F-60966 AMPLIFIER, ENERGY GATED

DESCRIPTION

V4 TELEPHONE REPEATERS

CONTENTS PAGE

1. GENERAL 1
INTRODUCTION 1
PURPOSE OF ENERGY GATED AMPLIFIER . 1
EQUIPMENT CHARACTERISTICS 1
2. PHYSICAL DESCRIPTION 2
ENERGY GATED AMPLIFIER 2
V4 SYSTEM MOUNTING SHELF ARRANGEMENTS 3
3. FUNCTIONAL DESCRIPTION 4
4. POWER 5
5. MAINTENANCE 5
6. REFERENCES 5

1. GENERAL

INTRODUCTION

1.01 This section describes the Energy Gated Amplifier (EGA) and contains the following information:

- Physical description of the EGA
- Functional description of the EGA
- EGA power requirements
- Maintenance philosophy.

1.02 When this section is reissued, the reason(s) for reissue will be listed in this paragraph.

PURPOSE OF ENERGY GATED AMPLIFIER

1.03 The functions of the EGA are to suppress noise and amplification of valid data signals. The EGA is a special purpose amplifier that has been designed as an alternative for the 227D amplifier in a V4 repeater system. This amplifier is intended for use in a private line multipoint data channel suitable for 9600 bit per second data.

1.04 This amplifier is used with voice-grade transmission facilities. The EGA is located at selected inputs of combining bridges in the return path to the master station of a broadcast polling multipoint channel. The EGA is not intended to transmit voice signals and its power requirements differ from those of the 227-type amplifier.

EQUIPMENT CHARACTERISTICS

1.05 The EGA is compatible with V4 telephone repeater equipment. The key component of the amplifier is a charged coupled device which functions as a 3-millisecond analog delay line and is located in the amplifier's transmission path (Fig. 1). This device is used to assure that even the first part of a valid data message will be transmitted.

1.06 When no equalizer is used, the EGA can accept inputs between the −16 dBm and +7 dBm transmission level points (TLP). This input is determined after the equalizer if an equalizer is used. The EGA output is operated at a +7 TLP. Accurate adjustment of the output through the use of the gain adjustment is required when using an EGA. Adjustment procedures are described in Section 332-104-504.

1.07 Transformer T1 is used in conjunction with external wiring connections which can provide an input impedance of 600 ohms ±10 percent or 1200 ohms ±10 percent over a frequency range of 200 Hz

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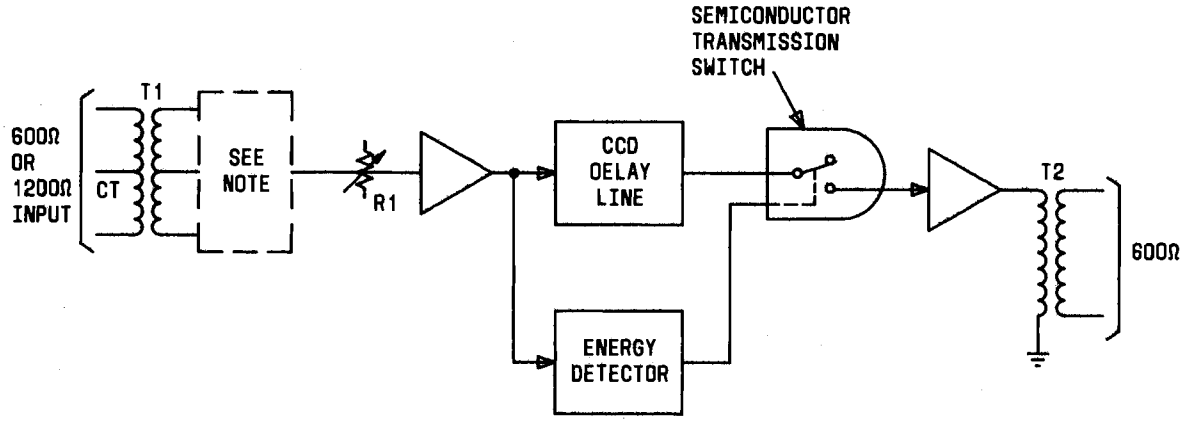

NOTE: DOTTED BOX INDICATES EXTERNAL CIRCUITS WHICH ARE USED TO SET INPUT IMPEDANCE AND TO PROVIDE EQUALIZATION WHEN USED IN THE 1200-OHM CASE.

