# TRANSMISSION AND NOISE MEASURING SYSTEM

# 1W NOISE AMPLIFIER-RECTIFIER WITH C-MESSAGE WEIGHTING

# DESCRIPTION



CONTENTS



## 1. GENERAL

**1.01** This section describes the 1W noise amplifier-rectifier panel (J64001W) modified for C-message weighted noise measurements by the addition of a "C-message" panel. The panels are part of the combined Transmission and Noise Measuring System per SD-95900-01 provided at testboards, switching maintenance centers, D2 channel bank bays, and other locations. They are also part of the Noise Measuring System per SD-59433-01 which is associated with the Transmission Measuring System per SD-59432-01 at voice-frequency patch bays and at packaged N carrier terminals.

**1.02** This section is reissued to cover changes in the power supply arrangements and to make minor changes in the text. This reissue does not affect Equipment Test Lists.

**1.03** The noise measurements are made in dB above reference noise using C-message weighting (dBrnc). (Reference noise of 0 dBrnc corresponds to −90 dBm or 90 dB below 1 milliwatt at 1000 Hz.) The amplifier-rectifier and the associated meter are capable of measurements in the range from 15 to 55 dBrnc. This range may be restricted at some testboards to 15 to 45 dBrnc.

**1.04** The amplifier-rectifier panel and the C-message panel are mounted in a bay which is in or near the testing area. The calibration arrangements are located in the same bay and include a key which connects a milliwatt supply through a 35-dB pad to the input of the amplifier-rectifier. Additional keys and pads provide features for checking the linearity of the meter readings. Normally, when the measuring system serves a testboard, a meter for calibration is provided also in the bay.

**1.05** The frequency weighting characteristic of the combined amplifier-rectifier and C-message panel attenuates frequencies other than 1000 Hz, in accordance with their relative interfering effect when heard through the receiver of a 500-type telephone set. Figure 1 shows a typical curve of the 1W amplifier-rectifier modified for C-message weighting, and a comparison is given with the design objective for C-message weighting.

**1.06** ▶Originally, when the system was converted to C-message weighting, power for both the amplifier-rectifier panel and the C-message panel was derived from the connecting circuit. Due to the fact that the voltage was, in many cases, insufficient to provide stable operation of the amplifier in the C-message panel, a change has been introduced which provides a separate battery supply lead to the C-message panel. All installations should be changed to agree with the latest arrangement (Fig. 2).◀

## 2. AMPLIFIER-RECTIFIER PANEL

**2.01** The amplifier-rectifier panel contains a 3-stage amplifier, as shown in Fig. 2. The gain of the amplifier is varied by the operation of relays A, C, and D in five steps of 5 dB each. The relays are energized by jacks, sensitivity control keys, or dial switches located in the associated noise measuring circuit. When operated, the relays increase the

amount of coupling between the amplifier stages and increase the amplifier gain, as shown in Table A. Table A also indicates the factor which is added to the meter reading in each case to obtain the actual measured noise.

TABLE A

| RELAY(S) OPERATED | INCREASE IN AMPLIFIER | ADD TO A SCALE METER READING |
|---|---|---|
| None | 0 | 40 |
| D | 5 | 35 |
| C | 10 | 30 |
| A | 15 | 25 |
| A & D | 20 | 20 |
| A & C | 25 | 15 |

**2.02** The 1W noise amplifier-rectifier is used to measure C-message weighted noise on a 600-ohm terminated, 900-ohm terminated, or high-impedance bridging basis. When the noise is measured on a 600-ohm terminated basis, the B relay in the amplifier-rectifier panel can be operated to provide a 600-ohm termination for the circuit being measured. For some applications, a 600- or 900-ohm termination is provided externally in the associated noise measuring circuit. In such cases, the 1W noise amplifier-rectifier is operated on a bridging basis and the B relay on the panel is not operated. These terminations are so designed that the system reads directly in dBrnc for either 600- or 900-ohm impedance without the need for adding correction factors. The input impedance of the amplifier-rectifier is in the order of 10,000 ohms, which is approximately the same as that of the 3-type noise measuring set arranged for bridging measurements.

**2.03** During calibration, the gain and sensitivity are adjusted by two potentiometers in the last stage of the amplifier. The potentiometers SENS ADJ and SCALE ADJ are used to obtain the desired output meter readings at specified input power levels.

**2.04** ◗Adjustable resistors U, V, and W and strapping options provide a means of adjusting the filament voltage. This represents a change over previous methods which provided for measuring the filament voltage. Hence, the FIL jack is no longer used. A check should be made to ensure that the ballast lamp (B3) in the power lead to terminal 5 of the amplifier-rectifier is coded 120A. This ballast lamp is provided in the connecting circuit.◀

**2.05** The weighting provided in the amplifier-rectifier panel approximates F1A LINE weighting and is obtained by the characteristics of the interstage coupling, feedback, and the varistor-type rectifier. The change to C-message weighting is accomplished by the addition of the C-message panel described in Part 3.

