

PBX SYSTEMS  
No. 755A  
LINK AND LINK ALLOTTER CIRCUIT

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Circuit Note 102 is revised to provide for use with recorded telephone dictation trunks.

All other headings under Changes, no change.

1. PURPOSE OF CIRCUIT

1.1 This circuit is used to provide a means for connecting PBX stations for intercommunication and a PBX station to a tie trunk.

2. WORKING LIMITS

2.1 Maximum external circuit loop 400 ohms.

2.2 Minimum insulation resistance 20,000 ohms.

3. FUNCTIONS

3.01 To provide means for a link to select the calling line.

3.02 To extend the start lead to the next link.

3.03 To furnish dial tone to the calling station from the link when it is ready to receive dial pulses.

3.04 To record dial pulses and test the called line for busy or idle indication.

3.05 To provide busy tone to the calling subscriber if the called line is busy.

3.06 If the called line is idle, to supply ringing current to ring the station bell.

3.07 To furnish audible ringing tone to the calling station while the called station while the called station is being rung.

3.08 To trip ringing when the called station answers.

3.09 To provide talking battery to both calling and called stations.

3.10 To ground the start leads for the ringing interrupter, dial tone and busy tone when these are required.

3.11 To restore the link to normal after both calling and called stations replace the receiver on the switchhook or release the "L" key in the station set.

3.12 To transfer the start lead to the succeeding link by means of the link allotter (CH1), (CH2) and (CH3) relays when the link is seized or when the link fuse operates. This permits a subscriber to obtain a second link when the first link seized is in trouble.

3.13 When all links are busy or out of service, to transfer the start lead to the busy lead "TS" in the tone, ringing, alarm and common timing circuit to provide means for giving a busy tone to the calling station.

3.14 To provide means for manually cutting the link out of service.

3.15 To make the dialing of extra digits ineffective.

3.16 To increase the battery charging rate in the power circuit on a local call.

3.17 To cause the release of the called line when a trunk key is operated after the called line is connected to the talking circuit by the operation of the local key.

3.18 To provide audible ringing tone to the called subscriber when this called subscriber removes the receiver from the switchhook while the local key is not depressed.

3.19 To provide for dialing a second line for conference service, after the first subscriber has answered and then replaced the receiver on the switchhook.

3.20 To provide for giving a busy tone to the calling subscriber and stopping the ringing of the bell of the first called subscriber if the second called subscriber on a conference connection is busy.

3.21 Provides for a two line hunting group so that if the first line is called and is busy the second line will receive the call.

3.22 Provides for tie trunk service.

4. CONNECTING CIRCUITS

4.1 No. 755A PBX Station Circuit - SD-66507-01.

No. 755A PBX Tone, Ringing, Alarm and Common Timing Circuit - SD-66506-01.

No. 755A PBX line, Line Switch and Call Allotter Circuit - SD-66504-01.

No. 755A PBX Power Charge and Discharge Circuit - SD-80588-01.

4.5 No. 755A PBX Tie Trunk - SD-66600-01.  
(typical)

## DESCRIPTION OF OPERATION

### 5. SEIZURE OF LINK

When the station receiver is removed from the switchhook and the station local or (L) key is operated, the (ST) relay (Fig. 1) operates in series with a relay in the line, line switch and call allotter circuit. Relay (ST) connects ground to the "DTS" lead to start the dial tone functioning and transfers the tip of the line through the "P2" winding of the (A) relay from a direct ground to a ground through a repeating coil winding in the tone, ringing, alarm and common timing circuit for the purpose of supplying dial tone to the calling subscriber when the link is connected to the called line. The (ST) relay also connects the "SMS" lead to the "OSM" lead and when ground is connected to the "SMS" lead, the select magnet associated with the link in the line, line switch, and call allotter circuit will operate. When the link is connected to the line through the cross points of the line switch a circuit is closed to hold the (ST) relay operated and the (A) relay will operate which operates relay (B). Relay (B) holds operated under control of the (CO) relay in the line circuit over the "CH" lead. Relay (B) opens the "SMS" lead from the "OSM" lead releasing the select magnet, releases the associated (CH) relay in Fig. 2 and partially closes a circuit for the (C) and (P1) relays. The (B) relay also operates a relay in the power charge and discharge circuit for increasing the charging rate while the link is being used and connects ground to a common lead for holding and operating relays later described.

