PRIVATE LINE TELEPHONE SERVICE
SS-1 SELECTIVE SIGNALING SYSTEM
DESCRIPTION

CONTENTS PAGE

1. GENERAL

1.01 This section describes the equipment arrangements and operating principles of the SS-1 Selective Signaling System. This system is designed for use on 4-wire multistation private line telephone circuits such as used by the F.A.A., airlines, pipeline companies, utility companies, etc. The system may also be used on Telephone Company order wires and other multistation circuits.

1.02 The principal features of the SS-1 System are:

(1) Selective signals are transmitted and received over 4-wire multistation telephone voice facilities.

(2) The system has a capacity of 81, 2-digit dial codes.

(3) Transistorized or electron tube SF signaling units are used.

(4) The Keyer oscillator is transistorized.

(5) Signaling frequencies are 2600/2400 cycles on a frequency shift basis.

(6) Talk-off protection is provided similar to that for SF unit used on toll circuits.

(7) Equipment is packaged so that it may be installed at the central office or the station or divided between the central office and station.

(8) During the dialing interval, the voice TRANSMITTING paths of all stations are open to prevent voice currents from interfering with the transmitting circuit prior to the transmission of the first dial pulse. Busy tone, as described later, is supplied to all stations over the receiving loop except to the calling station.

(9) Conference calls may be established by dialing several 2-digit station codes in rapid succession or by dialing a grouping code which will signal a predetermined number of stations.

(10) Two adjacent SS-1 Systems may be interconnected by a 2-digit code.

2. DESCRIPTION

(A) Over-all Circuit

2.01 Three major equipment arrangements are provided for the SS-1 System:

(1) Decoder, Keyer and SF unit located at central office with sending and receiving relays at station—maximum of two station codes transmitted over loop using loop signaling. See Fig. 1 for this arrangement.

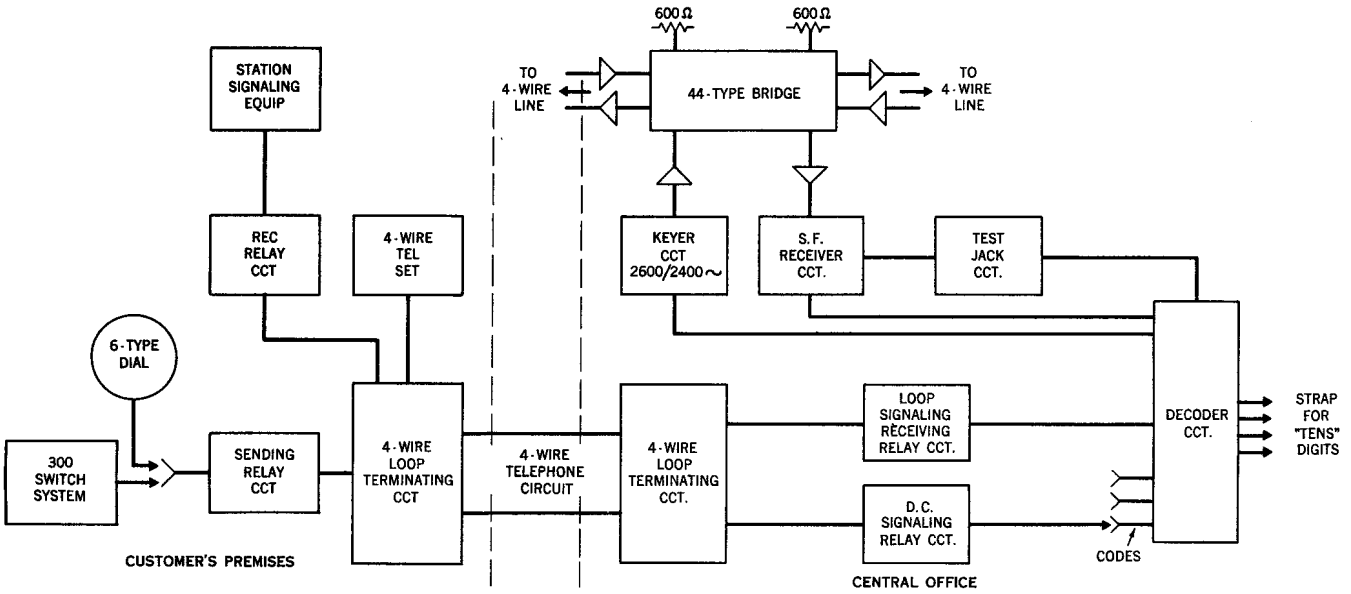

Fig. 1 — SS-1 Equipment Located At Central Office

(2) Decoder located at station — station codes transmitted over DX signaling facilities. See Fig. 2 for this arrangement.

