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APPENDIX 1 Application Notes

INTRODUCTION

The EMUTEL *ULTRA* is an invaluable tool that is useful when multiple basic rate ISDN and primary rate ISDN terminals must be tested or demonstrated.

The **EMUTEL *ULTRA*** provides eight primary rate interfaces (PRI) and two basic rate interfaces (BRI) into which ISDN terminal equipment (e.g. terminal adapters, ISDN telephones, PABXs, video conferencing systems) can be plugged. The BRIs may be S_0 interfaces (i.e. I.430 compatible) or U interfaces (i.e. ANSI T1.601 compatible). They need not be the same type. The PRIs may be either 8 S_{2m} (i.e. E1 G.703 compatible) or 8 T1 interfaces or 4 of each.

Additionally an optional plug in card may be added. Basic rate plug in cards are available with 7 S_0 interfaces or 7 U interfaces. Primary rate plug in cards are available with 7 S_{2m} (E1) interfaces or 7 T1 interfaces. An analogue plug in card is available with 14 analogue ports.

A call on any bearer channel on any interface can be connected to any other bearer channel on any other interface. Virtually any type of call can be connected as the **EMUTEL *ULTRA*** supports unrestricted digital, voice, 3.1kHz audio, V.110 and V.120 bearer capabilities. The **EMUTEL *ULTRA*** can also provide a 40V, 1W power supply on each of the BRIs operating in both normal and restricted modes if they are S_0 interfaces and 88V 1.5W normal and sealing (i.e. 20mA current limit) on U interface. Internal tones (A law and μ law) are provided for voice/3.1 kHz terminals.

The unit also supports X.25 packet calls on the D channel of BRI1 and BRI2.

Also available as a software option is a protocol analyser. When activated it will report what is happening at each of the BRI and PRI interface ports. Decoding can be enabled or disabled at:-

- Layer 1 (physical layer).
- Layer 2 (data link layer).
- Layer 3 (call control layer).

If layer 1 decoding is enabled the analyser will report the

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state of the physical connection.

At layers 2 and 3 you can select one of four possible modes of operation:-

- No reporting.
- Display message contents as hex bytes.
- Display message contents in brief text messages.

OR

- Display message contents in detail, decoding all the information elements at layer 3. The originator, the interface number and the time are clearly identified in each message.

This manual outlines how the **EMUTEL *ULTRA*** should be set up and how the terminal equipment is connected.

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Introduction

This section allows you to set up and use your **EMUTEL ULTRA** with minimum effort. If you follow this guide and the terminal equipment still does not function then please read the complete manual.

The steps are as follows:-

Unpack the EMUTEL ULTRA

Unpack the **EMUTEL ULTRA**. There should be a Terminal Cable (DB9-DB25), two ISDN Cables (RJ45-RJ45) and a Mains Power Cable.

If you have ordered any Network Personality Modules they should also be included. Note that the Protocol Analyser is not contained on a separate module.

If you have ordered the analogue option there should be seven adapters: either RJ45 to two RJ11 or RJ45 to two BT connectors.

Plug in the power cable

Plug the power cable into the rear of the unit and switch on (**EMUTEL ULTRA** will work on 110V or 240V mains supply without adjustment).

Plug terminals into correct interface

Plug terminals into correct BRI or PRI interface (power up screen will tell you what interfaces are installed on the **EMUTEL ULTRA**).

Make a call

Make a call from one terminal to the other. (The default telephone numbers and other parameters are shown in Table 1.)

If the call did not work

For BRI calls where no LEDs became lit on the front panel then the terminals probably require power feeding. If not already switched on turn it on by following the instructions in Chapter 2 Software Setup/Hardware Setup Screen.

For PRI calls where no LEDs became lit on the front panel then the framing format probably requires changing. Follow the instructions in Chapter 2 Software Setup/Hardware Setup Screen.

QUICK REFERENCE GUIDE

Also check that the interface being used is the correct type for the terminal (i.e. U interface terminals will not work on an S interface and T1 terminals will not work on an E1 interface).

If the P LED comes on but no D LED then there is a problem with Layer 2. Try making the call again - this may fix the problem.

QUICK REFERENCE GUIDE

Parameter	Default Setting
Baud Rate	19,200
Parity	None
Stop Bits	2
Data Bits	8
BRI (S/U) Power Feeding	ON
100 Ω Terminators	100 BRI/120 PRI
B channels/PRI	30
Use SPIDS	Optional
Numbering Option	Multiple Subscriber Numbering
CLIP	ON
BRI 1	384700/10
BRI 2	384720/30
BRI 9	384860/70
BRI 10	384880/90
BRI 11	384900/10
BRI 12	384920/30
BRI 13	384940/50
BRI 14	384960/70
BRI 15	384980/90
PRI 1	386000
PRI 2	386100
PRI 3	386200
PRI 4	386300
PRI 5	386400
PRI 6	386500
PRI 7	386600
PRI 8	386700
PRI 9	386800
PRI 10	386900
PRI 11	387000
PRI 12	387100
PRI 13	387200
PRI 14	387300
PRI 15	387400

Table 1 **EMUTEL ULTRA** Default Settings

PRODUCT SPECIFICATION

ISDN / analogue connections ISDN Simulation Mode

The **EMUTEL ULTRA** provides a combination of ISDN S₀ or U BRI ports, ISDN S_{2m} or T1 PRI ports, and analogue ports, all operating as the network side of the connection. The available combinations are described in the introduction

The BRI interfaces can optionally provide a supply to power terminal equipment. This is 40V,1W for S₀ and 88V,1.5W for U.

The analogue interfaces provide -48V power feeding to power telephones.

LED Indicators

In operation, LEDs indicate the operating level of each port. The LEDs operate as follows:-

- Physical layer activated on the BRI interfaces.
- Data link layer activated on the BRI interfaces.
- B1/B2 channel connected on the BRI interfaces.
- B channel(s) connected on the PRI interfaces.
- Off hook on the analogue interfaces.
- Ringing on the analogue interfaces.
- Power is on.

Terminal Port

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

GPIB Port

An IEEE-488 GPIB port is provided for use in automatic test set ups. The address is set by the DIP switch on the base of the unit.

Network Personality Module

The **EMUTEL ULTRA** can be made to simulate country specific networks (e.g. 1TR6, BT, Euro ISDN etc.) by plugging a pre-programmed Network Personality Module into the slot on the front of the unit.

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Unpack the **EMUTEL ULTRA**

First unpack the **EMUTEL ULTRA** and check for signs of damage in transit. If the unit or packaging is damaged this should be reported immediately to your supplier.

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.

Check Options Supplied

To check which options have been installed inside the main unit check the option label on the back of the unit or the power up screen on the TERMINAL:-

- **EMUTEL ULTRA** Network Simulator.
- Cables for ISDN - RJ45-RJ45 (2 off).
- Mains Cable.
- Terminal Cable DB9-DB25 (1 off).
- **EMUTEL ULTRA** Protocol Analyser (Option).
- **EMUTEL ULTRA** Network Personality Modules (Options).
- This Manual.

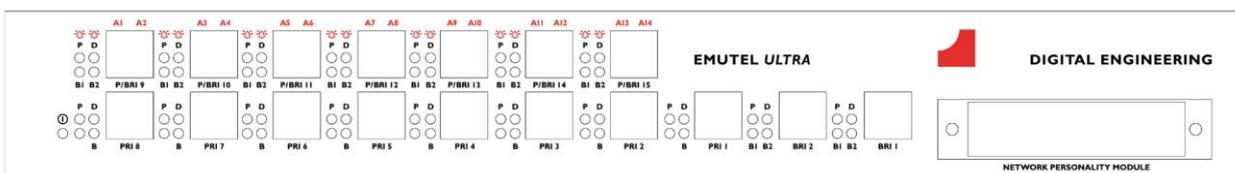


Figure 1 The **EMUTEL ULTRA** Front Panel

Start Up Sequence

The BRI1-BRI2 RJ45 connectors provide the BRI interfaces into the unit and the PRI1-PRI8 connectors provide the PRI connections into the unit. The P/BRI9-15 may provide BRI, PRI or analogue interfaces depending on the options fitted.

When the unit is first switched on all the LEDs will illuminate and then turn off. If groups of LED's are flashing there is an error. Refer to the section on fault finding.

The **EMUTEL ULTRA** powers up with the terminal port

HARDWARE SETUP

operating at 19200 baud, 8 data bits, 2 stop bit, no parity before changing to the stored settings. Pressing <ctrl-c> at this time will restore the factory defaults. This is useful if a setting has been changed and the **EMUTEL ULTRA** ceases to operate as a result. Holding down <ctrl-c> for about 20 seconds during power up will restore a working configuration to the **EMUTEL ULTRA**.

ISDN and Analogue interface Pinouts

The following table shows the pinouts of the RJ45 connectors for the ISDN and analogue interfaces. The analogue interface has 2 interfaces on each connector. Figure 2a shows an RJ45 plug.

