Installation and maintenance manual

2+8

BT

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1.1 Introduction

The 2+8 is a microprocessor-controlled Hybrid Keysystem/PABX. See Figure 1.1. It has an ultimate capacity for two exchange lines and eight extensions. The 2+8 is supplied complete as a 2+8 system in its basic form and does not require any expansion hardware.

The 2+8 CCU is a Y=0 system (the CCU is virtually transparent to the serving exchange). Internal switching of the extensions and exchange lines is done by miniature sealed relays, so the 2+8 signalling from the CCU is totally dependent on the signalling from the extension Telephone or Systemphones.

1.1.1 Central Control Unit

The 2+8 Central Control Unit is completely self-contained in a single box unit housing the mains power unit, a single PCB on which is mounted the main processor, facility software in PROM, two Peripheral processors, and all switching relays and IDC connectors for the extensions and exchange lines. No separate Network Terminating and Test Point is required by the system. Break jacks are provided on the exchange line IDCs.

1.1.2 Systemphone

The 2+8 Systemphone is exclusive to the 2+8 system, having full LST operation, direct selection and display status of exchange lines and extensions and a 10 number store.

The Systemphones require a 10 second power up period, measured from the moment they are plugged into the extension socket, before they can be used.

1.1.3 Telephones

Approved Telephone extensions must be fitted with an earth recall facility which is used for line access and hold. Telephones using Time Break recall only are not suitable.

1.1.4 Modes of working

The 2+8 is a Hybrid small switching system. This means it can be used as a PBX where incoming calls are routed to a controlling operator extension or as a Keysystem where incoming calls can be answered by any extension which is programmed to ring. In Keysystem mode the 2+8 can be set to a third option known as Exclusive line working where the second exchange line can be dedicated to one extension user or to a Facsimile machine. The 2+8 can also employ a mix of Systemphones and approved telephones.

Figure 1.1 **Typical 2+8 system**

2 + 8 CCU

Mains supply ◀

Exchange line (s) ◀

Systemphone extension

LJU2/1A

Telephone extension

LJU2/1A

External extension

LJU2/1A   Surge protection
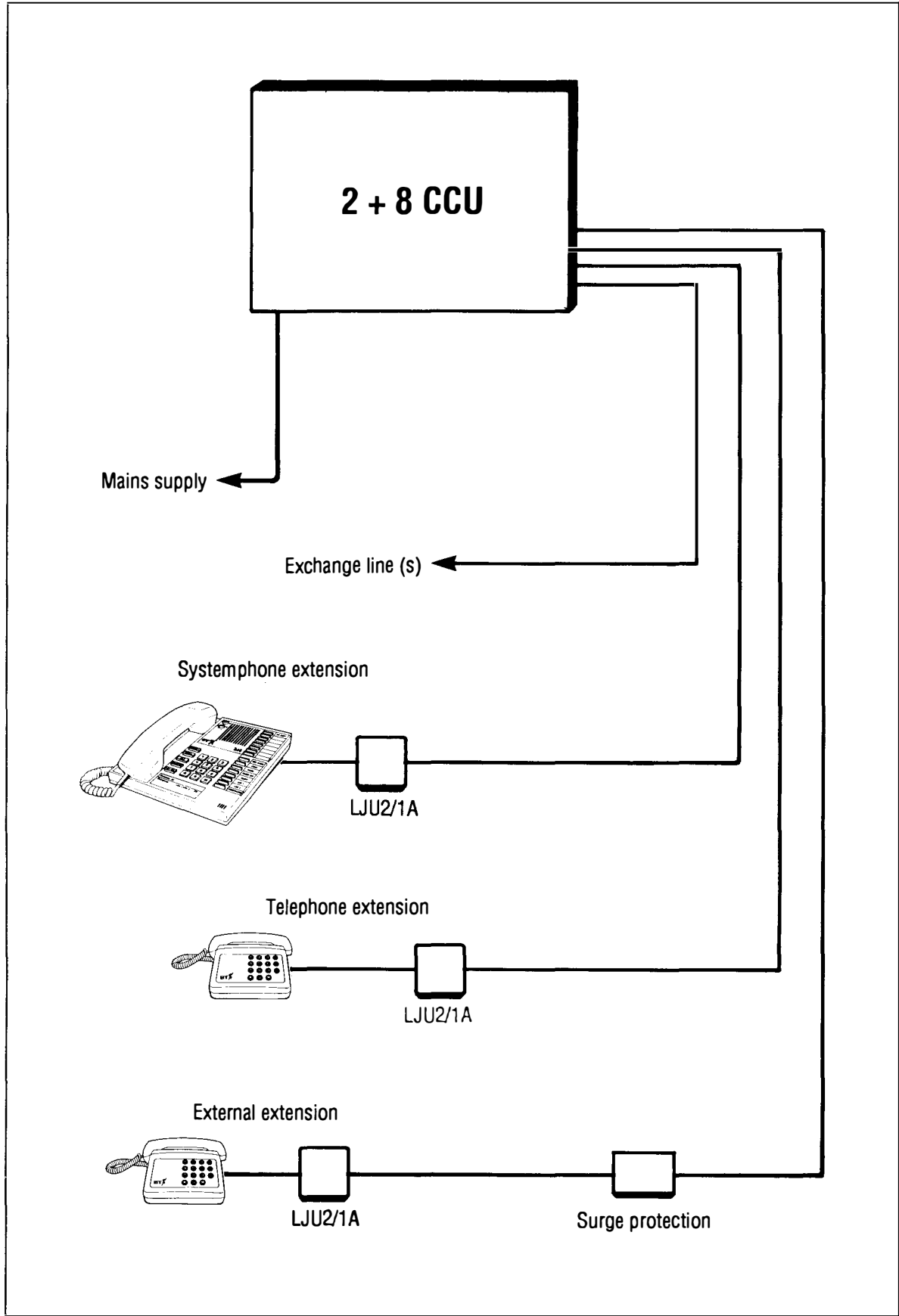
1.1.4.1 PBX mode

In PBX mode extension 20 is designated as the operator position. Although not essential it is recommended that a Systemphone be fitted to extension 20 to give visual status of the exchange line and extensions.

All incoming calls and any extension keying 0 after going off- hook will be routed to the operator position. Any other extension can go off- hook and key the call pickup code (8) to answer an incoming call if required.

If the operator extension is engaged when an incoming call arrives, warn tone will be applied to the operator extension (see paragraph 1.1.4.4). If the operator extension is making an outgoing call or being rung and an incoming call arrives on the second line the second extension (21) will be rung. If extension 21 is off-hook it will receive warn tone.

Extension 20 cannot be barred from making outgoing calls on either line. It is also the power fail extension for line 1. Extension 21 is the power fail extension for line 2.

1.1.4.2 Keysystem mode

Although not essential it is recommended that at least one Systemphone be fitted to the system to give visual status of the exchange line and extensions.

Incoming calls on exchange line 1 will ring extension 20 and any other extension which has its ringer programmed on. It is also the power fail extension for line 1.

Incoming calls on exchange line 2 will ring extension 21 and any other extension which has its ringer programmed on. It is also the power fail extension for line 2.

Extension 20 cannot be restricted from making outgoing calls on line 1. Its ringer cannot be programmed off for line 1.

Extension 21 cannot be restricted from making outgoing calls on line 2. Its ringer cannot be programmed off for line 2.

Any extension keying 0 after going off-hook will be routed to extension 20. Any other extension with its ringer programmed off can go off-hook and key the call pickup code (8) to answer an incoming call if required.

1.1.4.3 Exclusive line mode

This is similar in operation to Keysystem mode except that the second line becomes dedicated to extension 21. Differences from Keysystem mode are:

- extension 21 can access line 2 only
- line 1 cannot be diverted to extension 21.

If extension 21 is under divert the exclusivity of extension 21 will be transferred to the target extension.

Extension 21 will be rung by incoming calls on line 2 and extension 21 will be able to transfer calls and set up features such as diverts in the normal manner. No diverts will be possible to extension 21.