Fig. 1—Block Diagram of Energy Gated Amplifier

to 3KHz. The circuitry of these external connections are normally completed through a 359-type equalizer. The EGA output impedance is fixed at 600 ohms ±5 percent over a frequency range of 200 Hz to 3KHz. Frequency response of the EGA is within ±0.5 dB of the 1-KHz response when operated between 200 Hz and 3KHz.

1.08 The EGA is capable of delivering a +8 dBm peak signal (+1 dBm0 peak at +7 TLP) into a 600-ohm termination without overloading. Second-order intermodulation products will be at least 60 dB less than the output signal when determined through the use of the standard 4-tone −13 dBm0 test signal and the method contained in Section 332-104-504. Third order intermodulation products will be at least 70 dB less than the output signal when measured in the same manner.

1.09 When the EGA transmission switch is closed, the transmission delay is 3.13 ± 0.05 milliseconds. Envelope delay destortion in the frequency band of 300 Hz to 3 KHz will not be more than 300 microseconds. Envelope delay distortion in the frequency band from 500 Hz to 2800 Hz will not be more than 100 microseconds.

1.10 The peak-to-average ratio (P/AR) for the EGA exceeds 95 P/AR units. The RMS test power level equals −13 dBm0.

1.11 The amplifier noise output is less than 20 dBrnC in a 3-kHz band (flat weighting). This measurement is made with the transmission gate forced to the "ON" condition (amplifier active), the amplifier gain set to +24 dB, and the amplifier input terminated in 600 ohms.

2. PHYSICAL DESCRIPTION

ENERGY GATED AMPLIFIER

2.01 The F-60966 EGA has been designed to be physically similar to the 227D amplifier in order to maximize the compatibility with the V4 system. The orange front panel of the EGA permits rapid identification of the unit. The EGA along with dimensions is shown in Fig. 2

2.02 The front panel of the EGA has a gain adjustment, screw switch and green light emitting diode (LED). The gain adjustment can be varied from minus 2 (counterclockwise position) to a plus 13 (fully clockwise position). The screw switch adds 13 dB of gain to the amplifier when turned out. Together, the screw switch in combination with the gain control establish the gain of the EGA. The green LED on the front panel indicates when a signal is being transmitted through the EGA.

