MINIMASTER 3

MINIMASTER 3

SWITCHING SYSTEM

SYSTEM MANUAL

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MINIMASTER 3 SYSTEM MANUAL

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2. Introduction

2.2 Description

The Minimaster 3 is a mains powered, microprocessor controlled call connect system capable of supporting up to ten extensions and two exchange lines.

The terminals connect to the central control unit (CCU) through plug and socket master jacks (BS6317 ports).

The terminals must employ loop disconnect signalling, a recall switch is not required.

An installation comprises a CCU, one or two exchange lines and up to ten extensions.

2.2 Facilities

The following is a list of the facilities provided by the system:

- Internal calls from all extensions.
- Selection of defined exchange line.
- Hold.
- Enquiry during internal and external calls.
- Shuttle between exchange line and third party extension.
- Transfer.
- Call diversion.
- Three party conference between one exchange line and two extensions, or between three extensions.
- Secrecy on all connections.
- Secretarial override of call diversion.
- Last number redial.
- Alert tone to indicate incoming calls, if the designated receiving extension is busy.
- Any extension can answer an incoming call.
- Differential ringing cadence for internal and external calls.
- A choice of incoming ringing sequences to designated extensions.
- Night service.
- Mains fail connection of two designated extensions to the exchange lines.

2.3 Central Control Unit

The central control unit (CCU) is a single wall mounted unit. This unit houses:

- The power supply for the system, the extension line feed and the ringing generator.
- A single printed circuit board.
- Insulation displacement termination (IDT) for the exchange lines and extension lines terminations.
- A screw termination for an earth cable.

2.4 Terminals

A wide variety of terminal equipment can be connected to the system. Earth recall is not required by the system. Terminals must comply with the safety specification BS6301 and with the specification for simple extension telephones BS6317.

3. Operating instructions

3.1 Tones

The system supplies tones through the handset to the user, to indicate the system state. A single frequency signal is cadenced to provide the required tone. (See section 4.6.12 for technical specification.)

- Internal dial tone: ——————————————— (Continuous tone)

- Divert dial tone: —— —— —— (Intermittent tone)
  Both these tones indicate that the system is waiting for a dialled digit.

- Internal ring tone: —— —— (Long pause.)
  The extension dialled is being rung.

- Busy tone: — — — — (Short tone and pause.)
  The extension dialled is engaged.

- Alert tone: - - - (Very short tone, long pause.)
  An external call is waiting to be answered.

3.2 Ringing signals

The system supplies one of two ringing signals to the extensions, to indicate whether the announced call is internal or external. (See section 4.6.11 for technical explanation.)

- Internal ringing: ‾‾‾‾   ‾‾‾‾   (Slow repeated bursts.)
  An internal call is waiting to be answered.

- External ringing: ‾‾ ‾‾   ‾‾ ‾‾ (repeated double bursts)
  An external call is waiting to be answered.

3.3 Making calls

All extensions are able to make internal and external calls.

3.3.1 To make an internal call

1.   Lift the handset. Internal dial tone will be heard.

2.   Dial the required extension number, 20 - 29.

3.3.2 To make an external call

3.3.2.1 System selection of exchange line

1.   Lift the handset. Internal dial tone will be
     heard.

2.   Dial '9' and wait for exchange dial tone.

3.   Dial the required number.

Alternatively, the previous external number dialled
may be automatically re-dialled.

The system selects the exchange line as follows:

If only one line is free, that line is selected. If both lines are free, that line which was not selected for the last external call is selected.

3.3.2.2 User selection of exchange line

1. Lift the handset. Internal dial tone will be heard.

2. Dial '31' to select exchange line 1 or '32' to select exchange line 2 and wait for exchange dial tone. If only one exchange line is fitted, engaged tone will be returned if '32' is dialled.

3. Dial the required number.

3.3.3 Repeat last number

The last external number dialled from each extension is retained by the system, and can be re-dialled automatically.

