

PANEL SYSTEMS
2-WIRE RECORDING COMPLETING TRUNK
OUTGOING
TO TOLL SWITCHBOARD NO. 1 OR NO. 3

CHANGES

A. CHANGED AND ADDED FUNCTIONS

As a result of these changes it is possible by the operation of a key at the distant office to make this trunk test busy to selectors or connectors.

B. CHANGES IN APPARATUS

B.1 Added

(B) Relay Y63
(MB) Relay Y99

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 Figure 4 has been added.
- D.2 "W" option has been added and "X" option has been designated.
- D.3 Notes 113 and 114 have been added.

All other headings under "Changes", no change.

1. PURPOSE OF CIRCUIT

- 1.1 This circuit is for use in completing toll calls from noncoin panel system subscribers. It is a 2-wire circuit and functions between the panel district selector or office selector circuits and 2-wire recording completing trunk equipments at a combined line and recording toll switchboard.
- 1.2 A multiple of this circuit on the office link and connector circuit in a crossbar office located in the same building is provided on a "Provisional" basis to permit the common use of this circuit by subscribers in both the panel and the crossbar offices.

2. WORKING LIMITS

- 2.01 The maximum external subscribers circuit loop resistance over which relays (A) or (Al) will provide satisfactory supervision is 1500 ohms.
- 2.02 The minimum subscriber loop insulation resistance for the satisfactory operation and release of relays (A) or (Al) shall be 10,000 ohms.

2.03 The maximum earth potential with which relays (A) and (Al) will operate satisfactorily is ± 20 volts.

2.04 The maximum external P.B.X. trunk circuit loop resistance over which relays (A) or (Al) will provide satisfactory supervision is 15,000 ohms.

2.05 The minimum P.B.X. trunk insulation resistance with which relays (A) or (Al) will provide satisfactory supervision is 15,000 ohms.

2.06 The maximum earth potential with which relays (A) or (Al) will operate on P.B.X. trunk circuit loops is ± 10 volts.

2.07 The minimum rated resistance to 56 volts battery to the P.B.X. for the P.B.X. trunk release circuit shall be 6,000 ohms for the satisfactory release of relays (A) or (Al).

2.08 The minimum external rated resistance during the trunk guard test by the panel sender circuit shall be 1937 ohms to provide for the satisfactory non-operation of relay (A) on its primary winding during the trunk guard test.

2.09 A maximum external rated resistance over which relay (A) will operate on its primary winding alone is 750 ohms.

2.10 The maximum external trunk circuit loop resistance for the operation of relay (TK) shall be 3250 ohms.

2.11 The minimum external trunk circuit loop resistance which will release relay (TK) shall be 14,550 ohms.

2.12 The minimum trunk loop insulation resistance shall be 30,000 ohms.

3. FUNCTIONS

3.01 Provides means for preventing a false flash of the line signal during the trunk guard test by the panel sender circuit.

3.02 Provides means for signaling the toll operator when the panel district selector circuit has reached

the "Awaiting Operator" position or the crossbar district junctor is connected to this trunk. A crossbar district junctor is automatically cut through on this type of connection without awaiting a reversal from the recording completing trunk.

3.03 Provides the toll operator with switchhook supervision when the panel district circuit has reached the "cut-through" position or the crossbar district junctor is connected to this circuit.

3.04 Provides the subscriber with ringing induction tone until the toll operator answers and permits the return of the ringing induction tone whenever the toll operator disconnects before the subscriber.

3.05 Reverses the battery supply to the panel district selector circuit or the crossbar district junctor circuit when the toll operator answers. Prior to this reversal the direction of the polarity of the battery is such as to cause the operation of toll diversion apparatus in a connected P.B.X. trunk when required.

3.06 Provides means for holding the connection under the control of both the toll operator and the subscriber.

3.07 Provides a test busy condition to other hunting district selector circuits and crossbar markers after the panel district circuit has reached the "Awaiting Operator" position or this circuit is connected to the crossbar district junctor circuit.

3.08 Permits the subscriber to abandon the call and release the connection before the primary line signal has been answered.

3.09 Provides 48 volt transmission.

3.10 Provides a connection to the "TEST AND MAKE BUSY" jack in the "Outgoing Trunk Test Board" in the panel or the crossbar office for testing the interoffice cable and for making routine operating tests.

3.11 Provides a test jack with the circuit for making routine operating tests.

3.12 Provides an auxiliary supervisory relay in series with the regular supervisory relay on connections to crossbar subscribers to permit 1500 ohms subscriber loop connections in the crossbar office. When the district junctor is initially connected to this circuit there is only one winding of relay (A) in the circuit, therefore, only a

maximum of 750 ohms subscribers loops could be obtained. However, relay (A) in this case permits 1500 ohms subscribers loops and its windings are short-circuited when the toll operator answers and relay (A) is then operated at its maximum efficiency on both windings.

