



TYPE 874-VR AND -VRL

VOLTMETER RECTIFIER

1 INTRODUCTION

1.1 PURPOSE. The Type 874-VR/-VRL Voltmeter Rectifier (Figure 1) is primarily designed to operate as a voltage monitor in a 50-ohm coaxial system. With a suitable indicator, it will monitor the voltage behind a 50-ohm resistor and will thus serve as a very useful "building block" in measuring systems.

1.2 DESCRIPTION. The rectifier consists of a short piece of 50-ohm line with a diode mounted between the inner and outer conductors. The r-f signal is bypassed by means of a 300-pf mica disc capacitor and the detected output is brought out through the center connector of the rectifier. At the r-f output end, a 50-ohm resistor is mounted in series with the center conductor close to the diode to provide a 50-ohm source impedance. The output end is marked by an "R" engraved on the outer conductor. The detector is a Type 1N23B diode. All connectors are Type 874.

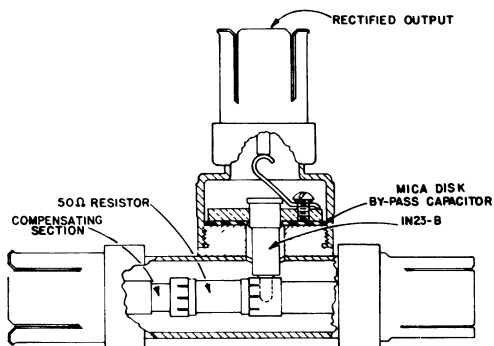


Figure 1. Interior detail of Type 874-VR.

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1.3 TYPE 874-VRL. The Type 874-VRL Voltmeter Rectifier is identical to the Type 874-VR except that it employs locking Type 874-BL Coaxial Connectors on the r-f arms. These connectors are compatible with both locking and nonlocking Type 874 Connectors. When two locking connectors are mated with each other, a firm mechanical coupling is achieved. Also, the shielding is improved significantly over that of the standard connector and, in general, the leakage is reduced by at least 50 db. In terms of VSWR, a locking connector mated with a nonlocking connector is equivalent to two nonlocking connectors mated. The VSWR characteristics of the basic Type 874-BL Locking Connector are similar to those of the basic Type 874-B (nonlocking) Connector, and both are described in the General Radio catalog. The quick-disconnect feature of the standard Type 874 Coaxial Connectors is retained in the locking type if the coupling nut is not engaged; however, the shielding is less effective.

2 OPERATING CHARACTERISTICS

2.1 VSWR. At 2.0 Gc, the VSWR is about 1.2, and at lower frequencies it will decrease almost linearly with the frequency to about 1.07 at 1.0 Gc. Above 2.0 Gc, the VSWR will increase rapidly as the resonant frequency of the diode is approached.

2.2 FREQUENCY CORRECTION. Due to resonance in the diode, the indicated voltage for a constant applied r-f voltage increases with frequency. A correction curve giving the ratio of actual to indicated voltage as a function of frequency is shown in Figure 2.

2.3 VOLTAGE CORRECTION. It should be kept in mind that the diode characteristic changes from square law at low voltage levels to linear

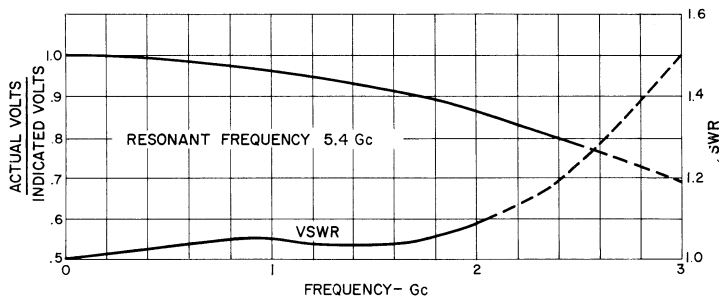


Figure 2. Typical VSWR and frequency correction for Type 874-VR/-VRL output.

