

FBX SYSTEM  
NO. 755A  
LINE, LINE SWITCH, AND  
CALL ALLOTTER CIRCUIT

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 In Fig. 6 the ground connected to the (MS) network, formerly undesignated, is now shown as "B" ground.

D.2 In Fig. 11 wiring associated with 3B and 8B of relay (L), formerly shown as regular wiring, is now shown as "ZA" option, and information concerning its use is added to table shown as part of Note 103. "ZA" option is to be removed when associated with a Recorded Telephone Dictation Trunk circuit because of the difference in battery potential between this circuit and the Dictation trunk.

D.3 Note 101 (B) is revised to specify the ground connections for Fig. 17, the select magnet contact protection networks.

All other headings under Changes, no change.

1. PURPOSE OF CIRCUIT

1.1 This circuit is used to provide means for connecting a key station or a keyless station to a link or a key station to a trunk and for permitting only one connection being established at one time. In connection with this circuit the 2 way ringdown Tie Trunk functions in the same manner as does the trunks to central office. Therefore all functions and description of operation in connection with the central office trunk apply to the 2 way ringdown tie trunk.

2. WORKING LIMITS

2.1 For Key Station

2.11 Maximum conductor resistance for each lead other than the "T" and "R" leads to the station equipment, 50 ohms.

2.2 For Key and Keyless Stations

2.21 Maximum external circuit loop resistance for the "T" and "R" leads, 400 ohms.

2.3 For leads to the Control Key.

2.31 Max. conductor res. for the 1, 2, 3, 4 & G leads Fig. 11 and for the 5, 6, 7 and 8 leads Fig. 9, 25 ohms.

2.32 Max. conductor res. for the L, A and "SW" leads, Fig. 11, 50 ohms.

2.33 Max. conductor res. for the "L" lead to a station associated with the control key, 25 ohms.

2.4 Max. res. of conductor between the (LL) relay and each line lamp, 50 ohms. Fig. 15.

2.5 Max. res. of conductor from each appearance of line lamp to grd. when used alone or with trunk lamps. Fig. 15.

1 line lamp alone with 1 or 2 trunk lamps, 50 ohms.

1 line lamp and 3 or 4 trunk lamps, 25 ohms.

2.6 Minimum insulation resistance for all leads to the station equipment, 30,000 ohms.

3. FUNCTIONS

3.01 Provides means for connecting any key station with any one of four trunks on incoming or outgoing central office calls.

3.02 Provides means for connecting any key or keyless station with any link circuit on originating calls.

3.03 Provides means for connecting the completing end of any link with any key or keyless station.

3.04 Provides means for transmitting busy tone to the calling station if the selected trunk is busy or if all links are busy.

3.05 Provides means for holding the connection under control of the switch-hook contact on key station calls and under control of supervisory relays in the link circuit on keyless stations calls.

3.06 Provides means for preventing double connection occurring on simultaneous calls by holding only one (LK) or (Ll) relay operated when a trunk or local connection is being established.

3.07 Provides a means for preventing the hold magnet operating until the finger of the select magnet bar is firmly in the trap associated with the crosspoints.

3.08 Provides means for continuing service in case the call allotter circuit fails

to function normally, that is, if the (E) relay does not operate on account of its operating circuit being opened at the contacts of one of the (L1) or (LK) relays.

3.09 Provides means for continuing service in case the "SM1" lead to the (S) relay or the "SM2" lead to the (S1) relay or the winding of either relay becomes open.

3.10 Connects ground to the "CO" lead from the link circuit to busy the line to incoming local calls.

3.11 Provides means for keeping all station leads excepting the "T" and "R" leads open until the receiver is removed from the station switchhook to prevent service interference in case these leads become grounded.

3.12 Provides means for connecting a keyless station to a trunk by means of a control at a key station.

3.13 Provides means for holding the select magnet associated with the completing end of a link until the called line is connected to the link.

3.14 Provides means for a station to answer local calls of another station or to originate or answer calls on a central office line not associated with the switching equipment of the PBX.

3.15 Provides means for a station line lamp which flashes on incoming calls and remains lighted steady when the station is busy.

