Part No: 5500039-12

LINKSTREAM Product Range

SOFTWARE REFERENCE MANUAL

APPLICABLE TO REVISION 7
SERIES SOFTWARE

CONTENTS

ACKNOWLEDGEMENTS
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SECTION 1

INTRODUCTION

This manual has been designed for use by personnel responsible for installation, configuration and management of the LINKSTREAM network. It assumes, therefore, a basic knowledge of network management and UNIX systems.

INTRODUCTION

From one of the international leaders in data and voice communications design comes the range of LINKSTREAM router products.

Outstanding as individual applications, this suite of products forms a powerful and integrated solution to the requirements of the remote access marketplace.

Designed and manufactured in the UK by Perle, the LINKSTREAM products' innovative concept combine differing technologies to provide the complete communications package for the remote office. A single, stand alone unit will link the LANs, PCs, printers, terminals, phones, faxes, modems and ISDN across the WAN connections to the central site, or to the Internet.

LINKSTREAM products support both major network protocols - TCP/IP and IPX - and operate in the UNIX and NetWare sectors.

The LINKSTREAM product range incorporates router with voice interfaces, ISDN access, WAN ports and comprehensive network management features.

SECTION 2

COMMAND LINE INTERFACE

INTRODUCTION

The LINKSTREAM presents a Command Line Interface to the user when attached to any of the channels. The unit is activated by pressing any key and will respond with

Welcome to LINKSTREAM

LINKSTREAM >

The user is then able to enter any of the commands in response to the system prompt. The commands can be entered in lower or upper case and can be abbreviated to just the highlighted letters identified. 'Space' or TAB can be used to separate commands and arguments. The Backspace and Delete keys are operational to edit lines.

The commands available enable the user to establish connections to hosts on the network and move between already established sessions. There are also commands for LINKSTREAM control and status reporting. The Command Line Interface also gives the user access to the Node Manager resident in the local unit or in any other LINKSTREAM on the network.

Full details of the commands are given in the following pages.

CLOSE

Description
This command is used to disconnect a specified session to which your terminal is connected.

Format
CLOSE <session>

Options

<session>	Specifies the session to be disconnected, number '0 - 3', '+' or '-'. '**0-3**' closes specified session. '**+**' closes most recently active session. '**-**' closes next most recently active session.

HELP

Description
This will display a 'Help' screen giving a brief description of the available commands.

Format
HELP

Options
None

LOCK

Description
This command allows the user to lock out a terminal without closing down current sessions, thus preventing unauthorised access. The command will request a password before disabling the terminal. This must then be re-entered before the port is unlocked.

Format
LOCK

Options
None

Operation
LINKSTREAM > LOCK
the screen will respond with
Lock Password: **
Enter the password (1 - 16 characters). The screen will display '*' for each character. On entering the password with the return key the screen displays
Verify:
Re-enter the same password. The screen responds with
Port <number> locked
Unlock password:
The port is now locked and will remain disabled until the selected password is entered to the **'Unlock password:'** prompt.

LOGIN

Description

This command allows the user to enter the Node Manager used for configuration and statistics gathering on the unit. The command will also allow the user to log into the Node Manager of any LINKSTREAM on the network by specifying the Telnet address of the unit.

Format

LOGIN <host> <port>

Options

If no additional address information is entered, the user will log into the local Node Manager.

<host> This is the IP address of the required LINKSTREAM or, if the Name Server table of the unit has been compiled, the name assigned to the required LINKSTREAM.

<port> The TCP port number of the Node Manager.

Operation

LINKSTREAM > LOGIN

This will access the local Node Manager.

LINKSTREAM > LOGIN 128.16.0.5 23

This will access the remote Node Manager at IP address as given.

LISTEN

Description

This command will put a user port into a passive mode, making it ready to accept incoming connections.

Format

LISTEN <port>

Options

<port>

This is the port number which will be put into a passive mode. If no number is entered, the port to which you are connected is used as default. If a different port number is entered, then the system manager password must be entered before the command will be executed.

OPEN

Description

This will open a transparent connection to a specified address/port on the network. This command is primarily intended to set up connections between units.

Format

OPEN <host> <port>

Options

The following additional address information must be specified:

<host> This is the IP address of the required unit or, if the Name Server table of the LINKSTREAM has been compiled, the name assigned to the target unit.

<port> The TCP port number of the target connection.

Operation

LINKSTREAM > OPEN 128.16.0.64 19

This will open the connection to the IP address and port number given.

A session is temporarily halted using the Telnet suspend character as selected on the channel session parameter screen. The default value for this is ^].

PING

Description

This is a debugging tool used to check if a destination is reachable and responding. This is done by sending an ICMP (Internet Control Message Protocol) echo request message and receiving an echo reply message. Successful receipt of a reply verifies the major sections of the data transport system. The command can send a single echo message or continuous messages according to options selected.

Format

PING [forever] <host> [t]

Options

[forever] If this word is included, the unit will continually send echo request messages. If omitted, only one message is sent.

<host> This is the IP address of the target host or, if the Name Server table of the LINKSTREAM has been compiled, the name assigned to the target unit.

[t] This is the time, in seconds, to wait for a response from the host. If no time is specified, a default of 15 seconds is used.

Operation
LINKSTREAM > PING 128.16.0.64
If successful, the terminal will respond with
host is alive
LINKSTREAM >

If unsuccessful, the terminal response is
No response from host
LINKSTREAM >

LINKSTREAM > PING FOREVER 128.16.0.64
If this format is used, the terminal will show multiple response messages until the operation is stopped by typing any character.

PPP

Description This command will switch the port to which the user is connected into PPP mode.

Format
PPp

Options
None

QUICK

Description Start quick set up menu

RESUME

Description This command will resume a session which has been halted using the 'CTRL-]' command. This will resume sessions to which your terminal is connected.

Format
RESUME <session>

Options
<session> Specifies the session to be resumed, number '0 - 3', '+' or '-'.
'**0-3**' resumes specified session.
'**+**' resumes most recently active session.
'**-**' resumes next most recently active session.

SEND

Description This is used to send Telnet codes to sessions on the port to which you are connected. These fulfil a number of control functions as defined by Telnet protocols.

Format
SEND <code> <session>

Options
<code> These are standard Telnet codes as set out below:

BRK	Break key pressed
IP	Interrupt process
AO	Abort output

AYT	Are You There
EC	Erase character
EL	Erase line

<session> Specifies the session to which the code is sent, number '0 - 3', '+' or '-'.
'**0-3**' sends code to specified session.
'**+**' sends code to most recently active session.
'**-**' sends code to next most recently active session.

Operation
LINKSTREAM > SEND ao 0
This would abort the output from session 0.

SHOW

Description
This command is used to give status information on a number of session parameters as detailed below.

Format
SHOW [sess] / [names] / [maps] / [arp] / [panic]

Options
The user should specify session or names to select the information required.

[sess] This will produce a list of active sessions giving the session number, the IP address and the port number.

[names] This produces a list of names as entered in the Name Server table.

[**map**] This produces a list of all TCBs and their current states.

[**arp**] This produces a list of the current ARP table.

[**panic**] This displays the last saved panic code.

Note: With **SHOW arp** and **SHOW map display IP addresses**, the user is required to enter the system manager's password before any list will be given.

Operation
LINKSTREAM > SHOW sess.
This will produce a table, in the following format, of the sessions on that particular port:

SESSION No	**ADDRESS**	**PORT No**
0	128.16.0.64	19

LINKSTREAM > SHOW names
This will produce a table, in the following format, of the names configured for the LINKSTREAM.

Configured NAMES are

local host	any1
any2	any3

LINKSTREAM > SHOW map
This will produce a table, in the following format, of all TCBs and their current status.

CHAN#	LOCALIP	PORT	STATUS	REMOTEIP	PORT	TYPE
CHN 0	200.0.0.22	2000	LISTEN			P

LINKSTREAM > SHOW arp

This will produce a table, in the following format, of current ARP entries.

ENTRY	IP	ETHERNET	STATUS	AGE
0	200.0.0.23	00:20:2f:00:01:77	RESOLVED	P
1	200.0.0.24	00:20:2f:00:01:77	RESOLVED	P

LINKSTREAM > SHOW panic
This will display, in the following format, the last saved panic code.

PANIC CODE: 0 x 0

SLIP

Description
This command will switch the port to which the user is connected into SLIP mode.

Format
SLip

Options
None

TELNET

Description
This command is used to open a Telnet connection across the TCP/IP Internet. This is used when accessing hosts which are not Perle equipment.

Format
TELNET <host> <port>

Options
The following additional address information must be specified:

<host> This is the IP address of the required host or, if the Name Server table of the LINKSTREAM has been compiled, the name assigned to the target host.

<port> The TCP port number of the target connection.

Operation

LINKSTREAM > TELNET 128.16.0.64 19

This will open a connection to the IP address and port number given.

VERSION

Description

This command will display the version number of the LINKSTREAM, TCP and ONEK software fitted.

Format

VERSION

Options

None

X PING

Description

This is a debugging tool that works in a similar way to the 'PING' command but operates for the IPX protocols. The command can send a single echo message or continuous messages according to the option selected.

Format

X PING [forever] <host> [t]

Options

[forever] If this word is included, the unit will continually send echo request messages. If omitted, only one message is sent.

<host> This is the IPX address of the target host specified in the following format:

<host> = [NETWORK NUMBER : NODE ID]

[t] This is the time, in seconds, to wait for a response from the host. If no time is specified, a default of 15 seconds is used.

SUMMARY OF COMMANDS

Command	Arguments	Description
Close	<SESSION>	Close a specific connection
Help		Show help page
LOCk		Lock current port
LOGin	<HOST> <PORT>	Log in to configuration manager
LIsten		Put current port into 'Listen' state
Open	<HOST> <PORT>	Open a transparent connection
Ping	[FOREVER] <HOST> [t]	Send ICMP Ping request(s)
PPp		Start PPP running on current port
Quick		Start quick set up menu
Resume	<SESSION>	Resume a specific session
SEnd	<CODE> <SESSION>	Send Telnet code (BRK/IP/A0/AYT/EC/EL)
SHow	[SESS]/[NAMES]	Show Telnet sessions or Name Server table
SLip		Start SLIP running on current port
Telnet	<HOST> <PORT>	Open a Telnet connection
Version		Display TCP version number
Xping	[FOREVER] <HOST> [t]	Send IPX ping requests

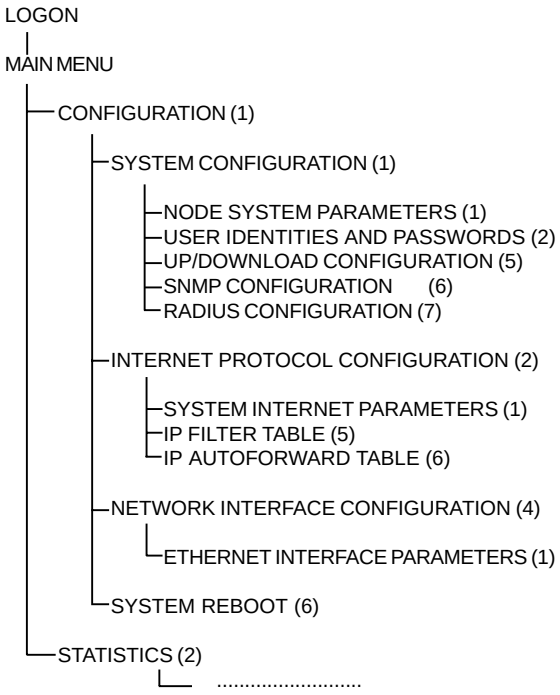
SECTION 3

SYSTEM CONFIGURATION

NB. Before configuring any other option, system configuration must be completed.

The diagram below gives the overall structure of the screens within the Node Manager, showing the pathways for system configuration.

It is advisable to configure the LINKSTREAM by systematically working through the screens in the order shown on the following pages. The numbers after each heading refer to the Node Manager screens, e.g. 1.1.1 =
1 - Configuration
1 - System configuration
1 - Node System Parameters

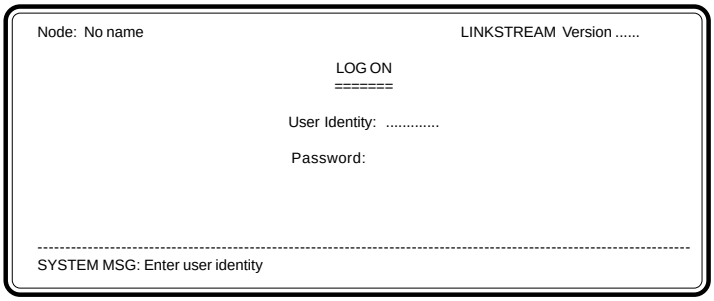


● MANDATORY SETTINGS

❑ NETWORK OPTIONS

LOG ON SCREEN

Configuration of the LINKSTREAM is achieved with the Node Manager. This is accessed from the 'LOGIN' command on the Command Line Interface. This will take the user to the Node Manager Log On screen as shown below.

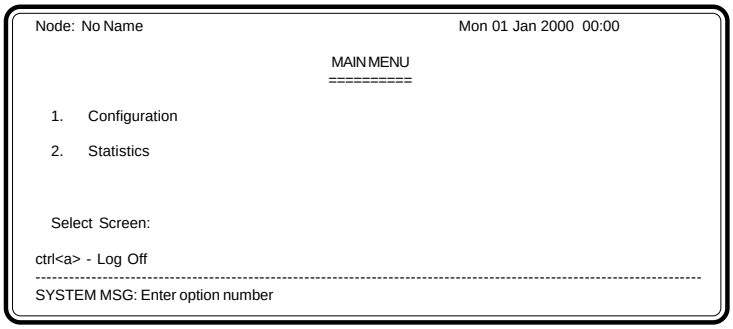


This screen shows the node name at the top.

To log on, enter the user identity (up to 8 characters) and the correct password.

If a cold start is done, the unit will return to default values for User Identity and Password. These are:
User Identity: manager
Password: .....(six full stops)

The LINKSTREAM is shipped from the factory with the default values as detailed in this section.



There are two screens from the main menu giving access to various aspects of the system. Screens are selected by entering the appropriate number to the prompt.

A number of control characters are used to perform specific functions, independent of the screen currently displayed.

CTRL-X Invokes the main menu from any other screen as long as the user is logged in.

CTRL-Y Returns the user from the current menu to the previous menu in the sequence.

CTRL-A Used as a log off command which is effective from all screens. On entry of the character, the system will return to the command line prompt.

CTRL-F Next page.

CTRL-B Previous page.
These characters are used to move through multiple pages of data such as routing tables and help screens. They are therefore only active on certain screens.

CTRL-Z Moves the cursor to the last configurable field on the screen.

Other control characters, specific to certain screens, are described in the relevant sections.

SYSTEM CONFIGURATION (1.1)

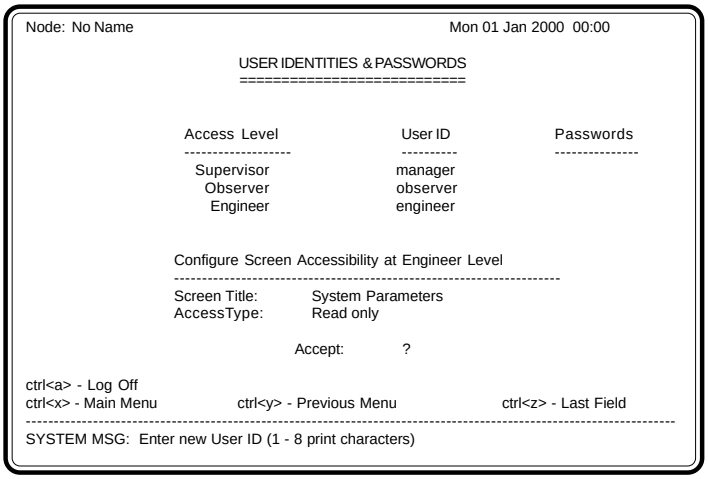
NODE SYSTEM PARAMETERS (1.1.1)

```
Node: No Name                                        Mon 01 Jan 2000  00:00

                              SYSTEM PARAMETERS
                              =================

Date (ddmmyy):                .......        Time (hhmmss):  . . . . . .

Number of Channels            8

Network Buffer Size:          160

Console Timeout               10 mins


                                        Accept:          ?

ctrl<a> -Log off
ctrl<x> - Main Menu        ctrl<y> - Previous Menu      ctrl<z> - Last Field
-------------------------------------------------------------------------------
SYSTEM MSG:  6 - digit date: dd = day 01-31, mm = month 01-12, yy = year 00-99
```

The following parameters must be defined:

- **Date and time**
  Enter in format defined.
- **Number of channels**
  User channels, 8, 16, 24.
- **Network Buffer size**
  Enter 142 to 1514 bytes. Default value = 160.
  The network buffers are used by all channels and protocols to send data through the LINKSTREAM. The buffer size should be greater than the largest packet to be received over the network. The memory area allocated to the network buffers is fixed, therefore larger buffers for bigger data packets will mean less sessions can be supported. The default figure of 160 bytes is an optimum value for packet size and number of sessions.
- **Console timeout**
  Between 0 - 59 minutes. Default value = 10.
  0 = No timeout.

Enter **'Y'** to **'Accept**:' to save displayed values.



The unit has 3 levels of operation - supervisor, observer and engineer. These allow different degrees of access to the internal features of the unit. Each level has a user ID and associated password which are entered by the user. These names have up to 8 characters.

The default user IDs and passwords are given below.

Access Level	**User ID**	**Passwords**
Supervisor	*manager*	*.....*
Observer	*observer*	******
Engineer	*engineer*	*??????*

The degree of access allowed for each level is as below:

Supervisor The Supervisor level has 'read and write' access to all screens.

Observer The Observer level has 'read only' access to all screens, i.e. they are not able to change any parameters.

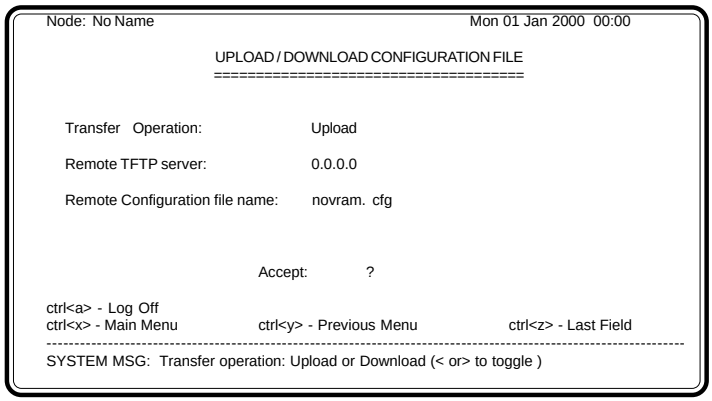
Engineer The Engineer level is configurable for each screen. See below.

'Configure Screen Accessibility' sections.

Using the '<' '>' keys, the user toggles through the screen options and sets each screen to 'read only' or 'read and write' as appropriate. The default condition is 'read only' on all screens.

N.B. All categories of user have 'read and write' access to the update screen fields on all the statistics screens, as any actions here will not affect the configuration of the LINKSTREAM.

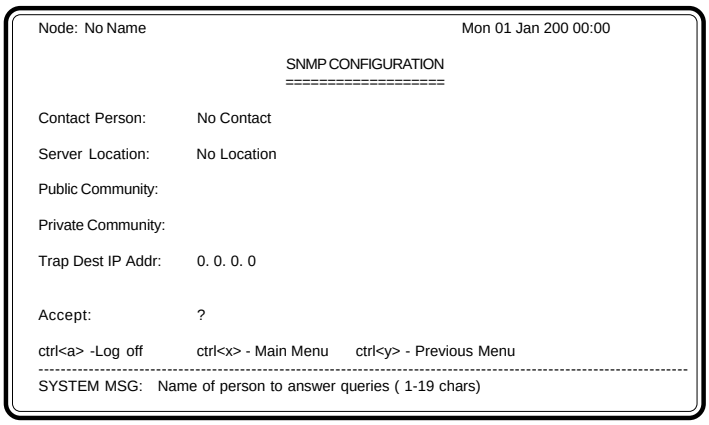
UPLOAD / DOWNLOAD (1.1.6)



To store network configuration on a PC the following parameters can be defined.

- **Transfer Operation**
  Select Upload/Download. Default = Upload.
  This parameter selects the desired function. Download will reload a stored configuration from the remote server. Upload will store the configuration to the remote server.
- **Remote TFTP server**
  Enter the IP address of the remote server to hold the configuration data.
- **Remote Configuration File Name**
  Enter the name of the file containing the configuration data.

Enter **'Y'** to **'Accept:'** to save the displayed values.



- **Contact Person**
  1-19 chars. Default = No Contact.
  Enter name of contact person for network.

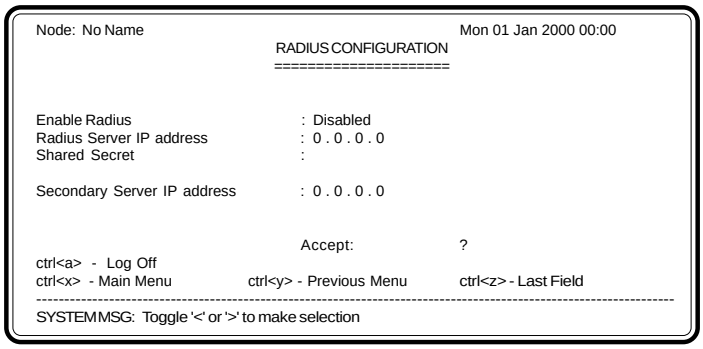
- **Server Location**
  1-19 chars. Default = No Location.
  Enter name for physical location of the device.

- **Public Community**
  1-19 chars. Default = Public.
  Enter password required from SNMP manager to read SNMP variables.

- **Private Community**
  1-19 chars. Default = Netman.
  Enter password required from SNMP manager to read and set variables.

- **Trap Dest IP Addr**
  The IP address of the server to which traps should be sent.

RADIUS CONFIGURATION (1.1.8)



The Security Server and Secondary Security Server options should be set if the unit is required to authenticate connections via a Radius security server (a secondary security server can be defined for resilience).

- **Enable Radius**
  Select Enabled/Disabled. Default = Disabled.

- **Radius Server IP address**
  The IP address of the server to which connection requests should be diverted for authentication.

- **Shared Secret**
  The secure password to be used for communication with the security server.

- **Secondary Server IP address**
  The IP address of the back up security server can be defined for resilience.

SYSTEM INTERNET PARAMETERS (1.2.1)

```
Node: No Name                                        Mon 01 Jan 2000 00:00

                          INTERNET PARAMETERS
                          ===================

Global RIP Status:          Disabled      Default Gateway:        0. 0. 0. 0

ARP Retries                      1

IP Checksum:                Enabled       IP Options:                 Enabled
IP Default TTL:                 15         IP Priority Ratio:              3

TCP Checksum :              Enabled       TCP Options:                Enabled
TCP Max Rexmt Timeout:          20         TCP Retry Count:                5
TCP Keep Alive Timer:            0         TCP Keep Alive Interval:        1
TCP Keep Alive Count:            2

Telnet Protocol Base No:      1000        Transparent Protocol Base No:  2000
Console Protocol Port No:       23

                                Accept:          ?
ctrl<a> - Log Off
ctrl<x> - Main Menu          ctrl<y> - Previous Menu          ctrl<z> - Last Field
-------------------------------------------------------------------------------
SYSTEM MSG:  Node Routing Information Protocol use.     ('<' or '>' to toggle)
```

The following parameters must be defined:

- ❑ **Global RIP status**
  Select Enabled/Disabled. Default = Disabled. This enables the use of the RIP protocol for the whole node

RIP must then be enabled on individual interfaces.

- ❑ **ARP retries**
  The number of times the ARP (Address Resolution Protocol) broadcast requests the MAC address.
- ● **Default Gateway**
  Enter IP address of gateway. This address overrides any learned default but it is not advertised over RIP.
- ❑ **IP Checksum**
  Select Enabled/Disabled. Default = Enabled.
- ❑ **IP Default TTL**
  Enter 1 - 255. Default = 15.
  This is the 'Time To Live' for packets crossing gateways and is used to prevent recycling packets around a network. As the packet passes through a gateway the TTL count is decremented. When the count reaches zero, the packet is discarded.
- ❑ **IP Options**
  Select Enabled/Disabled. Default = Enabled.
  When enabled allows the LINKSTREAM to respond to IP negotiation requests. The LINKSTREAM itself, however, does not negotiate IP options.
- ❑ **IP Priority Ratio**
  VIP speech packets have the low delay bit set in the IP Type of Service Field - some routers will correctly handle this field. Alternatively, all VIP speech packets can be recognised as UDP packets with source and destination port numbers in the range of 300 to 303 decimal. Some routers will permit prioritising on UDP port numbers.

Settings
Calculate settings as follows (minimum setting is 12 voice packets to every data packet):
12 x no. of voice channels for data utilisation.

- **TCP Checksum**
  Select Enabled/Disabled. Default = Enabled.
- **TCP Max Retransmission Timeout**
  Enter number, range 1 - 180. Default = 20 seconds.
  This defines the maximum time in seconds that the LINKSTREAM will wait for a packet acknowledgement before retransmitting.
- **TCP Keep Alive Timer**
  Enter 0 - 1440 minutes. Default = 0 (OFF).
  This defines the idle time for a connection. The LINKSTREAM will only send 'Keep Alive' polls to maintain the connection when this timer decrements to zero. Entering 0 will disable this function.
- **TCP Keep Alive Count**
  Enter number, range 1 - 10. Default = 2.
  TCP sends a 'Keep Alive' poll to other nodes on the network to maintain connections. This value gives the number of 'no responses' before TCP will cease polling.
- **TCP Options**
  Select Enabled/Disabled. Default = Enabled.
  This enables negotiation of TCP options such as segment sizes, etc.
- **TCP Retry Count**
  Enter number, range 1 - 10. Default = 5.
  This determines the number of times a packet is transmitted if no acknowledgement is received.
- **TCP Keep Alive Interval**
  Enter 1 - 60 minutes. Default = 1 minute.
  This is the time period between 'Keep Alive' polls. The TCP Keep Alive Timer and Keep Alive Interval are designed for ISDN operation to prevent LINKSTREAM bringing up the ISDN link to send 'Keep Alive' polls.
- **Telnet Protocol Base Number**
  Enter number, range 1 to 65535. Default = 1000.
  This is the base number of the Telnet Protocol port numbers for the LINKSTREAM. All user channel port numbers then increment by 1.
- **Transparent Protocol Base Number**
  Enter number, range 1 to 65535. Default = 2000.
  This is the base number of the Transparent Protocol port numbers for the LINKSTREAM. All user channel port numbers then increment by 1.
- **Console Protocol Port Number**
  Enter number, range 1 to 65535. Default = 23.
  This is the protocol port number for the Node Manager allowing Telnet access from remote nodes.

Enter **'Y'** to **'Accept:'** to save displayed values.

IP FILTER TABLE (1.2.5)

```
Node: NoName                                                Mon 01 Jan 2000 00:00

                                   IP FILTER TABLE                    Page:1
                                   ==============
Filter: IN
Policy: Accept

          IP Address        IP Mask          Lo/Hi Port     Prot   Policy  Bi.   Syn   Ack   I/Face
          ----------        -------          ----------     ----   ------  ---   ---   ---   ------
SRC:  ................  ................  ......../......  ......  ......  ....  ....  ....  ........
DST:  ................  ................  ......../......
SRC:  ................  ................  ......../......  ......  ......  ....  ....  ....  ........
DST:  ................  ................  ......../......
SRC:  ................  ................  ......../......  ......  ......  ....  ....  ....  ........
DST:  ................  ................  ......../......
SRC:  ................  ................  ......../......  ......  ......  ....  ....  ....  ........
DST:  ................  ................  ......../......
SRC:  ................  ................  ......../......  ......  ......  ....  ....  ....  ........
DST:  ................  ................  ......../......

                                   Accept:  .

ctrl<a> - Log Off          ctrl<b> - Page Backward          ctrl<f> - Page Forward
ctrl<x> - Main Menu        ctrl<y> - Previous Menu          ctrl<z> - Last Field
--------------------------------------------------------------------------------------------------
SYSTEM MSG: Toggle '<' or '>' to make selection
```

WHAT IS IP MASQUERADE?

IP Masquerade is an addition to the kernel networking code in LINKSTREAM. It is designed to allow systems that do not have an assigned IP address on the Internet to be able to interact with the Internet via a LINKSTREAM gateway. The LINKSTREAM gateway is the unit running IP Masquerade.

CAN I JUST PICK ANY ADDRESS FOR MY UNASSIGNED IPS?

There is an RFC (#1597) on which IP addresses are used on a non-connected network. There are 3 blocks of numbers set aside specifically for this purpose.

3. Private Address Space (Quoted from RFC 1597)

The Internet Assigned Numbers Authority (IANA) has reserved the following three blocks of the IP address space for private networks:

10.0.0.0 - 10.255.255.255
172.16.0.0 - 172.31.255.255
192.168.0.0 - 192.168.255.255

The first block is referred to as "24-bit block", the second as "20-bit block", and the third as"16-bit block". Note that the first block is a single class A network number, while the second block is a set of 16 contiguous class B network numbers and the third block is a set of 255 contiguous class C network numbers.

If a class C network is being used, the unit should be addressed as 192.168.1.1, 192.168.1.2, 192.168.1.3, ..., 192.168.1.x

IP FIREWALL ADMINISTRATION SYNTAX DESCRIPTION

The IP Filter table can consist of up to 50 rules (5 displayed per page). The rules can be divided into three different categories: the IP input firewall, the IP output firewall and the IP forwarding firewall. For each of these categories, a separate list is maintained.
Each rule is of the format:

	IP Address	IP Mask	Lo/Hi Port	Prot	Policy	Bi	Syn	Ack	I/Fac
SRC:	0.0.0.0	0.0.0.0	0/0	Any	Accept	No	No	No	Any
DST:	0.0.0.0	0.0.0.0	0/0						

To insert an entry in the table, move the cursor to the point where the rule should be inserted and type 'I' to create a default entry which can then be edited as required.

To delete an entry from the table, move the cursor to the unwanted rule and type 'd', then type 'd' again to confirm and the entry will be removed.

The firewall category that the rule belongs to can be selected by toggling the Filter field to display the appropriate category:

Filter: **<IN>/<OUT>/<Forward>**

where:

IN - IP input firewall rules. Any packet received by the firewalling host will be examined for a match with the IN firewall rules.

OUT - IP output firewall rules. Any packet generated locally by the firewalling host will be examined for a match with the OUT firewall rules.

FORWARD- IP forwarding firewall rules.Any packet received by the firewalling host but is not finally destined for the firewalling host will be examined for a match with the FORWARD firewall rules.

To change the default policy for the selected category of firewall toggle the policy field to the appropriate value. The default policy is used when no matching rule is found. The default policy has to be one of:

Policy: **<Accept>/<Deny>/<Reject>**

Accept - Accepts the packet through the firewall.

Deny - Denies the packet.

Reject - Denies the packet but returns an ICMP Destination Unreachable message to the source of the packet.

PARAMETERS

The following parameters can be configured for each rule:

SRC IP Address
Source specification. IP source must be specified as plain IP address, in dotted decimal format e.g. www.xxx.yyy.zzz.

SRC IP Mask
The mask must be specified as a network mask (in dotted decimal format). The mask is bitwise AND'ed with the source IP address to produce a range of IP addresses that will match. A mask of 0.0.0.0 combined with a source IP address of 0.0.0.0 will therefore match any packet.

SRC Lo/Hi Port
The source may include one or more port specifications or ICMP types. Each of them must be specified as a port number, or a (numeric) ICMP type. In the rest of this paragraph, a port means either a port specification or an ICMP type. To specify a range of ports enter the lower bound of the range in the Lo Port field and the higher bound of the range in the Hi Port field. Furthermore, if the value 'a' is specified as the Lo Port value, this will match any port, and no Hi Port value will be allowed. Valid numbers of the ICMP ports are:

Echo Reply	-	0
Destination Unreachable	-	3
Source Quench	-	4
Redirect (change a route)	-	5
Echo Request	-	8
Time Exceeded for a datagram	-	11
Parameter Problem	-	12
Timestamp Request	-	13
Timestamp Reply	-	14
Information Request	-	15
Address Mask Request	-	17
Address Mask Reply	-	18

Packets not being the first fragments of a TCP, UDP or ICMP packet are always accepted by the firewall. For accounting purposes, these second and further fragments are treated specially, to be able to count them in some way. The port number 0xFFFF (65535) is used for a match with the second and further fragments of TCP or UDP packets.

These packets will be treated for accounting purposes as if both numbers are 0xFFFF. The number 0xFF (255) is used for a match with the second and further fragments of ICMP packets. These packets will be treated for accounting purposes as if their ICMP types 0xFF. Note that the specified command and protocol may imply restrictions on the ports to be specified. Ports may only be specified in combination with the TCP, UDP or ICMP protocol.

Prot
The protocol of the packet. The specified protocol can be toggled to one of All, TCP, UDP or ICMP. Protocol 'All' will match with all protocols and is the default value.

Policy
The specified policy can be toggled to one of Accept, Deny, Reject or Masq. A policy of 'Accept' will accept any matching packet through the firewall. A policy of 'Deny' will drop any matching packet. A policy of 'Reject' will reject any matching packet but will send an ICMP Destination Unreachable message back to source host of the package. A policy of 'Masq.' will accept packets for forwarding. When this option is set, packets accepted by this rule will be masqueraded as if they originated from the local host. Furthermore, reverse packets will be recognised as such and they will be demasqueraded automatically, bypassing firewall. This option is only valid for the firewall categories OUT and FORWARD.