1. Lift the handset. Internal dial tone will be heard.

2. Dial '5' and wait for exchange dial tone.

3. Dial '5' again. The system will automatically re-dial the last external number dialled from that extension.

The system automatically selects an exchange line (See Section 3.3.2.1) when repeat last number is requested.

3.4 Receiving calls

Two ringing cadences are available to enable the (internal or external) origin of the call to be determined.

3.4.1 To answer call at an extension which is ringing

1. Lift the handset. The extension is now connected to the call.

3.4.2 Universal answer: To answer an incoming external call which is ringing at another extension

1. Lift the handset. Internal dial tone will be heard.

2. Dial '8'. The extension is now connected to the call.

It is not possible to use this facility to answer an internal call which is ringing at another extension.

3.4.3 Announcement of incoming external calls

Four options are available (See section 4.4) to present incoming external calls to up to three extensions. The option must be selected when the system is installed.

If an external caller decides to terminate the call before a connection to an extension is established, the system will continue to send possibly several cadences of ringing. If this abandoned call is now answered at the ringing extension or at another extension using the universal answer facility, exchange dial tone will be heard. The handset should be replaced.

3.5 Call Hold, Enquiry, Shuttle and Conference - External calls

A connection must first be established between an extension and an exchange line. To set up an enquiry, shuttle or conference the exchange line must first be placed oh 'hold'.

At least 10 seconds must elapse after completion of dialling an external number before the call can be placed on 'hold'. If 'hold' is unsuccessful, wait for another 10 seconds before trying again.

1. Dial '1'. Internal dial tone will be heard. The exchange line is now on 'hold'.

2. Dial the number of the required extension. If that extension is busy, dial '1' to revert back to the exchange line. If that extension is not busy, ringing tone will be heard. On answer, a connection is made between the two extensions and an 'enquiry' can be made.

3. Revert back to the exchange line by dialling '1'. The exchange line is released from 'hold' and the 'enquiry' extension is placed on 'hold'.

4. It is possible to 'shuttle' back and forth between the exchange line and the 'enquiry' extension by dialling '1' each time, (provided the called extension remains off hook).

A call on hold cannot overhear any connection. All external, internal and enquiry calls are secret.

5. To establish a 'conference' call between an exchange line and another extension follow steps 1 and 2 above. The exchange line is on 'hold' and an 'enquiry' call is established with another extension. Dial '4'. The exchange line is released from 'hold' and the 'conference' call is established.

6. Either extension can leave the 'conference', by replacing the handset, without affecting the connection of the other extension with the exchange line.

3.5.1 Abandoned external calls

If an extension places an exchange line on 'hold' and subsequently replaces the handset without releasing the exchange line from 'hold', that extension is immediately rung by the system. This 'abandoned' call can only be answered at the ringing extension. The extension handset must be lifted, to release the exchange line from hold.

3.6 Call Hold, Enquiry and Conference - Internal calls

A connection must first be established between two extensions. Either extension can originate the call.

1. Dial '1'. Internal dial tone will be heard. The 2nd extension is put on 'hold'.

2. Dial the number of the required 3rd extension. If the extension is not busy, ringing tone will be heard. On answer, a connection is made between the 1st and 3rd line extensions and an 'enquiry' can be made. If the required 3rd extension is busy, dial '1' to revert back to the 2nd extension line.

3. To revert back to the 2nd extension, dial '1'. The 3rd extension is not put on 'hold' and will hear internal dial

tone. It is not possible to 'shuttle' on internal 'enquiry'.

A call on 'hold' cannot overhear any connection. All external, internal and enquiry calls are secret.

4. To establish a 'conference' call between three extensions, first follow the steps 1 to 2 above. The 2nd extension is on 'hold' and an 'enquiry' call is established with a 3rd extension. Dial '4'. The 2nd extension is released from 'hold' and the conference is established.

5. Any of the three extensions can leave the conference, by replacing the handset, without affecting the connection between the other two extensions.

3.7 Call diversion

'Call diversion' allows any extension to divert all incoming external or internal calls to another host extension. Only the host extension is able to call the diverting extension. The diverting extension can originate calls.

