V100 VERSATILE MULTIPLEXER
V100 COMPACT MULTIPLEXER

Technical Manual

vocality
international

www.vocality.com

BEFORE INSTALLING THE UNIT

PLEASE REFER TO THE SAFETY INSTRUCTIONS IN APPENDIX A

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1

1 Introducing the V100

1.1 General Overview

The V100 multiplexer represents the culmination of many years' experience in the design of communications equipment. Not only does it provide an impressive range of features and options, but uses innovative and state-of-the-art technology to yield a high-performance solution to a diverse range of voice/data/audio and IP applications.

The architecture of the product has been designed to meet all essential requirements and yet allow for almost unlimited expansion and flexibility. The 1U chassis is the most compact format for mobile comms and its rugged and reliable design makes the V100 ideal for military or commercial deployment in remote areas. By linking many chassis together, a sophisticated hub site can be commissioned which exploits the versatile routing and bandwidth agility of the product.

The V100 allows voice, data, audio and IP sources (termed as "tributaries") to be multiplexed together over common network paths (termed as "aggregates") between V100s.

All data ports are viewed as universal, as they may be configured to be either aggregate link or tributary port. They may be synchronous or asynchronous, presented on a standard 15-way connector with V.24, V.11, RS530, V.35 or RS449 electrical interfaces all selectable from the supervisor port without the need to change cards or remove the lid. Each data port provides the ultimate flexibility in clocking options. This allows a unit to accept, source or onward link clocks, or even operate with asymmetric bandwidths. The basic unit is fitted with two data ports.

Two option card bays (one in the Compact Multiplexer) offer a wide range of hardware configurations to suit the application. The cards are easy to install from the rear panel and provide analogue voice/fax channels, additional data ports, ISDN BRI extension, high quality audio compression and E1/T1 compressed voice facilities. In addition to this, a Special Option Card bay allows the user to install an ISDN basic rate terminal adapter, an E1 link card or a TDM interface card and finally, a 10/100base-T port on the front panel (RevD units) provides connectivity for a Local Area Network (LAN) and integrates an IP routing and/or bridging function inside the mux.

The product offers point-to-multipoint link connectivity. This allows star or mesh network topologies to be designed with fully dynamic call routing and no need to decompress at the hub. Any or all data ports (including ISDN option card, E1 option card and TDM option card) may be used as aggregates, since the internal architecture will treat all ports in the same way. The flexibility of network topology means that remote sites with few channels may interoperate with complex central sites with complete compatibility. The LAN port may also be used to provide aggregate links across IP networks.

Despite the high level of integration, many networks will require more channels than can be supported in a single 1U chassis. This may readily be achieved using the High-Speed Channel (HSC), a 4Mbps serial bus for concatenating units together. If more than two units are required to be connected at the hub, this can be achieved by using back-to-back cables or by configuring IP Aggregates. This bus may be used to route traffic between any two units in the stack, thereby expanding the number of available channels. Chassis linked together in this way may thus operate as one cohesive unit and subject to bandwidth restriction, aggregates or tributaries may be assigned wherever they are required. This feature allows the network manager to solve complex topologies using the V100 chassis as redeployable building blocks.

The constraints of complex networks often lead to bandwidth restrictions or bottlenecks during periods of congestion. For this reason, it is possible to set a primary and a secondary route for all calls to take through the network. In addition to this, up to six user configurations may be designed and stored, which may be invoked as alternative strategies in the event of link failure or disruption. The network manager has access to comprehensive statistics and alarms which may stimulate such a disaster recovery plan.

A V100 network may be managed from the dedicated supervisor port of any chassis in the network. The user logs on to the required unit and configures the network from the most convenient management port using a clear and simple display, which may be accessed using a PC running a terminal emulation package such as HyperTerminal under Windows^{TM}. Alternatively, the supervisor may be operated in a terse teletype mode for integration into a central network management system. In either case, the port uses an RS232 interface. The supervisor may also be accessed using the telnet protocol in an IP network.

This user manual describes the use, configuration and installation of the V100 multiplexer.

1.2   Capabilities

1.2.1   Analogue Voice/FAX

A wide range of ITU-standard algorithms may be individually selected according to bandwidth and quality requirements, with bit rates from 5.3Kbps up to 64Kbps. All channels support Group 3 FAX at 2400-14400bps, V.22, V.22bis and V.32bis modem relay and provide G.168 echo cancellation. Bandwidth may be permanently assigned or used on-demand to optimise link use, when it may be redistributed among data channels using the Dynamic Bandwidth Allocation feature. Comfort Tone Generation and input/output gain adjustment allow the voice channels to be optimised for all situations.

The analogue voice cards are available in 2-, 4- or 8-channel form and provide FXO, FXS and 4-wire E&M (Tie-line) interfaces for connection to private analogue circuits. DTMF, MF and E&M signalling standards are supported.

1.2.2   Secure Voice Relay

With the addition of the optional Secure Voice Relay card, the analogue voice/FAX card is able to support data relays for STU-IIb and STU-III secure telephone units. This demodulates the encrypted traffic and passes it as data to the remote unit, where it is remodulated for the secure telephone at that end. The key benefit is that the encrypted traffic can then pass through a low-speed compressed voice channel, thereby saving valuable bandwidth. At no time is the sensitive traffic decrypted.

1.2.3   Data

The V100 chassis has two dedicated data ports in the chassis and further ports are available by adding 4-channel option cards, to yield a maximum of ten channels per chassis. Any port may be synchronous or asynchronous, at speeds up to 2Mbps and may be used as an aggregate or a tributary. It is possible to assign any tributary channel to be multiplexed over any aggregate channel, or to pass via the HSC to a port on any other unit, subject to bandwidth restrictions.

Ports configured as aggregates may be operated in fixed-carrier mode (for example over VSAT SCPC links) or in switched-carrier mode (for example in DAMA, Inmarsat-B or SCADA networks).

Data ports are implemented on 15-way 'D'-type connectors and support a wide range of software–selectable interface standards. Each port has two independent Phase-locked Loops (PLLs), which permit the RX and/or TX clock to be locked to any other port in the system, thus permitting onward-linking and asymmetric bandwidth operation if required.

1.2.4　ISDN BRI Extender

The ISDN BRI Extender card is able to present a Basic Rate interface (2B+D) at a remote site, by converting a standard terrestrial ISDN service into a synchronous internal connection and then back again at the far end. In this way, ISDN services may be simultaneously combined with any other services that the V100 can offer.

Since the card operates at the physical level only, it remains independent of layers 2 and 3 of the ISDN network protocol and so can be used world-wide without restriction.

The card may be used in switched or permanent modes, allowing the user to take full advantage of the flexible bandwidth control of the V100.

1.2.5　High Quality Audio

Broadcast-quality audio is supported by the MPEG option card, which is a complete MPEG/G.722/G.711 stereo audio Codec with a full range of MPEG1 and MPEG2 sampling and compression rates. The card presents left and right analogue channel interfaces on XLR connectors and also supports digital stereo AES/EBU operation with connection via the left channel. The local encoder/decoder algorithms may be different, with decoders automatically synchronising to the received coding, sample rate and bit rate.

The V100 system is designed to operate on asymmetric links through its versatile clocking architecture. It is therefore not only possible to select different coder/decoder types but to operate in simplex mode if required.

1.2.6　ISDN Basic Rate Interface Link Card

An optional integral ISDN Terminal Adaptor (TA) may be fitted which provides access to the ISDN2 service for backup or bandwidth-on-demand. This card is available with either an 'S0/T0'-bus interface or a 'U0'-bus interface and is fitted in the Special Options slot. International ISDN protocol variants are supported from the factory upon request.

The ISDN TA is configured from its own menu page and routing page, which allows the user to enter a primary and secondary ISDN number, set up call control parameters and select clock sources for locking the rest of the system.

The ISDN TA offers connectivity with both land and sea based Inmarsat GAN services.

1.2.7　E1 Link Card

An optional E1 link card may be fitted to provide an aggregate service over an E1 interface.

1.2.8   TDM Link Card

A TDM Link card may be fitted in the Special Option slot to provide an additional aggregate interface port. This port allows tributary data channels to be selected as Time-Division Multiplexed (TDM) ports, which are then carried over the new aggregate, not in a packetised manner but over fixed timeslots. The benefit of this feature is that such data does not then suffer the error-extension phenomenon associated with all packetised protocols, where a single bit error affecting a packet causes the whole packet to be rejected.

When a TDM Link card is fitted, the network must provide the master clock and the bit rate is restricted to 512Kbps

1.2.9   Expansion – The High Speed Channel

The V100 has a unique High-Speed serial Channel (HSC) dedicated to the interconnection of units. This port allows data and control information to pass between two chassis, so as to form a concatenated unit. Such a combination can then operate as one cohesive unit, a feature which not only gives expansion capability but also allows units to be decommissioned and replaced without disruption.

A 9-way D-type connector presents the 4-wire RS485 serial bus, which runs a proprietary protocol at 4Mbps. This allows up to 2Mbps of full-duplex data to pass between linked units and also carries receive and transmit clock signals to all units. In this way, any data port on either unit may be used as an aggregate WAN port and the demultiplexed data routed to a tributary channel on either chassis via the HSC. Full flexibility of clock sourcing via the HSC permits the network clock to be onward-linked to any other unit.

1.2.10   10/100base-T Integrated Router

Revision D of the V100 chassis introduces the integrated IP Router, presented on an RJ45 connector on the front panel. The majority of applications now demand IP connectivity in the field, as well as the established voice and data facilities. The V100 presents an integrated 10/100base-T port capable of supporting IPV4 bridging and routing functions over a satellite link. IP traffic is carried over the proprietary V100 link structure alongside other media. This confers a number of benefits such as improved fragmentation, efficiency and low latency.

The V100 IP port offers bridging and static routing capability with DHCP Server/Relay functions built in. A UDP relay function enhances this by allowing communication between a remote client and a server on the home network. Users can now plug their laptop into the remote V100 and log in to their home network, surf the internet and pick up E-mail.

The V100 IP port may also be used to provide IP aggregate connectivity between V100s over an intermediate IP network thus enabling data and voice to be carried over IP. The technology is not Voice over IP but Voice *and* IP.

1.2.11 Call routing

The V100 architecture supports point-to-multipoint topologies with programmable circuit routing. Ultimately, system topologies may be designed ranging from simple point-to-point applications for mixed voice/data services to full-mesh point-to-multipoint networks with dynamic call routing and redundant trunk routes.

In order to assign the most efficient route for packets to reach the destination, hubs require knowledge of the available aggregate routes to adjacent nodes in the network, together with the current bandwidth loading on each trunk port. A Routing page tells the V100 which aggregate to use to reach the destination port.

Each tributary channel in the network is assigned a numeric code according to its chassis, slot and channel number, with destinations being specified for each tributary in terms of the code of the destination port. In the case of telephony channels, either DTMF or E&M signalling digits are decoded and may be used to directly call the destination or look up the route in a Directory to establish the destination channel. The Directory translates real extension numbers into V100-style codes.

Calls are dynamically switched through the V100 network using the pre-programmed dialling codes. Intelligent re-routing techniques are used to avoid congestion or link failure by selecting alternative paths. If sufficient bandwidth cannot be found via any route, call progress tones keep the subscriber informed.

1.2.12 Dynamic Bandwidth Allocation (DBA)

The V100 may be programmed to allocate bandwidth dynamically between resources. Voice services are granted dedicated bandwidth for the duration of the call or transmission, with remaining bandwidth optionally transferred to the data ports. When the call ends, the bandwidth associated with it is returned to a pool of dynamic bandwidth. All synchronous data channels configured with "DBA" clock source are assigned to this pool, which is distributed between them in proportion to their bit rate. The V100 smoothly adjusts the clock speeds on all DBA ports whenever a change occurs in the DBA pool.

Asynchronous data ports (including the remote management function) automatically use the DBA pool. In the same way, channels are granted bandwidth from the pool in proportion to their bit rate but when they become inactive and data stops flowing, the internal connection downspeeds to a nominal 2400bps and the rest of the bandwidth is returned to the pool. The DBA pool has a lower priority than the voice or fixed synchronous data channels and will only contain any bandwidth if these types of channel are limited by careful configuration.

The DBA function may be invoked independently for transmit and receive, with the V100 routing engine constantly assessing the optimum conditions even across complex networks. In this way, data networks can make efficient use of bandwidth at all times, consistent with maximum Quality of Service (QoS) for voice calls.

1.2.13   Control and Monitoring

The chassis has a dedicated 9-way D-type connector for management and control, labelled "Supervisor". This port has an RS232 interface and presents either a formatted display for network control or a terse teletype mode for integration into the overall network management system. The facility for uploading and downloading configuration data using script files is also provided. Refer to the "V100 Teletype Manual" for a detailed explanation.

All of the units in a network may be controlled from the management port of any one unit, remote or hub. This includes any chassis connected via a High Speed Channel link at any point in the network. Remote management bandwidth is taken from the asynchronous data dynamic pool, with a minimum of 2400bps used in times of congestion and a maximum bandwidth up to the aggregate rate when there is no other traffic. In this way, the responsiveness of a connection to a remote unit is optimised at all times.

1.2.14   FLASH upgrading

The versatility of the system is maintained using upgradeable software running on a selection of option cards, which may be deployed in any V100 network. In order to maintain and support equipment in the field and also to provide upgrades and feature enhancements, all system software is held in field-programmable FLASH memory. The software release programmed in the factory contains a loader kernel, which can communicate with a PC-based download utility. When an upgrade is requested, Vocality International Ltd will supply the new target software suite and the downloader, which runs under Windows^{TM} 95/98, 2000 or XP. The target code is serially downloaded into the unit via the supervisor port, which will then boot and run the new code. The integrity of the unit is preserved at all times such that the original code may be restored in the event of a problem occurring during the process.

Units may be password-protected. To maintain the security this provides, the downloader utility requires that the correct read/write password is entered before downloading commences.

The V100 has seen three platform enhancements since its launch, each of which requires specific hardware support in the operating software. To ensure that the new software is a compatible revision, the downloader can automatically select the right file if a check box is ticked. Alternatively the file may be selected manually.

The download utility also allows units to be upgraded remotely by specifying the Node ID.

For full instructions on using the FLASH utility, refer to Application Note AN019.

1.3   Topologies

1.3.1   Star Networks

PBX
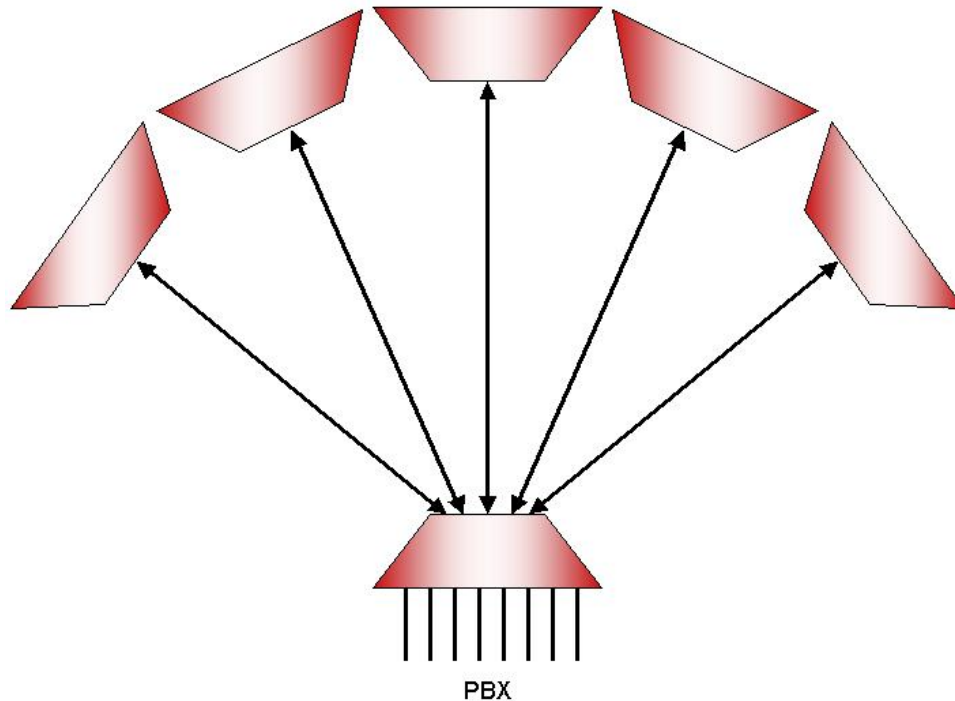
The ability to configure multiple aggregate ports allows Star network topologies to be built with the V100, ranging from simple point-to-point systems at one extreme to a cluster with up to 10 remotes per chassis at the other. Connections may be permanent or dynamic, the choice being made by the nature of the traffic. Data traffic will require fixed routes, whereas voice traffic will usually be switched. Here, if in-band signalling is specified, routes will be defined with reference to a directory of network addresses, which relate to the decoded dialing digits.

Connections may be established between any ports in the network, including the hub. When indirect or onward routes are implemented at the hub, voice/fax or MPEG data remains compressed.

1.3.2   Mesh Networks
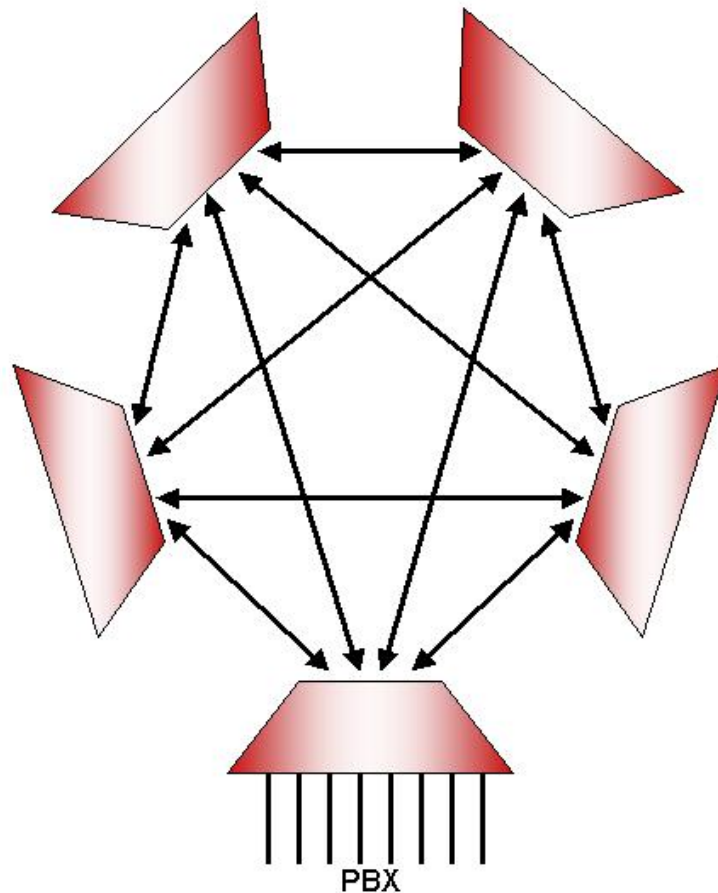
The expansion capabilities of the V100 make it an ideal foundation for a full-mesh network. Since any data port may be used as an aggregate link, complex networks may be designed which exploit the versatility of the system. Point-to-point connections for data channels, ISDN basic rate extension or MPEG audio broadcast happily co-exist alongside dynamic voice traffic or asynchronous data links.

When used in conjunction with a DAMA controller, the dynamic bandwidth and advanced compression techniques used by the V100 can produce a highly efficient and flexible satellite communications system.

1.3.3 Broadcast Networks
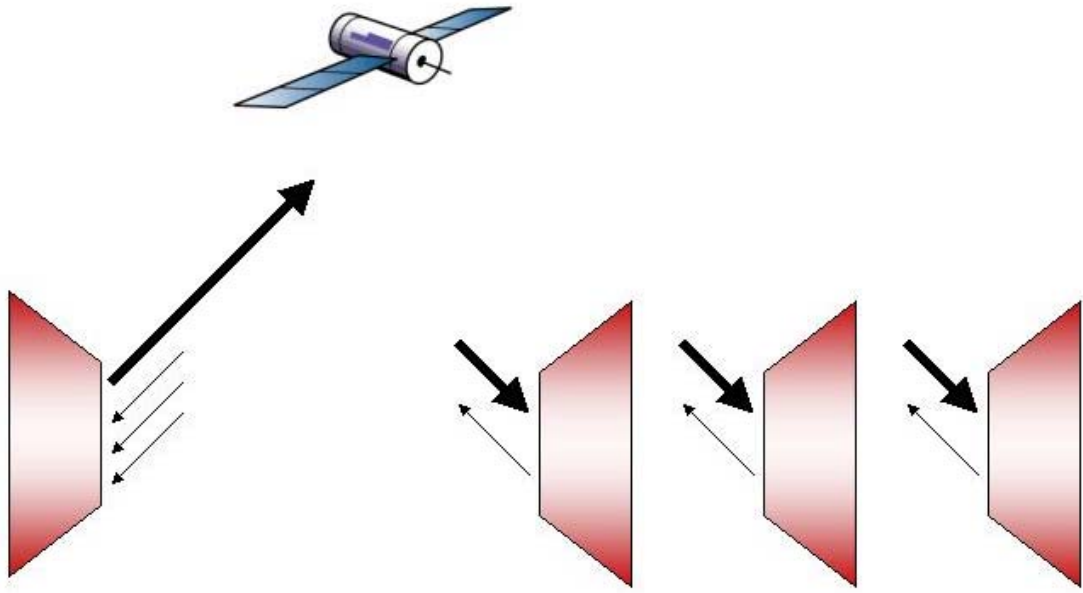
The V100 may be used in broadcast applications, where many remote units may wish to select a receive channel from a large outbound carrier. Often there is also a requirement for a return carrier from each site, which can be transmitted back to the hub. The flexibility of the unit is such that this kind of network topology can be used with all of the voice, data and IP facilities to provide a large network of users with fully integrated comms services.

It may also be desirable to connect various dedicated channels at the same time as these selectable broadcast services. The V100 may be configured to provide any combination of connectivity. When used with the multiple configuration stores, switching from one programme setup to the next is simple.

Chapter

2

2 Installation

2.1 Supply and Voltage Connection

2.1.1 V100 Versatile Multiplexer

A.C. 85-250V, 50/60Hz. Fuse rating 2A anti-surge. The V100 has a fused, filtered IEC inlet which must be connected to a line voltage within the range specified above. It may be operated only within the above limits. EMC performance may be affected if operated below 100V A.C.

2.1.2 V100 Compact Multiplexer

D.C. 9-36V or 18-72V, must be specified to the factory. Fuse rating 3A anti-surge. The V100 has a fused, diode-protected DC inlet, which must be connected to a line voltage within either of the ranges specified above.

2.2 Environmental

The V100 must be operated under the following conditions:

Ambient Temperature 0-50 degC

Humidity 0-90% RH non-condensing

Pressure 86-106 Kpa

2.3 Mechanical Construction

2.3.1 V100 Versatile Multiplexer

The V100 is housed in a 1U tall 19" rack-mount enclosure with an externally mounted fan and guard. The enclosure comprises four parts incorporating chassis, inner front panel, outer front panel and lid. The lid is retained by 15off M3 black, anodised, posidrive screws.

The front panel has indicators for PORT1 and PORT2 status (flashing red or green), TEST (red/green) and OPTION 0 (on RevD units), OPTION1 and OPTION2 data activity (red/green). The meaning of these indicators is discussed in Section 4.1. It also presents the 10/100base-T Ethernet port.
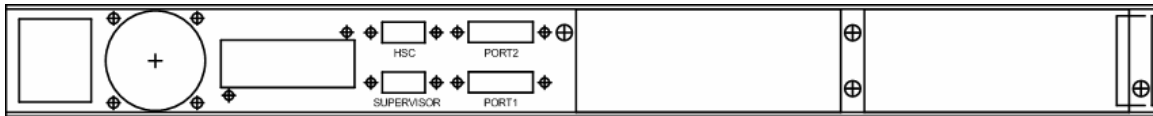
From left to right, the rear panel accommodates the IEC line inlet and fan, followed by the Special Option bay. Next are the DB9F Supervisor port, the DB9M HSC port and data ports 1 and 2 and finally Option Bay 1 and Option Bay 2. The example above is shown without any option cards fitted.

2.3.2   V100 Compact Multiplexer

The V100 Compact is housed in a 1U tall enclosure with a DC min-plug inlet and separate fuse. The enclosure comprises four parts incorporating chassis, inner front panel, outer front panel and lid. The lid is retained by 12off M3 black, anodised, posidrive screws.

The front panel has indicators for PORT1 and PORT2 status (flashing red or green), TEST (red/green) and OPTION 0 (on RevD units) and OPTION1 data activity (red/green). The meaning of these indicators is discussed in Section 4.1.
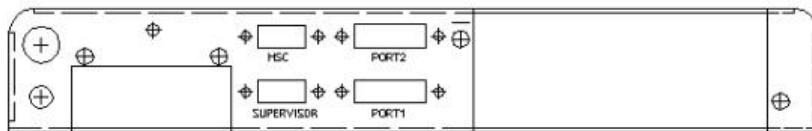
2.4   Option Card Installation

WARNING: STATIC SENSITIVE COMPONENTS!
ESD PRECAUTIONS MUST BE OBSERVED WHEN FITTING
OPTION CARDS REFER TO APPENDIX A

REMOVE POWER FROM THE UNIT. Option cards are installed from the rear of the unit. First unscrew the two blanking plate screws and remove the plate. Taking care to align the edges of the Option Card PCB with the card guides inside the unit, slowly slide in the card until the bezel is approximately 6mm from the rear panel. One final push will locate the connector internally and the bezel should lie flush with the rear panel. Replace the two locating screws.

2.4.1   Analogue Voice/Fax Card

The Analogue Voice/FAX card presents 8-way RJ45 connectors for a maximum of eight channels. The top four connectors for channels 5 to 8 are only activated when the expansion Voice/FAX Daughterboard (VI68702) is fitted. The orientation of channel numbers is as follows:
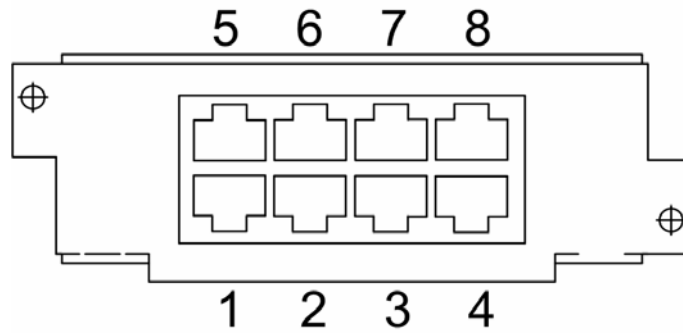
The Analogue Voice/FAX Motherboard (VI68701) is fitted with a number of jumper links which configure the hardware according to the application. These are set when the card is commissioned and should not need to be changed thereafter. All other configuration changes are made by software selection.

This card supports four fully independent voice/FAX channels. The ring voltage power supply module fitted to the motherboard has sufficient capacity for driving all eight channels and does not need to be upgraded.

The layout and white component identifications on the Voice/FAX Daughterboard are identical to those on the Motherboard to aid location when changing jumper settings.

The location of these jumper links is shown below:
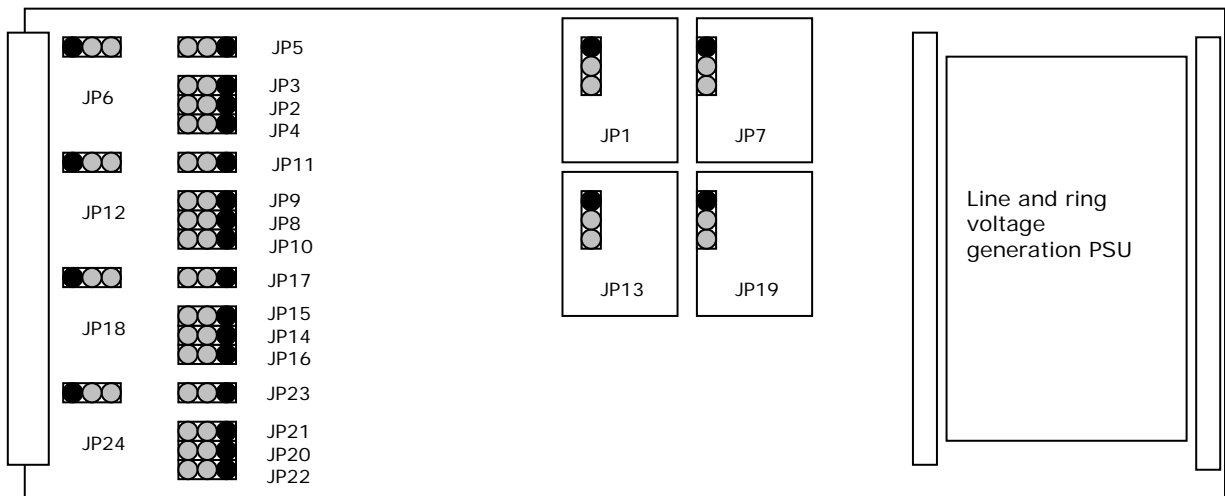
The Factory Default Jumper Settings are shown in bold italics:

Jumper	Description	1-2	2-3
JP1,7,13,19	FXO Loop current limit	*All other countries*	France/TBR21
JP2,8,14,20	'E' lead impedance	*1200ohms*	Fused
JP3,9,15,21	1u0 'E' lead filter	Not fitted	*Fitted*
JP4,10,16,22	'E' lead keying	**Normally open**	Normally closed
JP5,11,17,23	'E' lead reference	-48V	*0V*
JP6,12,18,24	'M' lead reference	0V	**-48V**

Jumpers 1-6 relate to channel 1, jumpers 7-12 to channel 2 and so on. In all of the following discussions, references to Jumper 1 are equally applicable to Jumpers 7, 13 and 19 of the other channels.

Jumper 1 allows the current limit in FXO mode to be set to conform to the French TBR21 requirement of 60mA.

Jumper 2 selects the impedance of the output contact closure presented by the 'E'lead. The default setting is for 1200ohms between 'E' and 'EREF', the alternative is a 0ohms connection with a 63mA fuse.

Jumper 3 allows a 1u0 capacitor filter to be connected from 'E' to 'EREF'.

Jumper 4 selects normally-open or normally-closed 'E'lead contacts.

Jumper 5 selects the polarity of the 'E'lead reference provided by the system, relative to chassis ground.

Jumper 6 selects the polarity to which the 'M'lead detector is referenced. In order to register a signal, the 'M'lead must be keyed to an external signal 48V more positive than the reference.

The operation of the voice ports is controlled by the choice of "Interface" on the configuration screen.

2.4.1.1   FXS mode

In this mode the V100 is connected to a circuit which requires a ringing voltage (a Subscriber port). This may be a telephone or a PABX trunk port, which operates on 2-wire circuits. For UK users, a British Telecommunications Master Socket must be connected to the port in order to ring standard UK telephones, since no ring capacitor is included in the interface. Interfaces to subscriber telephones of other countries usually require only the 2-wire connection and equipment may therefore be wired directly to the V100, since the telephones have an integral ringing capacitor.

FXS mode has two functions:

To convert a loop-to-ground signal from the remote unit into a ring voltage on the TIP and RING wires. The ring signal consists of a 75Vrms voltage with a frequency of approximately 25Hz, which is modulated with a standard UK cadence of 600mS ON, 400mS OFF, 600mS ON, 2400mS OFF. The standard cadences of other countries are selectable.

To provide bias for a telephone and convert a loop condition into a seizing signal (equivalent to 'M' lead loop-to-ground), which is then passed transparently to the remote unit. The V100 provides an on-hook voltage of –48V and supplies 28mA when the telephone handset is off-hook.

2.4.1.2 FXO mode

In this mode the V100 is connected to a 2-wire circuit which generates a ringing voltage (an Office port). This would normally be an extension port on a PABX.

FXO mode has two functions:

A ringing voltage on the TIP and RING wires is detected (equivalent to 'M' lead loop -to-ground) and the condition is "answered" by the V100 irrespective of the ringing cadence. The ringing signal is then passed through the V100 network to the remote telephone.

An active signal from the calling channel within the V100 network is converted into a 2-wire DC loop. This is seen as a seizing signal by the PABX. The speech path is then open, dialtone is drawn from the PABX and DTMF dialling may commence.

2.4.1.3 TIE-LINE mode

When the unit is configured to Tie-line mode, the RJ45 port may be connected to the Tie-line card of a PABX. The port presents a 4-wire voice interface and E&M signals. No ringing voltages are generated by, or should be connected to the ports in Tie-line mode. The type of E&M interface is defined by the jumper settings described above.

Standard 10pps dialling is detected on the 'M' lead, sampled and transferred transparently to be output on the 'E' lead of the remote unit. When the unit is powered off or loses carrier, the 'E' lead presents a busy signal to the connected PABX.

An active 'M' lead is the corollary of "Off hook" in the case of the 2-wire FXS interface and will request bandwidth in the same way. This allows a Tie-line port to interact with DBA data channels despite any dialling pulses on the 'M' lead, which are filtered out by software.

2.4.1.4 E&M Support

In Tie-line mode the voice channels operate a 4-wire speech interface and also present four wires for the E&M interface: E, EREF, M and MREF. The V100 can be configured to support two types of E&M signalling interface (types I and V) by jumper selection.

The V100 defines the 'M' circuit as the input and the 'E' circuit as the output. (The reverse of most PABXs) Therefore when connecting to the PABX, 'M' should be connected to 'M' and 'E' to 'E'. The 'E' circuit on the V100 provides a contact closure and the 'M' circuit has a current detector. The 'M'lead is sampled and passed to the remote port to be output as a contact closure on the 'E'lead.

The following diagram shows how the circuits are presented. By default, the jumper links are set in the factory for Type V operation (shown below):

Schematic 'E' circuit   Schematic 'M' circuit
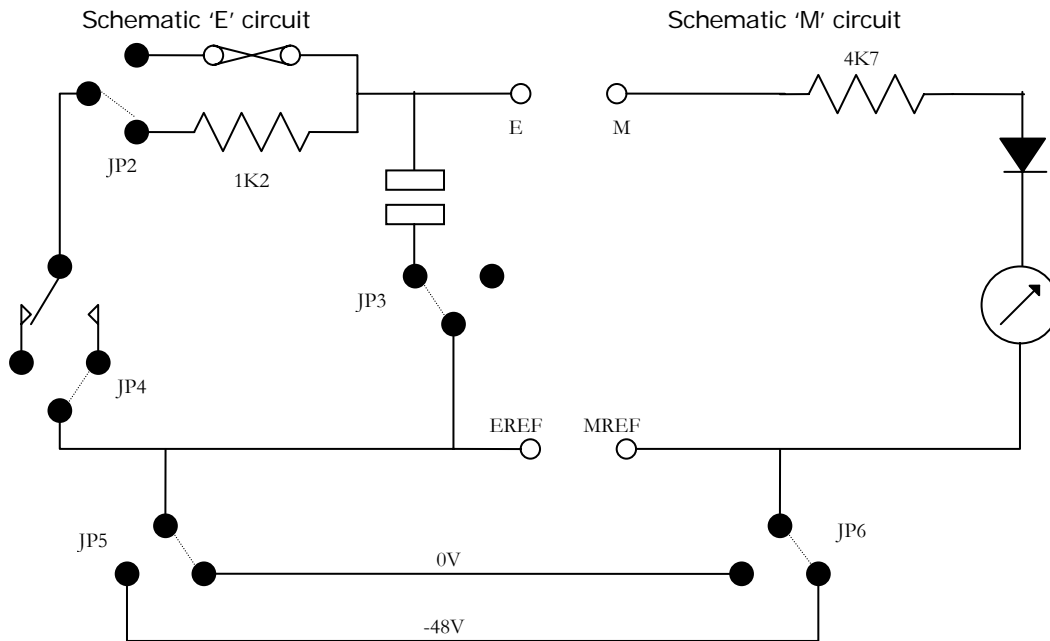
The E&M signalling return paths must be connected externally. This can be accomplished by connecting the EREF lead to the PABX frame ground with a good cable.

The current detector in the 'M' circuit has an internal impedance of 4K7 and by default is referenced to –48V. It can therefore be stimulated by keying the 'M'lead to ground.

The output signal is provided as a contact closure between the 'E'lead and the 'EREF'lead. The active state may be a break or a make, selected by JP4. JP2 and JP3 allow the selection of closure impedance and filtering, whilst JP5 selects the 'EREF'lead voltage reference. If the reference is set to 0V, the contact closure keys the signal connected on the 'E'lead to chassis ground via the selected impedance.