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at higher voltages. As an aid in correcting for this property of the diode, a typical rectification characteristic is given in Figure 3.

CAUTION: Voltages higher than 2 volts can permanently damage the diode.

2.4 D-C RETURN. An external low-resistance dc return path for the diode current must always be incorporated in the device to which the unmarked arm (preferably) is connected.

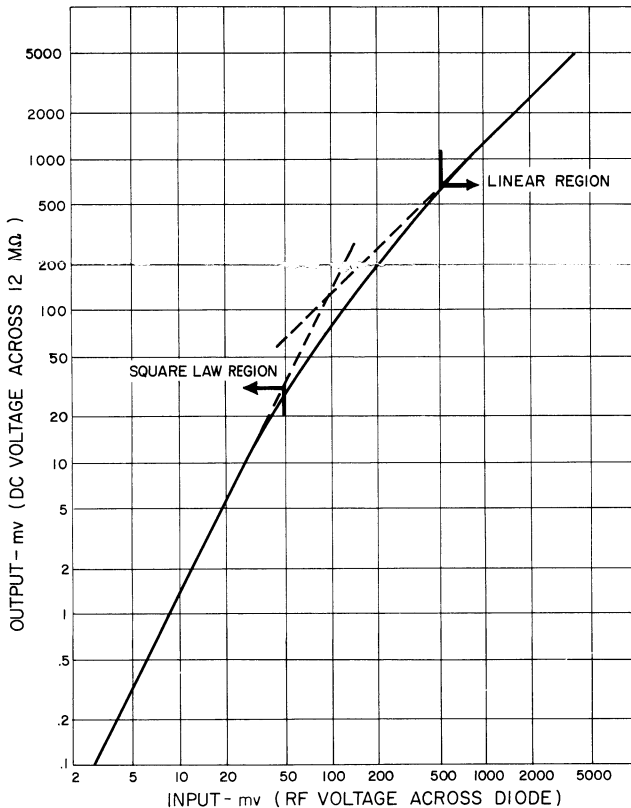


Figure 3. Typical rectification characteristic for Type 1N23B diode.

3 APPLICATIONS

3.1 VOLTAGE INDICATION. With the unmarked end connected to an oscillator and the end marked "R" connected to a load (through an arbitrary length of lossless 50-ohm line) the Voltmeter Rectifier and the associated line simulate a generator with an equivalent open-circuit voltage equal to the indicated voltage and an internal impedance of 50 ohms (resistive). The Type 874-VI Voltage Indicator is recommended as the indicating device.

3.2 SIGNAL GENERATOR. In conjunction with a Type 874-GAL Adjustable Attenuator, the 874-VR/-VRL can be used to convert an oscillator into a signal generator.¹ Figure 4 shows an example of a typical setup. The stub is used to produce a current maximum at the pickup loop in the attenuator, and the adjustable line (could be replaced by a single stub or double-stub transformer) is used as a matching transformer to obtain the maximum oscillator output.

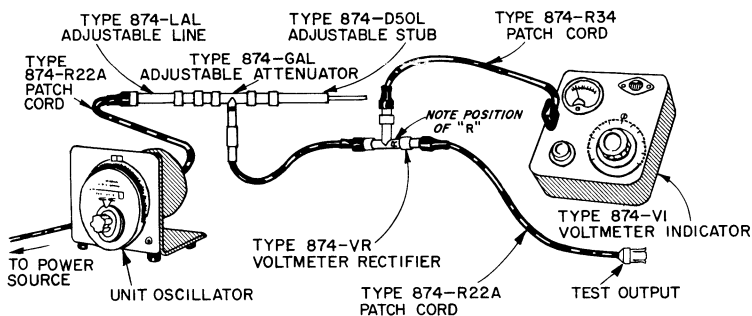


Figure 4. Use of Type 874-VR/-VRL to convert a unit oscillator to a signal generator.

3.3 AUTOMATIC AMPLITUDE CONTROL. The Type 874-VR/-VRL can be used, together with the Type 1263-B Power Supply², (Figure 5), to keep the output of an oscillator constant when the frequency is varied.