It is not possible to divert calls either if the extension is acting as host for another diverting extension or if the nominated host extension is already diverting its calls. Busy tone will be heard if call diversion is attempted in these cases, no call diversion will be invoked.

3.7.1 To set-up call diversion

1. Lift the handset. Internal dial tone will be heard.

2. Dial '41' followed by the number of the required host extension. E.g. dial '4124' to divert calls to extension 24. Divert dial tone will be heard to acknowledge this call diversion.

3. Divert tone instead of internal dial tone, will be heard by the diverting extension whenever the handset is lifted, to indicate that call diversion is invoked.

3.7.2 To cancel call diversion

1. Lift the handset. Divert tone will be heard.

2. Dial '41.' Wait about five seconds before replacing the handset, this allows time for the extension to signal these digits to the system.

3. Internal dial tone will be heard whenever the handset is subsequently lifted.

3.8 Night service

If 'night service' is invoked, all incoming external calls are announced at only one extension.

If the system is equipped with two exchange lines, the extension nominated to receive incoming calls on 'night service' must be equipped only with a central bell. Calls may only be answered at another extension by use of the 'universal' answer facility. If two incoming external calls are being announced at this extension, the bell will continue to ring until both calls have been answered.

The central bell facility may also be provided on single exchange line installations.

'Night service' can only be invoked and revoked from extension 21.

3.8.1 To invoke default 'night service'

1. To invoke 'night service' to ring extension 23 (default night service extension), lift the handset of extension 21. Internal dial tone will be heard.

2. Dial '44'. Wait about five seconds before replacing the handset, this allows time for the extension to signal these digits to the system.

3.8.2 To nominate the 'night service' extension

'Night service' can be invoked to indicate incoming calls at any one of the extensions. See above concerning the use of central bells.

1. To invoke 'night service' to ring a nominated extension, lift the handset of extension 21. Internal tone will be heard.

2. Dial '44' followed by the extension number of the extension nominated to announce incoming calls. Internal dial tone will be heard, to indicate that 'night service' has been invoked.

3.8.3 To cancel 'night service'

1. Lift the handset of extension 21. Internal dial tone will be heard.

2. Dial '45'. Internal dial tone will be heard, to indicate that 'night service' has been revoked.

3.9 Mains failure operation

In the event of a power failure, exchange line 1 is connected to extension 21 and exchange line 2, if provided, is connected to extension 22.

None of the facilities of the system are available during mains failure operation.

Calls can be made from and received by the extensions that are connected to the exchange lines.

3.10 Additional information

3.10.1 Speech paths

The system has two internal speech paths and two external speech paths, therefore two external calls and two internal calls can take place simultaneously. External and internal speech paths cannot be exchanged, so if only one external speech path is in used it is still only possible to make two internal calls simultaneously.

If an enquiry call is made during an external call, two speech paths are used; one external and one internal.

If a conference call is required between one exchange line and two extensions, two speech paths are required to set up the conference; one external and one internal. Once the conference has been established, only the external speech path is used, the internal speech path being made available for another internal connection.

Only one internal speech path is required for enquiry during internal calls and for establishing a conference call between three extensions.

3.10.2 Numbering plan

The following is a summary of the numbering plan:

0 - Spare

1 - Hold and Enquiry

2 - Internal Calls

3 - Designated Exchange Line Access

31 - Select exchange line 1

32 - Select exchange line 2

41 - Call diversion

44 - Invoke Night Service

45 - Revoke Night Service

5 - Repeat Last Number

8 - Universal Call Answer

9 - Exchange Line Access

4. Installation

4.1 'Anti-static' precautions

The printed circuit board (p.c.b) holds devices which can be damaged by the discharge of static electricity, resulting in severely shortened life expectancy or failure. These devices are the integrated circuits mounted on the p.c.b. Care should be taken to avoid touching these devices or adjacent circuitry.