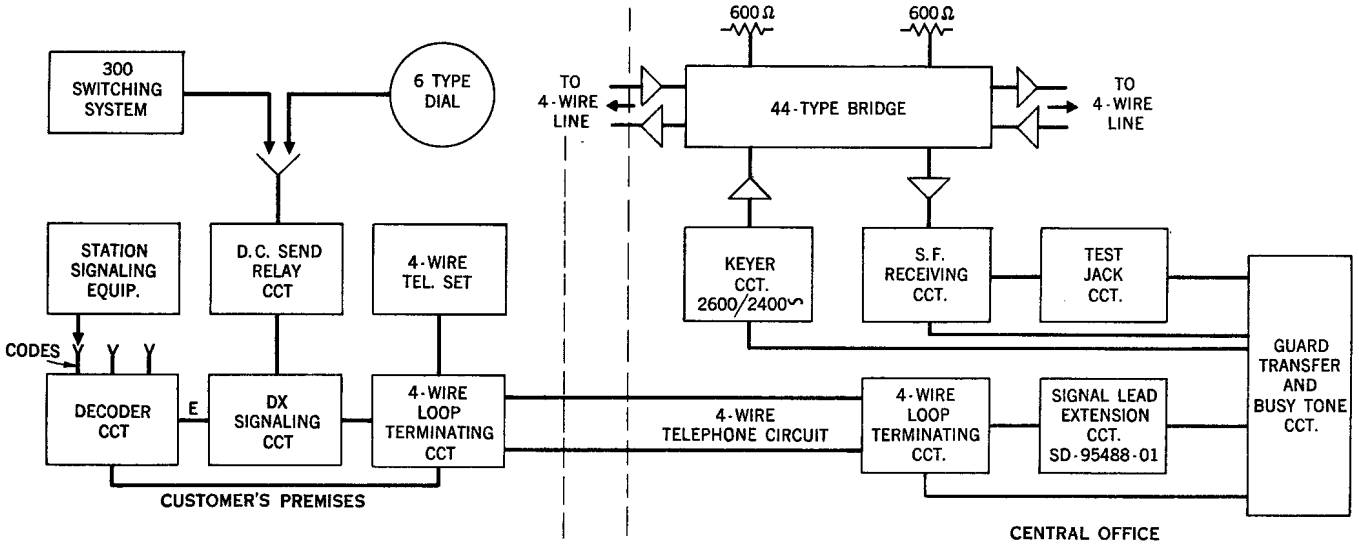

Fig. 2 — Decoder Located At Station

(3) All of SS-1 equipment located at the station. See Fig. 3 for this arrangement.

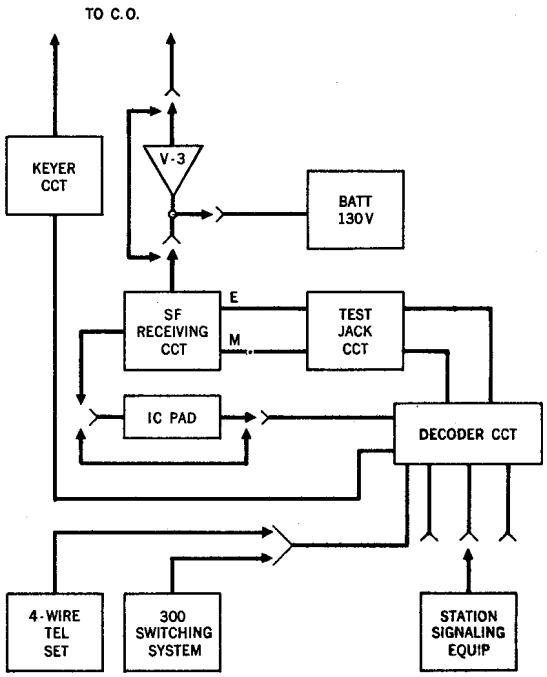

Fig. 3 — All SS-1 Equipment Located At Station

2.02 When one or two station codes are required at the customer's premises, the Decoder may be located at the central office. The station equipment is operated by means of loop signaling over the local loop (channel). When more than two station codes are required, the Decoder is located at the station and the SF receiver E-lead is extended to the Decoder by DX signaling facilities over the local channel (loop). The station signaling equipment is connected to the Decoder at the station.

2.03 The code is originated by the station dial in the form of D.C. pulses. These pulses are transmitted over loop or DX signaling facilities to the transistorized Keyer at the central office. When all the SS-1 equipment is located at the station, these signaling facilities are not required, since the Keyer is located at the station. The Keyer converts the D.C. pulses to 2600/2400 cycle tones. These tones are transmitted over the 4-wire circuit to all SF receiver units. Between signal pulses, 2400 cycles is momentarily transmitted to insure proper operation of the SF receivers.

2.04 As the calling station dial moves off — normal for each digit, the transmitter of the telephone set is shorted momentarily. This prevents voice currents from causing dialing errors.

2.05 If more than six seconds elapse before dialing the second digit, all Decoders will be automatically released and restored to the idle condition. When a digit is dialed in error, it may also be cancelled by dialing the digit "ONE".

2.06 During the idle condition, no tone is present on the SS-1 Signaling System. The Keyer circuit transmits tone on the circuit only during the dialing interval.

2.07 When the SF units are in the idle condition, they are in a "high guard" condition. This is necessary to prevent false operation of the SF unit due to talk-off.

2.08 To obtain reliable operation of the SF receiver, it must be changed from the "high guard" condition to a "low guard" condition. This is accomplished by the Keyer which elongates the first dial pulse of each digit to approximately 100 milliseconds in length.

2.09 The elongated pulse conditions the SF receiver for the reception of the dial pulses which follow. Shown in Fig. 4 is a comparison of the D.C. input pulses to the Keyer and the output tone pulses which result.

2.10 The SF receiver converts the 2600 cycle tone to D.C. pulses. These pulses alternately break ground which is normally on the E-lead to the Decoder.

2.11 The 2400 cycles is inserted between pulses of 2600 cycles to insure that the SF receiver will release after each pulse of 2600 cycles. This insures the proper per cent break time which may be impaired by low values of return loss on the circuit.