1.1.4.4 Warn tone

Warn tone is provided to indicate an incoming call to the system where an extension user who would normally be in a position to take the call cannot because that extension may be:

- programming
- being rung
- setting up an outgoing call.

Note The CCU regards an outgoing call as being in progress during:

MF signalling – the first 20 seconds following exchange line seizure.

Pulse signalling – the first eight seconds from the end of each break pulse.

The warn tone lasts for one second and is not repeated. The external party is disconnected from the system during the warn tone in order for the CCU to apply it.

1.1.5 Ringing defaults

At switch-on, when in Keysystem Mode, the CCU sets all extensions to ring if an incoming call arrives. Individual extensions can be prevented from ringing by programming them off. The ringer default on is a mandatory requirement to ensure that incoming calls are indicated when power is restored after a power failure.

Some ringers can be programmed off for each line and some cannot. Refer to the following table.

Table 1.1 **Incoming ring defaults**

	PBX mode		Keysystem		EXCL line mode	
	Line 1	Line 2	Line 1	Line 2	Line 1	Line 2
Ext. 20	No	No	No	Yes	No	N/A
Ext. 21	N/A	N/A	Yes	No	N/A	No
Ext. 22	N/A	N/A	Yes	Yes	Yes	N/A
Ext. 23	N/A	N/A	Yes	Yes	Yes	N/A
Ext. 24	N/A	N/A	Yes	Yes	Yes	N/A
Ext. 25	N/A	N/A	Yes	Yes	Yes	N/A
Ext. 26	N/A	N/A	Yes	Yes	Yes	N/A
Ext. 27	N/A	N/A	Yes	Yes	Yes	N/A

No = Ringer cannot be programmed off for that line
Yes = Ringer can be programmed off for that line
N/A = Not applicable

1.1.6 **Electro-static Precautions (ESP)**

The 2+8 system contains electro-static components, to ensure long term reliability of the system. The only components that should be handled on the PCB are the IDCs, DIL switches and line voltage links. If the PCB or any other components are liable to be handled then the following precaution should be taken.

Wrist straps

Before handling printed circuit boards or components, a wrist strap must be worn and connected to a good earth point. The functional earth terminal (refer to Figure 2.4) provided on the CCU can be used with a clip.

Note The functional earth must be connected to the system for this to be effective.

2.1 Installation procedures

2.1.1 Equipment required

- 2+8 Central Control Unit	One
- Systemphone	As required
- Approved telephones	As required
- Master jacks LJU2/1A	One per extension
- Cable equipment (6-wire)	As required
- 13A mains plug	One.

2.1.2 Location for Central Control Unit

The CCU is intended for installation in a residential or office-type environment. It needs to be mounted at a convenient working height on a dry flat wall. The normal limits are usually considered to be between 1m from the floor to the bottom of the CCU case to 1.75m to the top of the case.

Do not site the CCU where it will be subjected to excessive levels of heat, dust, damp, or high humidity. Locations near sources of electromagnetic radiation such as heavy electrical switch gear (for example, lift machinery or electric arc welders) should be specifically avoided.

Allow at least 100mm of free space all round the CCU for ventilation purposes.

The CCU will need to be within approximately two and a half metres of a dedicated mains power supply outlet. The 2+8 must not share the same mains supply socket with any other electrical appliance.

2.1.3 Mounting the CCU

When a suitable location has been found, mark the three screw locations on the mounting surface using the template provided in the packing case. Alternatively use the fixing dimensions given in Figure 2.1. All dimensions shown are in millimetres.

If the CCU is to be mounted on masonry and plaster board suitable wall plugs must be used. Drill and plug three holes in the wall at the marked locations. The holes should be deep enough to accept a 1 inch number 8 round head screw or its metric equivalent.

Figure 2.1 **CCU, Wallmounting**
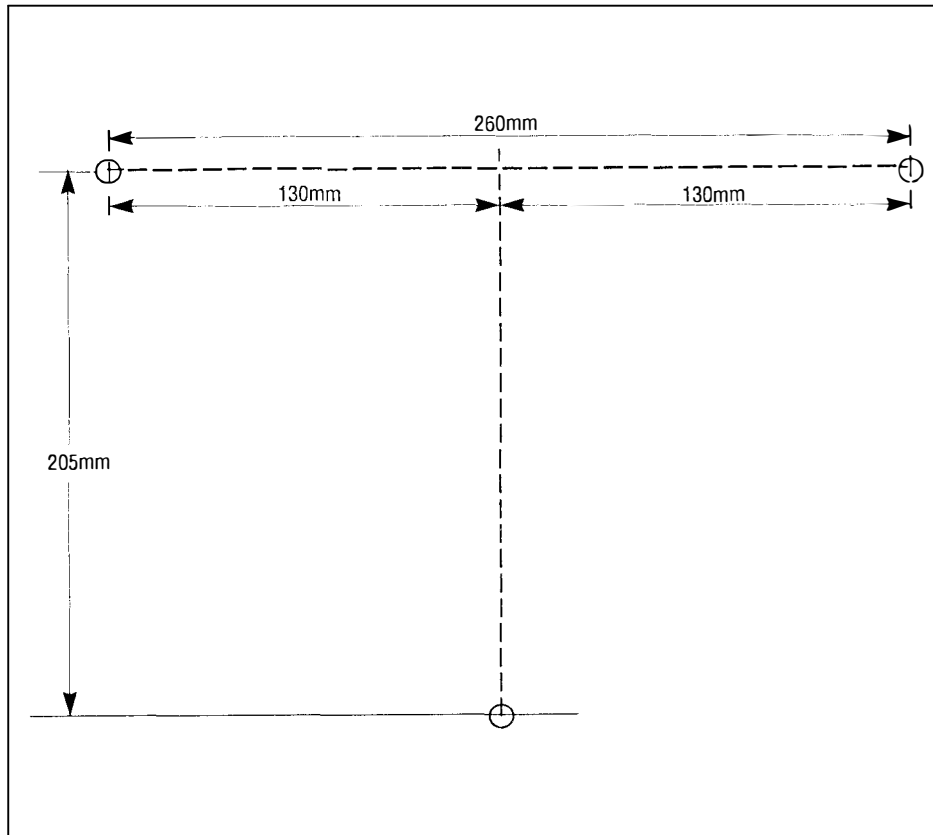
The CCU is mounted on the wall by inserting and setting the top two screws to the correct wall clearance, hanging the CCU on these two screws, and then inserting and tightening the bottom screw. The procedure in detail is as follows:

1 Using the plastic strip depth gauge provided in the CCU packing case, screw in the top two screws until they grip the depth gauge gently such that it can be slid out from under the screw heads.

2 Loosen the CCU top cover transit retaining screws and lift to remove the cover completly.

3 Remove the top cover metal transit retaining screws and replace them with the plastic retaining screws and retaining washes. Set the cover aside in a safe place.

4 Hang the CCU base on the top two screws, using the keyhole-type slots in the base.

5 Insert the bottom screw and tighten it just enough to hold the base of the CCU firmly against the wall. Do not use excessive force when tightening the screw.

6 Check that the CCU is securely attached to the wall and will not fall off. Replace the top cover and secure with the cover retaining screws.

2.1.4 The mains supply

Do not connect the mains supply to the CCU until all cabling and wiring is complete.

> **WARNING**
> **Do not switch on the mains power to the system until you have read Section 4.1** *Safety precautions and switch on.*

The CCU comes supplied with 3m of mains cable, which forms an integral part of the mains interference suppression components. If the mains socket is closer to the CCU than 2.5m, coil up the excess slack neatly and secure the coil with suitable self-adhesive tape.

> **WARNING**
> **Do not cut the cable short.**

Note You may shorten the mains cable by a small amount if you need to re-terminate the mains plug for maintenance purposes.

Terminate the mains lead with a 13A plug approved to the requirements of BS1363 and the Statutory Instrument 1987 No. 603 Consumer Protection. A 3A cartridge should be fitted to the plug. Terminate the plug neatly in accordance with the following convention and as shown in Figure 2.2.

1 The wire coloured Green and Yellow must be connected to the terminal in the plug marked either by the letter E or by the safety earth symbol.

