PART VI—PRIVATE BRANCH EXCHANGE SERVICES

PRIVATE BRANCH EXCHANGE SERVICES—GENERAL

GENERAL

A private branch exchange (PBX) system consists of (1) a switchboard or other switching equipment on the customer's premises, (2) trunk lines connected to a central office, and (3) a number of telephones called PBX stations connected to the switchboard.

Connections between PBX stations and to the central office are made either manually through the switchboard or mechanically through its associated equipment, the methods employed depending on the type of PBX system used.

With PBX service, the answering and distributing of incoming calls is centralized. In addition outgoing calls and intercommunicating calls between stations can be supervised and controlled to whatever extent the customer desires.

The type and capacity of PBX system furnished depends on the customer's present and future requirements for telephone service. The customer's requirements are determined through analysis of the volume and nature of present and estimated future traffic or, in the case of a new customer, information on other firms of similar size and type is used as a basis for determining requirements.

The smaller PBX switchboards are ordinarily stocked and can be installed within a short time. The larger systems, however, must be specially engineered to meet the particular requirements, and the equipment needed must be ordered and shipped from the factory.

The smaller and simpler PBX systems are furnished on the basis of a minimum service period of one month. For the larger or more complex systems the contract term is a year or more.

Although complete information on the features and operation of specific types of PBX systems is given in the sections following, certain features and arrangements common to practically all types of PBX systems are described in this section.

TYPES OF PBX SYSTEMS

PBX systems are divided into two main types: Manual and dial systems.

MANUAL PBX SYSTEMS — With a manual PBX system, the switchboard attendant connects all calls, including (1) incoming calls to PBX stations, (2) outgoing calls from PBX stations to the central office and (3) calls between PBX stations (intercommunicating calls).

DIAL PBX SYSTEMS—With a dial PBX system, an attendant distributes the incoming calls to the PBX stations. Calls originating at PBX stations to the central office or to other PBX stations are normally completed mechanically by operation of the dials at the originating stations.

EQUIPMENT

SWITCHBOARDS—A switchboard is a cabinet equipped with keys, jacks, cords and associated lamp or other signals employed in establishing and breaking connections.

FINISHES—The two standard finishes for switchboards are oak and mahogany-walnut. The latter finish is designed to harmonize with either mahogany or walnut finishes. Mahogany or dark walnut finishes, formerly used, are no longer available except on older switchboards.

Special finishes may be provided at additional charges based upon cost when standard finishes do not meet customer requirements.

ATTENDANTS' TELEPHONE SETS—Attendants' sets are telephone instruments provided for the use of PBX attendants in operating switchboards. One set is provided without charge for each cordless PBX and each cord PBX position. Several types of sets are available and the selection depends upon the type of switchboard and the particular operating requirements at each switchboard.

With cordless switchboards, handsets are ordinarily used. Headsets may be provided by special arrangements.

Headsets are usually provided on cord switchboards to give the attendant free use of both hands. A handset equipped with cord and plug may be furnished as an auxiliary set for use during off-peak periods or as a regular set where the traffic is light and intermittent.

All cord switchboards are equipped with jacks for the use of headsets; cordless switchboards are not. (See exhibits for illustrations of different types of attendants' sets.)

ATTENDANTS' CHAIRS—The customer furnishes office chairs of standard height for use with single position switchboards. However, chairs of extra height are required, which are furnished and maintained by the telephone company without charge, for each position of:

1. Two-position non-multiple switchboards of the 551 type which are mounted on a 6-inch platform furnished by the telephone company to accommodate the longer cords required to extend the attendant's reach. (Chairs of extra height are not required when the customer furnishes at his own expense a platform

large enough to accommodate both chairs and switchboard.)

(No platform is required for two-position 555 type boards because the longer cords are accommodated by provision of an auxiliary pulley attached to the cord unit.)

2. Multiple cord switchboards of the 551, 552, 605, 606 types which have a high key shelf.

DIAL EQUIPMENT—Dial equipment is the apparatus associated with dial PBX systems for mechanical connection and disconnection of calls originating from PBX stations. The equipment is located separately from the switchboard, a special room ordinarily being required for the larger systems.

POWER EQUIPMENT AND SUPPLY—In the operation of a PBX system direct current is required for energizing transmitters and for operating relays and lamp signals. Alternating current (20 cycle) is required for ringing PBX station bells and sometimes for operating tie line signals.

The telephone company provides all electric power required for operation of (1) manual PBX systems and (2) key station dial PBX systems. The customer provides all electric power required for operation of attended and unattended dial PBX systems.

For operation of manual PBX systems and key station dial PBX systems, the direct current is supplied from the central office over cable pairs or from local batteries located on the customer's premises. The alternating current for ringing purposes is also supplied from the central office over cable pairs or by means of generator equipment located on the customer's premises. Whenever charging or ringing generator equipment is employed, the customer is compensated for the commercial power required to operate such equipment.

For operation of dial PBX systems (other than key station dial PBX systems), all power is supplied by a power plant consisting of a ringing generator, storage batteries, and a charging generator located on the customer's premises. The customer furnishes the commercial power required to operate the power plant.

BATTERY CABINETS—A separate cabinet may be required for housing storage batteries associated with cord switchboards installed in remote locations. When attached to the switchboard, the battery cabinet is provided in a matching finish.

TELAUTOGRAPH PANELS—A special panel may be located between two regular positions of multiple PBX switchboards for the purpose of mounting telautograph equipment. This equipment is sometimes used in hotels for transmitting written mesages by wire. (See section following which describes multiple manual cord switchboards.)

OPERATION AND SUPERVISION

OPERATION—On manual PBX systems all connections (1) between PBX stations and (2) between the stations and the central office or other PBX's are established and released by the switchboard attendant. On dial PBX systems only incoming calls from the central office are handled by the attendant. The calls originated at PBX stations to the central office or to other stations or to other PBX's are (with some exceptions) made mechanically without the assistance of the attendant. The attendant at a cordless manual board establishes and breaks the connections by operation of keys; at a cord type, by inserting a cord pair into the proper station, trunk, or the line jack to establish a connection, and by removal of the cord pair to break the connection.

Each station, trunk and tie line terminated on a manual switchboard has an associated line signal which indicates an incoming call to the PBX. On cordless manual boards, the trunk line signal is a drop signal restored manually by the attendant; the station line signal is a shutter type restored automatically. On manual cord boards, both the station and trunk line signals are lamp signals.

All station and trunk visual line signals are supplemented by a buzzer signal.

In addition to the line signals, supervisory signals are employed to indicate to the attendant (1) when calls have been answered by PBX stations and (2) when PBX stations have hung up. The exact manner in which the supervisory signals operate is described in the sections following for each type of PBX system. However, the main principles involved in the operation of supervisory signals, including the effect of the signals on the connections in the central office, are outlined in the paragraphs below headed "Supervision."