## 3. C-MESSAGE PANEL

**3.01** The C-message panel contains a nonlocking key, plug-in amplifier, and frequency shaping filter, as shown in Fig. 2. Electrically, it is located directly following the input circuit of the amplifier-rectifier. Physically, it is located adjacent to the amplifier-rectifier panel to limit the length of interpanel wiring. The C-MSG OUT key is arranged so that, when held operated, the C-message panel is bypassed. During the initial calibration subsequent to installation, the key is held operated while the SENS ADJ potentiometer on the amplifier-rectifier panel is adjusted. The key is then released and the gain of the plug-in amplifier is adjusted. The key may also be used during trouble investigation. During subsequent routine calibration and noise measurements, the key is normal and the amplifier-rectifier panel input leads are connected through the key to the input of the plug-in amplifier. The output of the plug-in amplifier is passed through a frequency shaping filter (FL1) and back through the C-MSG OUT key to the input of the amplifier-rectifier.

**3.02** The frequency shaping filter (FL1) on the C-message panel alters the amplitude-frequency characteristic of the band of noise measured so that, when combined with the weighting of the amplifier-rectifier circuit, the resultant characteristic is C-message weighting.

**3.03** The plug-in amplifier compensates for the 1-kHz loss of the frequency shaping filter and the loss due to resistors R1 and R2 in the input leads. The total gain provided by the plug-in amplifier is approximately 26 dB. The amplifier gain adjustment is made during initial calibration of the system, as discussed in 3.01. Resistors R1 and R2 provide an input impedance of approximately 10,000 ohms for the amplifier.

## 4. OUTPUT METER

**4.01** The output meter is connected to the rectified output of an amplifier-rectifier by the connecting circuits. The circuits are so arranged that one or more output meters are common to both the transmission (J64001U) and noise (J64001W) amplifier-rectifiers. A projection-type, bracket-type, or panel-mounted type meter can be used. The meters are electrically equivalent and have a resistance of about 180 ohms with full scale current of approximately 1.5 milliamperes. With proper sensitivity and scale adjustments, the meter indicates accurately to within 0.2 dB on the 5- to 15-dB range on the A scale of the meter.

**4.02** The meters have two scales. The scale designated B (black) reads 15 to 0 dB from left to right. This scale is used for making transmission loss measurements when the meter is used with the 1U amplifier-rectifier. The other scale (usually red), designated A, reads 0 to 15 dB from left to right and is used when measuring transmission gain or noise. The total noise measured is the sum of the meter reading on the A scale plus the designation on the jack or on the operated sensitivity key or dial switch. Due to a slight nonlinearity of the meter when used with the 1W amplifier-rectifier, noise readings are recommended in the 5- to 15-dB range on the A scale and the control keys or dial switches should be operated accordingly.

## 5. OPERATION

**5.01** Access to the input of the 1W noise amplifier-rectifier and control of its sensitivity and input impedance are provided by the connecting circuit SD-95900-01 or SD-59433-01. The connecting circuits also switch the output of the rectifier to the output meter where the noise measurements can be read.

**5.02** The 1W amplifier-rectifier is calibrated with its input terminated in 600 ohms and with all sensitivity relays (A, C, and D) released, to provide a meter reading of 15 on the A scale of the meter when the input power is −35 dBm at 1000-Hz and 600-ohms impedance. This is equivalent to 55 dBrnc at 1000 Hz, which is the maximum measuring range provided by the 1W panel and meter. Table B shows the sensitivity control designations, the output meter sensitivity on the A scale, and the sensitivity relay operated. Descriptions of the controls and sensitivity keys or dial switches are contained in the sections of practices applying to the specific systems.

**TABLE B**

| SENSITIVITY DIAL SETTING OR KEY OPERATED (Note 1) | OUTPUT METER SENSITIVITY ON A SCALE IN DBRNC | RELAY(S) OPERATED IN 1W PANEL |
|---|---|---|
| A+40 (Note 2) | 40 to 55 | None |
| A+35 (Note 2) | 35 to 50 | D |
| A+30 (Note 3) | 30 to 45 | C |
| A+25 | 25 to 40 | A |
| A+20 | 20 to 35 | A & D |
| A+15 | 15 to 30 | A & C |

***Note 1:*** Factor added to meter reading A to obtain total measured noise.

***Note 2:*** This measurement range may not be provided by the sensitivity keys at some testboards.

***Note 3:*** The A+30 key may not be provided at some testboards and maintenance centers. In such cases, this range is obtained with all sensitivity keys normal.