I/Face
The interface via which the packet is received, or via which the packet is going to be sent. The specified interface can be one of ANY, Local, Eth-I, SNAP, Ser. 0, Ser. 1, Asy.0. Asy.1, Asy.2, ..., Asy.23. The value '*Any*' matches any interface.

DST IP Address
DST IP Mask
DST Lo/Hi Port
Destination specification. See the description of the source parameters for a detailed description of the syntax, default values and other requirements. Note that ICMP types are not allowed in the DST Hi/Lo Port fields. ICMP types can only be specified as part of the source options.

Bi.
Bi-directional mode. The specific value can be one of Yes or No. If yes is specified, the rule will match with IP packets in both directions.

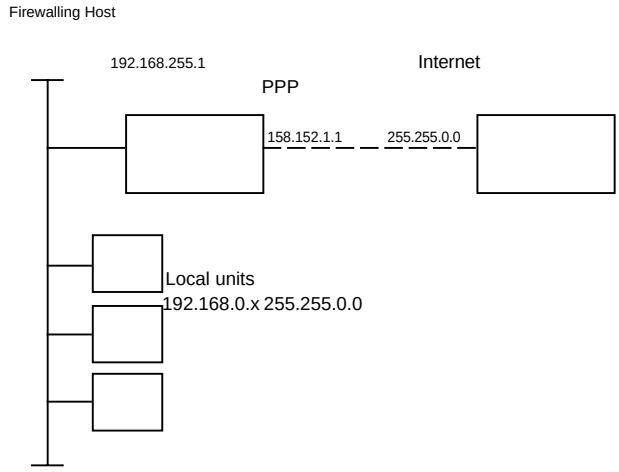
OTHER OPTIONS

Ack.
Only match TCP packets with the ACK bit set (this option will be ignored for packets of other protocols). The specific value can be one of Yes or No.

Syn
Only match TCP packets with the SYN bit set and the ACK bit cleared (this option will be ignored for packets of another protocol). The specified value is either YES or NO.

EXAMPLE This section provides a more in-depth guide to using firewalling.

The set-up for a firewall/masquerade system behind a PPP link with a static PPP address Trusted interface is 192.168.255.1, PPP interface 158.152.1.1 and is Async. channel 1. Each incoming and outgoing interface is listed individually to catch IP spoofing as well as stuffed routing and or masquerading. Note that anything not explicity allowed is forbidden.



Incoming set default policy of Deny. Note that the default policy is irrelevant because there is a catch-all rule with Deny.

Filter: IN Policy: Deny

Local interface, local machines, going anywhere is valid.

	IP Address	IP Mask	Lo/Hi Port	Prot	Policy	Bi	Syn	Ack	I/Fac
SRC:	192.168.0.0	255.255.	Any/0	All	Accept	No	No	No	Eth_II
DST:	0.0.0.0	0.0.0.0	Any/0						

Remote interface, claiming to be local units, IP spoofing, get lost.

	IP Address	IP Mask	Lo/Hi Port	Prot	Policy	Bi	Syn	Ack	I/Fac
SRC:	192.168.0.0	255.255.	Any/0	All	Deny	No	No	No	Asy.1
DST:	0.0.0.0	0.0.0.0	Any/0						

Remote interface, any source, going to permanent PPP address is valid.

	IP Address	IP Mask	Lo/Hi Port	Prot	Policy	Bi	Syn	Ack	I/Fac
SRC:	0.0.0.0	0.0.0.0	Any/0	All	Accept	No	No	No	Asy.1
DST:	158.152.1.1	255.255.255.255	Any/0						

Loopback interface is valid.

	IP Address	IP Mask	Lo/Hi Port	Prot	Policy	Bi	Syn	Ack	I/Face
SRC:	0.0.0.0	0.0.0.0	Any/0	All	Accept	No	No	No	Local
DST:	0.0.0.0	0.0.0.0	Any/0						

Catch-all rule, all other incoming denied.

	IP Address	IP Mask	Lo/Hi Port	Prot	Policy	Bi	Syn	Ack	I/Face
SRC:	0.0.0.0	0.0.0.0	Any/0	All	Deny	No	No	No	Any
DST:	0.0.0.0	0.0.0.0	Any/0						

Outgoing, set default policy of Deny. Note that the default policy is irrelevant because there is a catch-all rule with Deny.

Filter:OUT Policy: Deny

Local interface, any source going to local net is valid.

	IP Address	IP Mask	Lo/Hi Port	Prot	Policy	Bi	Syn	Ack	I/Fac
SRC:	0.0.0.0	0.0.0.0	Any/0	All	Accept	No	No	No	Eth_II
DST:	192.168.0.0	255.255.0.0	Any/0						

Outgoing to local net on remote interface, stuffed routing, Deny.

	IP Address	IP Mask	Lo/Hi Port	Prot	Policy	Bi	Syn	Ack	I/Fac
SRC:	0.0.0.0	0.0.0.0	Any/0	All	Deny	No	No	No	Asy.1
DST:	192.168.0.0	255.255.0.0	Any/0						

Outgoing from local net on remote interface, masquerade.

	IP Address	IP Mask	Lo/Hi Port	Prot	Policy	Bi	Syn	Ack	I/Face
SRC:	192.168.0.0	255.255.0.0	Any/0	All	Masq.	No	No	No	Asy.1
DST:	0.0.0.0	0.0.0.0	Any/0						

Anything else outgoing on remote interface is valid.

	IP Address	IP Mask	Lo/Hi Port	Prot	Policy	Bi	Syn	Ack	I/Face
SRC:	158.152.1.1	255.255.255.255	Any/0	All	Accept	No	No	No	Asy.1
DST:	0.0.0.0	0.0.0.0	Any/0						

Loopback interface is valid.

	IP Address	IP Mask	Lo/Hi Port	Prot	Policy	Bi	Syn	Ack	I/Face
SRC:	0.0.0.0	0.0.0.0.	Any/0	All	Accept	No	No	No	Local
DST:	0.0.0.0	0.0.0.0	Any/0						

Catch-all rule, all other outgoing is denied.

	IP Address	IP Mask	Lo/Hi Port	Prot	Policy	Bi	Syn	Ack	I/Face
SRC:	0.0.0.0	0.0.0.0.	Any/0	All	Deny	No	No	No	Any
DST:	0.0.0.0	0.0.0.0	Any/0						

Forwarding, set default policy of Deny. Note that the default policy is irrelevant because there is a catch-all rule with Deny.

Filter:FORWARD Policy: Deny

Masquerade from local net on local interface to anywhere.

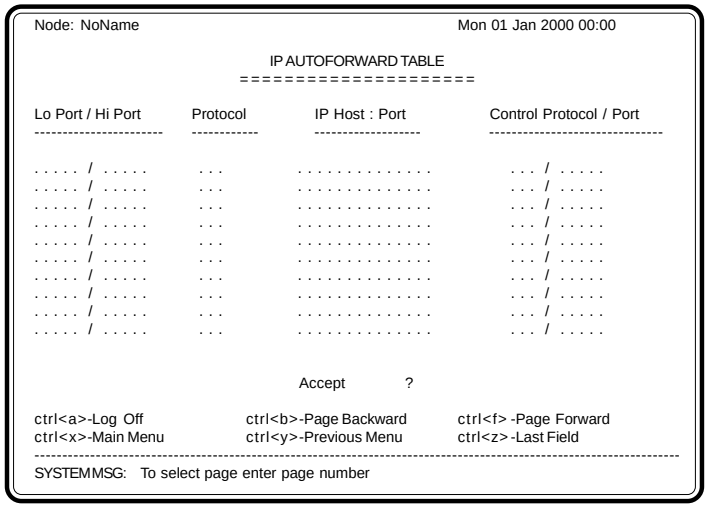
	IP Address	IP Mask	Lo/Hi Port	Prot	Policy	Bi	Syn	Ack	I/Face
SRC:	192.168.0.0	255.255.0.0	Any/0	All	Masq.	No	No	No	Asy. 1
DST:	0.0.0.0	0.0.0.0	Any/0						

Catch-all rule, all other forwarding is denied.

	IP Address	IP Mask	Lo/Hi Port	Prot	Policy	Bi	Syn	Ack	I/Face
SRC:	0.0.0.0	0.0.0.0	Any/0	All	Deny	No	No	No	Any
DST:	0.0.0.0	0.0.0.0	Any/0						

Remember that the set of rules is scanned top to bottom and each rule is appended to the existing set of rules so any restrictions need to come before global rules.

IP AUTOFORWARD TABLE (1.2.6)



The IP Autoforward table allows IP to forward packets on a pre-defined port number to a host hidden behind an IP firewall. It also allows IP masquerading to work with programs such as RealAudio which do not send out a packet on all ports they wish to receive on.

The feature works by adding an entry to the kernel masquerading table whenever a packet is received on a given range of ports. Normally, the masquerading code takes care of this, but it can only do so if the masqueraded host first sends a packet on one of those ports. Programs like RealAudio only send packets out on one port (7070) and expect to receive packets on a wide range of ports (6970-7170 inclusive). Without the feature, any packet received on port other than 7070 would be discarded.

The table can consist of up to 50 entries, (10 entries at a time are displayed) of the following format:

LoPort/Hi Port	**Protocol**	**IP Host:Port**	**Control Protocol/Port**
0-65535/0-65535	UDP/TCP	xxx.xxx.xxx.xxx:nnnn	UDP/TCP/nnnn

The *Lo Port* and *High Port* specify the range of ports which should be forwarded to hidden *IP Host*, (with option port). The *Protocol* parameter should be either TCP or UDP, depending on the type of packet that will be received (generally UDP). *Control Protocol* and *Port* are optional parameters to replace the *IP Host:Port* option to determine which host packets should be sent to.

Whenever a connection is opened to port Control Port, the IP address of that host is saved and will receive packets on the specified port Lo Port/High Port range.

To insert an entry in the table, move the cursor to the point where the entry should be inserted and type 'I' to create a default entry which can then be edited as required.

To delete an entry from the table, move the cursor to the unwanted entry and type 'd', then type 'd' again to confirm and the entry will be removed.

Configuration example:

Lo Port/Hi Port	Protocol	IP Host:Port	Control Protocol/Port
25/0	TCP	192.168.1.1	
6970/7170	UDP		TCP / 7070
19/0	TCP	192.168.1.1:23	

The first IP Autoforward entry sets up LINKSTREAM to forward on TCP port 25 (SMTP) to the hidden host 192.168.1.1.

The second IP Autoforward entry sets up LINKSTREAM to forward packets on UDP ports 6970-7170 inclusive to the last masqueraded host which sent a TCP packet on port 7070 (RealAudio's control Connection).

The third entry allows LINKSTREAM to use single port redirection, where packets arriving on TCP port 19 (CHGEN) are redirected to port 23 (TELNET) of hidden host 192.168.1.1.

After adding the entries, accept the screen and the masqueraded units should be able to use RealAudio.

The following is a listing of some common programs which need an IP Autoforward entry:

RealAudio:
TCP 7070
UDP 6970-7171

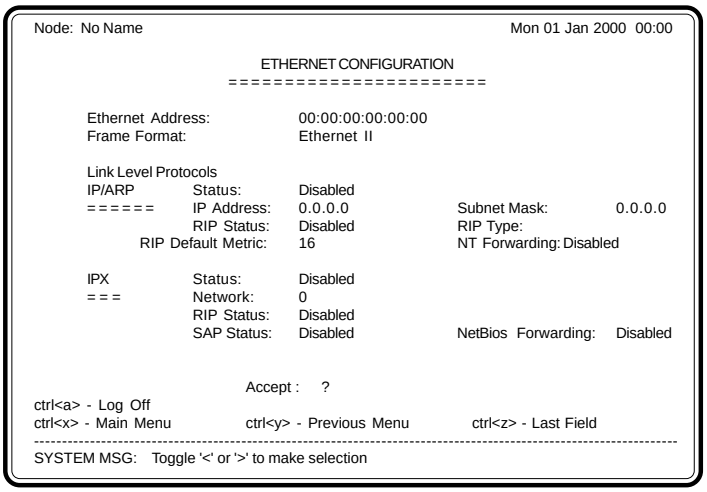
PowWow:
TCP 13223

Internet Phone:
UDP 22555

WebPhone:
TCP 21845
UDP 21845

ETHERNET INTERFACE CONFIGURATION (1.4)

ETHERNET INTERFACE PARAMETERS (1.4.1)



The following parameters must be defined:

Frame Format

Select Ethernet II/802.3 RAW/802.2/802.2 SNAP. Default = Ethernet II. The selection will be dependent on the protocols to be supported and the frame type used on the existing network.

Ethernet II - Supports IP/ARP/IPX
802.3 RAW - Supports IPX only
802.2 - Supports IPX only
802.2 SNAP - Supports IP/ARP/IPX

The required Frame Format is first selected and the Link Level Protocols for IP/ARP and IPX are configured as appropriate. Note that IP/ARP can only have one Frame Format active at any time, ie. Ethernet II or 802.2 SNAP. IPX can have all formats active simultaneously with different network numbers entered for each.

Link Level Protocols

IP/ARP

IP Address

Enter IP address of the unit 4 octets in the form 0.0.0.0.

❑ **Subnet Mask**

Enter a 4 octet address depending on the network class. 4 octets in the form 0.0.0.0. Note that a recommended default mask will be generated as the IP address is entered.

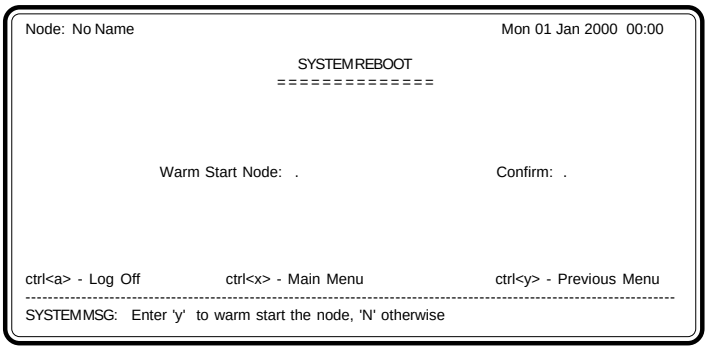
- **RIP Status**
  Select Disabled/Passive/Active. Default = Disabled.
  Disabled = RIP not active.
  Passive = Received RIP responses will be added to the routing table.
  Active = Received RIP response will be added to the routing table and the contents of the routing table will be broadcast.
- **RIP Type**
  Select RIP 1 ONLY/RIP1 compatible.
  Default = RIP 1 compatible.
  RIP 1 ONLY = RIP 1 packets are broadcast only.
  RIP 1 compat = RIP 2 packets are broadcast only.
- **NT Forwarding**
  Select Enabled/Disabled. Default = Disabled. Use to enable support for NT server on the LINKSTREAM.
- **RIP Default Metric**
  Enter value 1-15 or 16 = OFF. Default = 16.
  This option sets the metric (number of hops) to be used when LINKSTREAM wishes to broadcast. It can be used as a default gateway by the attached network.

IPX

- **Status**
  Select Enabled/Disabled. Default = Disabled.
  Use to enable support for IPX protocols on the LINKSTREAM.
- **Network**
  Enter the IPX External Network Number to which the LINKSTREAM is attached. Up to 8 hexadecimal characters.
- **RIP Status**
  Select Enabled/Disabled. Default = Disabled.
  Global Enable for IPX RIP on the LINKSTREAM.
- **NetBios Forwarding**
  Select Enabled/Disabled. Default = Disabled.
  Enables forwarding of NetBios packets.
- **SAP Status**
  Select Enabled/Disabled. Default = Disabled.
  Enables broadcasts of services tables from the LINKSTREAM.

Enter **'Y'** to **'Accept:'** to save the displayed values.

SYSTEM REBOOT (1.6)



When LINKSTREAM has been configured, a system reboot is required. Rebooting the system will clear all buffers.

SECTION 4

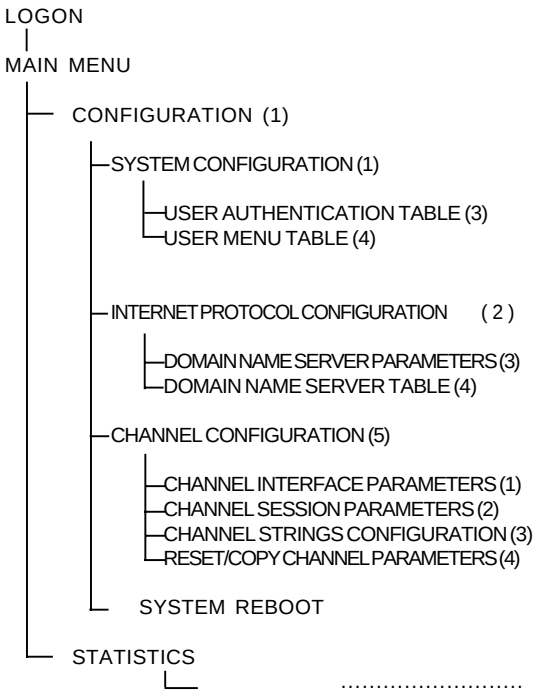
TERMINAL SERVER CONFIGURATION

NODE MANAGER - SCREEN STRUCTURE

NB. Before configuring any other option, system configuration must be completed.

The diagram below gives the overall structure of the screens within the Node Manager, showing the pathways for terminal server configuration.

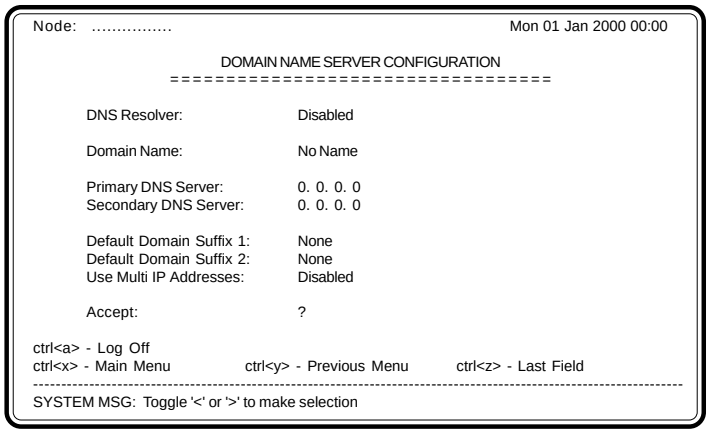
It is advisable to configure LINKSTREAM by systematically working through the screens in the order shown on the following pages. The numbers after each heading refer to the Node Manager screens, e.g. 1.1.1 =
1 - Configuration
1 - System configuration
1 - Node System Parameters



● MANDATORY SETTINGS

❑ NETWORK OPTIONS

DOMAIN NAME SERVER PARAMETERS (1.2.3)

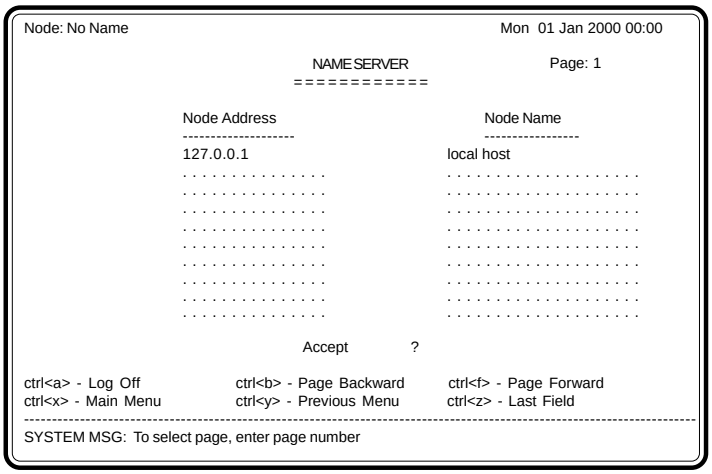


The following parameters must be defined:

- **DNS Resolver**
  Select Enabled/Disabled. Default = Disabled.
  This parameter will enable/disable the Domain Name Server Resolver function in the LINKSTREAM.
- **Domain Name**
  Enter the Domain Name for the unit - up to 255 characters. Use ctrl<d> to delete any characters after the cursor.
- **Primary DNS Server**
  Enter the IP address of the primary Domain Name System Server to be used by the LINKSTREAM.
- **Secondary DNS Server**
  Enter the IP address of the secondary Domain Name System Server to be used. This will be accessed if the primary DNS Server is unreachable.
- **Default Domain Suffix 1**
  Default = None.
  If a fully qualified (i.e. complete) Domain Name has not been entered above then a default suffix can be entered in this field. This contains the labels of the higher levels of the hierarchy of the Domain Name System. This will then be concatenated onto the Domain Name when it is sent over the network.
- **Default Domain Suffix 2**
  Default = None.
  This is an optional second Domain suffix with the same characteristics of Default Domain Suffix 1. It will be used if the Default Domain Suffix 1 has failed to get a response across the network.
- **Use Multi IP Addresses**
  Select Enabled/Disabled. Default = Disabled.
  This feature will allow a common Node name (service name) to be shared across more than one IP address. When enabled, if the name resolver responds with a list of possible IP addresses, each address will be tried in turn. This will continue until a connection is made or all addresses have been tried.

Enter **'Y'** to **'Accept:'** to save the displayed values.

DOMAIN NAME SERVER TABLE (1.2.4)



The above table is completed by associating the appropriate Node Address with its Node Name. The table can have up to 50 entries, arranged on 5 pages of 10. Moving between the pages is done using the 'CTRL<f>' and 'CTRL<b>' keys.

To add an entry, move the inverse field to the next free slot in the Node Address column, using the cursor keys. Enter 'i<CR>' to enable the insert mode and a template address '0.0.0.0' is displayed. Overwrite this with the desired address and enter <CR>. The inverse field will move to the Node Name column where the required name can be entered.

Alternative names and IP addresses can be added to the preceeding entry by entering 'A' for append instead of 'I'. These alternative entries are indented for clarity.

Typing an 'A' in the address field causes the entry to be appended to the immediately preceeding current line. Typing an '=' in either address or name field uses the null entry in that field. The system will then use the previous entry for that particular type. Lists of alternative IP addresses and names can be built up for an entry. When resolving names to IP addresses, all possible IP addresses are returned, to be tried in turn. When resolving IP addresses to names, only the first name is returned, therefore this should be the 'best' name for the destination.

CHANNEL CONFIGURATION (1.5)

CHANNEL INTERFACE PARAMETERS (1.5.1)

```
Node: No Name                                          Mon 01 Jan 2000  00:00
                          CHANNEL INTERFACE PARAMETERS
                          ============================

 Channel Nr:                 0          Local Buffer Size:              160
 Channel Name:               CHAN_00    Forward Timer:                   10
 Password:                   Enabled    Threshold:                        7
 Status:                     Enabled
 Speed:                      9600 bps   Need RTS:                  Disabled
 Parity:                     None       Connect Protocol:              Data
 Stop Bits:                  1          Discard Connect Data:      Disabled
 Data Bits:                  8          Disconnect Protocol:           None
 Inbound Flow Control:       XON/XOFF   Disconnect Char:                  0
 Outbound Flow Control:      XON/XOFF   Disconnect Count:                 0
 DCD Control                 Normal     Break Delay:               1 Char
 Inactivity Timeout (min):   0
 Data Compression:           Disabled   Welcome Message            Default
                                        System Prompt              Default

                                Accept:          ?

ctrl<a> -Log off          ctrl<b> - Configure Serial Interfaces
ctrl<x> - Main Menu       ctrl<y> - Previous Menu          ctrl<z> - Last Field
-------------------------------------------------------------------------------
SYSTEM MSG:  Enter channel number (0 to max no. channel - 1)
```

The following channel parameters must be defined:

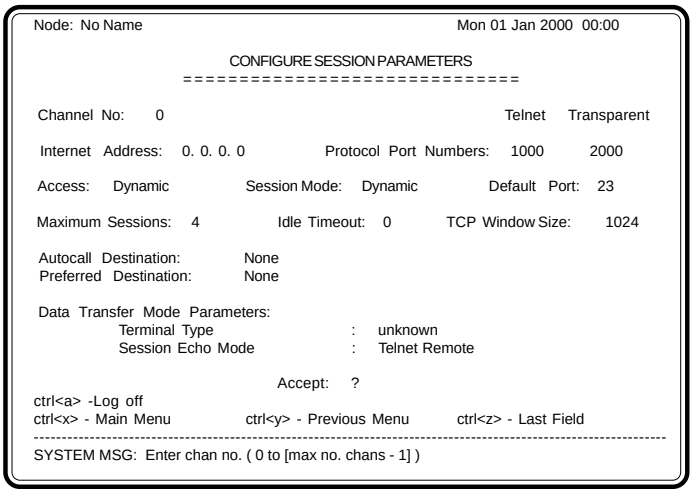
- ❑ **Channel number**
  0-23.
  Enter number to select channel for configuration.
- ❑ **Channel name**
  Up to 16 characters.
- ❑ **Password**
  Select Enabled/Disabled. Default = Disabled.
  If set to Enabled, will prompt the user for a user name and password to allow access to a server menu.
  Refer to the User Authentication table: 1.1.3.
- ❑ **Status**
  Select Enabled/Disabled/Local loop/Remote loop. Default = Enabled.
- ❑ **Speed**
  Select 50/75/110/150/300/600/1.2K/2.4K/4.8K/9.6K/14.4K/19.2K/28.8K/38.4K/57.6Kbps. Default = 9.6Kbps.
- ❑ **Parity**
  Select None/Odd/Even/Force Odd/Force Even. Default = None.
- ❑ **Stop bits**
  Select 1/1.5/ 2. Default = 1.
- ❑ **Data bits**
  Select 5/8 bits. Default = 8.
- ❑ **Inbound Flow control**
  Select NONE, XON/XOFF, DTR/CTS, IXON/XOFF. Default = XON/XOFF.
- ❑ **Outbound Flow control**
  Select NONE, XON/XOFF, DTR/CTS, IXON/XOFF. Default = XON/XOFF.
- ❑ **DCD Control**
  Select Normal/High/True. Default = Normal.

- **Inactivity Timer**
  Enter 0 - 60 minutes. Disabled if set to 0. If the timer is set and no data passes for the specified time, the local interface is dropped allowing the connection to be freed.
- **Data compression**
  Select Enabled/Disabled. Default = Disabled.
- **Local Buffer Size**
  Enter 82 to 1514 bytes. Default = 160.
  This is the serial data buffer size allocated per user channel. Note that this should not be greater than the network buffer size.
- **Forward Timer**
  Enter number in range 1 - 1000mS. Default = 10mS. This value is the time allowed between characters. If no characters are received within the period specified, the LINKSTREAM will forward the existing packet, irrespective of how full it is. For applications with low traffic volumes, this number should be <100mS.
- **Threshold**
  Enter number in range 1 - 8 bytes. Default = 7. This is the number of bytes held in the UART receive buffer before generating an interrupt.
- **Need RTS**
  Select Enabled/Disabled. Default = Disabled.
  If enabled, this will require that RTS input is asserted before the channel will respond. If the channel is configured as Remote, then connection will be refused until RTS is asserted.
- **Connect Protocol**
  Select None/Data/Break/Carriage Return/RTS/ Ring in (Pin 1 of the RJ45 connector).
  Default = Data.
- **Discard Connect Data**
  Select Enabled/Disabled. Default = Disabled.
  If enabled, any characters received at this channel while it is in the IDLE state will be discarded.
- **Disconnect Protocol**
  Select None/Break/Double Break/Character/RTS.
  Default = None.
  If Character selected, the disconnect character and disconnect count should be entered.
- **Break Delay**
  Select 1char/250mS/500mS/750mS/1sec/1.5sec/ 2sec/ 3sec/4sec/5sec. Default = 1char.
  This allows break characters of various lengths to be generated at the channel, the minimum length being at least 1 character.

- **Welcome Message**
  Select Disabled/Default/User Defined. Default = Default.
  This allows the user to turn off welcome messages if required by disabling the feature. The default message is 'Welcome to LINKSTREAM'. User defined messages are entered using the Channel String Configuration screen.
- **System Prompt**
  Select Disabled/Default/User Defined. Default = Default.
  This allows the user to turn off the system prompt if required by disabling the feature. The default prompt is 'LINKSTREAM>'. User defined prompts are entered using the Channel String Configuration screen.

Enter **'Y'** to **'Accept:'** to save displayed values.

CHANNEL SESSION PARAMETERS (1.5.2)



The following channel parameters must be defined:

- ❑ **Channel Number**
  0-23.
  Enter number to select channel for configuration.
- ❑ **Internet Address**
  The default value will be the address entered on the Ethernet configuration screen.
- ❑ **Protocol Port Numbers**
  These are the port numbers assigned to user channels for Telnet and Transparent operation.
  Telnet - Enter number in range 1 - 65535.
  Default = 1000 + channel number.
  Transparent - Enter number in range 1 - 65535.
  Default = 2000 + channel number.
- ❑ **Access**
  Select None/Dynamic/Dedicated/Local/Remote/LPD.
  Default = Dynamic.
  None = Channel not in use.
  Dynamic = The channel is able to initiate or receive a connection call.
  Dedicated = The channel will initiate a call to the address in the Autocall destination when the connect protocol conditions are satisfied. This option will disable Welcome Message and System Prompt.

Local = The channel can only initiate connections. *Remote* = The channel can only receive connection calls.

PVC = Permanent Virtual Circuit. For special applications only and should not be used without consulting Perle.

LPD = Line Printer Daemon. The channel supports a serial printer using the LPD protocol as defined by RFC 1179. When selected, the only parameters that can be configured are the Idle Timeout and Telnet Newline Filtering.

- **Session Mode**
  Select Telnet/Transparent/Dynamic. Default = Transparent.
  Telnet = Channel will accept Telnet connections only.
  Transparent = Channel will accept Transparent connections only.
  Dynamic = Channel will accept both Telnet and Transparent connections.
- **Default Port.**
  Port number used when calling a remote node if no port number is specified. Default value is 23.
- **Maximum Sessions**
  Up to 4 sessions per channel.
- **Idle Timeout**
  0 - 60 minutes. Disabled if set to 0. Connection across the network dropped at end of timeout if no data activity.
- **TCP Window Size**
  64 to 8192 bytes. Default = 1024.
  This is the number of bytes sent before an acknowledgement should be received.
- **Autocall Destination**
  Enter a destination name if it is configured in the Name Server table, or the IP address and port number of the desired destination. The port will then automatically call up the destination specified when the connect protocol conditions for the port are satisfied, e.g. presence of data if 'Connect on Data'.
  Default entry = NONE, i.e. no Autocall.
- **Preferred Destination**
  Enter a destination name if it is configured in the Name Server table, or the IP address and port number of the desired destination. When a Preferred Destination is defined the user does not have to enter a destination to open a session, the LINKSTREAM will connect to the preferred value, i.e. the user types '0 <CR>' to the Command Line Interface to connect. Default entry = NONE, i.e. no Preferred Destination.

- **Data Transfer Mode Parameters**
  These define the terminal type and the parameters controlling the data transfer characteristics for a session.
- **Terminal Type**
  Enter the terminal type or 'None' to delete.
  The string entered will be used for Telnet terminal type negotiation by UNIX hosts, e.g. VT100. This field can contain up to 10 user defined characters. This parameter is permanently shown on the screen.

  The following parameters are accessed sequentially using the < > keys. The value of a particular parameter is selected by moving the cursor to the associated options field and again using the < > keys to select the required option.

- ***Session Echo Mode***
  Select Telnet Remote/None/Local. Default = Telnet Remote.
  This selects the echo mode for characters. 'Telnet Remote' is only valid in Telnet mode and causes the session to negotiate the echo protocol.
  Session Binary Mode
  Select Enabled/Disabled. Default = Disabled.
  When enabled it allows a Telnet connection to a channel to negotiate Binary Mode operation. If unsuccessful, the connection will continue in normal mode.
  Active Session Local Character
  Select 'Suspend + Verbatim/All Telnet Char/None'. Default = Suspend + Verbatim.
  This is used to select which Telnet characters are looked for by the channel. This can be none, all characters or just the Suspend + Verbatim characters.
  Select None for Async to Async data tranfer.
  Telnet Newline Filtering
  Select 'None/<CR>/<CR+LF>/<CR+Null>'.
  Default = None.
  Telnet will always append a <LF> character to each <CR>. This option selects how the <CR+LF> sequence is treated to avoid multiple <LF>s onto a terminal.
  None = Send through received <CR+LF> transparently.
  CR = Just send a <CR>.
  <CR+LF> = Send <CR+LF>.
  <CR+Null> = Send <CR+Null>.

Active Session Messages
Select Disable/Default/User Defined. Default = Default. This allows the user to turn off active session messages. The default messages are 'Connected...' and 'Disconnected'. User defined messages are entered using the Channel Strings Configuration screen.

Default Connect Command
Select None/Telnet/Open. Default = None.
Passive Session Message
Select Disabled/Default/User Defined. Default = Default.
This allows the user to turn off passive session messages. The default messages are 'Connected...' and 'Disconnected'. User defined messages are entered using the Channel Strings Configuration screen.
Session Error Message
Select Enabled/Disabled. Default = Enabled.
Telnet Break Action
Select Ignore/Telnet Break/Telnet IP. Default = Ignore.
This selects the action to take when a break character is detected at this channel when a session is established. Telnet Break will cause an IAC/BREAK command to be transmitted to the remote connection. Telnet IP will cause an IAC/Interrupt process command to be transmitted.
Break on Telnet
Select Enabled, Disabled. Default = Disabled.
This defines the action to take when the channel receives a Telnet IAC/Interrupt Process command from the remote connection. If enabled, a break signal is generated.
Note that a break signal is always generated if a Telnet IAC/Break Command is received from the remote connection.
Telnet BRK Char
Select None or 'control character'. Default = None.
Select a control character to signify a Break key if no key is available on the user's keyboard.
The following is a set of characters used for specific Telnet functions. Options exist for all characters which can be selected by the user. The default values and functions are given below.