2 The wire coloured Blue must be connected to the terminal in the plug which is marked with the letter N.

3 The wire coloured Brown must be connected to the terminal which is marked with the letter L.

Figure 2.2 **Terminating the 13A plug**
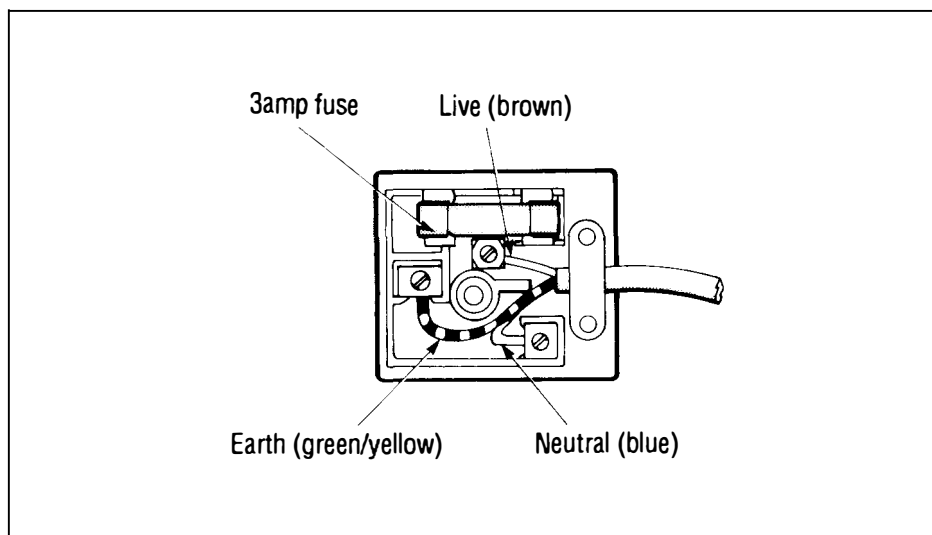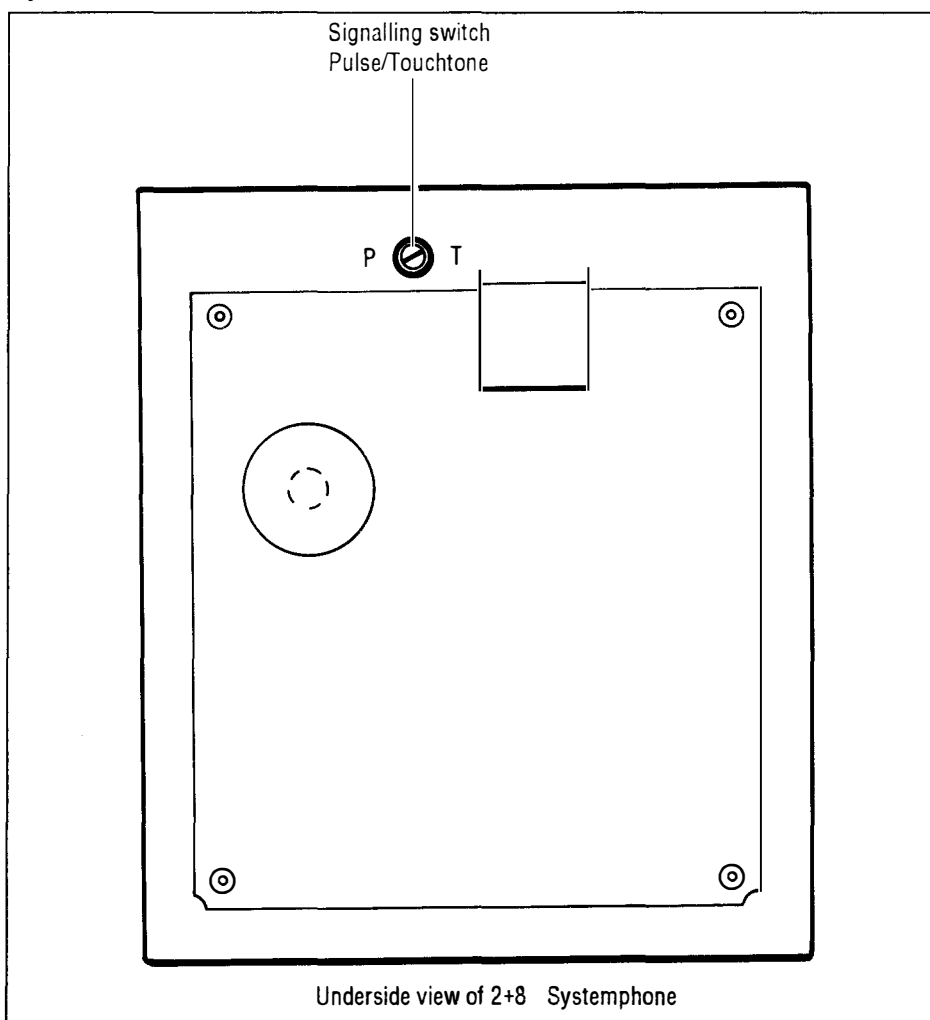
2.1.5 Extension Systemphones

The 2+8 uses its own optional Systemphone. Although not essential it is recommended that it be connected to the first extension (20). The system may be partially or fully equipped with Systemphones or any mix of Systemphones and ordinary approved telephones.

The Systemphone has full loudspeaking capability, a 10 number store, and LEDs to display the status of the exchange lines and extensions. For further details of the Systemphone please see the *2+8 Systemphone User's Guide.*

The Systemphone uses Pulse or TouchTone signalling. The selector switch, which is of the rotary type, is located under the Systemphone as shown in Figure 2.3. Use a small screwdriver to alter the setting, anticlockwise for Pulse (marked P) or clockwise for TouchTone (marked T).

The Systemphone also has the ability to switch from Pulse to TouchTone from the keypad. With the telephone off-hook, press the ✳ key to switch the internal dialler to TouchTone signalling. Once the Systemphone has been switched in this way, it will remain in TouchTone signalling mode until it goes on-hook again.

Figure 2.3   **Systemphone P/T switch location**

Signalling switch
Pulse/Touchtone

P ⊘ T

Underside view of 2+8   Systemphone

2.1.6 Extension telephones

The 2+8 is approved for use with (green spot) approved telephones, which may be connected to any extension. The system uses Master-type line jacks at the telephone instrument irrespective of the telephone or Systemphone used.

All approved extension telephones on the system must be fitted with a working Earth recall key. It should be noted that a local earth is not needed at the telephone and that the recall signal to the CCU from the extension telephone does not apply a physical earth condition.

The extension Telephone may use either TouchTone or Pulse signalling. It should be noted that the system is transparent to the extension telephone when it is switched through to the exchange line ports. Thus, telephone signalling must be compatible with the serving exchange or host PABX.

2.1.7 Cabling and wiring

Do not exceed the following resistance limits when connecting extensions to the CCU (using $0.5mm^2$ tinned copper conductor):

- 25 Ω or 150m for Systemphone extensions
- 50 Ω or 300m for approved telephone extensions.

Great care should be taken when selecting the cable routes to ensure that the cabling complies with the current edition of the IEE wiring regulations. This document details the separation requirements between telecommunications cables and cables carrying mains supply voltages. Generally the route chosen must be such that:

■ Telecoms cables must not be drawn into the same conduit or duct as cables carrying mains voltages.

■ Telecoms cables must not be run or fixed adjacent to cables carrying mains voltages. Where a telecommunications cable has to run in parallel or cross a mains cable an appropriate amount of cable separation must be maintained as specified in IEE regulations.

Note Even if a cable run complies with IEE requirements long parallel runs adjacent to mains cables can induce mains hum.

■ Cables should not be run through any area designated as having an explosive atmosphere.

The extension and exchange line cables must be of twisted-pair construction using insulated tinned copper wires of nominal $0.5mm^2$ cross-sectional area. It is important that this size and type of wire is used as incorrect types could result in unreliable connections.

The extension and exchange line cables enter the CCU at the right-hand side of the CCU when viewed from the front of the case. Pass the cables through the cable slot in the CCU case adjacent to the relevant Insulation displacement connectors.

