AMBASSADOR

Electronic Switching System

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ELECTRONIC
SWITCHING
SYSTEM

These guide notes have been designed to assist Field Staff with the installation and maintenance of AMBASSADOR ESS. To gain maximum benefit from them they should be read completely, by both Installation and Maintenance staff.

Contents

The E.S.S can be used on any of the following lines:—

DEL exclusive only
PBX extensions (with or without recall)
PBX extensions 'C' wire signalling
Private circuits

Where the ESS is connected to exchange line(s) external extensions may be provided by using an External Extension Adaptor for each external extension. The external extension uses any standard telephone fitted with an earth recall button which is used for "Hold and Transfer". The extension has most of the facilities of an ESS extension, see Para 6.2.

Where the ESS is connected to a PBX Extension which uses earth recall, external extensions may be fitted but the telephone should not have a recall button. These external extensions will have limited facilities, see Para 6.2.

The types of telephone available are:—

Telephone ESS 8520 (S.C.) — self contained loop/disconnect signalling.
Telephone ESS 8530 (M.F.) — multi frequency signalling.

Also available will be:—

Telephone ESS 8521 (S.C) **+** 10 address repertory dialling.
Telephone ESS 8522 (S.C) **+** on hook dialling (OHD).
Telephone ESS 8523 (S.C) **+** OHD **+** 10 address rep. dialling.
Telephone ESS 8531 (M.F) **+** 10 address rep. dialling
Telephone ESS 8532 (M.F) 1**+** OHD
Telephone ESS 8533 (M.F) **+** OHD **+** 10 address rep. dialling.
Telephones ESS 8531 and 8533 use Battery Secondary No. 33.
Telephones ESS 8521 and 8523 use Battery Dry No. 102

The type of telephone used will depend on the type of Exchange or PBX to which the system is connected.

2. Cabling

The ESS uses 4 wire connexions between the telephones, Private Circuit or External Extension Adaptors and the CCU. The 4 wires are used as 2 speech wires and 2 data wires. It has been found that quad formation 4 wire cables cause overhearing between the speech and data pairs. Because of this Cable Equipment 2501F should be used for all cabling, but if this is not available 6 wire cable, Cable Equipment 2503F may be used. These cables are of "twisted pair" formation and minimise the overhearing problem.

All cable terminations are of the Insulation Displacement Termination type made using an Inserter Wire No2A.

Before terminating in the C.C.U the cables should be laid in the cable guide formed on the right hand side of the unit (when mounted vertically). The hinged covers should be opened and the cable laid in place. The covers **MUST** then be closed and "snapped" shut before terminating takes place. This is important as when closed the hinged covers form the support for the edge of the printed circuit board that carries the terminal blocks.
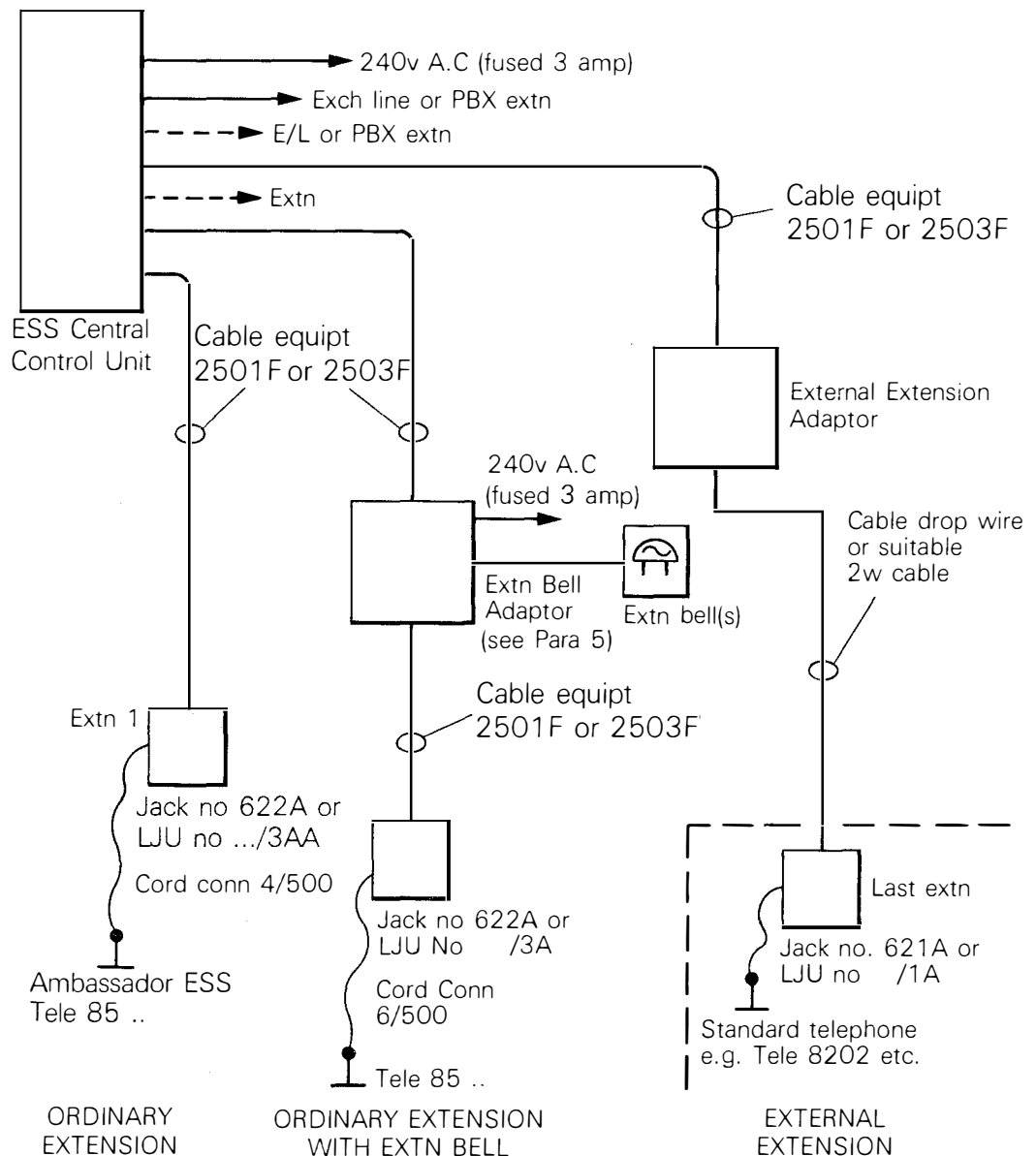

Fig.3. Typical layout and cabling for an ESS

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A maximum loop resistance of 250Ω is permitted between an ESS extension and the CCU. Using 0.5 mm conductors this is the equivalent of a 1.5 km route length of cable. The overall loop resistance of the furthest extension to the Exchange must not exceed NORMAL DEL signalling limits.

3. Central Control Unit (CCU)

General – The 1 + 3 system connects to a CCU, Equipment ESS SA 10251, which measures 300 mm x 190 mm x 75 mm and the 2 + 4 system uses a CCU, Equipment ESS SA 10252, which measures 480 mm x 190 mm x 75 mm. Both are designed to be wall mounted, with 3 fixing holes in the base-plates.

Both sizes of CCU may be mounted horizontally or vertically with the integral power unit uppermost. They must **not** be mounted with the power at the bottom.

Cover Removal – To remove the outer cover of the CCU first prise out the central logo button using a Screwdriver No 1. This uncovers the cover fixing screw. When refitting the cover, note that it is designed to fit in one position only. It is important that the cover is not forced into position as this will damage the interior stiffening ribs. Note that the logo button may be positioned to allow the 'T' to be upright if the CCU is mounted horizontally.

The inner cover of the CCU is held by a single central hexagonal nut. Under all normal circumstances there is no need to remove this cover and it should be left in place. If however it becomes necessary to remove the inner cover, the mains supply **MUST** be switched **OFF** before the cover is removed.
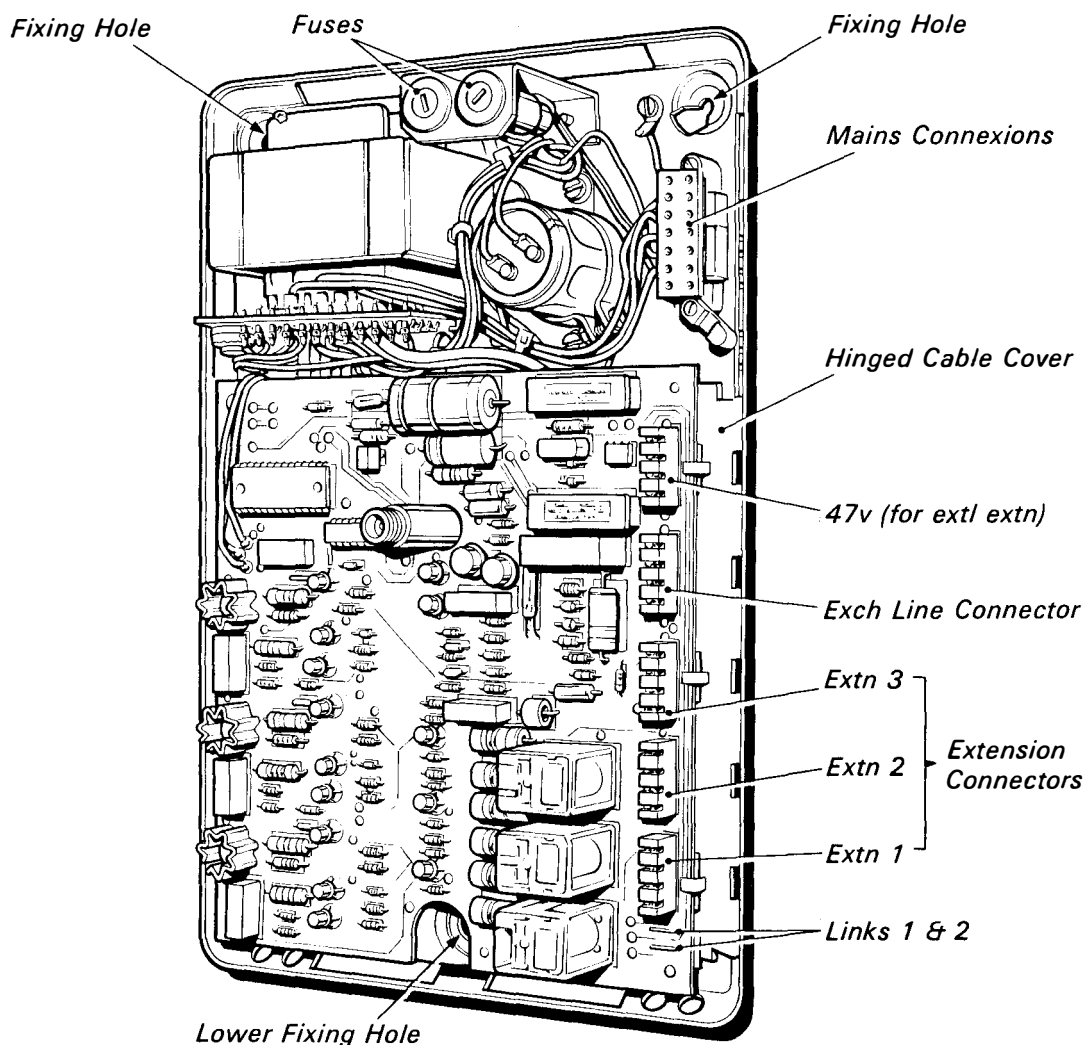

Fig.4. Equipment ESS SA 10251 (1+3) (Both Covers Removed)

Fixing Hole   Fuses   Fixing Hole

Mains Connexions

Links 2 & 3

47v (for extl extn)