Session Suspend Character
Default = ^] *Suspends the current session.*
Telnet IP Char
Default = ^U *Sends the Telnet IP code.*
Telnet AO Char
Default = ^O *Sends the Telnet AO code.*
Telnet EC Char
Default = ^? *Sends the Telnet EC code.*
Telnet EL Char
Default = ^K *Sends the Telnet EL code.*
Telnet AYT Char
Default = ^T *Sends the Telnet AYT code.*
Session Verbatim Char
Default = ^V *Indicates that the next character is to be sent transparently as data. This allows the above control characters to be sent across a session.*

```
Node: No Name                                          Mon 01 Jan 2000  00:00

                          CHANNEL STRINGS CONFIGURATION      String Space: 1856
                          ================================

Channel Nr: 0.                                          Channel Name: CHAN_00
Welcome String            Status:   Default
                          Text:     None
Command Line Prompt       Status:   Default
                          Text:     %s

Active Session Message    Status:   Default
            Connect:      None
            Disconnect:   None                                Errors: Enabled

Passive Session Messages  Status:   Enabled
            Connect:      None
            Disconnect:   None

                               Accept:?
ctrl<a> - Log off
ctrl<x> - Main Menu          ctrl<y> - Previous Menu       ctrl<z> - Last Field
-------------------------------------------------------------------------------
SYSTEM MSG:  Enter chan. no. ( 0 to [ max no. channels-1] )
```

This screen is used to configure system messages issued by the LINKSTREAM. Messages can be configured on a per channel basis.

- ❑ **String Space**
  This displays the number of bytes left in the string area of the NOVRAM. Maximum area is 2048 bytes.
  (For information only).
- ❑ **Channel Numbers**
  0-23.
  Enter number to select channel.
- ❑ **Welcome String:Status**
  Select Disabled/Default/User Defined. Default = Default.
  This allows the user to turn off welcome messages by disabling the feature. The default string is 'Welcome to LINKSTREAM'. User defined messages are entered on the next line.
- ❑ **Welcome String:Text**
  Default = None.
  Enter message to be displayed when the channel is woken.
- ❑ **Command Line Prompt:Status**
  Select Disabled/Default/User Defined. Default = Default.
  This allows the user to turn off the Command Line prompt by disabling the feature.The default prompt is 'LINKSTREAM>'. The default messages are 'Connected...' and 'Disconnected'. User defined messages are entered on the next line.

- **Active Session Error Messages:Status**
  Select Enabled/Disabled. Default = Enabled.
  This allows the active session error messages to be turned off.
- **Active Session Messages:Connect**
  Default = None.
  Enter the message to be displayed at the calling end of a connection when the connection is established.
- **Active Session Messages:Disconnect**
  Default = None.
  Enter the message to be displayed at the calling end of a connection when the connection is closed.
- **Passive Session Messages:Status**
  Select Enabled/Disabled. Default = Enabled.
  This allows the passive session error messages to be turned off.
- **Passive Session Messages:Connect**
  Default = None.
  Enter the message to be displayed at the call end of a connection when the connection is established.
- **Passive Session Messages:Disconnect**
  Default = None.
  Enter the message to be displayed at the called end of a connection when the connection is closed.

Enter **'Y'** to **'Accept:'** to save displayed values.

USER STRING DEFINITIONS

The user is able to define output strings including escape sequences and control codes. In order to reduce memory requirements, shorthand sequences are also available as set out below:

- **Control Codes**
  The ASCII character '^' indicates the next character is to be treated as a control character. Note that only upper case letters are supported.

  Commonly used control characters:

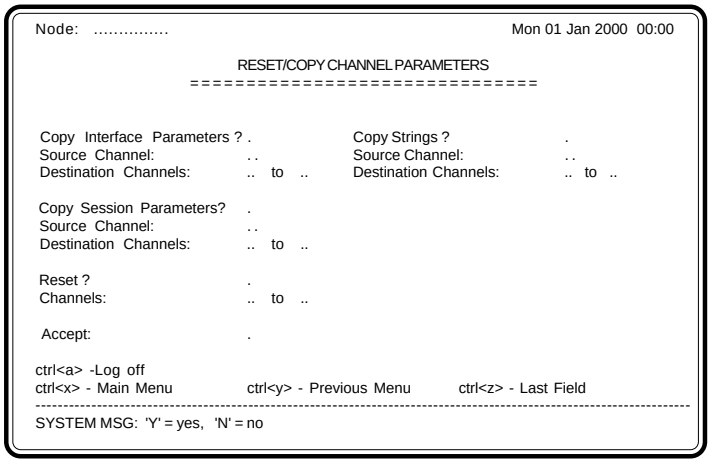
'^M'	Carriage Return
'^J'	Line feed
'^G'	Bell
'^S'	XOFF
'^Q'	XON

❑ **Shorthand Strings**

The ASCII character '%' is used as a prefix for a set of predefined strings as set out below.

%a	Insert the IP address of the channel
%c	Insert the channel name
%Cnn	Use the relevant string from channel number 'nn'
%d	Insert the current date as 'dd/mm/yy'
%D	Insert the current date as text: e.g. Mon 23 Oct 2000
%g	Insert the character '>'
%l	Insert the character '<'
%n	Insert the prefix of the DNS domain name, i.e. up to the first '.' in the domain name
%Nxx	Insert the first xx characters of the fully qualified domain name
%p	Insert the channel number as 1 or 2 digits
%P	Insert the string 'Port'
%s	Insert the string <CR><LF>LINKSTREAM>'
%t	Insert the current time as 'hh:mm:ss'

Strings can be edited in place by using the '>' and '<' keys to move the cursor along the string. New data is inserted at the cursor position. Backspace and delete remove the previous characters. 'Ctrl-D' deletes the rest of the string from the current cursor position.

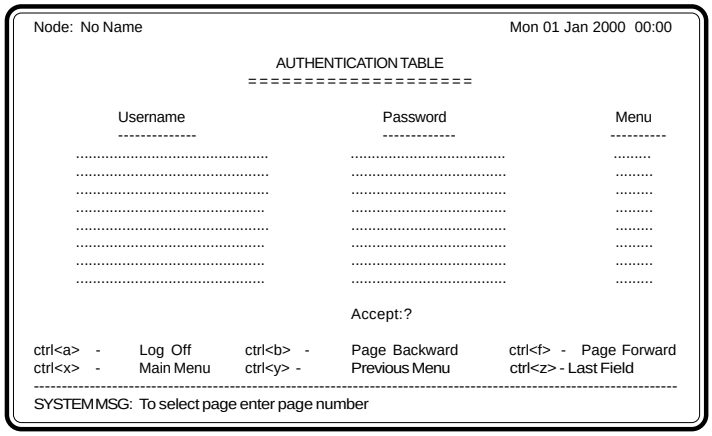


This screen is used to copy interface session and string parameters between channels. The source channel number is entered then the range of channel numbers to be configured. To copy to one channel, just enter the number of that channel.

To activate changes made by copying, each channel must be RESET. Beware that resetting a channel will affect any sessions currently open.

Channel activity can be reset, buffers and counters cleared, by entering **'Y'** to **'Reset'** then entering the range of channels as with the copy commands.

Enter **'Y'** to **'Accept:'** to save displayed actions.



This screen lists authorised users of the User Menu Table. To configure a channel to use User Authentication, set the 'Password' parameter on the Channel Interface Parameter screen (1.5.1).

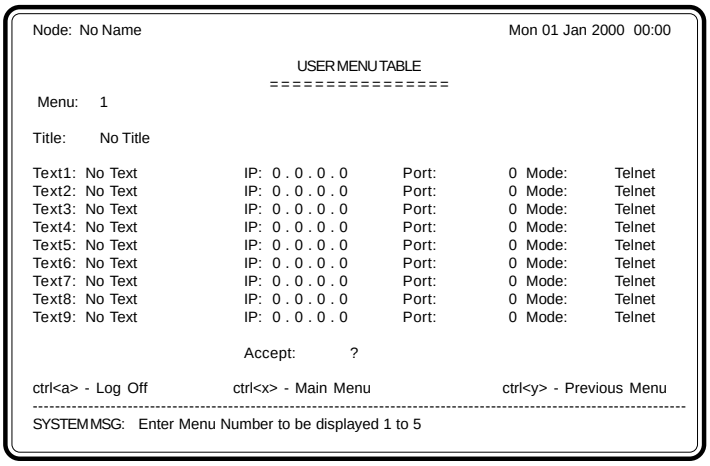
- **Page**
  Each page holds 10 user names.

- **Username**
  Enter user's name - up to 16 characters.

- **Password**
  Enter password associated with user's name.

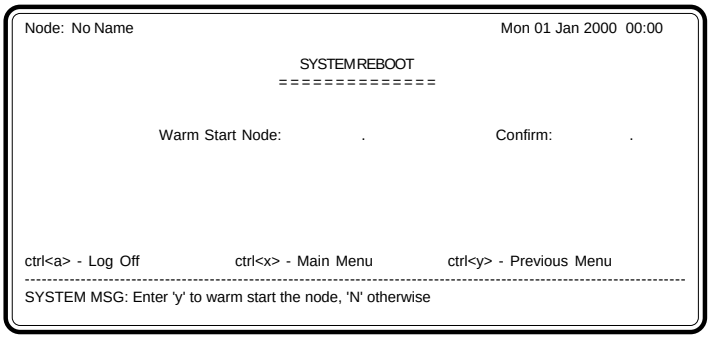
- **Menu**
  Enter menu number assigned to the user.

USER MENU TABLE (1.1.4)



This screen is used in conjunction with the Authentication Table.

- **Menu**
  Multiple menus (up to 5) can be configured depending on the number of security levels.
- **Title**
  Welcome message associated with this menu. Refer to Channel Strings Configuration / User String Definitions for control characters and shorthand strings.
- **Text**
  Provides the option menu for the user: 1 - 9. The user types the menu number required.
  See User String Definitions for control codes supported. Ensure text strings are terminated by Carriage Return, Line Feed.
- **IP**
  The IP address associated with the particular text number.
- **Port**
  Port number associated with the IP address.
- **Mode**
  Telnet or Transparent.



When the LINKSTREAM has been configured, a system reboot is required. Rebooting the system will clear all buffers.

SECTION 5

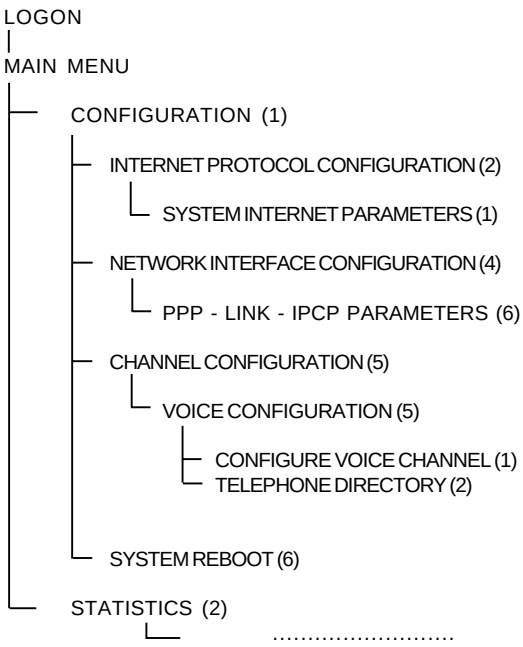
VOICE CONFIGURATION

NODE MANAGER - SCREEN STRUCTURE

NB. Before configuring any other option, system configuration must be completed.

The diagram below gives the overall structure of the screens within the Node Manager, showing the pathways for voice configuration.

It is advisable to configure LINKSTREAM by systematically working through the screens in the order shown on the following pages. The numbers after each heading refer to the Node Manager screens, e.g. 1.1.1 =
1 - Configuration
1 - System configuration
1 - Node System Parameters



● MANDATORY SETTINGS

❑ NETWORK OPTIONS

INTRODUCTION

IP networks are now firmly established as **the** network standard and so, when designing any network to take you through into the new millenium, you must consider open systems using TCP/IP protocols. Why confine your organisation's potential in a dead-end network with closed systems and proprietary or dated technology when the **VIP** technology from Perle can open the door to a powerful communications structure?

Utilising the latest technology, **VIP** integrates voice, fax and data communications for both LAN and WAN applications across any network, including legacy systems, with PPP protocol support ensuring third party connectivity. Supporting IP and NT protocols, **VIP** is designed for easy installation in both remote and central sites and, because of its modular format, supports **unlimited** remote sites.

Adding voice to a LAN and WAN network

VIP is designed to integrate into any intranet network environment and because it uses the Ethernet protocols there are no incompatibility problems with legacy systems. Your existing hubs, switches and routers can all be utilised to build an appropriate architecture for your organisation's needs.

VIP: where can it be used

VIP technology provides both an IP Ethernet interface as well as dual router WAN interface using PPP protocol. This router interface can operate in both lease line and dial up - modem and ISDN - applications.

With IP prioritisation, the throughput for voice traffic is managed to ensure that the voice quality is guaranteed, regardless of the data traffic loading.

NETWORK DESIGN CONSIDERATIONS

Basic Considerations

Speech data is time-critical. Just as data terminal users will find response 'sluggish' if character echo times start to exceed 100mS, it is usually considered that approximately 400mS is the absolute maximum end-to-end delay that telephone users will tolerate (compare with the 250mS delay introduced by satellite links). The tolerance to this delay will vary from user to user, and from application to application. Note also that this delay has nothing whatsoever to do with the tail length of the echo canceller.

The goal then, is to ensure that the majority (greater than 95%) of speech packets arrive at their ultimate destination within severall hundred mS. Several steps can be taken to achieve this goal.

To ensure an upper limit on the transit delay of speech packets, the network designer can consider the following points:

1. Allocate Generous Bandwidth

For example, on an Ethernet segment bandwidth is quite cheap, and experiments show that loading a segment to 20% will not normally incur performance penalties. Similarly, 2Mbps microwave links may very well provide enough bandwidth without the need to take special precautions, depending on the network loading. Measurements with timed ICMP 'pings' may give some useful indication of network transit delays.

Low speed links in particular, such as 64Kbps, may require careful network design.

2. Use Bandwidth Efficiently

Ensure that UDP header compression is used on a WAN link. This will halve the voice bandwidth. Consider link-level data compression carefully, as most compression algorithms will cause the already highly compressed speech data to expand by more than 12%.

3. Prioritise Speech Data

VIP speech packets will have the Low Delay bit set in the IP Type of Service Field - some routers will correctly handle this field. Alternatively, all **VIP** speech packets can be recognised as UDP packets with source and destination port numbers in the range of 300 to 303 decimal - some routers will permit prioritising on UDP port numbers.

Multiprotocol routers may be able to prioritise IP traffic over other protocols.

Note that it is unlikely that bridge based networks will be able to support prioritisation.

4. Reduce Serial Link Latencies

Use smaller MTUs - a 1500 byte Ethernet packet will take 180mS to traverse a 64Kbps link. Even prioritised data will be blocked during this time.

5. Use the Correct Playback Delay

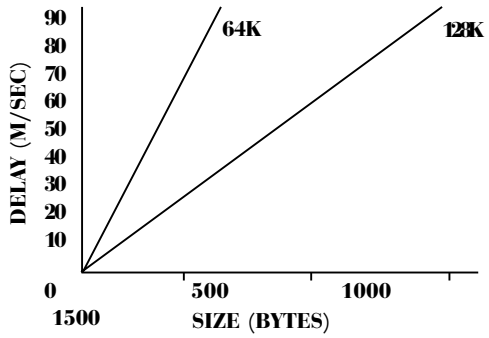
Set the received Playback Delay to a value consistent with the network transit jitter levels. Values set too high will needlessly introduce delays, while values set too low will result in lost packets and lower speech quality.

Example
Voice over a 64Kbps WAN link. To utilise maximum frame size (MTU) for low delay, and to reduce voice clipping, the recommended throughput delay is less than 90mS.

Minimum delay of 30mS .03 x 64000 / 8 = frame size of 240 bytes.
Set playback delay to the same value as MTU 30mS = 3.

Maximum delay of 90mS .09 x 64000 / 8 = frame size of 720 bytes.
Set playback delay to the same value as MTU 90mS = 9.

RECOMMENDED FRAME SIZE TO THROUGHPUT DELAY



IDLE LINE TIME

If no voice packets are received from the remote voice port for the Idle Line Time, the local port will assume that either the remote port has cleared the connection, or a network line fault has occurred; in either case the local port will close its connection end.

USER FEATURES

VIP technology is designed to be easily installed and operated. From the network managers point of view the technology is easily integrated, configured and maintained. As far as the users are concerned, calls are made in the usual way.

Each phone on the network has a unique IP address (identity) and connections can be made in two forms - dedicated or switched.

Dedicated (Direct)
The dedicated service is for point to point operation. In this mode, each phone has a dedicated local IP address and remote destination address. When connection is requested, i.e. when the phone is picked up, the network will automatically connect with the destination IP address and the connection will be established as soon as the other end responds, i.e. when the receiver is picked up.

Switched (Dial)
The switched service allows the network manager to configure an IP table which allows up to 12 DTMF digits to correspond to an IP address. This allows the user to key in a number which **VIP** recognises and automatically connects to its IP address.

ROLI/RILO interfaces
VIP ROLI/RILO interfaces can provide a long-line extension from a PBX to a phone with an industry standard two wire interface. Time break recall is supported.
Physical interface: Analogue 2 wire, incorporating an optional (strappable) ring capacitor.

ROLI (FXS) interface
A loop start operation that provides connection to a standard, single-line telephone instrument, the line circuit of a Key Telephone System (KTS), or a loop start trunk circuit of a PBX. This interface provides power and ringing signals to its interfacing equipment.

RILO (FXO) interface
A loop start operation that emulates a single-line telephone to central office lines or PBX stations. It recognises ringing signals and draws current to indicate an active state.

E&M and AC15 interfaces
VIP tie-line interfaces provide the connections for internetworking PBXs together.
Physical interface: Analogue 2 or 4 wire, E&M signalling DC5, and types 1 to 5, AC15 in band signalling.

VOICE OVER IPX NETWORKS

Reliable delivery of time-critical data, such as voice traffic, relies heavily on the following points:

* identifying low-delay packets to ensure prioritised delivery

* fragmenting large packets to ensure acceptable link access latency

The IP suite of protocols address these issues with the corresponding protocol features:

* an optional Quality of Service field in every IP packet
* a recognized method of fragmenting large packets into smaller packets, and reassembling them at the receiving end

NETWARE

Netware, being a simpler proprietary suite of protocol, does not support any of these advanced features. However, by 'tuning' Netware parameters it should be possible to optimize IPX traffic to coexist with both voice and data IP traffic sent across low-speed (64Kbps) links.

Tests conducted at Perle with Netware 3.11 show that with the majority of IPX packets restricted to less than 576 bytes, quality speech transmission is possible while simultaneously transmitting large amounts of data in the form of Logon/off sequences and large file transfers. As a first approximation, a 576 byte packet takes 71mS to be sent across a 64K link, thereby introducing an element of 'jitter' of 71mS in the received voice packets. This jitter is removed by an elastic buffer at the receive node which must have a jitter attenuation range of the same order - so a 'playback delay' parameter of approximately 90mS would probably be suitable, although an additional allowance may also have to be made for congestion induced jitter, finite processing time, etc.

As noted, Netware does not support fragmentation. Novell documentation indicates that version 3.xx and below supports SPX which will always use packet sizes of less than 576 bytes, which should produce good speech quality. Versions 4.xx with SPX II can use larger packets - up to 1600 bytes, or an equivalent jitter value of 190mS. Consideration must also be given to NCP options - depending on whether the Large Internet Packet option is set, whether a router is detected, etc. It is suggested that the configuration of a given Novell network should be studied to confirm that large packets are not permitted, paying attention to whether SPX or SPX II is used, whether the Shell revision permits Packet Burst mode, LIP options, etc.

VOICE CONFIGURATION (1.5.5)

```
Node:  ................                                Mon 01 Jan 2000  00:00
                    VOICE CONFIGURATION MENU
                    ========================

                    1.     Configure Voice Channel

                    2.     Telephone Directory

                    Select Screen :

ctrl<a> - Log Off        ctrl<x> - Main Menu        ctrl<y> - Previous Menu
------------------------------------------------------------------------------
SYSTEM MSG:  Enter option number
```

Options are selected by entering the appropriate number to the prompt.

The **VIP Card** is configured using the appropriate screen under the Node Manager. The screen is located in the Channel Configuration area of the configuration menu. Details of this are given below.

VOICE CHANNEL CONFIGURATION (1.5.5.1)

```
Node:  ................                                Mon 01 Jan 2000  00:00

               VOICE CHANNEL CONFIGURATION
                    ===========================

    Local Voice Port:  .                       Call Status:      ........

    Channel Mode:          Disabled
    Local  Interface:      Subscriber
    Routing Type:          Dial
    Remote  IP Address:    0. 0. 0. 0
    Remote  Voice  Port:   0
    Playback  Delay:       3   (1/100's sec)
    Idle  Line  Time:      55  (1/100's sec)
    Silence Supression:    Disabled
    RX  Level:             0  dB
    TX  Level:             0  dB

                           Accept:          ?

    ctrl<a> - Log Off
    ctrl<x> - Main Menu    ctrl<y> - Previous Menu      ctrl<z> - Last Field
    ------------------------------------------------------------------------
    SYSTEM MSG:
```

The following parameters must be defined:

- ❑ **Local Voice Port**
  Select the appropriate local voice port number (0-3).

- **Channel Mode**
  Select Enabled/Disabled.
  Default = Disabled.
- **Local Interface**
  Select Subscriber/PBX/Tie Line according to the interface configured in the hardware.
- **Routing Type**
  Select 'Direct' for point to point operation using the dedicated remote IP address.
  Select 'Dial' for switching service using the voice routing table. Default = Dial.
- **Remote IP Address**
  Enter the IP address of the unit at the other end of the required voice connection. Enter the address in the form 0.0.0.0.
- **Remote Voice Port**
  Select the appropriate remote voice port number at the other end of the voice channel (0-3).
- **Playback Delay**
  Set the received playback delay to a value consistent with the network transit jitter levels. Values set too high will needlessly introduce delays, whilst values set too low will result in lost packets and lower speech quality. The setting is in multiples of 3, e.g. 3, 6, 9.

	Speed			
MRU BYTES	**64Kbps**	**128Kbps**	**192Kbps**	**256Kbps**
250	3	3	3	3
500	6	3	3	3
1,000	12	6	3	3
1,500	18	9	6	3

  This chart depicts the minimum settings - higher values will ensure more consistent voice quality.

- **Idle Line Time**
  A call will clear down if no voice packets are received from the remote voice port for the idle line time. The local port will assume that either the remote port has cleared the connection, or a network line fault has occurred; in either case, the local port will close its connection end.
  The idle line time should therefore always be set to a value greater than the playback delay, i.e. 18 (180mS).

- **Silence Suppression**
  Default = Disabled.
  This setting transmits all voice packets, including silence packets.

❑ **With comfort noise**
This setting allows the suspension of silence packets and enables comfort noise generation locally.

VIP ATTENUATION

❑ **Attenuation**
It is recommended that a dB meter is used.

❑ **ROLI / RILO**
ROLI and RILO interfaces should be set at 0dB, i.e. the inbound and outbound amplitude is equal.

❑ **AC15 and E&M**
AC15 and E&M interface attenuation settings will be PBX dependent. See appropriate PBX manual for details.

❑ **RX Level (Output)**
Select the RX signal level between 6dBm and -17dBm. Adjust this value to achieve the best voice quality.*

❑ **TX Level (Input)**
Select the TX signal level between 6dBm and -17dBm. Adjust this value to achieve the best voice path performance.*

Voice adjustment:
(1) Set the Tx and Rx levels on the VIP port to 0dB.
(2) Check the voice quality for voice performance.
If voice is 'clipping' or distorted, adjust the Tx level +ve (decrease gain) to achieve the best performance.
(3) If volume needs altering, adjust the Rx level +ve (increase gain).

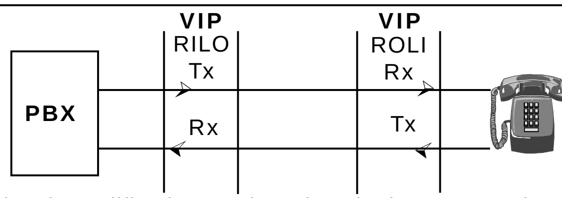
***CAUTION:** Extreme settings may cause excessive feedback oscillation.

Input and output levels

Rx level 0dB	+	=	increase amplification
	-	=	decrease amplification
Tx level 0dB	+	=	decrease attenuation
	-	=	increase attenuation

❑ **Call Status**
This shows the current status of the connection.

IDLE Phone line not in use
ACTIVE Phone line connection is busy



Signal amplification settings in 1dB increments: input amplification 0 is no amplification, and 6dBm is maximum attenuation, or -17dBm is maximum amplification. The default is set at 0dBm.

PBX ATTENUATION

PBX Tie Trunk Application Adjustments

Many PBXs have selectable input/output level combinations for Tie Trunks, e.g. +7/-16, -16/+7 and 0/0dB. Level option 0/0dB should be selected. Also, PAD (2dB) Switching Option, if available, should be selected.

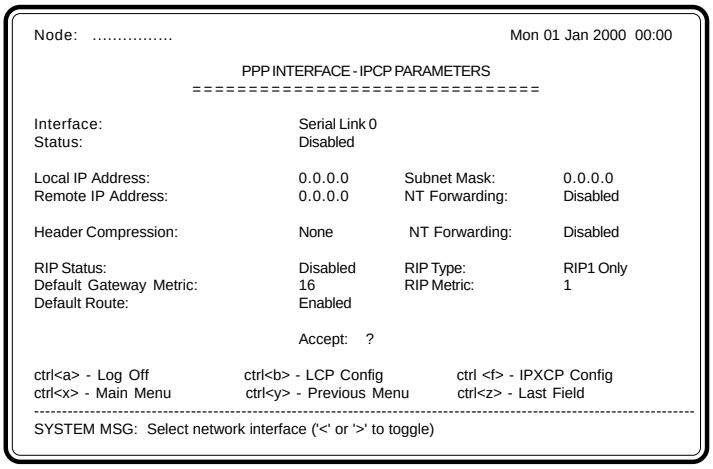
TELEPHONE DIRECTORY (1.5.5.2)

```
Node: ................                                    Mon 01 Jan 2000  00:00

                         TELEPHONE DIRECTORY                        Page 1
                        ====================
Telephone No              Interface        IP Address           Voice Port
..............................  ...............  ....................   ...
..............................  ...............  ....................   ...
..............................  ...............  ....................   ...
..............................  ...............  ....................   ...
..............................  ...............  ....................   ...
..............................  ...............  ....................   ...
..............................  ...............  ....................   ...
..............................  ...............  ....................   ...

                               Accept ?

ctrl<a> - Log Off         ctrl<b> - Page Backward        ctrl<f> - Page Forward
ctrl<x> - Main Menu       ctrl<y> - Previous Menu        ctrl<z> - Last Field
-----------------------------------------------------------------------------
SYSTEM MSG:  To select page enter page number
```

The voice routing table is used to associate the telephone number to the remote network address. If the network address is requested, the **VIP Card** will route the voice traffic to the remote IP address.

- ❑ **Telephone No**
  This is the telephone number for the destination IP address. Enter up to 12 digits with <CR> which causes the cursor to move to the next column.
- ❑ **Interface**
  This determines the physical interface type at the remote address. Select Subscriber/PBX.
  Terminate with <CR> which causes the cursor to move to the next column.
- ❑ **IP Address**
  This will determine the remote IP destination address for the voice to be connected to. Terminate with <CR> which causes the cursor to move to the next column.
- ❑ **Voice Port**
  This will determine the port number at the remote address. Terminate with <CR> which causes the cursor to move to the next column.

Enter **'Y'** to **'Accept:'** to save the completed table.



This setting allows the IP header to be compressed across the serial link to reduce voice bandwidth requirements. This parameter can only be used Perle to Perle.

- **Header/Voice Compression**
  Select one of the following:
  None
  No compression.

  Allow VJ/Do voice
  This setting allows VJ and voice header compression if requested by the remote unit. Set when using asynchronous data and voice.

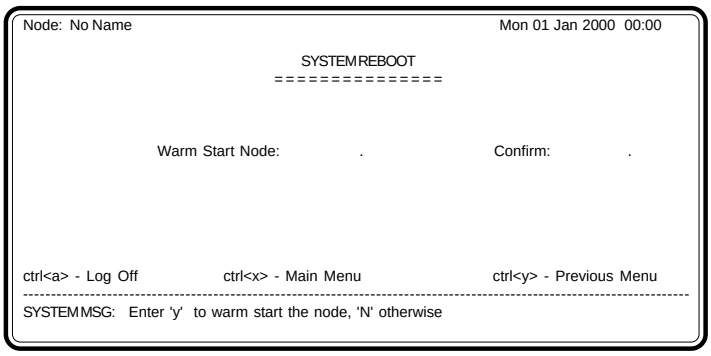
  Do VJ/Do Voice
  This setting requests VJ and voice header compression by the remote unit. Set when using asynchronous data and voice.

  Do voice comp
  This setting requests voice header compression by the remote unit. Set when using voice only.

  Allow VJ comp
  This setting allows VJ header compression if requested by the remote unit. Set when using asynchronous data.

  Do VJ comp
  This setting requests VJ header compression by the remote unit. Set when using asynchronous data.

SYSTEM REBOOT (1.6)



Once configured, a system reboot is required. Rebooting the system will clear all buffers.

SECTION 6

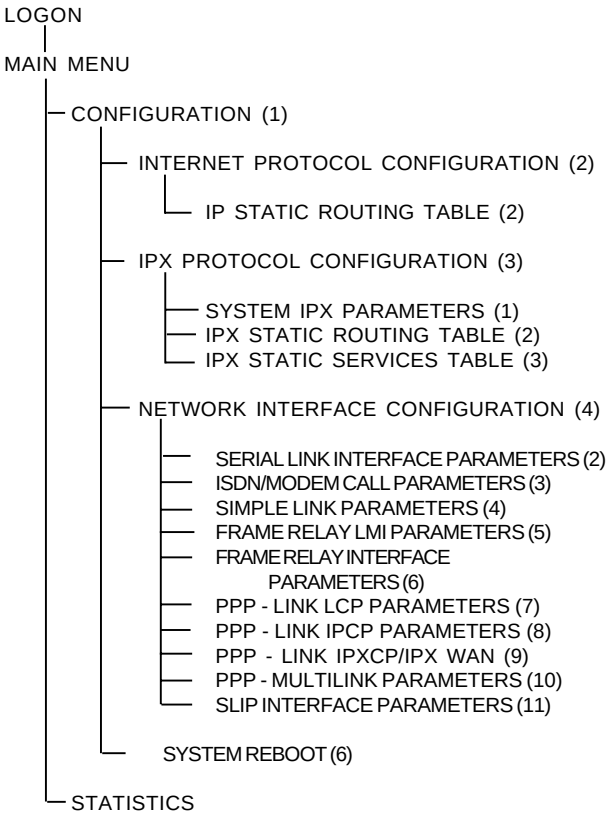
ROUTER CONFIGURATION

NODE MANAGER - SCREEN STRUCTURE

NB. Before configuring any other option, system configuration must be completed.

The diagram below gives the overall structure of the screens within the Node Manager, showing the pathways for router configuration.

It is advisable to configure LINKSTREAM by systematically working through the screens in the order shown on the following pages. The numbers after each heading refer to the Node Manager screens, e.g. 1.1.1 =
1 - Configuration
1 - System configuration
1 - Node System Parameters



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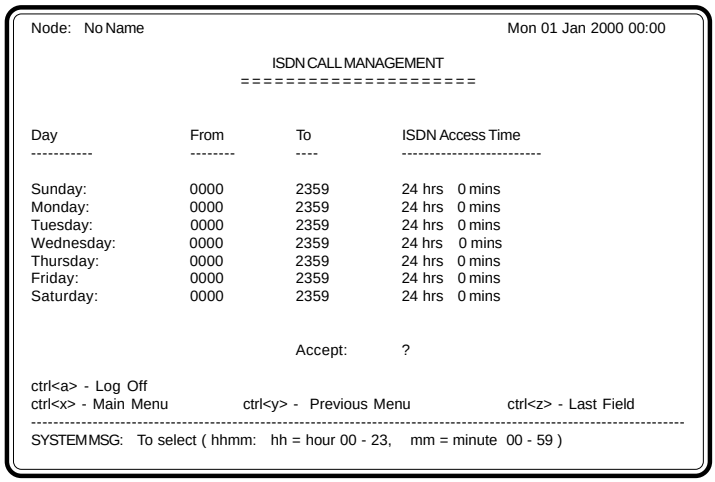
● MANDATORY SETTINGS

❑ NETWORK OPTIONS

SYSTEM CONFIGURATION MENU (1.1.5)

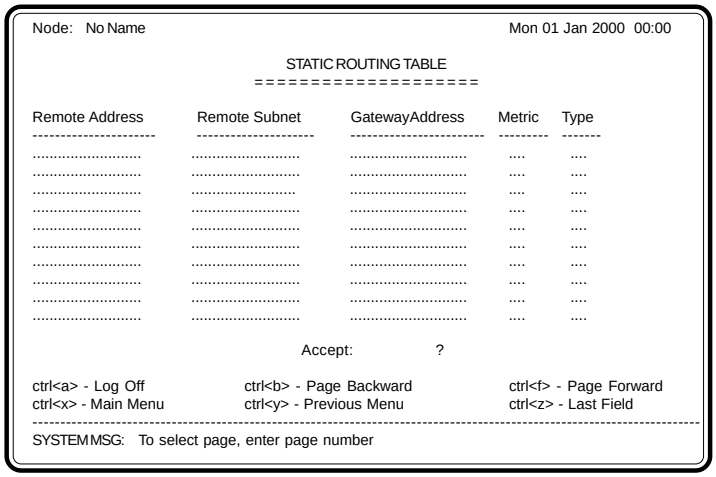
ISDN CALL MANAGEMENT (1.1.5)



This screen allows you to limit the total duration of the ISDN calls. This could make it less likely, for example, for a rogue host application to keep an ISDN line up unexpectedly with NT polling, etc. It remains the system manager's responsibility to monitor ISDN usage.