## 6. MAINTENANCE

**6.01** Maintenance of the 1W noise amplifier-rectifier requires periodic calibration with an accurate milliwatt supply and periodic checks of scale matching, the sensitivity controls, and frequency weighting requirements. It is necessary to check for the latter requirements only when components are replaced or when major repairs are made.

**6.02** The test and adjustment procedures and test requirements are covered in ▶Sections 103-231-500 and 103-231-510.◀ The procedure calls for the application of −35 dBm at 1000 Hz to the input of the amplifier-rectifier, with the A, C, and D relays unoperated, and the adjustment of the SENS ADJ control for a meter reading of 15 on the A scale. This level is obtained from the milliwatt supply and a 35-dB pad which is part of the calibrating circuit. Additional pads of 5- and 10-dB loss, controlled by keys, are inserted to check the linearity of the meter reading. The SCALE ADJ control on the amplifier-rectifier is adjusted to meet the linearity requirements.

### A. Trouble Testing

**6.03** When the requirements cannot be met, if the system exhibits instability, or if difficulty is experienced in making adjustments, the circuit should be investigated for trouble. ▶A schematic diagram of the 1W noise amplifier-rectifier and C-message weighting panel is shown in Fig. 2.◀ It is particularly important to check the electron tubes and electrolytic capacitors whenever trouble is experienced.

**6.04** Replacement of electron tubes in the 1W noise amplifier-rectifier should be made in accordance with the SD-drawing. ▶The 310A and 311A tubes have been rated "Manufacture Discontinued." If a panel is equipped with these tubes and if any one of them fails, all tubes should be replaced with 328A and 329A tubes and the filament voltage readjusted.◀

### 7. LIST OF DRAWINGS (Not attached)

| SECTION | TITLE |
|---|---|
| SD-95102-01 | 1W Noise Amplifier-Rectifier Circuit |
| SD-95102-02 | 1W Noise Amplifier-Rectifier Circuit |
| SD-59432-01 | Transmission Measuring Circuit |
| SD-59433-01 | Noise Measuring Circuit |
| SD-95900-01 | Transmission and Noise Measuring Circuit |

