

**BLACK BOX Catalogue Ltd**

*The Source for Connectivity*



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**EMUTEL *PRO***  
**BASIC RATE PRIMARY RATE ISDN NETWORK**  
**SIMULATOR PROTOCOL ANALYSER**



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## INTRODUCTION

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

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

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 PRO** supports unrestricted digital, voice, 3.1kHz audio, V.110 and V.120 bearer capabilities. The **EMUTEL PRO** 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 40V 1W normal and sealing (i.e. 20mA current limit) on U interface. Internal tones (A law and  $\mu$  law) are provided for voice/3.1 kHz terminals.

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 state of the physical connection.

At layers 2 and 3 the user 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.

The **EMUTEL PRO** can also function as a stand alone protocol analyser connecting between a BRI and PRI ISDN terminal and a real ISDN network.

This manual outlines how the **EMUTEL PRO** should be set up and how the terminal equipment is connected in simulator mode and in transparent mode.



## QUICK REFERENCE GUIDE

**Introduction** This section allows you to set up and use your **EMUTEL PRO** 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 PRO** Unpack the **EMUTEL PRO**. 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.

**Plug in the power cable** Plug the power cable into the rear of the unit and switch on (**EMUTEL PRO** 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 PRO**).

**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** If the call did not work and 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.

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 TI terminal will not work on an EI 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
40 V Power	ON
100 $\Omega$ Terminators	100 BRI/120 PRI
B channels/PRI	30
Use SPIDS	No
Numbering Option	Multiple Subscriber Numbering
CLIP	ON
BRI 1	384000/10
BRI 2	384020/30
PRI 1	384100-384129
PRI 2	384200-384229

Table 1 EMUTEL *PRO* Default Settings

## PRODUCT SPECIFICATION

<b>ISDN Connections Network Simulator Mode</b>	The <b>EMUTEL PRO</b> provides two ISDN S <sub>0</sub> or U BRI ports and two ISDN E1 (S <sub>2m</sub> ) or T1 PRI ports operating in NT mode. The BRI interfaces can optionally provide 40 V, 1 W supply to power terminal equipment.
<b>Transparent Mode-BRI</b>	A terminal is connected to the <b>EMUTEL PRO</b> BRI1 interface and the <b>EMUTEL PRO</b> BRI2 interface is then connected to the network. All terminal/network messages pass through the <b>EMUTEL PRO</b> unaltered. The protocol analyser can decode these messages and terminal power can be provided locally.
<b>Transparent Mode-PRI</b>	This operates in the same way as BRI transparent mode with the terminal connected to the PRI1 interface and the network into the PRI2 interface.
<b>LED Indicators</b>	<p>In operation, LEDs indicate the operating level of each port. Note that the LEDs do not operate in transparent mode. The LEDs operate as follows:-</p> <ul style="list-style-type: none"><li>■ Physical layer activated.</li><li>■ Data link layer activated.</li><li>■ B1/B2 channel connected on the BRI interfaces or a single B LED to indicate that at least one B channel is active on the PRI interface.</li><li>■ Power is on.</li><li>■ <b>EMUTEL PRO</b> is using Network Personality Module.</li></ul>
<b>Data Ports</b>	Four X.21 compatible data ports are available at the rear of the <b>EMUTEL PRO</b> . These provide access to the B channels on each interface for external test equipment.
<b>Terminal Port</b>	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.
<b>Auxiliary Port</b>	The auxiliary port receives or transmits clock and frame information which allows two <b>EMUTEL PROs</b> to be locked to a single reference clock. This is useful if more than two PRI or two BRIs are required for a particular terminal.
<b>Network Personality Module</b>	The <b>EMUTEL PRO</b> 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.



## HARDWARE SETUP

- Unpack the EMUTEL *PRO*** First unpack the **EMUTEL *PRO*** 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 bottom of the unit or the power up screen on the TERMINAL:-
- **EMUTEL *PRO*** Network Simulator.
  - Cables for ISDN - RJ45-RJ45 (2 off).
  - Mains Cable.
  - Terminal Cable DB9-DB25 (1 off).
  - **EMUTEL *PRO*** Protocol Analyser (Option).
  - **EMUTEL *PRO*** Network Personality Modules (Options).
  - This Manual.



**HARDWARE SETUP**

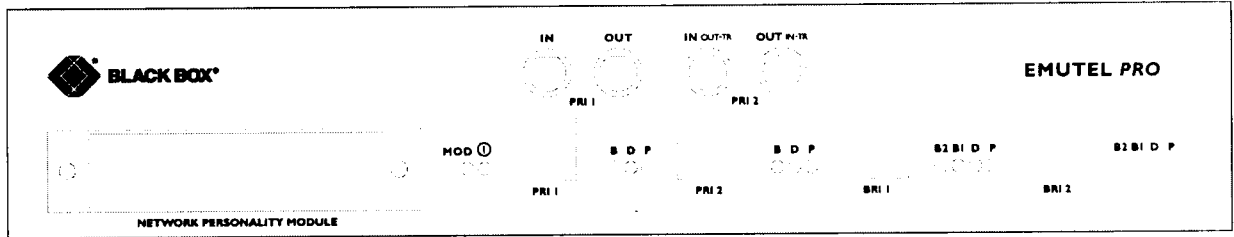


Figure 1 The **EMUTEL PRO** Front Panel

The BRI1 and BRI2 RJ45 connectors provide the BRI interfaces into the unit while the PRI1 and PRI2 connectors provide the PRI connections into the unit.