SUPERVISION—CENTRAL OFFICE CONNECTIONS—The supervisory signals described above are arranged to provide through or non-through supervision or a combination thereof for connections between PBX stations and the central office.

The different types of supervision on central office calls are described below:

1. Through supervision places the central office equipment under the direct control of the PBX station user. When the station user hangs up, a disconnect signal appears at the central office as well as at the PBX board. In a manual central office, the operator receives the disconnect signal regardless of whether the attendant breaks the connection at the PBX. In a dial central office, the disconnect signal from the PBX station releases the central office connection if the call was originated at the PBX.

PRIVATE BRANCH EXCHANGE SERVICES—GENERAL

2. Non-through supervision places the central office connection under the control of the PBX attendant. The disconnect signal is not received in the central office until the attendant breaks the connection at the PBX board.

THROUGH vs NON-THROUGH SUPERVISION — The kind of supervision furnished for central office connections depends on (1) size and type of PBX and (2) type of central office (manual or dial), as indicated below. The advantages, limitations and uses of through supervision are:

1. Advantages—Assures prompt disconnection of call at central office even if attendant delays the breaking of connection at PBX. Conserves facilities. Eliminates possibility of overtiming long distance calls due to attendant's failure to take down the PBX connections promptly.

2. Limitations—PBX station user's attempt to recall PBX attendant (to transfer call or for other reasons) may result in a cut-off at central office. Outgoing call in a dial central office area will be cut off. An incoming or outgoing call in a manual central office area may be cut off.

3. Uses—Through supervision is normally provided on manual cordless and small cord non-multiple boards because PBX attendants at such boards often perform receptionist or clerical duties which may at times divert their attention from the switchboard. Newer non-multiple cord boards may be equipped for (1) through supervision on outgoing calls not often subject to transfer and (2) non-through supervision on incoming calls which are more subject to transfer.

The advantages, limitations and uses of non-through supervision are:

1. Advantages—PBX station user may recall attendant to transfer call or for other reasons without risk of cut-off.

2. Limitations—No assurance of prompt disconnection of call at central office if attendant delays breaking of connection at PBX. Facilities may be tied up unnecessarily. Possibility of over-timing long distance calls.

3. Uses—Non-through supervision is normally provided on large manual PBX's (except hotel PBX's) and attended dial PBX's because (1) there are more occasions to transfer incoming calls in the case of the larger PBX's and (2) PBX attendants usually devote full time to operation of PBX and handle little or no receptionist or clerical work which would divert their attention from PBX.

   a. Non-through supervision is also required when a recorder connector is associated with any type of PBX so that PBX stations can flash attendant without risk of cut-off when they want a voice recorder connected.

   b. Non-through supervision may also be required when a PBX is equipped with manual conference equipment so that PBX stations can flash attendant to request conference connections.

A switchboard can be converted from one type of supervision to another by a simple wiring change made on the customer's premises.

SUPERVISION—TIE LINE CONNECTIONS—The type of supervision on calls between PBX's over tie lines is similar to that provided for connections between PBX stations and the central office (see Part X).

SUPERVISION—CALLS BETWEEN PBX STATIONS —Double supervision is provided on calls completed manually between two PBX stations, that is, the attendant receives a disconnect signal from both the originating and the called station when they hang up.

TRAINING PBX ATTENDANTS—The operation of a PBX system at the customer's premises is the responsibility of the customer, but the telephone company encourages the customer to maintain certain standards which experience indicates helps insure maximum efficiency and benefits from the service of the particular customer and telephone service in general. In order that this high standard of service be maintained, initial and continuation training activities among all PBX customers are carried out by the telephone company's Traffic department representatives without charge to the customer.

PBX STATIONS

STATIONS AND STATION LINES — The telephones which are connected to the PBX are called PBX stations, and the lines connecting the stations to the PBX are termed PBX station lines.

Telephones on the same station line in addition to the PBX station are known as PBX extensions. The number of telephones permitted on a PBX station line is governed by the amount of usage and by the limitation of four bells per line.

By means of key equipment one telephone instrument may be connected to any one of several PBX station lines. Usually the same lines also are connected to other telephones associated with key equipment.

Handsets, headsets, outdoor sets, and other types of telephone instruments may be used on PBX station lines.

Special features or arrangements of PBX stations may be provided with some types of PBX systems, such as the restriction of usage by some stations to intercommunicating calls only, and the provisions of party line PBX stations under certain conditions.

Most of the stations of a PBX system are located on the customer's premises, but a few may be located on other premises involving the same or a different customer. Such stations are called off-premises PBX stations, as indicated below.

OFF-PREMISES STATIONS—Because PBX stations located on other premises of the same or different customer are usually a considerable distance from the PBX, line relays at the PBX or long line equipment, or both, may be required to extend the transmission and signaling range of the PBX. The long line equipment may be located at the PBX or central office, or both. (See Part X).

PBX TRUNKS

PBX trunks are the telephone lines between the central office and the PBX system. Ordinarily the trunks are numbered in sequence (2501, 2502, 2503, etc.), the arrangement being called consecutive service (auxiliary or rotary service). The number of the first trunk is listed in the telephone directory. An incoming call will be completed to the next idle trunk if the first is in use. The searching for and selection of idle trunks is done by the operator in manual central offices and by the switching equipment in dial central offices. On outgoing calls the selection of trunks is in the reverse order. A consecutive trunk group operates more efficiently than a non-consecutive group and has a much larger call carrying capacity.

TRUNK ARRANGEMENTS

With manual PBX systems, the central office trunks are arranged in numerical sequence (consecutive service) for incoming calls and are used by the attendant in the reverse order for outgoing calls.

In the smaller attended dial PBX systems, all trunks are usually "combination" terminated on both the switchboard and on the automatic switching equipment to handle both incoming and outgoing traffic, including calls dialed direct by PBX stations. Larger dial systems may have, in addition to "combination" trunks, (1) certain trunks terminated on the switchboard only for incoming calls and outgoing calls handled by the attendant and (2) other trunks terminated on the automatic switching equipment only, for handling outgoing calls dialed direct by PBX stations without the assistance of the switchboard attendant.

More complete information on dial PBX trunk arrangements will be found in the sections following which describe the various types of dial systems.

GRADED TRUNK ARRANGEMENTS

The switching equipment in a dial central office automatically searches for and selects an idle trunk in a PBX trunk group in order to complete an incoming call to the PBX. The following types of dial central office equipment will search through 100 trunk terminals for an idle trunk:

1. Cross-bar
2. Panel
3. Step-by-step (only if equipment called level hunting connectors is used).

When rotary hunting connectors (instead of level hunting connectors) are used in step-by-step dial central offices, the switching equipment will search through only 10 trunk terminals for an idle trunk. In other words, an incoming call has a choice of only 10 trunks, regardless of the size of the PBX trunk group. Consequently, when there are more than 10 trunks in the PBX trunk group, an arrangement is made in the central office to offset this limitation and to assure that each trunk in the entire group handles a proportionate share of the traffic. The arrangement is called grading of trunks.

