

ISDN *LineMaster*

l i t e

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INTRODUCTION

The LineMaster lite is an invaluable tool which is useful when multiple basic rate ISDN terminals must be tested or demonstrated.

The **LineMaster lite** provides two basic rate interfaces (BRI) into which ISDN Terminal Equipment (e.g. terminal adapters, ISDN telephones, PABXs, video conferencing systems) can be plugged. The BRI's may be either all S₀ interfaces (i.e. I.430 compatible) or all U interfaces (i.e. ANSI T1.601 compatible).

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 **LineMaster lite** supports unrestricted digital, voice, 3.1kHz audio, V.110 and V.120 bearer capabilities. The **LineMaster lite** can also provide a 40V, 1W power supply on each of the BRI's operating in both normal and restricted modes if they are S₀ interfaces and 70V 1.5W normal and sealing (i.e. 750mW current limit) on U interface. Internal tones (A law and u law) are provided for voice/3.1 kHz terminals.

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

The LineMaster lite is supplied with either ETSI, USA or NTT protocol support built in to the unit. This manual is written as if CCITT protocol was provided and ETSI, USA or NTT support on a plug in Network Personality Module. This is to provide a similar structure between manuals for different products where CCITT is the basic network and Network Personality Modules provide the support for other networks. Please read chapter 2 alongside chapter 4, 5 or 6 as appropriate.

PRODUCT SPECIFICATION

- Introduction** This section allows you to set up and use your **LineMaster lite** 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 LineMaster lite** Unpack the **LineMaster lite**. There should be a Terminal Cable (DB9-DB9), two ISDN Cables (RJ45-RJ45) and a Mains Power Adapter with Power Cable.
- Plug in the power cable** Plug the power adapter into the rear of the unit; plug in the power adapter into the power supply and switch on (**LineMaster lite** power adapter will work on 110V or 240V mains supply without adjustment).
- Plug terminals into correct interface** Plug terminals into correct BRI interface.
- 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 LED's came on the front panel then the terminals probably require 70V/40V power feeding. If not already switched on turn it on by following the instructions in Chapter 2 Software Setup/Hardware Setup Screen.

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.

Parameter	Default Setting
Baud Rate	19,200
Parity	None
Stop Bits	2
Data Bits	8
70 V / 40 V Power	ON
Use SPIDS	No
Numbering Option	Normal
CLIP	OFF
BRI 1	384000/10
BRI 2	384020/30

Table 1 **LineMaster lite** Default Settings

- ISDN Connections** The **LineMaster lite** provides two ISDN S₀ or U BRI ports. The BRI interfaces can optionally provide 40 V, 1 W on the S interface and 70 V 1.5W on the U interface to power terminal equipment.
- LED Indicators** In operation, LED's indicate the operating level of each port :-
- Physical layer activated.
 - Data link layer activated.
 - B1/B2 channel connected on the BRI interfaces
 - Power is on
 - Unit is operational
- 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.
- Internal Battery** The **LineMaster lite** contains an internal battery which will power the interface and electronics in portable applications and in the event of a power failure.

HARDWARE SETUP

Unpack the LineMaster lite

First unpack the **LineMaster lite** 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 :-

- **LineMaster lite** Network Simulator.
- Cables for ISDN - RJ45-RJ45 (2 off).
- Mains Power Adaptor
- Mains Cable.
- Terminal Cable DB9-DB9 (1 off).
- This Manual.

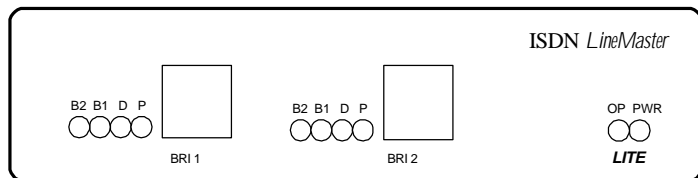


Figure 1 The **LineMaster lite** Front Panel

The BRI 1 and BRI 2 RJ45 connectors provide the BRI interfaces into the unit.