**Start Up Sequence**

When the unit is first switched on all the LEDs will illuminate. During this period 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 **EMUTEL PRO**. If this occurs the **EMUTEL PRO** will restore the factory defaults. This is useful if a setting has been changed and the **EMUTEL PRO** ceases to operate as a result. Powering up the **EMUTEL PRO** and immediately typing <ctrl-c> will restore a working configuration to the **EMUTEL PRO**.





## HARDWARE SETUP

### Interface Pinout

The  $S_0$  interface is a 4 wire interface and the U interface is 2 wire. Figure 2 shows the signals provided as the BRI RJ45 connector.

### S Interface Pinout (NT Mode)

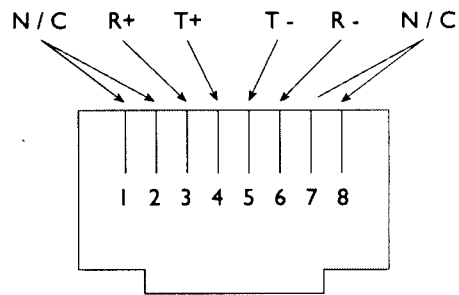


Figure 2a RJ45 Signals (S Interface NT Mode)

### S Interface Pinout (TE Mode) (i.e. in BRI Transparent Mode)

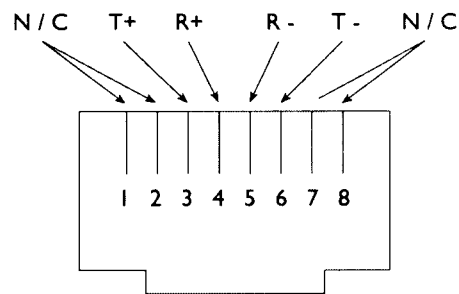


Figure 2b RJ45 Signals (S Interface TE Mode)

### U Interface Pinout

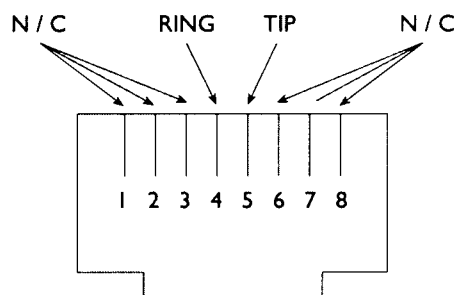


Figure 2c RJ45 Signals (U Interface)



## HARDWARE SETUP

### PRI Interface Pinout T1 and E1 (NT Mode)

The  $S_{2m}$  (E1) and T1 interfaces are 4 wire interfaces. The pinout is shown in Figure 3.

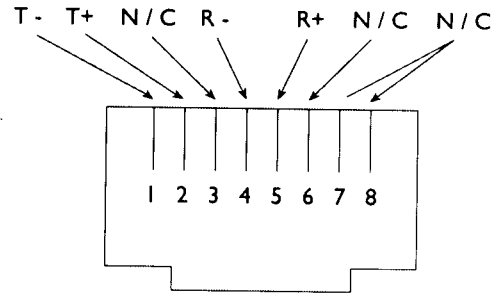


Figure 3a RJ45 Signals (E1/T1 NT Mode)

### PRI Interface Pinout T1 and E1 (TE Mode) (i.e. PRI Transparent Mode)

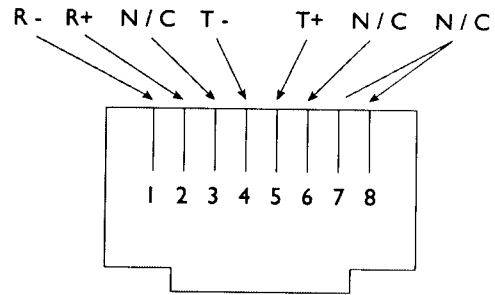


Figure 3b RJ45 Signals (E1/T1 TE Mode)

### Use of PRI BNC Connectors

The RJ45 connectors PRI1 and PRI2 provide 120 ohm balanced twisted pair connections (see fig 3) for the PRI interfaces. A 75 ohm unbalanced coax connection is also provided using the BNC connectors located above the RJ45 connectors.

Do not connect equipment to the RJ45 and BNC coax connectors simultaneously.

Note that BNC coax cables require a 75 ohm termination whereas RJ45 cables require a 120 ohm termination.

## HARDWARE SETUP

### Interface Configuration in Transparent Mode

When using the **EMUTEL PRO** in Network Simulator mode the ISDN cables of the terminal equipment are plugged into the sockets provided.

In BRI Transparent Mode the terminal is plugged into the BRI1 interface and the network into the BRI2 interface. ISDN messages are routed from the terminal to the network through the **EMUTEL PRO**.

In PRI Transparent Mode the terminal is plugged in the PRI1 interface and the network into the PRI2 interface.

Note that if you are using the BNC connectors in PRI transparent mode the BNC connectors for PRI2 swap operation (i.e. In becomes Out and Out becomes In).

The LEDs perform no function in Transparent Mode.

Figure 4a shows a schematic of how the power is generated at the ISDN S<sub>0</sub> 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).

