

An Introduction to Large Cordless P.A.B.X.s

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Cordless-type P.A.B.X.s with less than 50 extensions have been used for many years. Above this size a cord-type switchboard has always been provided with the automatic equipment. The use of a cordless board with these installations is now accepted, and the general aspects of cordless P.A.B.X. working are discussed. The interim designs which have been given approval for immediate use before a standard version is developed are dealt with briefly.

INTRODUCTION

THE term "large cordless," although understood by those familiar with private automatic branch exchange (P.A.B.X.) practice, does perhaps call for explanation. It is customary to define P.A.B.X.s of less than 50 extensions capacity as small P.A.B.X.s and those with 50 or more extensions as large P.A.B.X.s. This is because if the size exceeds 50 extensions a change is made from the packaged or unit-type equipment of limited capacity to extensible equipment, which, for all practical purposes, can be of unlimited capacity.

A manual board, of either cord or cordless type, is an essential part of a P.A.B.X., primarily because incoming exchange calls are connected to extensions by an operator. The essential differences between these two kinds of installation are as follows:

P.A.B.X. with a Cord Manual Board. All telephone traffic that must be passed via the P.A.B.X. operator is connected in a conventional private-manual-branch-exchange (P.M.B.X.) manner using plug-and-cord connexion. The manual board has a manual multiple of extensions and incoming and outgoing circuits. Supervision of calls and release of connexions are controlled by the operator.

P.A.B.X. with a Cordless Manual Board. All manually-controlled traffic is presented automatically to the operator in order of arrival and is routed through the automatic equipment by the operator, using keysending. The operator is concerned only with the setting-up of a call, which, once established, is disconnected from the cordless position. Release of the connexion is automatic.

At present, there are three standard designs of P.A.B.X.s used by the Post Office, and these have been described in an earlier article.* Briefly, the three types are the No. 1, with a cordless manual board and automatic equipment for a maximum of 49 extensions, the No. 2, a similar equipment but with a cord manual board, and the No. 3, again with a cord manual board, for large installations.

HISTORY

At the time of the development of the present standard P.A.B.X.s, about 1950, it was intended to complete the series with a large cordless design. Later, there was some doubt whether such equipment was needed or could compete economically with the No. 3. Although it was considered that cordless working was most desirable in the small size (as has been borne out by events—the

demand for the No. 2 cord type is almost negligible), it did not necessarily follow that the same considerations would apply to the large installations. Faced with a program of the development of more essential types of subscribers' apparatus, it was decided therefore to shelve the project temporarily.

This position was maintained until approximately 1958 when there was considerable demand for cordless installations from customers requiring large P.A.B.X.s. The Post Office had no standard equipment to offer, but fortunately some of the P.A.B.X. manufacturers had already designed and supplied equipment for the export market. These equipments, subject to some rationalization, are now being used to satisfy the immediate demands in the home market.

GENERAL CONSIDERATIONS INFLUENCING THE INTRODUCTION OF CORDLESS INSTALLATIONS

Conditions have changed since the earlier decision was made to shelve the development of large cordless P.A.B.X.s. Although it is still true to-day that such installations have a higher initial cost than those with cord-type manual boards, a much greater emphasis is placed upon the advantages to be obtained from reducing manual operation to a minimum and providing automatic connexion where possible. The reason for the present trend towards cordless working can perhaps best be judged by considering some of the advantages and disadvantages in the light of present-day conditions.

Advantages of Cordless Working

(a) Apart from the connexion of the incoming exchange call, full automatic working can be given with improved facilities and more control from the extension telephone.

(b) Less operating effort is required.

(c) The limitations imposed by the necessity for a manual multiple are removed.

(d) A smaller switchroom is required, representing a saving in expensive accommodation.

(e) Distribution of traffic, particularly the incoming traffic, is more easily controlled and is presented to the operator for connexion in sequence of arrival.

(f) The design of switchboards and the layout of switchrooms can be far less functional and more pleasing in appearance, making the operator's task more congenial and easing staff problems.

Disadvantages of Cordless Working

(a) Increased initial cost of equipment. This may be on average about 25 per cent, but varies considerably according to the requirements of the installation.

(b) More equipment space is required. This is, however, usually the least expensive accommodation.

(c) If full advantage is taken of the reduction in operating force which can be made, a less personal service is given. This may be of importance in some classes of business. Indeed, if a high standard of personal service is to be given then a cordless installation is likely to prove expensive.