2.4.1.5 Linking for E&M Type I

To operate with an E&M type I interface, the V100 must provide a contact closure to ground on the 'E' lead and a current detector referenced to ground on the 'M' lead:
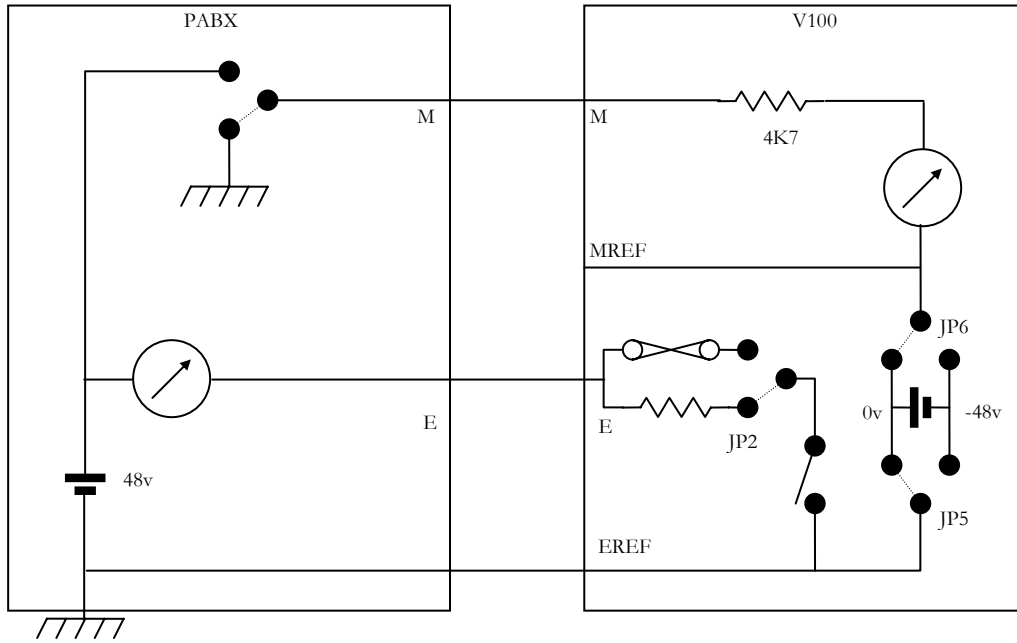
Details of the jumper settings are as follows:

Jumper	Description	Setting
JP2	'E' lead impedance	1-2
JP5	'E' lead reference	2-3
JP6	'M' lead reference	1-2

2.4.1.6 Linking for E&M Type V

To operate with an E&M type V interface, the V100 must provide a contact closure to ground on the 'E' lead and a current detector referenced -48V on the 'M' lead:
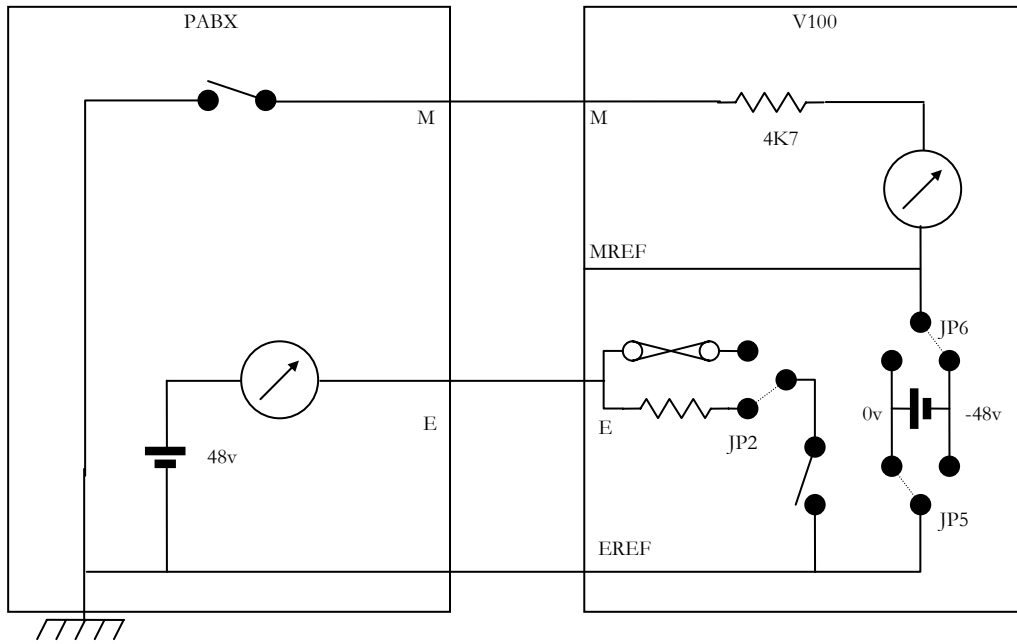
Details of the jumper settings are as follows:

Jumper	Description	Setting
JP2	'E' lead impedance	1-2
JP5	'E' lead reference	2-3
JP6	'M' lead reference	2-3

2.4.2 Voice/FAX Daughter Card

The Analogue Voice/FAX Daughter Card (VI68702) is hosted by the 4-channel Analogue Voice/FAX card (VI68701), which presents connectors for channels 5 to 8 when required. These are activated when the Daughter Card is detected. The host card must be removed from the chassis and the Daughter Card plugged in on top of the mating connectors. The whole assembly may then be reinstalled in the chassis.
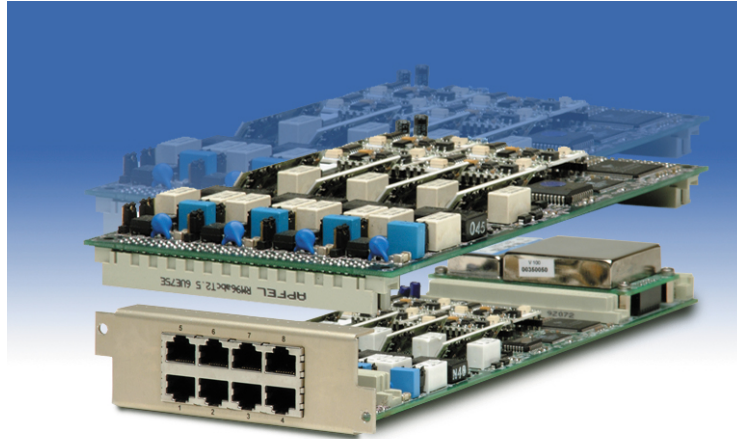
The Analogue Voice/FAX Daughter Card is fitted with a number of jumper links which are identical in position and function to those on the Analogue Voice/FAX Motherboard. Please refer to section 2.4.1 for details.

The Daughter Card supports a further four fully independent voice/FAX channels. The ring voltage power supply module fitted to the motherboard has sufficient capacity for driving all eight channels and does not need to be upgraded.

2.4.3 Secure Voice Relay Card

The Secure Voice Relay Card (VI68709) is also hosted by the 4-channel Analogue Voice/FAX card (VI68701) and has the same footprint as the Voice/FAX Daughter Card. It works in parallel with the four channels on the host card and so the connectors for channels 5 to 8 are not used. In this way, all of the standard features of the voice motherboard are still available with the addition of the ability to relay the encrypted data from military secure telephones, both STU-IIB and STU-III. At no time is the secure data decrypted.

Support for other encrypting telephones may be added by software update.
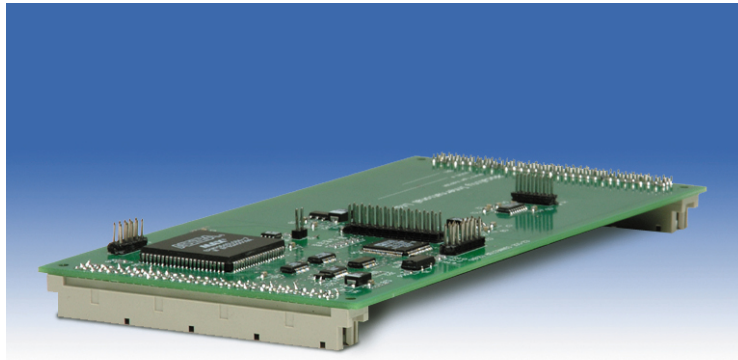
The STU Relay Card has no user-changeable jumper links and is detected automatically by the system.

2.4.4 Quad High Speed Data Card

The Quad High-speed Data Card (VI68705) presents four DB15F connectors with the same pin out as ports 1 and 2 on the chassis. The orientation of channel numbers is shown on the card:
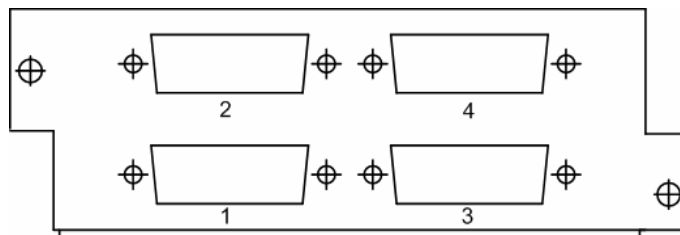
The card is fitted with four V100 Universal Interface cards(VI68710) which are replaceable, mounted in 72-pin SIMM sockets. It is also fitted with several jumper links, located as follows:
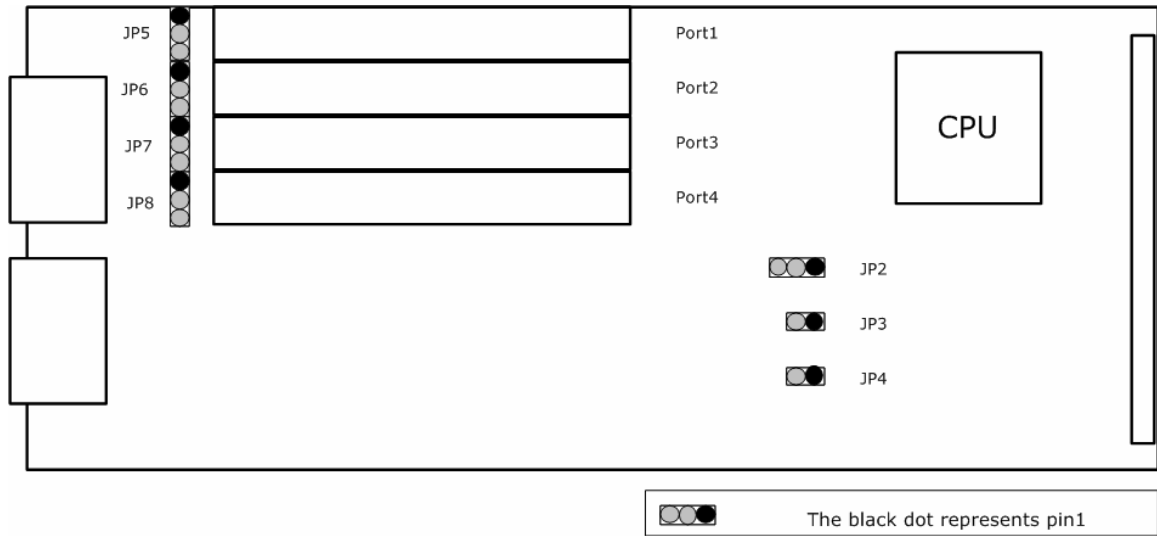
The Factory Default Jumper Settings are shown in bold italics:

Jumper	Description	1-2	2-3
JP2	CPU clock source	*Local oscillator*	V100 system clock
JP3	Push button reset (do not fit)	*Not fitted*	N/A
JP4	Address 17 enable	*Not fitted*	N/A
JP5	Port 1 pin 8 selection	*EXTXCA*	GND
JP6	Port 2 pin 8 selection	*EXTXCA*	GND
JP7	Port 3 pin 8 selection	*EXTXCA*	GND
JP8	Port 4 pin 8 selection	*EXTXCA*	GND

2.4.5 MPEG High Quality Audio Card

The High-quality Audio Card (VI68704) presents four XLR-style connectors for LEFT IN, LEFT OUT, RIGHT IN, RIGHT OUT analogue audio signals. The LEFT IN and LEFT OUT connectors are also used for connections in AES digital mode.

This card supports two separate high-quality channels, which may be used for mono, dual mono, stereo or joint stereo feeds. The rear panel is as follows:
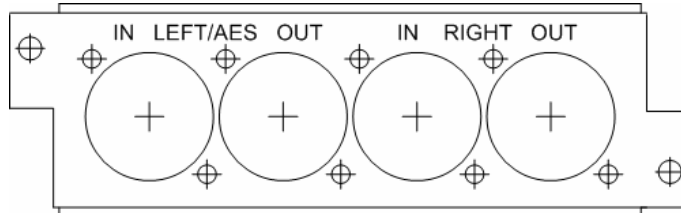
The card is fitted with a number of jumper links which configure the hardware according to the application. All other configuration changes are made by software selection.
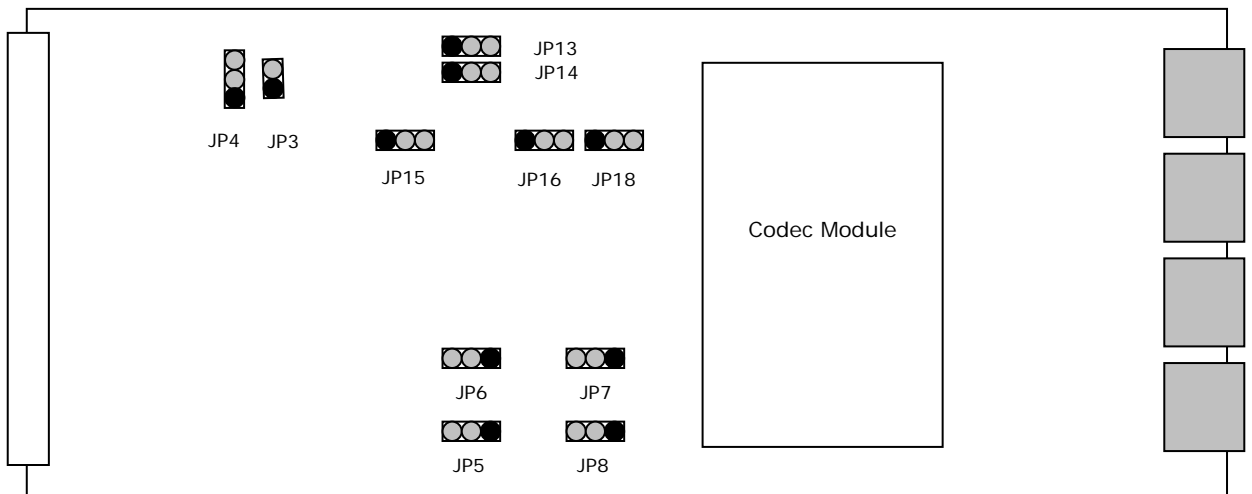
The jumpers are set when the card is commissioned and should not need to be changed thereafter. Jumpers JP9, JP10, JP11 and JP17 are pin headers used for factory diagnostics and are not referred to below. The Factory Default Jumper Settings are shown in bold italics:

Jumper	Description	1-2	2-3
JP3	Push button reset	*Short to reset*	N/A
JP4	Watchdog	*CPU control*	Oscillator
JP5	AES RX SRC settling control	200uS jitter filter	*800uS jitter filter*
JP6	AES RX SRC group delay	Short	*Long*
JP7	AES TX SRC group delay	Short	*Long*
JP8	AES TX SRC settling control	200uS jitter filter	*800uS jitter filter*
JP13	Sample frequency range (use JP13/JP14 together to select one frequency pair)	*F1=24.576MHz* *F2=49.152MHz*	F1=16.384MHz F2=32.768MHz
JP14			
JP15	Frequency select	*Select F1*	Select F2
JP16	Reference source divider	Gate Array	*Synthesiser*
JP18	SRC clock source	*Divider*	Gate Array

2.4.6   ISDN Network Extension Card

The ISDN Basic Rate Extension card (VI68706) presents an 8-way RJ45-style socket compatible with the standard S0/T0 ISDN basic rate interface. This is used to connect to the terrestrial ISDN network (in TE mode) or to any S0/T0 ISDN terminal device (in NT mode). There is also a set of 8 DIL switches that should be set according to the intended mode of operation and an array of 12 LEDs which give useful status information at all times.
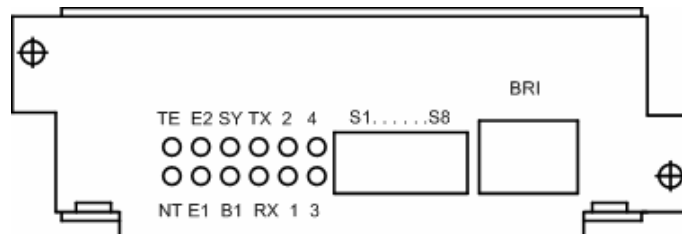
The BRI Extender card provides a means of representing a normal basic-rate ISDN service at a remote site, just like the real thing. This is done by connecting the card at the hub site in TE (Terminal Equipment) mode to the terrestrial network, either to a basic rate network presentation or to a digital extension on a PBX and at the remote site, connecting the card in NT (Network) mode to the user's ISDN terminal device. This is achieved using four logical channels between the BRI cards across the V100 network:

Channel 1 is dedicated to the BRI ISDN D Channel. This channel is permanent and requires a bandwidth of 4800 bits/sec.

Channel 2 is dedicated to the ISDN B1 Channel and occupies a bandwidth of 64000 bits/sec when required.

Channel 3 is dedicated to the ISDN B2 Channel and occupies a bandwidth of 64000 bits/sec when required.

Channel 4 is dedicated to an internal BRI Control Channel. This channel is permanently connected and requires a bandwidth of 4800 bits/sec.

The DIL switches should be set as follows:

	S1	S2	S3	S4	S5	S6	S7	S8
NT mode settings	ON	OFF	OFF	OFF	OFF	OFF	ON	ON
TE mode settings	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

The meaning of the LED indicators is as follows:

TE	E2	SY	TX	2	4
🟢	🔴	🟡	🟡	🟡	🟡
🟢	🔴	🟡	🟡	🟡	🟡
NT	**E1**	**B1**	**RX**	**1**	**3**
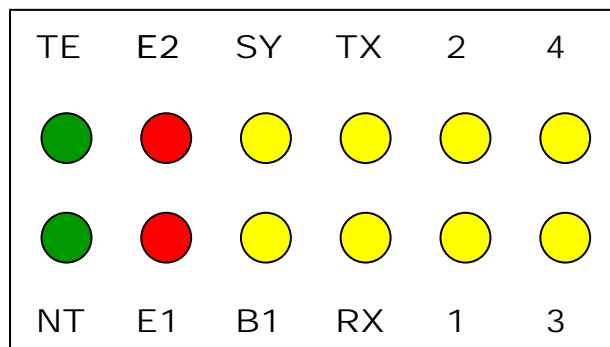
NT (green) indicates that the card is in NETWORK mode and terminal equipment should be plugged into it.

TE (green) indicates that the card is in TERMINAL EQUIPMENT mode and should be plugged into an S0/T0 network port.

E1 (red) indicates that there is an error on the local card.

E2 (red) indicates that there is an error on the remote card.

B1 (yellow) indicates that Bearer 1 is locally synchronized.

SY (yellow) indicates that Bearer 1 is remotely synchronized.

RX (yellow) indicates that data is being received locally.

TX (yellow) indicates that data is being transmitted locally.

1,2,3,4 (yellow) indicate internal status.

2.4.7 Special Option Cards

Four option cards are available, all of which occupy the Special Option slot on the rear panel. **For RevD and Compact multiplexers**, the installation procedure is simply to remove the Special Option blanking plate and plug the chosen interface into the slot, replacing the screws afterwards.

For RevC units, all interfaces plug into the same carrier card, the TDM Framer Card (VI68713). The card assembly is plugged into mating connectors on the V100 motherboard and the interface card occupies the Special Option slot on the rear panel. In all cases, the same installation procedure should be followed. To install it, first remove the lid, then remove the Special Options blanking plate by unscrewing the two M3 retaining screws. Next remove the M3 screw, shakeproof washer and plastic clip next to J6 on the motherboard and also the M3 screw and shakeproof washer next to JP15. The clip will not be required. Replace these screws with the 2off type2 10mm mounting pillars supplied in the fitting kit. If not already prepared, connect the TDM card and the interface card together using the mating 16x2-way connectors. Position the assembly above JP13, JP14 and JP15. To do this, the blanking plate attached to the Interface Card must first be carefully positioned flush with the rear panel of the main unit. JP15 (34-way) on the motherboard mates with the 34-way header at the end of the TDM card; only 3 pins (a14-a16) of JP13 on the motherboard mate with the 3-pin header underneath the TDM card; JP14 on the motherboard mates with the pass-through connector JP6 on the TDM card. Align all three connectors carefully before gently plugging them together. Use the two M3 screws and shakeproof washers previously removed to fix the TDM assembly to the new mounting pillars. Complete the installation by fixing the new Interface Card blanking plate to the rear panel of the unit using the two original retaining screws. Replace the lid and screws.

The TDM Framer Card is fitted with a number of jumper links, which configure the hardware according to the application. Most of these are permanently soldered wire links, but there are two adjustable jumpers JP4 and JP10.

The Factory Default Jumper Settings are shown in bold italics:

Jumper	Description	1-2	2-3
JP4	Framer mode	*Standard*	Reduced mode
JP10	ISDN Interface select	U0	*S0/T0*

The interface card options are as follows:

2.4.7.1   TDM Serial Interface

The TDM Serial Interface (VI68714) is presented on a 15-way D-type female connector and supports RS449, V.35 and RS232 interfaces. Refer to the section above for installation details.

2.4.7.2   ISDN Basic Rate S0/T0 Interface

The ISDN basic rate S0/T0 interface card presents an RJ45 connector and is fitted with its own blanking plate. Follow the same procedure as above for the TDM Serial Interface.

2.4.7.3   ISDN Basic Rate U0 Interface

The ISDN basic rate U0 interface card presents an RJ45 connector and is fitted with its own blanking plate. Follow the same procedure as above for the TDM Serial Interface.

2.4.7.4   E1 Link Card

The E1 link card (V168708) provides an aggregate connection using a framed or unframed 2.048 MHz E1 link. The card provides both an RJ45 connector interface and dual BNC Rx/TX interface. Use the one appropriate to your network equipment.

NOTE: **The E1 link card can only be fitted to a V100 revision D4 or later, or to a revision D3 unit modified to MR68700D3 or later.**

NOTE: **ISDN signalling is not supported on the aggregate link.**

On the V100 motherboard, JP21 – JP23 and JP25 & JP27 need to be set to the E1 position rather than the ISDN position:

a. JP21, JP22, JP23 - Fit links in position 1-2 for E1, closest to the left hand side of the board viewed from the rear, (2-3 are default for TDM/ISDN)

b. JP25, JP27 - Fit links in position 1-2 for E1, farthest from the rear of the board viewed from the rear (2-3 are default for TDM/ISDN)

Key: The black dot represents pin1:
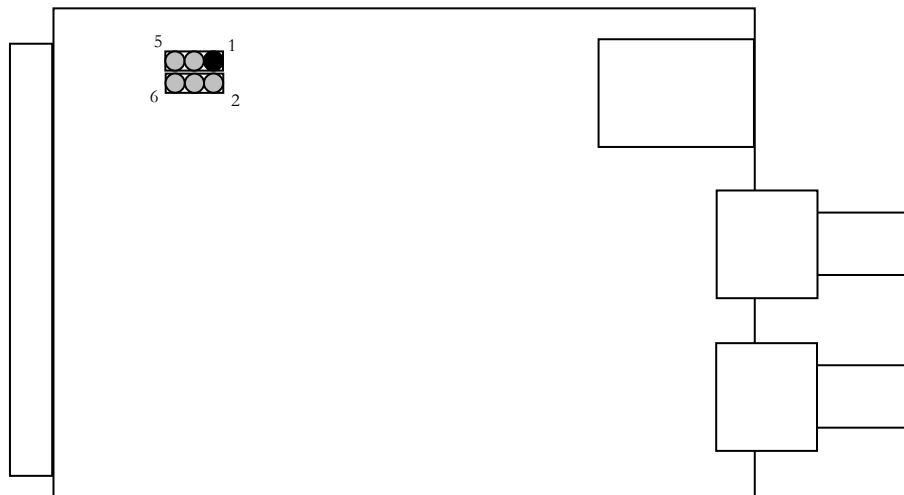
On the E1 Link card, jumpers need to be applied according to the connector and line impedance required. **The default setting is for 75 Ohm Unbalanced BNC.**

For 75 ohm, unbalanced, Coaxial BNC, operation (default) the links should be set as follows:

JP2	1-3, 2-4

For 120 ohm, balanced, UTP operation the links should be set as follows:

JP2	3-5, 4-6

To install the E1 Link Card, follow the procedure above as for all other Special Option cards.

2.5   FLASH Software Upgrading

Flash V1.16.exe

The unit is supplied from the factory with both the operating software and a small loader kernel already programmed into the FLASH memory devices on the main PCB. The loader may be used at any time to upload new versions of software in the field as required.

To upload a new version of software, a PC is required and a supervisor cable type VI68724A, together with a Windows™ 95/98/2000/XP utility called "flash.exe", also supplied by Vocality International Ltd, with the new update. The latest information is contained in Application Note AN019, which may be downloaded from the Vocality International support site at www.vocality.com.

Connect the cable to the V100 supervisor port and to the chosen COM port on the PC. Run the "flash.exe" utility, which will display a window as follows:
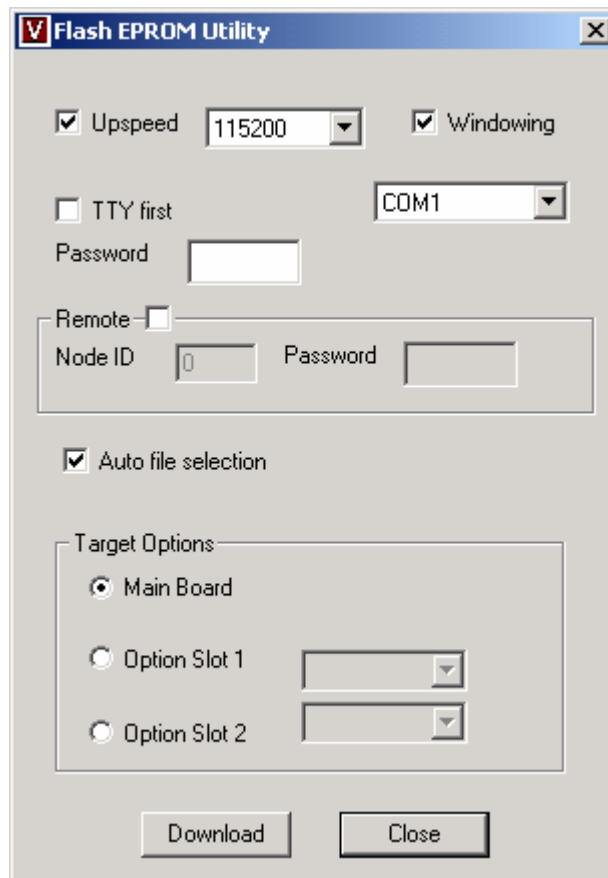
The V100 supervisor communication port normally runs at 9600bps. To help ensure the quickest FLASH programming it is recommended that the "Upspeed" value be configured as high as possible (115,200) with "Windowing" checked. However, you may need to select a slower rate and switch windowing off (leave the box unchecked) if you are using an older PC. When "Windowing" is switched on, multiple records are sent together instead of each one being sent individually. This can significantly improve the transfer speed, especially on remote downloads.

Next select the I.D. of the unit to program. By default, the locally connected unit is the download target but by checking the "Remote" box it is possible to enter the Node I.D. of any remote chassis. When doing this it is advisable to enable windowing, again by checking the box, to allow FLASH to optimise the speed of transfer consistent with any link delay. Finally, select the COM port.

Once all parameters have been defined, click "Download". The next window asks for the filename of the new code, usually "V100.abs" unless the "Auto file selection" box has been checked. Select this (double-click or select it and choose Open) and the file will be transferred to the V100 with a progress bar for information. When the download is complete, the unit will automatically restart with the new code. Upon completion, click OK to close the Flash program. If, during download, there are a large number of retries reported, try restarting the download with Windowing turned off.

NOTE: **Ensure that when choosing a file to download, you select the correct Revision of the multiplexer, i.e. make sure you download Rev D software to a Rev D chassis. If, say, Rev D software is inadvertently download to a Rev C chassis, the unit will be unusable and will need to be returned to Vocality International Ltd for reprogramming.**

With the latest version of the Flash Loader program, there is a newly supported option. This allows the download of new software to Quad Data cards and E1 Digital Cards housed in the option slot(s) of the multiplexer. To do this, the relevant option slot must be checked, and the correct card chosen from the drop down menu in the Target Options area of the Flash Loader.

Please note that for Quad Data cards to be upgraded in this way, there is a special hardware modification that is required on the Quad card itself. In addition, the main board software of the box must be at least Release 2.1.22C3 and the Quad card software must be at least Version 1.01. If any of these conditions are not met, the Quad card will need to be returned to Vocality for upgrade.

To upgrade the E1 card there are no such limitations, provided the main board is on a software version that already supports the E1 Digital Card.

If at any time during the transfer process, an error is encountered or there is a power failure or disconnection, the original software should still be valid and operation may continue as before. The download may be recommenced. However, connection and power must be continuously maintained during the "Burn" phase of the update as failure to do so may result in software corruption which will require the unit to be sent back to Vocality for re-programming.

Unit configurations are maintained during FLASH reprogramming.

Chapter

3

3 Configuring V100

3.1 The Node ID

The most important item in the V100 configuration is the Node ID. This is a unique number between 0 and 239 which specifies each chassis in the network and it must be programmed into the unit before anything else. This is done on the SYSTEM menu – see section 3.4.2 for details.

Once the Node ID has been programmed, the unit should be restarted since this allows it to clear all previous routing information and assume the new identity without confusion.

3.2 Slot and Port Numbers

The V100 Versatile Multiplexer:

Slot 0 – The Chassis   **Option Slot 1**   **Option Slot 2**

The V100 Compact:

Slot 0 – The Chassis   **Option Slot 1**
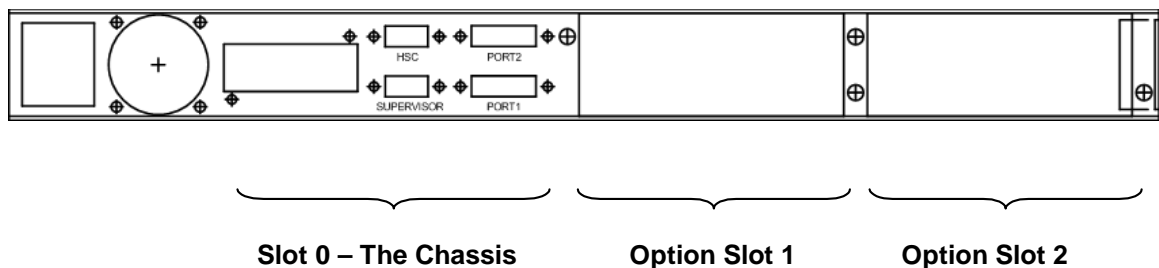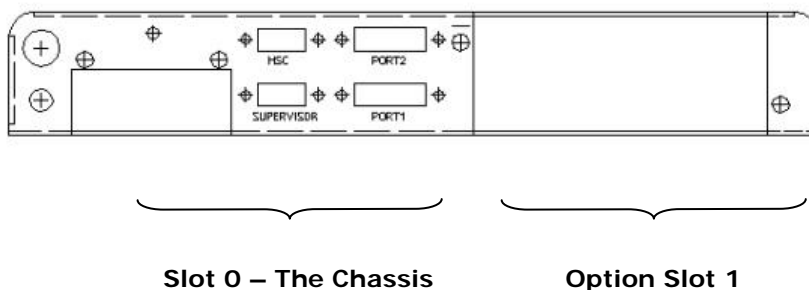
Throughout the configuration of the V100, references are made to slot locations and port numbers in the network. By convention, the syntax used is "NODE:SLOT:CHANNEL", where NODE is the Node ID, SLOT is a number which means the chassis (0), Option slot 1 (1), or Option Slot 2 (2) and CHANNEL is a number which means the particular channel number within that slot. So, for example, the DB15 connector labelled "PORT1" on the chassis of Node 3 would be indicated as "3:0:1", or the data channel 4 on the card plugged into Option Slot 2 would be called "3:2:4".

The integrated IP router is considered to be in slot 0. Channels 0:10 through 0:31 are used to represent IP tributaries.

The configuration pages list local channels only, so they begin with a simplified version just using the slot and channel numbers, such as "0:1" and "0:2".

The routing of voice channels is often done dynamically by decoding the DTMF dialling digits. In this case, the destination field is simply set to "AUTO" and the route is either directly decoded from the dialled digits or looked up in the internal directory. So, for example, if the directory number for "23:1:7" is "820", then when the number "820" is dialled from anywhere in the network, the telephone on channel 7 of the card in Option Card 1 in node 23 will ring.

3.3   Using the Supervisor

3.3.1   User Interface

The V100 provides either a formatted menu control structure for interactive user control, or a simple Teletype mode for interface to a network management system. The use of the formatted supervisor is described here; the Teletype mode is described in a separate manual supplement.

In formatted mode, the unit is configured by moving around the menus using the cursor keys and selecting from a choice of available options for each parameter. The current cursor position is highlighted in most terminal emulations. There are also a number of keys, which may be used as a shortcut or to access additional features. The keys are summarised below, with key names represented between chevrons, e.g. <SPACE> for the spacebar, <CR> for Carriage Return or Enter.

The unit is configured using an asynchronous terminal or PC running Windows™ 95/98/2000/XP HyperTerminal, connected to the dedicated DB9F port on the back panel marked "SUPERVISOR". On the "Connect To" tab, HyperTerminal should be configured to use COM1 and on the "Settings" tab, the Function, arrow and ctrl keys should be set to act as terminal keys:
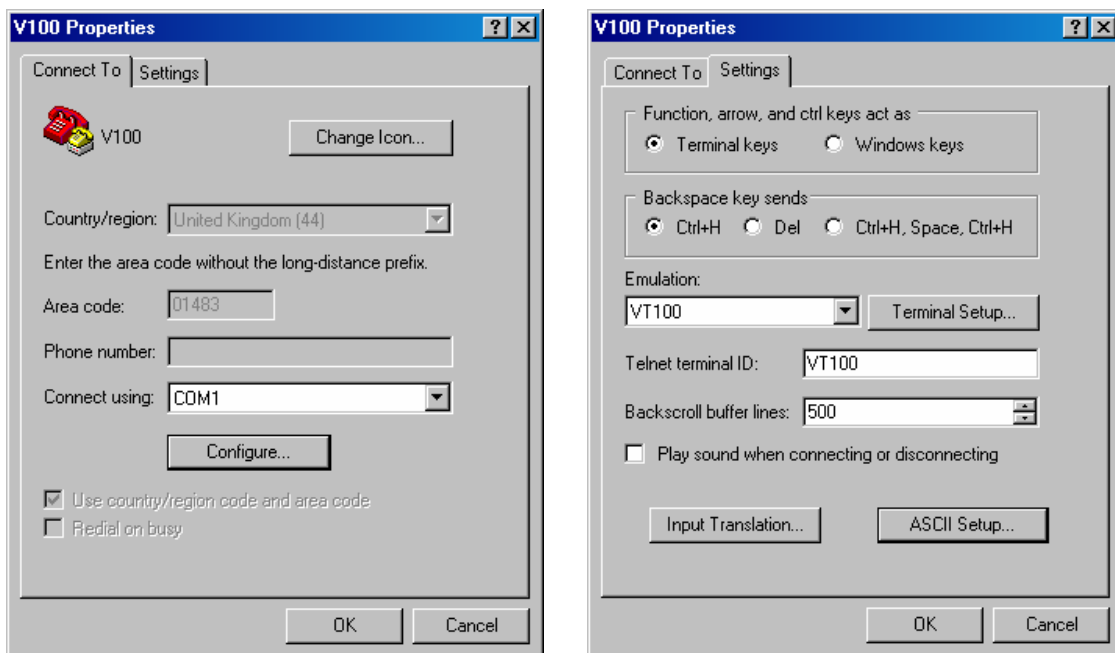
Click on the "Configure" button to set HyperTerminal to operate at 9600bps, 8 data bits, no parity, one stop bit with no flow control:
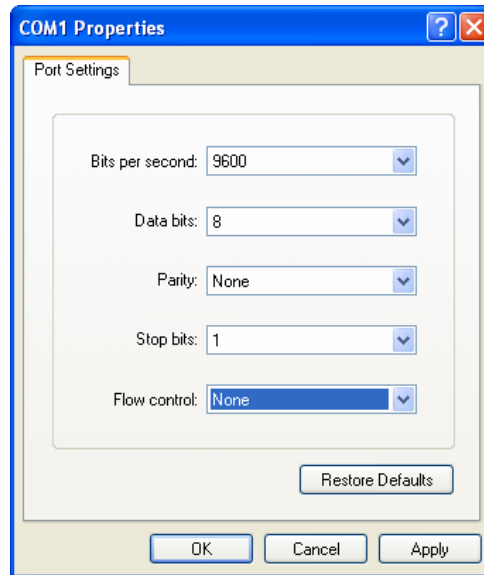
The V100 supports most common terminal emulations, such as VT100, VT52, TVI925 and will automatically detect the emulation in use. When the V100 is powered up with no passwords entered, it displays the following information:

(This menu may be returned to at any time by entering <CTRL>&<E>). Teletype mode may be entered at this time by typing <CTRL>&<T> twice (the commands and responses used in teletype mode are detailed in a separate manual). Once in Teletype mode, the above menu may again be returned to by entering <CTRL>&<E>. To use the full-screen formatted configuration display, proceed as described below.

```
  V100 - HyperTerminal
  File  Edit  View  Call  Transfer  Help

  ****************************************************************
  *                                                              *
  *           Vocality International V100 Multiplexer            *
  *                  Version 02_01.22 H/W RevD                   *
  *                                                              *
  *              CRs:PRODUCTION REL02_01.22C.2                   *
  *                                                              *
  *     Serial Number: 10358 MAC Address: 00:50:c2:20:31:04      *
  *                                                              *
  *        Please press the UP ARROW key on your terminal        *
  *                  to connect to the supervisor                *
  *                                                              *
  ****************************************************************

  Connected 00:00:17    Auto detect    9600 8-N-1    SCROLL  CAPS  NUM  Capture  Print echo
```
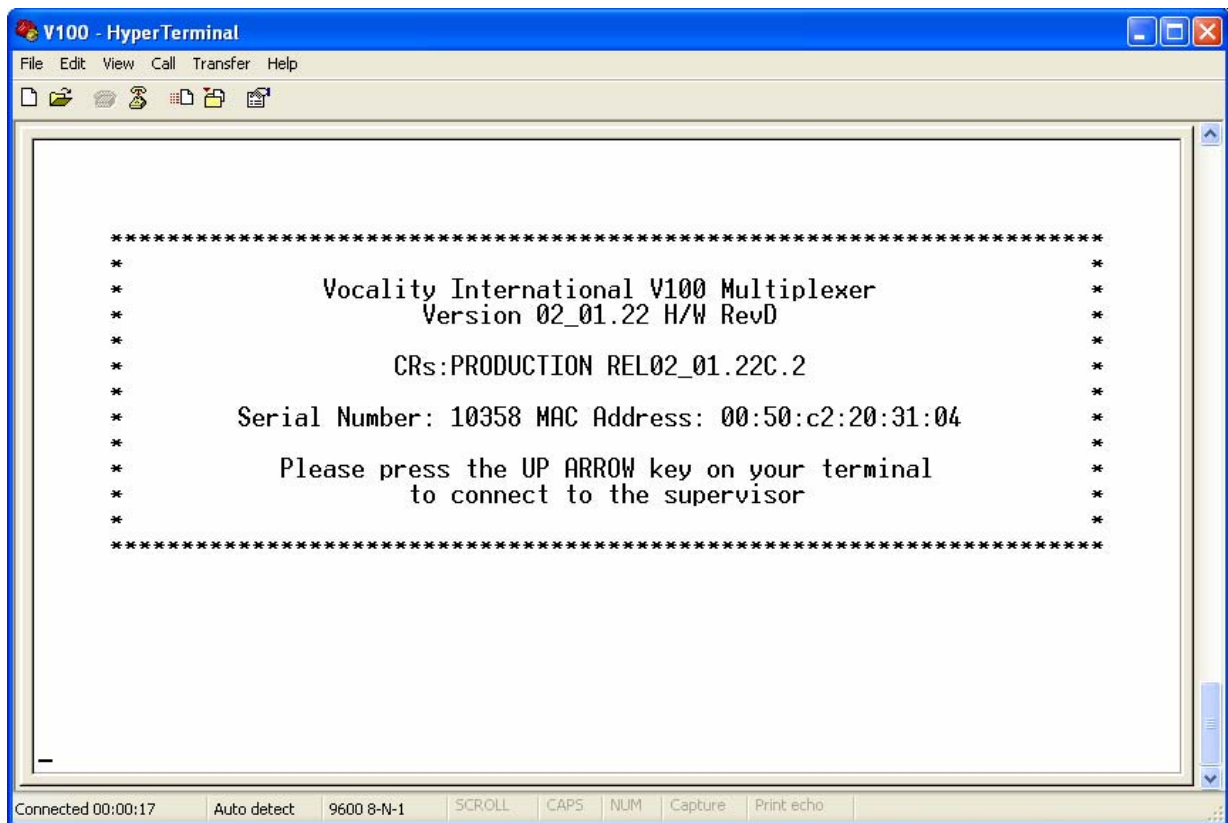
3.3.2   Cursor Movement

<Up Arrow>	Move to parameter above the current cursor position.
<Down Arrow>	Move to parameter below the current cursor position.
<Right Arrow>	Move to parameter to the right of the current cursor position.
<Left Arrow>	Move to parameter to the left of the current cursor position.
<CR>	Select a menu
<ESC>	Return to the previous screen

3.3.3   Parameter Selection

Some parameters are selected by toggling around a sequence of choices, some are entered as alphanumeric characters. Context-sensitive instructions are given at the bottom of the screen.

