ISDN LineMaster

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INTRODUCTION

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

The **LineMaster** provides three basic rate interfaces (BRI) into which ISDN terminal equipment (e.g. terminal adapters, ISDN telephones, PABXs, video conferencing systems) can be plugged. The BRIs may be either S_0 interfaces (i.e. I.430 compatible) or U interfaces (i.e. ANSI T1.601 compatible). All 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 **LineMaster** supports unrestricted digital, voice, 3.1kHz audio, V.110 and V.120 bearer capabilities. The **LineMaster** 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 μ law) are provided for voice/3.1 kHz terminals.

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

As a terminal adapter the **LineMaster** will provide up to six X.21 data channels at 64kbps or 56kbps. Calls are set-up and cleared down using simple commands on the terminal attached to the control port.

Also available as a software option is a protocol analyser. When activated it will report what is happening at each of the 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 you can select one of four possible modes of operation:-

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

OR

- Display message contents in detail, decoding all the information elements at layer 3.

The originator, the interface number and the time are clearly identified in each message.

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

In addition the data passed between BRI1 and BRI2 can be delayed by up to 750ms thus simulating the effects of satellite delays.

Finally the **LineMaster** ISDN signalling can be disabled and permanent B channel connections established between each interface. This manual outlines how the **LineMaster** 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 **LineMaster** 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

Unpack the **LineMaster**. There should be a Terminal Cable (DB9-DB9), three 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 (**LineMaster** will work on 110V or 240V mains supply without adjustment).

Plug terminals into correct interface

Plug terminals into correct interface (power up screen will tell you what interfaces are installed on the **LineMaster**).

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

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

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 and vice-versa).

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 Parity Stop Bits Data Bits	19,200 None 2 8
40 V Power	ON
100 Ω Terminators	In
Use SPIDS Numbering Option	Optional Multiple Subscriber Numbering
CLIP	ON
BRI 1 BRI 2 BRI 3	384000/10 384020/30 384040/50

Table 1 **LineMaster** Default Settings

ISDN Connections Network Simulator Mode

The **LineMaster** provides any mix of three ISDN S_0 or U interface ports operating in NT mode. The BRI interfaces can optionally provide 40V, 1W supply to power terminal equipment.

ISDN Connections Terminal Equipment Mode

The **LineMaster** provides any mix of three ISDN S_0 or U interface ports operating in TE mode. The S_0 bus 100 ohm termination resistors can be isolated under software control allowing other equipment to be connected to the line.

Transparent Mode

A terminal is connected to the **LineMaster** BRI1 interface and the **LineMaster** BRI2 interface is then connected to the network. All terminal/network messages pass through the **LineMaster** unaltered. The protocol analyser can decode these messages and terminal power can be provided locally.

Permanent B Channel Connections

Normal ISDN Signalling is suspended and permanent connections made between the BRI interfaces.

LED Indicators

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:-

- Physical layer activated.
- Data link layer activated.
- 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.
- Power is on.
- **LineMaster** is using Network Personality Module.

Data Ports

Six X.21 compatible data ports are available at the rear of the **LineMaster**. These provide access to the ISDN network in TE mode and also allows external test equipment to be connected to the B channels while in NT mode.

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.

Auxiliary Port

The auxiliary port receives or transmits clock and frame information which allows several **LineMaster**s to be locked to a single reference clock. This is useful if more than three BRIs are required for a particular application. This can be used to facilitate six simultaneous calls on a back to back configuration.

Network Personality Module

The **LineMaster** 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.

Unpack the LineMaster

First unpack the **LineMaster** 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:-

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

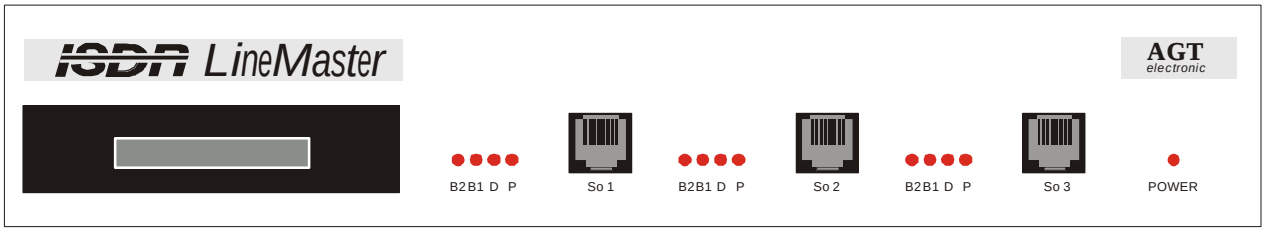


Figure 1 The **LineMaster** Front Panel

The BRI1, BRI2 and BRI3 connectors provide the S_0 or U interface ports. It is important that nothing is connected into these ports until the unit is set-up properly. Connecting the **LineMaster** when in simulator mode, with the power supply active, to the telephone network is liable to damage the network or the **LineMaster**.

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 **LineMaster**. If this occurs the **LineMaster** will restore the factory defaults. This is useful if a setting has been changed and the **LineMaster** ceases to operate as a result. Powering up the **LineMaster** and immediately typing <ctrl-c> will restore a working configuration to the **LineMaster**.