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* ROCHE, J. J. Post Office Standard P.A.B.X.s. *P.O.E.E.J.*, Vol. 46, p. 159, Jan. 1954 and Vol. 47, pp. 41 and 133, Apr. and Oct. 1954.

PRESENT AND FUTURE DEVELOPMENT

The development of a Post Office standard design of a large cordless P.A.B.X. is now proceeding in co-operation with the telephone manufacturers, through the medium of the British Telephone Technical Development Committee. A considerable amount of work has to be done before this development will be complete, and it is unlikely that equipment will be available for service until 1962. Standardization is being limited, as with the P.A.B.X. No. 3, to circuits, components and facilities.

Until the standard design is available, the manufacturers' own designs are being used. A relatively large number of these installations will be in service by the time the standard P.A.B.X. is available, and they will be identified as P.A.B.X.—A.E.I. No. 4, A.T.E. No. 4, E.T. No. 4, G.E.C. No. 4 and S.T.C. No. 4.† Post Office standard components are used for all types and the facilities are very similar, although the method of providing a facility may vary in detail.

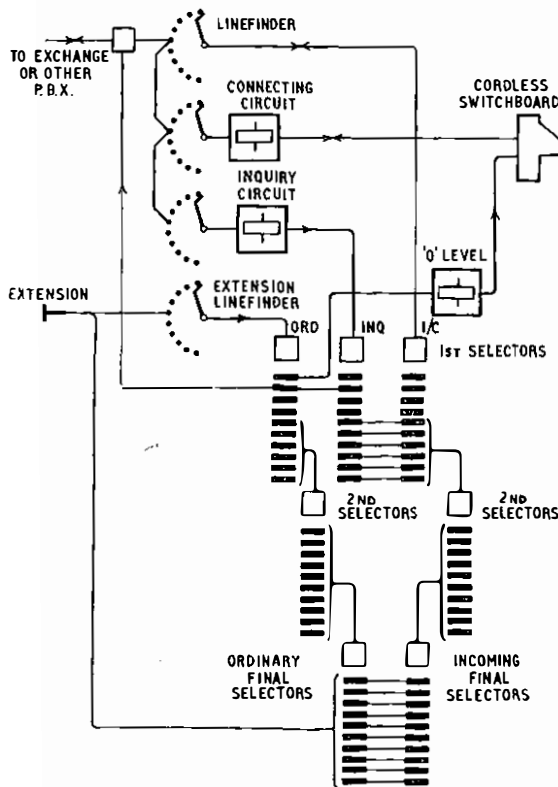


FIG. 1.—SIMPLIFIED TRUNKING DIAGRAM OF A CORDLESS P.A.B.X.

PRINCIPLES OF CORDLESS P.A.B.X. WORKING

It is only possible in a short article to deal with the more important aspects, mainly the differences between the present standard P.A.B.X. No. 3 and the cordless type. Fig. 1 shows a much-simplified typical trunking diagram of a cordless installation.

Extension-to-extension calls and other directly-dialled calls are connected in a similar manner to that used in the standard P.A.B.X. No. 3 and do not call for comment. The main differences in design concern the cordless

† A.E.I.—Associated Electrical Industries, Ltd.; A.T.E.—Automatic Telephone & Electric Co., Ltd.; E.T.—Ericsson Telephones, Ltd.; G.E.C.—General Electric Co., Ltd.; S.T.C.—Standard Telephones & Cables, Ltd.

switchboard and the method of connecting calls by the operator. Also, the inclusion of an automatic inquiry and transfer facility does necessitate some fundamental changes. This facility is important because normally an established call is not supervised by the operator.

Connexion of Incoming Calls

Incoming calls may be operator-connected or dialled direct to extensions automatically. All incoming exchange calls are operator-connected, as are inter-switchboard circuits which cannot, for any reason, be given dialling facilities. Where dialling is provided the arrangements follow standard P.A.B.X. practice, and only the connexion of a call via the operator will be briefly explained.

