BLACK BOX ®
NETWORK SERVICES

Primary to Basic Rate ISDN Multiplexer (Options of Port combinations):

(8) S BRI & (2) PRI -	ISU9421-R2
(16) S BRI & (2) PRI -	ISU9420-R2
(8) S BRI & (16) POTS & (2) PRI -	ISU9422-R2
(16) POTS & (2) PRI -	ISU9423
(32) POTS & (2) PRI -	ISU9424

Primary Rate to Basic Rate ISDN Multiplexer

How To Contact your Local Black Box

Italy:

Black Box Italia S.P.A

Tel: 0227400280
Fax: 0227400219
Web Site: www.blackbox.it

Deutschland:

Black Box Deutschland

Tel: 0811/5541-0
Fax: 0811/5541-499
Web Site: www.blackbox-deutschland.com

Switzerland:

Datacom Black Box Services AG

Tel: 0554517070
Fax: 0554517075
Web Site: www.black-box.ch

Netherlands:

Black Box Datacom BV

Tel: 03032417799
Fax: 0302414746
Web Site: www.blackbox.nl/

Belgium:

Black Box

Tel: 027258550
Fax: 027259212
Web Site: www.blackbox.be

Australia:

Black Box Catalog Australia PTY LTD

Tel: 0398797100
Fax: 0398702955

Brazil:

Black Box Do Brasil.

Tel: (011) 5515-4000
Fax: (011) 5515-4002
Web Site: www.blackbox.com.br

Canada:

Black Box Canada Corp.

Tel: 0416-736-8000
Fax: 0416-736-7348
Web Site: www.blackbox.com

Mexico:

Black Box De Mexico S.A. de C.V

Tel: 05-420-0100
Fax: 05-420-0123
Web Site: www.blackbox.com.mx

Japan:

Black Box Catalog

Tel: 03-3820-5011
Fax: 03-3820-5010
Web Site: www.blackbox.co.jp/

SALES: 0118 965 5100

France:

Black Box Catalogue

Tel: 0145606700
Fax: 0145606747
Web Site: www.blackbox.fr

Spain:

Black Box Comunicaciones S.A.

Tel: 34 91 663 0200
Fax: 34 91 661 84 35
Web Site: www.blackbox.es

U.S.A

Black Box Corporation

Tel: 724-746-5500
Fax: 724-746-0746
Web Site: www.blackbox.com

Chile

Black Box Chile

Tel: 00 562 223 8811
Fax: 00 562 225 1002
Web Site: www.Blackbox.cl

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Introduction

The Product

The Primary to Basic Rate ISDN Multiplexer from Black Box allows analogue and basic rate ISDN terminals to be used with a primary rate ISDN connection. A primary rate terminal ISDN can also be connected.

Basic rate interfaces (BRI) and analogue (PSTN) interfaces are provided by line cards. Up to 2 line cards can be fitted.

There are 2 BRI line cards - a card with 8 S0 interfaces (I.430 compatible) and a card with 8 U interfaces (ANSI T1.601 compatible).

The analogue card has 16 analogue interfaces.

The Primary rate interfaces (PRI) can be configured as S2m interfaces (i.e. E.1 G.703 compatible) or T.1 interfaces.

The manual

This manual outlines how the Primary to Basic Rate ISDN Multiplexer should be set up and how the network and terminal equipment is connected.

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Product Specifications

ISDN Connections

The Primary to Basic Rate ISDN Multiplexer connects to the network via an ISDN S2m or T.1 PRI interface acting as a terminal.

The Primary to Basic Rate ISDN Multiplexer provides up to sixteen BRI's via line cards with 8 S0 or 8 U ports and one ISDN S2m or T.1 PRI port operating in NT mode. The BRI interfaces can optionally provide power feeding (40V, 1W for S0 ; 88V, 3W for U).

LED's indicate the operating level of each port. (1) P led to indicate physical layer and data link layer activated, (2) B led to indicate that at least one B channel is active.

Analogue (PSTN) Connections

The Primary to Basic Rate ISDN Multiplexer provides up to 32 analogue lines via line cards with 16 analogue lines.

The analogue lines feature -48V feed and ringing. Tone (DTMF) and pulse dialling are supported. FSK (ETSI), and FSK (Bellcore) caller ID signalling are provided.

An LED at each port indicates off-hook and ringing.

Terminal Port

A V.24 port is provided allowing the connection of an ANSI (or Wyse 50) compatible terminal or PC for setting up the unit.

Ethernet Port

An IEEE 802.3 Ethernet port is provided for connection to a local area network.

LED's indicate (1) network present, (2) network activity.

Modem Port

An optional modem port is provided to allow the Primary to Basic Rate ISDN Multiplexer to be controlled remotely.

LED's indicate that the modem is (1) off hook / ringing, (2) connected.

Power

The Primary to Basic Rate ISDN Multiplexer is available in mains powered and dc powered versions. The mains version accepts a voltage of 110-240V AC (50-60Hz). The DC version accepts a voltage of -36V to -72V DC. Maximum power consumption is 90W.

Mechanical

The Primary to Basic Rate ISDN Multiplexer is enclosed in a 2U high 19" rack case. Dimensions are approximately 9cm high x 49cm wide x 40cm deep. Weight is approximately 5Kg.

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Quick Reference Guide - Introduction

The Primary to Basic Rate ISDN Multiplexer consists of a chassis, mains or DC power supply, controller card and up to 2 line cards. The controller card must be fitted in the first slot.

There are no user serviceable parts inside the Primary to Basic Rate ISDN Multiplexer. It should only be opened by approved maintenance staff, otherwise the warranty will be invalidated.
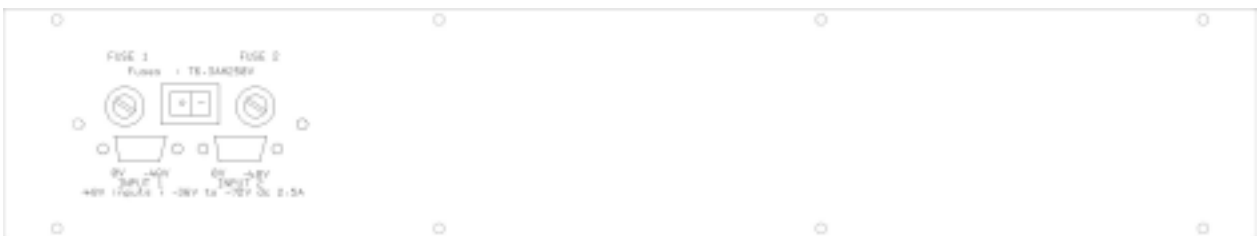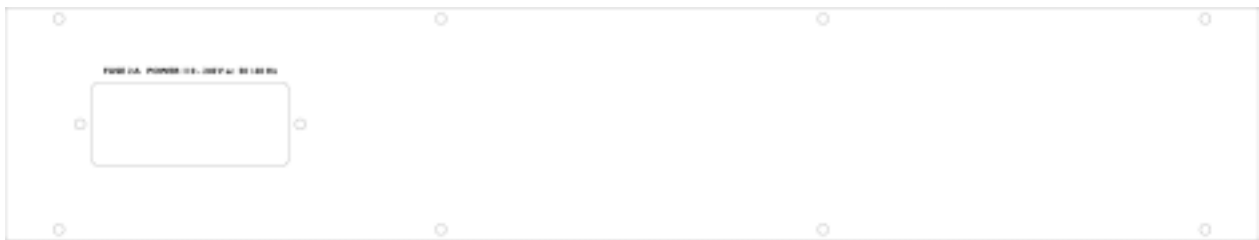
Figure 1 The Primary to Basic Rate ISDN Multiplexer front and rear panels

Chassis

The chassis consists of a metal case and a backplane to accept the controller card, line cards and power supply.

Mains Power supply

The mains power supply has a universal input suitable for 110V-240Vac/50-60Hz. Connection to any other source may result in the unit failing to comply with safety requirements.

Power should be supplied via an IEC mains lead (supplied).

The power supply must have a protective ground (earth). If not the mains filter will force the metal case to a voltage equal to half the mains supply voltage.

DC power supply

The DC power supply has 2 input connectors. Both accept a voltage of -36V to -72V. Power can be connected to either or both input connectors.

NB: the 0V connections on both connectors are common and are connected to the case.
The 0V connection should be connected to earth.

Figure 2   The Primary to Basic Rate ISDN Multiplexer controller card

Controller card

The controller card features 2 primary rate ports, 2 PC Card slots (not used), modem (optional), LAN port, terminal port and LED's.

The terminal port is a V.24 compatible control port to which a PC or VT100 compatible terminal or a PC emulating an ANSI terminal (e.g. running Procom, Windows Terminal, Hyper terminal etc.) can be connected.

The LAN port is an IEEE 802.3 compatible Ethernet port.

It allows the Primary to Basic Rate ISDN Multiplexer to be controlled remotely via Telnet. Software upgrades are possible via FTP. SNMP is also supported. If SNMP is to be used contact Black Box for the MIB file.

The Line port is the modem (optional), which connects to an analogue telephone line.

Port 1 and port 2 are the primary rate ports - PRI 1 and PRI 2. PRI 1 provides the PRI connection to a PRI line. PRI 2 provides the PRI connection to a PRI terminal equipment.

Pin-outs of the terminal, Ethernet, modem and PRI ports are given in an appendix.

LED's indicate power and alarm.

For each primary rate port the P LED is on when both physical link layer and data link layer are active. It flashes when only the physical link is active. The B LED is on when any B channel is in use.

For the Ethernet port the P LED indicates network present and the B LED indicates network activity.

For the modem port, the P LED is on for off-hook and flashing for ringing. The B LED indicates modem connected.

U and S cards

Figure 3   The Primary to Basic Rate ISDN Multiplexer U card and S card

The U and S cards feature 8 Basic Rate Ports and LED's.

Ports 1-8 are BRI 1-8 if fitted in the first line card slot or BRI 9-16 if fitted in the second line card slot.

Pin-outs of the BRI interfaces are given in an appendix.

LED's indicate power and alarm.

For each port the P LED is on when both physical link layer and data link layer are active. It flashes when only the physical link is active. The B LED is on when any B channel is in use.

A card

Figure 4   The Primary to Basic Rate ISDN Multiplexer A card

The A card features 16 analogue (PSTN) ports and LED's.

Ports 1-16 are A1-16 if fitted in the first line card slot or A17-32 if fitted in the second line card slot.

Pin-outs of the analogue interfaces are given in an appendix.

For each port the LED is on when a phone is connected and off-hook. The LED flashes to indicate ringing.

Restoring default settings

When the unit is first switched on the terminal port will default to 19200 baud, no parity, 8 data bits and 2 stop bits and will search for a <ctrl-c> being transmitted to the Primary to Basic Rate ISDN Multiplexer. If this occurs the Primary to Basic Rate ISDN Multiplexer will restore the factory defaults otherwise it will use the stored settings.

If a setting has been changed and the Primary to Basic Rate ISDN Multiplexer ceases to operate, powering up the Primary to Basic Rate ISDN Multiplexer, while holding down <ctrl-c> for the first 20 seconds will restore a working configuration to the Primary to Basic Rate ISDN Multiplexer.

The default settings are listed in an appendix.

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Installation

Unpack the Primary to Basic Rate ISDN Multiplexer

First unpack the Primary to Basic Rate ISDN Multiplexer and check for signs of damage in transit. If the unit or packaging is damaged this should be reported immediately to Black Box.

Take an Inventory

Assuming there is no damage, take an inventory of the parts supplied. Check that the items ordered were actually received. The list below should be of help in identifying each part.

- The Primary to Basic Rate ISDN Multiplexer ISDN Multiplexer
- Cables for ISDN - RJ45-RJ45 (2 off)
- Mains Cable
- Terminal Cable DB9-DB9 (1 off)
- This Manual

Connect to a PC or terminal

Plug the terminal cable into the rear of the unit and connect to a terminal or PC.

(The Primary to Basic Rate ISDN Multiplexer default terminal settings are ANSI terminal compatible, 19200 baud, 8 data bits, no parity, 2 stop bits).

Connect power

Plug the power cable into the rear of the unit and switch on

(The Primary to Basic Rate ISDN Multiplexer will work on 110V or 240V mains supply without adjustment).

Configure the Primary to Basic Rate ISDN Multiplexer

Set up the Primary to Basic Rate ISDN Multiplexer using the menus (see the Menu System chapter which commence on page 21).

Connect PRI line

Plug an ISDN cable into PRI 1 (port 1 on controller card) and connect it to the network provided PRI line.

Connect terminal equipment

Plug a basic rate terminal into an enabled BRI, an analogue telephone into an enabled analogue line or a primary rate terminal into PRI2 (if enabled).

Make sure that the equipment is compatible with the interface it is connected to.

NB: in the UK master sockets should be connected between the analogue connections (RJ11) and telephones.

Make calls

Try making calls from the enabled ports e.g. call the speaking clock.

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Menu System

Introduction

This chapter outlines the user interface of the Primary to Basic Rate ISDN Multiplexer and how the various functions of the Primary to Basic Rate ISDN Multiplexer are set up and used.

The Primary to Basic Rate ISDN Multiplexer has 2 user interfaces - command line interface and menu system. The menu system is described here. Details of the command line interface are provided in the "Command Line Interface" chapter.

The menu system is not available when the Primary to Basic Rate ISDN Multiplexer is being accessed via Telnet.

The user interfaces operate in 2 modes - user and super. User mode only allows read access to configuration. Super mode allows read and write access. There is a facility to protect access to super mode with a password.

Power Up Screen

Assuming that the hardware has been set up as described in the "Installation" chapter, when power is applied the following message should be displayed on the user terminal or PC

```
Copyright Black Box 1999
ISDN Multiplexer V1.3e 16 November 1999

User Mode    - Type 'super' <RETURN> for write access
Command Mode - Type 'menu' <RETURN> to use menus

mux [U]>
```

Figure 5 The Primary to Basic Rate ISDN Multiplexer power up display

The default data format is 19200 baud, 8 data bits, 2 stop bits, no parity. If no message appears then there is probably something wrong with the control cable. If some characters are displayed but the format is strange then the terminal parameters are probably incorrect. Try adjusting the terminal parameters so that they match the Primary to Basic Rate ISDN Multiplexer.

The Primary to Basic Rate ISDN Multiplexer starts with the command line interface and user mode. Type 'super' <RETURN> to change to supervisor mode.

Type 'menu' <RETURN> to change to the menu system.

Copyright Screen

When the menu system is first selected the Copyright Screen is displayed. It can be displayed again by pressing <ESCAPE> from the main menu.

To return to the command line interface press <ESCAPE> from the Copyright Screen.

```
Copyright Black Box 1999
ISDN Multiplexer V1.3e 16 November 1999
BRI 9U  BRI10U  BRI11U  BRI12U  BRI13U  BRI14U  BRI15U  BRI16U
BRI 1U  BRI 2U  BRI 3U  BRI 4U  BRI 5U  BRI 6U  BRI 7U  BRI 8U
                                              PRI 1P  PRI 2P
```

Figure 6 The Primary to Basic Rate ISDN Multiplexer copyright screen

Nothing further will happen until you press a key. Note that once the unit has been set up by the user it is not necessary to set it up each time it is powered on, and consequently the terminal need not be connected thereafter.

Status Information

Further status information can be switched on and off by pressing 's'. B channels are marked /, -, #, r meaning disabled, not in use, in use, requested respectively.

Main Menu

Press 'Enter' to display the main set up screen, shown in figure 7.

```
                System Setup
                Hardware Setup
                Software Setup
                Analyser Setup
```

Figure 7   Main System Menu

Changing Parameters

The setup of the Primary to Basic Rate ISDN Multiplexer is structured like a tree with the menu of figure 7 at the top.

The user moves to a more detailed lower function by using the <up-arrow> and <down-arrow> keys to select the desired function and presses <enter> on the keyboard.