	PRI	BRI		Dual analogue
	E1 or T1	S	U	
1	T-	NC	NC	TIP / A
2	T+	NC	NC	SHUNT
3	NC	R-	NC	RING / B
4	R-	T-	RING	NC
5	R+	T+	TIP	NC
6	NC	R+	NC	TIP / A
7	NC	NC	NC	SHUNT
8	NC	NC	NC	RING / B

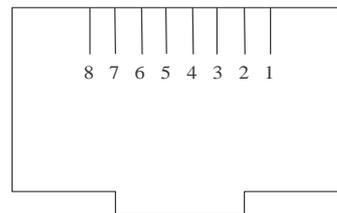


Figure 2a RJ45 plug (front view)

The following table shows the pinouts of the RJ11 and BT connectors for the analogue interface. An adaptor is provided to split the RJ45 connection to either 2 RJ11 connectors or 2 BT connectors.

HARDWARE SETUP

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

	BT connector
1	NC
2	A
3	NC
4	SHUNT
5	B
6	NC

RJ11 and BT plugs are shown in figure 2b and figure 2c.

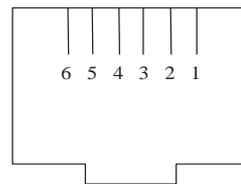


Figure 2b RJ11 plug (front view)

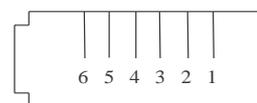


Figure 2c BT plug (front view)

Figure 4a shows a schematic of how the power is generated at the ISDN S₀ interface port while figure 4b shows a schematic of U interface power feeding. (See Software Setup/Hardware Setup Screen for an explanation of how the power feeding for the BRI operates.)

HARDWARE SETUP

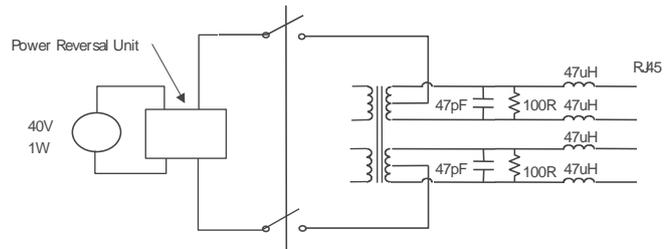


Figure 4a Schematic of 40 V Power Supply (S I / F)

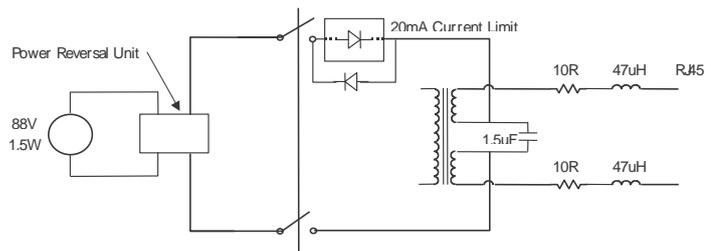


Figure 4b Schematic of 88V Power Supply (U I / F)

LED Indicators

Beside each ISDN interface port is a group of LEDs. These LEDs indicate the state of the ISDN interface beside them. The P LED lights whenever the ISDN line has activated. The D LED lights whenever the Data Link layer for that port is active (i.e. Multi-Frame Established). The corresponding B channel LED on the BRI interfaces (B1/B2) lights whenever that bearer channel is connected. On the PRI interface one B LED is provided which lights whenever there is an active B channel.

Beside each analogue port LEDs indicate off hook and ringing.

In addition the Power LED lights whenever 5 V power is present in the unit.

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Network Personality Module

Beside the two PRI interfaces is the slot for the Network Personality Module. The **EMUTEL ULTRA** can be made to simulate specific networks (e.g. 1TR6) by plugging the relevant Network Personality Module into this slot.



Figure 5 **EMUTEL ULTRA** Back Panel

Terminal Port

The **EMUTEL ULTRA** has one V.24 compatible control port to which a PC or VT100 compatible terminal or a PC emulating an ANSI terminal (e.g. running Procomm, Windows, Terminal, Hyper Terminal etc.) can be connected. The pinout of the port is shown in figure 6. Table 3 lists the operation of each pin.

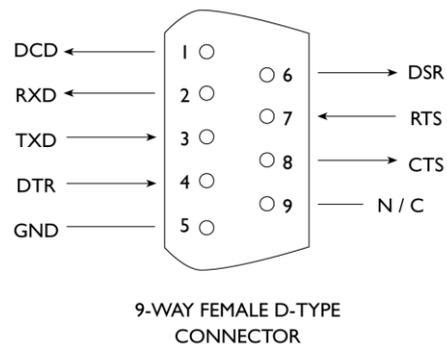


Figure 6 V.24 Terminal Port

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

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6	DSR	Data Set Ready (always active)
7	RTS	Request to Send (input- ignored)
8	CTS	Clear to Send (output- active when EMUTEL ULTRA can receive Data)

Table 3 Terminal Port Pin Description

IEEE-488 GPIB Port

The **EMUTEL ULTRA** has one IEEE-488 compatible GPIB (general purpose interface bus) port. Several **EMUTEL ULTRA's** can be connected along with other IEEE-488 compatible equipment to a suitable controller (e.g. a PC with an IEEE-488 card). A DIP switch on the base sets the address.

At this time the software to support the GPIB port has not been implemented.

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Start-up Sequence

When the **EMUTEL ULTRA** is powered up it transmits an opening message, referred to later in the “Copyright Screen” (see Chapter 2). Once the **EMUTEL ULTRA** has been set up properly then it is not necessary to connect a terminal. To set up the **EMUTEL ULTRA** press any key on the terminal or PC keyboard and the setup screen, figure 7, is presented. Chapter 2 covers setting up the **EMUTEL ULTRA**.

The factory default settings for the **EMUTEL ULTRA** are 19200 baud, 8 data bits, 2 stop bits, no parity, although you can change these settings. If the **EMUTEL ULTRA**'s settings in memory become corrupt it may not be possible to operate the terminal as the baud rate may be wrong. The **EMUTEL ULTRA** will always power up with the terminal port operating at 19200 baud, 8 data bits, 2 stop bit, no parity before changing to the stored settings. Holding down <ctrl-c> for about 20 seconds during power up will reload the factory defaults and the terminal should start to function normally again.

Power

The **EMUTEL ULTRA** power connector will accept an IEC mains lead (supplied). The **EMUTEL ULTRA** has a universal input suitable for 110-240 V ac 50-60 Hz. Connection to any other source may result in the unit failing to comply with safety requirements.

Warning - Earth the Emutel *ULTRA*

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

There are no user serviceable parts inside the **EMUTEL ULTRA**. It should only be opened by approved maintenance staff, otherwise the warranty will be invalidated.

Once the terminal has been connected to the control port, power can be applied. All the LEDs will light and then

HARDWARE SETUP

extinguish once the power on self-test is completed. (The Power LED will stay on.) The terminal should now display the opening copyright message and can be set up as described in the next chapter.

SOFTWARE SETUP

Introduction

This chapter outlines the user interface of the **EMUTEL ULTRA** and how the various functions of the **EMUTEL ULTRA** are set up and used.

Assuming that the hardware has been set up as described in Chapter 1, when power is applied the following message should be displayed on your terminal or PC.

Copyright Screen

```
Copyright Digital Engineering 1993
NT Simulator (xxxx) Vx.x (xx) dd mm yy S/N xxxxxxxx
```

```
B9  B10 B11 B12 B13 B14 B15
x   x   x   x   x   x   x
x   x   x   x   x   x   x   x   x   x
P8  P7  P6  P5  P4  P3  P2  P1  B2  B1
```

Figure 6 Copyright Screen

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 **EMUTEL ULTRA**.

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

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The **EMUTEL ULTRA** now displays the main set up screen, shown in figure 7.

```
Hardware Setup
Software Setup
Terminal Setup
Telephone Number Setup
Analyser Setup
```

Figure 7 Main System Menu

Changing Parameters

The set up of the **EMUTEL ULTRA** is structured rather like a tree with the menu of figure 7 at the top. You move 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. 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>.

Once you have located the item you wish to change use <space> to cycle through the various options permitted.

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:-

Hardware Setup

This function allows you to set up the communications ports, and various other hardware functions of the **EMUTEL ULTRA**.

Software Setup

This function allows you to change the operation of the **EMUTEL ULTRA** by switching on and off information elements in the call control messages or by changing the way in which the layer 2 and layer 3 software operates. This function can be used to enable facilities such as Multiple

SOFTWARE SETUP

Subscriber Numbering and Subaddressing.

Terminal Setup

This function allows you to change the terminal type.

Telephone Number Setup

This function allows you to change the default telephone numbers for each interface and the special purpose telephone numbers.