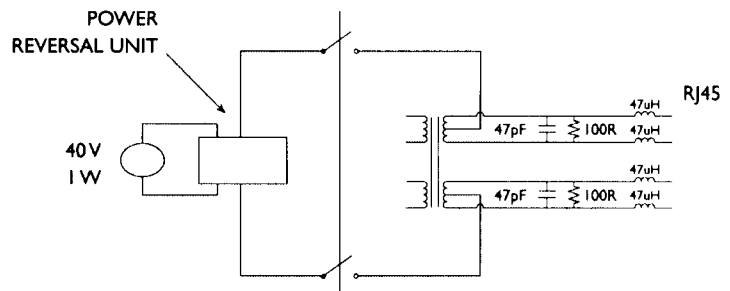


Figure 4a Schematic of 40 V Power Supply (S I / F)

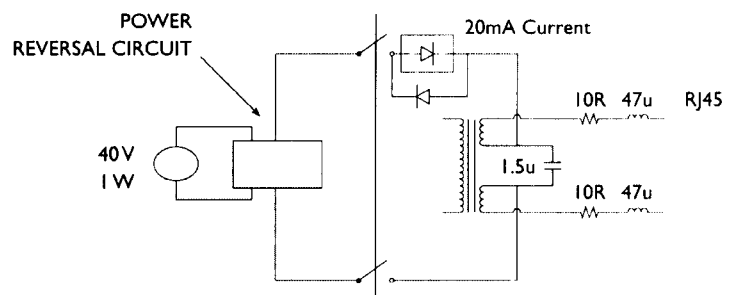


Figure 4b Schematic of 40 V Power Supply (U I / F)



## HARDWARE SETUP

### 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.

The Network Personality Module LED is lit whenever the **EMUTEL PRO** is using the Network Personality Module.

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

When the unit is first switched on all the LEDs will illuminate. They will then extinguish and the four channel BRI2 LEDs will indicate, for about 1 second, the configuration being used. The **EMUTEL PRO** will then switch to the mode defined by the internal configuration (usually NT mode).

Table 2 below lists the configuration indicated by the LEDs on power up.

Led Name	Description
P	ON = NT Mode OFF = Transparent Mode
D	ON = 40 V Power Active OFF = 40 V Power Inactive
B1	ON = 100 Ohm Term In OFF = 100 Ohm Term Out
B2	ON = Local Clock OFF = Remote Clock

Table 2 Power Up Configuration



## HARDWARE SETUP

### Network Personality Module

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

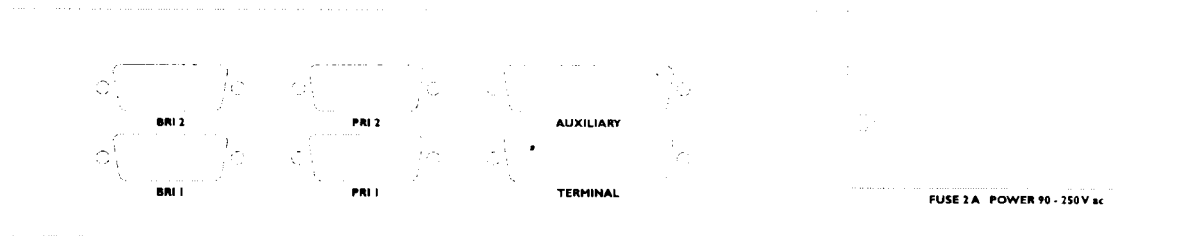


Figure 5 **EMUTEL PRO** Back Panel



## HARDWARE SETUP

### Terminal Port

The **EMUTEL PRO** has one V.24 compatible terminal 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.

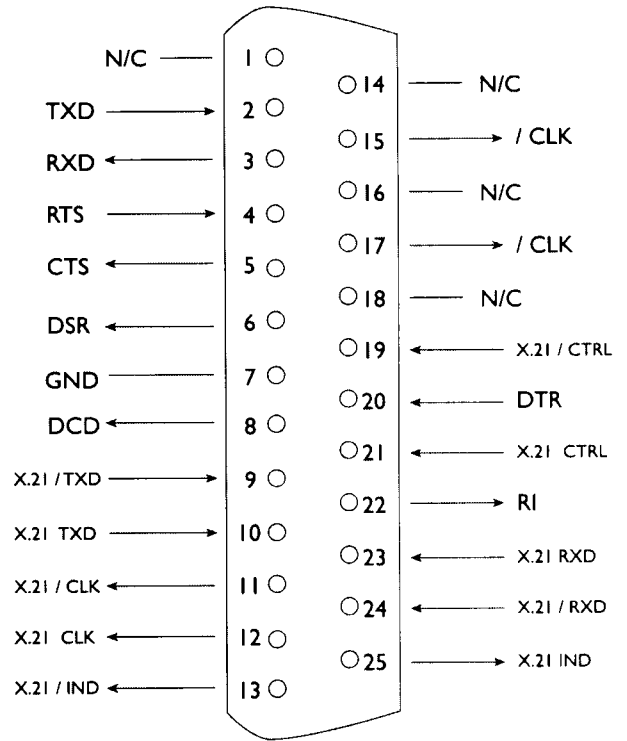


Figure 6 V.24 Terminal Port

## HARDWARE SETUP

Pin	Function	Description
8	DCD	Data Carrier Detect (always active)
3	RXD	Received Data (output)
2	TXD	Transmitted Data (input)
20	DTR	Data Terminal Ready (input- ignored)
7	GND	Ground
6	DSR	Data Set Ready (always active)
4	RTS	Request to Send (input- ignored)
5	CTS	Clear to Send (output- active when <b>EMUTEL PRO</b> can receive Data )

Table 3 Terminal Port Pin Description

### X.21 Data Ports

The **EMUTEL PRO** has four X.21 data ports on the back panel. A single X.21 connector is provided for each ISDN interface. Figure 7 shows the pinout of each X.21 connector. Table 4 lists the X.21 signals and describes each one.