(B) Decoder

2.12 The basic Decoder is equipped with one code relay. This relay will decode a maximum of nine "UNITS" digits when all the digits

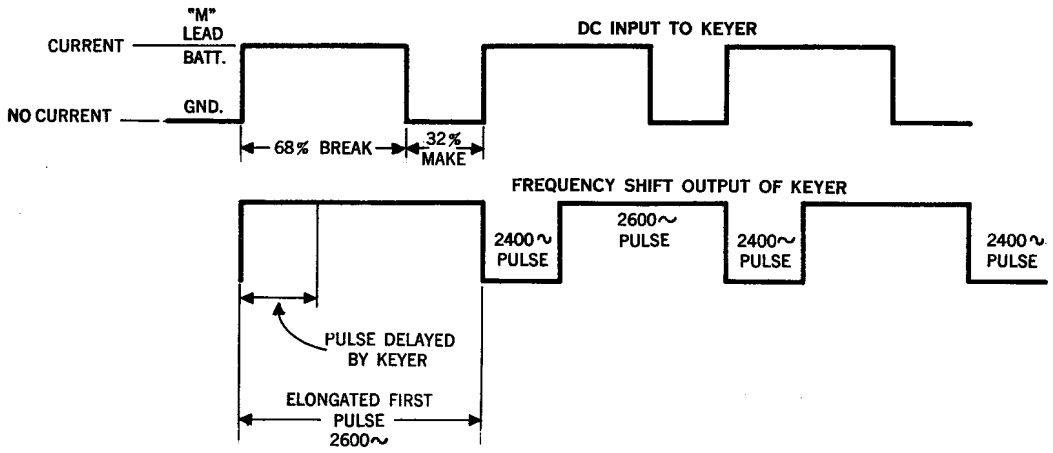

Fig. 4 — Comparison of Keyer Input and Output Pulses

are assigned to one "TENS" digit, such as 62 through 60. A maximum of eight "UNITS" digits can be used when they are assigned to two "TENS" digits such as 42 through 45 and 52 through 55. Additional code relays may be added on an optional basis to increase the capacity from nine to eighty-one codes.

2.13 The Decoder, upon receipt of an incoming signal from the SF unit, will open the customer transmitting and receiving loop. The 2600/2400 cycle tones on the circuit act as busy tone to all stations on the circuit except the one originating the call.

2.14 The "first digit" pulse operates a pulse counting relay in the Decoder which corresponds to the digit dialed. This provides a ground to operate the proper code relay. The "second digit" pulse again operates the pulse counting relay and places a 100 millisecond ground through the operated code relay contacts. These contacts are cross-connected to the station signaling equipment. In other words, the "first digit" to the Decoder selects the code relay and the "second digit" causes the Decoder to place a 100 millisecond ground on the proper digit lead.

2.15 The "TENS" digit pulses received by the Decoder operate the pulse counting relays shown in Fig. 5. These relays provide a ground which is connected through the TR relay contacts to the B-lead corresponding to the digit dialed. This ground operates the "TENS" digit D relay that is cross-connected to the B-lead. The D relay then locks operated to ground through contacts on the ON relay.

2.16 The TR relay operates and transfers the Decoder output from the winding of the D relay to its contacts in preparation for the UNITS digit. The station signaling equipment is connected to the D (code relay) relay contacts which corresponds to the assigned station code.

2.17 The UNITS digit pulses operate the Decoder pulse counting relay and place a momentary ground through the operated TR contacts to the D relay contacts corresponding to the digit dialed. This ground is then transmitted over loop or DX signaling facilities to the station signaling equipment.

2.18 Assume code 27 is dialed. The pulses corresponding to the TENS digit "2" operate the Decoder. This puts a ground on the B-2 lead which operates the TENS digit relay D1. The pulses corresponding to UNITS digit "7" cause the Decoder to place a ground on lead C7. This ground is placed on the station signaling equipment as shown in Fig. 5.

(C) Code Relay

2.19 Additional code relays may be added to the Decoder to increase the number of code leads from 9 to 81. The additional D relays are the same as the D1 relay shown in Fig. 5. Relay

