

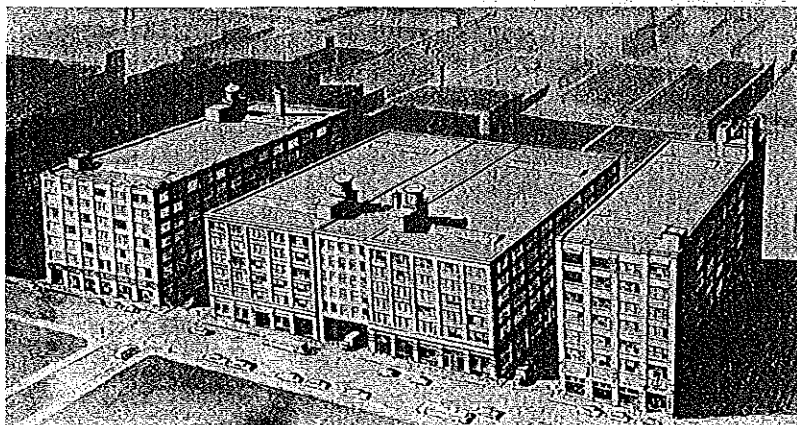
# TYPE 95 P-A-B-X SWITCHBOARD

1 2 STNS  
3 TRKS  
6 PATHS

Bulletin 691



ORIGINATORS OF THE AUTOMATIC DIAL TELEPHONE



*Factory and General Offices of Automatic Electric Company, Chicago, U. S. A.*

AUTOMATIC ELECTRIC COMPANY is an organization of designing, engineering, and manufacturing specialists in the fields of communication, electrical control and allied arts. For more than sixty years the company has been known throughout the world as the originator and parent manufacturer of the Strowger Automatic Telephone System. Today Strowger-type equipment serves over 75% of the world's automatic telephones. The same experience and technique that have grown out of the work of Automatic Electric engineers in the field of telephone communication are also being successfully applied on an ever-increasing scale to the solution of electrical control problems in business and industry.

## PRINCIPAL PRODUCTS

**Strowger Automatic Telephone Systems**—Complete automatic central office equipment for exchange areas of any size, from small towns to the largest metropolitan networks.

**Community Automatic Exchanges**—Unattended automatic units for small rural or suburban areas, with facilities for switching into attended exchanges.

**Automatic Toll Boards**—An adaptation of Strowger principles to toll switching, resulting in simplification of operators' equipment and greater economy of operating and toll circuit time.

**Private Automatic Exchanges**—Available in various capacities, with or without central office

connections, and with facilities for special control services to meet the needs of the user.

**P.B.X. Switchboards**—A complete range of cordless and cord types for the modern business.

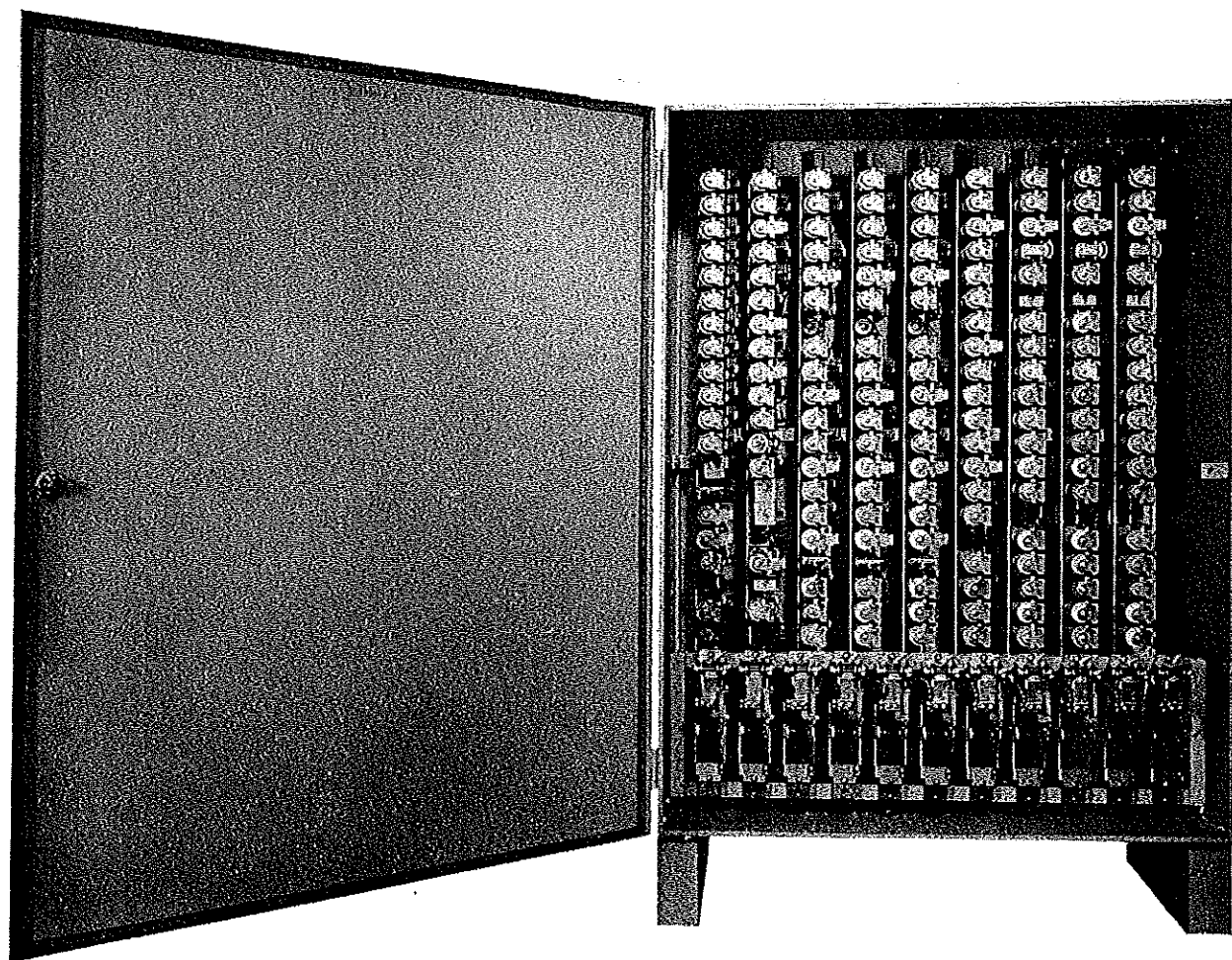
**Telephone Instruments**—Modern designs for automatic or manual exchanges, including the Monophone—the world's most attractive and efficient handset telephone.