4.2 Securing the Central Control Unit (CCU) to the wall

The CCU is designed for fixing to a vertical wall (it must not be operated in a horizontal position). A three meter mains cable is fitted with a 13 Amp plug, so the CCU must be fitted within safe reach of a suitable 240 Volt a.c. mains socket.

Do not connect the CCU to the mains supply until all wiring has been completed and the CCU is securely fixed to the wall, with the cover in place.

First remove the cover by loosening the 4 captive screws recessed into the corners of the lid. Visually check the CCU to ensure no damage has occurred in transit.

Drill 4 holes into the wall, to take No 8 X 25 mm counter sunk screws. The top holes should be 250 mm apart and similarly the bottom holes. The distance between each top hole and the bottom hole vertically below should be 246 mm. If fixing to a masonry or stud-partition wall, suitable wall plugs must be used. If fixing to a wood surface it may only be necessary to drill pilot holes.

Screw 2 No. 8 X 25 mm screws into the top holes until approximately 15 mm protrudes. Hang the CCU onto these 2 screws using the key hole slots in the base. Put two more screws into the bottom two holes and tighten until secure. Now tighten the top screws until they too are secure. Check that the CCU is now firmly fixed to the wall.

4.3 Attaching the wiring to the CCU

The functional earth should now be attached to the earth terminal. Pass the earth cable through one of the cable entry holes in the lower edge of the CCU and run it towards the earth terminal. Strip 5 mm off the insulation, and insert the bare end into the earth terminal. This screw terminal is located at the bottom right hand edge of the p.c.b to the left of the exchange line terminals. The earth cable to be used is specified later in this section. Ensure that this earth cable is securely terminated.

The exchange lines should now be run in through the cable entry holes in the lower edge of the CCU and terminated on the Insulation Displacement Terminals (IDT's) marked 'EXCH 1' and 'EXCH 2' at the bottom right hand edge of the p.c.b. If only one exchange line is to be connected, it must be connected to the IDT marked 'EXCH 1' and switch 4 must be set to 'ON'. (See Section 4.4).

The wires from the ten extensions must now be run in through the cable entry holes in the bottom edge of the CCU. Ensure that sufficient cable is available to enable re-termination if necessary.

The two wire from each extension must be terminated on the associated extension IDT marked from right to left as '21', '22', etc to '29' and '20'. If all ten extensions are not being equipped, the preferred arrangement is to equip adjacent extension positions, starting at extension 21.

A system equipped with only one exchange line must always have extension 21 equipped. A system equipped with 2 exchange lines must always have both extension 21 and extension 22 equipped.

Note: Only equipment complying with BS6301 and BS6317 may be connected to these extension ports.

4.4 Setting the option switches

Four dual in-line (d.i.l) switches are located on the top left hand side of the p.c.b. to the right of the mains transformer. These switches are used to select the required incoming call ringing sequence and to select one or two exchange line operation.

Switch 4 is nearest the top edge of the p.c.b. A switch is in the ON position when the protruding plastic used for operating the switch is pushed towards the left hand side of the p.c.b.

If one exchange line is supplied, set switch 4 (top switch) to the ON position (Push switch to the left).

Refer to Fig 4.1 to set the desired incoming call ringing sequence. The sequence ends when the call is answered.

Options	SW1	SW2	SW3	Incoming call ringing sequence
1	OFF	OFF	OFF	Incoming calls only ring extension 21. This option must only be selected if only one exchange is fitted.
2	ON	OFF	OFF	Incoming calls ring extension 21 for 20 seconds and then ring extension 22 for 20 seconds. This sequence is then repeated.
3	ON	ON	OFF	Incoming calls first ring extension 21 for 20 seconds, then ring extension 22 for 20 seconds, and finally ring extension 23 for 20 seconds before repeating this sequence from extension 21.
4	ON	ON	ON	The incoming call sequence is the same as for option 3 above (ON ON OFF) but the sequence does not repeat itself after ringing 23 for 20 seconds. Instead, 23 continues to ring until the call is answered or the caller abandons the call. This option must only be selected if a central bell is equipped at extension 23.

