

COMMON SYSTEMS  
SIGNALING  
SIGNAL LEAD EXTENSION CIRCUIT  
FOR EXTENDING E AND M LEADS  
FROM SIGNALING CIRCUITSSECTION I - GENERAL DESCRIPTION1. PURPOSE OF CIRCUIT

1.01 This circuit is designed for use with a DX signaling circuit to interconnect a signaling circuit and a trunk circuit when the distance between them is too great to connect them directly through the E&M leads.

SECTION II - DETAILED DESCRIPTION1. GENERAL

1.01 When the conductors between a trunk circuit and a signaling circuit exceed the allowable resistance for the proper operation of either circuit, it is necessary to use a signal lead extension circuit at the signaling circuit end of the conductors and either a signal lead extension circuit or a DX signaling circuit at the trunk circuit end.

1.02 This signal lead extension circuit is associated with a CX Signaling Circuit or a single-frequency signaling circuit.

1.03 The R relay has 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 wire. Winding 7-1 is in series with the neutralizing wire. Winding 2-4 and 7-8 are the balancing windings for the 2-3 and 7-1 windings, respectively. Resistor B is a potentiometer which applies -19.2 volts for 48-volt office battery to apex terminal 7. Apex terminal 2 is connected through the A resistor to a pole-changing device in the trunk or signaling circuit.

1.04 In the normal released condition, the E lead from the signaling circuit is open, the S relay is released, and ground is applied to the apex (terminal 2) through contact 5 of the S relay. Current will flow through the 2-4 and 7-8 windings of the R relay. This current causes the R relay to be operated to contact 6. With the relays thus operated, ground is connected over the M lead to the signaling circuit.

1.05 The R relay at the trunk circuit end responds to changes from ground sent by the S relay.

1.06 The R relay at the signaling circuit end responds to changes from ground to battery applied by the trunk circuit over the M

lead and its armature opens the ground and connects battery on the M lead to the signaling circuit.

2. NEUTRALIZATION AND BATTERY COMPENSATION

2.01 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, dc or ac earth potentials or other longitudinal interference are canceled out.

2.02 The potential applied to the apex of the neutralizing circuit from the midpoint of the B resistor partially compensates for battery variation between the two signal lead extension circuits.

3. Z, W, V, AND J OPTIONS

3.01 When Fig. 1 is supplied and the A and B leads are connected to a trunk through transformer windings and are shunted by a 4-uF capacitor, the Z option is provided to prevent kickoff of the R relay when signals are sent from the signaling circuit to the trunk circuit.

3.02 When Fig. 2, 3, or 4 is supplied, the W, V, and J options permit the connection of 0-, 1.3-, 2-, 4-, or 6-uF capacitance in the balancing network of the R relay to prevent kickoff under various transformer and loop conditions.

4. TESTING R RELAYS

4.01 The TST jack is provided for testing and adjusting the R relay. Current flow tests may be made as indicated in the Circuit Requirements Table.

5. PATCHING PACKAGE - OPTION Q

5.01 Option Q is provided when this circuit is part of a patching package which is used to make good central office equipment in private line service.

SECTION III - REFERENCE DATA1. WORKING LIMITS

1.01 The maximum conductor loop resistance is: for Fig. 1, 1500 ohms; for Fig.

2, 3, or 4, 5000 ohms.

1.02 The maximum circuit length is: for Fig. 1, 15 miles; for Fig. 2, 3, or 4, 75 miles. When E-type repeaters are used, see SD-99421-05; when V4 repeaters are used, see SD-99421-03.

1.03 The minimum insulation resistance is 100,000 ohms.

1.04 The maximum dc earth potential is  $\pm 45$  volts.

## 2. FUNCTIONAL DESIGNATIONS

None.

## 3. FUNCTIONS

3.01 When a signal lead extension circuit is connected to either another signal lead extension circuit or a DX signaling circuit associated with a trunk circuit, it will perform the following functions.

3.02 Signals received on the E lead from the signaling circuit will be retransmitted to the E lead of the trunk circuit.

3.03 Signals transmitted over the M lead of the trunk circuit are retransmitted to the M lead of the signaling circuit.

3.04 Signals may be transmitted in either direction without interfering with signals being transmitted in the opposite direction.

3.05 Earth potentials and interference are neutralized by the symmetrical arrangement of an operating circuit and a neutralizing circuit.

3.06 Battery potential differences are minimized by the potentials applied to the neutralizing wire.

3.07 This circuit may be part of a patching package.

## 4. CONNECTING CIRCUITS

4.01 When this circuit is listed on a keysheet, the connecting information thereon is to be followed.

- (a) 1600- or 2000-Hz Signaling Circuit - SD-56202-01.
- (b) CX Signaling Circuit - SD-95048-01.
- (c) Repeating Coil Circuit - SD-96452-01.
- (d) 4-Wire Terminating Circuit - SD-96463-01.
- (e) Patching Package Application Schematic - SD-99405-01.

## 5. MANUFACTURING TESTING REQUIREMENTS

5.01 This circuit shall be capable of performing all the functions specified in 3. FUNCTIONS and meeting all the requirements of the Circuit Requirements Table.

## SECTION IV - REASONS FOR REISSUE

### D. Description of Changes

D.1 Reference to Notes 106 and 107 is made in Circuit Note 101.

D.2 Information Note 314 is removed from the Information Notes and placed in the Cross-Connection Notes as Note 402.

D.3 Capacitors A and B of Fig. 4 are changed to have one lead of each permanently connected.

D.4 Resistor code 145A is changed to 221A.

D.5 Fig. 57 is added to show the strapping of the A, B, C, D, and E resistors.

D.6 Reference is made to Note 2 in the Circuit Requirements Table for Fig. 2, 3, and 4.

D.7 Capacitor C, option B, is added to Fig. 4.

D.8 The Circuit Requirements Table is changed to show corrected current flow requirements for Fig. 4.

D.9 Resistor code KS-14603 is changed to KS-20289 as a cost reduction item.

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