Analyser Setup

This function allows you to change the analyser options.

SOFTWARE SETUP

Hardware Setup Screen

On selecting this option you are presented with the screen of figure 8.

```
Hardware Setup

Coms Port Baud Rate      xxxx
Coms Port Parity        xxxx
Coms Port Stop Bits     xxxx
Coms Port Data Bits     xxxx
NT(LT)/TE/Tran Mode     xxxx
100 ohm Terminators   xxxx
BRI S/U Power Feed      xxxx
BRI S Power Mode        xxxx
BRI U Power Mode        xxxx
BRI S Bus Timing        xxxx
Selected Tone           xxxx
PRI E.1 I/F Config      xxxx
PRI T.1 I/F Config      xxxx
Analogue Ring Mode      xxxx
Analogue Caller ID Mode xxxx
Analogue Disconnect Mode xxxx
```

Figure 8 Hardware Setup Menu

All of the fields in figure 8 are changed by highlighting the required field and cycling through the options using the <space>. The fields are listed below:-

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 you will have to change the terminal setup also.

NT(LT) / Tran Mode

In NT mode the **EMUTEL ULTRA** will simulate an ISDN network, allowing PRI and BRI terminals to be plugged in and to call each other.

A future option will be permanent b channel connections.

100 ohm Terminators

The 100 ohm terminators for the BRI interfaces are always

SOFTWARE SETUP

- present. The 120 ohm terminators for the PRI interfaces are always installed so it is not possible to change this field. This field is displayed to provide compatibility with other Emutel family members.
- BRI S/U Power Feed** Setting this to ON forces the **EMUTEL ULTRA** to provide a nominal 40 V 1 W dc supply to the ISDN S₀ interfaces and a nominal 88 V 1.5 W dc supply to the U interfaces if any terminal adapters or ISDN telephones require it.
- BRI S Power Mode** This field allows you to switch the power from normal mode to restricted mode i.e. the power provided at the ISDN BRI S₀ interface will switch polarity. This field should be set to normal operation unless you wish to test the terminal adapter operation in restricted power mode.
- BRI U Power Mode** The U interface module is fitted with a current limiter circuit which restricts the total current to 20 mA in sealing mode. Switching to normal mode power will disable the current limiter and the U interface will be supplied with the full 88 V 1.5 W power available. This will be necessary for testing NT1s and other line powered devices.
- S Bus Timing** In NT mode using an S interface this field will switch between adaptive timing or fixed timing on the S₀ interface. Use adaptive timing if the S₀ interfaces have long cables attached.
- Selected Tone** The **EMUTEL ULTRA** can generate a tone on a B channel whenever a terminal dials a particular telephone number (see Chapter 2 Software Setup/Telephone Number Setup Screen). This field is used to select the tone frequency and power level. It is also possible to select dial tone, ring tone, error tone (reorder tone) and busy tone using this field. Note that the '+' and '-' keys can be used to skip frequencies while <space> will skip to the next supported power level.
- PRI T1 I/F config.** This field switches between AMI and B8ZS encoding on the T1 interface and sets the framing to SLC96, SF, T1DM or ESF.

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Analogue Ring Mode

This field allows you to set the shape of the ringing voltage on analogue interfaces. It is normally set to sinusoidal but can be changed to trapezoidal which increases the REN from 2 to 3.

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.

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.

SOFTWARE SETUP

Software Setup Screen On selecting this option the screen of figure 9 is displayed.

```
Software Setup

Network Type                nnnn
Drop Layer 2 if No Call Active  xxxx
Drop Layer 1 if Layer 2 Inactive  xxxx
Drop TEI if Layer 1 Inactive  xxxx
Number of B Channels per PRI      n
Use Service Profile Ids (SPIDs)  xxxx
Allow Overlap Sending/Receiving  xxxx
Numbering System Option          xxxx
Called Party Number              xxxx
Calling Party Number              xxxx
Called Party Sub-addressing      xxxx
Calling Party Sub-addressing     xxxx
Higher Level Compatibility       xxxx
Lower Level Compatibility        xxxx
D-Channel X.25 Setup             xxxx
```

Figure 9 Software Setup Menu

These features are enabled or disabled by selecting the relevant field and pressing <space>:-

Network Type Can be changed on NAT/AT&T/DMS and BT Network Personality Modules only.

Drop Layer 2 if No Call Active If activated the **EMUTEL ULTRA** will disconnect layer 2 after a predetermined time if there are no active calls. This time can be set up by pressing <enter> on this field if it is activated. The screen of figure 10 is presented.

L2 Drop Timeout Setup

SOFTWARE SETUP

```
Timeout until L2 Dropped (secs) nn
```

Figure 10 Drop Timeout Menu

Pressing <esc> will leave the value unchanged and <enter> will allow you to change the default value.

Drop Layer 1 if Layer 2 Inactive

If enabled the **EMUTEL ULTRA** will deactivate layer 1 immediately layer 2 becomes inactive.

Drop TEI if Layer 1 Inactive

If activated the **EMUTEL ULTRA** will remove its TEI value(s) once the layer 1 is deactivated. The terminals will then have to send an ID Request once they become active again.

Number of B channels per PRI

You can select between 6 and 30 (23 if using NAT/AT&T/DMS or NTT Network Personality Module).

To set each PRI or BRI interface as being point-point or point-multipoint operation press <enter> and the screen of figure 11 will be displayed.

```
Point to Point/Multipoint Setup
```

```
All PRI Point to Point
```

```
BRI 1          xxxxx
BRI 2          xxxxx

BRI 9          xxxxx
BRI 10         xxxxx
BRI 11         xxxxx
BRI 12         xxxxx
BRI 13         xxxxx
BRI 14         xxxxx
BRI 15         xxxxx
```

Figure 11 Point-Point/Point-Multipoint Setup

CHAPTER 2

SOFTWARE SETUP

Each basic rate interface can be set to point-point mode (i.e. no broadcast TEI in use for SETUP messages) or in point-multipoint mode (i.e. broadcast TEI 127 used).

Use Service Profile IDs (SPIDs)

This field allows the **EMUTEL ULTRA** to accept a Service Profile Identifier from the terminal and assign a Terminal Endpoint to it. While using the NAT/AT&T/DMS network personality card this field can be set to (a) Optional - SPIDs may be used but if they are not calls can still be made (b) Mandatory - SPID initialisation must be completed successfully before calls can be made (c) AutoSPID - same as (b) but the AutoSPID feature of National ISDN 1997 i.e. enabled. If using any other network support card (or none) this field is fixed at Optional. If this field is activated you can press <enter> to set up the SPIDs and the screen of figure 12 is presented.

Service Profile Identifier Setup - Main Board

```
Channel #1 Tel No tttttt          ssssssssss
Channel #1 Tel No tttttt          ssssssssss
Channel #2 Tel No tttttt          ssssssssss
Channel #2 Tel No tttttt          ssssssssss
```

Plug In Module Service Profile Setup

Figure 12 Service Profile ID Setup Menu (main board)

You can change any of the SPIDs by moving to the relevant SPID and pressing <enter>. A prompt appears requesting the new SPID value.

Select Plug In Module Service Profile Setup to access SPIDs for BRI9 - BRI15.

Figure 13 shows the display.

Service Profile Identifier Setup - Plug in Module

SOFTWARE SETUP

```
Channel #9 Tel No tttttt      ssssssssss
Channel #9 Tel No tttttt      ssssssssss
Channel #10 Tel No tttttt     ssssssssss
Channel #10 Tel No tttttt     ssssssssss
Channel #11 Tel No tttttt     ssssssssss
Channel #11 Tel No tttttt     ssssssssss
Channel #12 Tel No tttttt     ssssssssss
Channel #12 Tel No tttttt     ssssssssss
Channel #13 Tel No tttttt     ssssssssss
Channel #13 Tel No tttttt     ssssssssss
Channel #14 Tel No tttttt     ssssssssss
Channel #14 Tel No tttttt     ssssssssss
Channel #15 Tel No tttttt     ssssssssss
Channel #15 Tel No tttttt     ssssssssss
```

Figure 13 Service Profile ID Setup Menu (expansion board)

Allow Overlap Sending/Receiving

If activated the **EMUTEL ULTRA** will allow Overlap Receiving on certain enbloc dialled calls. If deactivated Overlap Receiving is not allowed. For a further explanation of how Overlap Receiving works read the information in Chapter 4 on fault finding section entitled Overlap Receiving Will Not Work.

The remaining options affect the contents of the SETUP message sent from the **EMUTEL ULTRA** to the called terminal as follows:-

Numbering System Option

The **Normal** numbering system uses the numbers assigned to each B channel in the Telephone Number Setup Menu. (Note that for each PRI only 1 telephone number is stored. The last 2 digits are used to select the b channel e.g. dialling 386100 would select PRI2 b1, dialling 386129 would select PRI 2 b30).