Start Up Sequence

When the unit is first switched on all the LED's 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 **LineMaster lite**. If this occurs the **LineMaster lite** will restore the factory defaults. This is useful if a setting has been changed and the **LineMaster lite** ceases to operate as a result. Powering up the **LineMaster lite** and immediately typing <ctrl-c> will restore a working configuration to the **LineMaster lite**.

S Interface Pinout

The S₀ interface is a 4 wire interface and the U interface is 2 wire. Figure 2 Shows the signals provided as the BRI RJ45 connector.

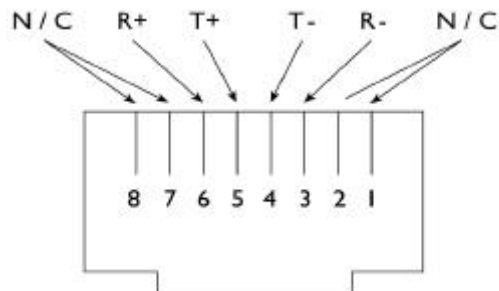


Fig 2a RJ45 Signals

U Interface Pinout

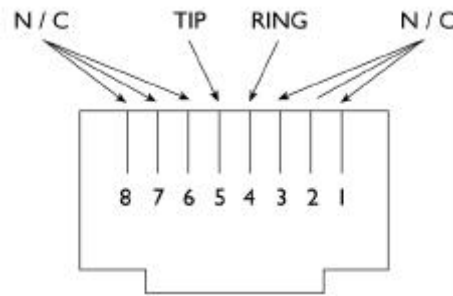


Fig 2b RJ45 Signals

Figure 3a shows a schematic of how the power is generated at the ISDN S₀ interface port while Figure 3b 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).

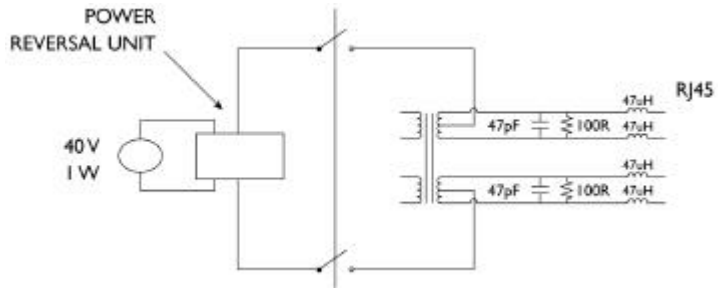


Fig 3a Schematic of 40 V Power Supply (S I / F)

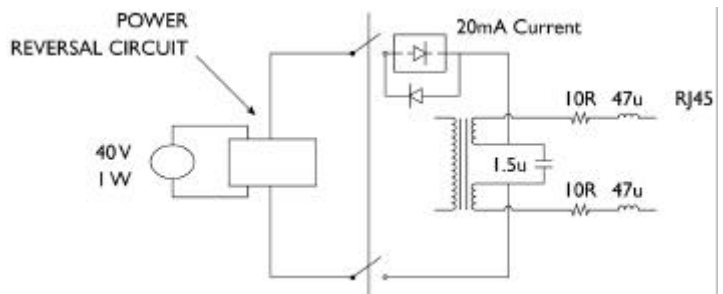


Fig 3b Schematic of 70 V Power Supply (U I / F)

LED Indicators

Beside each ISDN interface port is a group of LED's. These LED's indicate the state of the ISDN port 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.

In addition the Power LED lights whenever 5 V power is present in the unit. The Operating LED blinks whenever the **LineMaster lite** is operational.

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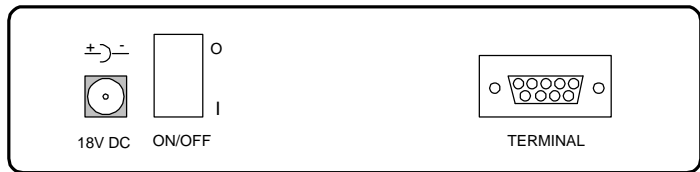


Figure 4 **LineMaster lite** Back Panel

Control Port

The **LineMaster lite** 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 5. Table 2 overleaf lists the operation of each pin.