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To move to the next higher function press the <esc> key on the keyboard. Note that <u> and <d> perform the same function as <up-arrow> and <down-arrow>.

The <home> and <end> keys can be used to move the cursor to the first and last item in the menu if the terminal program supports them.

If there is more than 1 column of items in the menu to move across the menu. <left-arrow> and <right-arrow> can also be used to display the menu for the previous and next ports in the Number Setup menu's for individual BRI's and analogue interfaces.

Once you have located the item you wish to change use <space> or <+> and <-> to cycle through the various options permitted. Numeric values can also be altered by using <enter> and typing a new value.

Use <backspace> to change to the lowest numeric value or first option.

Some information must be entered by typing it in rather than using <space>, e.g. telephone numbers. Move to the item to be changed and press <enter>. A prompt will appear at the bottom of the screen requesting the information.

The options listed in figure 7 are as follows.

System Set-up

This function allows you to set the system mode, name, password and time. There are also options to save and recall settings and restore default settings. Another option allows the FLASH to be reprogrammed for software update. Configuration of IP address (for Telnet and FTP) is also included.

Hardware Setup

This function allows you to set up the communications ports, and various other hardware functions of the Primary to Basic Rate ISDN Multiplexer.

Software Setup

This function allows you to change the operation of the Primary to Basic Rate ISDN Multiplexer by enabling and disabling ports/channels, setting up numbers and semi-permanent connections etc.

Analyser Setup

This function allows you to operate the protocol analyser.

System Setup Screen

On selecting this option, the user is presented with the screen of figure 8.

To change the fields in System Setup highlight the required field and cycle through the options using the <space>. The fields are listed below: -

```
                        System Setup

                System Mode         xxxx
                System Name         xxxx
                System Password     xxxx
                System Time         xxxx
                IP Setup
                Restore defaults
                Save settings
                Recall settings
                Reprogram FLASH
                Reprogram Analogue
```

Fig 8 System Setup Menu

System Mode

This option switches the Primary to Basic Rate ISDN Multiplexer between user and supervisor modes. A password is requested for supervisor mode unless there is no password stored.

In user mode, access to the menus is read only.

System Name

This option allows the Primary to Basic Rate ISDN Multiplexer to be given a name. If a name has been given, it is displayed on the copyright screen and is used as the prompt for the command line user interface. The name can be up to 15 characters in length.

NB: Use <BACKSPACE> to delete the name.

System Password

This option allows a password to be set up so that it has to be entered before supervisor mode can be selected. It is hidden in user mode.

NB: Use <BACKSPACE> to delete the password.

System Time

This option allows the time to be set. If a real time clock is detected a date can also be entered. This time is used for the protocol analyser.

IP Setup

This option brings up a menu, which allows IP addressing to be configured. 2 modes are available -auto and fixed.

Auto mode means that IP address, subnet mask and gateway are configured automatically by the Primary to Basic Rate ISDN Multiplexer by requesting values from a BOOTP or DHCP server on the network. This is the default mode. It allows The Primary to Basic Rate ISDN Multiplexer to be used via Telnet without the user having knowledge of free IP addresses on the network.

NB: the automatically configured settings can be viewed using the status system command. It should be remembered that these settings may change if The Primary to Basic Rate ISDN Multiplexer is switched off and on or disconnected from the network.

Fixed mode means that IP address; subnet mask and gateway are configured in the menu. It is important to ensure that the IP address is unique. If the subnet mask is not known set it to '0.0.0.0'. If no gateway is to be used set it to '0.0.0.0'

It is generally best to use the fixed mode.

Changes to the IP address, subnet mask, gateway has no effect until escape is pressed.

The menu also allows up to 3 target IP addresses for SNMP traps to be defined.

Restore Defaults

This option restores the factory default settings. Confirmation is requested before the settings are changed. If the saved setting for the terminal baud rate etc is different to the current setting an option to use the current terminal setting is given.

Save Settings

This option saves the current settings for future recall. Confirmation is requested before the saved settings are changed. These saved settings can be recalled at any time, even if the power has been switched off and on.

NB: the Primary to Basic Rate ISDN Multiplexer has 2 areas to store settings so that they are not lost on power down.

1) Current settings
This area holds the current settings. It is updated when any settings change is made and is reloaded on power up.

2)Saved settings
This area holds the saved settings, which are saved and recalled by using this menu.

Recall Settings

This option allows the saved settings to be restored. Confirmation is requested before the settings are changed. If the saved setting for the terminal baud rate etc is different to the current setting an option to use the current terminal setting is given.

Reprogram FLASH

This option allows the Primary to Basic Rate ISDN Multiplexer to be reprogrammed with new software. More details are given in an appendix.

Reprogram Analogue

This option allows an The Primary to Basic Rate ISDN Multiplexer analogue card or a DSP module on an The Primary to Basic Rate ISDN Multiplexer analogue card to be reprogrammed with new software. More details are given in an appendix.

Command line equivalents

System Mode	supervisor / user
System Name	read / set name
System Password	read / set password
System Time	read / set date
	read / set time
IP Set-up	read / set ip
	read / set target
Restore Defaults	Default
Save Settings	save
Recall Settings	recall
Reprogram FLASH	swl
Reprogram Analogue	swl analogue

Hardware Setup Screen

On selecting this option the user is presented with the screen of figure 9.

To change the fields in Hardware Setup highlight the required field and cycle through the options using the <space>. The fields are listed overleaf :-

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```
                    Hardware Setup

          Coms Port Baud Rate        xxxx
          Coms Port Parity           xxxx
          Coms Port Stop Bits        xxxx
          Coms Port Data Bits        xxxx
          Terminal type             xxxx
          BRI S/U Power Feed         xxxx
          BRI S Power Mode          xxxx
          BRI U Power Mode          xxxx
          BRI S Bus Timing          xxxx
          PRI E1/T1 Mode            xxxx
          PRI Equaliser             xxxx
          PRI E1 Mode               xxxx
          BRI T1 Mode               xxxx
          Analogue Ring Mode        xxxx
          Analogue Caller ID Mode   xxxx
          Analogue Disconnect Mode xxxx
```

Fig 9 Hardware Setup Menu

Coms Port Parameters

These are the parameters for the control terminal i.e. baud rate, parity, stop bits and data bits. Note that changing these parameters will mean that the user will have to change the terminal setup to match.

Terminal Type

You can select a terminal type by typing <space>. Supported terminals are ANSI, ANSI-Colour and Wyse-50.

BRI S/U Power Feed

Setting this to On enables power feeding to the ISDN S0-interfaces and U interfaces for any terminal adapters, ISDN telephones or NT-1's that require it.

BRI S Power Feed

This field allows you to switch the power from normal mode to restricted mode, i.e. the power provided at the ISDN BRI So interface will switch polarity. This field should usually be set to Normal. Current limiters allow 25 mA per port in normal mode and 10 mA per port in restricted mode. This is equivalent to 1 W and 400 mW at 40 V.

BRI U Power Feed

Current limiters on the U interfaces allow 20 mA per port in sealing mode and 40 mA per port in normal mode. This is equivalent to 1 W and 400 mW at 40 V.

This field should be set to sealing unless the terminal equipment is designed to be line powered.

BRI S Bus Timing

In NT mode using an S interface this field will switch between adaptive timing and fixed timing on the S0 interface. Use adaptive timing if the S0 interfaces have a long cable attached.

PRI E1/T1 Mode

This field allows you to set the PRI interfaces to E1 or T1.

PRI Equaliser

This field allows you to enable an equaliser on the PRI ports which allows them to work over longer cable lengths.

PRI E1 Mode

This field allows you to set the line code, framing standard and international (Si) bit usage on E1 interfaces.

PRI T1 Mode

This field allows you to set the line code and framing standard on T1 interfaces. It is currently fixed as ESF/B8ZS.

Analogue Ring Mode

This field allows you to set the characteristics of the ringing voltage on analogue interfaces. If it is set to Normal the ringing is 25 Hz with a dual cadence of 0.4s on, 0.4s off alternating with 0.4s on, 2s off. If it is set to USA the ringing is 20Hz with a cadence of 2s on, 4s off.

Analogue Caller ID Mode

This field allows you to set the format of the caller ID signal on analogue interfaces. FSK (ETSI) is for European telephones and FSK (Bellcore) is for American telephones. It can also be set to Off to disable it.

Analogue Disconnect Mode

This field allows you to set the change in the line state that occurs for 0.5 seconds when the network is disconnecting the call. It is normally set to Line break but can be changed to Line reversal or Line unchanged.

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Command line equivalents

Coms Port Baud Rate	read / set communication
Coms Port Parity	read / set communication
Coms Port Stop Bits	read / set communication
Coms Port Data Bits	read / set communication
Terminal Type	read / set terminal
BRI S/U Power Feed	read / set power bri
BRI S Power Mode	read / set power s
BRI U Power Mode	read / set power u
BRI S Bus Timing	read / set s
PRI E1/T1 Mode	read / set mode pri
PRI Equaliser	read / set mode equaliser
PRI E1 Mode	read / set e1
PRI T1 Mode	read / set t1
Analogue Ring Mode	read / set analogue ring
Analogue Caller ID Mode	read / set analogue clid
Analogue Disconnect Mode	read / set analogue disconnect

Software Setup Screen

On selecting this option the user is presented with the screen of figure 10.

To change the fields in Software Setup highlight the required field and cycle through the options using the <space>. The fields are listed below :-

NB: some options are not shown depending on the protocol, routing and CLID mode selected.

```
          Software Setup

          Protocol                    xxxx
          Routing Mode                xxxx
          Datalink Setup
          Channel Setup
          Connection Setup
          Number Setup
          Routing Setup
          CLID Generation             xxxx
          CLID Number type            xxxx
          CLID Screening type         xxxx
          Use Internal Tones          xxxx
          BRI Require SPID            xxxx
          BRI HOLD Reserve Channel    xxxx
          Numbering plan              xxxx
```

Fig 10 Software Setup Menu

Protocol

This option selects the protocol used on all ISDN connections.

The options are ETSI EuroISDN and National ISDN.

Routing Mode

(ETSI protocol only)

This option selects the routing mode used to route calls.

The options are Number and Channel.

If it is set to number outgoing calls are routed to the first free b channel on PRI 1 and incoming calls are routed by Called Party Number.

If it is set to channel calls are routed by b channel according to the routing table (see Routing Setup).

NB: in National ISDN mode outgoing calls are routed to the first free b channel on PRI 1 and incoming calls are routed by Called Party Number.

Datalink Set-up

This option brings up a menu, which allows the datalink mode of individual BRI's to be set up.

If it is set to point-to-point, only one TA can be fitted on each BRI. The TA should have a fixed TEI of 0.

If it is set to point to multipoint 8 TA's can be fitted on each BRI.

(with National ISDN protocol this is effectively limited to 2 since only 2 SPID's per BRI are supported).

For most terminal equipment, point to multipoint should be used.

For some PBX's point-to-point should be used.

Channel Set-up

This option brings up menus, which allow the number of channels to be used for calls on each interface to be set up. Use the cursor keys and <ENTER> to select the interface type and then use the cursor keys to select the interface to be set up. Use <SPACE> to change the number of channels required. <BACKSPACE> can be used to make the number of channels 0.

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For primary rate interfaces the range is 0-30 for E1 and 0-23 for T1. For basic rate interfaces, the range is 0-2.

e.g. if the number of channels for PRI 2 is set to 6 then b1-b6 can be used for calls provided they are not assigned to semi-permanent connections.

The values in Channel Setup should meet the following formula to ensure that there are enough channels on PRI 1 for all the calls that can be made. For simplicity, this formula assumes no semi-permanent connections are set up on channels enabled for calls.

(no. of BRI channels enabled)
+ (no. of channels enabled on PRI 2)
≤ (no. of channels enabled on PRI 1)

Calls on hold release the b channel on the BRI if there is a spare channel on PRI 1 or it is the first call on hold with b channel reserve on (always on for ETSI protoco1). This ensures that calls on hold do not prevent other BRI's from having access to 2 b channels on PRI 1.

NB: the b channel is not released if Routing Mode is set to channel.

The number of spare channels on PRI 1 is

(no. of channels enabled on PRI 1)
- (no. of BRI channels enabled)
- (no. of channels enabled on PRI 2)

Connection Set-up

This option brings up menus that allow semi-permanent connections to be set up. Use the cursor keys and <ENTER> to select either PRI 1 or PRI 2 and then use the cursor keys to select the timeslot to be set up. Use <SPACE> to cycle through 1 channel at a time. Use <#> to cycle through 1 port at a time. Use <BACKSPACE> to set to unallocated.

Connections can be made between PRI 1 and PRI 2 or any BRI. This is to allow leased line connections to be set up.

Connections can also be made between PRI 2 and any BRI. This is to allow a router to be connected.

The timeslot on PRI 2 assigned to the d channel (16 for E1, 24 for T1) can be can be assigned a semi-permanent connection. If this is done no calls can be made on PRI 2.

If a connection clashes with another connection a '#' is displayed and the connection must be changed before another connection can be modified or the menu exited.

Changes to the connections have no affect until escape is pressed to exit the connection menu.

Routing Set-up

This option brings up a menu which allows b channels on PRI 1 to be assigned to b channels on PRI 2 or b channels on BRI's. It is not displayed if Routing Mode is set to Number.

NB: The timeslots on PRI 1 and 2 assigned to the d channel (16 for E1, 24 for T1) cannot be used.

Use the cursor keys to select the timeslot to be set up. Use <SPACE> to cycle through 1 channel at a time. Use <#> to cycle through 1 port at a time. Use <BACKSPACE> to set to unallocated.

If a route clashes with another route a '#' is displayed and the route must be changed before another route can be modified or the menu exited.

The relevant channels have to be enabled for calls to be made (see Channel Setup).

A command line option (auto route) allows the routing table to be generated quickly based on channels enabled in Channel Setup.

Changes to this menu have no affect until escape is pressed to exit it.

Number Setup (ETSI protocol)

This option brings up menus that allow numbers to be assigned to the basic rate interfaces. Use the cursor keys and <ENTER> to select the number to be changed. Use <ENTER> to change the number. Use <BACKSPACE> to delete a number.

10 numbers can be set up for each basic rate interface, 5 numbers can be set up for each analogue interface and 1 number can be set up for PRI 2.

The numbers used for ETSI protocol and National ISDN protocol are stored separately. The correct protocol should be selected before changing the numbers.

Some examples for numbers are given in an appendix.

Numbers can include '?' if that digit is to be ignored in the number comparison. Numbers can also have a '*' OR '+' at the end of the number if extra digits at the end of the number are to be acceptable.

A subaddress can be included by adding a'#' followed by the subaddress. The subaddress can't include '?', '+' or '*'. If a subaddress only is to be stored use ?# followed by the subaddress.

Numbers can have an 'r' at the end of the number (or number#subaddress) if the calling party number on outgoing calls is to have the presentation indicator set to restricted. NB: this applies only if CLID generation is on.

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The numbers in Number Setup have 2 purposes:

Choosing the port to send a call to

(This does not apply if Routing Mode is set to channel)

This depends on the network providing a Called Party Number in the SETUP message. This can be either a full number or the last few digits. It also depends on the network routing several numbers to the Primary to Basic Rate ISDN Multiplexer. This requires Multiple Subscriber Numbering (MSN) or Direct Dialling In (DDI) to be provided by the network. Alternatively, a single number with subaddresses is acceptable. In this case, the network needs to provide Called Party Subaddress as well as Called Party Number in the SETUP message.

The numbers (ignoring any subaddress) are compared with the end of the Called Party Number. They should be at least as long as the part of the number that is different between each number but not longer than the Called Party Number provided by the network. If the number includes a subaddress then this is checked for an exact match with the Called Party Subaddress.

Incoming calls are routed to the first matching BRI with a free b channel. If there are no matching ports, they are routed to a free b channel on the PRI port. If this also fails, the call is rejected.

NB: the number entered for PRI 2 has no effect on the routing of the call.

If the matched number ends in '+' then the Called Party Number (except any extra digits) is not sent to the BRI.

Calling Line Identification

This applies if CLID Generation is set to "Yes". The Primary to Basic Rate ISDN Multiplexer adds or changes the Calling Party Number in SETUP messages to the network.

If there is a Calling Party Number in the SETUP message from the terminal and it matches one of the numbers for that port then it is passed through unchanged. Otherwise, the first number for that port is used. If it is blank then the Calling Party Number (if any) is passed through unchanged. If it contains '?' these are replaced by '0'. If it ends in '*' or '+' the '*' or '+' is omitted.

The numbers are compared with the end of the Calling Party Number. They should be at least as long as the part of the number that is different between each number but not longer than the Calling Party Number that is provided by the terminal.

If the Calling Party Number in the SETUP message from the terminal doesn't match but is less than 5 digits and the first number for that port ends in '*' then the Calling Party Number from the SETUP message is added to the first number for that port. This is useful for PBX's where the extension number is provided as the Calling Party Number.

Number Set-up (National ISDN protocol)

This option brings up menus that allow numbers to be assigned to the basic rate interfaces. Use the cursor keys and <ENTER> to select the number to be changed. Use <ENTER> to change the number. Use <BACKSPACE> to delete a number.

Two numbers can be set up for each basic rate interface, one number can be set up for each analogue interface and one number can be set up for PRI 2.

The numbers used for ETSI protocol and National ISDN protocol are stored separately. The correct protocol should be selected before changing the numbers.

Some examples for numbers are given in an appendix.

The match numbers in Number Setup have 2 purposes :

Choosing the port to send a call to.

Two match numbers (a) and (b) can be set up for each BRI port. They are for 2 separate TA's or for 1 TA that uses 2 SPID's.

The match numbers should be chosen from the directory numbers for the PRI line. The match number set up for the BRI TA acts as the directory number for the BRI TA. The Service Profile Identifier (SPID) for a BRI TA is equal to the match number with 0101 added. This is the generic SPID format from Bellcore National ISDN 97.

NB: The match numbers should all be different.

Incoming calls have the Called Party Number in the SETUP message compared with the match numbers. The call is routed to the BRI TA with a matching match number. If there is no matching match number, the call is routed to a free b channel on the PRI port. If this also fails, the call is rejected.

NB: the number entered for PRI 2 has no effect on the routing of the call.

(ii) Calling Line Identification

This applies if CLID Generation is set to "Yes". The Primary to Basic Rate ISDN Multiplexer adds or changes the Calling Party Number in SETUP messages to the network.

The menu includes a CLID number for PRI 2 and match numbers for the BRI's. The match numbers also act as CLID numbers.

If there is a Calling Party Number in the SETUP message from the terminal and it matches one the CLID numbers for that TA then it is passed through unchanged. Otherwise, the CLID number for that TA is used.

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If the TA is not SPID initialised then all the CLID numbers for that port are checked. If there is no match the CLID number for the first TA is used. If it is blank then the Calling Party Number (if any) is passed through unchanged.

CLID Generation

This option allows the port (PRI 2, a BRI or analogue line) from which a call is made to be detected by the network. When it is set to "Yes" outgoing calls have their Calling Party Number checked against the numbers in Number Setup. If it is not present it is added. If it is incorrect it is replaced.

CLID Number type (only if CLID generation on)

This option allows the choice of number type and plan in the calling party number when CLID generation is on to be configured.

If it is set to Normal, it is unchanged if number passed, set to unknown type / unknown plan if number changed).

If it is set to National, it is always set to national type / ISDN/telephony plan.

NB: if it is set to national the numbers in number setup should be the national number (area code without prefix digit followed by local number)

CLID Screening type (only if CLID generation on)

This option allows the choice of screening indicator in the calling party number when CLID generation is on to be configured.

If it is set to Normal it is unchanged if number passed, set to user- provided /not screened if number changed).

If it is set to National it is always set to network generated

Use Internal Tones
(ETSI protocol only)
This option allows the source of tones (dial, error, busy and ring) for calls to/from the basic rate ports to be selected.

If it is set to no the network provided tones are used.

If it is set to yes then the internal tones for dial, error and ring are used for outgoing calls and the internal tone for ring is used for incoming calls.

If it is set to auto then the internal or network provided tones are used depending on the presence of a progress indicator.

NB: for National ISDN protocol it is set to yes but not displayed.

BRI Require SPID (National ISDN protocol only)

This option controls how calls to/from uninitialised BRI TA's are handled. If it is set to YES they are blocked.

An uninitialised BRI TA is one that has not provided a valid SPID.

BRI HOLD Reserve Channel (National ISDN protocol only)

If this option is set to "Yes" one b channel on the BRI is kept free if one or more calls are on hold with no specific b channel reserved on that BRI. Hence, at least one of the calls can be retrieved at all times.

NB: for ETSI protocol it is set to yes but not displayed.

Numbering plan (National ISDN protocol only)

This option sets how the Primary to Basic Rate ISDN Multiplexer decides to stop waiting for more digits when keypad dialling is being used. This is necessary since National ISDN does not support overlap dialling on PRI lines. The dialled digits have to be stored until the whole number is received.

If it is set to "Unknown", the number is assumed complete 10 seconds after the last digit is received.

If it is set to N.America the number format is known for local, national, special and N11 numbers and the number is assumed complete after 0, 4 and 20 seconds as appropriate. Since the number format is not known for international numbers in this case the number is assumed complete 10 seconds after the last digit is received.

With either setting dialling '#' after the number indicates that the number is complete.

The N.America setting should be used for the countries that share the international code of '1'. These are USA, Canada, Bahamas, Barbados, Bermuda, Caribbean, Puerto Rico and US Virgin Islands. Otherwise, the "Unknown" setting should be used.

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Command line equivalents

Protocol	read / set mode protocol
Routing Mode	read / set mode route
Datalink Setup	read / set mode bri
Channel Setup	read / set channels pri
	read / set channels bri
Connection Setup	read / set connection pri
Routing Setup	read / set route
Number Setup	read / set number pri
	read / set number bri
CLID Generation	read / set mode clid
CLID Number Type	read / set mode number
CLID Screening Type	read / set mode screening
Use Internal Tones	read / set mode tone
BRI Require SPID	read / set mode spid
BRI HOLD Reserve Channel	read / set mode reserve
Numbering plan	read / set mode plan

Analyser Setup Screen

On selecting this option the user is presented with the screen of figure 11.

To change the fields in Figure 7 highlight the required field and cycle through the options using the <space>. The fields are listed below :-