Multiple Subscriber Numbering (MSN) is also available. If this feature is enabled and a number is called the last digit (last two digits on a PRI) is treated as a wildcard i.e. dialling

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384701 will connect to the channel whose number is set up as 384700. In addition to this the dialled number is provided to the destination terminal in the Called Party Number information element, assuming that the Called Party Number information element is enabled. (Note that in BT and 1TR6 Network Personality Modules only the last digit dialled is provided regardless of whether the Called Party Number information element is enabled or not.)

The third option is **Auxiliary Working**. Enabling this feature sets all B channels on an interface to the same telephone number. Lastly **Direct Dialling In** (DDI) is provided. This works in basically the same way as MSN. Overlap receiving works independently of the numbering option.

Note that when using the North America Network Personality Module these options are described differently. Please refer to the North America Network Personality Module (Chapter 10) for more information.

Called Party Number

If activated a Called Party Number information element is included in the SETUP message sent to the destination terminal. This is the network generated directory number if the calling terminal did not send a Called Party Number information element to the **EMUTEL ULTRA** in its transmitted SETUP message or simply a copy of the terminal supplied number if it did include a Called Party Number information element in its transmitted SETUP message to the **EMUTEL ULTRA**.

Note that a Called Party Number is sometimes included in the SETUP message from the EMUTEL ULTRA to the called terminal even if this field is set to No.

If switched to Yes pressing <enter> when on this field displays the screen of figure 14.

Called Party Number Setup

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Type	tttttttt
Plan	ppppppppp

Figure 14 Called Party Number IE Setup

This screen allows you to reconfigure the Called Party Number information element before it is sent to the called party. If Type or Plan are set to automatic then the Called Party Number will be passed through the **EMUTEL ULTRA** unaltered. The Type field can be forced to a different setting by pressing <space> while on the Type field.

Available settings are:-

- Unknown
- International
- National
- Network
- Subscriber
- Abbreviated

Similarly the Plan field can be forced to a fixed value.

Available plans are:-

- Unknown
- ISDN / Telephony
- Data
- Telex
- National
- Private

Calling Party Number

If this feature is activated a Calling Party Number information element is included in the SETUP message sent from the **EMUTEL ULTRA** to the destination terminal. This is the network generated directory number if the calling terminal did not send a Calling Party Number information element in its transmitted SETUP message to the **EMUTEL ULTRA** or simply a copy of the terminal supplied number it did include a Calling Party Number information element in

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its transmitted SETUP message to the **EMUTEL ULTRA**.

If switched to Yes pressing <enter> when on this field displays the screen of figure 15.

Calling Party Number Setup

Type	tttttttt
Plan	pppppppppp
Screening	sssssssss
Presentation	pppppppppp

Figure 15 Calling Party Number IE Setup

This screen allows you to reconfigure the Calling Party Number information element before it is sent to the called party. If Type, Plan, Screening or Presentation are set to automatic then the Called Party Number will be passed through the **EMUTEL ULTRA** unaltered.

The Type field can be forced to a different setting by pressing <space> while on the Type field.

Available settings are:-

- Unknown
- International
- National
- Network
- Subscriber
- Abbreviated

Similarly the Plan field can be forced to a fixed value.

Available plans are:-

- Unknown
- ISDN / Telephony
- Data
- Telex

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- National
- Private

The Screening field can be forced to a fixed value.

Available screening indicators are:-

- User Provided Not Screened
- User Provided Verified and Passed
- User Provided Verified and Failed
- Network Provided

The Presentation field can be forced to a fixed value.

Available presentation indicators are:-

- Presentation Allowed
- Presentation Restricted
- Number Not Available

Note that if Presentation Restricted is chosen no number digits will be included in the Calling Party Number information element.

Called Party Subaddress

If this feature is enabled a Called Party Subaddress information element is included in the SETUP message sent to the destination terminal, but only if the calling terminal sent a Called Party Subaddress information element in its transmitted SETUP message to the **EMUTEL ULTRA**. The CCITT and ETSI Network Personality Modules allow the generation of a Called Party Subaddress by dialling an enbloc number and the Called Party Subaddress separated by a # (e.g. dial 384000#123 to generate a subaddress of 123).

Calling Party Subaddress

If this feature is enabled a Calling Party Subaddress information element is included in the SETUP message sent to the destination terminal, but only if the calling terminal sent a Calling Party Subaddress information element in its transmitted SETUP message.

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Higher Level Compatibility

If this feature is activated a Higher Level Compatibility information element is included in the SETUP message sent to the destination terminal. If this information element is supplied by the calling terminal then a copy is simply passed to the destination terminal, otherwise the **EMUTEL ULTRA** generates this information element based on the contents of the Bearer Capability.

If activated pressing <enter> when on this field allows you to map the "information transfer capability" field of the Bearer Capability information element to the "high layer characteristics identification" of the High Layer Compatibility information element (see Q.931). To allow you to set up this mapping the screen of figure 16 is displayed.

The table is edited in the normal fashion - move to the element to be changed and use <space> to cycle through the available options until the desired option is selected.

The available options are:-

- Telephone
- Fax Group 2 / 3
- Slow Scan Video
- Fax Group 4
- Teletex - basic mixed and fax
- Teletex - basic and processible
- International Videotex
- Telex
- Message Handling
- OSI Application
- Maintenance
- Management

One of these options is then chosen for each of the displayed fields to define the mapping required. For example, 'Speech' in the Bearer Compatibility information element might be mapped to 'Telephony' in the High Layer

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compatibility information element.

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Higher Layer Compatibility Setup

Speech translates as	xxxxxxxxxx
Unrestricted Digital translates as	xxxxxxxxxx
Restricted Digital translates as	xxxxxxxxxx
3.1 kHz Audio translates as	xxxxxxxxxx
7 kHz Audio translates as	xxxxxxxxxx
Video translates as	xxxxxxxxxx

Figure 16 Translation from Bearer Capabilities to HLC

Lower Level Compatibility

If this feature is activated a Lower Level Compatibility information element is included in the SETUP message sent to the destination terminal. If this information element is supplied by the calling terminal then a copy is simply passed to the destination terminal, otherwise the **EMUTEL ULTRA** generates this information element from the Bearer Capability information element.

D-Channel X25 Setup

If this feature is activated then it is possible to send D channel packet data between BRI1 and BRI2.

When activated typing <enter> when on this field allows you to configure the parameters of each interface. The screen of figure xxx is displayed.

X25 Setup

BRI1 PVC	xxxxxxxxxx
BRI1 Outgoing Only	xxxxxxxxxx
BRI1 Bothway	xxxxxxxxxx
BRI1 Incoming Only	xxxxxxxxxx
BRI2 PVC	xxxxxxxxxx
BRI2 Outgoing Only	xxxxxxxxxx
BRI2 Bothway	xxxxxxxxxx
BRI2 Incoming Only	xxxxxxxxxx

Figure xxx X25 Setup Screen

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You can enter a logical channel number for PVC connections, Incoming Calls, Bothway Calls, Outgoing Calls and a TEI value to be used on the particular channel.

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Terminal Setup Screen

On selecting this option you are presented with the screen of figure 17.

```
Terminal Setup
```

```
Terminal Type          ttttt
```

Figure 17 Terminal Type Setup Menu

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

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Telephone Number Setup Screen

On selecting this option the screen of figure 18 is displayed.

```
Telephone Number Setup

Configure BRI numbers      xxxx
Configure PRI numbers     xxxx

Busy Number               xxxx
Unallocated Number        xxxx
No User Responded Number  xxxx
Call Rejected Number      xxxx
Out of Order Number       xxxx
Temporary Failure Number  xxxx
No Answer Number          xxxx
Test Tone Number          xxxx
Loopback Number           xxxx
```

Figure 18 Telephone Number Setup Menu

The fields of figure 18 are modified by selecting the relevant telephone number using the <up-arrow> and <down-arrow> keys and pressing <enter>. A prompt to enter a new telephone number appears at the bottom of the screen.

Selecting Configure PRI numbers allows numbers for each PRI to be set. The display is shown in figure 19.

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Primary Rate Interface Telephone Number Setup

PRI1 Number	xxxx
PRI2 Number	xxxx
PRI3 Number	xxxx
PRI4 Number	xxxx
PRI5 Number	xxxx
PRI6 Number	xxxx
PRI7 Number	xxxx
PRI8 Number	xxxx
PRI9 Number	xxxx
PRI10 Number	xxxx
PRI11 Number	xxxx
PRI12 Number	xxxx
PRI13 Number	xxxx
PRI14 Number	xxxx
PRI15 Number	xxxx

Figure 19 PRI Telephone Number Setup Menu

To make a call simply dial the telephone number of the relevant port.

Whenever Multiple Subscriber Numbering (MSN) is enabled (see Software Setup Menu/Numbering System Option) the last digit in the telephone number is treated as a wildcard, i.e. if Port 1 B1 Number is set to 384710 and you dial 384716 a connection will be made to BR11 B1.

