a general-purpose, unregulated, 300-volt dc and 6.3-volt ac supply, while the Type 1201-B has a regulated plate voltage supply to minimize the effects of line-voltage fluctuations. Both supplies are primarily for bench use but can be rack mounted.

An adjustable supply, the Type 1205-B if available, can also be used. Refer to page 7 for specifications on all supplies.

TYPE 1212-A UNIT NULL DETECTOR

Section 2 OPERATING PROCEDURE

2.1 POWER SUPPLY. The Unit Null Detector may be firmly attached to a Unit Power Supply by means of two locking strips provided. These strips fit over the top and bottom edges of the cabinets, sliding in place from the rear. The Unit Null Detector and Unit Power Supply are equipped with matching power connectors that eliminate the need for an interconnecting cable.

Of course, any other power supply capable of furnishing 325 volts dc at 40 ma and 6.3 volts ac at 0.9 ampere may be used with the Unit Null Detector. A multipoint connector is supplied for connection to the Unit Null Detector.

2.2 OPERATION. Turn the power supply on and allow a few minutes warmup time. Then short-circuit the null detector input at the front panel and zero the meter using the ADJUST ZERO adjust. The instrument is now ready for use.

The meter has an approximately logarithmic response to input voltage up to 100 volts, as shown in Figure 3. Frequency response in decibels is given in Figure 4.

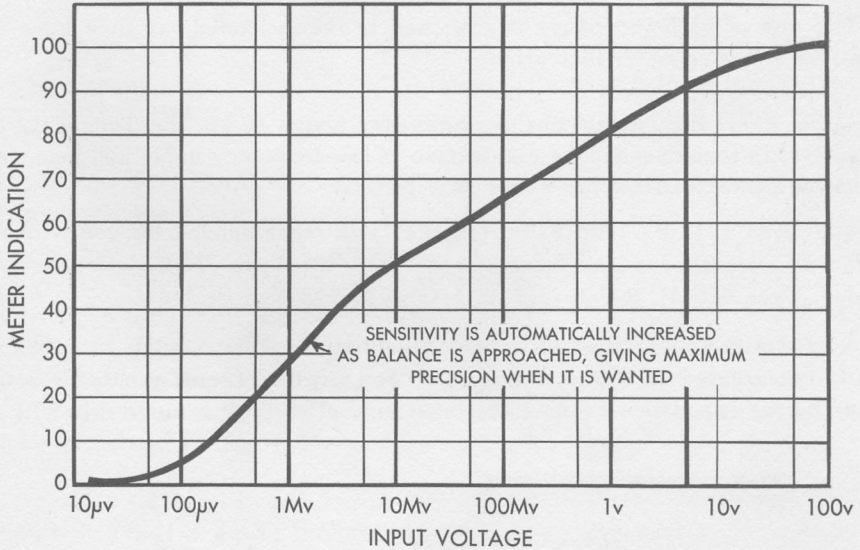


Figure 3. Typical Voltage-Response Curve.

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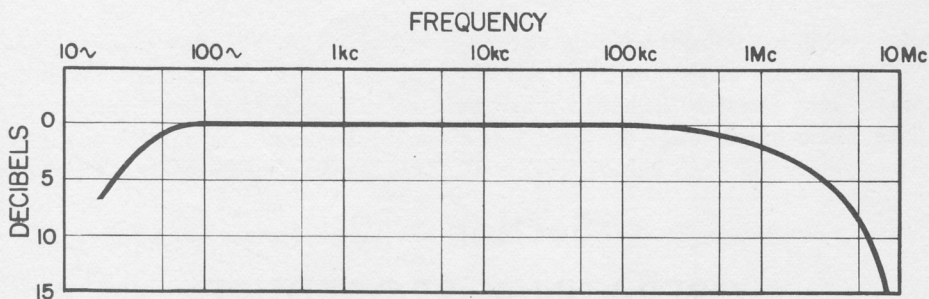


Figure 4. Typical Frequency-Response Curve.

The METER SENSITIVITY screw-driver adjustment has a small effect on the maximum sensitivity of the null detector and a very large effect on the voltage required to drive the meter offscale. Adjust this control so that the meter reads full-scale (or as far upscale as possible) with the maximum voltage to be used applied to the input of the null detector. This provides maximum sensitivity at null without running the meter offscale when not at null.