**Exchange Accessory Equipment**—Auxiliary exchange and substation equipment, including manual desks, testing apparatus, transmission equipment, and all accessories needed for the operation and maintenance of the modern telephone exchange.

Makers also of electrical control apparatus for industrial, engineering and public utility companies, telephone apparatus for railroads and pipe line companies, private telephone systems of all types, electrical and communication devices for aircraft and airways control, and special communication apparatus for military and naval departments.

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*Figure 1. Type 95 P-A-B-X. Switchboard, front internal view.*

## TYPE 95 P-A-B-X SWITCHBOARD

### 1. CAPACITY AND SERVICE FEATURES

The Type 95 Private Automatic Branch Exchange has a capacity of 12 local stations and 3 central-office trunks, combining facilities for automatic interior telephone communication and trunk service to an automatic or manual central office without the need for an attendant's cabinet. It provides for a maximum of 6 simultaneous conversations—up to 3 local calls and 3 trunk calls. Service is secret on all connections (except as described under § 1.07).

**1.01 Local Calls**—Calls between local stations are made by dialing one-digit or two-digit numbers. Station numbers are 2 through 8, and 92 through 96.

**1.02 Trunk calls**—Outgoing calls to the central office are made by dialing "0." Since this P-A-B-X uses no attendant's cabinet, arrangements provide that incoming trunk calls may be answered at certain stations (see § 1.03), and, if desired, transferred to another station. Incoming calls operate one or more audible trunk signals. Visual trunk signals are optional. Trunk signals should be so located as to attract the attention of those who may be required to answer incoming calls. The party answering simply lifts his handset and is automatically connected to the trunk.

**1.03 Classes of local station**—Local stations may be up to 12 in number. Each of the 12 stations can be of any of the following four classes:

**Non-restricted**—Can answer and originate interior calls; and can *originate*, answer, and transfer central-office calls.

**Semi-restricted**—Can answer and originate interior calls; and can *answer* and transfer (but not originate) central-office calls.

**Restricted**

(a) Can answer and originate interior calls. Cannot originate central-office calls nor answer such calls directly, but can receive *transferred* central-office calls.

(b) As above, except cannot receive transferred central-office calls.

**1.04 Types of telephones**—Restricted stations may use any standard common-battery automatic (dial) telephones. Semi-restricted and non-restricted stations require automatic telephones with grounding push buttons.

**1.05 Trunk-call transfer**—If a central-office call, originated or received at one local station, is to be transferred to another, the party at the original local station presses the grounding button, receives dial tone, dials the number of the station wanted, waits for that station to answer, and tells the called party of the call. As soon as the first party hangs up, the equipment automatically connects the called party to the trunk.

**1.06 Holding trunk while making internal call for information**—A party at a non-restricted or semi-restricted station can press the grounding button momentarily to hold a central-office call while calling another local station to obtain information. When the information has been obtained (or if the called party does not answer), the grounding button is pressed again to reconnect the first local station to the trunk. This feature is used also when the called party does not want to receive a transferred call and so tells the transferring party.

**1.07 "Tick tone" feature (optional)**—When a central-office call is to be transferred to a local station which is busy already on an interior call, "tick tone" is heard by the party attempting to transfer and by the parties on the local call. This tone notifies the busy station that a trunk call is waiting. The feature is optional; see *Note* on page 7. (If tick tone is not used, the party attempting the transfer will hear busy tone.) If the party at the busy station does not want the call, he can so inform the transferring party who again presses the grounding button to reconnect to the trunk call as in § 1.06.

**1.08 Auxiliary link**—An auxiliary link, provided as standard equipment, permits placing central-office calls even when all 3 regular links are busy. This link cannot be used to make interior calls, but is automatically made available for outgoing calls when needed. The link is used only to *set up* a connection; afterward it is released for further use.

**1.09 Paging service**—When specified, a paging system (amplifier and speakers) can be provided with the switchboard to permit paging from any station. The paging system is connected to the switchboard, and access to the system is obtained by dialing "99." P-A-B-X parties use this feature in the following manner: If a call is made from one station to another station and an answer is not received, the calling party simply hangs up, lifts the handset again, dials the number of the paging system, and pages the desired party by speaking into the telephone in the normal manner. The calling