If Auxiliary Working is enabled all B channels on an interface use the same telephone number but only one number is allowed.

Direct Dialling In (DDI) works in exactly the same way as MSN.

To dial an individual b channel use the normal numbering system. The last 2 digits are used to select the b channel e.g. dialling 386100 would select PRI2 b1, dialling 386129

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would select PRI 2 b30).

Selecting Configure BRI numbers allows numbers for each BRI to be set. The display is shown in figure 20.

If the analogue module is fitted the numbers for BRI 9 b1 to BRI 15 b2 are used for A1 to A14.

Basic Rate Interface Telephone Number Setup

```
BRI1 B1 Number : xxxx      BRI9 B1 Number : xxxx
BRI1 B2 Number : xxxx      BRI9 B2 Number : xxxx
BRI2 B1 Number : xxxx      BRI10 B1 Number : xxxx
BRI2 B2 Number : xxxx      BRI10 B2 Number : xxxx
                               BRI11 B1 Number : xxxx
                               BRI11 B2 Number : xxxx
                               BRI12 B1 Number : xxxx
                               BRI12 B2 Number : xxxx
                               BRI13 B1 Number : xxxx
                               BRI13 B2 Number : xxxx
                               BRI14 B1 Number : xxxx
                               BRI14 B2 Number : xxxx
                               BRI15 B1 Number : xxxx
                               BRI15 B2 Number : xxxx
```

Figure 20 BRI Telephone Number Setup Menu

To make a call simply dial the telephone number of the relevant port and B channel.

Whenever Multiple Subscriber Numbering (MSN) is enabled (see Software Setup Menu/Numbering System Option) the last digit in the telephone number is treated as a wildcard, i.e. if Port 1 B1 Number is set to 384710 and you dial 384716 a connection will be made to BRI1 B1.

If Auxiliary Working is enabled all B channels on an interface use the same telephone number but only one

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number is allowed.

Direct Dialling In (DDI) works in exactly the same way as MSN.

A series of failure numbers are also defined. If you dial any of these numbers the call is rejected with a cause value defined by the failure mode, i.e. calling the User Busy number will cause the call to be rejected with cause value 17.

A number is defined for test tones. Dialling this will force the **EMUTEL ULTRA** to send a PCM tone (A law or μ law) on the B channel. The tone frequency and power level are adjusted in the Hardware Setup Menu. Note that silence, dial tone, busy tone, and error tone can also be sent.

A number is defined for loopback. Dialling this number will force the **EMUTEL ULTRA** to loop back the data on the b channel.

ANALYSER OPERATION

Introduction

Before the analyser can be used it must be configured as explained in Chapter 2. The information is repeated here for convenience.

On selecting the analyser setup option from the main menu the screen of figure 21 is displayed.

```
Analyser Setup

Analyser Time          nn:nn:nn dd/mm/yy
Layer 1 Hardware       xxxx
Layer 2 Data Link     xxxx
Layer 3 Call Control  xxxx
Channel Filter Menu   xxxx
Call Reference Filter  xxxx
Analyser Specification xxxx
Activate Analyser     xxxx
```

Figure 21 Analyser Setup Menu

This screen defines how the protocol analyser option operates.

The time stamp on the analyser display can be changed to the current time rather than elapsed time since power up.

The analyser will report activity at layers 1, 2 and 3. Select the reporting level required at each layer by moving to the particular option and pressing <space>. The reporting levels available are:-

- Inactive - no reporting of any activity.
- Hex Display - Messages are displayed as hex digits.
- ASCII Short Display – messages are displayed in a shortened text form.
- ASCII Long Display – messages are displayed in text form and all the information elements are decoded and displayed.

You can also select channel filtering. If selected a menu

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ANALYSER OPERATION

sets the channels that reporting will take place on.

A call reference filter can also be set up. To use this facility move to the Call Reference field and press <enter>. You are now prompted to enter a call reference value. Once entered only calls having this call reference will be reported at layer 3, layers 1 and 2 being unaffected.

You may also select the decoding of messages which are defined for a particular ISDN network. The networks currently supported are CCITT (general purpose), BTNR191/BT ETSI (UK), AT&T 5ESS (USA), NT DMS100 (USA), National ISDN 1 (USA), 1TR6 (Germany) and VN2/3 (France), ETSI (Europe), NTT (Japan).

Enter analyser mode by setting Activate Analyser to Yes and pressing <enter>. To exit analyser mode press <esc>.

Information Provided at Layer 1

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

```
23: Ch BRI1 L1 STATE = Activated
      00:01:75:30.271
```

The information presented is outlined below.

Sequence Number	Each message has a unique sequence number so that old messages can be easily located.
Channel Number	The channel number (e.g. BRI1, BRI2, PRI1, PRI2 etc.) on which the event occurred.
Layer Number	The layer on which the event is being reported.
State	The new state of the physical layer e.g. Activated.
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.

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

Information Provided at Layer 2

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

```
23: TE Ch BRI2 L2          00:01:75:30.271
SAPI= 0, TEI= 40, C/R= 0, P/F=1, TYPE= SABME
```

The information presented is outlined below.

Sequence Number

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

Originator

This field reports which side generated the message, TE for terminal generated messages and NT for network generated messages.

Channel Number

The channel number (e.g. BRI1, BRI2, PRI1, PRI2 etc.) on which the event occurred.

Layer Number

The layer on which the event is being reported.

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.

Service Access Point Identifier*

Terminal Endpoint Identifier*

Command / Response Bit*

Poll / Final Bit*

Type*

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

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

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below.

```
23: TE Ch BRI2 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:-

Send Sequence Number N(s)*

Receive Sequence Number N(r)*

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

```
23: TE Ch BRI2 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:-

Management Entity Identifier*

Reference Number (Ri)*

Management Message Type*

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

Action Indicator*

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

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

```
23: TE Ch BRI2 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.

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

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Information Provided at Layer 3

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

```
23: TE Ch BRI1 L3          00:01:75:30.271
PD= 65, LEN= 1, FLAG= Orig, CALL REF= 3, TYPE= SETUP
```

The information presented is outlined below:-

Sequence Number	Each message has a unique sequence number so that old messages can be easily located.
Originator	This field reports which side generated the message, TE for terminal generated and NT for network generated.
Channel Number	The channel number (e.g. BRI1, BRI2, PRI1, PRI2 etc.) on which the event occurred.
Layer Number	The layer on which the event is being reported.
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.
Protocol Discriminator*	
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.
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: TE Ch BRI1 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'
```

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```
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 codeset and length appears as a heading above each information element decode and the decoded information is indented by 1 space.