3.16 Provides means for operating a ringer common to a group of trunks and a station on an incoming call to a station.

3.17 Provides for tie trunk service.

3.18 Provides for operation with recorded telephone dictation trunk.

#### 4. CONNECTING CIRCUITS

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

4.1 Standard Subscriber Station Set.

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

4.3 No. 755A PBX Link and Link Allotter Circuit. SD-66611-01.

4.4 Long Line Circuits. SD-66086-01 (Typical).

4.5 No. 755A PBX Tone Ringing Alarm and Common Timing Circuits. SD-66506-01.

4.6 No. 755A PBX Dial Tie Trunk Circuits. SD-66600-01 (Typical).

4.7 No. 755A 2 Way Ringdown Tie Trunks. SD-66605-01 (Typical).

4.8 Recorded Telephone Dictation Trunk. SD-65728-01.

#### DESCRIPTION OF OPERATION

##### 5. KEY STATIONS FIGS. 1 AND 2

##### 5.1 Originating or Answering Trunk Calls

When the receiver is removed from the switchhook of a key station set, the (L) relay will operate. The holding ground for this relay is transferred when the relay operates from a ground in this circuit to a ground in the tone, ringing, alarm and common timing circuit. The purpose of this transfer is to provide a means to transmit a busy tone to the station in case the trunk selected is busy to the station or in case the subscriber tries to make a local call when all the links are busy. Under either of these conditions, a relay in the tone circuit will operate, which will transfer the holding ground for the (L) relays from a direct ground to a ground thru the winding of a repeating coil, and with the operation of other relays tone will be transmitted to the station through the winding of the repeating coil. The operation of the (L) relay also closes the station leads 1, 2, 3 and 4 to the "CS" leads of the four trunks, the "L" station lead to the "ST" lead of the link and link allotter circuits and the station lead "G" to the "G" lead in Fig. 4 or 5. These leads are kept open until the (L) relay operates for the purpose of preventing service interference in case one of these leads to the station becomes grounded. The "G" lead is the common lead to the station set and when the handset is removed from its mounting, this "G" lead is closed through the mounting contacts to the various keys in the substation set. Keys 2, 3, 4 and 5 in the station set are associated with the trunks whereas the last key is associated with the links and is used for local intercommunicating service. If the first trunk key is operated when the handset is removed from its mounting, an operating circuit for the (L1) relay, Fig. 4 or Fig. 5, and a relay in the trunk is closed through the contacts of the (L) relay, and the operated contacts of the first trunk key and the mounting. This relay in the trunk when operated connects the associated (SO) selecting magnet in the switch to the "SMS1" and "SMS2" leads in Fig. 6, and the (L1) relay when operated opens the locking chain for other (L1) relays associated with stations having higher numbers. The operation of the (L1) relay also operates the (E) and (N) relays. The (E) relay closes a holding circuit for

itself and the operated (L1) relay and operates the (E1) and (E2) relays. When the (E1) and (E2) relays operate, the operating circuits for all the (L1) and (LK) relays and the (E) relay are opened thus preventing any other call from proceeding at this time. The operation of the (E1) relay operates the (MS) relay which connects ground to the "SMS" leads for operating the (SO) selecting magnet. The (MS) relay is slow to operate to allow time for the release of any (L1) relay associated with a station having a higher number or an (LK) relay which may be operated before operating the selecting magnet. The (MS) relay also closes a holding circuit for the (E) and (E1) relays, opens the operating circuits of the (M) and (N) relays and closes a holding circuit for itself to the contacts of the (N) relay. This insures holding operated the (E) and (E1) relays until all other relays are released which will prevent double connection. In case the circuit from the operating ground of the operated (L1) relay to the (E) relay is opened, the (E) relay will fail to operate which will also fail to operate the (E1), (E2) and (MS) relays. However, as previously mentioned, the (L1) relay also operates the (N) relay which operates the (M) relay. The operation of the (M) relay releases the (N) relay. With the (N) relay released and the (M) relay operated a ground is connected to the "SMS" leads for operating an (SO) selecting magnet. This insures service in case the (E) relay does not operate due to its operating circuit being opened at one of the contacts of the (L1) or (LK) relays. The (M) and (N) relays are slow to function to allow the call allotter circuit to function normally before connecting emergency ground to the "SMS" leads for operating the selecting magnets. A double connection, however, might occur on simultaneous calls if the (E) relay does not operate. The operation of the (SO) selecting magnet which is associated with the first trunk moves the fingers of the selecting magnet bar into the trap of the cross-points on the zero level. These cross-points are associated with all station lines. The (SO) selecting magnet also operates the (S) and (S1) relays in Fig. 6 which connect ground on the "A" lead and close a holding circuit for the (E) and (MS) relays. The (S) and (S1) relays are slow operating relays for the purpose of insuring that the fingers of the selecting magnet bar will be firmly in the trap before the cross-points are closed through by the operation of the hold magnet. The (S) and (S1) relays perform the same functions. The two relays are used to prevent service interruption in case the lead or winding of one of the relays becomes open. The leads multiple to the contacts of all the selecting magnets, and they are connected in such a way that in case the strapping leads become open at the contacts of the selecting magnets, either the (S) or (S1) relay will operate, depending on which side of the open the operated selecting