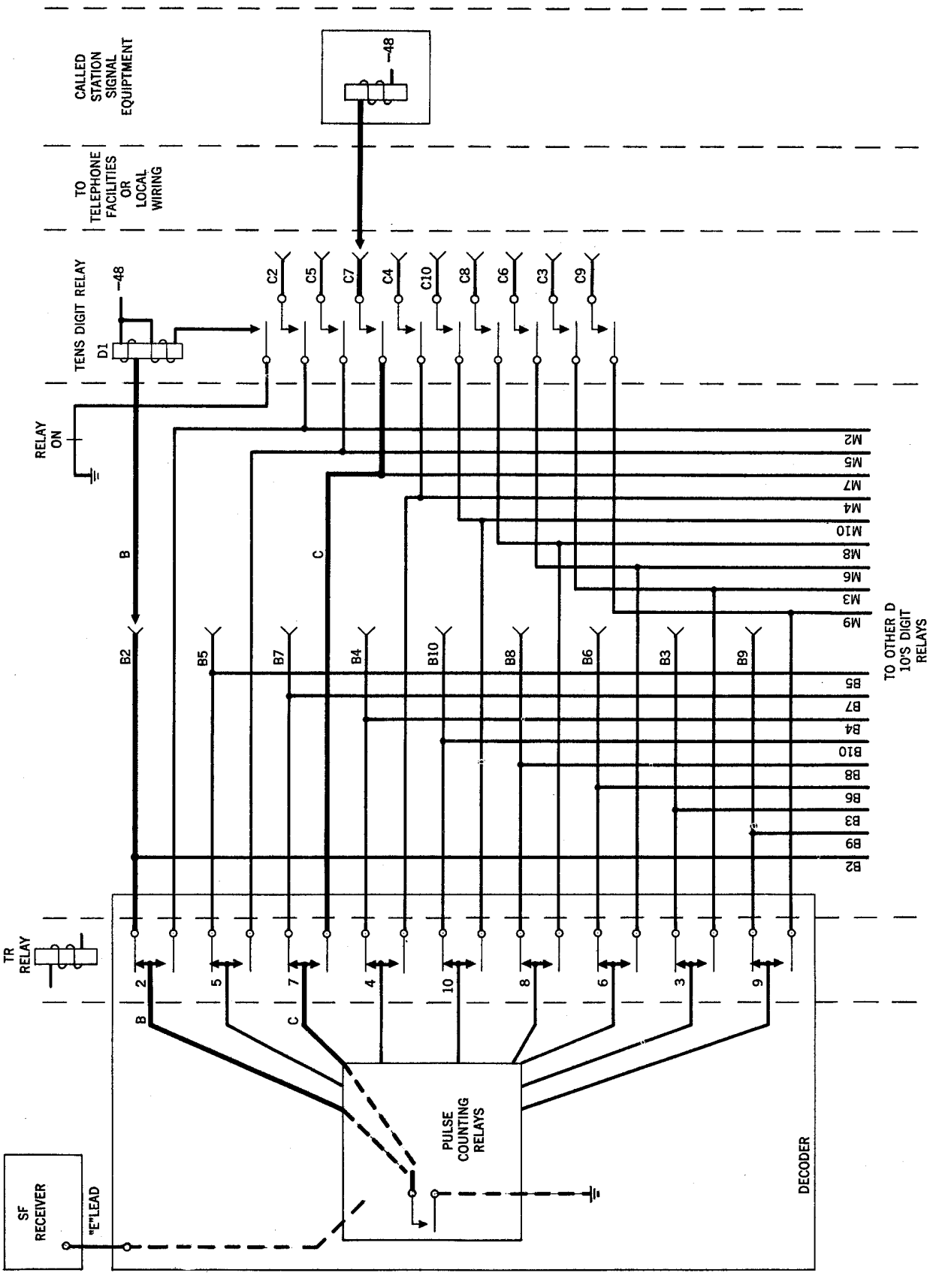

Fig. 5 — Operation of Code Relays

D2 will provide the nine digits 3-2 through 3-0. Relay D3 provides the digits 4-2 through 4-0, etc.

(D) Keyer

2.20 The Keyer includes a transistorized oscillator, a pulse repeating circuit and a time delay circuit. The time delay circuit lengthens the first pulse through the Keyer to insure proper operation of the SF receiver. The first pulse conditions the SF unit so that it will follow the pulses correctly. Fig. 4 shows the elongated 100 millisecond pulse.

2.21 The station dial pulses the Keyer M-lead to ground and battery. The first battery pulse operates relay ON1. This connects the 2600 cycle tone to the 4-wire voice circuit, opens the calling station transmitting loop and provides busy tone to the remaining stations on the line. Fig. 6 shows the details for this operation.

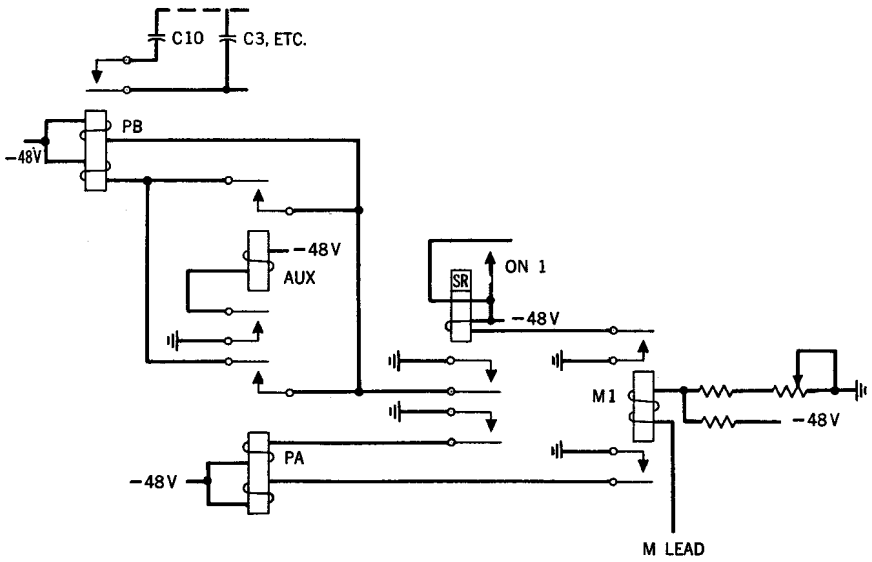

Fig. 6 — Simplified Keyer Shift Circuit

2.22 The PB relay operates at the end of each pulse through control relay PA. When relay PB operates, capacitor C10 is connected to the oscillator tuned circuit. This shifts the oscillator frequency from 2600 cycles to 2400 cycles. At the end of each digit, the pulsing ceases and 2400 cycles is transmitted over the line until the slow releasing ON1 relay releases. This feature is provided to insure that the SF receiver functions properly.

2.23 The transistorized oscillator is very stable in frequency and amplitude and is tuned to 2600 cycles by means of capacitors C3 through C9. The Keyer circuit also minimizes changes in per cent break which may occur due to power supply voltage variations.

(E) Loop or DX Signaling (Station to C.O.)

2.24 The station transmitting loop is connected to contacts on the ON relay as shown in Fig. 7. The station dial operates the ON relay and pulses the P relay. Relay ON opens the station transmitting loop to prevent noise from entering the circuit during dialing. The P relay will pulse closed the loop for loop signaling. It also provides ground and battery pulses on the M-lead for DX signaling. Completion of dialing restores relays P and ON to the released condition.

(F) Loop Signaling (C.O. Receiving from Station)

2.25 The receiving relay of the loop signaling circuit converts the loop signal to equivalent M-lead conditions to operate the Keyer. As the station loop is closed, the R relay shown in Fig. 8 operates and changes the M-lead from ground to battery. In the normal conditions the