- **Day**
  Select Sunday to Saturday.
- **From**
  Enter the time for the ISDN to start.
- **To**
  Enter the time for the ISDN to stop.
- **ISDN Access Time**
  Calls are only permitted between the 'from' and 'to' times on each day, and only up to the maximum time set in 'ISDN Access Time'.

Enter '**Y**' to '**Accept:**' to save the completed table.



The Static Routing Table is used to associate the gateway address to be used for remote network addresses that are not on the local LINKSTREAM. If the network address is requested, the LINKSTREAM will route the traffic to the gateway with the specified address as the first hop of the route. The gateway addresses specified should, therefore, be in units directly connected to the local LINKSTREAM.

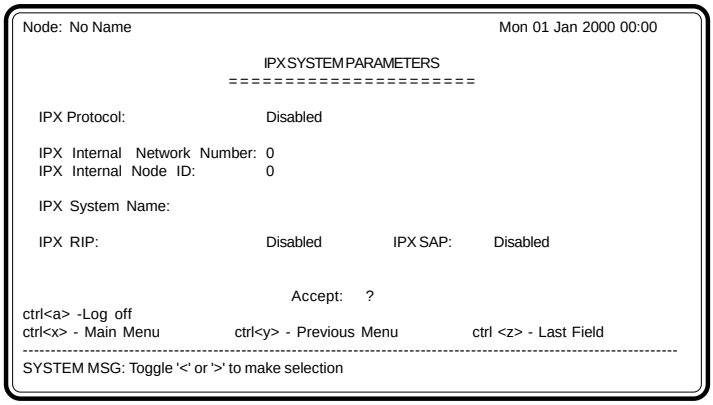
To add an entry, move the inverse field to the required position in the Remote Address column using the cursor keys. Enter 'i<CR>' to enable the insert mode and template addresses. '0.0.0.0' is displayed. Overwrite these with the information as set out below.

- **Remote Address**
  This is the IP address of the destination which may be either a subnetted network or a specific Host address. Terminate the address with <CR> which causes the cursor to move to the next column.
- **Remote Subnet**
  This is the IP Subnet mask of the destination network. A subnet mask of 255.255.255.255 indicates a Host specific route. Terminate the address with <CR> which causes the cursor to move to the next column.
- **Gateway Address**
  This is the IP address of the first hop gateway which should be directly connected to the LINKSTREAM.

- **Metric**
  Value 1-15 or 16 = Disabled. Default value = 16. This is the number of hops required to reach the destination.
- **Type**
  Select the attributes of the route as below:
  PA - Permanent Advertised
  Route cannot be overwritten by RIP information and is included in RIP broadcasts.
  PN - Permanent Non-advertised
  Route cannot be overwritten by RIP information and is not included in RIP broadcasts.
  RA - Replacement Advertised
  Route can be overwritten by RIP information if the metric of the RIP route is better (i.e. lower). The information is included in RIP broadcasts.
  RN - Replacement Non-advertised
  Route can be overwritten by RIP information if the metric of the RIP route is better. The information is not included in RIP broadcasts.

Enter '**Y**' to '**Accept:**' to save the completed table.

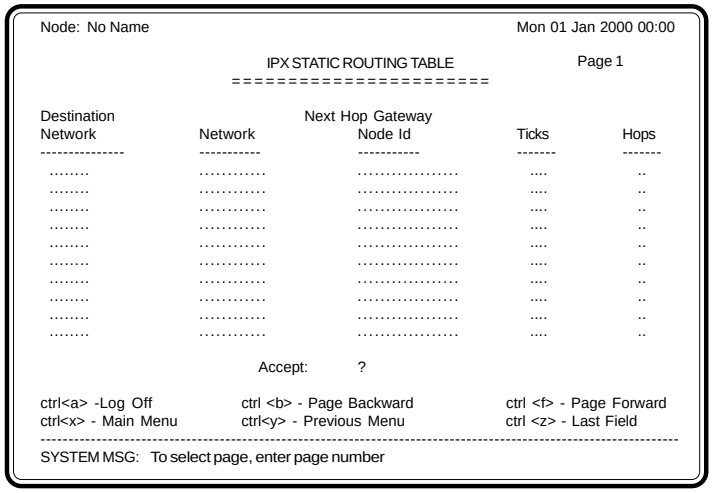
SYSYTEM IPX PARAMETERS (1.3.1)



The following parameters must be defined:

- **IPX Protocol**
  Select Enabled/Disabled. Default = Disabled.
  Global Enable/Disable of support for IPX protocol.
- **IPX Internal Network Number**
  Enter the Internal Network number for the device.
  1-8 hexadecimal digits.
- **IPX Internal Node Identity**
  Enter the node number for the unit.
  Up to 12 hexadecimal digits.
- **IPX System Name**
  Enter the system name for the unit.
  Up to 48 characters.
- **IPX RIP**
  Select Enabled/Disabled. Default = Disabled.
  Enable global IPX RIP for the unit.
- **IPX SAP**
  Select Enabled/Disabled. Default = Disabled.
  Enable global IPX SAP for the unit.

IPX STATIC ROUTING TABLE (1.3.2)



The IPX Static Routing Table is used to associate the next hop gateway address with the required destination where this is not on the local network. The LINKSTREAM will then route the traffic for a requested destination network to the next hop gateway with the specified network and node identity.

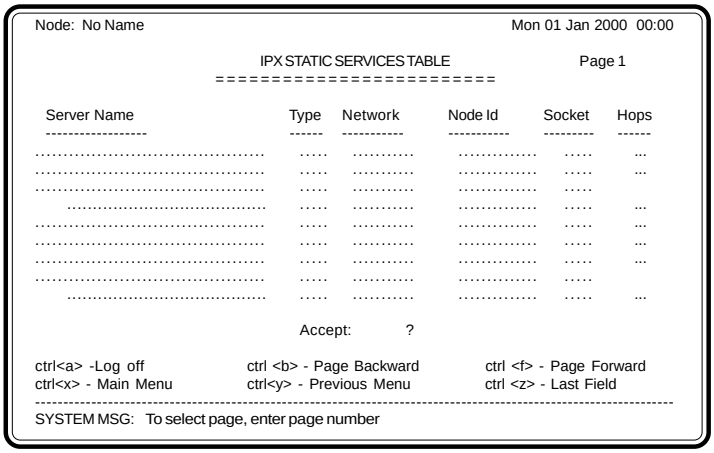
To add an entry, move the inverse field to the required position in the 'Destination Network' column using the cursor key. Enter 'i<CR>' to enable the insert mode and template entries are displayed along the row. Overwrite these with the appropriate information.

To delete an entry, move the inverse field to the required position in the 'Destination Network' column and enter 'd<CR>'. The row will be highlighted and the system message will ask for confirmation. Re-enter 'd<CR>' to delete the entry.

- **Destination Network**
  Enter the IPX address of the desired network. Terminate the address with <CR> which causes the cursor to move to the next column.
- **Next Hop Gateway**
  Network - Enter IPX External Network containing the gateway.
  Node ID - Enter the node number of the gateway.
- **Ticks**
  Enter the number of ticks (1/18th sec) taken to reach the destination network. Up to 4 decimal digits.
- **Hops**
  Enter the number of routers to pass through to reach the destination network. Up to 2 decimal digits.

Enter **'Y'** to **'Accept:'** to save the completed table.

IPX STATIC SERVICES TABLE (1.3.3)



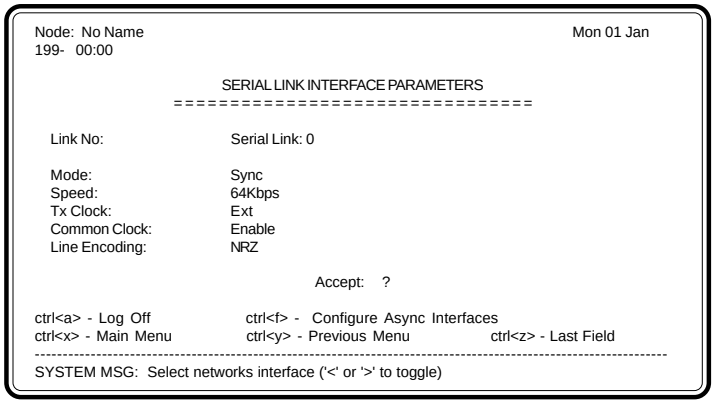
The IPX static services table gives the description and location of services offered by servers on the internetwork. This information is broadcast around the network for use by client machines.

To add an entry, move the inverse field to the required position in the server name column using the cursor key. Enter 'i<CR>' to enable the insert mode and template entries are displayed along the row. Overwrite these with the appropriate information.

To delete an entry, move the inverse field to the required position in the server name column and enter 'd<CR>'. The row will be highlighted and the system message will ask for confirmation. Re-enter 'd<CR>' to delete the entry.

- **Server Name**
  Enter the name of the server providing the specified service. Up to 48 characters scrolling, 30 visible at any time.
- **Type**
  Enter the 4 digit code for the appropriate services offered by the designated service.
- **Network**
  Enter the IPX Internal Network Number of the designated server. Up to 8 hexadecimal digits.
- **Node Identity**
  Enter the node number of the designated server. Up to 12 hexadecimal digits.
- **Socket**
  Enter the socket number for the selected service on the designated server. Up to 4 hexadecimal digits.
- **Hops**
  Enter the number of routes to pass through to reach the network of the designated server. Up to 2 decimal digits.

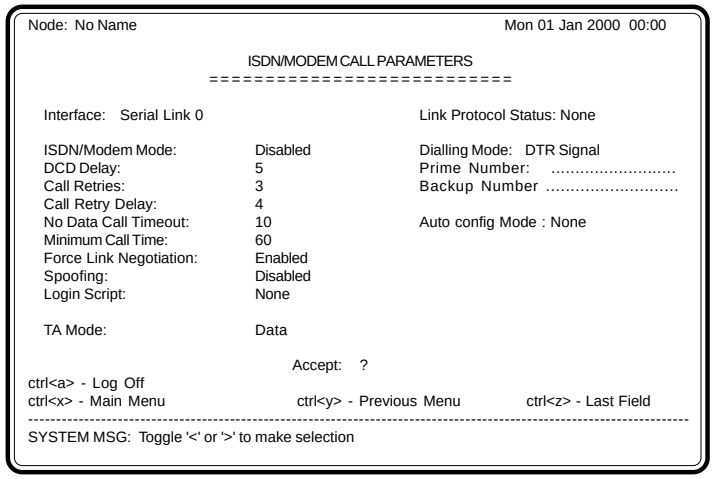
SERIAL LINK INTERFACE PARAMETERS (1.4.2)



The following link parameters must be defined:

- **Link number**
  Enter 0 or 1 for required link.
- **Mode**
  Synchronous.
- **Speed**
  Select 2.4/4.8/9.6/14.4/19.2/38.4/48/56/64/128/192/256/320/384/448/512Kbps.
  Default = 64Kbps.
- **Tx clock**
  Select Internal/External. Default = External.
  Int = Internal clock output from the serial link interface.
  Ext = External clock from attached DCE.
  Default = Ext.
- **Common clock**
  Select Enabled/Disabled. Default = Enabled.
  Set to Enabled for X.21 external clock operation.
  Set to Disabled for V.24 and V.35 operation.
- **Line Encoding**
  Select NRZ or NRZI. Default = NRZ.
  This option selects the physical line encoding to be used for communications with the Frame Relay network.

ISDN / MODEM CALL PARAMETERS (1.4.3)



The following parameters must be defined for the interfaces. These settings will only apply to a serial link or asynchronous channel when it has been set up as a network interface, i.e. enabled for SLIP/PPP/Perle proprietary as appropriate.

These values can be configured according to the characteristics of the terminal adaptor or modem connected to the LINKSTREAM. The characteristics of the ISDN network will also affect the parameter values and, hence, should be considered in configuring the LINKSTREAM.

The asynchronous channels can be used for modem access without being a network interface.

Note that the selected interface should be disabled to set up ISDN/Modem parameters. If the interface has not been previously used, it must first be enabled then disabled before ISDN/Modem call parameters can be set. This is to enable a valid clock for the interface.

- **Interface**
  Select the appropriate serial link (0-1) or asynchronous channel (0-23).
- **Link Protocol Status**
  Select.
- **ISDN/Modem Mode**
  Select Disabled/Dial In Only/Dial Out Only/Dial In & Out. Default = Dial In & Out.
  Dial In Only = Will only accept external calls.
  Dial Out Only = Will only make calls from the unit.
  Dial In & Out = Will both make and accept calls.
- **DCD Delay**
  Enter 0 - 300 seconds. Default = 5 seconds.
  This parameter allows for delays in setting up the call.
- **Call Retries**
  Enter 0 - 10. Default = 3.
  This determines the number of connection retries.
- **Call Retry Delay**
  Enter 0 - 300 seconds. Default = 4 seconds.
  This determines the period between call retry attempts.

- **No Data Call Timeout**
  Enter 0 - 65535 seconds. Default = 60 seconds.
  This determines the period of no data activity before the LINKSTREAM will drop the control signal to disconnect the call.
- **Minimum Call Time**
  Enter 0-65535 seconds. Default = 60 seconds.
  Sets the minimum time for a call. Used to make more efficient use of ISDN services and avoid unnecessary extra calls.
- **Force Link Negotiation**
  Select Enabled/Disabled. Default = Disabled.
  This parameter determines whether the logical link will be re-negotiated when the physical link becomes connected. This would be applicable as an ISDN connection is raised and lowered according to data activity. This parameter is only operable with the link running PPP.
  Back up will only operate with links running PPP and is dependent on RIP being enabled throughout the network. In order to use the back up feature, the user should enable RIP on the Links 0 and 1 on the 'SERIAL LINK PARAMETERS' screen. The RIP metric should be set up as '1' for the leased line link and '2' for the ISDN link. This will mean that RIP will use the leased line when it is available, and only revert to the ISDN when it has failed. At that point the RIP metric for the leased line will become 16, hence giving it a higher cost than the ISDN.
  For back up, the LCP Echo packets are being used to monitor link status. On back up links (ISDN or modem), if both ends are to initiate the call (ATD dialling), ensure that they have different call retry timeouts. This will avoid both ends seeing 'Engaged' as they attempt to make a call in response to the same link down event. Both ends of the link should also be running LCP timeouts set to different values. This will ensure both ends will not see the link down simultaneously which again could lead to the mutually 'Engaged' condition.
- **Spoofing**
  Select Enabled/Disabled. Default = Disabled.
  When enabled, this will spoof RIP packets thus preventing excessive use of the ISDN/modem line.
- **Login Script**
  See Appendix C.
- **Dialling Mode**
  Select ATD Command/DTR Signal. Default = ATD Command.
  ATD Command = LINKSTREAM sends an AT command to the ISDN module/modem to call a number. In this mode the LINKSTREAM can both initiate and receive calls. The ISDN/modem mode should therefore be set for Dial In & Out.
  DTR Signal = LINKSTREAM raises DTR to the ISDN module/ modem causing it to dial a pre-stored number.

In this instance, the calling interface should be set for Dial Out Only and the interface on the remote LINKSTREAM set to Dial In Only. Calls can, therefore, only be initiated in one direction.

- **Prime Number**
  This is the ISDN number to be called by the LINKSTREAM when data is to be sent over the link. This number is used in the 'AT' dial mode of operation of the ISDN module.
- **Backup Number**
  This number will be used if the Prime Number is unobtainable for any reason, i.e. engaged or line down.
- **Auto Configuration Mode**
  This mode configures the terminal adaptor automatically, therefore eliminating the need to access the terminal adaptor manually.
  Select None/OFF/NORMAL/LOCAL MSN/LOCAL SUB ADDRESS/ DTR AUTODIAL.
  None = No change to TA configuration.
  OFF = Disables the port from answering.
  NORMAL = Enables the port to answer.
  LOCAL MSN/MSN NUMBER = MSN option enabled, requests MSN number.
  LOCAL SUB-ADDRESS/LSA NUMBER = Sub-address option enbled, requests sub-address number.
  DTR Autodial/DTR number = This option is available if DTR dialling mode is selected. This enables DTR Autodial in the Auto Configuration mode. A Dial String must then be entered in the DTR number field
- **TA Mode**
  Select Command/Data. Default = Data.
  Data mode = The LINKSTREAM is set up to pass synchronous data to the ISDN line via the module.
  Command mode = This mode opens up a transparent connection into the ISDN module to configure the unit.
  This is needed for nonstandard settings and to set the module for DTR dialling. When entering this mode, the screen will display 'Enter AT commands (ctrl<b> to return to on-line system)'. The user is then directly connected to the ISDN module. Enter ctrl<b> to return to the Serial Link Parameters screen.

Enter **'Y'** to **'Accept:'** to save the displayed values.

- **ISDN Module Configuration**
  When the 'Command Mode' is entered, the user is connected transparently to the ISDN module. The module can then be configured as required according to the dialling mode previously selected. The module accepts 'AT' commands and the following settings are recommended for use with the LINKSTREAM.
  Enter the commands as shown in heavy type and the module will respond with 'ok' if the command is accepted.

i) DTR dialling

Configuration of module at Master end - 'Dial Out' only.

AT&F	Reset to factory default
AT&Q2	Interface Async off line/Sync on line - dial on DTR.
AT&D2	DTR ON to OFF drops the connection.
AT&Z=xxxx	Enter desired ISDN number (xxxx).
AT&W	Write settings to non-volatile RAM.

Configuration of module at Slave end - 'Dial In' only.

AT&F	Reset to factory default.
AT&Q1	Interface Async off line/Sync on line - no dial on DTR.
AT&D2	DTR ON to OFF drops the connection.
ATS0=1	Answer ISDN call after 1 ring.
AT&W	Write settings to non-volatile RAM.

ii) AT dialling

The configuration is the same at each end - 'Dial In and Out'.

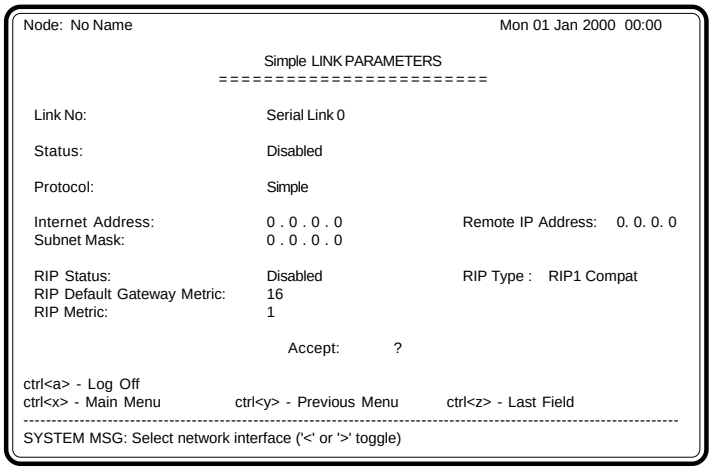
AT&F	Reset to factory default.
AT&Q1	Interface Async off line/Sync on line - no dial on DTR.
AT&D2	DTR ON to OFF drops the connection.
ATS0=1	Answer ISDN call after 1 ring.
ATQ1	Disable command responses.
ATE0	Command Echo off.
AT&W	Write settings to non-volatile RAM.

In all dialling modes the interface parameters are as below:

Async - 9600bps, 8 bits, no parity
Sync - 64000bps

Note that the ISDN module is supplied set up for 'AT' dialling from Port 1. Port 2 has answering disabled. This will allow the user to simply enter the destination ISDN number on the '**ISDN/Modem Call Parameters**' screen in order to establish an ISDN link between two LINKSTREAMS.

SIMPLE LINK PARAMETERS (1.4.4)



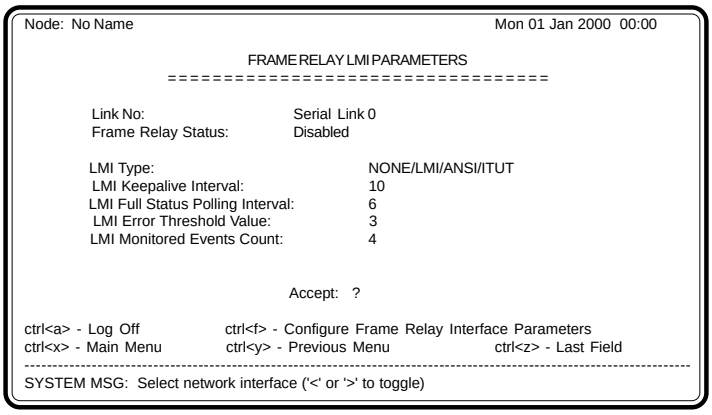
The following Simple Link parameters (HDLC) can be defined when PPP protocol is not being used over the links

- **Link number**
  Enter 0 or 1 for the required link.
- **Status**
  Select Enabled/Disabled. Default = Disabled. Enables Perle protocols on the selected link.
- **Protocols**
  Select Simple/VJ Comp/TUNNEL. Default = Simple.
  Simple = Simple proprietary with PPP framing.
  Simple/VJ*Comp* = Simple proprietary with VJ header compression.
  TUNNEL = IP tunnelling for HDLC and SDLC synchronous data.
- **Remote IP address** (Tunnelling option only)
  Default = 0.0.0.0. Enter 4 octet IP address for remote Tunnel connection.
- **Internet Address**
  Enter the required Internet Address for the interface. 4 octets in the form 0.0.0.0.
- **Subnet Mask**
  Enter 4 octet address depending on the network class. 4 octets in the form 0.0.0.0. Note that a recommended default mask will be generated as the IP address is entered.
- **RIP Interface Status**
  Select Disabled/Passive/Active. Default = Disabled.
  Disabled = RIP not active.
  Passive = Received RIP responses will be added to the routing table.
  Active = Received RIP response will be added to the routing table and the contents of the routing table will be broadcast.

- **Default Gateway Metric**
  Enter value 1-15 or 16 = off. Default = 16.
  This option sets the metric (number of hops) to be used when LINKSTREAM wishes to broadcast. It can be used as a default gateway by the attached network.
- **RIP type**
  Select RIP 1 ONLY/RIP1 compatible.
  Default = RIP 1 compatible.
  RIP 1 ONLY = RIP 1 packets are broadcast only.
  RIP 1 compat = RIP 2 packets are broadcast only.
- **RIP Metric**
  Enter value 1-15. Default = 1.
  This option sets the metric to be broadcast for the interface providing a route to specific networks, i.e. not a default gateway.
- **Default Route**
  Select Enabled/Disabled. Default = Disabled.

Enter **'Y'** to **'Accept:'** to save displayed values.

FRAME RELAY LMI PARAMETERS(1.4.5)

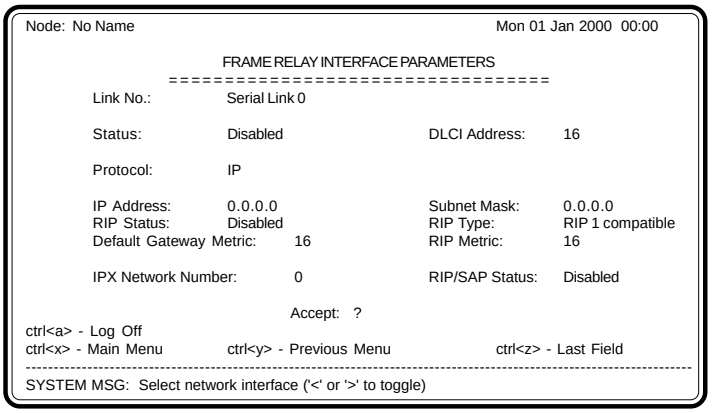


Local Management across the user-network interface is implemented by an exchange of messages over a special virtual circuit that connects the Linkstream to the Frame Relay Network. LMI messages are used to verify that the Frame Relay switch is operational and to send and receive full status reports on all active virtual circuits. This screen is used to set a number of variables that are required for the Local Management Interface (LMI). The default values are set to work in most operating environments.

- **Link Number**
  Select Serial Link 0/1 for the required Frame Relay WAN link.
- **Frame Relay Status**
  Select Enabled/Disabled. Default = Disabled.
  Enable Frame Relay LMI on the selected link.
- **LMI Type**
  Select the LMI type NONE/LMI/ANSI/ITUT for the specified link. Default = ITUT.
  LMI = LMI defined by the Gang of Four (Cisco, Digital Equipment Corporation, Northern Telecom, StrataCom)
  ANSI = ANSI T1.617 Annex D
  ITUT = Q.933 Annex A
  NONE = No LMI messages are sent or received on this Frame Relay link.
- **LMI Keepalive Interval**
  The number of seconds between status enquiry messages. The range is 5 to 30 seconds. Default = 10.
- **LMI Full Status Polling Interval**
  The number of status enquiry intervals that pass before issuing a full status enquiry message. The range is 1 to 255. Default = 6.
- **LMI Error Threshold Value**
  The maximum number of unanswered status enquiries allowed before declaring that the interface is down. The range is 1 to 10. Default = 3.
- **LMI Monitored Events Count**
  The number of status polling intervals over which the number of errors is accumulated and compared to the error threshold. The range is 1 to 10. Default = 4.

Enter '**Y**' to '**Accept**:' to save displayed values.

FRAME RELAY INTERFACE PARAMETERS (1.4.6)

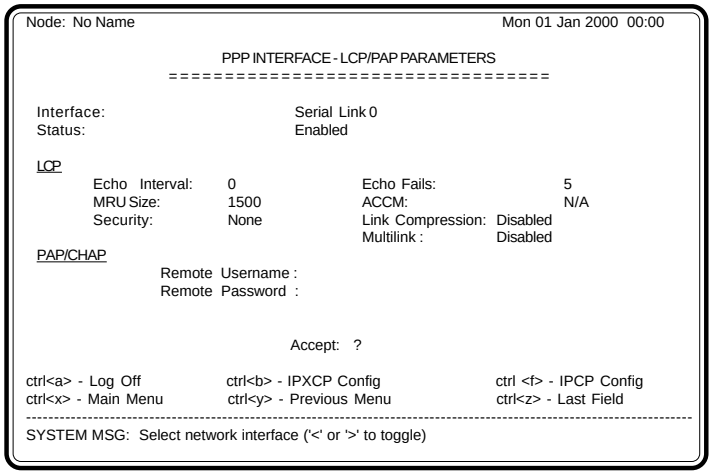


This screen is used to set the protocol-related parameters required by a specified virtual circuit (DLCI).

- **Link Number**
  Select Serial Link 0/1 for the required Frame Relay WAN link.
- **Status**
  Select Enabled/Disabled. Default = Disabled.
  Enable Frame Relay DCLI on the specified link.
- **DCLI Address**
  Select the DLCI number in the range 16-1007 for the link. Default = 16.
  This value is used for communication with the Frame Relay network.
- **Procotol**
  Select IP/IPX/IP and IPX/PPP. Default is IP.
  This option selects the protocol, which will be transported over Frame Relay on this link.
  NOTE: If PPP is selected then use the PPP screens to configure the LCP and NCP parameters for this link.
- **IP Address**
  Enter the required Internet Address for the interface. 4 octets in the form 0.0.0.0. The Linkstream uses this address when responding to Inverse ARP messages from the Frame Relay network.
- **RIP Interface Status**
  Select Disabled/Passive/Active. Default = Disabled.
  Disabled = RIP not active
  Passive = Received RIP responses will be added to the routing table.
  Active = Received RIP responses will be added to the routing table. RIP broadcast packets will be sent on the specified link.

- **Default Gateway Metric**
  Enter value 1-15 or 16 = off. Default = 16.
  This option sets the metric (number of hops) to be used when the Linkstream wishes to broadcast. It can be usedas the default gateway by the attached network.
- **RIP Type**
  Select RIP 1 Only or RIP 1 Compatible. Default = RIP 1 Only.
  RIP 1 Only = RIP 1 packets are broadcast only.
  RIP 1 Compatible = RIP 2 packets are broadcast only.
- **RIP Metric**
  Enter value 1-15. Default = 1.
  This option sets the metric to be broadcast for the interface providing a route to specific networks (i.e. not a defaultgateway).
- **IPX Network Number**
  Enter the IPX network number for this link. 1-8 hexadecimal digits.
- **RIP/SAP Status**
  Select Enabled/Disabled. Default = Disabled.
  Enable IPX RIPs and SAPs to be sent over the

PPP - LINK LCP PARAMETERS(1.4.7)



The following PPP - LCP/PAP interface parameters must be defined and will apply only to the selected channel/link.

- **Interface**
  Select the appropriate serial link (0-1) or asynchronous channel (0-23).
- **Status**
  Select Enabled/Disabled. Default = Disabled.

LCP Settings

- **Echo Interval**
  Select 0-65535 seconds. Default = 0.
  This defines the time period in seconds between sending LCP Echo Request packets.
- **Echo Fails**
  Select 1-10. Default = 5.
  This defines the number of LCP Echo Reply packets that can be missed before the interface is brought down and restarted.

  These two parameters are used to determine the elapsed time before a leased line is declared as down. The back up process will then be initiated.

  Note that back up can only be used when the interface is configured for PPP and as a leased line.

- **MRU (Maximum Receive Unit)**
  Enter value 128-1518 bytes. Default = 1500 bytes.
  This defines the maximum packet size to be received over PPP.

- **ACCM (Asynchronous Control Character Map)**
  For asynchronous interface only. Default = 0x0. This option is used to allow the 32 control characters between the values 00 to 1Fhex to be sent over the link. The ACM is a 32 bit number in which each bit represents the control character whose value equates with the bit position, e.g. the 10th bit represents control character 10 (0Ahex). When the bit is set, the appropriate control character is preceded by an escape sequence and the bit 6 complemented, thus allowing the character to pass over the link. This process is reversed at the receiving end.

  For example, to send XON and XOFF which have decimal values of 17 and 19, the 17th and 19th bits of the ACM are set, thus giving a value of 000A0000. The bit numbers for the ACM number from 31 on the left to 0 on the right.

- **Security**
  Select None/UPAP/CHAP. Default = None.
  None = No security.
  UPAP CLIENT = Sends username and password to authentication.
  UPAP SERVER = Requests authentication from client.
  UPAP BOTH = Requests and sends authentication.
  CHAP CLIENT = As UPAP client.
  CHAP SERVER = As UPAP server.
  CHAP BOTH = As UPAP both.
  N.B. Server will check username password with User Authentication Table or Radius Server if configured. Client will send remote username plus password for authentication.

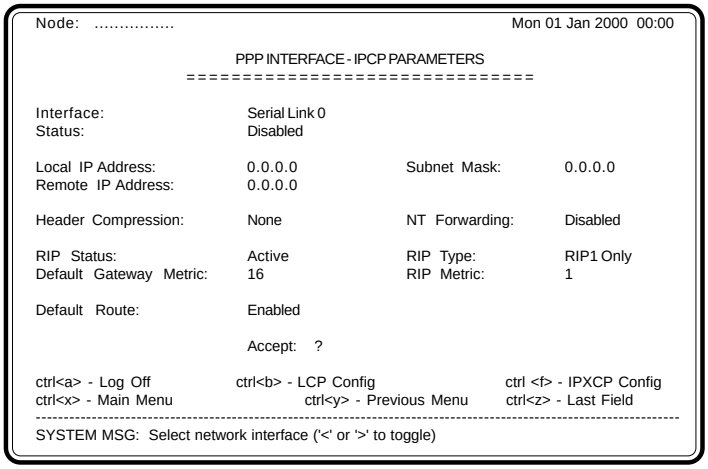
- **Link Compression**
  Select Enabled/Disabled. Default = Disabled.
  This option will allow PPP STAC compression for each of the WAN links.

- **Multilink PPP (MP)**
  An addition to the basic PPP protocol to allow more than one link to a destination.
  Select Enabled/Disabled. Default = Disabled.
  See PPP-Multilink Parameters.

PAP Settings

- **Remote Username**
  Enter username for PAP - maximum of 32 characters.
- **Remote Password / Local Password**
  Enter password for PAP - maximum of 32 characters.

Enter **'Y'** to **'Accept:'** to save the displayed values.