```
Analyser Setup

Layer 1 Hardware        xxxx
Layer 2 Data Link       xxxx
Layer 3 Call Control    xxxx
Channel Filter
Call Reference Filter   xxxx
Analyser Specification  xxxx
Activate Analyser
```

Fig 11 Analyser Setup Menu

Layer 1 Hardware

This option allows the reporting level for layer 1 to be selected. The options are OFF and ASCII Short Display.

Layer 2 Data Link

This option allows the reporting level for layer 2 to be selected.

The options are OFF, HEX Display, ASCII Short Display and ASCII Long Display.

Layer 3 Call Control

This option allows the reporting level for layer 3 to be selected. The options are OFF, HEX Display, ASCII Short Display and ASCII Long Display.

Channel Filter

This option brings up a menu, which allows reporting for individual basic rate and primary rate interfaces to be enabled/disabled.

Call Reference Filter

This option allows reporting at layer 3 to be limited to a single call reference. Use <SPACE> to disable the call reference filter.

Analyser Specification

This option tells the analyser which protocol it should assume when decoding the messages. The protocols that can be decoded are CCITT (general purpose), BTNR191 (UK), AT&T 5ESS (USA), NT DMS100 (USA), National ISDN 1 (USA), 1TR6 (Germany) and VN2/3 (France), ETSI (Europe).

Activate Analyser

This option clears the screen and activates the analyser. To exit analyser mode press <esc>.

See the "Protocol Analyser" chapter for a description of the analyser trace display and the commands that can be used to scroll through the trace.

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Command line equivalents

Layer 1 Hardware	read / set analyser l1
Layer 2 Data Link	read / set analyser l2
Layer 3 Call Control	read / set analyser l3
Channel Filter	read / set analyser pri read / set analyser bri
Call Reference Filter	read / set analyser reference
Analyser Specification	read / set analyser protocol
Activate Analyser	analyser

Protocol Analyser

Introduction

The Protocol Analyser is a useful feature for checking the operation of the Primary to Basic Rate ISDN Multiplexer. It allows the ISDN protocol on each interface to be checked.

The analyser is operated using the Analyser Setup Menu (the "Menu System" chapter).

This section describes the display of the analyser trace and the commands that can be used to scroll through the trace.

Information Provided at Layer 1

A typical display of a layer 1 message is shown below.

23: Ch BRI 1 L1 STATE= Activated
     00:01:75:30.271

The information presented is outlined below.

(a) Sequence Number

Each message has a unique sequence number so that old messages can be easily located.

(b) Channel Number

The channel number (e.g.BRI 1) on which the event occurred.

(c) Layer Number

The layer on which the event is being reported.

(d) State

The new state of the physical layer e.g. Activated.

(e) Timestamp

The time that the message was recorded. The timestamp has the form dd:hh:mm:ss.nnn where dd represents days, hh hours, mm minutes, ss seconds and nnn milliseconds.

Note that layer 1 messages are generated only if a change occurs in the state of the physical link.

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Information Provided at Layer 2

A typical display of a short ASCII layer 2 message is shown below.

```
23: TA Ch BRI 2 L2            00:01:75:30.271

SAPI= 0, TEI= 40, C/R= 0, P/F=1, TYPE= SABME
```

The information presented is outlined below.

(a) Sequence Number

Each message has a unique number so that old messages can be easily located.

(b) Originator

This field reports which side generated the message. For PRI 1 the text is MUX for ISDN Multiplexer (The Primary to Basic Rate ISDN Multiplexer) generated messages and NET for messages generated by the network (exchange or switch). On the other ports, the text is TA for terminal generated messages and MUX for messages generated by the ISDN Multiplexer (The Primary to Basic Rate ISDN Multiplexer).

(c) Channel Number

The channel number (e.g. BRI 1) on which the event occurred.

(d) Layer Number

The layer on which the event is being reported.

(e) Timestamp

The time that the message was generated (NT message) or received (TE message). The timestamp has the form dd:hh:mm:ss.nnn where dd represents days, hh hours, mm minutes, ss seconds and nnn milliseconds.

(f) Service Access Point Identifier*

(g) Terminal Endpoint Identifier*

(h) Command/Response Bit*

(i) Poll/Final Bit*

(j) Type*

The message type, being one off I, RR, RNR, REJ, SABME, DM, UI, DISC, UA, FRMR, XID.

A typical display of a long ASCII layer 2 message is shown below.

```
23: TA Ch BRI 2 L2                    00:01:75:30.271
SAPI= 0, TEI= 40, C/R= 0, P/F=1, TYPE= INFO
N(R)= 1, N(s)= 1
```

The following information has been added:

(k) Send Sequence Number N(s)*

(l) Receive Sequence Number N(r)*

Layer 2 management transactions may be also decoded in long form messages. A typical decode follows.

```
23: TA Ch BRI 2 L2       00:01:75:30.271
SAPI= 0, TEI= 40, C/R= 0, P/F=1, TYPE= UI
MEI= 15, Ri= 7FCD, MSG TYPE= ID Request, Ai= 0
```

The following information has been added:

(m) Management Entity Identifier*

(n) Reference Number (Ri)*

(o) Management Message Type*

One of ID Request, ID Assigned, ID Denied, ID Check Request, ID Check Response, ID Remove, ID Verify.

(p) Action Indicator*

Only Information and certain Unnumbered Information messages at layer 2 include layer 3 messages.

Fields marked with * are explained further in CCITT Q.921 Digital Subscriber Signalling System No 1, Data Link Layer.

A typical display of a hex layer 2 message is shown below.

```
23: TA Ch BRI 2 L2              00:01:75:30.271

02 81 00 02 41 01 81 0D 18 01 89
```

The information contained in the message is not decoded but simply displayed as hex octets.

Information Provided at Layer 3

A typical display of a short ASCII layer 3 message is shown below.

```
23: TA Ch BRI 1 L3            00:01:75:30.271

PD= 65, LEN= 1, FLAG= Orig, CALL REF= 3, TYPE= SETUP
```

The information presented is outlined below.

(a) Sequence Number

Each message has a unique sequence number so that old messages can be easily located.

(b) Originator

This field reports which side generated the message. For PRI 1 the text is MUX for ISDN Multiplexer (The Primary to Basic Rate ISDN Multiplexer) generated messages and NET for messages generated by the network (exchange or switch). On the other ports the text is TA for terminal generated messages and MUX for messages generated by the ISDN Multiplexer (The Primary to Basic Rate ISDN Multiplexer).

(c) Channel Number

The channel number (e.g. BRI 1) on which the event occurred.

(d) Layer Number

The layer on which the event is being reported.

(e) Timestamp

The time that the message was generated (NT message) or received (TE message). The timestamp has the form dd:hh:mm:ss.nnn where dd represents days, hh hours, mm minutes, ss seconds and nnn milliseconds.

(f) Protocol Discriminator*

(g) Call Reference*

The call reference consists of three parts, the Length of the call reference, the Value of the call reference and the Originator of the call reference.

(h) Message Type*

One of the Q.931 supported messages, or network specific message.

A typical display of a long ASCII layer 3 message is shown below.

```
23: TA Ch BRI 1 L3              00:01:75:30.271
PD= 65, LEN= 1, FLAG= Orig, CALL REF= 3, TYPE= SETUP
CALLING PARTY NUMBER:0 LENGTH= 7
TYPE= Unknown PLAN= ISDN/Telephony NUMBER= '234231'
CALLED PARTY NUMBER:0 LENGTH= 7
TYPE= Unknown PLAN= ISDN/Telephony NUMBER= '384020'
```

In the long ASCII message, decode all the information elements contained in the message are decoded. Information elements are separated by a blank line, the information element name together with relevant code set and length appears as a heading above each information element decode and the decoded information is indented by 1 space.

For more information on * marked fields, messages and information elements refer to CCITT Q.931 Digital Subscriber Signalling System No 1, Network Layer.

A typical display of a hex layer 3 message is shown below.