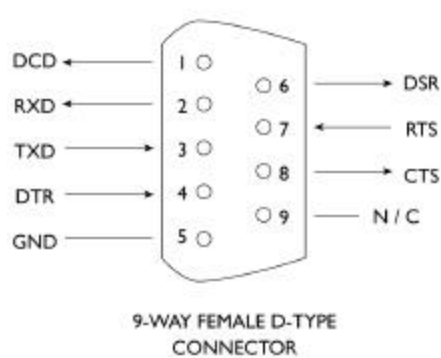


Figure 5 V.24 Terminal Port

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

Table 2 Terminal Port Pin Description

Start-up Sequence

When the **LineMaster lite** is powered up it transmits an opening message, referred to later in the "Copyright Screen" (see Chapter 2). Once the **LineMaster lite** has been set up properly then it is not necessary to connect a terminal. To set up the **LineMaster lite** press any key on the terminal or PC keyboard and the setup screen, Figure 6, is presented. Chapter 2 covers setting up the **LineMaster lite**.

The factory default settings for the **LineMaster lite** are 19200 baud, 8 data bits, 2 stop bits, no parity, although these settings can be changed by the user. If the **LineMaster lite**'s settings in memory become corrupt it may not be possible to operate the terminal as the baud rate may be wrong. The **LineMaster lite** 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

HARDWARE SETUP

time when the power up LED's are on. Typing <ctrl-c> during this time will reload the factory defaults and the terminal should start to function normally again.

Power The **LineMaster lite** power adapter will accept an IEC mains lead (supplied). The **LineMaster lite** power adapter 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.

There are no user serviceable parts inside the **LineMaster lite**. 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 LED's 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 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 **LineMaster lite** and how the various functions of the **LineMaster lite** are set up and used.

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

Copyright Screen

```
NT Simulator (XXX) Vx.xx dd mmm yyyy S/N xxxxxxxxx
```

```
XX XX  
B1 B2
```

```
X.25 version Vx.xx
```

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 **LineMaster lite**.

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.

The **LineMaster lite** now displays the main set up screen, shown in Figure 6.

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

Fig 6 Main System Menu

Changing Parameters

The set up of the **LineMaster lite** is structured rather like a tree with the menu of Figure 6 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 6 are as follows :-

Hardware Setup

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

Software Setup

This function allows you to change the operation of the **LineMaster lite** 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 Sub-Addressing.

SOFTWARE SETUP

- 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 B channel and the special purpose telephone numbers.
- Hardware Setup Screen** On selecting this option you are presented with the screen of Figure 7.

Hardware Setup

```
Coms Port Baud Rate      xxxx
Coms Port Parity         xxxx
Coms Port Stop Bits      xxxx
Coms Port Data Bits      xxxx

NT(LT)/Permanent Bchan  xxxx
70V/40V Power           xxxx
70V Power Operation     xxxx
40V Power Operation     xxxx
S Bus Timing            xxxx
Selected Tone           xxxx
Ch1/B1 Delay            x   ms
Ch1/B2 Delay            x   ms
```

Fig 7 Hardware Setup Menu

All of the fields in Figure 7 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) / Permanent B Chan** The **LineMaster lite** will function only in NT simulation mode and in permanent B channel Mode.
- Permanent B Channel Connection disables normal ISDN signalling and allows for the creation of permanent connections between B channels. Any B channel on any interface can be connected to any other B channel. The D channels are not connected.
- If the Permanent B Channel Connection is selected you can configure the B Channels by typing <enter>. The screen if figure 8 is displayed.

Permanent B Channel Connection Setup

```
BRI1 B Channel 1 -> BRIx B Channel x
BRI1 B Channel 2 -> BRIx B Channel x
BRI2 B Channel 1 -> BRIx B Channel x
BRI2 B Channel 2 -> BRIx B Channel x
```

Figure 8 B Channel Connection Setup Menu

To change the B channel connections move to the relevant field and press <space> until the desired B channel is selected

- 70V / 40V Power** Setting this to ON forces the **LineMaster lite** to provide a nominal 40 V 1 W dc supply to the ISDN S₀ - interface and a 70V 1.5 W dc supply to the U interface if any terminal adapters or ISDN telephones require it.
- 40V 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 S₀ interface will switch polarity. This field should be set to normal operation unless you wish to test the terminal adapter operation in

SOFTWARE SETUP

restricted power mode.