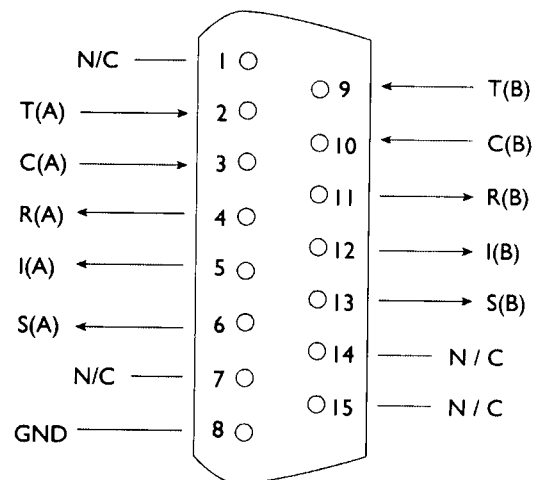


Figure 7 X.21 Data Port

## HARDWARE SETUP

	Function	Description
4,11	RXD	Received Data (input)
2,9	TXD	Transmitted Data (output)
3,10	CON	Control (input) indicates that input data is valid
5,12	IND	Indicate (output) indicates that transmit data is valid
6,13	CLK	Data Clock (output) -frequency depends on number of B channels connected to X.21 interface
8	GND	Signal Ground

Table 4 X.21Data Port Signals

### Auxiliary Port

The auxiliary port is currently used only to allow the **EMUTEL PRO** to receive network clock and frame synchronisation from another **EMUTEL PRO**. This forces the two **EMUTEL PROs** to align the ISDN data to each other allowing a terminal requiring more than 2 PRI or 2 BRI interfaces to be connected to multiple **EMUTEL PROs**.

The pinout of this port is shown in Figure 8. Table 5 defines the signals supplied on the auxiliary port.

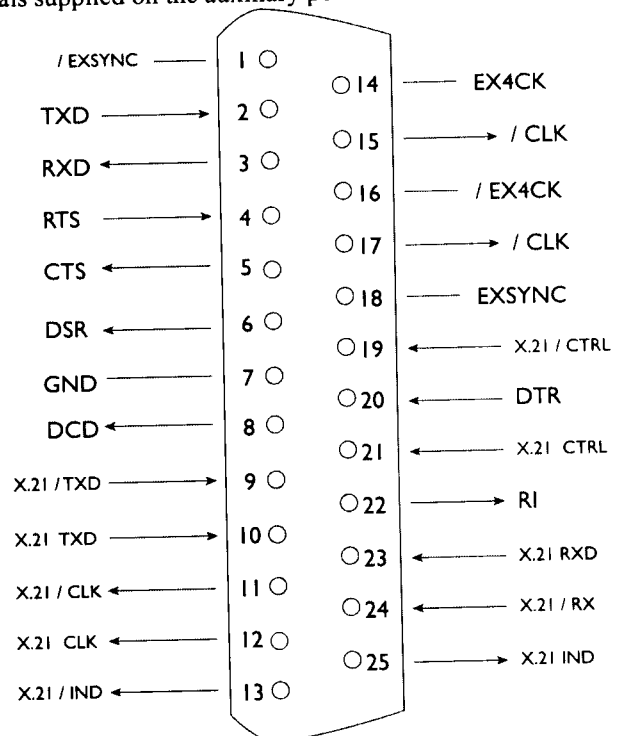


Figure 8: Auxiliary Port Pinout



## HARDWARE SETUP

Pin	Function	Description
1,18	EXSYNC	8kHz frame pulse signal to enable two <b>EMUTEL PROs</b> to lock frame alignment
14,16	EX4CK	4.096 MHz clock signal to enable two <b>EMUTEL PROs</b> to lock clock frequencies
3	RXD	V.24 Received Data (output)
2	TXD	V.24 Transmitted Data (input)
4	RTS	V.24 Request to Send (input- ignored)
5	CTS	V.24 Clear to Send (output- active)
6	DSR	V.24 Data Set Ready (always active)
7	GND	Ground
8	DCD	V.24 Data Carrier Detect (always active)
15,17	CLK	V.24 Clock (Output)
20	DTR	V.24 Data Terminal Ready (input- ignored)
22	RI	V.24 Ring In (always active)
9,10	X21TXD	X.21 Transmitted Data (input)
23,24	X21RXD	X.21 Received Data (output)
19,21	X21CON	X.21 Control (input) indicates that input data is valid
13,25	X.21IND	X.21 Indicate (output) indicates that transmit data is valid
11,12	X21CLK	X.21 Clock (output)

Table 5 Auxiliary Port Signal Definitions

### Start-up Sequence

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

The factory default settings for the **EMUTEL PRO** are 19200 baud, 8 data bits, 2 stop bits, no parity, although these settings can be changed by the user. If the **EMUTEL PRO's** settings in memory become corrupt it may not be possible to operate the terminal as the baud rate may be wrong. The **EMUTEL PRO** will always power up with the terminal port operating at 19200 baud, 8 data bits, 2 stop bit, no parity and will maintain this setting during the time when the power up LEDs are on. Typing <ctrl-c> during this time will reload the factory defaults and the terminal should start to function normally again.