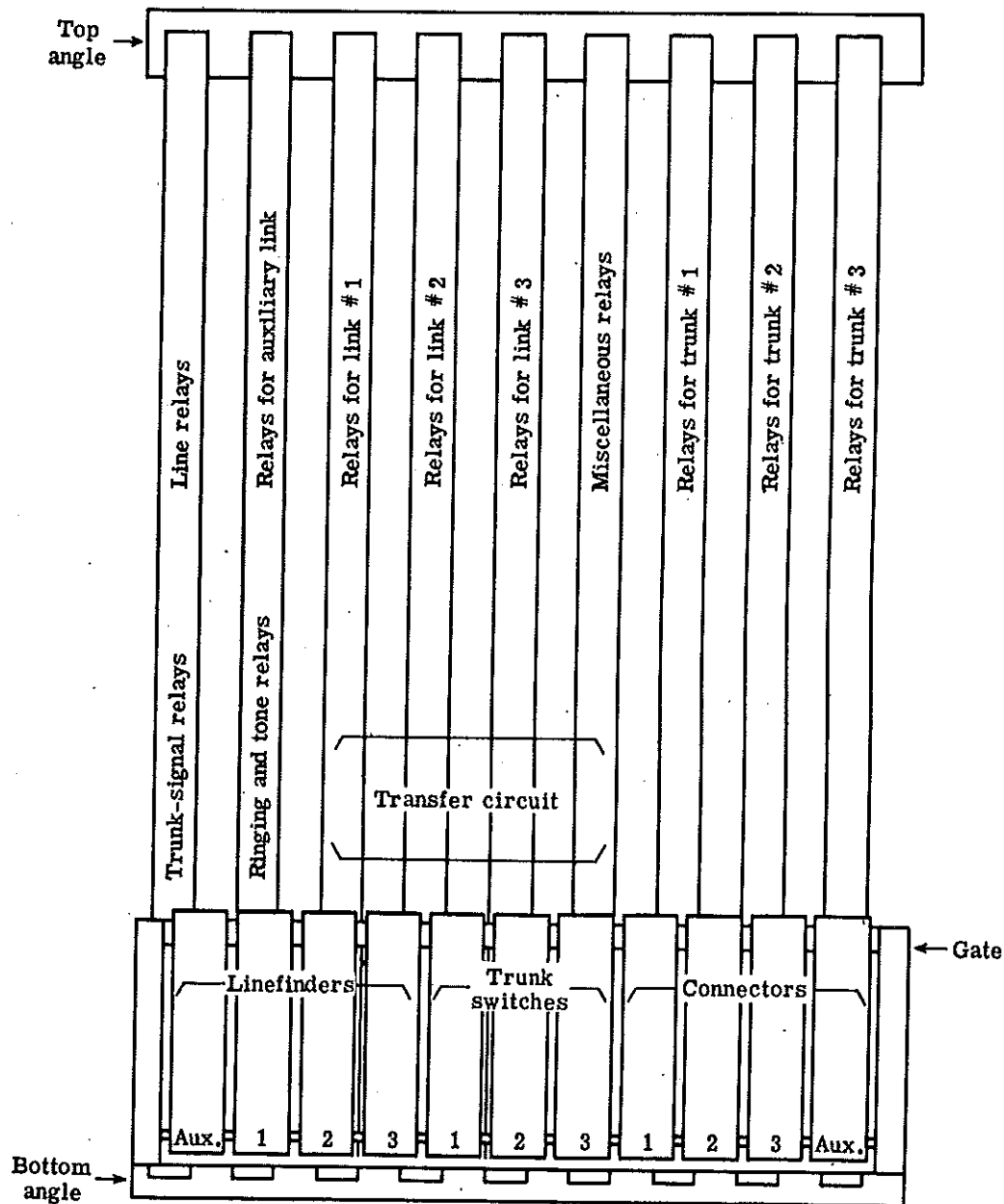


Figure 2. Switchboard, front internal view.  
Arrangement of switching equipment.

party's voice is amplified and broadcast throughout the required area. Then the paging party hangs up. The paged party goes to the nearest telephone and dials the number of the paging party.

**1.10 Line and trunk resistances**—Where the P-A-B-X is used in conjunction with a 48-volt central office, trunks can have 750 $\omega$  maximum trunk loop resistance. Local station lines can have 350 $\omega$  maximum loop resistance.

## 2. PHYSICAL DATA

**2.1 Switchboard**—The switchboard is housed in a steel cabinet 40½" high, 27¾" wide, and 13" deep. The cabinet and contents weigh 260 pounds (shipping weight, 300 pounds). Front and rear doors are provided on the cabinet. As illustrated in Figures 1, 2, and 3, all components or fixtures holding these components are attached to angle bars which are fastened across the top and bottom of the cabinet. All rotary stepping switches are fastened on a rectangular steel framework ("gate") at the base of the mounting framework. This gate is pivoted at its bottom so that the entire frame may be tilted forward, exposing the banks of the rotary switches. The various relay groups are assembled on relay strips and fastened vertically in the cabinet across the angle bars. Locations of the various relay groups are indicated in Figure 2.

At the rear of the unit near the base are the fuse panel, ringing transformer, and terminal block (Figure 3). Power connections are made to the fuse panel and all other connections to the terminal block. External leads are brought through porcelain-lined openings on the left side of the cabinet. Frequently a wall-mounting distributing frame (terminal block) is employed with the switchboard. This is located conveniently and connected by cable to the switchboard terminal block. All connections to trunks, stations, etc., are then made at this distributing frame.

**2.2 Power supply**—A 24-volt, 25-ampere-hour battery is recommended. The batteries can be charged from the central office over a cable pair or from a 3-ampere battery charger located at the P-A-B-X. If the commercial power supply is reliable and service interruptions during commercial power failures are not likely to be serious, a 24-volt, 3-ampere battery eliminator can be used. Power equipment is *not* included in the switchboard cabinet.

**2.3 Telephones**—Conventional dial telephones are employed at all stations restricted from transferring calls. For stations having the transfer facility, each telephone is equipped with a push button (Figure 4). Three wires are required to connect each push-button instrument to the switchboard, while two wires are required to connect each regular telephone (see § 3.6).

