

GENERAL DESCRIPTION **750A PBX**

1. GENERAL:

1.1 This section describes the equipment, operating, circuit and maintenance features of the 750-A Private Branch Exchange for residential use in dial or manual system central office areas.

2 EQUIPMENT DESCRIPTION:

General:

2.1 The equipment for the 750-A Private Branch Exchange consists mainly of the station apparatus, switching equipment, lamp indicator and auxiliary control cabinets. The following are some of the outstanding features:

- (a) Dial intercommunicating service.
- (b) Provision for originating and answering and transferring central office calls at several stations.
- (c) Provision of a new hand telephone set with the necessary buttons for trunk and dial intercommunicating service contained in the base.
- (d) Reduction in the number of wires to each station as compared with equipment previously used for residence systems.
- (e) General improvement in appearance of equipment as compared with equipment previously used for residence systems.
- (f) Provision of arrangements such that on all types of connections (station-to-central office and station-to-station), other stations are locked out from the connections.
- (g) Provision of dial and busy tones, machine ringing and audible ringing signal.

2.2 This equipment is furnished in two sizes. One size consists of an equipment completely wired and equipped for 15 lines, three trunks and three link circuits so that three local intercommunicating and three central office trunk connections can be made at the same time. The second size is wired and equipped for eight lines, two trunks and two link circuits so that two local intercommunicating connections and two central office connections can be made at the same time. However, the same size equipment cabinet is used for both arrangements.

2.3 For convenience of designation in this description a station having equipment for direct association with central office trunks will be called a "Key Station." Stations not so equipped (but provided with a regular dial telephone) will be called "Keyless Stations."

Station Equipment:

2.4 Key stations are provided with telephone sets having key equipment for connecting to central office trunks, for holding the trunks and for connecting to the local dial intercommunicating equipment. When a hand telephone set is used, the key equipment is contained in an applique base of the telephone set as shown in Fig. 1. When a desk set or wall set is used, the key equipment is contained in a separate unit (6009-type key

unit) that can be attached to a desk or table, or mounted on the wall.



Fig. 1.

2.5 The key equipment contains five push buttons. Three of the buttons are used to make connections to three trunks. The key equipment associated with these buttons is interlocking so that depressing one button unlocks the one previously depressed. They are designated 1, 2 and 3 in black filling on a background of red, green and white, respectively, which correspond to the colors of the lamp caps in the trunk indicator. The fourth button is a non-locking trunk holding button designated H. It is depressed when it is desired to set up a holding condition in a trunk with the associated trunk button operated. The fifth button is designated L and the key equipment associated with it is interlocking with the key equipment associated with the trunk buttons. It has no springs associated with it but serves when depressed to insure that the trunk buttons are released so that the conductors of the station line are connected to the line circuit of the dial intercommunicating equipment when it is desired to dial a local intercommunicating call.

2.6 The applique base of the hand telephone set contains in addition to the key equipment, terminals for terminating the cord conductors associated with the key equipment. The hand set mounting also contains a pair of make contacts through which the control lead to the trunk connecting circuit is wired. The desk stand is the same as the 51-C and 51-CN desk stands except that an additional pair of make contacts is provided. The wall telephone set has extra terminals for terminating the additional leads in the cable and an extra pair of make contacts. The subscribers' sets used with hand and desk

stand telephone sets have extra terminals for terminating the additional conductors in the cable.

2.7 The hand telephone set used for a key station can be obtained in black finish and the five recently standardized finishes, i.e., ivory, French grey, old brass, statuary bronze and oxidized silver. The desk stand and wall set together with the associated key unit, and all subscribers' sets are available in the standard black finish.

2.8 Each station is provided with a subscriber's set, the ringer being used to indicate an incoming intercommunicating call. Two arrangements are available for indicating incoming central office calls; one arrangement, which is similar to the arrangement now provided with the No. 1 residence system, consists of a different toned bell for each trunk. If desired, the different toned bells, or a bell common to all trunks, can be provided, and in addition trunk lamp indicators as shown in Fig. 2 are conveniently located to indicate the particular trunk associated with the incoming call.

