

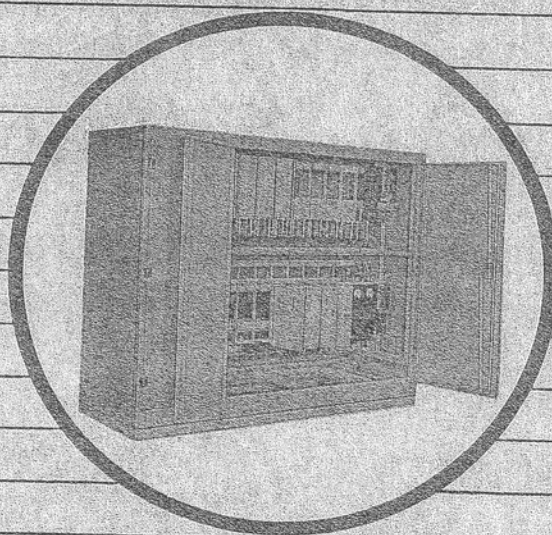
P-A-Xs and P-A-Ys 818

AUTOMATIC ELECTRIC TRAINING SERIES

Bulletin 818

PRIVATE AUTOMATIC EXCHANGES
AND
PRIVATE AUTOMATIC BRANCH EXCHANGES

STROWGER AUTOMATIC
TELEPHONE SYSTEMS



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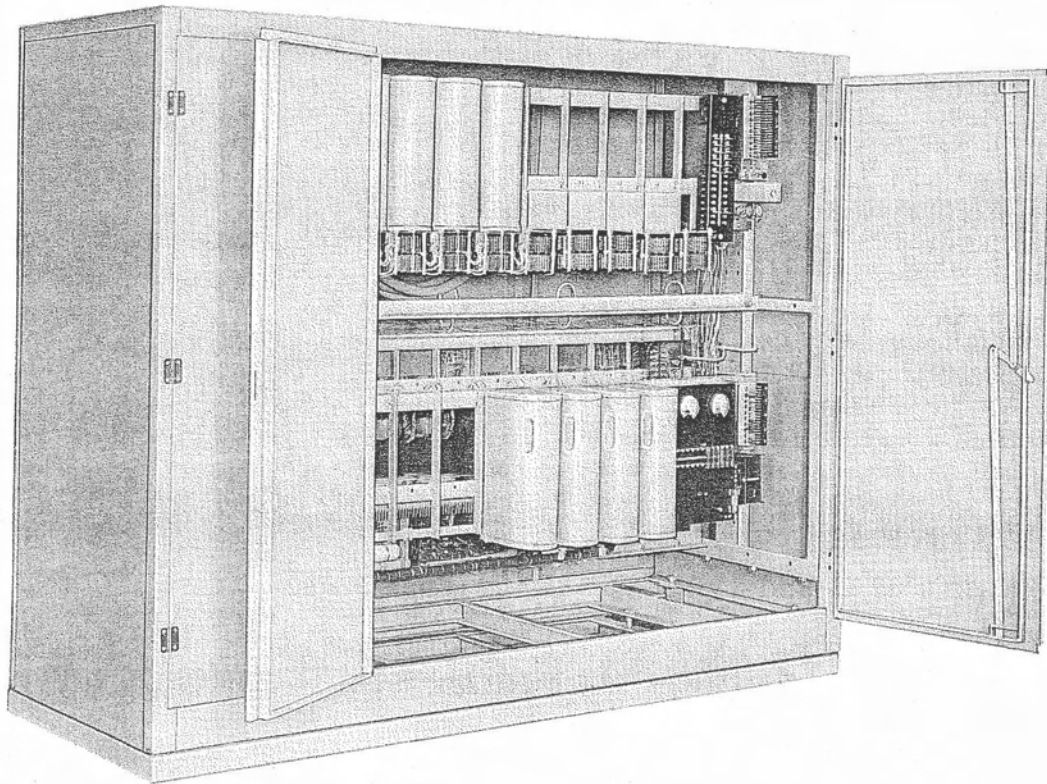
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An A. E. Co. P-A-B-X system (type 75).

PRIVATE AUTOMATIC EXCHANGES AND PRIVATE AUTOMATIC BRANCH EXCHANGES

PART I

1. INTRODUCTION

The Private Automatic Exchange, abbreviated P-A-X, is an automatic intra-office telephone system which serves business houses and institutions. The P-A-X is composed of standard switching equipment designed to fit the specific requirements of any enterprise. P-A-X switchboards are produced in a number of standard types and sizes ranging from three telephones to any number desired. And once installed, initial switchboard capacity may be increased. Planned expansion requirements can easily be met with Automatic Electric Company's flexible P-A-X systems.

The P-A-X, as an isolated, local system, has a number of advantages from the standpoint of both service and cost. First, it gives "double track" telephone service. An inquiry received on a call made from a city exchange telephone may be investigated privately over the P-A-X while the city call is waiting. Automatic local communication also speeds interior information flow and eliminates calls handled locally by a switchboard attendant.

Switching equipment employed in the P-A-X systems vary with the specific demands and requirements of the user enterprise. In systems with plunger lineswitches, one switch is associated with each line. They function, primarily, to connect a calling line to an idle connector. Essential to plunger lineswitch control is the masterswitch. This control switch keeps up to 100 plunger lineswitches in proper position. It operates to assure that a group of plunger lineswitches are connected to a single free outgoing connector. Generally, each plunger lineswitch group consists of 25 to 100 lineswitches per masterswitch. Each lineswitch also has access thru a masterswitch to a maximum of 10 outgoing trunks. The masterswitch steps all idle plunger lineswitches in a group to a position opposite an available trunk. This preselect system is then in position for the next subscriber call. Figure 1 illustrates a typical plunger lineswitch circuit.

In some systems the rotary switch replaces the plunger lineswitch. Basically, the rotary

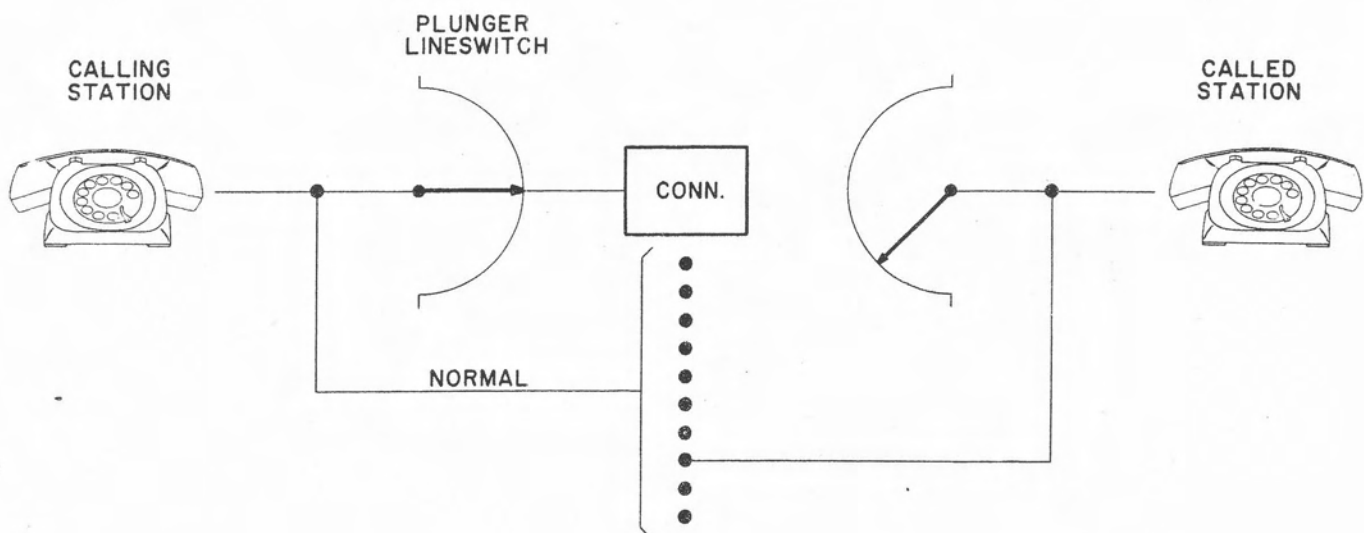


Figure 1. Typical plunger lineswitch circuit as used with the Type 25 P-A-X Switchboard.

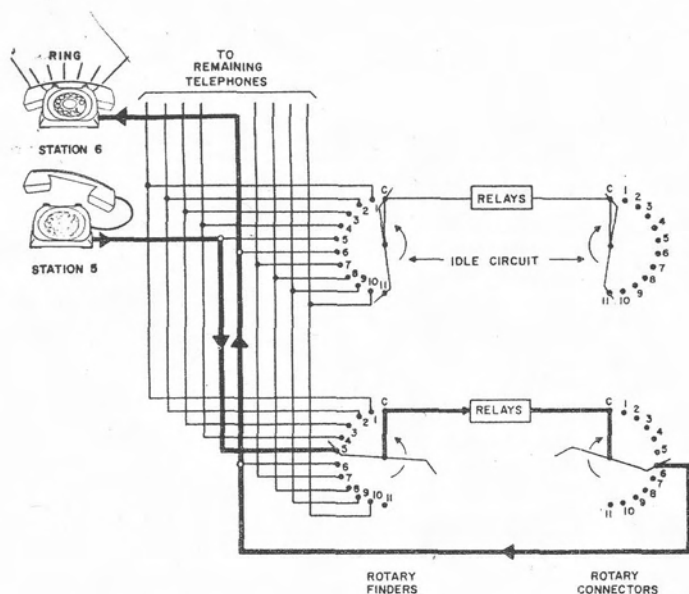


Figure 2. Rotary linefinders and connectors as employed in the Type 32A1 Switchboard.

lineswitch serves as a single-motion, non-numerical switching device for connecting a calling line to an idle trunk. The operation of this switch is entirely automatic. When a caller picks-up his telephone handset, the rotary switch is activated. In addition, no masterswitch is required.

The rotary linefinder is shown in figure 2. The switch connects a "seized" subscriber's line to an idle trunk. At the other end of the line, a rotary stepping switch serves as a connector. This arrangement is used in the Type 32A1 P-A-X Switchboard.

Other systems using rotary linefinders substitute two-motion, numerical Strowger connector switches. The Strowger switch replaces the one-motion rotary stepping switch for connecting a link to a called party. This type is used with the Type 32A31 Switchboard. The Strowger, two-motion switch can also serve

as a linefinder. In this case the switch becomes a non-numerical switch in connecting a calling subscriber's line thru a trunk link to a connector. The Strowger linefinder comes in two capacity sizes - 100 and 200 lines. The 200-line linefinder is so arranged that it selects any one of two groups of 100 bank contacts. In the 100-line Strowger finder system, the mechanism selects a line from one group of 100 bank contacts. This system is found, for example, in the Type 75 P-A-X Switchboard. Figure 3 details the circuit.

In actual operation, a distributor switch common to all linefinders in a group determines which idle finder will serve the next call. When a subscriber picks up his telephone handset, the line equipment busies his line to all other callers, activates the group relays, and marks his line contacts on all the linefinder banks. The linefinder then searches out the marked line and puts thru a connection to a connector. Once this circuit is established, dial pulsing may begin.

There are two general classifications of private automatic exchanges. The "stock board" type denotes a switchboard that is a "standard item." It has specific wiring and equipment arrangements and is readily available when required. It is designed to meet normal user requirements. A "stock board" then, is a private automatic exchange that is wired and equipped at the factory in a "standard" manner.

The second classification of private automatic exchanges is the "specially engineered" unit. This type unit is non-standard in size and is available for those users who have special capacity and service requirements. The "specially engineered" unit is custom built for abnormal user needs.

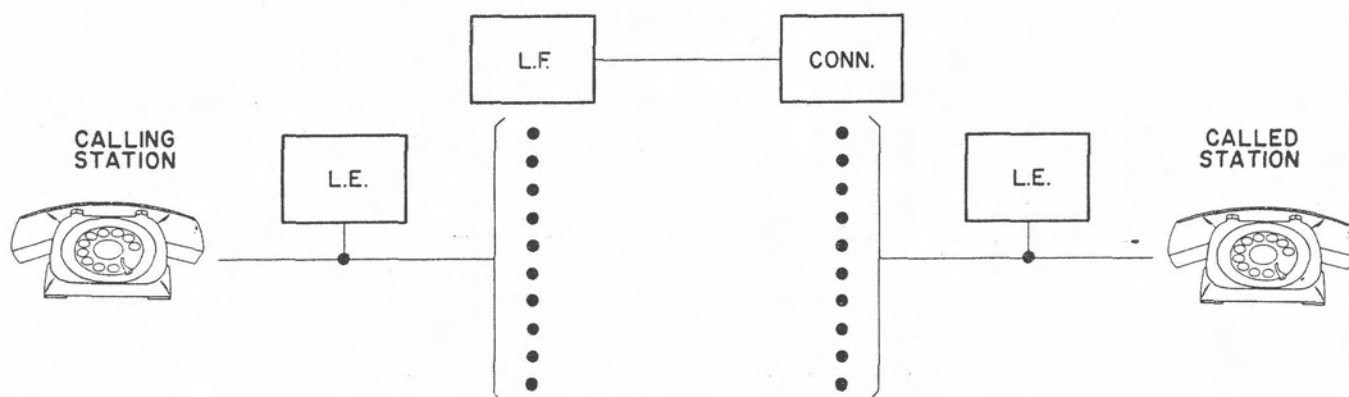


Figure 3. Strowger 100-line linefinder as used in the Type 75 P-A-X Switchboard.