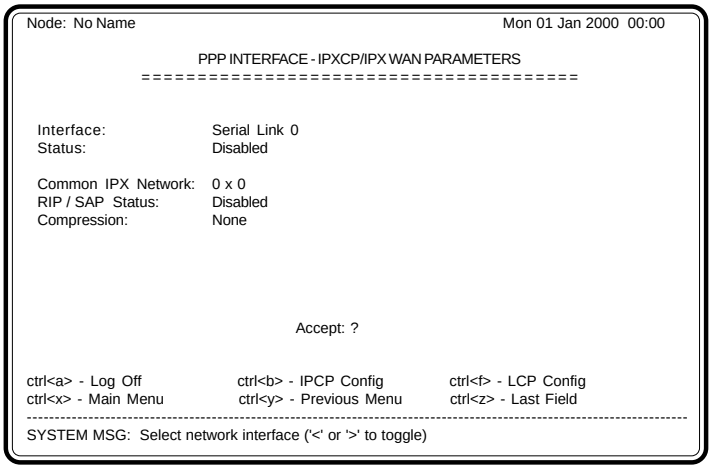
The following PPP - IPCP interface parameters must be defined and will apply only to the selected channel/ link.

- **Interface**
  Select the appropriate serial link (0-1) or asynchronous channel (0-23).
- **Status**
  Select Enabled/Disabled. Default = Disabled.
- **Local IP Address**
  Enter IP address of the selected interface.
- **Subnet Mask**
  Enter subnet mask for the selected interface.
- **Remote IP Address**
  Enter IP address of the link interface at the remote end.
- **Header/Voice Compression**
  Default = None.
  Select one of the following:
  None = No compression.
  DO VJ COMP = Force VJ compression.
  ALLOW VJ COMP = Negotiate VJ compression.
  DO VOICE COMP - See Voice Configuration.
  DO VJ/DO VOICE - See Voice Configuration.
  ALLOW VJ/DO VOICE - See Voice Configuration.
- **NT Forwarding**
  Select Enabled/Disabled. Default = Disabled. Use to enable support for NT server on the LINKSTREAM.
- **RIP Status**
  Select Disabled/Passive/Active. Default = Disabled.
  Disabled = RIP not active.
  Passive = Received RIP responses will be added to the routing table.

Active = Received RIP responses will be added to the routing table and the contents of the routing table will be broadcast.

- **RIP Type**
  Select RIP 1 ONLY/RIP1 compatible.
  Default = RIP 1 compatible.
  RIP 1 ONLY = RIP 1 packets are broadcast only.
  RIP 1 compat = RIP 2 packets are broadcast only.
- **RIP Metric**
  Enter value 1-15. Default = 1.
  This option sets the metric to be broadcast for the interface providing a route to specific networks, i.e. not a default gateway.
- **RIP Default Gateway Metric**
  Enter value 1-15 or 16 = OFF. Default = 16.
  This option sets the metric (number of hops) to be used when the LINKSTREAM wishes to broadcast. It can be used as a default gateway by the attached network.
- **Default Route**
  Select if remote IP address is not known.
  Select Enabled/Disabled. Default = Disabled.

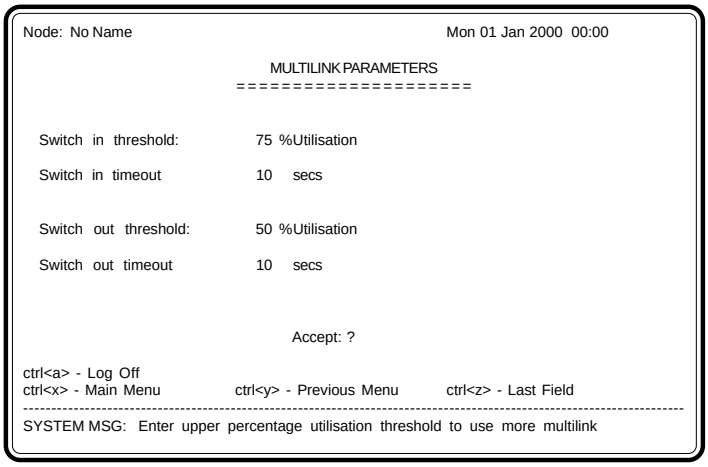
Enter **'Y'** to **'Accept:'** to save displayed values.



The following PPP - IPXCP interface parameters must be defined and will apply only to the selected channel/link.

- **Interface**
  Select the appropriate serial link (0-1) or asynchronous channel (0-23).
- **Status**
  Select Enabled/Disabled. Default = Disabled.
- **Common IPX Network**
  Enter the required IPX network number for the selected interface. This number will then be used for RIP broadcasts. If no number is entered and the value left at 0x0, the internal IPX network number is used for RIP broadcasts.
- **RIP/SAP Status**
  Select Enabled/Disabled. Default = Disabled.
  Enables RIP/SAP broadcasts from the selected interface.
- **Compression**
  Select None/Do Comp/Allow Comp. Default = None.
  None = No compression allowed.
  Do Comp = Compression selected on link.
  Allow Comp = Compression will occur if negotiated with the unit at the remote end of the link.

Enter **'Y'** to **'Accept:'** to save displayed values.



Enter this screen to configure the secondary multilink links. Where links are of the same speed, the order of priority is as follows: leased line; ISDN; asynchronous. Where links of differing speeds are utilised, the highest speed link takes priority. Note that there should be at least 10% difference between the switch in and switch out threshold utilisation. Recommended settings are as shown on the screen above.

- **Switch in threshold**
  Enter the required utilisation value for the secondary link to switch in.
- **Switch in timeout**
  Enter the required time in seconds that the threshold has to be met before the second link is switched in.
- **Switch out threshold**
  Enter the required utilisation value for the secondary link to switch out.
- **Switch out timeout**
  Enter the required time in seconds that the threshold has to be met before the second link is switched out.

Enter **'Y'** to **'Accept:'** to save displayed values.

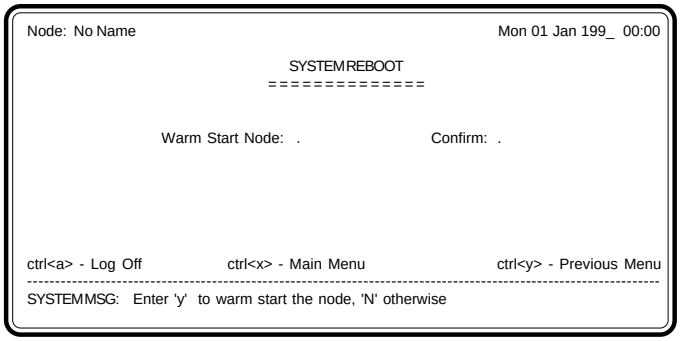
```
Node: ..............                                  Mon 01 Jan 2000  00:00

                          SLIP INTERFACE PARAMETERS
                        ============================

Interface:                      Async Chan  0
Link Status:                    Disabled

Local IP Address:               0.0.0.0          Subnet Mask:   0. 0. 0. 0
Remote IP Address:              0.0.0.0

Compression:                    None

SLIP MTU size:                  256

RIP Interface Status:           Disabled         RIP Type:      RIP1 Only
Default Gateway  Metric:        16               RIP Metric:    1

                                Accept:  ?
ctrl<a> - Log Off
ctrl<x> - Main Menu        ctrl<y> - Previous Menu        ctrl<z> - Last Field
--------------------------------------------------------------------------------
SYSTEM MSG:  Select network interface ('<' or '>' to toggle)
```

The following interface parameters must be defined and will apply only to the selected channel.

- **Interface**
  Select the appropriate asynchronous channel (0-23).
- **Link Status**
  Select Enabled or Disabled. Default = Disabled.
- **Local IP Address**
  Enter IP address of the selected interface.
- **Subnet Mask**
  Enter subnet mask for the selected interface at the remote end of the link.
- **Remote IP Address**
  Enter IP address of the link interface at the remote end.
- **Compression**
  Select None/Do Comp/Allow Comp. Default = None.
  None = No compression allowed.
  Do Comp = Compression selected on link.
  Allow Comp = Compression will occur if negotiated with the unit at the remote end of the link.
- **SLIP MTU (Maximum Transmit Unit)**
  Enter value 64-1500 bytes. Default = 256 bytes. This defines the maximum packet size to be transmitted over SLIP.
- **RIP Interface Status**
  Select Disabled/Passive/Active. Default = Disabled.
  Disabled = RIP not active.
  Passive = Received RIP responses will be added to the routing table.
  Active = Received RIP response will be added to the routing table and the contents of the routing table will be broadcast.

- **Default Gateway Metric**
  Enter value 1-15 or 16 = OFF. Default = 16.
  This option sets the metric (number of hops) to be used when LINKSTREAM wishes to broadcast. It can be used as a default gateway by the attached network.
- **RIP Metric**
  Enter value 1-15. Default = 1.
  This option sets the metric to be broadcast for the interface providing a route to specific networks, i.e. not a default gateway.

Enter **'Y'** to **'Accept:'** to save the displayed values.



This screen is entered to reboot the system and requires a confirmation response. Rebooting the system will clear all buffers.

SECTION 7

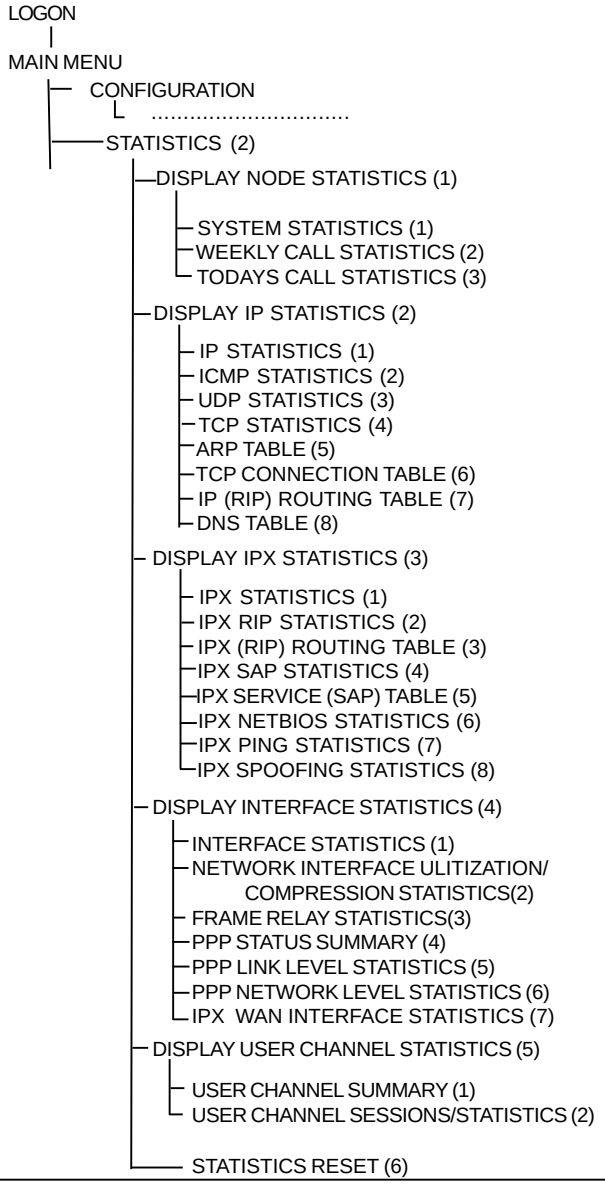
DIAGNOSTIC & STATISTICS CONFIGURATION

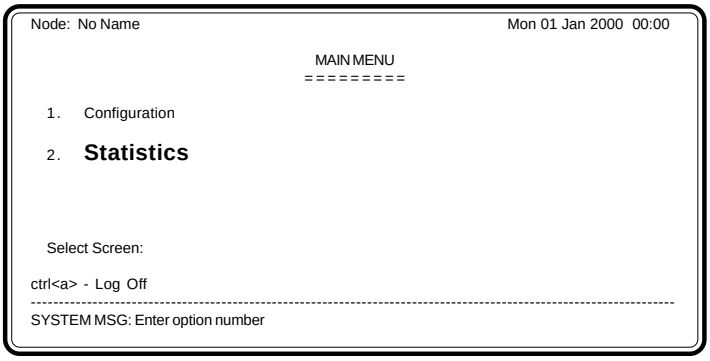
INTRODUCTION

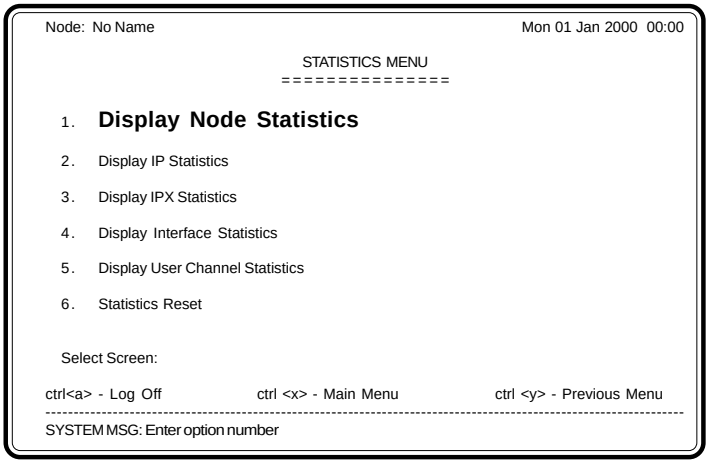
This section gives details of the statistics screens available on LINKSTREAM.

Access and adjustment of the various screens is achieved in the same way as the configuration screens.

The diagram below gives the structure of the statistics screens within the Node Manager.

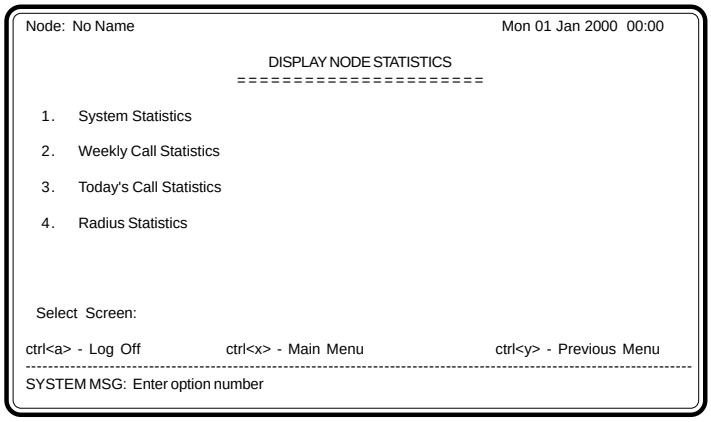






Options are selected by entering the appropriate number to the prompt.

On most screens, the data can be updated regularly by use of the Update Count. This can be set from 0 to 59 and the time period can be selected as seconds (secs) or minutes (mins). The counts can be cleared by entering **'Y'** to the **'Clear: ?'** prompt where appropriate.



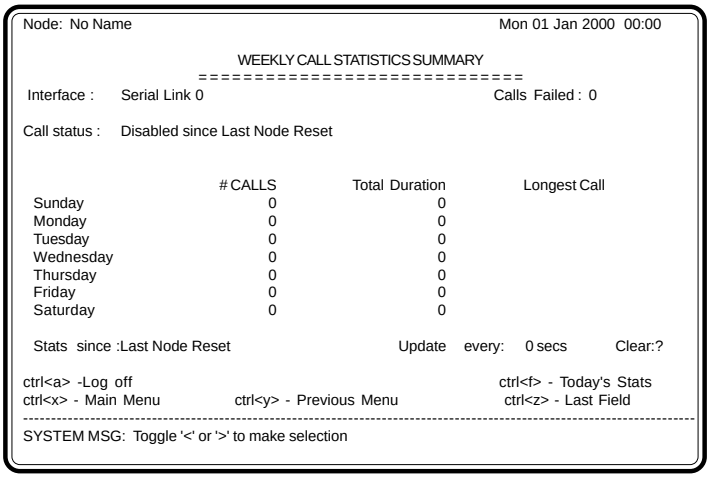
Options are selected by entering the appropriate number to the prompt.

SYSTEM STATISTICS (2.1.1)

```
Node: No Name                                          Mon 01 Jan 2000  00:00
                              SYSTEM STATISTICS
                              =================
  Last Node Reset :   Mon 01 Jan 199-  17 : 38 : 00     System Up Time     0 : 00 : 00

  Node IP Address:  0.0.0.0                    Node MAC Address:  00:00:00:00:00:00

                                 Current              Minimum              Maximum
  Network Buffer Stats:              696                  654                  714
  Large Buffer Stats:                 30                   30                   30

  No. of Active Chans:                 1                    0                    1
  No. of Active Calls:                 2                    0                    2

                    Resource        Local       Ethernet       Serial         Chan
  Total Errors:            0            0              0            0            0

  Stats since:  Last Node Reset        Update every:  0 secs          Clear:  ?

ctrl<a> -Log off
ctrl<x> - Main Menu          ctrl<y> - Previous Menu       ctrl<z> - Last Field
-------------------------------------------------------------------------------------------------------------------------
SYSTEM MSG:  Enter time interval  (0 - 59 secs/mins)
```

This screen shows the IP address and the MAC (Ethernet) address of the LINKSTREAM. The columns of figures then show the 'current' value of a parameter together with the 'maximum' and 'minimum' values since the screen was last cleared. The parameters are:

- **Network Buffer Stats**
  The number of network buffers in use.
- **Large Buffer Stats**
  The number of large buffers which are used for bigger packets.
- **No. of Active Chans**
  The number of channels currently active.
- **No. of Active Calls**
  The number of connection calls through the LINKSTREAM.
- **Total Errors**
  This gives a summary of the error performance of all aspects of the LINKSTREAM.
  'Resource' is incremented when memory is unavailable for network buffers.
  'Local' is incremented for errors on connections between channels on the local node.
  The remaining values show errors on the appropriate interfaces.
- **Update every**
  The update count can be set from 0 to 59 and the time period can be selected as seconds (secs) or minutes (mins). The counts can be cleared by entering **'Y'** to the **'Clear:'** prompt.



This screen shows the weekly call statistics for ISDN or modem calls from the specified interface. The data will cover the last 7 days with the values for a particular day being updated at midnight. If, therefore, the screen is checked on a particular day, such as Monday, the values for Monday will be for last week. The values for the current day are shown in the 'Today's Call Statistics' screen.

- **Interface**
  Select the appropriate serial link or asynchronous channel as required.
- **Call Status**
  Shows current status as Disabled/Up/Down.
- **Calls**
  Number of calls on that day.
- **Total Duration**
  Total duration of all calls that day, shown in hh:mm:ss format.
- **Longest Call**
  Shows the duration of the longest call and the time it started, i.e. hh:mm:ss from hh:mm:ss

  Selecting ctrl <f> will move to the daily call statistics for the selected interface.

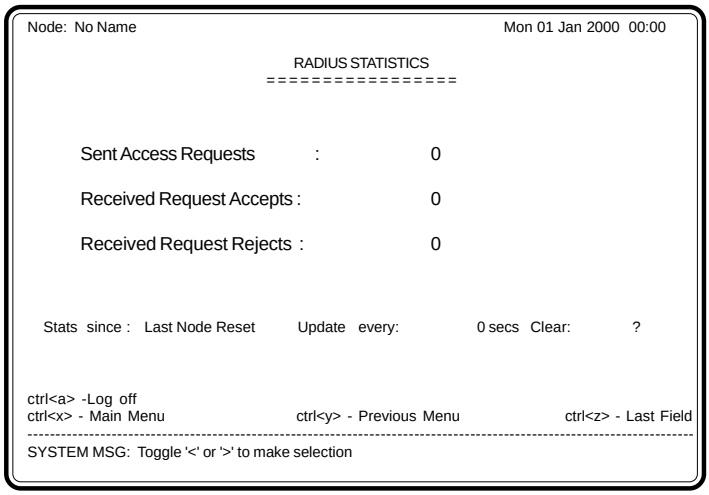
TODAY'S CALL STATISTICS (2.1.3)

```
Node: No Name                                                    Mon 01 Jan 2000  00:00

                          TODAY'S CALL STATISTICS SUMMARY
                          ==============================
Interface:        Serial Link 0

   Hour           #Calls       Duration         Hour              #Calls     Duration

 00.00 to 00.59      0          h:mm:ss       12.00 to 12.59          0        h:mm:ss
 01.00 to 01.59      0          h:mm:ss       13.00 to 13.59          0        h:mm:ss
 02.00 to 02.59      0          h:mm:ss       14.00 to 14.59          0        h:mm:ss
 03.00 to 03.59      0          h:mm:ss       15.00 to 15.59          0        h:mm:ss
 04.00 to 04.59      0          h:mm:ss       16.00 to 16.59          0        h:mm:ss
 05.00 to 05.59      0          h:mm:ss       17.00 to 17.59          0        h:mm:ss
 06.00 to 06.59      0          h:mm:ss       18.00 to 18.59          0        h:mm:ss
 07.00 to 07.59      0          h:mm:ss       19.00 to 19.59          0        h:mm:ss
 08.00 to 08.59      0          h:mm:ss       20.00 to 20.59          0        h:mm:ss
 9.00  to  09.59     0          h:mm:ss       21.00 to 21.59          0        h:mm:ss
 10.00 to 10.59      0          h:mm:ss       22.00 to 22.59          0        h:mm:ss
 11.00 to 11.59      0          h:mm:ss       23.00 to 23.59          0        h:mm:ss

 Stats  since:    Last Node Reset                Update every:     0 secs   Clear:  ?

ctrl<a> -Log off                                                      ctrl<f> - Weekly Stats
ctrl<x> - Main Menu              ctrl<y> - Previous Menu              ctrl<z> - Last Field
------------------------------------------------------------------------------------------
SYSTEM MSG:  Toggle '<'  or '>' to make selection
```

This screen shows the daily call statistics for ISDN or modem calls from the specified interface. The statistics refer to the current day and all values are zeroed at midnight. The data will then be updated during the day into the appropriate hourly periods.

- **Interface**
  Select the appropriate serial link or asynchronous channel as required.
- **# Calls**
  Number of calls during the hourly period shown.
- **Duration**
  Total duration of all calls during the hourly period shown in h:mm:ss format.

  Selecting ctrl <f> will move to the weekly call statistics for the selected interface.

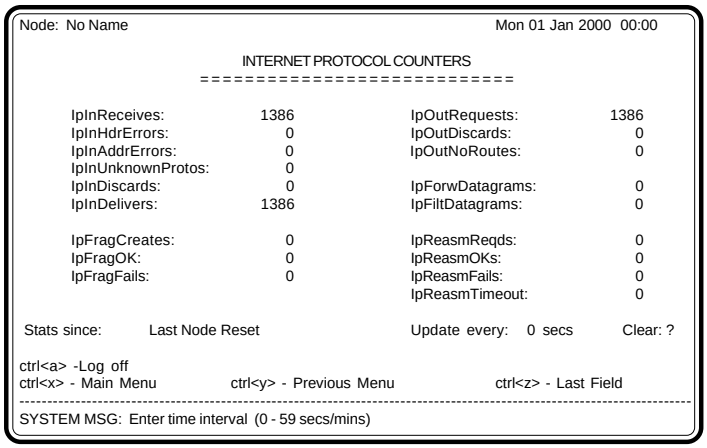


This screen shows the Radius server statistics.

- **Sent Access Requests**
  This shows the number of access request packets sent to a Radius server.

- **Received Request Accepts**
  This shows the number of request accept packets received from a Radius server.

- **Received Request Rejects**
  This shows the number of request rejects received from a Radius server.



This screen shows counter values for various parameters of the Internet Protocol. They are basically divided into inbound and outbound counts as set out below.

- **INBOUND**

  IpInReceives
  This is the total number of IP packets received.
  IpInHdrErrors
  This is the number of IP packets with header errors.
  IpInAddrErrors
  This is the number of IP packets with address errors.
  IpInUnknownProtos
  This is the number of IP packets with unknown protocols.
  IpInDiscards
  This is the number of IP packets discarded.
  IpInDelivers
  This is the number of IP packets transferred to higher levels (TCP).

  IpFragCreates
  This is the number of fragments created.
  IpFragOK
  This is the number of correct fragments.
  IpFragFails
  This is the number of failed fragments.

- **OUTBOUND**

  IpOutRequests
  This is the number of IP requests to output packets.

  IpOutDiscards
  This is the number of IP packets discarded before output.

  IpOutNoRoutes
  This is the number of IP packets not sent on due to lack of routing data.

  IpForwDatagrams
  This is the number of IP packets sent out.

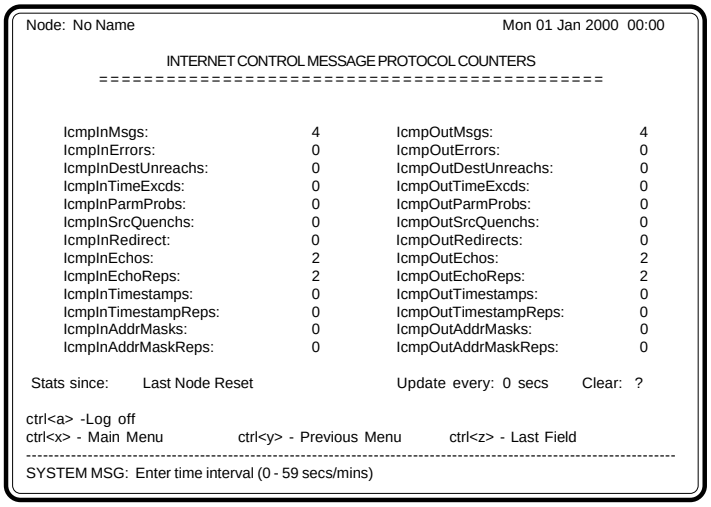
  IpReasmReqds
  This is the number of fragment reassemblies requested for output.

  IpReasmOKs
  This is the number of fragment reassemblies output correctly.

  IpReasmFails
  This is the number of fragment reassemblies that have failed.

  IpReasmTimeout
  This is the number of failed fragment reassemblies due to timeout.

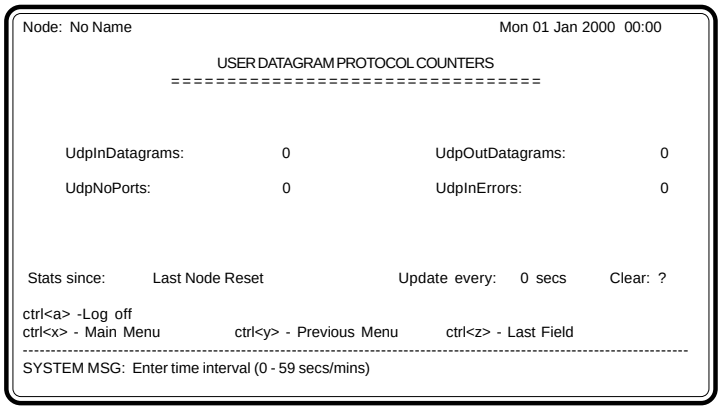
INTERNET CONTROL MESSAGE PROTOCOL STATISTICS (2.2.2)



The Internet Control Message Protocol allows gateways to send error or control messages to other gateways or hosts on the network. This screen shows count values for Internet Control messages. These are divided into inbound and outbound categories, the same parameters applying to both, as detailed below.

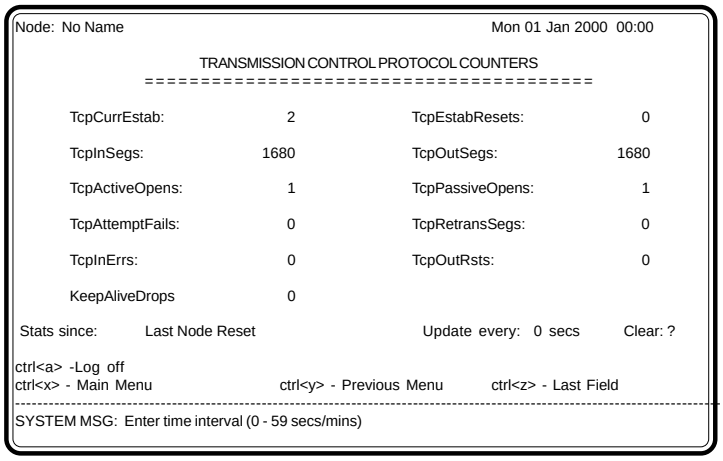
- **Icmpin/outMsgs**
  This shows the total number of messages.
- **Icmpin/outErrors**
  This shows the number of messages indicating errors.
- **Icmpin/outDestUnreachs**
  This shows the number of messages indicating the destination was unreachable.
- **Icmpin/outTimeExcds**
  This shows the number of messages indicating time exceeded for receipt of a datagram.
- **Icmpin/outParmProbs**
  This shows the number of messages indicating parameter problems on a datagram.
- **Icmpin/outSrcQuenchs**
  This shows the number of messages indicating a source quench.
- **Icmpin/outRedirect**
  This shows the number of messages indicating a datagram has been redirected.

- **Icmpin/outEchos**
  This shows the number of messages requesting an echo reply.
- **Icmpin/outEchoReps**
  This shows the number of messages replying to echo requests.
- **Icmpin/outTimestamps**
  This shows the number of messages requesting a timestamp.
- **Icmpin/outTimestampReps**
  This shows the number of messages replying to timestamp requests.
- **Icmpin/outAddrMasks**
  This shows the number of messages requesting address masks.
- **Icmpin/outAddrMaskReps**
  This shows the number of messages replying to timestamp requests.



This screen shows counter values pertaining to UDP, details as below.

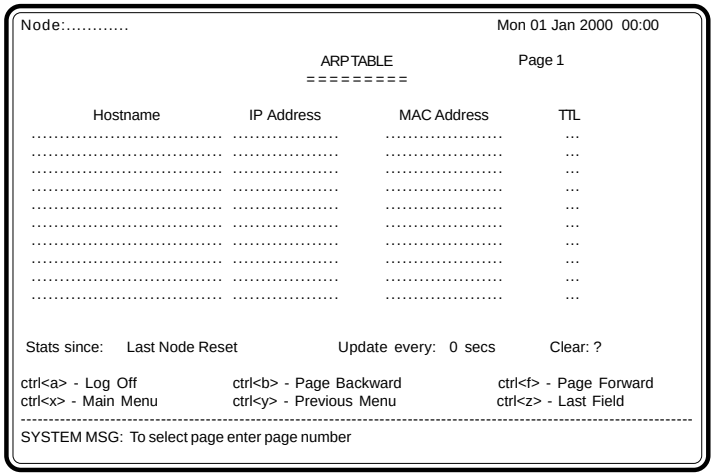
- **UdpInDatagrams**
  Number of inbound UDP datagrams.
- **UdpOutDatagrams**
  Number of outbound UDP datagrams.
- **UdpNoPorts**
  Number of UDP calls to non-existent ports.
- **UdpInErrors**
  Number of inbound UDP datagrams in error.



This screen shows counter values pertaining to the TCP protocol, details as below.

- **TcpCurrEstab**
  This shows the number of TCP connections currently established.
- **TcpEstabResets**
  This shows the number of resets on established connections.
- **TcpInSegs**
  This shows the number of inbound TCP segments.
- **TcpOutSegs**
  This shows the number of outbound TCP segments.
- **TcpActiveOpens**
  This shows the number of TCP connections initiated from the LINKSTREAM.
- **TcpPassiveOpens**
  This shows the number of TCP connections received by the LINKSTREAM.
- **TcpAttemptFails**
  This shows the number of attempted connections that failed.
- **TcpRetransSegs**
  This shows the number of TCP segments retransmitted.
- **TcpInErrs**
  This shows the number of TCP segment errors.
- **TcpOutRsts**
  This shows the number of outbound TCP resets.
- **KeepAliveDrops**
  This shows the number of dropped TCP sessions.

ADDRESS RESOLUTION PROTOCOL TABLE (2.2.5)



The Address Resolution Protocol (ARP) is used to dynamically bind the IP address (and its host name, if defined) to a low level hardware address on the Ethernet, the MAC address. The ARP table is dynamic and hence if the IP address of an Ethernet node is changed, this would be reflected in the table.

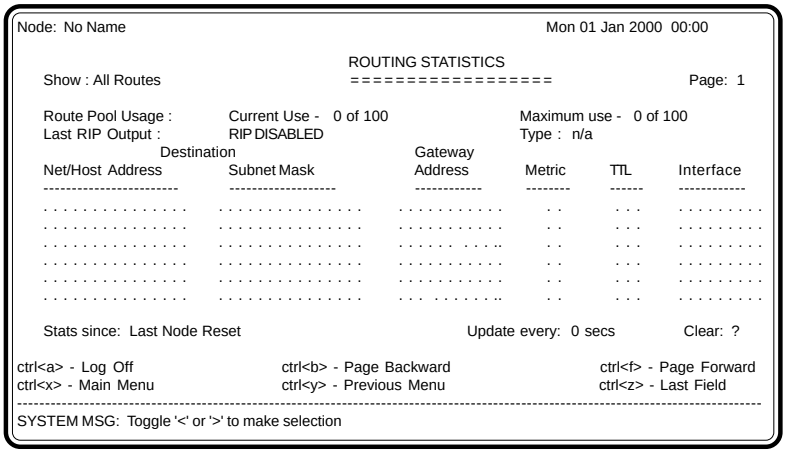
The period for which an IP and MAC address are bound together will timeout. The end column, TTL, gives the 'Time To Live' in seconds and indicates for how long the address combination is valid. If there is continued activity at those addresses, then the timers are continually being restarted. A combination of IP to MAC address will therefore only disappear from the table if there is no activity at that address.

```
Node:.....                                                    Mon 01 Jan 199-
00:00

 Format : Names              TCP CONNECTION TABLE              Page 1
                             ====================

 Local Address                    Remote Address              State
 128.16.0.64:23                   *.*.*.*:*                   LISTEN
 128.16.0.64:2000                 *.*.*.*:*                   LISTEN
 128.16.0.64:2001                 *.*.*.*:*                   LISTEN
 128.16.0.64:2002                 *.*.*.*:*                   LISTEN
 128.16.0.64:2003                 *.*.*.*:*                   LISTEN
 128.16.0.64:2004                 *.*.*.*:*                   LISTEN
 128.16.0.64:2005                 *.*.*.*:*                   LISTEN
 128.16.0.64:2006                 *.*.*.*:*                   LISTEN
 128.16.0.64:2007                 *.*.*.*:*                   LISTEN
 128.16.0.64:19                   *.*.*.*:*                   LISTEN

                                  Update every:  0  secs

ctrl<a> - Log Off          ctrl<b> - Page Backward     ctrl<f> - Page Forward
ctrl<x> - Main Menu        ctrl<y> - Previous Menu     ctrl<z> - Last Field
-------------------------------------------------------------------------------
SYSTEM MSG:  Toggle '<' or '>' to make selection
```

This screen shows all the local IP addresses set up in the LINKSTREAM. This would include the host address, gateway address, serial link addresses and the addresses of the user channels.