An aural null indication is often preferable to a visual indication, especially when the signal being detected is very noisy, as the ear can discriminate against noise much better than can a meter. The aural indication is also about 20 db more sensitive, and should be used for maximum sensitivity at audio frequencies. The headphones are connected through the Type 274 Jacks at the rear of the instrument. The headphones also make it easy to identify residual signals, especially when they are caused by hum picked up by the device under test.

The use of high-impedance headphones is recommended, as they have the smallest effect on meter indication.

2.3 USE WITH FILTERS. For measurements above 10 kc, the Type 1212-P1 (Figure 5) is recommended for elimination of low-frequency noise and hum. Attenuation characteristics are shown in Figure 6.

The Type 1212-P2 1-Mc Filter (Figure 7) is recommended for use with the Unit Null Detector for 1-Mc measurements with the Type 716-CS1 Capacitance Bridge, Type 916-AL R-F Bridge, and Type 1606-A R-F Bridge.

A general-purpose filter circuit for elimination of harmonics, etc, can be easily constructed as shown in Figure 8. The tap on the coil should be determined by the impedance seen on the input side of the filter, since this will af-

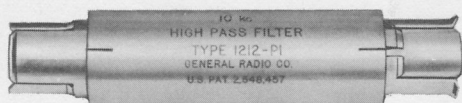


Figure 5.
Type 1212-P1
High-Pass Filter.

TYPE 1212-A UNIT NULL DETECTOR

fect both insertion gain and Q of the filter. The variable capacitor allows tuning over a range of frequencies. The entire filter should be shielded in a Type 874-X Insertion Unit or a Type 1607-P601 Component Mount. Both have Type 874 connectors.

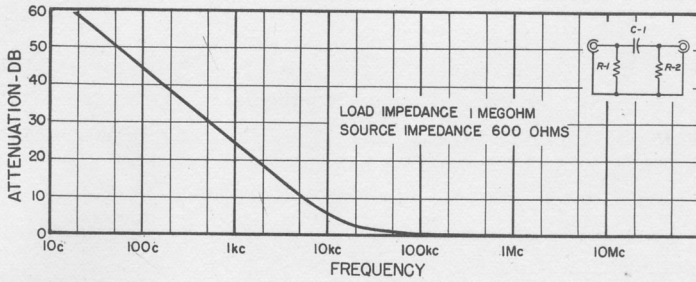


Figure 6.
Attenuation Characteristics of Type 1212-P1 High-Pass Filter.

Figure 7.
Type 1212-P2 1-Mc Filter.

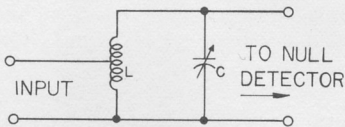


Figure 8.
General-Purpose Filter Circuit.

2.4 USE WITH RF MIXER. Complete operating instructions are supplied with the mixer (Figure 9).

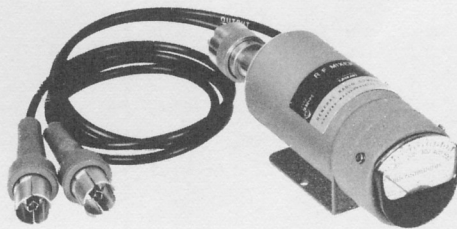


Figure 9. Type 1212-P3 RF Mixer.

Section 3

SERVICE AND MAINTENANCE

3.1 GENERAL. The two-year warranty given with every General Radio instrument attests the quality of materials and workmanship in our products. When difficulties do occur, our service engineers will assist in any way possible.

In case of difficulties that cannot be eliminated by the use of these service instructions, please write or phone our Service Department, giving full information of the trouble and of steps taken to remedy it. Be sure to mention the serial and type numbers of the instrument.

Before returning an instrument to General Radio for service, please write to our Service Department or nearest district office (see back cover), requesting a Returned Material Tag. Use of this tag will insure proper handling and identification. For instruments not covered by the warranty, a purchase order should be forwarded to avoid unnecessary delay.