2. AUXILIARY SERVICES

Automatic Electric Company provides a multitude of auxiliary services for use with P-A-X and P-A-B-X equipment. This section will describe several of these services in detail; other services will be outlined briefly for reader acquaintance. Further information concerning any of A. E. Co.'s auxiliary services will be furnished on request.

2.1 Code Call

The function of code call service is the paging or signaling of individuals when they are not directly accessible by telephone. Units providing a maximum of 10 one-digit codes or a maximum of 125 three-digit codes are supplied by A. E. Co.

Code call equipment is operated by dialing the code call prefix number. This connects the paging party to code call equipment. If the equipment is idle, the calling party dials the assigned code number of the party sought. The called party answers by dialing the assigned code "answering" number. The two parties are then connected via a private P-A-X connection. If the called party cannot be reached, the equipment is disconnected by either (1) replacing the handset, or (2) using a preset automatic cut-off.

If desired, divisional code call equipment may be installed and arranged to sound in different plant areas by dialing different code access numbers. Each assigned number automatically sounds an "annunciator" system in the area where the individual is likely to be.

2.2 Conference Calls

Conference equipment permits a desired number of telephones to be connected to a common line. Conferencing parties may simultaneously speak and listen. Three types of conference arrangements are available.

2.2.1 Group conference. Group conference equipment allows the simultaneous signaling of ten predetermined stations in a fixed conference group. To originate a conference call, one member of the fixed group dials the assigned number of the conference connector. The group conference unit is "seized," and automatically rings all lines assigned to the group. Stations may withdraw from the conference at any time. But once a party withdraws, he cannot return to the conference. The last party hanging up in the conference group idles the unit.

2.2.2 Progressive conference. Progressive conference equipment allows the addition of stations to a conference circuit. Any P-A-X

station may originate a conference call by dialing the prescribed progressive conference number. The last two digits of each individual station are then dialed. As each party answers, the switch mechanism releases and allows the originator to dial other stations. If a dialed party does not answer, the originator momentarily hangs-up before dialing the next number. This auxiliary service is available only for 48-volt switchboards. It can serve up to 20 stations.

2.2.3 "Meet-Me" conference. This auxiliary service derives its name from the prearranged conference time and date. At the prescribed time, each party in the conference group dials the conference number. All P-A-X stations can have access to the conference circuit. In contrast to the other conference systems, the "Meet-Me" conference allows parties to enter, leave, and re-enter the circuit as long as there are sufficient selectors or connectors.

2.3 Direct Line Service

Many times in a P-A-X system a majority of individual telephone calls go from one particular station to another. To avoid repeated dialing thru P-A-X equipment, the direct line service can be provided in addition to regular equipment. In this system, ringing of the other particular line is accomplished by merely lifting the handset. The P-A-X equipment, itself, is used only for battery and ringing current.

2.4 Dictating Service

If a number of persons need access to a dictating machine, it may be convenient to have the machine P-A-X connected. Anyone desiring dictation service dials the machine access number. In one system the machine is arranged to start recording by pressing and holding a button on the telephone handset. Another system uses a machine start number. For a correction or playback, additional numbers are dialed.

Access to a number of dictating machines is possible with A. E. Co.'s dictating service. Types 50 and 75 P-A-X systems are especially applicable to the multi-machine dictating service.

2.5 Type 11 Executive Quick-Call Service (Optional Speakerphone)

The Type 11 executive quick-call system maintains direct line communication between an executive and up to 20 individual private local telephones. Since direct line service eliminates dialing, executive quick-call service instantly connects the executive to those individuals most frequently called.

The Type 11 quick-call system gives one executive in an organization master-station control of all initiated direct line calls. He may selectively call any of 20 individual telephone stations designated as "direct line." These 20 stations, however, cannot call the executive except thru the P-A-X by dialing in the usual manner. The executive may call, in addition, any of the direct line stations by P-A-X dialing.

The executive reaches a direct line station by using manual push keys located on the master-station control unit (quick-call cabinet). To reach a direct line station, the executive selects and then presses a cabinet push key. He rings the called station's telephone by picking-up his telephone handset or pressing the ON button of his optional Speakerphone.

If the called station's telephone tests "busy," another key on the cabinet will place a distinctive "tone" signal in the background of the called party's conversation. Or, if the executive chooses, the handset may be left off the hook until the call is completed. He will be automatically connected to the called party immediately after the conversation. An optional feature allows still another choice in quick-call service. By pressing another push key, the executive can "cut-in" on the busy line.

For the convenience of "hands free" operation, the executive quick-call system can be used with the Type 88T Speakerphone. If the Speakerphone is used, the calling party's voice is heard thru a small speaker next to the telephone. The executive's voice is picked-up by a tiny microphone located in the base of the telephone. The handset is not taken off the hook. In addition, loudspeaker operation permits a direct line party to talk freely in group conversation with more than one person in the executive's office.

2.6 Executive Right-of-Way Service

This auxiliary service gives an executive the convenience of a separate, private conversation channel. It enables him to join any established conversation despite a "busy" signal. A warning tone may also be applied for informing the conversing parties that an executive wants to cut-in.

An executive reaches a busy party thru a reserved connector. Normally, the executive's telephone is equipped with two-line pick-up keys. One key connects to the regular P-A-X equipment and the other to the right-of-way connector. To cut in the executive presses the associated connector key and dials the number. He is then directly connected to one of the conversing parties. When the other

party drops out, the executive and remaining party are connected via the standard P-A-X connector.

2.7 Executive Cut-in Service

Executive cut-in service incorporates the same general features as the executive right-of-way service. This system, however, does not provide a separate conversation channel. Executive cut-in service employs standard telephones with a grounding push button and is used only with the Types 47A and 47B P-A-X Switchboards.

In operating the cut-in service, the executive presses a grounding push button on the telephone. His telephone immediately connects to the wanted party's telephone. The called party and the executive remain connected when the unwanted party hangs-up.

2.8 P-A-X Fire Alarm Service

P-A-X telephones can be used alone as an emergency alarm. But the more elaborate fire alarm reporting systems require auxiliary equipment.

One fire alarm reporting system provides service for a maximum of 90 stations. In the event of fire, the reporting station dials the assigned P-A-X number and is immediately connected to fire alarm equipment. The fire alarm equipment identifies the location of the reporting station and sends a signal to a central fire office. At the same time, the fire marshal is notified and a connection is placed and locked between his telephone and that of the reporting party. This insures that a direct connection can be maintained with the reporting party.

2.9 Monitoring Service

When telephone supervision is necessary, Automatic Electric Company's monitoring service allows listening-in on conversations. Signal lamps, associated with individual talking paths, are part of a monitor panel. The person monitoring a call can listen-in without disturbing the conversation. He may also engage in conversation with the talking parties.

Monitoring service involves the use of a portable handset with a cord and telephone-type plug. A cut-in button on the handset cuts the transmitter in and out of the monitor panel for conversing with talking P-A-X parties. A person monitoring a circuit inserts the plug-ended cord into the telephone jack just under the glowing panel light. If he wishes to converse, he presses the transmitter operate button on the handset and interrupts the conversation.

2.10 Pick-up Service

Pick-up service permits an individual to answer calls on his telephone by dialing a special number from any other telephone in the system. For those away from their desks much of the time, this is an important service.

2.11 Secretarial Answering Service

Several arrangements may be made whereby a secretary has facilities for answering and transferring calls made to a department group. The secretarial answering service unit can be obtained in six or ten-line sizes with a signal lamp and three-position key for each line.

When a call comes in on a line, a corresponding lamp flashes. If the called party is away from his telephone, the secretary pushes up the line key to answer the call. By moving the key to the "hold" position, the secretary can hold the line while answering other calls.

If third party information is needed, the secretary turns an idle line key to the answer position and dials the number. After the information is obtained, the third party key is returned to normal and the "hold" line is returned to the answer position. Only one line can be connected to the secretary's telephone at one time. However, several calls can be held simultaneously.

2.12 Voice Paging Service

Voice paging is similar to the code calling service described in section 2.1. Here, however, the calling party is connected directly thru the P-A-X to the plant loudspeaker system instead of to visual or audible annunciators. The wanted party is not paged by code in this system.

A party wishing to contact another party lifts his station handset and dials the designated P-A-X voice "paging" number. If the system is idle, ring-back tone signals him to begin paging the wanted person. The calling party pages by speaking directly into his handset. The called party answers by dialing a voice paging "answer" number. This connects him to the calling party and disconnects paging equipment.

A. E. Co. also offers an alternative voice paging service. In this system, the party using the paging service hangs up after talking over the speaker system. The paged party then dials, through regular telephone equipment, the P-A-X number of the paging party. He does not use a paging "answer" number.

2.13 Toll Restriction Service

Toll restriction service applies to those situations where some non-restricted stations make, receive and transfer central office calls, but cannot make toll calls to the public exchange. If a restricted toll number is dialed, all digits are absorbed by the restricted service adaptor. The number will not be transmitted to the central office. The trunk releases after absorption of the restricted digits and makes the trunk available to other calls.

Automatic Electric Company offers two additional circuit arrangements for toll restriction. One circuit is used to restrict stations completely from the toll operator or automatic ticketing equipment. Another circuit restricts certain stations from "long haul" toll calls, but allows stations to reach "short haul" toll area thru ticketing equipment.

2.14 Night Answer and Transfer Service

For night answer service, several lines in a P-A-B-X are tied to central office equipment. These lines connect central office trunks to night answer jacks on the attendant cabinet. The night answer jacks, in turn, connect to a night answer and transfer unit.

A call received during the night seizes the night answer and transfer unit. Automatic seizure rings the night bell, or operates a code call machine. Any local telephone in the P-A-B-X can answer the incoming call by dialing a predetermined night "answer" number.

If a second party in the local system is wanted, the answering party uses another telephone and dials the wanted local number. After the first party reaches the local number, the second party dials a "transfer" number and is connected thru to the incoming call. The first answering party can then retire from the circuit.

3. P-A-X SYSTEMS

This section and the following section on P-A-B-X systems are written to familiarize the telephone man with the more important types of automatic equipment available from A. E. Co. All P-A-X units will not be described. Only the important features of commonly used stock systems will be outlined. Additional information on any specific P-A-X or P-A-B-X system can be obtained under separate cover.

3.1 Types 32A1 and 32A21 P-A-X Switchboards

These two P-A-X systems are similar in performance, functions, and auxiliary services

offered. They differ in line capacity and number of possible simultaneous conversations. The Type 32A1 P-A-X has an "ultimate" line capacity of 10 single-party telephones. The switchboard can handle two simultaneous conversations.

The Type 32A21 P-A-X has increased "ultimate" capacity (22 lines) and handles three simultaneous conversations. In both systems, telephone capacity can be doubled by using two-party lines.

Switchboard equipment on the 32A1 and 32A21 P-A-Xs is very much alike. The 32A1 equipment consists of four 11-point rotary switches and associated relays. Two switches serve as linefinders and two function as connectors.

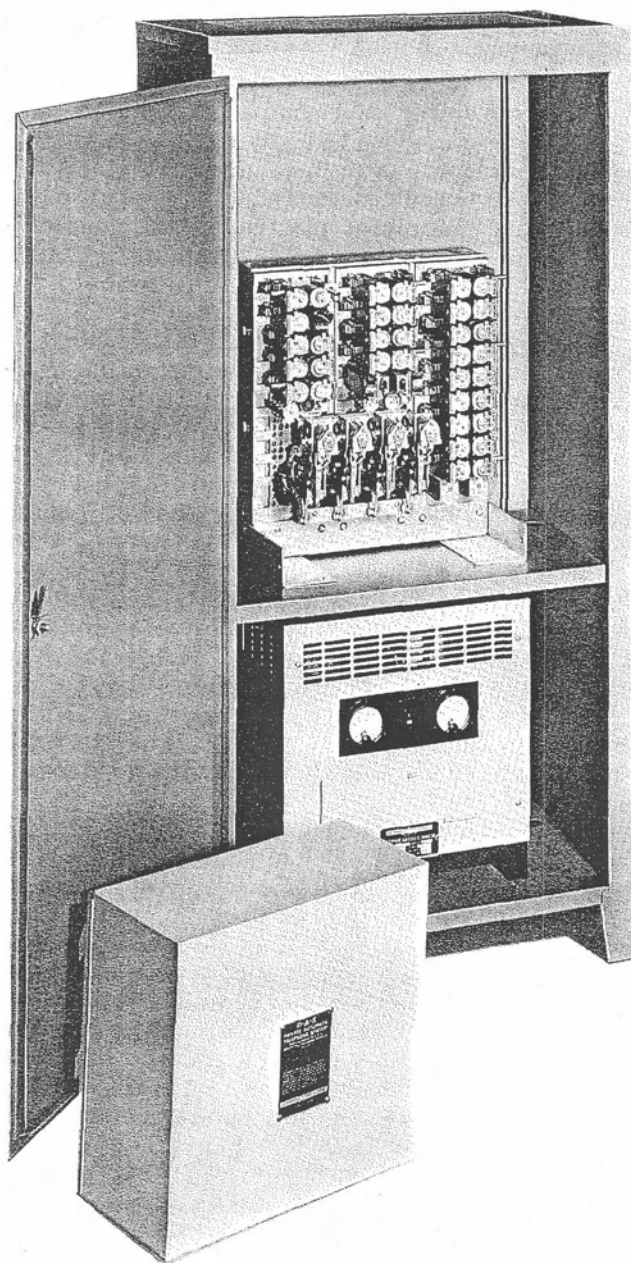


Figure 4. Type 32A1 P-A-X Switchboard.