A signal is given on all the cordless positions when an incoming call arrives. Each position is provided with a maximum of eight connecting circuits, and the operator who accepts the call selects a connecting circuit. The finder associated with this connecting circuit finds the circuit calling and connects it to the operator. To connect the call to an extension the operator will operate the appropriate key and cause the incoming linefinder to find the calling circuit, connecting also the associated 1st selector. At this stage, two separate paths are maintained, one incoming from the calling circuit to the position circuit and the other outgoing from the position circuit to a 1st selector. It is over this second path that the key sender will send the required pulses, setting up the switch train in response to the operator's keying of the extension number. The call remains connected via the position until the called extension answers. The connecting circuit is then released for further use and the incoming circuit is connected directly to the 1st selector.

Should a called extension be engaged, then, if the caller decides to wait, the connexion will be put automatically into the "ring when free" condition when the operator withdraws from the circuit. Again, the position equipment is released when the call is ultimately established, but while in the "ring when free" condition it remains under the supervision of the operator.

It will be noticed from Fig. 1 that there are two separate dialling routes to an extension. The incoming route, which is used for all outside calls, and the local or ordinary route for extension-to-extension calls. This is because the final selectors which deal with traffic over the incoming route have to provide facilities which are not required on the simple extension-to-extension call and it is generally economical to split them into two groups. It is, however, to some extent a matter of design, and combined final selectors are sometimes used in a common group.

In all circumstances the indication of an incoming call at the cordless position must show the class of call, i.e. whether it is an exchange, inter-switchboard or 0-level call, etc. Common answering may be provided, which means that the next call waiting, whatever its class, is accepted by the operator. Alternatively, selective answering can be given whereby an operator can select the class of call to be answered. Selective answering enables priority to be given to certain types of call, but is particularly valuable for large installations where the operators may be divided into groups, dealing with certain classes of traffic.

Connexion of Outgoing Calls

Outgoing calls, with minor exceptions, can be made automatically by the extensions. This is the ideal

arrangement if maximum advantage is to be obtained from a P.A.B.X. This is particularly so for cordless exchanges, because traffic routed via the cordless position uses expensive equipment and the minimum provision of this equipment should be the aim. Unfortunately, this ideal is rarely obtained in practice, primarily because freedom of access to the outside network for all extensions is not always permissible from the customer's viewpoint.

Where the outgoing traffic can be dealt with automatically the arrangements follow normal practice. If a call is to be connected via the manual position then 0 is dialled. The operator accepts the demand over the 0-level circuit and connexion is made by reversion of the call over the manual-board selector train to the extension concerned. When established, the connexion is identical to that for an incoming call.

Selection of an outgoing route by the operator is made by operating the required route-selection key, but on installations with a large number of routes, selection is made by keying one or two code digits.

Automatic Inquiry and Transfer

On private branch exchanges it is often necessary for the user of an extension to make an inquiry of another extension while already engaged on an exchange call. This is known as the inquiry facility and is available on the standard P.A.B.X. No. 3, but transfer of the call is not possible without the intervention of the P.A.B.X. operator. It is obviously of advantage to complete this transfer automatically and it is possible to do this on a cordless P.A.B.X.

An inquiry call is initiated by depressing the recall button on the extension telephone. This causes the circuit to divide at the terminating relay-set, holding the established call and providing a route through the inquiry circuit to the inquiry 1st selector. The required extension can then be dialled. If the call is to be trans-



FIG. 3—S.T.C. NO. 4 CORDLESS SWITCHBOARD

ferred, the original switching train is released but the incoming 1st selector is used as a linefinder and is repositioned to the point on the bank multiple at which the inquiry selector is standing. The switching train set up through the inquiry selector is thus held, and transfer of the connexion is made to the second extension. The inquiry selector is then released for further use.

Another method employed on two of the present designs does not use an inquiry selector. The inquiry call is set up over a free incoming linefinder and 1st selector. On transfer, the linefinder used for the inquiry takes up the same position on the bank multiple as the one previously used, and the original switching train is released.

MANUFACTURERS' DESIGNS OF CORDLESS P.A.B.X.

Fig. 2-6 show the various designs of switchboard in current production. They illustrate how advantage can be taken of individual approach to physical design, for which there is scope in this type of apparatus because of the small amount of equipment which has to be provided on the switchboard.

The essential operating controls are similarly placed on all switchboards, but there are variations in detail. The illustrations are of switchboards equipped for particular installations, and even with the same design some changes in layout will be found, according to the size of the installation and facilities required. Further, the switchboards shown are early designs and they may be remodelled as experience is gained. Switchboards may also be specially designed to meet individual requirements.

