

COMMON SYSTEMS  
SIGNALING  
ONE WAY RECEIVING CIRCUIT  
ONE WAY SENDING CIRCUIT  
ALARM CIRCUITS, JACK CIRCUITS  
AND MISCELLANEOUS CIRCUITS  
FOR CIVIL AIR DEFENSE WARNING  
SYSTEM

CHANGES

B. CHANGES IN APPARATUS

B.1	Superseded	Superseded By
	5LA Dial (Fig. 7) "Y" Option	6E Dial "X" Option

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Options "X" and "Y" were added in Fig. 1 because the 5LA dial is rated Mfr. Disc.

D.2 The "working limit" for the (S) relay was changed. It formerly specified a maximum conductor loop resistance of 2000 ohms.

D.3 The title was changed. It formerly read, "For civil air raid warning system".

D.4 Information Note 301 was changed. It formerly read, "strap res. (A), (B) and (C) in Fig. 1".

D.5 Information Note 302 was changed. It formerly read, "strap res. (A), (D), and (E) in Fig. 2".

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3320-RJD-FSE-U7

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## CHANGES

## A. CHANGED OR ADDED FUNCTIONS

- A.1 Test jack circuits were added.
- A.2 A dial circuit was added.
- A.3 Battery supply circuits for use with test sets were added.
- A.4 Dummy line circuits were added.
- A.5 An extension lamp circuit to provide alarm indications at a testboard or switchboard was added.
- A.6 Provision was made for the use of line and loop jacks with one-way receiving circuits.
- A.7 The existing functional descriptions were completely revised.

## B. CHANGES IN APPARATUS

## B.1 Added

Fig. 6

1 239-type Jack  
1 326-type Jack  
1 2EE Key Unit  
1 19YD Res.

Fig. 7

1 5LA Dial  
1 239-type Jack

Fig. 8

1 238-type Jack  
1 239-type Jack  
1 18FN Res.

Fig. 9 or 12

1 285-type Jack  
1 249-type Jack

Fig. 10

1 7500, KS-13492, L1 Res.

Fig. 11

1 18BJ Res.

Fig. 14

1 J68602CU Battery Supply Unit

## C. CHANGES IN CIRCUIT REQUIREMENTS OTHER THAN THOSE APPLYING TO ADDED OR REMOVED APPARATUS

- C.1 Reference 1T(AL2) for relay (AL2) was moved from the "Conn. Bat." column to the "Block or Insulate" column.
- C.2 Test note 2 was changed. It formerly read "Strap terms. 1 and 2 on T.S."
- C.3 Test note 5 was changed. It formerly read "Remove ckt. from service by patching in spare ckt."
- C.4 Test note 9 was added and the equivalent information under "Remarks" was removed.
- C.5 The qualification "When jack ckts. are not provided with Fig. 1" was added to the existing data on relays (R) and (R1), and the requirements to be used when jack circuits are provided were added.
- C.6 Test note 10 was added.
- C.7 The reference to miscellaneous circuits was added in the title of the table.

## D. DESCRIPTION OF CIRCUIT CHANGES

- D.01 Figs. 6 to 15 were added.
- D.02 The connecting information for Figs. 1, 4 and 5 was changed.
- D.03 The "A" and "B" leads were added in Figs. 1 and 3.
- D.04 Option "Z" and lead designation "T" were added in Fig. 5.
- D.05 The battery designations were added.
- D.06 The wording covering the number of circuits for fuses S1, S2 and S3 was changed, and the information on fuses S4, S5, F1 and P1 was added.
- D.07 Note 103 was changed and Notes 104 and 105 were added.
- D.08 Option "Z" and Figs. 6 to 15 were added in the Options Used Table.

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D-3 suael  
D-4 suael and

D.09 The key face information for the 2EE key unit was added.

D.10 The battery symbols for the PLT, FIL and 130V SIG batteries were added.

D.11 The working limits for relay (S) were added.

D.12 The reference to "Miscellaneous Circuits" was added in the title.

D.13 The references to the cross-connection figures were added in the circuit figures.

D.14 Cross-connection Figs. 51 to 55 were changed, and Figs. 56 to 58 were added.

D.15 Note 203 was added.

D.16 The multipling information for the alarm leads in Fig. 3 was added.

All other headings under Changes, no change.

1. PURPOSE OF CIRCUIT

1.1 This circuit provides auxiliary units which are required in addition to two-way repeaters in order to furnish the inter-office signaling facilities for the civil air raid warning system.

2. WORKING LIMITS

2.1 The maximum conductor loop resistance for proper operation of relays (R) and (R1) in Fig. 1 is 1500 ohms.

2.2 The maximum conductor loop resistance for proper operation of relay (S) in Fig. 2 is 2000 ohms.

2.3 The minimum insulation resistance shall not be less than 15,000 ohms.

3. FUNCTIONS

3.01 Provides a one-way receiving circuit for repeating pulses received from the control point (or alternate control point) to a loop circuit in a central office.