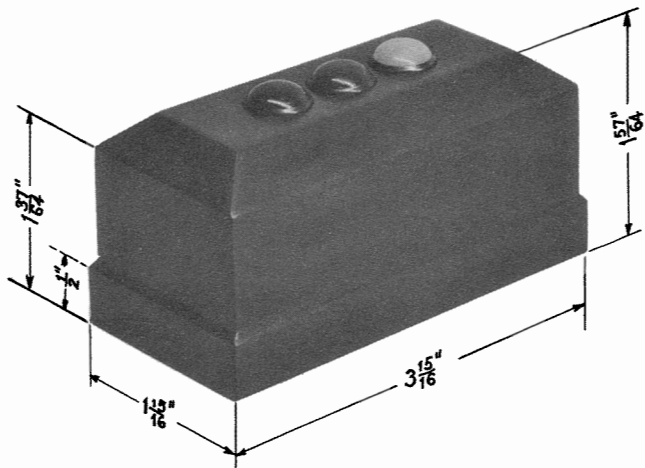


Fig. 2.

2.9 The lamp indicator used to provide a visual signal on incoming calls from central office trunks contains three lamps, one for each of the three trunks. The lamp caps are colored red, green and white to correspond with colors of the buttons in the key equipment provided with the telephone set for key stations. This lamp indicator can be obtained in black and the recently standardized colors.

2.10 The equipment that can be used for keyless stations is the standard type described in the Bell System Practices covering Station Equipment.

Control Cabinet:

2.11 This cabinet, when required, is used to connect central office trunks to keyless stations and consists of a small mahogany box containing three pairs of 531-type keys, a face plate and a connecting block. The face plate is finished in old brass and has a RING designation engraved for each of three keys and TALK and MON designations engraved for each of the

remaining three keys. One end of the box may be removed by unfastening a single lock screw, which exposes a phenol fiber connecting block mounting 25 terminal punchings. The keys, mounting plate and face plate can be removed from the box as a unit and the face plate can be separated from the mounting plate by unfastening two screws. The base of the cabinet is drilled so that it may be fastened to a wall or desk.

Switching Equipment:

2.12 The switching equipment, consisting of the line and trunk circuit apparatus, dial intercommunicating apparatus is housed in a cabinet as shown in Fig. 3. The line and trunk circuit equipment is arranged for a maximum of 15 line circuits and three trunk circuits. The apparatus used in these circuits consists mainly of relays. The dial intercommunicating equipment is arranged for a maximum of three link circuits so that three simultaneous local intercommunicating connections can be made. The apparatus in these link circuits consists of one 206-type selector per link circuit, and the necessary relay and miscellaneous apparatus. Other miscellaneous apparatus, such as apparatus for the tone, ringing, and alarm circuit, terminal strips, fuse panel, etc., is also mounted in the equipment cabinet.