A PBX trunk group may be graded at the central office by dividing the trunks into sub-groups and routing a proportionate share of the incoming traffic to each subgroup. (See exhibits.)

When a trunk group exceeding 20 trunks is to be connected to a step-by-step dial central office, consideration should be given to providing service with level hunting connector equipment (instead of rotary hunting connectors) if such equipment is available in the central office.

The graded trunk arrangement for incoming service to a PBX from a step-by-step dial central office is similar to the arrangement provided for outgoing service in dial PBX's where more than 10 trunks are provided for outgoing calls dialed direct by PBX station users.

TIE LINES

A tie line interconnects PBX systems for the primary purpose of communication between stations of the two systems. There are several different types of tie lines available, for both local and interchange services; the main difference is in the method of operation and signaling. The various types of PBX tie lines are described and illustrated in Part X.

PRIVATE BRANCH EXCHANGE SERVICES—GENERAL

NIGHT SERVICE

When a PBX is unattended at night or on holidays, incoming and outgoing service may be furnished directly to certain PBX stations if desired. The kind of arrangement used to provide night service depends upon the customer's requirement and the type of PBX service provided. The various arrangements are described below:

SIMPLE TRUNK-TO-STATION CONNECTIONS — At the close of the business day, one PBX station is connected to each trunk to be used. With manual cordless switchboards, the connections are made by operating a trunk key and a station key to the same talking path. With non-multiple manual cord switchboards, a trunk jack is connected to a station jack by means of a cord pair. Special night trunk jacks are required for equipment reasons with some multiple manual cord switchboards and with the cord switchboard associated with dial PBX's. Under certain conditions a night connection involving more than two PBX station bells may not operate satisfactorily.

Incoming calls are directed to the listed number in the same manner as during the day: A call which reaches the first trunk will ring the station to which the trunk is connected. If the first trunk is busy, a call which reaches the next idle trunk can be answered only at the station to which the trunk is connected. If a call reaches a trunk to which no station has been connected, it will not ring any PBX station.

NIGHT NUMBER LISTINGS—Where it is desired to route incoming calls to certain departments, the arrangement described above will not meet the requirements. It is necessary to list one or more departments in the telephone directory with a separate telephone night number for each department. One of the trunks in the trunk group is utilized for each department listed. To prevent the central office operator or dial equipment from employing the consecutive service feature of searching for and selecting the next idle trunk in the trunk group, two different arrangements are possible:

1. If the customer has some non-consecutive trunks (but not out dial trunks) used during regular business hours for outgoing service, one or more of these may be listed. When called, these numbers will test busy if the trunk is in use; the call will not be passed on to an idle trunk. Additional charges apply for the night listings.

2. If the customer does not have any non-consecutive trunks, one or more of his consecutive trunks may be bridged to other manual jacks or dial terminals in the central office. The night jacks or terminals are given telephone numbers different from the consecutive group numbers. The trunks will test busy if in use; the call will not be completed to an idle trunk. Additional charges apply for the night jacks or terminals and for the night listings involved.

For examples of night number listings see Part II.

PATCH CORDS—Where the customer desires more than one station to be able to answer calls over one PBX trunk, a detached cord called a patch cord is provided for use with cord PBX's. On one end is a plug which is inserted into a trunk jack and on the other end are two or three plugs which are inserted into as many station jacks. Under certain conditions a patch cord arrangement involving more than two PBX station bells may not operate satisfactorily.

DIAL PBX NIGHT SWITCHING ARRANGEMENT—An arrangement may be made whereby a night watchman or other designated person at a dial PBX station can answer and transfer incoming calls to other dial stations. The arrangement may be provided with dial PBX systems which have an associated manual cord switchboard. (See section following on attended dial PBX systems for complete description.)

OPTIONAL AUXILIARY SERVICES

CONFERENCE EQUIPMENT—An arrangement at the PBX switchboard enabling several people to participate in a telephone conference, consists of a special group of jacks at cord manual switchboards or a dial-operated circuit in dial switching systems. Such equipment is not provided on cordless switchboards. Two types of conference service are available: Manual and dial.

Manual PBX conference equipment is provided in two capacities:

1. Four-jack equipment—Provides for interconnecting four PBX stations, or three PBX stations and one central office trunk or tie line.

2. Five-jack equipment — Provides for interconnecting five PBX stations, or three PBX stations and two central office trunks or tie lines (or one trunk and one tie line).

With manual switchboards a conference can be arranged by notifying the PBX attendant who calls the other people involved and then sets up the conference connections in the conference jacks. If a central office trunk or a tie line is involved in the conference, the attendant uses the first jack in the four-jack strip, and the first and second jacks in the five-jack strip for interconnecting the trunk or tie lines.

The PBX should have a sufficient number of cord pairs to provide the conference service without interference with other calls.

The quality of transmission on manual PBX conference calls is usually satisfactory where all points connected are in the same central office area. Fully satisfactory transmission cannot be assured when (1) toll connections or (2) two off-premises stations are involved if either station is located in another central office area.

Dial PBX conference equipment is provided in five and ten station capacities. The services of the PBX attendant are not required in that all connections are made through the dial switches and the service is limited to PBX stations and repeating tie lines. The person wishing to call a conference notifies the other conferees in advance so that they can all dial the conference code number at a specified time. Conference service is available on a 24-hour basis since the assistance of the PBX attendant is not required in setting up the the conference connection.

RECORDER CONNECTOR—This equipment is required when it is desired to associate customer-owned voice recording equipment with a telephone company PBX system. Recorder connectors may be associated with any type of PBX except manual cordless switchboards. The recorder connector produces a tone at 15-second intervals to notify all parties to the telephone conversation that a recording is being made. The recorder connector is described and illustrated in Part III.

PAGING AND CODE CALLING SYSTEMS — These systems may be associated with a PBX for summoning people to the telephone. Loud speakers may be used for voice paging or bells or other audible signals for signaling by code.

The loud speaker paging system may or may not be connected to the PBX switchboard. Where connected to the PBX, the loud speaker system may be used by either the attendant or by PBX station users.

Manual code call systems are not connected to the switchboard system and can be used only by a person at the push button code sending set. Dial code call systems are connected to the dial equipment of a dial PBX and may be used by the PBX attendant or by station users.

Loud speaker paging and code calling systems are covered in Part III.

