

**600/1500-CYCLE
 SELECTIVE SIGNALING EQUIPMENT
 FOR 4-WIRE PRIVATE LINES
 DESCRIPTION**

1.00 GENERAL

1.01 This section was formerly Station Installation and Maintenance Section C53.431, Issue 2. Except for editorial changes and renumbering for inclusion in the Station Operations Manual, no other revisions have been made.

1.02 This section describes the 600/1500-cycle selective signaling equipment which provides means for selectively calling any station or predetermined group of stations on a 4-wire multi-station private line.

1.03 This equipment may be associated with 4-wire stations, 102A, 109A, or 111A key equipments, or PBXs provided the latter employs an auxiliary trunk circuit in conjunction with the tie trunk circuit to convert from 4-wire to 2-wire operation. In the case of the 109A and 111A key equipments, provisions are made for outgoing 600/1500-cycle signaling only.

1.04 No standard arrangements are available to provide this selective signaling equipment on 2-wire private lines.

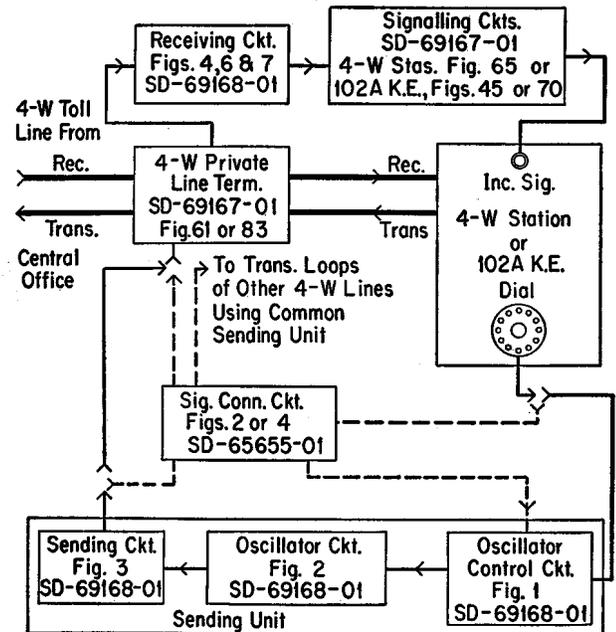
2.00 USE

2.01 The principal application for this equipment is to be found in industries which conduct their business over large diversified areas by means of private telephone lines. Typical customers, for example, might be the domestic air line companies, the FAA air traffic control centers, towers and communication stations, right-of-way companies, steel companies, and other industries which disseminate information concerning orders, inventories, dispatches, reservations, etc, to a specific station or groups of stations on a multi-station 4-wire private line.

3.00 DESCRIPTION

General

3.01 The two-tone selective signaling equipment, as this is generally known, provides a complete voice-frequency signaling system installed on the customer's premises and connected to the telephone station facilities that are normally employed with 4-wire private lines as illustrated in the block diagrams in Fig. 1 and 2. The two-tone



LEGEND
 — Speech Path
 — Signal Path
 --- Signal Path Using Sig Conn Circuit When Common Sending Unit For More Than One 4-wire Line is Employed.

Fig. 1 — 600/1500-cycle Selective Signaling System for 4-wire Station or 102A Key Equipment Terminations

