

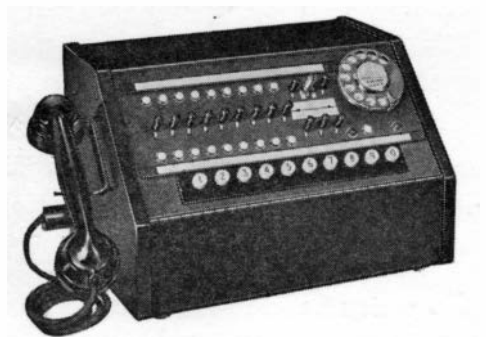
Private Automatic Branch Exchanges (PABXs)



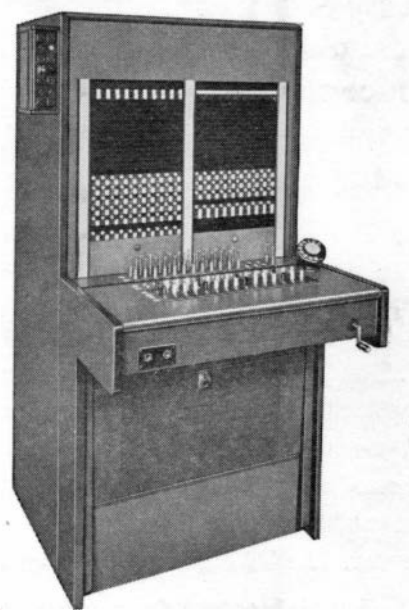
DESCRIPTIVE
DLD400
September 1966

PRIVATE AUTOMATIC
BRANCH EXCHANGES

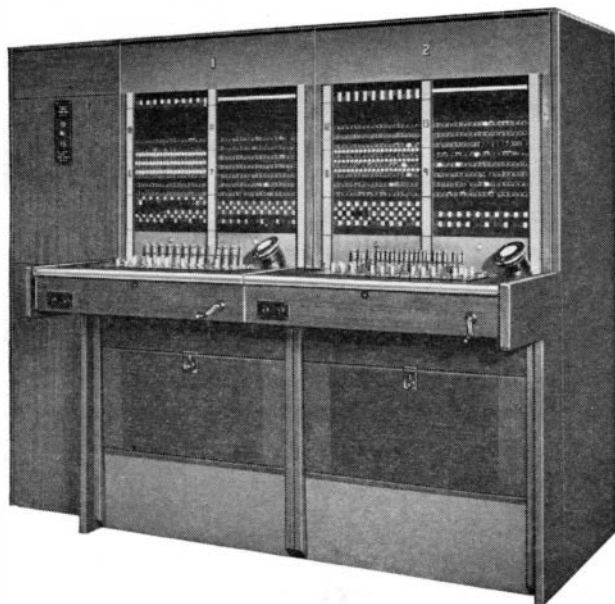
PABX 1



PABX 2



PABX 3



PABX 4



FOREWORD

A PABX is an automatic telephone installation which gives automatic internal service and public exchange service on a single system. On each telephone connected to a PABX it is possible to dial other extensions and also to make or receive public exchange calls.

Depending upon the type, size and cost of a PABX a variety of further facilities can be provided, and maximum use can be made of automatic techniques to reduce the manual operating work to a minimum. Fully and effectively used, a PABX can help customers to get the utmost benefit from their telephone service.

TYPES OF PABX

There is virtually no limit on the size of a PABX. The Post Office provides and maintains the smaller types on rental terms, but larger installations have to be tailor-made to meet actual needs and the customer buys the equipment himself from an approved contractor. The PABXs available on rental are

PABX 1 which caters for organisations needing not more than 10 exchange lines and 49 extensions. A small cordless switchboard is provided for an operator.

PABX 2 which is designed to meet the needs of organisations wanting a larger telephone system with limited automatic facilities. This PABX provides up to 10 exchange lines and 49 automatic extensions, as well as up to 30 manual extensions, and is equipped with a cord-type switchboard for an operator.

The larger PABXs, which are bought by the customer himself, are

PABX 3 which meets the needs of organisations wanting 50 or more automatic extensions; a liberal number of manual extensions can be provided as well, and a cord-type manual switchboard is fitted. The maximum capacity is set by the switchboard:

this normally accommodates 1,200 extensions, but if necessary a switchboard to serve up to 4,000 extensions may be provided.

PABX 4 which has an unlimited capacity, but costs rather more initially. The cordless switchboard supplied with this PABX incorporates a number of original features.

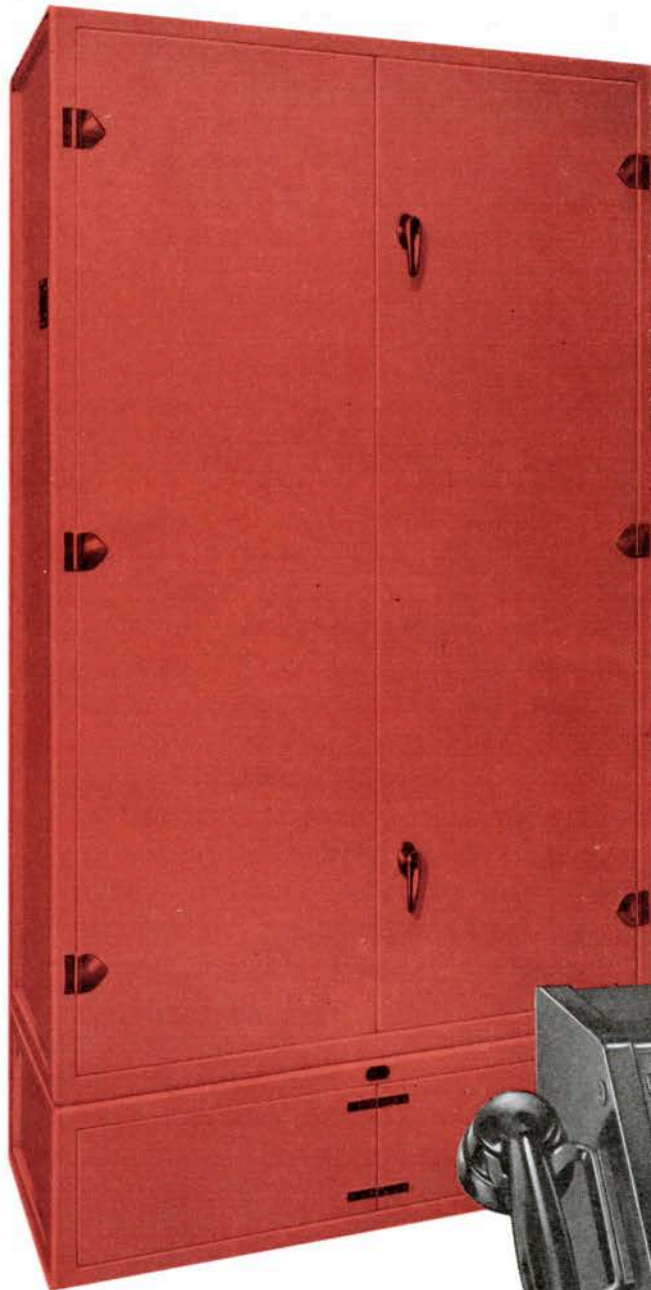
For the extra cost the PABX 4 offers more facilities than are available on the PABX 3, and if these are used to the full it is sometimes possible to save operator time; on the other hand with the PABX 3 a more personal service can be given by the operators, as calls made via the switchboard remain under their care at all stages.