The cables should remain sheathed inside the CCU housing within reach of the IDC. Guide the cables neatly into the channel space between the IDC blocks and the CCU case side.

2.1.8 Connecting the extensions

For information the ringer equivalence number for 2+8 extension ports is 4.

LJU 2/1A master jacks are required, one per extension. All extensions irrespective of whether they are using an approved telephone or Systemphone are 6-wire connected at the master jack.

Note Only five wires are connected at the CCU; the sixth (pin 3) is spare, and the wire must be neatly laid back away from the IDCs.

Extensions are numbered 20 to 27. Extensions must be connected in one continuous block starting at 20, and there must be no gaps in the numbering sequence that will leave an extension without a telephone.

Run 6-wire cable from the CCU to each extension telephone location. Pass the cable through the cable entry hole in the CCU and terminate the extension wiring in accordance with the following table.

Table 2.1 **CCU to Master Jack Extension wiring**

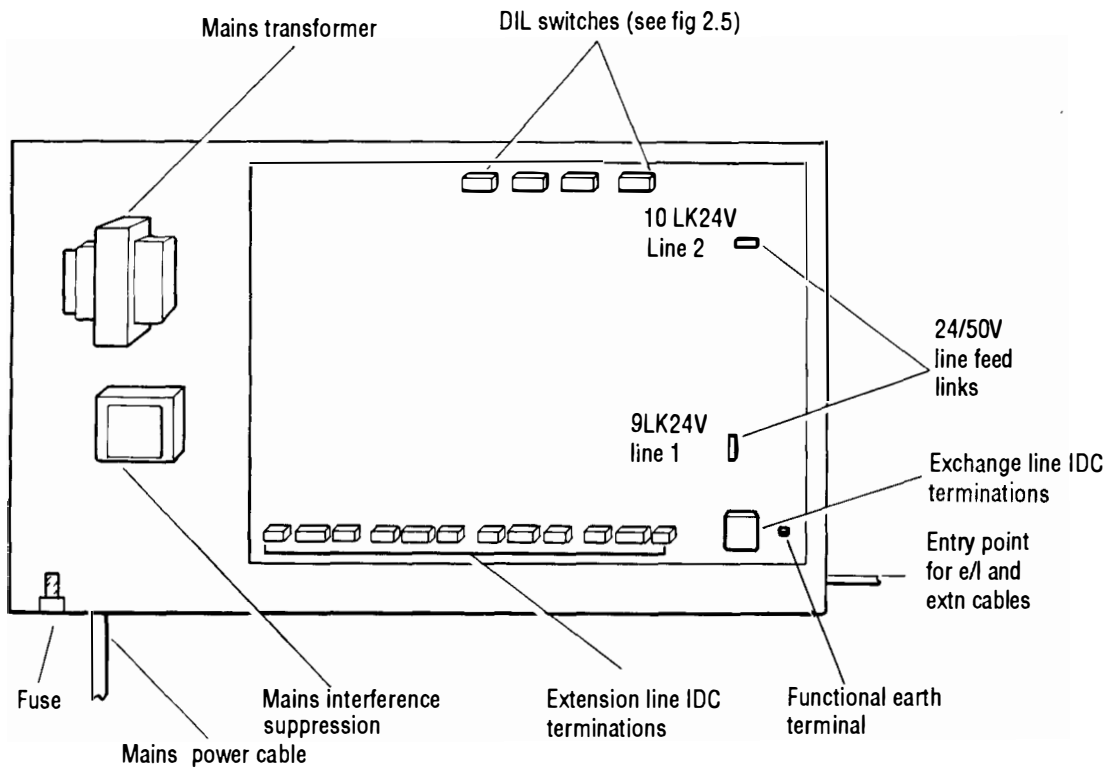| CCU Extension IDC		Master jack IDC
1	Green/White	1
2	Blue/White	2
	Orange/White	3 Not used
4	White/Orange	4
5	White/Blue	5
6	White/Green	6

2.1.8.1 Connecting parallel extensions

Additional LJUs can be connected to the master LJU of any extension port using either serial or spur cabling.

Any approved secondary LJUs or socket doublers can be used for connecting additional extensions to the master LJU, providing the cabling wiring procedure and maximum REN value are the same as paragraphs 2.1.7 and 2.1.8.

Note Systemphones can not be paralleled with other Systemphones, 2-wire telephones or sockets which are part of ancillary apparatus (refer to paragraph 2.1.15 and Section 10.1, *Statutory information*).

Figure 2.4 **CCU, Internal view**

Mains transformer

DIL switches (see fig 2.5)

10 LK24V
Line 2

24/50V
line feed
links

9LK24V
line 1

Exchange line IDC
terminations

Entry point
for e/l and
extn cables

Fuse

Mains interference
suppression

Extension line IDC
terminations

Functional earth
terminal

Mains power cable

2.1.9 Connecting the exchange lines

> CAUTION
> Do not connect the exchange lines until the 2+8 has been subjected to a pre-connection inspection.

Feed the exchange line cable(s) through the CCU cable entry hole and terminate the A and B wires on the IDC terminals marked A and B on the main printed circuit board.

2.1.10 Connecting extension bells/tone callers

A high impedance extension bell or tone caller may be connected to an extension. The cabling and wiring procedure is the same for connecting extensions (see paragraph 2.1.8) except that additional two-wire cabling/wiring will be needed from the master jack to the extension bell position. Connect the bell across the master jack IDC terminations pin numbers 3 and 5.

2.1.11 External extensions

The 2+8 system is approved for external extensions providing the extension instrument is within the confines of the customer's premises and the system's operational limits. See Section 10.1, *Statutory information.*

Care should be taken when selecting external cable routes to ensure that the cabling complies with current wiring regulations and that exposure to high voltage surges is kept to the minimal.

Protection of the CCU and telephones against high voltage surges is recommended where extensions and external cabling are likely to be subjected to induced high voltage surges such as lightning (for example, overhead spans). The provision of protection is at the discretion of the system maintainer and should be agreed before acceptance testing. Protection can be in the form of a gas discharge tubes (GDT) (protectors 21A) fitted across each pair of wires and to earth. These should be mounted in a box connection 200 series or any other approved type of box connection offering similar protection. The protection should be installed at each end of the external cabling or as specified in any current installation practises on external protection.

2.1.12 **Earthing**

2.1.12.1 **Functional earth**

The functional earth is separated from the Power Protective earth in the CCU. The functional earth for the 2+8 must be derived from the main building earth point and not from any 13A ring main. Current BT practices for functional earthing should be applied on all installations.

The 2+8 requires a functional earth to be connected if:

- The functional earth terminal is to be used for *Electro-static Precautions (ESP)*. See paragraph 1.1.6.

- It is to be piggy-backed on a PABX requiring a forward Earth recall from the 2+8 to the host PABX.

- The 2+8 could be subjected to high-voltage line surges. This a discretionary decision of the system maintainer and should be agreed before acceptance testing.

The functional earth wire must be 1.5mm^2 solid copper conductor using cream-coloured insulation. Any other colours such as green or green/yellow must not be used because these are reserved for the power protective earths.