Exch line Connectors

Extn 4

Extn 3

Extension
Connectors

Extn 2

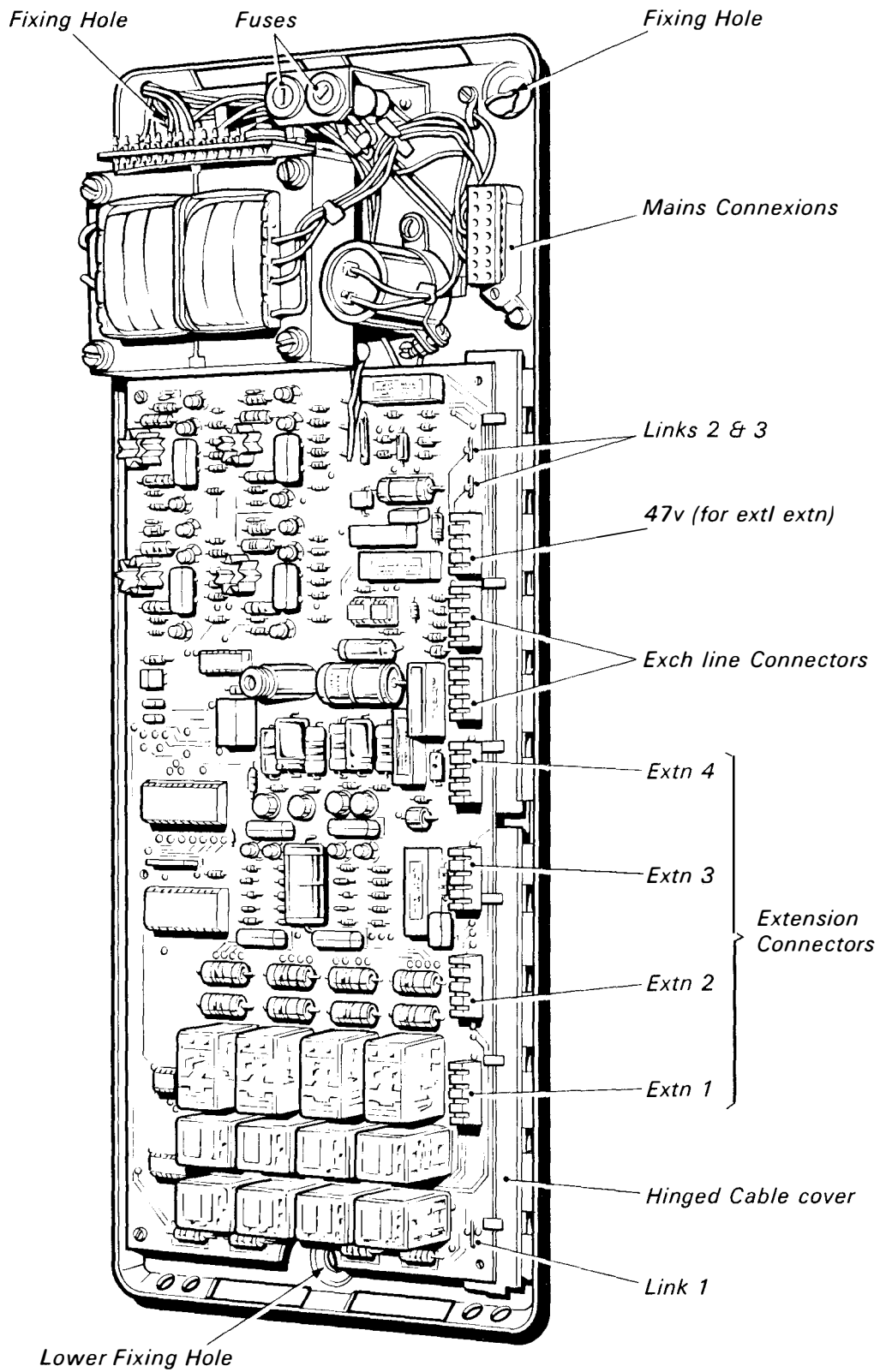Extn 1

Hinged Cable cover

Link 1

Lower Fixing Hole

Fig 5. Equipment ESS SA 10252 (2 + 4) (Both Covers Removed)

Note – The mains supply **MUST** be switched **OFF** before removing the inner cover of a CCU, but in all normal circumstances it should not be necessary to remove this cover which is held by a single hexagonal nut.

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Power Unit – The power cable from the mains socket outlet should be no more than 3 metres in length.

The CCU power unit has two bayonet fitting fuse holders, spare cartridge fuses are held in a carrier formed in the inner case of the unit. In the 1 **+** 3 CCU fuse FS1 is a 500 mA anti-surge mains fuse and FS2 is a 1 amp fuse in the dc output.
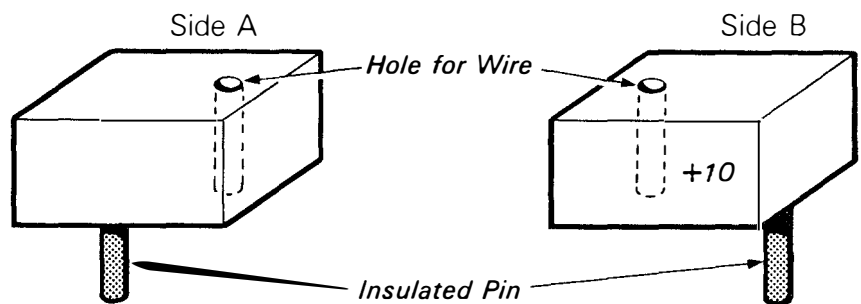
In the 2 **+** 4CCU fuse FS1 is a 1 amp anti-surge fuse and FS2 is a 2 amp fuse.

Power Unit Voltage Adjustment – The mains connexions to the power unit section of the CCU should be adjusted to suit the mains voltage. The adjustment is made in 10V increments from 220V to 250V **but should be set at 240v.**

The method of adjustment is by two movable links which are held in place by the terminals screws.

The links are

i. plus 10V adjustment

ii. 220-240V adjustment

Side A   Side B

Hole for Wire

+10

Insulated Pin

Side A   Side B

240   220

Connecting Pins   Insulated Pin   Connecting Pins

E   N   Line

240

Mains Connector with links
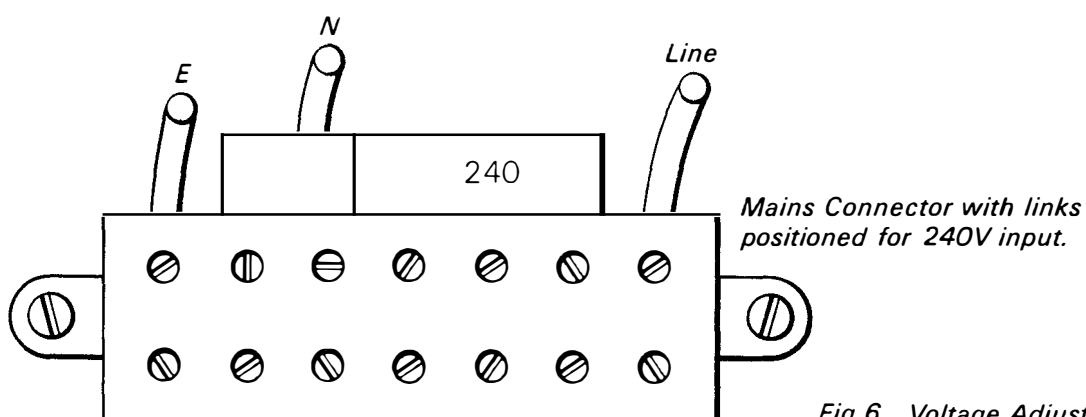positioned for 240V input.
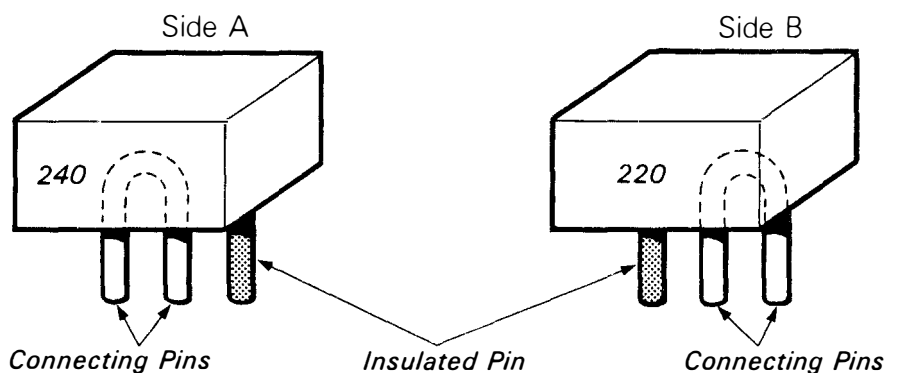
Fig 6. Voltage Adjusting Links

4. The Telephone

The telephone has the same styling as the Ambassador telephone but has a wider body to accommodate an extra row of press buttons, each of which has an associated light emitting diode (LED). These buttons are used to obtain various facilities which are described later.

"Divertee" lamp (Green)

Facility Buttons

"Message Waiting" Lamp (Red)

"Calls Diverted" Lamp (Green)

Personal Directory under "flip-up" panel with number label

Fig 7. Tele 8530

Button Designations

1 + 3 SYSTEM

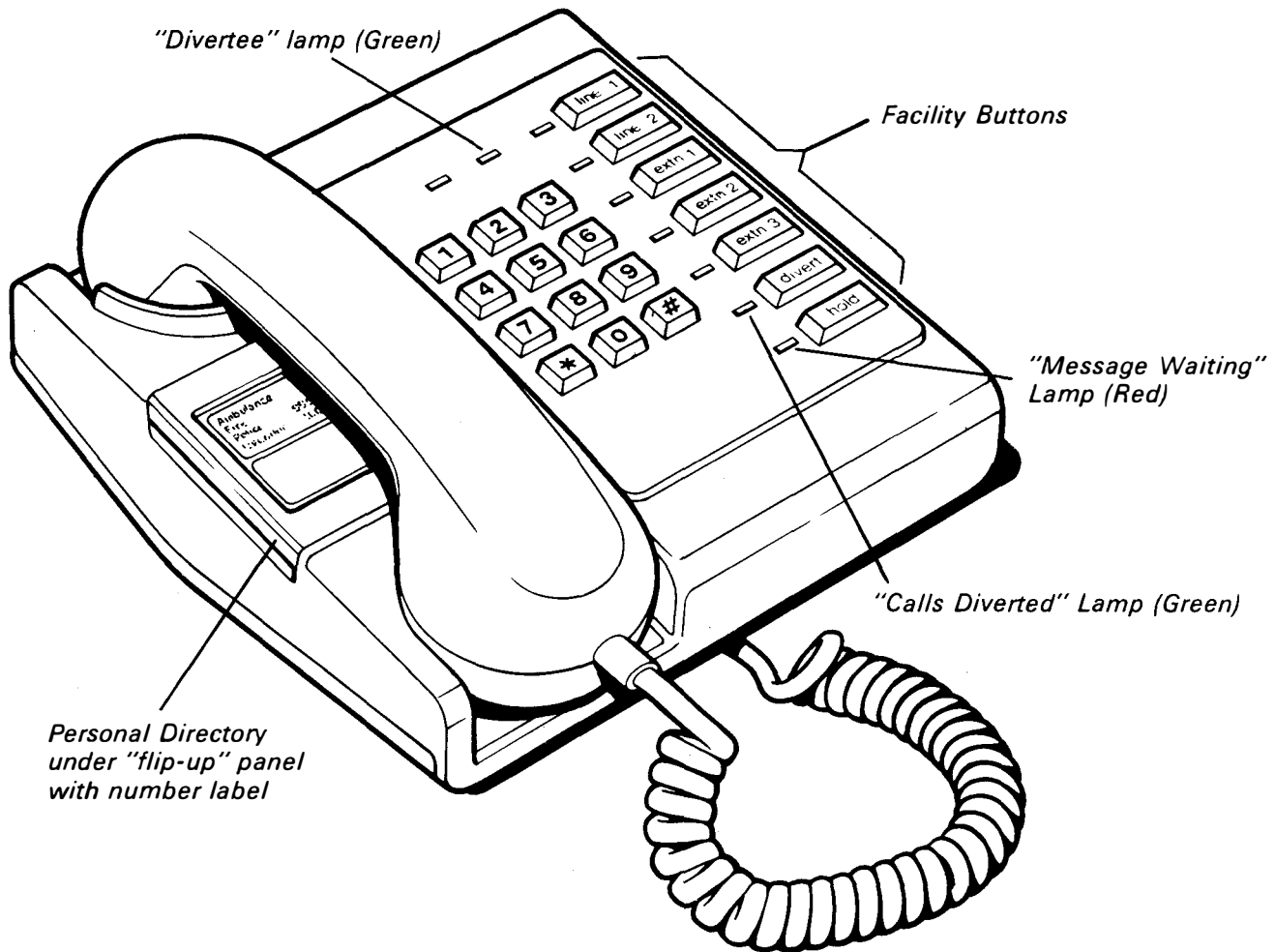| FACILITY BUTTON	Extn 1	Extn 2	Extn 3	
1	LINE	LINE	LINE	
2	SPARE	SPARE	SPARE	*Note the facility buttons*
3	EXTN 2	EXTN 3	EXTN 1	*number downwards*
4	EXTN 3	EXTN 1	EXTN 2	
5	SPARE	SPARE	SPARE	
6	DIVERT	DIVERT	DIVERT	
7	HOLD	HOLD	HOLD	

2 + 4 SYSTEM

FACILITY BUTTON	Extn 1	Extn 2	Extn 3	Extn 4
1	LINE 1	LINE 1	LINE 1	LINE 1
2	LINE 2	LINE 2	LINE 2	LINE 2
3	EXTN 2	EXTN 3	EXTN 4	EXTN 1
4	EXTN 3	EXTN 4	EXTN 1	EXTN 2
5	EXTN 4	EXTN 1	EXTN 2	EXTN 3
6	DIVERT	DIVERT	DIVERT	DIVERT
7	HOLD	HOLD	HOLD	HOLD

Spare buttons on ESS telephones should be "locked" by moving the centre slide to the left. Lift off the clear plastic cover and label, adjust the slide, check that the button is locked and replace the cover.
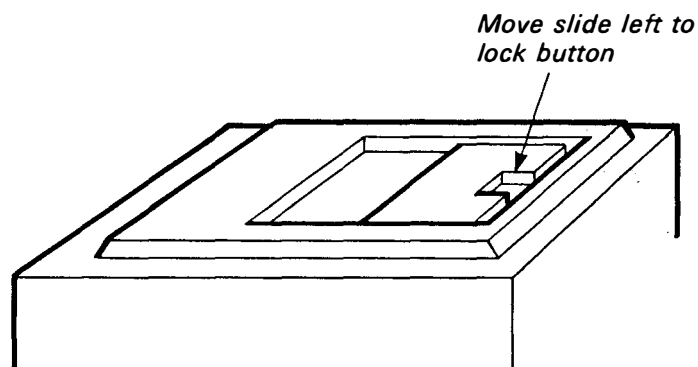
Move slide left to lock button

Fig 8. Locking Spare Buttons

The telephone contains both a tone-caller and a buzzer. Incoming calls, both exchange line and intercomm calls, normally only operate the buzzer.