3.2 CRYSTAL-DIODE REPLACEMENT. If the input voltage required for full-scale deflection of the meter is much less than normal, or if maximum sensitivity is low, especially at low frequencies, one of the crystal diodes may not be functioning properly. Remove the crystals and check them with a battery-operated ohmmeter (Weston model 980 or equivalent). The forward resistance should be less than 700 ohms, and the back resistance greater than 100 kilohms. When replacing crystals, including the voltmeter rectifier crystal, be sure to observe proper polarity, and be careful not to damage the crystals by heat when soldering.

3.3 TUBE TEST VOLTAGES. The following voltages were measured with a 20,000-ohm-per-volt meter, between tube pins and ground. Voltages are dc except where otherwise indicated, and may vary by 20 percent.

TUBE (TYPE)	PIN	VOLTS	TUBE (TYPE)	PIN	VOLTS	TUBE (TYPE)	PIN	VOLTS
V1 (6AK5)	2	2.0	V3 (6AK5)	2	2.4	V5 (12AX7)	1	145
	3	0		3	0		3	1.5
	4	6.0		4	6.3 AC		4	6.3 AC
	5	102		5	120		5	6.3 AC
	6	125		6	137		6	145
	7	2.0		7	2.4		7	0
					5		145	8
V2 (6AK5)	2	2.3	V4 (0A2)			9	0	
	3	0						
	4	6.3 AC						
	5	112						
	6	132						
	7	2.3						

TYPE 1212-A UNIT NULL DETECTOR

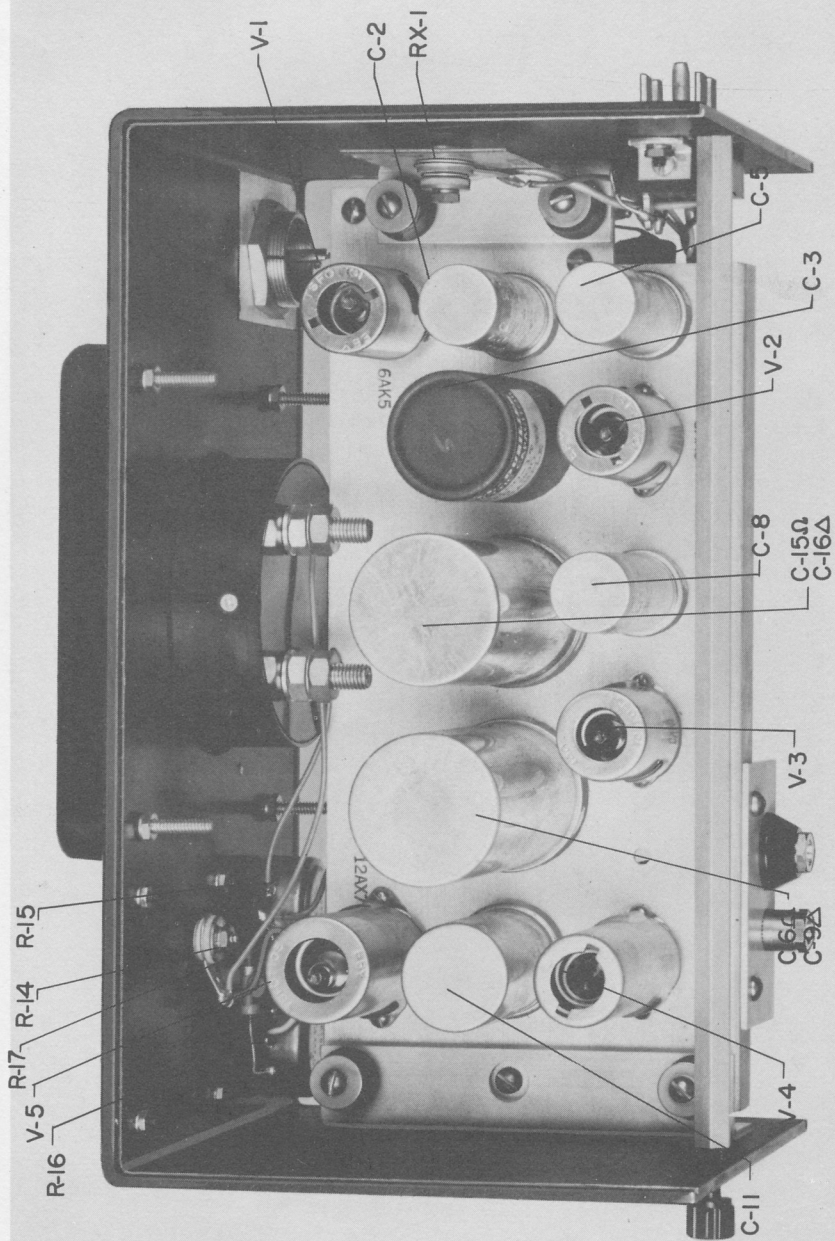


Figure 10. Top Interior View.