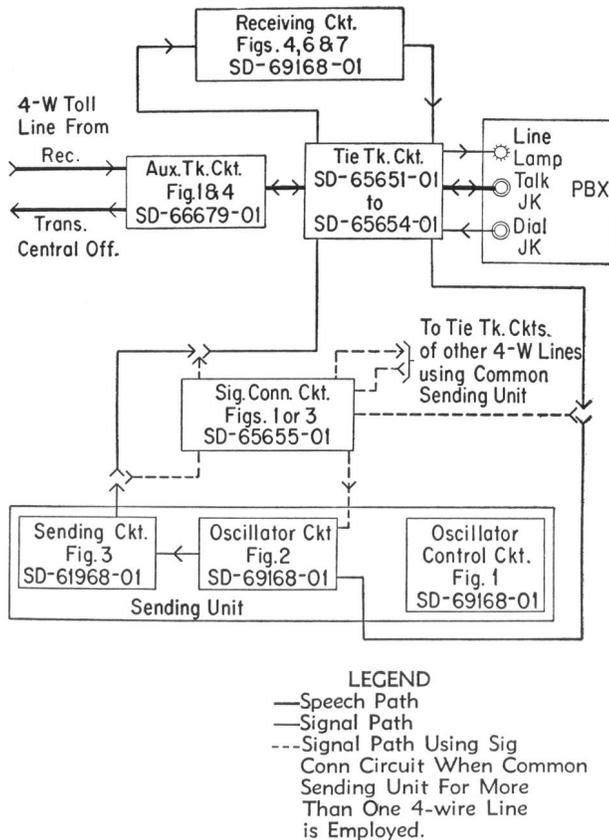


Fig. 2 — 600/1500-cycle Selective Signaling System for 4-wire Termination at PBX

equipment consists of three basic units: the sending unit, the receiving unit, and the power supply unit. These three units, when used together, provide for 2-way selective signaling.

3.02 Where two-tone signaling is required in only one direction, the receiver, or the sending unit, depending on the requirements, is not provided, and 20-cycle, dc, or loudspeaker signaling may be employed in the opposite direction.

3.03 One sending unit may be associated with as many as ten multistation lines at a given station by the provisions of signaling connector units.

3.04 Receiver units may be added at any station on a particular circuit until the system capacity of 170 station calling codes has been realized.

4.00 EQUIPMENT AND OPERATING FEATURES

Sending Unit

4.01 The sending unit which is shown in Fig. 3 is a shop-wired unit occupying seven 1-3/4 by 19-inch mounting plate spaces. A screw-type terminal strip mounted on the front of the unit is provided for external connections.

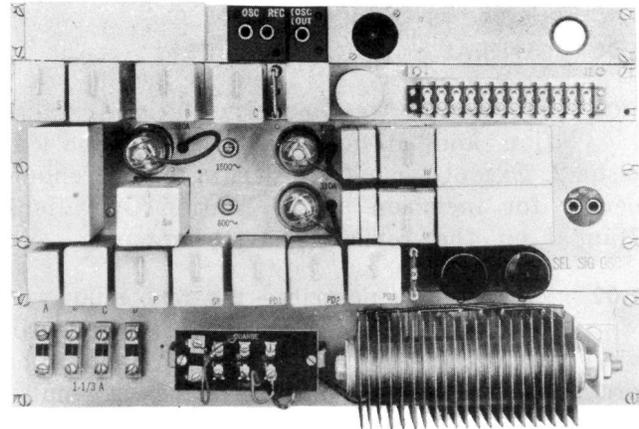


Fig. 3 — Sending Unit

4.02 This unit is comprised of an oscillator circuit, an oscillator control circuit, a sending circuit, and a 24-volt dc supply circuit.

4.03 The oscillator generates the 600-cycle and 1500-cycle frequencies required for signaling and applies them alternately to the transmitting loop of the 4-wire private line under the direction of the oscillator control circuit and the customer's dial. The oscillator is released automatically upon completion of dialing or at a PBX upon disconnection of the cord from the dial jack. However, before it releases, a single pulse of signaling frequency is transmitted to the line to restore any selectors that may be off normal.

4.04 The oscillator control circuit employs a digit counting selector which functions to maintain the tone connection to the line until the complete code of four or five digits has been transmitted, and to remove it upon termination of dialing. This control circuit is not used where a PBX termination is provided, as the insertion of

the plug in the dial jack connects the oscillator to the line, and the removal of the plug disconnects the oscillator from the line.

4.05 The 24-volt dc supply provides battery for the filaments of the electron tubes and for the relay operation within the sending unit. It may also be used to activate an external signaling circuit. The plate circuit supply for the electron tubes of the oscillator is obtained from a separate power supply described in 4.13 through 4.16.

Receiving Unit

4.06 The receiving unit which is shown in Fig. 4 is a shop-wired unit occupying eight 1-3/4 by 19-inch mounting plate spaces. Two screw-type terminal strips mounted on the front of the unit are provided for external connections.