Note that while the above process is occurring the **LineMaster** will default to TE mode with no interface power applied

Interface Pinout

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

S_0 Interface Pinout (NT Mode)

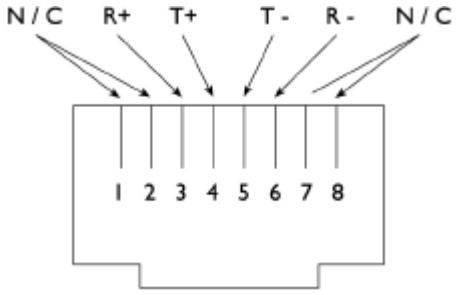


Figure 2a RJ45 Signals (S Interface NT Mode)

S_0 Interface Pinout (TE Mode/Transparent Mode)

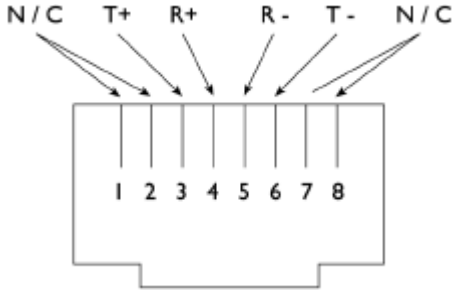


Figure 2b RJ45 Signals (S Interface TE Mode)

U Interface Pinout

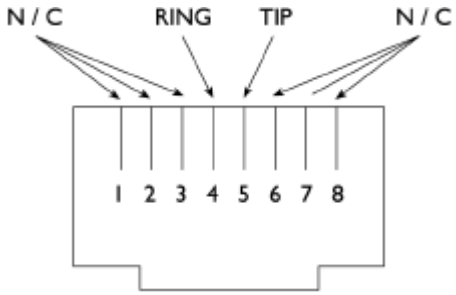


Figure 2c RJ45 Signals (U Interface)

Interface Configuration in Terminal Equipment Mode

When using the **LineMaster** in Terminal Equipment Mode (i.e. as a Terminal Adaptor) the ISDN cables provided are plugged into the interfaces on the **LineMaster** and into the Network Termination equipment provided by the local telephone company. The order in which cables are connected is not important.

Interface Configuration in Transparent Mode

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

In 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 **LineMaster**.

The LEDs perform no function in Transparent Mode.

Figure 3a shows a schematic of how the power is generated at the

ISDN S_0 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.)

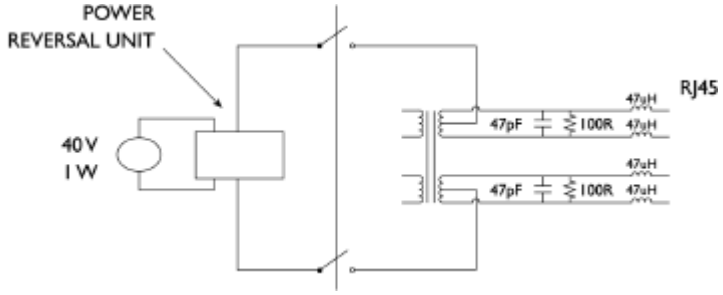


Figure 3a Schematic of 40 V Power Supply (S_0 I / F)

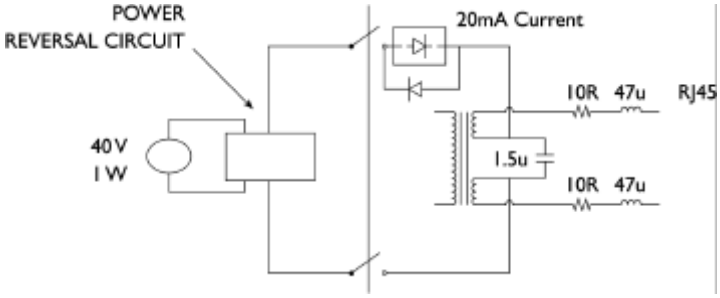


Figure 3b Schematic of 40 V Power Supply (U I / F)

LED Indicators

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

In addition the Power LED lights whenever 5V power is present in the unit.
When the **LineMaster** is first switched on all the LEDs will illuminate. They will then extinguish and the four channel BRI3 LEDs will indicate, for about 1 second, the configuration being used. The **LineMaster** 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.

PLED	Name	Description
P	ON	NT Mode
	OFF	Transparent Mode
D	ON	BRI Power Active
	OFF	BRI Power Inactive
B1	ON	BRI Terminators In
	OFF	BRI Terminators Out
B2	ON	Local Clock
	OFF	Remote Clock

Table 2 Power Up Configuration

Network Personality Module

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

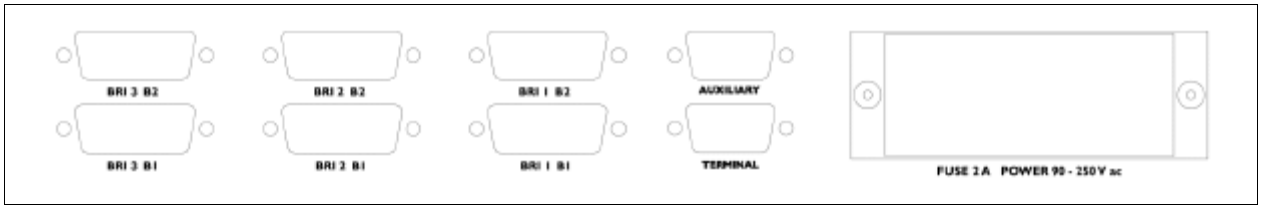


Figure 4 **LineMaster** Back Panel

Terminal Port

The **LineMaster** has one V.24 compatible terminal port in 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 3 lists the operation of each pin.

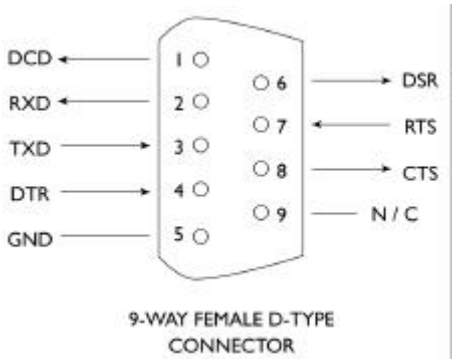


Figure 5 V.24 Terminal Port

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** can receive Data)

Table 3 Terminal Port Pin Description

X.21 Data Ports

The **LineMaster** has six X.21 data ports on the back panel. A single X.21 connector is provided for each ISDN interface B channel. Figure 6 shows the pinout of each X.21 connector. Table 4 lists the X.21 signals and describes each one.