Fig 4.1   Incoming call ringing sequence options

4.5 Testing

Confirm that the switches within the CCU have been set to select the incoming ringing sequence required by the customer and to provide for the number of exchange lines fitted.

Check once again that all wiring is secure, the switches have been correctly set and the installation looks tidy and correct.

Replace the CCU cover and gently tighten the 4 retaining screws until the cover is secure.

The mains power should not be connected at this stage.

Lift off the handset of extension 21 and confirm that exchange dial tone can be heard. If a second exchange line is fitted, lift off the handset of extension 22 and confirm that exchange dial tone can be heard.

Connect the system to the mains and turn on the supply.

Lift off the handset of each fitted extension and confirm that internal dial tone can be heard.

Make a call on each of the exchange lines. Check that transmission is functioning.

Make an internal call to each fitted extension. Confirm that all bells ring satisfactorily. Answer the call and confirm that transmission is functioning.

Arrange to have an incoming call on each line. Confirm that the incoming call ringing sequence is the option selected by the switch settings. Answer the call and confirm that transmission is functioning.

4.6 Additional information

4.6.1 Earth connection

A functional earth must be provided for the system, and must not be derived from the systems mains earth through the 13 Amp plug.

This functional earth must originate from a proven building earth point and be terminated within the CCU on the screw terminal provided on the printed circuit board. The earth cable should be insulated, and the conductor should be copper with a minimum cross sectional area of 1.5 mm. The resistance of this earth should not exceed 4 ohms.

4.6.2 Extension wiring

The two wire extension wiring is connected within the CCU on IDT. The extension end of each cable is terminated at a master line jack on terminals 2 and 5. The master line jack enables plug and socket connection of terminal equipment.

The loop resistance of each extension circuit must not exceed 200 ohms. For example, if 0.5 MM^2 CSA copper cable is used, the maximum distance an extension can be from the CCU is approximately 1190 meters.

4.6.3 External extensions

The system can support extensions with a maximum wiring loop resistance of 200 ohms (See Section 4.6.2).

If the external extension has any overhead wiring it is recommended that local lightening protection is provided in the extension wiring.

4.6.4 Connection losses within the CCU

When planning the installation of a system, the loss within the CCU on an extension to exchange line connection must be considered, to ensure that the installation conforms with the local exchange planning requirements.

The connection losses are:

- Extension to exchange line connection, nominally 1.5 dB at 800 Hz.

- Extension to extension connection, nominally 7 dB at 800 Hz.

4.6.5 Single exchange line installation

The system can be equipped with a single exchange line:

- The exchange line must be terminated on the IDT marked 'EXCH 1' (See Section 4.3).

- Option switch 4 must be set to ON (See Section 4.4).

The system will always select exchange line 1 when the exchange line access digit '9' is dialled.

If the user attempts to access the unequipped exchange line 2 by dialling the access digits '32', the system will return engaged tone.

As the system is only equipped with one exchange line the following are permitted:

- The incoming call ringing sequence option 1 can be selected (See Section 4.4).

- 'Night service' can be set-up to announce incoming calls at any equipped extension position. The extension position need not be equipped with a central bell (See Section 4.6.9).

4.6.6 Physical specification

CCU dimensions: 385mm x 280mm x 80mm
CCU weight: 3.5 Kg

4.6.7 Power requirements

- Power supply: 240 Volts, 192 Volts minimum, 264 Volts maximum, 50 Hz.

- Power consumption on idle, all extensions on hook, nominally 16 Watts.

- Power consumption, all extensions off hook: 45 Watts nominally.

4.6.8 The ringing generator

The ringing generator of the system has the nominal capacity to
support a maximum of four high impedance bells at each of the
extension positions, inclusive of the bell within the extension
telephone. The actual capacity depends on the bell types and
mix used with each installation. If the ringing generator is
overloaded with bells they may not sound at an acceptable
level, they may ring intermittently or they may not ring at
all. However, no damage will be done to the system.