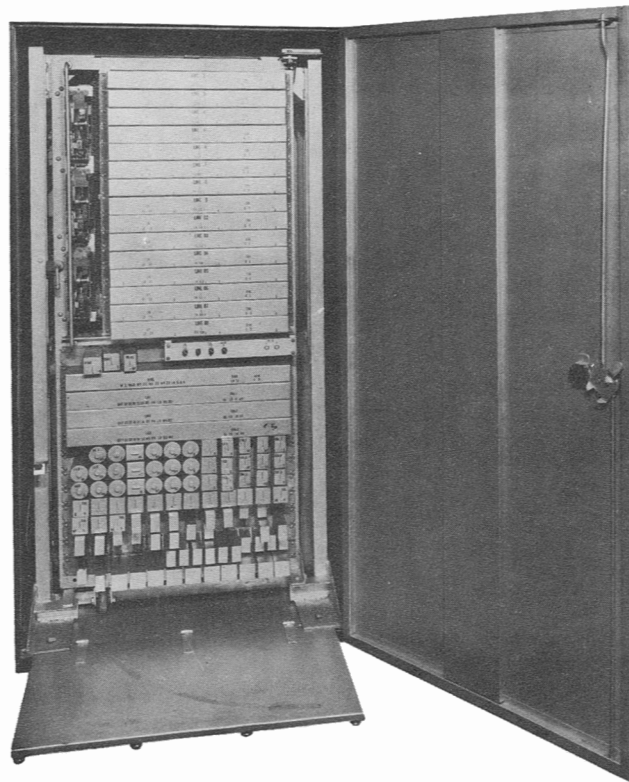


Fig. 3.

2.13 In order to provide an arrangement that is compact and at the same time provide maintenance access, the relay and switch equipment is mounted on a gate which swings open as shown in Fig. 4, so that the wiring side of the apparatus is easily accessible. This gate, when opened, is supported by a rubber-tired wheel which travels on a sheet metal platform

The metal platform is hinged so that it can be placed in an upright position between the relays and the casing door when not in use.

2.14 The casing as shown in Fig. 5 is made of sheet metal with the outside finished in olive green. The inside of the casing is finished with aluminum paint. Near the top on the left rear wall is a cable hole for the incoming cable. The floor is drilled for attaching the apparatus frame.

Numbering Plan:

2.15 The numbering plan is determined by the link switch used for registering dial pulses in the dial intercommunicating equipment. This switch is a single-motion selector of the 206-type and it is, therefore, necessary to use a certain numbering plan. The first terminal of this switch is not used but is busied so that a preliminary pulse will not result in a wrong number. Terminals 2 to 9, inclusive, are used for eight station lines. The 10th terminal is used as a normal position, so that when zero is dialed the switch rests on this terminal awaiting another digit. The 11th terminal is not used because of circuit difficulties encountered, so that the remaining seven lines are

cared for by terminals 12 to 18 inclusive, and are reached by dialing 02 to 08 inclusive.

Power Equipment:

2.16 The power plant consisting of an 18-volt radio type storage battery provides a voltage range of from 15 to 21 volts. When the P B X is near the central office, it is usually economical to float the battery over cable conductors from the 24-volt central office battery. It may be found economical in some instances to float the battery over cable conductors from a 48-volt central office battery. When the P B X is so distant from the central office that it is impracticable to use cable conductors, the battery is charged by means of a Rectox rectifier.

Note: Uninterrupted ringing current is supplied from the central office over cable conductors and interrupted at the P B X as covered under 4.9.

2.17 The battery, together with the other power apparatus, with the exception of the rectifier, is mounted in the switching equipment cabinet. The battery is placed on the floor in the rear of the cabinet and is covered with a sheet metal cover.