70V Power Operation

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 70 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 **LineMaster lite** can generate a tone on a B channel whenever a terminal dials a particular telephone number (see Telephone Number Setup). 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.

Software Setup Screen

On selecting this option the screen of Figure 9 is displayed.

Software Setup

```
Network Type
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 BRI        n
Use Service Profile IDs (SPIDs)    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 X25 Setup                xxxxx
```

Fig 9 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 USA Network Personality Module only.

Drop Layer 2 if No Call Active

If activated the **LineMaster lite** 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

Timeout until L2 Dropped (secs) nn

Fig 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 **LineMaster lite** will deactivate layer 1 immediately layer 2 becomes inactive.

Drop TEI if Layer 1 Inactive

If activated the **LineMaster lite** will remove its TEI value(s) once

SOFTWARE SETUP

the layer 1 is deactivated. The terminals will then have to send an ID Request once they become active again.

Number of Datalinks per BRI

To set each 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
```

```
BRI # 0          xxxxx
BRI # 1          xxxxx
```

Fig 11 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)

If activated the **LineMaster lite** will accept a Service Profile Identifier from the terminal and assign a Terminal Endpoint to it. 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
```

Fig 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.

Allow Overlap Sending/Receiving

If activated the **LineMaster lite** 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 **LineMaster lite** 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.

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.

N.American Only

The numbering option in the Software setup has been re-worded.

SOFTWARE SETUP

- 2 DN/2 SPID (Fixed B)** Each BRI port has 1 Directory Number (DN) and 1 SPID number for each B channel. (Normal Mode)
- 2 DN/2 SPID/MSN** Each BRI port has 2 Directory Numbers (DN) and 2 SPID numbers. MSN also operates in this mode.
- 1 DN/1 SPID (x2)** Each BRI port has 1 Directory Number (DN) and 1 SPID number only.(Auxillary Working)

In N.American software there is no Direct Dialling In.

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 **LineMaster lite** 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 **LineMaster lite**.

Note that a Called Party Number is always included in the SETUP message from the LineMaster lite 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 13.

Called Party Number Setup

```
Type          tttttttt
Plan          pppppppppp
```

Fig 13 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 **LineMaster lite** 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 **LineMaster lite** to the destination terminal. This is the network

SOFTWARE SETUP

generated directory number if the calling terminal did not send a Calling Party Number information element in its transmitted SETUP message to the **LineMaster lite** or simply a copy of the terminal supplied number it did include a Calling Party Number information element in its transmitted SETUP message to the **LineMaster lite**.

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

```
Calling Party Number Setup

Type          tttttttt
Plan          pppppppppp
Screening     ssssssssss
Presentation  pppppppppp
```

Fig 14 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 **LineMaster lite** 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.

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.

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 Sub

SOFTWARE SETUP

Address information element in its transmitted SETUP message to the **LineMaster lite**. 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 send a Calling Party Subaddress information element in its transmitted SETUP message.

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 **LineMaster lite** 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 15 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.
- Teletex - basic.
- 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.

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 **LineMaster lite** generates this information element from the Bearer Capability information element.

D Channel X.25 Setup

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

SOFTWARE SETUP

When activated typing <enter> when on this field allows you to configure the parameters of each interface. The screen of figure 19 is displayed.