### Power

The **EMUTEL PRO** power connector will accept an IEC mains lead (supplied). The **EMUTEL PRO** has a universal input suitable for 90-250 V ac 50-60 Hz. Connection to any other source may result in the unit failing to comply with safety requirements.



## **HARDWARE SETUP**

**Warning - Earth the Emutel PRO**

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

## SOFTWARE SETUP

### Introduction

This chapter outlines the user interface of the **EMUTEL *PRO*** and how the various functions of the **EMUTEL *PRO*** 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 Ltd 1993
NT Simulator Vx.x dd mmm yyyy S/N nnnnnnnn
Configuration BRI1=x BRI2=x PRI1=x PRI2=x
```

Figure 9 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 *PRO***.

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.



## SOFTWARE SETUP

The **EMUTEL PRO** now displays the main set up screen, shown in Figure 10.

```

Hardware Setup
Software Setup
Terminal Setup
Telephone Number Setup
Analyser Setup

```

Figure 10 Main System Menu

### Changing Parameters

The set up of the **EMUTEL PRO** is structured rather like a tree with the menu of Figure 10 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 press <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 10 are as follows:-

- |                               |  |
|-------------------------------|--|
| <b>Hardware Setup</b>         | This function allows you to set up the communications ports, and various other hardware functions of the <b>EMUTEL PRO</b> .   |
| <b>Software Setup</b>         | This function allows you to change the operation of the <b>EMUTEL PRO</b> 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 Subscriber Numbering and Subaddressing. |
| <b>Terminal Setup</b>         | This function allows you to change the terminal type.  |
| <b>Telephone Number Setup</b> | This function allows you to change the default telephone numbers for each B channel and the special purpose telephone numbers.   |
| <b>Analyser Setup</b>         | 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 11.

```

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
40V Power                    xxxx
Power Operation              xxxx
NT Mode Clock                xxxx
BRI S Bus Timing             xxxx
Selected Tone                xxxx
PRI E.1 I/F Config          xxxx
PRI T.1 I/F Config          xxxx
Data Port 0 Mode            xxxx
Data Port 1 Mode            xxxx
Data Port 2 Mode            xxxx
Data Port 3 Mode            xxxx

```

Figure 11 Hardware Setup Menu

All of the fields in Figure 11 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)/TE/Tran Mode**

This field selects between Network Terminator Mode (NT), BRI Transparent Mode and PRI Transparent Mode. In NT mode the **EMUTEL PRO** will simulate an ISDN network, allowing PRI and BRI terminals to be plugged in and to call each other. In BRI Transparent mode a basic rate terminal is plugged into interface BRI1 while interface BRI2 is connected to the Public ISDN network. Calls can be made on the public network through the **EMUTEL PRO** which passes all messages transparently. PRI Transparent mode works identically except that a primary rate terminal is plugged into interface PRI1 and interface PRI2 is connected into the Public ISDN network.



## SOFTWARE SETUP

### 100 ohm Terminators

This field configures the 100 ohm terminating resistors on the ISDN S<sub>0</sub> interfaces and the 120/75 ohm resistors on the PRI interfaces. If the **EMUTEL PRO** is in BRI Transparent mode then the 100 ohm termination resistors on the BRI2 interface can be switched out or in. The 100 ohm termination resistors for BRI1 are always installed. This field is also used to set the termination resistance of the S<sub>2m</sub> PRI interfaces. This can be switched from 120 ohm to 75 ohm. T1 interfaces are always terminated by 100 ohms. Note that this option has no effect on any BRI U interface.

### 40V Power

Setting this to ON forces the **EMUTEL PRO** to provide a nominal 40 V 1 W dc. supply to the ISDN S<sub>0</sub> interface or U interface if any terminal adapters or ISDN telephones require it.

This should normally be turned ON in NT(LT) mode and BRI transparent mode (see note for U interface operation under Power Operation).

### Power Operation

This field allows you to switch the power from normal mode to restricted mode, i.e. the power provided at the ISDN BRI S<sub>0</sub> 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.

Note that the U interface module is fitted with a current limiter circuit which restricts the total current to 20 mA in normal mode. Switching to restricted mode power will disable the current limiter and the U interface will be supplied with the full 40V 1W power available. This will be necessary for testing NT1s and other line powered devices.

### NT Mode Clock

This field allows the clocks used to generate the timing for the interfaces in NT(LT) mode to be driven from another **EMUTEL PRO**. Both **EMUTEL PRO** interfaces are then synchronised at the same speed. This field must be set to LOCAL if only one **EMUTEL PRO** is being used and REMOTE to receive clocking signals from another **EMUTEL PRO**.

### S Bus Timing

In NT mode using an S interface this field will switch between adaptive timing or fixed timing on the S<sub>0</sub> interface. Use adaptive timing if the S<sub>0</sub> interfaces have long cables attached.

### Selected Tone

The **EMUTEL PRO** 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 dialtone, 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 E1 I/F config.

This field switches between AMI and HDB3 encoding on the E1 interface and sets the S bit to 1 or to reflect the status of the FEBE bit in the S<sub>2m</sub> interface, and to switch CRC4 multi-framing on or off.

## SOFTWARE SETUP

**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.

**Data Port Mode** These fields select the operating mode of the X.21 ports. Incoming calls are accepted only if they conform to the incoming call operating mode as follows (a) 64k only - only 64k unrestricted digital accepted, (b) 56K only - only 56k unrestricted calls accepted, (c) Auto - both 64k and 56k calls accepted, or (d) Any - the incoming call will be accepted irrespective of the bearer capability.

**Software Setup Screen** On selecting this option the screen of Figure 12 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
    
```

Fig 12 NT Mode 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 PRO** 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 13 is presented.

