

13G1 ONE-WAY REPEATER (J70107)

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1. GENERAL

1.01 This section gives the operating principles and a description of the circuit and the equipment for the 13G1 one-way repeater for use in No. 2 and 9B telegraph serviceboard offices and for use in telegraph testboard offices. It is used as a line repeater or as a loop repeater. The 13H1 repeater is rated "Mfr Disc." Existing 13H1 units in the field may be modified for serviceboard applications only, to look like 13G1 repeaters. This modification omits all apparatus not required for serviceboard applications.

1.02 This section is reissued to show means for operating the 13G1 repeater with one-way parallel-polar loops and with full-duplex direct-leg loops in serviceboard offices. It also provides a neutral-to-hub conversion circuit for a 43A1 channel terminal in connection with a 144A1 coupling unit.

1.03 The 13G1 repeater consists of one polar relay and associated apparatus with provision for optional connections for polar, neutral or open-and-close transmission for sending and for receiving.

1.04 With polar operation, there is a reversal of current in the line or loop for marking and for spacing. With neutral operation (some-

times called effective polar) and also with open-and-close operation, there is current for marking and no current for spacing. In the case of neutral operation, there is no current for spacing because there is ground or like polarities at both ends of the line or loop circuit and the circuit is not electrically open. With open-and-close operation, during the spacing condition, the circuit is electrically open.

1.05 In No. 2 and 9B serviceboard offices, 13G1 repeaters are used in combination with 144B1 coupling units to interconnect lines or loops with serviceboard hub circuits. Also in these offices, two 13G1 repeaters in combination with two 144A1 coupling units are employed to form a concentration group repeater. Two 13G1 repeaters are also used for full-duplex direct-leg operation. In addition, the 13G1 repeater is employed for one-way .010 amp. parallel-polar loops. To provide a neutral-to-hub conversion circuit for a 43A1 channel terminal, two 13G1 repeaters and a 144A1 coupling are required.

1.06 In telegraph offices, the 13G1 repeater has three applications. One is with 144B1 and 144B2 coupling units for electronic regeneration circuits using No. 2 and 9B serviceboard hub circuits. The second is for one-way line or loop operation equivalent to services now performed by other one-way 13-type repeaters, and the third is for operating one-way .010 amp. parallel-polar loops from a line repeater.

1.07 A new line noise suppression unit is used with the 13G1 repeater. A potentiometer for adjusting line current is furnished as part of the noise suppression unit. The 13G1 repeater replaces the 13F1 for use in telegraph testboard offices. The 13F1 repeater is being retained as standard for use in No. 1 serviceboard offices only.

2. BASIC OPERATING FEATURES

2.01 Polar transmission requires the application of polar voltages; that is, positive and negative polarities at the contacts of the sending repeater and a bias winding for the receiving relay is not employed. Polar operation may be metallic or ground return. For ground return, one winding is employed and it is connected directly to ground and poled for negative marking at the sending point. For metallic return operation, both windings are used and they are connected series aiding and poled optionally for negative mark or positive mark. For polar operation, the receiving current should be within the range of about .010 to .035 amperes. The basic circuit for receiving polar with ground or metallic return is shown in Fig. 1.

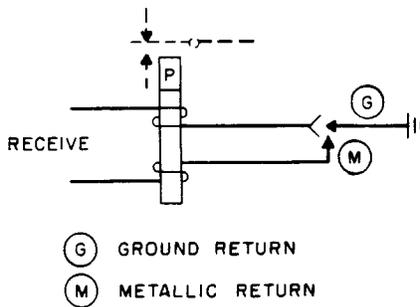


Fig. 1

2.02 Polar sending from the 13G1 repeater employs positive or negative 130 volts for marking, and negative or positive 130 volts for

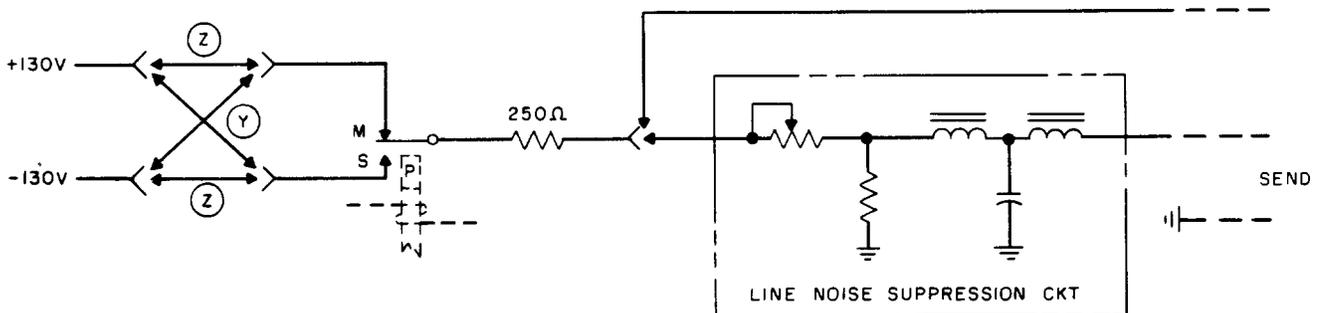


Fig. 2

spacing, respectively. Ground or metallic return may be employed and the use of a line noise suppression unit is optional. This form of transmission is shown in Fig. 2. Polar voltages are also transmitted for neutral operation and for effective polar operation.

2.03 In the case of open-and-close sending, as shown in Fig. 3, the contacts of the repeater open or close a .0625 amp. loop. This makes use of a flow of current in the line for the closed or marking condition and zero current for the open or spacing condition. In some cases, battery or ground may be connected to one of the contacts.