The 'Remote Address' column gives the IP address to which each local address is connected. The 'State' column gives the status of each connection.

ROUTING (RIP) STATISTICS (2.2.7)



This screen shows the routing table currently held by the LINKSTREAM. These can be either 'All Routes' or can be restricted to the categories as set out below.

- **Show**
  Select from the following. Default value is 'All Routes'.
  All Routes = Displays all routes held by the LINKSTREAM.
  Dynamic Routes Only = Displays only those routes learnt by RIP over the network.
  Static Routes Only = Displays only those routes manually entered into the LINKSTREAM tables.
  Default Route Only = Displays only the default routes either that were entered manually into the LINKSTREAM or the default received by RIP.
- **Page**
  Enter the page number up to 99.
  If the number is greater than the last page held, the LINKSTREAM will display the last page.

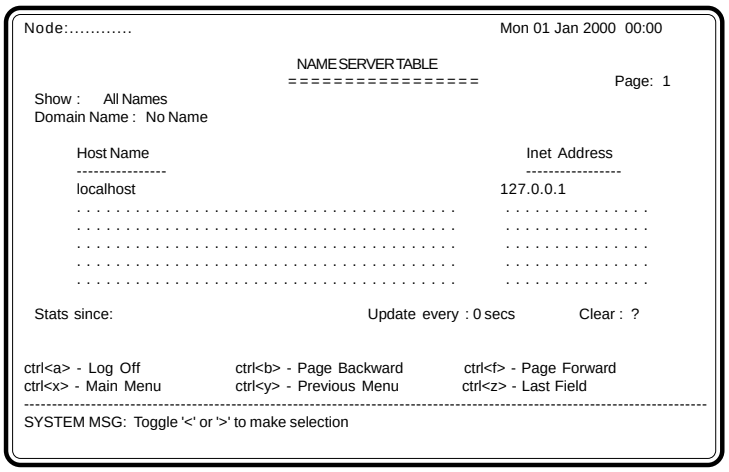
The parameters shown are set out below.

- **Route Pool Usage**
  The LINKSTREAM is able to store up to 250 routes. The memory is allocated in bands, beginning at 100 routes, and incrementing by 50 as required, up to the maximum. The 'Current Use' shows how many routes are currently held. 'Maximum Use' shows how many routes have been held since the screen was last cleared.
- **Last RIP Output**
  Timestamp of last RIP broadcast received.

- **Type**
  Displays 'Timeout' or 'Triggered'.
- **Destination - Net/Host Address & Subnet Mask**
  IP address and mask.
- **Gateway Address**
  Gateway to reach associated destination.
- **Metric**
  Value of 1 - 15 or 16 = OFF. Number of hops to reach destination.
- **TTL**
  Time to Live for this route, in seconds.
  Under RIP, routes are normally valid for 180 seconds.
- **Interface**
  Description of the LINKSTREAM interface used to reach the gateway.

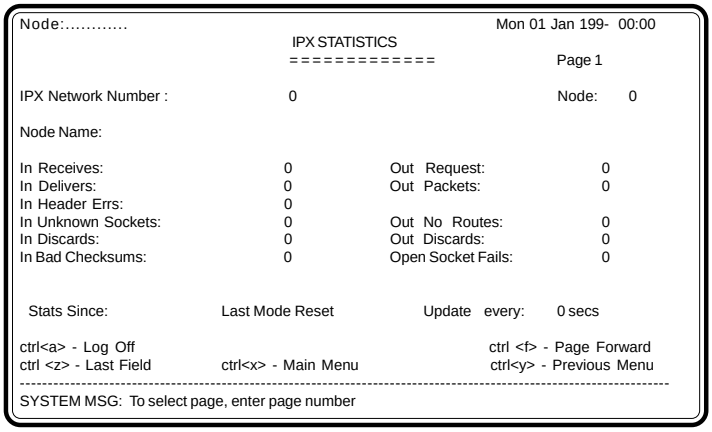
The update count can be set from 0 to 59 and the time period can be selected as seconds (secs) or minutes (mins). The counts can be cleared by entering **'Y'** to the **'Clear:'** prompt.

DOMAIN NAME SERVER TABLE (2.2.8)



This screen shows the host names and associated IP addresses held by the LINKSTREAM. These can either be all names or can be restricted to the categories as set out below.

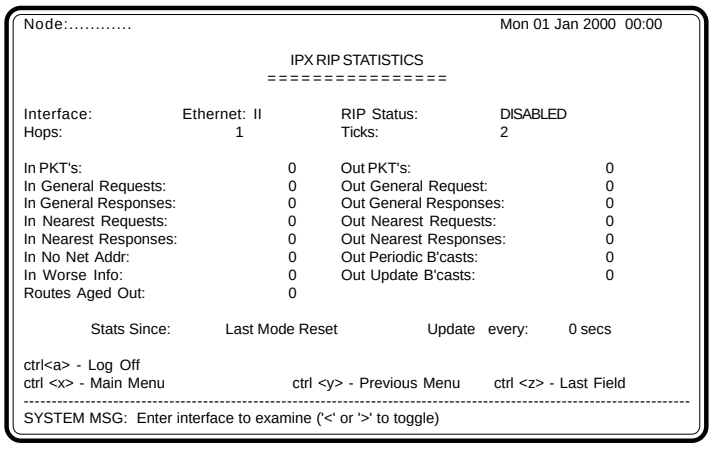
- **Show**
  Select from the following. Default value is 'All Names'.
  All Names = Displays all host names held by the LINKSTREAM.
  Dynamic Names Only = Displays only those names learnt by the DNS from central Name Servers.
  Static Names Only = Displays only those names manually entered into the LINKSTREAM tables.
- **Page**
  Enter the page number up to 9.
  If the number is greater than the last page held, the last page will be displayed.



This screen shows the IPX statistics. The parameters shown are:

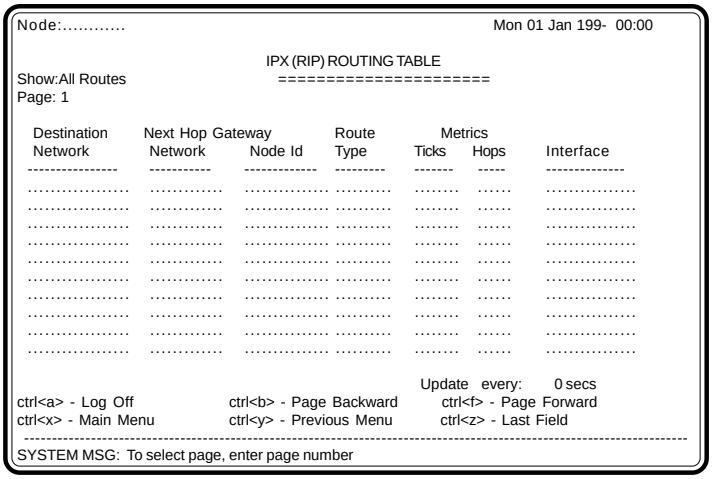
- **In Receives**
  Total number of IPX packets received.
- **In Delivers**
  Number of IPX packets received addressed for the LINKSTREAM itself.
- **In Header Errors**
  Number of packets received with header errors.
- **In Unknown Sockets**
  Number of IPX packets received with unknown socket numbers.
- **In Discards**
  Number of IPX packets received that are discarded due to errors.
- **In Bad Checksums**
  Number of packets received with checksum errors.
- **Out requests**
  Total number of IPX packets generated internally for transmission. Not all packets may be transmitted.
- **Out Packets**
  Total number of IPX packets transmitted.
- **Out No Routes**
  Number of IPX transmission packets discarded as the LINKSTREAM did not have a valid route.
- **Out Discards**
  Number of outgoing IPX packets discarded. This will happen if there are insufficient output buffers, i.e. congestion.
- **Open Socket Fails**
  Number of outgoing IPX packets discarded due to no response being received from a previously open socket.

IPX RIP STATISTICS (2.3.2)



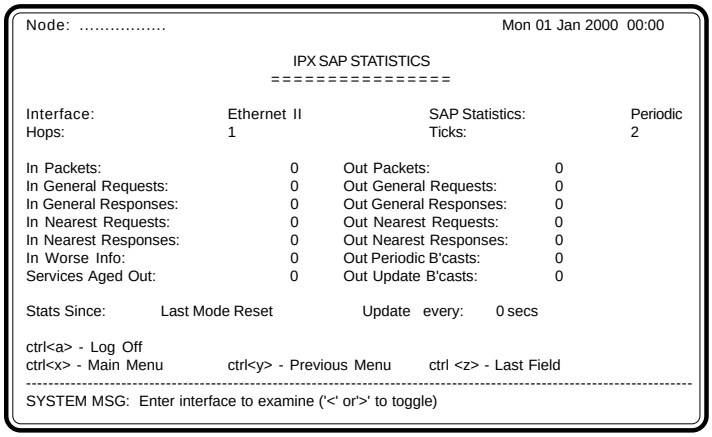
This screen shows the statistics associated with IPX RIP. Parameters are displayed for both inbound and outbound packets, details as below.

- **In/Out PKT's**
  Total number of IPX RIP packets.
- **In/Out General Requests**
  Number of General Request packets transferred seeking general network information.
- **In/Out General Responses**
  Number of General Response packets transferred carrying general network information. Generated in response to General Requests.
- **In/Out Nearest Requests**
  Number of Nearest Request packets transferred carrying nearest server requests.
- **In/Out Nearest Responses**
  Number of Nearest Response packets transferred carrying nearest server information. Generated in response to Nearest Requests.
- **In No Net Address**
  Number of IPX RIP update packets received with no information on valid network addresses.
- **In Worse Information**
  Number of IPX RIP packets received with poorer routes than those already held. The poorer route is stored in the Alternate Route List.
- **Routes Aged Out**
  Number of routes that have been removed from the table due to no updates being received.
- **Out Periodic Broadcasts**
  Number of periodic RIP broadcasts.
- **Out Update Broadcasts**
  Number of updated RIP broadcasts.



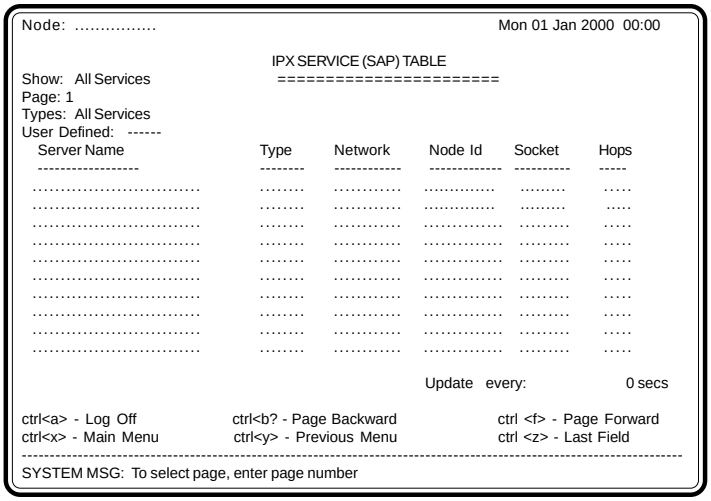
This screen shows the IPX RIP routing table currently held. These can either be 'All Routes' or can be restricted to the categories set out below.

- **Show**
  Select from the following. Default = All Routes.
  All Routes = Displays all routes held.
  Static Routes Only = Displays only those routes manually entered.
  Learned Routes Only = Displays only those routes learned by IPX RIP.
- **Page**
  Enter the page number, 1 to 9. If the number is greater than the last page held, the last page will be displayed.
  The parameters shown are:-
- **Destination Network**
  IPX External Network number of the final destination network.
- **Next Hop Gateway - Network & Node Identity**
  IPX External Network number and node Number of the adjacent gateway.
- **Route Type**
  Displays route type, STATIC or LEARNED.
- **Ticks**
  Time to reach destination network in 1/18th secs.
- **Hops**
  Number of routers to pass to reach destination network.
- **Interface**
  Displays the interface on the LINKSTREAM for this route.



This screen shows the statistics associated with IPX SAP. Parameters are displayed for both inbound and outbound packets, details as below.

- **XX Packets**
  Total number of IPX SAP packets.
- **XX General Requests**
  Number of General Request packets transferred seeking general network information.
- **XX General Responses**
  Number of General Response packets transferred carrying general network information. Generated in response to General Requests.
- **XX Nearest Requests**
  Number of Nearest Request packets transferred carrying nearest server requests.
- **XX Nearest Responses**
  Number of Nearest Response packets transferred carrying nearest server information. Generated in response to Nearest Requests.
- **In No Net Address**
  Number of IPX SAP update packets received with no information on valid network addresses.
- **In Worse Information**
  Number of IPX SAP packets received with poorer routes than those already held. The poorer route is stored in the Alternate Route List.
- **Services Aged Out**
  Number of routes that have been removed from the table due to no updates being received.
- **Out Periodic Broadcasts**
  Number of periodic SAP broadcasts.
- **Out Update Broadcasts**
  Number of updated SAP broadcasts.



This screen shows the IPX SAP services known to the LINKSTREAM. These can either be 'All Services' or can be restricted to the categories set out below:

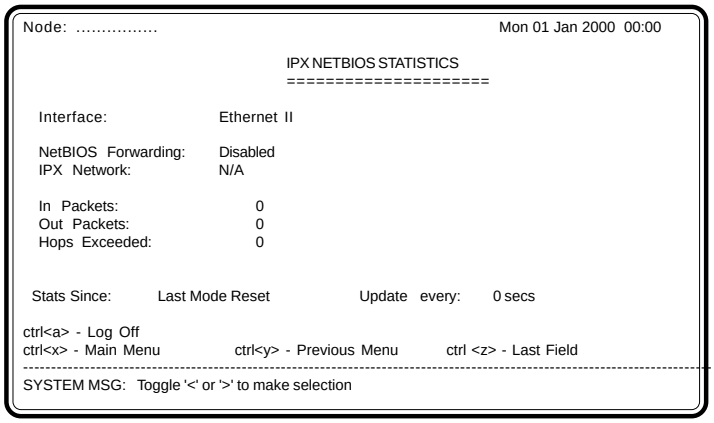
- **Show**
  Select from the following. Default = All Services.
  All services = Displays all services known to the

  LINKSTREAM.
  Static Services Only = Displays only those services manually entered.
  Learned Services Only = Displays only those services learned IPX SAP.
- **Page**
  Enter the page number 1 to 9. If the number is greater than the last page held, the last page will be displayed.
- **Types**
  Select from the following. Default = All Services.
  All Services = Displays all service types.
  File Servers (4) = Displays only file services available.
  Print servers (7&0x47) = Displays only print services available.
  User Defined = Displays only those services matching the type entered in the 'User Defined' field.

The parameters shown are:

- **Server Name**
  Name of server providing service.
- **Type**
  Code for service type.

- **Network**
  IPX external network number of the associated LINKSTREAM.
- **Node Identity**
  Node number of the associated server.
- **Socket**
  Socket number of the displayed service on the server.
- **Hops**
  Number of routes to pass through to reach the required server.



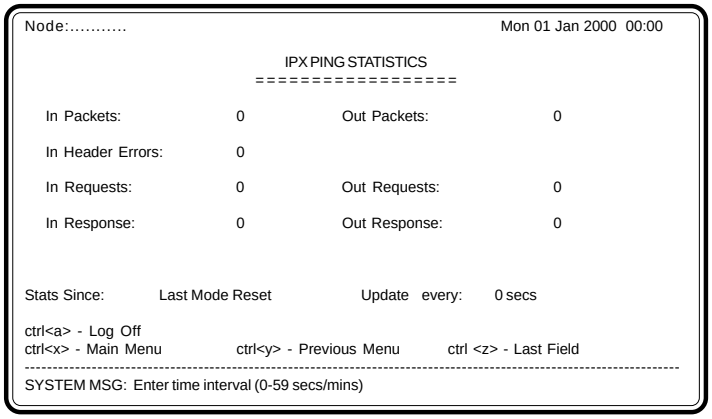
This screen shows the IPX NETBIOS statistics for the specified interface:

- **Interface**
  Select the appropriate Ethernet interface from Ethernet II/802.3 RAW/802.2/802.2 SNAP.

The following parameters are shown

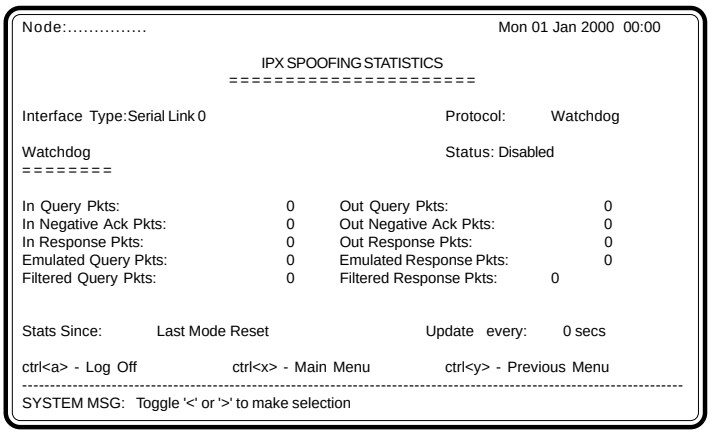
- **NETBIOS Forwarding**
  Function status shown.
- **IPX Network**
  IPX Network Number.
- **In Packets**
  Number of NETBIOS packets received.
- **Out Packets**
  Number of NETBIOS packets transmitted.
- **Hops Exceeded**
  Number of packets received where router hops have exceeded the expected number.

IPX PING STATISTICS (2.3.7)



This screen shows the IPX PING statistics. Parameters are displayed for both inbound and outbound packets, details as below:

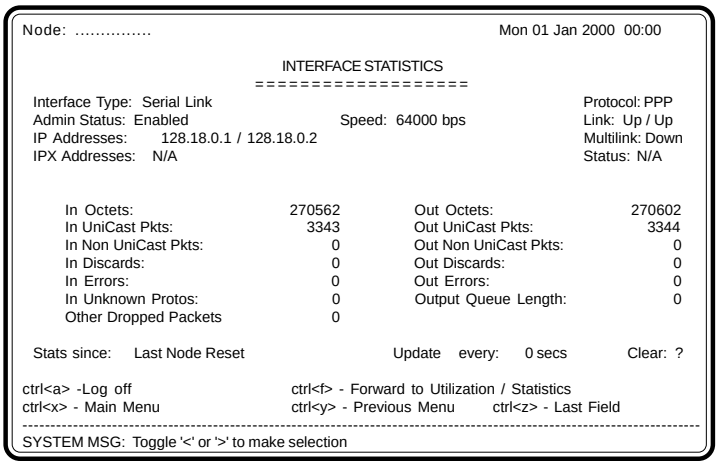
- **In/Out Packets**
  Total number of IPX PING packets.
- **In Header Errors**
  Number of IPX PING packets received with header errors.
- **In/Out Requests**
  Number of IPX Ping requests through the LINKSTREAM.
- **In/Out Responses**
  Number of IPX PING responses through the LINKSTREAM.



This screen shows the IPX spoofing statistics for the specified interface. Parameters are displayed for both inbound and outbound packets as set out below:

- **Interface Type**
  Select the appropriate interface.
- **Protocol**
  Select from Watchdog/RIP/SAP/Serialization. Default = Watchdog.
  The spoofing statistics associated with the selected protocol are then displayed.
  Watchdog = This protocol normally sends 'Are you there' packets to check the link status. Hence these packets are spoofed when the link is down.
  RIP = Protocol sending RIP packets
  SAP = Protocol sending SAP packets
  Serialisation = Protocol sending security packets containing Novell licence information to monitor network for illegal traffic.
- **In/Out Query Packets**
  Number of packets transferred requesting network information. This type of packet is only counted when the link is up.
- **In/Out Negative Acknowledge Packets**
  If, during spoofing, an 'Emulated Query Packet' fails to get a response after a given number of tries, the remote unit should be informed. To do this, the local unit brings up the link and sends a Negative Acknowlege Packet, incrementing the 'Out Negative Acknowledge Packets' count. The remote unit receives this, increments the 'In Negative Acknowledge Packets' count and stops sending 'Emulated Response Packets' to the appropriate destination. The network details will then be updated on the remote LAN.

- **In/Out Response Packets**
  Number of packets transferred containing network information generated in response to a 'Query' packet. These packets are only counted when the link is up.
- **Emulated/Filtered Query Packets**
  When the link is down, the Query/Response packets are spoofed. Query packets received by the LINKSTREAM at one end of the link are filtered and the 'Filtered Query Packets' count will increment. The LINKSTREAM at the other end of the link will generate (or emulate) Query packets which are transmitted over the remote LAN. The 'Emulated Query Packets' count is incremented.
- **Emulated/Filtered Response Packets**
  These operate when the link is down. A Response Packet received at a LINKSTREAM is filtered and the 'Filtered Response Packets' count is incremeted. At the remote end of the link, the LINKSTREAM will emulate a Response Packet when receiving a Request Packet and increment the 'Emulated Response Packets' count.



This screen simply displays counts of various parameters associated with the selected interface. Both 'In'bound and 'Out'bound figures are given.

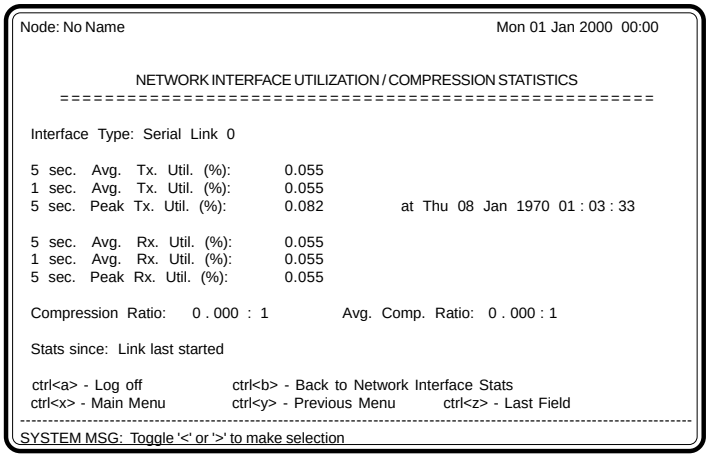
- **Interface Type**
  * Ethernet * Serial Link* Asynchronous
  Select the appropriate type. This will only display if interface is active.
- **Admin. Status**
  Indicates if the link is enabled or disabled.
- **Link**
  This shows the status of connections on the link. If the link is running Perle protocol over ISDN, this field will show 'UP' or 'DOWN' according to link status. If running PPP over ISDN, the link field will show two words indicating the state of the Logical/Physical links.

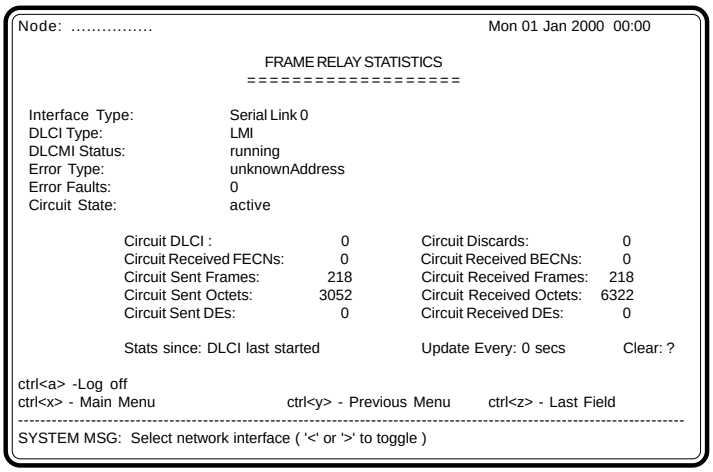
Logical link states:	UP
	DOWN
Physical link states:	/DOWN
	/CALL
	/UP
	/WAIT

  i.e. If the PPP link is up and the call is up over the dial-up (or ISDN) link, the field will show: 'Link : UP/UP'.
  If the PPP link is up but the physical call is not connected the field will show:
  'Link : UP/DOWN'.
  CALL indicates an ISDN call is being made.
  WAIT indicates the link is in the Call Retry Delay state.

- **Octets**
  This displays the number of bytes through the interface.
- **UniCast Packets**
  This displays the number of packets with a defined MAC address.
- **Non UniCast Packets**
  This displays the number of broadcast packets.
- **Discards**
  This displays the number of packets discarded.
- **Errors**
  This displays the number of packets with errors.
- **Unknown Protos**
  This displays the number of packets with unknown protocols.
- **Output Queue Length**
  This displays the number of packets awaiting transmission.
- **Utilization**
  This is the average percentage utilisation of the interface bandwidth.
- **Other Dropped Packets unknown**
  This displays the number of dropped packets across any system interface.

- **ctrl<f> Utilization / Compression Statistics**
  This function raises an additional screen for network interface utilisation and compression statistics. See below.





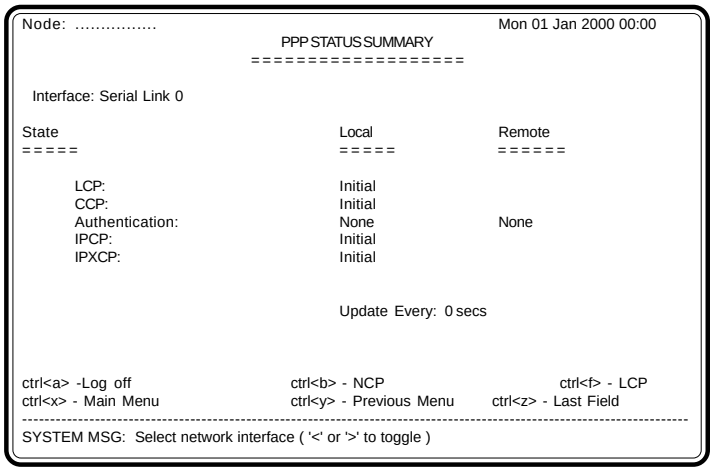
This screen shows values pertaining to an individual DLCI on the Frame Relay network. An SNMP Manager can also retrieve this information

- **Interface Type**
  Select the type of interface i.e. Serial Link 0/1
- **DLCI Type**
  Indicates whether this DLCI is used for management (LMI) or data (DLCI).
- **DLCI Status**
  This indicates the status of the Frame Relay interface as determined by the performance of the DLCMI. If no DLCMI is running, the Frame Relay interface will stay in the running state indefinitely.
  running = initialization complete, system running
  fault = error threshold exceeded
  initializing = system start up
- **Error Type**
  This indicates the type of error that was last seen on this interface
  unknownError = undefined error
  receiveShort = frame was not long enough to allow demultiplexing - the address field was incomplete or for virtual circuits using Multiprotocol over Frame Relay, the protocol identifier was missing or incomplete.
  receiveLong = frame exceeded maximum length configured for this interface
  illegalAddress = address field did not match configured format
  unknownAddress = frame received on a virtual circuit which was not active or administratively disabled.
  dlcmiProtoErr = unspecified error occurred when attempting to interpret link maintenance frame.
  dlcmiUnknownIE = link maintenance frame contained an Information Element type which is not valid for the configure link maintenance protocol.

dlcmiSequenceErr = link maintenance frame contained a sequence number other than the expected value.
dlcmiUnknownRpt = link maintenance frame contained a Report Type Information Element whose value was not valid for the configured link maintenance protocol.
noErrorSinceReset = no erors have been detected since the last cold start or warm start.

- **Error Faults**
  The number of times the interface has gone down since it was initialized.
- **Circuit State**
  Indicates whether the particular virtual circuit is operational.In the absence of a Data Link Connection Management Interface, virtual circuit entries (rows) may be created by setting virtual circuit state to 'active' or deleted by changing Circuit state to 'invalid'.
  Whether or not the row actually disappears is left to the implementation, so this object may actually read as 'invalid' for some arbitrary length of time. It is also legal to set the state of a virtual circuit to 'inactive' to temporarily disable a given circuit.
- **Circuit DLCI**
  Shows the DLCI number for the virtual circuit.
- **Circuit Discards**
  The number of inbound frames dropped because of format errors or because the VC is inactive.
- **Circuit Received FECNs**
  The number of frames indicating forward congestion recevied since the virtual circuit was created.
- **Circuit Received BECNs**
  The number of frames indicating backward congestion received since the virtual circuit was created.
- **Circuit Sent Frames**
  The number of frames sent from a specified virtual circuit since it was created.
- **Circuit Received Frames**
  The number of frames received over a specified virtual circuit since it was created.
- **Circuit Sent Octets**
  The number of octets sent from a specified virtual circuit since it was created.
- **Circuit Received Octets**
  The number of octets received over a specified virtual circuit since it was created.
- **Circuit Sent DEs**
  The number of frames sent with the Discard Eligible (DE) bit set.
- **Circuit Received DEs**
  The number of frames received with the Discard Eligible (DE) bit set.

- **Stats since**
  Elapsed time in seconds since the statistics collection started. This value is either the time since the unit was powered up or the time since the statistics was last cleared.
- **Update every: secs**
  Specify the time interval between screen refreshes for the statistics counters. Default = 0 secs.
- **Clear**
  Reset all the statistics counters to zero.



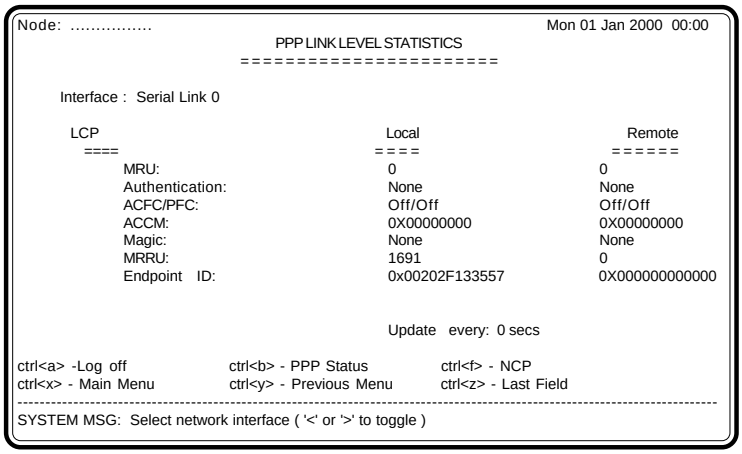
This screen shows the PPP negotiation status and statistics that have been negotiated for the specified interface. The status for both the local and remote end of the PPP link is displayed.

- **Interface**
  Select the appropriate serial link or asynchronous channel as required.

State

- **LCP**
  LCP status. Initial or open.
- **IPCP**
  IPCP status. Initial or open.
- **IPXCP**
  IPXCP status. Initial or open.
- **CCP**
  CCP status. Initial or open.

PPP LINK LEVEL STATISTICS (2.4.5)

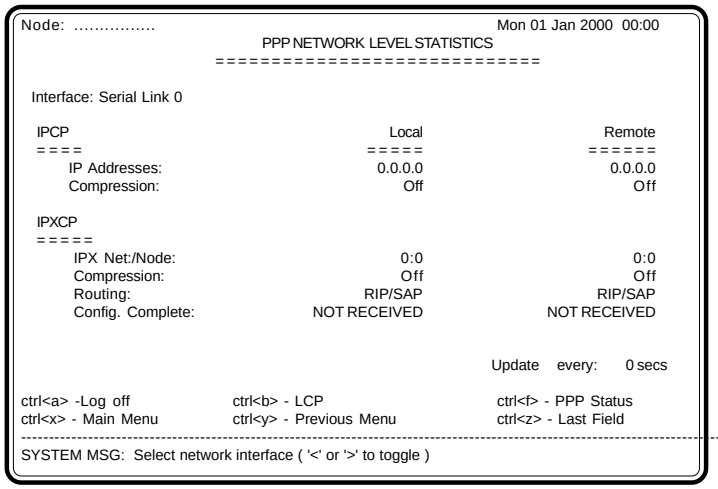


This screen shows the PPP link level statistics for the specified interface. The status for both the local and remote ends of the PPP link is displayed.

- **Interface**
  Select the appropriate serial link or asynchronous channel as required.

LCP

- **MRU (Maximum Receive Unit)**
  Maximum packet size transferred over PPP link (64-1500 byte).
- **Authentication**
  Method negotiated. None, UPAP or CHAP.
- **ACFC/PFC (Address Control Field Compression/ Protocol Field Compression)**
  Negotiated as ON or OFF.
- **ACCM (Asynchronous Control Character Map)**
  32 bit word defining allowable control characters.
- **Magic**
  A 4 byte random number generated within PPP and used to detect looped-back links. This number is generated internally by the software.
- **MRRU**
  MRRU = Multilink Maximum (Received) Reconstructed Unit. This indicates that the sender implements the Multilink.
- **Endpoint ID**
  Endpoint Identify Discriminator. This identifies the sender with the MAC address.