magnet is. Ground on the "A" lead is closed through the contacts of the operated (L1) relay to the (CO) relay associated with the calling line. The (CO) relay will operate which operates the holding magnet and connects ground on the "G" lead to the station circuit. Ground on the "S1" lead to the trunk circuit is closed through the cross-points of the switch after the hold magnet operates. Ground on the "G" lead holds the (CO) relay operated through the contacts of the handset mounting, the 1st trunk key and the cross-points, and shorts the (L1) relay, releasing it. The operation of the hold magnet removes battery from the winding of the (L) relay as well as closing the cross-points and connects ground on the "CO" lead to the links for busyng the calling line to incoming local calls. This causes the (L) relay to release which opens the 1, 2, 3 and 4 station leads to the trunks, the "ST" lead to the link and link allotter circuits, and the "G" lead to Fig. 4 or 5. This releases the relay in the trunk which releases the (SO) selecting magnet. When the (SO) selecting magnet releases, the (S) and (S1) relays will release, releasing the (E) and (MS) relays if operated or the (M) relay if it is operated. The (MS) relay releases the (E1) and (E2) relays. The release of these relays prepares the circuit for the establishment of another call. Connection from the station to the central office through the first trunk is now established. Incoming or outgoing calls are established in the same manner.

## 5.2 Disconnection on Trunk Connections

When the handset is replaced on its mounting, or when the 1st trk. key at the station set is released the circuit holding the (CO) relay is opened at the contacts of the mounting or the 1st trk. key which releases the (CO) relay. The release of the (CO) relay releases the holding magnet and removes ground from the "G" lead to the station circuit. The opening of the cross-points removes ground from the "S1" lead to the trunk circuit. The hold magnet releasing, opens the cross-point contacts and permits the finger associated with the selecting magnet bar to restore to normal, and removes the busy ground on the "CO" lead from the link and link allotter circuit. Connections on the second, third and fourth trunks are made in the same manner as is a connection on the first trunk excepting that the respective key must be depressed at the station set and that the (S1), (S2) or (S3) selecting magnet will operate instead of the (SO) selecting magnet.

## 5.3 Station-to-Station Connections

### 5.31 Connecting Calling Station Line to Link

This circuit functions in the same manner for a station-to-station connection

as it does for a station-to-trunk connection excepting that the (L) key at the station set is depressed instead of one of the trunk keys and that instead of a relay in the trunk circuit operating when the (L) relay operates, a relay in the link circuit will operate. This link relay will indirectly operate the (S5), (S7) or (S9) selecting magnet which will, when the line circuit holding magnet operates, associate the originating end of the link with the calling station in the same manner as the (S0) selecting magnet associated the trunk with the calling station.