(NOTE: the Post Office has not yet adopted a standard design for the PABX 4 and for this reason the customer needs Post Office approval before a PABX 4 can be connected to the public telephone system)

The approved contractor supplying a PABX 3 or 4 will also install it at the customer's premises. The Post Office provides the extension wiring and telephones for these PABXs and maintains the whole installation.

Full details of these PABXs follow.

Private Automatic Branch Exchange No.1 (PABX 1)



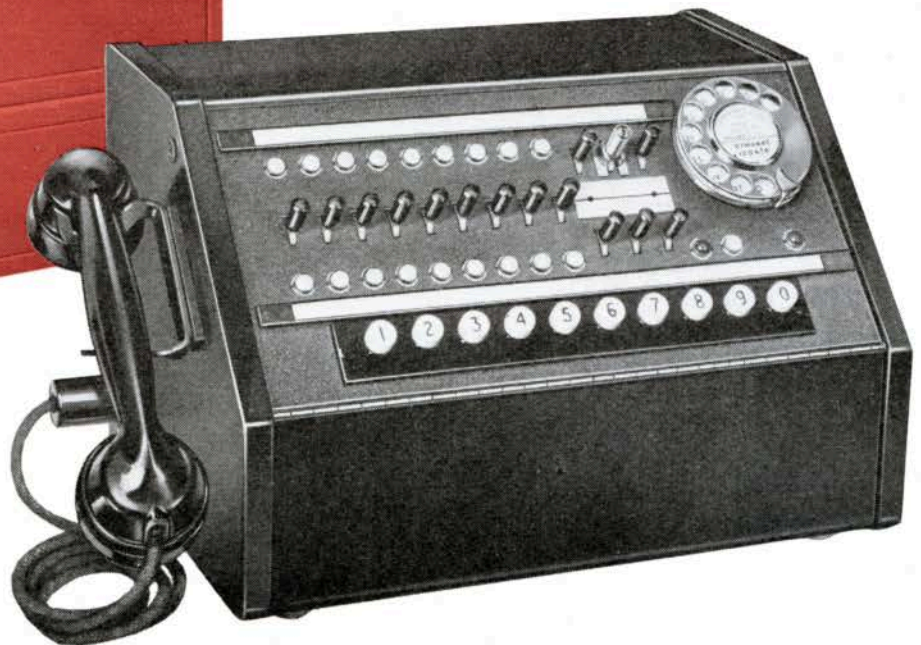
The PABX 1 cordless switchboard and automatic equipment cabinet

The PABX 1 is a modern, automatic telephone system which effectively meets the communication needs of small or medium sized businesses and commercial organisations. The system accommodates up to 10 exchange lines and 49 automatic extensions and provides for automatic connexion to the public telephone network and full internal dialling between extensions.

Incoming exchange calls are received on a small, compact, key-operated switchboard on a table or desk, and are dealt with by the PABX operator. A small number of manual extensions and lines to other PBXs can be connected to the system.

[Note: PBX means either a Private Automatic Branch Exchange (PABX) or a Private Manual Branch Exchange (PMBX)]

The automatic equipment is contained in a steel cabinet which has front and rear doors to let the maintenance engineer get at both sides of the racks. Power to operate the



equipment is supplied from a secondary-cell battery linked with an automatically controlled charging unit connected to the mains. The PABX 1 is available in four sizes. Details are shown with the general information.

GENERAL FACILITIES

Extensions call each other simply by dialling the number.

Extensions make outgoing exchange calls by first dialling 9 for connexion to an exchange line.

Any extension can be connected in such a way that it cannot dial 9 for an exchange line but can get through to the public system only by way of the operator's switchboard.

Incoming exchange calls are first received at the switchboard and then extended to the required extension by the operation of press-buttons.

A few manual extensions can be provided. Automatic extensions can call them direct but they receive incoming exchange calls and make all outgoing calls through the switchboard.

Lines to other PBXs can be provided.

Extensions dial 7 for connexion to an inter-PBX line and in some instances it is possible over these lines to dial direct to extensions on a distant PABX.

On an outgoing exchange call, timing of the call stops and the exchange line is released immediately the extension handset is put back.

Extensions dial 0 to call the switchboard operator.

SWITCHBOARD FACILITIES

Extensions are called from the switchboard by press-button.

Ringling is automatically applied to extensions on calls from the switchboard.

Calls to or from extensions are automatically released when the extension handset is put back.

If on an incoming call the called extension is engaged the caller can wait and be

automatically connected immediately the extension is free.

The PABX operator can interrupt an engaged extension to ask if another call can be accepted. A ticking sound indicates that the operator is on the line.

An incoming or outgoing exchange call can be held on the switchboard by connecting it to a special holding number. After holding, the call can be connected to an extension by press-button.

EXTENSION FACILITIES

Calls between extensions are released when either extension handset is put back.

On calls to or from the exchange or another PBX, pressing the button on the telephone twice, calls in the PABX operator, who can then hold the call or transfer it as required.