4.6.9 Central bell

A central bell is a centrally sited bell to which all calls can
be routed if not previously answered. The central bell is
fitted to one of the extensions terminals, usually extension
23, in place of other terminal equipment. A central bell is
therefore always free to ring. If there are two incoming
exchange line calls both ringing at the central bell, the bell
will continue to ring until both calls have been answered.

The bell must be high impedance.

The provision of a central bell effectively reduces the system
to an extension capacity of nine.

4.6.10 Subsidiary Connection (Piggy-backing)

The system can be used as a subsidiary off another private
branch exchange (PABX).

Due to the transmission loss through the system being greater
than zero it is a List B system.

The system cannot obtain the host PABX's recall, so only limited facilities of the host PABX will be available.

The use of the system 'repeat last number' facility is not recommended if the host PABX requires an exchange line access digit pause. The system is unable to insert such a pause and digits could be lost if the facility is used.

The exchange lines to which the system has access through the host PABX must be of the required quality to satisfy the local exchange planning regulations. This is to compensate for the loss within the CCU and within the host PABX.

It is not recommended that on a two exchange line system one of the exchange lines is connected to an extension position on a host PABX and the other exchange line is connected to the local exchange.

Before connecting to the host PABX, consult the approved maintainer for the host PABX.

4.6.11 Ringing cadence

One of two ringing cadences can be supplied to an extension, to indicate to the user the origin of a call. An external call is announced by two short rings followed by a two second silent period. An internal call is announced with a cadence of a single ring and a two second silent period.

Caller	Freq	Cadence
Internal	25 Hz	1.00 sec on - 2.00 sec off
External	25 Hz	0.40 sec on - 0.20 sec off
		0.40 sec on - 2.00 sec off

4.6.12 Tones used by the system

The system provides a tone of a single frequency and this tone is cadenced to produce the required indications.

Tone	Freq	Cadence
Dial tone	425 Hz	continuous
Busy tone	425 Hz	0.38 sec on - 0.38 sec off
Ringing tone	425 Hz	1.00 sec on - 2.00 sec off
Alert tone	425 Hz	0.10 sec on - 2.50 sec off
Diversion dial tone	425 Hz	0.75 sec on - 0.75 sec off

5. Maintenance

5.1 Maintenance procedure

For the purposes of maintenance the system installation includes all extension wiring and phone sockets.

The sytem does not require any periodic maintenance, except for the user to check that the ventilation grilles are not obstructed.

5.2 Fault Location

If a fault is reported, tests should be made to identify the cause as follows:-

5.2.1 System will only function in the mains failure mode.
Check the mains supply. If the mains is not at fault the two fuses should be tested. The mains plug is fitted with a 3 amp fuse and a 315mA slow blow fuse is located within the CCU. For safety reasons it is essential that the mains supply is disconnected before the CCU fuse is removed.

5.2.2 Check for customer mis-operation.

5.2.3 If an exchange line is suspected of being faulty, temporary reversal of the two lines will assist in deciding whether the problem lies within the CCU or on the exchange line.

5.2.4 If an extension circuit is suspected of being faulty the following procedure is recommended:-

5.2.4.1 Disconnect the extension cabling at the CCU, connect a known test telephone and retest. If the circuit still appears faulty the CCU must be changed. If on retest the system functions satisfactorily proceed to 5.2.4.2

5.2.4.2   Reconnect the extension wiring, connect the test telephone at the phone socket and repeat the test. If the extension circuit now tests OK the maintainer for the extension instrument must be informed, if the circuit still appears faulty the phone socket should be changed and the test repeated. If after this test the extension still appears faulty the cabling must be disconnected at both the CCU and phone socket and checked for continuity, short circuits and earth connections.