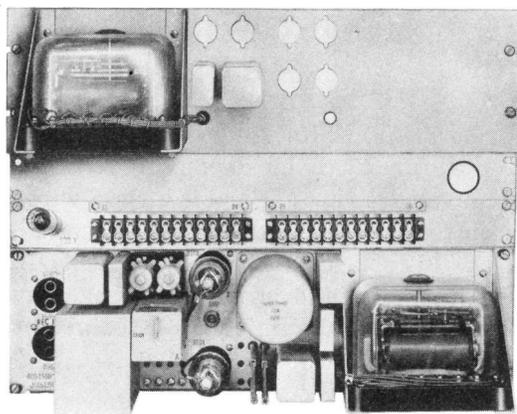


Fig. 4 – Receiving Unit

4.07 The filament and plate supply for the electron tubes in the receiving unit is obtained from the power supply described in 4.13 through 4.16.

4.08 The basic unit comprises a receiving circuit and one 60-type selector arranged for signaling one to four stations. Four auxiliary 60-type selectors may be added, however, to provide for a maximum of 20 stations. Where more than 20 selections are required on the same premises, additional receiving units are employed.

4.09 The receiving circuit detects the alternate 600-cycle or 1500-cycle tones on the line caused by successive dial pulses from the distant sending unit and converts each change of frequency to a dc pulse which in turn operates the 60-type selectors associated with the receiving units. All selectors will respond, but only the selector or selectors whose code wheel pin setting corresponds to the code dialed will come to rest on a contact which will close an external signaling circuit. This external circuit is arranged to lock in the signal since the sending unit at the distant end in releasing, as discussed in 4.03, transmits an additional pulse to release any selectors that may be in an off-normal position.

4.10 The incoming signal is released as usual by answering the call or by the operation of an automatic time-out circuit, if provided, within 30 seconds when the call is unanswered.

4.11 A recall made by redialing the code will cause the signal to function for a 2-second interval.

4.12 Additional stations may be called in, if desired, by dialing consecutively either their respective individual codes or a group calling code.

Power Supply Unit

4.13 The power supply unit is a shop-wired unit occupying one 1-3/4 by 19-inch mounting plate space. A terminal strip requiring soldered connections is mounted on the rear of the unit for external wiring.

4.14 One power supply unit is required per one combined sending and receiving unit, two receiving units, or one sending unit.

4.15 Commercial 110-volt 60-cycle power is required, and a 15-foot cord is provided where only a receiver unit is used for the connection from this power unit to the 110-volt commercial source. If a sending unit is used alone or in combination with a receiving unit, the long cord to the commercial source is associated with the 24-volt dc supply circuit of the sending unit, and a short cord is used for connecting the two power units together.

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4.16 The unit supplies 130-volt dc for the electron tube plate voltage of both the sending and receiving units and 10-volt 60-cycle for the electron tube filament voltage of the receiving unit.

Signaling Connector Unit

4.17 The signaling connector unit is furnished in four types depending on the voltage range and PBX or station termination involved. The four units are shop wired, with two circuits per unit, and each occupies one 1-3/4 by 19-inch mounting plate space.

4.18 One circuit per line is required except where the line terminates at a PBX and 4-wire station or stations on the same premises. In this case, two circuits per line are required: one for the PBX termination and one for the 4-wire station terminations.

4.19 This circuit, which is shown on SD-65655-01, provides an arrangement to permit a two-tone sending circuit to be associated with as many as ten private lines, one line at a time. The purpose of the circuit is to obtain better utilization of the sending equipment at stations where a number of private lines terminate and the traffic per line is relatively light.

102A Key Equipment Units

4.20 Flashing Unit, Signaling Unit, and Lamp Control Unit—One-lamp Signals: Each of these units is a separate shop-wired unit which mounts on one 1-3/4 by 19-inch mounting plate. The flashing unit will mount two circuits per unit, the signaling unit, six circuits, and the lamp control unit, five circuits. One flashing circuit is required per line and one signaling circuit per 102A key equipment position or group of positions functioning as a unit with the same signaling code. If more than one signaling circuit is provided at an installation, one lamp control circuit is required per 12 signaling circuits. When these three circuits are used together, an incoming two-tone signal will flash the line and busy lamp associated with the private line at the key box position which is being called and, at the same time, will light the line and

busy lamp at the other positions steadily. When the call is answered, however, the line and busy lamp at all positions will be lighted steadily as a busy signal. These circuits are shown on SD-69167-01.