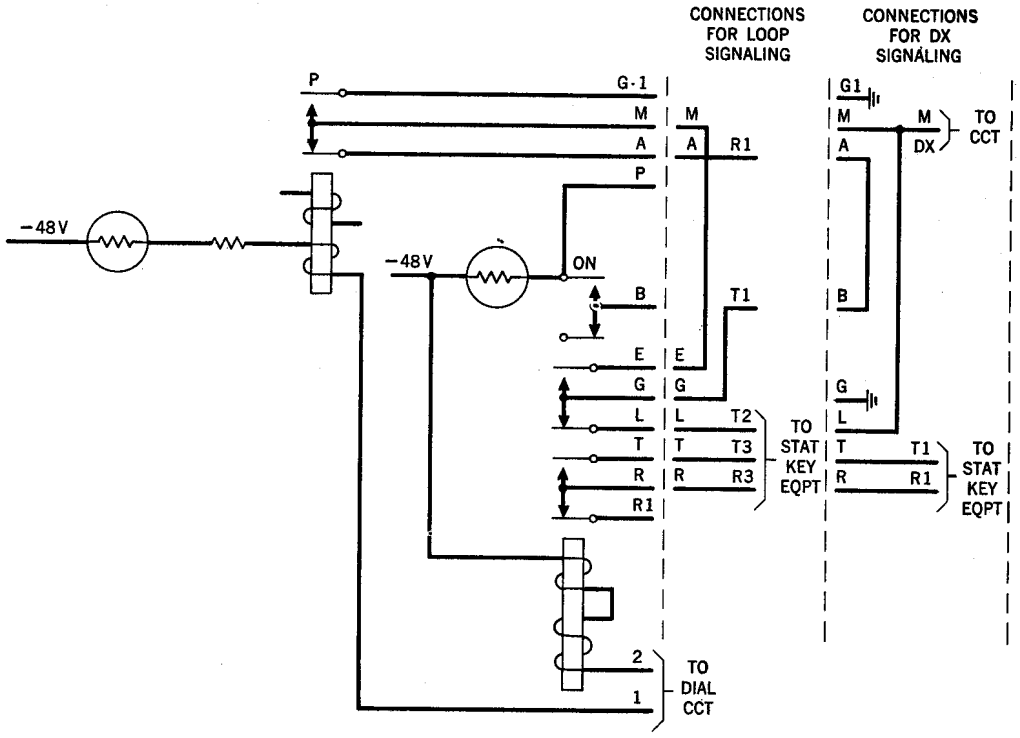

Fig. 7 — Operation of ON and P Relays

R relay is held released due to the balanced current flowing in the two relay windings. Closing the loop operates the relay through the bias winding and puts battery on the M-lead.

(G) Loop Signaling (C.O. to Station, 1 or 2 Codes)

2.26 The operation of central office relay C1 or C2, as shown in Fig. 9, transmits a 100 millisecond signal pulse by means of loop signaling to the station. A ground on code lead C1 operates relay C1 and puts battery and ground on the loop to the station. A ground on code lead C2 operates relay C2 and puts battery and ground of reversed polarity on the station loop.

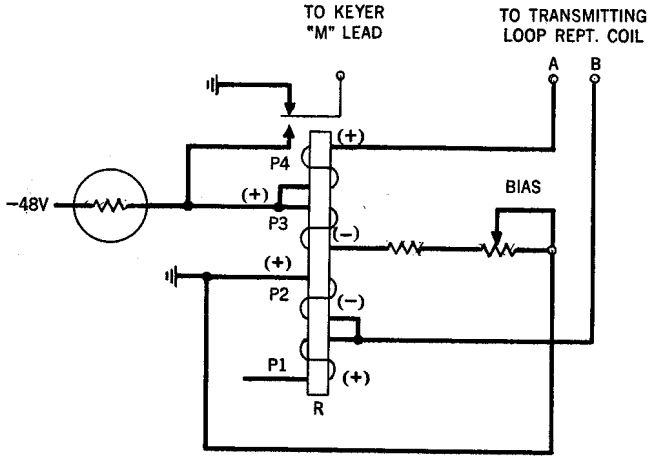

Fig. 8 — Operation of M-Lead to Keyer

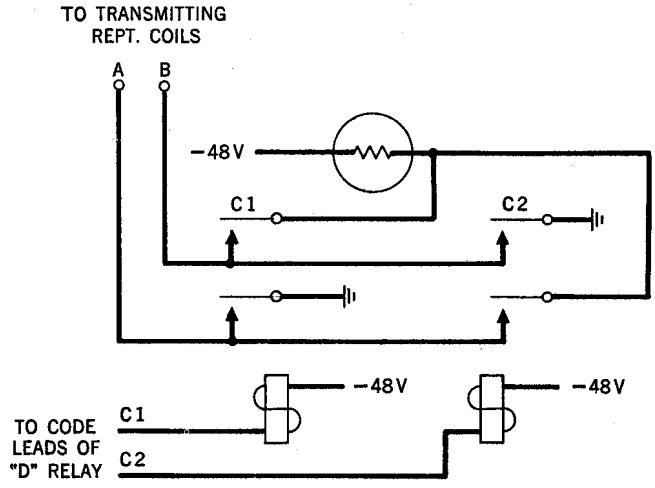

Fig. 9 — Operation of Sending Code Relays

(H) Loop Signaling (Station Receiving from C.O., 1 or 2 Codes)

2.27 The relays shown in Figs. 10 and 11 are used in conjunction with one of the sending relays shown in Fig. 9. When only one code is required at the station, relay C1 operates when battery is received from the sending relay. When two station codes are required, relays C2 and C3 are required. The varistors designated C2 and C3 operate relay C2 when the A-lead is positive and operate relay C3 when the A-lead is negative.

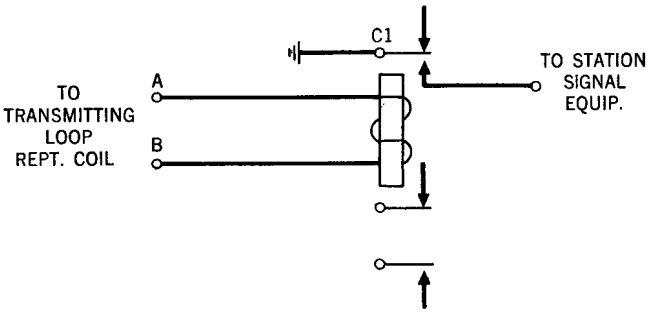

Fig. 10 — Operation of Code Relay for One Station Code

(I) Pulse Repeating and Busy Tone Circuit

2.28 This circuit is used in conjunction with the Keyer and Decoder circuits. It is used to open the station loop and transmit busy tone during the dialing interval. The pulse repeating and busy tone circuit will operate a maximum of two station loops. When a third loop is required, an additional circuit must be provided. This circuit permits one Keyer, one SF receiver and one Decoder to serve more than one station loop. Fig. 12 shows a simplified block diagram illustrating the use of this circuit.