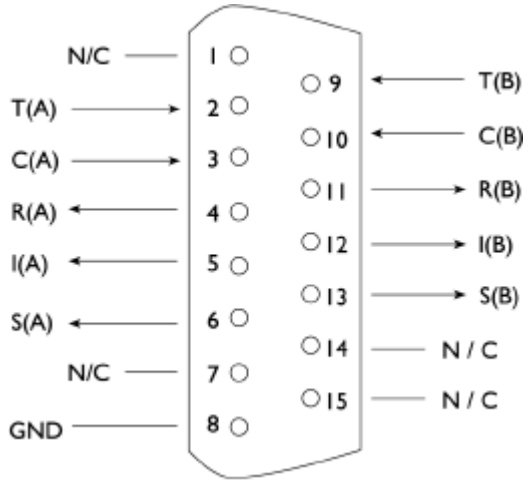


Figure 6 X.21 Data Port

Pin	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

Auxiliary Port

The auxiliary port is currently used only to allow the **LineMaster** to receive network clock and frame synchronisation from another **LineMaster**. This forces the two **LineMaster**s to align their ISDN data to each other allowing a terminal requiring more than 3 BRI interfaces to be connected to multiple **LineMaster**s.
The pinout of this port is shown in figure 7. Table 5 defines the signals supplied on the auxiliary port.

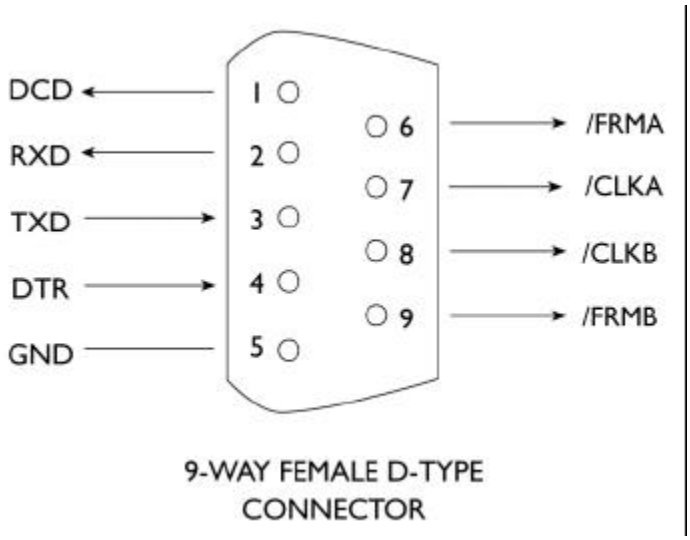


Figure 7 Auxiliary Port Pinout

Pin	Function	Description
6	/FRMB	8kHz frame pulse signal to enable two **LineMaster**s to lock frame alignment
9	/FRMA	8kHz frame pulse signal to enable two **LineMaster**s to lock frame alignment
2	RXD	V.24 Received Data (output)
3	TXD	V.24 Transmitted Data (input)
7	/4CLKA	4.096 MHz clock signal to enable two **LineMaster**s to lock clock Frequencies
8	/4CLKB	4.096 MHz clock signal to enable two **LineMaster**s to lock clock Frequencies
5	GND	Ground
1	DCD	V.24 Data Carrier Detect (always active)
4	DTR	V.24 Data Terminal Ready (input – ignored)

Table 5 Auxiliary Port Signal Definitions

Start-up Sequence

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

The factory default settings for the **LineMaster** are 19200 baud, 8 data bits, 2 stop bits, no parity, although you can change these settings. If the **LineMaster**'s settings in memory become corrupt it may not be possible to operate the terminal, as the baud rate may be wrong. The **LineMaster** 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 **LineMaster** power connector will accept an IEC mains lead (supplied). The **LineMaster** 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.

Warning - Earth the LineMaster

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 **LineMaster.** 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.

Introduction

This chapter outlines the user interface of the **LineMaster** and how the various functions of the **LineMaster** 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

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

XX XX XX
 B1 B2 B3
 X.25 version Vx.xx
```

Figure 8 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 **LineMaster**.

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** now displays the main set up screen, shown in figure 9.

```
Hardware Setup
Software Setup
Terminal Setup
Telephone Number Setup
Analyser Setup
AT Command Processor
```

Figure 9 Main System Menu

Changing Parameters

The set up of the **LineMaster** is structured rather like a tree with the menu of figure 9 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 9 are as follows:-

Hardware Setup

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

Software Setup NT Mode

This function allows you to change the operation of the **LineMaster** 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 TE Mode

This function is identical to NT mode except that no control over network facilities is allowed.

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.

Analyser Setup

This function allows you to change the analyser options.

AT Command Processor TE mode only

This function, available only in TE mode, allows the user to control the **LineMaster** as a three channel terminal adaptor using a subset of the ubiquitous 'AT' command set. The commands available are outlined in Chapter 3 AT Commands.

Hardware Setup Screen

On selecting this option you are presented with the screen of figure 10.

```
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
     S Bus Timing                 xxxx
     Selected Tone                xxxx
     BRI1/B1 Delay                xxxx
     BRI2/B2 Delay                xxxx
     Data Port 1 Mode             xxxx
     Data Port 2 Mode             xxxx
     Data Port 3 Mode             xxxx
     Data Port 4 Mode             xxxx
     Data Port 5 Mode             xxxx
     Data Port 6 Mode             xxxx
```

Figure 10 Hardware Setup Menu

All of the fields in figure 10 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), or Line Terminator Mode (LT) on a U interface, Terminal Equipment Mode (TE) and Transparent Mode and Permanent B Channel Connection Mode.

In NT mode the **LineMaster** will simulate an ISDN network, allowing up to nine terminals to be plugged in and to call each other (i.e. three terminals per interface).

In Transparent Mode a terminal is plugged into BRI1 while BRI2 is connected to the Public ISDN network. Calls can be made on the public network through the **LineMaster**, which passes all messages transparently.

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 11 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
     BRI3 B Channel 1 ->  BRIx B Channel x
     BRI3 B Channel 2 ->  BRIx B Channel x
```

Figure 11 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

100 ohm Terminators

This field configures the 100 ohm terminating resistors on the ISDN S_0 interfaces. (Note - changing this option has no effect on U interface module).

If the LineMaster is in TE mode and plugged into an ISDN S_0 interface connection in parallel with another terminal adaptor which contains terminating resistors then this field should be set to OUT, otherwise it should be set to IN.