The tone-caller operates to an incoming exchange line call only under power fail conditions.

If the customer wishes to have the tone-caller sounding for all incoming calls at one or more ESS telephones those extensions must be connected via Extension Bell Adaptors. See fig 3. and para 5.

The base of the telephone (fig 9) allows for the line cord to enter from either the rear or the left hand side of the telephone. Both the line cord and the handset cord are plug ended and plug into sockets contained under a lid which also covers a battery container.
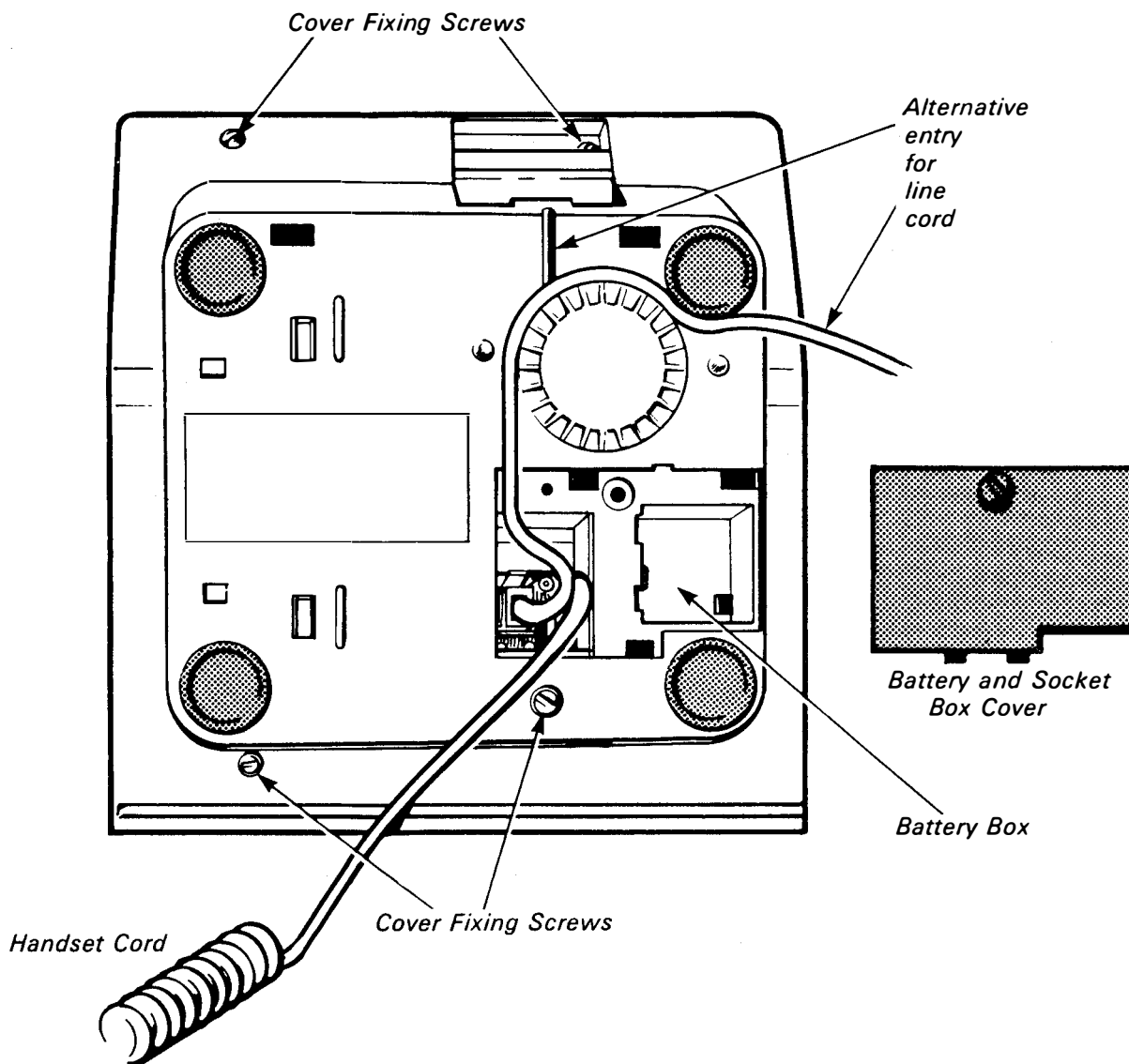
Cover Fixing Screws

Alternative entry for line cord

Battery and Socket Box Cover

Battery Box

Handset Cord

Cover Fixing Screws

Fig 9. Base of ESS Telephone

4.1 Handset No 16 –

The telephone uses the Handset No 16B, which is distinguishable from the Handset 16A by its "Pepper Pot" earpiece and a small recess under the earpiece, see Fig 10.

Recess
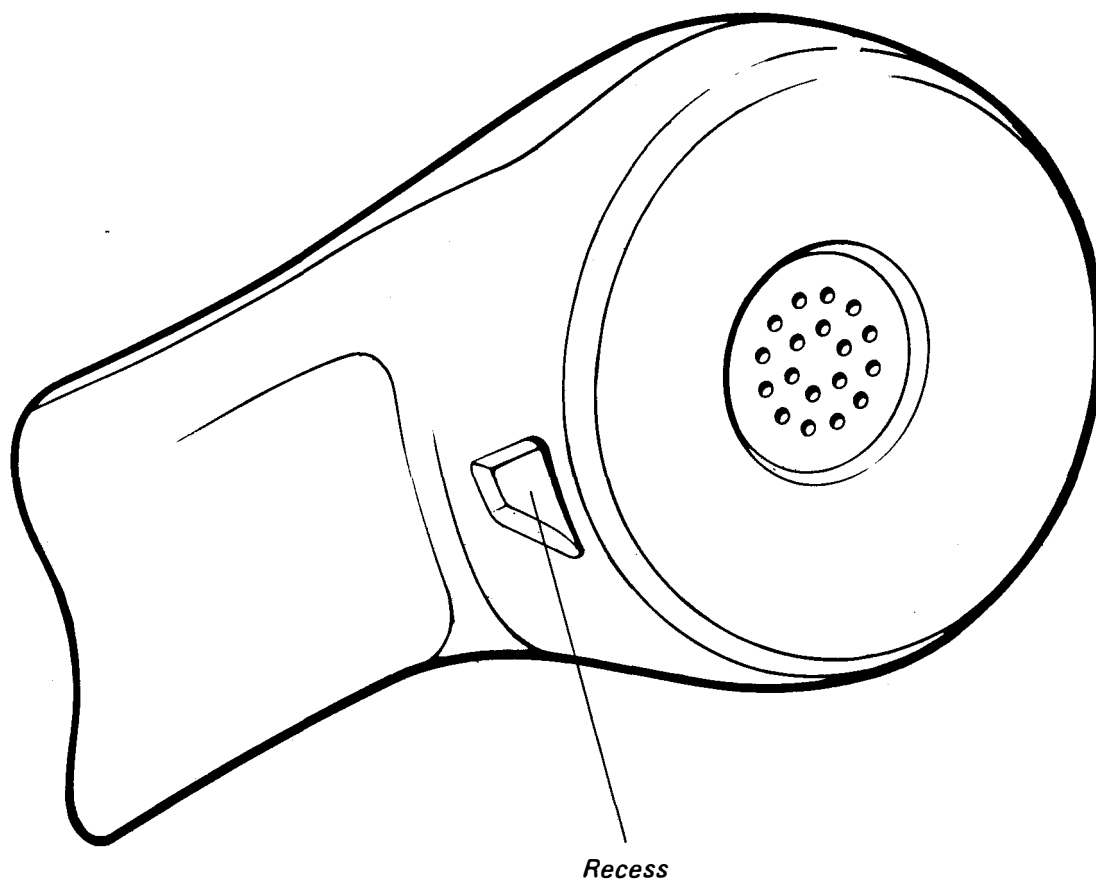
Fig 10. Earpiece of Handset No. 16B

Also available are 3 facility handsets, these are of similar appearance to the Handset No 16B but have the components required for the facility mounted within the earpiece, the facilities are:–

An amplified handset with volume control at the rear of the earpiece. Handset No 16C.
A neon indicator at the rear of the earpiece to give a visual indication of an incoming call. Handset No 16D.
A locking/non-locking on-off switch used as a transmitter cut-out. Handset No 16E.

These handsets are shown in Fig 11

Note – Handset No 16D is **not** suitable for use with AMBASSADOR ESS unless an Extension Bell Adaptor is fitted.

To Terminal Block
Blue   Green

To Cord Conn
4/503
Blue   Green

HANDSET 16C-(AMP)

Volume Control

White to Cord Conn
4/503

Red to T16

To Terminal Block
Orange Black

To Cord Conn

Orange   Black

Neon
Indicator

Orange to
White on Mic

Red to
Blue on Mic

Locking/Non
Locking
ON-OFF
Switch

Green Red
To Cord Conn
6/503

HANDSET 16D - (NEON)

Green Red
To Cord Conn
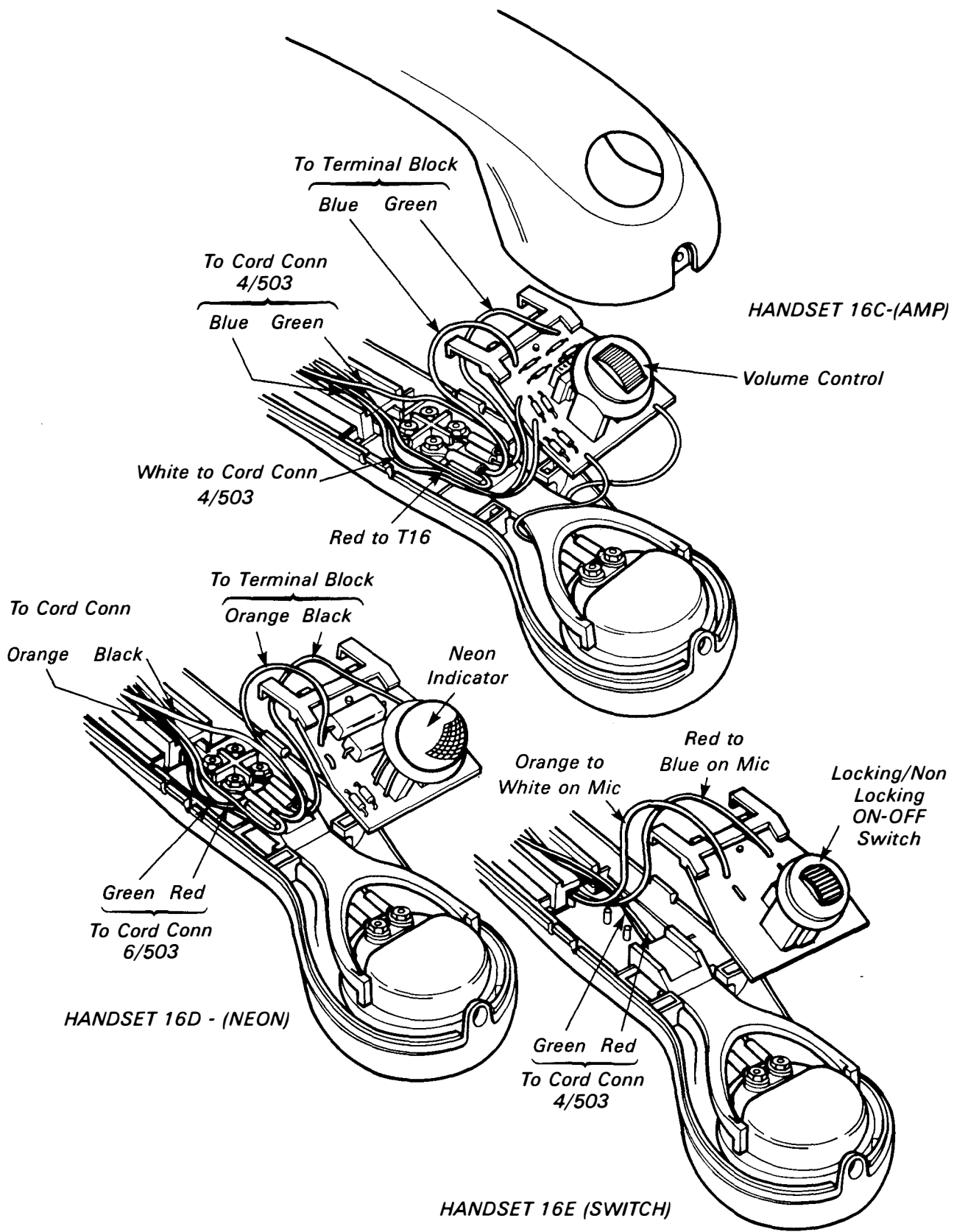4/503

HANDSET 16E (SWITCH)

Fig 11.   Handsets Nos 16C, D and E

4.2 Microphone and Receiver Insets – Access to the microphone and receiver insets or other components is obtained by removing the fixing screw at the receiver end of the handset and pulling the two halves apart, starting at the receiver end. Do **not** use a screwdriver or other blade to prise the sections apart.