Associated with each line is a relay. One additional relay serves all lines as a "common" relay. Included in the switching unit is the ringing equipment. Figure 4 is a photograph of the Type 32A1 P-A-X, and figure 2 illustrates a simplified switching arrangement of the 32A1.

The Type 32A21 P-A-X also utilizes rotary linefinders and connectors. However, this unit uses six 25-point switches for operation. Three switches serve as linefinders and three as connectors. The Type 32A21 has 22 line relays, and auxiliary and common relays. Figure 2 diagrams the switching circuit.

The ringing arrangements of the systems are not alike. The Type 32A1 uses only a single-digit number for single-party ringing of its ten lines. The Type 32A21 has three numbering groups for its 22 lines. Because 25-point rotary switches are used, numbers 1 to 9, 01 to 09, and 001 to 004 can be assigned to subscriber lines. For two-party ringing in either of these P-A-X systems, an additional ringing digit is suffixed to the line digit. The suffixed digit applies a long or short ring for party-line identification. The ringing digit must be redialed for each telephone ring.

As figure 4 indicates, the lower cabinet section in the Type 32A1 contains all the power supply equipment. Power is supplied to the switching unit by a battery eliminator delivering 24-volts dc, at 3-amperes. A 12-cell storage battery and a 1-ampere battery charger can also be used. Under certain conditions a 110-volt d-c power supply source may be used as optional power source equipment. The Type 32A21 P-A-X uses the same power equipment.

An all-metal cabinet mounts the switchboard unit and power equipment. When storage batteries and associated charger are used in place of a battery eliminator, an additional cabinet unit usually mounts on top of the two-compartment cabinet. The lower portion of the cabinet then houses the storage batteries.

Like the "32A1", the P-A-X Type 32A21 houses all relays, ringing equipment, terminal blocks and fuses on mounting bases enclosed within the cabinet. The "32A21" also has two short angle pieces which serve as feet for mounting the switchboards independent of the cabinet.

Auxiliary services are available for both the Type 32A1 and Type 32A21. Most of the services outlined in section 2 can be used. It should be noted, however, that installation of special equipment may cut-down the number of individual telephone links.

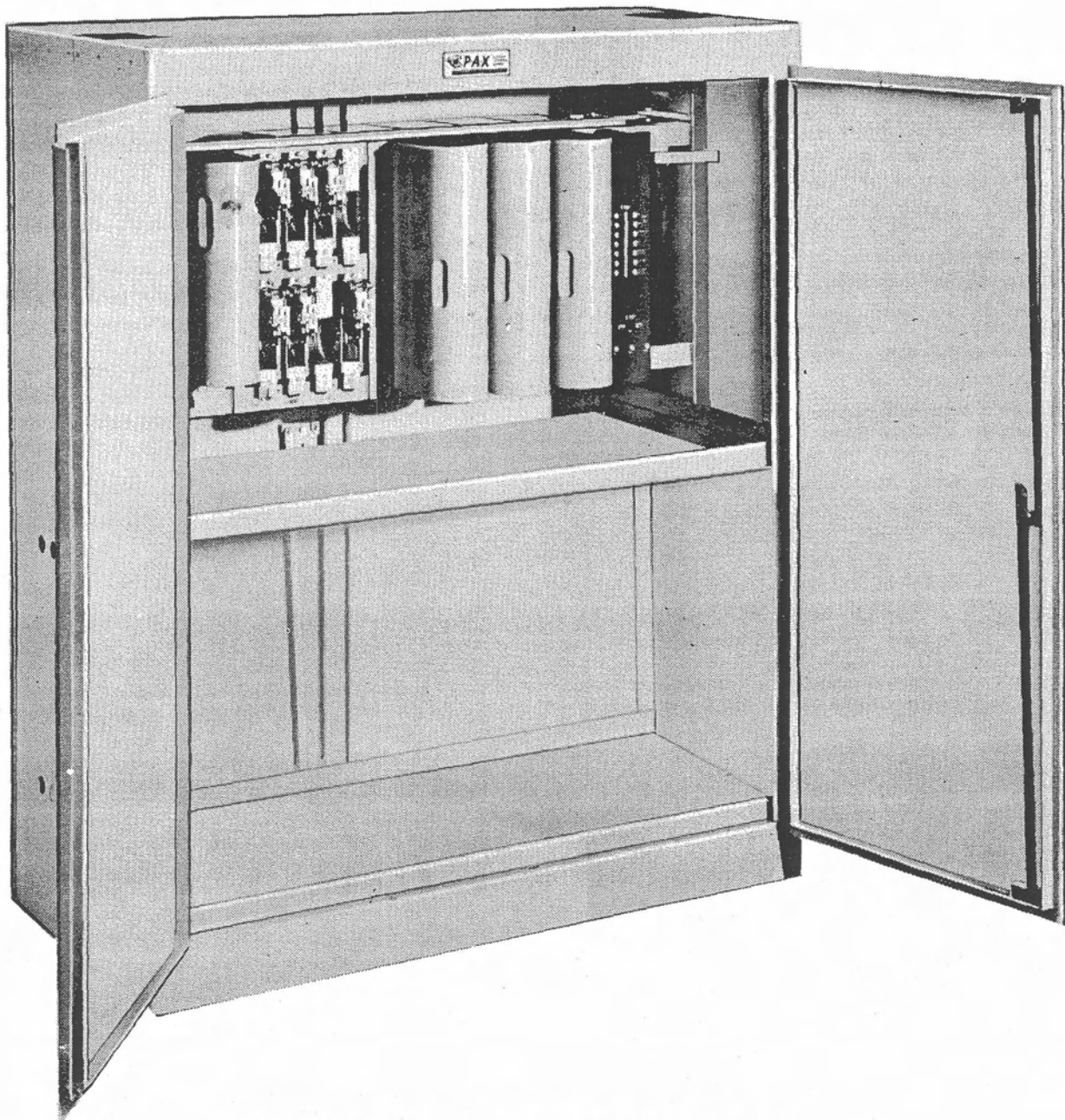


Figure 5. Type 32A31 P-A-X Switchboard (linefinder side).

3.2 Type 32A31 P-A-X Switchboard

The Type 32A31 P-A-X Switchboard has an "ultimate" capacity of 50 lines and provisions for seven possible simultaneous conversations. If desired, it may be equipped to serve only 30 lines with any number of conversation channels ranging from three to seven. All internal wiring is in place for future expansion to the maximum 50 telephones.

The metal switchboard cabinet divides into two horizontal compartment sections. This is similar in nature to the previously discussed Type 32A1 and Type 32A21 Switchboards. The upper section contains line and switching equipment. The lower cabinet section houses power equipment. It holds either a 24-volt dc,

3-ampere battery eliminator, 12-cell storage batteries with a 1-ampere charger, or special voltage control equipment. Refer to figure 5 for a linefinder view of the Type 32A31.

The talking path is the finder-connector type. The linefinder is a six level, 25-point rotary switch. Its wipers are so arranged that during a single revolution, the switch successfully tests each of the 50-lines in the 32A31 P-A-X Switchboard. The talking circuit is completed with a two-motion Strowger connector (see section 1). Figure 6 depicts a typical 25-point rotary linefinder and 100-line Strowger connector switch circuit.

For automatic single-party ringing in the Type 32A31 Switchboard, all telephones are assigned

two-digit numbers. They range from 11 to 50 with individual ringers bridged across the line. When two stations are connected to a common line for two-party operation, one telephone number is required for each party. Numbers 11 to 50 are assigned to one station and numbers 61 to 00 are assigned to the second line member. Ringers of the first station are connected from one side of the line to ground; ringers of the second station are connected from the other side of the line to ground.

3.3 Type 32A38 P-A-X "Common-talk" Switchboard

The Type 32A38 P-A-X Switchboard is a "common-talk", isolated exchange. It has an "ultimate" capacity of 100 lines. Ordinarily, only one conversation can take place at a time. Three service types are provided. They are the (1) fully automatic; (2) automatic master-station control of regular stations, and (3) automatic master-station control of regular stations with added auxiliary masterstations. The Type 32A38 can also be arranged for auxiliary services including a secret service feature. This "common-talk" system is especially designed to meet the service requirements of schools, small factories and offices where traffic is not heavy.

When designed for fully-automatic service, the Type 32A38 P-A-X comprises a maximum of 100 telephones connected to a single two-conductor line. The bell of each telephone is rung over an individual wire when the distant caller dials the correct two-digit number. The bell at a called station rings only once. To re-ring, the number must be dialed again. In some cases, "busy" lamps are provided for observing whether or not the system is in use.

The switchboard switching unit consists of a Strowger two-motion switch, associated relays, ringing apparatus and a line terminal block. Two talking leads from each telephone terminate on the terminal block to form a common-talk circuit. Ring leads terminate on the bank terminals of the Strowger switch. Although all telephones are connected to one common pair of line wires, it is customary to install the system with individual wires for each telephone. These wires are then connected together on a line terminal block at the switchboard. Figure 7 is a photograph of the Type 32A38 P-A-X Switchboard.

The mounting equipment includes five vertical relay strips on which are mounted the Strowger switch, all relays and ringing equipment. The vertical strips are bolted to cross angles at the top and bottom of the upper compartment of the two-compartment sheet metal cabinet. Power equipment is located in the lower portion of the cabinet.

In some instances the telephones of the Type 32A38 are not all designated "common-talk." A divided arrangement can be set up where one group of telephones is designated "secret service," and another group as "ordinary service." The secret service group consists of a maximum of 30 telephones. Any two stations in this group can carry on secret conversation without being overheard by stations assigned to the "ordinary" service group. Other "secret service" stations, however, may intrude on the conversation. Also, a conversation started within the secret group automatically "splits" the two groups. This makes it possible for two simultaneous calls with the secret service arrangement. One call can take place in the secret service group while the second is associated with the ordinary service

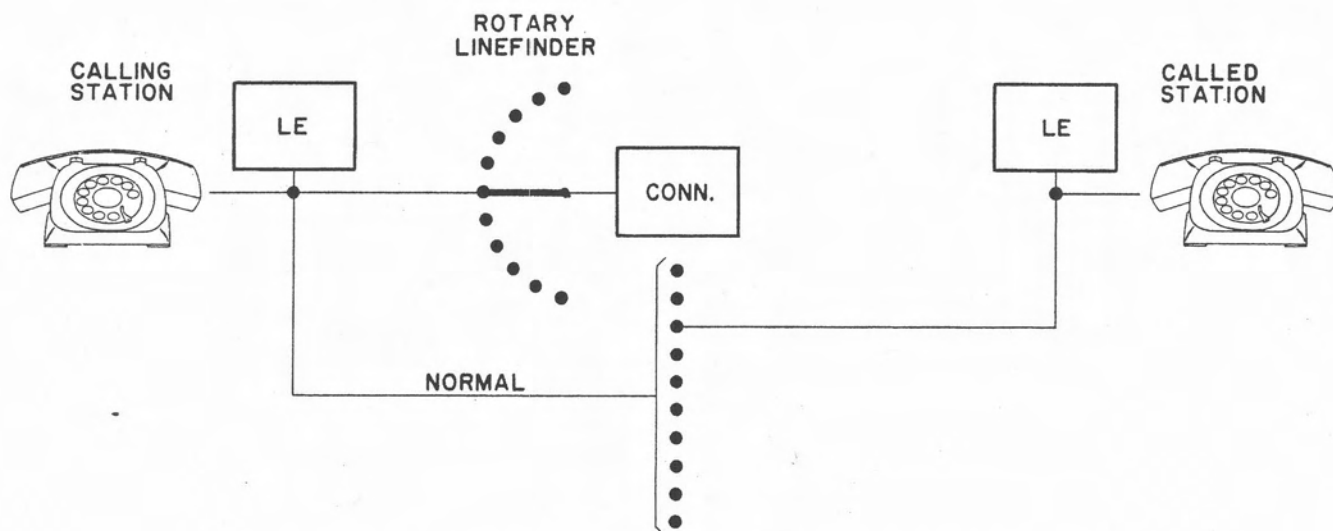


Figure 6. Type 32A31 P-A-X Switchboard. Demonstrating rotary linefinder, Strowger connector principle.

