

CIRCUIT DESCRIPTION
SYSTEMS DEVELOPMENT DEPARTMENT
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CD-66151-01
Issue 11-D

PBX SYSTEMS
NO. 750A
TRUNK CIRCUIT
TO CENTRAL OFFICE

CHANGES

A. CHANGED AND ADDED FUNCTIONS

- A.1 Flashes the trunk lamps on incoming calls and lights them steady on a busy condition.

B. CHANGES IN APPARATUS

- B.1 Added

1 - R1603 Relay (R1) Fig. C
1 - R403 " (BU) " C

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 Fig. C was added to provide for flashing the trunk lamps on incoming calls and to light them steady on a busy condition.
- D.2 Note 114 was added.
- D.3 The (T) relay for the fourth trunk was added.
- D.4 The cabling diagram was changed to provide for the fourth trunk.

All other headings under "Changes", no change.

1. PURPOSE OF CIRCUIT

- 1.1 This circuit is used to provide two-way service between the central office and the 750A P.B.X.

2. WORKING LIMITS

2.1 Station

Maximum resistance per conductor	10 ohms
Minimum insulation resistance	
Manual and Panel Areas	20,000 "
Step-by-Step Areas	30,000 "

2.2 Trunk

Maximum Conductor Loop Resistance	750 ohms
Minimum Insulation Resistance	
Manual and Panel Areas	20,000 "
Step-by-Step Areas	30,000 "
Maximum Resistance of Conductor between (R1) relay and each (trunk) Lamp	5 "
Maximum Resistance of Conductor from each appearance of (trunk) lamps to ground	2.5 "

3. FUNCTIONS

- 3.01 To connect the station to a trunk if the trunk is idle when a trunk key is operated.
- 3.02 To return busy tone to the station if the trunk, on which the key is depressed, is busy.
- 3.03 When provided for, to allow a particular station to connect to a busy trunk.
- 3.04 To connect a holding condition to the trunk when the hold key at the station is depressed.
- 3.05 To remove the holding condition when the trunk is reseized by a station.
- 3.06 To give an audible signal on an inward call from central office.
- 3.07 To give a steady or flashing visual signal when required on an inward call from central office.
- 3.08 When the central office is equipped with machine ringing and the visual signal is provided, to give a steady or flashing visual signal during ringing and silent periods.
- 3.09 To extinguish the visual signal and stop the audible signal after the central office call is abandoned or after it is answered.
- 3.10 To normally connect the station to the line and link circuit.
- 3.11 To indicate to the line circuit that a trunk call is being made so that the line circuit may be cut off from the station.
- 3.12 To restrict any station from making outward calls on any trunk when required.

- 3.13 To provide means to increase the charging rate when the trunks are in use.
- 3.14 To give a steady visual signal when the trunk is busy.

4. CONNECTING CIRCUITS

- 4.1 750A P.B.X. station circuit.
- 4.2 750A P.B.X. line and link circuit.
- 4.3 750A P.B.X. tone, ringing alarm and common timing circuit.
- 4.4 P.B.X. emergency transfer key circuit.
- 4.5 Standard line circuits at manual, panel or step-by-step central offices.
- 4.6 750A P.B.X. power charge and discharge circuit.

DESCRIPTION OF OPERATION

5. OUTWARD CALL TO CENTRAL OFFICE

5.1 Non-Restricted Lines

On a non-restricted line "X" wiring, Fig. 1 will be used. When one of the trunk keys at the station is operated, the "RR" lead and lead "YY", "BB", "W" or "Y" depending on which trunk key is depressed, are connected together through a resistance at the station. Relay (T) in the trunk then operates, but relay (H) will not receive sufficient current to operate. Relay (T) operates the (C) relay and grounds the "S" lead to the line and link circuit in order to cut off the tip and ring of the line circuit from the station. Relay (C) locks in series with the (LO) relay, the (LO) relay operating to open the battery from the (C) relay operating circuit and from all of the other (C) relays that are connected to this trunk. This prevents any other station from being connected to this trunk. Relay (LO) also opens the (R) relay and the (A) subset from across the trunk, and operates the (K) relay Fig. 4 thru the (P) or (S) windings or the (K1) relay Fig. 5 or the (BU) relay as the case may be, which grounds the "CT" lead to the "Power Charge and Discharge Circuits". The (BU) relay if provided also lights the trunk lamps steady as a busy indication. Relay (C) connects the tip and ring of the station

to the trunk, prepares the holding circuit and opens the "BT" lead and the ground which were connected to the station by the operation of the (T) relay. The purpose of connecting the "BT" lead and ground to the ring and tip of the station will be described later. The station is now connected to the central office and the call is extended in the usual manner.