```
23: TA Ch BRI 2 L2              00:01:75:30.271
41 01 81 0D 18 01 89
```

The information contained in the message is not decoded but simply displayed as hex octets.

Analyser Commands

As soon as you enter analyser mode stored messages (if there are any) are displayed in accordance with the analyser options selected. You may enter <esc> to exit analyser mode, change the decode options and enter analyser mode again without losing any messages. The options available are: -

(a) <m> - Manual Mode

The analyser enters manual mode. Automatic display of incoming messages is stopped and the user can review the messages in the message buffer. Pressing M again will leave manual mode.

(b) <home> or <b>- Go to First Message

Will display messages starting at the oldest message in the buffer. This command works in manual and automatic modes.

(c) <end> or <e>- Go to Last Message

Will go to the last message in the buffer and display any new messages that arrive. This command works in manual and automatic modes.

(d) <up> or <u> - Review Previous Message

Will display the message which arrived just before the last message displayed. This command works only in manual mode.

(e) <down> or <d> - Go to Next Message

Will display the message which arrived just after the last message displayed. This command works only in manual mode.

(f) <c> - Clear Buffer

Will remove all messages from the buffer. This command works in manual and automatic modes.

(g) <h> - Pause Display

Will pause a scrolling display. Pressing <h> will start the display scrolling again.

Note that whenever an attempt is made to move to a message beyond the start or end of the message buffer a beep will be sent to the terminal.

Command Line Interface

Introduction

The command line interface is an alternative user interface to the menu system. All menu items have an equivalent command.

The command line interface can be accessed via the serial port, via the (optional) modem or (by using Telnet) via the Ethernet port.

There are some commands that have no equivalent in the menu system. These are debug, history, trace, upload, the reset commands and the restart commands.

As with the menu system there are 2 modes - user and super.

There are many commands that can only be used in super mode. These are upload, diagnostic, swl, all set commands, all reset commands, all restart commands and read password.

Some commands only apply when National ISDN protocol is selected. They are set mode reserve, set mode route, set mode spid and set mode plan.

One command applies only when ETSI protocol is selected. It is set mode tone.

Some commands apply only if ETSI protocol is selected and Routing Mode is set to Channel. They are set route p ri and auto route.

Two commands apply only if CLID generation is enabled. They are set mode number and set mode screening.

Commands will not be accepted if they refer to a port that is not fitted.

Two commands - menu and diagnostic are not available when using Telnet.

Syntax

Commands are shown in full. When part of a word is in lower case, only the upper case part is required.

Commands are not case sensitive. Commands typed as upper case are displayed as lower case.

Commands must include a space between each word.

When number(s) are specified individual numbers or groups of numbers in the specified range are acceptable (no spaces allowed)
e.g.　　1-15
　　　　1-2,3,6-8
　　　　1,4,9

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all is accepted for a number range.
yes and **no** are accepted as pseudonyms for **on** and **off**.
rem can be used at the start of a command so that it is ignored.

Read commands

All **set** commands have an equivalent **read** command. This is normally the **set** command with **set** replaced by **read** and the last parameter omitted. e.g. **set power BRI** on has an equivalent read command **read power BRI**.

Groups of settings can be read by a shortened form e.g. **read power** is equivalent to **read power BRI** followed by **read power s** followed by **read power u**

Help commands

There are **help** commands provided to show the syntax of every command except read commands.

All **set** commands have an equivalent **help** command. This is normally the **set** command with **set** replaced by **help** and the last parameter omitted. e.g.   **set power BRI on** has an equivalent read command **help power BRI**.

Help on groups of set commands can be read by a shortened form, e.g. **help power** is equivalent to **help power BRI** followed by **help power s** followed by **help power u**

Typing **help** on its own gives a full list of commands.

Command rota

Previous commands can be selected for use again using the up and down cursor keys. This requires terminal emulation to be set correctly.

List of commands

> analyser
> auto route
> cls
> debug analogue
> debug bri
> debug pri
> diagnostic
> help commands
> history
> menu
> read commands
> recall
> reset system

reset l1 bri
reset l1 pri
reset l3 analogue
reset l3 bri
reset l3 pri
restart bri
restart pri
save
set analogue clid
set analogue disconnect
set analogue ring
set analyser bri
set analyser l1
set analyser l2
set analyser l3
set analyser pri
set analyser protocol
set analyser reference
set channels analogue
set channels bri
set channels pri
set communication
set connection pri
set date
set e1
set ip
set mode bri
set mode clid
set mode protocol
set mode plan
set mode pri
set mode reserve
set mode route
set mode tone
set mode spid
set name
set number bri
set number pri
set password
set power bri
set power s
set power u
set route pri
set s
set t1
set time
start l1 bri

start l2 bri
start l2 pri
status
status bri
status pri
status system
supervisor
swl (software load)
swl analogue
trace
upload
user
version

ANALYSER command

Clears the screen and enables protocol analyser display.

Syntax

ANALYser

Examples:

```
mux [U]> analyser
    3 : TA  Ch BRI1  L3                        00:16:14:12.173
        PD= 8, LEN= 1, FLAG= Orig, CALL REF= 1  SETUP

    4 : MUX Ch PRI1  L3                        00:16:14:12.217
        PD= 8, LEN= 2, FLAG= Orig, CALL REF= 4  SETUP

    7 : NET Ch PRI1  L3                        00:16:14:12.285
        PD= 8, LEN= 2, FLAG= Dest, CALL REF= 4  SETUP ACKNOWLEDGE

    9 : MUX Ch BRI1  L3                        00:16:14:12.316
        PD= 8, LEN= 1, FLAG= Dest, CALL REF= 1  SETUP ACKNOWLEDGE
```

Related commands

set analyser l1
set analyser l2
set analyser l3
set analyser bri
set analyser pri
set analyser reference
set analyser protocol
trace

Menu Equivalent

Analyser Setup   - Activate Analyser

AUTO ROUTE command

Generates a routing table based on channel setup. (ETSI protocol only - also requires routing mode to be channel)

Channels on PRI 1 are allocated to enabled channels on PRI 2 and enabled channels on BRI's in that order. Use read route PRI to view the generated routing.

If there are insufficient channels on PRI 1 to route to all the other enabled channels an error message is displayed and the existing routing table is unchanged.

Syntax

AUto ROUte

Examples: mux [S]> auto route

Related commands:

set mode route
set route pri

Menu Equivalent

None.

CLS command

Clears the terminal screen.

Syntax

CLS

Examples: mux [U]> cls

Related commands

None.

Menu Equivalent

None.

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DEBUG ANALOGUE command

Displays the status of an analogue port and any changes to its status until <ESCAPE> is pressed.

Syntax

DEBug Analogue [port]

port　　　　　Port number from 1 (for A1) to 32 (for A32)

Examples

```
mux [U]> debug analogue 11
[              ]vl2: no tei's assigned
[              ]vl3: b: free
[13:28:18.265]vl2: tei 64 sapi 0 TEI assigned
[13:28:18.610]vl3: b: tei 64 #1 u->n (call setup) [pri 1
tei 0 #1 ts01(b1) ]
```

Related commands

debug BRI
debug PRI

Menu Equivalent

None.

DEBUG BRI command

Displays the status of a basic rate port and any changes to its status until <ESCAPE> is pressed.

Syntax

DEBug BRi [port]

Port   Port number from 1 (for BRI 1) to 16 (for BRI 16)

Examples:

```
mux [U]> debug bri 1
[              ]l1: active
[              ]l2: no tei's assigned
[              ]l3: b1: free
[              ]l3: b2: free
[17:22:12.817]l2: tei 64 sapi 0 TEI assigned
[17:22:12.900]l2: tei 64 sapi 0 multiple frame established
[17:22:13.003]l3: b1: tei 64 #1 u->n (call setup) [pri 1 tei 0
#2 ts01(b1) ]
[17:22:14.973]l3: b1: tei 64 #1 u->n (clearing) [pri 1 tei 0
#2 ts01(b1) ]
[17:22:17.029]l3: b1: free
[17:22:22.196]l2: tei 64 sapi 0 TEI assigned
```

Related commands

debug analogue
debug PRI

Menu Equivalent

None.

DEBUG PRI command

Displays the status of a primary rate port and any changes to its status until <ESCAPE> is pressed.

Syntax

DEBug PRi [port]

Port - Port number from 1 (for PRI 1) to 2 (for PRI 2)

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Examples

```
mux [U]> debug pri 1
[              ]l1: active
[              ]l2: tei 0 sapi 0 multiple frame established
[              ]l3: ts01(b1)  : tei 0 #1 u->n [bri 8 tei 0 #1 b1
(connected)]
[              ]l3: ts02(b2)  : free
[              ]l3: ts03(b3)  : semi-permanent connection to pri
2 ts01(b1)
              "
              "
[              ]l3: ts31(b30) : free
[17:18:05.455]l3: ts01(b1)  : tei 0 #1 u->n [bri 8 tei 0 #1 b1
(clearing)]
[17:18:06.449]l3: ts01(b1)  : free
[17:18:55.430]l1: not active
[17:19:00.770]l2: tei 0 sapi 0 awaiting establishment
[17:19:01.771]l2: tei 0 sapi 0 TEI assigned
[17:19:14.759]l1: active
[17:19:15.016]l2: tei 0 sapi 0 multiple frame established
```

Related commands

debug analogue
debug bri

Menu Equivalent

None.

DEFAULT command

Restores the default settings.

Syntax

DEFault

Examples:

```
            mux [S]> default
            Restore defaults
            Confirm Yes/No (Y/N)
            Y
            Defaults restored
```

Related commands

None

Menu Equivalent

System Setup
- Restore defaults

DIAGNOSTIC command

Switches to diagnostic mode. An internal trace is enabled. The Primary to Basic Rate ISDN Multiplexer will operate at a reduced speed in this mode. Press <D> to return to normal mode.

This command is not permitted during Telnet or modem access.

Syntax

DIAGnostic

Examples:

```
mux [S]> diagnostic
**** Diagnostic mode   ****
**** Press [D] to exit ****
-> DLE | PH-DATA-IND         | Ch=0 [8]  FC FF 03 0F DB 13 01
FF
       | SAPI=3F, C/R=0, TEI=7F <UI>
-> MDL | MDL-UNITDATA-IND    | Ch=0 CEI=3F,7F [5] 0F DB 13 01
FF
----------- start 60499, end 6049d --------------------------
-------
----------- UI: Ri=DB13, Type=01, Ai=7F ---------------------
-------
----------- ID REQ chan 0 count 10 -------------------------
-------
-> DLE | DL-UNITDATA-REQ    | Ch=0 CEI=3F,7F [5] 0F DB 13 02
81
       | PD=0F Ri=DB13 {ID-Assigned} Ai=40
```

Related commands

None.

Menu Equivalent

Press <D> from Copyright Screen.

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HELP commands

There is an equivalent **help** command for every command (except **help** and **read** commands). The correct syntax for a command is shown.

Syntax

HElp [text]

Text - a command with any values omitted

Help on groups of commands can be read by using a shortened form (see examples).

If help is required for a **set** command, the word **set** can be omitted.
If **text** is omitted help is given on all commands.

Examples

```
mux [U]>help set power s
SEt POWer S [NORmal|RESTRicted]

mux [U]>help power s
SEt POWer S [NORmal|RESTRicted]

mux [U]>help power
SEt POWer S [NORmal|RESTRicted]
SEt POWer U [SEAling|NORmal]
SEt POWer BRi [OFF|ON]
mux [U]>

mux [U]>help trace
TRace
```

Related commands

set commands
read commands

Menu Equivalent

None.

HISTORY command

Displays information on the last 20 calls.

NB: only calls that have connected are shown. Calls are not included in the history until they are cleared.

Syntax

HIStory

Examples:

```
mux [U]>history
Interface   In/Out   Calling/Called        Duration
BRI 2       OUT      384087                9
BRI 2       OUT      384087                5
BRI 2       OUT      384087                21
BRI 2       OUT      384060                9
BRI 2       OUT      384060                11
```

Related commands

None.

Menu Equivalent

None.

MENU command

Switches from command line interface to menu system.

Press <ESCAPE> from the copyright screen to return to the command line interface.
This command is not permitted during Telnet access.

Syntax

MEnu

Examples: mux [U]> menu

Related commands
None

Menu Equivalent

None

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READ commands

There is an equivalent **read** command for every **set** command. The setting is displayed in the form of a command that will make that setting.

Syntax

REAd [text]

Text - a set command with the set and the value to be set omitted

Groups of settings can be read by using a shortened form (see examples).

Examples:

```
mux [U]>read power s
set power s normal

mux [U]>read power
set power s normal
set power u sealing
set power bri on
```

Related commands

set commands
help commands

Menu Equivalent

All menus.

RECALL command

Recalls the alternate settings and stores them as the current settings.

Syntax

RECall

Examples:
```
mux [S]> recall
Recall settings
Confirm Yes/No (Y/N)
Y
Settings recalled
```

Related commands

save

Menu Equivalent

System Setup
      - Recall settings

RESET L1 BRI command

Resets layer 1 on a basic rate port ie deactivates interface, resets driver and interface and activates interface.

Syntax

RESEt L1 BRi [port]

Port - Port number(s) from 1 (for BRI 1) to 16 (for BRI 16)

Examples:
```
    mux [S]> reset l1 bri 2
    bri 2: layer 1 reset requested
```

Related commands

reset l1 pri
reset l3 analogue
reset l3 bri
reset l3 pri

Menu Equivalent

None.

RESET L1 PRI command

Resets layer 1 on a primary rate port ie resets driver and interface.

Syntax

RESEt L1 PRi [port]

Port - Port number(s) from 1 (for PRI 1) to 2 (for PRI 2)

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Examples

```
mux [S]> reset l1 pri 2
pri 2: layer 1 reset requested
```

Related commands

reset l1 bri
reset l3 analogue
reset l3 bri
reset l3 pri

Menu Equivalent

None.

RESET L3 ANALOGUE command

Resets layer 3 on an analogue port ie clears the call.

Syntax

RESEt L3 Analogue [port]

Port - Port number(s) from 1 (for A1) to 32 (for A32)

Examples
```
mux [S]> reset l3 analogue 2
a2: layer 3 reset requested
```

Related commands

reset l1 bri
reset l1 pri
reset l3 bri
reset l3 pri

Menu Equivalent

None.

RESET L3 BRI command

Resets layer 3 on a basic rate port ie clears all calls. Also frees SPID's when National ISDN protocol is selected.

Syntax

RESEt L3 BRi [port]

Port - Port number(s) from 1 (for BRI 1) to 16 (for BRI 16)

Examples:
```
mux [S]> reset l3 bri 2
bri 2: layer 3 reset requested
```

Related commands

reset l1 bri
reset l1 pri
reset l3 analogue
reset l3 pri

Menu Equivalent

None.

RESET L3 PRI command

Resets layer 3 on a primary rate port ie clears all calls.

Syntax

RESEt L3 PRi [port]

Port - Port number(s) from 1 (for PRI 1) to 2 (for PRI 2)

Examples
```
mux [S]> reset l3 pri 2
pri 2: layer 3 reset requested
```

Related commands

reset l1 bri
reset l1 pri
reset l3 analogue
reset l3 bri

Menu Equivalent

None.

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RESTART BRI command

Sends a restart message to a basic rate port. This command can only be used for point-to-point ports.

NB: if any calls are active a reset l3 bri command should be used first.

Syntax

RESTArt BRi [port]

Port - Port number(s) from 1 (for BRI 1) to 16 (for BRI 16)

Examples:

```
mux [S]> restart bri 1
bri 1: requesting restart message
```

Related commands

restart pri

Menu Equivalent

None.

RESTART PRI command

Sends a restart message to a primary rate port.

NB: if any calls are active a reset l3 pri command should be used first.

Syntax

RESTArt PRi [port]

Port- Port number(s) from 1 (for PRI 1) to 2 (for PRI 2)

Examples

```
mux [S]> restart pri 1
pri 1: requesting restart message
```

Related commands

restart bri

Menu Equivalent

None.

SAVE command

Saves the current settings as the alternate settings.

Syntax

SAve

```
Examples:
     mux [S]> save
     Save settings
     Confirm Yes/No (Y/N)
     Y
     Settings saved
```

Related commands

save

Menu Equivalent

System Setup
    - Save settings

SET ANALOGUE CLID command

Sets the format of the caller ID signal for analogue ports.

Syntax

SEt Analogue CLid [mode]

mode OFF   Caller ID disabled
        ETSI   FSK to ETSI standard
        BELLCore   FSK to Bellcore standard

Examples:

```
     mux [S]> set analogue clid etsi
     OK
```

Related commands

set analogue disconnect
set analogue ring
Menu Equivalent

Hardware Setup
- Analogue Caller ID Mode

SET ANALOGUE DISCONNECT command

Sets the type of line change when a call is disconnected.

Syntax

SEt Analogue DISConnect [mode]

mode   OFF   No change
       BREak   Line break
       REVerse   Line reversal

Examples:
```
     mux [S]> set analogue disconnect break
     OK
```

Related commands

set analogue clid
set analogue ring

Menu Equivalent

Hardware Setup
- Analogue Disconnect Mode

SET ANALOGUE RING command

Sets the waveform shape used for ringing on analogue ports.

Syntax

SEt Analogue RIng [mode]

mode   NORmal   Normal (UK style) ringing
       USA   USA style ringing

Examples:
```
mux [S]> set analogue ring normal
OK
```

Related commands

set analogue clid
set analogue disconnect

Menu Equivalent

Hardware Setup
- Analogue Ring Mode

SET ANALYSER BRI command

Enables/disables analyser display for a basic rate port

Syntax

SEt ANALYser BRi [port] [mode]

Port - Port number(s) from 1 (for BRI 1) to 16 (for BRI 16)

mode	OFF	display off
	ON	display on

Examples
```
mux [S]> set analyser bri 12 on
OK
```

Related commands

analyser
set analyser l1
set analyser l2
set analyser l3
set analyser pri
set analyser protocol
set analyser reference
trace

Menu Equivalent

Analyser Setup
- Channel Filter

SET ANALYSER L1 command

Sets the analyser display mode for layer 1 (physical) of the ISDN trace.

Syntax

SEt ANALYser L1 [mode]

mode   OFF   no display
               SHort   short text display

Examples:
```
mux [S]> set analyser l1 short
OK
```

Related commands

analyser
set analyser bri
set analyser l2
set analyser l3
set analyser pri
set analyser protocol
set analyser reference
trace

Menu Equivalent

Analyser Setup
- Layer 1 Hardware

SET ANALYSER L2 command

Sets the analyser display mode for layer 2 (datalink) of the ISDN trace.

Syntax

SEt ANALYser L2 [mode]

mode - OFF   no display
      HEx   hexadecimal display
      SHort   short text display
      LOng   long text display

Examples:
```
mux [S]> set analyser l2 short
OK
```

Related commands

analyser
set analyser bri
set analyser l1
set analyser l3
set analyser pri
set analyser protocol
set analyser reference
trace

Menu Equivalent

Analyser Setup
- Layer 2 Data Link

SET ANALYSER L3 command

Sets the analyser display mode for layer 3 (call control) of the ISDN trace.

Syntax

SEt ANALYser L3 [mode]

Mode -	OFF	no display
	HEx	hexadecimal display
	SHort	short text display
	LOng	long text display

Examples:
```
Mux [S]> Set analyser l3 short
OK
```

Related commands

analyser
set analyser bri
set analyser l1
set analyser l2
set analyser pri
set analyser protocol
set analyser reference
trace

Menu Equivalent

Analyser Setup
- Layer 3 Call Control

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SET ANALYSER PRI command

Enables/disables analyser display for a primary rate port

Syntax

SEt ANALYser PRi [port] [mode]

Port - Port number(s) from 1 (for PRI 1) to 2 (for PRI 2)

Mode - OFF   display off
      ON   display on

Examples:
```
mux [S]> set analyser pri 2 on
OK
```

Related commands

analyser
set analyser bri
set analyser l1
set analyser l2
set analyser l3
set analyser protocol
set analyser reference
trace

Menu Equivalent

Analyser Setup
- Channel Filter

SET ANALYSER PROTOCOL command

Sets the protocol assumed for the analyser trace.

Syntax

SEt ANALYser PRotocol [protocol]

protocol		
ETSI	ETSI protocol	
NAT1	Bellcore National ISDN protocol	
5ESS	AT&T 5ESS protocol	
DMS	NORTEL DMS100 protocol	
VN3	VN3 protocol	
BT	BTNR191 protocol	
1TR6	1TR6 protocol	
NTT	NTT protocol	

Examples:
```
mux [S]> mux [S]> set analyser protocol etsi
OK
```

Related commands

analyser
set analyser bri
set analyser l1
set analyser l2
set analyser l3
set analyser pri
set analyser protocol
trace

Menu Equivalent

Analyser Setup
- Analyser Specification

SET ANALYSER REFERENCE command

Sets the analyser call reference filter.

Syntax

SEt ANALYser REFerence [callref]

callref   A call reference (1 to 126 for BRI, 1 to 65534 for PRI)

If callref is omitted any existing call reference filter is deleted

Examples
```
mux [S]> mux [S]> set analyser reference 27
OK
```

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Related commands

analyser
set analyser bri
set analyser l1
set analyser l2
set analyser l3
set analyser pri
set analyser protocol
trace

Menu Equivalent

 Analyser Setup
- Call Reference Filter

SET CHANNELS ANALOGUE command

Sets the number of b channels that can be used for calls on an analogue port.

Syntax

SEt CHannels Analogue [port] [channels]

Port -   Port number(s) from 1 (for A1) to 32 (for A32)

Channels - Maximum number of channels - 0 to 1

Examples
```
    mux [S]> set channels analogue 11 1
    OK
```

Related commands
set channels bri
set channels pri

Menu Equivalent
Software Setup
- Channel Setup
- Analogue Ports

SET CHANNELS BRI command

Sets the number of b channels that can be used for calls on a basic rate port.

Syntax

SEt CHannels BRi [port] [channels]

Port - Port number(s) from 1 (for BRI 1) to 16 (for BRI 16)

Channels - Maximum number of channels - 0 to 2

Examples

```
mux [S]> set channels bri 14 2
OK
```

Related commands

set channels analogue
set channels pri

Menu Equivalent

Software Setup
- Channel Setup
- Basic Rate Ports

SET CHANNELS PRI command

Sets the number of b channels that can be used for calls on a primary rate port.

Syntax

SEt CHannels PRi [port] [channels]

Port - Port number(s) from 1 (for PRI 1) to 2 (for PRI 2)

Channels - Maximum number of channels - 0 to 30 (for E1) / 23 (for T1)

Examples
```
mux [S]> set channels pri 1 30
OK
```

Related commands

set channels analogue
set channels bri

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Menu Equivalent

Software Setup
- Channel Setup
- Primary Rate Ports

SET COMMUNICATION command

Sets up the terminal port.

Syntax

SEt COMmunication [baudrate] [data] [parity] [stopbits]

Baudrate - Baud rate in bits per second.
        Allowed values are 4800, 9600, 19200, 38400, 57600 and 115200

| Data - | 7 | 7 data bits |
| | 8 | 8 data bits |

parity -	N	no parity
	E	even parity
	O	odd parity

| Stopbits - | 1 | 1 stop bit |
| | 2 | 2 stop bits |

Examples
```
mux [S]> set communication 19200 8 N 1
OK
```

Related commands

set terminal

Menu Equivalent

Hardware Setup
- Coms Port Baud Rate
- Coms Port Parity
- Coms Port Data Bits
- Coms Port Stop Bits.

SET CONNECTION PRI command

Sets up or removes a semi-permanent connection.

Syntax

SEt CONnection PRi [port1] [timeslot]
or SEt CONnection PRi [port1] [timeslot] [port2] [channel]
or SEt CONnection PRi [port1] [timeslot] [port3] [timeslot]

port1 -   Port number(s) from 1 (for PRI 1) to 2 (for PRI 2)

port2 -   A port number from 1 (for BRI 1) to 16 (for BRI 16)

port3 -   Port number 2 (for PRI 2)

timeslot -   Timeslot number(s) between 0 and 31 (for E1)
                     Timeslot number(s) between 1 and 24 (for T1)

Channel -   A b channel number between 1 (for b1) and 2 (for b2)

If port2/port3 and channel/timeslot are omitted then any existing connection is removed.

Examples:
```
    mux [S]> set connection pri 1 1 pri 2 1
    OK
    mux [S]> set connection pri 1 2 bri 15 1
    OK
    mux [S]> set connection pri 2 3 bri 15 2
    OK
```

Related commands

None

Menu Equivalent

Software Setup
- Connection Setup

SET DATE command

Sets the stored date.

Syntax

SEt DAte [date]

Date -   date formatted as DD/MM/YY

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Examples:
```
mux [S]>set date 13:04:15
```

Related commands

None

Menu Equivalent

System Setup
        - System Time

SET E1 command

Sets up the framing, line code and international bit of the E1 primary rate ports.

Syntax

SEt E1 [linecode] [frame] [sibit]

| Linecode - | HDB3 | HDB3 line code |
| | AMI | AMI line code |

| Frame - | BAsic | Basic framing |
| | CRC4 | CRC-4 multiframing |

| Sibit - | 1 | Si (international) bits are 1 |
| | FEBE | Si (international) bits are FEBE bits |

If frame is basic then sibit must be 1.

Examples:
```
mux [S]> set e1 hdb3 crc4 1
OK
```

Related commands

set mode equaliser
set mode pri

Menu Equivalent

Hardware Setup
        - PRI E1 Mode

SET IDLE

Sets the number of minutes that the command line interface can be idle in supervisor mode before reverting to user mode.

Syntax

SEt IDLe [idle time]

Idle - idle time in minutes (1-250)

If idle is omitted, there is no limit.

Examples:
```
mux [S]>set idle 20
OK
system_1 [S]> set idle
OK
mux [S]>
```

Related commands

None

Menu Equivalent

None

SET IP command

Sets the ip address configuration. If it is set to auto a BOOTP or DHCP server is needed on the network.

Syntax

SEt IP FIxed [IP address] [subnet mask] [gateway]
SEt IP AUto
IP address -   IP address (must be unique)
Subnet mask -   subnet mask for the network or 0.0.0.0 if not known
Gateway -   IP address of gateway or 0.0.0.0 if no gateway

Examples:
```
mux [S]> set ip fixed 192.168.0.40 255.255.255.0 0.0.0.0
OK
mux [S]> set ip auto
OK
```

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Related commands

None

Menu Equivalent

System Setup
- IP Setup

SET LENGTH command

Sets the number of lines that the command line interface will display before prompting the user to press a key.

Syntax

SEt LENgth [length]

Length -   display length (1-250)

If length is omitted, there is no limit.

Examples:
```
    mux [S]>set length 20
    OK
    system_1 [S]> set length
    OK
    mux [S]>
```

Related commands

None

Menu Equivalent

None

SET MODE BRI command

Sets a BRI to be point-to-point (PP) or point-to-multipoint (PMP)

Syntax

SEt MOde BRi [port] [mode]

Port - Port number(s) from 1 (for BRI 1) to 16 (for BRI 16)

Mode - PP   Point-to-point
       PMp   Point-to-multipoint

Examples:
```
mux [S]> set bri 1 pmp
OK
```

Related commands

None

Menu Equivalent

Software Setup
    - Datalink Setup

SET MODE CLID command

Enables/disables Calling Party Number checking/generation.

Syntax

SEt MOde CLid [mode]

Mode - ON   Calling Party Number checking/generation enabled
      OFF   Calling Party Number checking/generation disabled

Examples:
```
mux [S]> set mode clid on
OK
```

Related commands

set number pri
set number bri
set mode number
set mode screening

Menu Equivalent

Software Setup
- CLID Generation

SET MODE EQUALISER command

Enables/disables the equaliser on the PRI interfaces

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Syntax

SEt MOde EQUaliser [mode]

Mode -   ON   Equaliser enabled
              OFF   Equaliser disabled

Examples:
```
     mux [S]> set mode equaliser on
     OK
```

Related commands

set mode pri
set e1
set t1

Menu Equivalent

Hardware Setup
- PRI Equaliser

SET MODE NUMBER command

Sets the number type and plan, in the calling party number, when CLID generation is on. NB: if it is set to national the numbers in number setup should be the national number (area code without prefix digit followed by local number)
(only if CLID generation on)

Syntax

SEt MOde NUMber [mode]

Mode - NORmal   normal (unchanged if number passed, set to
                    unknown type / unknown plan if number changed)
       NATIONal   always set to national type / ISDN/telephony plan

Examples:
```
     mux [S]> set mode number normal
     OK
```

Related commands

set number pri
set number bri
set mode clid
set mode screening

Menu Equivalent

Software Setup
- CLID Number Type

SET MODE PLAN command

Sets the number plan used to detect dialling completion.
(National ISDN protocol only)

Syntax

SEt MOde PLan [mode]

Mode -	NORmal	Numbering plan unknown
	USa	USA Numbering plan

Examples:
```
mux [S]> set mode plan usa
OK
```

Related commands

None

Menu Equivalent

Software Setup
- Numbering plan

SET MODE PRI command

Sets the primary rate ports to E1 or T1.

Syntax

SEt MOde PRi [mode]

Mode -	E1	2.048 Mbits/s (30B+D)
	T1	1.544 Mbits/s (23B+D)

Examples:
```
mux [S]> set mode pri e1
OK
```

Related commands

set e1
set t1
set mode equaliser

Menu Equivalent

Hardware Setup
- PRI E1/T1 Mode

SET MODE PROTOCOL command

Sets the protocol used on all ISDN connections.

Syntax

SEt MOde PROtocol [mode]

Mode -   ETSI   ETSI EuroISDN
                      NAT1   National ISDN

Examples:
```
mux [S]> set mode protocol etsi
OK
```

Related commands

None

Menu Equivalent

Software Setup
- Protocol

SET MODE RESERVE command

Enables/disables b channel reservation on hold (National ISDN protocol only).

Syntax

SEt MOde RESERve [mode]

Mode -   ON   Reserve a b channel when calls on hold
              OFF   Don't reserve a b channel when calls on hold

Examples:
```
mux [S]> set mode reserve on
OK
```

Related commands

None

Menu Equivalent

Software Setup
- BRI HOLD Reserve Channel

SET MODE ROUTE command

Sets the routing mode for calls (ETSI protocol only).

Syntax

SEt MOde ROUte [mode]

| Mode - | NUmber | Number based routing |
| | CHannel | Channel based routing |

Examples:
```
mux [S]> set mode route number
OK
```

Related commands

auto route
set route

Menu Equivalent

Software Setup
- Routing Mode

SET MODE SCREENING command

Sets the screening indicator in the calling party number when CLID generation is on.
(only if CLID generation on)

Syntax

SEt MOde SCReening [mode]

Mode -   NORmal   normal (unchanged if number passed, set to user provided /not
            screened if number changed)
            NETwork   always set to network generated

Examples:
```
     mux [S]> set mode screening normal
     OK
```

Related commands

set number pri
set number bri
set mode number
set mode clid

Menu Equivalent

Software Setup
- CLID Screening Type

SET MODE SPID command

Sets the acceptance/rejection of calls when terminal initialisation has not occurred (ie valid
SPID not received) (National ISDN protocol only)

Syntax

SEt MOde SPid [mode]

Mode -   OPTional   Calls permitted without terminal initialisation
            MANdatory   Calls not permitted without terminal initialisation

Examples:
```
     mux [S]> set mode spid optional
     OK
```

Related commands

None

Menu Equivalent

Software Setup
- BRI Require SPID

SET MODE TONE command

Enables/disables local tone generation. (ETSI protocol only)

Syntax

SEt MOde TOne [mode]

Mode -   ON   Use internal tones
             OFF   Use network tones
             AUto   Use internal or network tones depending on presence
                                         of progress indicator.

Examples:
```
mux [S]> set tone on
OK
```

Related commands

None

Menu Equivalent

Software Setup
- Use Internal Tones

SET NAME command

Sets the system name. The command prompt changes to reflect it.

Syntax

SEt NAme [name]

Name -   name (up to 15 characters, no spaces allowed)

If name is omitted, the system name is deleted and the default prompt is used.

Examples:
```
mux [S]>set name system_1
OK
system_1 [S]> set name
OK
mux [S]>
```

Related commands

None

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Menu Equivalent

System Setup
     - System Name

SET NUMBER BRI command

Sets up a telephone number for a basic rate port.

Syntax

SEt NUmber BRi [port] [x] [number]

Port -   Port number(s) from 1 (for BRI 1) to 16 (for BRI 16)

X -   Number(s) between 1 and 10 (ETSI protocol)
             Number(s) between 1 and 2 (National ISDN protocol)

number   telephone number (up to 15 digits)

If number is omitted, any existing telephone number is deleted.

For National ISDN protocol, the SPID is automatically changed to number+0101.

Examples:
```
mux [S]> set number BRI 15 10 555123
OK
```

Related commands

set number PRI

Menu Equivalent

Software Setup
- Number Setup
- Basic Rate Ports

SET NUMBER PRI command

Sets up a telephone number for a primary rate port.

Syntax

SEt NUmber PRi [port] [x] [number]

Port -   2   (for PRI 2)

x -   1

number   telephone number (up to 15 digits)

If number is omitted any existing telephone number is deleted.

Examples:
```
mux [S]> set number PRI 2 1 555123
OK
```

Related commands

set number BRI
set number PRI

Menu Equivalent

Software Setup
- Number Setup
- Primary Rate Ports

SET PASSWORD command

Sets the system password. This password is required to enter supervisor mode.

Syntax

SEt PAssword [pass]

Pass -   password (up to 15 characters, no spaces allowed)

If pass is omitted, the system password is deleted and no password is required to enter super mode.

Examples:
```
mux [S]>set password hello
OK
```

Related commands

None

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Menu Equivalent

System Setup
        - System Password

SET POWER BRI command

Enables/disables power feeding to basic rate ports (both s and u).

Syntax

SEt POWer Bri [mode]

Mode -   ON   Power enabled
               OFF   Power disabled

Examples:
```
mux [S]> set power bri on
OK
```

Related commands

set power s
set power u

Menu Equivalent

Hardware Setup
        - BRI S/U Power Feed

SET POWER S command

Sets the power-feeding mode on basic rate S interfaces. (Switches power polarity).

Syntax

SEt POWer S [mode]

Mode -   NORmal   Normal mode power
               RESTRicted   Restricted mode power

Examples:

```
mux [S]> set power s normal
OK
```

Related commands

set power bri
set power u

Menu Equivalent

Hardware Setup
     - BRI S Power Mode

SET POWER U command

Sets the power-feeding mode on basic rate U interfaces. (Switches current limiter).

Syntax

SEt POWer U [mode]

Mode -	SEAling	Sealing mode power (current limiter on)
	NORmal	Normal mode power (current limiter off)

Examples:
```
mux [S]> set power u sealing
OK
```

Related commands

set power bri
set power s

Menu Equivalent

Hardware Setup
     - BRI U Power Mode

SET ROUTE PRI command

Sets up or removes a route. (ETSI protocol only - also requires routing mode to be channel)

Syntax

SEt ROUte PRi [port1] [timeslot]
or SEt ROUte PRi [port1] [timeslot] [port2] [channel]
or SEt ROUte PRi [port1] [timeslot] [port3] [timeslot]

port1 -	Port number 1 (for PRI 1)
port2 -	A port number from 1 (for BRI 1) to 16 (for BRI 16)
port3 -	Port number 2 (for PRI 2)

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timeslot -   Timeslot number(s) between 0 and 31 (for E1)
                                      Timeslot number(s) between 1 and 24 (for T1)

Channel -   A b channel number between 1 (for b1) and 2 (for b2)

If port2/port3/port4 and channel/timeslot are omitted then any existing route is removed.

Examples
```
mux [S]> set connection pri 1 1 pri 2 1
OK
mux [S]> set connection pri 1 2 bri 8 1
OK
```

Related commands

auto route
set mode route

Menu Equivalent

Software Setup
- Routing Setup

SET S command

Sets the timing mode on the S interfaces.

Syntax

SEt S [mode]

Mode -   FIxed   Fixed timing
              ADaptive   Adaptive timing

Examples:
```
mux [S]> set s fixed
OK
```

Related commands

None

Menu Equivalent

Hardware Setup
     - BRI S Bus Timing

SET TARGET command

Sets the target IP addresses for SNMP traps. Up to 3 target IP addresses can be defined. An IP address of 0.0.0.0 is used to show no target defined. The IP address can also be omitted to set no target defined.

Syntax

SEt TARGet [x] [IP address]
SEt TARGet [x]

X -   Number between 1 and 3

IP address -   IP address (must be unique)

Examples:
```
mux [S]> set target 1 192.168.0.88
OK
mux [S]> set target 1
OK
```

Related commands

None

Menu Equivalent

System Setup
- IP Setup

SET TERMINAL command

Sets up the terminal emulation to be matched.

Syntax

SEt TErminal [type]

Type -   COLOUR   ANSI Colour
                ANSI   ANSI
                WYse   Wyse 50

Examples:
```
mux [S]> set terminal colour
OK
```

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Related commands

set communication

Menu Equivalent

Hardware Setup
- Terminal type

SET T1 command

Sets up the framing and line code of the T1 primary rate ports.

Syntax

SEt T1 [linecode] [frame]

Linecode -   B8ZS   B8ZS line code

Frame -   ESF   ESF framing

Examples:
```
mux [S]> set t1 b8zs esf
OK
```

Related commands

set mode pri
set mode equaliser

Menu Equivalent

Hardware Setup
        - PRI T1 Mode

SET TIME command

Sets the stored time.

Syntax

SEt TIme [time]

Time -   time in 24 hour clock and format HH:MM:SS

Examples:
```
mux [S]>set time 13:04:15
```

Related commands

None

Menu Equivalent

System Setup
      - System Time

START L1 BRI command

Starts layer 1 on a basic rate port ie activates it.

Syntax

STARt L1 BRi [port]

Port -   Port number(s) from 1 (for BRI 1) to 16 (for BRI 16)

Examples:
```
mux [S]> start l1 bri 2
bri 2: layer 1 establishment requested
```

Related commands

start l2 bri
start l2 pri

Menu Equivalent

None.

START L2 BRI command

Starts layer 2 on a basic rate port ie starts the data link.
NB: only ports in point to point mode can have layer 2 started by this command.

Syntax

STARt L2 BRi [port]

Port -   Port number(s) from 1 (for BRI 1) to 16 (for BRI 16)

Examples:
mux [S]> start l1 bri 2
bri 2: layer 2 establishment requested

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Related commands

start l1 bri
start l2 pri

Menu Equivalent

None.

START L2 PRI command

Starts layer 2 on a primary port ie starts the data link.

Syntax

STARt L2 PRi [port]

Port -   Port number(s) from 1 (for PRI 1) to 2 (for PRI 2)

Examples:
```
mux [S]> start l1 pri 2
pri 2: layer 2 establishment requested
```

Related commands

start l1 bri
start l2 bri

Menu Equivalent

None.

STATUS command

Displays the status of the system including all ports. It is equivalent to status system, status analogue, status bri, and status pri.

Syntax

STATus

Examples:
```
mux [U]> status
```

Related commands

status analogue
status bri
status pri
status system

Menu Equivalent

None.

STATUS ANALOGUE command

Displays the status of analogue port(s).

Syntax

STATus Analogue [port]

Port -   Port number(s) from 1 (for A1) to 32 (for A32)

If port is omitted the status of all analogue ports is displayed.

Examples
```
    mux [U]>status analogue 11
     a11 status:
             number(1) : '14'
             number(2) : ''
             number(3) : ''
             number(4) : ''
             number(5) : ''
             clid generation:off
             local tones: off


     a11 virtual BRI status:
        layer 2 point-multipoint : tei 64 sapi 0 multiple
    frame established
        layer 3 b: tei 64 #1 u->n (call setup) [pri 1 tei 0
    #1 ts01(b1) ]
```

Related commands

status
status bri
status pri
status system

Menu Equivalent

None.

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STATUS BRI command

Displays the status of basic rate port(s).

Syntax

STATus BRi [port]

Port -   Port number(s) from 1 (for BRI 1) to 16 (for BRI 16)

If port is omitted the status of all basic rate ports is displayed.

Examples:
```
    mux [U]> status bri 1
    bri 1 : S  interface (fixed timing, normal power)
     layer 1 not active
     layer 2 point-multipoint : no TEI's assigned
     layer 3 b1: free
             b2: free
             number( 1) : '01'
             number( 2) : ''
                    "
             number( 9) : ''
             number(10) : ''
             clid generation:off
             local tones: off
```

Related commands

status
status analogue
status pri
status system

Menu Equivalent

None.

STATUS PRI command

Displays the status of primary rate port (s).

Syntax

STATus PRi [port]

Port -   Port number(s) from 1 (for PRI 1) to 2 (for PRI 2)

If port is omitted the status of all primary rate ports is displayed.

Examples:
```
mux [U]> status pri 1
pri 1 : E1 interface (hdb3 / crc4 / 1)
 layer 1 active
 layer 2 point-point : tei  0  sapi  0  multiple  frame
established
 layer 3 ts00( f ) : framing channel
         ts01(b1)  : tei  0  #1  u->n  [bri 8 tei 0 #1 b1
(connected)]
            "
            "
         ts16( d ) : signalling channel
           "
           "
         ts31(b30) : free
```

Related commands

status
status analogue
status bri
status system

Menu Equivalent

None.

STATUS SYSTEM command

Displays system status.

Syntax

STATus SYstem

Examples:

```
mux [U]> status system
system:
 hardware: dig19 (16U 2P [set to E1])
 software: (development  version)  (flash)[  boot  sector:
v2.0b ]
 tcp/ip : fixed
   ip address  : 192.168.0.130
   subnet mask : 255.255.255.0
   gateway     : 0.0.0.0
   snmp trap address 1 : 0.0.0.0
   snmp trap address 2 : 0.0.0.0
   snmp trap address 3 : 0.0.0.0
 protocol: ETSI
 real time clock: detected
```

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```
access: user - read only
name: (no name)
password: (no password)
time: 23/12/98 12:11:04
comms: 115200,8,N,2 (ansi terminal)
calls: 0 active (0 on hold), 0 suspended (0 cleared)
```

Related commands

status
status analogue
status bri
status pri

Menu Equivalent

None.

SUPER command

Selects supervisor mode (read and write access).
The user is prompted for a password if there is a password stored.

Syntax

SUPervisor

Examples
```
mux [U]>supervisor
OK
mux [S]>
```

Related commands

user
set password

Menu Equivalent

System Setup
    - System Mode

SWL command

(Software Load)
Uploads new software to FLASH. More details are given in an appendix.

Syntax

SWL

Examples:
```
mux [S]>swl
```

Related commands

None

Menu Equivalent

System Setup
- Reprogram FLASH

SWL ANALOGUE command

Uploads new software to the analogue card. More details are given in an appendix.

Syntax

SWL Analogue

Examples:
```
mux [S]>swl analogue
```

Related commands

None

Menu Equivalent

System Setup
- Reprogram Analogue

TEST BRI command

Tests U interface line quality by sending a loopback command to the NT-1 and performing a 20 second bit error rate test.

Syntax

TESt BRi [port]

Port -   Port number(s) from 1 (for BRI 1) to 16 (for BRI 16)

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Examples:
```
    mux [S]> test bri 2
    bert test bri 2:
      activating.............
      waiting for sync...
      testing...................
      1282828 bits,0 errors
```

Related commands

None.

Menu Equivalent

None.

TRACE command

Clears the protocol analyser and enables protocol analyser display.

Syntax

TRace

Examples:
```
    mux [U]> trace

        3 : TA  Ch BRI1  L3                    00:16:14:12.173
            PD= 8, LEN= 1, FLAG= Orig, CALL REF= 1   SETUP

        4 : MUX Ch PRI1  L3                    00:16:14:12.217
            PD= 8, LEN= 2, FLAG= Orig, CALL REF= 4   SETUP

        7 : NET Ch PRI1  L3                    00:16:14:12.285
            PD= 8, LEN= 2, FLAG= Dest, CALL REF= 4   SETUP
    ACKNOWLEDGE

        9 : MUX Ch BRI1  L3                    00:16:14:12.316
            PD= 8, LEN= 1, FLAG= Dest, CALL REF= 1   SETUP
    ACKNOWLEDGE
```

Related commands

set analyser l1
set analyser l2
set analyser l3
set analyser bri
set analyser pri
set analyser reference
set analyser protocol
analyser

Menu Equivalent

None

UPLOAD command

Lists all the commands that would create the current configuration. If the output is logged to a file a command file is created which can be sent to The Primary to Basic Rate ISDN Multiplexer later to restore this configuration.

Some commands are preceded by a rem to prevent them being executed if a file generated in this way is used for configuration.

NB: When using a PC to send a command file make sure that it is set for hardware flow control.

Syntax

UPload

Examples:
```
mux [S]> upload
set analyser bri 1 off
set analyser bri 2 off
      "
       "
set terminal ansi
rem set time 12:15:42
```

Related commands

None

Menu Equivalent

None

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USER command

Selects user mode (read only).

Syntax

USEr

Examples:
```
mux [S]>super
OK
mux [U]>
```

Related commands

supervisor
set password

Menu Equivalent

System Setup
        - System Mode

VERSION command

Returns the current version number.

Syntax

VErsion

Examples:
```
mux [U]> version
 software: V1.3a 23 December 1998 (flash)[ boot sector: v1.0a
]
```

Related commands

None

Menu Equivalent

Version information is displayed on copyright screen.

Fault Finding

Introduction

This section seeks to provide some guidance on solving common problems encountered in using the Primary to Basic Rate ISDN Multiplexer.

Changing a parameter on a The Primary to Basic Rate ISDN Multiplexer caused it to stop operating

Changing parameters on the Primary to Basic Rate ISDN Multiplexer may cause the unit to change operating modes and appear to stop functioning.

To recover from this condition reload the factory defaults (see Quick Reference Guide).

Windows terminal program will not move up and down menus

When using the Windows terminal emulation program in its default configuration the <up> and <down> arrow keys will not function with the menus. This is because Windows uses these keys and does not pass any characters to the Primary to Basic Rate ISDN Multiplexer.

In most cases <up> can be replaced with the 'u' or 'U' key and <down> by the 'd' or 'D' key. Alternatively, change the operation of the terminal program by disabling the "Use Function, Arrow and Ctrl Keys for Windows" option.

No communication with terminal port

Communication failure can occur for several reasons. Firstly check that the Primary to Basic Rate ISDN Multiplexer is powering up properly. The power LED should illuminate and the other LED's should turn on and off. The internal relays should usually switch on power up and this should be audible.

Next check the cable. The Primary to Basic Rate ISDN Multiplexer provides a DCE connection so a cable with a 9 way D male to 9 way D female connected pin for pin will connect The Primary to Basic Rate ISDN Multiplexer to a PC.

If the cable is correct then check the communication parameters. The default is 19200-baud, no parity, 2 stop bits and 8 data bits.

To restore the default communication parameters reload the factory defaults (see Quick Reference Guide).

Changing parameters had no effect on operation of the Primary to Basic Rate ISDN Multiplexer

Some parameters, once changed, will not effect the operation of the unit immediately. If the Primary to Basic Rate ISDN Multiplexer does not seem to be operating properly use the

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<esc> key to go back to the previous menu. If this does not work, then switch The Primary to Basic Rate ISDN Multiplexer off and on again.

Protocol Analyser will not run.

Check the analyser option i.e. at least one level of decode must be enabled and the interface to which the terminal is connected must be enabled. If you are not sure, set decode for layers 1, 2 and 3 on all interface ports.

Network connection will not activate at layer 1 (i.e. P led does not illuminate)

Check that you have selected the correct primary rate mode for the PRI line.

Check PRI E1/T1 mode in Hardware Setup matches the PRI line.

E1 -   Check PRI E1 Mode in Hardware Setup matches the line coding and framing standard on the PRI line. If this information is not known try HDB3/CRC-4/Si=1.

T1 -   Check the network is compatible with The Primary to Basic Rate ISDN Multiplexer. It should be T1 (1.544 Mbit/s) with Extended Super Frame (ESF) and B8ZS line coding.

Terminal will not activate at layer 1 (i.e. P led does not illuminate)

If the P LED does not illuminate then the physical connection between the terminal and the Primary to Basic Rate ISDN Multiplexer is not functioning. Check first that the terminal is connected to the correct interface type. The Copyright Screen displays the type of interface installed for each port.

If it is a BRI terminal, try changing the power settings in Hardware Setup. Set BRI S/U Power Feed to ON. If it is an S interface BRI terminal, try setting BRI S Power Mode to both normal and restricted.

For US originating products with U interfaces then BRI U Power Mode should be set to "Sealing". To power NT-1's the U interface power should be set to Normal. Be careful when switching to U interface normal power as products intended to be connected to current limited U interface may be damaged by non-current limited power (e.g. Motorola Bitsurfer).

For primary rate check that PRI E1/T! Mode in Hardware Setup matches the terminal.