In NT(LT) mode the field will automatically be set to IN.

If the **LineMaster** is in 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.

40V Power

Setting this to ON forces the **LineMaster** to provide a nominal 40V 1W dc supply to the ISDN S_0 interface or U interface if any terminal adapters or ISDN telephones require it.

This should normally be turned ON in NT(LT) mode and 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 power on an ISDN BRI S_0 interface and from sealing to full line power on an ISDN BRI U interface. This field should be set to normal/sealing operation unless you wish to test the terminal adapter operation in restricted power mode or operate an NT-1 using line power.

Note that the U interface module in sealing mode is fitted with a current limiter circuit that restricts the total current to 20 mA. Switching to restricted/non-sealing 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 NT-1s and other line powered devices but will damage any equipment designed to operate with sealing current only.

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 **LineMaster**. Both **LineMaster** interfaces are then synchronised at the same

speed. This field must be set to LOCAL if only one **LineMaster** is being used and REMOTE to receive clocking signals from another **LineMaster**.

S_0 Bus Timing In NT mode using an S_0 interface this field will switch between adaptive timing and fixed timing on the S_0 interface. Use adaptive timing if the S_0 interfaces have long cables attached.

Selected Tone The **LineMaster** 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.

B Channel Delay The **LineMaster** can be programmed to insert a time delay into the BRI1 B channels. Both B1 and B2 can be programmed for different delay values.

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.

Outgoing calls can be either 64kbps unrestricted digital or V.110 56kbps. Changing the outgoing mode changes the bearer capability information element included in the SETUP message.

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 Data Links per Channel  xxxx
    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
    Calling Party Subaddressing       xxxx
    Higher Level Compatibility        xxxx
    Lower Level Compatibility         xxxx
    D-Channel X25 Setup               xxxx
```

Figure 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 **LineMaster** 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.

```
L2 Drop Timeout Setup

Timeout until L2 Dropped (secs) nn
```

Figure 13 Drop Timeout Menu

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

Drop Layer 1 if Layer 2 Inactive

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

Drop TEI if Layer 1 Inactive

If activated the **LineMaster** 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 Data Links per Channel

You can choose either 1 or 2 data links per interface in TE mode. The **LineMaster** will set up the required number of datalinks. When more than one datalink is requested a call on B1 will be set up on the first datalink and a call on B2 will be set up on the second datalink. Otherwise both calls will be set up on the single datalink. In NT mode three datalinks may always be used.

To set each 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

    BRI 1                   xxxx
    BRI 2                   xxxx
    BRI 3                   xxxx
```

Figure 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 **LineMaster** to accept a Service Profile Identifier from the terminal and assign a Terminal Endpoint to it. While using the NAT/AT&T/DMS network personality card this field can be set to (a) Optional - SPIDs may be used but if they are not calls can still be made (b) Mandatory – SPID initialisation must be completed successfully before calls can be made (c) AutoSPID - same as (b) but the AutoSPID feature of National ISDN 1997 i.e. enabled. If using any other network support card (or none) this field is fixed at Optional. If this field is activated you can press <enter> to set up the SPIDs and the screen of figure 15 is presented.

```
Service Profile Identifier Setup

    Channel #1 Tel No tttttt              sssssssss
    Channel #1 Tel No tttttt              sssssssss
    Channel #2 Tel No tttttt              sssssssss
    Channel #2 Tel No tttttt              sssssssss
    Channel #3 Tel No tttttt              sssssssss
    Channel #3 Tel No tttttt              sssssssss
```

Figure 15 Service Profile ID Setup Menu

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** 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 5 on section entitled “Overlap Receiving Will Not Work”.

The remaining options affect the contents of the SETUP message sent from the **LineMaster** 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 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.

N.American Software only

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

2 DN/2 SPID (Fixed B)

Each BRI port has 1 Directory Numbers (DN) and 1 SPID numbers for each B channel.

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 Numbers (DN) and 1 SPID numbers only.

In N.American software there is no Direct Dial In option

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.** 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**.

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

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

```
Called Party Number Setup

Type                    ttttttt
Plan                    ppppppppp
```

Figure 16 Called Party Number IE Setup

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

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

```
Calling Party Number Setup

     Type                 tttttttt
     Plan                 ppppppppp
     Screening            sssssssss
     Presentation         ppppppppppp
```

Figure 17 Calling Party Number IE Setup

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

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 **LineMaster**. 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.

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

If activated pressing <enter> when on this field allows you to map the “information transfer capability” field of the Bearer Capability information element to the “high layer characteristics identification” of the High Layer Compatibility information element (see Q.931). To 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

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** 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. 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            xxxxxxxxxx
     BRI1 PVC HLC            xxxxxxxxxx
     BRI1 LOC                xxxxxxxxxx
     BRI1 HOC                xxxxxxxxxx
     BRI2 LTC                xxxxxxxxxx
     BRI2 HTC                xxxxxxxxxx
     BRI2 LIC                xxxxxxxxxx
     BRI2 HIC                xxxxxxxxxx
     BRI2 TEI Value          xxxxxxxxxx

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

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, see Appendix 1.

Terminal Setup Screen

On selecting this option you are presented with the screen of figure 20.

```
Terminal Setup

Terminal Type            ttttt
```

Figure 20 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 21 is displayed.

```
Telephone Number Setup

     BRI1 B1 Number                    xxxx
     BRI1 B2 Number                    xxxx
     BRI2 B1 Number                    xxxx
     BRI2 B2 Number                    xxxx
     BRI3 B1 Number                    xxxx
     BRI3 B2 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 B1 Number               xxxx
     Data Port B2 Number               xxxx
```

Figure 21 Telephone Number Setup Menu

The fields of Figure 21 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 (are) treated as a wildcard, i.e. if BRI1 B1 Number is set to 384010 and you dial 384016 a connection

will be made to BRI1 B1. If Auxiliary Working is enabled all B channels on an interface use the same telephone number but only one 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 **LineMaster** 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.

AT Commands

The **LineMaster** while configured in TE mode can be operated by means of an AT command set. Extensions are provided to control the ISDN functions, such as B-channel selection.