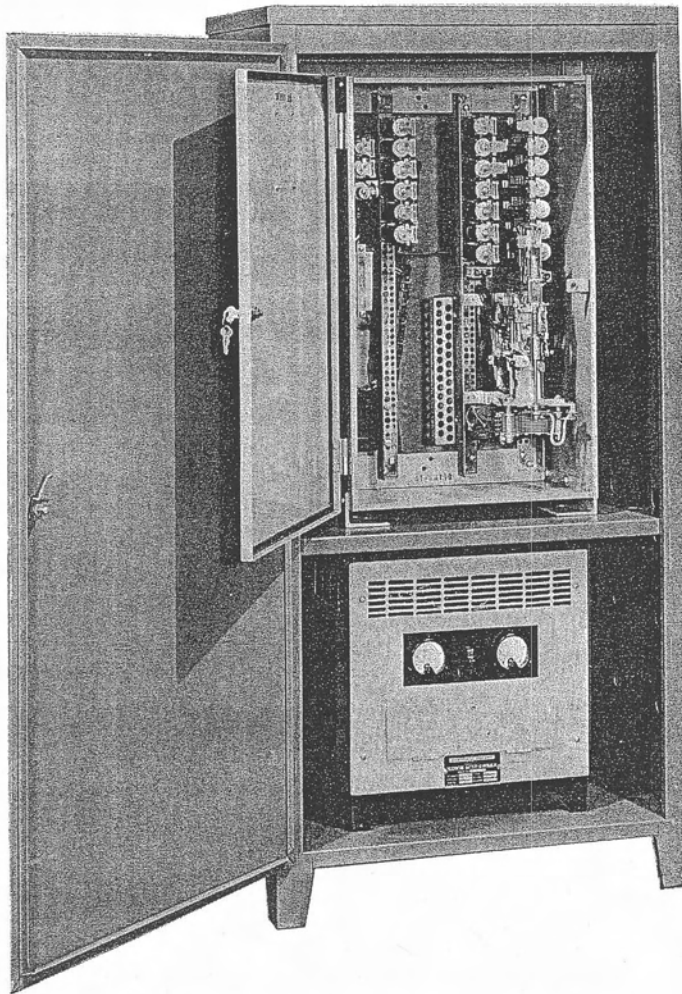


Figure 7. Type 32A38 P-A-X Switchboard.

group. For two simultaneous calls, the secret service connection must be established prior to the ordinary service group connection. Figure 8 demonstrates the Type 32A38 P-A-X with two group service.

The Type 32A38 can be provided with an automatic master-station control arrangement. Here, one station is assigned as a "master" or "control" station. This station is the only one equipped with a dial for selective signaling of all other stations in the system. Other "outlying stations" are restricted to calling the master station. They cannot dial or call among themselves.

The third Type 32A38 P-A-X arrangement adds dial equipped stations to the master station. These additional stations are termed "auxiliary masterstations." The masterstation or auxiliary masterstations can selectively signal any one of the "outlying" stations and also signal each other. Outlying stations, however, can still only signal the masterstation.

Direct line service can be provided for any two stations which have frequent occasion to

call each other. This removes traffic from the switchboard and supplies secret service. No switching equipment is utilized and two calls may be in progress simultaneously (one in the switchboard and one on the direct line). The two stations arranged for direct line service may also be connected to the P-A-X by means of a switching key for both P-A-X and direct line service.

Like all previously discussed P-A-X switchboards, the 32A38 P-A-X is designed to operate from either a 24-volt d-c power supply, a 12-cell 20 ampere-hour battery with a 1-ampere charger, or other power sources with proper voltage control.

3.4 Types 47A and 47B P-A-X Switchboards

The Types 47A and 47B P-A-X Switchboards are identical in switching, line and auxiliary equipment. They differ only in line capacity. The Type 47A P-A-X Switchboard has an ultimate capacity of 20 single-party lines, while the Type 47B P-A-X has a maximum capacity of 40 single-party lines. Four simultaneous calls can be attained with the 47A P-A-X; the 47B can have six.

If desired, P-A-X telephone capacity can be doubled by arranging for party-line operation. Automatic ringing accompanies single-party signaling and selective signaling is used for party-line ringing. Figure 9 shows the 47A Switchboard.

The switchboard unit includes line relays (one per line), auxiliary and common relays, ringing equipment, dial and busy relays, terminal blocks and fuses. Twenty-five-point rotary stepping switches serve as both linefinders and connectors. The switchboard units are housed in steel cabinets. Front and rear doors lift off. All units, including the power supply, are mounted on a series of plates that are bolted to the frame. The rotary switch bank, though, is mounted between two horizontal bars and bolted to the frame.

Figure 2 presents a switching schematic diagram of the Type 47A P-A-X. The linefinder principle is much the same as with other P-A-X systems discussed in this bulletin. The 25-point rotary linefinder rotates and tests for the calling line when the caller picks up the handset. The calling line is then connected to another 25-point rotary connector switch. In these type P-A-Xs, however, the connector is stepped differently than normal.

The 25-point rotary connector switch is designed to receive dial pulses for selective signaling of either party on a two-party line. The first party is assigned a number for ringing on one side of the line to ground, and

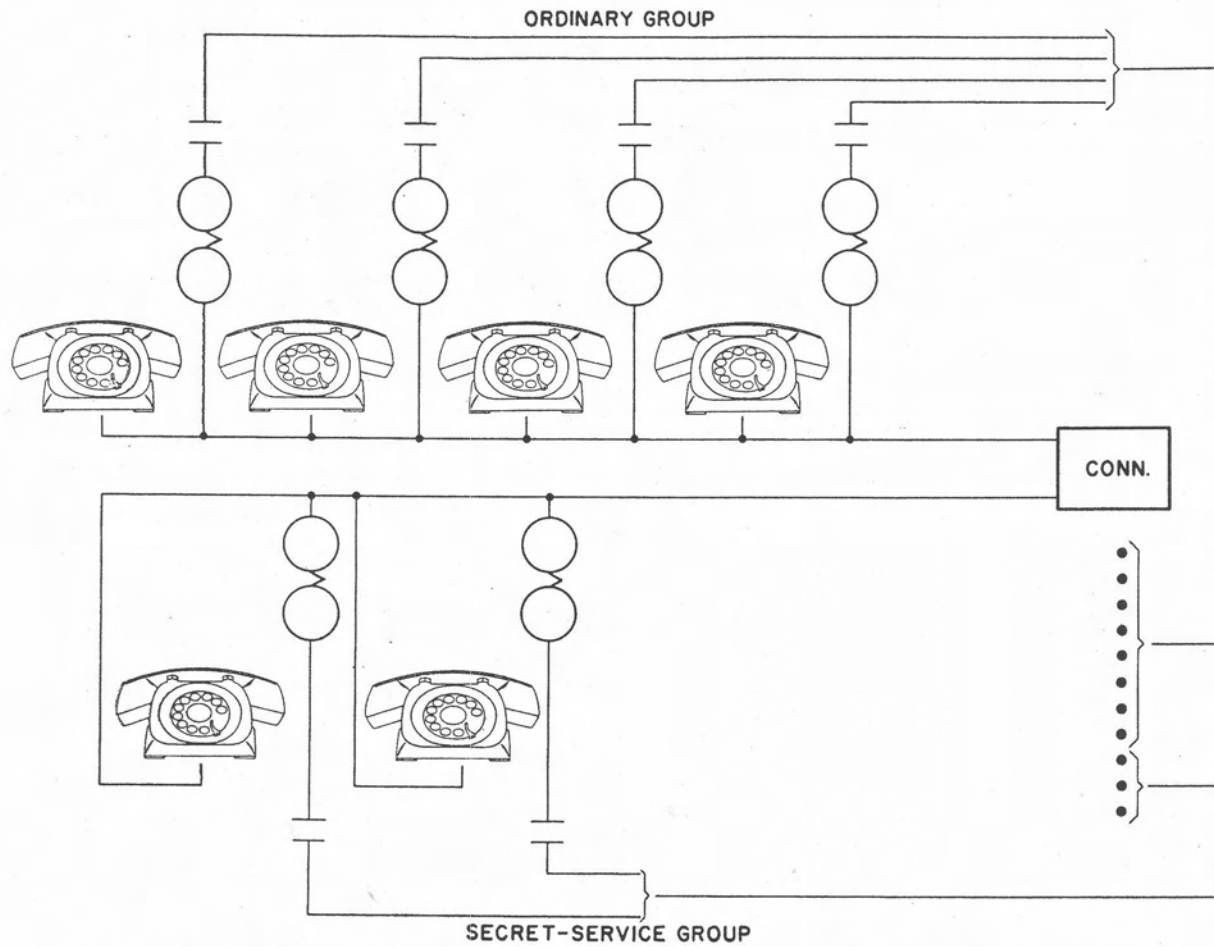


Figure 8. Type 32A38 P-A-X Switchboard. Demonstrating a system with two group services.

the second party's number rings from the other side of the line to ground. Selective dial numbering causes selective ringing of each telephone over a common pair of wires.

Power in the Types 47A and 47B P-A-Xs is usually supplied by a 24-volt battery eliminator. If an eliminator is not used, a 12-cell storage battery arrangement can be placed at the bottom of the switchboard cabinet. It is charged by a 3-ampere (type 47A) or 6-ampere (type 47B) battery charger located outside the cabinet.

3.5 The Types 25 and 50 P-A-X Systems

The Types 25 and 50 P-A-X systems are specially designed to meet expandable telephone needs. They are characterized by compact sectional design and ease of expansion-on-location. "Stock" installations can be readily supplemented by additional sections. The 25 and 50 P-A-X systems are also fully adaptable for use with the auxiliary services described in section 2. The design and functions of the 25 and 50 are similar. This section will discuss these similarities along with the distinguishing features of each system.

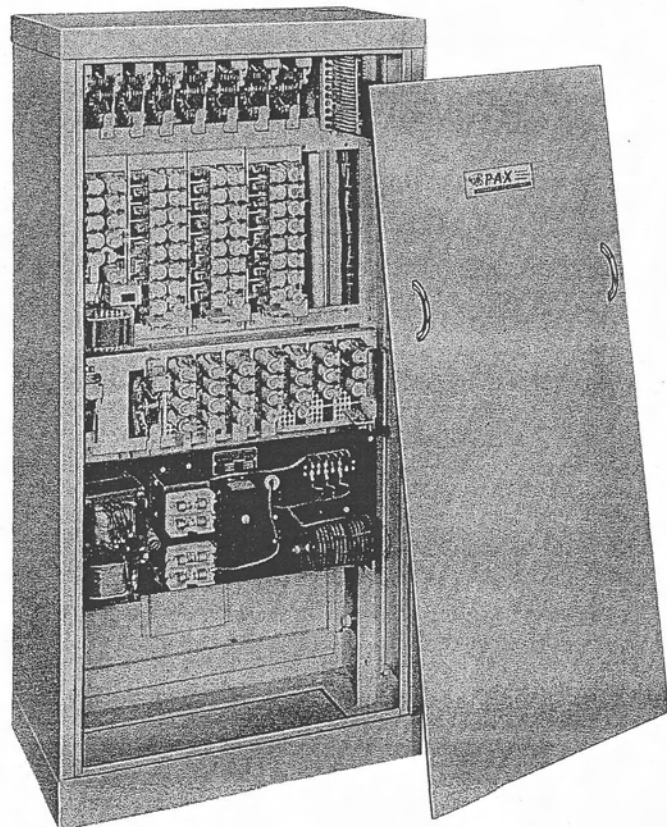


Figure 9. Type 47A P-A-X Switchboard.

Both the 25 and 50 P-A-X systems are fully automatic telephone exchanges. Each uses a plunger lineswitch-Strowger connector system. In special cases, the Type 50 may also add a selector. The Type 25 Switchboard is adapted for use where initial requirements are near 25 lines and probable "ultimate" growth will not exceed 75 lines. The Type 50 is used for installations of 35 or more telephones and where future requirements could approach 100 to 200 lines. More than 100 lines can be achieved in the Type 50 only by "additional stock" equipment.

The Types 25 and 50 P-A-X switchboards are designed with shelves mounted on sectional frames. The shelves are mounted on both sides of end frames to form a double-sided unit. Shelf units are individually located one above the other in a metal cabinet with hinged front and rear doors. All switch wiring terminates on terminal blocks located on the shelves. The switchboards can be rearranged easily to facilitate installation of additional equipment in the future. Size differentiates the Type 25 and 50 P-A-X shelves. A Type 50 shelf section holds 50 lineswitches while the Type 25 is restricted to 25 lineswitches. The Type 50 also has three more connector positions. While the Type 25 can house 7 connectors, the Type 50 P-A-X can accommodate 10.

Figure 10 shows a connector view of a two section Type 50 P-A-X Switchboard. The top section accommodates an 11-position connec-

tor shelf with eight connectors and associated equipment. The lower section houses the power equipment. Included in the lower section are the ringing apparatus, tone and charge control, and auxiliary service equipment.

The lineswitch side of the Type 50 contains two sections. The lower portion contains 50 lineswitches and a masterswitch. The upper shelf holds 25 lineswitches with a mechanical link to the masterswitch on the lower section. The upper section also has room for 25 additional lineswitches.

In cases where the Type 50 is designed with selectors as initial equipment, shelves in sectional cabinets are included with the basic equipment. Each shelf mounts ten selectors. The number of selectors used with the unit is determined by local traffic requirements.

The switchboard unit of the Type 25 P-A-X includes one self-aligning plunger lineswitch for each line in service. Each initial "stock" unit of two sections is equipped with 25 plunger lineswitches, a masterswitch, seven Strowger connectors, and associated equipment. The connector side contains the power shelf. Here, the voltmeter, ammeter, and ringing apparatus are located.

The initial unit of 25 plunger lineswitch expands to 50 lineswitches for 50 line capacity. Further expansion is possible with the addition of another unit of 25 lineswitches. A tone and charge control relay complete the switchboard equipment.