An automatic extension can, by pressing the button on the telephone once, hold an exchange call and make an enquiry of another extension. The original call can be returned to by pressing the button again; or if the handset is simply replaced the call is transferred to the other extension. This operation can be repeated as often as required on the call. Manual extensions do not have this arrangement.

For night service there is a special key on the switchboard. When this is in the 'night service' position incoming exchange calls cause suitably sited bells to ring continuously. Any automatic extension can then answer the call by dialling 8, and can, if necessary, transfer it to any other extension. A different kind of night service can be given by putting individual exchange lines through to selected extensions.

PABX 1 SIZES

1	Size	4+15	5+24	7+35	10+49
2	Exchange lines (see note 1)	4	5	7	10
3	Automatic extensions	15	24	35	49
4	Manual extensions (see note 2)	2	2	4	4
5	Inter-PBX lines (see note 3)	2	2	3	3
6	Connecting circuits	3	4	6	7
7	Enquiry trans- fer circuits	1	1	1	1
8	0 level assist- ance circuits	2	2	2	2

Notes (1) Reduced to 9 on the 10+49 size if 3 inter-PBX lines are required.

(2) Instead of the same number of automatic extensions.

(3) Instead of the same number of automatic extensions. Intercommunication with another PBX can be provided over a group of inter-PBX lines. Access to this group is by dialling 7.

The capacity of a unit cannot be increased beyond its limit. Greater capacity can be obtained only by replacing the whole unit with a larger size.

GENERAL INFORMATION

Numbering arrangements and dialling codes

Level 1 – Not used, for technical reasons

Level 2 to 6 – Extensions

Level 7 – Lines to another PBX

Level 8 – Unattended night service

Level 9 – Exchange lines

Level 0 – PABX operator

All extensions, manual and automatic, have two-digit numbers in the ranges 21 to 35; 21 to 44; 21 to 55; 21 to 69 according to the type of PABX. (20 is used by the PABX operator for holding purposes)

Alarms

An audible signal is given on the switchboard to call attention to incoming calls; this is also used as an alarm for mains failure and other fault conditions. An alarm-cut-off key is also provided on the switchboard. Operation of the night-service key suppresses the audible signal.

In the event of a mains failure complete service is maintained on the PABX by means of the battery. Calls are not interrupted.

Tones

Dialling, ringing, engaged, ticking and number unobtainable tones are provided from a ringing and tone relay set in the PABX equipment.

Accommodation

It is recommended that the automatic equipment, power plant and distribution frame should be installed in a room separate from the operator's switchboard. The equipment room should have adequate heating, lighting and ventilation.

The minimum sizes necessary are
4+15 or 5+24 size – 8' 6" by 6' 8"
7+35 or 10+49 size – 9' 0" by 8' 0".

The overall height of the room should not be less than 7' 6".

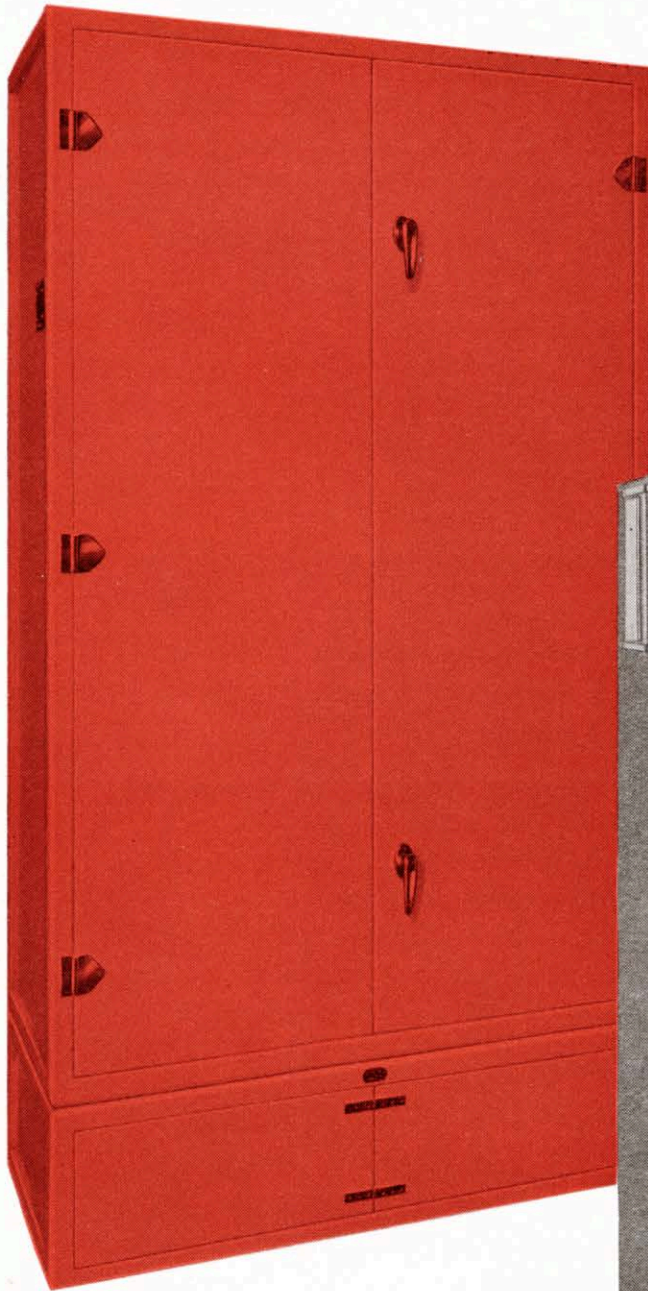
Dimensions and weights

Equipment	Width	Depth	Height	Weight
Cordless manual switchboard	1' 3"	11 $\frac{1}{4}$ "	9 $\frac{1}{2}$ "	about 30 lb
4+15 or 5+24 cabinet	2' 10"	2' 0"	6' 11"	996 – 1,080 lb
7+35 or 10+49 cabinet	3' 9"	2' 0"	6' 11"	1,232 – 1,288 lb
Distribution frame	1' 6"	2' 0"	6' 9"	160 lb
Rectifier unit	1' 3 $\frac{1}{2}$ "	9 $\frac{1}{2}$ "	1' 8 $\frac{3}{4}$ "	53 lb
Secondary-cell battery				
For 4+15 and 5+24 size	3' 4"	9"	5' 0"	308 lb
For 7+35 size	3' 4"	9"	5' 0"	392 lb
For 10+49 size	4' 1"	1' 6"	6' 10"	1,008 lb