The release of the (CH1) (CH2) or (CH3) relay in Fig. 2 will transfer the ground lead to the next link for the next digit. The (ST) relay holds operated through its primary and secondary windings in series with the (T2) relay and a relay in the line circuit. The subscriber upon releasing the dial tone will operate the (A) relay which will release and operate the (A) relay in unison with the make and break of the dial contacts. The (C) relay operates when the (A) relay releases on the first pulse of each digit and remains operated until the end of the last pulse of each digit. On the first pulse or subsequent pulses the (P1) relay operates when the (A) relay releases. On the second pulse or

subsequent even pulses the (P3) relay will operate and the (P1) relay will be released. The (P1) relay when operated connects ground to a lead to operate the odd numbered register relays and when it is released it connects ground to a lead to operate the even register relays. These register relays can only operate while the (C) relay is operated.

The numbering system used in the 10 line PBX is 20 to 29 and in the 20 line PBX is 20 to 39. The (P1), (P2) and (P3) relays operate and release in the following manner. When the (A) relay releases on the first pulse, the (P1) relay will operate and when the (A) relay reoperates the (P2) relay will operate and the (P1) relay will hold operated through its own contact and the primary winding of the (P2) relay under control of the (C) relay. When the (A) relay releases on the second pulse the (P3) relay will operate and the (P2) relay will hold operated through its secondary winding. The operation of the (P3) relay releases the (P1) relay and transfers the operating circuit of the (C) relay to a hold circuit. The purpose of this is to remove any shunt from around the (P2) relay when the (A) relay reoperates so as not to interfere with the fast release requirement of the (P2) relay.

### 6. PRELIMINARY PULSE

In the case of a momentary opening of the line before a digit has been dialed the (A) relay will release and the (C) and (P1) relays will operate. When the (P1) relay operates the (SW) relay will operate and will hold under control of the (C) relay. When the (A) relay reoperates the (C) relay will release, releasing the (P1) and (SW) relays again preparing the circuit to receive the first digit.

### 7. DIALING

When the (P1) relay operates on the first pulse of the first digit the (SW) relay operates as mentioned above. When the (P1) relay releases on the second pulse of the first digit the (T2) relay operates and locks to the common ground lead under control of the (HS) and (B) relays. The (T2) relay releases the (ST) relay, partly closes the (SP) relay to the "S2" lead, partly closes the operating circuit for the (C1) relay and closes the odd lead from the contact of the (P1) relay to the (T3) relay. In the case of a third pulse the (T3) relay will operate when the (P1) relay operates and will lock to the common ground lead. The (T3) relay closes the even lead from the (P1) relay to the (DC) relay so that in case four or subsequent pulses are dialed on the first digit the (DC) relay will operate and prevent connection to any station. The operation of the (T3) relay also transfers the ground lead from the 20-29 "CO" leads to the 30-39 "CO" leads and transfers the hunting leads if "S" and "Z" wiring is used

from the 26 and 27 "CO" leads to the 36 and 37 "CO" leads respectively. When three pulses only are received on the first digit the (C) relay will release at the end of the third pulse which will release the (SW) relay. The release of the (SW) relay transfers the odd and even leads from the (P1) relay contacts to the unit register relays (1-7), (2-8), (3-9), (4-0), (5-6) and (6). It also partly closes a circuit for operating the (C1) relay. On the first pulse of the second digit the (C) and (P1) relays again operate; the (C) relay at this time operates the (C1) relay. The (P1) relay connects ground to the odd and even leads to operate the (1-7), (2-8), (3-9), (4-0), (5-6), and (6) relays depending upon the digit dialed. The (2-8) relay will release the (1-7); the (3-9) will release the (2-8); the (4-0) will release the (3-9) and the (5-6) will release the (4-0). The (6) relay, however, will not release the (5-6) relay. If more than six pulses are dialed on the second digit the (6) relay will remain operated (1-7), (2-8), (3-9) and (4-0) relays will reoperate and release in the order named as they did when the first four pulses were dialed. When the (1-7) relay operates on the seventh pulse the (5-6) relay will release. The following table shows the relays operated for any given number dialed on the second digit.