4. CONNECTING CIRCUITS

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

4.01 Panel District Selector Circuits - "Sender Selector" Offices - ES-240071

4.02 Panel District Selector Circuits - "Link" Offices - SD-21627-01

4.03 Panel Office Selector Circuits - ES-240252

4.04 2-Wire Panel Subscriber Recording Completing Trunk at No. 1 and No. 3 Toll Offices - SD-62187-01

4.05 Test Set Circuit for 2-Wire Panel System Subscriber Recording Completing Trunks - SD-90470-01

4.06 Crossbar Office Link and Connector Circuit - SD-25033-01

4.07 Power Ringing Circuit - SD-80594-01

4.08 Test and Make Busy Jack Circuit - Panel Office - SD-21612-01

4.09 Test and Make Busy Jack Circuit - Crossbar Office - SD-25166-01

4.10 Test Cord Circuit for Outgoing Trunks at the "Outgoing Trunk Test" for - Panel Office - SD-21612-01

4.11 Test Cord Circuit for Outgoing Trunks at the "Outgoing Test Board" - Crossbar Office - SD-25177-01

4.12 Trunk Make Busy Circuit - SD-21075-01

DESCRIPTION OF OPERATION

5. INCOMING CALL - Panel Connection

When this trunk is seized by a district or office selector battery through resistance (F1) and the primary winding of relay (A) is connected to the tip side of the trunk and ground through resistance (F) is connected to the ring side of the trunk causing a momentary closure through the (TG) and overflow relays in the sender circuit during the period of selection beyond in the district selector. Relay (A) is designed not to operate at this time thereby

preventing a premature flash of the line lamp during the trunk guard test period. When the district selector circuit reaches the "Awaiting Operator" position relay (A) operates on its primary winding in series with the polarized relay in the district selector circuit, in turn operating relay (F). The operation of relay (F), (a) reverses the signaling leads to the tip and ring conductors on the toll end of the trunk, (b) operates relay (B), (c) connects ground to the sleeve of the district selector circuit and the "S1" lead of the secondary multiple of the office link and connector circuit in the crossbar office and if "X" option is provided operates relay (C). The operation of relay (B) connects ground to the sleeve of the district selector circuit and the "S1" lead of the secondary multiple in the office link and connector circuit, and holds relay (C). If "W" option and Figure 4 are used the (B) relay also operates the (MB) relay. The (MB) relay in operating opens the lead to the make busy circuit and operates the (C) relay. The operation of relay (C) connects battery and ground through the windings of relay (TK) to the ring and tip conductors of the trunk outgoing to the toll office thereby causing the high resistance relay at the toll office end to operate and light a line lamp. Relay (C) also connects ringing induction tone to the subscribers end of the trunk. Relay (TK) does not operate at this time due to the high resistance at the toll office end of the trunk.

6. INCOMING CALL - Crossbar Connection

When this trunk is connected to a crossbar district junctor circuit, battery through resistance (F1), the primary winding of relay (A) and the windings of relay (A1), Fig. 3, on the tip side of the trunk and ground through resistance (F) connected to the ring side of the trunk operates relay (A1)* in series with the connected subscribers line. The operation of relay (A1) operates relay (F1). The operation of relay (F1)** (a) operates relay (F), (b) connects ground to the "S" lead of the office link and connector circuit. The operation of relay (F) (a) reverses the signaling leads to the tip and ring of the toll end of the trunk, (b) operates relay (B), (c) connects ground to the panel district sleeve circuit and the "S1" lead of the office link and connector circuit and (d) operates relay (C). The operation of relay (B) connects ground to the panel district sleeve circuit and the "S1" lead of the office link and connector circuit and holds relay (C). If "W" option and Figure 4 are used the (B) relay also operates the (MB) relay. The (MB) relay in operating opens the lead to the make busy circuit and operates the (C) relay.

The operation of relay (C) connects ringing induction tone to the subscribers end of the trunk and connects battery and ground through the windings of relay (TK) to the ring and tip conductors outgoing to the toll office thereby causing a high resistance relay at the toll office to operate and light a line lamp. Relay (TK) will not operate at this time due to the high resistance loop.

*Relay (A) performs no function at this time and whether it operates or not when relay (A1) operates is irrelevant to the description of operation of this circuit at this time. Relay (A1) operates in series with the subscribers line because the crossbar district junctor cuts through automatically without awaiting a reversal from the recording completing trunk.

**Relay (F1) is a slow release relay to prevent the release of the crossbar switches should the subscriber flash the switchhook before the toll operator answers.