<+> or <Spacebar>	Select next item in list
<->	Select previous item in list
<Spacebar> at alphanumeric field	Clear field
<Characters>	Enter literal data

3.3.4   Updating the Configuration

When a menu has been edited, the changes are stored in non-volatile system memory by entering <ESC>, which prompts the user with this message:

"Save Changes (y/n)?"

Responding with a <Y> will update the non-volatile memory. The changes may be abandoned by entering <N> instead.

If at any time the user wishes to clear all configuration settings and start again from factory defaults, return to the terminal selection screen (Section 3.3.1) by entering <CTRL>&<E>, then enter <CTRL>&<R> three times, to which the unit will prompt:

"Set Factory Defaults and Reboot?"

To proceed, enter "y". Any other key will abort.

3.3.5   Password Protection

To prevent unauthorised access to the menus, the V100 has three levels of password protection; Read-only, Read/Write and Superuser.

The serial number is used in the password mechanism. By default, the units have no passwords configured, and there is no password required to access the supervisor port. The user can configure two levels of password through the SYSTEM menu. The first is for read-only (RO) access - the second is for read-write (RW) access. Once a RW password has been configured then any future access to the supervisor port (either local or remote) will encounter a request for a password before allowing access. If the RW password is entered, then the supervisor port works as before with full management functionality. If the RO password is entered, then the menu system is presented, but any changes made to the configuration will not be saved - also access to the debug menus and debug mode (and other shortcuts) are prevented. **The RO password is only effective once the RW password is entered**.

Password entry is in a conventional format, with the entry being asterisked out and password setting requiring re-entry for confirmation. The password is case-sensitive. If the user forgets their configured password there is a backdoor mechanism to get them back into their units. This backdoor is the "superuser" password - it is unique for each V100, and consists of an encrypted key based on the serial number. Once entered, the user is given normal read-write privileges to allow him/her to set the RW password to something that they can remember! A superuser password can only be supplied by Vocality International on the following telephone number:

+44 1483 813120

Please be prepared to supply your name, company name and the serial number of the unit.

Status	Unit Response	Access rights
No password or default	None	Full access to menus, terminal and debug mode
RO password entered	Prompt for password	Full access to menus but no configs can be changed – no access to terminal and debug modes.
RW or superuser password entered	Prompt for password	Full access to menus, terminal and debug mode

The FLASH loader utility – FLASH.EXE - will not work straight away if a RO or RW password has been configured. The FLASH loader has been updated to request the user for a password. If no password has been configured or the unit is running an older revision of software that does not support passwords, then leaving the password field blank will allow programming to work as before. The utility presents separate fields for local and remote passwords to fully support remote unit downloading.

Some extra notes about the password scheme:

Users are encouraged to configure the ACCESS TIMEOUT on the SYSTEM screen to activate auto-logout.

NOTE: **Users are advised not to configure the ACCESS TIMEOUT to less than 10 seconds.**

Once a password has been entered it is effective until that session is completed with a CTRL-E command or the session is inactive for the configured access timeout. - i.e. a CTRL-E to escape to the top-level menu will require the user to re-enter the password (if configured) to continue.

In read-only access mode, the lines which divide the menu screens are composed of the tilde "~" character. (In default or read-write mode they use the hyphen "-").

3.4   Menu Structure

3.4.1   Basic Information

Once the user has entered an UP ARROW cursor key on the terminal selection screen, the following page appears:
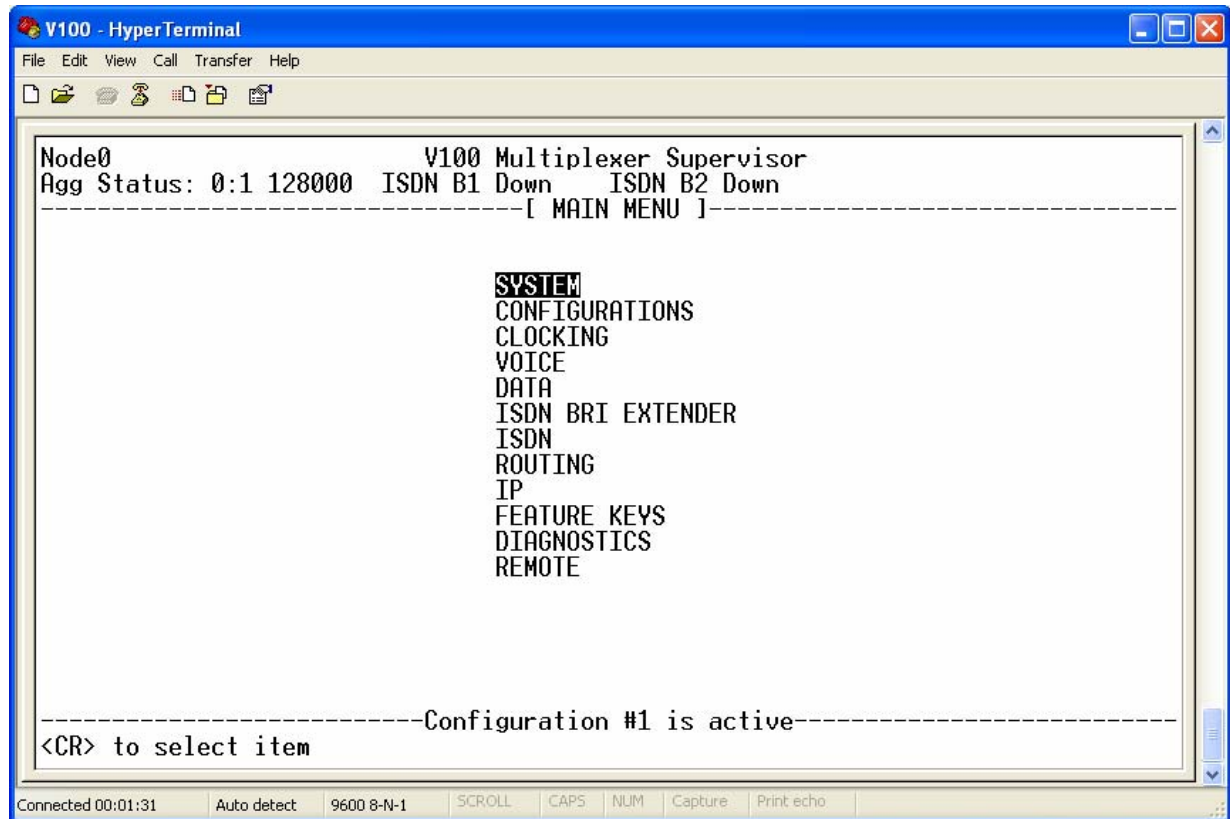
This is the Main Menu page. From here all of the submenu pages may be accessed by moving the highlighted cursor up or down and pressing <ENTER>. To return up the menu tree, press <ESC> at any time. The screen shown above is an example; the menu for each option card will only be shown if the card is fitted.

All of the menu pages display the status lines at the top of the screen for information. At top left, the Node Name of the currently logged unit appears. Below the "V100 Multiplexer Supervisor" banner, the connection status of the aggregate links is displayed. In the example above, chassis data port 0:1 is configured as an aggregate and has lost connection with a remote unit. Below this, the third line confirms the current menu page.

At the bottom of the screen, the active configuration store (one of six – the seventh is for backup/reconfig only) is shown and on the final line, a context-sensitive help line guides the user as to what may be entered in the current field.

3.4.2 The SYSTEM menu

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

NODE0                    V100 Multiplexer Supervisor
Agg Status: 0:1 Lost     E1 Lost
------------------------------[ SYSTEM ]------------------------------

   NODE NAME              : NODE0        NODE ID          : 000

   CONFIGURATION BY REMOTE : Enabled     HSC MODE         : Slave


   ALARM RELAY DELAY      : None         OPTION 0         : ISDN
   ALARM RELAY MODE       : Auto

   COUNTRY                : UK           RW PASSWORD      :
                                         RO PASSWORD      :
   CONNECTION TIMEOUT     : 10 seconds   ACCESS TIMEOUT   : 0 seconds
   RECEIVE READY FILTER   : 1 seconds    ACTIVITY TIMEOUT : 30 seconds
   DATA CHANNEL ACTIVATION : Auto
   DATA CHANNEL FLAG      : Always On    BACKUP TIMER     : 40 seconds
   TIE-LINE ACTIVATION    : M-Lead       FALLBACK MODE    : 2 Min
   ASYNC BUFFER SIZE      : 32 buffers   FALLBACK TIMER   : 40 seconds
------------------------------------------------------------------------
Enter Text

Connected 02:16:52    Auto detect    9600 8-N-1    SCROLL  CAPS  NUM  Capture  Print echo
```

NODE NAME

The SYSTEM SETTINGS menu allows the user to define a name for the chassis, which appears at the top left-hand corner of the screen and is used to address the unit in Teletype mode. This may be alphanumeric but must start with a letter.

NODE ID

The I.D. number specifies the chassis and must be unique within the network; the V100 uses it to route packets to the correct destination. This number must be entered explicitly into each unit before the network is configured and cannot be entered remotely. All other fields (except the "Configuration By Remote" field – see below) may be edited locally or remotely.

CONFIGURATION BY REMOTE

Allows or prevents other users on the network from configuring this V100 via either Telnet or remote configuration. The "Configuration By Remote" field may only be set locally since this prevents remote tampering.

ALARMS

The V100 contains a summary alarm relay, which presents voltage-free changeover contacts on three pins of the supervisory port. These may be wired into an external network monitoring system to record loss of power or loss of carrier on any aggregate port. The alarm mode may be selected, together with an activation delay.

COUNTRY

Four country selections are available to allow the user to tailor the ring cadence and comfort tones of the voice channels to suit national standards.

CONNECTION TIMEOUT

Data paths in a V100 network are managed in terms of connections. When a telephone is lifted and a destination channel number dialled, a connection request is processed by the routing software and either accepted or rejected according to the existing link traffic. The CONNECTION TIMEOUT parameter allows the network manager to optimise the timeout before the V100 rejects the request. This can be adjusted to allow slow-response networks (e.g. DAMA) time to connect.

RECEIVE READY FILTER

In satellite systems there is often a "Carrier Detect" or "Receiver Ready" signal returned by the network when the connection is made. In SWITCHED carrier modes (see Data Configuration), this is used by the V100 as an indication to proceed. The signal produced by satellite modems can be unstable during the initial stages of carrier acquisition and so a programmable filter is provided to guarantee the "Receiver Ready" signal is steady before the V100 sends connection messages across the link.

DATA CHANNEL ACTIVATION

Connections for data channels in the V100 network are always point-to-point. In other words, however complex the route taken from say, terminal to computer, a permanent connection is still set up between the two devices. Here, the "DATA CHANNEL ACTIVATION" option is left in its default state of "Auto". In some cases, it may be desirable for the connected terminal equipment to switch the bandwidth on only when required; in this case the "DATA CHANNEL ACTIVATION" option may be set to "Flag", such that the connection is set up when the terminal affirms the RTS signal (or equivalent in V.11, RS449 or V.35 modes) into the port. This allows more flexible interworking with voice and DBA data channels.

DATA CHANNEL FLAG

In a similar way, the "DATA CHANNEL FLAG" setting allows the user to select how the "CTS" (or equivalent) signal from the V100 reacts. It may be set permanently on, to activate only when the connection is made or to reflect the state of the "RTS" signal at the remote port.

TIE-LINE ACTIVATION

For voice channels, the "TIE_LINE ACTIVATION" field specifies how Tie-line bandwidth is requested. In "Auto" mode, a permanent connection is made which takes bandwidth all the time. When set to "M-lead", connections are made only when the M-lead is seized, thereby yielding bandwidth when not required.

"M-lead & Back Busy" was developed to overcome a failing in system topologies which are indirectly connected to a remote analogue PABX. Such systems in the V100 network could take the form of a unit connected via the HSC or an intermediate node, where the carrier status of the overall link is unknown. In such a case the call is placed by the local PBX, which sees the local port is free and raises the M-lead. The local unit tries to connect to the remote port but the connection fails because a link along the way is down. To the calling PBX, the call status is unknown because there is no feedback and the user hears nothing.

To avoid this frustrating phenomenon, the "M-lead & Back Busy" selection was designed. Here, the local port issues pings every 30 seconds from mapped Tie-Line ports (provided the system Tie-Line Activation mode is set to "M-Lead & Back Busy" and the Tie-Line port has an algorithm selected). The remote port responds to this ping if it is free. The local port checks for Ping Response timeouts (45 seconds) and asserts a BackBusy request. If the port is in the idle state the BackBusy state is immediately translated into the E-Lead signal. So, the state of BackBusy is translated to the E-Lead signal, unless the port is turned off in which case the E-Lead signal is affirmed (busy).

This provides the following features on mapped Tie-Line Voice channels:-

- BackBusy will be asserted between 15 and 45 seconds after loss of communication

- BackBusy will be disaffirmed between 0 and 30 seconds after communication is restored.

- A manual back busy facility is activated by turning the coder algorithm off.

ASYNC BUFFER SIZE

The "ASYNC BUFFER SIZE" field allows the user to optimise the number of 100mS input buffers used by asynchronous channels. This can be useful when channels are used for remote internet access which is made at a negotiated rate and cannot be controlled.

HSC MODE

The High Speed Channel port is configured, either as the unique master, which polls for any units on the bus, or as a slave which acts a channel expansion chassis. The HSC has independent RX and TX clocks running at 4Mbps, which may be supplied either by an internal or an external source. See "Expansion – the High Speed Channel (HSC)".

NOTE: **TDM CARD OPERATION**
When the TDM Framer Card is fitted AND AT LEAST ONE DATA CHANNEL IS IN TDM MODE, the HSC port

may not be used. The configuration fields for HSC on the SYSTEM SETTINGS menu are automatically removed and replaced by two alternative fields, which configure the TDM clocking: The "TDM MODE" field allows the selection of the electrical interface type used on the TDM card, while the "TDM TXC" field defines the transmit clock source.

OPTION 0

This field is used to specify the Special Option Card in use, if any. Selection from "NONE", "TDM", "E1" or "ISDN" is used during the initialisation of the unit.

PASSWORDS

The RW and RO passwords allow the user to enter personal codes to restrict supervisor access to Read-Write or Read-Only. In both cases, the code must be followed by a carriage return and then entered a second time for confirmation. The new password is saved when the screen is exited in the normal way. Once a password is entered, the user is prompted to enter it when first logging on to the system before any access is granted to the menus. Refer to section 3.3.5 for details.

ACCESS TIMEOUT

As an additional security feature, if either an RW or an RO password has been set, the "ACCESS TIMEOUT" parameter allows the user to specify a period of keyboard inactivity after which menu access is denied. When this happens, the user is logged off and the following message is displayed:

Password Access Expired....

Re-Enter Password for Node0:

This feature can be turned off by entering a value of zero seconds.

ACTVITY TIMEOUT

The "ACTIVITY TIMEOUT" is relevant to dial-up links only. When configured, it sets the aggregate dial-up link's activity timeout period. After the specified period of inactivity the dial-up link is dropped.

This feature can be turned off by entering a value of PERMANENT.

TDM SYNC BACKUP

TDM SYNC BACKUP is ONLY displayed if a TDM card is inserted. Values are 'OFF', 'ON'

OFF = default and maintains its ability to operate in simplex mode of operation. BackUp mode cannot be used.

ON = allows backup/fallback operation by enabling keep alive Signal Message response and timeout on fail which requires full-duplex link bandwidth. Only use this feature if you need the backup facility with a TDM link.

BACKUP TIMER

This defines the period for which a clock failure or carrier detect failure condition must persist on the Primary Route before connections are re-routed to the backup link. It allows the unit to continue through minor link errors and small periods of inactivity such as re-cabling or configuring without instantly switching to the backup link.

FALLBACK MODE

Fallback Mode defines the behaviour adopted when attempting to return from the secondary link to the primary link, after it has been restored following a failure. There are two selections; "Auto" and "Auto (No BW)"

FALLBACK TIMER

This defines the period the primary link has to be active and stable, before the secondary will swap back to the primary. It will restart if there is another loss of primary during this period. This prevents glitches or an unstable carrier switching the unit. Note that the option to fallback immediately on a carrier return, without qualifying the carrier for a period, is specified by setting the timer to 0. It is also possible to prevent automatic fallback by setting the timer to "Never". Here the aggregate will stay on secondary forever; it is possible to manually cause a fallback by subsequently entering "Reset" and saving the entry, when the unit will fall back to Primary immediately and change the timer setting back to "Never" itself, ready for next time.

These facilities also work in ReConfig mode, to switch Aggregates back to the Primary route.

The parameters and options available on the SYSTEM menu are shown in the following table:

Field	Options	Description
NODE NAME	Any Alphanumeric string up to 8 characters	Allows the user to enter a convenient network name for the chassis. Also used as identifier in Teletype Mode.
NODE I.D.	0-240 numeric	Network I.D. for this chassis. MUST be unique
CONFIGURATION BY REMOTE	Enabled,	Configuration settings may be changed by another unit in the network
	Inhibited	Configuration settings may only be changed at the local unit
ALARM RELAY DELAY	None, 2s, 5s, 10s, 20s, 1min, 2min, 5min	The delay following an alarm event after which the alarm relay is activated

Field	Options	Description
ALARM RELAY MODE	Auto,	When an alarm event occurs, the alarm relay is energised after the programmed delay. It is de-energised if the alarm condition is removed (see "Alarms")
	On,	When an alarm event occurs, the alarm relay is energised after the programmed delay and stays on
	Off,	The alarm relay stays off
	Toggle	When an alarm event occurs, the alarm relay is energised after the programmed delay and then toggles on and off according to the delay period.
COUNTRY	UK,	BT standard ringing cadence
	US,	AT&T standard ringing cadence
	France,	France Telecom standard ringing cadence
	Germany	Deutsche Telecom ringing cadence
CONNECTION TIMEOUT	10-255 numeric entry	Number of seconds after which a connection request is rejected
RECEIVE READY FILTER	0-255 numeric entry	Number of seconds from assertion of RR after which signal is accepted
DATA CHANNEL ACTIVATION	Auto,	Connection is made when one end is mapped
	Flag	Connection only is made when one end is mapped AND 'C' lead affirmed at both ends
DATA CHANNEL FLAG	Always On,	Channel output signal always asserted
	Follows Connect,	Channel output signal asserted when connection is established
	Follows Remote,	Channel output signal follows remote input signal transparently
	Follows Alarms	Channel output signal disaffirmed during alarm conditions
TIE LINE ACTIVATION	M-Lead	Connections are only made when the M-Lead is seized.
	M-Lead & Back-Busy	Same as above but pings are used to check the link status. See the section "TIE LINE ACTIVATION" above this table for details.
	Auto	Permanent connection is made which takes bandwidth all the time.
ASYNC BUFFER SIZE	8-256 numeric entry	Number of 1K buffers used by data channels in async mode
HSC MODE	Master,	Logged unit polls other units on the HSC bus
	Slave	Logged unit waits to be polled on the HSC bus and replies
TDM MODE*	RS449, V.35, V.24	Defines the electrical interface standard of the TDM port.
OPTION 0	None,	No Special Option Card fitted
	ISDN,	Basic Rate ISDN pump fitted
	E1	E1 Link Card fitted

Field	Options	Description
	TDM	TDM Interface Card fitted
RW PASSWORD	Alphanumeric entry	Read-Write access password
RO PASSWORD	Alphanumeric entry	Read-Only access password
ACCESS TIMEOUT	0-86400 numeric	Supervisor keyboard timeout period. 0 = Permanent access (default) 1-86400 = Seconds as entered
ACTIVITY TIMEOUT	PERMANENT	PERMANENT = Permanent supervisor access
	0-86400 numeric	If either an RW or an RO password has been set, this sets the aggregate dial-up link's activity timeout period. 0= immediate timeout 1-86400 = Seconds as entered.
TDM SYNC BACKUP	OFF	OFF Default and maintains simplex mode of operation. Backup mode cannot be used. Only displayed if TDM card is installed.
	ON	Retains backup/fallback operation but requires full-duplex carrier. Use only if the backup feature is required. Only displayed if TDM card is installed
BACKUP TIMER	0-600 seconds	Period of Primary clock or carrier loss after which backup occurs.
FALLBACK MODE	Auto	Unit falls back to the primary route once carrier is restored, after the Fallback Timer has expired. Switched aggregates will not wait for carrier to be restored but fall back anyway when the timer expires 0 – instantaneous we fallback instantly on carrier return
	Auto (No BW)	As above but checks to see if active connections on Secondary Aggregate. If yes will not fall back. If no will fall back. Safe option to preserve existing connections.
FALLBACK TIMER	0-300	Period of good carrier required before fallback occurs. Setting "0" results in instant fallback if carrier good. Switched aggregates fall back anyway when timer expires.
	NEVER	Unit never falls back to primary. May only be forced back by "Reset".)
	RESET	Force the unit to fall back immediately.

3.4.3   The CONFIGURATIONS menu

The V100 supports multiple configuration stores which allow up to six different configurations to be stored on the V100. A seventh configuration is also available to provide a configuration for the secondary routing reconfiguration option. The selection of which configuration is being edited or used at any time is made in the CONFIGURATIONS menu. There are also options for copying and deleting configurations.

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

NODE0                    V100 Multiplexer Supervisor
Agg Status: 0:1 Lost     E1 Lost
--------------------------------[ CONFIGURATIONS ]--------------------------------

ACTIVE CONFIGURATION# :  1
EDIT   CONFIGURATION# :  1
COPY CONFIGURATION#    : None    TO CONFIGURATION# :None
DEFAULT CONFIGURATION#: None

Configuration# Size     Description

1               2396
2               753
3               753
4               753
5               753
6               753
Backup          753




------------------------Configuration #1 is active------------------------
Use <SPACE>/+ or - to select

Connected 02:41:16    Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

CONFIGURATION#

The "CONFIGURATION#" identifies the configuration number. Seven configurations may be stored (1-6, BACKUP). Any of the scripts may be designated the "ACTIVE" script, or may be edited, copied, or reset to the factory "DEFAULT" setting.

SIZE

The configuration size is shown in bytes.

DESCRIPTION

A description may be given to a configuration number to help identify it.

Field	Options	Description
ACTIVE CONFIGURATION#	1-6	The number of the Configuration currently being used.
EDIT CONFIGURATION#	1-6	The number under which to save the Configuration currently being edited.
	Backup	Edit the Backup Configuration.
COPY CONFIGURATION#	1-6	The number of the Configuration currently being copied.
	Backup	The Backup Configuration is currently being copied.
	None	No Configuration is currently being copied.
TO CONFIGURATION#	1-6	The number the Copied Configuration will be saved under.
	Backup	The Copied Configuration will be saved as the Backup Configuration.
	None	No copy will take place.
DEFAULT CONFIGURATION#	1-6	Set the Configuration specified back to the factory default settings.
	Backup	Set the Backup Configuration back to the factory default settings.
	None	No Configuration is currently being set to the factory default settings.
CONFIGURATION#	Information only	The configuration (1-6 or Backup).
SIZE	Information only	The size in bytes of the configuration file.
DESCRIPTION	Alphanumeric text	Up to 55 characters used to identify the configuration.

3.4.4 The CLOCKING menu

The clocking menu specifies how the GRX and GTX clocks in the V100 are driven.

NOTE: **In earlier versions of software, the reference clock is configured differently. Please refer to the appropriate manual for more information.**

SOURCE

Configures the source for driving the GRX and GTX system clocks.

AGGREGATE

When the SOURCE is configured to DATA, AGGREGATE specifies which data interface clock is driving GRX or GTX. When SOURCE is configured to IP AGG, AGGREGATE specifies the name of IP Aggregate driving GRX or GTX. For all other values of SOURCE, the AGGREGATE field is not used.

Field	Options	Description
GRX SOURCE	None	GRX system clock is not driven by anything.
	ISDN, TDM, E1	Sets the specified option card (ISDN, TDM, E1 Link) as the source for the GRX clock.
	HSC	Sets the HSC interface as the source for the GRX clock.
	Data	Sets the source to either the motherboard data port (0:1 or 0:2) or to a quad data port (1:x or 2:x)
	BRI EXT1, BRI EXT2	Sets the source to the BRI Extender card
	AUDIO1, AUDIO2	Sets the source to the AUDIO card
	IP AGG	Sets the named IP Aggregate as the source.
AGGREGATE	None	
	Slot:Channel	When Source is set to Data, the data slot: channel must be specified. The motherboard data port is identified as 0:1 or 0:2. The quad data port is identified as 1:x or 2:x
	Text	When Source set to IP AGG, enter the name of the IP Aggregate.
GTX SOURCE	None	
	ISDN, TDM, E1	GTX system clock is not driven by anything.
	HSC	Sets the specified option card (ISDN, TDM, E1 Link) as the source for the GTX clock.
	Data	Sets the HSC interface as the source for the GTX clock.
	BRI EXT1, BRI EXT2	Sets the source to either the motherboard data port (0:1 or 0:2) or to a quad data port (1:x or 2:x)
	AUDIO1, AUDIO2	Sets the source to the AUDIO card
AGGREGATE	None	
	Slot:Channel	When Source is set to Data, the data slot: channel must be specified. The motherboard data port is identified as 0:1 or 0:2. The quad data port is identified as 1:x or 2:x
	Text	When Source set to IP AGG, enter the name of the IP Aggregate.

3.4.5   The VOICE menu

The voice menu provides access to sub-menus that provide configuration for the voice services in the V100.

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

NODE0                    V100 Multiplexer Supervisor
Agg Status: 0:1 Lost    E1 Lost
------------------------------[ VOICE #1]------------------------------


                         ANALOGUE PORTS
                         SIGNALS & TONES
                         DIRECTORY
                         VOICE ACTIVATION












------------------------Configuration #1 is active------------------------
<CR> to select item

Connected 04:21:15    Auto detect    9600 8-N-1    SCROLL  CAPS  NUM  Capture  Print echo
```
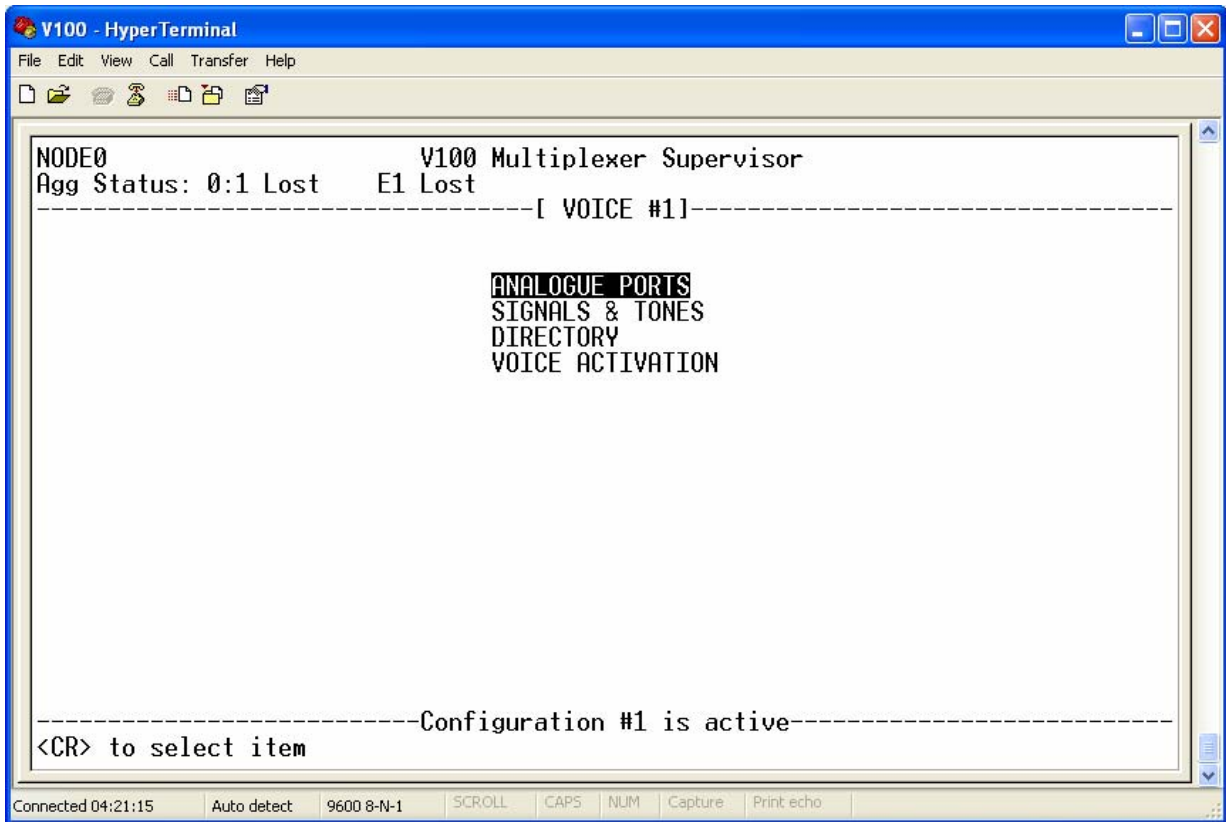
3.4.5.1 The ANALOGUE PORTS menu

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

NODE0                      V100 Multiplexer Supervisor
Agg Status: 0:1 Lost    E1 Lost
---------------------------[ ANALOGUE PORTS #1]---------------------------


Channel  ClkRef   SigType  Interface  Algorithm      I-Gain-O      Destination
 1:1     GRXCLK   DTMF     FXS        NetCode 9.6K   0dB    0dB    1:2:1
 1:2      "       STU      FXS        NetCode 9.6K   0dB    0dB    AUTO
 1:3      "       STU      FXS        NetCode 9.6K   0dB    0dB    AUTO
 1:4      "       E&M      Tie-Line   NetCode 9.6K   0dB    0dB    1:2:4




----------------------------Configuration #1 is active----------------------------
Use <SPACE>/+ or - to select

Connected 04:24:01   Auto detect   9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

CHANNEL

All voice channels detected on power-up are presented on the same menu page. The slot number and channel number distinguish the position of the channel within the chassis.

CLOCK REFERENCE

All voice ports may be configured completely independently of each other. The only restriction is that the reference clock source is common to all the channels in an option slot, since the voice motherboard (VI68701) contains one PLL. As with all other cards, the PCM sample clock generated on the voice card must be phase-locked to either the GRX or the GTX clock busses.

SIGTYPE

Voice channel connections are made by dialling the remote destination. This may be done using tone-based signalling, loop dialling or E&M pulses according to the application. The choice of signalling type allows the user to specify how the channel is operated and also which of the modem or fax relays may be used. "DTMF" signalling type decodes the tone pair digits and passes them to the remote end. "E&M" passes all tones but decodes pulse dialling digits if present. The remaining options pass all tones but allow the user to select which modem/fax relay function will operate. "TRANS" signalling passes all tones and loop pulses transparently and turns off all of the modem/fax relay functions. "V.22" permits only the V.22

modem relay to operate, and "STU" permits only the STU-IIB/STU-III relay to operate (if the card is fitted).

INTERFACE

When the interface type is set to "FXS", the port provides DC loop current or ring voltage for driving a telephone or a trunk port on a PABX, while "FXO" configures the port to accept DC current or ring voltage; both types are 2-wire interfaces. When set to "TIE-LINE", the port is configured as a 4-wire E&M port and should not be connected to network voltages.

ALGORITHM

The wide range of voice algorithms allows a trade-off between voice quality, delay and bandwidth. It is possible to select a different coder in each direction, with the sending coder forcing the choice of receiving coder; this allows different bandwidth to be used according to which end makes the call.

GAIN

Analogue voice applications often require adjustment to optimise the speech quality. This can be caused by poor line impedance matching, signal loss and echo across the telephone network. A combination of input and output gain adjustment over a wide range allows the user to achieve the clearest line, consistent with echo cancellation. At the far end, input gain should be adjusted down to the lowest level which cancels any echo, then the near end output gain adjusted to compensate for the overall signal level.

DESTINATION

When a voice channel destination is specified as "AUTO", calls made on this channel will be automatically routed to the dialled destination port according to the DTMF or E&M signalling received. It is also possible to set up fixed destinations, as in the example above, by entering the specific address of the destination V100 port. This feature is useful when configuring Tie-lines between PABXs, or "hotlines" between telephones and avoids the need for the user to enter any dialling digits just to route through the V100 network.

Using the Directory menu it is possible to specify personalised numbers instead of V100-style port numbers. This allows an existing network numbering scheme to be used with the V100, as well as permitting the use of node numbers greater than 9.

The parameters and options are shown in the following table:

Field	Options	Description
CHANNEL	Information only	Displays the numbers of all data channels installed.
CLKREF	GRXCLK, GTXCLK	Clock reference bus used by the voice card PLL
SIGTYPE	DTMF,	DTMF signalling passed. All relays enabled
	E&M,	E&M signalling passed. All relays enabled

Field	Options	Description
	TRANS,	All signalling passed in-band. All relays disabled
	V.22,	As DTMF, but only V.22 data modem relay enabled
	STU,	As DTMF, but only STU-IIB/STU-III relays enabled
	NOSTU	As DTMF, but all relays except STU-IIB/STU-III enabled
INTERFACE	FXS,	2-wire port configured to drive a telephone or Trunk Line input
	FXO,	2-wire port configured to connect to an extension port
	Tie-line	4-wire E&M port. No telephone voltages allowed
ALGORITHM	Off,	Channel not used
	G.711-A 64K,	PCM coded voice
	G.711-u 64K,	PCM coded voice
	G.726 16K,	ADPCM coded voice
	G.726 24K,	ADPCM coded voice
	G.726 32K,	ADPCM coded voice
	G.726 40K,	ADPCM coded voice
	G.727 16K,	E-ADPCM coded voice
	G.727 24/16K,	E-ADPCM coded voice with asymmetric bit rate TX/RX
	G.727 24K,	E-ADPCM coded voice
	G.727 32/16K,	E-ADPCM coded voice with asymmetric bit rate TX/RX
	G.727 32/24K,	E-ADPCM coded voice with asymmetric bit rate TX/RX
	G.727 32K,	E-ADPCM coded voice
	G.727 40/16K,	E-ADPCM coded voice with asymmetric bit rate TX/RX
	G.727 40/24K,	E-ADPCM coded voice with asymmetric bit rate TX/RX
	G.727 40/32K,	E-ADPCM coded voice with asymmetric bit rate TX/RX
	G.723.1 5.3K,	ML-PLQ compressed voice
	G.723.1 6.3K,	ML-PLQ compressed voice
	G.729A 8K,	CELP compressed voice
	Transp. 64K,	Raw PCM sampled voice
	Netcode 6.4K,	Proprietary CELP compressed voice
	Netcode 7.2K,	Proprietary CELP compressed voice
	Netcode 8K,	Proprietary CELP compressed voice
	Netcode 8.8K,	Proprietary CELP compressed voice
	Netcode 9.6K	Proprietary CELP compressed voice
I-GAIN-O	-31dB to +31dB	Input and Output gains
DESTINATION	"NODE:SLOT:CHANNEL",	Voice channel has fixed destination
	AUTO	Call routed by dialled digits
	BTXnnn,	Broadcast TX channel number
	BRXnnn,	Broadcast RX channel number
	BTRttt,rrr"	Broadcast TX and RX channel numbers

3.4.5.2 The SIGNALS & TONES menu

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help
──────────────────────────────────────────────────────────
NODE0                   V100 Multiplexer Supervisor
Agg Status: 0:1 Lost    E1 Lost
───────────────────────[ SIGNALS & TONES #1]──────────────────


   DTMF RELAY           : Disabled

   DTMF OUTPUT LEVEL    : +3dBm
   DTMF TWIST           : -3dB

   SIGNAL OUTPUT GAIN   : -7dB




   ───────────────────────Configuration #1 is active───────────────────
   Use <SPACE>/+ or - to select

Connected 04:27:39    Auto detect    9600 8-N-1    SCROLL  CAPS  NUM  Capture  Print echo
```
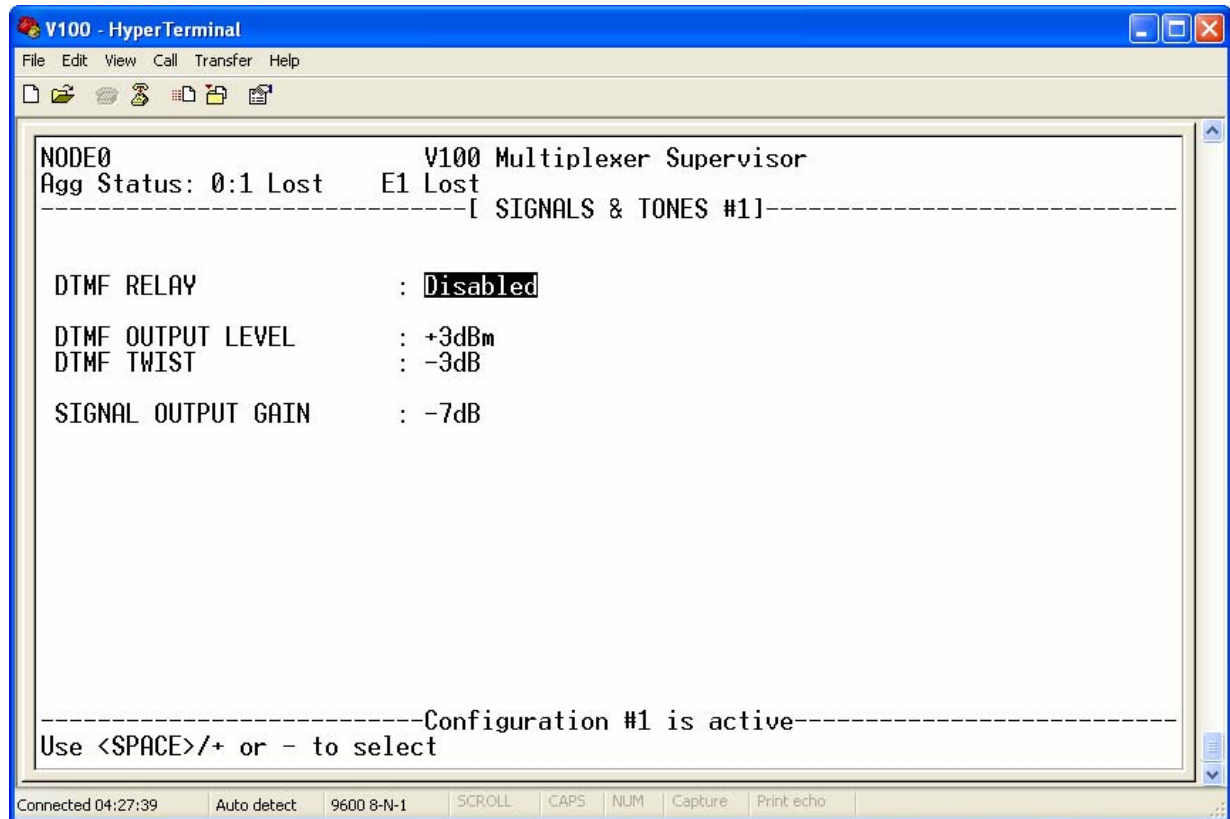
DTMF RELAY

DTMF Relay mode is enabled or disabled on all ports. When DTMF Relay mode is disabled, the V100 operates as it did prior to release 2.1.22 - the DTMF tones are carried through the compressed voice path.

When DTMF Relay is enabled, the DTMF digits are regenerated in the decoder and thus are not subject to the loss effects through the standard encoder/decoder path. If DTMF is disabled and DTMF applications do not seem to be working, the user may enable DTMF and tune the signal levels as necessary until the application detectors work correctly.

NOTE: **DTMF Relay must be enabled on at least the encoding side for the relay to work -even if DTMF Relay is disabled on the decoder, the DTMF digit is regenerated correctly.**

DTMF OUTPUT LEVEL

By using the DTMF Output Level setting, it is possible to adjust the volume of DTMF tone pairs relative to all other (comfort) tones. The relative output level of the low frequency tone for DTMF digits (relative to the high frequency output level) can be tuned.

DTMF TWIST

The twist allows you to set the relative levels of each member of the tone pair if necessary although by using the defaults this is rarely necessary.

SIGNAL OUTPUT GAIN

The Signal Output Gain setting adjusts the output volume of both DTMF tones and call progress tones - i.e. the volume of generated DTMF tones is controlled via a combination of the DTMF output level and Signal output gain.

Field	Options	Description
DTMF RELAY	Disabled	Default
	Enabled	Enables DTMF Relay.
DTMF OUTPUT LEVEL	Mute	Mutes the output.
	-31dBm - +3dBm	Sets the output level..
DTMF TWIST	-4dB-0dB	Sets the DTMF Twist.
DTMF TWIST	-4dB-0dB	Sets the DTMF Output Gain.

3.4.5.3   The DIRECTORY menu

Any of the voice channels in the network may be assigned a dialling code such that dialling digit sequences map on to physical destination ports. This page lists all ports in the network and allows the user to enter DTMF destination numbers that the network will use to set up calls, without having to use the V100 hardware port numbering scheme. The DIRECTORY page of all voice ports in a network could look like this:

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

NODE0                    V100 Multiplexer Supervisor
Agg Status: 0:1 Lost    E1 Lost
--------------------------------[ DIRECTORY ]------------------------------------

Channel        Code         Channel        Code         Channel        Code
0:1:1          800          1:1:8          827
0:1:2          801          2:2:1          840
0:1:3          803          2:2:2          841
0:1:4          804          2:2:3          842
1:1:1          820          2:2:4          843
1:1:2          821
1:1:3          822
1:1:4          823
1:1:5          824
1:1:6          825
1:1:7          826


<New Code>      <Delete All Codes>    <Tidy List>

Type <ctrl d> to delete selected entry

------------------------------Configuration #1 is active-------------------------
Press <SPACEBAR> to activate

Connected 04:36:04   Auto detect   9600 8-N-1   SCROLL  CAPS  NUM  Capture  Print echo
```

This facility firstly allows voice ports on units with node numbers greater than 9 to be dialled from a telephone or PABX when using the V100 "AUTO" destination mode. Secondly it may be used to integrate ports connected over a V100 network into an existing dialling plan or corporate extension list. The direct hardware numbering scheme may still be used at the same time i.e both "114" and "823" would dial port 1:1:4 as long as the number 114 has not also been used as a directory code.