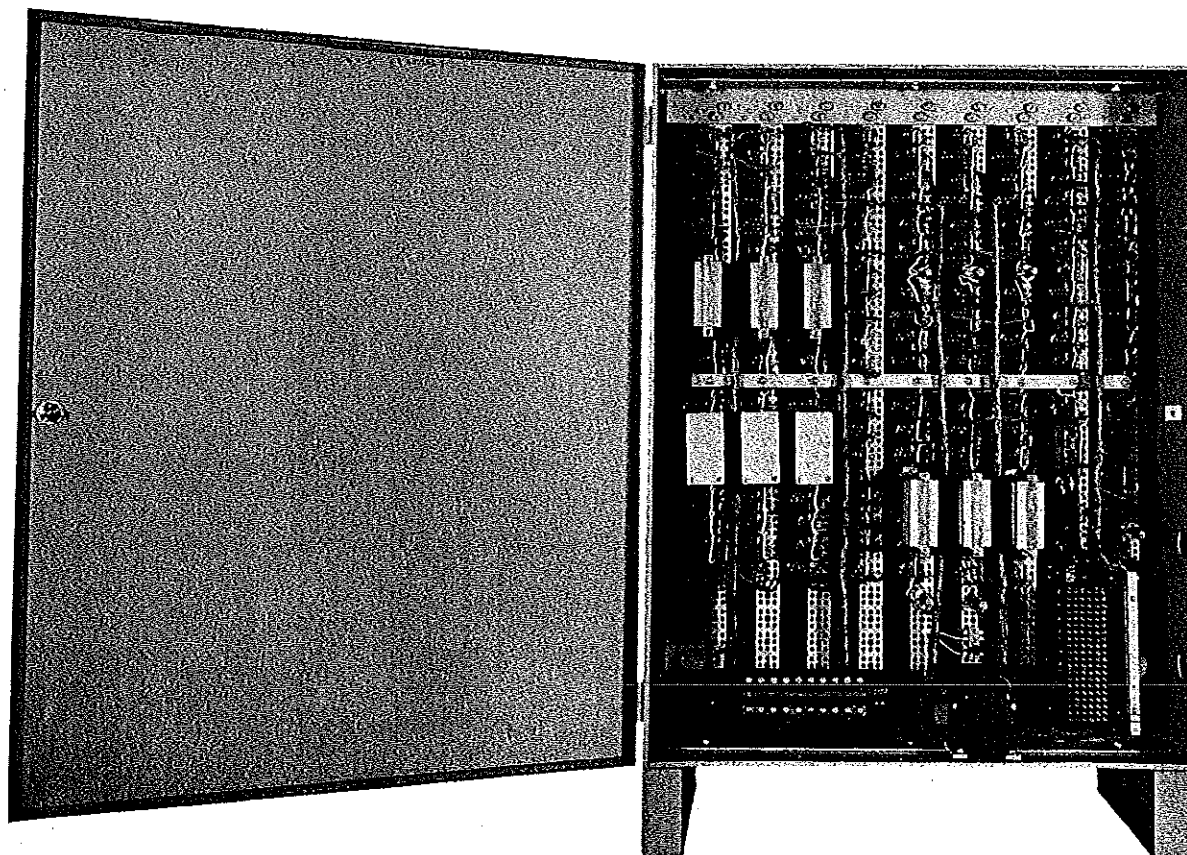


Figure 3. Rear of switchboard.



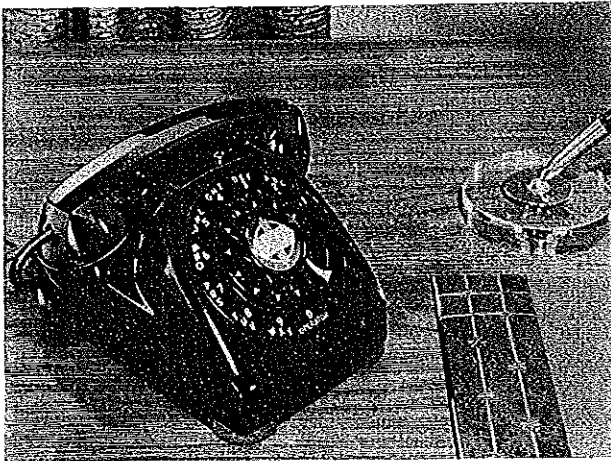


Figure 4. Type 80 Monophone with push button.

**2.4 Trunk signals**—Conventional straight-line ringers may be used for the trunk signals. These are *not* operated directly by the ringing current placed on the trunk at the central office. Instead, the ringing current causes the P-A-B-X switchboard to connect its own ringing generator to the trunk signal. When Automatic Electric Company provides ringers for use as trunk signals, these are generally furnished in the Type 32 ringer box. Trunk signals should be located so as to attract the attention of all parties equipped to answer trunk calls directly. If one ringer is insufficient for this purpose, several may be used and connected in multiple to the switchboard (or distributing frame). A neon dome-type desk lamp (D-94011 assembly H, J, or K for red, white, or green dome respectively) can be used as a visual signal in addition to the ringers and can be connected in multiple with them.

### 3. INSTALLATION

A complete set of blueprints is furnished with each P-A-B-X switchboard. These provide dimensions and wiring and circuit information, and, with the information given below, comprise all required installation data.

**3.1 Placing and mounting the switchboard**—Place the switchboard in a dry, dust-free area, centrally located with respect to all the P-A-B-X telephones. If a distributing frame is used, all trunk, station, and paging-system connections are brought to it, and cable is used to connect the distributing frame to the switchboard (Figure 5).

Allow sufficient area on each side of the P-A-B-X unit so that the front and back doors may be fully opened without interference. If batteries and charger supply the power, put these on a suitable rack.

At the time of installation, be sure to remove the wood clamping strip, spacers, and their mounting screws, located beneath the rotary switch gate. Refer to "Method of Assembly" drawing D-210200 note 53.