Under the AT command set, each string of commands must begin with an AT and be terminated by carriage return. Commands are not interpreted until the carriage return is received. Commands may be entered in either upper or lower case.

The AT may be followed by any number of setting commands, in any sequence. Commands are interpreted sequentially until an action command or a syntax error is signalled. All commands after an action command or syntax error are ignored. Examples of action commands are Dial (D), Answer (A) and Hangup (H).

Editing is allowed by means of backspacing. A line may be aborted by <ctrl x>.

Note that commands which need a parameter will be given a default value if the given parameter in the command string is out of range or not given at all.
Note that the command interpreter operates only in command mode. Calls are connected using the ATCnD command but the user always remains in command mode. Successful calls connect directly to the X.21 data ports and operate only in synchronous 64 kbps or 56 kbps.

The AT Command Set

A - Answer

The **LineMaster** will answer an incoming call on the relevant data port if one is present.

A/

Re-execute the last command line.

C - ISDN Channel Select

Selects the channel to be used for following commands.

Parameters:-

0 – BRI1 B Channel 1.
1 – BRI1 B Channel 2.
2 – BRI2 B Channel 1.
3 – BRI2 B Channel 2.
4 – BRI3 B Channel 1.
5 – BRI3 B Channel 2.

&C - X.21 INDICATE Option

The **LineMaster** will operate the relevant X.21 INDICATE signal in accordance with the parameter supplied.

Parameters:-

0 –INDICATE shall remain on at all times.
1 –INDICATE shall remain off at all times.
2 –INDICATE shall be on only if there is an active call.

D - Dial

This command directs the **LineMaster** to attempt to establish a connection on the relevant port. No command following the dial command will be interpreted.

Parameters :-

[0-9] digits 0 – 9.
S The stored Telephone Number.
L Last number redial

&D - CONTROL Option

This command controls how the **LineMaster** responds to the X.21 CONTROL signal according to supplied parameter.

Parameters :-

0 **LineMaster** will ignore the state of the CONTROL signal.
1 **LineMaster** will drop an active call if CONTROL is in an inactive state
2 **LineMaster** will attempt to establish a call using the stored telephone number if CONTROL is active.

E - Command echo

Enables and disables echo of the command string to the terminal.

Parameters :-

0 Echo off.
1 Echo on. (default)

F - Select X.21 Profile

Selects the profile for outgoing and incoming calls according to the supplied parameter.

Parameters :-

0 Outgoing 64 kbps calls. Accept incoming 64 kbps calls
1 Outgoing 64 kbps calls. Accept incoming 56 kbps calls
2 Outgoing 64 kbps calls. Accept either 64 kbps or 56 kbps incoming calls
3 Outgoing 64 kbps calls. Accept any incoming call
4 Outgoing 56 kbps calls. Accept incoming 64 kbps calls
5 Outgoing 56 kbps calls. Accept incoming 56 kbps calls
6 Outgoing 56 kbps calls. Accept either 64 kbps or 56 kbps incoming calls
7 Outgoing 56 kbps calls. Accept any incoming call

Note that these settings are also displayed on the Hardware Setup Screen.

&F - Restore factory configuration

Reload the specified factory default configuration.

H - Hangup

This command disconnects the call connected to the selected port.

&H - Toggles Command Commentary

Deciphering or debugging an AT command string can often be quite time consuming. The Command commentary displays a description of each command as it happens.

I - Identification

Causes the **LineMaster** to return product identity and version information.

Parameters :-

0 returns the product code i.e. contents of S38. (default)
1 returns version number and release date of system software.
2 returns copyright notice.

&O - S-Register format

Allows the input and output of S-Registers in either hexadecimal or decimal format.

Parameters :-

0 Decimal format (default)
1 Hexadecimal format

Q - Quiet control

This command enables or disables the sending of result codes according to the parameter supplied.

Parameters :-

0 Disable result codes.
1 Enable result codes.

%R - Prints the contents of the S-registers.

S - Read /Write S-registers

To read an S-Register :- ATSn?
To write an S-Register :- ATSn=v

where n is the number of the register, and v is the value to be written.

After the first use of ATS, a default S-Register is set. Any subsequent changes to the specified S-Register, do not need to identify it. For example,

ATS2=0 .. will set S2 as default).
ATS? .. will print the contents of the default register (S2).

&V - Display directory Displays the contents of the phone number written to with the AT&Z command.

V - Result code form This command is used to select short-form or long-form result codes as responses to commands.

Parameters :-

0 enables short-form (numeric) result codes.
1 enables long-form result codes. (default)

&W - Store configuration Stores the current configuration in the specified profile.

Z - Reset This will force the **LineMaster** to do a soft reset and recover the stored configuration.

&Z - Store telephone number Stores a number which can be retrieved by ATDS.

AT Commands by Function

Action Commands

A - Answer
A/ - Re-execute the last command line
D - Dial
H - Hangup
&H – Toggles Command Commentary
I - Identification
%R - Prints the contents of the S-registers.
S - Read /Write S-registers
Z - Reset

General Setup

C - ISDN Channel Select
E - Command echo
F - Select Port Profile
&F - Restore factory configuration
&I - Short verbose result codes
&O - S-Register format
Q - Quiet control
V - Short-form or long-form result codes
&V - Display directory
&W - Store configuration
&Z - Store telephone number

Results and Responses

The **LineMaster** responds to commands and to activity on the line by issueing the following messages :-

OK

The OK result acknowledges successful execution of an AT command line.

CONNECT xxxxx

This result means that the attempted call has successfully established a connection. The number following the connect message indicates the transmission speed of the link.

RING

The **LineMaster** sends this message when an incoming call is detected.

ALERTING

The **LineMaster** sends this message when an outgoing call is made and the far end is ringing.

REMOTE DISC

The **LineMaster** sends this message when an outgoing call is cleared by the far end.

NO CARRIER

This result is returned in two situations. Firstly, when an outgoing call fails to connect within the period specified by S7. The second type of occurrence is the case of an established call being auto-disconnected

ERROR

The **LineMaster** will return the ERROR message if any part of the AT command sequence contains a syntax error, or if it is unable to execute any part of the command sequence.