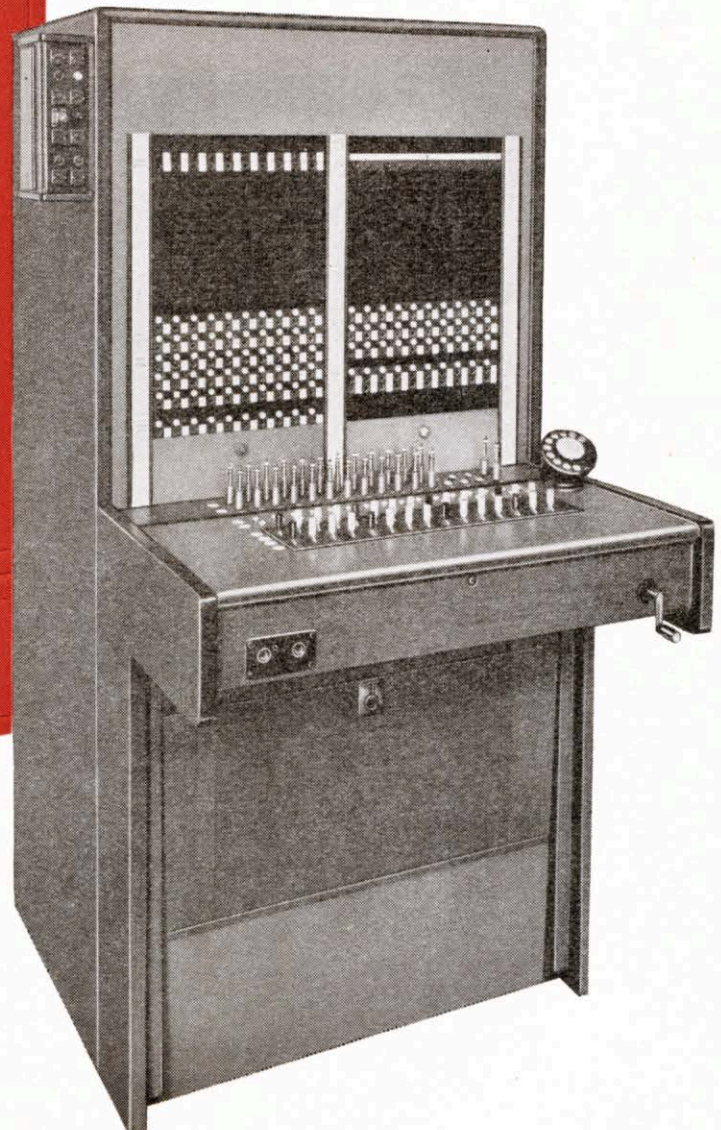
Private Automatic Branch Exchange No.2 (PABX 2)

The PABX 2 has been designed to provide both automatic and manual telephone service on the one system. The PABX is particularly suitable for those organisations who want most of the advantages of automatic working while still giving some of their staff a more personal telephone service.

The system is equipped with standard



The PABX 2 cord-type manual switchboard and automatic equipment cabinet



automatic apparatus units of the PABX 1 type and can accommodate up to 10 exchange lines and 49 automatic extensions as well as up to 30 manual extensions. A small number of lines to other switchboards can be connected to the system.

The PABX operator is provided with a modern cord-type switchboard and the PABX is available in four sizes. The automatic equipment, operating power supply and other apparatus are similar to the PABX 1. Other details are given below.

GENERAL FACILITIES

Note: The facilities provided by the PABX 2 are generally the same as those given by the PABX 1. The differences are

Incoming exchange and other calls are extended to all extensions by means of switchboard cord circuits.

All calls from manual extensions are made through the switchboard and completed by means of cord circuits.

Lines to other PBXs can be provided. Automatic extensions dial 7 for connexion to these lines but the operator can also connect both automatic and manual extensions to these lines at the switchboard.

All extensions have an individual light on the switchboard. This shines when 0 is dialled or when the handset on a manual extension is lifted.

On calls to extensions from the switchboard, ringing is applied by repeatedly pressing a ringing key on the switchboard.

On an outgoing exchange call, timing of the call stops when the extension handset is put back. If an incoming call is received on the exchange line before the extension has been disconnected from the switchboard a flashing light signal is given and the operator can intercept the call without the extension being called.

Incoming callers cannot wait on an engaged extension to be automatically connected when the extension becomes free.

Automatic extensions can, by pressing the button on the telephone once, hold an exchange call and make an enquiry of another extension. A second operation of the press-button restores the original call. Manual extensions do not have this facility.

To transfer a call from one extension to another the operator is called in by pressing the button on the telephone twice.

PABX 2 SIZES

The PABX 2 is available in the same four sizes as the PABX 1 with the addition that up to 30 manual extensions can be provided on each of the four sizes.

GENERAL INFORMATION

Switchboard

A single-position, modern, cord-type, floor-standing switchboard is provided for the PABX operator.

Numbering arrangements and dialling codes

These are the same as those for the PABX 1 but the manual extensions have three-digit numbers beginning with 0. This is to make sure that if a manual extension is dialled the call is connected to the switchboard.

Alarms

The arrangements are as provided on the PABX 1.

Tones

Similar to those on the PABX 1, but on calls completed by the PABX operator ringing tone is not fed back to the calling extension.