Feed the functional earth wire into the CCU and terminate securely on the functional earth terminal (see Figure 2.4) provided on the CCU PCB.

```
CAUTION
Do not use excessive force when tightening this screw.
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2.1.12.2 **Mains protective earth**

The mains protective earth is derived from the mains supply socket. Before connecting the CCU power plug, test that a good earth exists at the mains socket earth with an Earth Loop Impedance Tester (Tester 400A or equivalent).

You should also ensure that there is a good continuity between the earth pin of the mains plug and the metalwork of the CCU base.
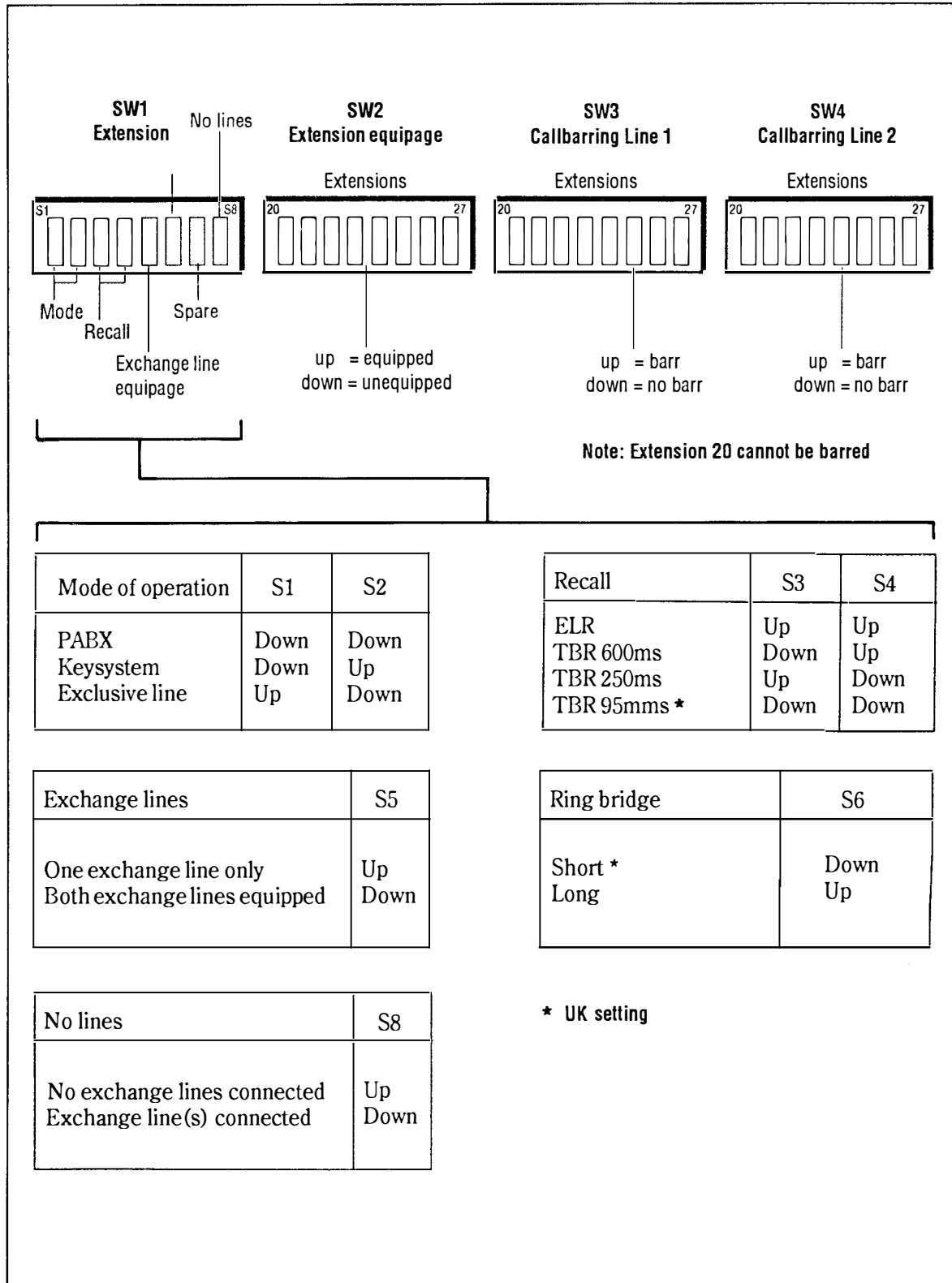
2.1.13 **Setting the CCU DIL switches**

Refer to the customer 2+8 configuration form.

There are four banks of 8-way Dual In Line (DIL) switches on the main Printed circuit board (see Figure 2.4). These must now be set for the required operating conditions (see Figure 2.5). Check each switch in each switch bank and ensure that it is correctly set before switching on the mains supply.

If a switch setting is changed while the mains power is connected, it will be necessary to switch off the CCU and switch it back on again for the processor to reset itself and store the new switch setting.

Figure 2.5 **DIL switches**

Mode of operation	S1	S2
PABX	Down	Down
Keysystem	Down	Up
Exclusive line	Up	Down

Recall	S3	S4
ELR	Up	Up
TBR 600ms	Down	Up
TBR 250ms	Up	Down
TBR 95mms *	Down	Down

Exchange lines	S5
One exchange line only	Up
Both exchange lines equipped	Down

Ring bridge	S6
Short *	Down
Long	Up

No lines	S8
No exchange lines connected	Up
Exchange line(s) connected	Down

* **UK setting**

Note The TBR duration options of 250ms or 600ms are only provided for Continental installations.

Note Ring Bridge is set to Short interval ring duration. The Long duration option is provided only for Continental installations where it may be needed.

A detailed description of each switch bank and its configuration is given below.

2.1.13.1 Switch bank SW1, configuration

This switch bank consists of eight switches numbered from S1 to S8 (S7 is spare). The other switches are used as follows:

S1 and S2: Modes of operation
Three modes of operation are available for the CCU:

- PBX
- Keysystem
- Exclusive line.

Set the mode of operation in accordance with the Mode of operation table in Figure 2.5.

S3 and S4: Forward recall type
These switches are used to send one of four recall options from the 2+8 exchange line ports forward to the parent exchange or host PABX. The four options are as follows:

- Earth recall
- Time Break recall 95 milliseconds *UK setting
- Time Break recall 250 milliseconds
- Time Break recall 600 milliseconds.

Set S3 or S4 in accordance with the Recall table in Figure 2.5. The 95 millisecond setting must be used in the UK. The remaining options are provided for use only in other countries.

Note For direct exchange line connection ensure that the Forward Recall is set to - TBR 95ms.

S5: Exchange line equipage
This switch sets the CCU to work with either one or two exchange lines. Its function is to inform the processor that the second line is to be ignored if it is not connected. Set S5 in accordance with the Exchange lines table in Figure 2.5.

S6: Ring Bridge
This switch sets the processor to expect short or long interval ringing arriving at the exchange line ports. This switch must be set to the short option in the UK. The long option is provided only for use in other countries.

Time period:

- short   silent ring period 3.5 seconds (max.)
- long   silent ring period 5.8 seconds (max.).

S7: SPARE
This switch has no function and is totally ineffective.

S8: No lines switch

This switch sets the 2+8 to work as a switching system without the exchange line ports connected. The 2+8 can then be used as a switching system on its own, totally independent of the exchange lines, but using the extension ports only.

Use of the No lines switch is primarily intended to allow the 2+8 extensions to be tested prior to the standard Pre-Connection Inspection (PCI) as part of the DTI procedures for installation of multi-line switching systems.

Set switch S8 as required in accordance with the No lines table as given in Figure 2.5 (see Section 6.1 *Commissioning the system*).

2.1.13.2 Switch bank SW2, Extensions equipped

This switch bank consists of eight switches numbered from S1 to S8, which correspond to extensions 20 to 27 respectively. Set the switch up if the extension is equipped, and down if the extension is not equipped.

Note   Although extensions 20 and 21 are always equipped, and consequently switches S1 and S2 do not work, it is recommended that you set them both in the up position so that is possible to tell how many extensions are equipped by glancing at the switch bank.

2.1.13.3 Switch bank SW3, Call barring, Line 1

This switch bank consists of eight switches numbered from S1 to S8, which correspond to extensions 20 to 27 respectively. Set the switch up if the extension which it controls is to be barred from access to exchange line port 1. (Internal calls and incoming exchange line calls will be allowed.) Set the switch down if the extension is to be allowed access.

Note   Extension 20 cannot be barred from access to exchange line port 1 or 2, so switch S1 has no effect.

2.1.13.4 Switch bank SW4, Call barring, Line 2

This switch bank consists of eight switches, numbered from S1 to S8 which correspond to extensions 20 to 27 respectively. Set the switch up if the extension which it controls is to be barred from access to exchange line port 2 (internal and incoming calls will be allowed). Set the switch down if the extension is to be allowed access.