**3.2 Installation of distributing frame and of cable (if used)**—A wall-type terminal box (26-pair) is recommended for use as a distributing frame. Place the distributing frame in a central location and install cable between the frame and the switchboard terminal block. The cable should consist of at least 42 conductors. Use threadless steel-tube conduit to bring cable through walls even if lead-covered cable is employed. It is recommended that steel-tube conduit also be employed for carrying the entire run of cable to the switchboard if the cable is not lead sheathed.

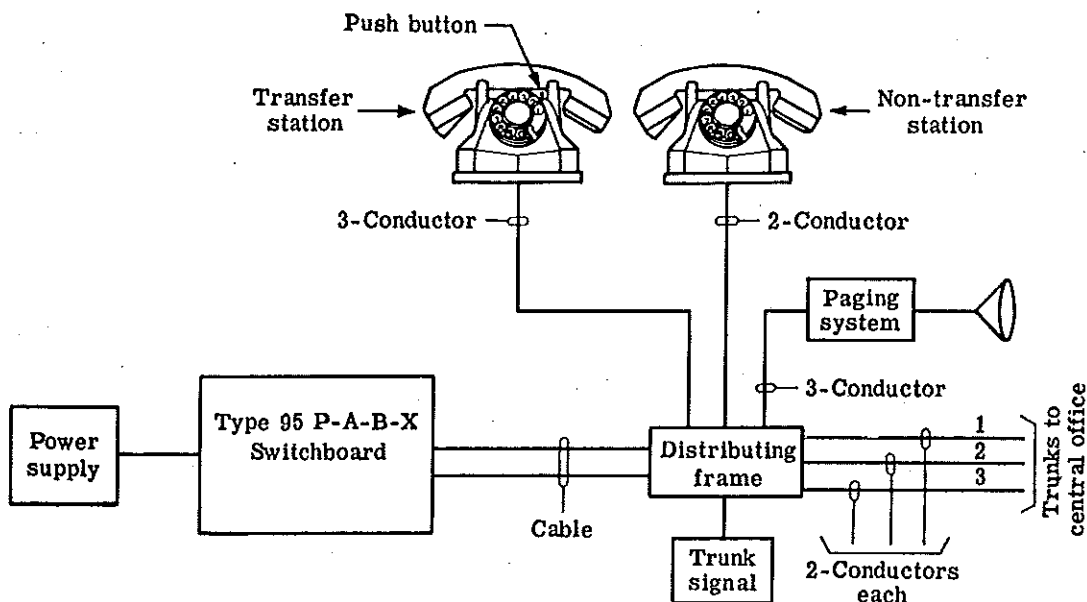


Figure 5. General plan for wiring.  
Distributing frame is optional.



**3.3 Trunk wiring**—A pair of wires is required to connect the switchboard to each central-office trunk. The three trunk pairs are run from the trunk distributing terminal (where the trunks enter the building) to the switchboard terminal block, or to the distributing frame if used (Figure 5).

At the switchboard, central-office trunks are connected to the respective pairs of terminals *T* and *R* adjacent to the trunk number designations (1, 2, 3) on the lower left side of the terminal block (Figure 6). The tip (+) side of the trunk is connected to terminal *T* and the ring (−) side to terminal *R*.

If central-office trunks or local lines require protection, use individual station protectors.

**IMPORTANT:** In the central office, at the line equipment of each trunk from a Type 95 P-A-B-X, disconnect the wire whereby (when the line is idle) ground would be applied to the positive (tip) of the trunk. Type 95 P-A-B-X trunk circuits require normally open + trunk.

**3.4 Switchboard terminal-block strapping** — “Outside” service (discussed in § 1) is permitted or blocked by strappings at the switchboard terminal block.

*Note:* The choice of busy tone, or of tick tone with busy override, when a public-exchange call is to be transferred, is determined by connections soldered at relay M3 of each local link. See note 4 on Automatic Electric Company drawing H-75426 shipped with switchboard. Usually switchboards are wired at the factory for tick tone and busy override. If the customer changes these connections, he should adapt all three local links alike.

The three rows of 12 terminals each (counted from the top of the terminal block) designated *ST*, *TS*, and *TM*, respectively, provide means to control the services permitted each station (Figure 6). Strappings are made in the following manner:

(a) **Answer trunk calls directly**—When a station has this service, its terminal *ST* (start) is connected to common terminal *NRS* (non-restricted start) in the lower left corner of the terminal block. If the station is not permitted this service, its terminal *ST* is strapped to common terminal *RS* (restricted start).

(b) **Originate trunk calls**—To provide this service, strap terminal *TS* (trunk start) to terminal *TSC* (trunk start common) at the bottom of the terminal strip. To restrict a station from this service, strap its terminal *TS* to the common *GRD* terminal also at the bottom of the terminal block.

(c) **Receive trunk calls on a transfer**—All stations normally are arranged for this service. To restrict a station from this service, strap its terminal *TM* (transfer marking) to terminal *TMC* (transfer marking common) at the bottom of the terminal block. Use this strapping when the P-A-B-X station is to be fully restricted; i.e., permitted only inside service.

*Note:* The transferring privilege, as contrasted with the privilege of receiving a trunk call on a transfer, is not arranged for on the terminal block, but is a service common to all stations equipped with push buttons. Stations lacking the push button cannot transfer trunk calls.

**3.5 Power and ground connections**—Connect the battery or battery-eliminator output to the switchboard. Use #12 B.R.C. wire, and connect the positive and negative terminals of the battery or battery eliminator to the respective bus bars on the back of the switchboard fuse panel. Also run a length of #12 B.R.C. wire from a suitable ground (earth) to the ground lug on the switchboard fuse panel (see “Method of Assembly” drawing).