3.4.5.4   The VOICE ACTIVATION menu

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

NODE0                      V100 Multiplexer Supervisor
Agg Status: 0:1 Lost    E1 Lost
--------------------------[ VOICE ACTIVATION ]---------------------
ACTIVATION SCRIPT :
1
2
3
4
5
6
7
8

DEACTIVATION SCRIPT :
1
2
3
4
5
6
7
8
------------------------Configuration #1 is active------------------------
Enter Text

Connected 04:36:46   Auto detect   9600 8-N-1   SCROLL  CAPS  NUM  Capture  Print echo
```

The VOICE ACTIVATION menu should be used only when it is necessary to guarantee that no data, IP or Voice traffic is sent over a link. For example, when using Inmarsat to prevent the unit automatically connecting and incurring call charges.

In all other configuration locations no destination mappings should be configured – that is, they should be left blank.

The activation script is run when the first voice call goes off-hook. A single TTY command (please refer to the TTY Manual for more information) is entered on each line which assigns a destination to the voice, data or IP channel.

The deactivation script is run when the last voice call goes on-hook. A single TTY command is entered on each line which removes the destinations added in the activation script. Both the activation script and the deactivation script are limited to eight TTY commands.

3.4.6 The DATA menu

All data ports on the V100 are considered to be universal. Any port may be configured as an aggregate or a tributary, as DTE or DCE, as sync or async and with a wide variety of clocking options. There is considerable flexibility built in to the V100 data channels; for this reason, the user should clearly understand the implications of all configuration options.

```
 V100 - HyperTerminal                                              _ □ X
File  Edit  View  Call  Transfer  Help
 D ⊆   ⊛ ⅜   ⅊ ⅓   ⅊
┌─────────────────────────────────────────────────────────────────────┐
│NODE0                    V100 Multiplexer Supervisor                  │
│Agg Status: 0:1 Lost    E1 Lost                                      │
│-------------------------------[ DATA #1]----------------------------│
│                                                                     │
│                              -----RX clock----- -----TX clock-----   │
│Channel Iface Mode Type Format Rate     Source Ref Rate    Source Ref Destination│
│ 0:1    RS449 Agg  DTE  NRZ    0         Ext <GTX 120000   Rxc   -   │
│ 0:2    V.11  Trib DCE  NRZ    128000    Dba <GRX                 1:0:2│
│                                                                     │
│                                                                     │
│                                                                     │
│                                                                     │
│-----------------------------Configuration #1 is active--------------│
└─────────────────────────────────────────────────────────────────────┘
Connected 04:39:12    Auto detect    9600 8-N-1    SCROLL  CAPS  NUM  Capture  Print echo
```

CHANNEL

The two data channels resident in the chassis and any additional channels present on Quad Data Cards (VI68705) are all presented on the same menu page. The slot number and channel number distinguish the position of the channel within the chassis.

IFACE

The electrical interface standard used by each port must be selected according to the equipment to be connected. In the V100, all standards use the same 15-way D-sub connector and are adapted to the conventional connector format using an external cable (see Appendix B)

MODE

Data channels may operate in one of two basic modes, either as an **aggregate** port or as a **tributary** channel. An aggregate port performs the function of multiplexing a number of tributary connections over a carrier service to a remote unit. The V100 is capable of operating multiple aggregate ports.

When a TDM card is fitted, it is then possible to nominate data ports to operate as TDM channels by selecting "TDM" mode. These channels are still tributary ports but the data is not packetised; instead it passes over a timeslot in the frames being transmitted by the TDM card.

TYPE

The port type field allows the user to select the correct circuit presentation for the data port. When DTE type is selected, the port is configured as Data Terminating Equipment and may be logically connected using a straight cable to modems, for example (which are normally DCE). In other words, the TXD signal is an output from the V100 and should be connected to the TXD pin on the modem, which is an input.

When DCE is selected, all of the signals reverse direction and the port is configured as Data Circuit terminating Equipment and may be logically connected using a straight cable to terminals, for example. The TXD signal is now an input to the V100 and should be connected to the TXD pin on the PC, which is an output. The changeover is performed under software control and no jumper links need to be changed internally.

FORMAT

The format field is used to specify the kind of data to be transferred by the port. If synchronous, then transparent (SYNC) or NRZ framed data may be selected, or if async then the specific word structure is selected. The format must be the same at both ends of the multiplexer link.

In async modes an additional parameter is accessible immediately to the right of the main format entry which consists of a single character. This allows the user to select from Raw, Error-corrected or Compressed operation (Raw is selected by default). See section 4.10 "Async Error-correction and Compression" for details.

CLOCK SETTINGS

The V100 offers independent RX and TX clocks on every port and each one has three settings controlling rate, source and reference. The convention used is that the RX clock is associated with the direction of data from the aggregate to the tributary, whereas the TX clock is associated with the flow of data from the tributary to the aggregate. The clock source defines where the clock physically comes from. The reference field defines whether that clock is used as a reference by the unit or if instead the unit generates the clock using one of the two internal busses as a reference. When the clock is generated by the unit, the rate field must be specified. For external ("EXT") or looped clocks, it may be left blank.

Every Data port has two independent Phase-Locked Loops (PLLs) associated with it; one for the receive clock and the other for the transmit. In combination with the two internal clock busses this allows channels to be set up for asymmetric bit rates, or to onward link or phase lock to any Clock source in the network.

Clock switching selections are available according to the following table:

RXC	TXC
EXT (Input, from pin)	EXT (Input, from pin)
TXC (Output, looped from TXC)	RXC (Output, looped from RXC)
DBA (Variable output, from PLL)	DBA (Variable output, from PLL)
PLL (Output, locked to clock bus)	PLL (Output, locked to clock bus)
SLV Only to be used under guidance of qualified service personnel	SLV Only to be used under guidance of qualified service personnel
INT (Output, locked to oscillator)	INT (Output, locked to oscillator)

In PLL, INT and DBA modes, where an output clock is being derived from a Phase-Locked Loop, the PLL reference source must be selected from either the Global Receive Clock (GRX) bus or the Global Transmit Clock (GTX) bus. The reference clock bus must first be attached to a source by selecting for example, ">GRX" (**TO** GRX) on the "Clocking" menu, implying that the selected channel clock is driven on to the internal GRX bus. The RX PLL reference for the tributary channel may then be derived from the GRX bus by selecting "<GRX" (**FROM** GRX) on the Data Channels menu.

NOTE: **In earlier versions of software, the reference clock is configured differently. Please refer to the appropriate manual for more information.**

In DBA modes, the "Rate" entered is the maximum rate at which the channel will run, when there is no demand for bandwidth from higher priority sources such as voice channels.

Refer to the "Clocks" section in the Features chapter for more details.

DESTINATION

Destinations are needed by tributary channels to specify to which port the data should be sent and the format follows the rules "NODE:SLOT:CHANNEL". The destination must be a channel of the same type, i.e. a data channel destination must always be another data channel, but it can be anywhere in the network, even for example, on the same card. This can be a useful aid in diagnostics.

Another useful technique is to specify a loopback in the destination field. By entering the word "LOOP" as the destination, data to be sent out of a port is looped back internally to the receiver. By entering the word "ECHO" as the destination, data coming into a port is internally looped to the transmitter. This is applicable to aggregate ports and tributaries, but care should be exercised when using aggregate loopbacks!

Tributary in ECHO:
Data transmitted back
out of the port

Tributary in LOOP:
Data transmitted back
over the aggregate

Aggregate in LOOP:
Data transmitted back out of all tributaries

Aggregate in ECHO:
All data transmitted back over the aggregate
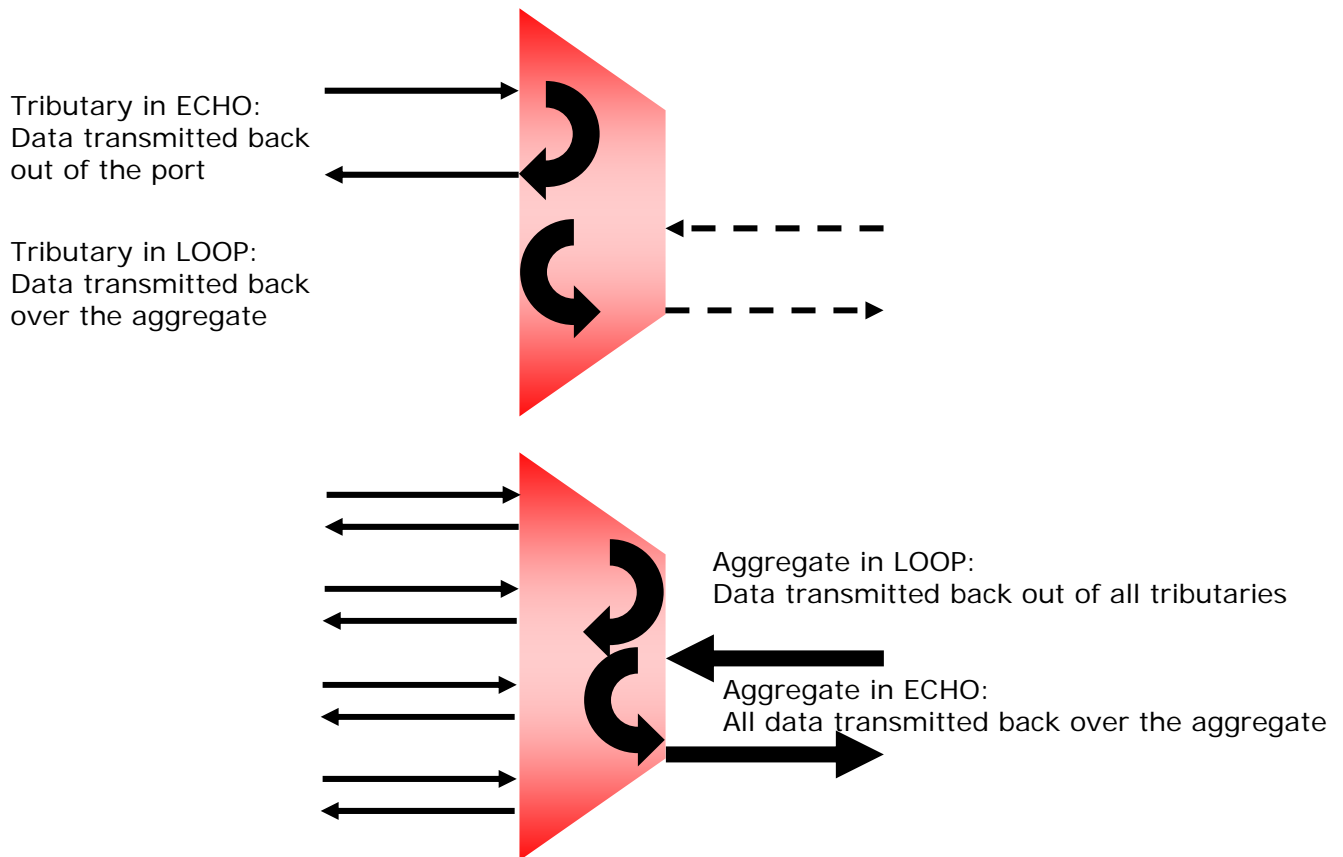
The V100 operates by sending packets from tributaries to their corresponding port using a route, which is looked up based on the destination in the packet header. This is usually via an aggregate port but could be via a dial-up ISDN link or a connection using the HSC. In any case, the route a packet takes out of the multiplexer may be indirect, going via another unit to reach the final destination. Aggregate ports therefore use routing information only and do not need a destination to be specified in the menu; **the destination field should be left blank.** The only exceptions to this are SWITCHED or SCADA modes, which are specified by entering the keyword in the destination field.

Tributary ports however are the end points of all connections and so, the port address of the final destination **must be specified by all tributaries.** This is true of both point-to-point connections and broadcast connections, which are discussed more fully in the context of the voice menus in section 3.4.5.

The parameters and options for the DATA menu are shown in the following table:

Field	Options	Description
CHANNEL	Information only	Displays the numbers of all data channels installed in the unit on a separate line.
INTERFACE	V.11, V.24, V.35, RS449	Electrical interface standard used on the port.
MODE	Agg,	Channel is used as an Aggregate
	Trib,	Channel is a tributary
	TDM	Channel is a tributary, multiplexed through TDM port
TYPE	DTE,	Port is configured as Data Terminating Equipment (TX is an output)
	DCE	Port is configured as Data Communications Equipment (TX is input)
FORMAT	Sync,	Data is transparent synchronous
	NRZ,	Data is synchronous, HDLC Non-Return to Zero format
	NRZI,	Data is synchronous, HDLC Non-Return to Zero Inverted format
	8N1,	Data is async, 8bits, no parity, one stop
	8N2,	Data is async, 8bits, no parity, two stop
	7E1,	Data is async, 7bits, even parity, one stop
	7E2,	Data is async, 7bits, even parity, two stop
	7O1,	Data is async, 7bits, odd parity, one stop
	7O2,	Data is async, 7bits, odd parity, two stop
	7N1,	Data is async, 7bits, no parity, one stop
	7N1.5,	Data is async, 7bits, no parity, 1.5 stop
	5N1,	Data is async, 5bits, no parity, one stop
	5N1.5	Data is async, 5bits, no parity, 1.5 stop
FORMAT (ASYNC)	R,	Raw data passed transparently
	E,	Error-correction active
	C	Compression active (error-correction is automatic)
RX CLOCK RATE	50-2048000bps	Receive clock bit rate. This may be set at any rate from 50 to 2048000bps (synchronous) or 50 to 115200bps (asynchronous)
RX CLOCK SOURCE	Ext,	RX clock input from the interface
	Txc,	RX clock output, looped from TX
	PLL,	RX clock output, derived from PLL
	Int,	RX clock output, phase-locked from system clock
	Dba	Dynamic Bandwidth Allocation (output)
RX CLOCK REFERENCE	-	None
	<GTX,	The reference for the TX PLL is taken from the Global RX Clock bus
	<GRX	The reference for the RX PLL is taken from the Global RX Clock bus

Field	Options	Description
TX CLOCK RATE	50-2048000bps	Transmit clock bit rate. This may be set at any rate from
		50 to 2048000bps (synchronous) or
		50 to 115200bps (asynchronous)
TX CLOCK SOURCE	Ext,	TX clock input from the interface
	Rxc,	TX clock output, looped from RX
	PLL,	TX clock output, derived from PLL
	Int,	TX clock output, phase-locked from system clock
	Dba	Dynamic Bandwidth Allocation (output)
DESTINATION	"NODE:SLOT:CHANNEL",	Data will only be transmitted to the designated port
	LOOP,	Port TX data is internally looped to RX
	ECHO,	Port RX data is internally looped to TX
	SWITCHED,	Aggregate link requested by RTS flag
	SCADA	Aggregate link uses SCADA protocol
	BTXnnn,	Broadcast TX channel number
	BRXnnn,	Broadcast RX channel number
	BTRttt,rrr"	Broadcast TX and RX channel numbers

3.4.6.1   Asynchronous Channels

Asynchronous operation is configured simply by selecting an async format from the menu. When a channel is configured to operate with an asynchronous format, the TXC fields are removed and only a rate and a reference field are displayed. An additional single-character FORMAT field is displayed to the right of the normal field which allows the user to select (R)aw, (E)rror-corrected or (C)ompressed mode for data transfer. (See section 4.10)

It is permissible to operate aggregate channels in asynchronous mode as well as tributaries. The reference field is not required for tributary operation and should be left set to "-"; if the channel is an aggregate then the selected rate may be used to drive the GRX reference by configuring the clocking menu. In this way, synchronous tributaries and voice channels may still be used successfully over an async aggregate, although they cannot be phase–locked between chassis.

Asynchronous tributary channels will pass data characters in and out of the port at the specified rate. Internally however, they use bandwidth from the Dynamic Pool; this means that when they are temporarily inactive, all but 2400bps of their bandwidth can be given back to the pool for use by other channels. Before a channel fills up with data to the limit of its buffers, the channel CTS signal is disaffirmed to the connected equipment as a means of hardware flow control. For details of how async channels operate internally, refer to the Dynamic Bandwidth Allocation (DBA) section 4.5.

3.4.7 The AUDIO Card menu

The high–quality Audio Card (VI68704) provides a 48KHz/24-bit full stereo encoder and decoder for the transmission of analogue or AES digital audio over the V100 network. The user may select any combination of MPEG-I, MPEG-II, G.722 or G.711 encoder and decoder, together with a range of stereo or mono modes, which are specific to type.

```
V100 - HyperTerminal                                              [_][口][X]
File  Edit  View  Call  Transfer  Help
D ☞  ☎ ☒  ▭ ☒  ☞

Node0                      V100 Multiplexer Supervisor
Agg Status: 0:1 128000  E1 Lost
--------------------------------[ MAIN MENU ]--------------------------------


                         SYSTEM
                         CONFIGURATIONS
                         CLOCKING
                         VOICE
                         DATA
                         AUDIO
                         ROUTING
                         IP
                         E1 LINK
                         FEATURE KEYS
                         DIAGNOSTICS
                         REMOTE




-------------------------Configuration #1 is active-------------------------
<CR> to select item

Connected 00:06:34   Auto detect   9600 8-N-1   SCROLL  CAPS  NUM  Capture  Print echo
```

SLOT

The configuration of the Audio Card is similar to all other V100 Options, with the exception that only one card can be displayed on the screen at a time due to space limitations; if a second card is fitted it is accessed by toggling the "Slot" field. All of the configuration parameters are displayed down the screen, with general settings at the top and settings for the Encoder and Decoder at the bottom.

DESTINATION

There is only one logical channel for the whole card, so destinations will always be of the form "X:X:1".

ACTIVATION

The "Activation Time" parameter allows the user to operate the card dynamically, with bandwidth only being used when there is a signal on the input, for example speech-operated. When a transmission begins, the connection to the remote decoder is made and the card uses bandwidth according to the "Coder Bit Rate". When it ends, the Activation Time holds the connection open for the selected duration before clearing it. If a new signal is detected before the end of the period, the timer is restarted. This may be used to bridge the time between music tracks, for example. The input signal threshold is adjusted using the "Activation Level" parameter, which ranges from 1 to 10 in a logarithmic manner. When the "Activation Time" is set to zero, the channel is permanently active.

MODE

The card may be connected to Analogue or Digital signals and indeed may convert one format to the other from end to end as configured by the "Mode" parameter. In analog mode, signals up to 0.775vrms may be connected to the inputs. Output levels are adjusted in the factory to reproduce this from a reference input. In Digital mode, stereo AES/EBU format data packets are transferred on the LEFT IN/OUT connectors.

CLOCK REFERENCES

Internally, the sample clock rate is fixed at 48KHz, which may be phase-locked to either the GRXCLK or the GTXCLK reference busses as selected by the "Sample Clock Ref" field (The encoder and decoder sample rates are the same since they use the same Real-Time Audio (RTA) interface internally and they must be the locked at both ends of the V100 link). The sample clock rate is automatically up- or down-converted to achieve better sound quality at lower bit rates using Sample Rate Converters, to provide 2:1, 3:1, 4:1 or 6:1 up- and down-sampling for compatibility with 48KHz, 32KHz, 24KHz, 16KHz or 8KHz sample rates in external equipment. They also produce the intrinsic rate of 16KHz used by G.722 and 8KHz used by G.711. In Digital mode, the sample clock is extracted from the incoming AES/EBU data stream by the encoder and may be used to drive the GRXCLK or GTXCLK bus for onward-linking as defined by the "AES Clock Ref" field. The decoder at the remote end then restores the AES/EBU clock with the decoded data. Finally in G.711/G.722 modes the number of samples in each frame may be adjusted according to the "Frame Length (samples)" field.

CODER TYPE

The "Coder Type" field selects the overall Encoding and Decoding standard. It is possible to set a different type in each direction, or to disable one direction completely. The "Coder Bit Rate" may be set according to type. G.711 and G.722 always run at 64Kbps and MPEG allows a wide range from 8Kbps to 448Kbps, which may be set according to the available bandwidth. An MPEG decoder will automatically follow the encoder bit rate.

CODER BIT RATE

The "Coder Mode" field is dependent upon the Encoder type. A G.711 encoder may operate in A-Law or u-Law, always at 64Kbps. A G.722 encoder may only operate in Mode 1 (64K). The available MPEG encoders vary according to bit rate, Type and Layer. MPEG-1 permits sample rates of 48KHz, 44.1KHz and 32KHz with selectable encoded rates between 32Kbps and 448Kbps. MPEG-2 achieves similar quality at half the sample rates, i.e. 24KHZ, 22.05KHz and 16KHz, with encoded data rates of between 8Kbps and 256Kbps. Layer I of the standard supports the standard MPEG encoding characteristics, while Layer II uses additional techniques such as psycho-acoustic modelling to reduce the encoded bit rate. The choice is left to the user.

CODER MODE

In MPEG modes, the encoder may be set to one of four audio modes. In **Mono** mode, the entire bit pool is allocated to one channel. In **Dual Mono** mode, the bit pool is statically divided into two parts; this implies that the audio characteristics of one channel do not affect the bandwidth used by the other. In **Stereo** mode, correlation is assumed between both channels. The bit pool is dynamically divided into two sliding parts. This implies that if one channel can be encoded by a small quantity of bits, these may temporarily be used by the other channel. Finally in **Joint Stereo** mode, correlation between the input channels is actively investigated in all sub-bands. In the case of a substantial correlation, a single audio signal and a "balance" signal are coded instead of two separate audio signals. As this takes fewer bits, more can be used for the audio signal. The extent to which this is used depends upon the MPEG psycho-acoustic model.

The PCM input processing technique is set automatically irrespective of the encoder used. This allows the input PCM data to be averaged in mono mode to be used by both channels.

The parameters and options are shown in the following table:

Field	Options	Description
SLOT	1,2	Selects which card to configure
DESTINATION	"NODE:SLOT:CHANNEL",	Remote card address. Channel number is always 1.
ACTIVATION TIME	0, 1-120 seconds	Permanent bandwidth Connection hold-up time after input signal mutes
ACTIVATION LEVEL	1-10	Activation signal threshold
MODE	Analogue, Digital	Analogue signal input and output AES/EBU digital stereo signals using LEFT I/O connectors
SAMPLE CLOCK REF	GRXCLK, GTXCLK	Select reference source for PLL
PCM SAMPLE RATE	48K	Information Only
FRAME LENGTH (SAMPLES)	384, 512, 1184	Number of sample per frame for G.711/G.722
CODER TYPE	None, G.711, G.722, MPEG	No coder selected G.711 encoder or decoder selected G.722 encoder or decoder selected MPEG encoder or decoder selected
CODER BIT RATE	8-448K	Depends on Coder Mode: See table below
CODER MODE	Various	Depends on Coder Type: See table below
MPEG TYPE	MPEG-1, MPEG-2	Coding standard
MPEG LAYER	I, II	MPEG coding complexity

Valid Coder Mode/Bit Rate combinations:

CODER TYPE	CODER MODE	BIT RATES
G.711	A-Law	64K
	u-Law Z	64K
	u-Law NZ	64K
G.722	Mode 1 (64K)	64K
	Mono	32K
MPEG-1 Layer I	Mono,Stereo, Joint Stereo, Dual Mono	64K, 96K, 128K, 160K, 192K, 224K, 256K, 288K, 320K, 352K, 384K, 416K, 448K
	Mono	32K, 48K, 56K
MPEG-1 Layer II	Mono,Stereo, Joint Stereo, Dual Mono	64K, 80K, 96K, 112K, 128K, 160K, 192K, 224K, 256K, 320K, 384K
MPEG-2 Layer I	Mono,Stereo, Joint Stereo, Dual Mono	32K, 48K, 56K, 64K, 80K, 96K, 112K, 128K, 144K, 160K, 176K, 192K, 224K, 256K
MPEG-2 Layer II	Mono,Stereo, Joint Stereo, Dual Mono	8K, 16K, 24K, 32K, 40K, 48K, 56K, 64K, 80K, 96K, 112K, 128K, 144K, 160K

3.4.8   The ROUTING menu

The routing menu describes the mechanisms the multiplexer uses to direct traffic across a network. The principle of the routing table is to configure which aggregate is used to reach a particular destination. The destination is typically a target node number, but can also be a target slot or channel number if traffic to different channels within slot, or slots within a node are to traverse the V100 network along different paths.

The following example shows a V100 routing setup with a leased satellite service, Inmarsat satellite service, IP aggregate and E1 link interconnecting four V100 units. The units are labelled Node0, Node1, Node2 and Node3. A leased satellite service connects Node1 (port 0:1) to Node2 (port 0:1). These same two units may also be connecting via Inmarsat. In this example, the Inmarsat service is used to carry voice calls between Node1 and the rest of the V100 network – the leased satellite service carries other multiplexed traffic. Each node has a voice card is slot 1 – this is used to differentiate routes for voice calls. An IP aggregate connects Node2 to Node3. On Node2 this IP aggregate is configured with the name "Node3". On Node3 this IP aggregate is configured with the name "Node2". An E1 link connects Node0 to Node3. For full connectivity between all V100s in the network, each node must contain a route to each other node in the network.

INMARSAT

ISDN   ISDN

1   2
V100   V100

0:1   Leased Satellite Link   0:1

0   3
V100   V100   IP

E1
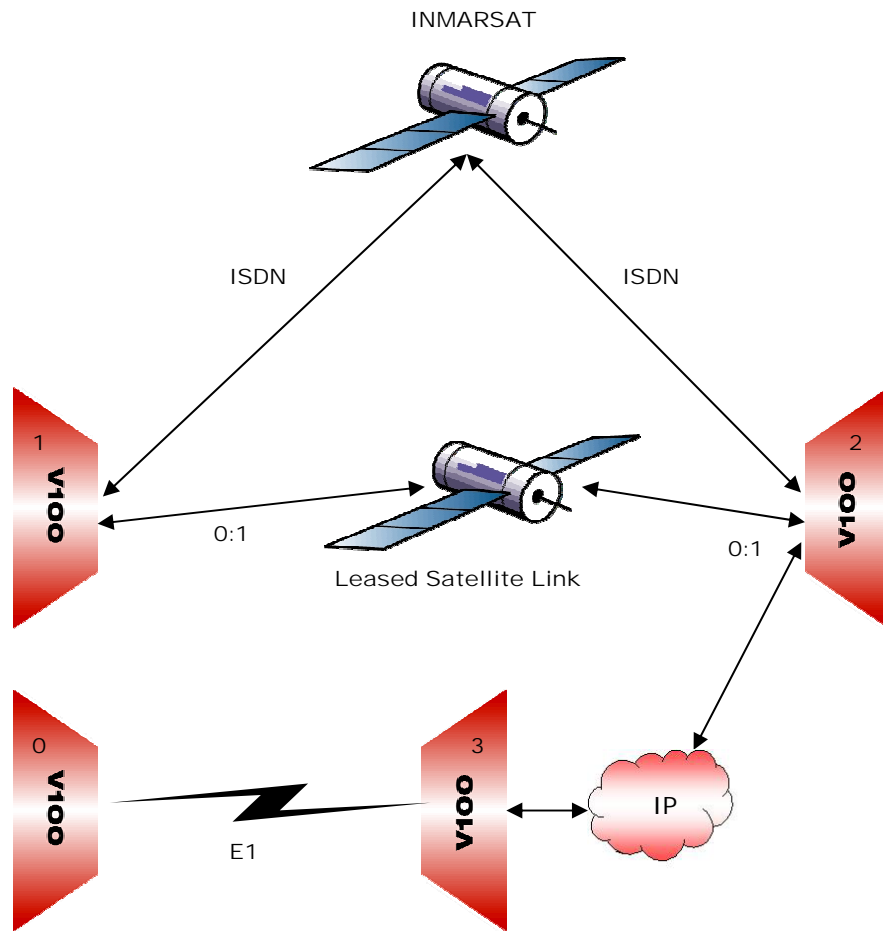
Node0 uses the E1 link to reach all other nodes. The routing table on Node0 is:

Node1 routes all non-voice traffic via the leased satellite service on port 0:1. The voice traffic destined to slot 1 on other nodes is routed via the ISDN port – the ISDN number to dial to reach Node2 is specified in the "Connect Using" field:

Node2 uses the IP aggregate to Node3 to communicate with Node0 and Node3. Voice traffic to Node1 is routed over the ISDN service. Other traffic to Node1 is routed via port 0:1:

Node3 uses the E1 link to communicate with Node0. It uses the IP aggregate to Node2 to reach Node1 and Node2:

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node3                     V100 Multiplexer Supervisor
Agg Status: 0:1 128000  E1 Lost
------------------------------[ ROUTING #1]------------------------------

Name           Node Slot Chan Agg  Connect Using           Alternate

Node0           0    ANY ANY E1
SEC: NONE           ----------------------------------------------------
Node1           1    ANY ANY IP    Node2
SEC: NONE           ----------------------------------------------------
Node2           2    ANY ANY IP    Node2
SEC: NONE           ----------------------------------------------------




<NEW ROUTE>    <DELETE ALL ROUTES>    <TIDY LIST>

------------------------------Configuration #1 is active------------------------------
Enter Text

Connected 04:54:38    Auto detect    9600 8-N-1    SCROLL  CAPS  NUM  Capture  Print echo
```

It is necessary to enter the routes to all nodes since any chassis only has knowledge of its immediate neighbours; the address in the data packets contains the full destination port address so by consulting the routing table, every node can determine the next route to the destination even if it is to an intermediate node, no matter how many nodes there are in the network.

The V100 architecture allows a maximum of 240 chassis to be interconnected in a single network and individual routing information must be entered into each chassis when the network is commissioned. Once all the data has been entered, the entire network may be managed from any node – the remote supervisor function depends on the routing tables as well!

Three options are presented on the ROUTING page, each of which may be accessed using the conventional cursor keys and selected using the <space> bar. The typical entry sequence is as follows:

STEP 1   Select <DELETE ALL ROUTES> to clear all entries and start afresh.

STEP 2   Select <NEW ROUTE> to create a new entry line in the table. This may then be accessed using the cursor keys to enter data. Repeat this step until all routes has been entered.

STEP 3   Select <TIDY LIST> to regroup the entries in a logical order. All routes from each node are arranged in ascending order, with any specific channel routes from each node at the end of each group.

NOTE: **It is not necessary to use the ROUTING menu for simple point-to-point or ring topology networks.** The complex example above requires the user to specify particular routes other than those that the V100 will automatically work out. The V100 uses a technique called implicit routing to automatically establish the most direct aggregate route to adjacent nodes. Any configured routes are overlaid on top of the implicit routes; any duplicate implicit routes are replaced. In this way, by starting with implicit routes, the entries required to set up even a complex network are minimised and the routing tables are kept as simple as possible.

Field	Options	Description
NAME	Text Field	Provides an identifying name for the route
NODE	0-255 numeric	Identity of node to which traffic will be routed
SLOT	0, 1, 2	Identifies the slot within the specified node which traffic will be routed to.
	ANY	Any of the available slots on the target NODE.
CHAN	0-31	Identifies the channel within the specified SLOT on the specified NODE which traffic will be routed to. If specified then the SLOT must contain a specific slot number.
	ANY	Any of the available channels on the target SLOT on the target NODE.
AGG	Dev: Chan	Identify the aggregate to use to route traffic to the target NODE:SLOT:CHAN
	E1	Use the E1 link card
	-	No aggregate configured
	ISDN	Route via the ISDN card in Option slot. The number to dial across the ISDN network is specified in the CONNECT USING field. If two separate routes use the same dialled number, then the terms ISDN1 and ISDN2 can be used here to differentiate the separate routes across the ISDN network
	HSC	Route via the HSC port
	IP	Route using an IP aggregate. The CONNECT USING field specifies the name of the IP aggregate to use.
CONNECT USING	Text	Only used for routes using ISDN or IP aggregates. For ISDN aggregates this is the number to dial across the ISDN network for this route. For an IP aggregate route this is the name of the IP aggregate to use – this must match the name of a configured IP aggregate.
ALTERNATE	Text	Only used for ISDN aggregates. This is an alternative number to dial across the ISDN network if the dial attempt to the number specified in the CONNECT USING field fails.
SEC	NONE	SEC is the secondary routing mode to use. Secondary routing is used to describe the rules for using a secondary path between two V100s. When a secondary path is available, secondary routing is configured by selecting a value other than NONE. Other secondary routing configurable options appear at this time.
	BACKUP	BACKUP mode allows you to specify which aggregate to use for reaching the specified Node/Slot/Channel if the primary aggregate fails.

Field	Options	Description
	RECONFIG	RECONFG is the same as BACKUP, but also indicates that the active configuration is switched to the BackUP config. This is used for selecting different tributary properties for use in the secondary routing environment - e.g. the secondary route may have much less bandwidth than the primary route, and therefore some lower priority services are not configured in the BackUp configuration.
	TOPUP, BONDING and BoD are all mechanisms for sharing the bandwidth between separate aggregates.	
	TOPUP	TOPUP works on ISDN and DATA aggregates. TOPUP will use the secondary link when the assigned tributary connection rates on the first exceed the primary link bandwidth.
	BONDING	BONDING works on ISDN and DATA aggregates. BONDING provides a permanent bonded link between the primary and secondary aggregate. IP aggregates must have their secondary routing mode set to NONE.
	BoD	BoD is used for ISDN aggregates only, and provides a traffic monitoring dial-on-demand service. The parameters for BoD are configured through the ISDN menu. This is the recommended bandwidth sharing mechanism for ISDN aggregates.

Note that more specific routes (i.e. those with specific channel and slot targets) always take precedence over least specific routes.

3.4.9   The IP Menu

The IP router feature is configured from an entry on the main menu – "IP".

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node0                     V100 Multiplexer Supervisor
Agg Status: 0:1 128000  E1 Lost
--------------------------------[ IP      #1]-------------------------------


                          GENERAL
                          NETWORKS
                          IP STATIC ROUTE TABLE
                          ACCESS TABLE
                          UDP RELAY TABLE
                          DBA POOLS
                          MAC SOURCE FILTER TABLE
                          SERVICE MANAGEMENT
                          IP AGGREGATES




                -------------Configuration #1 is active-------------------
<CR> to select item

Connected 00:10:00    Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

Under the "GENERAL" menu, the user configures the Ethernet port speed and type and enters the IP address of the DNS server in the network. In the example below, the IP router has been programmed to act as a remote DHCP server, capable of dynamically distributing IP addresses to clients. This mode would typically be used at the remote site, where the office LAN needs to be presented such that PCs and laptops can be plugged in as normal.

If more than one connection is required then a hub would be connected into the V100 via an RJ45 network crossover cable.

CHAPTER 3 CONFIGURING V100

3.4.9.1 The GENERAL menu

The parameters and options are shown in the following table:

Field	Options	Description
ETHERNET MODE	AUTONEGOTIATE, 100Mbps/FULL DUPLEX, 100Mbps/HALF DUPLEX, 10Mbps/FULL DUPLEX, 10Mbps/HALF DUPLEX	Local connection mode
DNS SERVER	Numeric IP address entry as: nnn.nnn.nnn.nnn	IP address of the DNS Server in the host network
DHCP SERVER MODE	OFF, SERVER*, RELAY**	The Integrated IP Router acts as a DHCP client. The Integrated IP Router acts as a DHCP server. The Integrated IP Router relays DHCP address negotiations transparently between the client and the host server
*SERVER MODE = "SERVER"		
LEASE	Numeric entry 0-99999 secs	Duration of the DHCP IP address lease. (0=permanent)
ADDRESS RANGE....TO	Numeric IP address entry as: nnn.nnn.nnn.nnn	Inclusive range of grantable IP addresses

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Field	Options	Description
WINS SERVER	Numeric IP address entry as: nnn.nnn.nnn.nnn	IP address of the WINS Server in the host network
DOMAIN NAME	Alphanumeric entry	Domain name of local network
**SERVER MODE = "RELAY"		
PRIMARY ADDRESS	Numeric IP address entry as: nnn.nnn.nnn.nnn	Primary IP address of the DNS Server in the host network
SECONDARY ADDRESS	Numeric IP address entry as: nnn.nnn.nnn.nnn	Secondary IP address of the DNS Server in the host network (optional)
BRIDGE PRIORITY	0-65535	Sets the Spanning Tree bridge priority.
HELLO TIME(secs)	1-10	Sets the Spanning Tree hello time.