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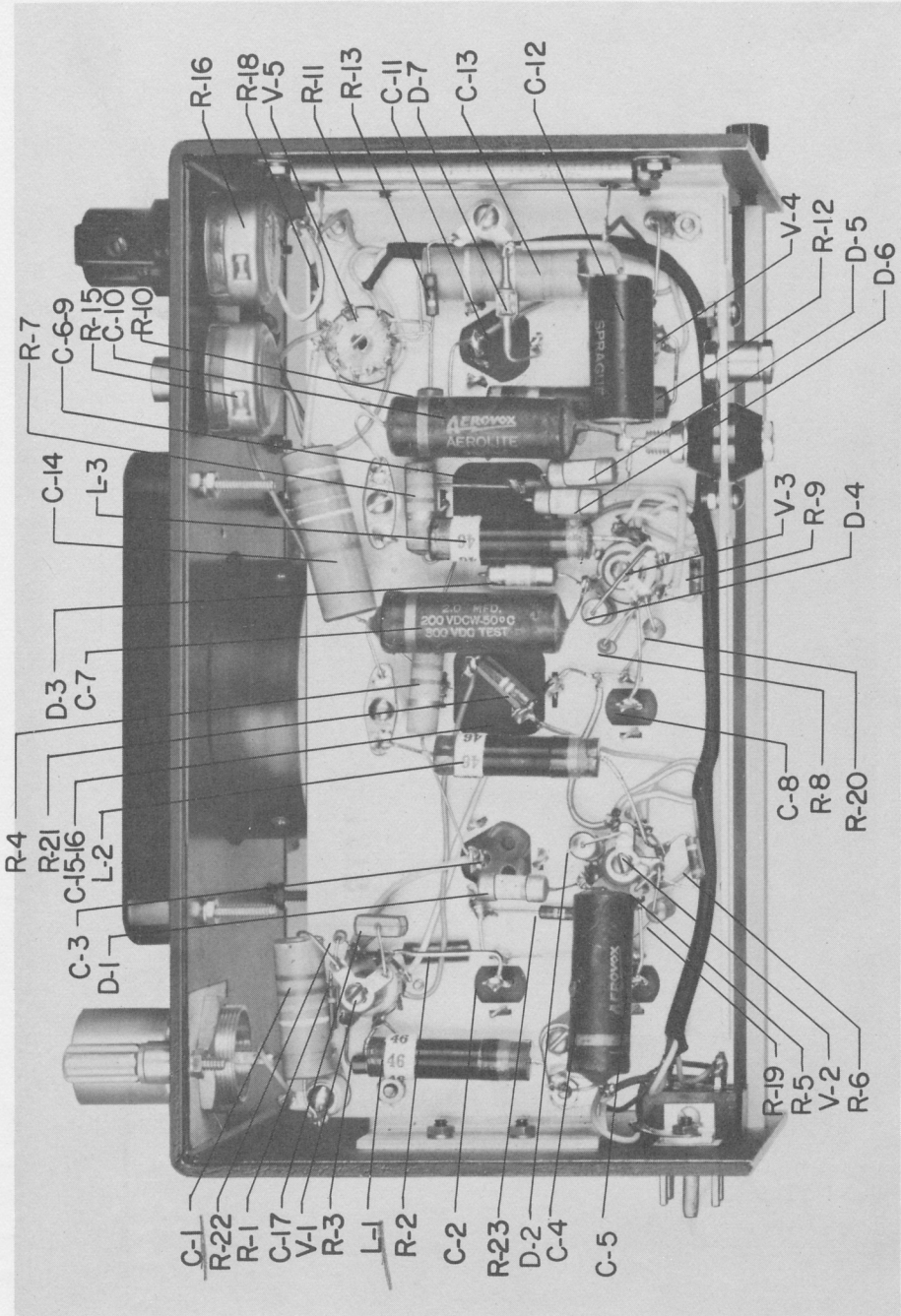


Figure 11. Bottom Interior View.