**3.6 Installation of telephone instruments**—Run leads from each instrument terminal block to the switchboard terminal block, or to the distributing frame if used. Use duplex (two-conductor) wire to connect stations without push buttons. Use triplex (three-conductor) telephone wire to connect stations with push buttons. The third conductor provides the ground required at all stations having the transfer privilege. It may be advisable to provide this third conductor also in wiring to stations not having this privilege, in anticipation of possible later conversion of these stations to transfer service.

The telephone (or line) number is determined by the terminals on the switchboard terminal block to which a particular station is connected. Accordingly, the line conductors of the station which is to have telephone

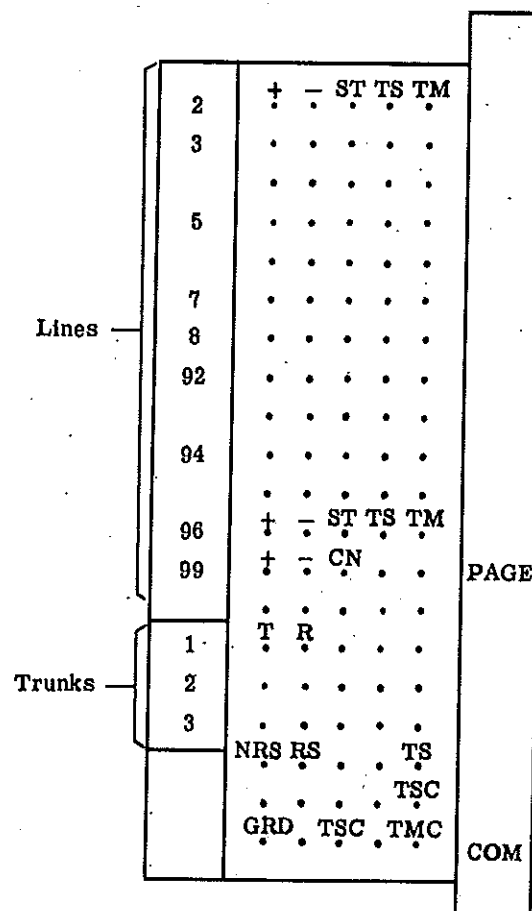


Figure 6. Switchboard terminal block.

number 2, are connected to the top pair of + and — terminals on the left side of the switchboard terminal block (Figure 6). The third conductor from each station (if used) is connected to a common terminal designated *GRD*. To avoid clicks at push-button telephones, make sure the + conductor of the telephone is connected to the + switchboard terminal.

The three terminals (+, —, and CN) adjacent to 99 on the terminal block provide the connections for a paging system when used.

**3.7 Trunk-signal installation**—Mount the trunk signal or signals (ringers or lamps) at any convenient location near the non-restricted and semi-restricted telephones. Two leads are required to connect the ringer or lamp to the switchboard or distributing frame. If more than one ringer or lamp is used, connect them in multiple.

**3.8 Installation of paging system (if used)**—Locate the paging-system amplifier where convenient, and mount the speaker or speakers so that they will be audible at all P-A-B-X stations. Three leads are required to connect the amplifier to the switchboard or distributing frame. Triplex telephone wire is suitable for this purpose.

#### 4. PERFORMANCE TESTS

Before the P-A-B-X is put into service, performance tests listed below are made by the installer. Tests 4.1 through 4.3 are done at the switchboard terminal block (Figure 6) with three telephones (hereinafter referred to as telephones A, B, and C). It is suggested that tests 4.1 through 4.3 be made *before* any telephone instruments are installed in their permanent locations. This prevents interference by non-test personnel. After tests 4.1 through 4.3, the telephones are installed and test 4.4 made from them. Splitting the performance tests in this way saves time, especially when the telephones are installed at widely separated locations.

**4.1 Local calls**—Clip telephone A to line 96 terminals + and —; clip telephone B to line 2 terminals + and —. From A call B, checking dial, ring-back, and busy tones. Repeat with B at lines 3, 4, 5, 6, 7, 8, 92, 93, 94, and 95.

**4.2 Originating, receiving, and transferring outside calls**—Clip telephone A to line position that has *TS-TSC* strap (to permit originating outside call.) Clip telephone B to line position that has *ST-NRS* strap (to permit receiving outside call) and clip telephone B grounding wire to terminal *GRD*. Clip telephone C to any third line position that does *not* have *TM-TMC* strap and can therefore receive a transferred call. If the central office is automatic, dial "0," wait for dial tone from central office, dial P-A-B-X number, and check ring-back tone. Answer B, checking transmission. Transfer call to C by pressing push button momentarily at B, waiting for dial tone, and then dialing C. Answer at C. Disconnect at B. Check transmission between A and C. Repeat but do not disconnect at B after answering at C. Instead, press push button at B a second time after disconnecting at C. Note transmission between A and B since C was called here, for information only, after which B was connected back to outside call. Repeat with C off the hook. Note

tick tone at C when call is transferred. If tick tone cannot be heard over dial tone, dial "9" at C to remove dial tone. If central office is manual, dial "0" to reach operator, and have her extend call back to P-A-B-X.

**4.3 Call capacity**—To check that all links and trunks are functioning, make the following tests:

- (a) Operate busy keys on local links 1, 2, and 3 and on trunks 1 and 2. Clip telephone A to any line having *TS-TSC* strap. From A dial "0", noting dial tone before and after dialing if central office is automatic. Note that operator answers if central office is manual.
- (b) Repeat (a) above twice, first with trunks 1 and 3 busied, and second with trunks 2 and 3 busied.
- (c) Release busy key on local link 1. Clip B to any line. Call A from B. Disconnect.
- (d) Repeat (c) twice, first with links 1 and 3 busied, and second with links 2 and 3 busied.