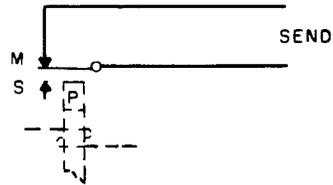


Fig. 3

2.04 In both neutral or open-and-close operation with a line current of .0625 amp., the relay has .03125 amp. spacing bias current. With the arrangement as shown in Fig. 4, the transmitting repeater must send either open-and-close or neutral whereas in Fig. 5 the transmitting repeater must send either polar or open-and-close to battery.

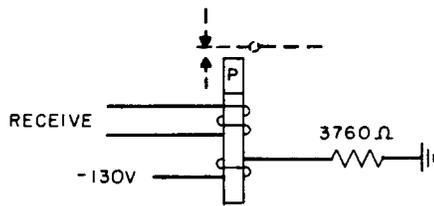


Fig. 4

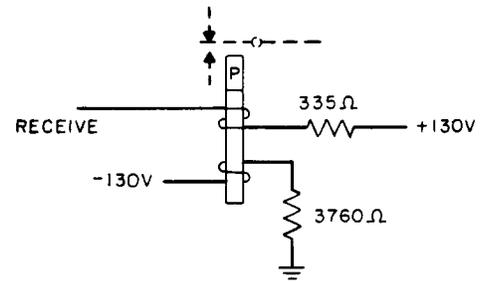
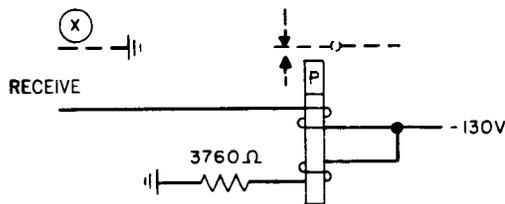


Fig. 6



(X) OPEN-AND-CLOSE, OPTIONAL

Fig. 5

2.05 When the 13G1 repeater is connected for sending to a 144B1 or a 144B2 coupling unit, the marking potential is positive 130 volts and the spacing potential is negative 130 volts. When receiving from a 144B1 or 144B2 coupling unit, the operation is .0625 amp. open-and-close with positive 130 volts supplied through the line winding of the repeater to serve as plate battery for the output tube in the 144B1 unit. In this case, a bias current of .03125 amp. is required. The basic circuit for receiving from a 144B1 or 144B2 unit is shown in Fig. 6.

2.06 The concentration group repeater arrangement requires positive 130 volts for mark and negative 130 volts for space on the contacts of the 13G1 repeater sending to a coupling unit, and the coupling unit in turn "drives" the other 13G1 repeater on a polar basis with approximately .0075 amp. for mark and .0075 amp. for

space. As mentioned in Par. 1.05, two repeaters and two coupling units are required for a concentration group repeating arrangement.

2.07 Two 13G1 repeaters may be used for interconnecting a neutral type 43A1 channel terminal and a 144A1 coupling unit to provide a neutral-to-hub conversion circuit in a No. 2 and 9B serviceboard as shown in Fig. 17. When transmission is from the associated 43A1 channel terminal toward the coupling unit, a marking current of .0625 amp. is furnished for the "A" repeater relay from +130-volt telegraph battery through winding 3-6, R6 resistor and via the RL lead to the receiving output tubes of the channel terminal. When a space is received from the channel terminal, no current flows through the winding 3-6, but bias current of .03125 amp. flows from +130 volt battery through the 2-7 winding and R4 resistor to ground, and operates the relay to its spacing contacts. The resulting polar voltages (+130 volts for mark and -130 volts for space) on the armature of the relay are sent via the R lead to the 144A1 coupling unit. When transmission is from the 144A1 coupling unit, both relay windings of the "B" repeater are operated by a .007 amp. polar current supplied by the coupling unit. The +130 volt marking potential on the relay armature is divided by R6 resistor and the 1000-ohm battery tap so that -75 volts are applied via the SL lead to the send control tube of the 43A1 channel terminal. When a spacing signal is transmitted, a -130 volt potential is applied to the SL lead.

2.08 The 13G1 repeater can be arranged for receiving from a relay-type line repeater and sending to parallel-polar, .010 amp. one-way loops as shown in Fig. 18. Since the line repeater sends +130 volts for mark and -130 volts for space, the current through R6 resistor, winding 3-6, and R4 resistor to ground is .019 amp. polar. To operate the parallel-polar loops, -130 volts for mark and +130 volts for space are required. A maximum of ten one-way station loops, each associated with a loop pad and a relay-operated teletypewriter, can be operated from a single 13G1 repeater. The .010 amp. loop current in each loop is adjusted by means of the loop pad rheostats.

2.09 Two 13G1 repeaters may be connected between a relay-type line repeater and a full-duplex loop in a No. 2 and 9B serviceboard as shown in Fig. 19. When modified for serviceboard operation, the line repeater sends +130 volts for mark and -130 volts for space. This polar voltage applied to repeater "A" results in a polar current through R6 resistor, winding 3-6, and R4 resistor to ground. The armature connects to -130 volts for mark and +130 volts for space in order to send neutral, .0625 amp. signals to the receive loop. When repeater "B" is receiving from the send loop and is sending to the line repeater, a marking current of .0625 amp., as determined by adjustment of the send loop pad, flows through winding 3-6 to -130 volt battery. In this case, a .03125 amp. bias current is required. The send relay of the line repeater is operated by a polar current of .015 amp. by the armature via the R2 and R8 resistors.