7. TOLL OPERATOR ANSWERS

When the toll operator answers, the high resistance is short-circuited at the toll switchboard thereby operating relay (TK). The operation of relay (TK) disconnects the ringing induction tone from the subscribers end of the trunk and operates relay (RV). The operation of relay (RV) (a) reverses the battery supply to the panel district circuit, causing it to step into the "cut-through" position or reverses the battery supply to the crossbar subscribers line, (b)* arranges the connections to relay (A) to include both windings in the circuit, (c) locks itself up on its primary winding under control of relay (B) and (d) operates relay (J) with "Y" wiring or extends the control of relay (B) to the contacts of relay (TK) with "Z" wiring. The operation of relay (J) (a) connects the control of relay (B) to the contacts of relay (TK) for holding the connection under control of both the toll operator and the subscriber, (b) short-circuits the windings of relay (A1) causing relay (A1) to release, (c) connects ground to lead "S" of the office link and connector circuit. The release of relay (A1) releases relay (F1) which restores the control of relay (F) to relay (A)**. The circuit is now arranged for talking.

*Only one winding of relay (A) was wired in the circuit before the toll operator answered in order to obtain easier non-operate margins during the trunk guard test by the panel sender circuit on a connection from a panel subscriber.

**With the operation of relay (RV) both windings of relay (A) are now in the circuit. This permits relay (A) to operate over a maximum crossbar subscribers loop and therefore relay (A1) is no longer required in the connection.

8. SIGNALING THE TOLL OPERATOR

Relay (A) in following the operation of the switchhook at either the panel or crossbar subscriber stations causes relay (F) to operate and release in unison. The operation and release of relay (F) reverses the battery and ground at the toll board end of the trunk causing the supervisory lamp in the connected cord circuit to flash as a recall signal or to light steadily as a disconnect circuit.

9. HOLD AND DISCONNECT

A connection is held as long as the toll operators cord is connected to the trunk or the subscriber has the receiver off the switchhook. When the subscriber disconnects relays (A) and (F) release and function as described in paragraph 8. When the toll operator disconnects, relay (TK) releases in turn releasing relay (B). The release of relay (B) (a)* disconnects ground from the panel district sleeve circuit and the crossbar "S1" lead, and (b) releases relays (J), (C), (MB) and (RV). The release of relay (C) opens the signaling circuit to the toll switchboard. The release of relay (J) removes the short-circuit from the windings of relay (A1) and removes ground from the "S" lead of the office link and connector circuit+. The release of relay (RV) restores the talking battery to the tip conductor and ground to the ring conductor++.

*The removal of ground from the panel district sleeve circuit disconnects the panel district selector circuit on a panel connection.

+The removal of ground from the "S" lead of the office link and connector circuit causes the release of the connected crossbar switches.

++With battery normally connected to the tip, and ground normally connected to the ring on the crossbar connection the crossbar P.B.X.'s may be arranged for toll diversion due to the out-through of the crossbar junctor without a reversal from the recording completing trunk.

10. TESTING

To make this trunk busy to hunting panel district selectors or crossbar markers, connect ground to the "S" lead at the panel district or office multiple or at the local IDF or to the "S1" lead in the office link and connector frame "Secondary Multiple" in the crossbar office.

To make routine operating tests in a panel office, the plug of the test set will be inserted into the jack shown in Fig. 2. The insertion of the plug (a) connects the tip and ring of the trunk to the tip and ring of the test circuit respectively, (b) opens the sleeve circuit to the panel district selector circuit between the trunk and district or office multiple, (c) connects ground to the associated sleeve terminal in the district or office multiple and the "S1" lead on the secondary multiple of the office link and connector frame, (d) connects the trunk sleeve circuit to the test set and (e) operates relay (C). When the test is completed plug for the test set is removed and the circuit is restored to normal.

To test the conductors that are used for connecting this trunk to the toll office a connection may be made to the associate "TEST AND MAKE BUSY" jack at the outgoing trunk testboard in the crossbar office or the panel office. When the test circuit is connected ground will be connected to the sleeve of this circuit on the panel office multiple and the "S1" lead of the secondary multiple of the crossbar office link and connector circuit thereby providing a busy condition to hunting selectors or markers. Relay (C) is also operated.

To make routine operating tests on this circuit from the outgoing trunk testboard in a crossbar office a connection is made to this circuit at the testboard beyond, via the test jack which is shown on the office link and connector circuit.

11. TOLL DIVERSION

This circuit is not arranged for operation with P.B.X.'s in panel offices arranged for toll diversion.

When a subscriber in a P.B.X. arranged for toll diversion in a crossbar area dials a long distance call battery on the tip conductor and ground on the ring conductor of this trunk will cause the operation of the toll diversion feature at the private branch exchange.

12. TRUNK MAKE BUSY - FIG. 4

If a make busy key at the distant office is operated to make busy the trunk group of which this is part, ground will be connected to the "Sl-Sl6" lead of Fig. 4. If the trunk at this time is busy handling a call (MB) relay will

be operated and the make busy ground will have no effect as long as the trunk is held. However, upon disconnection the (MB) relay releases and upon release connects the make busy ground to the "S" lead in panel offices and the "Sl" lead in crossbar offices so that the trunk circuit will test busy.

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DEPT. 3350-WCO-RSW