AUDIBLE RECALL SIGNAL—Consists of a low tone in the attendant's headset receiver which sounds each time the cord lamp signal is lighted or retired by the operation of the switchhook by the station user. The signal is a special feature which may be provided with cord switchboards on a special assembly basis to enable the attendant, without removing her headset, to turn away from the switchboard from time to time during light load hours to perform other work without unduly delaying the answers to recalls. It might also be employed in any case where PBX service is not satisfactory because station users frequently encounter delays in recalling the attendant on any established call. Use of the signal is not recommended where the proportion of outgoing calls dialed by PBX stations is large, since each dial pulse causes the tone to be heard in the attendant's receiver, which would be annoying and on multiple boards would cause confusion with the busy test.

GENERAL AGREEMENTS

Under the terms of formal agreements between the telephone company and certain special classifications of customers, customer-owned telephone communication facilities may be connected to telephone company facilities where such connections are required by military necessity or public safety or where the customer's facilities are now, or were when originally constructed, in hazardous, remote, or inaccessible locations. The General and Special Contracts Manual describes and explains the agreements which have been executed with such customers as railroad, oil, pipe line, gas, power and light companies and with the United States Army, Navy and Coast Guard. One of the main purposes of formal written agreements between the telephone company and certain customers is to avoid the duplication of facilities which might be necessary if interconnection were not permitted.

FIELD LINES

A field line is a customer-owned telephone line or channel which is terminated in a telephone company-owned PBX switchboard. Field line terminations on company PBX's are permitted only when the customer is a party to a general agreement (described above).

ENTRANCE FACILITIES—Line or channel facilities, usually within base rate areas, required to connect customer-owned field lines to telephone company-owned PBX's are called entrance facilities.

FIELD LINE TERMINAL EQUIPMENT — Telephone company PBX switchboards are ordinarily arranged for common battery operation and require field line terminal equipment to connect to field lines which are usually magneto type lines. Field line terminal equipment is not required when magento lines are connected to magneto type switchboards or common battery lines to common battery switchboards.

Subject to tariff regulations and the terms of the particular agreement in effect, connections may be made between field lines and any other line terminated on a cord switchboard including connections to local PBX stations, trunks and tie lines (sometimes called terminating connections) and connections to other field lines and interexchange PBX stations and tie lines (sometimes called through connections).

PRIVATE BRANCH EXCHANGE SERVICES—GENERAL

Two types of field line terminal equipment are available; one-jack and two-jack.

1. The one-jack arrangement will meet the requirements for the so-called terminating connections. This arrangement is also satisfactory for connections to other field lines and interexchange PBX station and tie lines, except for relatively long lines where the amplification requirements are such that a form of transmission control, termed "pad control," described in "2" below is desired. When the field line, which is terminated in a one-jack arrangement, has telephone repeater equipment or is of the carrier type, an additional feature called idle circuit termination or repeater termination may be required to reduce the possibility of howling or singing of the repeater or carrier which may be heard on other channels when the field line is not in use. The insertion of a plug in the field line jack removes the idle termination feature to prevent its causing transmission loss during conversations.

2. When there is a requirement to connect a field line to another field line (or to an interexchange PBX station or tie line) and the over-all length and make-up of the circuits require considerable amplification for transmission reasons, pad control equipment is usually required at the PBX. This feature provides a grade of transmission on connections to local PBX stations similar to that obtained on connections to other field lines. This feature also tends to reduce howling on the circuit which is caused by the maximum gain of the repeater or carrier system. In order to provide this control feature it is necessary to use the two-jack terminal arrangement. The pad control is associated with one jack which is used for connections to local PBX stations, trunks and tie lines. Where connections are to be established to other field lines (or interexchange PBX stations and tie lines) the second jack is used, which by-passes the pad control equipment. The future requirements of the customer should be considered when deciding between the one-jack and the two-jack arrangement.

Cordless common battery manual switchboards may be equipped with field line terminal equipment. Such lines may terminate on modified trunk or station keys. The use of idle circuit termination or transmission pad control features is not contemplated.

Field line terminal equipment has been and may still be in some cases classified as (1) no cord circuit supervision and (2) full cord circuit supervision, or as (1) terminating types and (2) through-and-terminating types. These references have lead to some misunderstanding, and in view of present types of standard equipment available, the present classification of one-jack and two-jack appears most appropriate.

SUPERVISION—The supervisory signals received by the PBX attendant are the same as for interexchange PBX stations and tie lines (Part X).

SPECIAL FIELD LINE ARRANGEMENTS—Field line terminal equipment may have to be modified to meet certain requirements and conditions. Modifications sometimes required include:

1. Locked-in re-ring lamp signal — The switchboard operator sometimes misses the ordinary re-ring signal indicated by the flashing of the cord circuit supervisory lamp, particularly if she turned away from the switchboard or is performing other duties in addition to operating the board. To remedy this condition the operation of the line lamp can be modified to provide a locked-in re-ring signal.

2. Code ringing—Normally the line lamp lights on the first application of ringing current and continues to burn until a plug is inserted for answering the call. However, the line lamp circuit can be modified to burn only during periods when ringing current is applied to the line and is extinguished when ringing current is not applied. This arrangement is sometimes desired where code ringing is required. This feature cannot be provided where the locked-in re-ring lamp signal is required.

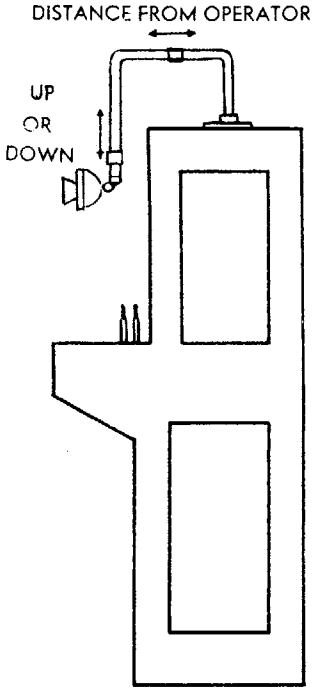
3. Selective Signaling — Railroad company field lines which are used for train dispatching are sometimes equipped with customer-owned selective signaling equipment and are referred to as selectored lines. Outgoing signaling from the dispatching point is by means of dial impulses produced by either a turn button key or a set of push buttons which actuate selectors at the distant point. The operation of this selective signaling equipment is sometimes performed by the PBX attendant and sometimes by the dispatcher.

   When selectored lines terminate on a PBX, auxiliary sending or receiving line circuits are furnished by the telephone company (this is in addition to the field line terminal equipment). Selective signaling systems usually employ higher voltages than can be permitted on telephone company facilities and protection against these voltages is provided by means of the auxiliary line circuit equipment.