4.21 Flashing Unit and Signaling Unit—Two-lamp Signals: Both of these units are shop-wired, each of which mounts on one 1-3/4 by 19-inch mounting plate. Two circuits are provided on the flashing unit mounting plate, and a maximum of eight may be provided on the signaling unit plate. One flashing circuit is required per line and one signaling circuit per 102A key equipment position or group of positions functioning as a unit with the same signaling code. With this arrangement, an incoming two-tone signal will flash the line and busy lamp associated with the private line at all positions and will light the supervisory lamp at the particular position which is being called. These circuits are shown on SD-69167-01.

PBX Units

4.22 Tie Trunk Units: Several types of tie trunk units are available depending on the type of PBX and voltage range. Each is a shop-wired unit, one circuit per unit, and occupies the space of two 1-3/4 by 19-inch mounting plates. One unit is required per line, and circuit drawings covering these various tie trunk units are listed in Part 9.

4.23 Auxiliary Trunk Unit and Repeating Coil Unit: The auxiliary trunk circuit shown on SD-66679-01 consists of two units: the auxiliary trunk unit and repeating coil unit. The auxiliary trunk unit is a single-circuit unit, and the repeating coil unit is a 2-circuit unit, each unit occupying the space of one 1-3/4 by 19-inch mounting plate. One auxiliary trunk circuit is required per line. In addition, one repeating coil circuit is required per line where the two-tone signaling is terminated at a PBX only. Where both station and PBX terminations are provided on the same premises, the repeating coil circuit is not required, as a similar circuit (4-wire terminating circuit) is provided for the 4-wire private line station and the auxiliary trunk unit is multiplied from this terminating circuit. The auxiliary trunk is used to convert from 4-wire to 2-wire operation.

5.00 DIALING CODES

5.01 By means of a wiring option in the oscillator control circuit either a 4- or a 5-digit dialing code may be employed. The 5-digit code is at the present time most widely used on private lines with the exception of those terminating at PBXs or those associated with FAA circuits in which case the 4-digit code is employed. In the case of 4-digit operation at stations, special instructions should be given for its proper operation. This will be discussed further in 5.03.

Five-digit Codes

5.02 The first digit of the 5-digit code, although arbitrarily selected, is always the digit 2. The purpose of using this digit is to allow time for the sending circuit to operate and apply tone to the line. As the dial is pulled off normal and allowed to return, sending out the first digit, the oscillator may or may not cause the selectors at the receiving stations to step off normal. Assuming that it does, however, the digit 2 is followed immediately by the digit 1 which causes all the selectors to restore to normal. The selectors are then ready to receive the last three digits of the calling code which constitutes the selecting portion of the code. The selector, or the selectors as the case may be, whose code wheel setting corresponds to the code dialed will operate and cause the signal to function as described in 4.09.

Four-digit Codes

5.03 Stations: The two functions performed by dialing the digits 2 and 1 for the 5-digit code are, in the case of the 4-digit code, performed by just dialing digit 1. Pulling the dial off normal for digit 1 energizes the oscillator and connects signaling tone to the circuit. In order to ensure that sufficient time is allowed for both of these operations, the dial should be held momentarily against the finger stop. Dialing the next three digits performs the same function as is associated with the 5-digit code.

5.04 PBXs: As discussed in 4.04, the oscillator control circuit is not used where PBX terminations are involved. The dialing circuit is wired directly to the oscillator circuit, and the

insertion of the plug into the dial jack activates the oscillator and connects the tone to the line. The digit 1 is dialed without any hesitation at the finger stop being required. This operation will restore any selectors which may be off normal. The three selecting digits are then dialed and, upon completion of dialing, the plug is removed from the dial jack releasing the oscillator. It might be noted that prior to the above operation, it was necessary to insert a plug in the talk jack.