(J) Guard Transfer and Busy Tone Circuit

2.29 This circuit is used at the central office when only one station is connected to the associated 4-wire bridge at the office. When the circuit operates, it opens the loops to the station and applies busy tone during the dialing interval.

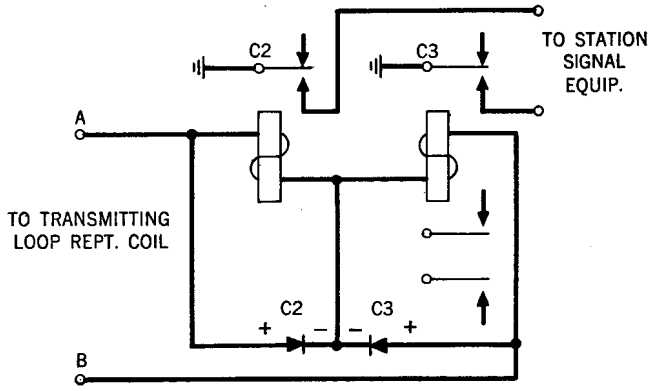

Fig. 11 — Operation of Code Relays for Two Station Codes

(K) Loop Cut-Off Relay

2.30 This is an optional feature which may be provided when loop line noises are excessive. For instance, this prevents loop noise on an open wire line (local channel) from being transmitted into the 4-wire backbone circuit. The cut-off relay connects and disconnects the station loop under the control of the station switchhook. The station transmitting loop is opened at the central office and terminated in 600 ohms when the station is idle.

(L) Intersystem Switching Circuit

2.31 The Intersystem Switching Circuit makes it possible to interconnect two adjacent SS-1 Systems. When the 2-digit grouping code is dialed, the two systems are interconnected for both voice transmission and signaling. Stations on either system may be dialed.

2.32 Another feature of this circuit is that a 3-digit code must be dialed on the called system when conflicting codes exist on both systems. If code "XX" is assigned to both systems, the digit "ONE" must be added to all codes on the called system. All codes on the called system then become "XIX." This locks out the conflicting "XX" code on the calling system. Stations on the calling system may be dialed by using the assigned two digits. The digit "ONE" is also used to cancel a digit when it is dialed in error. A disconnecting 2-digit code must be dialed to restore the two systems to normal. Fig. 13 shows the application of the intersystem switching circuit in the backbone circuit.