X.25 Setup

```
BRI1 PVC LLC          xxxxxxxxxxxx
BRI1 PVC HLC          xxxxxxxxxxxx
BRI1 LOC              xxxxxxxxxxxx
BRI1 HOC              xxxxxxxxxxxx
BRI2 LTC              xxxxxxxxxxxx
BRI2 HTC              xxxxxxxxxxxx
BRI2 LIC              xxxxxxxxxxxx
BRI2 HIC              xxxxxxxxxxxx
BRI2 TEI Value       xxxxxxxxxxxx

BRI1 PVC LLC          xxxxxxxxxxxx
BRI1 PVC HLC          xxxxxxxxxxxx
BRI1 LOC              xxxxxxxxxxxx
BRI1 HOC              xxxxxxxxxxxx
BRI2 LTC              xxxxxxxxxxxx
BRI2 HTC              xxxxxxxxxxxx
BRI2 LIC              xxxxxxxxxxxx
BRI2 HIC              xxxxxxxxxxxx
BRI2 TEI Value       xxxxxxxxxxxx
```

Figure 19 X.25 Setup Screen

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.

The first two entries on each channel are used to specify the highest and lowest logical channel number for Permanent Virtual Connections. The next six entries are used to specify highest and lowest logical channels for outgoing calls, highest and lowest logical channels for bothway calls and the highest and lowest logical channels for incoming calls. Lastly the fixed TEI value to be used on the particular channel is specified.

X.25 restart

RESTART on L2 establish xx

Force simulator to issue a RESTART message when L2 establishes. For more information on X.25 refer to Appendix 1.

Terminal Setup

On selecting this option the user is presented with the screen of Figure 15.

```
Terminal Setup
Terminal Type      ttttt
```

Fig 15 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

On selecting this option the screen of Figure 16 is displayed.

```
Telephone Number Setup

BRI 1 B1 Number      xxxx
BRI 1 B2 Number      xxxx
BRI 2 B1 Number      xxxx
BRI 2 B2 Number      xxxx

Busy Number          xxxx
Unallocated Number   xxxx
No User Responded Number      xxxx
```

SOFTWARE SETUP

Call Rejected Number		xxxx
Out of Order Number	xxxx	
Temporary Failure Number	xxxx	
No Answer Number		xxxx
Test Tone Number		xxxx

Fig 16 Telephone Number Setup Menu

The fields of Figure 16 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.

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 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 except that the Called Party Number information element is always enabled for MSN operation.

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 **LineMaster lite** 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.

FAULT FINDING

Introduction	This section seeks to provide some guidance on solving common problems encountered in using the LineMaster lite .
Changing a parameter on the LineMaster lite forced it to stop operating	<p>Changing parameters on the LineMaster lite may cause the unit to change operating modes and appear to stop functioning.</p> <p>To recover from this condition reload the factory defaults. When the LineMaster lite powers up the configuration LED's will light for about 1 second. During this period if the LineMaster lite receives a <ctrl-c> character it will reload the defaults. The LineMaster lite defaults to 19200 baud, 2 stop bits, 8 data bits and no parity during this period.</p>
Terminal will not activate at layer 1 (i.e. P led does not illuminate)	<p>If the P LED does not illuminate then the physical connection between the terminal and the LineMaster lite 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 70 V / 40 V power supply. If this does not help switch power operation between normal and restricted if the terminal is connected to a So BRI.</p> <p>For US originating products with U interfaces then the U interface power should be set to sealing. To power NT-1's the U interface power should be set to Normal. Be careful when switching to U interface to normal power as products intended to be connected to a current limited U interface may be damaged by non current limited power.</p>
Terminal will not answer a call	<p>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 LED's 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 or 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.</p> <p>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.</p> <p>Another possibility is that the terminal requires a Subaddress. Switch on Called Party Subaddress and Calling Party Subaddress in the Software Setup Menu.</p>
Terminal can dial only one number to set up two calls	<p>If the calling terminal can be programmed with one telephone number to dial two calls then the LineMaster lite. Numbering System option must be switched from Normal to Auxilary Working, MSN or DDI. In Normal operation each B channel has a separate telephone number. To call B1 on interface 2 dial 384020 and to dial B2 on interface 2 dial 384030 (if using the default numbering system).</p> <p>The other possibilities are :-</p>

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. 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 **LineMaster lite**. 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 / Properties 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 **LineMaster lite** 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 **LineMaster lite** 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 **LineMaster lite** 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 **LineMaster lite** is not powering up properly because the network personality module installed in the **LineMaster lite** will not start up and the LED's on the front panel may flash. In this case see section entitled Network Personality Module will not work.