All switchboards have the common feature of an operating panel and a supervision panel. The operating panel contains the connecting-circuit keys in the centre,



FIG. 2—A.E.I. NO. 4 CORDLESS SWITCHBOARD



FIG. 4—E.T. NO. 4 CORDLESS SWITCHBOARD

with the keysender on the right and common-control keys on the left. The supervision panel contains supervisory, circuit-identification and other essential information which has to be displayed. The individual connecting-circuit supervision and incoming-call lamps may be on the supervision panel or the operating panel according to the design.

P.A.B.X.s A.E.I. No. 4 and S.T.C. No. 4

The A.E.I. and S.T.C. switchboards (Fig. 2 and 3) have common features in that the supervision panel is in the form of a display, illuminated as required. All supervision is given on this panel. This has the advantage that the actual designation of the signal can be illuminated, but this is necessary in any event because the supervisory indication may be somewhat remote from the key to which it refers. Both switchboards shown are equipped for common answering, a common answer bar being provided in front of the connecting-circuit keys. The automatic equipment in both exchanges is similar to that previously outlined, using inquiry selectors and separate final selectors.

P.A.B.X.s A.T.E. No. 4, E.T. No. 4 and G.E.C. No. 4

Individual lamp supervision is given on the E.T., A.T.E., and G.E.C. switchboards (Fig. 4, 5 and 6). The E.T. No. 4 switchboard uses press-type keys throughout. All the switchboards shown have selective answering. The automatic equipment is again similar to that previously outlined, but inquiry selectors are not used. Also, the A.T.E. No. 4 P.A.B.X. has separate final selectors, whereas the E.T. No. 4 and G.E.C. No. 4 use common final selectors.

CONCLUSION

The cordless type of P.A.B.X. represents the nearest approach to completely automatic working which can be



FIG. 5—A.T.E. NO. 4 CORDLESS SWITCHBOARD

made at present. Whether the full advantages of this can be obtained depends to a large extent upon acceptance by the customer of the implications of reducing operator control to the minimum. With the advent of subscriber trunk dialling it becomes more desirable to have freedom of access from the extension point, and the addition of local metering and equipment to bar certain classes of call may go a long way to satisfying the cus-

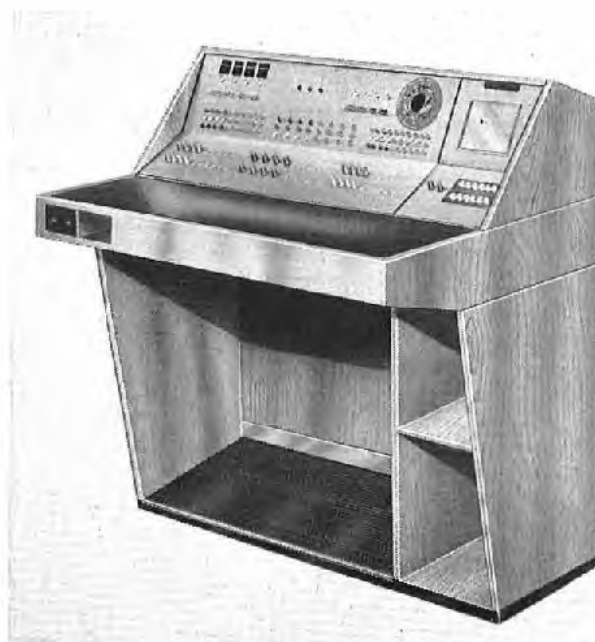


FIG. 6—G.E.C. NO. 4 CORDLESS SWITCHBOARD

tomers that calls can be controlled and accounted for without the intervention of an operator. Both these facilities will be available on the P.A.B.X. Automatic call-accounting would seem an almost complete answer. An installation with this facility is in hand, but unless costs can be reduced it is unlikely to provide the general answer.

It may well be that main exchange equipment of the future will allow for direct dialling into extensions on a P.A.B.X., dispensing almost entirely with the services of an operator. Only cordless installations already contain the equipment to enable this to be done should it become practicable.

There is little doubt that there is a strong demand for cordless installations. Although they are in the early stages of development, more than 50 per cent of the orders for installations for 1959-60 were of the cordless type. Complete supersession of the cord P.A.B.X. No. 3 is, however, unlikely. It will continue to be available where it can be used to advantage.

ACKNOWLEDGEMENT

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