For E1 equipment, check that PRI E1 Mode in Hardware Setup matches the line coding and framing standard for the terminal. If this information is not known try HDB3/CRC-4/Si=1.

For T1 equipment check it is compatible with The Primary to Basic Rate ISDN Multiplexer. The Primary to Basic Rate ISDN Multiplexer supports Extended Super Frame (ESF) and B8ZS line coding.

Terminal will not make or answer a call.

If the P light stays off see the section on "Terminal will not activate at layer 1". If the P light flashes check that there are not too many terminals on the line. For basic rate, the maximum is 8 (1 for point-to-point) and for primary rate, the maximum is 1.

For a basic rate port, check that the BRI Setup is correct in Software Setup. This should be point-to-point, if it is a point-to-point terminal expecting TEI=0. Otherwise, it should be point to multipoint, which allows automatic TEI assignment.

If the P light fails to light, the terminal may be faulty.

Now check that there are channels enabled on that port and that there are sufficient channels enabled on PRI 1, i.e. check Channel Setup is correct in Software Setup.

If ETSI protocol is set and routing mode is set to channel check that a route to PRI 1 has been set up.

Check that the terminal is compatible with the network. For example, if using an ETSI network the terminals should be ETSI compliant. Other terminals may not function due to protocol errors.

For BRI TA's being used with National ISDN protocol, check that the correct SPID has been entered in the TA. This should consist of the number for the TA (in Number Setup) + 0101. NB: if BRI Require SPID in Software Setup is set to "No" the The Primary to Basic Rate ISDN Multiplexer will allow calls to made without a correct SPID but the TA may block the call itself.

Use the protocol analyser to display the layer 3 messages. The called terminal may send DISCONNECT, RELEASE or RELEASE COMPLETE with a cause value indicating the problem.

A potential problem may be that called terminal and calling terminal do not support the same bearer capability, in which case the called terminal will send RELEASE COMPLETE with a cause "Incompatible Destination". Another possibility is that the called terminal is expecting a Called Party Number or Calling Party Number information element in the SETUP message. These are optional services from the network.

Incoming calls are rejected or not routed correctly

If the B light on the called port switches on but the P light stays off see the section on "Terminal will not activate at layer 1".

For a basic rate port check that the BRI Setup is correct in Software Setup. This should be point-to-point, if it is a point-to-point terminal expecting TEI=0. Otherwise, it should be point to multipoint which uses the global TEI (127).

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Now check that there are channels enabled on that port and that there are sufficient channels enabled on PRI 1 ie check Channel Setup is correct in Software Setup

If ETSI protocol is set and routing mode is set to channel check that a route to PRI 1 has been set up.

Otherwise, check that Called Party Number and Number Setup are compatible as follows...

Use the protocol analyser to check that the network is providing a CalledParty Number in the SETUP message and that a match number in Number Setup matches it.

For ETSI protoco1, a match requires the n digits of the match number for the port that the call is to be routed to match the last n digits of the Called Party Number.

For National ISDN protocol, a match requires the match number for the BRI TA that the call is to be routed to - match the Called Party Number. The n digits of the shorter number are compared to the last n digits of the longer number. This allows a match when an area code is not included in one of the numbers.

B channel not freed (B light stays on) when call is on hold

If ETSI protocol is set and routing mode is set to channel, the b channel should not be freed.

Otherwise, when calls are placed on hold, the B channel on PRI 1 is kept reserved. The b channel on the BRI for a call on hold is only freed if there is a spare channel on PRI 1. When the b channel is freed, it is possible for the BRI to have more than 2 b channels on PRI 1 allocated to it. Hence to ensure that all enabled BRI's still have access to 2 b channels on PRI 1 the b channel for the call on hold on the BRI is only freed if there is a spare channel on PRI 1 or it is the first call on hold with b channel reserve on.
The number of spare channels is
    (no. of channels enabled on PRI 1)
    - (no. of analogue channels enabled)
    - (no. of BRI channels enabled)
    - (no. of channels enabled on PRI 2)

Appendices

Reprogramming the FLASH

New software can be uploaded via the serial port, modem (optional) or the Ethernet port. Telnet and FTP are used with the Ethernet port.

If the software is corrupted then upload has to be done via the serial port.

Initiating software upload from boot ROM

If the FLASH checksum is invalid, the Primary to Basic Rate ISDN Multiplexer will request reprogramming on power up.

If the FLASH is corrupted but still passes checksum, the Primary to Basic Rate ISDN Multiplexer can be forced to request reprogramming on power up. Set your terminal/PC to 19200 baud, 8 data bits, no parity and 2 stop bits. Switch the Primary to Basic Rate ISDN Multiplexer on and press <ctrl-d> while the LED's are all on.

The following is displayed:
```
ISDN Multiplexer BOOT 2.0b 26th October 1999
Ready to upload new firmware into FLASH.
Confirm Yes/No (Y/N)
```

NB: if a debug prompt is displayed press <escape>.

If you wish to change to a higher baud rate it is possible to change over to 115200 baud by pressing <Escape> <9> <Return> .Set your PC/terminal to match and press <Escape>. The prompt will be re-displayed.

Press <Y> to proceed.

Initiating software upload from the menu system or command line interface

Firstly, you may wish to change to a higher baud rate in hardware setup or by using set communication and set your PC/terminal to match.

Select Reprogram FLASH in system setup and press <Enter> or type swl <ENTER> from the command line interface.

NB: supervisor mode is required.

The following is displayed if the serial port is being used.

Press <1> to proceed using serial port, or <2> to proceed using FTP.

```
Ready to upload new firmware into FLASH
Select download method
(1)- serial port (2) - FTP  (ESC) - abort
```

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The following is displayed if the Ethernet port is being used (Telnet access). Press <Y> to proceed using FTP.

```
Ready to upload new firmware into FLASH (via FTP)
Confirm Yes/No (Y/N)
```

The following is displayed if the modem is being used Press <Y> to proceed.

```
Ready to upload new firmware into FLASH
Confirm Yes/No (Y/N)
```

File transfer using serial port

If upload was initiated from the menu or command line, the ISDN protocol stack is stopped and the line cards are reset (all LED's on the line cards will come on, relays may click on S cards).

The following is displayed:

```
ISDN Multiplexer BOOT 2.0b 26th October 1999
Clearing RAM
Ready for S-RECORDs
```

Now send the file as raw ASCII. (Or press <ESCAPE> to abort)

The LED's for PRI 1 will scroll during the download.

If the file is valid, the following is displayed:

```
S-RECORD download complete
initialise FLASH programming
FLASH erase
```

LED's will scroll for a few seconds then the following is displayed:

```
FLASH program
```

LED's will scroll for a few more seconds then the following is displayed:

```
FLASH program complete
```

If the file is not valid, an error message will be displayed. The existing FLASH program will not have been changed.

If upload was initiated using the boot ROM then the following is displayed:

```
Running debugger
Boot Debugger
>00C00164
```

Type <z> <Enter> to restart the Primary to Basic Rate ISDN Multiplexer.

If upload was initiated using the command line or menu then the Primary to Basic Rate ISDN Multiplexer will restart automatically if there were no errors otherwise press a key to make the Primary to Basic Rate ISDN Multiplexer restart.

File transfer using FTP

The ISDN protocol stack is stopped.

The following is displayed:
```
Ready for s-records
  send via FTP to 192.168.0.40
  with user name 'ISDN', password 'MULTIPLEXOR'
```

Now using an FTP program, log in and send the file.
LED's on PRI 1 will scroll during the upload.

If the file is valid the following is displayed:
```
valid s-record file received
DO NOT SWITCH OFF
  - system  will  reset  when  erase/program  sequence  is
    complete
```

If the upload was initiated using Telnet then the following is displayed:
```
telnet will disconnect - reconnection possible in 30
seconds
```
The line cards are reset (all LED's on the line cards will come on, relays may click on S cards).

LED's on PRI 1 will scroll during the erase/program sequence. The Primary to Basic Rate ISDN Multiplexer will then reset.

If the file is not valid, an error message will be displayed. The existing FLASH program will not have been changed. The Primary to Basic Rate ISDN Multiplexer will reset automatically.

Log out or disconnect using the FTP program.

File transfer using modem

The ISDN protocol stack is stopped.

The following is displayed:
```
Ready for s-records
```

Now send the file as raw ASCII. (or press <ESCAPE> to abort)
LED's on PRI 1 will scroll during the upload.

If the file is valid the following is displayed:@
```
valid s-record file received
DO NOT SWITCH OFF
  - system  will  reset  when  erase/program  sequence  is
complete
modem  will  disconnect  -  reconnection  possible  in  30
seconds
```

The line cards are reset (all LED's on the line cards will come on, relays may click on S cards).

LED's on PRI 1 will scroll during the erase/program sequence. The Primary to Basic Rate ISDN Multiplexer will then reset.

If the file is not valid, an error message will be displayed. The existing FLASH program will not have been changed. The Primary to Basic Rate ISDN Multiplexer will reset automatically.

Reprogramming an Analogue card

New software for the analogue card can be uploaded via the serial port, modem (optional) or the Ethernet port. Telnet and FTP are used with the Ethernet port.

There are 2 pieces of software, which can be loaded on to an analogue card
1 - card software
2 - DSP module software

Initiating software upload to analogue card

Firstly, you may wish to change to a higher baud rate in hardware setup or by using set communication and set your PC/terminal to match.

Select Reprogram Analogue in system setup and press <Enter> or type swl analogue <ENTER> from the command line interface.

NB: supervisor mode is required.

The following is displayed if the serial port is being used.

Press <1> to proceed using serial port, or <2> to proceed using FTP.

```
Ready to upload new firmware into analogue card
Select download method
(1)- serial port (2) - FTP  (ESC) - abort
```

The following is displayed if the Ethernet port is being used (Telnet access):
```
Ready to upload new firmware into analogue card (via FTP)
```

The following is displayed if the modem is being used:
```
Ready to upload new firmware into analogue card
Confirm Yes/No (Y/N)
```

The following is displayed. Press <1> or <2> to select the line card to be reprogrammed.
```
Select line card
      (1) - Card 1 (2) - Card 2 (ESC) - abort
```

The following is displayed. Press <1> to reprogram the card software, or <2> to reprogram the DSP module software.

```
Select card or DSP module
(1) - card (2) - DSP
```

Reprogramming card software

If the software is to be uploaded via FTP the following is displayed:

```
[card %d, current version %s]
Requesting analogue card to accept new program
Ready for s-records
send via FTP to 192.168.0.40
with user name 'ISDN', password 'MULTIPLEXER'
```

Now using an FTP program log in and send the file or press <escape> to abort.

Otherwise, the following is displayed:

```
[card %d, current version %s]
Requesting analogue card to accept new program
Ready for s-records
```

Now send the file as raw ASCII or press <escape> to abort.

In both cases, LED's on PRI 1 will scroll during the upload. When upload is complete, the following is displayed:

```
Transferring s-records
```

The LED's continue to scroll as the file is transferred to the analogue card. When upload is successfully completed, the following is displayed:

```
Download result: 'OK'
Waiting for analogue card to reprogram FLASH
 - DO NOT SWITCH OFF
[Programming takes around 30 seconds]
```

The LED's continue to scroll as the analogue card reprograms its FLASH with the new software.

The following should be displayed:

```
Program result: 'OK'
```

If telnet is being used the following is displayed:

```
telnet will disconnect - reconnection possible in 30
seconds
```

If the modem is being used the following is displayed:

```
modem  will  disconnect  -  reconnection  possible  in  30
seconds
```

The line cards are reset (all LED's on the line cards will come on, relays may click on S cards).

The Primary to Basic Rate ISDN Multiplexer will now reset.

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If the file is not valid, an error message will be displayed. The existing card software will not have been changed. The Primary to Basic Rate ISDN Multiplexer will reset automatically.

If FTP is being used log out or disconnect using the FTP program.

Reprogramming DSP module software

If the software is to be uploaded via FTP the following is displayed:
```
[card %d, DSP version %s]
Ready for s-records
send via FTP to 192.168.0.40
with user name 'ISDN', password 'MULTIPLEXER'
```

Now using an FTP program log in and send the file or press <escape> to abort.

Otherwise the following is displayed:
```
[card %d, DSP version %s]
Ready for s-records
```

Now send the file as raw ASCII or press <escape> to abort.

In both cases, LED's on PRI 1 will scroll during the upload. When upload is complete the following is displayed:
```
Requesting analogue card to accept new DSP program
Transferring s-records
```

The LED's continue to scroll as the file is transferred through the analogue card to the DSP module. When upload is successfully completed, the following is displayed:
```
Program result: 'OK'
Waiting for analogue card to reprogram DSP
 - DO NOT SWITCH OFF
[Programming takes around 30 seconds]
```

The LED's continue to scroll as the analogue card reprograms the DSP module with the new software.

The following should be displayed:
```
Program result: 'OK'
```

If telnet is being used the following is displayed:
```
telnet will disconnect - reconnection possible in 30
seconds
```

If the modem is being used the following is displayed:
```
modem will disconnect - reconnection possible in 30 seconds
```

The line cards are reset (all LED's on the line cards will come on, relays may click on S cards).

The Primary to Basic Rate ISDN Multiplexer will now reset.

If the file is not valid, an error message will be displayed. The existing DSP module software will not have been changed. The Primary to Basic Rate ISDN Multiplexer will reset automatically.

If FTP is being used log out or disconnect using the FTP program.

Default Settings

This table shows the default settings for the Primary to Basic Rate ISDN Multiplexer. Some settings apply to only one protocol.

ETSI mode only settings

The following settings apply only to ETSI mode
Routing Mode
Routing Setup
Use Internal Tones
In National ISDN mode routing is always number based and internal tones are always used.

National ISDN mode only settings

The following settings apply only to National ISDN mode
BRI Require SPID
BRI HOLD reserve channel
Numbering plan
In ETSI mode, channel reserve on hold is always enabled. The other settings are not relevant.

Numbers
Separate numbers are stored for ETSI and National ISDN protocols. Hence, 2 sets of default numbers are listed.

SPID's

The SPID's (National ISDN protocol only) are fixed as the number in Number Setup with 0101 appended. e.g. BRI 12 has SPID's 3841120101 and 3841520101 if the default numbers are unchanged.

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	Parameter	**Default Setting**	
System Setup	System Name	no name	
	System Password	no password	
	IP settings	auto, no SNMP targets	
Hardware Setup	Coms Port Baud Rate	19,200	
	Coms Port Parity	None	
	Coms Port Stop Bits	2	
	Coms Port Data Bits	8	
	Terminal type	ANSI	
	BRI S/U Power feeding	On	
	BRI S Power Mode	Normal	
	BRI U Power Mode	Sealing	
	BRI S bus timing	Fixed	
	PRI E1/T1 mode	E1	
	PRI Equaliser	Off	
	PRI E1 mode	HDB3/CRC-4/Si=FEBE	
	PRI T1 mode	B8ZS/ESF	
Software Setup	Protocol	ETSI EuroISDN	
	Routing Mode	Number	
	Datalink Setup	all point-multipoint	
	Channel Setup	PRI 1	30
		PRI 2	0
		BRI's	2
	Connection Setup	all unallocated	
	Number Setup	See next table	
	Routing Setup	all unallocated	
	CLID Generation	No	
	Use Internal Tones	No	
Analyser Setup	Layer 1 Hardware	Inactive	
	Layer 2 Data Link	Inactive	
	Layer 3 Call Control	ASCII long display	
	Channel filter	all disabled	
	Call reference filter	Inactive	
	Analyser Specification	ETSI	

Number Setup for ETSI mode			
BRI 1	or A1, A2	01, 51	
BRI 2	or A3, A4	02, 52	
BRI 3	or A5, A6	03, 53	
BRI 4	or A7, A8	04, 54	
BRI 5	or A9, A10	05, 55	
BRI 6	or A11, A12	06, 56	
BRI 7	or A13, A14	07, 57	
BRI 8	or A15, A16	08, 58	
BRI 9	or A17, A18	09, 59	
BRI 10	or A19, A20	10, 60	
BRI 11	or A21, A22	11, 61	
BRI 12	or A23, A24	12, 62	
BRI 13	or A25, A26	13, 63	
BRI 14	or A27, A28	14, 64	
BRI 15	or A29, A30	15, 65	
BRI 16	or A31, A32	16, 66	
PRI 2		99	

Number Setup for National ISDN mode			
BRI 1	or A1, A2	384101, 384151	
BRI 2	or A3, A4	384102, 384152	
BRI 3	or A5, A6	384103, 384153	
BRI 4	or A7, A8	384104, 384154	
BRI 5	or A9, A10	384105, 384155	
BRI 6	or A11, A12	384106, 384156	
BRI 7	or A13, A14	384107, 384157	
BRI 8	or A15, A16	384108, 384158	
BRI 9	or A17, A18	384109, 384159	
BRI 10	or A19, A20	384110, 384160	
BRI 11	or A21, A22	384111, 384161	
BRI 12	or A23, A24	384112, 384162	
BRI 13	or A25, A26	384113, 384163	
BRI 14	or A27, A28	384114, 384164	
BRI 15	or A29, A30	384115, 384165	
BRI 16	or A31, A32	384116, 384166	
PRI 2		384199	

ISDN interface Pin-outs

The following table shows the pin-outs of the RJ45 connectors for the ISDN interfaces.

