

COMMON SYSTEMS
SIGNALING
TWO WAY REPEATER CIRCUIT
FOR CIVIL AIR RAID WARNING
SYSTEM
BALANCED LOOP

CHANGES

B. CHANGES IN APPARATUS

- B.1 Replaced Replaced By
1-18EB Resistance (N) 1-19CE re-
-sistance (N)

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 The (N) resistance was formerly an 18EB. The 19 type resistance is used to provide a shunt path to battery or ground from the (R) relay armature for wave shaping purposes.
- D.2 The battery and ground connections to the (B) resistance were formerly shown permanently connected as "Y" option.
- D.3 The connecting information on the A1 and A2 leads is revised.
- D.4 Information previously omitted from the circuit requirements table is added.

All other headings under changes, no change.

1. PURPOSE OF CIRCUIT

- 1.1 This circuit is designed for repeating dial pulses in a civil air raid warning network connecting control points and code sending offices.

2. WORKING LIMITS

- 2.1 Non-composited operation on an exchange area cable.
- 2.11 The maximum conductor loop resistance between two units shall not exceed 1500 ohms.
- 2.12 The maximum length of conductor between two repeaters shall not exceed 15 miles.
- 2.2 Operation on composited circuits.
- 2.21 This circuit will operate over composited side or composited phantom circuits of #16 gauge or #19 gauge cable equipped with type E or type C terminal composite sets with or without one intermediate type E bypass set.

2.22 The maximum overall length of line between repeaters is 50 miles of cable when the side circuit is composited or 100 miles of cable when the phantom circuit is composited. The maximum conductor loop resistance of the signaling path is 5000 ohms.

2.3 Operation on composited open wire circuits.

2.31 This circuit will operate over composited open wire circuits equipped with type C terminal composite sets. Composited side or compositeu phantom circuits may be used.

2.32 The maximum overall length of composited open wire line between repeaters is 100 miles, with maximum leakage of 200,000 ohms per mile.

2.33 One mile of #19 gauge cable may be substituted for each two miles of open wire lines.

3. FUNCTIONS

- 3.1 Signals received on the "S" or "S1" lead are retransmitted through the "L1" lead over a line or loop circuit to a similar repeater at the distant end of the line or loop.
- 3.2 The "S" lead of one repeater may be connected to the "S1" lead of a similar repeater in the same office.
- 3.3 Signals may be transmitted in either direction over the circuit.
- 3.4 Earth potentials and interference are neutralized by the symmetrical arrangement of an operating circuit and a neutralizing circuit.
- 3.5 Battery potential differences in the offices at the ends of a line circuit are minimized by the potentials applied to the neutralizing wire.

4. CONNECTING CIRCUITS

When this drawing is listed on a keysheet the connecting information thereon is to be followed.

- 4.1 Two Way Repeater Circuit - Open and closed Loop - SD-95682-01.

- 4.2 Miscellaneous Circuits - SD-95683-01.
- 4.3 Code Distributing Circuit - SD-95678-01.
- 4.4 Application Schematic - SD-95684-01.
- 4.5 Repeat Coil Circuit - SD-96452-01.
- 4.6 Type "C" Composite Set - SD-56166-01.
- 4.7 V3 Application Schematic - SD-95144-01.

DESCRIPTION OF OPERATION

5. GENERAL

5.1 This circuit terminates a line or loop circuit connecting two central offices. When the central offices are within the same local exchange area a simple balancing arrangement shown in Fig. 3 is provided. When Fig. 3 is used the balancing network is fixed and the circuit is adjusted by means of line resistances shown in Fig. 2. These circuits do not require composite sets.

5.2 When circuits longer than 15 miles of #19 gauge cable are required composited operation is necessary. When composited line facilities are required, an adjustable balancing network must be provided. This network is shown on the application schematic for the Civil Air Raid Warning System. When composited line facilities are required, an adjustable balancing network must be provided. This network is shown on the application schematic for civil air raid warning system.

6. RELAY CIRCUIT (Fig. 1)

6.1 The (R) relay had quadded windings which are used in pairs. Terminal 2 is the apex of the 2-4 and 2-3 windings. Terminal 7 is the apex of the 7-1 and 7-8 windings. Winding 2-3 is connected in series with the operating wires. Winding 7-1 is connected in series with the neutralizing wire. Windings 2-4 and 7-8 are the balancing windings for the 2-3 and 7-1 windings respectively. Resistance (B) is a potentiometer which applies -24 volts to apex terminal 7. Apex terminal 2 is connected through the (A) resistance to a pole changing contact on the (S) relay.

6.2 In the normal condition current flows through the "S" or "S1" lead and the 1-6 winding of the (S) relay and a contact of the (R) relay to ground or -48 volt battery. This current holds the (S) relay closed to

the No. 4 contact when the repeater is wired for "X" option or the No. 3 contact when the repeater is wired with the "Y" option. The repeater connected at one end of a line will be wired with "X" option and the repeater at the far end of the line will be wired with "Y" option.

6.3 Since the (S) relay at one end of the line applies ground through the apex terminal 2 to the line and the repeater at the distant end applies -48 volt through the apex terminal 2 to the line current will flow in the line conductor during the normal condition. In case the line circuit is opened the (R) relays in the repeaters at both ends of the line will operate and an indication of trouble will be registered. If the line circuit is grounded the indication will only appear at the repeater transmitting ground.

6.4 When the line circuit is opened and the (R) relay operates the current through the (A) relay is reduced to zero and after a short interval the (A) relay will release. This interval is of sufficient length to prevent the release of the (A) relay during the transmission of dial pulses. When the (A) relay releases it sectionalizes the line by terminating it in both directions at the repeater. This prevents an open line from disabling the system and reestablishes the circuit in parts which can be individually controlled.

7. NEUTRALIZATION AND BATTERY COMPENSATION

7.1 The neutralizing wire is connected to the (R) relay winding circuit in a manner identical to the operating wire except that the windings are reversed. Therefore d-c or a-c earth potentials or other longitudinal interference is canceled out.

7.2 The potential applied to the apex of the neutralizing circuit from the midpoint of the "B" resistance partially compensates for battery variation in the central offices at the two ends of the line circuit.

8. "Z" OPTION

When the "T" and "R" leads are connected to a trunk through repeating coil windings and are shunted by a 4 mf condenser the "Z" option is provided to prevent kick off of the (R) relay when

signals are sent from the repeater circuit to the trunk.

9. TESTING RELAYS

The (TST S) jack is provided for testing and adjusting the (S) relay.

Current flow tests may be made as indicated in the circuit requirements table.

The (TST R) jack is provided for testing and adjusting the (R) relay. Current flow tests may be made as indicated in the circuit requirements table.

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