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

```
23: TE Ch BRI2 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.

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

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:-

<m> - Manual Mode

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

<home> or - Go to First Message

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

<end> or <e> - Go to Last Message

Will go to the last message in the buffer and display any new messages which arrive. This command works in

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manual and automatic modes.

**<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.

<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.

<c> - Clear Buffer

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

<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.

FAULT FINDING

Introduction

This section seeks to provide some guidance on solving common problems encountered in using the **EMUTEL ULTRA**.

Changing a parameter on the EMUTEL ULTRA forced it to stop operating

Changing parameters on the **EMUTEL ULTRA** may cause the unit to change operating modes and appear to stop functioning.

To recover from this condition reload the factory defaults. The **EMUTEL ULTRA** powers up with the terminal port operating at 19200 baud, 8 data bits, 2 stop bit, no parity before changing to the stored settings. Pressing <ctrl-c> at this time will restore the factory defaults. Holding down <ctrl-c> for about 20 seconds during power up will restore a working configuration to the **EMUTEL ULTRA**.

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 **EMUTEL ULTRA** is not functioning. Check first that the terminal is connected to the correct interface type. The "Copyright Screen" displays the type of interfacing installed. Or check the settings in the Hardware Setup Menu. Switch on the BRI power feeding. If this does not help switch power operation between normal and restricted if the terminal is connected to an S₀ BRI.

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

Terminal will not answer a call

Firstly check that the call is actually being routed to the called terminal as expected. To do this dial the number of the called terminal and check that one of the B channel LEDs illuminate. If the terminal responds by activating the ISDN line (P LED illuminates) and by starting up layer 2 (D

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LED illuminates) then the terminal has received the call and is not answering for a specific reason (e.g. incompatible Bearer Capability, wrong Calling Party Number, wrong Called Party Number etc).

If neither P nor D LED illuminate then the terminal may be faulty or else refer to the guidance notes for section entitled "Terminal will not activate at layer 1".

If the protocol analyser option is available set it 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. Turn on these options in the Software Setup Menu and ensure that the called terminal is programmed accordingly. Conversely the terminal may be refusing the call because a called party number has been supplied but it is programmed for a different number.

It is also necessary that both terminals are running the same protocols. Most protocols (not 1TR6) will work with the basic CCITT network supplied on the **EMUTEL ULTRA** but may have reduced functionality.

Another possibility is that the terminal requires a Subaddress. Switch on Called Party Subaddress and Calling Party Subaddress in the Software Setup Menu.

For terminals based on NAT/AT&T/DMS protocols the correct endpoint ID at layer 3 must be used. If this is the source of the problem it may be necessary to restart both **EMUTEL ULTRA** and terminal to ensure SPID initialisation

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is successfully completed.

Another problem may be the number of digits used in the Called Party Number information element. Terminals from North America usually have a 7 digit called party number and the terminals may not accept a 6 digit number which is the default on the **EMUTEL ULTRA**. To get around this problem change the numbering scheme of the **EMUTEL ULTRA**.

Other NAT/AT&T/DMS voice band terminals may require a Call Appearance information element to be sent in the Setup message to the terminal. Set this up as defined in section NAT/AT&T/DMS network personality module.

Terminal can dial only one number to set up two calls

If the calling terminal can be programmed with one telephone number to dial two calls then the **EMUTEL ULTRA** Numbering System option must be switched from Normal to Auxiliary Working, MSN or DDI.

Normal

For BRI's each B channel has a separate telephone number. To call B1 on BRI 2 dial 384720 and to dial B2 on BRI 2 dial 384730 (if using the default numbers).

For PRI's only 1 telephone number is stored. The last 2 digits are used to select the b channel e.g. using the default numbers dialling 386100 would select PRI2 b1, dialling 386129 would select PRI 2 b30.

Auxiliary Working

One number is assigned per interface. Dialling this number can route a call to B1 on the called interface. Dialling this number again will route a call to B2 on the called interface, and so on. No other numbers will be accepted.

Multiple Subscriber Numbering (MSN)

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A base number is assigned to an interface. An interface can be called by dialling any of ten numbers referenced to the base by changing the last digit (two digits for PRI interface). For example using MSN and the default numbering system interface B1 will respond to all numbers in the range 384700-384709. The Called Party Number information element is always included in the SETUP message sent to the terminal.

Direct Dialling In (DDI)

This works in exactly the same way as MSN except that the called party number is sent to the called terminal if the Called Party Number option is enabled in the Software Setup Menu.

Windows Terminal Emulation will not move up and down menus

If 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 **EMUTEL ULTRA**. 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 Windows by clicking on the Settings and Terminal Preferences options and then disable 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 **EMUTEL ULTRA** is powering up properly. The power LED should illuminate and the correct power up sequence should be observed (see Chapter 1). In particular the internal relays should switch on power up and this should be audible.

Next check the cable. The **EMUTEL ULTRA** 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 **EMUTEL ULTRA** to a PC.

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If the cable is correct then check the communication parameters. The default is 19200 baud, no parity, 2 stop bits and 8 data bits. If the parameters have changed then during the power up sequence hold down <ctrl-c> at the keyboard of the terminal (terminal set for default communications parameters) for about 20 seconds and all the factory defaults should be restored (see Chapter 1).

Another possibility is that the **EMUTEL ULTRA** is not powering up properly because the network personality module installed in the **EMUTEL ULTRA** will not start up and the LEDs on the front panel may flash. In this case see section entitled "Network Personality Module will not work".

Parameters are lost when Network Personality Module is changed

If more than one type of software is being used, e.g. CCITT ROM, ETSI Network Personality Module, USA Network Personality Module, the parameter table may be of a different length. Hence when a different type is used the settings may be considered invalid and reset to that software's default.

The solution is to upgrade all the software types to the same version number.

Overlap receiving will not work

Overlap Sending/Receiving is available on the **EMUTEL ULTRA** and operates as follows.

(a) Overlap Sending used to dial the call

Here the calling terminal sends a SETUP message to the **EMUTEL ULTRA** without any Called Party Number information. The **EMUTEL ULTRA** will respond with SETUP ACK and the calling terminal can now dial the call by sending the Called Party Number as digits in INFO messages. Once the **EMUTEL ULTRA** has received enough digits to route the call the **EMUTEL ULTRA** will send SETUP to the called terminal but will not include the Sending Complete information element. If the called terminal responds with CALL PROCEEDING, ALERTING or

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CONNECT then the **EMUTEL ULTRA** will send CALL PROCEEDING to the calling terminal followed by ALERTING or CONNECT as appropriate. The called terminal does not support overlap receiving in this case. However if the called terminal sends SETUP ACK then the **EMUTEL ULTRA** will continue to accept digits in INFO messages from the calling terminal and will pass these to the called terminal. Once the called terminal has received enough digits to route the call internally it will send CALL PROCEEDING, ALERTING or CONNECT to the **EMUTEL ULTRA** and the **EMUTEL ULTRA** will send CALL PROCEEDING to the calling terminal followed by ALERTING or CONNECT as appropriate.

(b) Enbloc dialling used to dial the call

Here the calling terminal sends a SETUP containing the Called Party Number information required to route the call. If the Called Party Number option is enabled in the Software Setup Menu then all of the enbloc digits are forwarded to the called terminal. Otherwise only the overlap extension digits (i.e. the full dialled number less the digits used to route the call e.g. 384700 for BRI 1) are sent in the Called Party Number information element.

(c) Enbloc Dialling used to dial the call with an incomplete number

This is a combination of (a) and (b). The SETUP message contains some of the Called Party Number information to the **EMUTEL ULTRA**. If the Called Party Number option is enabled in the Software Setup Menu then all of the enbloc digits are forwarded. If not only the overlap extension digits are forwarded. The terminal responds with SETUP ACK. The calling terminal supplies the remaining digits in INFO messages until enough digits are sent to start routing. Operation at the called terminal is the same as before.

However dialling a Called Party Number (i.e. base number

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plus overlap extension digits) ending in '0' will disable overlap receiving at the called terminal and the SETUP message sent by the **EMUTEL ULTRA** to the called terminal will include a Sending Complete information element. The called terminal must respond with CALL PROCEEDING, ALERTING or CONNECT without waiting for more digits from the **EMUTEL ULTRA**.

If overlap receiving does not work check the called party number does not end in '0'. To change this reprogram the base number using the Telephone Number Setup Menu or enable DDI / MSN which will provide a range of 10 numbers with the last digit being 'don't care'.

It is also possible to completely disable Overlap Receiving for all numbers by setting the Enable Overlap Sending / Receiving option in the Software Setup Menu to No. All SETUP messages sent to the called terminal will now have the Sending Complete information element included.

It is worth checking if the terminal (say PABX) requires point-point operation at the **EMUTEL ULTRA** to function in overlap receiving. If so the interface into which the terminal has been plugged requires setting to point-point mode (see Software Setup/Software Setup Screen).

Changing parameters had no effect on operation of EMUTEL ULTRA

Some parameters once changed will not effect the operation of the unit immediately. If the **EMUTEL ULTRA** does not seem to be operating properly use the <esc> key to go back to the main power up Copyright Screen. If this does not work then switch the **EMUTEL ULTRA** off and on again. Please inform Digital Engineering.

Protocol Analyser will not run

Firstly check that you have purchased this option. If not you will still be able to enter the protocol analyser but no messages will be decoded.

To enter the protocol analyser move to the Activate Analyser field and switch it to Yes. Then press <enter> to start the

FAULT FINDING

analyser.

If this does not work then 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.

If there is still no output check that the correct protocol analyser specification (i.e. network type) is being used for the terminal.

Network Personality Module will not work

The most likely cause of the Network Personality Module not functioning is that the **EMUTEL ULTRA** is not licensed for use with that type of Network Personality Module.

A license number is programmed into each **EMUTEL ULTRA** which sets the network personality modules that it can use and also enables/disables the protocol analyser.

A new license number will be provided if additional network personality modules are purchased.

If the Network Personality Module has just been reprogrammed then it is possible that it was not reprogrammed correctly. Try programming the Network Personality Module again.

ETSI Network Personality Module

Introduction

This section outlines the differences in operation of the **EMUTEL ULTRA** between the CCITT emulation provided on the standard **EMUTEL ULTRA** and the ETSI Network Personality Module.

Figure 22 shows the Software Setup Menu when simulating an ETSI network.

Software Setup

Network Type	ETSI
Drop Layer 2 if No Call Active	xxxx
Drop Layer 1 if Layer 2 Inactive	xxxx
Drop TEI if Layer 1 Inactive	xxxx
Number of B Channels per PRI	n
Use Service Profile IDs (SPIDs)	xxxx
Allow Overlap Sending/Receiving	xxxx
Numbering System Option	xxxx
Called Party Number (DDI/MSN)	xxxx
Calling Party Number (CLIP)	xxxx
Called Party Subaddressing (SUB)	xxxx
Calling Party Subaddressing (SUB)	xxxx
Higher Level Compatibility	xxxx
Lower Level Compatibility	xxxx
Supplementary Services	xxxx

Figure 22 ETSI Software Setup Menu

Supplementary Services have been added to the menu. To access the supplementary services menu move to the Supplementary Services field and type <enter>.

Figure 23 overleaf shows the ETSI Supplementary Services Setup Menu.

ETSI Network Personality Module

ETSI Supplementary Services Setup

Connected Party Number (COLP)	xxxx
Advice of Charge (AOC)	xxxx
Call Waiting (CW)	xxxx
Call Hold (HOLD)	xxxx
Explicit Call Transfer (ECT)	xxxx
Call Diversion (CFU/CFB/CFNR/CD)	xxxx
Malicious Call Identification	xxxx
Three-Party Calling (3PTY)	xxxx
Supplementary Services Setup	

Figure 23 ETSI Supplementary Service Setup Menu

The services offered are as follows:-

Connected Party Number

The Connected Party Number information element is sent to the calling terminal as part of the CONNECT message. If the called terminal supplies a Connected Party Number this is sent to the calling party otherwise the **EMUTEL ULTRA** will generate one.

If switched to Yes pressing <enter> when on this field displays the screen of figure 24.

Connected Party Number Setup

Connected Party Number (COLP/COLR)	xxxx
Type	xxxx
Plan	xxxx
Screening	xxxx
Presentation	xxxx

Figure 24 Connected Party Number Setup Menu

Connected Party Number field manipulation is accomplished in the same way as for Calling Party Number and you should refer to Chapter 2 Software Setup/Calling Party Number for further information.

ETSI Network Personality Module

Advice of Charge

The **EMUTEL ULTRA** sends Advice of Charge information to the calling terminal. Various options are available:-

- CEPT Total - each AOC message shows total charge.
- CEPT Incremental - each AOC message adds a number of units to the total bill (above options can be chosen using codeset 5 or codeset 6).
- ETSI AOC-D- AOC messages show cost of call during and at the end of the call using AOC-D messages.
- ETSI AOC-E- AOC messages show cost of call during the call using AOC-D messages and at the end of the call using AOC-E messages.

ETSI AOC can be chosen using units or currency options.

If switched to Yes pressing <enter> when on this field displays the screen of figure 25.

Billing Parameters Setup