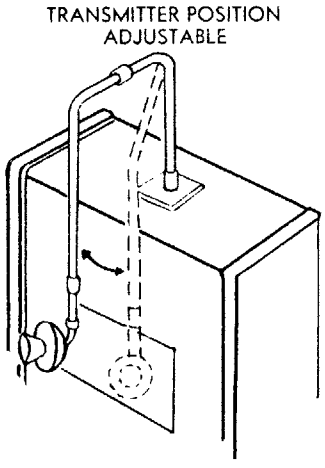
   When the operation of the selective signaling equipment is performed by the dispatcher, the necessary signaling equipment is usually located at his desk. When the selective signaling system is to be operated by the PBX attendant, the necessary keys or buttons to actuate the signals may be furnished by the customer or by the telephone company. When furnished by the customer they are mounted on a stand adjacent to the switchboard or may be located on the switchboard provided the customer's wiring is external to the switchboard and so located that no interference with the operation of the PBX will result. When the customer desires, and if space is available, the telephone company will provide the necessary selector keys in the key shelf or in the face of the switchboard. Such equipment is furnished at charges based on cost.

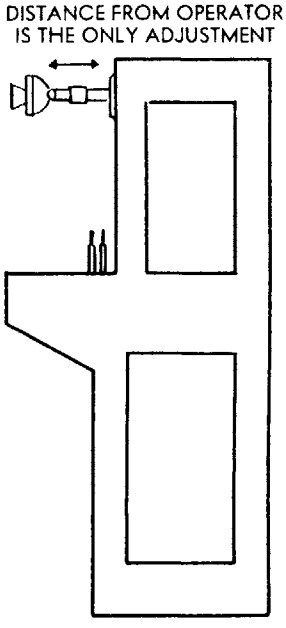
PBX ATTENDANTS' TELEPHONE SETS

FOR CORD SWITCHBOARDS

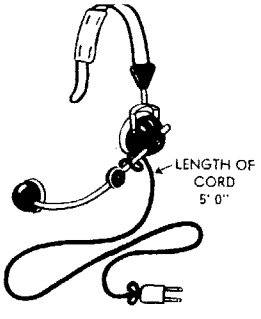


OVERHEAD TRANSMITTER ARM



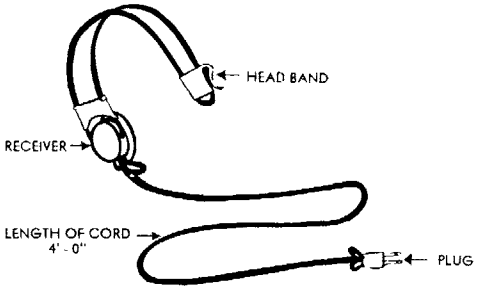


STRAIGHT
TRANSMITTER ARM



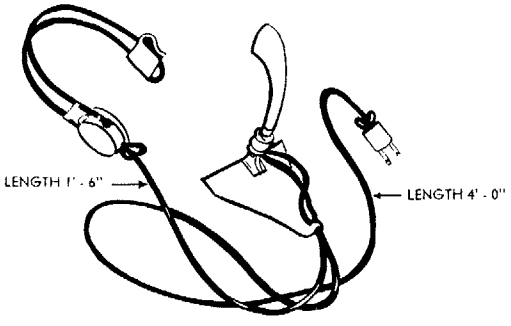
52 TYPE
HEAD TELEPHONE SET

One-piece type with transmitter mounted on arm attached to back of receiver case. Transmitter easily adjusted to head.



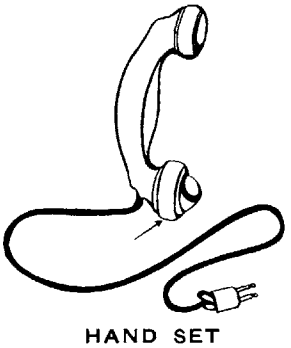
SINGLE HEAD RECEIVER

For use with either overhead or straight transmitter arms.



CHEST SET

Chest and hand sets are interchangeable but can not be used on board which has an overhead or straight transmitter arm.

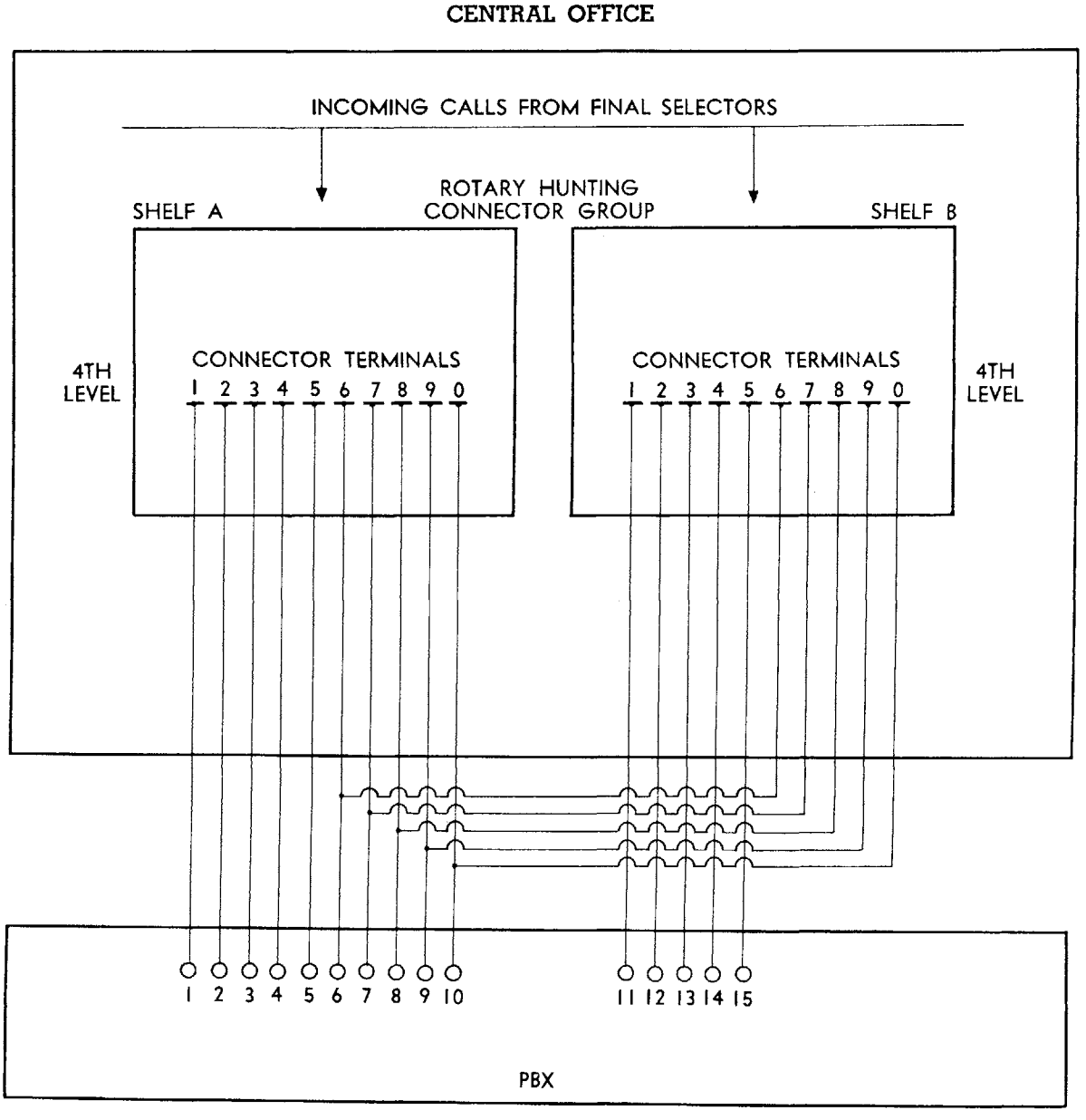


HAND SET

May be furnished as an auxiliary set for use during off-peak periods or as regular set when the traffic is light and intermittent.