3.4.9.2 The NETWORKS menu
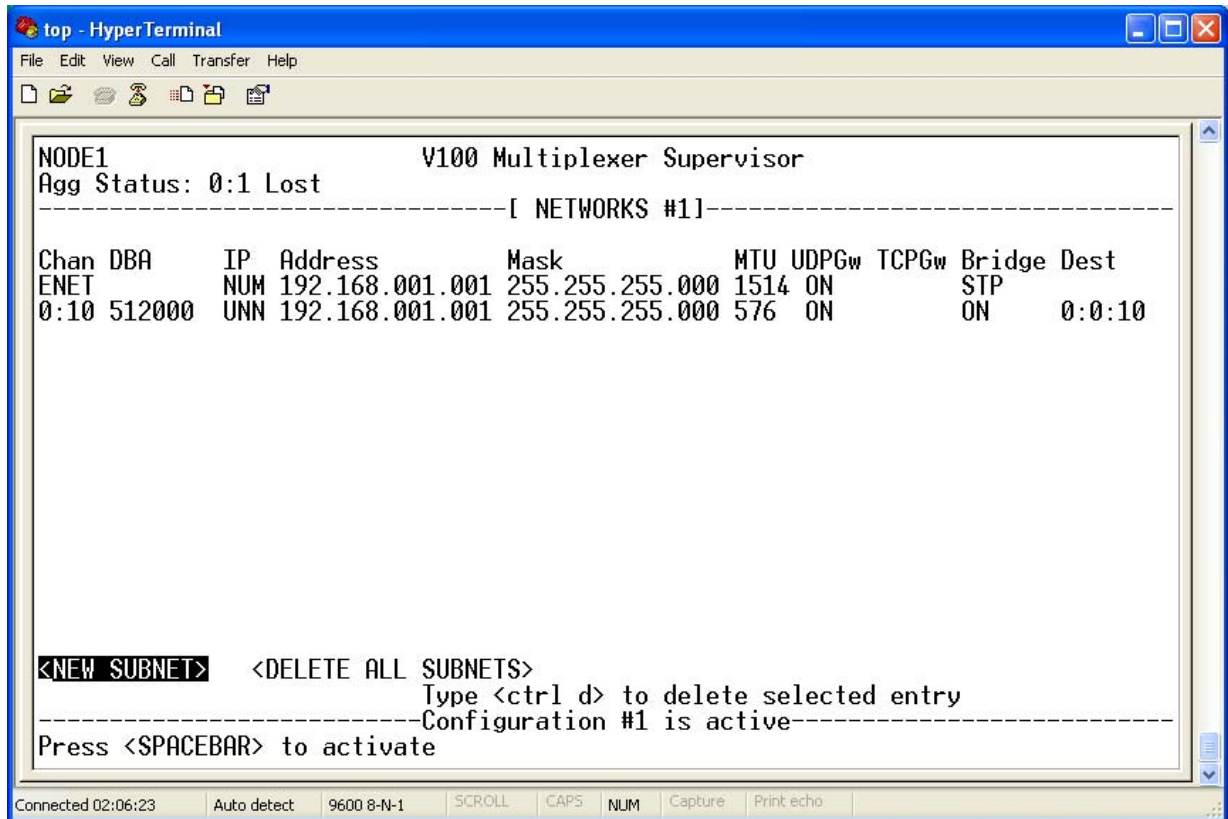
The Ethernet is represented in the user interface with the port name "ENET". The Ethernet must be configured with the IP address of the Ethernet port on the local network, and the mask of the local subnet. Any host stations (PCs), or routers on this local network, must be configured to use the IP address of the V100 Ethernet as the next-hop gateway for all IP networks that the V100 is providing interconnect services for. In the example below, the Ethernet port has been configured with the address 192.168.1.1, and the mask 255.255.255.0 – this mask allows the configuration of 253 other IP stations on the local network (two addresses are also reserved for broadcast use). The Maximum Transmission Unit (MTU) in bytes is typically left at the default value of 1514 for the Ethernet port. The UDP Gateway (UDPGw) option is discussed later in the UDP relay section.

The Bridge field allows bridging or bridging **and** Spanning Tree Protocol to be enabled on a per-port basis. If the IP field is configured as OFF and bridging is ON or STP then all traffic is bridged across the V100 network. If the IP field is NUM (for ENET port) or UNN (for tributary channels) and bridging is ON or STP, then IP traffic is routed across the V100 network and all other traffic is bridged. (See Section 0 for more information on Spanning Tree Protocol.)

The DBA and Destination fields are not used for the Ethernet port.

The TCP Gateway (TCPGw) option enables the use of the Performance Enhancement Protocol (PEP) and is either blank (because a Feature Key has not been programmed) or can be set to On or OFF, on both ENET and the logical channel.

The IP field is fixed at NUM for standard numbered packet support for the Ethernet port.

A set of numbers has been reserved within the V100 port numbering scheme for use as virtual IP ports. Being chassis ports, these are assigned to slot 0. In this example, the first virtual port, 0:10, is configured as a 512000bps DBA pipe connecting to the corresponding virtual port in the remote V100. All virtual ports use the same IP address allocation as the Ethernet port itself. It is possible to configure up to 22 such ports so as to link together the integrated routers of up 22 V100 chassis in the same IP network. Refer to section 4.13.4 for details.

The parameters and options are shown in the following table:

Field	Options	Description
CHAN	ENET, 0:10 - 0:31	Port or Virtual Port number
DBA	0-2048000	Maximum DBA rate allocation between V100 units
IP	UNN, NUM or OFF	IP routing mode. Unnumbered for tributary interfaces, numbered for the Ethernet interface or Off.
ADDRESS	Numeric IP address entry as: nnn.nnn.nnn.nnn	IP port address
MASK	Numeric IP address entry as: nnn.nnn.nnn.nnn or /bitcount	IP address mask. May be entered e.g. as "/24"
MTU	Numeric 128 to 1516	Maximum Transmission Unit. Set to give max 20mS packets
UPDGw	OFF, ON	User Datagram packet support
TCPGw	ON OFF	Enable/disable the TCP PEP optimization feature. This is only configurable if the TCPPEP feature has been purchased and the appropriate key has been entered in the feature key menu
Bridge	ON STP OFF	Bridging is enabled on the specified port Bridging and Spanning Tree Protocol is enabled on the specified port Bridging is disabled on the specified port
DESTINATION	NODE:SLOT:CHANNEL	Data will be forwarded to this virtual port address

3.4.9.3 The IP STATIC ROUTE TABLE menu

Each V100 IP router must be configured with static routes to tell it how to reach IP networks other than the one that it is locally attached to. An IP STATIC ROUTE TABLE menu screen is provided under the IP sub-menu to do this. Each configured route consists of a description, a destination address, a mask for the destination address and a next-hop:

CHAPTER 3 CONFIGURING V100

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node0                    V100 Multiplexer Supervisor
Agg Status: 0:1 128000  E1 Lost
--------------------------[ IP STATIC ROUTE TABLE #1]--------------------------

Description           Destination    Mask            NextHop
location1             192.134.063.002 255.255.255.000 192.134.244.043




<NEW ROUTE>     <DELETE ALL ROUTES>
                              Type <ctrl d> to delete selected entry
--------------------------Configuration #1 is active--------------------------
Press <SPACEBAR> to activate

Connected 00:11:27    Auto detect    9600 8-N-1    SCROLL  CAPS  NUM  Capture  Print echo
```
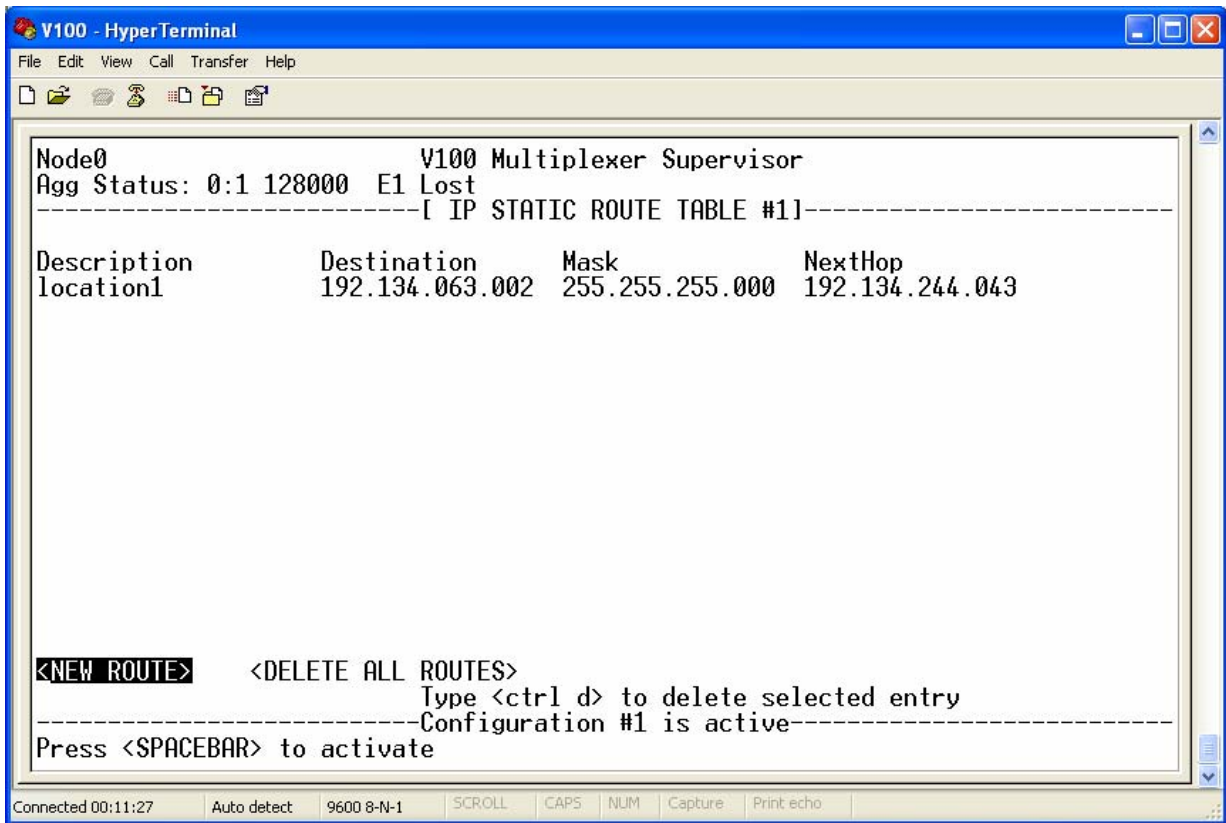
The parameters and options are shown in the following table:

Field	Options	Description
DESCRIPTION	Alphanumeric	For user entry
DESTINATION	Numeric IP address entry as: nnn.nnn.nnn.nnn	IP port address
MASK	Numeric IP address entry as: nnn.nnn.nnn.nnn or /bitcount	IP address mask. May be entered e.g. as "/24"
NEXT HOP	Numeric IP address entry as: nnn.nnn.nnn.nnn or /bitcount or Virtual port I.D. 0:[10:31] NODE:SLOT:CHANNEL	Address of forwarding node or port

3.4.9.4 The ACCESS TABLE menu

The supervisor configuration screens can now be accessed via the telnet protocol. To provide additional security to ensure that telnet access is only granted to the appropriate parties, an access table has been provided. The access table must be configured to specify which station or group of stations are allowed access to IP host facilities on the V100. Each access table entry comprises a description an IP address, an IP mask, and a service definition. When an attempt is made to access the host service (e.g. a telnet connection is requested), the access table is checked to ensure that an entry matches the requesting host. An IP address/mask pair of 0.0.0.0/0.0.0.0 will allow access from any station to the configured

service. The services that are controlled through this access are currently (i) the embedded telnet server, and (ii) "Chargen" (character generator) TCP server.

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

NODE0                    V100 Multiplexer Supervisor
Agg Status: 0:1 Lost     E1 Lost
-----------------------------[ ACCESS TABLE #1]---------------------------------
Description          Peer             Mask             Service
Telnet from all      000.000.000.000  000.000.000.000  Telnet
Chargen from PC      001.001.001.006  255.255.255.255  Chargen




<NEW ENTRY>     <DELETE ALL ENTRIES>
                        Type <ctrl d> to delete selected entry
-----------------------------Configuration #1 is active-------------------------
Press <SPACEBAR> to activate

Connected 00:26:03    Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

3.4.9.5   The UDP RELAY TABLE menu

Standard IPV4 router operation does not allow for the forwarding of subnet broadcasts. However certain network applications rely on the relay of UDP packets sent to the subnet broadcast address. For example Windows browsing service relies on Netbios datagram service packets (addressed to UDP port 138 and the IP subnet broadcast address) reaching all stations within the browsing domain. The UDPGw configuration must be turned to "On" for each port that we wish the relay operation to work on and an entry in the UDP relay table must be added for each service that must be relayed. Some well-known service types are pre-configured for addition to this table – other services require the appropriate UDP port number to be configured. The example below shows the configuration required to get legacy Windows^{TM} networking working smoothly:

```
🔴 V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help
  ▯ 🖙  📇 🔏  ▯📇 🔏  🔏

Node0                    V100 Multiplexer Supervisor
Agg Status: 0:1 128000  E1 Lost
------------------------[ UDP RELAY TABLE #1]-----------------------
SERVICE           PORT NUMBER
Domain Name       53
NetBIOS Name      137
NetBIOS Datagram  138
Other             200




<NEW ENTRY>      <DELETE ALL ENTRIES>
                         Type <ctrl d> to delete selected entry
------------------------Configuration #1 is active-----------------
Press <SPACEBAR> to activate

Connected 00:13:23    Auto detect    9600 8-N-1    SCROLL  CAPS  NUM  Capture  Print echo
```
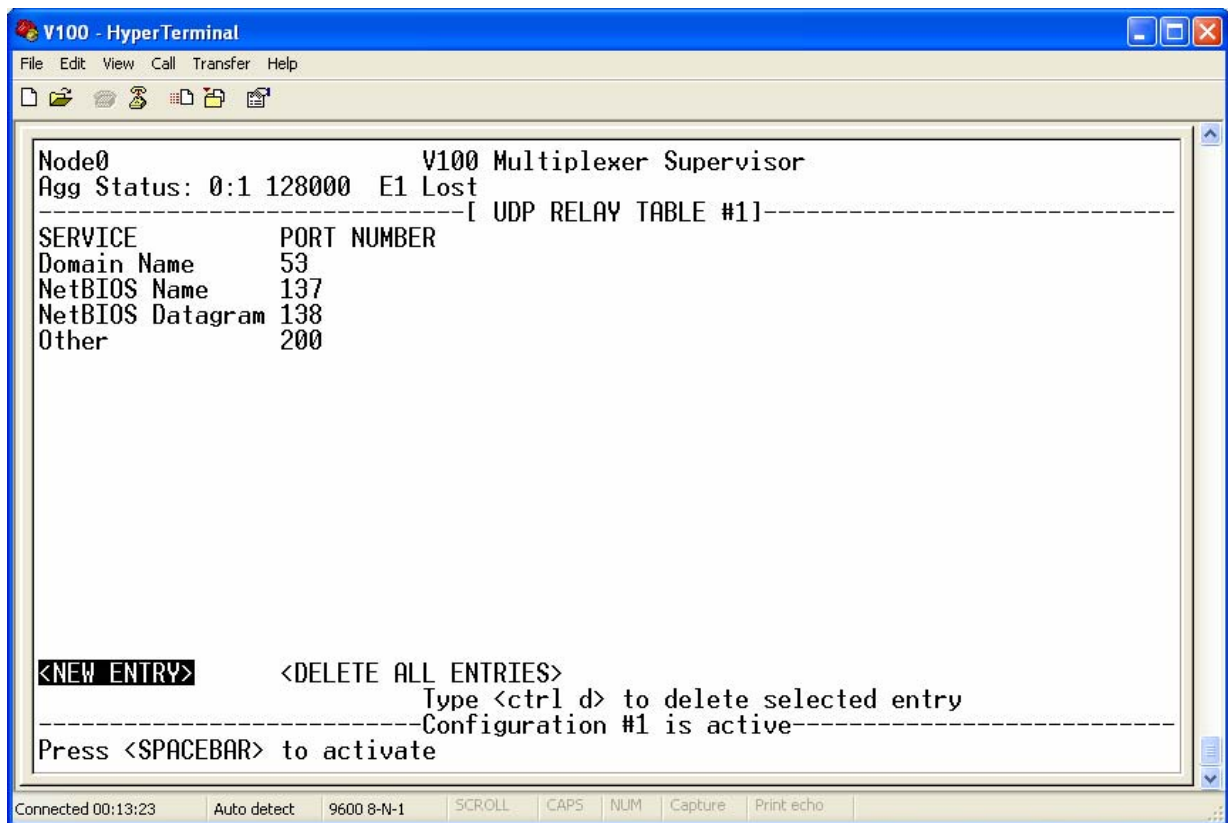
The parameters and options are shown in the following table:

Service	Port Number
Domain Name,	53
NetBIOS Name,	137
NetBIOS Datagram,	138
Time,	37
Other	For user entry

3.4.9.6   The DBA POOLS menu

DBA pools are used to pool available DBA-assigned bandwidth between IP tributaries that share a common aggregate path. The pooling allows unused bandwidth from one tributary in a pool to be assigned to other tributaries that currently have excess data routed through them. It is intended for use in networks where IP tributaries are routed across a common broadcast aggregate, or where several IP tributaries have been configured between two V100s and are used separately for service management. To use the DBA pooling, the IP tributaries must be assigned to DBA pools. There are 8 DBA pools (A-H) defined in the system. By default, no tributaries are assigned to the pools. A tributary is assigned to a pool by giving it a priority (highest/high/medium/low/lowest) within the pool. A pool must have at least two tributaries assigned to it for the pooling to be effective. The DBA pools menu provides the mechanism for assigning the tributaries to pools. All available IP tributaries are listed. Tributaries may be assigned to pools at different priorities.

The priority scheme defines how bandwidth is shared between tributaries. Each tributary always has access to the bandwidth assigned from the original DBA calculation.

However any bandwidth not used is then shared according to the following scheme:

- Highest priority tributaries share the spare bandwidth between them using as much as is needed.

- If any spare bandwidth is available after this then the remainder is shared with a weighting between high, medium and low priority tributaries

- Any spare bandwidth after this is assigned to lowest priority tributaries

Tributaries must only be configured in the same pool if they share a common aggregate path - otherwise bandwidth management will be compromised.

An example:

0:10 is an IP tributary between node 0 and node 1

0:11 is an IP tributary between node 0 and node 2

0:10 & 0:11 are routed across a broadcast aggregate.

On Node0 you can configure 0:10 and 0:11 in the same DBA pool.

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Unit0                      V100 Multiplexer Supervisor
Agg Status:
-------------------------------[ DBA POOLS #1]-------------------------------
                                   DBA POOL A
Channel    Pool Priority              Channel    Pool Priority
0:10       MEDIUM
0:11       MEDIUM




<POOL A>  <POOL B>  <POOL C>  <POOL D>  <POOL E>  <POOL F>  <POOL G>  <POOL H>
------------------------------Configuration #1 is active---------------------

Connected 02:30:13    Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

If 0:10 and 0:11 are both assigned 64kbps of bandwidth, then when 0:10 is not using its share, 0:11 has access to 128k of the broadcast aggregate. If 0:10 is only using 32kbps at any instant, then 0:11 is given access to 96kbps at the same instant.

Another example:

0:10, 0:11 & 0:12 are three IP tributaries between node 0 and node 1. 0:10 has been set up to provide bandwith for TCP application X. 0:11 has been setup to provide bandwidth for TCP application Y. 0:12 has been setup to provide bandwidth for TCP application Z. Application X is considered much more important than application Y, and Y is more important than Z.

DBA has assigned 64kbps to 0:10, 4kbps to 0:11 and 4kbps to 0:12.

By pooling 0:10, 0:11 and 0:12 together with 0:10 assigned at highest priority, 0:11 assigned at medium and 0:12 assigned at lowest priority, applications Y & Z can access the 64kbps bandwidth assigned to application X when it is not in use. Application Y gets access to the bandwidth before application Z.

3.4.9.7 The MAC SOURCE FILTER TABLE menu

This table adds a security feature to the V100 enabling the administrator to limit IP and bridge access to a defined set of end stations. By default the table is empty and no MAC source filtering occurs – all traffic is successfully received. As soon as a single entry is added to the table and the configuration changes are saved, MAC source filtering is enabled. Only stations whose MAC address appears in the MAC source filter table may access the IP and bridge services.

New entries are given a description which is used to identify the device specified by the MAC address in the table. The Address is the device's MAC address. In the example above, only the two devices with the MAC addresses 08:00:31:02:22:ad and 08:ab:11:00:a2:f4 will be able to receive traffic (however unauthorised units will still be able to receive traffic broadcast by the V100). Also, although unauthorised units will be able to access other machines on the remote network, the embedded DHCP server will not assign them addresses because it will not receive the DHCP request.

MAC source filter table entries affect all received Ethernet traffic including bridged, IP routed, PEP, and telnet traffic for the local supervisor.

A diagnostic monitor mode command is provided to view statistics from the filtering.

3.4.9.8   The SERVICE MANAGEMENT menu

The service management facility allows the V100 administrator to perform IP filtering and forwarding decisions based on fields within the protocol header in addition to the standard destination address. This allows bandwidth management per protocol, set of endstations (source and/or destination), and/or IP ToS field. Configuring the service management is a 3-stage process:

1. Defining sets of address ranges in the address definitions menu

2. Defining IP/UDP/TCP/ICMP protocol definitions in the protocol definitions menu

3. Applying address range matches against source and/or destination addresses in combination with matching IP TOS fields and protocol definitions to determine a filter disposition. This disposition is to either forward a packet down a specific tributary or discard the packet.

If no match is found in the configured filter table for a packet, then standard destination address IP routing is performed.

The Service Management feature allows the V100 administrator to perform IP filtering and forwarding decisions based on fields within the protocol header. This allows bandwidth management per protocol, set of endstations (source and/or destination) and/or IP Type of Service (ToS) field.

NOTE: **Service Management applies only to IP routed traffic. It does not apply to bridged traffic. Traffic forwarded by the PEP feature is also subject to Service Management.**

3.4.9.8.1 The ADDRESS DEFINITIONS menu

```
 V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node0                    V100 Multiplexer Supervisor
Agg Status: 0:1 128000  E1 Lost
--------------------------[ ADDRESS  DEFINITIONS #1]--------------------------
Name             Address        Mask           Operator
Internet         192.168.000.000 255.255.000.000 NOT MATCH
Location1        192.168.001.000 255.255.255.000 MATCH




<NEW ENTRY>        <DELETE ALL ENTRIES>
                           Type <ctrl d> to delete selected entry
--------------------------Configuration #1 is active--------------------------
Press <SPACEBAR> to activate

Connected 00:18:08   Auto detect   9600 8-N-1     SCROLL   CAPS   NUM   Capture   Print echo
```

NOTE: **This table does not define a filter, it only defines address ranges. Filters are created when address ranges are combined with protocols (see section 3.4.9.8.2) in the FILTER TABLE menu (see section 3.4.9.8.3).**

This menu allows the user to define the range of addresses to be used in the filtering definitions. Each range is given a name to identify it, an address range (ADDRESS and MASK), and an operator (either MATCH or NOT MATCH).

In the example above, the address 192.168.0.1 falls within the range defined by the entry INTERNET. However, since the operator is NOT MATCH, the entry only filters those addresses that **do not** fall within the address range specified. Since the address 192.168.0.1 does not fall within the range defined by the entry LOCATION1 either, Service Management filters are not applied to it.

However, the address 192.168.1.1 falls within the address range specified by the LOCATION1 entry. Since the operator is MATCH, this address is filtered using the rules defined in the SERVICE MANAGEMENT FILTER TABLE.

NOTE: **If an address definition that is in use in the SERVICE MANAGEMENT FILTER TABLE is deleted then any entries in the SERVICE MANAGEMENT FILTER TABLE that reference the deleted address entry are also deleted.**

3.4.9.8.2   The PROTOCOL DEFINITIONS menu

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node0                    V100 Multiplexer Supervisor
Agg Status: 0:1 128000  E1 Lost
--------------------------[ PROTOCOL DEFINITIONS #1]---------------------------
                 IP      ---SrcPort--    --DestPort--
Name            Proto   Min    Max      Min    Max
ToWeb           TCP     ANY    ANY      80     80
FromWeb         TCP     80     80       ANY    ANY
TFTP            UDP     ANY    ANY      23     23
V100IPAgg       UDP     1000   1002     1000   1002
prot55          55      -      -        -      -
ICMP            ICMP    -      -        -      -




<NEW ENTRY>      <DELETE ALL ENTRIES>
                      Type <ctrl d> to delete selected entry
--------------------------Configuration #1 is active--------------------------
Enter Text

Connected 00:21:06    Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

This page is used to define the protocols and ports used in the Service Management filters. Each entry is given a name which is used in the SERVICE MANAGEMENT FILTER TABLE.

The definition can either be a range of UDP ports for UDP IP packets, a range of TCP ports for TCP IP packets, or any other IP protocol. The IP PROTO field defines which IP protocol the packet is for. This is a decimal value for the IP protocol field in the received packet. Three special values of TCP, UDP, ICMP are available for common protocols. If a value other than TCP or UDP is entered, nothing else needs to be configured for the entry. If TCP or UDP (or the corresponding IP protocol number) is entered, a range of source and destination ports must be specified for the protocol definition. The range consists of a minimum and maximum (inclusive) decimal port number. The value ANY may be used to indicate the range does not matter for a particular entry. A single page of up to 14 protocol definitions is allowed.

NOTE: **If a protocol definition that is in use in the SERVICE MANAGEMENT FILTER TABLE is deleted then any entries in the SERVICE MANGEMENT FILTER TABLE that reference the deleted protocol entry are also deleted.**

3.4.9.8.3 The FILTER TABLE menu

```
V100 - HyperTerminal                                                    _ □ ✕
File  Edit  View  Call  Transfer  Help
D ⌾  ⌾ ⌛  ⌾ ⌾  ⌾

Node0                      V100 Multiplexer Supervisor
Agg Status: 0:1 128000  ISDN B1 Down    ISDN B2 Down
-------------------------[ FILTER TABLE #1]-----------------------------
Prio SourceAddr          DestAddr            TOS    Protocol        Result
01   Internet            Location1           ANY    ANY             0:10
02   Location1           ANY                 ANY    ToWeb           0:10




<NEW ENTRY>               <DELETE ALL ENTRIES>
                          Type <ctrl d> to delete selected entry
-----------------------------Configuration #1 is active-----------------
Press <SPACEBAR> to activate

Connected 00:27:15    Auto detect   9600 8-N-1    SCROLL  CAPS  NUM  Capture  Print echo
```

The FILTER TABLE combines address ranges and protocols defined in the other two Service Management menus and applies them to receive ports with IP ToS fields to define the entire filter.

PRIO

Each set of rules has a priority which defines the order the rules are applied - 01 is the highest priority. To change the priority of an entry, edit the PRIO field with a new number. All the entries are re-numbered to reflect changes to the priorities.

Filters are applied in the order of priority in the table. Once a filter is matched no other filters in the table are attempted. The SERVICE MANAGEMENT FILTER TABLE provides a single page of up to 15 entries.

ADDRESSES

The SOURCEADDR and DESTADDR fields can be configured with the value ANY or a name from the SERVICE MANAGEMENT ADDRESS DEFINITIONS menu. The value ANY indicates any source or destination address.

TOS

The TOS field may be any 8-bit hex value or the word ANY. This defines what the TOS field in the IP header should be to match the rule.

PROTOCOL

The PROTOCOL field can be configured with the value ANY or a name from the SERVICE MANAGEMENT PROTOCOLS DEFINITIONS menu. The value ANY indicates any IP, UDP or TCP protocol/port combination.

RESULT

The RESULT field is used to define the operation should all the other elements of the filter match. The entry may forward the traffic to a local port with an IP tributary (slot:port) or it may DISCARD the traffic.

NOTE: **If an address or protocol definition that is in use in the SERVICE MANAGEMENT FILTER TABLE is deleted then any entries that reference the deleted entry are also deleted.**

3.4.9.9 IP AGGREGATES menu

Each line in this menu represents a separate IP aggregate. Up to 31 IP aggregates may be specified. Additional pages are presented with menu buttons to move between pages if the number of configured aggregates exceeds the number on a single page.

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

NODE0                    V100 Multiplexer Supervisor
Agg Status: 0:1 Lost     E1 Lost
-----------------------------[ IP AGGREGATES #1]-----------------------------

            Peer             UDP      Mux   Reseq Tx
Description IP Address       Port TOS Delay Delay Clock          Rate    IP CIR
Route1      192.168.012.014 12345 1a  20    100   <GRX          512000  513400
Route2      192.168.033.012 10000 0   20    0     <GRX          502200  512000




<NEW AGGREGATE>        <DELETE ALL AGGS>
                           Type <ctrl d> to delete selected entry
-----------------------------Configuration #1 is active----------------------
Press <SPACEBAR> to activate

Connected 17:58:53    Auto detect    9600 8-N-1    SCROLL  CAPS  NUM  Capture  Print echo
```

The V100 supports multiplexing over IP networks. This is achieved through the configuration of point-to-point connections between pairs of V100s over an IP network. These connections are known as IP aggregates. The IP aggregates operate over the UDP transport protocol. The quality of tributary connections across the IP aggregate depends on the quality of service provided by the IP network. For optimum performance the IP network should provide a guaranteed level of service - where a fixed bandwidth is always available between the IP aggregate peers with minimum variation in latency. When an IP quality of service scheme is in place in the IP network, the IP QoS edge router can identify the V100 IP aggregate frames either by address/port recognition, or by configuring the IP aggregate to generate packets with a certain ToS (type of service) setting. The IP aggregate multiplexing protocol includes a facility for re-ordering multiplexed packets that were mis-ordered within the IP network (typically due to split-path routing with latency variation on the split paths). The IP aggregate can also be tuned to trade-off multiplexing overhead versus latency. A multiplexing period specifies the frequency at which tributary packets are multiplexed into IP packets over the IP network. A small multiplexing period will create a larger number of smaller IP aggregate packets. A large multiplexing period will create a smaller number of larger IP aggregate packets, thus reducing the IP header overhead at the expense of a greater multiplexing latency.

The IP aggregate protocol allows for the synchronization of V100 system clocks over the IP aggregate. An IP aggregate peer can be configured to transfer clock synchronization data (derived from the local GRX or GTX clock) to its peer. The peer can use this clock synchronization period to drive GRX and/or GTX.

NOTE: **The IP aggregates require a system clocking resource in order to run the clock synchronization period. Therefore if any IP aggregate is configured to either drive GRX or GTX via the clocking menu, or is configured to relay clock synchronization via a Tx Clock setting in the IP aggregate menu, then port 0:2 becomes unavailable for tributary or aggregate configuration.**

NOTE **Implicit routing is not supported across IP aggregates. V100 routes across the IP aggregate must be configured in the routing table.**

The parameters and options are shown in the following table:

Field	Options	Description
Description	Alphanumeric text	Up to 11 characters used to identify the configuration. This is used in the Connect Using field in the route table to match V100 routes to IP aggregates.
Peer IP Address	Numeric IP address entry as: nnn.nnn.nnn.nnn	IP address of the IP Aggregate Peer.
UDP Port	0-65535	The UDP Port number of the IP Aggregate Peer. This must be configured to the same value at each end of the IP aggregate.
TOS	0-FF hex value	Hex value relating to network provider's TOS/DSCP scheme. The IP TOS value is used in packets sent on each aggregate allows the IP aggregate network edge nodes to make bandwidth management service decisions based on IP address, UDP port numbers and/or IP TOS value.
Mux Delay	0-1000 milliseconds	The packetization period for multiplexed packets to be sent over the IP aggregate. The larger this value, the more efficient the multiplexing over the IP aggregate is. The smaller the value, the less jitter is introduced over the IP aggregate
Reseq Delay	0-1000 milliseconds	The maximum time to wait for out-of-sequence packets. This should be set to the largest expected variation in latency between different paths between the IP aggregate peers across an IP network with multiple paths. Setting this value too high creates unwanted jitter that may affect voice and data quality in networks where IP aggregate packets are lost.
Tx Clock	-	No clocking calibration information is sent to the peer.
	<GRX	Clocking calibration information is sent to the peer based on the GRX clock.
	<GTX	Clocking calibration information is sent to the peer based on the GTX clock

Field	Options	Description
	Master	Clocking calibration information is sent to the peer based on an internal clock, which can also be configured via the clocking menu to driver GRX and/or GTX
Rate	0-4096000 or automatically generated based on the IP CIR	The effective bandwidth of the IP aggregate that is available for multiplexing. This does not include the overhead of IP headers. When configured this Rate also determines the value set for the IP CIR. If a value is entered for Rate and then the user enters a value for IP CIR (discarding the automatically generated value) the Rate will be re-calculated based on the IP CIR.
IP CIR	Automatically configured based on the Rate or 0-4096000	The committed information rate required from the IP network to support this IP aggregate. This does include the overhead of IP headers, but can only be used when there is a non-zero multiplexing overhead configured. The IP CIR is automatically calculated based on the value entered for Rate. If a specific IP CIR is entered (discarding the automatically generated value), the Rate will be re-calculated based on the IP CIR.

3.4.10   E1 Link Card menu

The E1 LINK menu is displayed only when an E1 link card is detected in the option 0 slot.
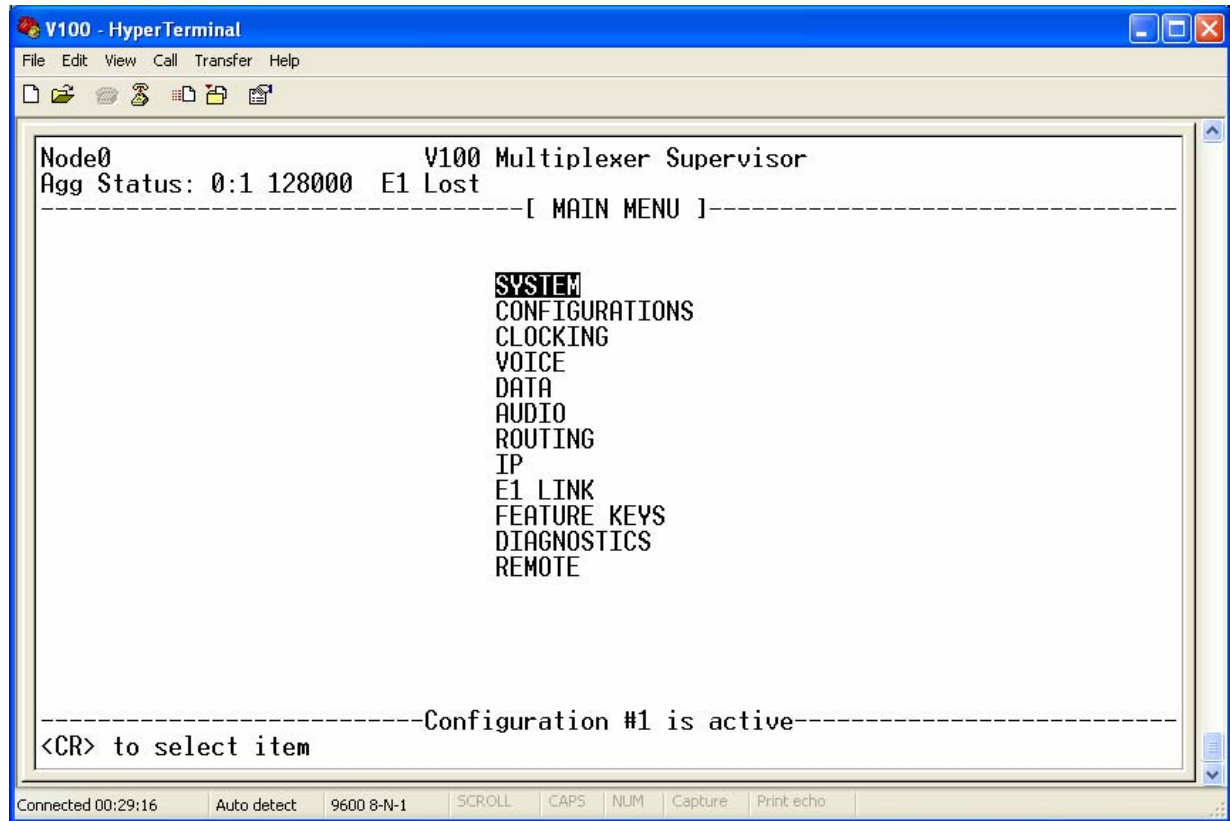
3.4.10.1   Restrictions

Due to hardware resources required for the E1 link card to operate, the following V100 functions are not available when the E1 link card is fitted to a unit:

High Speed Channel (HSC)

Internal PLL operation on port 0:2

When the E1 LINK option is selected, the following screen is displayed:

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node0                    V100 Multiplexer Supervisor
Agg Status: 0:1 128000  E1 Lost
----------------------------[ E1 LINK ]----------------------------


               OPERATING MODE   :  FRAMED
               LINE CLOCKING    :  SLAVE
               LINE TERMINATION :  75 OHM
               LOOPBACK MODE    :  NONE
               CRC4             :  ON

               TSLOT ASSIGN




               ------------------Configuration #1 is active------------------
Use <SPACE>/+ or - to select

Connected 00:29:51    Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```
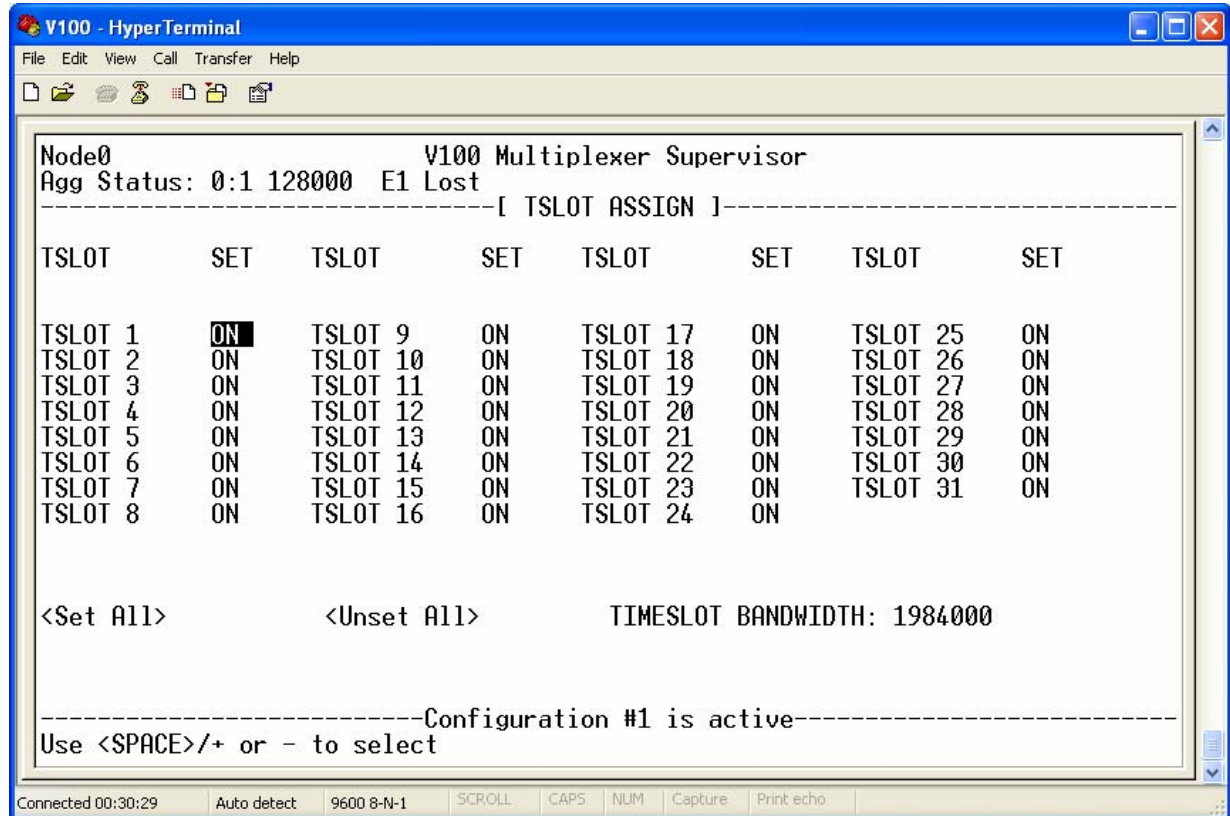
The parameters and options are shown in the following table:

Field	Options	Description
Options always present		
OPERATING MODE	Framed	The E1 link is a 2.048MHz G.704 structured link with 32, 64Kbps timeslots. In this mode framing data is carried in Timeslot 0.
	Unframed	The E1 link is a 2.048MHz unstructured link.
LINE CLOCKING	MASTER	The V100 provides a G.703 compliant clock to the link.
	SLAVE	The V100 recovers the clock from the link
LINE TERMINATION	75 Ohm, 120 Ohm	Termination resistance applied to the line.
LOOPBACK MODE	NONE	No loop back is present
	LOOP	Local loop. The card's Tx is looped to the Rx
	ECHO	Remote loop. Data Received by the link card is transmitted back to the remote end
Options present only when "Operating Mode" is "Framed"		
CRC 4	On, Off	Selects whether G.704 Cyclic Redundancy Check 4 error checking is carried out
TSLOT ASSIGN	Sub Menu	Provides accesses to the timeslot assignment submenu described in the following section

3.4.10.2 The TSLOT ASSIGN Menu

It is possible to hire a fractional E1 link from Telcos in which not all of the 31 available timeslots are allocated to carry data (only a maximum of 31 timeslots are available to carry data on a structured link as timeslot zero is used for framing). Hiring a fractional E1 link will reduce the cost.