TYPE 1212-A UNIT NULL DETECTOR

PARTS LIST

REF DESIG.	DESCRIPTION	PART NO.
R1	RESISTOR, Composition, 1M Ω \pm 5% 1/2w	6100-5105
R2	RESISTOR, Composition, 200 Ω \pm 5% 1/2w	6100-1205
R3	RESISTOR, Composition, 3.3K Ω \pm 5% 1/2w	6100-2335
R4	RESISTOR, Composition, 680 Ω \pm 10% 1w	6100-1689
R5	RESISTOR, Composition, 270 Ω \pm 5% 1/2w	6100-1275
R6	RESISTOR, Composition, 3.6K Ω \pm 5% 1/2w	6100-2365
R7	RESISTOR, Composition, 680 Ω \pm 10% 1w	6110-1689
R8	RESISTOR, Composition, 330 Ω \pm 5% 1/2w	6100-1335
R9	RESISTOR, Composition, 3.6k Ω \pm 5% 1/2w	6100-2365
R10	RESISTOR, Composition, 1K Ω \pm 10% 1w	6110-2109
R11	RESISTOR, Power, 4K Ω \pm 10%	6631-2409
R12	RESISTOR, Composition, 360 Ω \pm 5% 2w	6120-1365
R13	RESISTOR, Composition, 1M Ω \pm 5% 1/2w	6100-5105
R14	RESISTOR, Composition, 3K Ω \pm 5% 1/2w	6100-2305
R15	POTENTIOMETER, Composition, 5K Ω \pm 10%	6010-0800
R16	POTENTIOMETER, Composition, 2.5K Ω \pm 10%	6000-0400
R17	RESISTOR, Composition, 3K Ω \pm 5% 1/2w	6100-2305
R18	RESISTOR, Composition, 1M Ω \pm 5% 1/2w	6100-5105
R19	RESISTOR, Composition, 15 Ω \pm 5% 1/2w	6100-0155
R20	RESISTOR, Composition, 15 Ω \pm 5% 1/2w	6100-0155
R21	RESISTOR, Wirewound, 2.7 Ω \pm 5% 1/2w	6760-9279
R22	RESISTOR, Composition, 1M Ω \pm 5% 1/2w	6100-5105
R23	RESISTOR, Composition, 12K Ω \pm 5% 1/2w	6100-3125
R24	RESISTOR, Composition, 1.8K Ω \pm 5% 1/2w	6100-2185
R25	RESISTOR, Composition, 100 Ω \pm 5% 1/2w	6100-1105
R26	RESISTOR, Composition, 100 Ω \pm 5% 1/2w	6100-1105
R27	RESISTOR, Composition, 160K Ω \pm 5% 1/2w	6100-4165
C1	CAPACITOR, Ceramic, 0.022 μ f \pm 20% 600 dcwv	4407-3220
C2	CAPACITOR, Electrolytic, 200 μ f 6 dcwv	4450-1300
C3	CAPACITOR, Electrolytic, 40 μ f 200 dcwv	4450-1800
C4	CAPACITOR, Oil, 2 μ f \pm 20% 200 dcwv	4510-3900
C5	CAPACITOR, Electrolytic, 200 μ f 6 dcwv	4450-1300
C6	CAPACITOR, Electrolytic, 40 μ f 450 dcwv (Part of C9)	4460-0600
C7	CAPACITOR, Oil, 2 μ f \pm 20% 200 dcwv	4510-3900
C8	CAPACITOR, Electrolytic, 200 μ f 6 dcwv	4450-1300
C9	CAPACITOR, Electrolytic, 40 μ f 450 dcwv (Part of C6)	4460-0600
C10	CAPACITOR, Oil, 2 μ f \pm 20% 200 dcwv	4510-3900
C11	CAPACITOR, Electrolytic, 20 μ f 450 dcwv	4450-0300
C12	CAPACITOR, Wax, 1 μ f \pm 10% 100 dcwv	5010-3700
C13	CAPACITOR, Oil, 0.047 μ f \pm 10% 600 dcwv	4510-4200
C14	CAPACITOR, Oil, 0.047 μ f \pm 10% 600 dcwv	4510-4200
C15	CAPACITOR, Electrolytic, 1500 μ f 10 dcwv	4450-0700
C16	CAPACITOR, Electrolytic, 1500 μ f 10 dcwv	4450-0700
C17	CAPACITOR, Mica, 100pf \pm 10% 500 dcwv	4660-2900
D1-D6	DIODE, Semiconductor, Type 1N35 (paired)	6082-1004
D7	DIODE, Semiconductor, Type 1N54A	6082-1005
J1	CONNECTOR, Coaxial, Panel, Locking	0874-4501
J2	BINDING POST, Insulated	0938-9868
J3	GROUND TERMINAL	4150-2600
L1-L3	INDUCTOR, Choke, 60 μ h \pm 5%	4290-2300
M1	METER, 0 - 200 μ a dc	5730-1160
PL1	PLUG, Power, 3-wire	4220-4201
RX1	RECTIFIER	6080-1400
V1-V3	TUBE, Vacuum, Type 6AK5	8360-0700
V4	TUBE, Vacuum, Type OA2	8300-0100
V5	TUBE, Vacuum, Type 12AX7	8370-0900