## SOFTWARE SETUP

L2 Drop Timeout Setup

Timeout until L2 Dropped (secs) nn

Fig 13 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 PRO** will deactivate layer 1 immediately layer 2 becomes inactive.

**Drop TEI if Layer 1 Inactive**

If activated the **EMUTEL PRO** 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 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 14 will be displayed.

Point to Point/Multipoint Setup

```

PRI #0                xxxxx
PRI #1                xxxxx

BRI #0                xxxxx
BRI #1                xxxxx
    
```

Fig 14 Point-Point/Point-Multipoint Setup

Each 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 PRO** 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 is 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 15 is presented.



## SOFTWARE SETUP

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

```

Fig 15 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.

### Allow Overlap Sending/Receiving

If activated the **EMUTEL PRO** 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 PRO** 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. **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 384001 will connect to the channel whose number is set up as 384000. 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.



## SOFTWARE SETUP

### 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 *PRO*** 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 *PRO***.

**Note that a Called Party Number is always included in the SETUP message from the EMUTEL *PRO* to the called terminal if Multiple Subscriber Numbering is enabled.**

If switched to Yes pressing <enter> when on this field displays the screen of Figure 16.

Called Party Number Setup

```
Type           tttttttt
Plan           pppppppppp
```

Figure 16 Called Party Number IE Setup

This screen allows the user 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 *PRO*** 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



## SOFTWARE SETUP

### Calling Party Number

If this feature is activated a Calling Party Number information element is included in the SETUP message sent from the EMUTEL *PRO* 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 *PRO* or simply a copy of the terminal supplied number if it did include a Calling Party Number information element in its transmitted SETUP message to the EMUTEL *PRO*.

If switched to Yes pressing <enter> when on this field displays the screen of Figure 17.

#### Calling Party Number Setup

Type	tttttttt
Plan	pppppppppp
Screening	sssssssss
Presentation	pppppppppp

Figure 17 Calling Party Number IE Setup

This screen allows the user 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 *PRO* 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



## SOFTWARE SETUP

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

Available plans are:-

- Unknown
- ISDN / Telephony
- Data
- Telex
- 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 PRO**. 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.



## SOFTWARE SETUP

### 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 PRO** generates this information element based on the contents of the Bearer Capability.

If activated pressing <enter> when on this field allows the user 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 the user to set up this mapping the screen of Figure 18 is displayed.

The table is edited in the normal fashion - move to the field 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 compatibility information element.

#### 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 18 Translation from Bearer Capabilities to HLC



## SOFTWARE SETUP

### 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 PRO** generates this information element from the Bearer Capability information element.

### Terminal Setup Screen

On selecting this option the user is presented with the screen of Figure 19.

```
Terminal Setup

Terminal Type          ttttt
```

Figure 19 Terminal Type Setup Menu

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

### Telephone Number Setup Screen

On selecting this option the screen of Figure 20 is displayed.

```
Telephone Number Setup

BRI1 B1 Number          xxxx
BRI1 B2 Number          xxxx
BRI2 B1 Number          xxxx
BRI2 B2 Number          xxxx
PRI1 Base Number        xxxx
PRI1 Base Number        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
Data Port Number        xxxx
```

Figure 20 Telephone Number Setup Menu



## SOFTWARE SETUP

The fields of Figure 20 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. If the Numbering System Option is set to Normal pressing <enter> on either of the PRI numbers will display a further screen as shown in Figure 21 overleaf. This is used to set up a telephone number for each B channel on the PRI interface.

## SOFTWARE SETUP

## Primary Rate Interface Telephone Number Setup

B1 Number	xxxx	B16 Number	xxxx
B2 Number	xxxx	B17 Number	xxxx
B3 Number	xxxx	B18 Number	xxxx
B4 Number	xxxx	B19 Number	xxxx
B5 Number	xxxx	B20 Number	xxxx
B6 Number	xxxx	B21 Number	xxxx
B7 Number	xxxx	B22 Number	xxxx
B8 Number	xxxx	B23 Number	xxxx
B9 Number	xxxx	B24 Number	xxxx
B10 Number	xxxx	B25 Number	xxxx
B11 Number	xxxx	B26 Number	xxxx
B12 Number	xxxx	B27 Number	xxxx
B13 Number	xxxx	B28 Number	xxxx
B14 Number	xxxx	B29 Number	xxxx
B15 Number	xxxx	B30 Number	xxxx

Fig 21 PRI 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 (last two digits for a PRI) in the telephone number is treated as a wildcard, i.e. if Port 1 B1 Number is set to 384010 and you dial 384016 a connection will be made to Port 1 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.

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 number will force the **EMUTEL PRO** to send a PCM tone (A law or  $\mu$  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.



## 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 22 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        xxxx
Call Reference Filter  xxxx
Analyser Specification xxxx
Activate Analyser     xxxx
  
```

Fig 22 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. The user selects 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, reporting will only take place on the channels selected using this option.

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).