```
Time between billing messages      xxxx
Amount to be added each time      xxxx
```

Figure 25 Billing Parameters Setup Menu

Using this screen you can change the time between billing messages down to 1 second and the amount (either in units or currency) to be added to the bill with each billing message.

Call Waiting

Call is offered to the BRI interface even if both B channels are busy. If disabled calling user is returned busy immediately.

Call Hold

Call can be put on hold in the **EMUTEL ULTRA** using ETSI call hold (HOLD) protocol.

ETSI Network Personality Module

Explicit Call Transfer Calling terminal sets up a call and puts it on hold. Calling terminal sets up a second call. On activating Explicit Call Transfer the calling terminal is disconnected from both calls and these calls are connected together.

Call Hold Call can be put on hold in the **EMUTEL ULTRA** using ETSI call hold (HOLD) protocol.

Explicit Call Transfer Calling terminal sets up a call and puts it on hold. Calling terminal sets up a second call. On activating Explicit Call Transfer the calling terminal is disconnected from both calls and these calls are connected together.

Call Diversion Terminal sets may send messages to the **EMUTEL ULTRA** to cause it to forward an incoming call to another number under certain conditions. Supported facilities include CFU (call forward unconditional), CFB (call forward busy), CFNR (call forward no response) and CD (call deflection).

If you press <enter> when on this field the menu of figure 26 is displayed.

ETSI Call Forwarding Setup

Served User Notified of Diversion	xx
Calling User Notified of Diversion	xx
Served User Notified if Active	xx
Dvrting No Released to Dvrtd-to User	xx
Activ/Deact/Inter on Same Access	xx

Figure 26 ETSI Call Forwarding Setup Menu

This allows you to set up the call diversion parameters according to the information provided in ETS 300 207-1 Page 12.

ETSI Network Personality Module

Main Differences Between CCITT and ETSI

The main differences between CCITT and ETSI are:-

- The CONNECT message includes the CEPT Advice of Charge information element (if enabled) and the Date/Time information element.
- Advice of Charge (ETSI or CEPT option) is supplied in INFO or FACILITY messages during the call.
- Date/Time information element does not include seconds.

A subset of the CCITT Bearer Capability information element is allowed in the SETUP message sent to the network. The most notable restrictions are :-

- μ law encoding is not a valid layer 1 protocol in the Bearer Capability information element.
- V.120 rate adaptation is not a valid layer 1 protocol in the Bearer Capability information element.
- Keypad information element is not supported for sending the Called Party Number.
- Supplementary services available only for ETSI network.

BT Network Personality Module

Introduction

This section outlines the differences in operation of the **EMUTEL ULTRA** between the CCITT emulation provided on the standard **EMUTEL ULTRA** and the BT Network Personality Module.

Figure 27 shows the Software Setup Menu when simulating a BT network.

Software Setup

Network Type	BTNR191
Drop Layer 2 if No Call Active	xxxx
Drop Layer 1 if Layer 2 Inactive	xxxx
Drop TEI if Layer 1 Inactive	xxxx
Number of B Channels per PRI	n
Use Service Profile IDs (SPIDs)	xxxx
Allow Overlap Sending/Receiving	xxxx
Numbering System Option	xxxx
Called Party Number	xxxx
Calling Party Number	xxxx
Called Party Subaddressing	xxxx
Voice is End-to-End ISDN	xxxx

Figure 27 BT Software Setup Menu

The network type can be changed from BTNR191 (original BT ISDN Network) and BTETSI (new ISDN Network).

The BTNR191 network support defines a new parameter in the menu. Switching “Voice is End-to-End ISDN” to “On” changes some of the display messages used by the **EMUTEL ULTRA**.

Main Differences Between CCITT and BT

The main differences between CCITT and BT are:-

- In the RELEASE COMPLETE message a cause value of 21 has priority over other cause values whereas in CCITT a cause of 18 has priority.

BT Network Personality Module

There are many display messages on the BT network not found in the CCITT specification. The most commonly encountered messages are:-

- *03*1#
*86*number string#
*AA*NUMBER UNOBTAINABLE# or *EC*00#
*AA*CLEARED# or *EC*30#
*AA*NETWORK BUSY# or *EC*07#
*AA*NUMBER BUSY# or *EC*08#
*AA*INCOMPATIBLE TERMINAL# or *EC*13#
*AA*ERROR# or *EC*15#
*AA*NO REPLY# or *EC*1f#
*AA*NOT SUITABLE FOR DATA#
- A CALL PROCEEDING message in response to an outgoing SETUP message causes ALERTING to be sent to the calling party.
- SETUP ACKNOWLEDGE is sent by the network in response to a SETUP message even if the SETUP message contained the complete called party number.
- A subset of the CCITT Bearer Capability information element is allowed (see ETSI support card for more details).
- The Calling Party Number information element has a maximum length of 15 digits.
- Progress Indicator information element location field is always “network beyond interworking type”.
- Calling Party Number and Called Party Number information element type and plan field are always “unknown”.
- In MSN operation only the last digit of the Called Party Number is sent to the called terminal in the SETUP message.

- Generation of a Subaddress by concatenating the Called Party Number digits is supported in BT (e.g. dial enbloc 384000#123 generates a Called Party Subaddress of '123').

VN2/3 Network Personality Module

Introduction

This section outlines the differences in operation of the **EMUTEL ULTRA** between the CCITT emulation provided on the standard **EMUTEL ULTRA** and the VN2/3 Networking Personality Module.

Main Differences Between CCITT and VN2/3

The main differences are:-

- VN2/3 adds a new information element to the SETUP message “Mode de fonctionnement d’usager” in codeset 6. This is mandatory in the SETUP message in both user→network and network→user directions.
- In the user→network SETUP message the Higher Layer Compatibility information element is mandatory.
- The Sending Complete information element is not supported in VN3.

A subset of the CCITT Bearer Capability information element is allowed in the SETUP message sent to the network. The most notable restrictions are:-

- Coding Standard is fixed at CCITT.
- Information Transfer Capability is Speech, 3.1 kHz Audio or Unrestricted Digital.
- Information Transfer Rate is 64k only.
- Layer 1 protocol is G.711 A law or H.221/H.242 (G.722/G.725).
- A new optional information element “Facility d’usager a usager” in codeset 6 is defined. The **EMUTEL ULTRA** analyser decodes this although the **EMUTEL ULTRA** does not generate it.
- Octet 3a (Recommendation) is not supported in the Cause information element.

VN2/3 Network Personality Module

- Keypad information element is not supported.

1TR6 NETWORK PERSONALITY MODULE

Introduction

This section outlines the differences in operation of the **EMUTEL ULTRA** between the CCITT emulation provided on the standard **EMUTEL ULTRA** and the 1TR6 Network Personality Module.

Figure 28 shows the Software Setup Menu when simulating a 1TR6 network.