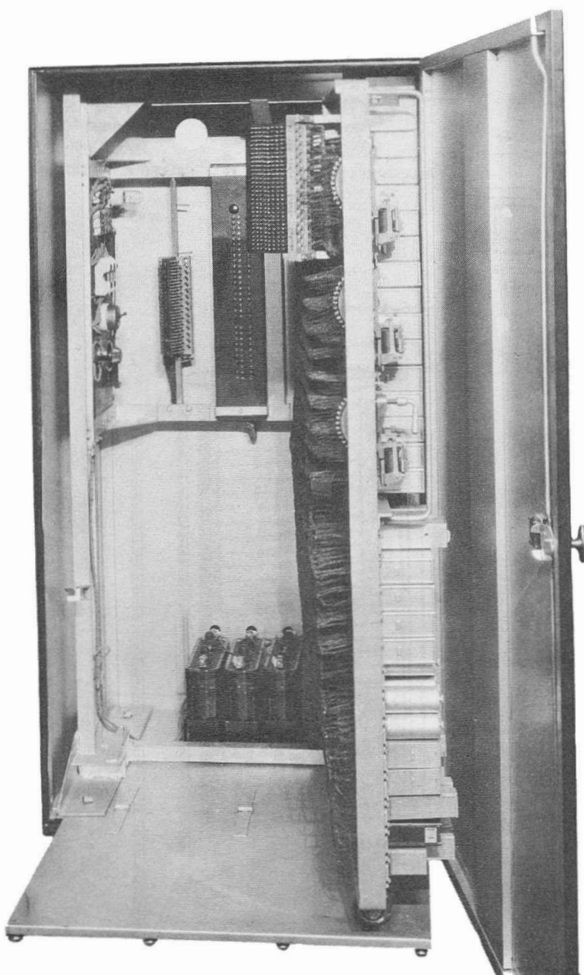


Fig. 4.

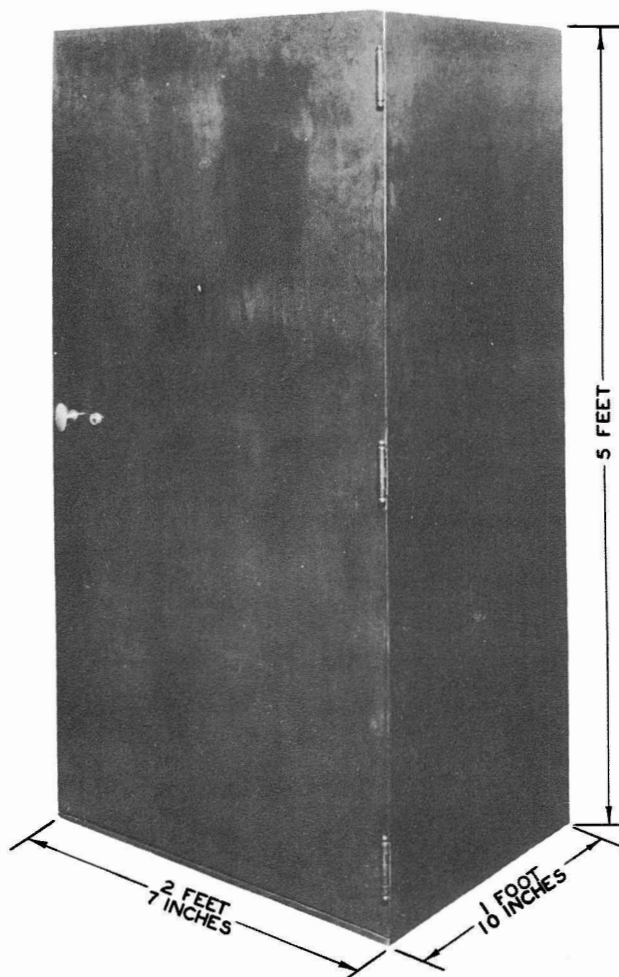


Fig. 5.

Holes are provided in the floor of the cabinet for ventilation. The other apparatus is mounted on an apparatus panel on the rear of the apparatus frame. The rectifier, when used, can be located in the basement or some other suitable remote place if it is not convenient to locate it near the equipment cabinet.

Cabling and Power Wiring:

2.18 The cables for the trunks (and battery feeders if used) to the central office and the station lines, and the power leads (if a Rectox rectifier is used), are brought in at the rear of the equipment cabinet and connected to the outgoing terminal strip. Two wires are required for each central office trunk. Key stations require six wires and keyless stations require two wires. The power leads are run from this terminal strip to the fuse panel, the apparatus panel and the battery. The ground bus-bars of the power circuit are connected to the frame at a ground lug near the top of the fuse panel. This same lug is used when the frame is grounded to a water pipe.

3. OPERATING FEATURES:

Local Intercommunicating Call:

3.1 A local intercommunicating call is made from any key station by operating the L button associated with the station equipment (if not already operated), lifting the hand set from the mounting and, after dial tone is heard, dialing the number in the regular manner. This type of call is shown diagrammatically in Fig. 6. If the calling station is a keyless station, it is only necessary to lift the hand set and after dial tone is received, dial the desired number. In either case, if the station dialed is busy, the calling station receives busy tone, but if the station dialed is not busy, it is rung by machine ringing and the calling station receives audible ringing tone. If the called station is a key station the call is answered by operating the L button and lifting the hand set. This type of call is answered at a keyless station by lifting the hand set.