Pulses	Relay Operated
1	(1-7)
2	(2-8)
3	(3-9)
4	(4-0)
5	(5-6)
6	(5-6) & (6)
7	(1-7) & (6)
8	(2-8) & (6)
9	(3-9) & (6)
0	(4-0) & (6)

At the end of the last pulse of the second digit the (C) relay will release and with the (C1) relay operated the (DC) relay will operate and lock to the common ground. The (C1) relay also partially closes a circuit for operating a relay in the call allotter circuit which controls the release of the select magnet. The (DC) relay partially closes the operating circuit for the (SP) relay operates the (SW) relay, connects the busy test relay to the "CO" lead of the line under test, opens an operating path for the (T3) relay to prevent it operating in case a third digit is dialed when the relay is non-operated and connects the common leads together which connect to the "CO" leads through the contacts of the register relays. These leads are open until dialing is completed to prevent two "CO" leads being tied together as a ground on one "CO" lead from the line, line switch and call allotter circuit would cause interference to another line by connecting this ground to another "CO" lead while the register relays are

operating and releasing. In the case of 28 being dialed the (T2), (6) and (2-8) relays will be operated. A circuit will be closed through from the (BY) relay through contacts of the (C1), (DC), (T3), (6) and (2-8) relays to the "CO" lead which connects to the "CO" lead of the 28 line in the line, line switch and call allotter circuit.

#### 8. CALLED LINE BUSY

If the line is busy, the (BY) relay will operate which will prevent further operation of the circuit for connection to the called line. When the (BY) relay operates, it opens its operating circuit and locks to the common ground. The 28 "CO" lead is open at the (BY) relay so no interfering battery will be left on the 28 "CO" lead. The operation of the (BY) relay also opens the "L2" lead to the line, line switch, and call allotter circuit and starts the busy tone circuit functioning which will cause busy tone to be transmitted to the calling subscriber. Other functions of the (BY) relay will be described under conference service.

#### 9. CALLED LINE IDLE

If the line is not busy the (SW) relay in operating after the completion of the second digit closes the "L1" and "L2" leads to the line, line switch and call allotter circuit which will operate a relay associated with the completing end of the link. This relay provides means for operating the select magnet also associated with the completing end of the link. When the select magnet operates it operates relays which will connect ground on the "A" lead which releases the (C1) relay by shorting its "P" winding. When the (C1) relay releases ground will be connected on the 28 "CO" lead which will operate the (CO) relay in the line, line switch, and call allotter circuit. The (CO) relay operates the holding magnet which closes the crosspoints of the switch connecting the link to the line. Ground for holding the (CO) relay operated is removed from the "CO" lead by the operation of the hold magnet but the (CO) relay is held operated over the "S" lead under control of the (E), (B) and (A) relays in the link circuit and the (CO) relay in the line circuit of the calling party. By means of the (DC) and (T2) relays being operated ground on the "S" lead from the line, line switch and call allotter circuit will operate the (SP) relay. The (SP) relay connects ringing current through the winding of the (R) relay to the called line and audible ringing current to the calling party.

#### 10. KEY STATION ANSWERS

When the called subscriber answers the (R) relay will operate regardless of whether or not the (L) key in the station

set is operated. The (R) relay will hold operated under control of the (SP) relay. When the (L) key in the station set is operated and the receiver is removed from the switchhook, the (HS) relay operates, opening the common ground lead which holds the (SW), (DC) and register relays operated, releasing these relays. The release of these relays removes ground from the 28 "CO" lead. The release of the (T2) relay releases the (SP) relay which releases the (R) relay and closes the (E) relay circuit to the calling line. The (E) relay in operating will open the operating circuit for the (C) and (Pl) relay to prevent an additional current drain in case the calling subscriber disconnects and the receiver at the called station is left off the switchhook or is in a permanent signal condition and opens a circuit from ground to the "S" lead. Ground, however, is connected to the "S" lead through contacts on the (HS) relay. The connection is now established with only the (A), (B), (E) and (HS) relays being operated. In case the called subscriber removes the receiver from the switchhook while the local key is in the non-operated position ringing tone will be connected to the line as an indication to the subscriber that the station is being called. This will take care of cases where a subscriber removes the receiver from the switchhook to make a trunk call just before the bell rings on an incoming local call.

#### 11. KEYLESS STATION ANSWERS

When the called subscriber answers the (R) relay will operate. On keyless stations the "L" and "TR" leads are closed through in the line circuit and when the (R) relay operates ground on the "TR" lead from the contacts of the (R) relay will operate the (HS) relay opens the common ground lead which holds the (SW), (DC) and register relays releasing these relays. The release of the (T2) relay releases the (SP) relay which releases the (R) relay and closes the (E) relay circuit to the called line. When the (E) relay is connected to the line it will operate, releasing the (R) relay and opening the circuit from ground to the "S" lead. The (E) relay in addition to performing the functions described in Par. 10, connects ground to the "TR" lead which will hold the (HS) relay operated when the (R) relay releases. Ground from the (HS) relay is now connected to the "S" lead. In case the calling party disconnects first the called party will be held to the link until the receiver is replaced on the switchhook. This prevents the called party being disconnected from the link and then connected to the originating end of another link and receiving dial tone.