## ANALYSER OPERATION

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 PRI1 L1 STATE = Activated00:01:75:30.271
```

The information presented is outlined below.

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

### 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.

<b>Sequence Number</b>	Each message has a unique number so that old messages can be easily located.
<b>Originator</b>	This field reports which side generated the message, TE for terminal generated messages and NT for network generated messages.
<b>Channel Number</b>	The channel number (e.g. BRI1, BRI2, PRI1 and PRI2) on which the event occurred.
<b>Layer Number</b>	The layer on which the event is being reported.
<b>Timestamp</b>	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.



## ANALYSER OPERATION

**Service Access Point Identifier\*****Terminal Endpoint Identifier\*****Command / Response Bit\*****Poll / Final Bit\*****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: 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 be also 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.*



## ANALYSER OPERATION

### Information Provided at Layer 3

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

```
23: TE Ch PRI1 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. 1, 2 for B1 and B2 and 16, 17 for P1 and P2) 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 PRI1 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'
```



## ANALYSER OPERATION

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 the user can review the messages in the message buffer. Pressing M again will leave manual mode.

#### <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.

#### <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 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.



## **ANALYSER OPERATION**

**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 PRO**.

### Changing a parameter on the EMUTEL PRO forced it to stop operating

Changing parameters on the **EMUTEL PRO** may cause the unit to change operating modes and appear to stop functioning. In particular switching NT Clock from LOCAL to REMOTE will cause the **EMUTEL PRO** to stop running unless an external clock is provided.

To recover from this condition reload the factory defaults. When the **EMUTEL PRO** powers up the configuration LEDs will light for about 1 second. During this period if the **EMUTEL PRO** receives a <ctrl-c> character it will reload the defaults. The **EMUTEL PRO** defaults to 19200 baud, 2 stop bits, 8 data bits and no parity during this period.

### 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 PRO** is not functioning. Check first that the terminal is connected to the correct interface type. The "Copyright Screen" displays the type of interfacing installed. If the **EMUTEL PRO** is being used in NT(LT) mode make sure that the **EMUTEL PRO** is switched to the correct mode in the Hardware Setup Menu. Now check the other settings in the Hardware Setup Menu. Switch on the 40 V power supply. If this does not help switch power operation between normal and restricted if the terminal is connected to an S<sub>0</sub> BRI.

For US originating products with U interfaces then the 40V power should be set to Normal (i.e. 20mA current limit). To power NT-1s the U interface power should be set to Restricted. Be careful when switching to U interface to Restricted power as products intended to be connected to a current limited U interface may be damaged by non current limited power (e.g. Motorola Bitsurfer).

If the **EMUTEL PRO** is being used in transparent mode (either BRI or PRI) the LEDs do not function and will normally remain off.



## FAULT FINDING

### **Terminal will not answer a call**

Check first 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 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 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. 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 PRO** 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 end point ID at layer 3 must be used. If this is the source of the problem it may be necessary to restart both **EMUTEL PRO** and terminal to ensure SPID initialisation is successfully completed.

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 PRO** Numbering System option must be switched from Normal to Auxiliary Working, MSN or DDI. In Normal operation each B channel has a separate telephone number. To call B1 on BR12 dial 384020 and to dial B2 on BR12 dial 384030 (if using the default numbering system).

The other possibilities are:-



## FAULT FINDING

### 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)

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 384000-384009. 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 PRO**. 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 PRO** 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 PRO** provides a DCE connection so a cable with a 25 way D male to 9 way D female (supplied with the unit) will connect the **EMUTEL PRO** 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. If the parameters have changed then during the power up sequence type <ctrl-c> at the keyboard of the terminal (terminal set for default communications parameters) and all the factory defaults should be restored (see Chapter 1). Another possibility is that the **EMUTEL PRO** is not powering up properly because the network personality module installed in the **EMUTEL PRO** will not start up and the LED on the front panel may flash. In this case see section entitled Network Personality Module will not work.

## FAULT FINDING

### **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.

### **EMUTEL PRO will not work in Transparent Mode**

To enter transparent mode use the NT(LT)/Trans Mode option in the hardware setup screen and set to either "BRI Transparent Mode" or "PRI Transparent Mode". Now press the <esc> key to return to the power up screen i.e. the copyright screen. This will restart the software.

Check that the network is plugged into interface BRI2 and the terminal into interface BRI1 for BRI Transparent Mode or that the network is plugged into PRI2 and the terminal into PRI1 for PRI Transparent Mode.

Check that the **EMUTEL PRO** is the only terminal connected to the ISDN line. If it is necessary to connect more than one terminal plug them all into the **EMUTEL PRO**.

Finally check the power feeding on the BRI interfaces. This may need to be switched on.

### **Overlap receiving will not work**

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

#### **(a) Overlap Sending used to dial the call**

Here the calling terminal sends a SETUP message to the **EMUTEL PRO** without any Called Party Number information. The **EMUTEL PRO** 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 PRO** has received enough digits to route the call the **EMUTEL PRO** 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 CONNECT then the **EMUTEL PRO** 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 PRO** 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 PRO** and the **EMUTEL PRO** will send CALL PROCEEDING to the calling terminal followed by ALERTING or CONNECT as appropriate.



## FAULT FINDING

### (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 enable 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. 384000 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 PRO**. 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 plus overlap extension digits) ending in '0' will disable overlap receiving at the called terminal and the SETUP message sent by the **EMUTEL PRO** 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 PRO**.

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 PRO** 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 PRO

Some parameters once changed will not effect the operation of the unit immediately. If the **EMUTEL PRO** 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 PRO** off and on again. Please inform Black Box Catalogue.



## **FAULT FINDING**

### **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 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 serial number programmed into the module does not match the **EMUTEL PRO** serial number on which it is running.

**Note that the network support Network Personality Modules will run only on the EMUTEL PRO for which they were 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 PRO** between the CCITT emulation provided on the standard **EMUTEL PRO** and the ETSI Network Personality Module.

Figure 23 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 23 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 24 shows the ETSI Supplementary Services Setup Menu.