Calls from Key Stations to Central Office:

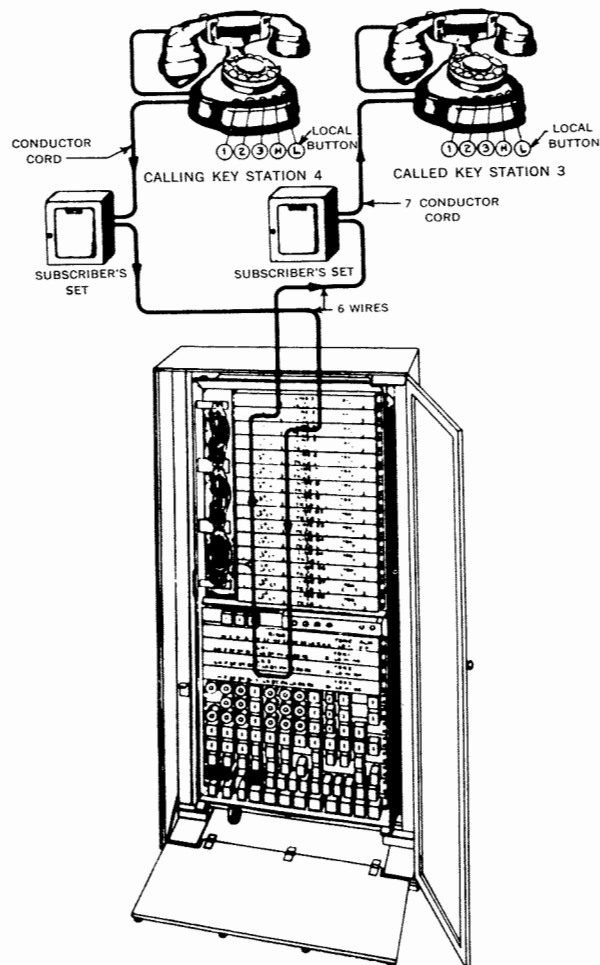
3.2 An outgoing trunk call can be made from any key station after operating the trunk button associated with the particular trunk over which the call is to be made by lifting the hand set from the mounting. If the trunk selected is in use, a busy tone will be heard, in which case it will be necessary to select another trunk. The operation of the trunk button of an idle trunk with the hand set removed from the mounting locks out all other stations from connecting to the trunk. If the central office is manual, the central office operator will be signaled. If the central office is dial, it will be necessary for the station to dial the desired number. The manual operator will receive a disconnect signal or the central office dial equipment will be released when the station replaces the hand set. The routing of this type of call is shown diagrammatically in Fig. 7.

Calls from Central Office to Key Stations:

3.3 An incoming call from central office to a key station is shown diagrammatically in Fig. 8. On a call from the central office, the signal associated with the trunk is operated. The call can be answered at any key station by operating the button associated with the particular trunk and by lifting the

hand set from the mounting. The first station to answer the call locks out all other stations from connecting to the trunk. If another station should attempt to connect to the trunk, a busy tone will be received. If the incoming call is for the station that first answered the call, no further operation is necessary. If, however, the call is for another station, it is necessary for the person who has originally answered the call to operate the holding button designated H. This operation places a holding bridge across the trunk. The button designated L is then operated, which releases the trunk button. The number of the desired station is dialed and the person answering is requested to pick up the particular trunk.

Note: If, however, during the transfer of a call this trunk is selected by some other station for an outgoing call before the desired station has answered, the incoming call will be connected to the station that is attempting to make the outgoing call and it will be necessary for that station to transfer the call again before selecting another trunk. This is, of course, inherent in this method of transferring calls.