### 5.32 Connecting Called Station Line to Link

When the calling party has completed dialing, ground on the "L1" lead Fig. 3A, 3B or 3C thru the link circuit and back over the "L2" lead will operate one of the (LK) relays which will operate the (B) relay. If the first link is allotted the (LK1) relay will operate. The (LK2) or (LK3) relay will operate in case the second or third link is allotted. The (LK1) relay holds in the chain circuit through the (E) relay contact in the same manner as does the (L1) relay. The (LK1) and (B) relays partially close the operating circuit for the (S4) selecting magnet. The (LK1) relay also operates the (E) relay which operates the (E1), (E2) and (MS) relays as described in Par. 5.1. When the (MS) relay operates the (S4) selecting magnet will operate which will operate the (S) and (S1) relays. These relays connect ground to the "A" lead which releases a relay in the link circuit. This link relay connects ground on the "CO" lead which operates the (CO) relay of the line being called and releases the (B) relay. The (CO) relay operates the hold magnet. The (B) relay is a slow release relay and will hold operated long enough to allow the hold magnet of the called line to operate. This provides for holding the selecting magnet operated until the cross-points of the switch are closed. The operation of the (CO) relay also connects ground to the "G" lead to the station circuit. Ground to the "S2" lead is closed to the link circuit after the hold magnet operates to operate a relay in that circuit which connects ringing current to the called line. The operation of the hold magnet connects ground to the "CO" lead to the link circuit, to busy the line to other calls, closes the cross-points and opens the operating circuit of the (CO) relay. The (CO) relay, however, does not release as it is held operated from a ground on the "S" lead in the link circuit thru the cross-points. The release of the (B) relay releases the selecting magnet which releases the (S) and (S1) relays. These relays release the (LK1), (E) and (MS) relays. The (MS) relay releases the (E1) and (E2) relays. When the called subscriber answers, ground on the "G" lead will be connected through the handset mounting spring contacts, the contacts of the (L) key (which should be operated

in answering a local call) and through the cross-point contacts over the "L" lead to a relay in the link which will operate and connect a second ground on the "S" lead for holding the (CO) relay operated. The operation of this last mentioned relay in the link will cause the ground from link on the "CO" lead to be removed.

### 5.33 Disconnection on Station-to-Station Connections

When the handset is replaced on its mounting or when the local key at the station set is released the circuit will function as described in Par. 5.2.

### 5.34 Line Lamps and Common Bell Ringing on Incoming Station Calls

When line lamps and common bell ringing are required on incoming station calls Fig. 14, 15 & 16 are used and Fig. 2 is modified as shown in Fig. 9. On an incoming call ground will be connected on the "CO" lead as mentioned in Par. 5.32. This ground will be extended to Fig. 14 over the "M" lead. This will operate the (LL) relay which will connect the lamp to the "LL" lead in the Tone, Ringing Alarm and Common Timing Circuit which will flash the lamp. The (L) relay also closes the "M" lead and the "CB1", "CB2" or "CB3" lead to operate the ringer which is common to a group of trunks and the station and operates the (CO) relay. The circuit then functions as described in Par. 5.32, excepting that when ground is removed from the "CO" lead, by the called party answering, the (LL) relay will release. If "R" wiring is used the lamp will remain lighted while the line is busy whether it be on a station to station connection or a station to trunk connection. The common bell is only used as a supplement to the regular station bell and is usually located at another station which is arranged to pick up calls to either station.

### 5.35 Pick-up of Station to Station Calls of Another Station or a Central Office Line Not Associated with the Switching Equipment of the PBX

When a station is to be arranged to pick up local calls of another station or a central office line not associated with the switching equipment of the PBX Fig. 12 is provided when a separate key is used at the station and Figs. 12 and 13 are provided if a spare trunk key is used at the station. Fig. 14 is generally used with this service and the lamp which will be associated with the line to be picked up will usually be placed at the station which will pick up the calls. When the separate key is operated the (SW) relay will operate which will connect the tip and ring leads of the station to pick up the call to the tip and ring leads of the station to be picked up, or of the central office line. If it is a station

line to be picked up the "L1" and "G" leads of the station to be picked up will be closed which will simulate the closed contacts of the handset mounting and (L) key to hold the link to the called line. Ground will also be connected to the "CO1" lead which will be connected to the "CO" lead to the links to make the line which picks up the call busy and open the "CO2" to "CO1" lead to prevent the hold magnet of this line from operating. The (SW) relay also connects ground to the "G" lead which will be closed thru the handset mounting and local key contacts at the station to the "L" lead to hold the (SW) relay operated. The separate key at the station is a non-locking key and is released as soon as the connection is made. It is necessary to have the local key at the station picking up the call operated, when the separate key is used. When a spare trunk key is used Fig. 13 is used as well as Fig. 12. When the trunk key is operated the (TK) relay will operate in series with the (L1) relay Fig. 4 and 5 which will operate the (SW) relay. Ground on the "G" lead will be closed thru the handset mounting and trunk key contacts to the (TK) relay. The (SW) relay will function as described above.