5.2 Restricted Lines

If a station is to be restricted from making outward central office calls "Y" wiring, Fig. 1, is used instead of "X" wiring. The operating ground for the (C) relay will then be disconnected so that when a station operates the trunk key relay (T) will operate, but relay (C) will not operate. Relay (T) will connect busy tone to the station in the same manner as described in section 8.1 for connecting to a busy trunk.

5. INWARD CALL FROM CENTRAL OFFICE

6.1 Operation with Machine Ringing

The trunk is arranged so that on machine ringing from central office, the lamp, Fig. 3, will flash or remain lighted steady as long as the central office is ringing and will be extinguished when the central office abandons the call. Relay (R) operates when ringing current is applied to the trunk, operating relay (R1) Fig. B or C which locks under control of the (IO) relay to a ground on the "LK" lead in the tone, ringing and alarm circuit. Relay (R1) also grounds the "R1" and "ST" leads to the tone, ringing and alarm circuit in order to start a timing chain in that circuit which will hold the (R1) relay operated and connects the subset in Fig. A-1 or the buzzer in Fig. A-2 to the tone, ringing and alarm circuit. The (R1) relay Fig. B also lights the trunk lamp steady if provided and the (R1) relay Fig. C operates the (BU) relay which connects the lamp to the tone, ringing, alarm and common timing circuit for flashing the lamp. The (BU) relay also closes the "CT" lead from ground to the power charge and discharge circuit. Relay (R) also grounds the "R" lead to the tone, ringing and alarm circuit to control the timing relays. During the silent period the timing circuit just mentioned will hold the (R1) relay locked until it is again held from the (R) relay. If the call should be abandoned before it is answered, the trunk lamp will flash or remain lighted until the

timing circuit opens the ground from the "LK" lead to release the (R1) relay. While the (R) relay is operated, a relay in this latter circuit is operated, which connects ringing current from the P.B.X. continuous ringing supply to the subset, causing the associated ringer to operate as long as the (R) relay is operated. When trunk lamps are provided, this subset may be omitted, and a common audible signal, shown in the tone ringing and alarm circuit, will be provided. To answer a call from any station, the trunk key is operated and the receiver moved from the switch-hook. Relays (T), (C) and (LO) now operate as described in paragraph 5.1. Relay (LO) opens the (R) relay from across the trunk and releases relay (R1), extinguishing the trunk lamp. Ringing is tripped at the station.

If a call is answered by a station which is restricted from making outward calls, "Y" wiring, Fig. 1, is provided and in this case the ground for the (C) relay is supplied by the (R1) relay. When the (LO) relay operates, it also grounds the (D) relay as the (R1) relay will then release.

6.2 Operation with Manual Ringing

When manual ringing is supplied from central office, the (TRUNK) lamp will not be continuously flashing or lighted, but will remain flashing or lighted until ground is opened from the (LK) lead by the "Tone, Ringing Alarm and Common Timing Circuit". The rest of the operation is the same as described in paragraph 6.1.

7. TRANSFERRED CALLS

7.1 Holding

In order to transfer an outward or an inward call, the hold key at the station is operated. This short-circuits a resistance located in the station equipment which is in series with the (H) and (T) relays, allowing sufficient current to flow to operate the (H) relay. The (H) relay operates relay (H1) Fig. 3. Relay (H1) locks to the (LO) relay, bridges the (H2) relay across the trunk to hold the trunk and opens the tip toward the station. Relay (H2) operates under this condition, operating relay (H4), which opens the ring of the trunk to the station, connects the non-inductive winding of the (H3) relay in series with the secondary winding of the (H2) relay

across the trunk and places a ground to the "RS" lead so that restricted line may pick up a held call. When the station hangs up or operates the (L) key, relays (C), (T), (IO), (H) and (H1) release. The connection is held as the resistance of the secondary winding of relay (H2) and the non-inductive windings of relay (H3) is not sufficient to give a disconnect at the central office. The station now dials locally and informs another station that a call is waiting on the trunk.