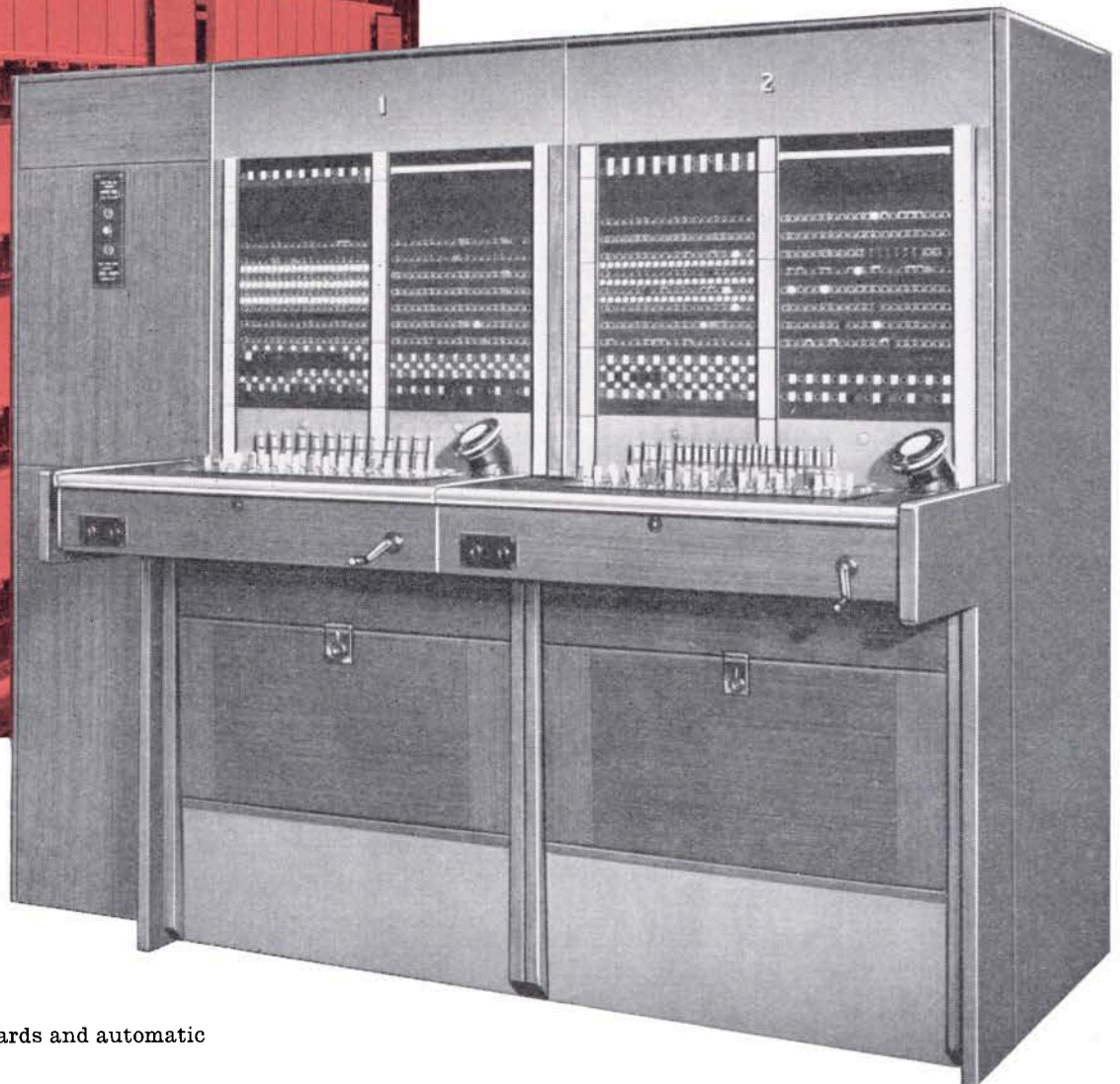
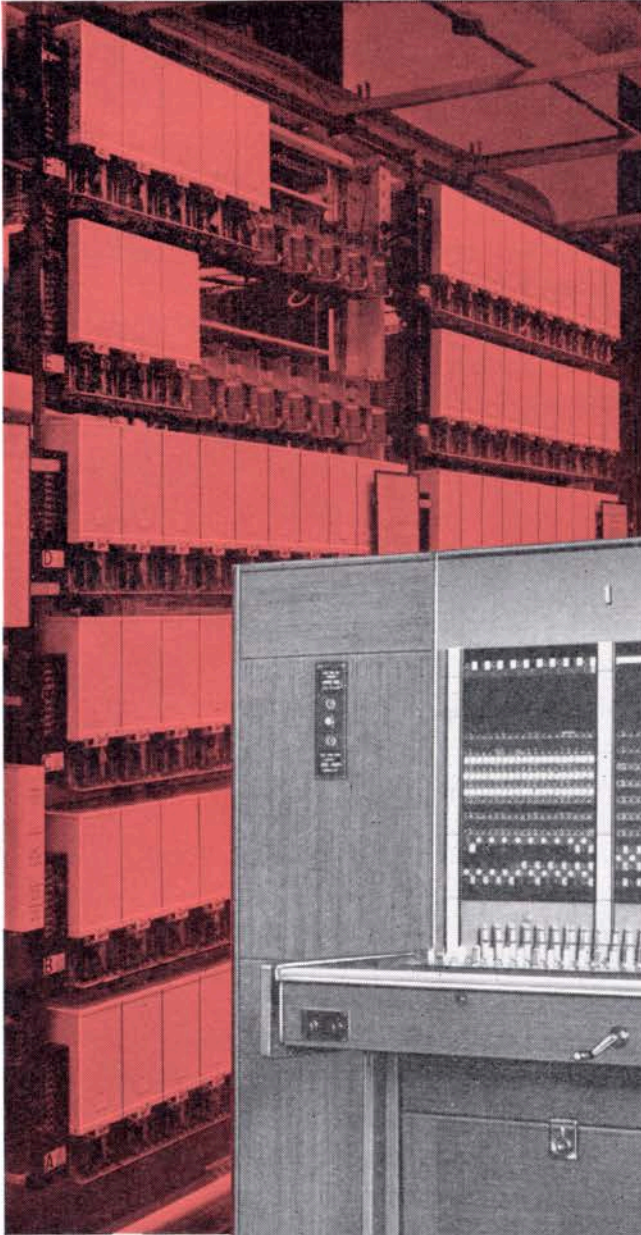
Accommodation, dimensions, space requirements and weights

These are similar to the PABX 1 but the manual switchboard needs a floor space 10' 9" by 7' 3". It is 2' 2" wide, 2' 9" deep and 4' 8" high; it weighs 300/400 lb.