**4.4 Installed telephones**—After the switchboard, trunk signals and all telephones are installed, make the following tests:

##### (a) Non-restricted telephones

- (1) Check dial tone; dial own number, checking busy tone. Hang up.
- (2) Dial "0", noting dial tone from automatic office or transmission if manual operator answers. If central office is automatic, dial number of this P-A-B-X and have call answered at non-restricted or semi-restricted telephone when trunk signal is observed there. Press push button momentarily at calling telephone. Note dial tone. Dial answered telephone, noting tick tone, if provided, or busy tone. Hang up at both telephones.

##### (b) Semi-restricted telephones

- (1) Perform step (a) (1) above.
- (2) Dial "0", noting busy tone. Hang up.
- (3) Answer a central-office call, noting transmission. Press push button momentarily. Dial own number, listen for tick tone (if it is used; otherwise busy tone).

##### (c) Restricted telephones

- (1) Perform steps (b) (1) and (b) (2), above.
- (2) Dial number of non-restricted or semi-restricted station manned by another installer. Note transmission.
- (3) If restricted telephone cannot receive transferred calls, have installer at non-restricted or semi-restricted telephone attempt a transfer. He should hear busy tone.

## 5. INSTRUCTIONS FOR MAKING AND RECEIVING CALLS

*Note:* A supply of Automatic Electric Company form FM-2121 Telephone Directory card-forms accompanies each Type 95 switchboard shipment. On the back of each card are instructions for use of the P-A-B-X system. Customers will be sent reasonable additional quantities of these cards gratis at any time upon request.

The instructions presented below may be given to the P-A-B-X parties verbatim or in modified form according to the customer's individual requirements. Further, it is advisable to inform each P-A-B-X party of the services for which his telephone is arranged.

### INSTRUCTIONS FOR USING YOUR TELEPHONE

*If your telephone is equipped with a push button, you may transfer outside calls to other parties in this office who are privileged to receive such calls.*

**To call another party in your office,** lift your handset, listen for dial tone (continuous humming), and then dial the number of the desired party. When you have finished dialing, you will hear ringing tone (intermittent "burring" sound) indicating that the bell of the called telephone is ringing—or you may hear busy tone (rapidly interrupted buzzing) indicating that the line you are calling is busy. In this case hang up, and attempt the call a few minutes later. Replace the handset when you finish conversing.

*Note:* Use the following paragraph in the instructions only if the switchboard is arranged to override the busy on a transfer.

**Tick Tone**—While you are connected to another party, you may hear continuous "ticking." This means that a third party has connected to your line and can hear your conversation. This party is holding an outside call and is waiting to transfer this call to you or to obtain information from you (see "To transfer an outside call. . ."). Conclude your conversation quickly so you can answer the waiting party.

**To make an outside (trunk) call,** lift your handset, listen for dial tone, and dial "0." Very shortly thereafter you will hear dial tone from the public exchange. Then proceed to dial the number of the public-exchange party you are calling. If you do not hear public-exchange dial tone after dialing "0", all trunks to the public exchange are busy. Replace your handset and try again later. If you hear busy tone after dialing "0", you are using a telephone from which outside calls cannot be made.

*Note:* If the P-A-B-X is trunk-connected to a manual office, the instructions should be as follows:

**To make an outside (trunk) call,** lift your handset, listen for dial tone, and dial "0." Very shortly thereafter, the public-exchange operator will answer.

**When the outside-call signal rings (or lights),** an outside party is calling. To answer this call, simply lift your handset. If you hear dial tone after lifting your

handset, the call has been answered by someone else or you are using a telephone from which outside calls cannot be answered.

**To transfer an outside call to another party,** tell the outside party to wait, and press the button on your telephone. When you hear dial tone, dial the number of the desired party, and when this party answers, tell him that an outside call is waiting; then hang up. The party you have dialed will then be connected automatically to the outside party. You may transfer an outside call to another station in this way, even if you have originated the call to the outside party or even if you have received the call on a transfer. Be sure that you have transferred the call to a party privileged to receive such calls. If the call was initiated to your office by the outside party and you have mistakenly hung up in attempting to transfer the call to a restricted party, simply pick up your handset again and you will be connected again to the waiting outside party. If you originated the call to the outside party, the connection will be lost.

If you receive busy tone after dialing or fail to get dial tone before dialing the other local party, you may reconnect to the outside party simply by pressing your push button again.

*Note:* If the switchboard is arranged to override the busy on a transfer, instead of the preceding paragraph use the paragraph below:

If you hear tick tone (see "Tick Tone" preceding) when you dial the other party's number, it is an indication that you have been connected to a busy line. Wait for a suitable break in the conversation and inform the desired party that a trunk call is waiting. Assuming the called party wishes to accept the outside call, both parties to the local call then *must hang up*. When both conversing parties hang up you will hear ring-back tone indicating that the desired party's line is being rung again. When this party answers, hang up and the call will be transferred automatically to him.

**To hold an outside call while calling another party for information,** proceed as you would to transfer a trunk call. Tell the outside party to wait, press the button on your telephone, and when you hear the dial tone, dial the number of the local party from whom you wish to obtain information. Do not hang up after conversing with this party, but press the push button again. You will then be reconnected to the outside party.

**To page another party**—If a local party is not at his desk when you call, you may page this party in the following manner: Dial "99." If you do not hear busy tone indicating that another party has been connected to the paging system, page the desired party several times simply by speaking into your handset in the regular way. Hang up after this, and await this party's call.

**If you hear someone paging you,** and you are asked to call him, go to the nearest telephone and dial the number of the paging party.