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node0                    V100 Multiplexer Supervisor
Agg Status: 0:1 128000  E1 Lost
--------------------------------[ TSLOT ASSIGN ]--------------------------------

TSLOT       SET    TSLOT       SET    TSLOT       SET    TSLOT       SET


TSLOT 1     ON     TSLOT 9     ON     TSLOT 17    ON     TSLOT 25    ON
TSLOT 2     ON     TSLOT 10    ON     TSLOT 18    ON     TSLOT 26    ON
TSLOT 3     ON     TSLOT 11    ON     TSLOT 19    ON     TSLOT 27    ON
TSLOT 4     ON     TSLOT 12    ON     TSLOT 20    ON     TSLOT 28    ON
TSLOT 5     ON     TSLOT 13    ON     TSLOT 21    ON     TSLOT 29    ON
TSLOT 6     ON     TSLOT 14    ON     TSLOT 22    ON     TSLOT 30    ON
TSLOT 7     ON     TSLOT 15    ON     TSLOT 23    ON     TSLOT 31    ON
TSLOT 8     ON     TSLOT 16    ON     TSLOT 24    ON


<Set All>          <Unset All>       TIMESLOT BANDWIDTH: 1984000



--------------------------Configuration #1 is active--------------------------
Use <SPACE>/+ or - to select

Connected 00:30:29    Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

If the E1 link card is connected to a fractional link, it is necessary to describe which of the 31 timeslots are available to carry the aggregate data. This is done via the TSLOT ASSIGN menu.

The menu has one entry for each of the possible data timeslots, labelled "TSLOT 1" through "TSLOT 31", each entry can be turned on or off by a toggle item. The entries can be navigated using the arrow keys and the entry toggled using the space bar. The current available bandwidth in Kbps is displayed beneath the entry table at the right hand side of the screen. When the aggregate is established, the available bandwidth is also displayed on the status bar. Two buttons are provided to ease configuration, one labelled "SET all" which turns all timeslots on and one labelled "Unset All" which turns all timeslots off.

3.4.11 The SECURE VOICE RELAY card

The four-channel analogue voice motherboard(VI68701) may optionally be fitted with a further four-channel daughterboard(VI68702) which offers an additional four channels with the same facilities, or a Secure Voice Relay Card (VI68709) which extends the functionality of the basic four channels to support data relay for STU-IIB or STU-III encrypted telephones on any or all channels. The Secure Voice

Relay (SVR) card has the same footprint as the voice daughtercard and attaches in the same way to the voice motherboard. On the rear panel, connectors 1 to 4 only are activated.

When fitted, the SVR card operates transparently with the analogue voice motherboard with no user intervention and does not restrict any of the normal clear voice functions normally available from the V100. All normal forms of analogue traffic are therefore still supported, including fax and data modem relay. All four channels may be operated with or without STU traffic, with different compression algorithms and with different line interfaces, just as before.

STU-IIB or STU-III telephones may be operated in secure mode at three digitisation rates; 2400bps, 4800bps or 9600bps. The V100 SVR card requires 5200bps, 7600bps and 12400bps to perform the relay function at each rate respectively and so when in relay mode, a slightly higher bandwidth is use by the channel. It is advisable to take this into consideration when planning bandwidth budgets.

In operation it is normal to establish a non-secure call from the connected Secure Telephone Unit (STU) in the normal way. Once established, the users confirm their identity verbally and then enter secure mode at either end. During this process, the STU devices perform a training sequence similar to that of a dialup modem, which is demodulated, transferred by the V100 to the remote end and remodulated in both directions. Once the training sequence is complete, the STU devices send encrypted data to each other transparently via the V100. When the call ends, the STU devices may either return to clear voice mode or terminate the call in the normal way. **At no time does the V100 decrypt or decipher the secure information.**

3.4.12 The ISDN Link Interface Card

The ISDN Basic Rate Link Interface card (VI68711) presents an ISDN 'S'-bus interface, compatible with any Euro-ISDN (NET3) network as standard (other national standards are supported by request from the factory), on the standard 8-way RJ45 connector. It gives the V100 the ability to dial up a single 64K bearer for communication with another V100 unit, which may be used as the sole aggregate, a supplementary aggregate or as a backup service for an aggregate port. The card is also available with a 'U'-bus presentation (see Part Numbers).

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node0                       V100 Multiplexer Supervisor
Agg Status: 0:1 128000  ISDN B1 Down      ISDN B2 Down
-------------------------------[ MAIN MENU ]----------------------------------


                        SYSTEM
                        CONFIGURATIONS
                        CLOCKING
                        VOICE
                        DATA
                        ISDN BRI EXTENDER
                        ISDN
                        ROUTING
                        IP
                        FEATURE KEYS
                        DIAGNOSTICS
                        REMOTE




-------------------------Configuration #1 is active---------------------------
<CR> to select item

Connected 00:31:41   Auto detect   9600 8-N-1   SCROLL   CAPS   NUM   Capture   Print echo
```

The card provides the V100 with a dual 64K bearer interface, either of which may be used as a permanent connection or dialled up in response to bandwidth requests from any tributaries that are routed over it.

To use the ISDN interface as a 64K backup service to another aggregate, it should be specified as a secondary route to a normally available primary aggregate (the corresponding unit must, of course, also have an ISDN Link Interface fitted). If the primary route fails, all connections are then re-routed via the ISDN interface, which will automatically dial the stored destination number.

This principle may be extended to provide top-up bandwidth on a temporary basis, simply by overbooking bandwidth on the primary route with the ISDN interface specified as the secondary route. Then, when a connection cannot be made over the primary route through congestion, the ISDN interface will automatically be used. The ISDN call will be maintained until all re-routed connections are closed, even if the primary route becomes free. Next time, the primary route will be used as normal.

LINK MODE

In normal operation the card is configured to **Dial On Demand,** in which case the ISDN link will be dialled when the first request for a connection is made, for example by a voice channel or data port which is routed over the ISDN link (See ROUTING). The ISDN connection will remain up until the last channel clears its bandwidth request or there is no traffic activity for the configured activity timeout (SYSTEM menu). It is also possible to specify which end makes the call by setting the other end into **Answer** mode (This can be useful for billing purposes).

CALL TIMER

The ISDN service carries a tariff based on call duration. It is therefore advantageous to be able to limit the maximum duration to prevent excessive call charges. The Call Timer offers a selection of times, including a permanent mode, after which any ongoing ISDN calls are dropped.

LINE TYPE AND TEIS

The user must configure the ISDN Link Interface to operate according to the correct service type. "Point to Point(PP)" mode requires fixed (known) Terminal Endpoint Identifiers (TEIs) to be set for Layer 2 of the protocol to establish a connection. The number is usually 0 but may be set in the range 0-63. Layer 1 is activated immediately with or without a call and Layer 2 comes up and stays up. This is useful for fixed links which use the ISDN network for connectivity. It is applicable to both S0 and U0 interfaces.

"Point to Multi Point(PMP)" mode, TEIs are negotiated automatically with the network via a broadcast channel 127 and assigned a number in the range 64-126. Layer 2 of the protocol is activated by an exchange of SABME UA (Unnumbered Acknowledge) messages and thereafter by sequentially numbered messages. This is stimulated by placing a call, which brings up first layer 1 and can take a few seconds to activate. Once activated, Layers 1 and 2 will stay active until physically disconnected. It is possible therefore that the first call may fail following line connection, but calls will always succeed thereafter. This is true for both S0 and U0 interfaces.

ISDN PROTOCOL

When the Line Type is changed, the menu is refreshed to display the correct TEI mode. Access to the TEI field itself is only permitted in Point-to-Point(PP) mode.

The ISDN protocols are programmed into the ISDN Link Interface Card in the factory and fall into two choices; EURO or US. If US protocols have been provided, it is possible to select from NI(National ISDN), AT&T 5ESS(Custom) and Nortel DMS100.

SPIDS AND LDNS

These are only applicable to ISDN connections in the USA and only therefore appear if the ISDN Link Interface is fitted with an American software stack. **The Service Profile IDentifier** (SPID) is a number assigned by the Local Exchange Carrier (LEC) or ISDN provider when the customer requests an ISDN line. It allows the network to associate the correct level of functionality with the terminal and also to identify a unique terminal on a BRI circuit (to which up to 8 may be connected) with the same directory number.

The generic SPID format is comprised of 14 digits which can be divided into the following three components: a 10 digit telephone number, a 2 digit Sharing Terminal Identifier and a 2 digit Terminal Identifier (TID). The 10 digit number is the main directory number associated with the terminal and includes the 3 digit area code. The 2 digit TID differentiates terminals that have the same main number and the same Sharing Terminal ID. These terminals have the same service profile, which means they have access to the same services and translations in the ISDN network switch. TID values range from

"01" to "08", with values assigned in sequential order beginning with "01". Terminals not sharing the same main number always use the value "01" by default.

Although the generic SPID format allows for many different combinations of Sharing TID and TID, configurations that use values other than "0101" may not be available from all ISDN service providers.

Local Directory Number (LDN): Used for call routing, the LDN is associated with a SPID and therefore with North American BRI interfaces. It is necessary for receiving incoming calls on the second B-channel.

SPID ALLOCATION

SPID Allocation may be performed manually by the user, who simply appends the relevant codes (if known) to the 10 digit local telephone number. Alternatively, if his ISDN service supports it, the V100 offers an Automatic SPID mode in which only one SPID is supported. The SPID 1 and LDN 1 fields cannot be entered and if a SPID response is received from the network in response to the first call, the fields are automatically updated on the menu. A third option – "Auto + SPID guessing" requires the user to enter the LDN field only. This enables the switch to guess against a likely or similar SPID to reduce the response time. This mode is recommended.

ANSWER DELAY

The Answer Delay is the delay in milliseconds between the V100 being presented with an ISDN call, and it indicating to the network that it can answer that call. It may be required when the V100 ISDN port is attached to equipment that is sensitive to the immediate answering of presented calls.

Some examples of the used of the SPIDs, LDNs and Allocation are given below:

US 'S' PMP, NI-1 ISDN, Manual SPID Entry

The above mode is used if the SPIDs and LDN values are known. The second fields may be left blank when only the first SPID entry is required. The SPID format is different for both the Switch Types and the Local Telecom Provider used, and knowledge of this is required before entry. A SPID code is asserted around the LDN with examples shown above.

All North American SPID codes tend to use this but the SPID entry requires local knowledge of the network type as well as the switch, ie two different networks using AT&T switches will have different SPID codes. Example entries might be as follows: NI   <nnnxxxxxxx0101> where nnn = 3 digit area code. xxxxxxx = 7 digit number.

AT&T <01xxxxxxx0>.

US 'S' PMP, NI-1 ISDN, Automatic SPID Entry

Only one SPID is supported. The SPID 1 and LDN 1 fields cannot be entered.

The ISDN Terminal Adaptor is programmed with blank SPID and LDN fields. The Auto SPID status is updated to give an indication of the Network Auto Switch response, once a call is made and the SPID/LDN fields are updated if a SPID response is received from the network. The SPID/LDN values are not saved in the configuration.

US 'S' PMP, NI-1 ISDN, Auto SPID Entry with SPID Guessing.

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node0                   V100 Multiplexer Supervisor
Agg Status: 0:1 128000  ISDN B1 Down    ISDN B2 Down
-------------------------------[ ISDN #1]-----------------------------------

    LINK MODE             : Dial On Demand
    CALL TIMER            : 5 mins
    LINE TYPE             : PMP                 TEI Mode  : Auto
    TEI                   : Broadcast 127
    ISDN Protocol         : NI(National ISDN)
    SPID Allocation       : Auto + SPID Guessing  <Enter LDN 1>
    AUTO SPID Status      : ->NoSpidDetect
    SPID 1                : 01010101010101
    LDN  1                : 1504567899
    ANSWER DELAY (ms)     : 0

    BoD DIAL THRESH (bps)  : 56000
    BoD CLEAR THRESH (bps) : 56000
    BoD DAMPING FACTOR (%) : 50
    BoD SEC ACTIVITY TIMER : 30 seconds


    ------------------------Configuration #1 is active------------------------
Use <SPACE>/+ or - to select

Connected 00:37:15    Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

Only one SPID is supported. In this case, SPID guessing requires the user to enter the LDN field only. This enables the switch to guess against a likely or similar SPID to reduce the response time. This mode is recommended. The SPID 1 field is set to SPID guessing format with the code above. The ISDN Terminal Adaptor is programmed as above. The Auto SPID status is updated to give an indication of the Network Auto Switch response, once a call is made and the SPID/LDN fields are updated if a SPID response is received from the network. The SPID/LDN values are not saved in the Configuration.

BOD

The BoD settings control the ISDN call management strategy when the secondary routing mode is set to BoD. The Bandwidth on Demand (BoD) feature continually monitors the level of traffic that is routed through the ISDN interface, and raises and clears the second bearer as required and configured. The traffic levels are calculated with a damping factor to avoid unnecessary dial and clear events in bursty traffic situations. The lower the damping factor the faster the V100 is to react to changes in traffic patterns (at the cost of potentially unexpected dial/clear events in bursty networks). When the dampened traffic level exceeds the dial threshold the second bearer is dialled. Once established, traffic is split between the two bearers. When both bearers are established and the dampened traffic level drops below the configured clear threshold, all traffic is routed over the first bearer channel. The second bearer is dropped if the dampened traffic level remains below the dial threshold for the secondary activity timer.

The parameters and options are shown in the following table:

Field	Options	Description
LINK MODE	Dial On Demand,	ISDN number dialled on first bandwidth request. Incoming calls also answered.
	Answer,	Incoming calls answered only.
	Dial Demand/Suspend	ISDN number dialled on first bandwidth request. Incoming calls also answered. ISDN connection dropped during idle periods of async data.
CALL TIMER	5min, 10mins, 20mins, 1 hour, 2 hours, 5 hours, 10 hours, 24 hours, Permanent	Maximum single call duration. The ISDN call will be terminated when this duration is exceeded.
LINE TYPE	PMP,	Point-to-multipoint. This is the default for Euro ISDN.
	PP	Point-to-point. A TEI must be entered in the range 0-63.
TEI	Broadcast 127,	PMP type for information only
	0-63	PP Terminal Endpoint Identifier
ISDN PROTOCOL	EURO ISDN,	ETSI NET3 European protocol. Information only.
	NI (National ISDN), ATT 5ESS, Nortel DMS-100	Visible only when the US protocols are loaded. These are the most common US protocol types.
SPID ALLOCATION	Manual,	SPID and LDN must be entered by the user.
	Automatic*,	SPID1, LDN1 are displayed automatically when allocated by the network
	Auto + SPID Guessing**	
AUTO SPID STATUS	* **Visible only in Automatic allocation modes	Displays the current status of SPID negotiation with the network. The SPID number is displayed when successful.
SPID1	Special field	Manual : Numeric Entry Automatic: Information only Auto+Guessing: 01010101010101
LDN1	Special field	Manual : Numeric Entry Automatic: Information only Auto+Guessing: Numeric Entry
SPID2	Special field	Numeric Entry, visible in Manual SPID allocation
LDN2	Special field	Numeric Entry, visible in Manual SPID allocation
BoD DIAL THRESH (bps)	0-64000	Sets the Bandwidth on Demand dial threshold which determines when the second bearer channel is dialled.
BoD CLEAR THRESH (bps)	0-64000	Sets the Bandwidth on Demand clear threshold which determines when the second bearer channel is dropped.
BoD DAMPING FACTOR (%)	0-99	Sets the Bandwidth on Demand damping factor which is used to calculate traffic levels and hence whether to dial up or drop the second bearer channel.
BoD ACTIVITY TIMER	0-86400	Sets the Bandwidth on Demand activity timer which determines after what time the second bearer is dropped if the dampened traffic level remains below the dial threshold
	PERMANENT	The second bearer channel is never dropped

3.4.13 ISDN Network Extension Card

The ISDN Network Extension Card (VI68706) allows a local 2B+D Basic Rate Interface (BRI) to be presented at a remote location via the V100 network. At the local end, the card is plugged into the terrestrial ISDN network as a standard terminal device (TE mode) and at the remote location, the ISDN interface is presented by the card to look like the ISDN network (NT mode). The cards then operate together by converting the data at the ISDN BRI (two B channels and one D-channel) into a synchronous bitstream, which is transmitted over dedicated bandwidth between the two V100 units and then reconverting the synchronous bitstream back into an ISDN BRI.

Each B-channel requires 64Kbps of bandwidth and in the V100 implementation, just 9.6Kbps of bandwidth is required for the D-channel protocol. The minimum advisable link bandwidth is therefore obtained from the following equation:

Link Bandwidth >= (64000*Number of bearers needed + 9600)/0.875

So if only one bearer will be used, a minimum link bandwidth of 84800bps is needed, or if both will be used, 157600bps. A typical application could be to extend analogue voice and ISDN bearer services over a satellite link to a remote destination, allowing a videoconferencing terminal to be connected at the same time as voice and data:
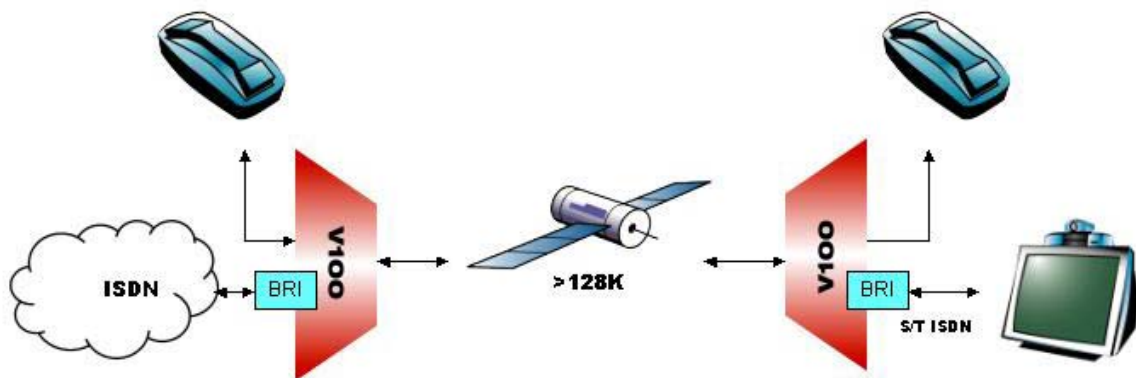
```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

NODE1                          V100 Multiplexer Supervisor
Agg Status: 0:1 Lost     ISDN B1 Down     ISDN B2 Down
------------------------------[ ISDN BRI EXTENDER #1]------------------------------


                               -RX clock- -TX clock-
Channel          Mode        Bearer     Ref        Ref       Activity      Destination
  2:1            NT           Both       <GRX        -        On-Demand       1:1:1












-------------------------------Configuration #1 is active-------------------------------
Use <SPACE>/+ or - to select

Connected 00:26:57    Auto detect    9600 8-N-1    SCROLL    CAPS    NUM    Capture    Print echo
```

In TE mode the card accepts the 48V supply from the network as a normal terminal device. In NT mode the card provides the 48V supply for passive ISDN terminal equipment.

ISDN networks world-wide comply with ITU recommendation I.430 which defines a common physical layer interface. However, several different and incompatible D-channel protocols have been implemented, leading to problems for equipment manufacturers. The V100 ISDN BRI Extender card overcomes these restrictions, since the extension technology converts data at the physical level S-bus interface and may therefore be used world-wide.

The ISDN service may be provided either as a permanent connection or set up on-demand in response to dialling requests from the network (at the TE end) or a terminal device (at the NT end), in which case the bandwidth is reassigned by the V100 between calls.

NOTE: **To ensure the optimum transmission efficiency and reliability, it is recommended that the BRI Extender Card be the only equipment connected to the NT1 of the ISDN network. The cable length should not exceed 1000m.**

CHANNEL

The ISDN Basic Rate Extender card is presented as one logical channel, which comprises both 'B' channels and the 'D' channel. It must always be referred to in mapping as channel number '1'.

MODE

The BRI Extender card fundamentally operates in one of two modes; either as a terminal device (TE), when it should be connected to an ISDN network, or as a network device (NT) when a terminal device should be plugged in to the card. The QSIG variants of each mode allow the cards to be connected to ISDN trunk lines on a digital PBX.

BEARER

This field allows Bearer1, Bearer2 or both bearers to be enabled for use. A full basic rate ISDN service would require 137.6Kbps of bandwidth to support but this may be reduced by limiting the number of bearers.

RX AND TX CLOCK REF

In order to distribute the ISDN clock throughout the V100 network, the ideal configuration would drive one of the Global Clock busses with the clock from the TE card, by selecting BRI EXT as the GRX SOURCE in the CLOCKING menu for example. This would then form the clock reference for all tributary channels in the TE mux, which could then onward link the clock over the satellite link. The recovered satellite clock is then driven on to the GRX bus of the V100 at the remote end and the BRI Extender card in NT mode uses this to synthesise a clock for the ISDN network presentation.

ACTIVITY

Users will normally take advantage of the switched nature of calls supported over the BRI Extender Card; "On Demand" mode allows bearer bandwidth to be allocated only when it is required. The channel may be forced into permanent operation to guarantee bandwidth at all times; this can be useful if the V100 is operating many switched services at the same time.

DESTINATION

The destination of the remote channel must be specified.

3.4.14 The FEATURE KEYS menu

The feature keys menu allows the entry of encrypted keys which enable enhanced features in the V100. Two types of keys are supported – permanent keys are purchased to permanently enable the features. Temporary keys are available to trial test a feature. They are active for up to 24 hours or until the V100 is restarted. Please contact Vocality International to obtain the appropriate keys for your units.
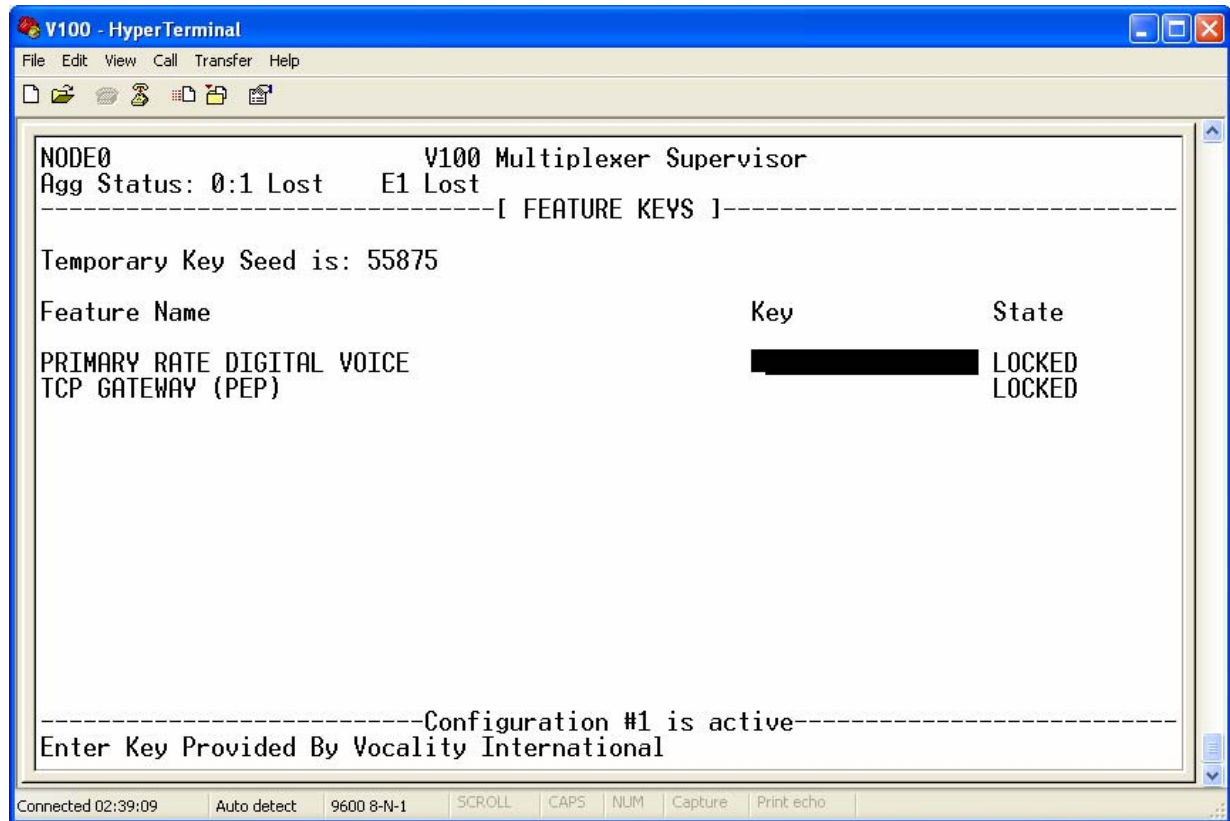
Select the feature you want to enable and then enter the key provided by Vocality in the appropriate field. Press <Enter> to accept the key. The screen below shows the TCP Gateway (PEP) feature has been temporarily enabled.

3.4.15 The DIAGNOSTICS menu

The Diagnostics menu allows the user to monitor all of the internal configuration, alarms and connection status messages that the unit generates. A small sub-menu presents several options, which allow the user to monitor the status of the integrated IP router or to view connection, configuration or alarm messages in a rolling display (with a combination of all three also available) or to view a HELP screen as the sixth option. These may be captured using, for example Windows™ Hyperterminal, for inspection at a later time. Refer to Section 4.3 for a detailed description of the diagnostics tools available.

3.4.16 The REMOTE menu

This Main Menu screen allows the user to log on to any unit in the network, by selecting the "REMOTE" option. The user is then prompted for the node I.D. number of the unit to be selected, as shown below:
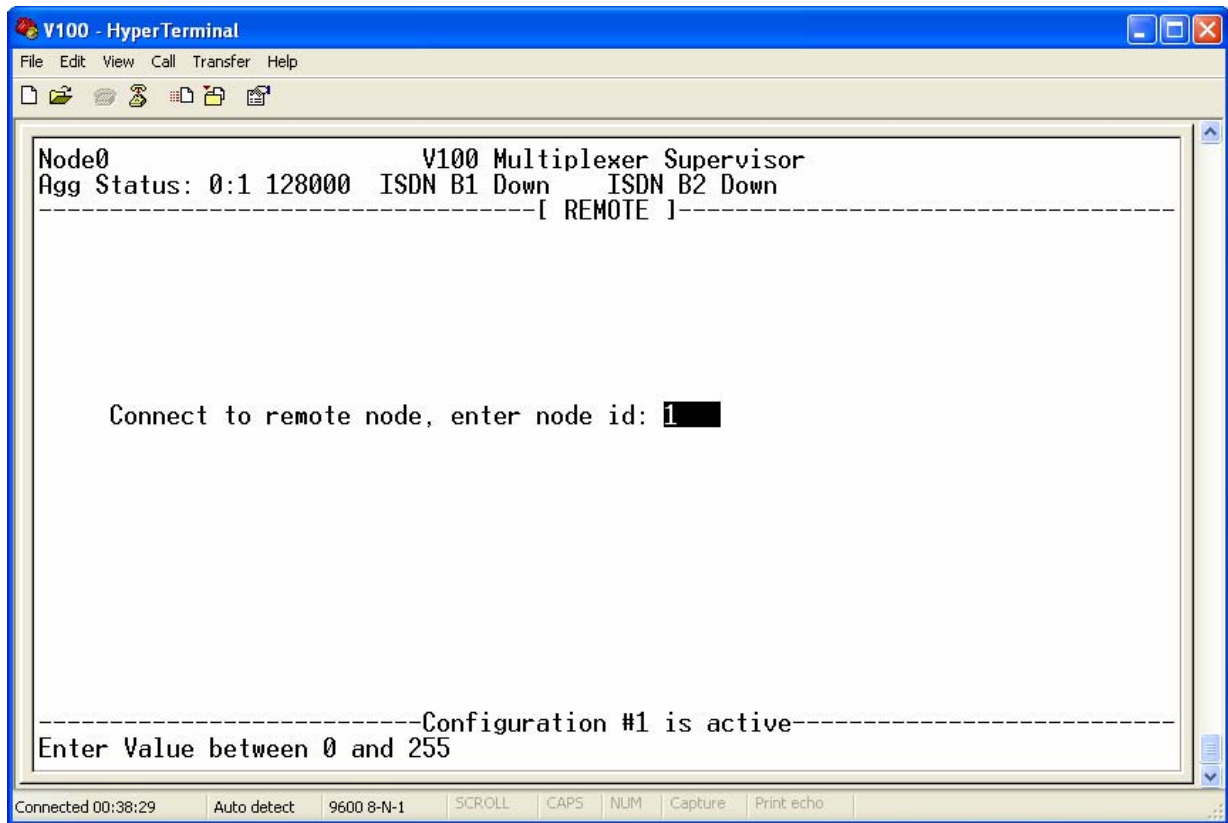
The required node number is then entered, followed by <CR> and the following message then appears:

"Connecting to node N. Please wait..."

If the connection is successful, the menu selection page of the chosen unit is then presented, as if logged on locally. All menus appear as normal and any data edited and accepted will be stored in the logged chassis. To return to the local unit, enter <CTRL>&<E> at any time. To configure or monitor a different unit, return to the local unit (the only location at which the "REMOTE" menu option is provided) and enter a different node I.D.

If the chosen unit cannot be reached due to, perhaps, a faulty or unconfigured aggregate route, the following message is displayed:

"Failed to connect to node N. Press any key..."

After pressing a key, the main menu selection page is again displayed. The user can then inspect the local menus to discover why the chosen remote could not be reached.

WARNING:

During the remote configuration process, it is of course possible to change settings which could result in loss of carrier to that remote unit. Under these circumstances, unpredictable results may occur. Be cautious when changing the configuration settings of any remote aggregate ports!

NOTE:

When a remote node is accessed, the connection to the chosen unit requires at least 2400bps of bandwidth, which must be available throughout the route to that node. If the route already supports a DBA (Dynamic Bandwidth Allocation) connection, the DBA rate will drop by 2400bps. If not, the connection to the remote supervisor will itself act as a DBA connection and use as much spare bandwidth as is available. This process is automatic and ensures that the responses of the remote unit are as rapid as possible.

Chapter

4

4 Features

4.1 Indicators

The V100 has six (RevC unit five) LED indicators on the front panel for displaying the status of the unit, as follows:

The port1 and port2 LEDs have three states in aggregate mode:

Fast flashing RED when carrier is lost

Solid GREEN when carrier is present

Flashing GREEN when a loop is detected on the port

In tributary mode the LEDs indicate data activity:

GREEN for good data packet sent or received

RED for an errored packet sent or received

The test LED has two states:

Solid RED when the unit has no valid configuration

Solid GREEN when an ISDN link call is made (RevC only) or as a power-on indicator (RevD only)

The option1 and option2 LEDs indicate data activity on the option card.

The option0 LED (for RevD only) indicates carrier on the special option card, which could be either the TDM Interface, ISDN Basic Rate Link Interface, E1 Link Card or IP Aggregate.

The LEDs are all illuminated RED for a short period when the unit is power cycled, whilst the self-test is in progress. When no LEDs would be illuminated or the unit is quiescent, an oscillating display is shown on the LEDs to indicate the unit has power.

4.2 Alarms

The alarm relay is a voltage-free single-pole changeover relay, which is activated when any ports on the local unit designated as aggregates do not have carrier with a remote unit. It is also activated when power is lost from the chassis.

The relay provides a set of normally-open and a set of normally-closed contacts. These may be used to drive an external visual or audible alarm or to integrate with a network management system.

4.3 Diagnostics

4.3.1 IP

There are a number of troubleshooting tools in an IP sub-menu beneath the DIAGNOSTICS menu. These tools allow the user to run the ping protocol (ICMP echo) from the V100, view the current internal IP route table, view the statistics from the IP router, view the statistics from the Ethernet device, and view the Address Resolution Protocol (ARP) table. When the network is not performing as expected, these tools can be used to troubleshoot behaviour.

The Diagnostics, IP sub-menu is shown below:
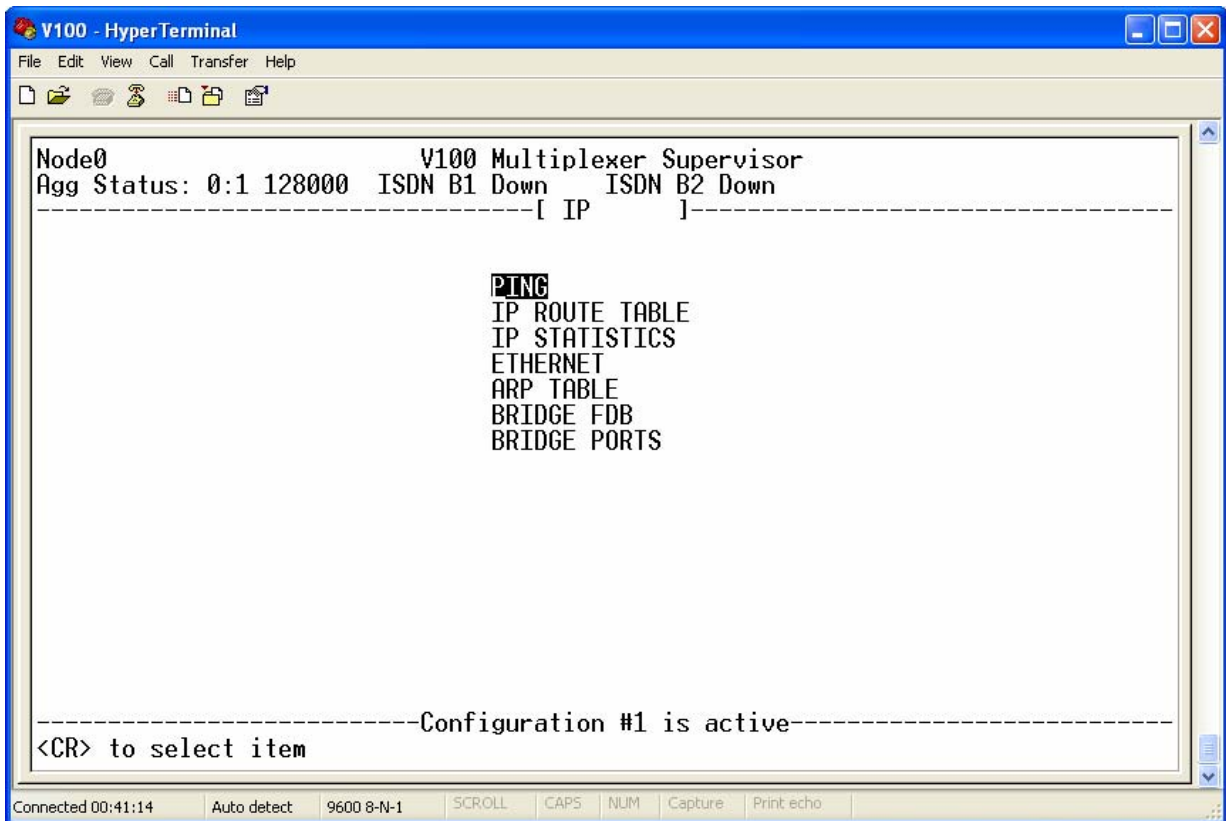
4.3.1.1   The PING menu

This menu provides the user with a series of screens, which can be used for running Ping tests and analysing the results. Refer to the following example configuration for IP routing across a pair of V100s:
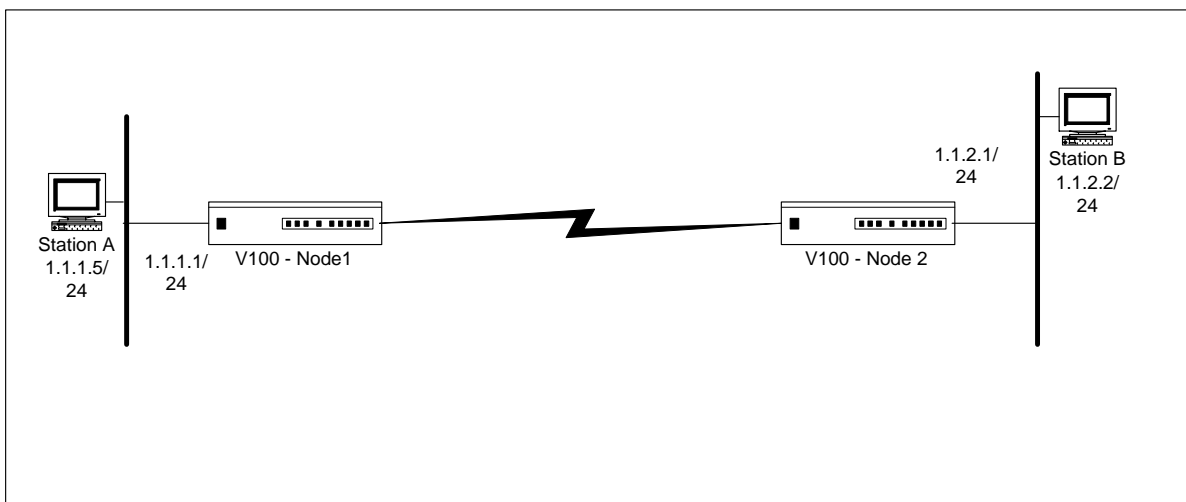
Troubleshooting - example network

If Station A is not successfully communicating with Station B, the following steps should be taken to troubleshoot the network configuration:

Local Ping Tests

Ping Station A from Node 1

Ping Station B from Node 2

Inter-V100 Ping Test

Ping Node 2 from Node 1 (or vice-versa)

Remote Ping Tests

Ping Node 2 from Station A

Ping Node 1 from Station B

Full Ping Tests

Ping Station A from Station B (or vice versa)

Selecting the PING test from the menu displays the following screen:

The table below shows the configurable parameters and the ranges that may be set:

Parameter	Range of Values
Target	IP address nnn.nnn.nnn.nnn
Count	0-9999 pings
Size	0-1472 bytes
Response Timeout(mS)	10-30000
Delay(mS)	0-60000 mS between pings

A simple guide to PING diagnostics is given below:

Problem	What to check	Solution
Local Ping test fails	Ethernet Connectivity: Is the green link light on the V100 Ethernet illuminated?	The V100 Ethernet port is configured as a hub-port – use a standard cable to directly connect to the station, or a cross-over cable to connect to a hub.
	IP network configuration on V100 & Station: Are the V100 ENET port and the station configured on the same IP subnet?	Correct the configuration
Inter-V100 Ping test Fails	V100 connectivity: Are other services operating between the V100s?	Standard V100 connection troubleshooting
	IP Subnet config on V100: Does Node1 have a subnet configured to Node 2 with a peer matching Node 2's channel ID? Does Node 2 have a subnet configured to Node 1 with a peer matching Node 1's channel ID? Are the DBAs configured at something other than 0? Are the IP addresses for the unnumbered links set the same for the local ENET port?	Correct configuration
	IP Route Configuration on V100: Is the NoRoutes count in the IP STATISTICS page incrementing? Is there an IP Route to get to Node 2 on Node 1? Is there an IP Route to get to Node 1 on Node 2?	Add Routes
Remote Ping Test fails	IP Route Configuration on Station: Does the station have a route configured that will ensure the ping request to the remote V100 node goes through the local V100 node?	Add correct route to Station
Full Ping test fails	IP Route Configuration on Stations: Does Station A have an IP route configured that will ensure that packets for Station B are routed through Node 1? Does Station B have an IP route configured that will ensure that packets for Station A are routed through Node 2?	Add correct route to Station

4.3.1.2 The IP ROUTE TABLE menu