6.00 SELECTOR WHEEL PIN SETTINGS AND OPERATING FEATURES

6.01 As shown in Fig. 5, the selector wheel is equipped with four fixed pins assigned to Positions 17, 19, 21, and 23 and two movable pins assigned between Positions 2 and 15. The normal position of the selector wheel is defined as the position of the moving signal contact when it is 17 counterclockwise steps away from fixed contact C1.

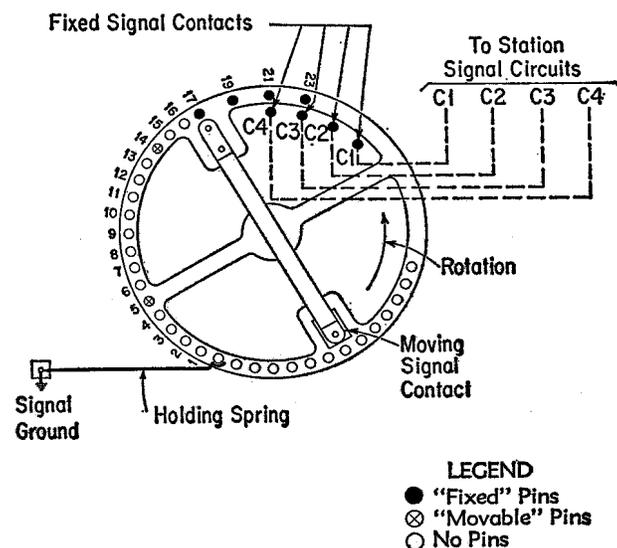


Fig. 5 - 60-type Selector Wheel

6.02 The selector wheel, when stepped off normal by dial pulses, will be returned to its normal position by a watch spring arrangement at the end of each digit if the holding spring does not find a pin to engage.

6.03 Assume that the selecting codes assigned to the selector wheel shown in Fig. 5 are 593, 595, 597, and 599. This would necessitate the two movable pins being placed in positions 5 and 14 by the installer. When one of these codes is dialed, the selector wheel rotates counterclockwise five steps for the first digit where the holding spring engages the first movable pin. The wheel then advances nine steps when the second digit is dialed with the holding spring engaging the second movable pin. The dialing of the last digit will advance the wheel either three, five, seven, or nine steps depending on the code dialed with the holding spring engaging either the 17, 19, 21, or 23 pin. This places the moving signal contact over either the C1, C2, C3, or C4 fixed contact, closing a circuit from the holding spring ground through the metal selector wheel and closed contact to the external signaling circuit via the C1, C2, C3, or C4 leads. After all the digits have been dialed, the selector wheel returns to normal as discussed in 4.09.

7.00 MOUNTING

General

7.01 In general, the two-tone equipment will be mounted in the same apparatus cabinet or relay rack with the associated station equipment. An exception to this may be where PBX terminations only are provided. In this case the PBX units associated with this two-tone equipment, ie, the tie trunk, auxiliary trunk, and signaling connector units would usually be mounted in the rear of the PBX section if space is available or, where dial PBXs are involved, on relay rack provided with this equipment, and the two-tone signaling units would mount in a separate apparatus cabinet of the 11- or 18-plate type.

7.02 From a standpoint of appearance, installation, and maintenance, the two-tone equipment and the associated relay equipment of the 4-wire station terminations should be mounted in one apparatus cabinet of adequate size. Where it appears initially that one cabinet would not be adequate, consideration should be given to the use of relay rack. In selecting this mounting arrangement, every effort should be made to determine the customer's future anticipated growth.

7.03 The relay equipment for the 4-wire station of the 109A key equipment consists principally of angle bracket assembled equipment or key telephone units which mount on mounting assemblies per ED-69143-01, G1 or G2 for bars 19 inches or 23 inches long, respectively. The number of these units provided will vary depending on the features requested by the customer. The space requirements for these units and the two-tone equipment will determine the type of mounting arrangement employed. An apparatus cabinet of the 26- or 45-plate capacity or relay rack would usually be provided depending on these requirements.

7.04 The relay equipment units associated with the 102A or 111A key equipment are shop-wired and arranged for mounting on 19- and 23-inch framework. Depending on the space requirements, a 45-plate apparatus cabinet or relay rack would usually be employed.