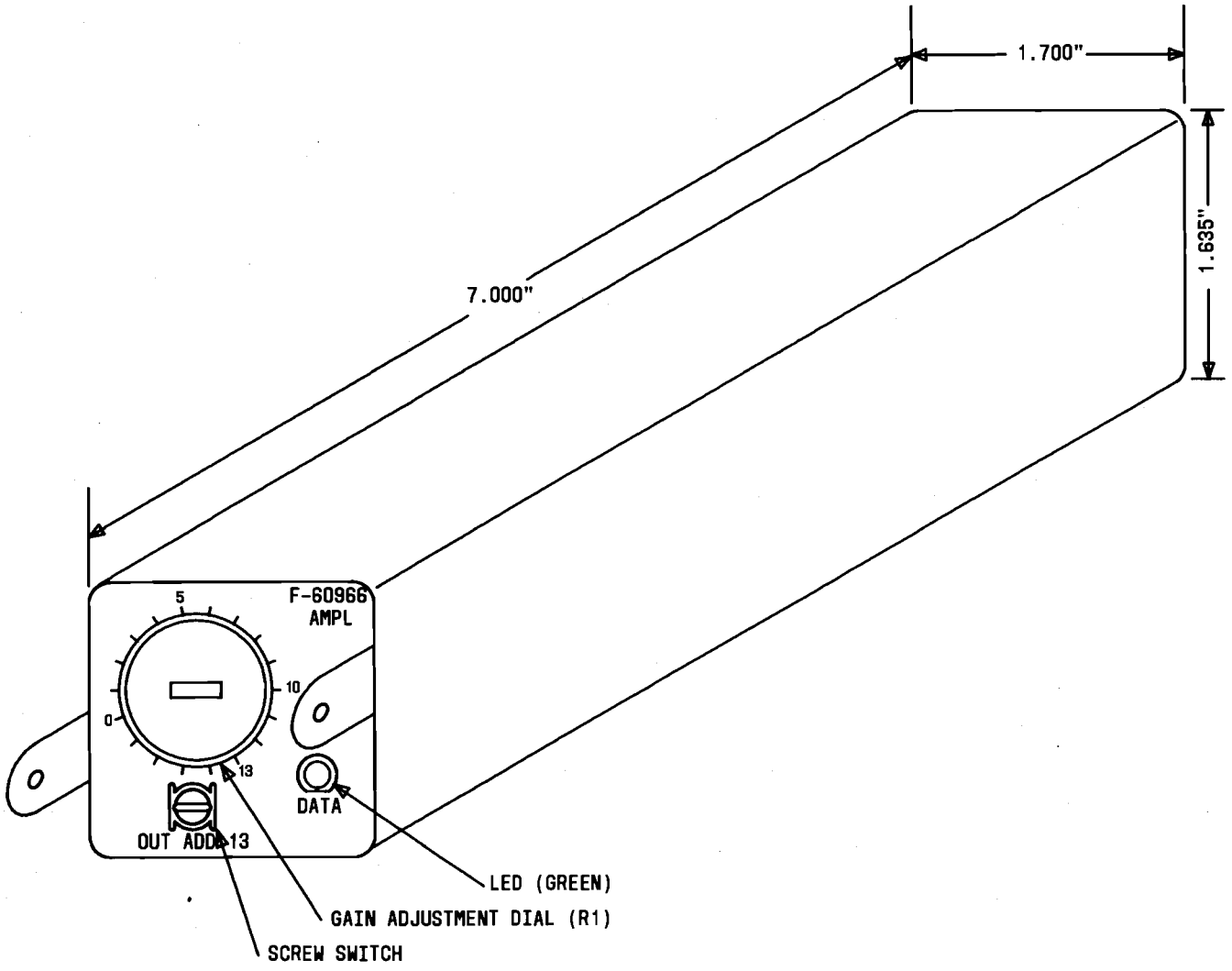

Fig. 2—Energy Gated Amplifier

V4 SYSTEM MOUNTING SHELF ARRANGEMENTS

2.03 The EGA may be mounted on a −24 volt optioned J98615 (227-type) amplifier mounting without any wiring modifications. Since the EGA consumes more power than a 227-type amplifier, a maximum of eight EGAs is allowed on each shelf. See Section 332-104-504 for more detailed information on the installation of the EGA units and the required mounting shelf decals.

2.04 An EGA may also be powered from -48 volts. In this situation, the 1400-ohm resistors that are mounted behind the shelf should each be replaced with two 804AA voltage regulation diodes in series as shown in Fig. 3. The necessary detailed information is presented in Section 302-104-504.

> ***Note:*** The band side (cathode) of the series voltage regulator diode circuit should be connected to pin 14 on the back of the amplifier socket.

2.05 The EGA may also be installed in the center shelf of an ED-2C029-30 (SD-99565-01) −48 volt Voiceband Multiport Split Bridge. This shelf is of the J98615 type and is wired for receiving amplifiers. When the J98615 mounting in the ED-2C029-30 bridge is to be converted to permit EGA's, the conversion rules differ from those for the stand alone