3.02 Provides a lamp indication whenever signals are originated at the control point (or alternate control point) and whenever system tests are made.

3.03 Provides a one-way sending circuit for repeating pulses within an office or over relatively short lines.

3.04 Provides line and loop patching jacks for use with one-way sending circuits, one-way receiving circuits and two-way repeaters.

3.05 Provides an alarm circuit for indicating trouble in two-way repeaters.

3.06 Provides a test jack circuit for making dialing or pulsing tests over an entire system.

3.07 Provides a test jack circuit for making dialing tests over one-way sections of a system.

3.08 Provides a dial circuit.

3.09 Provides dummy line circuits for terminating spare one-way receiving circuits and spare two-way repeaters.

3.10 Provides battery supply circuits for use with pulsing test sets, pulse repeating test sets and 2-type signaling test sets.

3.11 Provides an extension lamp circuit for indicating alarm conditions at testboards or switchboards (in addition to the regular indications at the bay containing the equipment).

4. CONNECTING CIRCUITS

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

4.01 Two-Way Repeater Ckt. - Balanced Loop SD-95681-01.

4.02 Two-Way Repeater Ckt. - Open and Closed Loop SD-95682-01.

4.03 Dial Pulse Receiving and Code Distributing Ckt. SD-95678-01.

4.04 Application Schematic SD-95684-01.

4.05 Repeating Coil Ckt. - SD-96452-01 or SD-95144-01\* (Typical)

4.06 Type "C" Composite Set Ckt. SD-56166-01.

4.07 Type "E" Composite Set Ckt. or Type "E" Bypass Ckt. - SD-95144-01\*.

4.08 Dial Pulse Receiving and Control Ckt. - SD-95685-01 or SD-95743-01.

4.09 Alarm Circuits

4.091 Crossbar Office

4.0911 Aisle Pilot Ckt. - SD-25087-01 (Crossbar No. 1)

4.0912 Alarm Ckt. - SD-25671-01 (Crossbar No. 5)

4.092 Panel Office

- 4.0921 Audible Alarm Ckt. for Floor Alarm Board - SD-21819-01.
- 4.0922 Floor Alarm Board Miscellaneous and Aux. Alarm Ckt. - SD-21203-01 (Battery Cut-off)
- 4.0923 Miscellaneous Alarm Ckt. - ES-226189 (Ground Cut-off)
- 4.093 Step-by-Step Office
- 4.0931 Audible and Visual Alarm Ckt. - SD-96188-01 (SXS No. 1)
- 4.0932 Pilot Lamp Ckt. - SD-31548-01 (SXS No. 1)
- 4.0933 Audible Alarm Ckt. - SD-31551-02 (SXS No. 1 or 350A)
- 4.0934 Pilot Lamp and Power Alarm Lamp Ckt. - SD-31573-01 (No. 350A)
- 4.0935 Miscellaneous Alarm Ckt. for Aisle Pilots - SD-31970-01 (No. 355A)
- 4.0936 Miscellaneous Alarm Ckt. for Alarm Control - SD-31980-01 (No. 355A)
- 4.094 Manual Office
- 4.0941 Annunciator Circuit - SD-15443-01 (Typical)
- 4.10 Test Sets
- 4.101 SXS Pulsing Test Set - SD-31481-01.
- 4.102 SXS Pulse Repeating Test Set - SD-31667-01.
- 4.103 Toll Pulse Repeating Test Set - SD-64540-01.
- 4.104 2A Signaling Test Set - SD-56134-01.
- 4.105 2B Signaling Test Set - SD-56134-02.
- 4.11 Battery Supply Filter for 2-type Signaling Test Sets - SD-56335-01\*\*

\* The actual title of SD-95144-01 is "V3 Telephone Repeater, Line and Balancing, Application Schematic".

\*\* The actual title of SD-56335-01 is "Testing Circuit for 2400 or 2600 cycle Single Frequency Signaling Ckts."

DESCRIPTION OF OPERATION

5. ONE-WAY RECEIVING CIRCUIT (FIG. 1)

5.1 The (R) and (R1) relays in Fig. 1 are controlled by dial pulses received over the loop from the control point (or the alternate control point). The (R) relay repeats these pulses to the two-way repeaters, one-way sending circuits and/or

dial pulse receiving circuits which are connected together in the loop circuit at the repeater point, and those circuits then transmit the pulses to the other offices in the system. On the first pulse, the (R1) relay operates the (A) relay, which locks up under control of the CA key and lights the ALM lamp. This feature is provided to give the central office attendant a positive indication whenever a signal is originated at the control point. At the end of the pulsing, the lamp may be extinguished by momentarily operating the CA key.