BUSY

This result is returned if an engaged signal is detected, when attempting to originate a call.

NO ANSWER

This result is returned if a continuous ringback signal is detected on the line, when attempting to originate a call.

The S-Registers

The S-Registers may be thought of as a series of 255 variables which the AT command set uses for various purposes. Although all are available to the user, not all should be changed. The following list details which can and can not be modified.

S0 - Rings to auto-answer

Range 0-255
Default 0
Units rings

Description :-

Allows you to choose how many rings should be detected before the **LineMaster** answers. A value of zero disables auto-answer, but any other value will cause immediate answer of an incoming call.

S3 – Carriage Return Character

Range 0-255
Default 13
Units ASCII Decimal

Description :-

S3 records your choice of character to be recognised as a carriage return in the command line and to be used in result code responses.

S4 - Linefeed Character

Range 0-255
Default 10

Units ASCII Decimal

Description :-

S4 records your choice of character to be used in result code responses.

S5 - Backspace Character

Range 0-255
Default 8
Units ASCII Decimal

Description :-

S5 records your choice of character to be recognised as a backspace.

S7 - Wait for carrier time

Range 1 - 255
Default 40
Units seconds

Description :-

S7 records the time that the **LineMaster** will wait for a connection from the remote end.

S14 – General bit mapped options

The bits are used as follows :-

0 – reserved
1 - command mode echo enable (ATE)
- 0:disabled
- 1:enabled

2 - result code transmission enable (ATQ)
- 0:enabled
- 1:disabled

3 - verbose result code enable (ATV)
- 0:enabled
- 1:disabled

7,6,5,4 – reserved

S27 – General bit mapped options

The bits are used as follows :-

2,1,0 – reserved
3 - S-register input/output format (AT&O)
- 0:decimal (default)
- 1:hex

7,6,5,4 – reserved

S40 – General bit mapped options for channel 0

The bits are used as follows :-

1,0 - indicate option (AT&C)
- 0:Indicate ON always
- 1:Indicate OFF always
- 2:Indicate ON only if call connected

3,2 - control option (AT&D)
- 0:Control state ignored
- 1:Control inactive will cause call to be dropped
- 2:Control active will force pre-stored number to be called

The bits are used as follows :-

6,5,4 - port profile (ATF)
- 0:64 kbps out 64 kbps in
- 1:64 kbps out 56 kbps in

- 2:64 kbps out 64/56 kbps auto in
- 3:64 kbps out any in
- 4:56 kbps out 64 kbps in
- 5:56 kbps out 56 kbps in
- 6:56 kbps out 64/56 kbps auto in
- 7:56 kbps out any in 7

3,2,1,0 reserved

S41 – General bit mapped options for channel 1 Format same as S40

S42 – General bit mapped options for channel 2 Format same as S40

S43 – General bit mapped options for channel 3 Format same as S40

S44 – General bit mapped options for channel 4 Format same as S40

S45 – General bit mapped options for channel 5 Format same as S40

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
     X.25 D Channel             xxxx
     Channel Filter             xxxx
     Call Reference Filter      xxxx
     Analyser Specification     xxxx
     Activate Analyser          xxxx
```

Figure 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. To select the reporting level required at each layer move 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 that are defined for a particular ISDN network. The networks currently supported are CCITT (general purpose), BTNR191/BT ETSI (UK), AT&T 5ESS (USA), NT DMS100 (USA), National ISDN 1 (USA), 1TR6 (Germany) and VN2/3 (France), ETSI (Europe), NTT (Japan).

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

Information Provided at Layer 1

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

```
23:  Ch BRI1 L1 STATE = Activated00:01:75:30.271
```

The information presented is outlined below.

Sequence Number

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

Channel Number

The channel number (e.g. BRI1, BRI2 and BRI3) on which the event occurred.

Layer Number

The layer on which the event is being reported.

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

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

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

Information Provided at Layer 2 A typical display of a short ASCII layer 2 message is shown below.

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

The information presented is outlined below.

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

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

Channel Number The channel number (e.g. BRI1, BRI2 and BRI3) on which the event occurred.

Layer Number The layer on which the event is being reported.

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

Service Access Point Identifier*
Terminal Endpoint Identifier*

Command / Response Bit*
Poll / Final Bit*
Type* The message type, being one 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.

Information Provided at Layer 3

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

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

The information presented is outlined below:-

Sequence Number

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

Originator

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

Channel Number

The channel number (e.g. BRI1, BRI2 and BRI3) 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*

Message Type*

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

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

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

CALLING PARTY NUMBER:0 LENGTH = 7
TYPE = Unknown PLAN = ISDN / Telephony NUMBER = ‘234231’

CALLED PARTY NUMBER:0 LENGTH = 7
TYPE = Unknown PLAN = ISDN / Telephony NUMBER = ‘384020’
```

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

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

```
23: TE Ch BRI2 L2       00:01:75:30.271
41 01 81 0D 18 01 89
```

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

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

X.25 D Channel

None
Hex
ASCII Short Display
ASCII Long Display

Analyser Commands

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

<m> - Manual Mode

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

<home> or <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 that 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 that arrived just after the last message displayed. This command works only in manual mode.

<c> - Clear Buffer

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

<h> - Pause Display

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

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

Introduction

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

Changing a parameter on the LineMaster forced it to stop operating

Changing parameters on the **LineMaster** 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 **LineMaster** to stop running unless an external clock is provided.

To recover from this condition reload the factory defaults. When the **LineMaster** powers up the configuration LEDs will light for about 1 second. During this period if the **LineMaster** receives a <ctrl-c> character it will reload the defaults. The **LineMaster** 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 **LineMaster** 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 **LineMaster** is being used in NT(LT) mode make sure that the **LineMaster** is switched to the correct mode in the Hardware Setup Menu. Now check the other settings in the Hardware Setup Menu. Switch on the 40V power supply. If this does not help switch power operation between normal and restricted if the terminal is connected to an S_0 BRI.