This screen shows the PPP network level statistics for the specified interface. The status for both the local and remote ends of the PPP link is displayed.

- **Interface**
  Select the appropriate serial link or asynchronous channel as required.

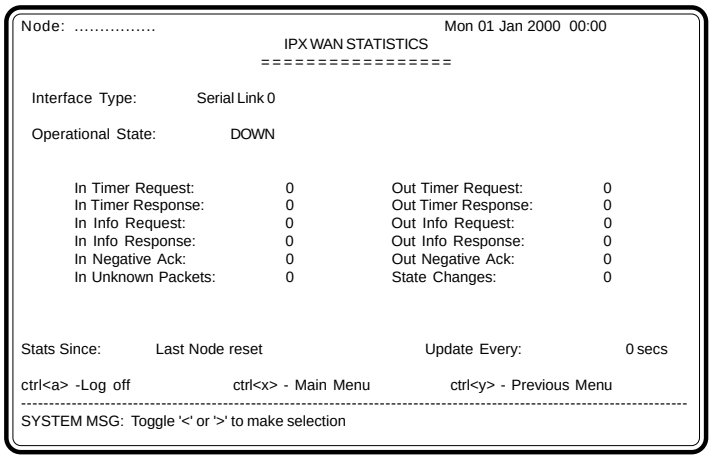
IPCP

- **IP Addresses**
  IP Addresses of the interfaces.
- **Compression**
  Shows negotiated VJ header compression status.

IPXCP

- **IPX Net:/Node:**
  The IPX network address and node number for the selected interface.
- **Compression**
  Shows negotiated compression status.
- **Routing**
  Shows routing protocol currently in operation.
- **Configuration Complete**
  Indicates that configuration negotiation is complete and confirmation is received at each end.

IPX WAN STATISTICS (2.4.7)



This screen shows the IPX WAN statistics for the specified interface. Most parameters are displayed for both inbound and outbound packets, details as below:

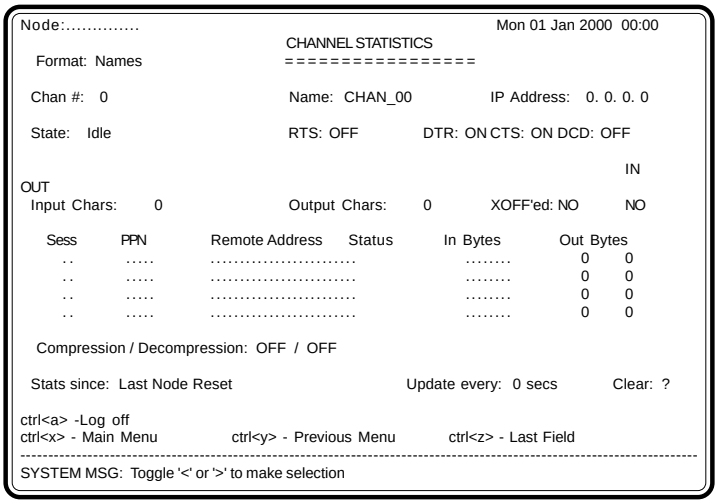
- **Interface Type**
  Select the appropriate serial interface.
- **Operational State**
  Shows interface status as UP or DOWN.

- **XX Timer Requests**
  Number of timer request packets transferred during link negotiation to establish the delay across the link.
- **XX Timer Responses**
  Number of timer response packets transferred during link negotiation sent in response to timer request packets.
- **XX Info Request**
  Number of info request packets transferred during link negotiation requesting the interface information.
- **XX Info Response**
  Number of info response packets transferred during link negotiation sent in response to info request packets.
- **XX Negative Ack**
  Number of negative acknowledge packets transferred indicating no response from the target unit. These packets are transferred as a result of the spoofing process.
- **In Unknown Packets**
  Number of packets received with unknown packet types.
- **State Changes**
  Number of state changes logged during link negotiation.

```
Node: .............                                                  Mon 01 Jan 2000  00:00

                                     CHANNEL SUMMARY
                                    ================                          Page:  1

                          Active        Accesses                     Timeouts
 Chan #      State       Sessions    Local   Remote   Calls   Session     Chan       Errors

   0         Idle           0          0       0        0        0          0          0
   1         Idle           0          0       0        0        0          0          0
   2         Idle           0          0       0        0        0          0          0
   3         Idle           0          0       0        0        0          0          0
   4         Idle           0          0       0        0        0          0          0
   5         Idle           0          0       0        0        0          0          0
   6         Idle           0          0       0        0        0          0          0
   7         Connected      1          1       0        1        0          0          0

   Stats since:  Last Node Reset                         Update every:  0 secs     Clear:  .

ctrl<a> - Log Off          ctrl<b> - Page Backward            ctrl<f> - Page Forward
ctrl<x> - Main Menu          ctrl<y> - Previous Menu            ctrl<z> - Last Field
-------------------------------------------------------------------------------------------
SYSTEM MSG:  To select page, enter page number
```

This screen summarises the calls on all the user channels, giving historical totals and current status, as below.

- **State**
  This shows the current connection status of the channel. Valid states are -
  Idle = Channel inactive.
  Connected = Session currently connected.
  Disconnected = Session disconnected.
  Local Mode = Connected to Command Line Interface.
  No Terminal = Channel not set up for input.
  Locked = Channel locked by user to prevent access to current sessions.
  The following are transitory states that may be seen as the channel switches between the stable states -
  Connecting, Disconnecting, Logging on
  LPD = Channel set up for Line Printer Daemon. Note: only the statistics marked **'*'** are logged.
- **Active Sessions**
  This shows the number of current active sessions.
- **Local Access**
  Shows the total number of calls initiated by the channel.
- **Remote Access***
  Shows the total number of calls received by the channel.
- **Calls**
  Shows the total number of overall calls on the channel.
- **Session Timeouts***
  This shows the total number of session timeouts, i.e. session dropped.
- **Chan Timeouts**
  This shows the total number of channel timeouts, i.e. channel returns to 'Listen' mode.
- **Errors***
  This shows the total number of errors on that channel.



This screen summarises the statistics for individual user channels, as below.

- **State**
  This shows the current connection status of the channel:
  No terminal, Idle, Connected, Disconnected, Locked, Local mode = (see User Channel Summary).
  Connecting = Session trying to connect.
  Disconnecting = Session trying to disconnect.
  Logging on = Session trying to log on.
  Timed out = Session not able to connect.
  PPP = Session running PPP mode.
  SLIP = Session running SLIP mode.
  Display menu = Channel in User Menu mode.
  Menu shell = Channel in Menu Shell mode.
  LPD = Session running LPD mode.
- **Input Chars & Output Chars**
  This shows the total number of characters, inbound and outbound.
- **Control Signal Status**
  This field shows the status of control signals and flow control and can be used to identify an apparent 'lock-up'. Valid states are

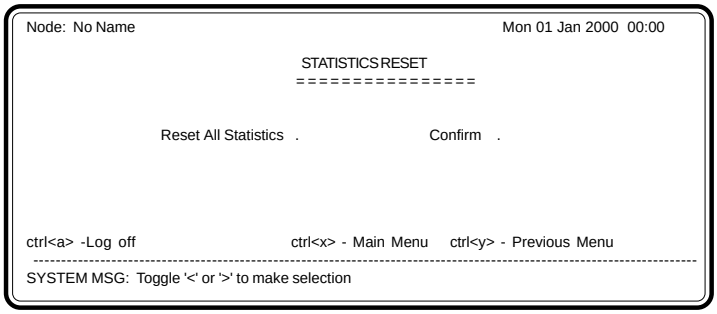
  RTS: ON/OFF CTS: ON/OFF
  DTR: ON/OFF DCD: ON/OFF
  XOFF'ed: NO/YES for incoming and outgoing flow control.

The rest of the screen shows data pertaining to individual sessions on the channel. Up to four sessions may be active at any time.

- **Sess**
  This shows the session number.
- **PPN**
  This is the Protocol Port Number. When a call is made from the LINKSTREAM, this can be any randomly assigned number between 1 and 65535. The PPN values entered for the channels are used by external hosts to reach that channel.
- **Remote Address**
  This is the IP address of the remote end of the connection.
- **Status**
  This shows the session status:
  Invalid, Closed, Sleeping, Closing, Active.
- **In Bytes & Out Bytes**
  This shows the total number of bytes, inbound and outbound.

The screen also shows the current average compression and decompression ratios if compression is enabled.

STATISTICS RESET



This screen is entered to clear all the statistics counters, i.e. a global statistics reset. A confirmation response is required before counts are cleared.

SECTION 8

TROUBLESHOOTING

SYMPTOM	*CAUSE*	*CORRECTION*
Attention light permanently on	*Corruption to novram* i.e. checksum of novram no longer matches checksum given after novram is read. Possible causes:- 1. LINKSTREAM was reset during saving parameters to novram 2. S/W downgraded 3. S/W upgraded	Requires cold restart
Run light not flashing	Possible causes:- 1. Power supply 2. Memory	Check fuse / power cable Check EPROM correctly fitted
Cannot ping local unit	Possible causes:- 1. Ethernet cable 2. Ethernet interface type 3. Ethernet address	Check cable Check internal Ethernet type Check Ethernet IP address is enabled: 1.4.1
Cannot ping remote unit	Possible causes:- 1. Default gateway not set correctly 2. WAN network address not set correctly 3. Reboot after changing settings 4. PPP protocol not set correctly 5. Network mask not set correctly	Check setting: 1.2.1 Check setting: 1.4.4 Check setting: 1.6 Check setting: 1.4.6 Check setting: 1.4.6

ISDN FAULT FINDING TIPS

1. Make sure you understand which type of ISDN service has been installed.
For example - ISDN2 to BTNR191 standard or ISDN2e to ETSI standard.
Note: ISDN2e is an enhanced version of ISDN2 and both types will interwork for both voice and data calls.
LINKSTREAM TAs are compatible with both types.

2. If more than one incoming call is required at a given site, MSN is recommended.
N.B. This option is available with ISDN2e at no extra cost.

3. If ISDN2 is installed, MSN numbers are normally 0-9, where 1-8 are MSN numbers allocated for use and are programmed into TA equipment where MSN is used.
Sub-addressing will allow up to six alpha numeric characters (except #) to be added to the number that is being dialled.
N.B. Check with BT to determine which service is provided.

4. If ISDN2e is installed, MSN information is passed as the whole of the ISDN number, normally up to 10 digits.
Sub-addressing will allow up to 20 alpha numeric characters (except #) to be added to the number that is being dialled. Again, check with BT if you are unsure how many digits are passed.

5. In the UK, the initial '0' is normally dropped at the incoming side, and therefore must be omitted in the LINKSTREAM ISDN set up (applies to ISDN2e).

6. To ensure a digital route end-to-end, the code 000 must replace the standard international access code of 00 when making international ISDN calls. Therefore the LINKSTREAM ISDN dial number should start with 000.

7. If the LED on the BT Linebox (may not be fitted on older models) is not lit, the line or Linebox is faulty. Contact BT or your Service Centre.

8. If you have problems with the terminal equipment, try substituting equipment that is known to be working. This should enable you to isolate the fault to an individual device.

9. When troubleshooting LINKSTREAM equipment with ISDN, it is useful to enter TA data mode on each unit and check manual dialling between TAs, thus eliminating the LINKSTREAM. This should determine if the fault lies with Perle TA or LINKSTREAM.
N.B. See manual for relevant AT commands.

10. If manually dialling responds immediately with 'NO CARRIER' this indicates a problem may lie with the ISDN cable, TA configured incorrectly, faulty TA or network not present or faulty.

11. If manually dialling does not respond immediately but eventually says 'NO CARRIER' this indicates a problem may be at the remote end, i.e. has not been set for answer, or misconfigured to answer a different number thus rejecting the call. Monitoring remote end (with echo and messages turned on), will display 'RING' messages if call is presented to its 'S' bus. If TA is correctly set to answer, message will display 'CONNECT 64000'. Note: Manual answering can be activated by typing 'ATA' following ring message. If answering manually, not automatically, check MSN number matches incoming number from network.

12. If you are using extension wiring connected to your ISDN2e Linebox, the problem may be associated with this wiring.

Unplug the extension wiring.

Ensure the **L/S** switch is in the **S** position.

Ensure **In/Out** switch is in the **IN** position.

Plug the terminal equipment into one of the Linebox sockets.

If the terminal equipment works satisfactorily, the problem is probably in the extension wiring and you will need to arrange for the supplier or maintainer of your wiring to check and correct the fault. Note: All extension wiring must have a Type 2 socket (which has terminating resistors), as the last socket.

13. Up to eight terminal devices may be connected to an ISDN2e line using extension wiring. The number of terminals is determined by the length and wiring configuration of the extension wiring.

FRAME RELAY FAULT FINDING TIPS

1. If the Link LED is not lit, the LMI is not active.

Check that the Frame Relay service you subscribe to matches you configuration.

Ensure Serial Link is setup for external clocking and check encoding.

Frame Relay LMI Type must be set correctly.

Also check cable connections to the CSU/DSU.

LMI status can be checked using the Frame Relay statistics screen:

DLCI Type: LMI

Circuit state: active

2. If the Link LED is lit and flashing periodically, the LMI is active.

In order to route user data (IP/IPX) across the Frame Relay link, both ends must have their respective LMI active. Once the LMIs become active, it may require a few minutes before user data will be routed.

If the user data does not get routed, check the DLCI setting for both ends. Note that DLCI addresses are usually unique for each frame relay hook up.

DCLI status can be checked using the Frame Relay statistics screen:

DLCI Type: DLCI

Circuit state: active

3.Confirming that both the LMI and the DLCI are active, remaining problems are usually related to IP and IPX configuration.

The PING utility can be used to help identify IP routing problems.

APPENDIX A

STANDARD APPLICATION CONFIGURATIONS

INTRODUCTION

This section gives details of the minimum configuration requirements to enable the LINKSTREAM to operate in a number of standard applications, as discussed in Section 1. Because most of the parameters have default values, there are only a small number of entries to enable the LINKSTREAM for use. These are detailed below for the particular application. For additional guidance, basic network diagrams are included for each operation. To find your way around the screens, use the 'Screen Structure' guide on page 4-1.

QUICK SETUP MENU

REFER TO THE LINKSTREAM INSTALLATION / USER GUIDE FOR QUICK SETUP INFORMATION.

COLD START

The LINKSTREAM can be completely restarted using the cold start mechanism.
N.B. - This will remove all the user-entered configurations and return all parameters to their default values.

A cold start is carried out as follows:

i) Hold in the 'RSET' and 'RSRT' buttons.
ii) Release the 'RSET' button.
iii) Release the 'RSRT' button.

The unit will then restart. All the front panel LEDs will come on for approximately 10 seconds. They will then all go out except for the RUN LED which will remain flashing.

TERMINAL ACCESS

After a cold start, access to the Node Manager is via any of the user channels. The terminal should be VT100 compatible and be set up for 9600bps, No Parity, 8 data and 1 stop bit.

PC CONNECTION

Where PCs are connected to async ports, it is advisable to set 'Active Session Local Character' for 'None'. Otherwise control characters sent from user or host may be stripped off and utilised by the Terminal Server. This can be configured in the 'Channel Session Parameters Screen'.

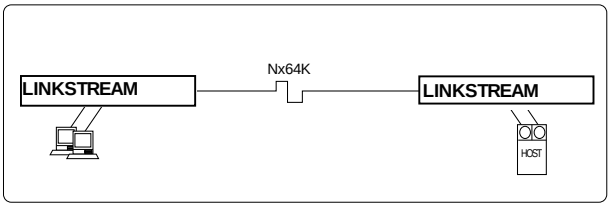
ASYNC TO ASYNC

When connections are set up one LINKSTREAM async port to another LINKSTREAM async port, it is normal to configure channel mode to 'transparent'. It is also advisable to set disconnect protocol or idle timeout to prevent the session being permanently active between the two ports.

PRINTER CONNECTION

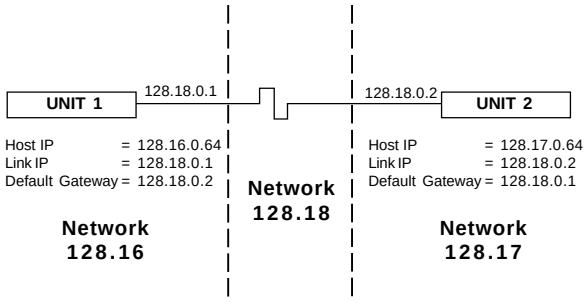
If the printer is connected to an async port, all messages should be disabled, transparent mode is normally used with 'Active Session Local Character' set for 'none'. This is usually configured as a remote channel.

STATISTICAL MULTIPLEXER



In this format, the LINKSTREAM provides a point to point link over Nx64K services for asynchronous traffic. The switching nature of the product allows sessions to be set up between channels on the local node as well as over the high speed link.

The prime inputs required for this configuration are setting up IP addresses for the LINKSTREAM Ethernet host and their link ports. The IP addresses of the default gateways are then entered which will create a pseudo network between the two units. Note that the IP addresses are default values and you can select your own. The resulting network is as below.



The configuration sequence is as follows:

UNIT 1

1. Plug a VT100 terminal into any user channel and hit any key to generate prompt.
2. Log into the Node Manager by typing '**Login**' to the **LINKSTREAM>** prompt.
3. Type '**manager**' to '**User Identity**' and 6 full stops and <CR> to '**Password**'.
4. Select option 1, '**Configuration**', on '**Main Menu**'.
5. Select option 2, **'Internet Protocol Screen'**.
6. Select option 1 to enter the '**System Internet Parameters**' screen.
7. Move the cursor to '**Default Gateway**' and enter '**128.18.0.2**'.
8. Move the cursor to '**Accept**' and enter '**Y**'.

9. Using '**CTRL-Y**' twice, return to the '**Configuration Menu**'.
   Select option 4 for '**Network Interface Configuration**'.
10. Select option 1 to enter the '**Ethernet Interface Parameters**' screen.
11. Move the cursor to '**Frame Format**', Select Ethernet II and select '**Enable IP Status**'. Internet address **'128.16.0.64'**
12. Move the cursor to '**Accept**' and enter '**Y**'.
13. Use '**CTRL-Y**' once to return to the '**Network Interface Configuration**' screen.
14. Select option 4 for **'Link Parameters'** and select **'Enabled'.** Set Internet address to **'128.18.0.1'.**
15. Move the cursor to **'Accept'** and enter **'Y'.**

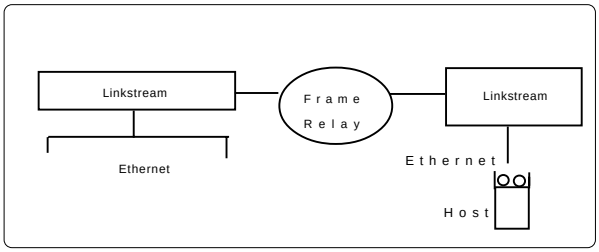
UNIT 2

1. Plug a VT100 terminal into any user channel and hit any key to generate prompt.
2. Log into the Node Manager by typing '**Login**' to the **LINKSTREAM>** prompt.
3. Type '**manager**' to '**User Identity**' and 6 full stops and <CR> to '**Password**'.
4. Select option 1, '**Configuration**', on '**Main Menu**'.
5. Select option 2, '**Internet Protocol Screen**'.
6. Select option 1 to enter the ' **System Internet Parameters**' screen.
7. Move the cursor to '**Default Gateway**' and enter '**128.18.0.1'.**
8. Move the cursor to '**Accept**' and enter '**Y**'.
9. Using '**CTRL-Y**' twice, return to the '**Configuration Menu**'. Select option 4 for '**Network Interface Configuration**'.
10. Select option 1 to enter the '**Ethernet Interface Parameters**' screen.
11. Move the cursor to '**Frame Format**', Ethernet II and select '**Enable IP Status'.** Set Internet address to **128.17.0.64**'.
12. Move the cursor to '**Accept**' and enter '**Y**'.
13. Use '**CTRL-Y**' once to return to '**Network Interface Configuration**' screen.
14. Select option 4 for '**Link Parameters**' screen and select '**Enabled**'. Set the Internet Address to '**128.18.0.2**'
15. Move the cursor to '**Accept**' and enter '**Y**'.
16. Use '**CTRL-Y**' twice to return to the '**Configuartion Menu**'. Select option 6 for '**System Reset**'.
17. Enter '**Y**' responses to reboot the node.

On connection, the two units will now allow sessions between ports when the appropriate IP address is called. You may wish to amend the channel interface parameters for your application, in which case the appropriate screen should be entered. The default values are:

Speed:	9600bps	**Connect Protocol**:	Data
Parity:	None	**Disconnect Protocol**:	None
Data bits:	8		
Stop bits:	1		
Flow Control:	XON/XOFF		

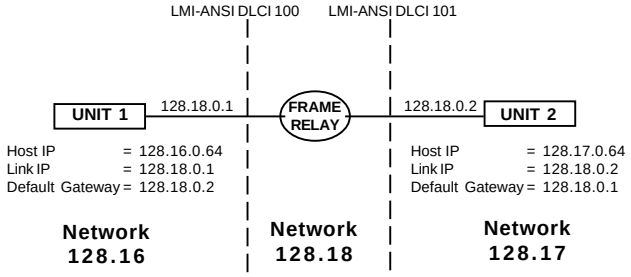
REMOTE ACCESS SERVER OVER FRAME RELAY



The Serial Link can be used to route IP (& IPX) traffic across Frame Relay for remote access to a corporate host.

The Serial Link is connected to a CSU/DSU using a V.35 or a V.24 cable.

When ordering a Frame Relay link be sure to ask your Frame Realy provider the line encoding (NRZ/NRZI), LMI type(LMI/ ANSI/ITUT), LMI counts and timer settings and DLCI addresses.



The configuration sequence is as follows:

UNIT 1

1. Plug a VT100 terminal into any user channel and hit any key to generate prompt.
2. Log into the Node Manager by typing '**Login**' to the **LINKSTREAM>** prompt.
3. Type '**manager**' to '**User Identity**' and 6 full stops and <CR> to '**Password**'.
4. Select option 1, '**Configuration**', on '**Main Menu**'.
5. Select option 2, **'Internet Protocol Configuration'**.
6. Select option 1 to enter the '**System Internet Parameters**' screen.
7. Move the cursor to '**Default Gateway**' and enter '**128.18.0.2**'.
8. Move the cursor to '**Accept**' and enter '**Y**'.

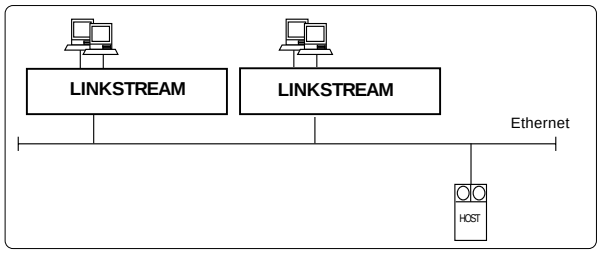
9. Using '**CTRL-Y**' twice, return to the '**Configuration Menu**'.
   Select option 4 for '**Network Interface Configuration**'.
10. Select option 1 to enter the '**Ethernet Interface Parameters**' screen.
11. Move the cursor to '**Frame Format**', Select '**Ethernet II**' and set '**IP/ARP Status**' to '**Enabled**'. Move the cursor to '**IP Address**' and enter **'128.16.0.64'**
12. Move the cursor to '**Accept**' and enter '**Y**'.
13. Use '**CTRL-Y**' once to return to the '**Network Interface Configuration**' screen.
14. Select option 5 for **'Frame Relay LMI Parameters'** screen.
15. Move the cursor to **'Link #'** and select '**Serial Link 0'**.
16. Move the cursor to **'Status'** and select **'Enabled'**.
17. Move the cursor to **'LMI Type'** and select **'ANSI'**.
18. Move the cursor to **'Accept'** and enter **'Y'.**
19. Use the **'CTRL-Y'** once to return to **'Network Interface Configuration'** screen
20. Select option 6 for **'Frame Relay Interface Parameters'** screen.
21. Move the cursor to **'Link #'** and select **'Serial Link 0'**.
22. Move the cursor to **'Status'** and select **'Enabled**'.
23. Move the cursor to **'DLCI Address'** and enter **'100'**.
24. Move the cursor to **'Protocol'** and select **'IP'**.
25. At the **'IP Address'** field enter **'128.18.0.1'**.
26. Move the cursor to **'Accept'** and enter **'Y'**.
27. Use the **'CTRL-X'** once to return to the **'Main Menu'** screen.
28. Select option 1, **'Configuration'** on **'Main Menu'**.
29. Select option 6,**'System Reboot'** on '**Configuration Menu'** and perform a software warm start.
30. Use **'CTRL-A'** once to logout.

UNIT 2

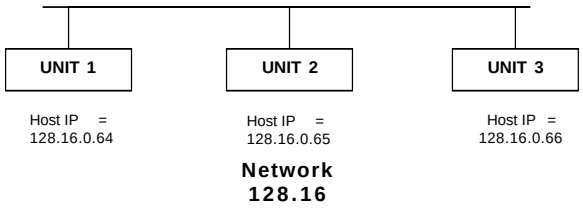
1. Plug a VT100 terminal into any user channel and hit any key to generate prompt.
2. Log into the Node Manager by typing '**Login**' to the **LINKSTREAM>** prompt.
3. Type '**manager**' to '**User Identity**' and 6 full stops and <CR> to '**Password**'.
4. Select option 1, '**Configuration**', on '**Main Menu**'.
5. Select option 2, '**Internet Protocol Screen**' on the **'Configuration Menu'**.
6. Select option 1 to enter the ' **System Internet Parameters**' screen.
7. Move the cursor to '**Default Gateway**' and enter '**128.18.0.1'.**
8. Move the cursor to '**Accept**' and enter '**Y**'.
9. Using '**CTRL-Y**' twice, return to the '**Configuration Menu**'. Select option 4 for '**Network Interface Configuration**' screen.
10. Select option 1 to enter the '**Ethernet Interface Parameters**' screen.

11. Move the cursor to '**Frame Format**',select **'Ethernet II '**and and set '**IP/ARP Status**' to 'Enabled'. Move the cursor to 'IP Address' and enter '128.17.0.64'.
12. Move the cursor to '**Accept**' and enter '**Y**'.
13. Use '**CTRL-Y**' once to return to '**Network Interface Configuration**' screen.
14. Select option 5 for **'Frame Relay LMI Parameters'** screen.
15. Move the cursor to **'Link #'** and select '**Serial Link 0'**.
16. Move the cursor to **'Status'** and select **'Enabled'**.
17. Move the cursor to **'LMI Type'** and select **'ANSI'**.
18. Move the cursor to **'Accept'** and enter **'Y'.**
19. Use the **'CTRL-Y'** once to return to **'Network Interface Configuration'** screen
20. Select option 6 for **'Frame Relay Interface Parameters'** screen.
21. Move the cursor to **'Link #'** and select **'Serial Link 0'**.
22. Move the cursor to **'Status'** and select **'Enabled**'.
23. Move the cursor to **'DLCI Address'** and enter **'101'**.
24. Move the cursor to **'Protocol'** and select **'IP'**.
25. At the **'IP Address'** field enter **'128.18.0.2'**.
26. Move the cursor to **'Accept'** and enter **'Y'**.
27. Use the **'CTRL-X'** once to return to the **'Main Menu'** screen.
28. Select option 1, **'Configuration'** on **'Main Menu'**.
29. Select option 6,**'System Reboot'** on '**Configuration Menu'** and perform a software warm start.
30. Use **'CTRL-A'** once to logout.

TERMINAL SERVER



In this mode, the unit acts as a traditional terminal server. Asynchronous devices/ports are attached to the channels of the LINKSTREAM and can then be connected to other devices on the Ethernet network. These can be host computers or devices connected to other LINKSTREAMS.
In this configuration, only one network is needed as all the units share the same LAN. The gateways are therefore not enabled, and the only requirement is to designate a new IP address for each unit. Note that the IP addresses are default values and you can select your own. The resulting network is as below.



UNIT 1

1. Plug a VT100 terminal into any user channel and hit any key to generate prompt.
2. Log into the Node Manager by typing '**Login**' to the **LINKSTREAM>** prompt.
3. Type '**manager**' to '**User Identity**' and 6 full stops and <CR> to '**Password**'.
4. Select option 1, '**Configuration**', on '**Main Menu**'.
5. Select option 4, '**Network Interface Configuration**', on '**Configuration Menu**'.
6. Select option 1, '**Ethernet Interface Parameters**' screen.
7. Move the cursor to '**Frame Format**' and select '**EnthernetII**'.
8. Move the cursor to '**Internet Protocol Status**' and select '**Enabled**'.
9. Move the cursor to '**Accept**' and enter '**Y**'.

UNIT 2

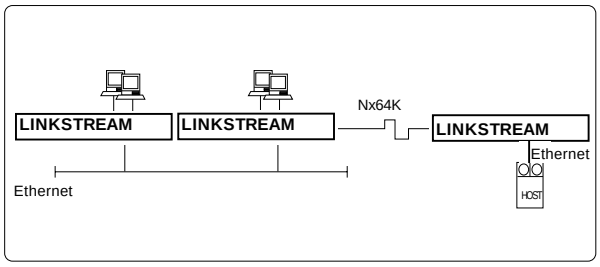
1. Plug a VT100 terminal into any user channel and hit any key to generate prompt.
2. Log into the Node Manager by typing '**Login**' to the **LINKSTREAM>** prompt.
3. Type '**manager**' to '**User Identity**' and 6 full stops and <CR> to '**Password**'.
4. Select option 1, '**Configuration**', on '**Main Menu**'.

5. Select option 4, '**Network Interface Configuration**', on '**Configuration Menu**'.
6. Select option 1, '**Ethernet Interface Parameters**' screen.
7. Move the cursor to '**Internet Address**' and enter '**128.16.0.65**'.
8. Move the cursor to '**Frame Format**' and select '**Ethernet II**'.
9. Move the cursor to '**Internet Protocol Address**' and select '**Enabled**'.
10. Move the cursor to '**Accept**' and enter '**Y**'.
11. Use '**CTRL-Y**' twice to return to the '**Configuration Menu**'. Select option 6 for '**System Reset**'.
12. Enter '**Y**' response to reboot the node.

If further units are required, follow the procedure as for unit 2 but increment the final digit for the Internet address each time as illustrated on unit 3.

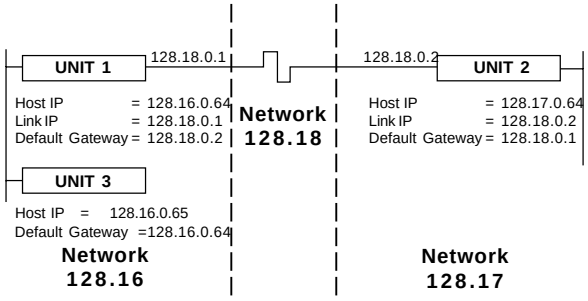
The set up parameters for the interface channels apply as for the multiplexer.

REMOTE SERVER WITH WAN LINK



With the provision of the WAN link on the LINKSTREAM, devices are able to access hosts or other serial devices on remote LANs or stand alone LINKSTREAMS. The LINKSTREAM is able to route its own traffic when used in this configuration. Routing of third party traffic is not recommended.

As with the multiplexer, the prime inputs required are the IP addresses for the LINKSTREAM Ethernet hosts, the link ports and the default gateways. Additional units can then be added to the LANs giving the network as set out below.



UNIT 1

1. Plug a VT100 terminal into any user channel and hit any key to generate prompt.
2. Log into the Node Manager by typing '**Login**' to the **LINKSTREAM>** prompt.
3. Type '**manager**' to '**User Identity**' and 6 full stops and <CR> to '**Password**'.
4. Select option 1, '**Configuration**', on '**Main Menu**'.
5. Select option 2, '**Internet Protocol Configuration**', on '**Configuration Menu**'.
6. Select option 1 to enter the '**System Internet Parameters**' screen.
7. Move the cursor to '**Default Gateway**' and enter '**128.18.0.2**'.
8. Move the cursor to '**Accept**' and enter '**Y**'.

9. Using '**CTRL-Y**' twice, return to the '**Configuration Menu**'.
   Select option 4 for '**Network Interface Configuration**' screen.
10. Select option 1 to enter the '**Ethernet Interface Parameters**' screen.
11. Move the cursor to '**Frame Format**', and select '**Ethernet II**' and set '**IP/ARP status**' to '**Enabled**'. Check '**IP Address**' is '**128.16.0.64**'.
12. Move the cursor to '**Accept**' and enter '**Y**'.
13. Use '**CTRL-Y**' once to return to '**Network Interface Configuration'** screen.
14. Select option 4 for '**Link Parameters**' screen. Select '**Serial Link 1**'.
15. Move the cursor to '**Status**' and select '**Enabled**'.
16. Set '**Internet Address**' to '**128.18.0.1**'.
17. Move the cursor to '**Accept**' and enter '**Y**'.