7.2 Seizure

When the same station or any other station operates the trunk key for this trunk operating the (T), (C) and (IO) relays, relay (H3) is connected in series with the station and operates. Relay (H3) short-circuits relay (H2) releasing it. Relay (H2) releases relay (H4) reconnecting the ring of the trunk to the ring of the station. Relay (H4) short-circuits relay (H3) which releases; the trunk is then connected for talking.

If the station which has answered the transferred call is restricted from outward calls, the (C) relay associated with this station will operate from ground on the (H4) relay, and will be held to ground on the (IO) relay when it operates.

8. GENERAL

8.1 Busy Trunk

When a trunk is busy and another station attempts to call central office on the busy trunk, the (T) relay associated with the calling station on this trunk operates. However, since the trunk is busy the (IO) relay which is common to all of the trunk (C) relays will be operated and the operating battery for all of the (C) relays will be opened, thus preventing the second (T) relay from operating the (C) relay. With the (T) relay operated under this condition, the busy tone lead "BT" to the tone ringing and alarm circuit is connected in series with the station through ground on the (T) relay. This starts the busy tone circuit and gives an indication to the calling station that the trunk is busy.

8.2 Secrecy

The trunks are normally arranged for secrecy. However, if it is desirable to allow a particular

station to connect to any one of the trunks, even though it is busy, this may be accomplished by a slight change in wiring at the (C) relay which will permit the (C) relay to operate in any case even though the (LO) relay is already operated.

8.3 Release from Central Office

If the trunk is in the holding condition, that is, with the (H2) relay bridged across the trunk and the connection is broken at the central office, the (H2) relay may release and restore the trunk circuit to normal.

BELL TELEPHONE LABORATORIES, INC.

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TRUNK CIRCUIT
TO CENTRAL OFFICE

CHANGES

B. CHANGES IN APPARATUS

B.1 Superseded Superseded by
584DD Subset Fig. A1 584DE Subset Fig. A1

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

C.1 In remarks column for relay (H1) changed "Insulate 3T
(H1)" to "Insulate 3T (H4)".

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The cabling diagram has been changed.

D.2 Added Note 113.

DEVELOPMENT

1. PURPOSE OF CIRCUIT

1.1 This circuit is used to provide two-way service between
the central office and the 750A P.B.X.

2. WORKING LIMITS

2.1 Station

Maximum resistance per conductor	10 ohms
Minimum insulation resistance	
Manual and Panel Areas	20,000 "
Step-by-Step Areas	30,000 "

2.2 Trunk

Maximum Conductor Loop Resistance	750 ohms
Minimum Insulation Resistance	
Manual and Panel Areas	20,000 "
Step-by-Step Areas	30,000 "
Maximum Resistance of Conductor between (R1) relay and each (trunk) Lamp	5 "
Maximum Resistance of Conductor from each appearance of (trunk) lamps to ground	2.5 "

OPERATION

3. FUNCTIONS

- 3.01 To connect the station to a trunk if the trunk is idle when a trunk key is operated.
- 3.02 To return busy tone to the station if the trunk, on which the key is depressed, is busy.
- 3.03 When provided for, to allow a particular station to connect to a busy trunk.
- 3.04 To connect a holding condition to the trunk when the hold key at the station is depressed.
- 3.05 To remove the holding condition when the trunk is re-seized by a station.
- 3.06 To give an audible signal on an inward call from central office.
- 3.07 To give a visual signal when required on an inward call from central office.
- 3.08 When the central office is equipped with machine ringing and the visual signal is provided, to give a steady visual signal during ringing and silent periods.
- 3.09 To extinguish the visual signal and stop the audible signal after the central office call is abandoned or after it is answered.
- 3.10 To normally connect the station to the line and link circuit.
- 3.11 To indicate to the line circuit that a trunk call is being made so that the line circuit may be cut off from the station.
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4. CONNECTING CIRCUITS