PHONE SOCKET CONNECTION FOR MINIMASTER 3

Typical BT Telephone   Cord Conn No. 4/502   Master Line Jack Unit
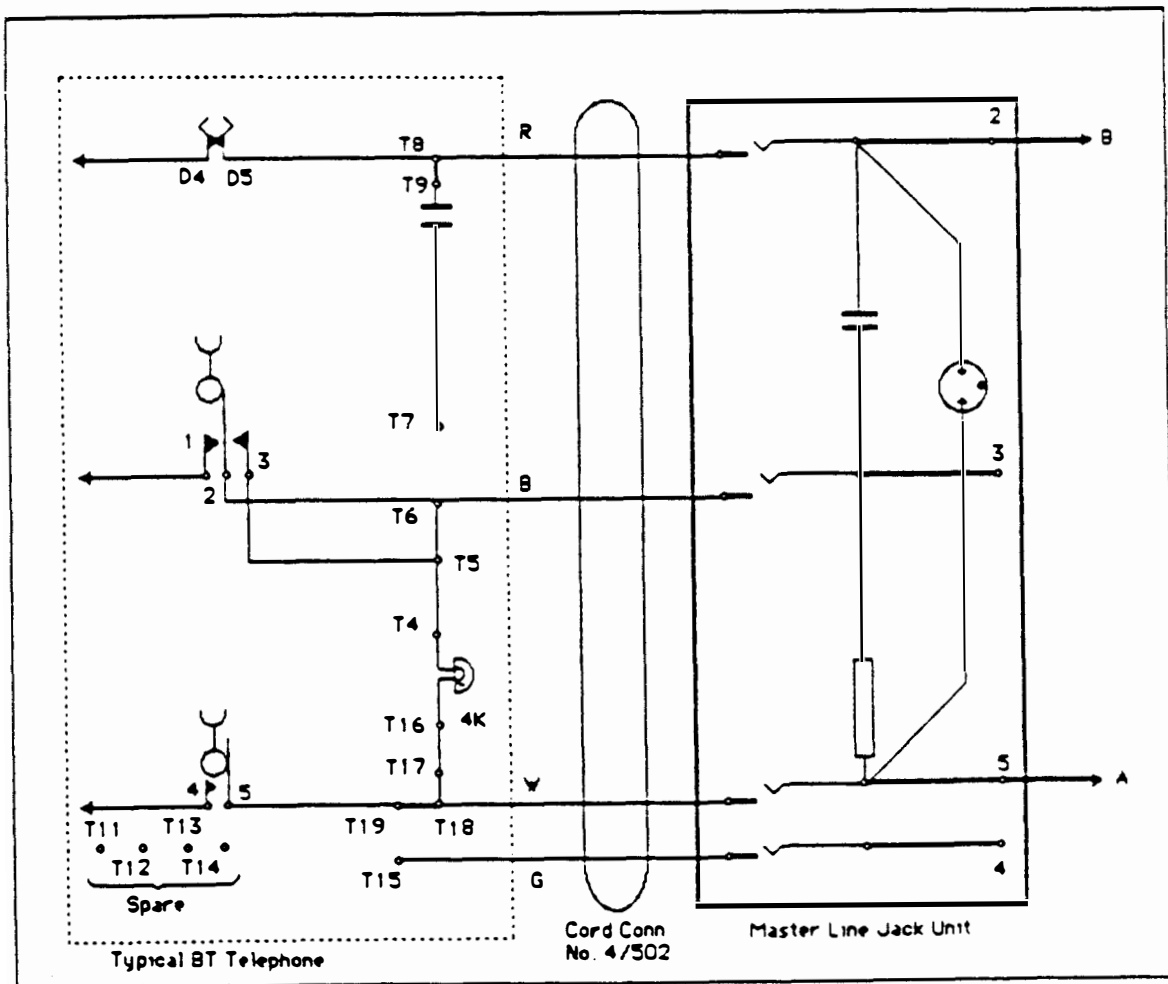
5.2.5   Having proved that the CCU is faulty the unit, minus its
        cover, should be replaced as follows:-

        First disconnect the unit from the mains and then remove the
        cover. Mark for identification purposes and disconnect the
        wires connected to the IDT's and the functional earth, remove
        the CCU from the wall by first loosening the top screws and
        removing the bottom screws. Lift the CCU off the top screws.
        Refer to the installation section of this manual when fitting
        the replacement unit.