Note   Extension 20 cannot be barred from access to exchange line port 1 or 2, so switch S1 has no effect.

2.1.14 Line voltage feed

When the CCU is unpacked, the exchange line ports are set to work with standard exchange line 50V line feed. If the exchange line feed is low, for example, about 24V, the 24V line feed option links must be set. These are identified on the main PCB as:

- 9LK24V (for line 1)
- 10LK24V (for line 2).

The approximate locations of the option links are shown in Figure 2.4 and 2.6.

Note If information on the line voltages is required then the Network Supplier or Host Switch Maintainer should be consulted.

*Figure 2.6* **Setting the line voltage feed links**
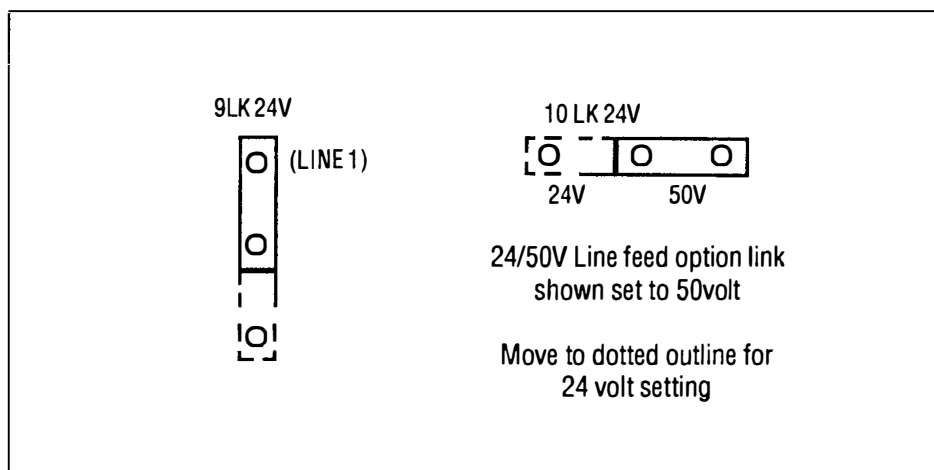
2.1.15 Answering machines with Systemphones

The series method of connecting telephones to answering machines, such as the BT Kingfisher and Wren, does not allow the continuation of all five wires from the extension socket to a 2+8 Systemphone. This means that the power feed and data information from the CCU to the Systemphone are not possible, resulting in the loss of the LED line, extension status and the loudspeaking operation. This can be overcome by using a Line Jack Unit 10/3A, commonly referred to as a doubler, and the connection arrangement shown in Figure 2.7.

Note Other types of ancillary equipment, such as fax machines, may also require this method of connection.

Figure 2.7   **Connections for an answering machine**

2 + 8 Systemphone

LJU10/3A
(doubler)

Wall socket
LJU 2/1A

Leave telephone socket empty

Answering machine
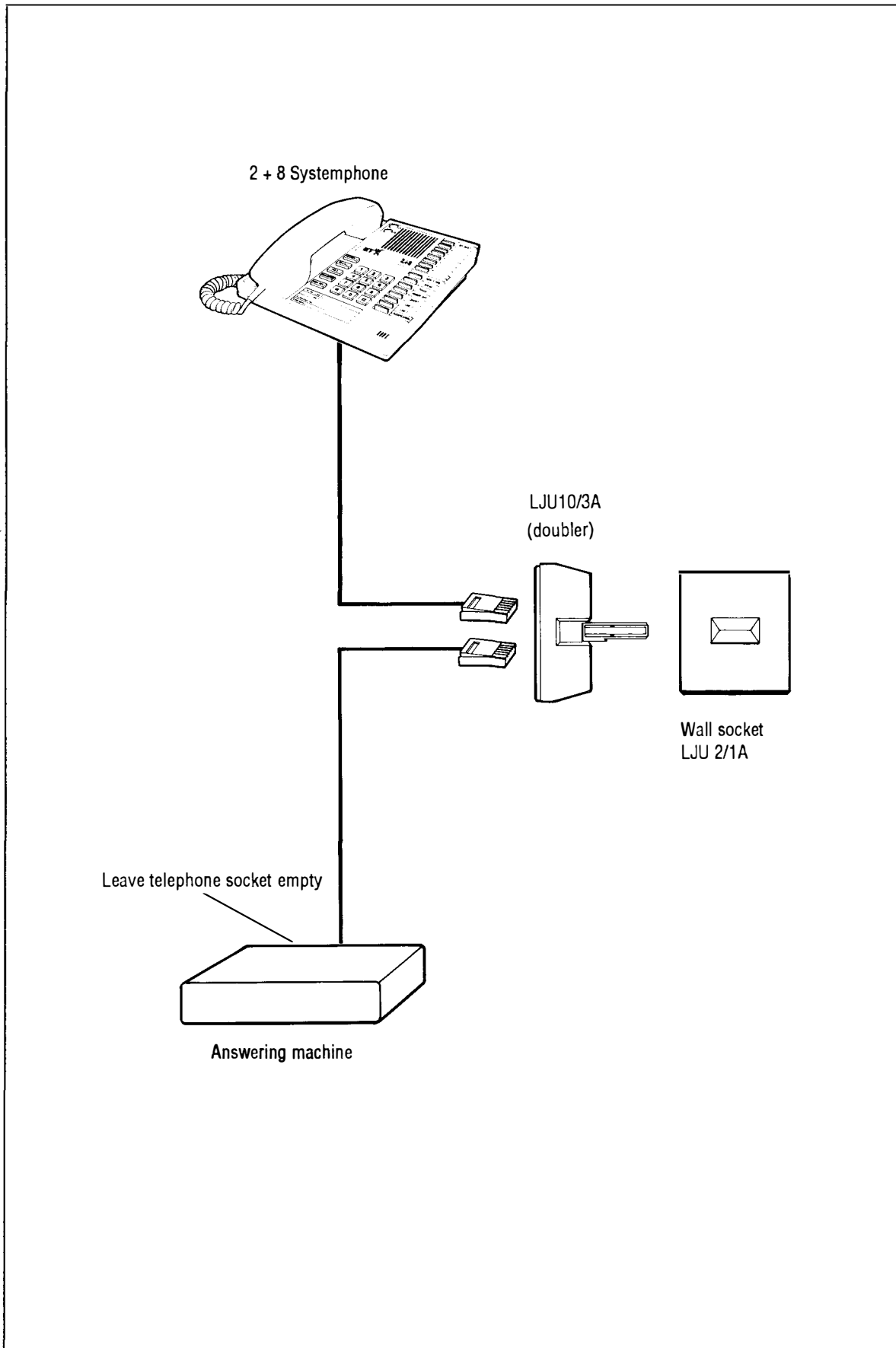
3.1 Subsidiary connection (piggy-backing)

Before connecting 2+8 to a host PABX the approved maintainer should be consulted. 2+8 may only be attached to PABXs given in List C of the DTI document 84011 I.

When the 2+8 is connected to a host PABX, it is a mandatory requirement that locking bars 2A or 3A are fitted to extension wall sockets serving extensions 20 and 21, holding the telephone plugs captive.

The 2+8 may be connected to a host PABX by connecting an extension from the host PABX to the exchange line port of the 2+8. The connection details are the same as those given in paragraph 2.1.9 for the exchange line, except that for Exchange line read Host PABX.

It will be necessary to select the forward recall type for either Earth or Time Break recall depending on the host PABX. This is selected by DIL switch on the CCU PCB. See paragraph 2.1.13 and Figure 2.5. See also paragraph 2.1.14 for setting of the LK1 and LK2 host PBX straps.

Note If Earth Loop Recall is selected it is important that the polarity of the exchange line A and B wire is correct or the recall facility may not work. Exchange line A and B wires must be terminated as labelled on the exchange line IDC terminals. See paragraph 2.1.9.

4.1 Safety precautions and switch on

Before switching on ensure that:

- The mains plug is fused with a 3A cartridge fuse.

- There is a reliable earth at the mains supply socket earth pin by testing with a 13A socket earth continuity tester.

- All four DIL switch banks and line voltage links have been correctly set.

- All equipped extensions have a telephone or a Systemphone connected.

- The CCU cover has been replaced.

- Switch on the mains power and allow at least 15 seconds for the CCU to go through its power up routine. At first the Systemphone LEDs will all light up, and eventually the line LEDs will be extinguished.

- When the 2+8 is in an idle state all LEDs on Systemphones should be extinguished. If the exchange line LED(s) remain on, this means that either the exchange line port(s) do not have lines connected or the line voltage feed straps may need to be set.

WARNING
Disconnect mains supply before removing CCU cover.

5.1 **Programming**

The programmable features of the 2+8 are as follows:

- Night service on/off
- Ringer on/off
- Speak on/off.

Programming instructions for all system features are given in the *2+8 Systemphone* and *Extension telephone* user's guides. Following a power failure the programming is lost and must be re-entered.

6.1 Commissioning the system

The following sections can be used as a guide to testing the system prior to handover of the 2+8 to the customer. These are:

- Commissioning procedure with lines connected (maintenance replacement of CCU).

- Commissioning procedure prior to lines being connected. The exchange line ports will be connected at a later stage following installation (new system prior to PCI).

- Commissioning procedure for systems with no lines connected. No direct or indirect connection to the Public Switched Telephone Network. System is used as an entirely independent switching system using the extensions only.

6.1.1 Commissioning procedure with line connected

1   Fit and appropriately mark Telephone and Systemphone labels at all equipped extensions.

2   Ensure that the MF/LD signalling of the Systemphones and telephones are set as required.

Note   If the Systemphones are set to Loop-disconnect signalling, keying ✽ after going off-hook will switch the Systemphone to MF signalling. Going on-hook will reset the Systemphone to LD signalling.

3   Set switch S8 to the down position in the configuration Switch bank SW1. Also ensure that all switches in all four banks are set as required (see Section 2.1.13, *Setting the CCU DIL switches*).

4   Replace the CCU cover and follow the instructions in Section 4.1, *Safety precautions*, and switch on.

5   Check that the System mode (PBX, Keysystem and Exclusive line) and the extensions configured for call barring are correct and operational.

6   At each Systemphone extension check that the Loudspeaking facility on Systemphones functions correctly by pressing the **LOUDSPEAKER** key or **EXTENSION** key. Ensure that internal dial tone is heard and that the volume can be adjusted.