3. DESCRIPTION OF CIRCUIT AND TYPICAL CONNECTIONS

3.01 The circuit of the 13G1 repeater consists of one 314A polar relay without external contact networks. For polar operation, ground return, either the 2-7 winding or the 3-6 winding of the relay is used, and for metallic return the 3-6 and 2-7 winding is used. For open-and-close or neutral operation which requires a bias winding, loop pads located on loop pad bays are used for adjusting line current for cases (either lines or loops) where the line

noise suppression unit and its associated line potentiometer is not employed. In cases where transmission from the 13G1 repeater causes interference to other circuits, the line noise suppression unit may be used with a loop to a station. For one-way .010 amp. parallel-polar loop operation, the line noise suppression unit should not be used to prevent excessive wear of the relay contacts.

3.02 The following Table I is a list of typical applications for the 13G1 repeater. This table includes references to the attached figures which show schematically the strapping of the contacts and the windings of the repeater for the option illustrated.

TABLE I

CIRCUIT ARRANGEMENT	FIG. NO.
Receiving Polar Ground Return and Sending Polar	Fig. 7
Receiving Polar Ground Return and Sending Open-and-Close	Fig. 8
Receiving Neutral or Effective Polar and Sending Polar	Fig. 9
Receiving Neutral, Effective Polar or Open-and-Close, and Sending Open-and-Close	Fig. 10
Receiving Polar Metallic Return and Sending Polar	Fig. 11
Receiving Polar Metallic Return and Sending Open-and-Close	Fig. 12
Receiving Neutral or Polar and Sending Polar	Fig. 13
Receiving Neutral or Polar and Sending Open-and-Close	Fig. 14
Receiving from a 144B1 or 144B2 Coupling Unit and Sending Polar	Fig. 15
Concentration Group Repeater Arrangement	Fig. 16
Two Repeaters Arranged for Neutral-to-Hub Conversion	Fig. 17
One-way, Parallel-Polar Loop Operation	Fig. 18
Two Repeaters Arranged for Full-Duplex Direct Leg Operation	Fig. 19