8.00 STATION ARRANGEMENTS

8.01 Various station arrangements are shown on SD-69167-01 for terminating the two-tone equipment at 4-wire station sets and the 102A key equipment. Terminations at 109A or 111A key equipment are shown on the standard drawings associated with either of these equipments.

8.02 PBX terminations are covered on several standard drawings which are listed in Part 9.

8.03 Terminations at stations located in explosive atmospheres are covered on ES-69190-01.

Telephone Sets

8.04 Various types of telephone sets are available for 4-wire private line station use. These include a non-push-to-talk or a push-to-talk handset with a hang-up mounting, a non-push-to-talk handset with a D-type mounting, a head telephone set, or a plug-ended non-push-to-talk handset, and a special handset with or without a special foot switch for push-to-talk operation for use in explosive atmospheres.

Keys

- 8.05** Keys are available as follows for the various features required.
- Control for switching two or three 4-wire lines at toll office.
 - Signaling on dc or 20-cycle basis.
 - Pickup of two to five 4-wire private lines.
 - Cutoff of signals.
 - Cutoff of station or PBX.
 - Special push-button signaling key for use in explosive atmospheres.

Signaling

8.06 In order to provide a maximum flexibility in adapting these facilities to the customer's needs, the circuits have been arranged to provide various combinations of 600/1500-cycle, 20-cycle, dc loop, or loudspeaker signaling as desired. These combinations include 600/1500-cycle signaling incoming and outgoing, 20-cycle incoming with either locked-in or nonlocked-in signals, 20-cycle outgoing, dc loop signaling, and loudspeaker signaling either incoming or outgoing.

8.07 When a loudspeaker is used for signaling, provisions are made for disconnecting the input to the loudspeaker when the attendant answers the call. Two filters coded 554A and 554B can be used to suppress objectionable 600/1500-cycle tones in loudspeakers. The 554A filter eliminates the 600-cycle tone and the 554B eliminates the 1500-cycle tone. While these filters eliminate the 600/1500-cycle tones, they do not affect the telephone receiver when the set is in the talking position. These filters are similar in design to key telephone units and can be mounted in 105-type apparatus boxes or on mounting bars in apparatus cabinets. Each filter is the equivalent of two key telephone units in size.

Talking Battery

8.08 Since stations on multistation private lines may be installed under varying conditions, several different types of talking battery supply arrangements have been provided for on SD-69167-01. They include dry cell battery supply, low output rectifier supply with automatic trans-

fer to emergency dry cell reserve in case of commercial power failure, and provisions for the use of any standard 14- to 26-volt power plant.

9.00 CIRCUIT DRAWINGS

<u>Title</u>	<u>Drawing Number</u>
Oscillator Circuit	SD-64691-01
Tie Trunk—551A, 551B, 551D or 600C PBX—600/1500-cycle sending, 600/1500-cycle or 20-cycle receiving	SD-65651-01
Tie Trunk—552A, 552D, 605A, 700C or 701A PBX—600/1500-cycle sending, 600/1500-cycle or 20-cycle receiving	SD-65652-01
Tie Trunk—551A, 551B, 551D or 600C PBX — 20-cycle sending, 600/1500-cycle or 20-cycle receiving	SD-65653-01
Tie Trunk—552A, 552D, 605A, 700C or 701A PBX—20-cycle sending, 600/1500-cycle or 20-cycle receiving	SD-65654-01
Signaling Connector Circuit	SD-65655-01
Auxiliary Trunk Circuit	SD-66679-01
Signal Circuit—102A Key Equipment	SD-69127-01
102A Key Equipment, 2- and 4-wire Toll Line Circuits	SD-69158-01
Attendant's Key and Telephone Circuit—102A Key Equipment..	SD-69159-01
109A Key Equipment	SD-69163-01
4-wire Private Line Circuit Arranged for Receiving and Transmitting 600/1500-cycle Signals..	SD-69167-01
600/1500-cycle Selective Signaling Equipment	SD-69168-01
Station Circuit for 4-wire Private Line—With Handset for Use in Explosive Atmosphere	ES-69190-01
Military Flight Service 102A Key Equipment, 4-wire Private Line and Station Circuits	SD-69191-01
111A Key Equipment	SD-69194-01