```
Software Setup

Drop Layer 2 if No Call Active      xxxx
Drop Layer 1 if Layer 2 Inactive    xxxx
Drop TEI if Layer 1 Inactive        xxxx
Number of B Channels per PRI        n
Use Service Profile IDs (SPIDs)     xxxx
Allow Overlap Sending/Receiving     xxxx
Numbering System Option              xxxx
Call Waiting                         xxxx
Billing                              xxxx
Additional Transmission Attributes   xxxx
Called User Status                   xxxx
Date/Time                            xxxx
```

Figure 28 1TR6 Software Setup Menu

Main Differences Between CCITT and 1TR6

The German 1TR6 network is very different to Q.931 based networks such as ETSI. To understand all of the differences refer to the 1TR6 specification. The **EMUTEL ULTRA** does not support all of the differences provided by 1TR6 but the following notes outline the main differences between the standard network and 1TR6.

1TR6 does not use the normal Q.931 protocol discriminator (i.e. = 8) but defines two new ones N0 (=1) and N1 (=65). Some messages are valid only with N0 and some only with N1.

1TR6 NETWORK PERSONALITY MODULE

The following Q.931 messages are not supported:-

- PROGRESS
- RESTART
- RESTART ACKNOWLEDGE

The following N0 messages are additional to Q.931:-

- REGISTER INDICATION
- CANCEL INDICATION
- FACILITY STATUS
- STATUS ACKNOWLEDGE
- STATUS REJECT
- FACILITY INFORMATION
- INFORMATION ACKNOWLEDGE
- INFORMATION REJECT
- CLOSE
- CLOSE ACKNOWLEDGE

None of these messages are supported by the **EMUTEL ULTRA**.

The following N1 messages are additional to Q.931:-

- DETACH
- CANCEL ACKNOWLEDGE
- CANCEL REJECT
- FACILITY ACKNOWLEDGE
- FACILITY CANCEL
- FACILITY REGISTER
- FACILITY REJECT
- REGISTER ACKNOWLEDGE
- REGISTER REJECT

None of these messages are supported by the **EMUTEL ULTRA**.

The following messages (supported by the **EMUTEL ULTRA**) are common to 1TR6 and Q.931 but their numeric value is different.

CHAPTER 8

1TR6 NETWORK PERSONALITY MODULE

- INFORMATION (1TR6 = 0 x 6d)
- STATUS (1TR6 = 0 x 63)

1TR6 also defines additional information elements not found in Q.931. These are mostly found in codeset 6:-

- Service Indicator
- Charging Information
- Date
- Facility Select
- Status of Facilities
- Status of Called User
- Additional Transmission Attributes

The only non-Q.931 message in codeset 0 is Connected Address.

The following Q.931 information elements are not supported in 1TR6:-

- Segmented Message
- Bearer Capability
- Call State
- Facility
- Progress Indicator
- Notification Indicator
- Date / Time
- Signal
- Switchhook
- Feature Activation
- Feature Indication
- Calling Party Sub-address
- Called Party Sub-address
- Transit Network Selection
- Restart Indicator
- Low Layer Compatibility
- High Layer Compatibility

Where information elements are supported by both Q.931 and 1TR6 they may have a different structure, e.g. the

1TR6 NETWORK PERSONALITY MODULE

Cause information element supports different cause values in 1TR6 and Q.931.

Because the Bearer Capability information element is not supported 1TR6 uses the Service Indicator information element in its place.

The 1TR6 Date information element is mandatory in the CONNECT, CONNECT ACKNOWLEDGE, DISCONNECT, and RELEASE messages from the **EMUTEL ULTRA**.

The 1TR6 Called User Status information element is mandatory in the ALERT message from the **EMUTEL ULTRA**.

The following information elements are used by the **EMUTEL ULTRA** and can be enabled in the Software Setup menu as shown in figure 29:-

Charging Information
Additional Transmission Attributes
Called User Status
Date

Figure 29 Software Setup Menu

The **EMUTEL ULTRA** also allows the generation of a call waiting SETUP message.

NTT NETWORK PERSONALITY MODULE

The following Q.931 information elements are not supported in NTT:-

- More Data
- Sending Complete
- Congestion Level
- Repeat Indicator
- Segmented Message
- Network Specific Facilities
- Date/Time
- Transit Network Selection

The following Q.931 information elements have restrictions not imposed in Q.931:-

- Bearer Capability
- Called Party Number
- Calling Party Number
- Signal

The NTT Called User Status information element is mandatory in the ALERT message from the **EMUTEL ULTRA**.

The following information elements which are not supported in Q.931 are available in NTT using codeset 6:-

- Advice of Charge
- Blocking Channel ID

USA Network Personality Module

Introduction

This section outlines the differences in operation of the **EMUTEL ULTRA** between the CCITT emulation provided on the standard **EMUTEL ULTRA** and the USA Network Personality Module.

The USA Network Personality Module covers three switch variants found in the USA i.e. Bellcore NAT-1, Nortel DMS100 and AT&T 5ESS.

Main Differences Between CCITT and Bellcore National ISDN-1

National ISDN-1 (NAT-1) defines four new ISDN messages not found in Q.931. These are network specific messages (i.e. two octet) and are:-

- KEY HOLD
- KEY RELEASE
- KEY SETUP
- ACKNOWLEDGE

These are not used in the **EMUTEL ULTRA**.

NAT-1 does not include the following Q.931 messages:-

- USER INFORMATION
- RESTART
- RESTART ACKNOWLEDGE
- SEGMENT
- CONGESTION CONTROL
- FACILITY

USA Network Personality Module

NAT-1 defines new information elements in codeset 0. These are:-

- Information Request
- Service Profile Identification
- Endpoint Identifier
- Information Rate
- End to End Transit Delay
- Transit Delay Selection and Identification
- Packet Layer Binary Parameters
- Packet Layer Window Size
- Packet Size
- Closed User Group
- Reverse Charging Information
- Redirection Number

The **EMUTEL ULTRA** supports Service Profile Identification and Endpoint Identifier information elements.

NAT-1 does not support the following Q.931 information elements:-

- Segmented Message
- Call Identity
- Facility
- Network Specific Facilities
- Display
- Date / Time
- Switchhook
- Restart Indicator
- Sending Complete

NAT-1 offers the following information elements in codeset 5:-

- Operator System Access
- Display Text

USA Network Personality Module

NAT-1 offers the following information elements in codeset 6:-

- Redirection Sub-address
- Redirection Number
- Call Appearance

In NAT-1 the signal information element is mandatory in the following network→user messages:-

- ALERTING
- RELEASE
- CONNECT ACKNOWLEDGE
- RELEASE
- RELEASE COMPLETE
- CALL PROCEEDING
- SETUP ACKNOWLEDGE
- DISCONNECT
- SETUP
- CONNECT

A subset of the CCITT Bearer Capability information element is allowed in the SETUP message sent to the network. The most notable restrictions are:-

- Information transfer capability is speech, unrestricted, 3.1kHz audio only.
- Transfer mode and rate is 64k, Packet mode.
- Layer 1 protocol is rate adapted, μ law.
- Rate is 56k.
- Layer 2 protocol is LAPD, LAPB.
- Layer 3 protocol is X.25.

USA Network Personality Module

Main Differences Between CCITT and Nortel DMS100

DMS-100 defines new ISDN messages not found in Q.931. These are network specific messages (i.e. two octet) and are:-

- KEY HOLD
- KEY RELEASE
- KEY SETUP
- KEY SETUP ACKNOWLEDGE
- RETRIEVE
- RETRIEVE ACKNOWLEDGE
- RETRIEVE REJECT
- HOLD
- HOLD ACKNOWLEDGE
- HOLD REJECT

These are not used in the **EMUTEL ULTRA**.

DMS100 defines new information elements in codeset 0 which are:-

- Connected Number
- Redirecting Number
- Redirection Number

DMS100 defines new information elements in codeset 6 which are:-

- Protocol Version Control
- Closed User Group
- Reverse Charging Indication
- Redirecting Subaddress
- Call Appearance

USA Network Personality Module

A subset of the CCITT Bearer Capability information element is allowed in the SETUP message sent to the network. The most notable restrictions are:-

- Information transfer capability is speech, unrestricted, 3.1kHz audio only.
- Transfer mode and rate is 64k, Packet mode.
- Layer 1 protocol is rate adapted, μ law.
- Rate is 56k.
- Layer 2 protocol is LAPD, LAPB.
- Layer 3 protocol is X.25.

The following differences are also noted:-

The Signal information element has additional values not defined in Q.931

User to User signalling is not supported in DMS100.

The Sending Complete information element is not supported in Q.931

Main Differences Between CCITT and AT&T 5ESS

This section to be defined.

APPLICATION NOTES

To be defined