GRADED CENTRAL OFFICE TRUNKS

STEP-BY-STEP DIAL OFFICES



1. Diagram illustrates 15-trunk group. Call number 3-2141.
2. Trunks 1-5, inclusive, are individual to connectors in Shelf A.
3. Trunks 11-15, inclusive, are individual to connectors in Shelf B.
4. Trunks 6-10, inclusive, are common to connectors in Shelves A and B.
5. Calls to the published number which are directed by the final selectors to connectors in Shelf A have a choice of 10 trunks (1-10).
6. Calls to the published number which are directed by the final selectors to connectors in Shelf B also have a choice of 10 trunks (11-15 and 6-10 in that order).
7. With trunk group of more than 20, consideration should be given to providing service in level hunting hundreds (if such equipment is available).

MANUAL CORDLESS SWITCHBOARDS

GENERAL

A manual cordless switchboard is a single position PBX designed to meet the minimum requirements for PBX service. It is provided when (1) centralized answering and control of calls over a small group of central office trunks and PBX stations is required, or (2) considerable communication between the stations is involved.

EQUIPMENT AND CAPACITIES

EQUIPMENT—The cordless switchboard is a small cabinet which may be placed on top of an office desk or table. It is equipped with keys for use in making connections between stations, trunks, and tie lines. There are two types of cordless switchboards, the 506 and the 507, both having the same basic service and operating features and the same capacities.

The 506 is an older type consisting of a wooden cabinet with the keys and necessary signals mounted on a vertical face panel (see exhibits). The cabinet may be provided in either oak or mahogany-walnut finish. The 506 is no longer manufactured, but is still in use and available for re-use.

The newer 507 type has a small and compact metal housing with a sloping key and signal panel (see exhibits). The metal housing has a neutral beige-gray wrinkle finish. Lamp signals are used instead of the drop and shutter types provided with the 506.

The attendant's telephone used with a cordless PBX is ordinarily a handset permanently connected to the switchboard. A headset with plug and jack connection may be provided with a cordless PBX only by special arrangement which would include a separately mounted dial where required. With the 507, a combination handset is used and the ringer (bell) in the handset serves as the common audible switchboard signal; with the 506, this signal is a buzzer in the switchboard associated with the drop type signals. A key is provided on both the 506 and 507 for turning off the audible signal when desired. As explained later in this section, a 1-A key set may be used with the 507-B to enable the attendant to pick up incoming central office calls when all the switchboard connecting paths are in use.

CAPACITIES—The 506 and the 507 are provided in two capacities:

	Trunks	Stations	Connecting Paths
506-A or 507-A	3	7	5
506-B or 507-B	5	12	5

The five connecting paths in the 506-A and 507-A switchboards provide for the maximum number of simultaneous connections possible with three trunks and seven stations. Although the 506-B and 507-B have a trunk and station capacity greater than that of the smaller switchboards, their capacity for simultaneous connections is the same, or only five.

OPERATION AND SUPERVISION

OPERATION—The cordless PBX is designed for use in common battery manual or dial central office areas, but can be modified to operate in magneto areas.

The operation of the signals and keys on the cordless switchboard is explained in the exhibits following. Both the 506 and 507 types are basically the same in method of operation.

SUPERVISION—Through supervision on trunk connections with the central office is normally provided on cordless switchboards which cannot be readily modified to provide non-through supervision. (See Part VI, Section 1, for explanation of through and non-through supervision.)

FEATURES AND ARRANGEMENTS

1-A Key Auxiliary Pickup Arrangement (With 507-B Only)—A 1-A key handset may be used as the attendant's telephone with the 507-B but not the 506-B, to enable the attendant to answer incoming central office calls when all five connecting paths are in use. The key set contains five pickup buttons associated with the trunks and a sixth button to connect the key set to the switchboard for normal operation.

When a trunk is picked up by pressing a key set button, the trunk lamp lights steadily until extinguished by momentary operation of the night service key. The trunk call may be held by pressing the associated hold key on the switchboard. The sixth button is operated to resume normal operation. When a connecting path becomes available, the call may then be completed to the PBX station.

In cases where there is a frequent need for more than five simultaneous connections, a cord type switchboard may meet the customer's requirements more effectively than the 1-A key set auxiliary pick-up arrangement.

Certain features and arrangements which may be provided with practically all types of PBX systems, including cordless switchboards, are described in other sections of the manual as indicated below.

1. Night service (Part VI, Section 1)—Provided by connecting a trunk and a station key to the same connecting path and operating the attendant's lower key to its bottom position to disconnect the signals at the switchboard. Two or more stations may be

connected to the same trunk as long as the limitation of bells per trunk is observed. A station cannot be connected to two or more trunks. In dial central office areas the stations must be equipped with dials to have outgoing service.

2. Off-premises stations (Part X, Section 1)—Available under the conditions prescribed for all PBX systems. Long line equipment is usually required (also frequently required for long on-premises station lines). The equipment is mounted in a separate apparatus cabinet with these exceptions: The equipment is already provided in the 507-A switchboard on station line 7, and in the 507-B on station line 12.

3. Tie lines (Part X, Section 1)—Local tie lines of the trunk-to-station type are usually provided. If the switchboards are not on the same premises or in the same building long line equipment is usually required. Although local tie lines of the type employing terminal equipment can be provided by modification of trunk or station key circuit, the trunk-to-station type will usually meet requirments. Interexchange tie lines of the magneto type can be terminated on cordless switchboards by modification of a trunk or station key circuit. Separate equipment cabinets are required to house tie line terminal equipment and each tie line of any type reduces the trunk or station capacity by one. Station line 1 on the 507-A and 507-B is arranged for termination of a magneto tie line without involved wiring changes in the switchboard.

4. Field lines (Part VI, Section 1)—Terminal equipment is required in terminating magneto field lines on modified trunk or station keys.