Private Automatic Branch Exchange No.3 (PABX 3)

Normally a PABX 3 has to be specially designed to meet a customer's particular communication needs. The Post Office does not offer these PABXs on rental terms and the customer must buy the equipment from an approved contractor, who will also be responsible for installing it. The Post Office provides the extension wiring and telephones, and maintains the whole installation.

A list of approved contractors will be provided on request.



A typical suite of PABX 3 switchboards and automatic equipment racks

The PABX 3 is an automatic telephone system suitable for organisations and businesses needing more than 49 automatic extensions. This type of PABX is extremely flexible and provides for a high degree of personal service to all extension users. It is capable of expansion from time to time as necessary; it can be extended to accommodate up to 1,200 extensions, and with a change of switchboard up to a maximum of 4,000 extensions.

All telephones on the system can make and receive exchange calls through the PABX switchboard; some or all extensions, as the customer decides, can also make exchange calls by direct dialling. There is full internal dialling between automatic extensions, and manual extensions can be provided up to the capacity of the switchboard. Lines to other PBXs and private circuits can be provided, and dependent automatic installations can be installed in separate premises.

Depending upon the size of PABX installed, one or more cord-type manual switchboards are necessary. Where more than one are provided they are put together to form a suite which can be extended at any time if the PABX capacity is increased.

The automatic equipment is mounted on open racks, with dust covers for individual items of apparatus. All circuits, components and general equipment are of standard design. Operating power is provided from a secondary-cell battery linked with an automatically controlled charging unit connected to the mains.

Details of the more usual facilities offered by the PABX 3 are described below. The system can also cater for a wide range of optional facilities and in certain instances special facilities can be designed to meet particular needs.

GENERAL FACILITIES

Extensions call each other simply by dialling the number.

Extensions make outgoing exchange calls by first dialling 9 for connexion to an exchange line. Any extension can be connected in such a way that it cannot dial 9 for an exchange line but can get through to the public system only by way of the operator's switchboard.

Incoming exchange calls are first received on the switchboard and then extended to the required extension by means of cord circuits.

Two kinds of manual extension can be provided. On one, all calls, both incoming and outgoing, have to be made through the switchboard. The other kind has the added facility of being able to receive directly-dialled calls from automatic extensions.

Lines to other PBXs can be provided. They are connected to both the automatic equipment and the switchboard. Automatic extensions dial a code for connexion to an inter-PBX line, and the switchboard operator can also connect extensions to these lines at the switchboard.

Private lines can be provided. Normally they are connected to the switchboard and all calls to or from them are handled by the operator. They can, subject to certain technical considerations, be connected as manual extensions and have the same facilities.

All extensions can call the switchboard operator when required. On PABXs with a capacity of up to 800 extensions each extension has an individual light on the switchboard which shines when 0 is dialled or when the handset on a manual extension is lifted. On larger-capacity PABXs this service is provided for all manual extensions and for selected automatic extensions; the remainder are connected to a common group of circuits when they dial 0 and have to tell the operator their number when the call is answered on the switchboard.

On an outgoing exchange call timing of the

call stops when the extension handset is put back. If an incoming call is received on the exchange line before the extension has been disconnected from the switchboard a flashing light signal is given and the operator can intercept the call without the extension being called.

On calls to extensions from the switchboard, ringing is applied by repeatedly pressing a ringing key on the switchboard.

The operator can interrupt any engaged extension to ask if another call can be accepted.

A visual indication of the next free exchange line or inter-PBX line can be given on the switchboard by a light above the free line.

Calls between extensions are released when either extension handset is put back.

Automatic extensions can, by a single operation of the press-button on the telephone, hold an exchange call and make an enquiry of another extension. A second operation of the press button restores the original call. This can be done as often as necessary on the same call.

To transfer a call from one extension to another the operator is called-in by pressing the button on the telephone twice.

Up to ten extensions can be grouped together and arrangements made for an incoming call to be connected automatically to the first disengaged extension in the group.

Night service can be given by connecting individual exchange lines to selected extensions. Alternatively, a small subsidiary night-service switchboard can be provided at which exchange calls can be received and then put through to selected extensions.

GENERAL INFORMATION

Switchboard

One or more cord-type multiple switchboards are installed, depending upon the size of the PABX. Each extension has separate socket terminals on the switchboard so that the operator can connect calls to the extension

without dialling. On PABXs with a capacity of up to 800 extensions one socket of each extension has a light by it to show when the extension is calling the switchboard. On larger PABXs extensions call the switchboard by means of common circuits, as in 'public' exchanges, but preferential service for important extensions can be arranged by giving them an individual calling light.

Numbering range and dialling codes

According to the size of PABX the numbering arrangements can vary. A three-digit, or a mixed three-and-four-digit, or a four-digit numbering scheme is used, depending upon the ultimate capacity of PABX likely to be needed. Usually the dialling codes are

Level 1	Not used	
Level 2	} Extensions	
Level 3		
Level 4		
Level 5		
Level 6	} Lines to other PBXs, or extensions	
Level 7		
Level 8	Lines to other PBXs	
Level 9	Exchange lines	
Level 0	PABX operator	

Manual extensions have numbers beginning with 0. This is to make sure that if the number of a manual extension is dialled the call is connected to the switchboard.

Dependent PABXs

Intercommunication with premises which are not very far from the main PABX installation, but too far to be served economically by external extensions, can be arranged if technically possible. Dependent PABXs are provided in the distant premises – which can be up to three or four miles away – and connected to the parent PABX by special lines. Extensions on the dependent PABXs have full intercommunication within their own premises without using the parent PABX equipment and can dial extensions in the main premises direct over the special lines ;

incoming exchange calls for the dependent PABX are received at the parent installation and put through by means of the special lines.

Alarms

Fault alarms are given on the PABX switchboard and/or on the automatic equipment to indicate failure of the mains supply, failure of the power ringing, failure of selector switches to release, blown fuses, etc. In the event of a mains failure complete service is maintained on the PABX, by means of the battery. Calls are not interrupted.

Tones

Standard dialling, ringing, engaged and number unobtainable tones similar to those used in public exchanges are given on the PABX.