7   Establish two simultaneous internal calls to check both speech paths are operational. Intercom busy LED will be lit when the two internal calls are established.

8   At each Systemphone extension check that at least one external telephone number can be stored and transmitted.

9   Seize each external line from each extension using all methods available. Ensure that external dial tone is heard and that good transmission is possible in both directions.

10   At each telephone extension check that the exchange line can be accessed and put on hold by pressing the **RECALL** key on that telephone. At extension 20, check that both exchange lines can be accessed and put on hold by pressing the **RECALL** key on that telephone.

11 Ensure that exchange line(s) and terminals can be answered and rung as configured. Check that the correct lines/numbers and extension are called and that good transmission is possible in both directions.

12 Switch off the mains power and check the operation of the power fail extensions 20 and 21.

13 Restore the mains power and check that the system is fully operational.

14 Return the completed 2+8 Customer Configuration Form to the customer.

6.1.2 Commissioning procedure prior to lines being connected

1 Fit and appropriately mark Telephone and Systemphone labels at all equipped extensions.

2 Ensure that the MF/LD signalling of the Systemphones and telephones are set as required.

Note If the Systemphones are set to Loop-disconnect signalling, keying ✳ after going off-hook will switch the Systemphone to MF signalling. Going on-hook will reset the Systemphone to LD signalling.

3 Set switch S8 to the UP position in the configuration Switch bank SW1. Also ensure that all switches in all four switch banks are set as required (see Section 2.1.13 *Setting the CCU DIL switches*).

4 Replace CCU cover and follow the instructions in Section 4.1, *Safety precautions*, and switch on.

5 Check that the System mode (PBX, Keysystem and Exclusive line) and the extension configured for call barring is correct and operational.

6 At each Systemphone extension check that the Loudspeaking facility on Systemphones functions correctly by pressing the **LOUDSPEAKER** key or **EXTENSION** key. Ensure that internal dial tone is heard and that the volume can be adjusted.

7 Establish two simultaneous internal calls to check both speech paths are operational. Intercom busy LED will be lit when the two internal calls are established.

8 Remove the mains plug from the 13A power socket. The system may now be subjected to pre-connection inspection.

9 Following a successful PCI, connect the exchange line(s) at the exchange line IDCs, restore switch S8 to its **down** position and replace the CCU cover. The system can now be powered up by replacing the mains plug in the 13A power socket.

10 At each Systemphone extension check that at least one external telephone number can be stored and transmitted.

11 Seize each external line from each extension using all methods available. Ensure that external dial tone is heard and that good transmission is possible in both directions.

12 At each telephone extension check that the exchange line can be accessed and put on hold by pressing the **RECALL** key on that telephone. At extension 20, check that both exchange lines can be accessed and put on hold by pressing the **RECALL** key on that telephone.

13 Ensure that exchange line(s) and terminals can be answered and rung as configured. Check that the correct lines/numbers and extension are called and that good transmission is possible in both directions.

14 Switch off the mains power and check the operation of the power fail extensions 20 and 21.

15 Restore the mains power, and check that the system is fully operational.

16 Return the completed 2+8 Customer Configuration Form to the customer.

6.1.3 Commissioning procedure with no lines connected

1 Fit and appropriately mark Telephone and Systemphone labels at all equipped extensions.

2 Ensure that the MF/LD signalling of the Systemphones and telephones are set as required.

3 Set switch 8 to the up position in the configuration Switch bank SW1. Also ensure that all switches in all four banks are set as required (see Section 2.1.13, *Setting the CCU DIL switches*).

4 Replace CCU cover and follow the instructions given in Section 4.1, *Safety precautions*, and switch on.

5 Check that the System mode (PBX, Keysystem and Exclusive line) and the extensions configured for call barring are correct and operational.

6 At each Systemphone extension check that the Loudspeaking facility on Systemphones functions correctly by pressing the **LOUDSPEAKER** key or **EXTENSION** key. Ensure that internal dial tone is heard and that the volume can be adjusted.

7 Establish two simultaneous internal calls to check both speech paths are operational. Intercom busy LED will be lit when the two internal calls are established.

8 Ensure that the terminals can be answered and rung as configured. Check that the correct lines/numbers and extension are called and that good transmission is possible in both directions.

9 Switch off the mains power and check the operation of the power fail extensions 20 and 21.

10 Restore the mains power and check that the system is fully operational

11 Return the completed 2+8 Customer Configuration Form to the customer.

7.1 Faulting and maintenance

There are no user-replaceable parts in the system. In the event of problems, faulting of the system is limited to checking the switch settings, voltage links, functional testing, mains plug or input fuse replacement and changeout of the Systemphone or CCU. A basic faulting flowchart for the 2+8 is given in Figure 7.1.