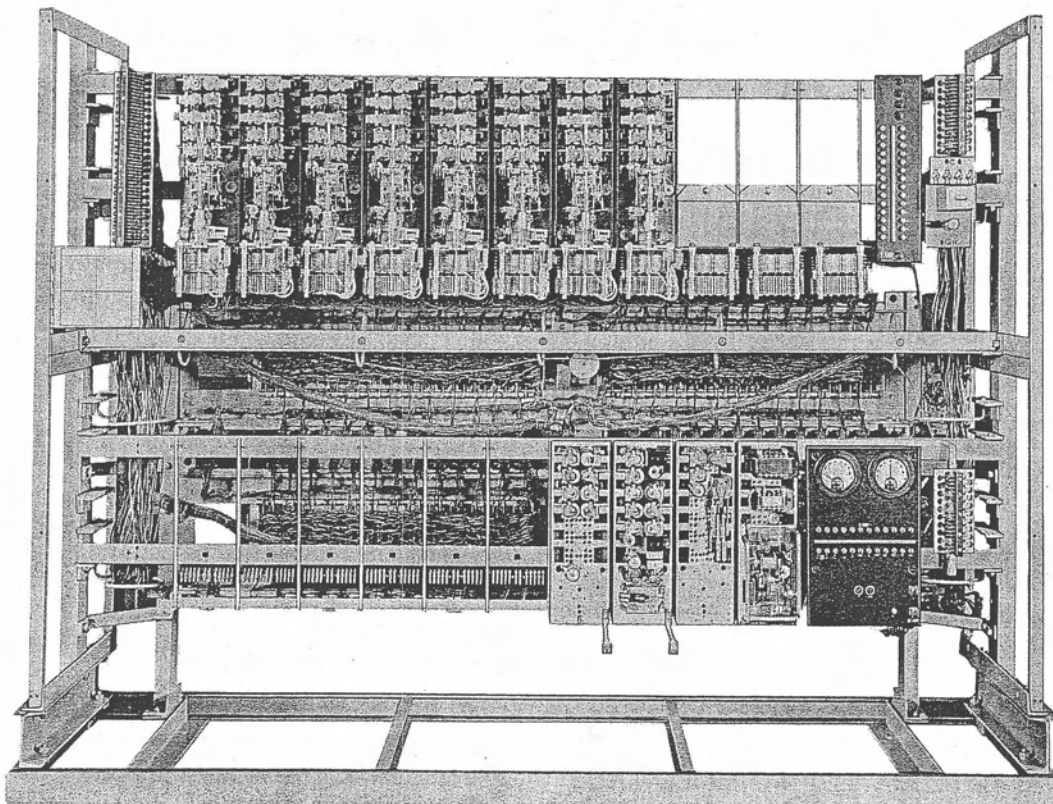


Figure 10. Type 50 P-A-X Switchboard (connector side).

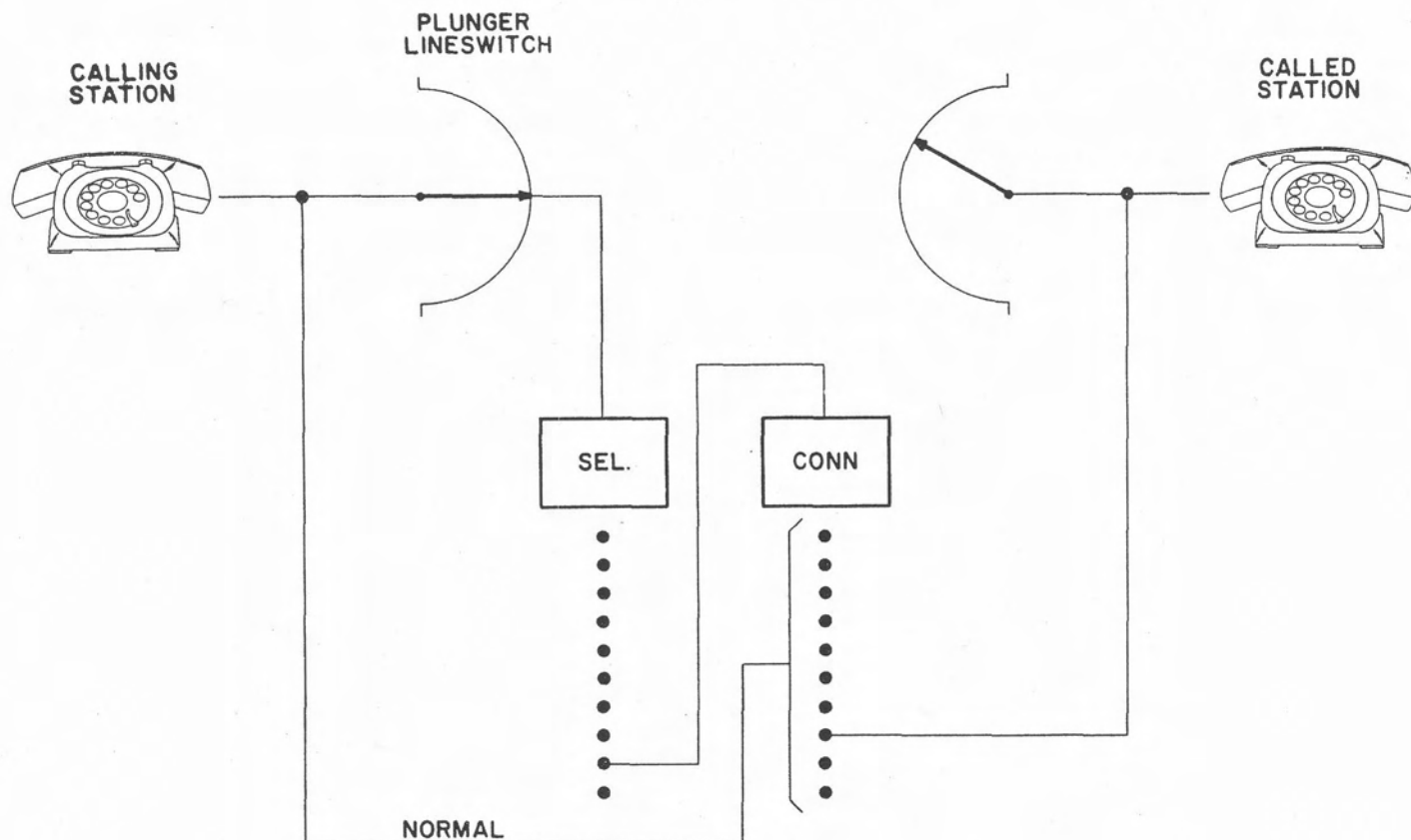


Figure 11. Type 50 P-A-X utilizing Strowger selectors.

The Type 25 P-A-X requires a 48-volt d-c power current. A battery eliminator can be used in place of the conventional battery charger system if local commercial power supply is dependable. When a battery charger system is used, a 23-cell, 48-volt battery group and associated charger is used. The power system used with the Type 50 is essentially that required for the Type 25.

Two-digit numbering is required in the Type 25 P-A-X. Usually numbers from 11 to 85 are assigned. If lines do not exceed 100, the Type 50 P-A-X also uses a two-digit numbering scheme. Three digit numbers are assigned when demand is over 100 lines or when 200-line Strowger connectors are employed.

Figure 1 illustrates a method of switching when ultimate line capacity is 100 lines or less and when 100-line Strowger connectors are in use. This diagram is applicable to both the Types 25 and 50 P-A-X systems. The same diagram also applies to the Type 50 P-A-X Switchboard when ultimate line capacity is 200 lines and 200-line Strowger connectors are used in place of 100-line connectors.

Figure 11 represents the usual Type 50 P-A-X switchboard switching method employing selectors between linefinders and connectors. This method makes it possible to expand-on-

location beyond 200-lines. The Type 75 P-A-X Switchboard is, however, the preferred switchboard if ultimate planned demand exceeds 200 lines.

Figure 1 will be used here to describe the switching steps in the "stock" Types 25 and 50 P-A-X systems. When a person removes his telephone handset from the cradle, the plunger of the associated lineswitch enters the lineswitch bank. This connects the calling line thru a free trunk to a connector. The connector returns dial tone to the subscriber and gives switching control to the caller's dial. Subscriber dialing steps the Strowger connector in two directions. The first digit steps the mechanism vertically and the second dialed digit rotates the mechanism to the called line's terminal banks. After dialing a free line, the calling party receives ring-back tone. The answering party completes the telephone connection.

3.6 Type 75 P-A-X Switchboard

The Type 75 P-A-X Switchboard is an intermediate capacity telephone system. It serves the demand between smaller capacity units and main exchanges. Specifically, it is used where requirements are between 50 and 100 lines, and where "ultimate" growth normally will

not exceed 200 lines. "Additional stock" equipment may be inserted, if necessary, to provide for over 200 lines.

As a common battery system, the "stock" Type 75 P-A-X serves 50 lines. The "initial" equipment handles 50 line service and can be expanded to serve an "ultimate" of 100 lines. A 50-line "selector" addition may be provided to increase capacity to 200 lines. Basic Type 75 P-A-X design provides for 10 simultaneous calls per 100 lines. In cases of high telephone use, overflow shelves can double simultaneous call capacity.

The Type 75 P-A-X is a Strowger linefinder-connector system. It is the only Automatic Electric Company P-A-X system using two-motion switches for both linefinder and connector functions. The "stock" 75 unit uses 100-line linefinders and connectors. But in cases where 200-line capacity is wanted, 200-line Strowger switches may be introduced. Up to 200 lines, selectors are not needed with the 200-line Strowger linefinder-connector system.

The "stock" Type 75 P-A-X Switchboard is constructed along the lines of the Types 25 and 50 P-A-X systems. It is "sectional" in design with switch shelves mounted on end frames. Shelves mount back to back to form a double sided unit. A metal cabinet serves as a housing for the shelf units. In contrast to the Type 25 arrangement, the cabinet uses swinging, collapsible doors on both sides.

Figure 12 shows a linefinder view of the Type 75 P-A-X Switchboard. The lower section houses a 10 position linefinder shelf with six linefinders, relay assembly, line equipment and a distributor. Unused space allows for expansion.

The connector side has an upper section with an 11 position connector shelf equipped with six connectors. The lower section houses the power panel, ringing converter and interrupter, and a tone and charge control relay group. The remaining positions can accommodate extra equipment.

The "stock" Type 75 P-A-X initial switchboard requires a two digit numbering scheme. Expansion over 100 lines requires a three digit scheme.

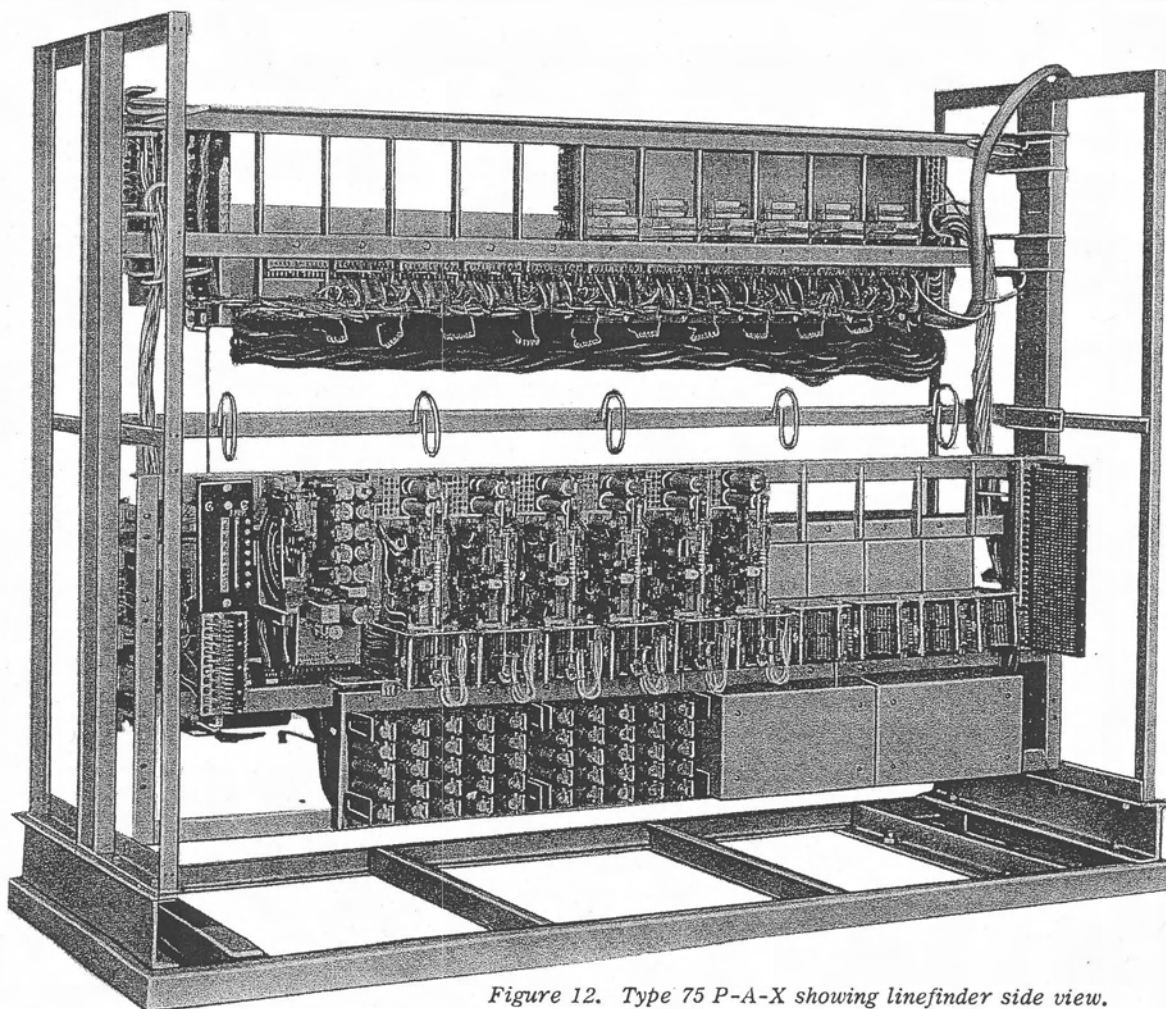


Figure 12. Type 75 P-A-X showing linefinder side view.