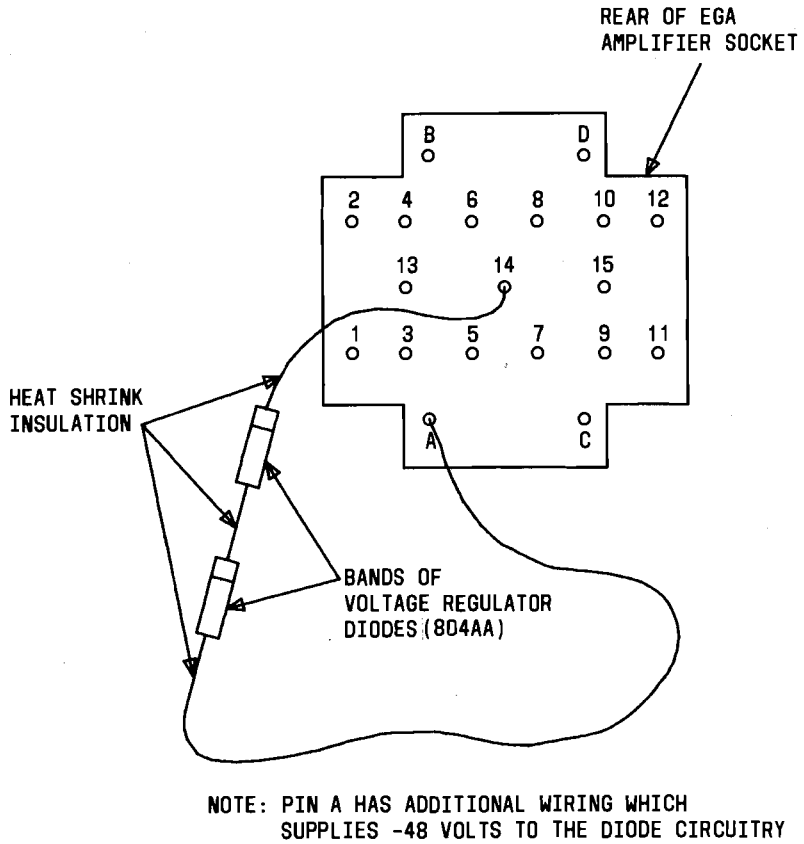

Fig. 3—Regular Diodes as Seen From Rear of −48 Volt Shelf

case (paragraph 2.04). In particular, any combination of EGA's, 227D amplifiers, and 849 networks required by proper channel design may be used. No deloading of the shelf is required because of the increased power dissipation. Substitution of voltage regulator diodes for the 1400-ohm resistors is again required. See Section 332-104-504 for conversion information.

3. FUNCTIONAL DESCRIPTION

3.01 Data signals and/or noise present at the input of the EGA will pass through the first amplifier and be applied to both the charge coupled device (CCD) delay line and the energy detector. The signal and/or noise in the delay line path reaches the transmission switch approximately 3 milliseconds after it has entered the delay line. The transmission switch is controlled by the energy detector. The transmission switch, therefore, either passes or blocks the signal and/or noise, dependent on the output of the energy detector.

3.02 Valid data signals are normally transmitted at −13 dBm0. If a data signal stronger than −31 dBm0 appears at the input of the EGA, the energy gate will close the transmission switch in less than 3 milliseconds, before any portion of the signal has reached the output of the delay line. The data signal then passes through the transmission switch and the second amplifier. This signal will then appear at the EGA output. Because of the fixed 3-millisecond delay in the delay line, the leading edge of the data signal is not lost. Observe that this 3-millisecond delay appears in the transmission path. The closing speed of the switch is proportional to the signal level. This, however, does not affect the transmission path since switch closure normally occurs before the leading edge of the data signal reaches the output of the delay line. When the transmission switch is closed, any noise which may be mixed in with the signal is also passed by the EGA.

3.03 The removal of the data signal (optional) from the input to the EGA causes the energy detec-

tor to open the transmission switch in 4.8 to 9.0 milliseconds. This delayed opening allows time for the last part of the data to pass through the delay line and transmission switch before the switch opens. Noise is blocked after the switch opens.

3.04 Noise power at the input to the EGA should be less than 48 dBrnC0. White noise having a power of 48 dBrnC0 or less in a 3-kHz band will not close the transmission switch. The transmission switch will be opened unless there have been data signals in the last few milliseconds. The open transmission switch inserts at leasts 40 dB of added attenuation in the transmission path for all frequencies in the 200-Hz to 3-kHz frequency range.

3.05 Without EGA's, circuit noise appearing at all inputs of the combining bridge will be summed in the bridge. This summing effect causes the bridge output to be noisier than any single input. When EGA's are used at the bridge's inputs, frequently only one EGA will be receiving valid data. If input noise levels are satisfactory, the transmission switches in the other EGA's will be opened and they will not supply noise to the bridge. The result, when EGA's are used, is that the bridge output will be no noisier than the single bridge input circuit that is receiving valid data.

3.06 The green LED is lighted when the transmission gate is closed. The operation of the green LED is helpful in diagnosing improper channel alignment, data streaming, singing, excessive channel noise, open circuits, and other similar conditions. Additional information is included in BSP 332-104-504.

4. POWER

4.01 The input voltage required to power the EGA is 20 to 30 volts dc. The EGA may be powered from the 48-volt office battery as described in paragraph 2.04 but a pair of voltage regulator diodes (804AA) connected in series with the banded end connected to pin 14, must be used to replace each 1400 ohm resistor that is mounted behind the shelf (Fig. 3).

4.02 Current consumption for the EGA is 30 to 50 milliamperes. Typical current for the EGA is 40 milliamperes.

5. MAINTENANCE

5.01 There is no routine maintenance required for the F-60966 EGA. If one of the repeaters is determined to be faulty, it should be removed from service and replaced by a spare. The defective unit should be returned to a Western Electric Service Center for repair.

6. REFERENCES

6.01 The following references contain additional informaion on the F-60966 EGA.

SECTION	TITLE
332-104-100	V4 Telephone Repeater
332-104-504	V4 Telephone Repeaters Energy Gated Amplifier (F-60966) Installation and Test