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DETAILED DESCRIPTION

5. OUTWARD CALL TO CENTRAL OFFICE

5.1 Non-Restricted Lines

On a non-restricted line "X" wiring, Fig. 1 will be used. When one of the trunk keys at the station is operated, the "RR" lead and lead "YY", "BB" or "W" depending on which trunk key is depressed, are connected together through a resistance at the station. Relay (T) in the trunk then operates, but relay (H) will not receive sufficient current to operate. Relay (T) operates the "C" relay and grounds the "S" lead to the line and link circuit in order to cut off the tip and ring of the line circuit from the station. Relay (C) locks in series with the (LO) relay, the (LO) relay operating to open the battery from the (C) relay operating circuit and from all of the other (C) relays that are connected to this trunk. This prevents any other station from being connected to this trunk. Relay (LO) also opens the (R) relay and the (A) subset from across the trunk, and operates the (K) relay Fig. 4 thru the (P) or (S) windings or the (K1) relay Fig. 5 as the case may be, which grounds the "CT" lead to the "Power Charge and Discharge Circuits". Relay (C) connects the tip and ring of the station to the trunk, prepares the holding circuit and opens the "BT" lead and the ground which were connected to the station by the operation of the (T) relay. The purpose of connecting the "BT" lead and ground to the ring and tip of the station will be described later. The station is now connected to the central office and the call is extended in the usual manner.

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6. INWARD CALL FROM CENTRAL OFFICE

6.1 Operation with Machine Ringing

The trunk is arranged so that on machine ringing from central office, the lamp, Fig. 3, will remain lighted as long as the central office is ringing and will be extinguished when the central office abandons the call. Relay (R) operates when ringing current is applied to the trunk, operating relay (R1) which locks under control of the (LO) relay to a ground on the "LK" lead in the tone, ringing and alarm circuit. Relay (R1) also grounds the "R1" and "ST" leads to the tone, ringing and alarm circuit in order to start a timing chain in that circuit which will hold the (R1) relay operated. Relay (R) also grounds the "R" lead to the tone, ringing and alarm circuit to control the timing relays. During the silent period the timing circuit just mentioned will hold the (R1) relay locked until it is again held from the (R) relay. If the call should be abandoned before it is answered, the trunk lamp will remain lighted until the timing circuit opens the ground from the "LK" lead to release the (R1) relay. Relay (R1) also connects the subset in Fig. A1 or the buzzer in Fig. A2, to the tone, ringing and alarm circuit. While the (R) relay is operated, a relay in this latter circuit is operated, which connects ringing current from the P.B.X. continuous ringing supply to the subset, causing the associated ringer to operate as long as the (R) relay is operated. When trunk lamps are provided, this subset may be omitted, and a common audible signal, shown in the tone ringing and alarm circuit, will be provided. To answer a call from any station, the trunk key is operated and the receiver removed from the switchhook. Relays (T), (C) and (LO) now operate as described in paragraph 5.1. Relay (LO) opens the (R) relay from across the trunk and releases relay (R1), extinguishing the trunk lamp. Ringing is tripped at the station.

If a call is answered by a station which is restricted from making outward calls, "Y" wiring, Fig. 1, is provided and in this case the ground for the (C) relay is supplied by the (R1) relay. When the (LO) relay operates, it also grounds the (C) relay as the (R1) relay will then release.

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8.2 Secrecy

The trunks are normally arranged for secrecy. However, if it is desirable to allow a particular station to connect to any one of the trunks, even though it is busy, this may be accomplished by a slight change in wiring at the (C) relay which will permit the (C) relay to operate in any case even though the (LO) relay is already operated.

8.3 Release from Central Office

If the trunk is in the holding condition, that is, with the (H2) relay bridged across the trunk and the connection is broken at the central office, the (H2) relay may release and restore the trunk circuit to normal.

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