Overlap receiving will not work

Overlap Sending/Receiving is available on the **LineMaster lite** and operates as follows.

Overlap Sending used to dial the call

Here the calling terminal sends a SETUP message to the **LineMaster lite** without any Called Party Number information. The

LineMaster lite 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 **LineMaster lite** has received enough digits to route the call the **LineMaster lite** 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 **LineMaster lite** 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 **LineMaster lite** 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 **LineMaster lite** and the **LineMaster lite** will send CALL PROCEEDING to the calling terminal followed by ALERTING or CONNECT as appropriate.

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. 384000 for BRI 1) are sent in the Called Party Number information element.

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 **LineMaster lite**. 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 **LineMaster lite** 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 **LineMaster lite**.

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

FAULT FINDING

element included.

It is worth checking if the terminal (say PABX) requires point-point operation at the **LineMaster lite** 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 LineMaster lite

Some parameters once changed will not effect the operation of the unit immediately. If the **LineMaster lite** 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 **LineMaster lite** off and on again. Please inform your supplier.

Garbage appears on screen everytime I power on

The most likely reason for this is the simulator and software Communications Package (eg.Hyperterminal) are at two different Baud Rates. To rectify this, you can either go through the various baud rates on the Communications Package until the correct one is found, or do a Factory Reset (ensuring you use a Baud Rate of 19200 on the Comms Package) when typing Control-C.