```
Node2                    V100 Multiplexer Supervisor
Agg Status: 0:1 128000
----------------------------[ IP ROUTE TABLE ]---------------------------------

Destination       Mask              NextHop          Type      Age
000.000.000.000   000.000.000.000   001.001.001.254  STATIC    0
001.001.002.000   255.255.255.000   0:10             STATIC    4




----------------------------Configuration #1 is active------------------------
```

The IP ROUTE TABLE, IP STATISTICS, ETHERNET and ARP TABLE screens are for information only. The two tables record the static routes in use while the IP STATISTICS and ETHERNET pages give detailed packet statistics and Address Routing Protocol conversions and are updated every ten seconds. These may be used to help track down any routing, congestion or filtering problems but require specialist knowledge – contact Vocality for details.

4.3.1.3 The IP STATISTICS menu

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node2                      V100 Multiplexer Supervisor
Agg Status: 0:1 128000
--------------------------------[ IP STATISTICS ]--------------------------------


  ipForwarding:          Gateway      ipReasmTimeout:        0
  ipDefaultTTL:          30           ipReasmReqds:          0
  ipInReceives:          10999        ipReasmOKs:            0
  ipInHdrErrors:         0            ipReasmFails:          0
  ipInAddrErrors:        0            ipFragOKs:             0
  ipForwDatagrams:       1000         ipFragFails:           0
  ipUnknownProtos:       0            ipFragCreates:         0
  ipInDiscards:          0
  ipInDelivers:          9999         ipRoutingDiscards:     0
  ipOutRequests:         10024
  ipOutDiscards:         0
  ipOutNoRoutes:         0




-----------------------------Configuration #1 is active-----------------------------

Connected 05:41:16    Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

The IP ROUTE TABLE, IP STATISTICS, ETHERNET and ARP TABLE screens are for information only. The two tables record the static routes in use while the IP STATISTICS and ETHERNET pages give detailed packet statistics and Address Routing Protocol conversions and are updated every ten seconds. These may be used to help track down any routing, congestion or filtering problems but require specialist knowledge – contact Vocality for details.

4.3.1.4   The ETHERNET menu

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node2                      V100 Multiplexer Supervisor
Agg Status: 0:1 128000
-------------------------------[ ETHERNET ]------------------------------

     CONNECTION STATE        : 100Mbps/FULL DUPLEX
     MAC ADDRESS             : 00:50:c2:20:31:04

     RECEPTION STATISTICS    :
          OCTETS             : 813986
          UNICAST PACKETS    : 11000
          MULTICAST PACKETS  : 0
          DISCARDS           : 0
          ERRORS             : 0

     TRANSMISSION STATISTICS :
          OCTETS             : 739972
          UNICAST PACKETS    : 9999
          MULTICAST PACKETS  : 1
          DISCARDS           : 0
          ERRORS             : 0


-------------------------Configuration #1 is active------------------------

Connected 05:41:34    Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```
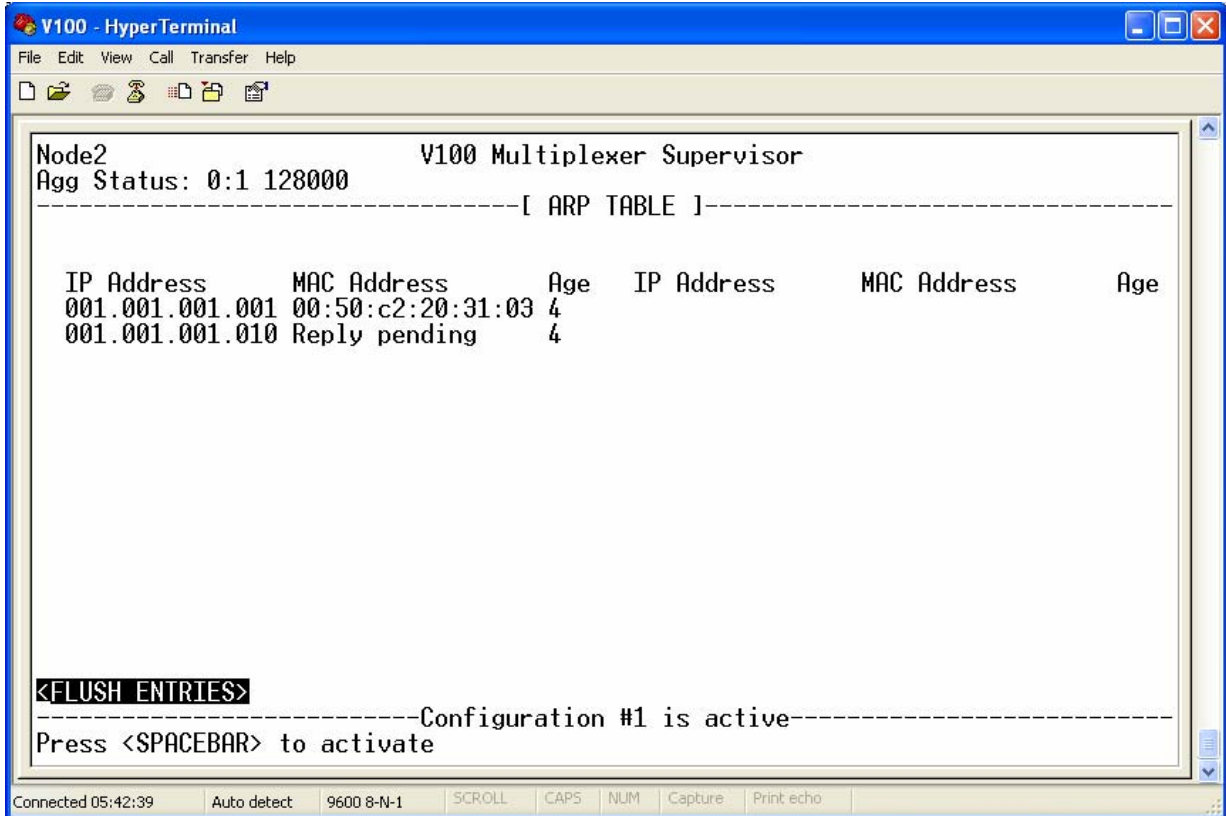
The IP ROUTE TABLE, IP STATISTICS, ETHERNET and ARP TABLE screens are for information only. The two tables record the static routes in use while the IP STATISTICS and ETHERNET pages give detailed packet statistics and Address Routing Protocol conversions and are updated every ten seconds. These may be used to help track down any routing, congestion or filtering problems but require specialist knowledge – contact Vocality for details.

4.3.1.5   The ARP TABLE menu
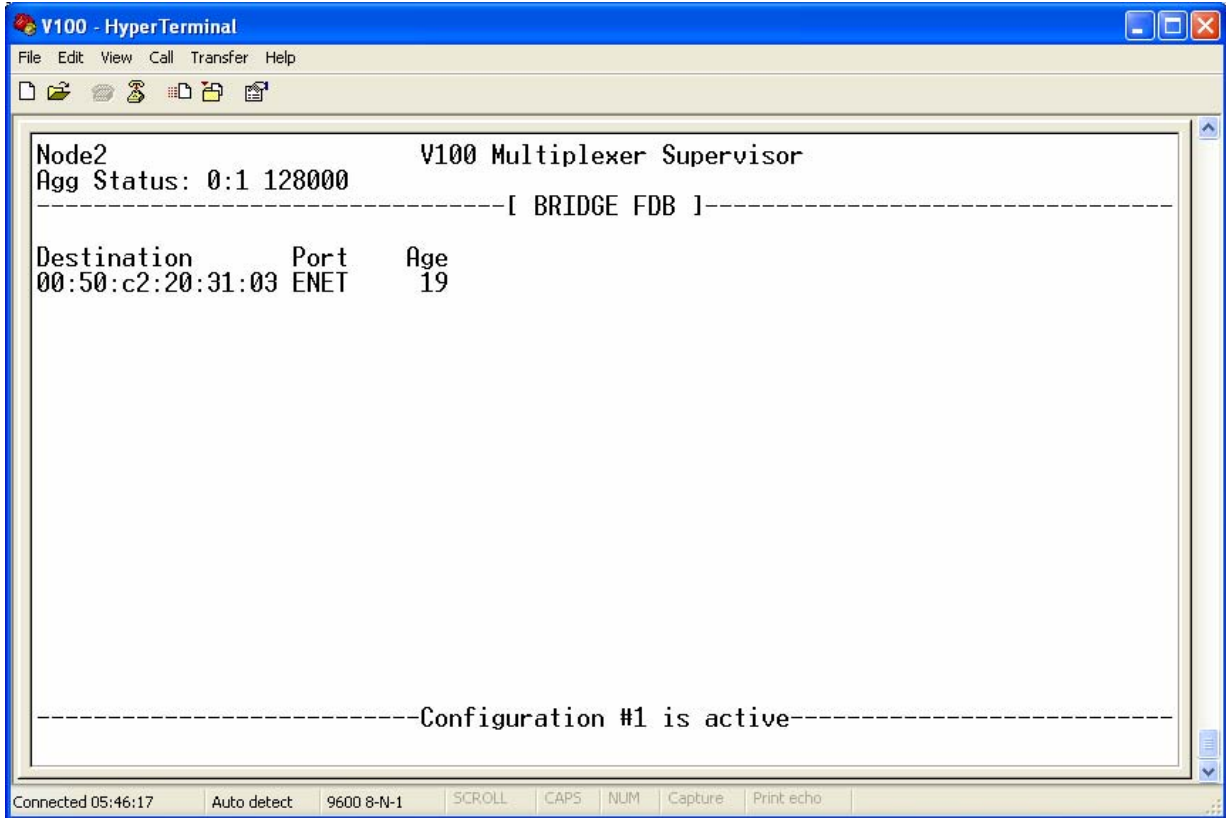
```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node2                        V100 Multiplexer Supervisor
Agg Status: 0:1 128000
---------------------------------[ ARP TABLE ]------------------------------------


  IP Address       MAC Address       Age    IP Address       MAC Address       Age
  001.001.001.001 00:50:c2:20:31:03 4
  001.001.001.010 Reply pending     4














 <FLUSH ENTRIES>
 --------------------------------Configuration #1 is active--------------------------
 Press <SPACEBAR> to activate

Connected 05:42:39   Auto detect   9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

This menu provides details of the current internal state of the IP address resolution protocol table of the embedded IP router. You may be asked to provide details of the contents of this table during troubleshooting sessions with qualified V100 service personnel.

4.3.1.6   The BRIDGE FDB menu

```
V100 - HyperTerminal                                                    _ □ X
File  Edit  View  Call  Transfer  Help

 □ ☞  ☎ ⅜  ⅲ ☝  ☝

 Node2                      V100 Multiplexer Supervisor
 Agg Status: 0:1 128000
 -------------------------------[ BRIDGE FDB ]-------------------------------

 Destination       Port    Age
 00:50:c2:20:31:03 ENET     19














 -------------------------Configuration #1 is active------------------------

Connected 05:46:17     Auto detect     9600 8-N-1     SCROLL   CAPS   NUM   Capture   Print echo
```

This menu provides details of the current internal state of the bridge forwarding database in the embedded transparent bridge. It indicates which MAC stations have been learned on which bridge ports. You may be asked to provide details of the contents of this table during troubleshooting sessions with qualified V100 service personnel.

4.3.1.7 The BRIDGE PORTS menu

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node2                      V100 Multiplexer Supervisor
Agg Status: 0:1 128000
-------------------------------[ BRIDGE PORTS ]-------------------------------


Port State  Forwarded    Flooded     Filtered Designated Bridge    Des Cost
ENET   FWD          0          0            0 8000:0050c2203104            0
0:10   FWD          0          0            0 8000:0050c2203104            0
0:11   FWD          0          0            0 8000:0050c2203104            0




---------------------------Configuration #1 is active-----------------------

Connected 05:46:44    Auto detect   9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

This menu provides details of the current internal state of the embedded transparent bridging ports. It includes details of the number of packets that have been forwarded (to a learnt destination), filtered (the destination is local) and flooded (multicast packet or unknown destination) through the configured bridge ports. It also provides details of the current spanning tree protocol state of each port if the spanning tree protocol is configured. You may be asked to provide details of the contents of this table during troubleshooting sessions with qualified V100 service personnel.

This page automatically refreshes periodically if no keys are hit.

4.3.2 The E1/T1/J1 DIAGNOSTICS menu

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

NODE0                    V100 Multiplexer Supervisor
Agg Status: E1 Lost
---------------------------[ E1/T1/J1 DIAGNOSTICS ]-------------------------


              ALARMS                              COUNTS
              ------                              ------

   No Signal (NOS):       NO          HDB3  Errors:          0
   Loss of Sync (LOS):    YES         CRC4  Errors:          0
   Remote Alarm (RAI):    NO
   Alarm Ind (AIS):       NO
   CRC4 Resync :          NO



<Zero Counts>



----------------------Configuration #2 is active-------------------------
Press <SPACEBAR> to activate

Connected 02:33:22    Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

This menu provides details of the current state of the E1 link card. It includes the current alarm status of the interface and provides counters for key interface statistics. You may be asked to provide details of the contents of this table during troubleshooting sessions with qualified V100 service personnel. This page automatically refreshes periodically if no keys are hit.

4.3.3   The SYSLOG menu

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

NODE0                    V100 Multiplexer Supervisor
Agg Status: 0:1 Lost    E1 Lost
------------------------------[ SYSLOG #1]---------------------------------

 DAEMON ADDRESS :        192.168.043.012

 TRACE TYPE              CATEGORY
 ==============================
 CONNECTION LOG          Local1
 CONFIGURATION LOG       Local2
 ALARM LOG               Local3
 IP LOG                  Local4
 CALL RECORD LOG         Local5
 ISDN LOG                Local6
 BoD LOG                 Local7




 ----------------------Configuration #1 is active------------------------
 Use <SPACE>/+ or - to select

Connected 02:59:09    Auto detect    9600 8-N-1    SCROLL  CAPS  NUM  Capture  Print echo
```

The SYSLOG feature allows the V100 to send log messages to an external server known as a Syslog Daemon. The protocol for sending these messages is described in RFC 3164. The protocol is run over UDP port 514.

The customer defines the IP address of the Syslog Daemon. If no IP address is specified then no log messages are sent to the Syslog Daemon. The messages that are sent can also be seen in the diagnostic log pages. They include a timestamp from the V100 indicating when the message was generated and two sequence numbers. Each trace type (CONNECTION, CONFIGURATION, IP, etc) has its own sequence range – this is the first sequence number generated. The second is a sequence number for all messages sent to the Syslog Daemon. These sequence numbers provide the user with an indication as to whether a log message has been missed. The message format is:

Nodename: Timestamp : (Specific Seq No : Overall Seq No) Trace message

The Syslog protocol provides a mechanism for each message to be sent with a category and a priority, to allow facilities such as filtering on the Syslog Daemon. The V100 sends all of its messages with a priority of 6 (Informational). Configuration options are provided to enable categories to be used for each type of log message. Each log message type can be configured to generate Syslog messages at categories Local0 through Local7, or not at all (Disabled). For example if a user wants to use the Syslog facility to monitor only voice port call records, then configure the Call Records category for Local0 and disable the category for all other traces.

Parameters and options for the SYSLOG menu are shown in the following table.

Field	Options	Description
Daemon Address	Numeric IP address entry as: nnn.nnn.nnn.nnn	IP address of the Syslog
Trace Type	Information only	Identifies the type of log message.
Category	Local0-Local 7	The category of the log type
	Disabled	Log messages are disabled for this trace message type

4.3.4 The CALL STATS menu

The CALL STATS menu has two sub-menus- the TRIB CALL STATS menu for voice ports and the AGG CALL STATS menu for switched aggregates. These menus are described in the following sections.

NOTE: **If a voice card is installed but no switched aggregates are configured, the TRIB CALL STATS menu is shown in place of the CALL STATS menu.**

NOTE: **If a voice card is not installed, and switched aggregates are configured, the AGG CALL STATS menu is shown in place of the CALL STATS menu.**

4.3.4.1 The TRIB CALL STATS menu

This menu provides call statistics for voice ports.

The call statistics provided are the same for voice ports and switched aggregates.

Step through the port statistics pages by using the <NEXT PORT> and <PREVIOUS PORT> buttons at the top of the page - if these buttons are not present there is just a single port to report statistics for.

Each page is split into three sections. The top sections report the call statistics for that port since the V100 last restarted, and the current state of the port. The middle section reports the call statistics for the last 24 hour period, split into 3 hour segments. The bottom section reports the call statistics for the last 7 days split into 24 hour periods.

NOTE: **Call statistics are not maintained through a restart of the V100.**

A "CallIn" represents an external device taking the port "off-hook". A "CallOut" represent the V100 taking the device "off-hook". This page automatically refreshes periodically if no keys are hit.

4.3.4.2   The AGG CALL STATS menu

This menu provides call statistics for switched aggregate ports.

Step through the port statistics pages by using the <NEXT PORT> and <PREVIOUS PORT> buttons at the top of the page - if these buttons are not present there is just a single port to report statistics for.

Each page is split into three sections. The top sections report the call statistics for that port since the V100 last restarted, and the current state of the port. The middle section reports the call statistics for the last

24 hour period, split into 3 hour segments. The bottom section reports the call statistics for the last 7 days split into 24 hour periods.

NOTE: **Call statistics are not maintained through a restart of the V100.**

This page automatically refreshes periodically if no keys are hit.

4.3.5   The SYSTEM INFO menu

This page provides a summary of the hardware, software and firmware component versions in the V100.

You may be asked to provide details of the contents of this table during troubleshooting sessions with qualified V100 service personnel.

4.3.6   The AGG STATUS menu

This menu provides a summary of the multiplexing currently occurring over each aggregate in the V100. The status is provided for each aggregate port in the system - each port's status is on a separate page. Use the <UP> and <DOWN> buttons to cycle through each port.

Each line in the status reports the current state of a tributary connection that is multiplexed over the aggregate.

This page automatically refreshes periodically if no keys are hit.

4.3.7 The CONNECTION LOG menu

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

000d:04h:27m:53s:45  ...CONNECT_REQ MESSAGE DISCARDED (Out of Service)
000d:04h:27m:53s:94  CONNECT_REQ[128000][128000] from Local 0:0:2 to 1:0:2
000d:04h:27m:53s:94  ...CONNECT_REQ MESSAGE DISCARDED (Out of Service)
000d:04h:27m:53s:94  DISCONNECT[OUT_OF_SERVICE] from Router 1:0:2 to 0:0:2
000d:04h:27m:54s:45  ...CONNECT_REQ MESSAGE DISCARDED (Out of Service)
000d:04h:27m:54s:45  DISCONNECT[OUT_OF_SERVICE] from Router 1:1:2 to 0:2:2
000d:04h:27m:55s:11  0:2 State=D0_DataIdle
000d:04h:27m:55s:11  CONNECT_REQ[128000][128000] from Local 0:0:2 to 1:0:2
000d:04h:27m:55s:11  ...CONNECT_REQ MESSAGE DISCARDED (Out of Service)
000d:04h:27m:55s:11  DISCONNECT[OUT_OF_SERVICE] from Router 1:0:2 to 0:0:2
000d:04h:27m:55s:16  0:2 State=D2_DataAwaitIndicateActive
000d:04h:27m:55s:21  0:2 State=D5_DataAwaitControlIdle
000d:04h:27m:55s:46  CONNECT_REQ[32000][0] from Local 0:2:1 to 1:1:1
000d:04h:27m:55s:46  ...CONNECT_REQ MESSAGE DISCARDED (Out of Service)
000d:04h:27m:55s:46  DISCONNECT[OUT_OF_SERVICE] from Router 1:1:1 to 0:2:1
000d:04h:27m:55s:46  CONNECT_REQ[9600][9600] from Local 0:2:2 to 1:1:2
000d:04h:27m:56s:28  ...CONNECT_REQ MESSAGE DISCARDED (Out of Service)
000d:04h:27m:56s:38  0:2 State=D5_DataAwaitControlIdle
000d:04h:27m:55s:11  CONNECT_REQ[128000][128000] from Local 0:0:2 to 1:0:2
000d:04h:27m:55s:11  ...CONNECT_REQ MESSAGE DISCARDED (Out of Service)
000d:04h:27m:55s:11  DISCONNECT[OUT_OF_SERVICE] from Router 1:0:2 to 0:0:2
000d:04h:27m:55s:16  0:2 State=D2_DataAwaitIndicateActive
000d:04h:27m:55s:21  0:2 State=D5_DataAwaitControlIdle
000d:04h:27m:55s:46  CONNECT_REQ[32000][0] from Local 0:2:1 to 1:1:_

Connected 03:00:46    Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```
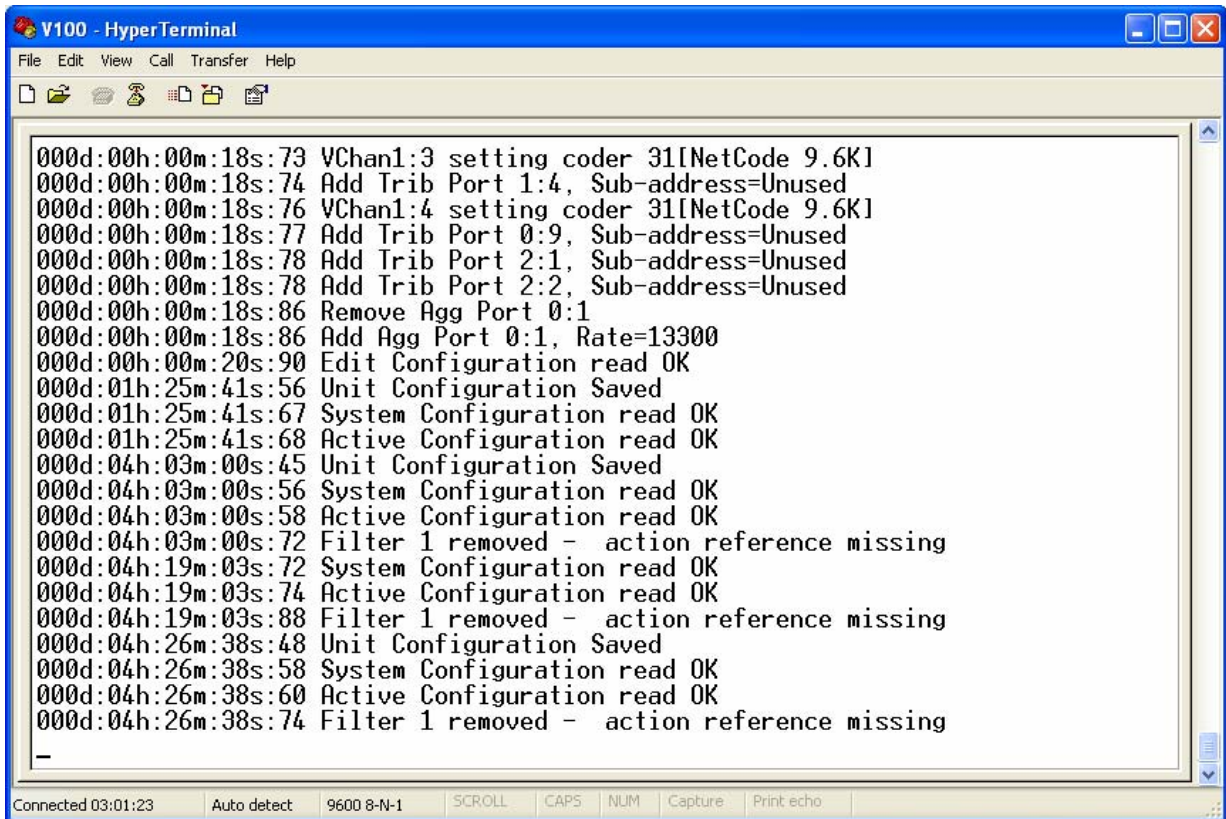
This log shows messages relating to the management of tributary connections. These messages refer to internal V100 state machines and protocols and are not intended for customer interpretation.

Commands to pause the log storage, resume the log storage, move through the log buffer, and list the entire contents of a log buffer are documented in the LOG HELP page.

You may be asked to provide details of the contents of these pages during troubleshooting sessions with qualified V100 service personnel.

These pages update as new log messages are generated.

4.3.8 The CONFIGURATION LOG menu
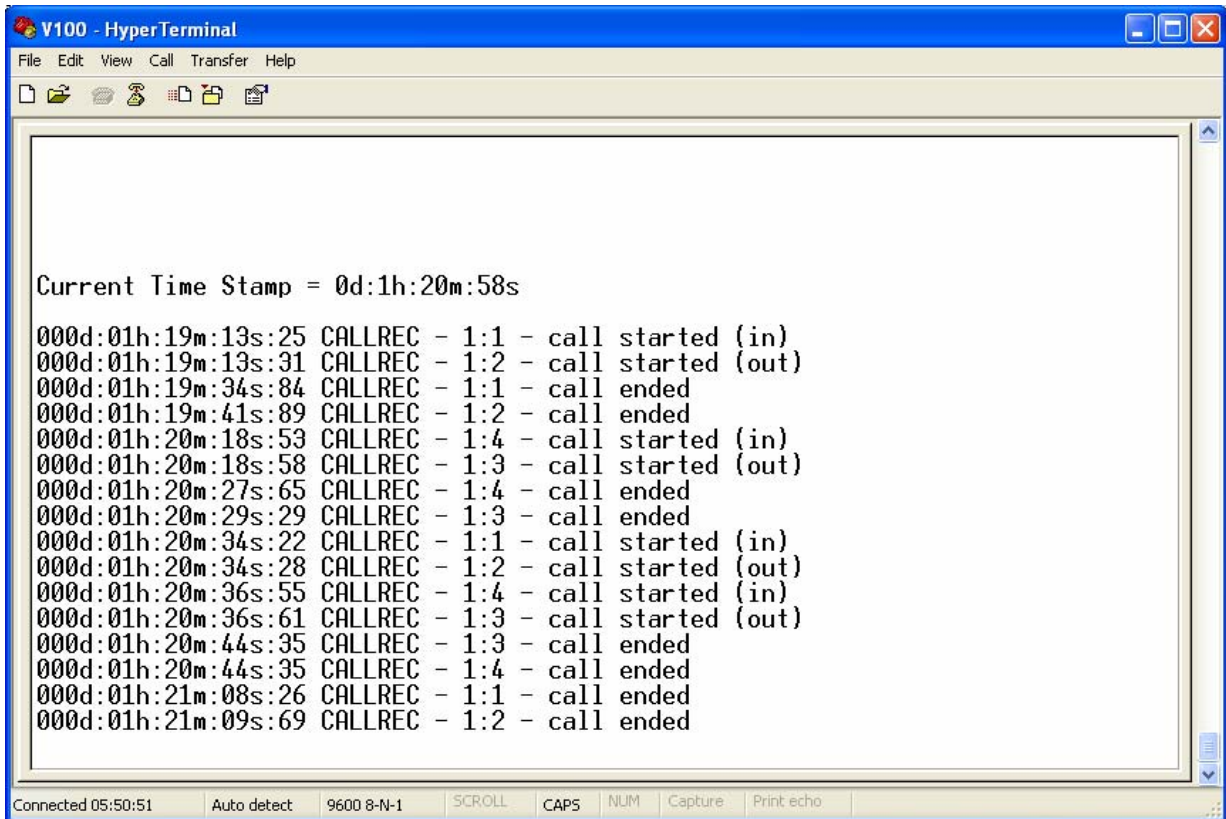


```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

000d:00h:00m:18s:73 VChan1:3 setting coder 31[NetCode 9.6K]
000d:00h:00m:18s:74 Add Trib Port 1:4, Sub-address=Unused
000d:00h:00m:18s:76 VChan1:4 setting coder 31[NetCode 9.6K]
000d:00h:00m:18s:77 Add Trib Port 0:9, Sub-address=Unused
000d:00h:00m:18s:78 Add Trib Port 2:1, Sub-address=Unused
000d:00h:00m:18s:78 Add Trib Port 2:2, Sub-address=Unused
000d:00h:00m:18s:86 Remove Agg Port 0:1
000d:00h:00m:18s:86 Add Agg Port 0:1, Rate=13300
000d:00h:00m:20s:90 Edit Configuration read OK
000d:01h:25m:41s:56 Unit Configuration Saved
000d:01h:25m:41s:67 System Configuration read OK
000d:01h:25m:41s:68 Active Configuration read OK
000d:04h:03m:00s:45 Unit Configuration Saved
000d:04h:03m:00s:56 System Configuration read OK
000d:04h:03m:00s:58 Active Configuration read OK
000d:04h:03m:00s:72 Filter 1 removed -  action reference missing
000d:04h:19m:03s:72 System Configuration read OK
000d:04h:19m:03s:74 Active Configuration read OK
000d:04h:19m:03s:88 Filter 1 removed -  action reference missing
000d:04h:26m:38s:48 Unit Configuration Saved
000d:04h:26m:38s:58 System Configuration read OK
000d:04h:26m:38s:60 Active Configuration read OK
000d:04h:26m:38s:74 Filter 1 removed -  action reference missing
_

Connected 03:01:23    Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```
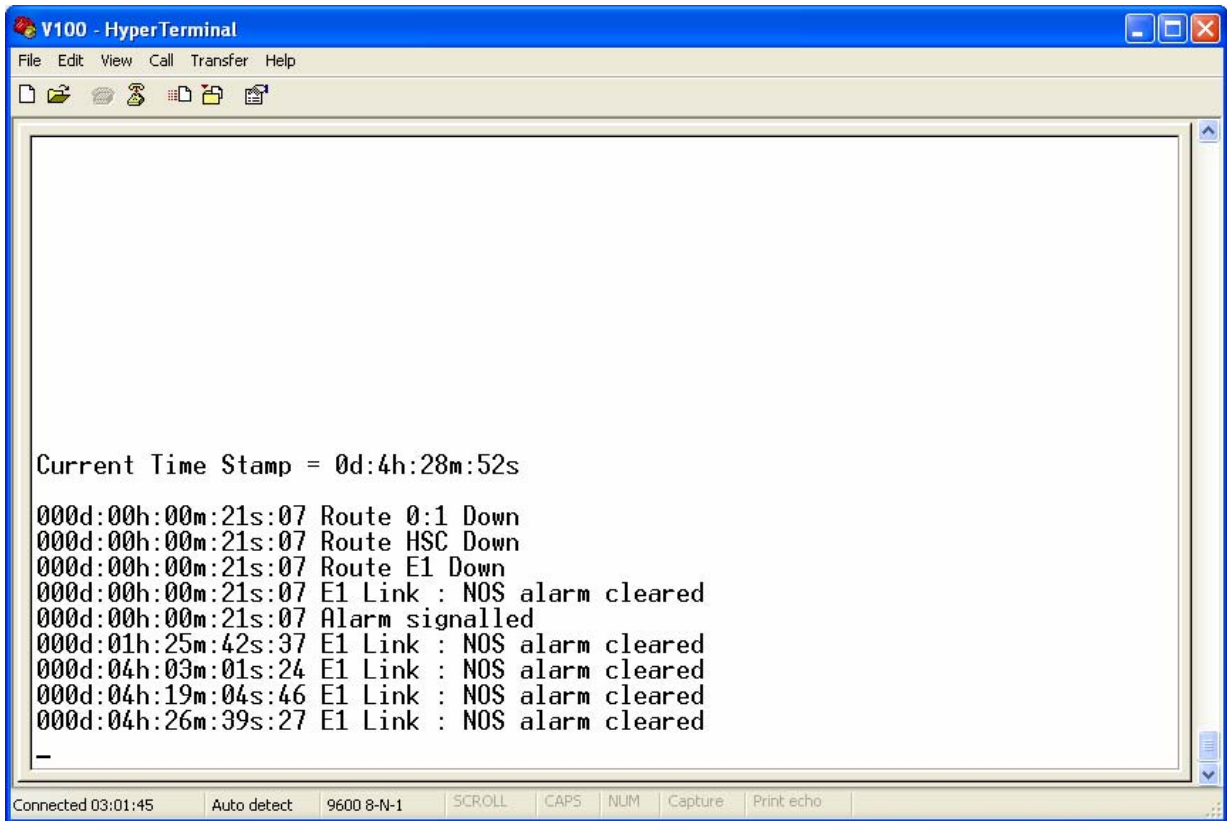
This log shows messages relating to the storage, retrieval and implementation of configurations. These messages refer to internal V100 state machines and protocols and are not intended for customer interpretation.

Commands to pause the log storage, resume the log storage, move through the log buffer, and list the entire contents of a log buffer are documented in the LOG HELP page.

You may be asked to provide details of the contents of these pages during troubleshooting sessions with qualified V100 service personnel.
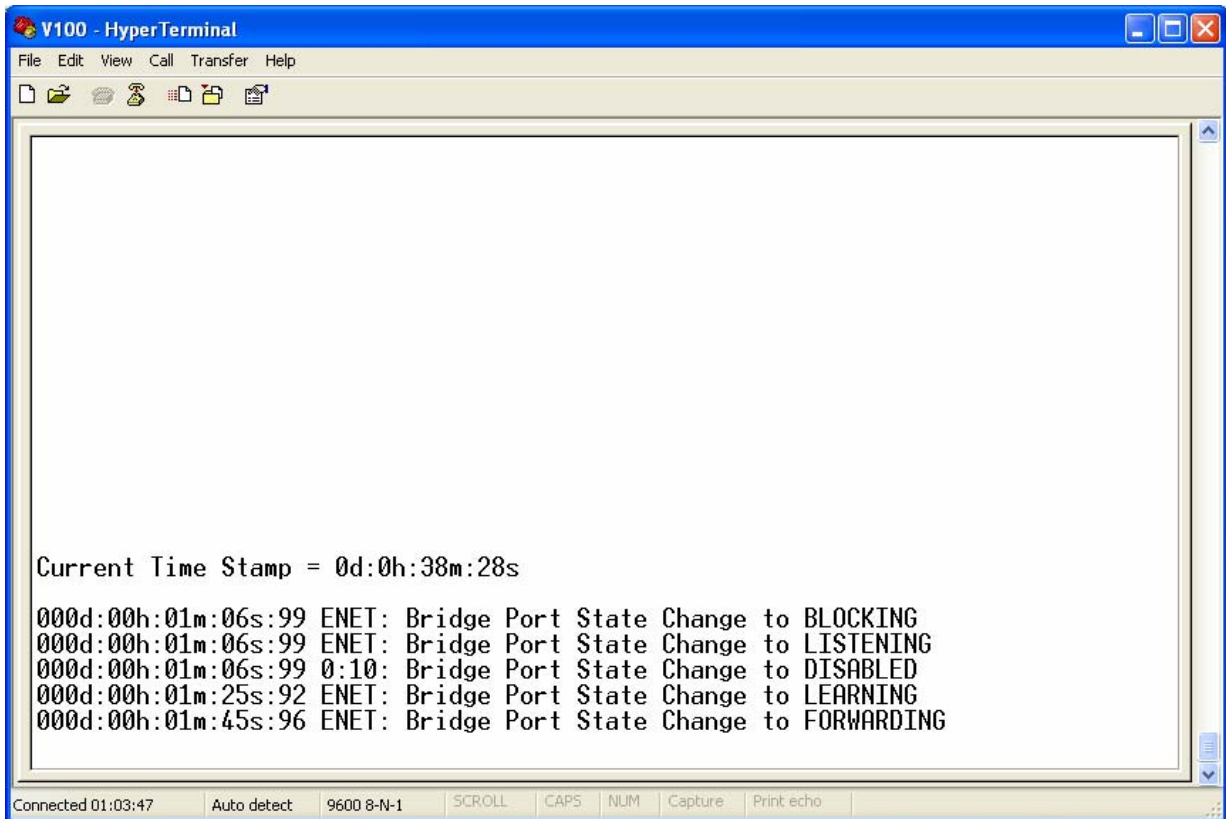
These pages update as new log messages are generated.