5. Power supply (Part VI, Section 1)—Direct current for talking purposes, lamp signals, and relay apparatus is provided by telephone company from the central office or storage batteries on customer's premises. The 20 cycle A.C. ringing current is also supplied by the company from the central office. A hand-operated generator is provided on the 506 switchboards for use in event of failure of the ringing current supply. When used with the 507 switchboards, the hand generator is located in a separate apparatus cabinet about the size of an ordinary bell box.

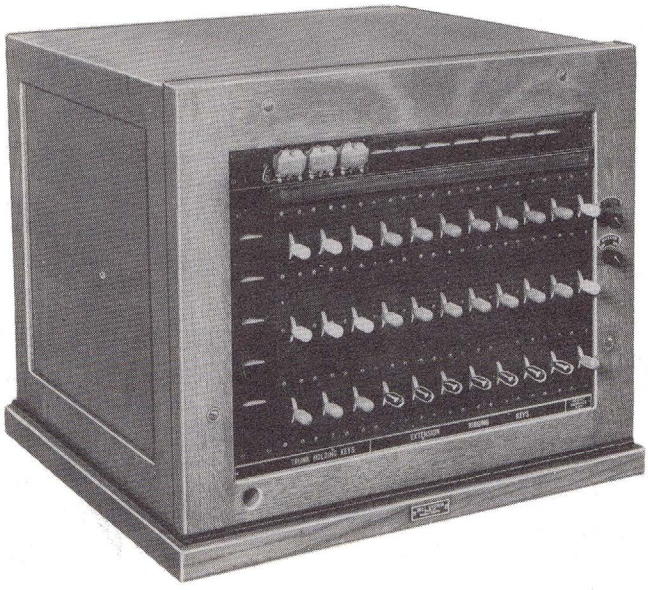
OPTIONAL AUXILIARY SERVICES

1. Paging and code calling systems (Part III, Sections 3 and 4)—Loud speaker paging system may be terminated on a cordless board by modification of a station key.

2. Conference equipment (Part VI, Section 1)—Not available for the cordless PBX.

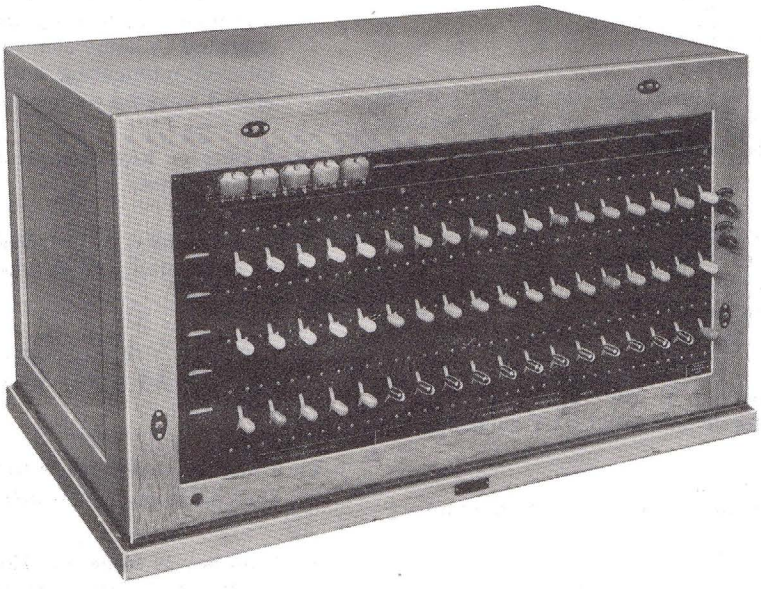
3. Recorder connector equipment (Part III, Section 1)—Not ordinarily provided with the cordless PBX.

MANUAL CORDLESS SWITCHBOARDS



NO. 506-A CORDLESS SWITCHBOARD

1′ 5¼″ Wide; 1′ 2⅜″ High; 1′ 3⅜″ Deep
Capacity: 3 Trunks—7 Stations
Standard Finishes: Oak and Mahogany-Walnut

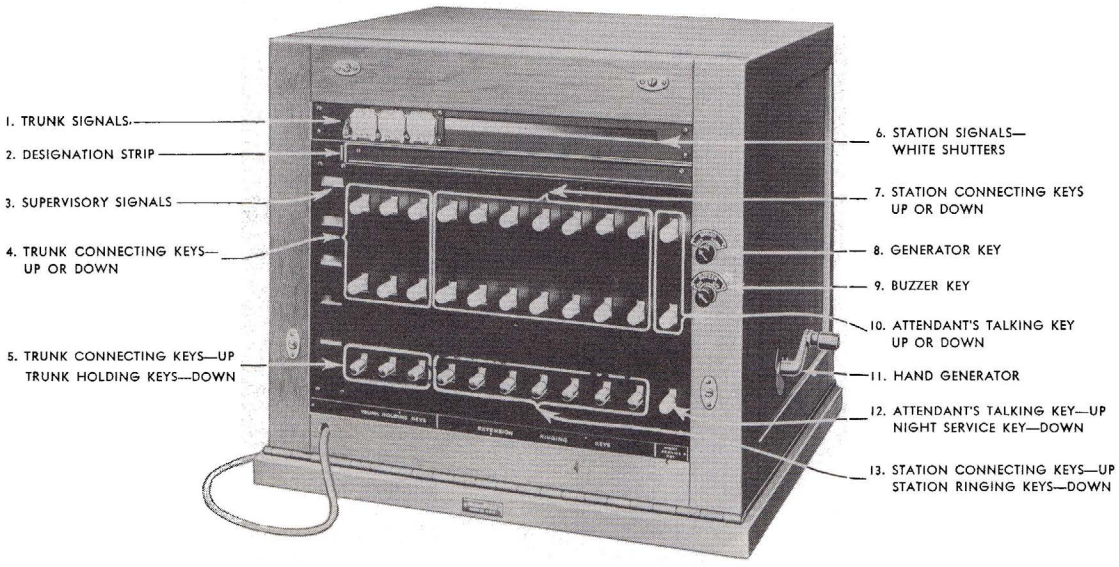


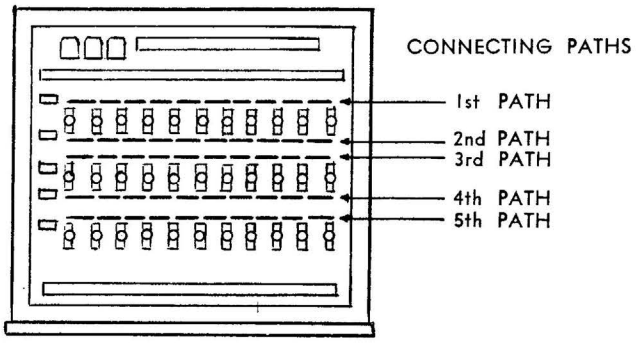
NO. 506-B CORDLESS SWITCHBOARD

2′ $\frac{11}{16}$″ Wide; 1′ 2⅜″ High; 1′ 3⅜″ Deep
Capacity: 5 Trunks—12 Stations
Standard Finishes: Oak and Mahogany-Walnut

OPERATION OF CORDLESS SWITCHBOARDS

506-A Illustrated: 506-B Identical in Operation





Connections between PBX stations or between PBX stations and trunks are made through five connecting paths by placing in the same position two keys in the same row, as follows:

a. Two keys raised to first path.
b. Two keys lowered to second path.
c. Two keys raised to third path.
d. Two keys lowered to fourth path.
e. Two keys raised to fifth path.