#### 12. CONFERENCE SERVICE

In case it is desired to have a third station in on a connection the called subscriber will replace the receiver on the

switchhook. The calling subscriber will not receive dial tone but will dial the number of the desired third station. When the first digit is dialed the (T2) relay will operate, and at the completion of the digit the (SW) relay will release. This operates the (SP) relay which causes the ringers at the first called station to operate. When the second digit is dialed and the second called station line is connected to the link in the same manner as the first line was, the bells of the two called subscribers will ring and when the second called subscriber answers, the first called subscriber bell will cease to ring and this being an indication that the second called subscriber has answered the first called subscriber will also answer. In case the second line is busy, the (BY) relay will operate when the line is tested which will release the (SP) relay causing the bells at the first called station to cease ringing and the calling subscriber to receive a busy tone. The first called subscriber will then answer operating the (HS) relay releasing the (BY) and all register relays. On a conference connection the stations connected to the terminating end cannot release until all called stations disconnect as the (HS) relay which can be operated from any station will hold the (CO) relay in the line circuit.

#### 13. DISCONNECTION

When the called party at a key station replaces the receiver on the switchhook or releases the (L) key of the station set the (HS) and (E) relays will release. The release of the (E) relay prevents the release of the called line. If a trunk key is operated while the receiver is off the switchhook the (E) relay will be operated. This removes ground from the "S" lead which indirectly releases the called line from the link. When the calling subscriber disconnects, the (A) relay releases and when the called subscriber disconnects the (HS), (E) and (B) relays release, restoring the circuit to normal. When the (B) relay is released a partial operating circuit is closed for the (CH1), (CH2) or (CH3) relay.

#### 14. LINE HUNTING

If line hunting is required "S" and "Z" wiring are provided. Otherwise "T" and "W" wiring are provided. Lines 26 and 27 are in one hunting group and 36 and 37 are in the other hunting group. In case line 26 is called and is busy, when relay (DC) operates as covered in Par. 7 busy ground on the "CO" lead of line 26 will be connected to "S" wiring to operate the (1-7) relay. The link will now test the "CO" lead of line 27 and function as described in Par. 8 or 9. The circuit functions in the same manner for lines 36 and 37 using "Z" wiring.

#### 15. FIGURE 2

Two of the (CH) relays are always operated when three links are used and the (CH1) and (CH2) relays can be operated when

two links are used, unless the associated links are busy or out of service. When the (CH1) and (CH2) relays are operated the first link will receive the call. When the (CH2) and (CH3) relays are operated the second link will receive the call and when the (CH3) and (CH1) relays are operated the third link will receive the call. In case the three (CH) relays are operated as might be the case of them being operated by hand the first link would receive the call. When the link has received the call the associated (CH) relay will release and cannot operate until the link becomes idle and then only in case another (CH) relay is released. When a link fuse operates or the (CO1), (CO2) or (CO3) key is operated, the associated (CH) relay will release transferring the "ST" lead to the next link thus preventing the associated link being allotted.

16. TIE TRUNK AND RECORDED TELEPHONE  
DICTATION SERVICE

When tie trunks or dictation trunks are provided Fig. 3 is used and also "V"

wiring at the (HS) relay. On incoming calls from a distant PBX over a tie trunk, stations are dialed thru the link in the same manner as on a station-to-station call. The (HS) relay, however, when operating will reverse battery and ground toward the tie trunk to provide the proper supervision to the distant PBX. On outgoing calls to a tie trunk or to a dictation trunk, the trunk is dialed in the same manner as a station. However, when the line circuit associated with the trunk is seized ground on the "TL" lead from the line, line switch and call allotter circuit operates the (TL) relay. This relay opens the tip and ring leads from the link and connects them directly from the station to the trunk circuit. The relay also opens the 2W lead to the link and connects ground to it for holding a calling keyless station, opens the "CH" and "CH1" leads to keep the link busy and opens the "S1" lead. The opening of this "S1" lead and the "T" and "R" leads releases all other operated relays in the link.

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