Equipment

The automatic equipment is mounted on open racks, usually 3' 6" to 4' 6" wide by 7' 6" to 7' 9" high and, when fully equipped, varying in

weight from 520 lb to about 1,200 lb. The number of racks installed will vary according to the size of the PABX. A small main cable and distribution frame is also provided.

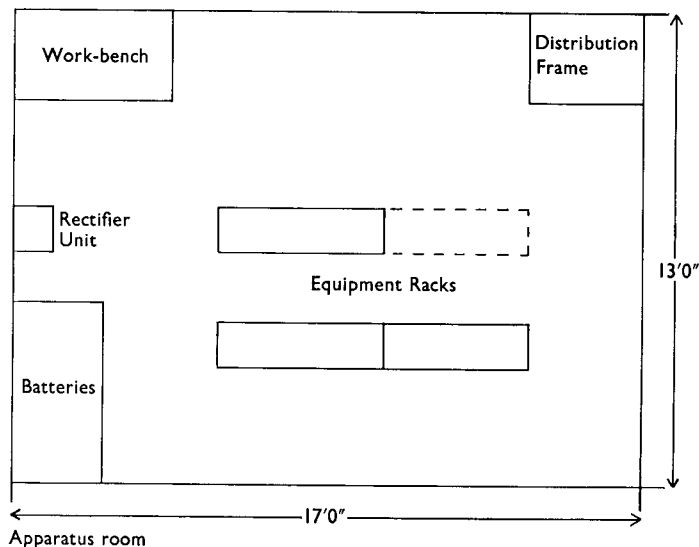
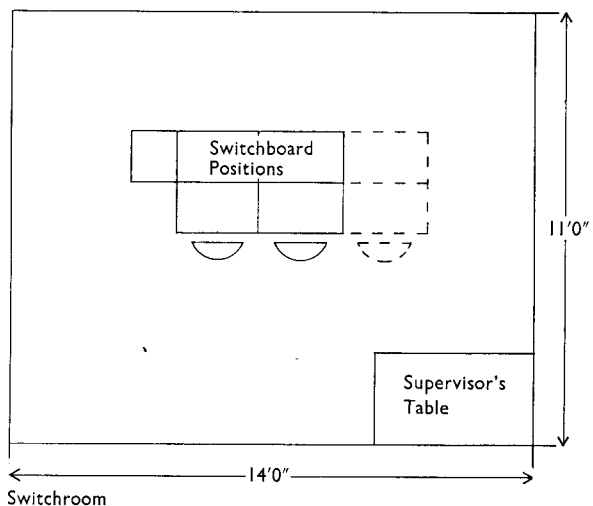
The manual switchboard position for a capacity of 1,200 extensions is 2' 2" wide, 2' 9" deep, and 4' 8" high. The number of positions will vary according to the size of PABX and volume of calls made to the switchboard.

Accommodation

It is recommended that, where possible, the automatic equipment, power plant and batteries, and the operator's switchboard should each be installed in separate but nearby rooms, which should have adequate heating, lighting and ventilation. The size of the rooms required will depend upon the ultimate capacity of the PABX to be installed. Typical floor plans are shown in the following diagrams and the minimum height required is about 9' for each room.

TYPICAL FLOOR PLANS

for 100/200 extension lines
and up to three manual positions



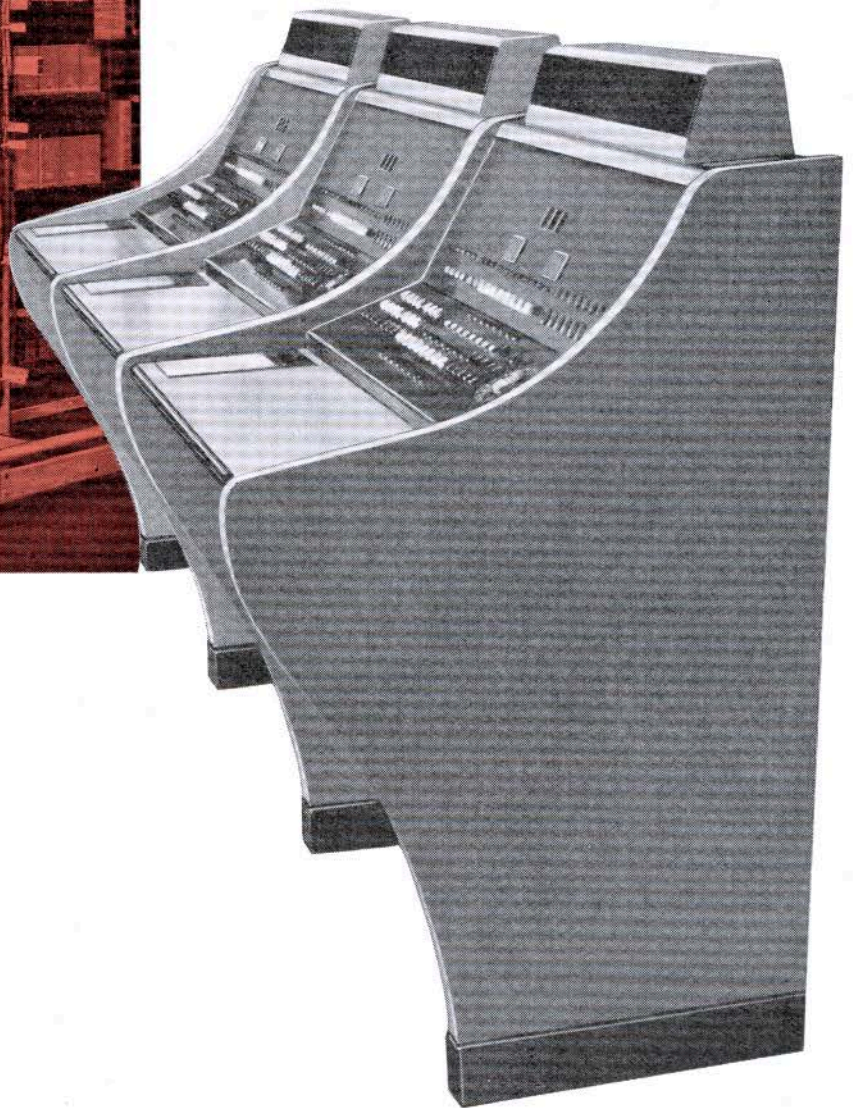
Private Automatic Branch Exchange 4



A typical suite of PABX 4 cordless switchboards and automatic equipment racks

The PABX 4 has virtually an unlimited capacity and uses the same standard types of automatic equipment, power plant and extension telephones as the PABX 3. The capital cost – which must be met by the customer – is greater than that of a PABX 3 of the same size, but it offers more facilities and uses a desk-type, cordless, manual switchboard in contemporary styling.