To reassemble the handset, start at the transmitter end, engage the two "pips", one either side of the cord entry, into their associated holes in the other half. Squeeze the two sections together. Replace the fixing screw.

The transmitter inset is a "linear microphone" type, Microphone Inset No 21A. "Carbon granule" type transmitter insets, Trans Inset No 16, **must not be used** on Ambassador ESS type telephones or on telephones used as External Extensions on an EPS installation. When ESS is fitted as an extension off a 2/- PMBX all extensions will need to be fitted with Mic Insets No 21A

"Pips" locate here

S3693/1

Fig 12
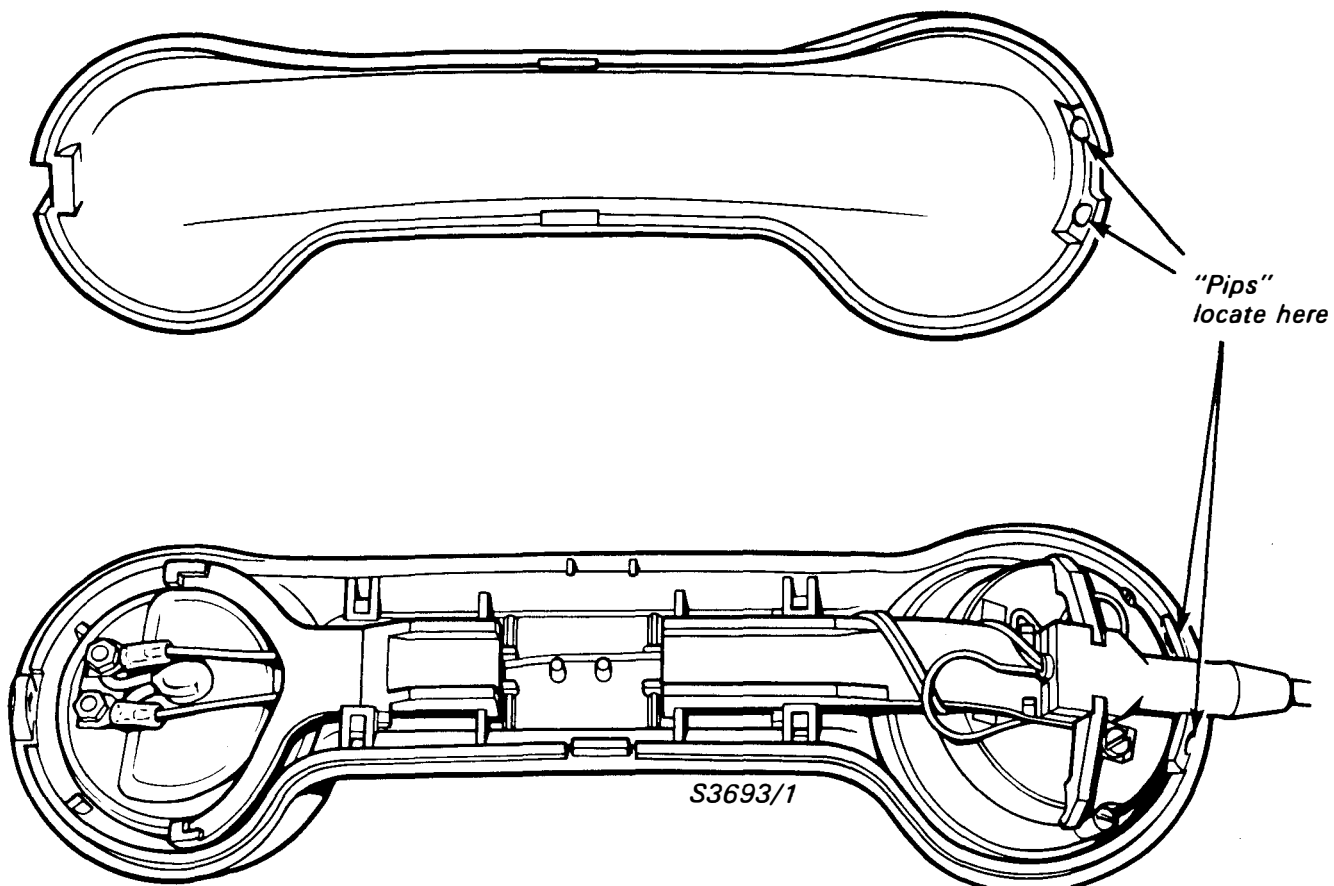
Microphone and receiver insets are removed by pressing downwards on the centre of the retaining clips and sliding the clip towards the centre of the handset as in Fig 13. Before removing an inset note how the leads are arranged to lie in the central groove. When replacing insets make sure that the leads are not trapped and that the clips are correctly positioned.

Note position of handset cord grommet

To remove insets press here and slide clip towards centre of handset
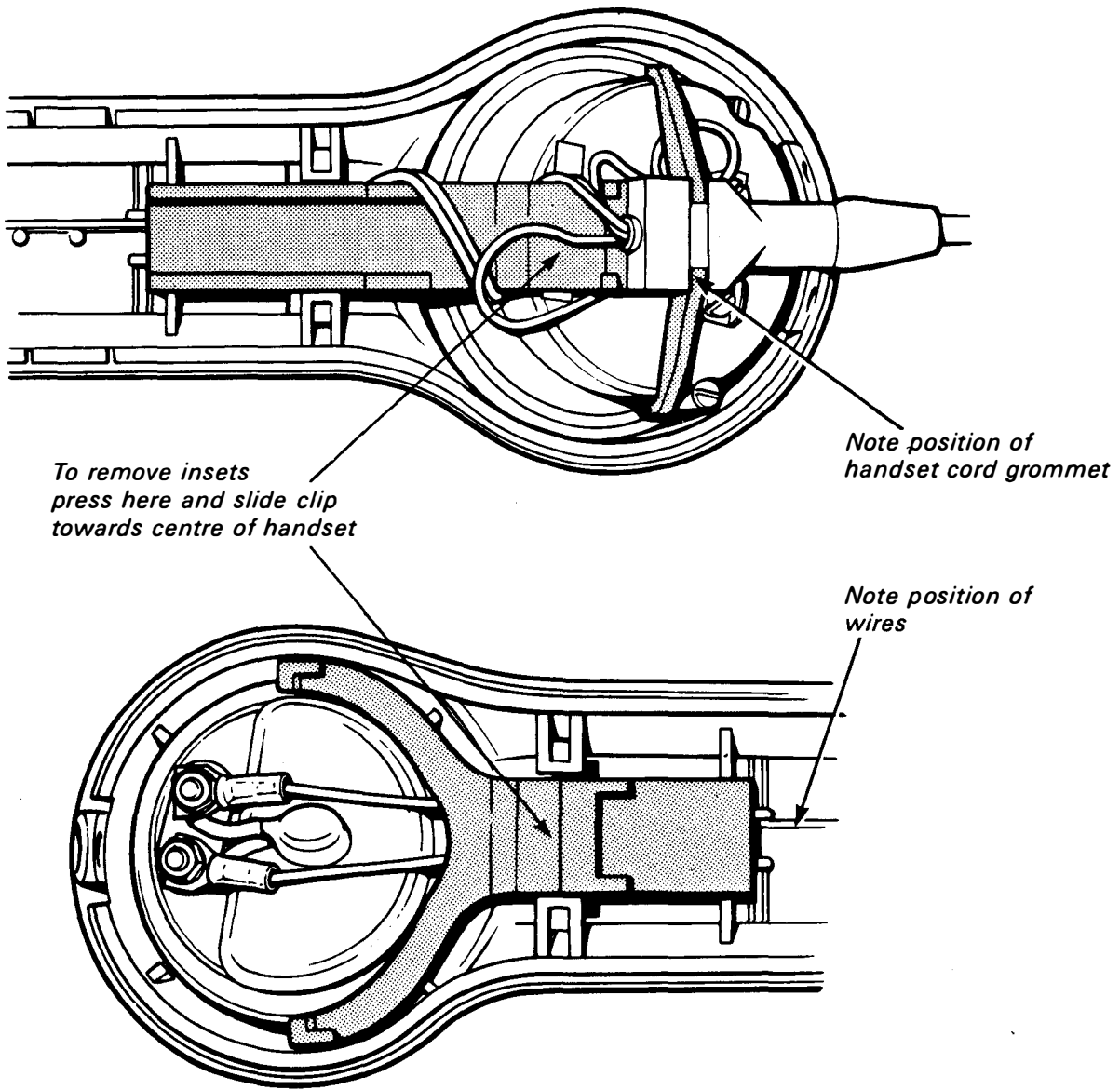
Note position of wires

Fig 13 Removal of Transmitter and Receiver

The cord grommet must lie in the position shown in Fig 13, that is with the waist of the grommet located in the projections of the transmitter retaining clip.

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5. Extension Bells

When providing an extension bell to be rung from an Extension Bell Adaptor, link "A" in the ESS telephone at the extension must be disconnected. Link "A" is on the printed circuit board alongside the Plan Module. Take care not to disturb any ribbon cable connexions or the Plan Module itself. The link is a "safety pin" type as shown in figs 15a and 15b.