```
Supplementary Services Setup

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

Figure 24 ETSI Supplementary Service Setup Menu



## ETSI NETWORK PERSONALITY MODULE

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 PRO** will generate one.

### **Advice of Charge**

The **EMUTEL PRO** 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).

### **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 PRO** 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 PRO** 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 25 is displayed.



## ETSI NETWORK PERSONALITY MODULE

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 25 ETSI Call Forwarding Setup Menu

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

### Malicious Call Identification

If enabled allows terminal sets to send a message to the **EMUTEL PRO** requesting that the calling party number of the last call be recorded.

### Three-Party Calling

The calling terminal sets up a call and puts it on hold. The calling terminal sets up a second call. On activating Three-Party Calling all three terminals are connected together

### 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:-

- 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 PRO** between the CCITT emulation provided on the standard **EMUTEL PRO** and the BT Network Personality Module.

Figure 26 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 26 BT Software Setup Menu

The network type can be changed from BTNR191 (original BT ISDN Network) and BT-ETSI (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 PRO**.





## BT NETWORK PERSONALITY MODULE

### 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.

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 PRO** between the CCITT emulation provided on the standard **EMUTEL PRO** 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'utilisateur" 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'utilisateur a usager" in codeset 6 is defined. The **EMUTEL PRO** analyser decodes this although the **EMUTEL PRO** does not generate it.
- Octet 3a (Recommendation) is not supported in the Cause information element.
- Keypad information element is not supported.

## 1TR6 NETWORK PERSONALITY MODULE

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

Figure 27 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 Datalinks per Channel          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 27 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 PRO** 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.

The following Q.931 messages are not supported:-

- PROGRESS.
- RESTART.
- RESTART ACKNOWLEDGE.



## ITR6 NETWORK PERSONALITY MODULE

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 PRO**.

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 PRO**.

The following messages (supported by the **EMUTEL PRO**) are common to ITR6 and Q.931 but their numeric value is different.

- INFORMATION (ITR6 = 0 x 6d).
- STATUS (ITR6 = 0 x 63).

ITR6 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 ITR6:-

- Segmented Message.
- Bearer Capability.
- Call State.
- Facility.
- Progress Indicator.



## ITR6 NETWORK PERSONALITY MODULE

- 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 ITR6 they may have a different structure e.g. the Cause information element supports different cause values in ITR6 and Q.931.

Because the Bearer Capability information element is not supported ITR6 uses the Service Indicator information element in its place.

The ITR6 Date information element is mandatory in the CONNECT, CONNECT ACKNOWLEDGE, DISCONNECT, and RELEASE messages from the **EMUTEL PRO**.

The ITR6 Called User Status information element is mandatory in the ALERT message from the **EMUTEL PRO**.

The following information elements are used by the **EMUTEL PRO** and can be enabled in the Software Setup menu as shown in Figure 28:-

Charging Information  
 Additional Transmission Attributes  
 Called User Status  
 Date

Figure 28 Software Setup Menu

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



## NTT NETWORK PERSONALITY MODULE

### Introduction

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

The Main Software Setup Menu is identical to the CCITT Menu but the Supplementary Service Setup Menu is shown in figure 29

NTT Supplementary Service Setup

Advice of Charge                    xx

Figure 29 NTT Supplementary Service Setup Menu

### Main Differences Between CCITT and NTT

NTT protocol is based on Q.931. The main differences between the two protocols are as follows:-

- Overlap Sending and Overlap Receiving states are not supported.
- SUSPEND and RESUME messages are supported only in point-point interfaces.
- NTT supports only  $\mu$  law voice/3.kHz audio, unrestricted digital and V.110 data (64K/56K)

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

- SETUP ACKNOWLEDGE
- USER INFORMATION
- CONGESTION CONTROL
- FACILITY

## 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 restriction not imposed in Q.931:-

- More Data.
- Sending Complete.
- Bearer Capability.
- Call Party Number.
- Calling Number.
- Signal.

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

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

- Advice if Charge
- Blocking Channel ID



## **NAT/AT&T/DMS NETWORK PERSONALITY MODULE**

### **Introduction**

This section outlines the differences in operation of the **EMUTEL PRO** between the CCITT emulation provided on the standard **EMUTEL PRO** and the NAT/AT&T/DMS Network Personality Module.

The NAT/AT&T/DMS Network Personality Module covers three switch variants found in North America 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 PRO**.

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

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





## NAT/AT&T/DMS 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 PRO** 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



## NAT/AT&T/DMS 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,  $\mu$  law.
- Rate is 56k.
- Layer 2 protocol is LAPD, LAPB.
- Layer 3 protocol is X.25.

**Main Differences Between CCITT and  
Nortel DMS100**

This section to be defined.

**Main Differences Between CCITT and  
AT&T 5ESS**

This section to be defined.