6. ONE-WAY SENDING CIRCUIT (FIG. 2)

6.1 The one-way sending circuit is connected into the loop circuit at a repeater office whenever a one-way branch circuit is required to reach a dial pulse receiving and code distributing circuit or a dial pulse receiving and control circuit in another office - called a code sending office. Signals appearing in the loop circuit at the repeater office operate relay (S), which applies alternate battery and ground over the branch circuit to pulse the receiving relay at the distant office.

6.2 A one-way sending circuit may also be used to transmit pulses from one code sending office to another, but such arrangements should be carefully considered in order to avoid having too many warning stations dependent upon a single branch circuit, and to avoid exceeding the general system limitation that there should not be more than ten inter-office links between either control point and any code sending office.

6.3 Another use for one-way sending circuits is as local repeaters in an office where there are more branch circuits than the number which it is permissible to connect directly into the loop circuit. In such cases, the branch circuits may be divided into groups (of not more than 6 per group), with each group supplied by a one-way sending circuit in the loop.

7. ALARM CIRCUIT (FIG. 3)

7.1 When a line or other failure occurs on the backbone circuit, one or more of the two-way repeaters connects ground to the "F" lead of Fig. 3, and relay (AL1) operates and connects ground or battery, as required, to the office alarm system. The operation of relay (AL1) also causes the operation of relay (AL2), which locks up under control of key CA and lights the ALM lamp. When the attendant answers the alarm and operates the ACO keys in the repeaters, the ground on the "F" lead is removed and the office alarms are silenced, but the ALM lamp remains lighted until the (AL2) relay is released by the momentary operation of the CA key.

7.2 When the trouble is cleared and the two-way repeaters return to normal, ground is again applied to the "P" lead and the cycle is repeated except that the ACO keys in the repeater must be released in order to silence the office alarms.

7.3 It may be noted that the keys and lamps in Fig. 3 have the same designations as those in Fig. 1, but it should not be difficult to tell them apart as they are mounted on different units.

#### 8. LINE JACK CIRCUIT (FIG. 4) AND LOOP JACK CIRCUIT (FIG. 5)

8.1 A line jack circuit, consisting of a line jack L and an equipment jack EQ1; and a loop jack circuit, consisting of a loop jack LP and an equipment jack EQ2; are associated with each two-way repeater and each one-way sending circuit. In the newer installations they will also be provided with the one-way receiving circuits. These jacks serve primarily as access points to facilitate testing, but they may be used for patching in those cases where spare lines or equipment have been installed. (In connection with the latter use, it should be noted that soldering iron changes will be required inside the units unless identical substitutions are made).

8.2 To permit cutting off branch circuits from a loop without introducing a false pulse in the loop, option "Z" has been added. When it is furnished, the insertion of a solid plug (349-type) in the LP jack cuts off the circuit on the associated EQ2 jack without disturbing the loop. Opening the branch will, however, bring in the alarms at offices on the branch.

8.3 **WARNING.** Opening the network at any of the jacks will interfere with the transmission of alerts to some parts of the network; and if certain jacks are opened, the entire network is made inoperative. Even a momentary break will cause alarms in some offices, and may sound them in all offices. Great care should, therefore, be taken before inserting any plugs, and the precautions described in Sec. 14 should be observed.

#### 9. TEST JACK CIRCUIT FOR SYSTEM TESTS (FIG. 6) AND DIAL CIRCUIT (FIG. 7)

9.1 The test jack circuit for system tests is provided to permit the telephone company to make periodic tests of the overall system. It is connected in the line to the control point (or alternate control point) so that pulses dialed into it will operate the R and R1 relays in the one-way receiving circuit in the same manner as the pulses received from the associated control point. To make the test, the DIAL jack is patched to the DIAL 9 jack and digit "9" is dialed while the SYS TST

key is held operated. This will actuate the office alarms and light an ALM lamp in all of the receiving offices; and, if the nine pulses are correctly received, will light a TST lamp in each office. (The ALM lamp associated with the one-way receiving circuit at the sending office will also light). The lamps will remain lighted and the alarms will sound until they are retired manually by the attendant in each office, but delay in doing so will not interfere with the transmission of an alert immediately after the test. If the TST lamp does not light at any receiving office, other lamps will indicate the nature of the failure.

9.2 The test jack circuit may also be used as a means for sending continuous pulses over the system in case it is desired to make percent break measurements. When a pulsing test set and a pulse repeating test set are used for this purpose, the latter set is connected to the DIAL 9 jack, since the contacts of the pulsing relay work on an open-closed basis in the same way as dial contacts. A different arrangement is required when a 2A or 2B signaling test set is used, however, since the pulsing relays in these sets transmit battery and ground pulses. This condition is taken care of by using jack TS1 and resistance R1, which limits the current through the R and R1 relays to the same value as with the former test sets. With either arrangement, the pulses are transmitted only while the SYS TST key is held operated.