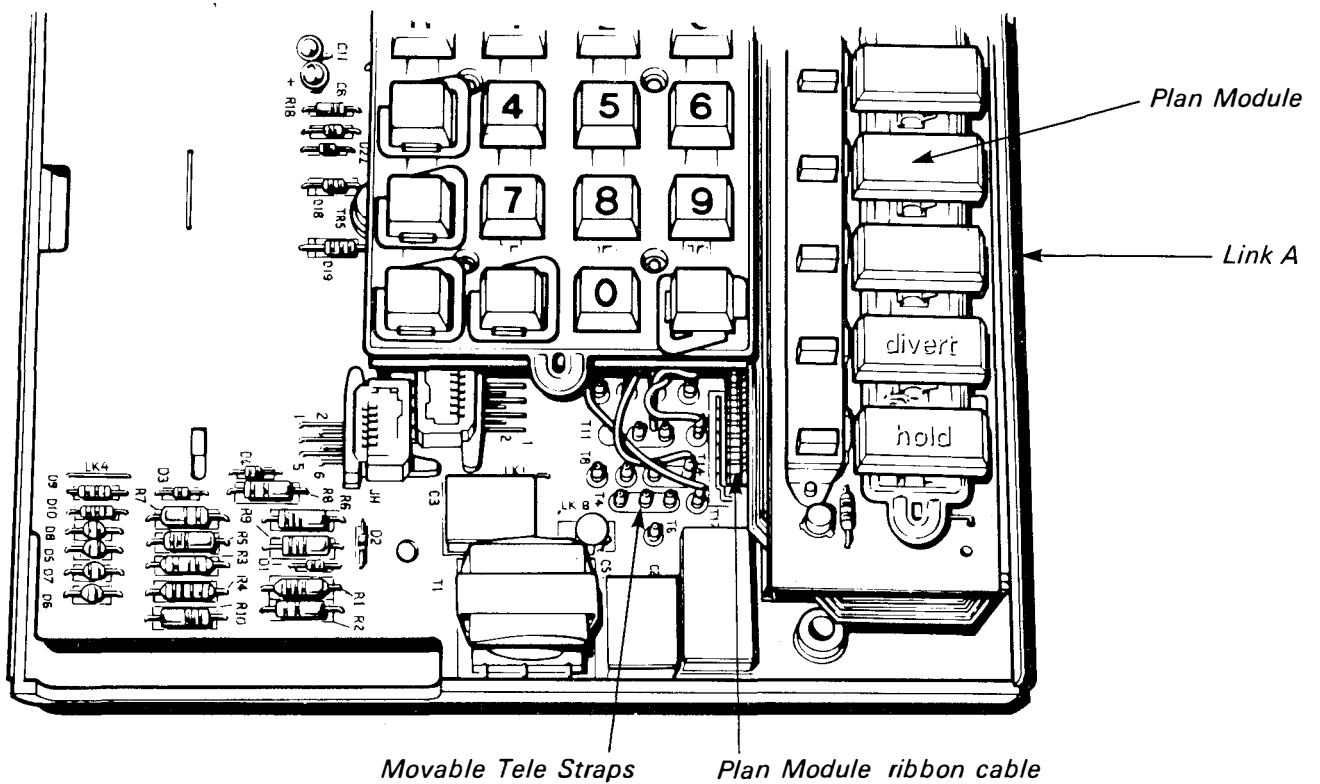It is necessary to change the tele cord to be a Cord Conn 6/500.
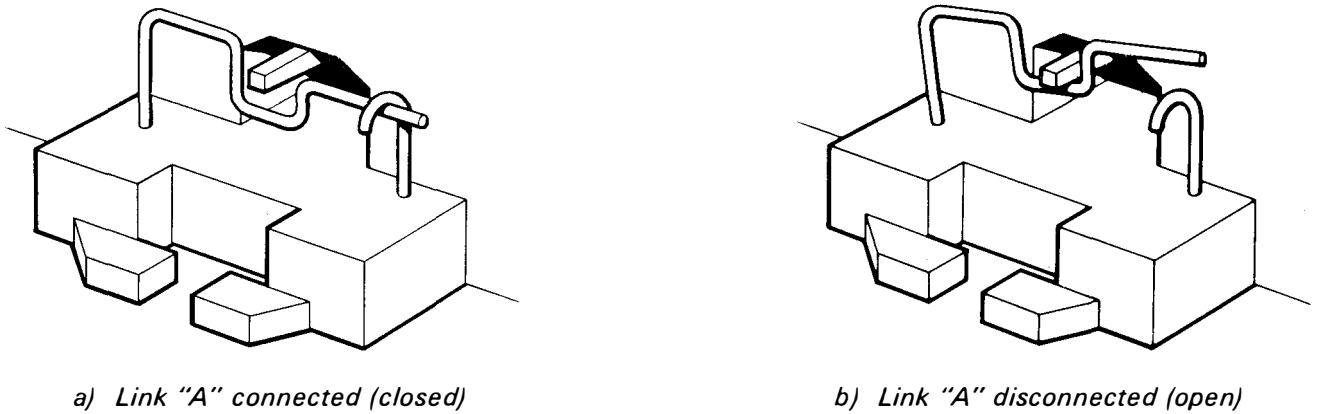
Fig 14. Position of Link "A"

a) Link "A" connected (closed)   b) Link "A" disconnected (open)

Fig 15 Link "A"

6. Facilities

The facilities available at ESS extensions and external extensions are described separately.

The system generates its own tones, these are used on internal calls

    i.   System Ringtone, a high pitched 440 Hz tone, with regular 0.262 secs on 0.262 secs off cadence.

    ii.   System Ringing – on intercom calls, buzzers are operated at the same cadence as system ringtone.

    iii.   System Busytone a high pitched tone 440 Hz with regular 0.131 secs on, 0.131 secs off cadence.

    iv.   "Pip" or "Click" tone – used with the Divert facility a single "pip" of tone repeated at approximately 5 sec intervals.

6.1 ESS Extensions

Outgoing Exchange Line Service – By lifting the handset and depressing the Line 1 (or Line 2 button), the exchange line is seized and both the LED associated with the exchange line and the LED associated with that extension will glow at all ESS extensions. Exchange dial tone will be heard and the required number may then be keyed.

Incoming Exchange Line Service – An incoming call is signalled at all ESS extensions by the LED against the exchange line button flashing. At those extensions which are programmed to receive an incoming ring, the call will also be signalled by the operation of the buzzer.

To answer the incoming call the handset is lifted and the exchange line button, indicated by the flashing LED, is depressed. The exchange line LED will revert to a steady glow at all extensions The LED against the extension button of the station using the exchange line will glow at all extensions to indicate that station is busy.

An ESS extension may be programmed to cut-off the buzzer on incoming exchange line calls. To provide this facility:–

    i.   Leave the handset "on-hook".

    ii.   Press and hold down the "Hold" button.

    iii.   Press and release the exchange line button.

    iv.   Release the "Hold" button.

Note – On a 2 **+** 4 system this procedure will have to be repeated on both lines if required.

To switch the buzzer on repeat the procedure described above, repeating the procedure will change the state of the buzzer.

To check whether the buzzer is on or off, with the handset on-hook press the "Hold" button. If the LED beside the exchange line button glows the buzzer is **on,** if the LED does not glow the buzzer is **off.**

This facility does not stop the buzzer sounding on intercom calls.

If all extensions that are programmed to receive an incoming call are either "off-hook" or in divert the tone callers will not sound on incoming calls. An incoming exchange line call will then be signalled by the normal lamp signal on all telephones and a "pip tone" which is injected onto the intercom speech path(s).

Intercom Calls – To make an intercom call first check that the LED associated with the required extension is not glowing. Lift the handset and press and release the required extension button, system ringtone will be heard and the called buzzer will operate at ringing cadence. The call is answered by the called extension lifting the handset. The LEDs against each extension button will glow while the intercom call is in progress. If an intercom call is attempted when the required extension is engaged the caller will receive system busytone. On a 1 + 3 system there is only one internal speech link and intercom calls are not secret, the other extension can join the intercom call by lifting his handset. On a 2 + 4 system there are 2 speech links, 2 simultaneous intercom calls can be set up at one time, both being secret from each other. Conference facilities are not provided.

Hold – Exchange line calls may be held by pressing the "HOLD" button. An enquiry call may then be made to another extension or in the case of the 2 + 4 system on the other exchange line. In all cases the enquiry call is secret from the held exchange line.

While a call is being held the lamp associated with the exchange line button will flash.

To return to the held line, press and release the exchange line button.

Transfer – An exchange line call may be transferred from one extension to another. The call is held as described in the previous paragraph and an enquiry call set up to the required extension. When the called extension answers the call may be transferred either by:–

      a   the holding extension replacing his receiver

      or

      b   the called extension pressing the appropriate exchange line button.

Divert – Internal calls may be diverted from one extension (the diverting extension) to another (the nominated extension). To programme the facility at the extension to be the diverting extension:–

      i.   Leave the handset "on-hook"

      ii.   Press and **hold down** both the "HOLD" and the "DIVERT" buttons.

      iii.   Press and release the extension button to which calls are to be diverted (the nominated extension).

      iv   Release all operated buttons.

The equipment is now programmed but to bring the facility into use it is necessary to once again depress and release the "DIVERT" button.

Subsequent operations of the "DIVERT" button will switch off or call-in the facility.

To cancel the "Divert" facility either:—

1 Reprogramme the facility to a spare extension (if any).

2 Temporarily switch off the mains power to the CCU.

While in "Divert":—

i. The diverting extension can make outgoing exchange or intercom calls but all incoming calls are signalled at the nominated extension.

ii. A green "Calls Diverted" lamp (LED) beside the "DIVERT" button glows on the diverting telephone and also a green lamp above the keypad on the nominated extension telephone glows.

iii. The nominated extension can call the diverting extension on intercom. The called buzzer only sounds while the button is pressed. While the call remains unanswered the red lamp (LED) beside the "HOLD" button will continue to glow until the handset is lifted. This informs the diverting extension that the nominated extension is calling or has called.

"Buzz" during "Divert":-

Whilst "On-Hook" the Diverting extension can signal the nominated extension without completing an intercom call, by depressing the required extension button to operate the buzzer. This can be used as a pre-arranged signal between diverting and nominated extensions.

Note — "Divert" cannot be set up, nor can calls be diverted if the Nominated extension is unplugged.

6.2 External Extensions

External extension can be provided, using a standard telephone with recall button connected by 2-wire cable to an External Extension Adaptor. (See Fig 3). The adaptor is fitted near the CCU and contains a press switch and integral lamp. With the switch operated the lamp glows to indicate that the bell at the external extension will ring on receipt of incoming exchange call. A second operation of the switch will switch-off the lamp and the bell will not ring. Alternate operations of the switch will connect or disconnect the bell and lamp.

Mounted on the circuit board contained within the Extension Adaptor is a "link" type switch SW2. This is similar to "Link A" in the telephone as shown in figure 15 To ensure correct operation of the "call exchange" facility this switch **must be OPEN.**

The facilities of an External Extension are:—

Exchange line calls

i. Incoming — subject to the bell being switched, incoming calls ring the bell and are answered by lifting the handset.

ii. Outgoing — outgoing service is obtained by lifting the handset and dialling '9'. If an exchange line is free, exchange dial tone will be heard. If a line is not available, "no tone" will be received.

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Intercom Calls — To make internal calls, lift the handset, dial '0' followed by the number of the required extension.

When a single external extension is provided it should be connected as the last extension. On intercom calls the digit "0" is dialled followed by the number of the required extension. When an external extension needs to be connected to other than the last extension, for example when there are two external extensions, it will have an exclusive dialling code for intercom calls. The dialling codes are shown in the following table.

1 + 3 System

Extl Extn No	Extn Reqd No	Digits Dialled
3	1	01
	2	02
2	1	02
	3	01
1	2	01
	3	02

2 + 4 System

Extl Extn No	Extn Reqd No	Digits Dialled
4	1	01
	2	02
	3	03
3	1	02
	2	03
	4	01
2	1	03
	3	01
	4	02
1	2	01
	3	02
	4	03

Hold — To hold an Exchange line call press the recall button. An enquiry call can be made while a call is held by dialling '0' followed by the extension number required. To return to the held call press the recall button again.

Transfer — The call is held and an enquiry call made as describved above. When the called extension answers and accepts the call, replace the handset.

Note — The "Hold" and "Transfer" facility are not available if the ESS is connected to a PBX with earth recall.

Divert — An external extension can be made a nominated extension to receive diverted calls but cannot be a diverting extension.

6.3 Inter PBX Circuit

This is fitted in place of an extension and may be called by depressing the appropriate extension button. The Inter PBX Adaptor operates in a similar manner to the External Extension Adaptor.

6.4 Private Circuit

This is fitted in place of an exchange line.

6.5 Bell Adaptor (Requires Mains Socket Outlet)

This is associated with an extension telephone if it is required that incoming calls are signalled by the tone caller and not the buzzer. The bell adaptor also permits the fitting of extension bells.

6.6 Mains Failure

Under power fail conditions **outgoing exchange line** calls may be made from ESS extensions but no lamp signals will be given. All extns on a 1 + 3 system will be connected to the exchange line, an **incoming call** will operate the tone caller at all extensions.

On a 2 + 4 system, line 1 will be connected to extensions 1 and 3, **incoming calls** will operate the tone callers at these extensions. Line 2 will be connected to extensions 2 and 4 and **incoming calls** will operate the tone callers at these extensions.

Intercom calls cannot be originated on either system.

When power is restored, calls in progress will be maintained. Any programmed "DIVERT" and "BUZZERS OFF" will be cancelled by a failure of mains power. These must be reprogrammed when the power is restored.

7. Maintenance

7.1 Test Conditions

The line(s) test normal DEL conditions, but will test "low-loop" if a megger test is used.

Testing from an ESS telephone towards the CCU, the speech pair and data pair both test 45vdc. The speech and data pairs must not be allowed to come into contact or reversed. The data pair must be correctly connected, the system will not operate with a reversal of the data pair.

7.2 Central Control Unit

There are no adjustable or changeable components in the CCU other than the power unit fuses. Spare fuses are held in a carrier formed in the inner cover of the CCU. In the 1 + 3 CCU fuse FS1 is a 500 mA anti-surge mains fuse, FS2 is a 1 amp fuse in the dc output. In the 2 + 4 CCU, fuse FS1 is a 1 amp anti-surge fuse, FS2 is a 2 amp fuse. Turn off the mains supply before changing fuses.

7.3 Faulting

There are three areas where faulting may be carried out, these are:—

Central Control Unit — Faulting on the CCU should be restricted to checking all cable and wire terminations, testing the power input and voltages and checking fuses. This testing does not require the inner cover to be removed.

Extension Telephones — Faulting on ESS 85XX telephones should be restricted to changing transmitter or receiver insets, cords or button tops. For faults other than on these items the complete telephone should be changed.

Remember that when the telephone is changed the labels must also be changed and spare facility buttons must be locked.