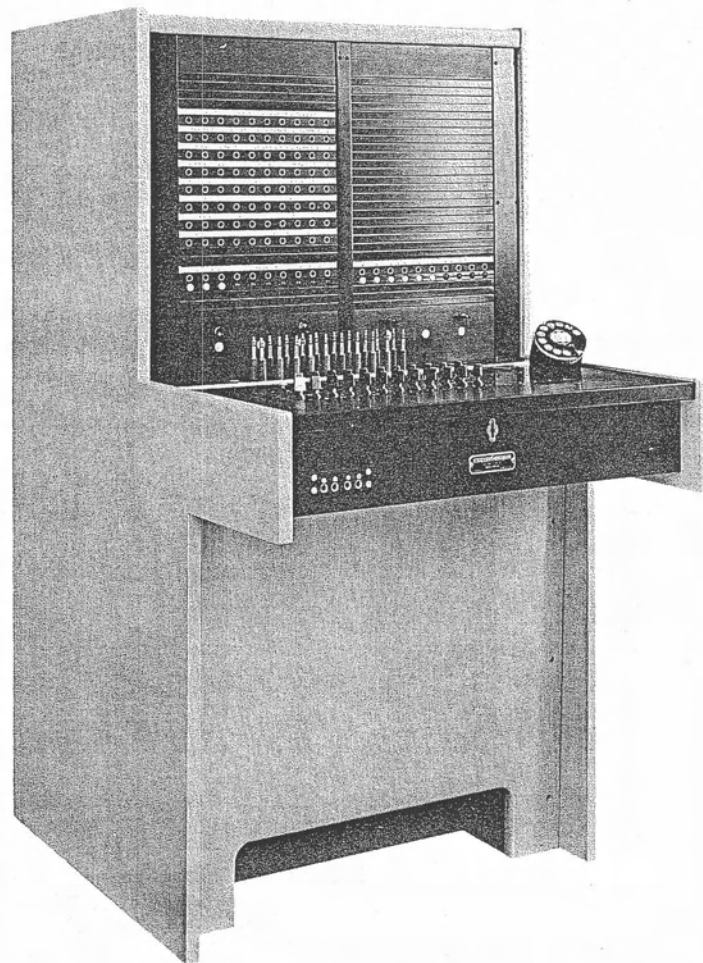


Figure 13. Type 33A35 Attendant Cabinet (floor-type).

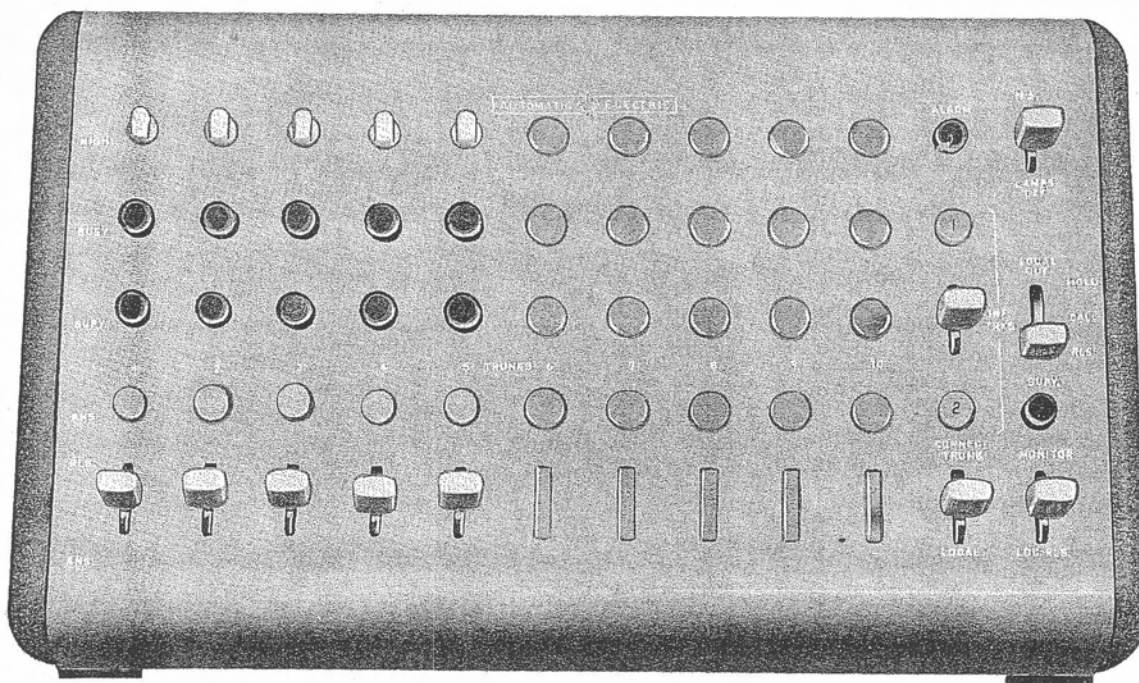


Figure 14. Type 51 Attendant Cabinet (turret-type).

PART II

1. INTRODUCTION

The Private Automatic Branch Exchange (P-A-B-X) is similar to the Private Automatic Exchange (P-A-X). The P-A-B-X, though, provides facilities for receiving and making calls to a central office. These calls are completed thru the same switching unit as are local calls.

The P-A-B-X requires the assistance of an attendant cabinet. Calls to a central office may also switch-thru by means of special telephones assigned P-A-B-X functions. All incoming calls are intercepted by either a local attendant or special telephones.

Outside calls may be made independent of the attendant on an automatic basis if the calling telephone is not trunk-denied (non-restricted). Other telephones must have the assistance of an attendant. If the system does not include an attendant, only non-restricted telephones can call outside. All telephones have normal P-A-X internal dialing.

In many instances, equipment specifically designed for P-A-X operation may be adapted for use as a P-A-B-X by adding equipment and providing a method of maintaining telephone intercept and transfer. Types 25, 50, and 75 P-A-X Switchboards can easily be converted to P-A-B-X operation. The Types 32A1, 32A21, and 32A31 P-A-X systems may also be converted with the use of special telephones. The Types 85 and 95 P-A-B-X Switchboards are, in themselves, complete P-A-B-X switching units.

Some organizations are too small to warrant converted P-A-X and standard stock P-A-B-X systems. The 10A or 10A1 Key Telephone Systems meet these special small organization needs. The system consists of a small switching unit and the Type 86 Key Telephone. This system supplies key feature combinations for signaling, picking-up a line, cutting-off an extension telephone, or "holding" a received call.

The P-A-B-X is usually given a specific public exchange telephone number which is listed in the local telephone directory. Each station within the P-A-B-X system also has a separate extension number. But this number is almost always unlisted in the public telephone

directory. All calls made from a public exchange telephone are thus intercepted and completed by an attendant.

An attendant at a P-A-B-X may have two different types of cabinet equipment. One is the familiar floor-type attendant cabinet (see figure 13) with a complete station multiple of all local telephones. Connection with incoming or local calls are set-up by using cord circuits.

The attendant may also have a cordless desk-mounted, turret-type cabinet (see figure 14). This type allows connections to be set-up by the attendant dialing directly into the local telephone or public exchange. Four attendant cabinets will be discussed in this bulletin. They are the Type 33A35 Attendant Cabinet, the Type 51 Attendant Cabinet, the Type 33A6A Attendant Cabinet, and the Type 33A19 Attendant Cabinet.

Outgoing calls from a P-A-B-X system can be handled in several ways. One method requires the constant services of an attendant. Here the attendant has power to exercise discrimination in granting trunk service to telephones listed as trunk-denied (restricted). Other telephones may dial out to the public exchange independent of the attendant. Central office access is from the 9th level of selectors or connectors. If special telephones are used, they too can be classed according to function and trunk privilege.

2. P-A-B-X SYSTEMS

2.1 Types 32A1, 32A21, 32A31 P-A-X Systems (Converted)

These basic P-A-X systems convert easily to P-A-B-X operation. One arrangement uses a Type 87 Telephone for maintaining internal and external telephone service. The interior system is primarily the basic P-A-X. One or two circuits, however, are paralleled with the P-A-X lines for central office trunk service. The special telephones (87 or other applicable telephone) permit a local party to switch to outside trunk lines.

On an 87 Telephone, an incoming call is answered by operating a "calling" trunk key. Any call may be transferred by operating a "hold" key and dialing the wanted P-A-X station. The wanted party connects to the incoming central office call by switching to the "calling" trunk.

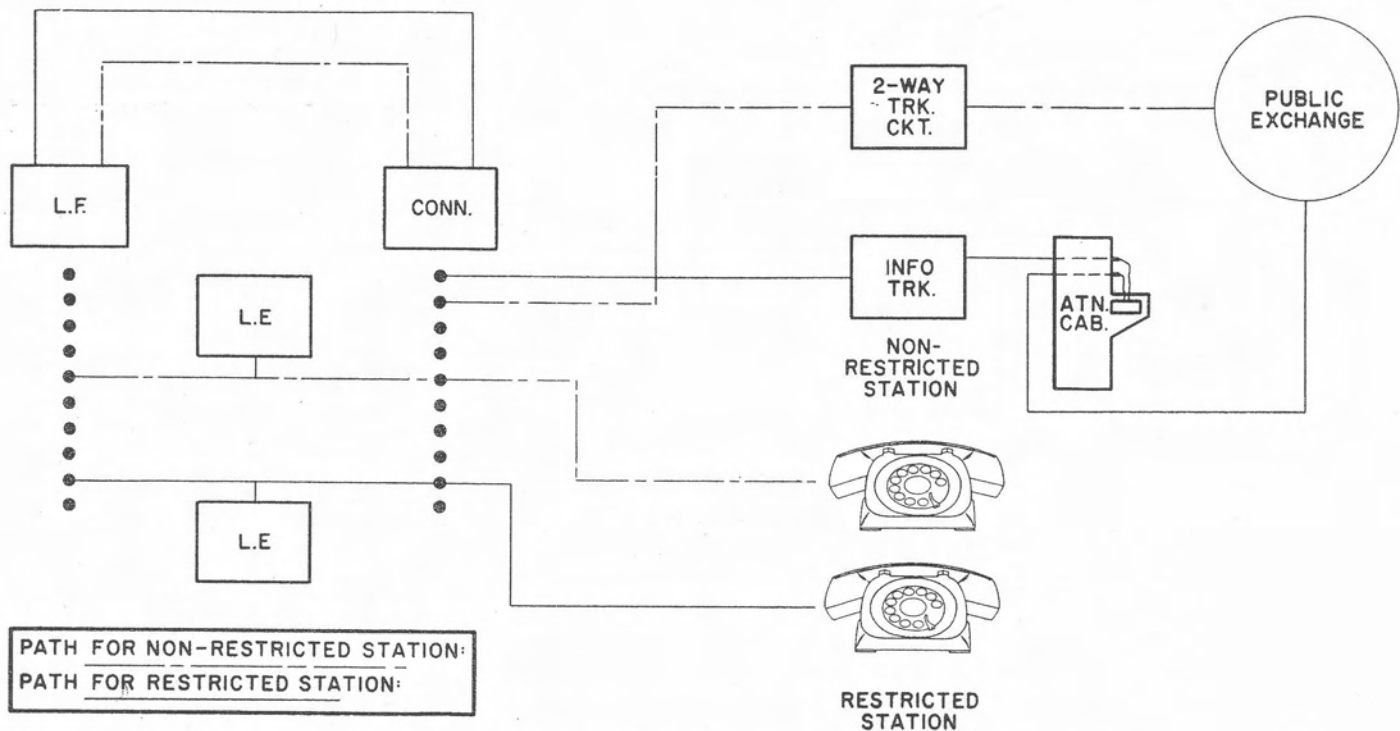


Figure 15. Type 75B P-A-B-X Switchboard circuit. Employs Type 33A35 Attendant Cabinet and 100-line system.

In calling to a central office telephone, the local party operates a free trunk key and dials into the public exchange. If a local call is received during outside conversation, a "hold" key will allow internal call answering and central office "hold." The public exchange call can be returned to the line by reoperating the trunk key.

The 32A1, 32A21 and 32A31 P-A-X systems afford one of the easiest methods of change to public exchange trunk service. By the addition of several central office trunk lines and special key telephones, P-A-B-X service is made available. No attendant or cabinet equipment is required for this conversion.