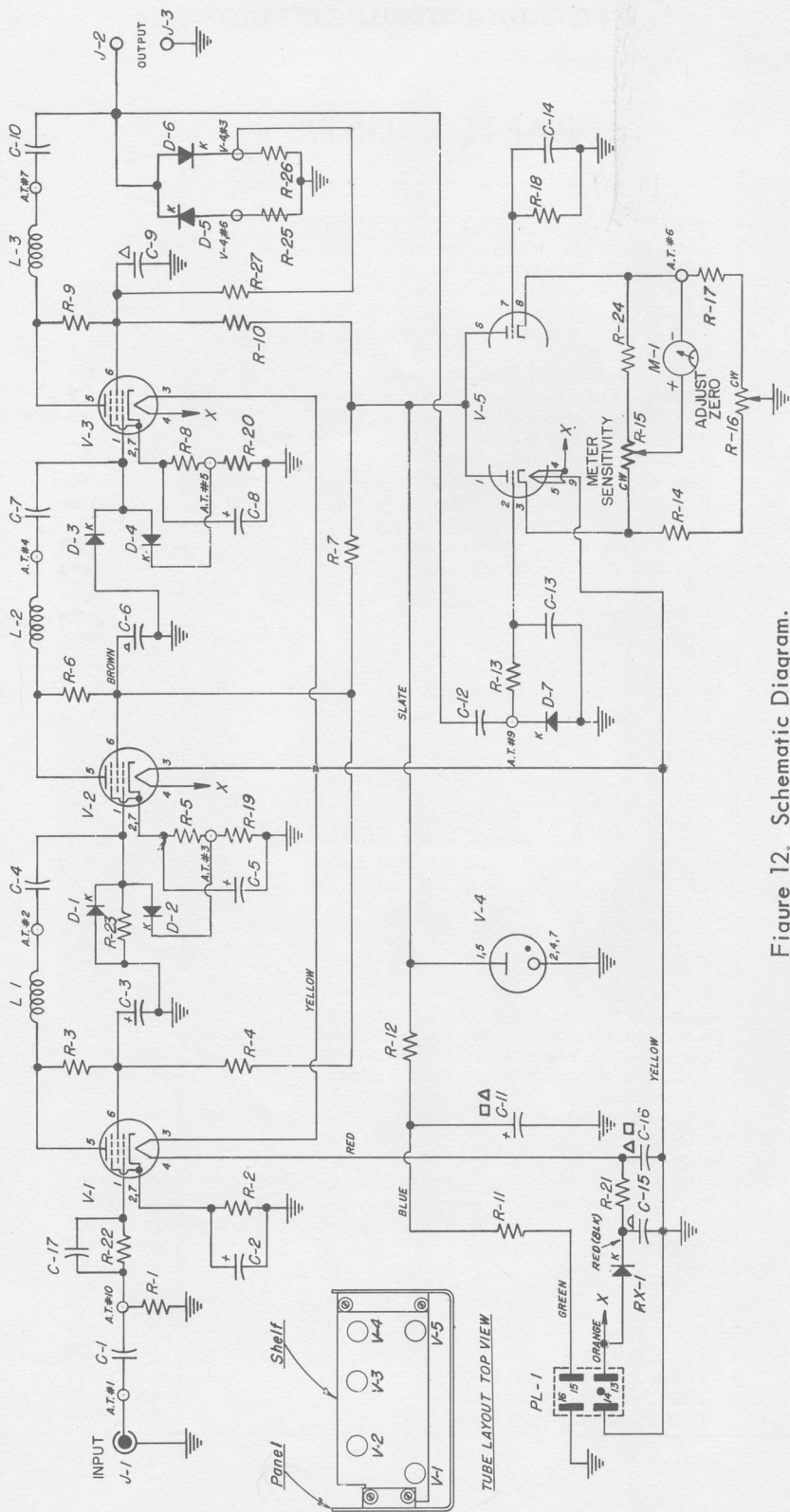


Figure 12. Schematic Diagram.

TYPE 1212-A UNIT NULL DETECTOR

RECOMMENDED UNIT POWER SUPPLIES

SPECIFICATIONS

TYPE 1201-B UNIT REGULATED POWER SUPPLY

Input: 105 to 125 volts (210 to 250 volts for TYPE 1201-BQ18), 50 to 60 cps, 90 watts full load at 115 volts. Can also be operated from 110- to 125-volt, 400-cycle supply for applications where a 400-cycle, 6.3-volt output can be tolerated.

Output: 300 volts dc regulated to $\pm 0.25\%$, 70 milliamperes maximum; 6.3 volts ac unregulated at 4 amperes maximum.

Ripple: Less than 1 millivolt, rms, (120 cps) at full load.

Connectors: Three-wire line cord permanently attached. Standard four-terminal receptacle mounted on cabinet side for convenient connection to Unit Instruments.

Accessories Supplied: Mating plug for equipment other than Unit Instruments.

Dimensions: Width 5, height $5\frac{3}{4}$, depth $6\frac{1}{4}$ inches (130 by 150 by 160 mm), over-all, not including power cord.

Net Weight: 6 pounds (2.8 kg).

TYPE 1203-B UNIT POWER SUPPLY

Input: 105 to 125 volts (210 to 250 volts for TYPE 1203-BQ18), 50 to 60 cps, 50 watts full load at 115 volts. Can also be operated from 110- to 125-volt, 400-cycle supply for applications where a 400-cycle, 6.3-volt output can be tolerated.

Output: At 115-volt input — 300 volts dc ($\pm 5\%$) at 50 milliamperes; 6.3 volts ac at 3 amperes. (With ac load at 1.5 amperes or less, maximum dc load is 65 milliamperes, about 285 volts dc.)

Regulation: At no load, dc output is 380 volts.