Noise — Some noise due to data may be heard at ESS extensions during quiet periods on calls. This noise will be more noticeable if extensions are not cabled with Cable Equipment 2501F or 2503. The noise may be checked by disconnecting the extension cabling and monitoring the speech pair at the CCU termination of that extension, using a Tele 280 etc. The noise should be no more noticeable when checked at the extension telephone, with the cable reconnected.

Handling Precautions — No special precautions are needed when handling ESS components but excessive handling of printed circuit boards should be avoided. At all times if the PCB is to be moved it should be held by the edge.

Some components are fitted with heat sinks and run hot. The heat sinks should not be disturbed as this may cause thermal overload of the components. One example of this is mounted on the ESS telephone PCB under the lower edge of the plan module. This may be uncomfortably hot to the touch and care should be taken to avoid this when the cover is removed.

On External Extensions, telephone faults should be treated following the normal procedures for standard telephones. Faults proved on to the External Extension Adaptor will require the Adaptor to be changed.

Cabling — All cabling should be checked for continuity. Special care should be taken to ensure there is no contact between the speech pair and data pair of the extension circuit. Such a contact could cause a failure of the complete system.

The data pair is polarised, a reversal of the data pair will cause a failure of that extension. A short circuit of the data pair may cause overloading of the power supply.
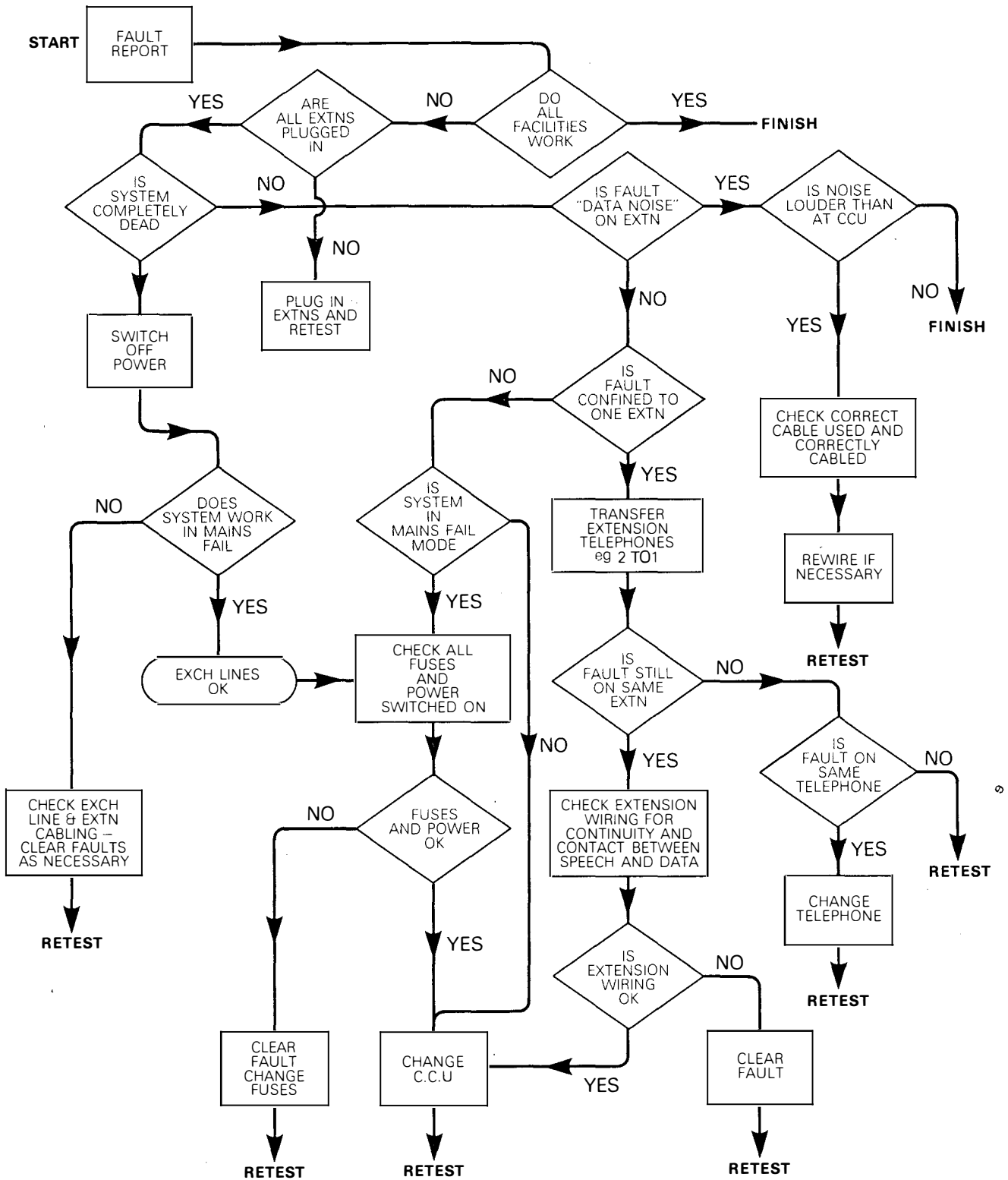
START | FAULT REPORT

ARE ALL EXTNS PLUGGED IN

DO ALL FACILITIES WORK — YES → FINISH

NO

YES

IS SYSTEM COMPLETELY DEAD

NO

IS FAULT "DATA NOISE" ON EXTN — YES → IS NOISE LOUDER THAN AT CCU

NO → FINISH

PLUG IN EXTNS AND RETEST

SWITCH OFF POWER

NO

IS FAULT CONFINED TO ONE EXTN

YES

CHECK CORRECT CABLE USED AND CORRECTLY CABLED

DOES SYSTEM WORK IN MAINS FAIL

IS SYSTEM IN MAINS FAIL MODE

TRANSFER EXTENSION TELEPHONES eg 2 TO1

REWIRE IF NECESSARY

NO

YES

YES

RETEST

CHECK EXCH LINE & EXTN CABLING – CLEAR FAULTS AS NECESSARY

EXCH LINES OK

CHECK ALL FUSES AND POWER SWITCHED ON

IS FAULT STILL ON SAME EXTN — NO

NO

IS FAULT ON SAME TELEPHONE — NO

RETEST

FUSES AND POWER OK

YES

CHECK EXTENSION WIRING FOR CONTINUITY AND CONTACT BETWEEN SPEECH AND DATA

YES

RETEST

NO

YES

CHANGE TELEPHONE

CLEAR FAULT CHANGE FUSES

CHANGE C.C.U

IS EXTENSION WIRING OK — NO

CLEAR FAULT

RETEST

YES

RETEST

RETEST

RETEST

RETEST

Fig 16. Ambassador ESS Faulting Logic

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8. How it Works

General Description – The system employs normal signalling to the exchange (either public exchange or PBX). Each ESS telephone has a standard keypad which can be either self-contained loop-disconnect pulsing (SC) or multi-frequency ac signalling (MF) to suit the type of exchange working. The telephones are connected to the CCU by 4 wire connections which are arranged as speech and data pairs. Signals from the keypad and speech signals in the usual form of "varying current" use the speech pair. All other signals use the data pair, and are in the form of coded – 3V pulses superimposed on a standing 50V supply from the CCU power unit.

Briefly, the microprocessor in the CCU continuously monitors the state of incoming exchange lines and the data pairs from the ESS telephones. The microprocessors in the telephones monitor the incoming data pairs from the CCU and the state of the gravity switch springs and the "function" buttons. Any change in the state of these is detected, causing an interchange of information within the system, which is used to process the call.

Power supplies – The power unit within the CCU supplies:–

    i. all the power required by the CCU

    ii. power to the microprocessor, LEDs and buzzer at each telephone, this power is fed to the telephone over the data pair.

    iii. power for the speech circuit and keypad, fed over the speech pair.

    iv. a 47V dc supply for use by any External Extension Adaptor that is fitted.

The power feed at each telephone contains a diode to protect the microprocessor circuitry against damage in the event of a reversal of the data pair. However under these circumstances a complete failure will result as there is no "constant polarity" circuit provided.

The power circuit contains a series regulator to control the voltage and a high impedance filter to block data signals from the power supply. All power supplies are generated by constant current circuits to prevent fluctuations of the dc supply, caused by the operation of the LEDs or buzzer, being detected as false data signals. Further protection against false data is provided by the LED driver circuit arranging that:–

    i. where each LED is "OFF" it is short-circuited by a transistor which is biassed "ON".

    ii. when the LED is lit, the transistor is biassed "OFF" and consequently the short circuit is removed.

so ensuring minimum fluctuations in supply current.

Operation – The system is designed to provide for 1 + 3, 2 + 4 and 5 + 10 sizes of installation. The 5 +10 system is know as 'Senator' and is described in a separate book. Although the system sizes differ the mircorprocessors in all CCUs are programmed on the assumption that all systems have ten extensions. Where there are less than 10, "padding routines" are included in the programme, to replace the "missing" extensions so keeping the operating cycle of the microprocessor the same in all systems. The "padding routines" are added or taken away automatically within the micróproessor as extensions are recovered or provided.

Figure 17 shows the principle of the CCU scanning and exchanging information with each extension in turn. Approximately 4m secs is taken to deal with each extension and a total of 65.5m secs is taken for the complete scanning cycle, this allows time for the CCU to perform its control functions. Each extension is scanned approximately 15 times a second, this is frequent enough to ensure that any key operation or incoming signal is detected.
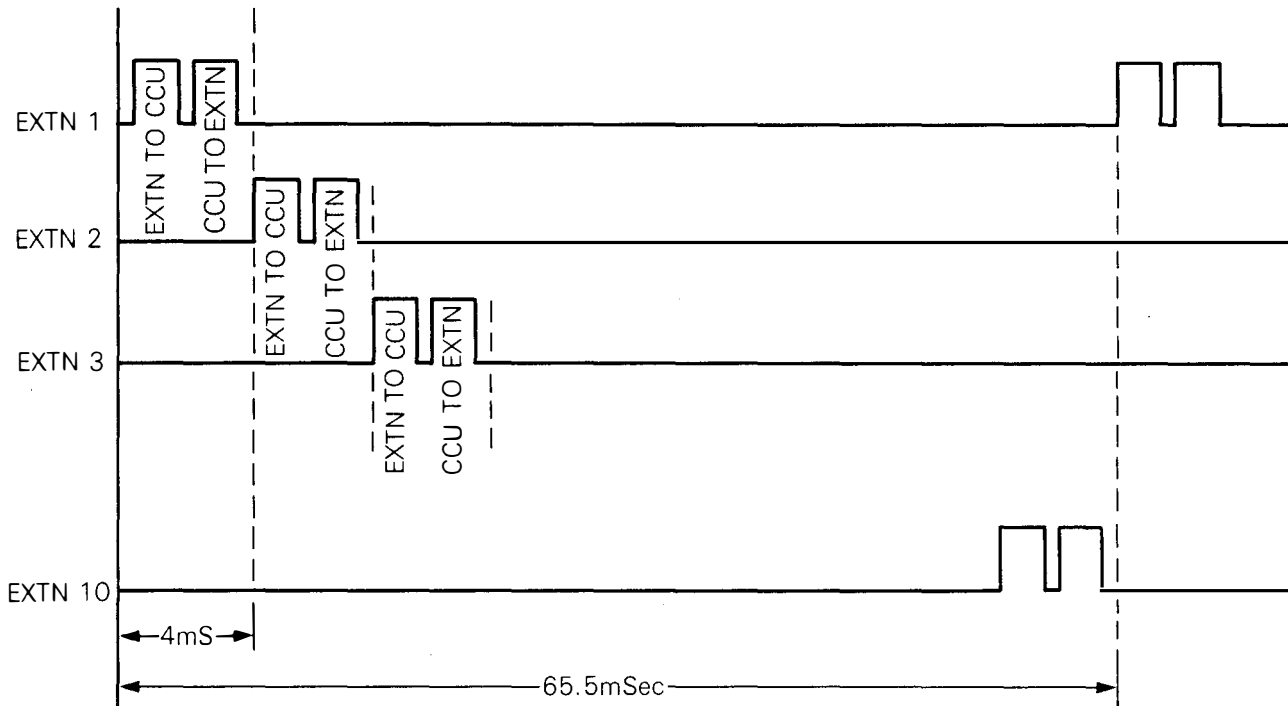

Fig 17. Scanning Rate

In each extension telephone the microprocessor scans the incoming data pair, the function button matrix and the gravity switch 5000 times a second until a signal is detected on the data pair. An incoming signal is received on each extension data pair every 65.5 m secs. This is in the form of 460 μsec "Prefix" signal followed by a 153 μsec "Start" signal as shown in Fig 18.
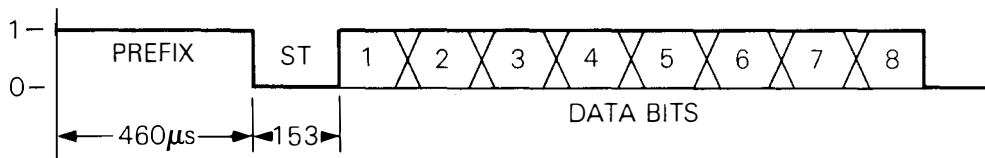

Fig 18. Data Transmission CCU to EXTN

The "Prefix" signal has a "logic 1" value and the "Start" signal a "logic 0" value. The "Start" signal is followed by eight 153 μsec signals termed "data bits" which will be either "logic 1" or "logic 0" depending on the information to be transmitted. On detecting the "Prefix" signal the extension microprocessor stops scanning the function button matrix etc and only scans the data pair until after the eighth data bit has been received.