## 6. KEYLESS STATION

6.1 Only station to station connections are made to and from the keyless stations unless controlled service is provided as covered in Par. 7. The circuit operation on these local calls is the same as for the local calls made to and from the key stations, excepting that the "G" and "L" leads are strapped ("T" wiring, Fig. 11) instead of closed through the contacts of the handset mounting and the L key at the station. On originating calls the (CO) relay after operating holds under control of the supervisory relay in the link circuit over the 2W lead through the cross-point contacts and the "H" and "L" leads thru the "J" strap wire. On a completing call, the "L" and "TR" leads from the link are closed through the cross-point contacts to a short by means of the "J" strapping to operate a relay in the link which is held operated under control of the calling station.

## 7. CENTRAL OFFICE SERVICE FOR KEYLESS STATION

7.1 When central office service for keyless stations is required leads 5, 6, 7 and 8 Fig. 8 are to be provided as required for the key station which will have control of this service. These leads are connected to the control key. "T" wiring in Fig. 11 will be omitted. Leads 1, 2, 3, 4, G, L, SW and A in Fig. 11 are also connected to the control key and the "CSNL" leads are connected to the various trunks. When it is desired to connect a keyless station to a trunk the key station will connect

to a trunk by operating the proper trunk key with the handset removed from its mounting. If the trunk is connected to a dial office the key station will dial the desired number. The control key will then be operated which will release the (CO) relay in Fig. 11 if it is operated which restores the hold magnet and switch to normal. When the handset at the keyless station is off its mounting the (L) relay in Fig. 11 operates and while the control key is operated there will be a circuit from the associated (L1) relay over the G leads thru the control key contacts to the "L" lead at the key station to the "L" lead Fig. 9 thru the contacts of the cross-points to the 5, 6, 7 or 8 leads depending on which trunk has been selected, over one of these leads to the control key contacts to the 1, 2, 3 or 4 leads in Fig. 11 thru the contacts of the (L) relay Fig. 11 over the "CSNL" lead to a relay in the selected trunk.

The operation of this relay in the trunk and the (L1) relay in Fig. 4 or 5 causes ground to be connected to the "A" lead in Fig. 11 to operate the (CO) relay. The (CO) relay in operating operates the hold magnet (HM) and when the cross-points are closed thru, ground on the "N" lead from the trunk will hold the (CO) relay operated. The person at the key station upon hearing the keyless station in on the connection will release the control key which is a non-locking key. The person at the key station may then disconnect from the trunk as the keyless station is held to the trunk under control of a relay in series with the trunk which is directly under control of the handset mounting contacts.

Station line lamp and common ringer service are provided for keyless stations and function in the same manner as for key stations as described in Par. 5.34.

## 8. DIAL TIE TRUNK SERVICE

8.1 Tie trunk connections are similar to keyless station connections and therefore Figs. 10 and 11 are used with the "TL" lead in Fig. 10 being used instead of the "S" and "S2" leads. On incoming calls from the tie trunks, the circuit functions the same as for keyless stations. For outgoing calls the circuit functions the same as for keyless stations excepting that ground will be connected to the "TL" lead to operate a relay in the link which will connect the tip and ring leads from the station directly to the tip and ring of the tie trunk, and the (CO) relay will be held from the tie trunk over the "A" lead.

RECORDED TELEPHONE DICTATION SERVICE

3.3 Recorded telephone dictation trunk connections are similar to dial tie trunk connections. Figs. 10 and 11 are used, with the "TL" lead in Fig. 10 being used instead of the "S" and "SL" leads, and "2A" wiring in Fig. 11 is removed.

When the dictation trunk is dialed connection of ground to the "TL" lead operates a (TL) relay in the link which connects the station directly to the trunk. The trunk connects ground to the "A" lead, which holds the (CO) relay operated.

TELEPHONE LABORATORIES, INCORPORATED

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