Introduction

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

Figure 20 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 Datalinks per Channel   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
```

Fig 20 ETSI Software Setup Menu

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 :-

- u 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.

Introduction

This section outlines the differences in operation of the **LineMaster lite** between the CCITT emulation provided on the standard **LineMaster lite** 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.
- KEY SETUP.
- ACKNOWLEDGE.

These are not used in the **LineMaster lite**.

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

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

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 **LineMaster lite** 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-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, u-law.
- Rate is 56k.
- Layer 2 protocol is LAPD, LAPB.
- Layer 3 protocol is X.25.

**Main Differences Between
CCITT and Nortel DMS100.
Main Differences Between
CCITT and AT&T 5ESS.**

This section to be defined.

This section to be defined.

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Purpose

The aim of this section is to give users a guide to the setup involved when using the X.25 option on the ISDN-Simulator. The X.25 implementation was developed to aid customers demonstrating user X.25 TE equipment. The X.25 functionality on the MINIAMT is limited and may not be suitable for the development of customer equipment.

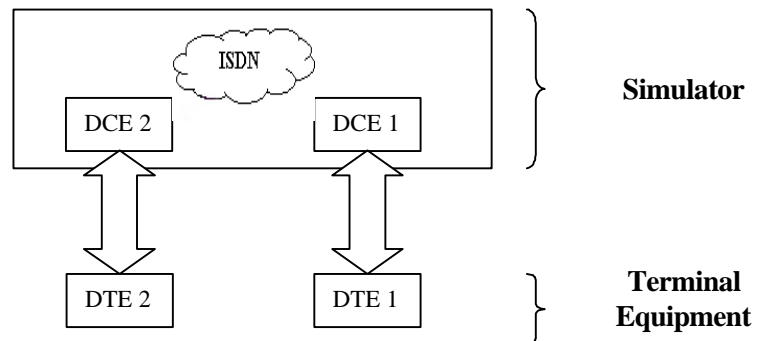
Example Setup

For the purpose of this example, An X.25 call will be placed from DTE 1 to DTE 2.

DTE 1 calls DCE 1

Call is routed through the ISDN cloud

DCE 2 call DTE 2



X-25 Setup Menu on the MINIAMT

Permanent Virtual Circuits (PVC's) – This is like a leased line connection, where a permanent connection is established between the two DTE's.

Switched Virtual Circuits (SVC's) – In this case the connection between the two DTE's is on a Temporary basis, and is only maintained for the duration of the call.

Parameters

Below is a list of the default values associated with the setup of the simulator (i.e. the DCE).

BRI1 PVC LLC	0 - Lowest Logical Channel (PVC)
BRI1 PVC HLC	0 - Highest Logical Channel (PVC)
BRI1 LOC	1 - Lowest Outgoing Channel (SVC)
BRI1 HOC	2 - Highest Outgoing Channel (SVC)
BRI1 LTC	3 - Lowest Two-way Channel (SVC)
BRI1 HTC	4 - Highest Two-way Channel (SVC)
BRI1 LIC	5 - Lowest Incoming Channel (SVC)
BRI1 HIC	6 - Highest Incoming Channel (SVC)
BRI1 TEI	1 - TEI Value to be used (Default 1)
BRI2 PVC LLC	0 - Lowest Logical Channel (PVC)
BRI2 PVC HLC	0 - Highest Logical Channel (PVC)
BRI2 LOC	1 - Lowest Outgoing Channel (SVC)
BRI2 HOC	2 - Highest Outgoing Channel (SVC)
BRI2 LTC	3 - Lowest Two-way Channel (SVC)
BRI2 HTC	4 - Highest Two-way Channel (SVC)
BRI2 LIC	5 - Lowest Incoming Channel (SVC)
BRI2 HIC	6 - Highest Incoming Channel (SVC)
BRI2 TEI	1 - TEI Value to be used (Default 1)

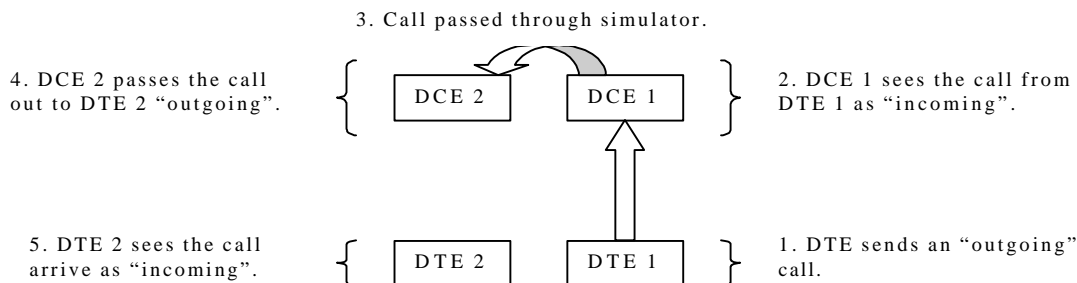
There should be similar options on the DTE, and it is important that the above settings within the simulator (i.e. DCE) match those of the DTE's. It is also worth noting that what is deemed as outgoing at

X25 OPERATION

one side is deemed as incoming at the other.

To expand on this:

When placing a call from DTE 1 to DTE 2 the following happens.



The process is reversed for a call in the opposite direction (i.e. DTE 2 to DTE 1).

Logical channel Setup

Assuming that the simulator settings are not changed (highlighted in grey below), then the DTE settings will be as follows.

DTE	Channel
<i>Outgoing</i>	5 & 6
<i>Two-way</i>	3 & 4
<i>Incoming</i>	1 & 2
DCE	Channel
<i>Incoming</i>	5 & 6
<i>Two-way</i>	3 & 4
<i>Outgoing</i>	1 & 2

The Two-way channels are used as reserve logical channels, and as they are bi-directional they support both Incoming and Outgoing.

TEI Value

Pressing <Enter> can change the Terminal Endpoint Identifier. As default this value is set to "1".

Called Party Number

When using SVC's it is necessary to send the called party number, as the call is still using the ISDN network. However, depending upon the Terminal Equipment being used, this may be called one of the following.

1. Called Party Number
2. Telephone number
3. Address
- Etc.

Restarts

Whenever an X25 call is being set up, a RESTART message must be sent. Normally the DTE will do this, however, due to a generalisation in the specification, some DTE's do not have this capability. For this reason an option has been implemented for the simulator to send a RESTART on Layer 2 establishment.

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