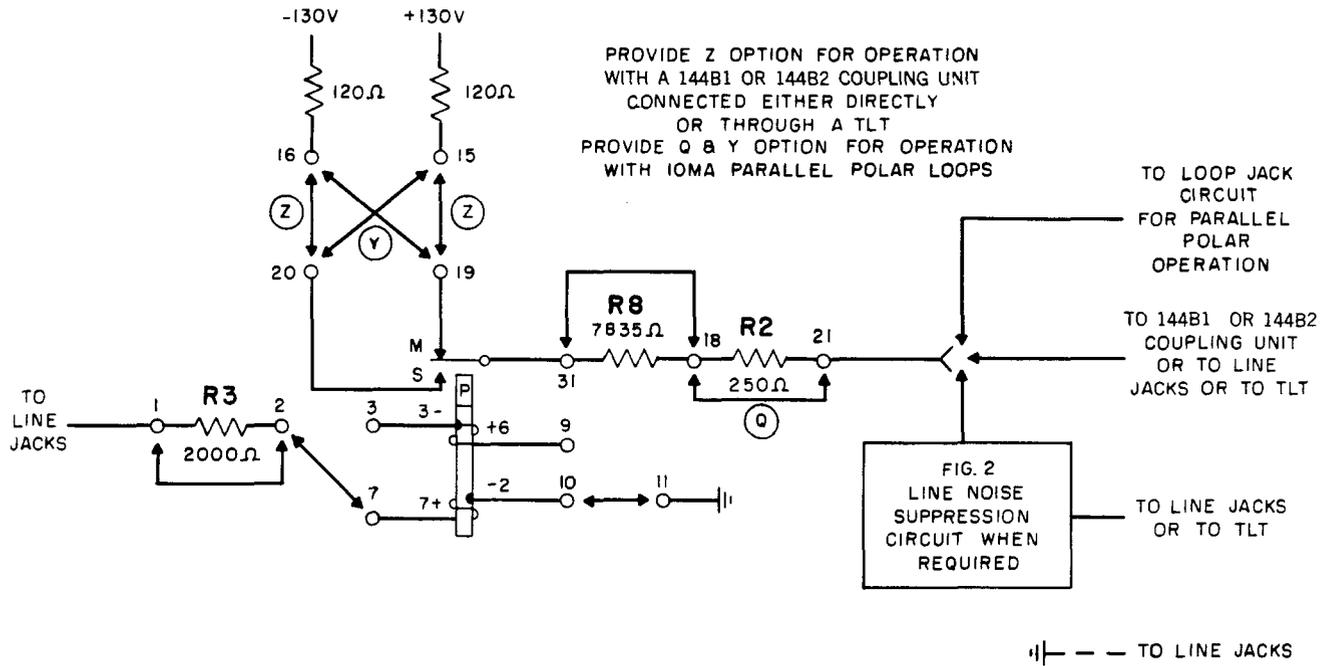


Fig. 7 - Receiving Polar Ground Return and Sending Polar

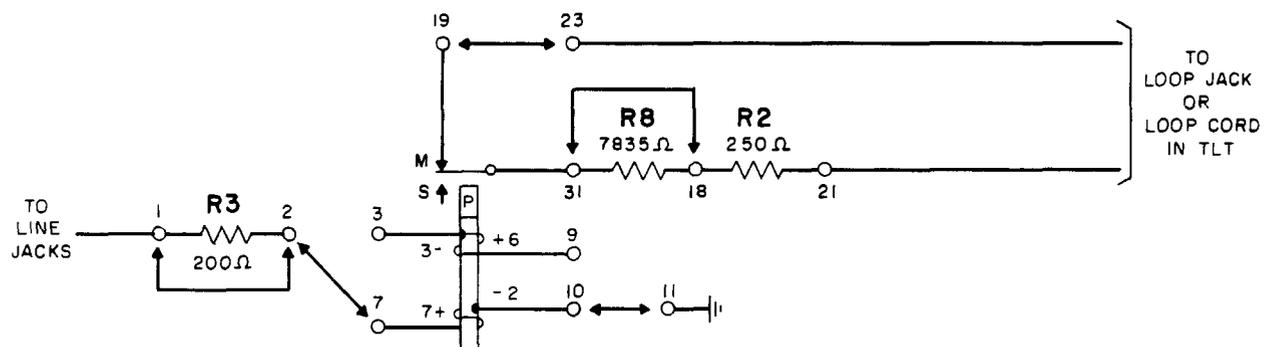


Fig. 8 - Receiving Polar Ground Return and Sending Open-and-Close

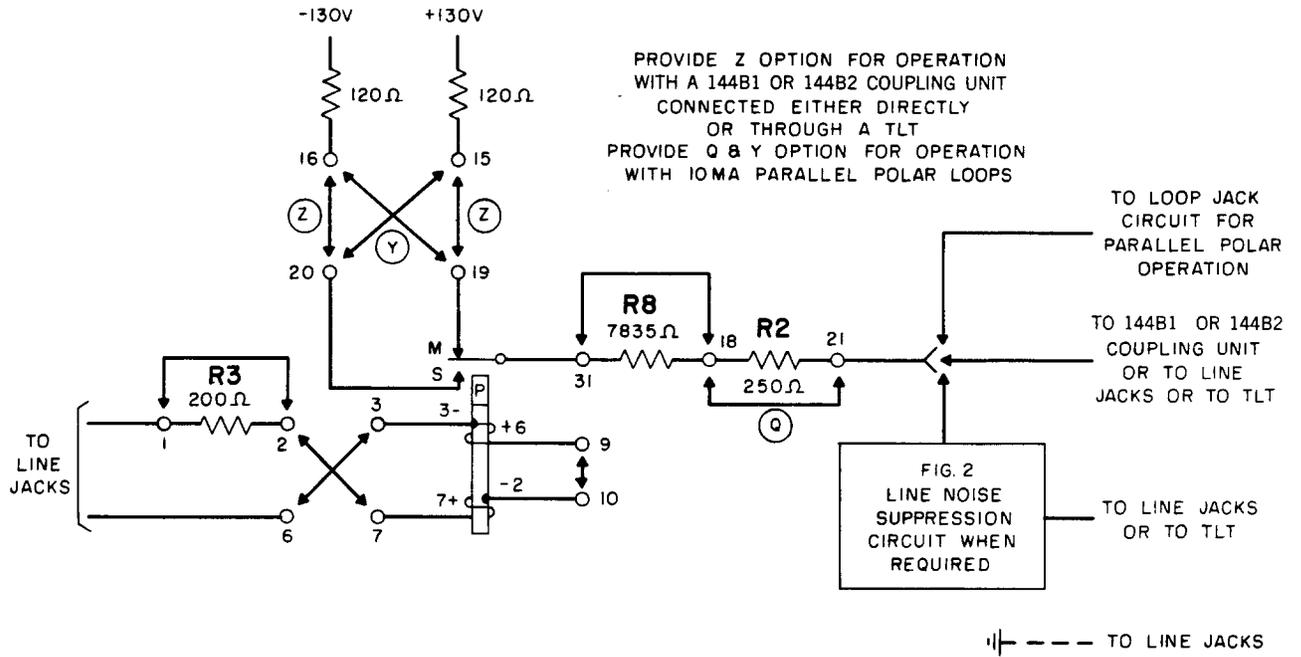


Fig. 11 - Receiving Polar Metallic Return and Sending Polar

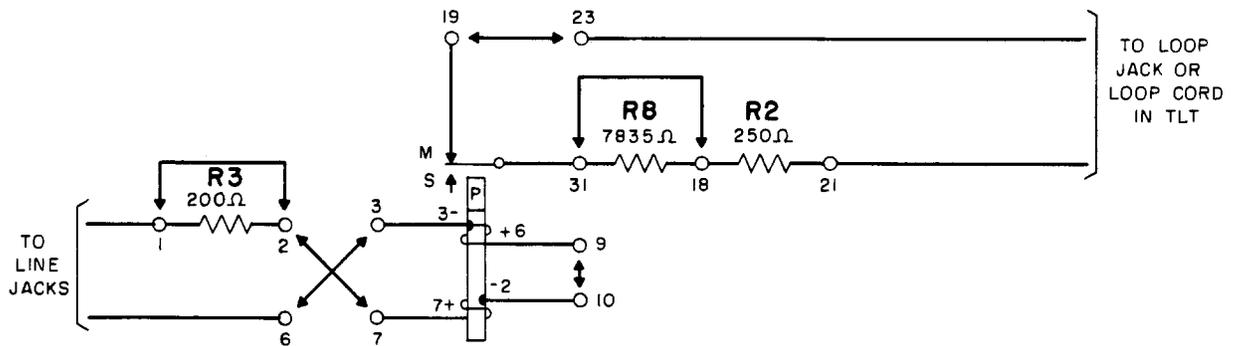


Fig. 12 - Receiving Polar Metallic Return and Sending Open-and-Close

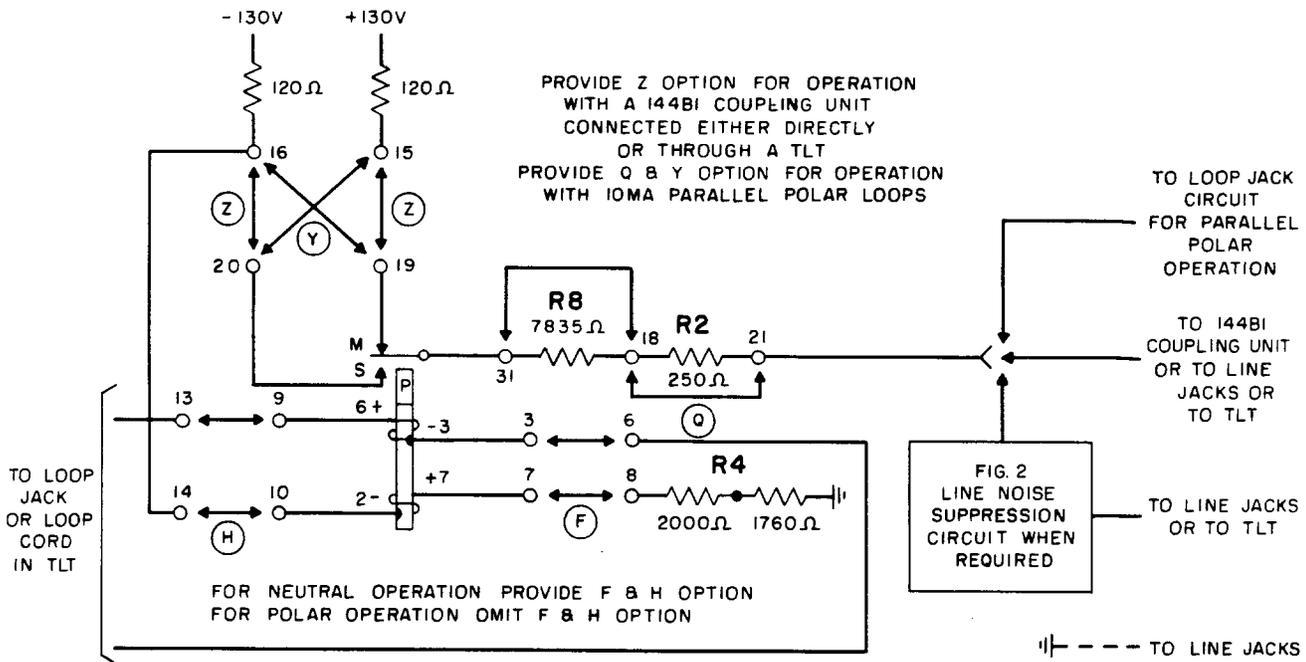


Fig. 13 - Receiving Neutral or Polar and Sending Polar

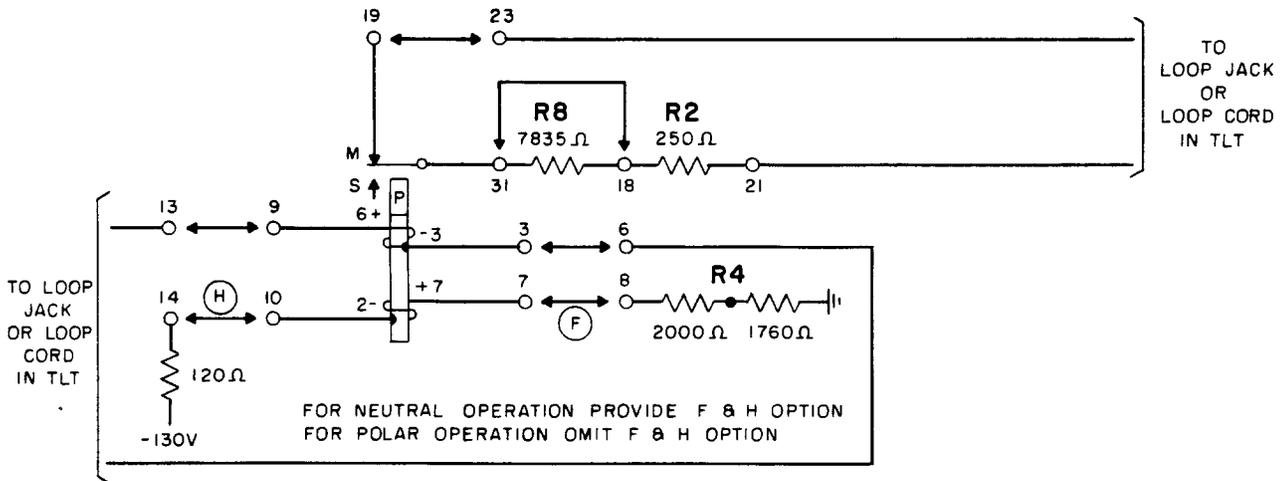