It incorporates several novel features which will, if fully utilised, produce a marginal saving in operator time, but with some loss of personal



service to the extension users. The differences in facilities and degree of personal service between the PABX 3 and 4 need careful assessment and consideration before a choice is made. The Telephone Manager will gladly help and advise on the relative merits of the two systems in particular circumstances.

As with the PABX 3, the customer must buy the equipment from an approved contractor who will also be responsible for installing it. The Post Office provides the extension wiring and telephones, and maintains the whole installation.

Apart from the operator's switchboard the PABX 4 is similar in design and construction to the PABX 3 already described; the automatic apparatus is mounted on the same type of open racks, and a similar type of power plant is provided. The main difference is the provision of the cordless, desk-type switchboard, and for this reason the PABX 4 is often called the cordless PABX. Dependent automatic installations in separate premises can be associated with a PABX 4, as with a PABX 3.

GENERAL FACILITIES

In common with the other systems described in this booklet, the PABX 4 provides a normal range of PABX facilities, including extension-to-extension dialling; extension-to-exchange dialling; connexion of incoming exchange calls by the PABX operator; through clearing; hold for enquiry; operator call-in for assistance; automatic transfer of calls; and night-service arrangements. Some special features are:

Selected extensions can be given priority calling to ensure that their calls are dealt with by the operator before calls from other extensions.

Incoming calls are put through to extensions by the PABX operator by the use of press-buttons. If a called extension is engaged the operator can leave the incoming call to be connected automatically when the extension is free.

The operator can speak to an exchange-line caller or to the called extension without being overheard by the other person.

Selective restriction on calls can be applied so that particular extensions can be prevented from making and/or receiving exchange calls, or having exchange calls transferred to them from other extensions. Inter-PBX line barring can also be arranged.

Facilities are usually provided for the operator to use press-buttons instead of a dial for outgoing exchange calls.

Calls over inter-PBX lines from other switchboards may be received by the PABX operator or, when signalling conditions permit, may be received direct by the extension required. Conversely, in most cases extensions can dial directly to other switchboards, and sometimes – if the distant switchboard is another PABX – directly to the required extension.

Night-service can be provided in one of the following ways:

- 1 Incoming calls on exchange or inter-PBX lines cause suitably sited bells to ring continuously until any extension answers by lifting the handset and dialling 8. If necessary, the call can be transferred to another extension in the usual way.

- 2 Incoming calls ring the bells of certain designated extensions, any of which answer simply by lifting the handset. If all designated extensions are engaged the next incoming call may ring an overflow bell or bells, or inject a warning tone on to a preselected designated extension. All designated extensions retain normal extension facilities.

- 3 Each exchange line on which night service is required is connected to an extension in such a way that the extension may answer all incoming calls on that line while retaining all normal extension facilities. A warning tone is given on any such extension which is engaged on an internal call when an incoming exchange call arrives, and when the handset is replaced the extension is re-rung automatically.

4 Each exchange line on which night service is to be provided is connected to a nominated extension in such a way that the extension becomes equivalent to a direct exchange line and loses all extension facilities. Only one extension can be connected to each exchange line.

GENERAL INFORMATION

Switchboard

One or more positions are provided, depending upon the size of the PABX. They are cordless, desk-type, floor-standing, contemporary in appearance, with compact styling, and adaptable for use in any shape of room since they do not have to be assembled in line as a suite. Maximum use is made of automatic techniques to reduce the amount of manual operating work.

The switchboard has a small desk with a sloping face panel on which are press-buttons, switches and either display lights or a translucent screen. Each approved contractor may produce his own version of the manual switchboard and although these conform to certain basic requirements, they may differ considerably in appearance. When making an outgoing call from the PABX switchboard the operator is automatically connected to a free exchange line by pressing a button. The call is set up through the automatic equipment and when established is disconnected from the switchboard. The PABX is designed to meet the needs of offices where extensions are allowed to dial their own exchange calls, and it is not as easy for the operator to obtain them as it is on a PABX 3: the operator cannot connect an outgoing call, on behalf of an extension, until the extension handset has been replaced, and the extension therefore has to be rung back.

Presentation of calls to the switchboard

All calls to the switchboard are presented approximately in their order of arrival to

operators. Under one system there are separate lights to indicate an exchange call, a call from an extension, a call from another PBX, etc, and if more than one light shines operators can select which type of call to answer. In another system all incoming calls share the same light and the type of incoming call is indicated by another light after the operator has answered the call.

Numbering arrangements and dialling codes.

These are similar to those used on the PABX 3 except that 8 is usually reserved for night service.

Alarms

These are similar to those on the PABX 3.

Tones

Standard dialling, ringing, engaged and number unobtainable tones are used and, in addition, there is a ticking tone which indicates that the operator has come in on an engaged line. Exceptionally, a distinctive ringing tone may be used for internal calls if required.

Accommodation

The same considerations apply to PABX 4 accommodation as for the PABX 3. There is some saving in the size of the room needed for a multi-position switchboard because the cordless boards can take up to 30 per cent less floor space than that needed for a similar number of PABX 3 switchboard positions, but the automatic equipment will usually need more room.

Optional Facilities

As with the other types of PABX there are various optional facilities that can be readily provided. Some of these are

Conference telephone calls between up to ten extensions, or between one exchange line and up to five extensions.

Key callers to enable selected extensions to

call up to twenty pre-determined extensions by pressing the appropriate key.

Staff location systems under the control of the operator.

Call queueing for calls to busy extensions.
Reception of incoming exchange line calls direct on to selected extensions. Remote controlled dictation systems.

Rental and connexion charges are shown in the preface sheet

The Telephone Manager will be glad to advise on the availability of standard optional facilities, the possibility of providing non-standard special facilities, and on all other questions about PABXs of any type or size.