If the customer's 2+8 system suffers from repeated lock-ups or crashes for no apparent reason, ask the customer if any other electrical appliance is being switched on or off at the time the system stops working. The 2+8 has designed-in mains interference suppression, line surge protection, and electrostatic discharge immunity. However, it is not possible to protect the system entirely from extreme levels of external interference and these can cause the central processor to stop working. The only immediate remedy is to power the system down and then up again.

If calls are being disconnected for no apparent reason the cause must be isolated to either the 2+8 system or the local switching network. A suggested method is to change the CCU and note if the fault still persists. Extreme levels of external interference can cause call disconnection which is usually followed by a complete system crash.

Figure 7.1   **Faulting flowchart**
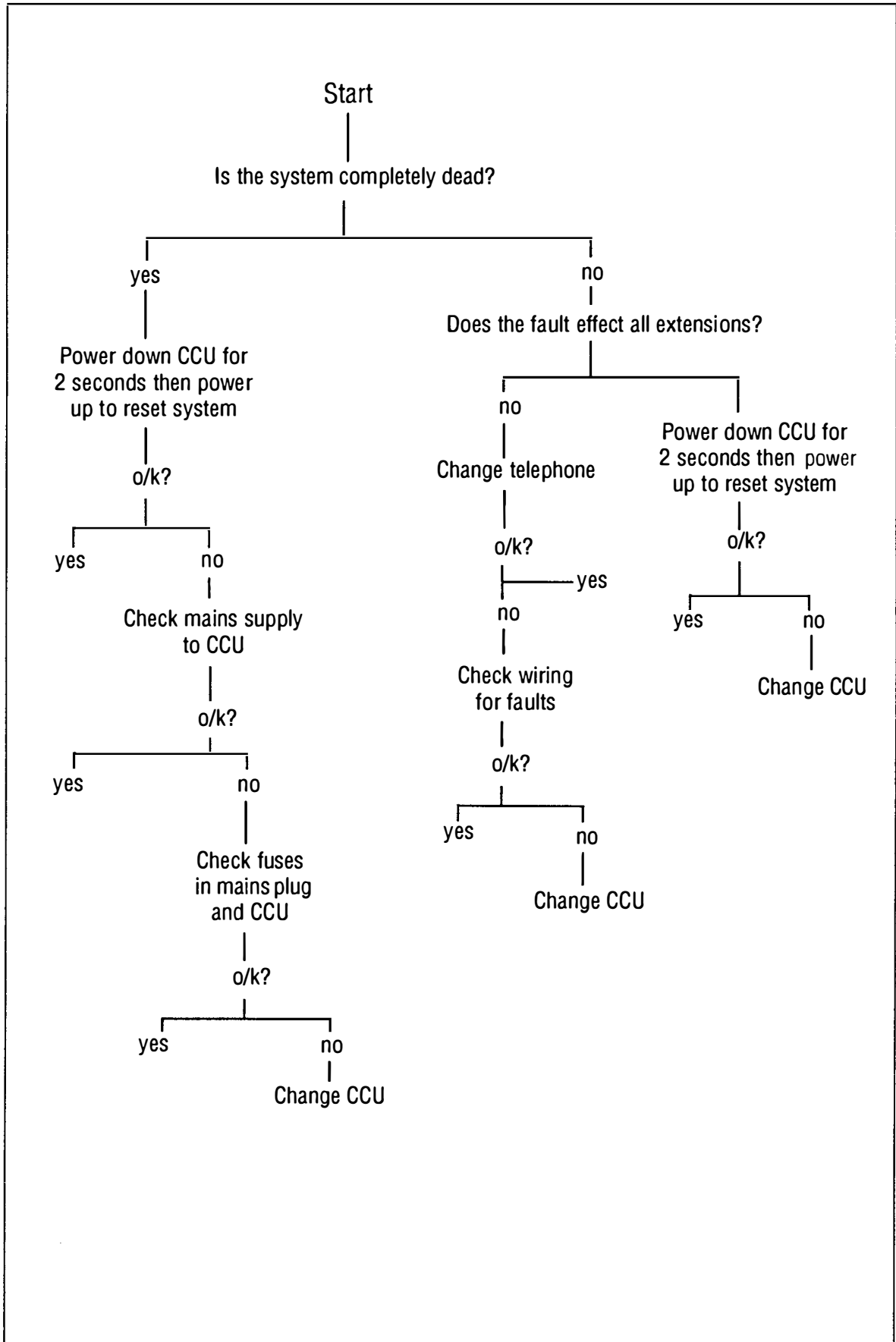
8.1 **Tones and ringing**

Tone	Frequency	Cadence
Internal dial tone	440/350Hz +/-0%	Continuous
Engaged tone	425Hz	0.72 Sec. ON 0.72 Sec. OFF
Ring tone	425Hz " "	1.26 Sec. OFF 0.54 Sec. ON
		0.18 Sec. OFF 0.90 Sec. ON
Special dial tone	425Hz " "	1.26 Sec. ON 0.18 Sec. OFF
Warn tone	425Hz " "	1.08 Sec. ON then OFF
Confirmation tone	425Hz " "	0.18 Sec. ON 0.18 OFF
		0.18 Sec. ON 0.18 OFF
		0.18 Sec. ON 0.54 OFF
Number unobtainable	440Hz	Continuous

Ringing

Internal ringing	25Hz	1.08 Sec. ON 1.8 Sec. OFF
External ringing	25Hz	0.54 Sec. ON 0.18 Sec. OFF
		0.54 Sec. ON 1.62 Sec. OFF
Internal fast ring	25Hz	0.36 Sec. ON 0.18 Sec. OFF
		0.36 Sec. ON 0.54 Sec. OFF

9.1 **Numbering plan**

0	Call extension 20 (Operator service)
10	Night service on
11	Night service off
20	1st Extension
21	2nd Extension
22	3rd Extension
23	4th Extension
24	5th Extension
25	6th Extension
26	7th Extension
27	8th Extension
30	Extension reset
40	Ring back when free
41	Exchange line 1
42	Exchange line 2
5	Call Park
61	Ringer on, line port 1
62	Ringer on, line port 2
66	Ringer off, both lines
69	Ringer on, both lines
70	Divert
71	Cancel Divert
8	Incoming call pick-up
9	Spare

10.1 **Statutory information**

These notes are applicable to 2+8 systems installed in the UK and connected to telecommunication systems operated by British Telecommunications, Kingston Communications (Hull) plc, or Mercury Communications Ltd.

■ The system is suitable for use on Exchange and Private branch exchange Lines which provide either Pulse or TouchTone signalling.

■ The 2+8 has been fully safety tested to BS 6301.

> **WARNING**
> **Connect only apparatus complying with BS 6301 to the extension ports. Other use will invalidate any approval given to the apparatus.**

■ The total Ringer Equivalence Number (REN) of each extension is 4.

Note Only one Systemphone can be connected to a single extension.

■ The REN of each Exchange line port is 1.

■ The REN of each of the Extension ports is 4.

■ The Approval for the use of External Extensions (connection of extension instruments) by the Department of Trade and Industry, is only granted provided the installation of the extension instrument is within the confines of the customer's premises and that the distance of the extension instrument from the 2+8 Control Unit does not exceed the followng limits when using 0.5mm^2 copper conductor:

- 150m for 2+8 Systemphone
- 300m for approved (green spot) telephones.

■ The 2+8 should be installed in accordance with BS 6701:Parts 1 and 2.

■ In order to provide a visual indication of the status of the lines of the 2+8 system, it is recommended that at least one extension instrument be a Systemphone.

■ Only telephones approved to BS 6317 1982 shall be connected to the 2+8 system. These must have a **RECALL** key and be capable of sending Earth Loop recall. Time Break recall types are not suitable.

■ The 2+8 is suitable for connection in subsidiary mode to most PBXs; however, satisfactory performance cannot be guaranteed with every allowable combination of host and subsidiary system.

■ A power failure will reset the system and return all extensions to their defaults. During power failure, extension 20 is connected to line 1, and extension 21 is connected to line 2, to enable incoming and outgoing calls.

■ The approval of the 2+8 facilities does not guarantee their satisfactory performance under all operating conditions.

■ Both exchange lines are configured for small call routeing mode (SCRM). Depending on the system configuration mode, all extension ports may be associated with the SCRM lines. Exchange lines are selected as follows:

Systemphone
Press the appropriate line key or key 41 (for line 1) or 42 (for line 2).

Approved (green spot) telephones
Press the telephone recall key or key 41 (for line 1) or 42 (for line 2).

■ Forward Earth or Time Break recall is provided on the exchange line ports. The maximum allowable installation resistance of the functional earth is 50 Ω.

■ The current feed from the extension ports is in the range of 22 to 28ma. The best overall performance of the system will be obtained by using approved extension telephones of impedance class A.

■ Payphones are not suitable for connection to the 2+8.

■ The 2+8 is designed for 240V ac 50Hz mains supply.

■ The 2+8 control unit and Systemphones have been designed to work in an office-type environment and with the following specific design limitations:

- operating temperature	0° to 40°C
- storage temperature	-20° to 60°C
- relative humidity	<80%
- main supply	240V ac +10% -5% 50Hz
- power consumption	100W with a fully loaded system.

10.2 **Notes**

Notes

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