1. Incoming calls indicated by falling of drop signal. These must be restored manually after each incoming call.

2. Telephone numbers and names or station numbers are shown on strip.

3. Shutter appears when station connected to connecting path has hung up. One signal is associated with each of five connecting paths.

4. Each trunk terminates in a vertical row of keys. Outgoing and incoming trunk connections are made by operating a trunk key up or down. Two trunk keys should not be operated to same connecting path at one time.

5. These trunk keys are the same as (4) except that when in downward position will hold trunk call.

6. Shutter appears when station desires to make call. One shutter is associated with each station.

7. Each station terminates in a vertical row of keys. For incoming or outgoing trunk calls station key is operated to same connecting path as trunk key. For intercommunicating calls two station keys are operated to same connecting path.

8. Generator key used to change from key ringing to hand ringing.

9. This key used to turn buzzer off or on. Buzzer serves as an audible signal when one of the visual signals operates.

10. Attendant's talking keys are provided to connect attendant's telephone to any of the five connecting paths.

11. Hand generator crank to be used in the event ringing current from central office is interrupted.

12. This key is same as (10) except when in downward position will disconnect signals on switchboard and permit night service connections.

13. These keys the same as (7) except when operated to non-locking downward position will ring on associated station.

MANUAL CORDLESS SWITCHBOARD

507-A

Dimensions: 13¼" wide, 8" high, 19" deep

Finish: Neutral beige-gray wrinkle

Capacity: 3 Trunks, 7 Stations, 5 Connecting Paths

Weight: 39 Pounds

Trunk Lamps (3 at lower left on face panel): White

Supervisory Lamps (vertical row of 5 at extreme left of face panel): Red

Station Lamps (horizontal row of 7 at bottom of face panel): Red

Trunk and Attendant's Keys: Light Tan

Station Keys: Dark Tan

Removable Designation Strip

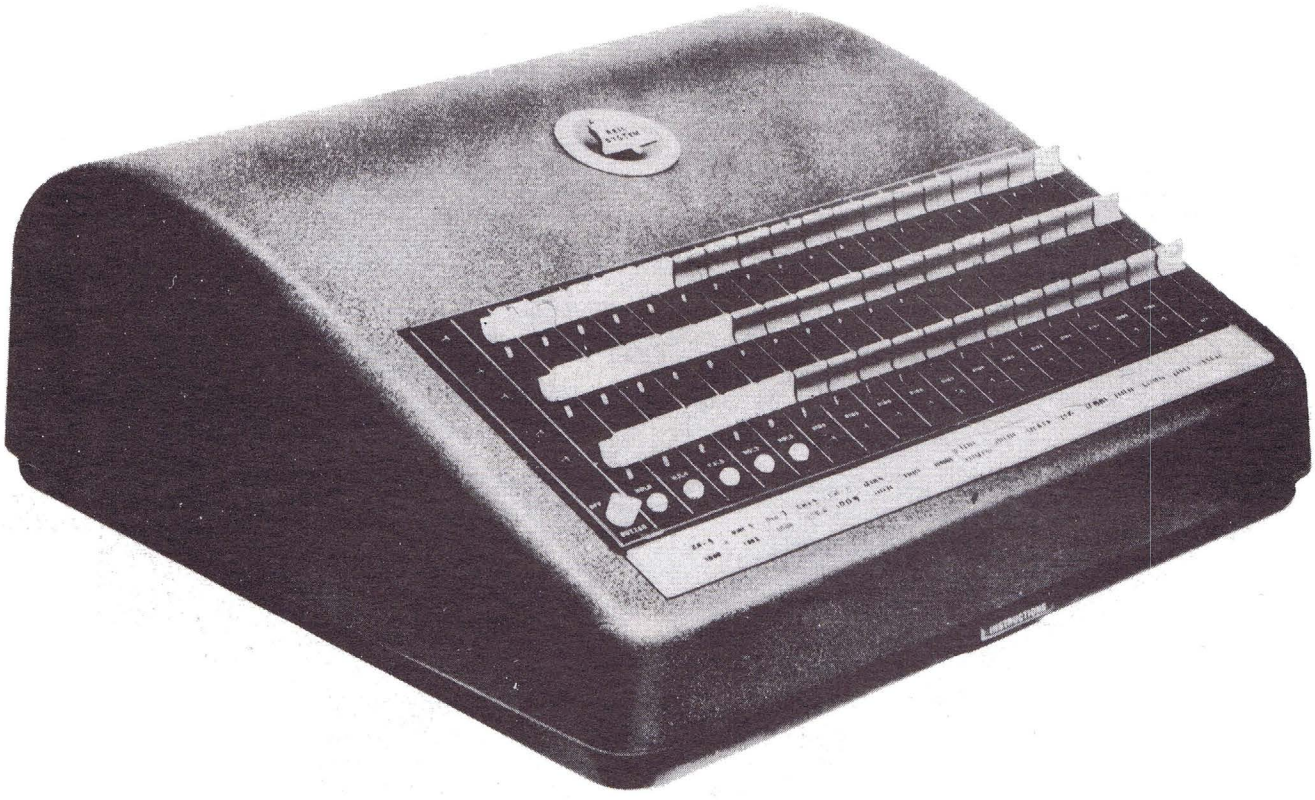
Pull-Out Slide For Operating Instructions Card (at bottom of switchboard)

Method of Operation Same As For 506-A Except Lamp Signals Provided Instead of Drops and Shutters

Exhibit 4

MANUAL CORDLESS SWITCHBOARD

507-B



Dimensions: 19¼" wide, 8" high, 19" deep

Finish: Neutral beige-gray wrinkle

Capacity: 5 Trunks, 12 Stations, 5 Connecting Paths

Weight: 54 Pounds

Trunk Lamps (5 at lower left on face panel): White

Supervisory Lamps (vertical row of 5 at extreme left of face panel): Red

Station Lamps (horizontal row of 12 at bottom of face panel): Red

Trunk and Attendant's Keys: Light Tan

Station Keys: Dark Tan

Removable Designation Strip

Pull-Out Slide For Operating Instructions Card (at bottom of switchboard)

Method of Operation Same As For 506-B Except Lamp Signals Provided Instead of Drops and Shutters