9.3 The parallel path through the normal contacts on the jacks and the SYS TST key are provided to guard against the transmission of false pulses on the system, since even a single pulse at this point will bring in the alarms at all receiving offices.

9.4 **WARNING.** Since the transmission of continuous pulses prevents the sending of any alerts, no such test should be made without taking the precautions discussed in Sec. 14.

#### 10. TEST JACK CIRCUIT FOR DIALING INTO ONE-WAY SENDING CIRCUITS (FIG. 8)

10.1 This test circuit is intended primarily for making dialing tests on branch circuits which are equipped with one-way sending circuits, but it may also be used for dialing into the loop side of two-way open-closed loop repeaters. Before making a test, the branch circuit is first cut off by inserting a solid plug in the LP jack as covered in Par. 8.2. This will immediately bring in the alarms and light the ALM and WD lamps at all of the offices down the branch. A dial is then connected to the TS2 jack by patching to the DIAL jack, if available, or by plugging in a dial hand test set; and the PLS OUT jack is patched to the EQ2 jack of the branch circuit. Battery through

resistance T and the dial contacts now re-operates the sending relay in the circuit under test, and the alarms and lamps can be retired by the attendants at the receiving offices. Digit "9" may now be dialed to check the operation of the branch circuit on pulses, and the alarms will come in and the ALM and TST lamps will light in the same manner as for the system test. If the branch circuit is a multi-link arrangement with several offices in tandem, this test may be repeated link-by-link if desired.

10.2 WARNING. Since this test isolates part of the network and prevents the sending of alerts to some warning stations, no such test should be made without taking the precautions discussed in Sec. 14.

#### 11. DUMMY LINE CIRCUITS (FIGS. 10 & 11)

11.1 When a spare one-way receiving circuit is provided, the (R) and (R1) relays will be normally operated to their No. 3 contacts (since there will be no current through their P1 windings) and relay (A) will be operated and the ALM lamp will burn continuously. To avoid this, a dummy line circuit per Fig. 10 may be provided, in which case the P1 windings will be energized as in a working circuit, the relays will be released and the lamp will remain dark.

11.2 When a spare 2-way repeater circuit is provided, there will be no current through the line circuit and the (R) relay will take the position which allows the alarm relay (A) to release. This causes the operation of the office alarms by grounding lead "F" in Fig. 3 on this drawing. The alarms may be silenced by operating the ACO key on the repeater, but this will leave the ALM lamp on the repeater burning continuously. To remedy this difficulty, the dummy line circuit per Fig. 11 has been made available. When it is provided, ground or battery - as required for an "X" or "Y" repeater, respectively - will be supplied from the repeater involved, over the "C" lead. This ground or battery, through the DL2 resistance, will hold the (R) relay of the repeater in the proper condition to keep the (A) relay operated, and the alarms will, therefore, remain silent without the use of the ACO key.

#### 12. BATTERY SUPPLY CIRCUITS FOR TEST SETS (FIGS. 9, 12, 13 & 14)

12.1 Portable test sets are used to provide continuous pulses and percent break

meters when percent break measurements are to be made on the civil air raid warning system. Fig. 9 covers the 48-volt battery supply jacks which are required when pulsing test sets and/or pulse repeating test sets are used. Fig. 12, in conjunction with either Fig. 13 or Fig. 14 covers the battery supply arrangements for the 2A and 2B signaling test sets. Fig. 13 is used for the 2A sets and for 2B sets which are wired for "V" option. Fig. 14 is used for 2B sets wired for "W" or "N" option.

#### 13. EXTENSION LAMP CIRCUIT (FIG. 15)

13.1 As previously indicated, an ALM lamp lights when the one-way receiving circuit (Fig. 1) or the alarm circuit (Fig. 3) is actuated. In the smaller offices, however, there may not be a terminal room attendant on duty at all times, so it is desirable to have additional indications at other locations. The extension lamp circuit makes it possible to provide a multiple appearance of these lamps at a switchboard or testboard having 24-hour coverage.

#### 14. TAKING EQUIPMENT OUT OF SERVICE

14.1 When any element of the civil air raid warning system is taken out of service, either for test or repair, some of the warning stations and siren stations - and in some cases all of them - are prevented from receiving warning alerts from the keypoint control station. It is extremely important, therefore, that the necessary work operations be completed with a minimum of delay and that the circuit be put back in service as quickly as possible.

14.2 In order that emergency arrangements may be made in case an air raid alert should occur while any of the equipment is out of service, the attendant at the keypoint control station and all telephone company personnel who may be concerned should be advised before any work, except a system dialing test, is started. The system dialing test takes such a short time that the chance of interfering with an alert is negligible, but coordination between the receiving offices and the sending office will still be required in order to determine that all offices received the test digit correctly.

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