UNIT 2

1. Plug a VT100 terminal into any user channel and hit any key to generate prompt.
2. Log into the Node Manager by typing '**Login**' to the **LINKSTREAM>** prompt.
3. Type '**manager**' to '**User Identity**' and 6 full stops and <CR> to '**Password**'.
4. Select option 1, '**Configuration**', on '**Main Menu**'.
5. Select option 2, '**Internet Protocol Configuration**', on '**Configuration Menu**'.
6. Select option 1 to enter the '**System Internet Parameters**' screen.
7. Move the cursor to '**Default Gateway**' and enter '**128.18.0.1**'.
8. Move the cursor to '**Accept**' and enter '**Y**'.
9. Using '**CTRL-Y**' twice, return to the '**Configuration Menu**'.
   Select option 4 for '**Network Interface Configuration**' screen.
10. Select option 1 to enter the '**Ethernet Interface Parameters**' screen.
11. Move the cursor to '**Frame Format**', select '**Ethernet II**' and set '**IP/ARP status**' to '**Enabled**'. Move the cursor to '**IP Address**' and enter '**128.17.0.64**'.
12. Move the cursor to '**Accept**' and enter '**Y**'.
13. Use '**CTRL-Y**' once to return to the '**Network Interface Configuration**' screen.
14. Select option 4 for '**Link Parameters**' screen. Select '**Serial Link 1**'.
15. Move the cursor to '**Status**' and select '**Enabled**'.
16. Move the cursor to '**Internet Address**' and enter '**128.18.0.2**'.
17. Check the '**Subnet Mask**' shows '**255.255.0.0**'.
18. Move the cursor to '**Accept**' and enter '**Y**'.

19. Enter the '**SYSTEM REBOOT**' screen and perform a software warm start.
20. Select option 2, check the speeds and clocking are correct for your application.
21. Select '**Ctrl Y**' to '**Exit**' if no changes have been made.

UNIT 3 & ABOVE
For additional units, follow the procedure for the unit in the appropriate network but increment the final digit for the Internet Address each time. Note that the serial link is not required on additional units as they communicate over the Ethernet.

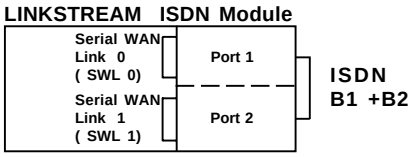
In order for Unit 3 to communicate with Unit 2, it must have Unit 1 defined as the Default Gateway. This is done by choosing the '**IP Protocol Configuration Screen**' screen and selecting **'Yes'** for **'IP Gateway'** and entering **'128.16.0.64'** for the Default Gateway.

ISDN

The LINKSTREAM has an option for an ISDN interface consisting of a module inserted onto the main card. This module carries one basic rate ISDN connection which will connect to services meeting Euro-ISDN standards throughout Europe. The basic rate ISDN interface presents two 64Kbps data channels and a 16Kbps signalling channel. This is known as '2B+D' where '2B' indicates the 64Kbps data channels and 'D' indicates the signalling channel. The data channels are identified as B1 and B2. Currently the LINKSTREAM only uses the two 64Kbps channels.

GENERAL DESCRIPTION

Perle's ISDN module provides two independent data ports which can be assigned onto the ISDN B channels. The two ports are directly connected to the Serial WAN Links in the LINKSTREAM as set out in the diagram below.



The connection path is therefore:-

LINKSTREAM Serial WAN Link 0 to ISDN module Port 1 to ISDN B channel
LINKSTREAM Serial WAN Link 1 to ISDN module Port 2 to ISDN B channel

The ports of the ISDN module will connect onto the B channels according to the configuration. In some applications they are fixed to a specific B channel while in others the B channel used is not critical, but the module will only answer a call from a particular ISDN number. This will be explained in the notes on specific applications.

The implementation of ISDN in the LINKSTREAM has been designed to give the same operation whether using the internal ISDN module as above or making use of an external ISDN Terminal Adaptor (TA). When configuring for ISDN, the LINKSTREAM implements a transparent link into the ISDN device to allow all the features to be used for configuration.

In the configuration mode the interface between the LINKSTREAM and the ISDN module operates at 9600bps, asynchronous.

Access into the module is from the 'ISDN/Modem Call Parameters' screen and the user enters the device from the 'TA Mode' field. See also section 4.

LINKSTREAM has two methods of initiating a call over the ISDN, one using the DTR control signal into the module, and the other to send an 'atd' dialling command with the associated ISDN number. The use of each will depend on the application. The DTR mode is more restricted in that it only allows a call to be made in one direction while the 'atd' mode allows a call to be made from either end of a link. Basic configuration details are given below.

DTR SIGNAL MODE

This mode is controlled by the X.21 bis software within the LINKSTREAM and causes the ISDN module to dial a pre-stored number. This occurs when the software detects that data needs to be transferred across the WAN link and the ISDN connection is down. One of the units is set up to make the call and the other to answer as below.

DTR SIGNAL MODE - DIAL OUT ONLY

This LINKSTREAM will initiate the call by raising the DTR signal to the ISDN number previously stored using the 'at&z' command. This LINKSTREAM is normally located at the remote site where terminals access a central host. It should have 'No Data Call Timeouts' set causing it to drop the call when there is no data to be sent.

DTR SIGNAL MODE - DIAL IN ONLY

This LINKSTREAM will only answer the call and is normally located at the central site with the host computer. Timeouts are disabled at this end as the remote end controls the call.

'ATD' DIALLING MODE - DIAL IN AND OUT

In this mode the LINKSTREAM is able to make and receive calls and will dial in response to the 'atd' dialling command sent to the module. The command will use the ISDN number stored in the 'Prime Number' field of the ISDN/ Modem Call Parameters screen. In this mode a 'No Data Call Timeout' can be set at both ends as either can drop the call.

Having selected the LINKSTREAM operating mode and configured the links, ISDN numbers etc., the user should then enter the configuration mode of the ISDN module by moving the cursor to the 'TA Mode' field and selecting the '>' key.

AUTO CONFIGURATION MODE

Auto configuration allows fast, easy set up of the TA module.
Having specified the mode required, the relevant 'at' strings are automatically sent to the TA. Therefore, this eliminates the need to access the terminal adaptor manually.

The ISDN module shares features in common with stand alone TAs in that they both use the Hayes 'at' command set and 'S' registers for basic configuration. There are extensions to this set which give further configuration options that are required for ISDN. These are often specific to the manufacturer. The details in this document refer only to the LINKSTREAM ISDN module. Please refer to the manufacturer's manual if an external TA is being used.

Given below are those 'at' commands and 'S' register settings used for LINKSTREAM applications. Each port in the module has its own set of registers so that they can be set up in different configurations. All other commands/registers use the default settings which are entered as part of the set up procedure:-

'AT' COMMANDS

The 'at' commands generally have parameters associated with them which give the relevant configuration settings.

All following commands and register access must be prefixed by AT: e.g. at&d0, ats0=1, at&X0='blank' (clears register).

COMMAND SUMMARY

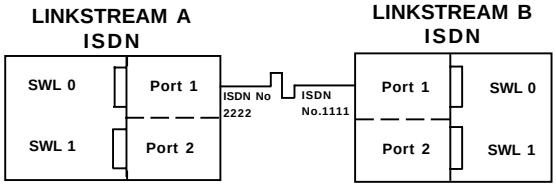
A - manually answer incoming calls
D - dial command
DS=n - dial stored no. n
DL - re-dial last dialled number
Dxxx#yyy - dial no. xxx with sub-address yyy
En - Echo option
0 = disabled, 1 = enabled
I0 - display product information
Qn - command result option
0 = enabled, 1= disabled,
0 is default
Sn=x - write value x to S register n
Sn? - display value of S register n
Z - soft reset
&D - Data terminal ready option
0 = Ignore DTR,
1 = monitor DTR and remain on-line,
2 = Monitor DTR hang up and enter command state,
2 is default
&F - load factory default settings
&Qn - dial/connect type
1 = Async dial/Sync connect, 2 = DTR call est./Sync connect, 1 = default
&Rn - RTS/CTS option
0 = CTS tracks RTS, 1 = CTS on RTS ignored,
0 is default
&S - DSR option
0 = DSR always on, 1 = DSR off until handshaking,
0 is default
&V - display TA configuration for current port
&W - store active profile (newly entered commands)
&Xn - dial back numbers, n=0-3 (see S120 below)
&Yn - CLI filtering numbers, n=0-3 (see S122 below)
&Zn - store dial number in &Z register n where n = 0, 1
0 is default

'S' REGISTERS

S0 - Answer mode 0 = never answer, 1 = auto answer
128 = manual answer, 0 = default
S22 - Async stop bits
0 = 1 bit, 1 = 1.5 bits, 2 = 2 bits,
0 is default
S24 - Async data bits
0 = 8 bits, 1 = 7 bits, 2 = 5 bits,
0 is default
S25 - DTR detection delay value, default is 5
S26 - RTS to CTS interval value, default is 1
S100 - local MSN number/s up to 20 digits, empty = no **MSN** - (see also S123 below)
S102 - local sub-address number
S103 - outgoing channel,
0 = any B channel, 1 = B1 only, 2 = B2 only, 3 = preferred B1, 4 = preferred B2, 5 = D channel,
0 is default
S111 - incoming channel, 0 = any B channel, 1 = B1 only, 2 = B2 only, 0 is default
S120 - dial back if incoming number is found in &X register,
0 = disabled, 1 = enabled,
0 is default
S121 - MMI sub-address
S122 - enable CLI filtering on numbers in &Y registers, 0 = disabled, 1 = enable,
0 is default
S123 - MSN digit check, 0 = no MSN checking, 1-6 = number of consecutive digits to check, i.e. if S100=45 and S123 =1 then incoming calls are answered if incoming MSN is a 4 or a 5. If S123=2 then incoming MSN must be 45.
0 is default.
S100 must have a number before S123 can be set.

DTR DIALLING

This is the simplest application in which a single 64Kbps ISDN link is set up between two units. A diagram of the connections is shown below.



In this application, examples are given of both DTR and 'atd' dialling. On other applications, only 'atd' configurations will be given.

In this example, LINKSTREAM A will be calling LINKSTREAM B only.

LINKSTREAM A configuration

1. Disable Serial Links 0 and 1 on the LINKSTREAM.
2. Enter '**ISDN / Modem Call Parameters'** screen for Serial Link 0. Set to '**Dial Out Only**' and '**DTR**' mode.
3. Set auto configuaration mode to '**DTR Autodial**', and enter '**DTR number**' dial string.
4. Accept screen twice to confirm settings and to restart the link protocol.
NB. The following commands are automatically sent to the TA module.

at&f	Reset to factory default
at&q2	Async off-line, sync on-line, dial on DTR
	DTR from on to off drops the call
at&z=2222	Desired ISDN number (2222)
at&w	Write settings to non-volatile RAM

5. Enter '**ISDN/Modem Call Parameters'** screen for Serial Link 1.
6. Set auto configuration mode to 'OFF'.
7. Accept screen to confirm settings.
N.B.The following commands are automatically sent to the TA module.

at&f	Reset to factory default
ats0=0	Disable answering on Port 2
at&w	Write settings to non-volatile RAM

LINKSTREAM B configuration

1. Disable Serial Links 0 and 1 on the LINKSTREAM.
2. Enter '**ISDN/Modem Call Parameters'** screen for Serial Link 0. Set to '**Dial In Only**'.
3. Set auto configuration mode to **'Normal'.**
4. Accept screen twice to confirm settings and to restart the link.

NB. The following commands are automatically sent to the TA module.

at&f	Reset to factory default
at&q1	Async off-line, sync on-line, no dialling
ate 0	Turns echo off
atq 1	Turns messages off
ats0=1	Answer ISDN call after 1 ring
at&w	Write settings to non-volatile RAM

5 . Enter '**ISDN/Modem Call Parameters**' screen for Serial Link 1.
6 . Set auto configuration mode to '**OFF**'.
7 . Accept screen to confirm settings.
N.B.The following commands are automatically sent to the TA module.

at&f	Reset to factory default
ats0=0	Disable answering on Port 2
at&w	Write settings to non-volatile RAM

'ATD' DIALLING In this example, either LINKSTREAM A or B can initiate the call.

LINKSTREAM A & B configuration
1 . Disable Serial Links 0 and 1 on the LINKSTREAM.
2 . Enter '**ISDN/Modem Call Parameters**' screen for Serial Link 0. Set to '**Dial In & Out**'.
3 . Enter the ISDN number of the remote LINKSTREAM connection (1111 or 2222).
4 . Set auto configuration mode to **'Normal'**.
5. Accept screen twice to confirm settings and restart the link protocol.
N.B.The following commands are automatically sent to the TA module.

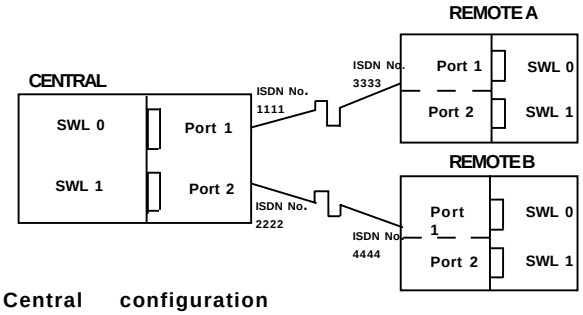
at&f	Reset to factory default
at&q1	Async off-line, sync on-line, no dial on DTR
ats0=1	Answer ISDN call after 1 ring
atq1	Disable status responses
ate0	Disable command echo
at&w	Write settings to non-volatile RAM

6 . Enter '**ISDN/Modem Call Parameters**' screen for Serial Link 1.
7 . Set auto configuration mode to '**OFF**'.
8 . Accept to confirm settings.
NB. The following commands are automatically sent to the TA module.

at&f	Reset to factory default
ats0=0	Disable answering on Port 2
at&w	Write settings to non-volatile RAM

ISDN 2 B CHANNEL NUMBERS

In this application, the Central LINKSTREAM connects to Remote A and B. At the Central site, the ISDN 2 connection has two numbers, one being assigned specifically to each B channel. This service is not available for new installations but older sites may still have this. It is still being supported by BT for the time being. A diagram of the connections is shown below.



Central configuration

1 . Disable Serial Links 0 and 1 on the LINKSTREAM.

2 . Enter '**ISDN/Modem Call Parameters**' screen for Serial Link 0. Set to '**Dial In & Out**'

3 . Enter the ISDN number of the remote LINKSTREAM connection from Link 0 (3333).

4 . Access Port 1 of the ISDN module in configuration mode and enter the following

at&f	Reset to factory default
at&q1	Async off-line, sync on-line, no dial on DTR
ats0=1	Answer ISDN call after 1 ring
ats103=1	Call out using B1 channel only
ats111=1	Accept calls from B1 channel only
atq1	Disable status responses
ate0	Disable command echo
at&w	Write settings to non-volatile RAM

5 . Enter '**ISDN/Modem Call Parameters**' screen for Serial Link 1. Set to '**Dial In & Out**'.

6 . Enter the ISDN number of the remote LINKSTREAM connection from Link 0 (4444).

7 . Access Port 2 of the ISDN module in configuration mode and enter the following

at&f	Reset to factory default
at&q1	Async off-line, sync on-line, no dial on DTR
ats0=1	Answer ISDN call after 1 ring
ats103=2	Call out using B2 channel only
ats111=2	Accept calls from B2 channel only
atq1	Disable status responses
ate0	Disable command echo
at&w	Write settings to non-volatile RAM

8 . Re-eable Serial Links 0 & 1 on the LINKSTREAM.

Remote A & B configuration

1. Disable Serial Links 0 and 1 on the LINKSTREAM.

2. Enter '**ISDN/Modem Call Parameters**' screen for Serial Link 0. Set to '**Dial In & Out**'.

3. Enter the ISDN number of the remote LINKSTREAM connection (1111 or 2222).

4. Select auto configuration mode to **'Normal'.**

5. Accept screen twice to confirm settings and to restart the link protocol.

N.B. The following commands are automatically sent to the TA module.

at&f	Reset to factory default
at&q1	Async off-line, sync on-line, no dial on DTR
ats0=1	Answer ISDN call after 1 ring
atq1	Disable status responses
ate0	Disable command echo
at&w	Write settings to non-volatile RAM

6. Enter '**ISDN/Modem Call Parameters**' screen for Serial Link 1.

7. Select auto configuration mode to '**OFF**'.

8. Accept screen to confirm settings.

N.B. The following commands are automatically sent to the TA module.

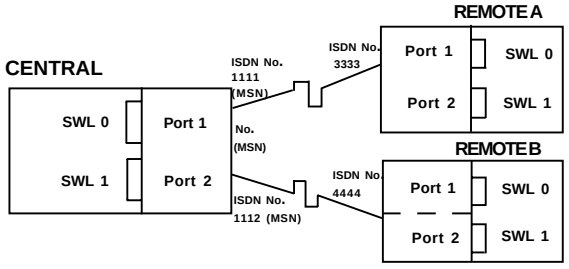
at&f	Reset to factory default
ats0=0	Disable answering on Port 2
at&w	Write settings to non-volatile RAM

MSN

MSN has now been brought in by BT and replaces the service where there are two ISDN numbers dedicated to the B channels.

Under MSN, the ISDN interface is assigned a bank of 10 numbers in sequence, for example 1110 to 1119. The final digit is then used to differentiate between devices attached to the interface. Each device has its own MSN number which corresponds to the last digit of the ISDN number. Up to 8 devices can be connected to the interface and each will only answer a call when its MSN number matches the last digit of the calling number of the network. Note that only two devices can be active at one time as there are only two B channels.

In this application, the Central site connection has the MSN service and connects to Remote A and B. A diagram of the connection is shown below.



Central configuration

1. Disable Serial Links 0 and 1 on the LINKSTREAM.

2. Enter '**ISDN/Modem Call Parameters**' screen for Serial Link 0. Set to '**Dial In & Out**'.

3. Enter the ISDN number of the remote LINKSTREAM connection (3333).

4. Select auto configuration mode to '**Local MSN**'. Enter MSN number.

5. Accept screen twice to confirm settings and to restart the link protocol.

N.B. The following commands are automatically sent to the TA module.

at&f Reset to factory default
at&q1 Async off-line, sync on-line, no dial on DTR
ats0=1 Answer ISDN call after 1 ring
ats100=1 MSN number for Port 1
ats123 MSN Digit Check (see S123 register on page B-13)
atq1 Disable status responses
ate0 Disable command echo
at&w Write settings to non-volatile RAM

6. Enter '**ISDN/Modem Call Parameters**' screen for Serial Link 1.

7. Enter the ISDN number of the remote LINKSTREAM connection from Link 1 (4444).

8 . Set auto configuration mode to '**Local MSN**': enter MSN number.

9 . Accept screen twice to confirm settings and restart the link.

N.B. The following commands are automatically sent to the TA module.

at&f	Reset to factory default
at&q1	Async off-line, sync on-line, no dial on DTR
ats0=1	Answer ISDN call after 1 ring
ats100=2	MSN number for Port 2
atq1	Disable status responses
ate0	Disable command echo
at&w	Write settings to non-volatile RAM

Remote A & B configuration

1 . Disable Serial Links 0 and 1 on the LINKSTREAM.

2 . Enter '**ISDN/Modem Call Parameters**' screen for Serial Link 0. Set to '**Dial In & Out**'.

3 . Enter the ISDN number of the remote LINKSTREAM connection (1111 or 1112).

4 . Accept screen twice to confirm settings and to restart the link.

N.B. The following commands are automatically sent to the TA module.

at&f	Reset to factory default
at&q1	Async off-line, sync on-line, no dial on DTR
at&d2	DTR from on to off drops the call
ats0=1	Answer ISDN call after 1 ring
atq1	Disable status responses
ate0	Disable command echo
at&w	Write settings to non-volatile RAM
atz	Reset the module

5 . Enter '**ISDN/Modem Call Parameters**' screen for Serial Link 1.

6 . Set auto configuration mode to '**OFF**'.

7 . Accept screen to confirm settings.

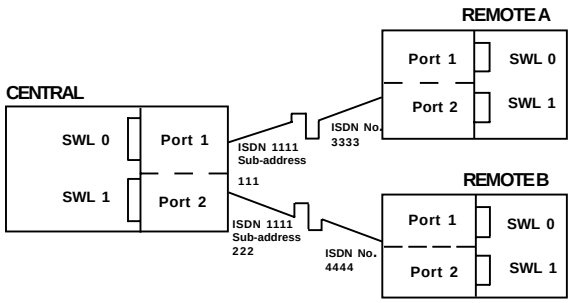
N.B. The following commands are automatically sent to the TA module.

at&f	Reset to factory default
ats0=0	Disable answering on Port 2
at&w	Write settings to non-volatile RAM

3 NODE TRIANGLE - SUB ADDRESSING AT CENTRAL

Sub-addressing is a further service offered by BT to allow multiple devices at an ISDN connection. A sub-address extension is added to the basic ISDN number and will be matched against the appropriate device at the called end.

In this application, the Central site connection has sub-addresses and connects to Remote A and Remote B. A diagram of the connections is shown below.



Central configuration

1. Disable Serial Links 0 and 1 on the LINKSTREAM.
2. Enter '**ISDN/Modem Call Parameters**' screen for Serial Link 0. Set to '**Dial In & Out**'.
3. Enter the ISDN number of the remote LINKSTREAM connection (3333).
4. Set auto configuration mode to 'Local Sub-address' and enter the sub-address number.
5. Accept screen twice to confirm settings and to restart the link.

N.B. The following commands are automatically sentto the TA module.

at&f	Reset to factory default
at&q1	Async off-line, sync on-line, no dial on DTR
ats0=1	Answer ISDN call after 1 ring
ats102=111	Sub-address of Port 1
atq1	Disable status responses
ate0	Disable command echo
at&w	Write settings to non-volatile RAM

6. Enter '**ISDN/Modem Call Parameters**' screen for Serial Link 1. Set to '**Dial In & Out**'.
7. Enter the ISDN number of the remote LINKSTREAM connection (4444).
8. Set auto configuration mode to 'Local Sub-address and enter the sub-address number.
9. Accept screen twice to confirm settings and restart the link.

N.B. The following commands are automatically sentto the TA module.

at&f	Reset to factory default
at&q1	Async off-line, sync on-line, no dial on DTR
ats0=1	Answer ISDN call after 1 ring
ats102=222	Sub-address of Port 2
atq1	Disable status responses
ate0	Disable command echo
at&w	Write settings to non-volatile RAM

Remote A & B configuration

1. Disable Serial Links 0 and 1 on the LINKSTREAM.
2. Enter '**ISDN/Modem Call Parameters**' screen for Serial Link 0. Set to '**Dial In & Out**'.
3. Enter the ISDN number of the remote LINKSTREAM connection (1111#111 or 1111#222).
4. Accept screen twice to confirm settings and restart the link.

N.B. The following commands are automatically sent to the TA module.

at&f	Reset to factory default
at&q1	Async off-line, sync on-line, no dial on DTR
ats0=1	Answer ISDN call after 1 ring
atq1	Disable status responses
ate0	Disable command echo
at&w	Write settings to non-volatile RAM

5. Enter '**ISDN/Modem Call Parameters**' screen for Serial Link 1.
6. Set auto configuration mode to **'OFF'**.
7. Accept screen to confirm settings.

at&f	Reset to factory default
ats0=0	Disable answering on Port 2
at&w	Write settings to non-volatile RAM
atz	Reset the module

FAULT FINDING

When problems are encountered in making an ISDN connection, there are features within the ISDN module that can be used to identify the nature of the problem. The most useful one is to manually dial across the ISDN network using the '**atd**' command and observe the status messages being reported.

To do this, log into the ISDN module configuration mode from the ISDN/Modem Call Parameters screen. The messages should then be switched on as below:-

atq0	Enable status response
ate1	Enable command echo
at&d0	Ignore DTR - this allows manual dialling at all times
atd1111	Dial ISDN number '1111'

The module will then respond with the following messages as appropriate

NO CARRIER	Carrier lost or not detected, i.e. no line or remote device
BUSY	The remote ISDN connection is engaged
CONNECT 64000	Connection established at 64000bps

At the end of the manual testing, type in the '**atz**' command which will reset the module and enter the settings for the selected operation.

MODEM OPERATION

ASYNCHRONOUS CHANNELS

The asynchronous user channels on LINKSTREAM are configured as DCE ports. These have 5 control lines available for modem controls, 3 outputs and 2 inputs. These are -

Inputs	**Outputs**
RTS	DCD
DTR	DSR
	CTS

The two inputs are monitored by the LINKSTREAM and, of the outputs, DCD and CTS can be controlled. The DSR output is fixed 'ON' by being tied high through a resistor.

The LINKSTREAM will work with a modem in three possible modes -

i) ***Outbound*** - will only initiate outgoing calls,
ii) ***Inbound*** - will only accept incoming calls,
iii) ***Bidirectional*** - will both initiate and accept calls.

Each of these modes is able to operate with either software or hardware flow control, hence allowing a wide variety of operational configurations to be used. The following sections show the configurations and connection details for the various modes and flow control options. Suggested pin connections are given between the RJ45 connector on the LINKSTREAM and the typical 25 way D-type connector on a modem.
Further details on the configuration screens are given in section 4 of this manual.

SOFTWARE FLOW CONTROL

❑ XON/XOFF

i) Outbound

LINKSTREAM		**Modem**
RXD	5	2 TXD
TXD	3	3 RXD
Ground	6	7 Ground
DCD	4	20 DTR

- Set up the user channel on the LINKSTREAM for XON/XOFF and DCD set to Normal. This means DCD will go high when a connection is made through the unit to the user channel.
- Set up the modem to dial a preprogrammed telephone number or to interactive mode to use AT commands. If set for a preprogrammed number, DCD going high will cause the modem to dial.
  In interactive mode, the connection through the unit will present the Modem Management interface to the user allowing AT commands to be entered.
- Disconnect method should be either Double Break, a special character or inactivity timer.

ii) Inbound

LINKSTREAM		Modem
RXD	5	2 TXD
TXD	3	3 RXD
Ground	6	7 Ground
DCD	4	
or		20 DTR
DSR	7	
RTS	1	22 RINGIN

- Set up the user channel on the LINKSTREAM for XON/XOFF.
- The channel should be set to DEDICATED and a destination IP address entered.
- Connect protocol should be set to RINGIN.
  This is connected to RTS which will cause the DEDICATED connection to be made through the LINKSTREAM on the ringing signal.
- The DTR modem setting option will give different connection options:
  If set to 'DTR assumed', no connection is needed.
  If DTR is required it can be connected DSR which is always high. This means the modem will answer the call as long as it is plugged into the LINKSTREAM.
  If connected to DCD, the modem will only answer the call when the connection has been made through the LINKSTREAM, and DCD is raised.

Disconnect method is determined by the pin connections used, i.e.

- dropping of DTR to the modem would need the DCD-DTR connection,
- inactivity timer is usable for all connection options.

iii) Bidirectional

LINKSTREAM		Modem
RXD	5	2 TXD
TXD	3	3 RXD
Ground	6	7 Ground
DCD	4	20 DTR
RTS	1	22 RINGIN

- Set up the user channel on the LINKSTREAM for XON/XOFF and DYNAMIC.
- Connect Protocol should be set to RINGIN.
- The modem should be set for Interactive mode.
- For outbound calls the user will use AT commands to set up the required number.
- Inbound calls will present the caller with the Command Line interface of the LINKSTREAM allowing them to make a connection to any point on the network.

HARDWARE FLOW CONTROL

❑ CTS/DTR

i) Outbound

LINKSTREAM	Modem
RXD 5	2 TXD
TXD 3	3 RXD
Ground 6	7 Ground
DCD 4	20 DTR
CTS 8	4 RTS
DTR 2	5 CTS

- Set up the user channel on the LINKSTREAM for CTS/DTR and DCD set to Normal.
- The modem configuration is as given in the OUTBOUND section for Software Flow Control.
- Some modems give the option to use DTR or RTS for flow control. The above cabling requires RTS to be selected.
- All other parameters are as for OUTBOUND in the Software Flow Control section.

ii) Inbound

LINKSTREAM	Modem
RXD 5	2 TXD
TXD 3	3 RXD
Ground 6	7 Ground
DCD 4	20 DTR
CTS 8	4 RTS
DTR 2	5 CTS
RTS 1	22 RINGIN

- Set up the user channel on the LINKSTREAM for CTS/DTR.
- All other parameters are as for INBOUND in the Software Flow Control section.

iii) Bidirectional

LINKSTREAM	Modem
RXD 5	2 TXD
TXD 3	3 RXD
Ground 6	7 Ground
DCD 4	20 DTR
CTS 8	4 RTS
DTR 2	5 CTS
RTS 1	22 RINGIN

- Set up the user channel on the LINKSTREAM for CTS/DTR and DYNAMIC.
- All other parameters are as for BIDIRECTIONAL in the Software Flow Control section.
  Note that the above cabling will require the modem to use RTS for flow control rather than DTR.

The above information refers to typical modem configurations. It is advisable that the instruction manual for the particular modem used is consulted to confirm its operation when connecting it to the LINKSTREAM.

APPENDIX B

GENERAL INFORMATION

The LINKSTREAM meets the following European standards -

BABT Approval No	NS/2220/1/P/603943
Safety	EN 60950:1992 incorporating amendments 1 and 2
Network safety	EN 41003:1993
Network connection	NET1 clause 8 and Annex A9 (X.21 variant only)
ISDN	Euro-ISDN to I-CTR3

The LINKSTREAM carries the CE mark which signifies compliance with the following standards:

EN 60950:1992
EN 41003:1993
EN 55081
EN 55082:1992 Immunity

STATUTORY REQUIREMENTS

WARNING For continued user safety protection, and for protection of the Telecommunications Network, this equipment must be connected to a protective earth.

WARNING For continued protection of the Telecommunications Network only SELV circuits should be connected to any user port.
Note: User channels are labelled 0 to 23.

SAFETY NOTICE

CAUTION

The LINKSTREAM has a component containing a lithium battery on the base card. There is a danger of explosion if this is incorrectly replaced. Replace only with the same type. Dispose of used batteries properly and do NOT cut open or expose to a naked flame or to temperatures outside the range of -20 to +60°C.

APPENDIX C

CHAT-SCRIPT CONFIGURATION GUIDE

To create a script that will log-on a user over a modem, use the chat-script configuration parameter on the ISDN Parameters Configuration Screen. To delete the specified chat script, type <ctrl-D> as the first character of the script and hit<RETURN>, the string 'None' should then be displayed.

Login Script:[-v] [-t timeout] expect-send

To enable the execution of the script select the appropriate dialling mode and Login Script option for the Dial Mode Parameter.

Dial Mode: <ATD + Login>/<DTR + Login

SYNTAX DESCRIPTION

- v	Verbose mode (optional).
- t	Default timeout value (optional). If not specified, a default of 5 seconds wille used.
expect-send	Content of the chat script.

DEFAULT

No chat-scripts are defined.

USAGE GUIDELINES

Chat-scripts are used in dial-on-demand routing to provide commands to log-on to remote systems. The defined script will only be used when a call is being made by the local systems. Some characteristics of chat-scripts are as follows:

- Chat-scripts are case sensitive.
- You can have any number of ABORT sequences active at once.
- When a chat-script starts, the default timeout is 5 seconds. Changes to the timeout persist until the next time you change them in the script.
- A string within quotation marks is treated as a single entity.

ESCAPE SEQUENCES

Chat-scripts are in the form expect-send, where the send string following the hyphen is executed if the preceding expect string fails. Each send string is followed by a return unless it ends with \c. ^x gets translated into the appropriate control character, and \x gets translated into x if \x is not one of the special sequences listed in Table 1-1.

See the book entitled *Managing uucp and Usenet* by Tim O'Reilly and Grace Todino for more information about chat-scripts.

The escape sequences used in chat-scripts are listed below:

TABLE 1-1 CHAT-SCRIPT ESCAPE SEQUENCES

ESCAPE SEQUENCES	*DESCRIPTION*
""	Expect a null string
EOT	Send an end-of-transmission character.
BREAK	Cause a BREAK. This is sometimes simulated using line speed changes and null characters. May not work on all systems.
\ c	Suppress new line at the end of the send string.
\ d	Delay for 2 seconds.
\K	Insert a BREAK.
\ n	Send a newline or linefeed character.
\ p	Pause for 1/4 second.
\ r	Send a return.
\ s	Send a space character.
\ t	Send a table character.
\ \	Send a backslash (\) character.

Expect-Send Pairs

Sample supported expect-send pairs are described in Table 1-2.

TABLE 1-2 SAMPLE SUPPORTED EXPECT-SEND PAIRS

Expect and Send Pair	Function
ABORT string	Starts scanning for the string in the input and if it is seen this indicates that the chat-script has failed.
TIMEOUT time	Sets the time to wait for in put, in seconds. The default is five seconds.

As an example of how expect-send pairs function, if the modem reports BUSY when the number is busy, you can indicate that you want the attempt stopped at this point by including ABORT BUSY in your chat-script.

ALTERNATIVE HANDLERS

ABORT SINK instead of ABORT ERROR means that the system will abort when it sees SINK instead of when it sees ERROR.

MISSED CHARACTERS

After the connection is established and <CR> is pressed, a second <CR> is often required before the prompt appears. You might include the following as part of your chat-script:

ssword:-/r-ssword

This means that after the connection is established you want "ssword" to be displayed. If it is not displayed, send a <CR> again after the timeout passes.

Example

The following example shows the script command being used to remote systems with the user name 'user' and password 'passwd'. The script will abort if the string 'ERROR' or 'Invalid Password' is received. If the log-on is successful, the script will then wait for the string 'Protocol' before sending the string 'ppp'. It will then wait for the string 'HELLO' before pausing for 2 seconds before finishing successfully.

```
Login Script:-v-t 10 ABORT ERROR ABORT "Invalid
Password" ogin:-\r-ogin: user password:\qpasswd
protocol:\qppp HELLO\d
```

INDEX

Numerics

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X