Fig. 14 - Receiving Neutral or Polar and Sending Open-and-Close

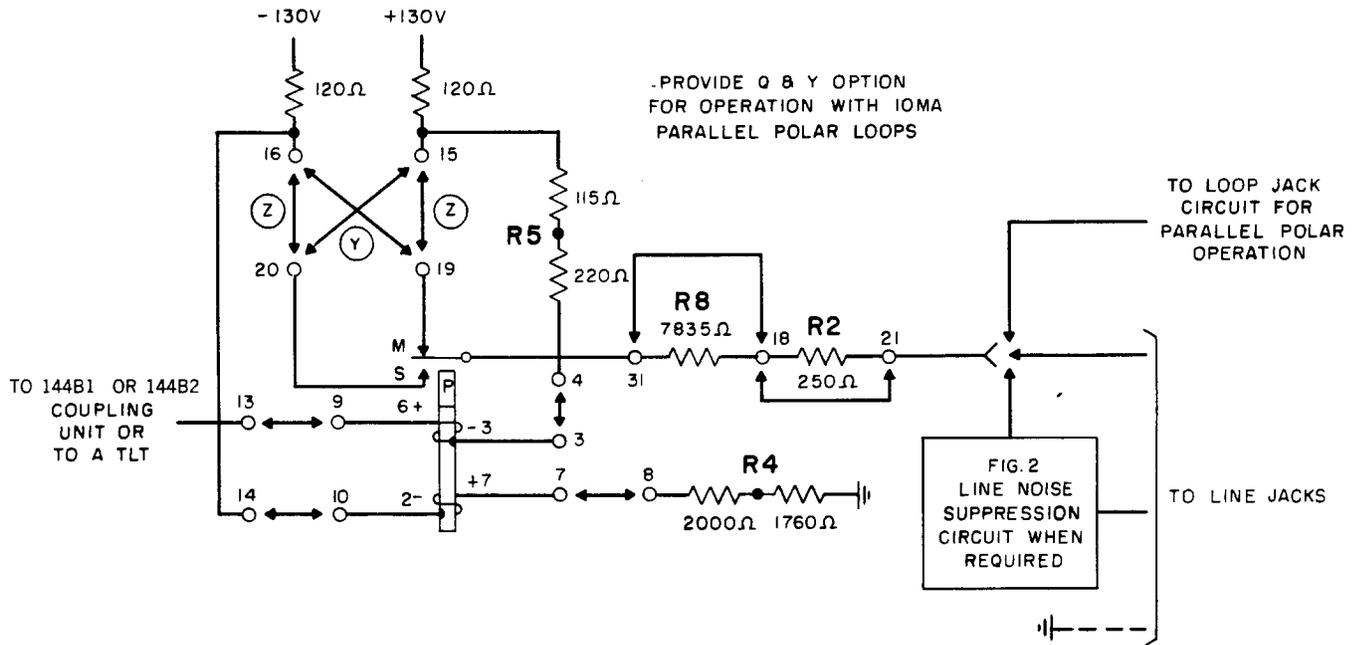


Fig. 15 - Receiving from a 144B1 or 144B2 Coupling Unit and Sending Polar

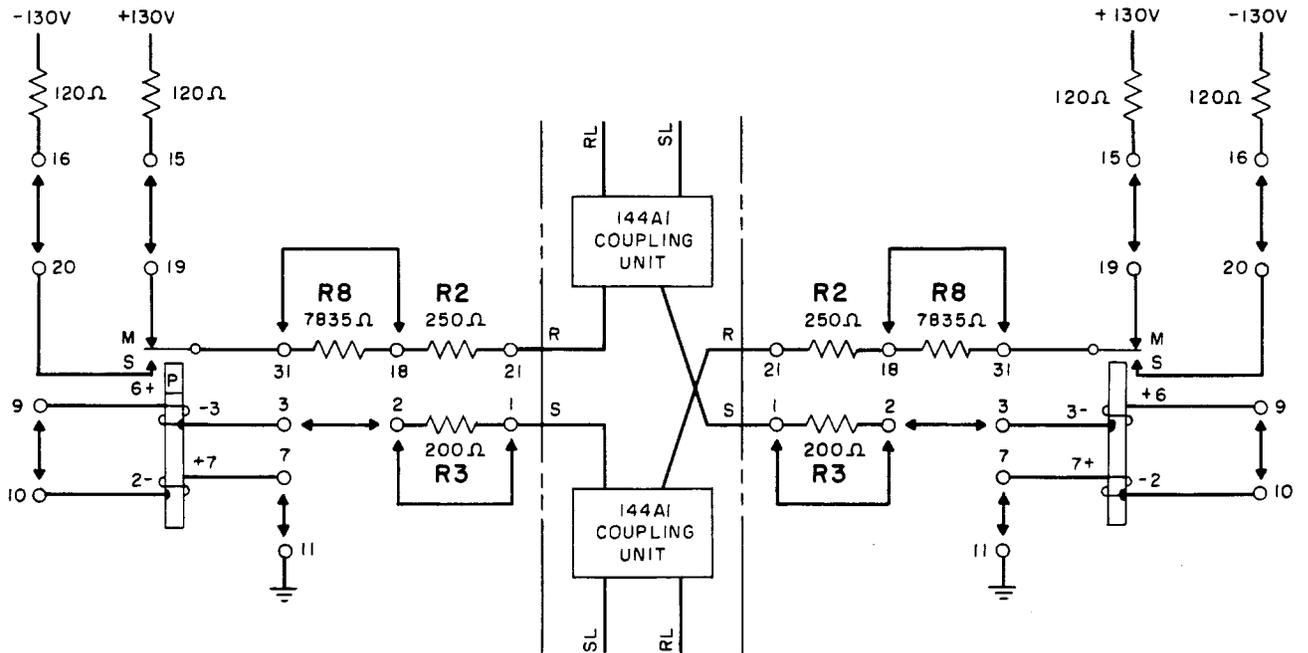


Fig. 16 - Concentration Group Repeater Arrangement

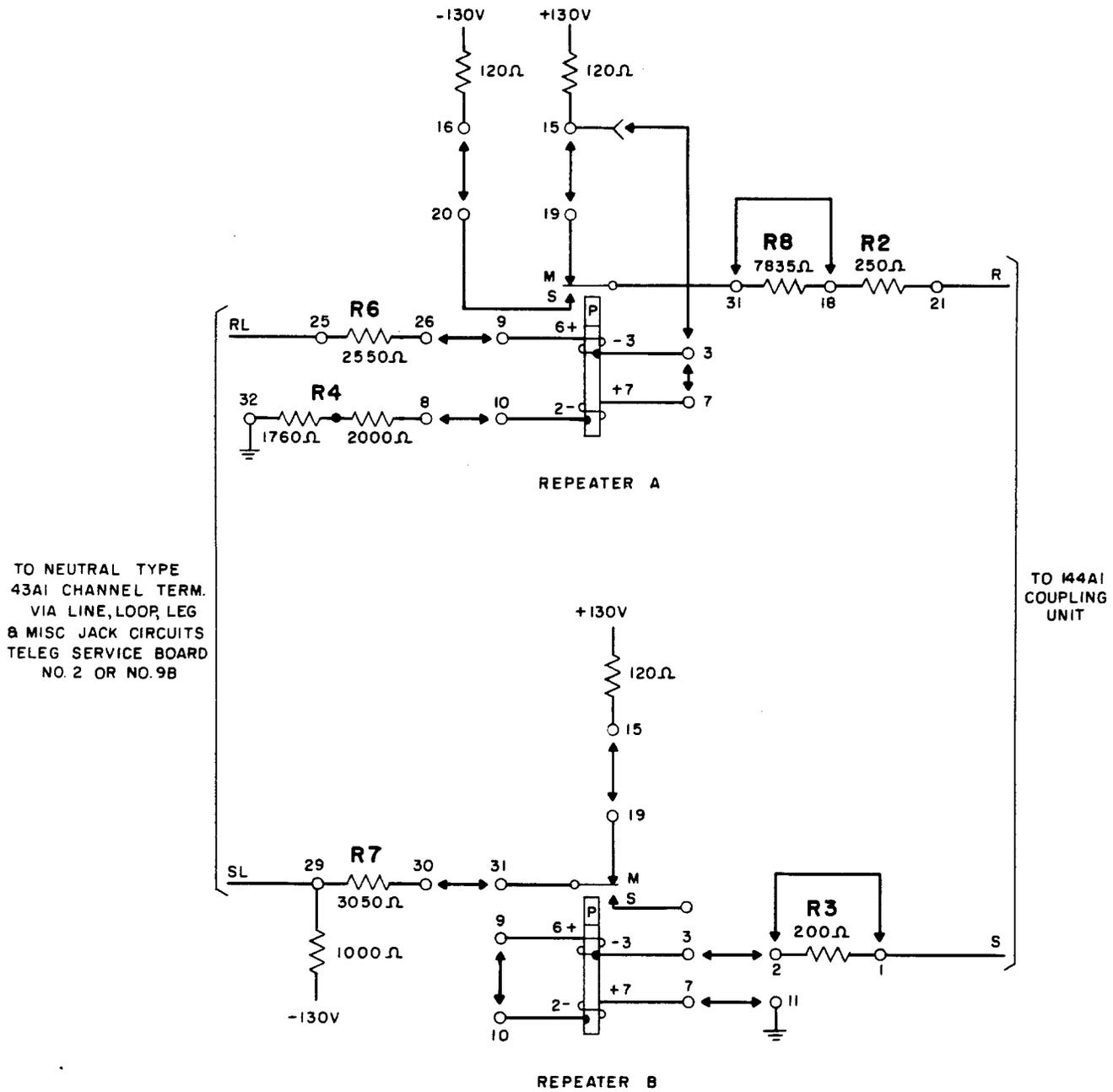


Fig. 17 - Two Repeaters Arranged for Neutral-to-Hub Conversion

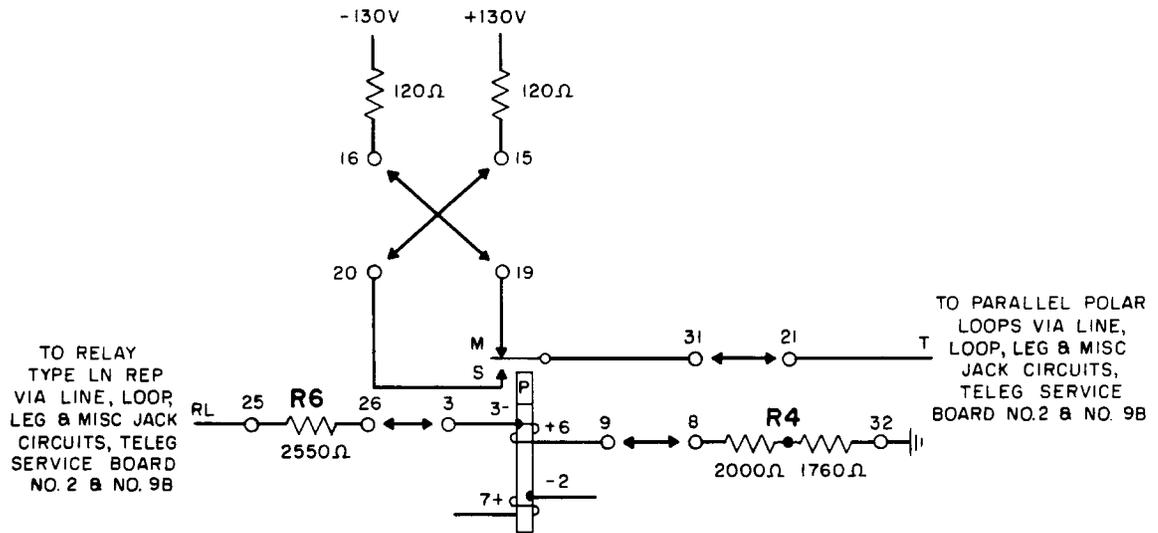


Fig. 18 - One-way, Parallel-Polar Loop Operation

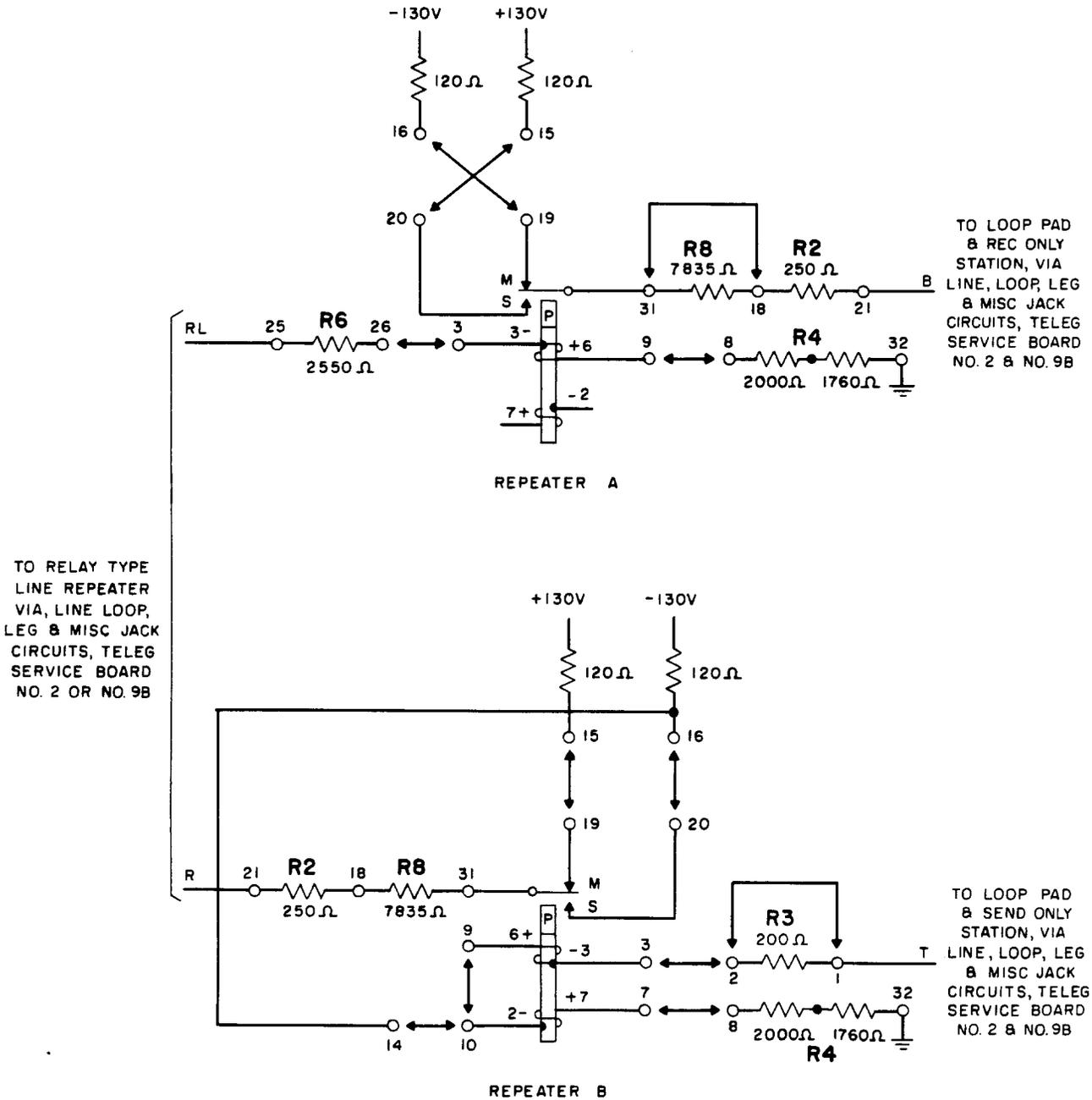


Fig. 19 - Two Repeaters Arranged for Full-Duplex Direct Leg Operation