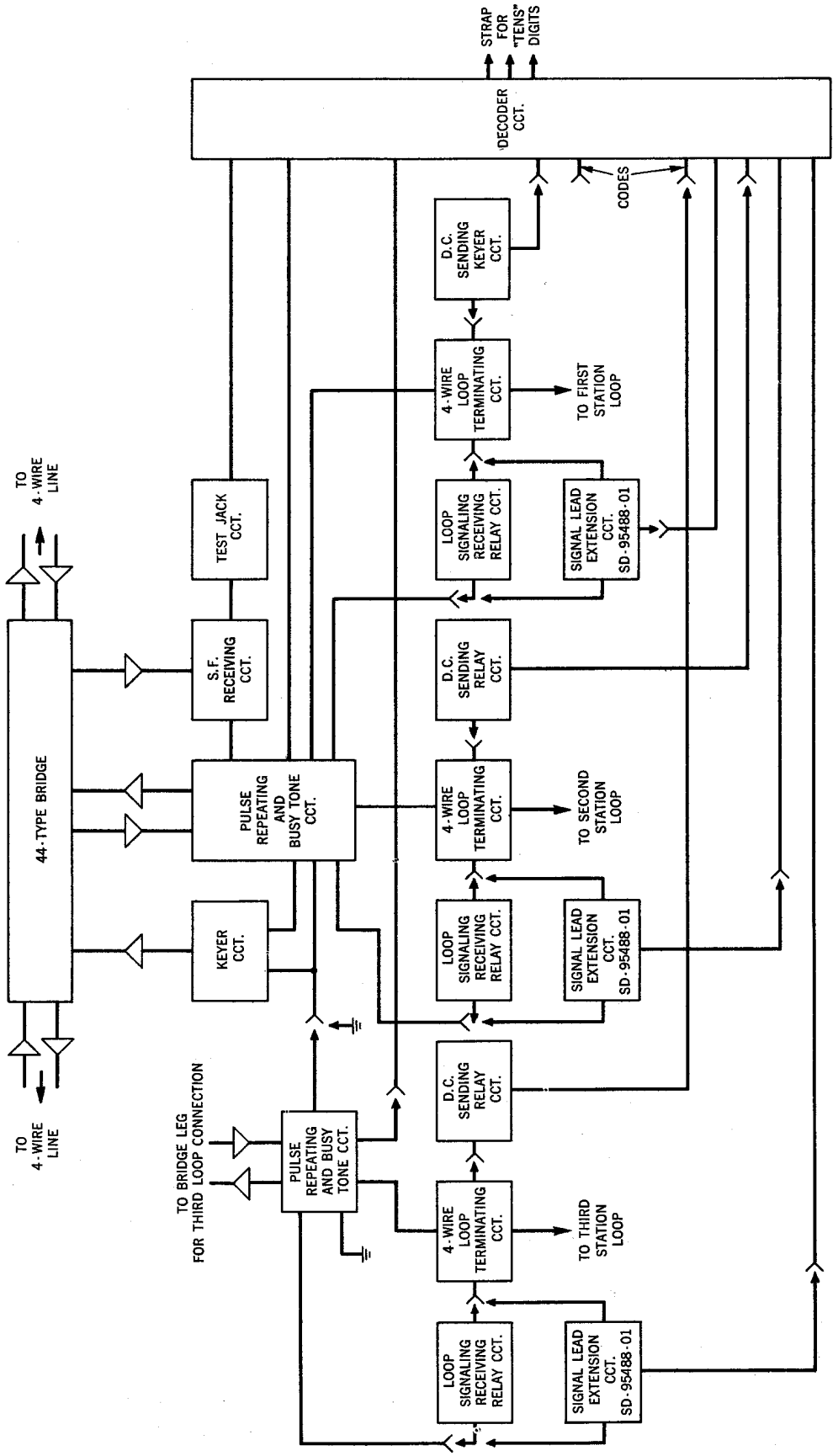

Fig. 12 — Central Office Equipment Required with Two or Three Station Loops

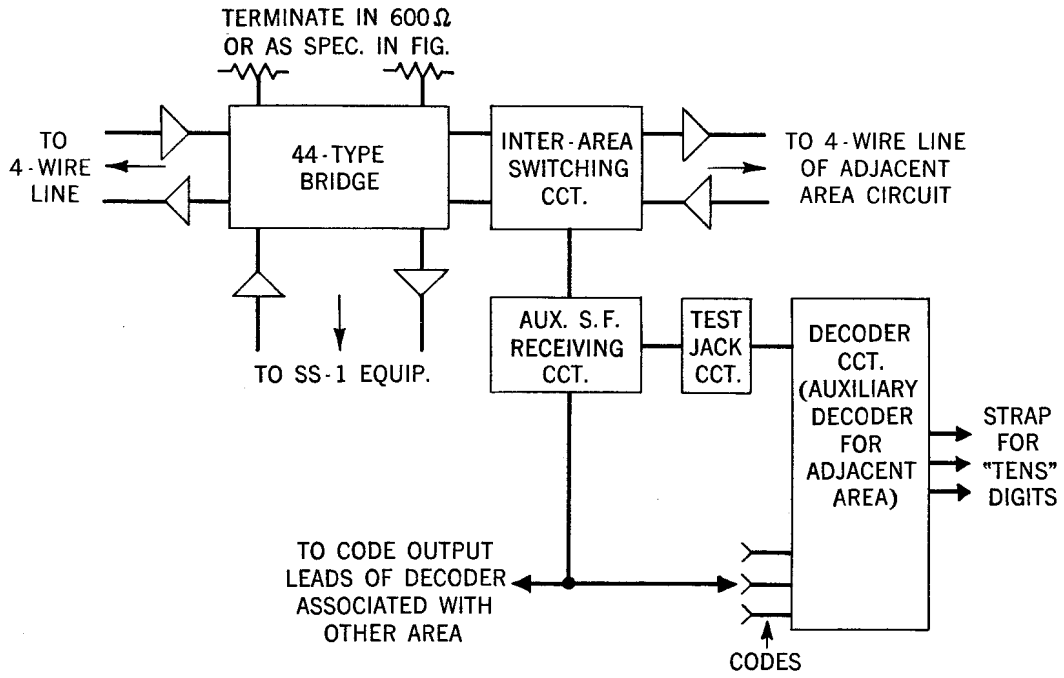

Fig. 13 — Intersystem Switching Circuit

3. EQUIPMENT ARRANGEMENTS

3.01 The SS-1 Selective Signaling System equipment may be installed as follows:

(A) All signaling equipment except the sending and receiving relays may be located in the central office.

(B) The signaling equipment may be divided between the station and central office.

(C) All signaling equipment may be located at the station.

(A) Central Office and Station Arrangements

3.02 When one or two codes are required at the station, the SS-1 equipment may be installed in the central office. The sending and receiving relays should be located at the station, however. Fig. 14 shows the central equipment for relay rack or cabinet mounting.

3.03 When more than two station codes are required at the customer's premises, the Decoder should be installed at the station. The signaling circuits should be extended over DX facilities to the station. Fig. 15 shows the package equipment layout for relay rack or cabinet mounting at the central office.

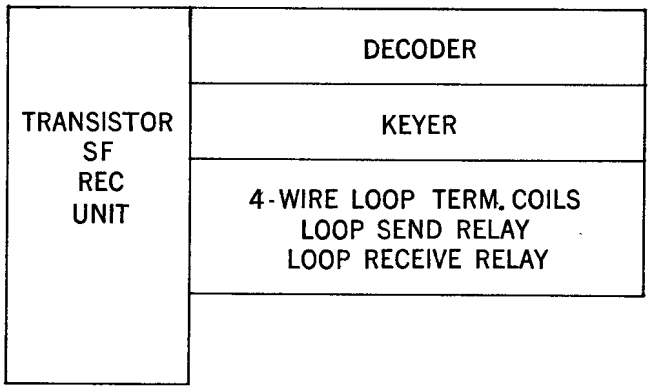

Fig. 14 — Equipment Located at Central Office

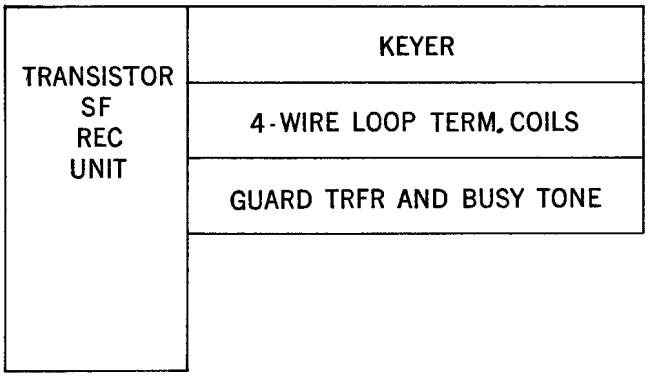

Fig. 15 — Equipment Located at Central Office (Decoder at Station)