For products originating from North America with U interfaces then the 40V power should be set to Normal/Sealing (i.e. 20mA current limit). To power NT-1s the U interface power should be set to Restricted/Non-Sealing. Be careful when switching the U interface to Restricted/Non-Sealing power as products intended to be connected to a current limited U interface (sealing current) may be damaged by non current limited power (e.g. Motorola Bitsurfer).
If the **LineMaster** is being used in transparent mode (either BRI or PRI) the LEDs do not function and will normally remain off.

Terminal will not answer a call

Firstly check that the call is actually being routed to the called terminal as expected. To do this, dial the number of the called terminal and check that one of the B channel LEDs illuminate. If the terminal responds by activating the ISDN line (P LED illuminates) and by starting up layer 2 (D LED illuminates) then the terminal has received the call and is not answering for a specific reason (e.g. incompatible Bearer Capability, wrong Calling Party Number, wrong Called Party Number etc).

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

If the protocol analyser option is available set it to display the layer 3 messages. The called terminal may send DISCONNECT, RELEASE or RELEASE COMPLETE with a cause value indicating the problem.

A potential problem may be that called terminal and calling terminal do not support the same bearer capability in which case the called terminal will send RELEASE COMPLETE with a cause "Incompatible Destination". Another possibility is that the called terminal is expecting a Called Party Number or Calling Party Number information element in the SETUP message. Turn on these options in the Software Setup Menu and ensure that the called

terminal is programmed accordingly. Conversely the terminal may be refusing the call because a called party number has been supplied but it is programmed for a different number.

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

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

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

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

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.

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.

Garbage appears on screen everytime I power on

The most likely reason for this, is that 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 using a baud rate of 19200 on the comms package when typing Control-C.

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**. 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 **LineMaster** is powering up properly. The power LED should illuminate and the correct power up sequence should be observed (see Chapter 1 Hardware Setup). In particular the internal relays should switch on power up and this should be audible.

Next check the cable. The **LineMaster** provides a DCE connection so a cable with a 9 way D male to 9 way D female (supplied with the unit) will connect the **LineMaster** 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 Hardware Setup). Another possibility is that the **LineMaster** is not powering up properly because the network personality module installed in the **LineMaster** will not start up and the LEDs on the front panel may flash. In this case see section entitled Network Personality Module will not work.

Parameters are lost when Network Personality Module is changed

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

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

LineMaster 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 " 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.

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

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 **LineMaster** and operates as follows.

(a) Overlap Sending used to dial the call

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

(b) Enbloc dialling used to dial the call

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

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 **LineMaster** 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

Some parameters once changed will not effect the operation of the

effect on operation of LineMaster

unit immediately. If the **LineMaster** 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** off and on again. Please inform your supplier.

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.

Also check that the correct interfaces have been enabled. If you are in doubt enable all interfaces to begin with.

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 **LineMaster** serial number on which it is running.

Note that the network support Network Personality Modules will run only on the LineMaster 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.

Introduction

This section outlines the differences in operation of the **LineMaster** between the CCITT emulation provided on the standard **LineMaster** 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
     D-Channel X.25 Setup                  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 overleaf shows the ETSI Supplementary Services Setup Menu.

```
ETSI Supplementary Services Setup

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

Figure 24 ETSI Supplementary Service Setup Menu

The services offered are as follows:-

Connected Party Number

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

Advice of Charge

The **LineMaster** 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 the call using AOC-D messages.
- ETSI AOC-E - AOC messages show cost of call at the end of

the call using AOC-E messages

- Currency or Units - AOC information can be sent as currency or units
- Currency Identifier – Three letters which will be sent with the AOC message when using currency.

If you press <enter. When on this field the menu of figure 25 is displayed.

```
Billing Parameters Setup

     Time between billing messages (secs)   5
     Amount to be added each time           1

     CEPT Total        (Codeset 5)          No
     CEPT Incremental  (Codeset 5)          No
     CEPT Total        (Codeset 6)          No
     CEPT Incremental  (Codeset 6)          No
     CEPT AOC Style                         Italtel (Italy)

     ETSI AOC-D ASN1                        No
     ETSI AOC-E ASN1                        No
     Currency or Units                      Units
     Currency Identifier                    EUR
```

Figure 25 Advice of Charge Setup Menu

The amount to be added each time is the number of units or currency amount to be added when each AOC message is sent. The time between messages defines the number of seconds between each AOC message. The AOC style refers to CEPT messages only and selects the format used by various telephone companies.

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

Call Hold Call can be put on hold in the **LineMaster** 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 **LineMaster** to cause it to forward an incoming call to another number under certain conditions. Supported facilities include CFU (call forward unconditional), CFB (call forward busy), CFNR (call forward no response) and CD (call deflection).

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

```
ETSI Call Forwarding Setup

   Served User Notified of Diversion           xx
   Calling User Notified of Diversion          xx
   Served User Notified if Active              xx
   Diverting No. Released to Diverted-to-User  xx

   Call Forwarding Unconditional       (CFU)   xx
   Call Forwarding User Busy           (CFB)   xx
   Call Forwarding User Busy           (CFNR)  xx
   Call Diversion                      (CD)    xx
```

Figure 26 ETSI Call Forwarding Setup Menu

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

Malicious Call Identification

If enabled allows terminals to send a message to the **LineMaster** 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:-

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

Introduction

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

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

```
Software Setup

     Network Type                          BTNR191
     Drop Layer 2 if No Call Active        xxxx
     Drop Layer 1 if Layer 2 Inactive      xxxx
     Drop TEI if Layer 1 Inactive          xxxx
     Number of B Channels per PRI          n
     Use Service Profile IDs (SPIDs)       xxxx
     Allow Overlap Sending/Receiving       xxxx
     Numbering System Option               xxxx
     Called Party Number                   xxxx
     Calling Party Number                  xxxx
     Called Party Subaddressing            xxxx
     D-Channel X.25 Setup                  xxxx
     Voice is End-to-End ISDN              xxxx
```

Figure 27 BT Software Setup Menu

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

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 common 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’).
- D Channel X.25 packet mode does not support switched virtual circuits. All packets sent on BRI1 are routed to BRI2 and vice-versa.

Introduction

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

Main Differences Between CCITT and VN2/3

The main differences are:-

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

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

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

Introduction

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

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