1. G. P. McCouch, "A New Look in High-Frequency Oscillators," *General Radio Experimenter*, 37, 8, August, 1963.

2. W. F. Byers, "Type 1263-B Amplitude-Regulating Power Supply," *General Radio Experimenter*, 35, 9, September, 1961.

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Constant output voltage is very important when the oscillator is being swept (for instance by a Type 1750-A Sweep Drive) for rapid measurement of the frequency response of a network. Remember, however, to correct for the diode resonance characteristic (Figure 2) at high frequencies. If a Type 874-VQ Voltmeter Detector is used as a matched detector after the unknown network, no frequency correction is required because the frequency errors in the two diodes tend to cancel each other. However, irregularities of up to 10 percent may occur owing to the output diode's response to harmonics generated by the input diode.

3.4 DETECTOR. With a Type 874-WN Short Circuit Termination connected to end marked "R", the Type 874-VR/-VRL can be used as a detector. The unit will have a fairly good match at frequencies up to 300 Mc.

The frequency response of the demodulated output is greatly dependent upon the amount of d-c load resistance connected across the detector output terminals. (For 1-Mc bandwidth the resistance should be less than 500 ohms.)

3.5 HETERODYNE MIXER. The Type 874-VR/-VRL can be used as a heterodyne mixer. The local oscillator should, in this case, be connected to the arm marked "R". I-f performance is frequency limited by the 300 pf bypass capacitor.

4 SERVICE AND MAINTENANCE

4.1 DIODE REPLACEMENT. To replace the Type 1N23B diode, unscrew the knurled mount supporting the rectified output connector, loosen the spring contact with a screwdriver, and remove the diode. The replacement diode should have a back resistance of at least 20,000 ohms at 1 volt dc (General Radio part no. is 6084-1002).

4.2 RESISTOR REPLACEMENT. If the resistor is damaged (this can be checked by measurement of the resistance, which should be 50 ohms, between the two r-f center conductors), unscrew the coupling nut on the "R" connector. The resistor will be accessible when the connector is removed. Replacement resistor (Part No. 6740-0600) can be obtained from our Service Department. Use of a Type 874-TOK Tool Kit will aid in connector removal.

4.3 CAPACITOR REPLACEMENT. To replace the bypass capacitor, unscrew the knurled assembly and remove the two diametrically positioned screws. The capacitor then comes apart. To decrease capacitance, insert additional mica spacers.

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SPECIFICATIONS

Maximum Voltage: 2 volts.

Diode: Type 1N23B.

Resonant Frequency: Approximately 5.4 Gc; correction curve supplied.

Bypass Capacitance: Approximately 300 pf; (shunt capacitance of crystal approximately 1 pf).

Frequency Range for Voltage Measurements: 15 Mc to 2.5 Gc, subject to resonance correction above 500 Mc. Voltage indications and correct voltage ratios can be obtained at both lower and higher frequencies. See curve, Figure 2.

Dimensions: (Length) 3-3/4 by (height) 2-1/2 inches (96 by 64 mm).

Net Weight: Type 874-VR, 5 ounces (140 grams); Type 874-VRL, 6 ounces (170 grams).

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

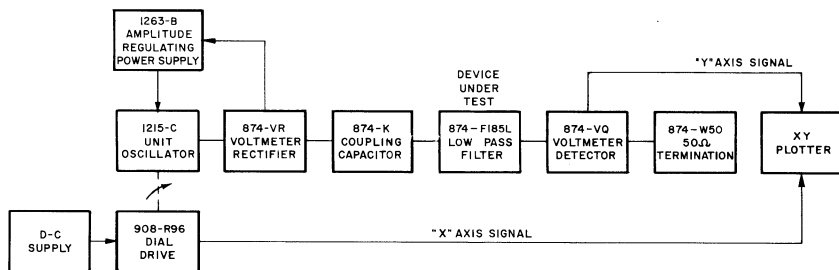


Figure 5. Swept frequency setup utilizing a Type 874-VR.

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