Calls from Keyless Stations to Central Office:

3.4 It may be found that in some instances it will be impracticable to provide six-wire lines to stations that are some distance from the switching equipment and that it is desirable due to unusual conditions to provide central office trunk service to these stations. For such cases a keyless dial telephone set can be used and connected by two wires to the equipment cabinet. A maximum of three of these lines can be multiplexed to a "control cabinet" located at a key station. Central office connections are established to the distant keyless station by the person at the key station having the control cabinet.

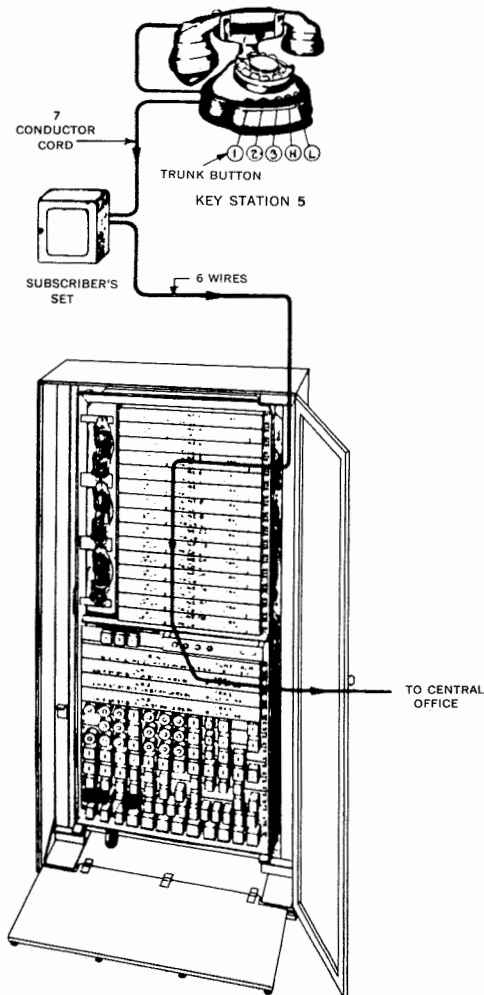


Fig. 7.

3.5 The equipment method of operation on a call to central office from a keyless station that is connected to the control cabinet is as follows: The keyless station dials the key station at which the control cabinet is located and requests a central office connection. The person at the key station then operates a talking (TALK) key mounted in the control cabinet and a trunk button of an idle trunk associated with the key station equipment. After this operation, the hand set can be replaced

on the mounting at the key station. The keyless station is bridged to the trunk via the key station and is able to make the desired call under the control of the person at the key station. The key station cannot be used for other calls throughout the duration of the connection to the keyless station. When the conversation has terminated, the talking (TALK) key in the control cabinet is restored to normal.