2.2 Types 25B, 50B, 75B P-A-B-X Switchboards

The Types 25B, 50B and 75B P-A-B-X Switchboards are the converted counterparts of the Types 25, 50 and 75 P-A-X systems. Internal equipment is the same and availability of auxiliary services for P-A-B-X operation is identical. Each series "B" P-A-B-X, however, connects to the public exchange thru an attendant cabinet. Special telephones for answering and transferring received central office calls are not used. This is in contrast to the previously discussed (section 2.1) converted P-A-X systems.

The series "B" P-A-B-X Switchboards are designed to operate in conjunction with an

attendant cabinet for attendant intercept of incoming calls. The attendant cabinet may be the cord floor-type (figure 13), or the desk-mounted, turret-type (figure 14). P-A-B-X attendant cabinets use either standard telephones without keys or with headsets (cord type).

Figure 15 is a schematic diagram of a typical Type 75B P-A-B-X Switchboard. It employs a cord-type attendant cabinet with a multiple of all local telephones. The cabinet, a Type 33A35, completes calls via cord circuits.

The Type 75B P-A-B-X is either a Strowger linefinder-selector-connector switching system or a linefinder-connector system. It incorporates an attendant cabinet, trunk circuits, and auxiliary service connections that are required. Two-motion linefinders make preparatory connections to selectors and connectors. For special capacity systems, regular 100-line two-motion connectors are used when selectors provide intermediate switching.

Figure 15 shows that direct access to public exchange trunks is made off the 9th connector level. Access to the attendant cabinet for local information is made off the 10th level. Auxiliary services normally are reached thru the 7th and 8th levels.

The Type 25B and 50B P-A-B-X Switchboards are arranged in much the same manner as the Type 75B. Line capacity, though, is less. Also,

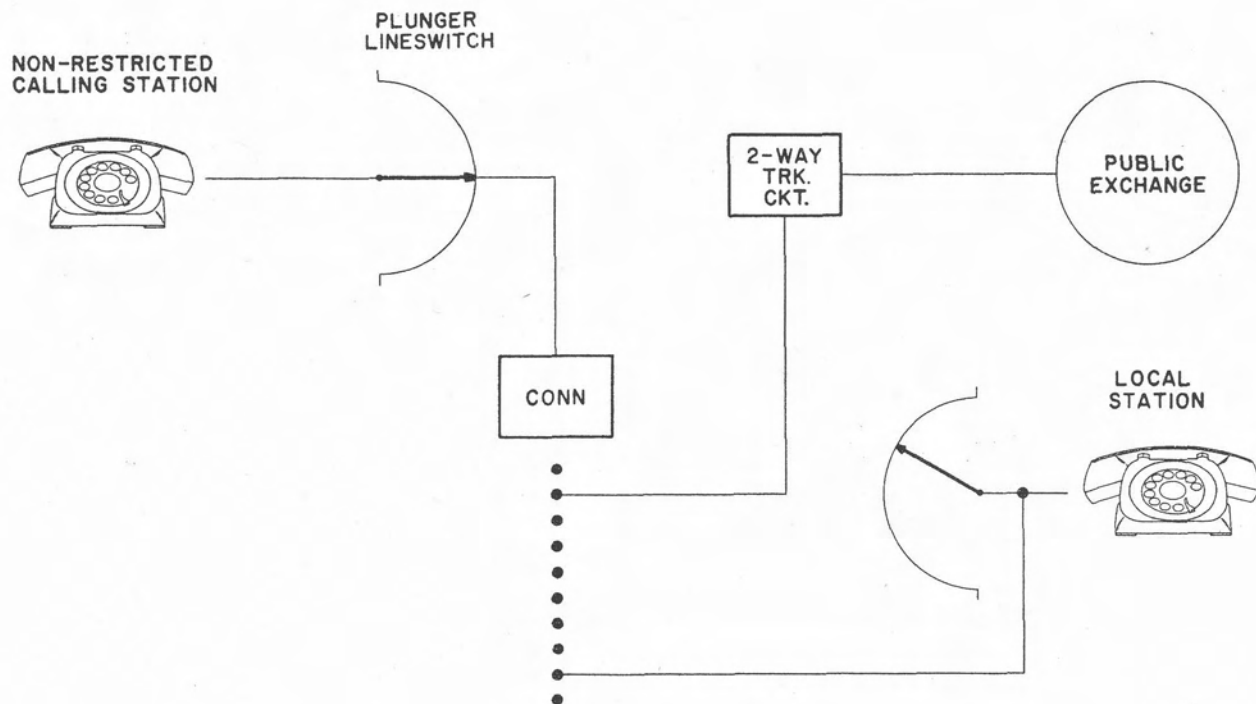


Figure 16. Types 25B and 50B P-A-B-X circuit block diagram.

plunger lineswitches are employed in place of Strowger linefinders. Type 50B installations, with a line capacity of less than 200 lines, do not use selectors. And no selectors are ever used in the Type 25B installation. Figure 16 is a simplified circuit block diagram of the 25B and 50B switching arrangements.

To make inside calls with series "B" P-A-B-X systems, the calling party lifts the handset and dials the number of the desired local station. The switchboard unit automatically connects the calling party to the called line.

When an outside trunk call is made, a non-restricted calling party lifts the handset and dials "9". He then dials the wanted public exchange party. Restricted telephones are not able to make calls directly to the public exchange. They must place a request with the local attendant. The calling party lifts the handset and dials information trunk number "0". He then gives the outside party's number to the attendant and hangs up. The attendant initiates and completes the outside call. She operates the transfer key and "recalls" the local station when the outside connection is made. The local party can then automatically connect to the trunk call.

All incoming calls are answered at the attendant cabinet by the attendant. When a call has been received, she operates a transfer key and dials or rings the number of the local station. The wanted party automatically connects to the trunk call.

2.3 Type 85 P-A-B-X Switchboard

The Type 85 P-A-B-X Switchboard offers 10-line local service with two external central office trunks. It is particularly suited to small business concerns that do not require a switchboard attendant or that have little internal telephone traffic. The unit handles two public exchange trunk calls and one internal call simultaneously (see figure 17).

The Type 85 P-A-B-X easily mounts on a wall or desk top. The unit includes a battery eliminator that operates from commercial 115-volt, 60 cycle a-c power and supplies 12-volt operating current. Other equipment includes a minor switch for selective signaling, a ringing vibrator, terminal block, fuses and transformer.

Key telephones must be used with the 85 P-A-B-X. The Type 87 Telephone is employed as a non-restricted telephone. A Type 80 serves on a restricted basis. A total of ten telephones can be connected in this P-A-B-X. Any arrangement of restricted and non-restricted telephones is possible.

The Type 87 Telephone may originate, receive, transfer, and be transferred to outside trunk calls. Use of the Type 80 restricted telephones allows only interior call answering and sending.

For internal service, all telephones have access to a common talking circuit. A called

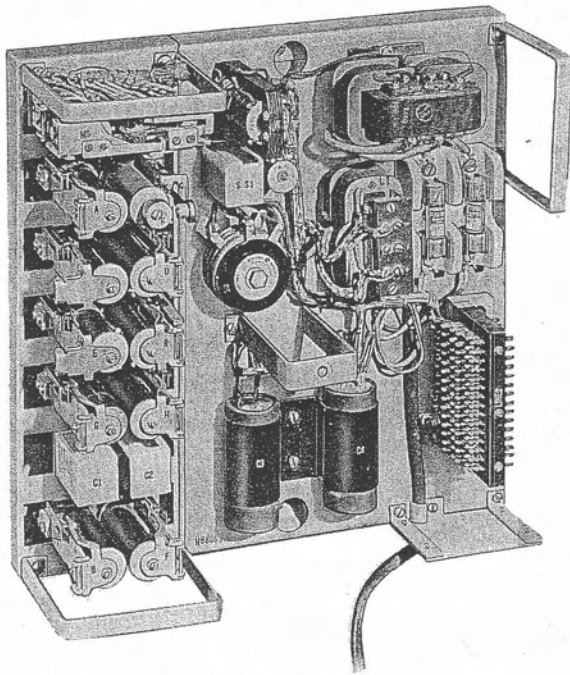


Figure 17. Type 85 P-A-B-X Switchboard.

station is selectively signaled when the caller dials the single digit number of that telephone. Calls incoming from the central office operate special signals and may be answered at any non-restricted station. Ringers are not operated by incoming calls at non-restricted stations. Centrally located audible signals serve this function.

When answering an incoming call with a Type 87 Telephone, the associated trunk key is pressed. To transfer a call, the incoming trunk "hold" key is pressed. The answering party then dials the wanted P-A-B-X local station. The wanted party connects to the incoming call by operating the correct trunk key on his telephone.

On an outside call, a free trunk key is pressed and the handset lifted. Dialing may then begin directly. On an inside call, ringing is not automatic. A rering must be accompanied by re-dialing.

2.4 Type 95 P-A-B-X Switchboard

The Type 95 P-A-B-X Switchboard gives communication between twelve local telephones with three central office trunks. It combines automatic interior communication with central office service without the need of an attendant cabinet. The unit permits a maximum of six simultaneous calls - three local and three trunk calls. All stations are provided with secret service. Figure 18 shows the 95 P-A-B-X Switchboard.

The 95 P-A-B-X Switchboard consists of line relays (one per line), auxiliary relays, fuse panel, ringing transformer, terminal blocks, and rotary switches. Three rotary switches serve as linefinders and three as connectors

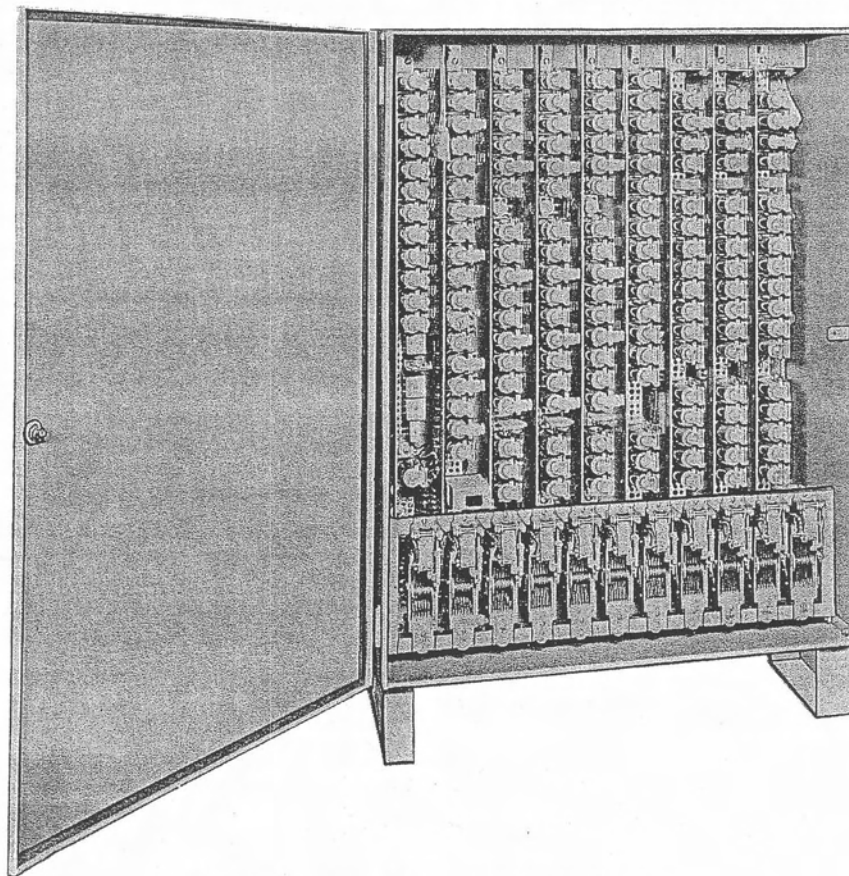


Figure 18. Type 95 P-A-B-X Switchboard.