SS1
SELECTIVE SIGNALING SYSTEM

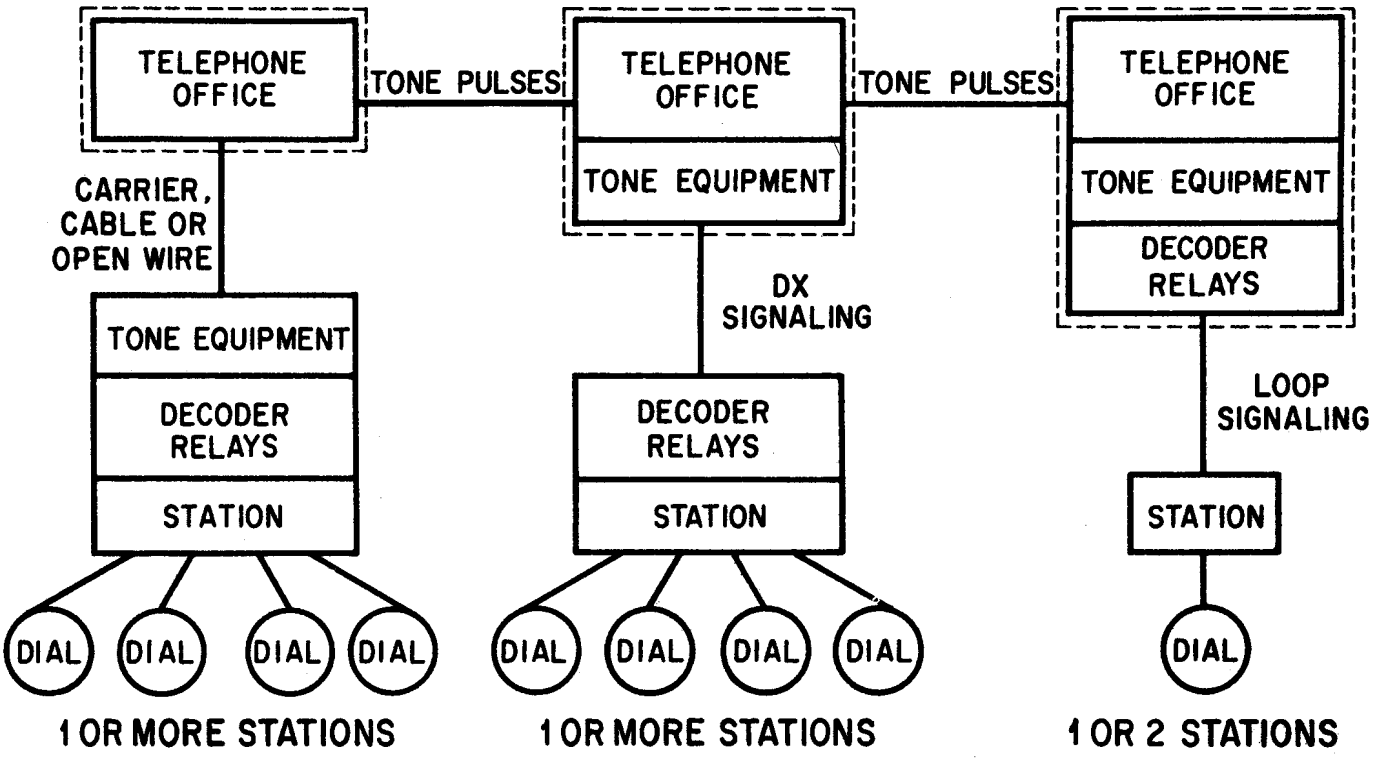

Fig. 16 — Simplified Schematic

(B) Station Installations

3.04 The SS-1 equipment may be installed at the station as a complete package unit made up of the components shown in Fig. 3. No loop or DX signaling facilities are required. The equipment may be mounted in an equipment cabinet or in a relay rack.

3.05 Fig. 16 is a simplified sketch showing the location of SS-1 equipment when various types of local facilities (channels) are used between the STC and the station. The three central offices are connected together by means of a 4-wire backbone circuit.

(C) Monitor Circuit

3.06 A Monitor Circuit is provided to observe dialed codes on the system. The equipment consists of a station package unit associated with a display of lamps. The lamps are cross-connected to the Decoder and provide a visual means for checking a dialed code on the system. The lamp circuit is shown in Fig. 26 of SD-98093-0100. The Monitor circuit should be installed at the control office and any other central office where it will be of assistance in locating and clearing signaling troubles.

4. POWER REQUIREMENTS

(A) Relay Equipment

4.01 When the relay equipment is located at the central office, it is arranged for 48-volt operation. The sending equipment located at the station is arranged for 24 or 48-volt operation. When the Decoder is located at the station, 48-volt battery must be supplied for its operation.

(B) V-3 Repeaters

4.02 When the entire SS-1 System is installed at the station, a V-3 repeater may be required. In this case, 48 volts and 130 volts are required.

5. LIST OF DRAWINGS

5.01 The following drawings pertain to SS-1 System:

The SS-1 Selective Signaling System	SD-98093-0100
Telephone Order Wire Circuit	SD-96508-01
Single Frequency Signaling Circuit—(Electron Tube)	SD-56292-01
Single Frequency Signaling Circuit—Modified E2B (Transistorized)	SD-98123-01-2
Single Frequency Signaling Circuit—(Transistorized)	SD-98124-01
DX Signaling Circuit	SD-95487-01
Signal Lead Extension Circuit	SD-95488-01
4-Wire Line Circuit for SS-1 Selective Signaling System Modifying 300 Key Equipment	SD-69372-01