```
Software Setup

     Drop Layer 2 if No Call Active          xxxx
     Drop Layer 1 if Layer 2 Inactive        xxxx
     Drop TEI if Layer 1 Inactive            xxxx
     Number of B Channels per PRI            n
     Use Service Profile IDs (SPIDs)         xxxx
     Allow Overlap Sending/Receiving         xxxx
     Numbering System Option                 xxxx
     Call Waiting                            xxxx
     Billing                                 xxxx
     Additional Transmission Attributes      xxxx
     Called User Status                      xxxx
     Date/Time                               xxxx
     D-Channel X.25 Setup                    xxxx
```

Figure 28 1TR6 Software Setup Menu

Main Differences Between CCITT and 1TR6

The German 1TR6 network is very different to Q.931 based networks such as ETSI. To understand all of the differences refer to the 1TR6 specification. The **LineMaster** 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.
-

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 **LineMaster.**

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 **LineMaster.**

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

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

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

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

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

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

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

Where information elements are supported by both Q.931 and 1TR6 they may have a different structure e.g. the Cause information element supports different cause values in 1TR6 and Q.931.

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

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

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

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

Charging Information
Additional Transmission Attributes

Called User Status
Date

The date can be changed by moving to the Date prompy and pressing <enter>. The screen of figure 29 is displayed. Enter the new date and time seperating each field with '.'.

```
1TR6 Date/Time Setup

Current Date/Time              12.11.94.15.05
```

Figure 29 1TR6 Date/Time Display

Call Waiting is always supported on the **LineMaster**.

Introduction

This section outlines the differences in operation of the **LineMaster** between the CCITT emulation provided on the standard **LineMaster** 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 30.

```
NTT Supplementary Service Setup

Advice of Charge                xx
```

Figure 30 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 μ law voice/3.1kHz 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.

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

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

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

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

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

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

- Advice of Charge.
- Blocking Channel ID.

Introduction

This section outlines the differences in operation of the **LineMaster** between the CCITT emulation provided on the standard **LineMaster** 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.

The main Software Setup Menu is identical to the CCITT menu with the addition of the Supplementary Services Menu. Three variants are encountered depending on the network type selected in the Software Setup Menu (i.e. AT&T 5ESS, Nortel DMS100 or Bellcore National ISDN-1).

Main Differences Between CCITT and Bellcore National ISDN-1

Figure 31 shows the supplementary services setup menu for National ISDN-1.

```
National ISDN Supplementary Services Setup

     Call Hold (I-HC)                          xxxx
     Flexible Calling (FC)                     xxxx
     EKTS Call Appearance Call Handling (CACH) xxxx
     Additional Call Offering (ACO)            xxxx
```

Figure 31 NAT-1 Supplementary Service Setup Menu

The services offered are as follows:-

Additional Call Offering

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

Call Appearance Call Handling

The Call Appearance information element is included with the SETUP message from the **LineMaster** and is used by the terminal to select the call instead of the Called Party Number information element.

Flexible Call Handling

Enabling this service allows such services as ADD, DROP, HOLD and TRANSFER.

Call Hold

Call can be put on hold in the **LineMaster** using Bellcore call hold (I-HC) protocol.

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 **LineMaster**.

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

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

- Redirection Sub-address.
- Redirection Number.
- Call Appearance.

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

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

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

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

Main Differences Between CCITT and Nortel DMS100

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

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

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

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

- Connected Number
- Redirecting Number
- Redirection Number

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

- Protocol Version Control
- Closed User Group

- Reverse Charging Indication
- Redirecting Subaddress
- Call Appearance

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

The following differences are also noted:-

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

User to User signalling is not supported in DMS100.

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

Main Differences Between CCITT and AT&T 5ESS

This section to be defined.

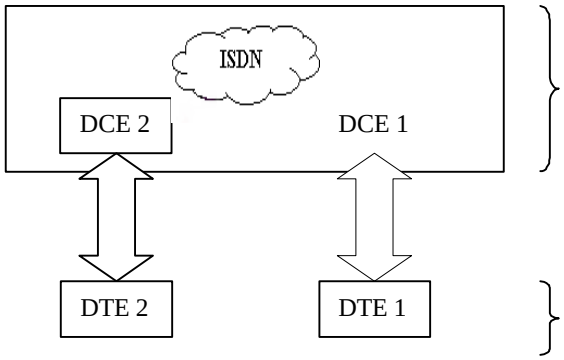
Purpose

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)

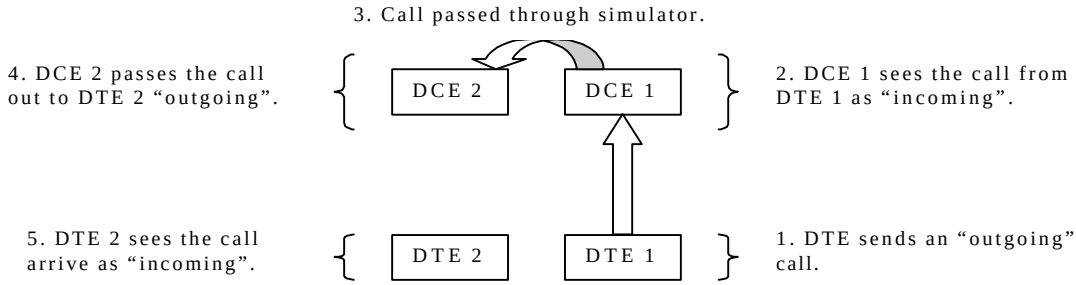
There should be similar options on the DTE, and it is important that the above settings within the simulator (i.e. DCE) match those of the

APPENDIX 1

DTE's. It is also worth noting that what is deemed as outgoing at 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**
Outgoing	5 & 6
Two-way	3 & 4
Incoming	1 & 2

DCE

Incoming	5 & 6
Two-way	3 & 4
Outgoning	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.

APPENDIX 1