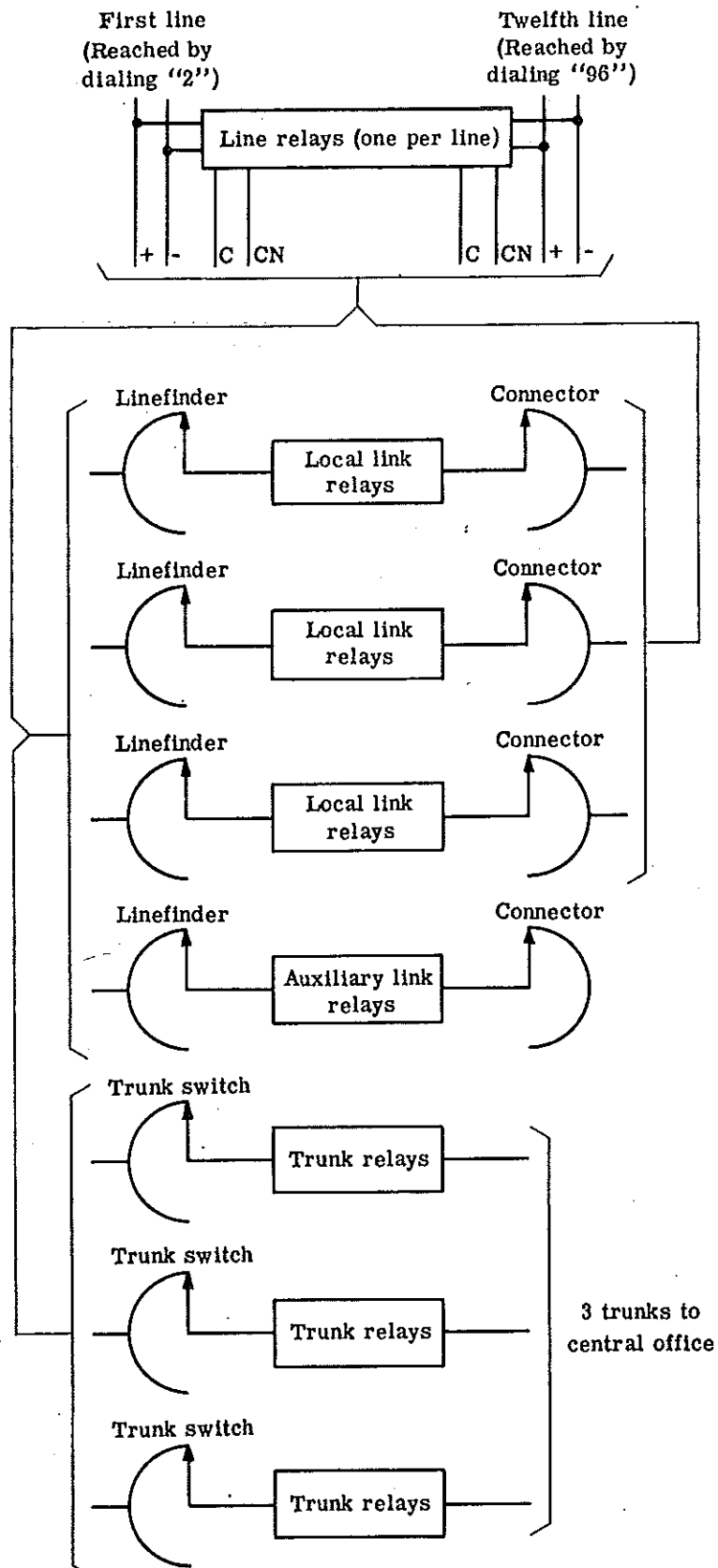


Figure 7. Block diagram of equipment functions.

## 6. PRINCIPLES OF OPERATION

The relationship of basic operating elements in the Type 95 P-A-B-X is shown in Figure 7, a functional block diagram.

(a) A total of six simultaneous conversations is possible—three local connections and three trunk connections. Local connections are established by means of the local (finder-connector) links; connections to trunks on outgoing calls are made through the trunk circuits which are seized initially by means of the local links. A local link is released from the calling line and is again available for use when a trunk circuit has "found" and connected to the calling line. On local calls between P-A-B-X parties, the links are held for the duration of the conversation.

(b) If all three regular local links are busy, the next station to originate a call will seize the auxiliary link. If the caller dials "0", the auxiliary link will transfer the call to a trunk. (The auxiliary link cannot, however, be used to call another local station.)

(c) As each link or trunk circuit becomes busy on a call, the succeeding link or trunk circuit is allocated for use and will be called into service on the succeeding call. Calls are allocated or distributed to the units by a chain arrangement of the starting circuits of the respective units. There is a chain circuit in the links for allocating the links, and another in the trunk circuits for allocating the trunk circuits.

The chain arrangement in the local links is such that a succeeding link is employed on a succeeding call even if the link preceding has released from a call before the succeeding call is made. A preceding link cannot be used again until the last link is used. In this way, calls, and consequently wear, are distributed among the links, making for longer life of the equipment. The auxiliary link is *not* called into use *unless all three regular links are busy simultaneously*.

## 7. MAINTENANCE

The Type 95 P-A-B-X is ruggedly constructed, designed for long use, and requires little attention. If batteries instead of a battery eliminator supply the power, they will require regular attention. Rotary stepping switches and other switchboard components should be inspected periodically and cleaned and lubricated if necessary in accordance with information supplied by Automatic Electric Company.

It is also recommended that telephone instruments be inspected yearly, and worn or damaged parts such as cords and mouthpieces, etc., replaced. At the time of such inspection, each dial should be checked for speed, and adjustments made as required.

A periodic performance check is recommended also and this can be made in a manner similar to that described in §4, "Performance Tests." Adjustment data for the various switching components is provided on adjustment sheets provided with the switchboard.









*Originators and Developers of the Strowger Step-by-Step "Director" for Register-Translator-Sender Operation . . . Machine-Switching Automatic Dial Systems*  
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