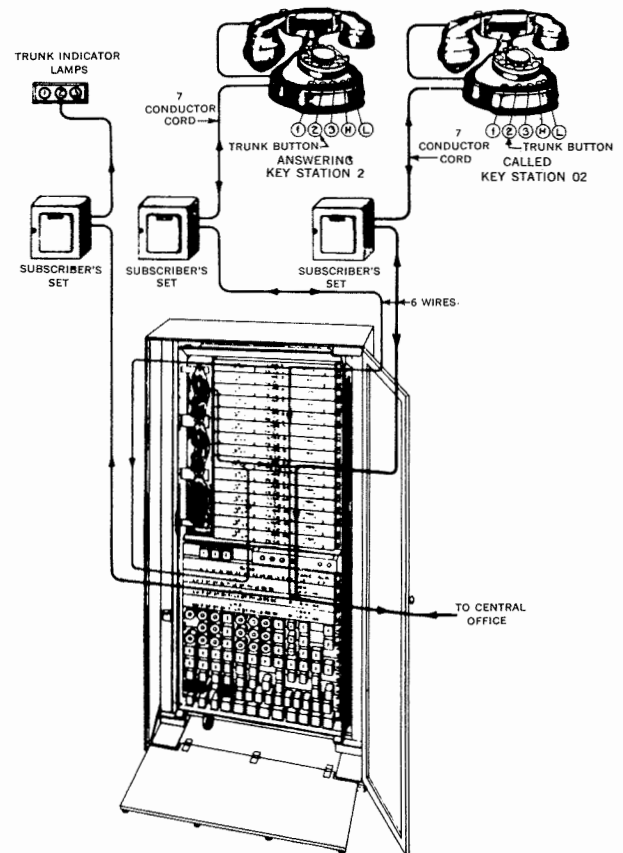


Fig. 8.

Calls from Central Office to Keyless Stations:

3.6 Incoming calls to keyless stations are handled as follows: If the station which has originally answered the call has the facilities for completing calls to keyless stations, the person at the key station should first monitor on the keyless station by operating the associated talking and monitoring key at the control cabinet to the monitoring (MON) position. If the keyless station is not in use, this key should be operated to the talking (TALK) position. A ringing (RING) key is provided for signaling the station. The key station cannot be used for other calls throughout the duration of the connection to the keyless station. When the conversation is terminated, the talking (TALK) key in the control cabinet is restored to normal. If the station originally answering the call has not the facilities for completing calls to keyless stations, it is necessary that the call be transferred to the key station having the control cabinet.

Restricted Service:

3.7 Two methods of restricting stations from access to central office trunks are provided with this system. The first consists of not connecting the trunk conductors at the particular station, in which case this station cannot originate or receive central office service. The second restrictive feature consists of an arrangement such that a key station can receive and transfer incoming central office calls but cannot make outgoing calls.

Non-Lock-out to Central Office Trunks:

3.8 Any key station can be arranged for non-lock-out trunk service, that is, a station can be arranged so that a connection can be made to one or more of the trunk circuits whether the trunks are busy or not. This feature is obtained by a minor wiring change at the C relay.

4. CIRCUIT FEATURES:

General:

4.1 The circuits in this P B X are designed to operate on a voltage range of from 15 to 21 volts.

Station Circuit:

4.2 When a hand telephone set is used at a key station, a 7-conductor cord is required between the telephone set and the subscriber's set except in the case when the key station is associated with a control cabinet when an 8-conductor cord is required. A desk stand telephone set is connected to the subscriber's set by a 5-conductor cord. The auxiliary key unit provided when a desk stand or wall telephone set is used, is connected to the subscriber's set by four conductors. The subscriber's set at each key station is connected to the dial intercommunicating equipment by six wires. Two of these wires are used for the talking conductors. One wire is required for each of the trunk circuits (maximum of three) for operating the relays associated with the trunk connecting circuit. The sixth wire is a common ground supply lead. A marginal relay is connected to this lead which functions when the hold H button is operated at the station to provide for holding the trunk.

4.3 When a control cabinet is used, an extra lead is required in the cord between the telephone set at the associated key station and the subscriber's set when a hand telephone set is provided thereby necessitating an 8-conductor cord. This lead is used so that the circuit for the trunk operating relays can be extended through make contacts on the talking (TALK) key in the control cabinet when the hand set at the associated key station is replaced on the mounting.

Line and Link Circuit:

4.4 This circuit is used to provide a connection between any two dial stations in the P B X. The line circuit consists of the usual line and cutoff relays and, in addition, a relay to dissociate the station line from the line circuit and to make the line circuit test busy to incoming intercommunicating calls when one of the trunk buttons is operated. The line finder circuit consists of a relay for each link circuit for each station line. This relay functions to connect the line circuit to the link circuit.

4.5 The link circuit consists essentially of a two-brush 206-type selector and associated relays, a battery supply circuit for both the calling and called stations and a chain circuit. The 206-type selector and associated relays function to receive dial pulses and indicate to the connector circuit the line to which the link is to be connected. A switch having two brushes is used in order to insure satisfactory operation on 15 to 21 volts. The battery supply circuit consists of the bridge condenser type. The coil supplying battery to the calling station also functions as a pulsing and supervisory relay.