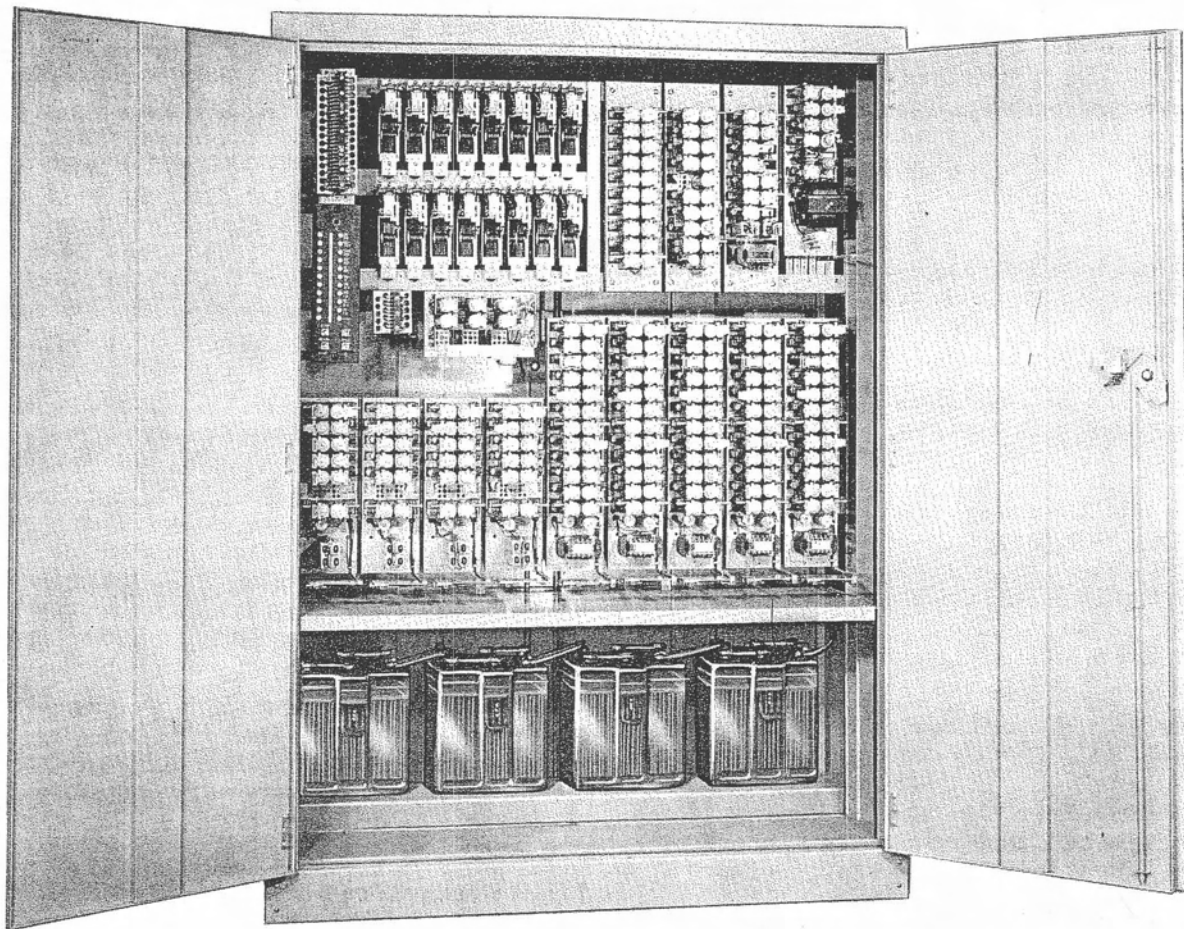


Figure 19. Type 33A6A P-A-B-X Switchboard.

for completing local calls. Three additional connectors establish connections to central office trunks. A final linefinder-connector group serves as an auxiliary link for central office calls. This link is used only when the three central office trunks are busy. It is not used for local switching.

The Type 95 P-A-B-X power supply consists of a 24-volt, 25 ampere-hour battery charged from a 1-ampere battery charger. If the commercial power supply is reliable, a 24-volt, 3-ampere battery eliminator can be used.

The Type 95 may use any of the special key telephones. But standard automatic telephones (Type 80 or 90) are usually used at all stations. Non-restricted stations are additionally equipped with grounding push buttons located on the telephone cradle.

Incoming calls on public exchange trunks are indicated by a common ringer or lamp signal. By lifting the handset of any push-button equipped telephone, the calling public trunk is automatically connected. To transfer an incoming public exchange call, the grounding button is pressed. This "holds" the public trunk and disconnects the telephone from the

local line. The wanted station's telephone number is then dialed. When the answering party hangs up, the trunk call is automatically shifted to the transfer party. Before the answering party hangs up, the party waiting on the line cannot overhear the local conversation.

To make an outside call from a non-restricted station, the user dials "0" to establish connection with the public exchange. The user then dials the exchange number. If public exchange dial tone is not heard, all trunks to the public exchange are busy. The auxiliary link permits placing central office calls when all three regular links are busy. This link cannot be used for internal calls but is automatically made available for outgoing calls.

2.5 Type 33A6A P-A-B-X Switchboard

The Type 33A6A P-A-B-X Switchboard has a capacity of 20 local lines and five public exchange trunks. Ultimate maximum service is four simultaneous local calls and five public exchange calls. The system can be complemented with its own specially designed attendant cabinet. It also may operate unattended. Figures 19 and 20 show the switching unit and the attendant cabinet.

The Type 33A6A P-A-B-X Switchboard consists of rotary switches and relay groups mounted on a steel framework. It is encased in an aluminum-finished metal cabinet. The cabinet is single sided and is arranged to mount two shelves of equipment. The source of power is located below the lower shelf.

The top shelf in the Type 33A6A P-A-B-X holds the rotary switches and a ringing converter. It also contains the terminal strip, fuse panel, and line and distributor relay groups. The lower shelf houses the relay groups associated with the finder, connector and trunk switches.

If the Type 33A6A system remains unattended, standard dial telephones are normally used at all stations. The stations which have access to public exchange trunks also have included a grounding-type push button. This button is located on the telephone near the handset.

Only non-restricted telephones can make outside calls in this P-A-B-X system. To reach an outside trunk, the calling local party first dials "9," the standard central office number. After getting dial tone, the local subscriber dials the directory number of the wanted station.

Incoming calls from the central office on an unattended basis are answered only at non-restricted telephones. The incoming call operates a common trunk signal located so that its signal is heard at several stations. The common trunk signal is not associated with any particular trunk, but merely indicates an incoming call. A call is answered at any non-restricted station by lifting the handset and dialing answer number "8."

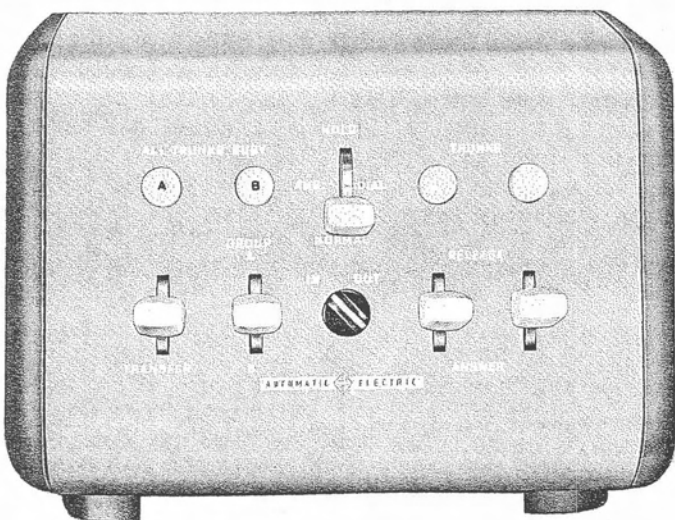


Figure 20. Attendant cabinet for Type 33A6A P-A-B-X Switchboard.

Incoming calls are transferred to other telephones by a transfer push button located near the handset on the telephone. To establish a transfer, the P-A-B-X answering party presses his transfer button. This places a holding bridge across the central office trunk. The answering party then dials the wanted station and requests that the transfer party switch to the incoming line. When the answering party releases the push button, the connection is complete from incoming caller to transfer party. There is one transfer line circuit for each central office trunk.

If an organization wants operator intercept of incoming calls, an optional attendant cabinet is added to existing P-A-B-X equipment (see figure 20). The attendant cabinet serves as one station arranged to answer and handle more than one incoming call from the public exchange. It can also maintain supervision over many of the local auxiliary services.

The Type 33A6A Attendant Cabinet has five operating keys and one turn key for use in local transfer and public exchange intercept. It also has four supervisory lamps for visual operator signaling.

The attendant cabinet has two ANSWER-RELEASE keys for making and answering calls over the public exchange trunks. The keys are located on the right side of the cabinet and are able to intercept and release incoming public trunk calls.

The key on the far left of the cabinet serves as a transfer key. Its function is the same as the transfer push button associated with non-restricted telephones on the unattended 33A6A P-A-B-X.

The attendant also has an information ANSWER-DIAL line key at her disposal. It is centrally located on the cabinet between the supervisory lamps. The key is essentially a non-restricted P-A-B-X line for receiving local calls. However, if both of the trunk keys are busy, the ANSWER-DIAL line may be used to make public exchange calls. The attendant, with two ANSWER-RELEASE keys and one ANSWER-DIAL line, has a total of three lines to handle incoming trunk line calls.

A turn key is also associated with the attendant cabinet. It is used for switching the public exchange common signal circuit from common trunk signals to the d-c buzzer in the attendant cabinet. A trunk group selection key completes the arrangement on the 33A6A Attendant Cabinet. It operates to select which trunk group (A or B) will be used for an incoming call.

2.6 Type 33A35 P-A-B-X Attendant Cabinet

The Type 33A35 P-A-B-X Attendant Cabinet is a floor-mounted, cord-type cabinet for answering service between public and local telephones. The equipment includes termination jacks, lamps, circuit cords and headset. Figure 13 is a photograph of the Type 33A35 P-A-B-X Attendant Cabinet.

The 33A35 Attendant Cabinet is initially wired for 100 local lines. It can be expanded to 300-lines if demand increases. The stock-type includes wiring for 10 two-way trunks operating to central offices. It is initially equipped, however, with six public exchange trunk circuits.

The keyshelf of the Type 33A35 Cabinet includes wiring for 15 cord circuits. The initial stock installation has cord circuits for a maximum of 10 simultaneous calls. The jackpanel arrangement includes five information and one outgoing trunk. The stock switchboard can be further complemented with a conference jack strip. This makes it possible for conference calling between a central office party and four local stations.

Upon receipt of a public exchange call, a trunk answering lamp glows. The attendant answers the call by first plugging the trunk (rear) cord into the calling central office trunk's jack. This places the TALK-RING key of the cord circuit in the talk position. The attendant then plugs the remaining cord (front cord) into the assigned jack of the local party. The non-locking TALK-RING key is then placed in the ring position. If the attendant wishes to talk with the local party first, she returns the TALK-RING key back to the talk position and converses. Cords associated with this circuit are taken down when the call is completed.

Normally, a local party initiates outside calls without attendant assistance. This is completed by dialing "9" and the wanted central office party's exchange number. Some restricted local telephones can reach the public exchange by dialing the local information trunk number "0". The attendant completes the call.

Other services are available with switchboard attendant supervision. Recall service on incoming calls is one. The attendant is "flashed" by the local party for call transfer to another local station. Delayed call service (toll calls for example) is initiated thru the attendant when it is best to be called back when the call is completed. Delayed call service is made by the attendant in much the same manner as receiving a central office call. The attendant takes the trunk cord of a circuit, plugs it into an exchange jack, dials the public exchange,

and waits for the call to be completed by the exchange operator. The local party is then rung and connected to the outside station. Delayed call, conference, and other forms of paging service are usually initiated by a local station over the information trunk.

A monitor key, located on the keyshelf, lets the attendant "listen-in" on any connected telephone circuit. The attendant may either talk with the monitored parties or listen-in without verbal participation.

A final service offered by the attendant is "splitting" received calls from the public exchange. Line splitting permits the attendant to offer a call made from the public exchange to the local party for acceptance. She is able to converse with both parties in private.

Two additional keyshelf keys, SPLIT and TALK-ON-TRUNK, are placed on the cabinet for this service. When a public exchange call is received, the attendant splits the line with the SPLIT key. This isolates any conversation with the local party. Operation of the TALK-ON-TRUNK key isolates any conversation with the trunk line party. With this service, both parties are prevented from overhearing another's private conversation with the operator.

2.7 Type 33A19 P-A-B-X Attendant Cabinet

This A. E. Co. floor-type attendant cabinet is similar in design and function to the Type 33A35 (section 2.6). The only significant difference in the two attendant cabinets is the location of the relay rack. In contrast to the Type 33A35, the 33A19 has an external location for the relay rack. All trunk and line relay equipment is mounted on this rack. Cord and positional relays, however, are housed inside the cabinet in a similar manner as the Type 33A35.

In locating the external relay rack of the Type 33A19, a position near the attendant cabinet is preferable. Cabling distance between the relay rack and the distributing frame of the P-A-B-X can thus be kept at a minimum.

2.8 Type 51 P-A-B-X Attendant Cabinet

The Type 51 P-A-B-X Attendant Cabinet is an example of a turret-type, desk-mounted switchboard unit. It maintains operator intercept and supervision of local and public exchange calls. Only the keys and associated lamps are located in the cabinet. Cords are eliminated. And all switching equipment is remotely located in a separate enclosure with cable connection.

The stock attendant cabinet is wired for a maximum of 10 two-way public exchange trunks. It is equipped with keys to serve five simultaneous trunk calls. Unlike the Type 33A35, no cords, dial, or ringing keys are needed to complete connections to local stations. Basic functions and over-all services, though, are similar to the Type 33A35. Figure 14 shows the Type 51 P-A-B-X Attendant Cabinet.

All incoming calls are intercepted by the attendant. A call is answered by removing the telephone handset and placing the locking-type RLS-ANS key in the answer position. After receiving the desired local number, the attendant operates the non-locking CONNECT TRUNK-LOCAL key to the local position. She dials the local number and retires from the line.

When the local P-A-B-X station returns the telephone handset to the cradle, the SUPY and ANS lamps glow. The attendant returns the answer key to normal and thus disconnects supervision to the exchange.

Calls to the public exchange are made directly from any non-restricted local station. The caller need only dial "9" and the public exchange number. Calls to the public exchange from the attendant cabinet are made by finding a free circuit and placing the answer key in the answer position. The attendant dials the outside number and completes the call.

A local station makes a delayed call to the public exchange by dialing the attendant over a local information trunk. The local party hangs up and the operator initiates the call to the outside. When the call is completed, the local caller is contacted as if the call was coming in to the P-A-B-X.

Making local calls to P-A-B-X stations direct from the attendant cabinet is another important service. The attendant may call any station independent of public exchange trunks. The Type 51 handles such calls over a free local trunk circuit.

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