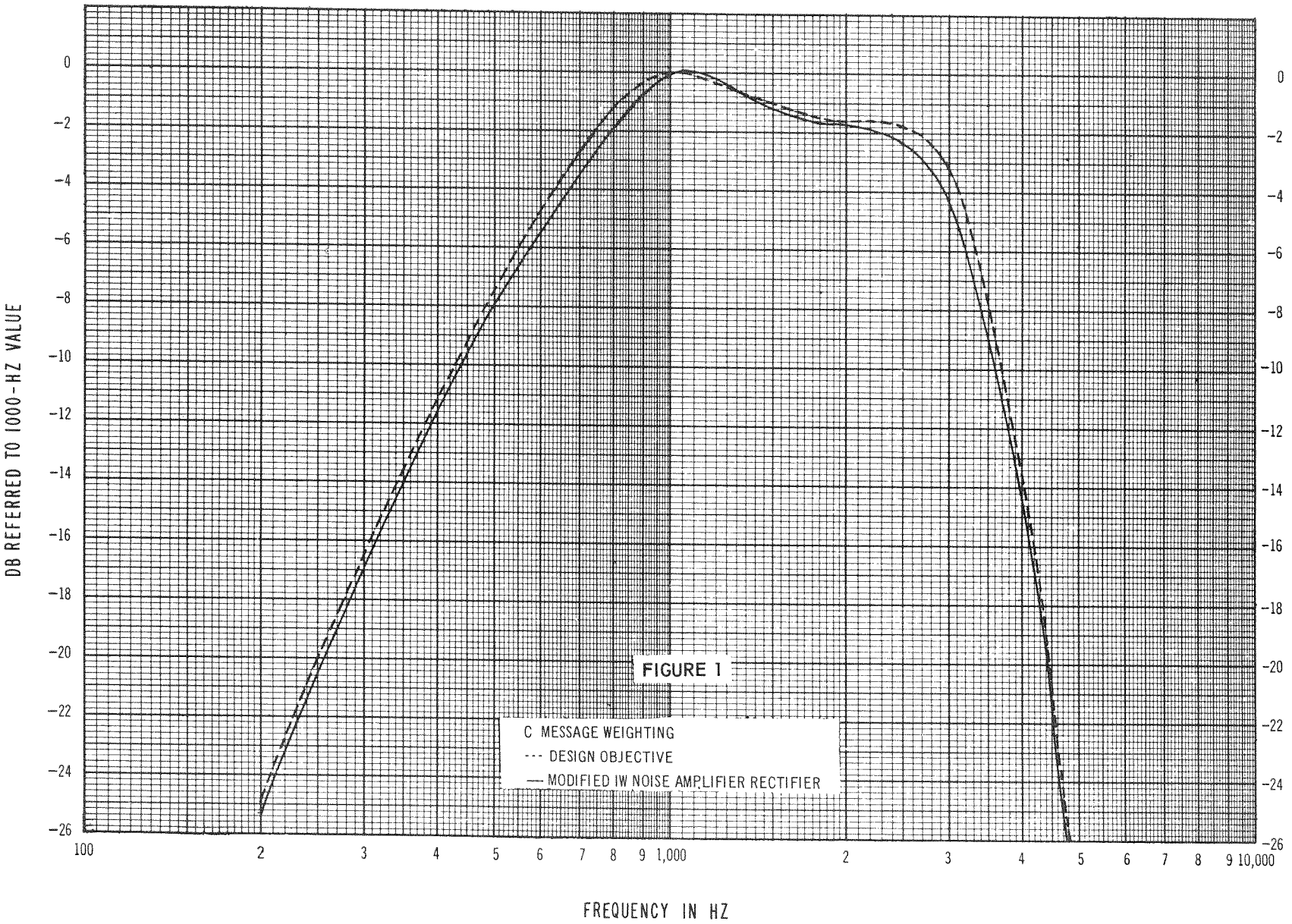


**Fig. 1—Comparison Between C-Message Weighting Design Objective and Characteristic Curve of Modified 1W Noise Amplifier Rectifier**

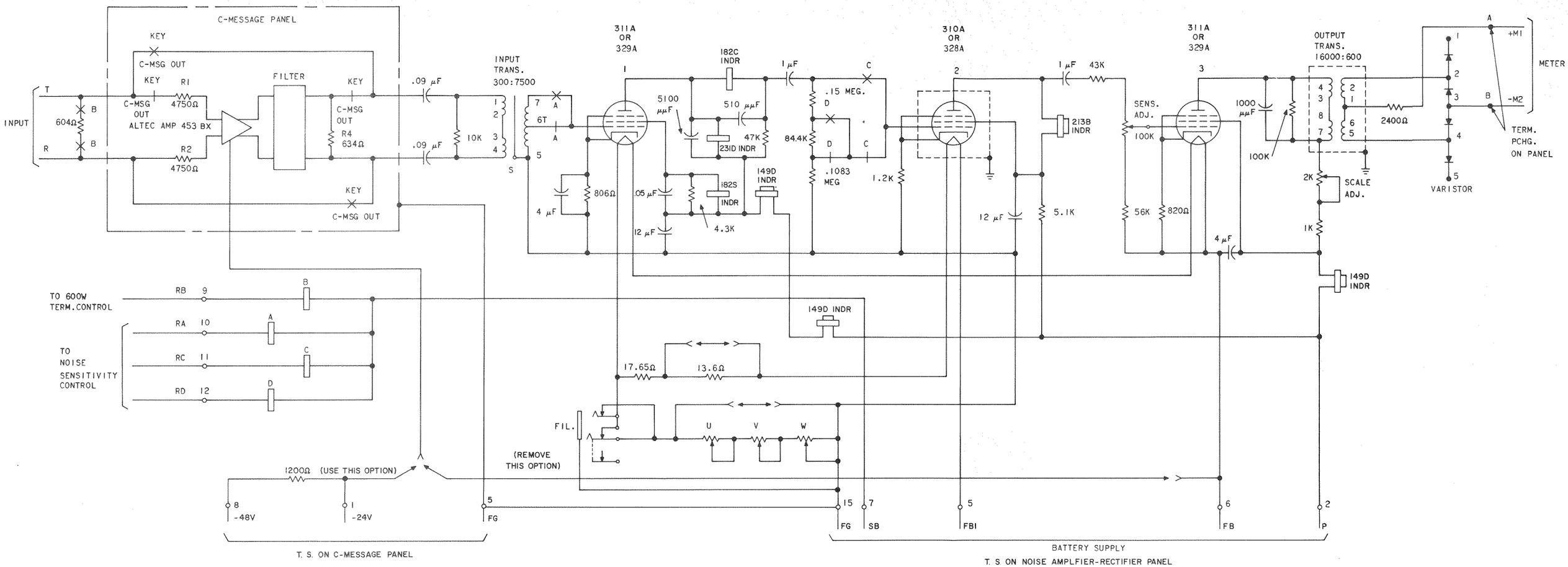


**Fig. 2—Schematic Circuit of 1W Noise Amplifier-Rectifier with C-Message Weighting**