4.6 A chain circuit is provided with each link circuit to control the use of the link circuit. When one link becomes busy, the chain circuit associated with that link circuit extends the start circuit to the succeeding link so that the next call will be cared for by the succeeding link. A key is associated with each link circuit so that, in case of trouble, the key can be operated to function the chain circuit and take the link circuit out of service. The connector circuit consists of a relay per link circuit for each station line and functions to connect the link circuit to the desired line.

Central Office Trunk Circuit:

4.7 This circuit is used to provide two-way service between the central office and the P B X. The trunk connecting circuit consists of the relays used to associate a station line with a trunk. Two relays are required for each station line for each central office trunk circuit. One of these relays operates whenever a trunk button is operated at an unrestricted key station with the hand set removed from the mounting. The second relay operates only if the trunk is idle.

4.8 The central office trunk circuit consists of ring-up relay apparatus which lights the trunk indicator lamp under control of a timing circuit and a standard subset for an audible signal and relay apparatus for providing holding, lockout and restricted service features. The holding control circuit consists of a relay for each station line and functions in connection with the hold H button at the station set to set up a holding condition in the central office trunk circuit.

Tone, Ringing, Alarm and Common Timing Circuit:

4.9 Dial tone is provided by a relay wired with a self-interrupting circuit. The interruptions for busy tone are obtained from a polarized relay which is controlled by another relay and a condenser and resistance circuit. This same interrupter circuit is used in connection with interrupting the continuous ringing current from the central office.

Charge and Discharge Circuit:

4.10 The battery can be charged either by means of cable conductors or by use of a Rectox charger. In either case, a variable resistance and two fixed resistances are furnished for purposes of regulating the rate of charge. Coarse variations are obtained by the fixed resistance and fine variations by means of the variable resistance. The resistances should be so adjusted that the specific gravity of the battery will be about the same every day at the same time, that is, the charging rate should be sufficient to replace the daily drain plus the internal losses of the battery.

4.11 The alarm arrangements provide the following features: The failure of a charge or discharge fuse causes an associated alarm-type fuse to operate the alarm circuit. All cable conductors used as charging leads are protected at the P B X with alarm-type fuses. The failure of one or more of these fuses will operate the alarm circuit.

5. MAINTENANCE FEATURES:

General:

5.1 The maintenance methods and procedures employed for the 750-A P B X are similar to those employed for other P B X's where the apparatus consists mainly of relays.

Link Circuit Fuse Alarm:

5.2 The link circuit fuses are equipped with separate alarm posts instead of a common alarm bar. When a link fuse operates, a relay in the link circuit is operated which removes the link from service, and lights the F lamp to give a visual alarm and operates the alarm bell at the P B X and the central office. A key is provided in order that the P B X alarm bell may be silenced, but the alarm lamp will remain lighted and the alarm leads to central office will remain closed until the fuse is replaced.

Other Circuit Alarms:

5.3 All other circuit fuses are provided with a common alarm bar and any of these fuses operated causes an alarm as described in 5.2.

Power Circuit Alarm:

5.4 When a trouble occurs in the power circuit, a relay is operated, which lights the P lamp, operates the alarm bell to give an audible and visual alarm at the P B X and an alarm at the central office. The bell may be silenced before the trouble is cleared by the operation of a key but the lamp remains lighted and the alarm leads to central office remain closed until the trouble is corrected in the power circuit.

6. CIRCUITS AND CIRCUIT DESCRIPTIONS:

6.1 The following is a list of drawings pertaining to the 750-A P B X. Detailed circuit descriptions will be found in the associated CD sheets.

Title	Drawing
Station Circuit	SD-66160-01
Line and Link Circuit	SD-66159-011
Central Office Trunk Circuit	SD-66151-011
Tone, Ringing, Alarm and Common	
Timing Circuit	SD-66161-011
Charge and Discharge Circuit	SD-80223-01