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The extension microprocessor is programmed to wait for 460 μsecs after receiving the data from the CCU and then send a "Start" signal and eight data bits, each of 153 μsecs to the CCU. Figure 19 shows the signals sent by the extension which signal the state of the function buttons, gravity switch and recall button (when applicable) to the CCU.
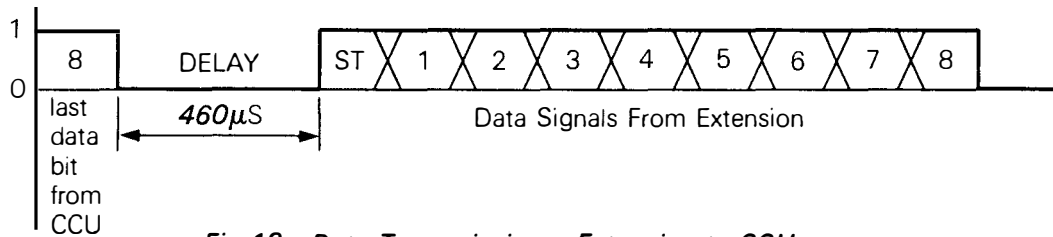

Fig 19. Data Transmission — Extension to CCU

The complete exchange of data between the CCU and one extension takes approximately 4 m secs and is shown in Fig 20.
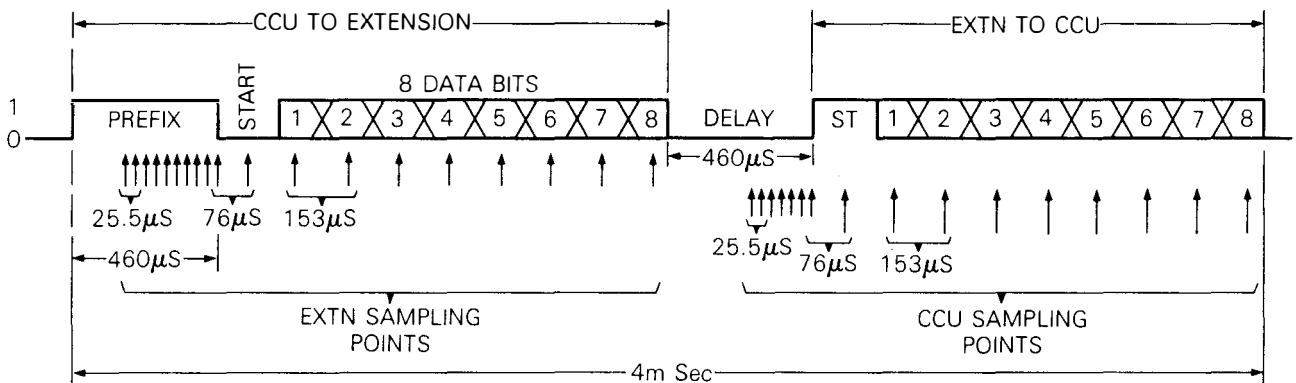
Fig 20. Data Timing & Sampling

Tones and Signals — The CCU generates two tones, one of 350 Hz and one of 440 Hz but in the 1 + 3 and 2 + 4 systems only the 440 Hz tone is used. The tone is supplied at a cadence of 131 msecs "on", 131 msecs "off" to form the system "engaged tone" and at 262 msecs "on", 262 msecs "off" to provide the system "ring tone".

The CCU also controls the signals which are used to light the LEDs and operate the buzzer, these are "pulsed" at 440 Hz at the same cadence as the ring tone.

Outline of Call Progress – Figures 21 and 22 show block diagrams of the 1 **+** 3 amd 2 **+** 4 systems, either of these figures may be referred to when considering the progress of a call.
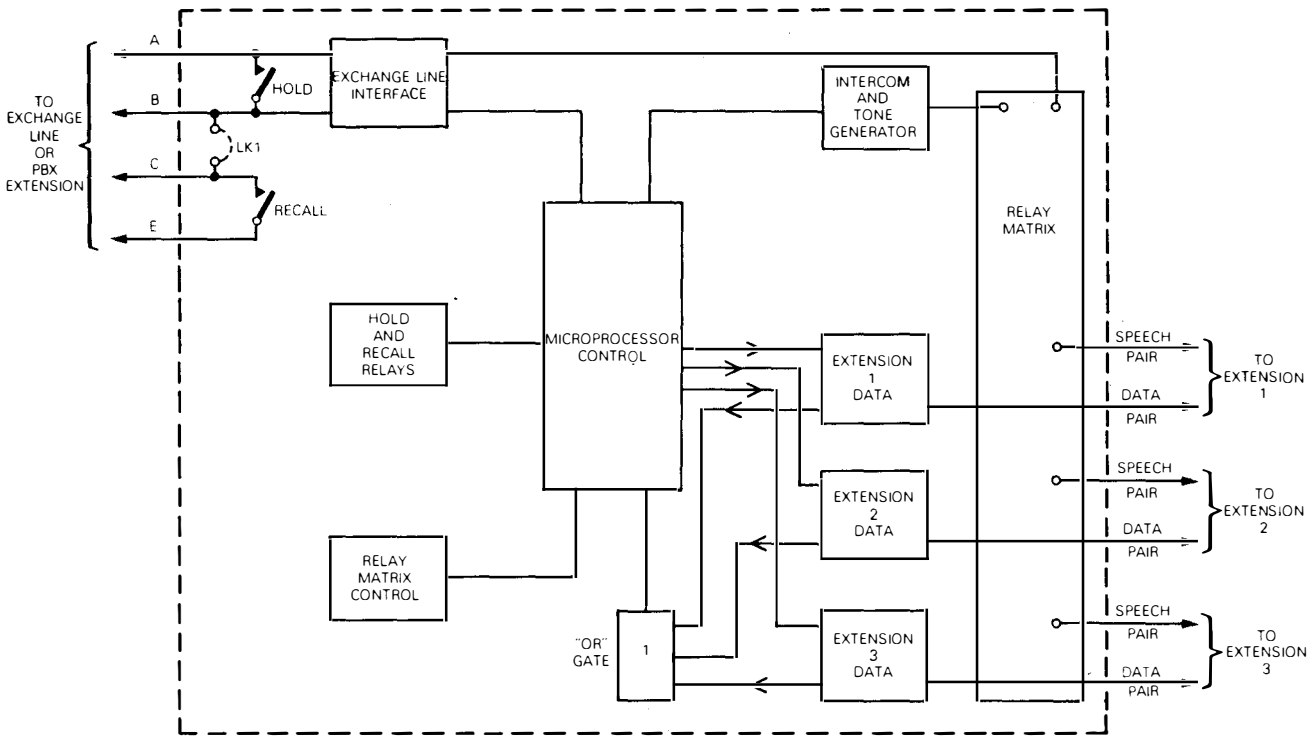
Note: LK1 is connected for earth recall and removed for C-wire signalling

Fig 21. Block diagram of a 1+3 CCU.
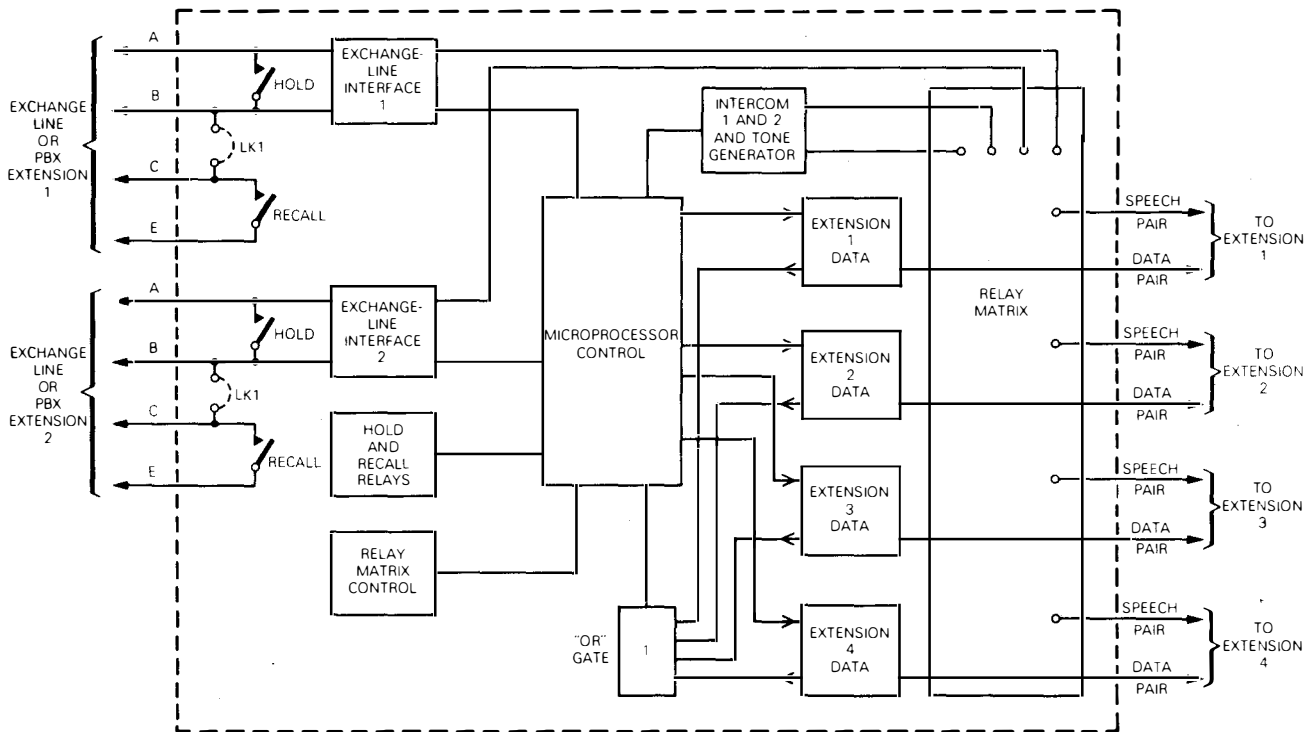
Note: LK1 is connected for earth recall and removed for C-wire signalling

Fig 22 Block diagram of a 2 + 4 CCU

Incoming Exchange Line Call (Line 1) – An incoming ringing signal activates a ringing detector in the exchange line interface. This sends a signal to the CCU microprocessor. The CCU transmits data to all extensions as previously described to cause all LINE 1 LEDs to flash and those buzzers programmed "ON" to operate at exchange ringing cadence. If all the extensions that are programmed to receive incoming exchange calls are either "off hook" or in "divert" a "click tone" is superimposed by the tone generator on the intercom speech highway(s) to indicate that an exchange call needs to be answered.

An extension answers the call by lifting the handset and depressing the LINE 1 button. Data signals representing "gravity switch operated" and "line 1 button operated" are sent to the CCU. The CCU recognises these signals and:–

   i. ceases to send buzzer signals

   ii. causes "line 1 LEDs to glow with a steady glow"

   iii. causes crosspoint relays to operate and connect the extension to line 1

Clear Down – As long as the call is in progress, signals are sent from the telephone indicating "gravity switch operated" and from the CCU to maintain the LED signals. The CCU also holds the crosspoint relays operated to connect the extension to line 1.

On clear down the extension telephone ceases to send "gravity switch operated" signals. The CCU then releases the crosspoint relays to release the exchange line and stops sending signals to operate the LEDs. The circuit restores to normal.

Intercom Call – Extension 1 Calls Extension 2 – Extension 1 lifts the handset and depresses the function button labelled "Extn2". The data signals generated by the gravity switch and the operated function button are received by the CCU as previously described. The CCU connects Extn 1 to the intercom highway and:–

   i. sends data to all extensions except Extn 1 to cause "Extn 1 LED" to glow.

   ii. if Extn 2 is free, data is sent to Extn 2 to operate the buzzer, and flash the LED associated with Extn 1 button, to intercom ringing cadence.

   iii. if Extn 2 is "Off-Hook" the tone generator is caused to return engaged tone to Extn 1.

If Extn 2 has no telephone connected, no tones are returned to Extn 1 as NU tone is **not** provided on ESS.