Ripple: Less than 80 millivolts, rms, (120 cps) at full load.

Connectors: Three-wire line cord permanently attached. Standard four-terminal receptacle on cabinet side for convenient connection to Unit Instruments.

Accessories Supplied: Mating plug for equipment other than Unit Instruments.

Dimensions: Width 5, height $5\frac{3}{4}$, depth $6\frac{1}{4}$ inches (130 by 150 by 160 mm), over-all, not including power cord.

Net Weight: 5 pounds (2.3 kg).

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TYPE 1205-B ADJUSTABLE REGULATED POWER SUPPLY

DC Output

Voltage: 0 to 300 volts continuously adjustable, at 200 milliamperes maximum.

Regulation: No load to full load, 0.1 volt; 0.75-volt change for $\pm 10\%$ change in line voltage.

Bias Output

Voltage: -150 volts dc fixed, at 5 milliamperes maximum.

Regulation: No load to full load, 0.5 volt; 2-volt maximum change for $\pm 10\%$ change in line voltage.

Unregulated AC Voltage: 2 circuits, each 6.3 volts nominal, at 5 amperes, can be connected in series or parallel.

Meter Accuracy: Voltage, 2%; current, 5%.

120-cycle Ripple: Less than one millivolt.

Internal Impedance: Approximately 0.3 ohm + 2 μ h shunted by 4 μ f.

Power Input: 105 to 125 volts, 60 cps; 250 watts at full load.

Accessories Supplied: Adaptor plug, spare fuses.

Dimensions: Width 9 $\frac{1}{2}$, height 5 $\frac{1}{4}$ inches (245 by 135 mm); depth behind panel 8 $\frac{1}{4}$ inches (210 mm).

Net Weight: 15 pounds (7 kg).

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