4. LINE NOISE SUPPRESSION UNIT

4.01 The line noise suppression unit consists of a 2500-ohm potentiometer for adjusting line current, two 307E inductors, a 4 μ f capacitor to serve as a low-pass filter to suppress the high-frequency components of telegraph signal, and a resistance of 1350 ohms connected to ground on the relay armature side of the filter to reduce the voltage applied to the line. A jack (LM) with an associated resistance is supplied to provide means for measuring line current with the meter in a 163A2 test unit.

5. OPERATING LIMITS AND ADJUSTMENTS

5.01 The operating limits for the 13G1 repeater are determined largely by the components of the overall circuit in which it operates. A marking current of .0625 amp. is required for each circuit arrangement requiring the use of a spacing bias winding on the relay. The limits for polar operation are the same as now used throughout the plant. For operation with the

144B1 and 144B2 coupling units, the circuit components are fixed.

5.02 No adjustments are required in the 13G1 repeater other than the proper adjustment of the line potentiometer for the proper line current.

5.03 The circuit is arranged for the desired operating option by simple strapping at the terminal strip on the unit.

6. DESCRIPTION OF EQUIPMENT

6.01 The 13G1 one-way repeater and the line noise suppression equipment are supplied as shop-wired units and each occupy two 1-3/4 inch mounting plates on a 19-inch relay rack.

6.02 The repeater and the line noise suppression unit are furnished in all cases as two circuit units without option.

7. REFERENCE INFORMATION

Circuit Schematic, 13G1 Repeater SD-70633-01