        The customer original cover should be fitted to the
        replacement unit and the new cover returned with the faulty
        unit.

        Note the position of the dual in-line (d.i.l) switches in the
        faulty unit, and set the switches in the replacement unit to
        the same setting.

5.3 Transportation

    The CCU should be handled with care and be transported with the
    cover in place in its original packing. Before the system is packed,
    it is advisable to ensure that the screw securing the printed
    circuit board and the transformer to the base are tight.

6. System Architecture

6.1 Control Circuit

The system is controlled by an interrupt driven RCA 1802A microprocessor. The programme store is an 8K 2764 EPROM and the data store is a 2K RAM. An I/O capability of 16 input and 24 output ports enables the processor to determine the state of various elements in the circuit, e.g. extension off-hook, incoming call on exchange line etc, and can in turn send out signals in response.

6.2 Switching Matrix

The switching matrix consists of semi-conductor crosspoint switches. These switches enable the various call connections to be established e.g. extension to extension, extension to exchange, call conference etc. The various system tones are provided by cadencing the relevant connections between the extension and internal tone generator path.

6.3 Power Supply

Circuit diagram No : C6024

The power supplies for the various circuit elements are derived from the mains 240V a.c. supply. A linear mode design is used. The power supply outputs and functions are as follows:

1. -48 Volts d.c. Extension d.c. feed.

2. -43 Volts d.c. To enable the extension ringing relays to be controlled by the logic voltage level.

3. +5 Volts d.c. Logic voltage level.

4. +12 Volts d.c. To power the crosspoints.

5. 5 Volts 100Hz pulse. To provide the 10 mSec interrupt signal to the processor.

6. 50 Volts 25Hz. To provide ringing to the extensions.

6.4 Extension Line Circuit

Circuit diagram No : C 6027

In the following description all component designations will be those associated with extension 21.

1. The -48 Volts d.c. feed for the extensions is fed to each leg of the line through a 750 ohm resistance and a winding of the inductor L1.

2. R61 and C11 provide proper impedance conditions on the line during speech transmission.

3. The ringing voltage is connected to the extension by operating relay RL1.

4. Off-hook detection when the extension circuit was previously idle or when ringing is being supplied to the extension is provided by circuitry based on the potential divider principle.

5. C21 and C31 isolate the switching matrix from the signalling voltages used on the line. ZD1 and ZD11 protect the switching matrix from voltage surges which may occur during connection and disconnection of the ringing voltage or during decadic pulsing from the extension.

6.5   Exchange Line Circuit

Circuit diagram No. : C 6028.

The component designations used in the description below are those associated with exchange line 1.

The mains fail connection relay RL11 is continuously operated while power is connected. If the power supply fails, RL11 connects exchange line 1 to extension 21.

1.   Incoming ringing is detected by an opto-coupler, software analysis validates the signal. To answer an incoming call, relays RL13 and RL15 are operated, this connects the exchange line to the transmission bridge.

2.   A current sink for the d.c. current flowing in the line is provided by TR19 and TR21. TR23 provides a feedback element. This gives the current sink a high impedance to a.c. signals in the line.

3.   The rectifier bridge BR1 ensures that the polarity of the voltage at the current sink is correct regardless of the polarity on the exchange line.

4.   A gas discharge tube GDT1 is connected across the line for protection against atmospherically induced voltage surges. Additional protection is provided by R123 and R125 and varistors VR1 and VR3. ZD21 and ZD23 protect the switch matrix and ZD25 protects the current sink.

5.   Loop-disconnect signalling pulses are sent to line by releasing RL15 and pulsing RL13.

6.   An exchange line may be put on 'hold' by releasing RL13 while holding RL15.

7.   The exchange line returns to the 'idle' state when RF13 and RL15 are released.

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