When Extn 2 lifts the handset, data signals indicate this to the CCU. The CCU disconnects the buzzer signals and ringing tone and connects Extn 2 to the (same) intercom highway and at all extensions except Extn 2 the "Extn 2" LED is caused to glow.

Transfer of Line 1 Call from Extn 1 to Extn 2 – With an exchange line call on line 1 established at Extn 1 the operation of the "Hold" button at Extn 1 signals the CCU causing the microprocessor to operate a Hold relay on Line 1 and release the crosspoint relay to disconnect Extn 1 from the line. Extn 1 then calls Extn 2 as previously described and asks Extn 2 to accept the call and pick up line 1. If Extn 1 replaces his handset the call will automatically be connected to Extn 2 by the CCU, which operates the appropriate switching relay and releases the "Hold" relay.

The transfer could be completed by Extn 2 depressing his "Line 1" button and so causing the CCU to operate in response to its data signals.

Diverting Calls from Extn 2 to Extn 3 – Extn 2 should have previously operated the "DIVERT" button and preprogrammed Extn 3 to be the "Nominated extension" as described in the facilities section. Extn 2 operates the "DIVERT" button to invoke the Divert facility. On receipt of the data signals from Extn 2 the microprocessor at the CCU examines its programme to determine:–

    i. which is the nominated extension

    ii. is it proper to receive diverted calls

Data signals are sent to Extn 2 to light the "Divert" LED and to Extn 3 to light the "Nominated" LED.

On receipt of an incoming call to Extn 2 the buzzer at Extn 3 will operate and the "Divert" LED at Extn 3 will flash in cadence with the buzzer, the buzzer at Extn 2 does not operate. Extn 3 then answers the call in the usual fashion.

Telephone 8500 Type Circuit

Notes:—

1. Disconnect Link A in the Plan Module when the telephone is used with an Extension Bell Adaptor and extension bell.

2. Line cord is normally a Cord Connecting 4/500, when an extension bell is fitted use Cord Connecting 6/500.

A { SPEECH
B { PAIR
C — DATA —
D — DATA +

(NOTE 5)

240V (FUSED) A.C. (3 AMP)

EXCHANGE LINE

(NOTE 1)

CABLE EQUIPT 2501F OR 2503F

CABLE EQUIPT 2503F

ESS CENTRAL CONTROL UNIT (CCU) 1 + 3

(NOTES 1) (AND 2)

"ORDINARY" EXTENSION

JACK No 622A OR LJU No../3A

CABLE DROPWIRE OR SUITABLE 2W CABLE

(NOTE 6)

EXTERNAL EXTN. ADAPTOR (NOTE 3)

EXTERNAL EXTENSION

JACK NO 621A OR LJU No ./1A

AMBASSADOR ESS
CONNEXION OF EXCHANGE LINE
'ORDINARY' EXTENSION
AND EXTERNAL EXTENSION

AMBASSADOR ESS Connexion of Exchange Line, "Ordinary"

Extension and External Extension

Notes:—

1. "C" wire and "Eth" wire are only provided when the ESS is fitted as a PBX extension.
   The earth connexion **must** be a signalling earth, TI A2 E 1001 refers

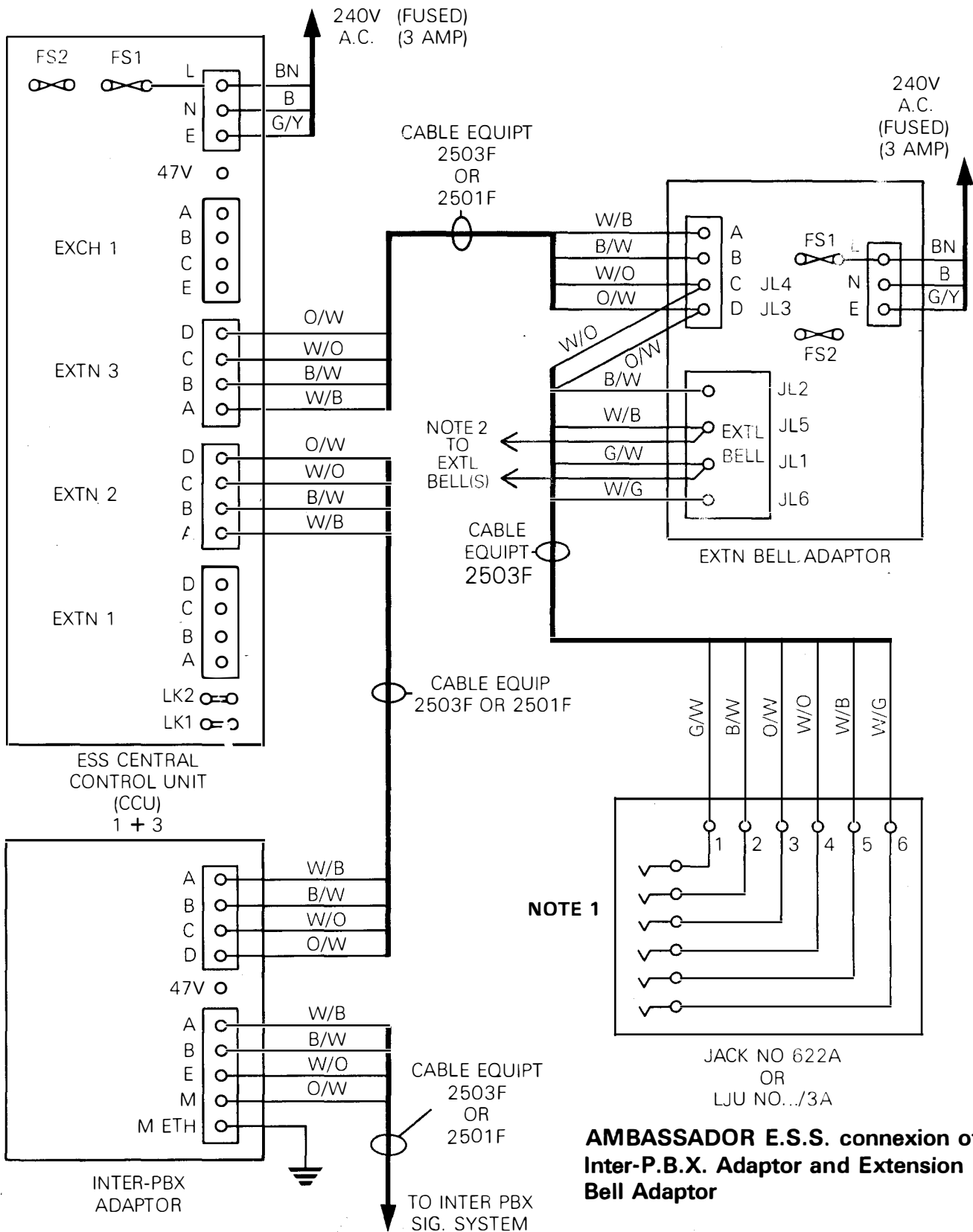2. If "C" wire signalling is required, links 1 & 2 in the 1 **+** 3 CCU and links 1, 2 & 3 in the 2 **+** 4 CCU must be removed.

3. External Extension Adaptor must be connected as the last extension ie extn 3 on a 1 **+** 3, or extn 4 on a 2 **+** 4 system.

4. To prevent overhearing between speech and data pairs all extension cabling must use Cable Equipment 2501F or 2503F. The correct colour sequence must be used.

5. The External Extension instrument may be any standard telephone with a "Hold" button fitted. A local earth is required at the extension to provide the "Hold" facility.

   If the ESS is connected to a PBX using Earth recall, the External Extension cannot have the "Hold" facility

6. The earth provided at the External Extension must be a signalling earth, TI A2 E 1001 refers

240V (FUSED)
A.C. (3 AMP)

FS2 FS1

L
N
E

BN
B
G/Y

240V
A.C.
(FUSED)
(3 AMP)

47V

EXCH 1

A
B
C
E

CABLE EQUIPT
2503F
OR
2501F

W/B
B/W
W/O
O/W

A
B
C
D

JL4
JL3

FS1
L
N
E

BN
B
G/Y

EXTN 3

D
C
B
A

O/W
W/O
B/W
W/B

FS2

W/O
O/W

B/W

JL2

EXTN 2

D
C
B
A

O/W
W/O
B/W
W/B

NOTE 2
TO
EXTL
BELL(S)

W/B
G/W
W/G

EXTL
BELL

JL5
JL1

JL6

EXTN 1

D
C
B
A

CABLE
EQUIPT
2503F

EXTN BELL ADAPTOR

LK2
LK1

CABLE EQUIP
2503F OR 2501F

ESS CENTRAL
CONTROL UNIT
(CCU)
1 + 3

G/W B/W O/W W/O W/B W/G

A
B
C
D

W/B
B/W
W/O
O/W

1 2 3 4 5 6

47V

NOTE 1

A
B
E
M

W/B
B/W
W/O
O/W

M ETH

CABLE EQUIPT
2503F
OR
2501F

JACK NO 622A
OR
LJU NO.../3A

INTER-PBX
ADAPTOR

TO INTER PBX
SIG. SYSTEM

**AMBASSADOR E.S.S. connexion of
Inter-P.B.X. Adaptor and Extension
Bell Adaptor**

Notes:— 1. Disconnect link "A" on the Plan Module of telephones used with
Extn Bell Adaptors to provide extension bell(s).

2. A total of 4 bells/tone callers may be connected in parallel to the
Extn. Bell Adapter. This includes the telephone tone caller if used.

10 List of Parts for Ambassador ESS

ITEM	DESCRIPTION	ITEM CODE
Central Control Unit 1 + 3	Equipment ESS SA 10251	41 0970
Central Control Unit 2 + 4	Equipment ESS SA 10252	41 0971
External Extension Adaptor	Adaptor ESS SA 10253	41 0972
Inter-PBX Adaptor	Adaptor ESS SA 10254	41 0973
Extension Bell Adaptor	Adaptor ESS SA 10255	41 0974
Ambassador ESS Telephone (MF)	Ambassador ESS Telephone 8530R Dk Brown	41 0975
Ambassador ESS Telephone (MF)	Ambassador ESS Telephone 8530R Stone	41 0976
Ambassador ESS Telephone (MF)	Ambassador ESS Telephone 8531R Dk Brown	
Ambassador ESS Telephone (MF)	Ambassador ESS Telephone 8531R Stone	
Ambassador ESS Telephone (MF)	Ambassador ESS Telephone 8532R Dk Brown	
Ambassador ESS Telephone (MF)	Ambassador ESS Telephone 8532R Stone	
Ambassador ESS Telephone (MF)	Ambassador ESS Telephone 8533R Dk Brown	
Ambassador ESS Telephone (MF)	Ambassador ESS Telephone 8533R Stone	
Ambassador ESS Telephone (SC)	Ambassador ESS Telephone 8520R Dk Brown	41 0977
Ambassador ESS Telephone (SC)	Ambassador ESS Telephone 8520R Stone	41 0978
Ambassador ESS Telephone (SC)	Ambassador ESS Telephone 8521R Dk Brown	
Ambassador ESS Telephone (SC)	Ambassador ESS Telephone 8521R Stone	
Ambassador ESS Telephone (SC)	Ambassador ESS Telephone 8522R Dk Brown	
Ambassador ESS Telephone (SC)	Ambassador ESS Telephone 8522R Stone	
Ambassador ESS Telephone (SC)	Ambassador ESS Telephone 8523R Dk Brown	
Ambassador ESS Telephone (SC)	Ambassador ESS Telephone 8523R Stone	
Line Cord 3000 mm (4 way)	Cord Conn 4/500 (L Grey) 3000 mm	51 2233
Line Cord 5000 mm (4 way)	Cord Conn 4/500 (L Grey)	51 2234
Line Cord 3000 mm (6 way)	Cord Conn 6/500 (L Grey) 3000 mm	51 2231
Handset Cord 200 mm (Helical)	Cord Conn 4/503 (L Grey) 200 mm	51 2230

List of Parts for Ambassador ESS (cont.)

ITEM	DESCRIPTION	ITEM CODE
Handset No. 16B (Mouldings) Amplifying Handset	Kit No. 470 (colour) Handset No. 16C Dk Brown	41 1037
	Handset No. 16C Stone	41 1038
Handset with Neon Indicator	Handset No. 16D Dk Brown	41 1039
	Handset No. 16D Stone	41 1040
Handset with transmitter	Handset No. 16E Dk Brown	41 1041
cut-off	Handset No. 16E Stone	41 1042
Fuse FS1 (Mains Input) 1 + 3	Fuse 72/05	31 4216
Fuse FS2 (Power Output) 1 + 3	Fuse 73/1	31 4179
Fuse FS1 (Mains Input) 2 + 4	Fuse 72/1	31 3873
Fuse FS2 (Power Output) 2 + 4	Fuse 73/2	