	PRI 1	PRI 2	BRI	
	E1 or T1	E1 or T1	S	U
1	R-	T-	NC	NC
2	R+	T+	NC	NC
3	NC	NC	R-	NC
4	T-	R-	T-	RING
5	T+	R+	T+	TIP
6	NC	NC	R+	NC
7	NC	NC	NC	NC
8	NC	NC	NC	NC

Analogue Pin-out

The following table shows the pin-out of the RJ11 connector for the analogue (PSTN) interfaces.

	RJ11 connector
1	NC
2	NC
3	TIP
4	RING
5	NC
6	NC

Ethernet interface Pin-out

The following table shows the pin-out of the RJ45 connector for the Ethernet interface.

	RJ45 connector
1	T+
2	T-
3	R+
4	NC
5	NC
6	R-
7	NC
8	NC

Modem Pin-out

The following table shows the pin-out of the RJ11 connector for the modem (optional).

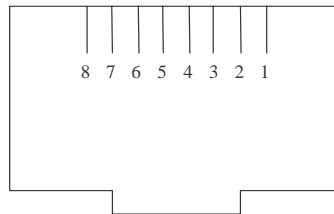|	RJ11 connector
1	NC
2	NC
3	TIP
4	RING
5	NC
6	NC

Figure 12 RJ45 plug (front view)
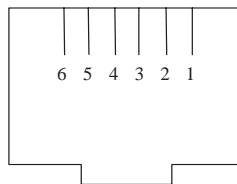
Figure 13 RJ11 plug (front view)

Terminal Port Pin-Out
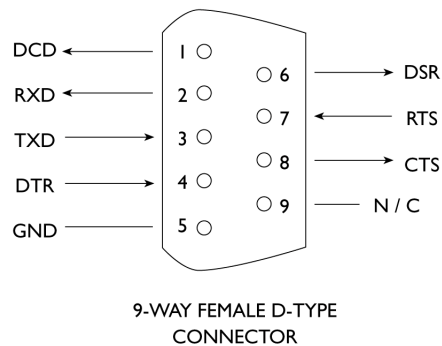
Figure 14 V.24 Terminal Port

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Pin	Function	Description
1	DCD	Data Carrier Detect (always active)
2	RXD	Received Data (output)
3	TXD	Transmitted Data (input)
4	DTR	Data Terminal Ready (input- ignored)
5	GND	Ground
6	DSR	Data Set Ready (always active)
7	RTS	Request to Send (input- active to allow **The Primary to Basic Rate ISDN Multiplexer** to send Data)
8	CTS	Clear to Send (output- active when **The Primary to Basic Rate ISDN Multiplexer** can receive Data)

BRI Power Feeding

Figure 15 shows a schematic of how the power is supplied at the ISDN S0 interface port while figure 16 shows a schematic of U interface power feeding.
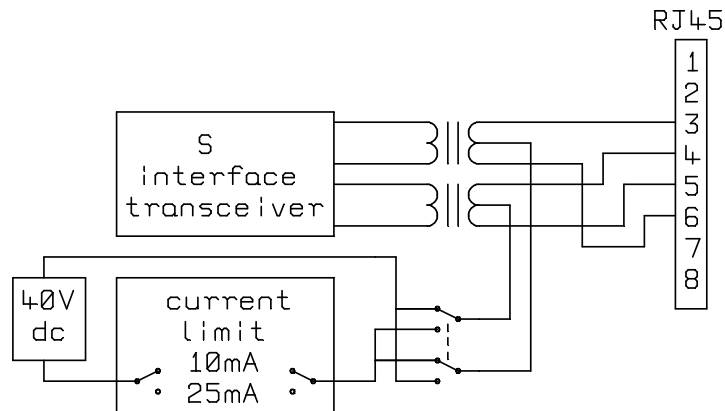

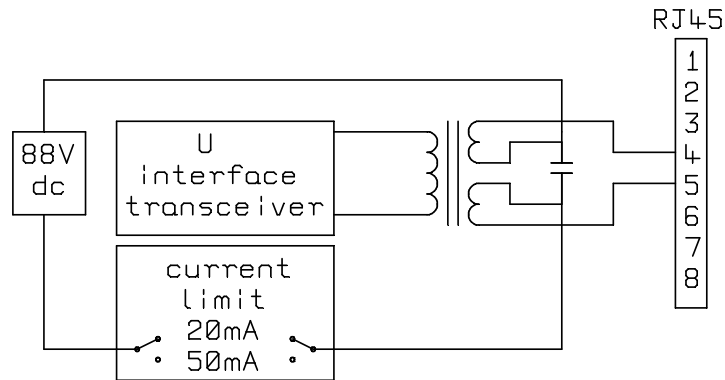Figure 15 Schematic of 40 V Power Supply (S interface)

Figure 16 Schematic of 88V Power Supply (U interface)

Examples of Number Set-up (ETSI protocol)

This appendix gives some example settings for Number Set-up when ETSI protocol is selected, and describes how incoming calls are routed (if Routing Mode is set to Number) and how the calling party number/subaddress on outgoing calls is effected (if CLID generation is on) in each case.

The examples for the telephone numbers are given as 7 digits ie just the local number. Telephone numbers with area code e.g. 04445551234 could be used but if the network doesn't include the area code in the Called Party Number then incoming calls would not be routed correctly. Shorter numbers could also be used. e.g. if all the numbers on the PRI are the same apart from the last 2 digits then a 2 digit number (like the default numbers) would be sufficient to route correctly.

When setting up the numbers it is important to delete any existing numbers that are no longer required.

For simplicity, the following text assumes that the same format of numbers is used for each interface.

Reject all incoming calls

Delete all numbers in Number Setup.
Set PRI 2 to have 0 channels in Channel Setup
CLID generation (for outgoing calls) is not appropriate in this case.

Route all incoming calls to PRI 2

Delete all numbers in Number Setup.
Set PRI 2 to have some channels in Channel Setup
CLID generation (for outgoing calls) is not appropriate in this case.

Calls will be routed to PRI 2 if there is a free b channel.

Route to first interface with a free channel

Store * or ? for first number for each interface that is to receive incoming calls.
CLID generation (for outgoing calls) is not appropriate in this case.

Incoming calls with any Called Party Number will be accepted by the first port with a free b channel (any Called Party Subaddress is ignored).

Route by telephone number

Store telephone number(s) (e.g. 5551234) for each interface that is to receive incoming calls.

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If CLID generation is on use the first number for an interface to hold the telephone number to be used when a Calling Party Number is to be changed on or added to an outgoing call.

10 different telephone numbers can be assigned to the same interface.

The same number can be used for several interfaces to form a multi-line hunt group.

For the example of 5551234
> Incoming calls with Called Party Number ending 5551234 will be accepted if there is a free b channel (any Called Party Subaddress is ignored).
>
> Outgoing calls (with CLID generation on) will have their Calling Party Number checked (any Calling Party Subaddress is ignored).
> Outgoing calls with Calling Party Number ending 5551234 will have their Calling Party Number unchanged. Otherwise if none of the numbers for that port match then the Calling Party Number (and Subaddress) will be changed to the first number (and Subaddress) stored for that port.

Route by subaddress

Store '?#' followed by a subaddress (e.g. ?#23) for each interface that is to receive incoming calls.

 NB: 10 different subaddresses can be assigned to the same interface.

CLID generation (for outgoing calls) is not appropriate with this format.

For the example of ?#23
> Incoming calls with any Called Party Number and with a subaddress of 23 will be accepted if there is a free b channel.

Route by telephone number and subaddress

Store a telephone number followed by '#' followed by a subaddress (e.g. 5551234#44) for each interface that is to receive incoming calls. NB: 10 different telephone numbers and subaddresses can be assigned to the same interface.

If CLID generation is on, use the first number for an interface to hold the telephone number and subaddress to be used when Calling Party Number and Calling Party Subaddress are to be changed on or added to an outgoing call.

For the example of 5551234#44
> Incoming calls with Called Party Number ending 5551234 and with a subaddress of 44 will be accepted.
>
> Outgoing calls (with CLID generation on) will have their Calling Party Number and Calling Party Subaddress checked.

Outgoing calls with Calling Party Number ending 5551234 and Calling Party Subaddress of 44 will have their Calling Party Number and Calling Party Subaddress unchanged. Otherwise, if none of the numbers for that port match then the Calling Party Number (and Subaddress) will be changed to the first number (and Subaddress) stored for that port.

Route based on telephone number with last digit as wildcard

Store a telephone number with a '?' in place of the last digit (e.g. 555123?) for each interface that is to receive incoming calls.

Store it as the first number if CLID generation is on and it is the preferred choice for when a Calling Party Number is to be changed on or added to an outgoing call. NB: the '?' is changed to 0 if it is used as the Calling Party Number.

This is a useful way of allocating 10 numbers (for MSN) to a basic rate interface.

For the example of 555123?
Incoming calls with Called Party Number ending 5551230 to 5551239 will be accepted if there is a free b channel (any Called Party Subaddress is ignored) .

Outgoing calls (with CLID generation on) will have their Calling Party Number checked (any Calling Party Subaddress is ignored).

Outgoing calls with Calling Party Number ending 5551230 to 5551239 will have their Calling Party Number unchanged. Otherwise if none of the numbers for that port match then the Calling Party Number (and Subaddress) will be changed to the first number (and Subaddress) stored for that port.

Route based on telephone number allowing for extension number (* option)

Store a telephone number with a '*' after the last digit (e.g. 5551234*) for each interface that is to receive incoming calls.

Store it as the first number if CLID generation is on and it is the preferred choice for when a Calling Party Number is to be changed on or added to an outgoing call.

For the example of 5551234*
Incoming calls with Called Party Number containing 5551234 will be accepted (any Called Party Subaddress is ignored).

Outgoing calls (with CLID generation on) will have their Calling Party Number checked (any Calling Party Subaddress is ignored).

Outgoing calls with Calling Party Number containing 5551234 will have their Calling Party Number unchanged. Otherwise if none of the numbers for that port match then the Calling Party Number (and Subaddress) will be changed to the first number (and Subaddress) stored for that port. If the received Calling Party Number is 4 digits or

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less it is assumed to be an extension number and will be appended to the new Calling Party Number.

Route based on telephone number allowing for extension number (+ option)

Store a telephone number with a '+' after the last digit (e.g. 5551234+) for each interface that is to receive incoming calls.

Store it as the first number if CLID generation is on and it is the preferred choice for when a Calling Party Number is to be changed on or added to an outgoing call.

For the example of 5551234+
>
> Incoming calls with Called Party Number containing 5551234 will be accepted (any Called Party Subaddress is ignored). The 5551234 and any preceding digits will not be passed through to the called interface. This is so that only the extension number is passed through.
>
> Outgoing calls (with CLID generation on) will have their Calling Party Number checked (any Calling Party Subaddress is ignored).
> Outgoing calls with Calling Party Number containing 5551234 will have their Calling Party Number unchanged. Otherwise if none of the numbers for that port match then the Calling Party Number (and Subaddress) will be changed to the first number (and Subaddress) stored for that port. If the received Calling Party Number is 4 digits or less it is assumed to be an extension number and will be appended to the new Calling Party Number.

Examples of Number Set-up (National ISDN protocol)

This appendix gives some example settings for Number Setup when National ISDN protocol is selected. It also describes how incoming calls are routed and (if CLID generation is on) how the calling party number on outgoing calls is affected in each case.

The examples for the telephone numbers are given as 7 digits i.e. just the local number. Telephone numbers with area code e.g. 4445551234 could also be used.

When setting up the numbers it is important to delete any existing numbers that are no longer required.

For simplicity, the following text assumes that the same format of numbers is used for each interface.

Subaddressing is not supported when National ISDN protocol is selected.

Reject all incoming calls

Delete all numbers in Number Setup.

Set PRI 2 to have 0 channels in Channel Set-up

CLID generation (for outgoing calls) is not appropriate in this case.

Program the SPID's of BRI equipment as 0101 if the BRI equipment needs a SPID to make outgoing calls.

Route all incoming calls to PRI 2

Delete all numbers in Number Setup.

Set PRI 2 to have some channels in Channel Set-up.

CLID generation (for outgoing calls) is not appropriate in this case.

Program the SPID's of BRI equipment as 0101 if the BRI equipment needs a SPID to make outgoing calls.

Calls will be routed to PRI 2 if there is a free b channel.

Route by telephone number

Store 1 or 2 telephone number(s) (e.g. 5551234) for each basic rate interface that is to receive incoming calls.

Program the SPID's of BRI equipment as telephone number+0101 if the BRI equipment needs a SPID to make outgoing calls or accept incoming calls. This also allows calls to be routed to a specific TA.

For the example of 5551234

Incoming calls with Called Party Number ending 5551234 will be accepted if there is a free b channel.

Outgoing calls (with CLID generation on) will have their Calling Party Number checked.

Outgoing calls with Calling Party Number ending 5551234 will have their Calling Party Number unchanged. If the endpoint identifier (linked to the SPID) is not included then Calling Party Number will be unchanged if it matches the other number for that interface. Otherwise, the Calling Party Number will be changed. The new Calling Party Number will be the number associated with the endpoint identifier (linked to the SPID) if the endpoint identifier is included. If the endpoint identifier is not included then the first number for that interface will be used.

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When used for a basic rate interface the SPID associated with the telephone number 5551234 is 55512340101.

Glossary

AMI	Alternate Mark Inversion
B8ZS	Binary 8 Zeros Suppression
BOOTP	Bootstrap Protocol
BRI	Basic Rate Interface
CLID	Calling Line Identification
CRC-4	Cyclic Redundancy Check -4
DDI	Direct Dialling In
DHCP	Dynamic Host Configuration Protocol
ESF	Extended Super Frame
ETSI	European Telecommunications Standards Institute
FSK	Frequency Shift Keying
FTP	File Transfer Protocol
HDB3	High Density Bipolar 3
IP	Internet Protocol
ISDN	Integrated Services Digital Network
MIB	Management Information Base
MSN	Multiple Subscriber Numbering
PRI	Primary Rate Interface
PSTN	Public Switched Telephone Network
REN	Ring Equivalent Number
SNMP	Simple Network Management Protocol
SPID	Service Profile Identifier
TA	Terminal Adapter
TEI	Terminal Equipment Identifier

S	4 wire point-to-multipoint BRI line (can also be used as point-to-point)
U	2 wire point-to-point BRI line

E1	2.048 Mbit/s PRI line with up to 30 b channels as used in most countries
T1	1.544 Mbit/s PRI line up to 23 b channels as used in the USA and some other countries

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