4.3.9   The ALARM LOG menu

This log shows messages relating to external events that may be considered alarm conditions.
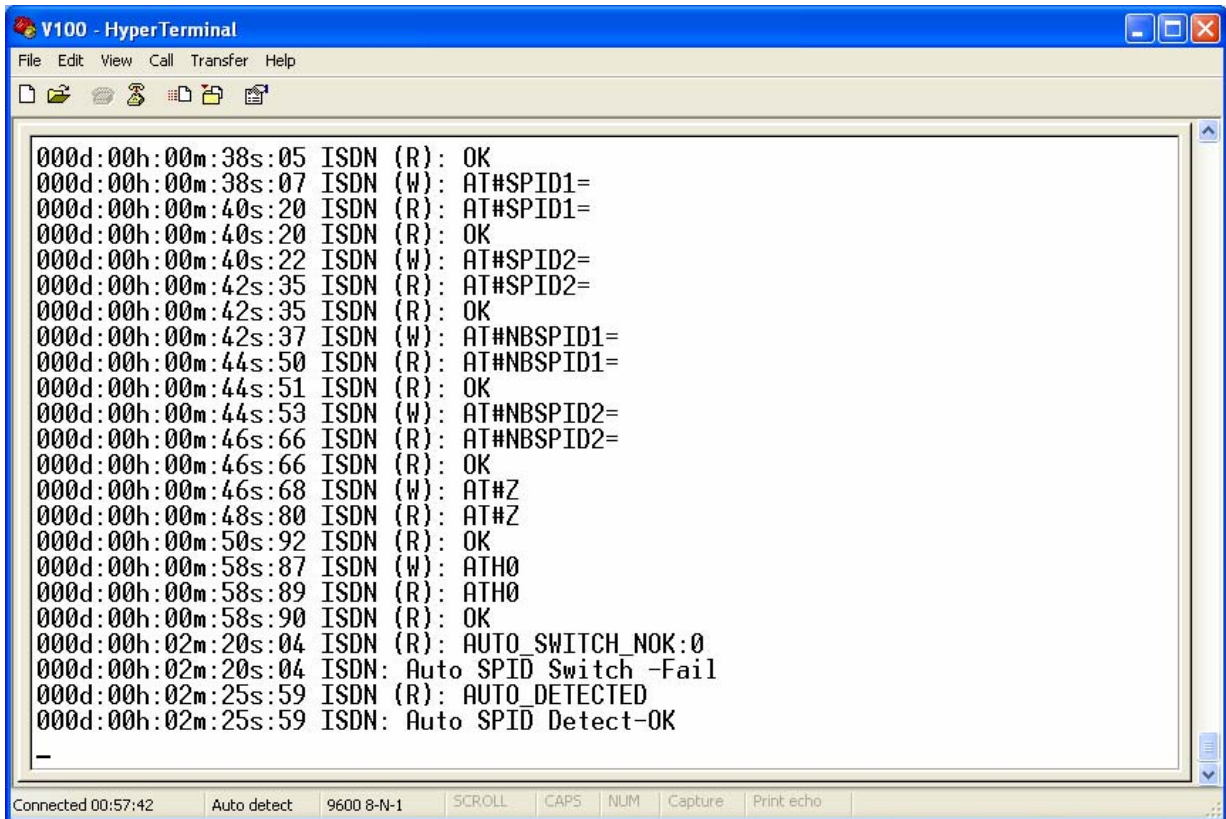
4.3.10 The CALL RECORD LOG menu

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Current Time Stamp = 0d:1h:20m:58s

000d:01h:19m:13s:25 CALLREC - 1:1 - call started (in)
000d:01h:19m:13s:31 CALLREC - 1:2 - call started (out)
000d:01h:19m:34s:84 CALLREC - 1:1 - call ended
000d:01h:19m:41s:89 CALLREC - 1:2 - call ended
000d:01h:20m:18s:53 CALLREC - 1:4 - call started (in)
000d:01h:20m:18s:58 CALLREC - 1:3 - call started (out)
000d:01h:20m:27s:65 CALLREC - 1:4 - call ended
000d:01h:20m:29s:29 CALLREC - 1:3 - call ended
000d:01h:20m:34s:22 CALLREC - 1:1 - call started (in)
000d:01h:20m:34s:28 CALLREC - 1:2 - call started (out)
000d:01h:20m:36s:55 CALLREC - 1:4 - call started (in)
000d:01h:20m:36s:61 CALLREC - 1:3 - call started (out)
000d:01h:20m:44s:35 CALLREC - 1:3 - call ended
000d:01h:20m:44s:35 CALLREC - 1:4 - call ended
000d:01h:21m:08s:26 CALLREC - 1:1 - call ended
000d:01h:21m:09s:69 CALLREC - 1:2 - call ended

Connected 05:50:51    Auto detect    9600 8-N-1    SCROLL    CAPS    NUM    Capture    Print echo
```

This log shows messages relating to voice and switched aggregate ports going on- and off-hook.

4.3.11 The ISDN LOG menu

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

000d:00h:00m:38s:05 ISDN (R): OK
000d:00h:00m:38s:07 ISDN (W): AT#SPID1=
000d:00h:00m:40s:20 ISDN (R): AT#SPID1=
000d:00h:00m:40s:20 ISDN (R): OK
000d:00h:00m:40s:22 ISDN (W): AT#SPID2=
000d:00h:00m:42s:35 ISDN (R): AT#SPID2=
000d:00h:00m:42s:35 ISDN (R): OK
000d:00h:00m:42s:37 ISDN (W): AT#NBSPID1=
000d:00h:00m:44s:50 ISDN (R): AT#NBSPID1=
000d:00h:00m:44s:51 ISDN (R): OK
000d:00h:00m:44s:53 ISDN (W): AT#NBSPID2=
000d:00h:00m:46s:66 ISDN (R): AT#NBSPID2=
000d:00h:00m:46s:66 ISDN (R): OK
000d:00h:00m:46s:68 ISDN (W): AT#Z
000d:00h:00m:48s:80 ISDN (R): AT#Z
000d:00h:00m:50s:92 ISDN (R): OK
000d:00h:00m:58s:87 ISDN (W): ATH0
000d:00h:00m:58s:89 ISDN (R): ATH0
000d:00h:00m:58s:90 ISDN (R): OK
000d:00h:02m:20s:04 ISDN (R): AUTO_SWITCH_NOK:0
000d:00h:02m:20s:04 ISDN: Auto SPID Switch -Fail
000d:00h:02m:25s:59 ISDN (R): AUTO_DETECTED
000d:00h:02m:25s:59 ISDN: Auto SPID Detect-OK
_

Connected 00:57:42     Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

This menu is seen only when an ISDN option card is installed in the V100.
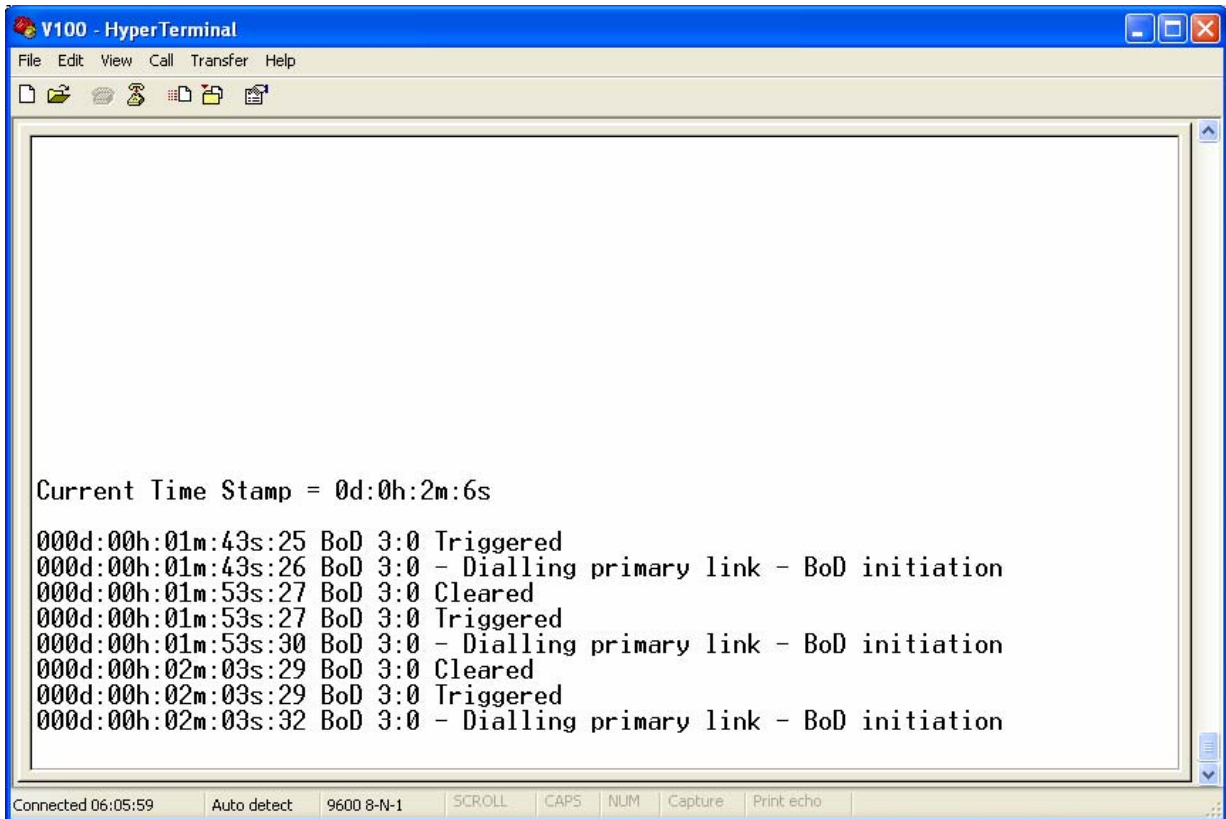
This log shows messages relating to the configuration and call control of the ISDN option card. These messages refer to internal V100 state machines and protocols and are not intended for customer interpretation.

Commands to pause the log storage, resume the log storage, move through the log buffer, and list the entire contents of a log buffer are documented in the LOG HELP page.

You may be asked to provide details of the contents of these pages during troubleshooting sessions with qualified V100 service personnel.

These pages update as new log messages are generated.

4.3.12 The BoD LOG menu


```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help




Current Time Stamp = 0d:0h:2m:6s

000d:00h:01m:43s:25 BoD 3:0 Triggered
000d:00h:01m:43s:26 BoD 3:0 - Dialling primary link - BoD initiation
000d:00h:01m:53s:27 BoD 3:0 Cleared
000d:00h:01m:53s:27 BoD 3:0 Triggered
000d:00h:01m:53s:30 BoD 3:0 - Dialling primary link - BoD initiation
000d:00h:02m:03s:29 BoD 3:0 Cleared
000d:00h:02m:03s:29 BoD 3:0 Triggered
000d:00h:02m:03s:32 BoD 3:0 - Dialling primary link - BoD initiation

Connected 06:05:59    Auto detect    9600 8-N-1    SCROLL  CAPS  NUM  Capture  Print echo
```

This log shows message relating to the operation of the bandwidth on demand protocol. These refer to internal V100 state machines and protocols and are not intended for customer interpretation.

4.3.13 The IP LOG menu

```
V100 - HyperTerminal

File  Edit  View  Call  Transfer  Help




Current Time Stamp = 0d:0h:38m:28s

000d:00h:01m:06s:99 ENET: Bridge Port State Change to BLOCKING
000d:00h:01m:06s:99 ENET: Bridge Port State Change to LISTENING
000d:00h:01m:06s:99 0:10: Bridge Port State Change to DISABLED
000d:00h:01m:25s:92 ENET: Bridge Port State Change to LEARNING
000d:00h:01m:45s:96 ENET: Bridge Port State Change to FORWARDING

Connected 01:03:47    Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

This log shows messages relating to the operation of the internal embedded IP router. These messages refer to internal V100 state machines and protocols and are not intended for customer interpretation.

Commands to pause the log storage, resume the log storage, move through the log buffer, and list the entire contents of a log buffer are documented in the LOG HELP page.

You may be asked to provide details of the contents of these pages during troubleshooting sessions with qualified V100 service personnel.

These pages update as new log messages are generated.

4.3.14 The ALL LOGS menu


```
000d:04h:29m:52s:93 CONNECT_REQ[128000][128000] from Local 0:0:2 to 1:0:2
000d:04h:29m:52s:93 ...CONNECT_REQ MESSAGE DISCARDED (Out of Service)
000d:04h:29m:52s:93 DISCONNECT[OUT_OF_SERVICE] from Router 1:0:2 to 0:0:2
000d:04h:29m:52s:98 0:2 State=D2_DataAwaitIndicateActive
000d:04h:29m:53s:04 0:2 State=D5_DataAwaitControlIdle
000d:04h:29m:53s:34 CONNECT_REQ[32000][0] from Local 0:2:1 to 1:1:1
000d:04h:29m:53s:34 ...CONNECT_REQ MESSAGE DISCARDED (Out of Service)
000d:04h:29m:54s:10 0:2 State=D0_DataIdle
000d:04h:29m:54s:10 ...CONNECT_REQ MESSAGE DISCARDED (Out of Service)
000d:04h:29m:54s:15 0:2 State=D2_DataAwaitIndicateActive
000d:04h:29m:54s:20 0:2 State=D5_DataAwaitControlIdle
000d:04h:29m:52s:93 CONNECT_REQ[128000][128000] from Local 0:0:2 to 1:0:2
000d:04h:29m:52s:93 ...CONNECT_REQ MESSAGE DISCARDED (Out of Service)
000d:04h:29m:52s:93 DISCONNECT[OUT_OF_SERVICE] from Router 1:0:2 to 0:0:2
000d:04h:29m:52s:98 0:2 State=D2_DataAwaitIndicateActive
000d:04h:29m:53s:04 0:2 State=D5_DataAwaitControlIdle
000d:04h:29m:53s:34 CONNECT_REQ[32000][0] from Local 0:2:1 to 1:1:1
000d:04h:29m:53s:34 DISCONNECT[OUT_OF_SERVICE] from Router 1:1:2 to 0:2:2
000d:04h:29m:54s:34 DISCONNECT[OUT_OF_SERVICE] from Router 1:1:1 to 0:2:1
000d:04h:29m:54s:34 CONNECT_REQ[9600][9600] from Local 0:2:2 to 1:1:2
000d:04h:29m:54s:34 ...CONNECT_REQ MESSAGE DISCARDED (Out of Service)
000d:04h:29m:54s:34 DISCONNECT[OUT_OF_SERVICE] from Router 1:1:2 to 0:2:2
000d:04h:29m:55s:26 0:2 State=D0_DataIdle
000d:04h:29m:55s:26 CONNECT_REQ[128000][128000] from Local _
```

This log shows all the log events regardless of their category. These messages refer to internal V100 state machines and protocols and are not intended for customer interpretation.

Commands to pause the log storage, resume the log storage, move through the log buffer, and list the entire contents of a log buffer are documented in the LOG HELP page.

You may be asked to provide details of the contents of these pages during troubleshooting sessions with qualified V100 service personnel.

These pages update as new log messages are generated.

4.3.15 The LOG HELP menu

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

NODE0                    V100 Multiplexer Supervisor
Agg Status: 0:1 Lost     E1 Lost
--------------------------------[ LOG HELP ]--------------------------------


                         TRACE COMMANDS
                         --------------
                         C = Clear trace
                         S = Proceed to start of trace
                         E = Proceed to end of trace
                         U = Scroll up trace
                         D = Scroll down trace
                         CR = Step down trace
                         L = List whole trace
                         P = Pause trace
                         M = Toggle display mode_




-------------------------Configuration #1 is active-------------------------
<ESC> to exit

Connected 03:03:08    Auto detect   9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

In most cases, the commands are self-explanatory with [S]tart, [E]nd, [U]p, [D]own moving the viewing window to the relevant point in the trace buffer. [L]ist outputs the contents of the whole trace buffer, which may be useful when capturing the trace to a file and [C]lear empties the buffer. The [P]ause command freezes the trace buffer and stops recording status messages. When the[R]esume command is entered, the last page in the buffer is repeated together with the next five messages from live output. The display then continues in real-time.

4.4 Call Progress Tones

With the ability to dynamically route telephone calls through the network, the V100 can act as a small PABX. It is therefore the case that in order to provide the subscriber with meaningful information while a call is connected, the V100 must provide audible call progress tones. Many applications for the V100 involve a satellite delay between subscribers and so no tones are generated for 600mS after a call sequence is commenced, to avoid confusion during the latency.

In the simplest scenario, the telephone is lifted and if bandwidth is available via the prescribed route and the destination party is not busy, the call is connected and the caller hears a ringing cadence, according to the country code selected, until the call is answered.

If the call is connected but the destination party is busy, the caller hears an "unavailable" tone pattern (long beeps, slow repeat).

If after the initial 600ms, the call setup has not completed (this can be the case with DAMA networks) but the call timeout has not been reached, the caller will hear a "call pending" tone pattern (fast beeps, fast repeat). This will give way either to the ringing tone pattern if successful, or to the "unavailable" tone pattern if the call fails or times out.

4.5   Dynamic Bandwidth Allocation

The versatility of the V100 multiplexer is a direct result of its packetised data transport architecture. Voice/FAX, MPEG, ISDN BRI, synchronous and asynchronous data are processed in a prioritised manner which reflects their individual demands for bandwidth.

The primary contention for bandwidth comes from Voice/FAX channels, which demand bandwidth when a call is active and from synchronous data channels, which either demand permanent bandwidth as in the case of a transparent channel, or which may demand bandwidth on a sporadic basis according to the traffic they carry. Dynamic Bandwidth Allocation(DBA) on the V100 data ports uses a sophisticated internal rate-change protocol to resolve the problem, which allows bandwidth to vary dynamically (on DBA ports) in both transmit and receive directions independently.

Data channels may be set to operate at any speed up to 2Mbps. In DBA mode, the maximum clock frequency of a synchronous tributary channel is configured by the user and the V100 then varies the actual clock rate applied to the channel according to traffic demand. DBA mode uses the channel's RXC and TXC phase-locked loops to generate an internal clock which is output to the connected device. Following any successful new connection, which is routed through the same aggregate as the DBA sync channel, the V100 calculates the highest permissible clock rate that is consistent with a total capacity of 87.5% on the chosen route and smoothly varies the output clock to the connected device. This allows a LAN Router with a relatively low loading factor to operate without penalty while the V100 simultaneously supports a voice/FAX call. As the voice traffic increases, the V100 is able to successively reduce the clock speed to the Router so as to permit high-priority calls to be made at the cost of minor and temporary reduction in Router throughput, which will probably go unnoticed by the LAN users. The clock rate is successively restored as soon as competing connections are closed again.

By convention, the TX clock at the local end sets the originating DBA maximum rate and the RX clock at the far end sets the terminating DBA maximum rate. They should be set equal and must both be set. The V100 also supports asymmetrical Dynamic Bandwidth Allocation to cater for those cases where network topology produces different bandwidth demands in each direction on an aggregate. In this case, the above rules are still obeyed, but the local TX/remote RX rate and the local RX/remote TX rate are set to different maximum values. In most cases, DBA will be used to drive bandwidth-agile devices such as routers and therefore will be used in V.11 single-clock mode. Here the DBA RX and TX rates are set the same throughout the connection, with the RX clock sources set to TXC. As with all other cases where the phase-locked loops are used, the clock reference(s) must be sourced from the correct internal global clock bus (GRX or GTX).

All data channels configured with "DBA" clock source are assigned a pool of dynamic bandwidth, which is distributed between them **in proportion to their configured bit rate**. The V100 smoothly adjusts the

clock speeds on all DBA ports whenever a change occurs in the DBA pool. The rate-change calculations are performed at both ends of the connection, with the overall size of the dynamic bandwidth pool limited by the lowest link bit rate across the network.

Asynchronous channels are treated in a similar way, where the configured channel bit rate again defines the proportion of the DBA pool allocated, but this time to the internal connection between the two ends, since the local connection speed out of the port must be set as configured. One extra feature takes advantage of the bursty nature of async data: when data stops, the internal connection speed drops to a nominal 2400bps (or the port speed, whichever is the lower) to maintain the connection ready for use while returning most of the bandwidth to the DBA pool. When the next data character is received by the port, the internal connection rate resumes its normal DBA level. In this way the V100 maximises bandwidth use automatically, without the user having to intervene or precalculate any bit rates.

At all times the V100 optimises buffering and delay so as to maintain voice quality and efficient data transfer. Packet lengths are constantly adapted to match the varying traffic demands of all channel types.

4.6   Asymmetric Bandwidth

The V100 is capable of considerable flexibility in clocking schemes and may operate RX and TX clock independently and at different rates.

Each direction has an associated Phase-Locked Loop (PLL) which may use as it reference the input clock, either Global clock (GRX or GTX) or the internal system clock. Each PLL is then capable of generating an output clock at any rate from 1600bps up to 2Mbps in steps of 800Hz. Below 1600bps, any multiple of 25bps from 50bps upwards may be generated.

4.7 Clocks

4.7.1 Port Clocks

Each data port supports the same functionality whether it is used as a tributary (DCE) or an aggregate(DTE), the choice being defined by software. By convention, the Receive Clock "RXC" is defined as "the clock associated with the direction of data flow from aggregate to tributary" and the Transmit Clock "TXC" as "the clock associated with the direction of data flow from tributary to aggregate". This assumes that aggregate ports are normally DTE presentation and tributaries are normally DCE, so for an aggregate, RX data is input and TX data is output whereas for a tributary, RX data is output and TX data is input.
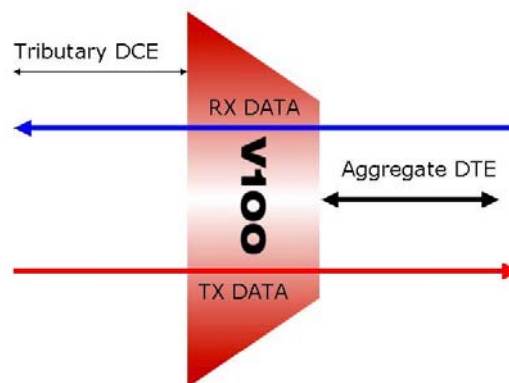
The RXC signal is selected from five possible modes:

(i) "EXT":   The external interface

(ii) "TXC":   The channel TX clock

(iii) "PLL":   From the port's RX Phase-locked Loop

(iv) "INT":   The internal system clock

(v) "DBA":   From the port's RX PLL as (iii), but the rate can be dynamically varied

The TXC signal is also selected from the five possible modes above, with the "TXC" option replaced by "RXC". A block diagram of the clock logic is shown below:
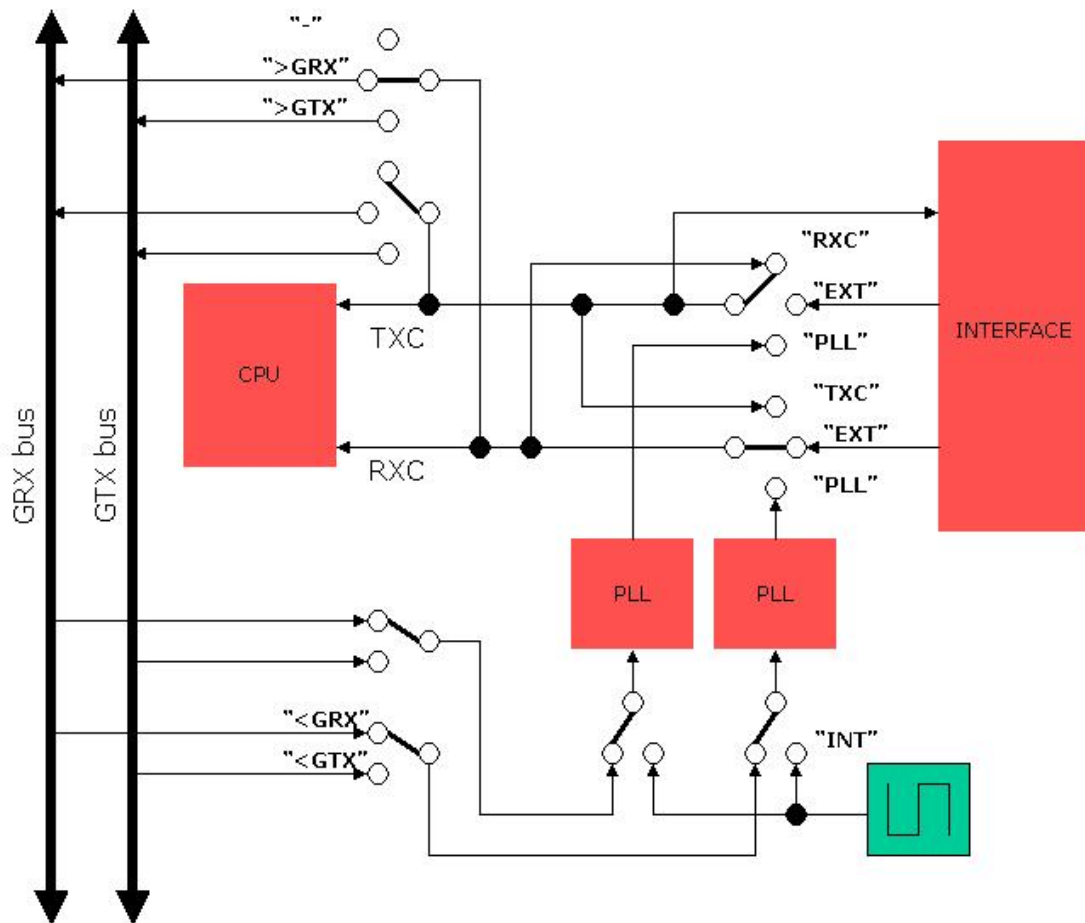
4.7.2   Global Clocks

There are two Global Clock busses internal to the V100 chassis, the purpose of which is to make a common clock signal available to all resources in the system. The busses may be driven by the RX or TX clock from any port or may be used as a reference by the PLLs of any port in the system. Generally, one of them is associated with the input data clock of the aggregate nominated as the master clock source. This one is used as the reference source for tributary data ports, voice channels and the 4Mbps High-speed Serial Channel.

Using this technique, it is possible to onward-link a clock from any port to any other in a V100 network, even if it is located in another chassis or even in a remote location via a satellite link.

It is essential that only one clock is configured to drive the GRX clock bus ("\>GRX") and one clock is configured to drive the GTX clock bus ("\>GTX") otherwise contention will result – this requirement is met by the CLOCKING menu. Any number of PLLs may use the GRX or GTX busses as their reference ("<GRX" or <GTX")

4.7.3   Phase-Locked Loops

The HSC and all data ports each have two independent Phase-locked Loops (PLLs) for the derivation of RXC or TXC. The reference clock for the PLLs is derived from the internal system clock or from either the

GRXCLK or the GTXCLK global clock busses as selected on the configuration menu. The PLLs allow data ports bit rates to be derived in steps of 800Hz up to 2Mbps.

Analogue voice cards have one PLL on the Voice Motherboard (VI68701) which derives the PCM bit rate from either of the Global Clocks. The PCM clock for four or eight voice channels will therefore be phase-locked to the link which supplies the Global Clock. Voice channels may therefore be locked to any link but only in groups per card - this is not regarded as a restriction since analogue voice applications will normally operate with a common PCM clock source throughout the system, even in point-to-multipoint cases.

4.8   Broadcast Mode

The V100 may be used in point-to-multipoint networks, where a number of remotes may wish to receive the same data via a shared outbound aggregate i.e. IP or Voice. To enale broadcast mode, a special route must be entered on the routing page using node I.D. 255 applied to the intended aggregate port at all the nodes.

For IP data the units are then configured normally.

For Broadcast Voice, special logical voice channels are utilised. In the example below, the hub unit is connected to a number of 4-wire voice feeds and each remote has chosen to listen to a selection from these.
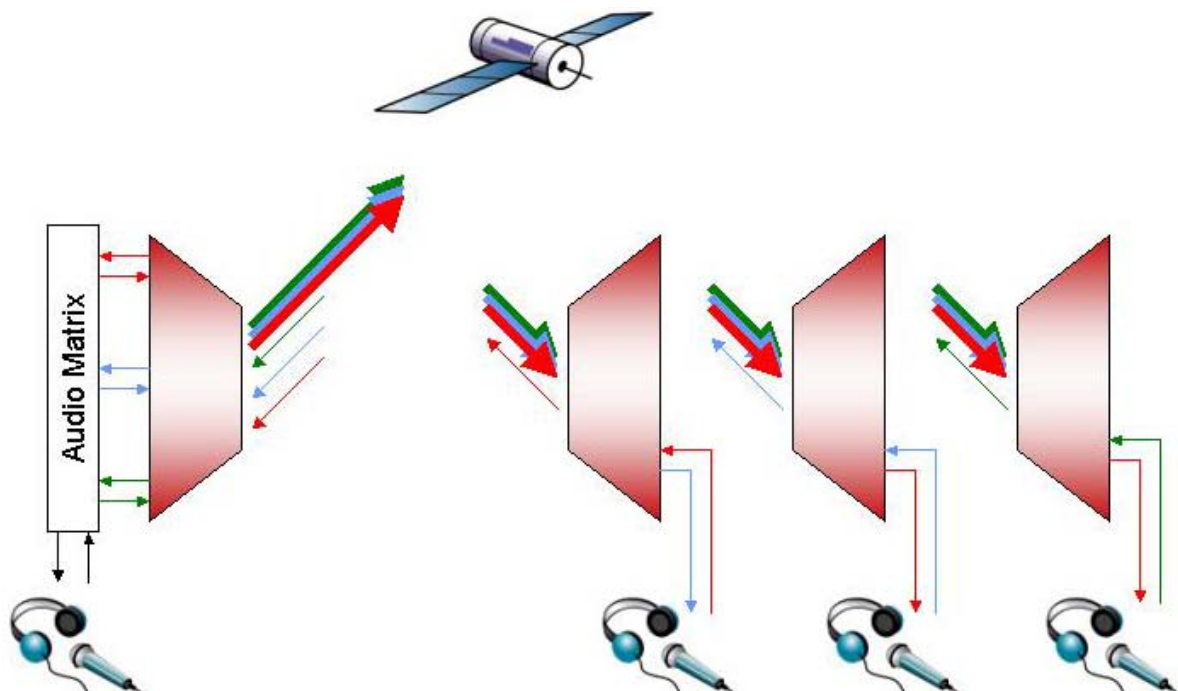
The example shows three remotes, each receiving a combined broadcast feed from the hub which consists of three contributions, red, blue and green. The first remote has chosen to listen to blue, the second one to red and the third one also to red. This topology is achieved by configuring a unique code in the destination field for each channel which either allows it to join or be extracted from a broadcast multiplex.

All channels that are to be broadcast are given the destination "BTXnnn" (where nnn is a logical channel number from 0 to 127). To receive this channel at a remote site, the corresponding code "BRXnnn" is entered.

So at the hub, the voice configuration page might appear as follows:

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node0Hub                        V100 Multiplexer Supervisor
AGGREGATE STATUS          : 0:1 Carrier 64000    0:2 Carrier 128000
------------------------------[ VOICE #1]------------------------------


Channel  ClkRef   SigType  Interface  Algorithm          I-Gain-O    Destination
 1:1     GRXCLK   DTMF     Tie-Line   NetCode 9.6K    0dB     0dB    BTX1
 1:2     "        DTMF     FXS        NetCode 9.6K    0dB     0dB    1:1:2
 1:3     "        DTMF     Tie-Line   NetCode 9.6K    0dB     0dB    BTX2
 1:4     "        DTMF     Tie-Line   NetCode 9.6K    0dB     0dB    BTX3










-------------------------Configuration #1 is active-------------------------

Connected 03:03:08    Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

Physical ports 1, 3and 4 are assigned to carry the three logical broadcast channels red, blue and green respectively. At the first remote unit, the corresponding voice configuration page would appear as follows, which picks out the second (blue) logical channel on port 1:

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node1Red                    V100 Multiplexer Supervisor
AGGREGATE STATUS        : 0:1 Carrier 64000
--------------------------------[ VOICE #1]--------------------------------


Channel  ClkRef  SigType  Interface  Algorithm      I-Gain-O    Destination
 1:1     GRXCLK  DTMF     Tie-Line   NetCode 9.6K   0dB    0dB  BRX2
 1:2       "     DTMF     FXS        NetCode 9.6K   0dB    0dB  0:1:2
 1:3       "     DTMF     Tie-Line   NetCode 9.6K   0dB    0dB  AUTO
 1:4       "     DTMF     Tie-Line   NetCode 9.6K   0dB    0dB  AUTO












--------------------------Configuration #1 is active--------------------------


Connected 03:03:08    Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

It is also possible to use the return path to the hub at the same time. If we extend the example by considering the first remote unit to provide the red feed, the second the blue feed and the third the green feed, then by specifying the destination codes as"BTRttt,rrr" at both ends (where "ttt" specifies a logical TX code and "rrr" specifies a logical RX code) we can make the return feeds available in a return broadcast from each unit. To pick out the right channels at each end, "ttt" at one end must match "rrr" at the other and vice versa. An example of the relevant configuration pages corresponding to this network is given below, where the hub is shown as Node0, red is Node1, blue is Node2 and green is Node3:

The Routing page for the Hub, Node0

The Voice Configuration for the Hub, Node0

The Voice Configuration for Node1 (Red)

The Voice Configuration for Node2 (Blue)

The Voice Configuration for Node3 (Green)

Note that it is also possible for simultaneous point-to-point connections to be made as normal by specifying the destinations in the usual way. Here, a 2-wire telephone connection is made between the Hub on channel 2 and Node1(Red) on channel 2. This also provides the illustration that broadcast channel numbers are LOGICAL numbers, not PHYSICAL numbers which relate to ports, since for example at the hub, port 1:3 is chosen to supply broadcast TX channel 2. Whenever this channel is to be received at the remotes it must be referred to as broadcast receive channel 2, so in the case of Node1(Red) we enter BTR4,2.

All broadcast feeds must be given a unique number – it is not sufficient to start numbering the TX channels from 1 at each node. In this example, feeds 1, 2 and 3 are provided at the hub and feeds 4, 5 and 6 at red, blue and green respectively.

4.9   Expansion – The High-Speed Channel (HSC)

The 9-way D-type connector on the rear panel of the V100 may be used to link a second chassis to expand the number of available channels at a single site, effectively building a larger multiplexer. The High-Speed Channel(HSC) presented on this port is a full-duplex synchronous serial bus running at 4Mbps, which is used to transfer data and control information between units without overhead penalty and with low latency. The HSC is configured on the System Settings menu.

4.9.1   HSC Data

One chassis must be configured as Master and will poll all other possible node numbers (from 0 to 240 excluding itself) on a rotating basis. The other unit must be configured as a Slave. The master and slave

then communicate as if over a standard aggregate port, but since data packets are being transferred over the private HSC bus, they incur no extra multiplexing overhead than normal.

Since bandwidth on the HSC is used for both control and data packets, the maximum aggregate of all data routes via the HSC must not exceed 2Mbps in either direction, so as to allow control packets to flow under all circumstances.

The HSC uses an RS485-style electrical interface and consists of RX and TX data pairs and separate RX and TX clocks. All signals are bussed between units by a twisted-pair cable and consist of one driving source and one receiver. In the example below, the master unit has an aggregate link to a remote unit and is linked via the HSC to the slave. Data for a tributary port on the slave is received by the master, routed to the slave and output from the relevant tributary channel.
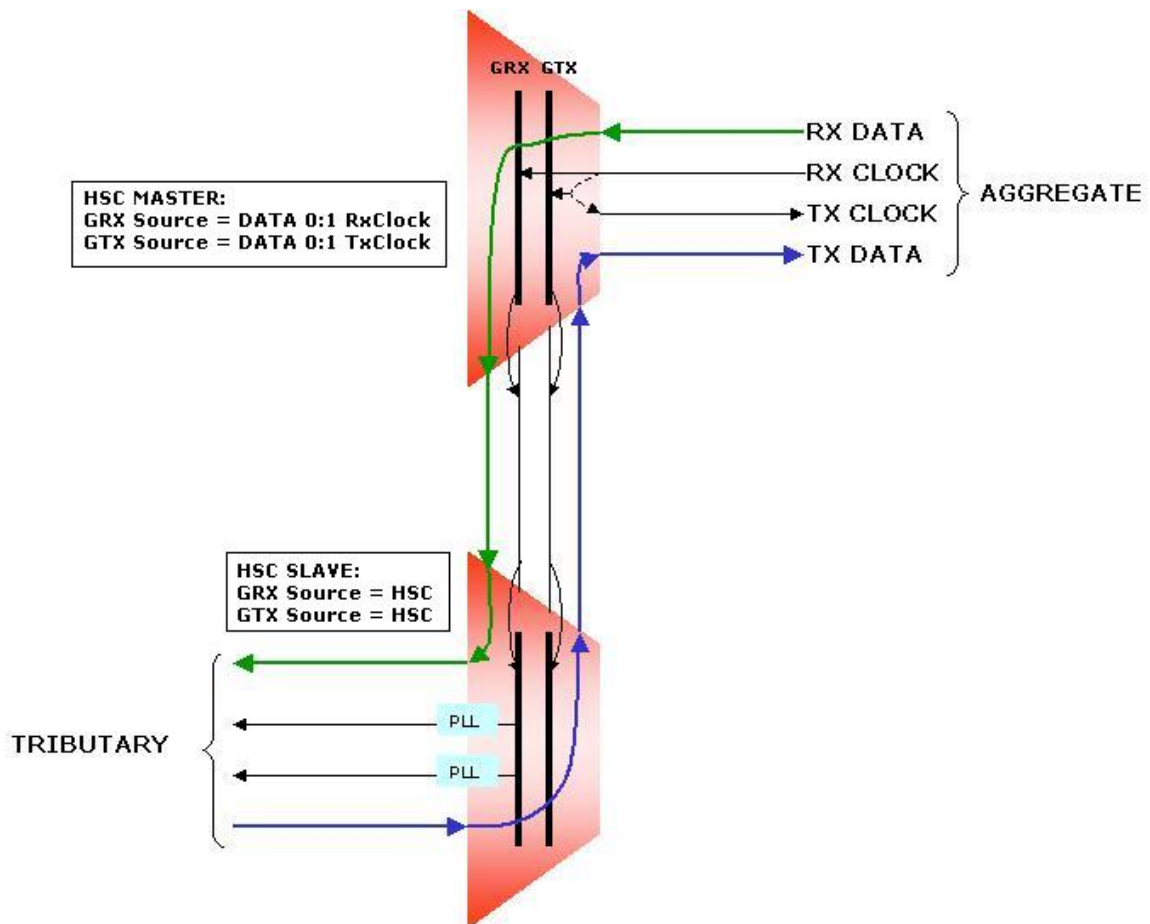
4.9.2   HSC Clocks

The example above shows the simplest clock application, where the aggregate RX clock drives the GRX of the master and is also looped back to the TX clock. The GRX is then used as the reference to derive the 4Mbps HSC RX clock. The HSC clock on the slave must be set to drive the GRX clock. This GRX then becomes the reference for the tributary PLLs in the slave, which derive the port clocks.

Each HSC clock bus must have only one driving source. However, either unit may be designated as the source for the clock (configure a non-HSC source for GRX/GTX), irrespective of whether it is the master or

not, and the other connected unit must receive it (configure HSC as the source for GRX/GTX). This gives the system the ability to onward-link a clock from any port on any unit to any other unit in the network via the HSC. This may also be done independently in the other direction, as shown in the following example, where the tributary TX clock is used to produce the aggregate TX clock for onward-linking into the network. Note the GTX reference bus is driven separately for this purpose:
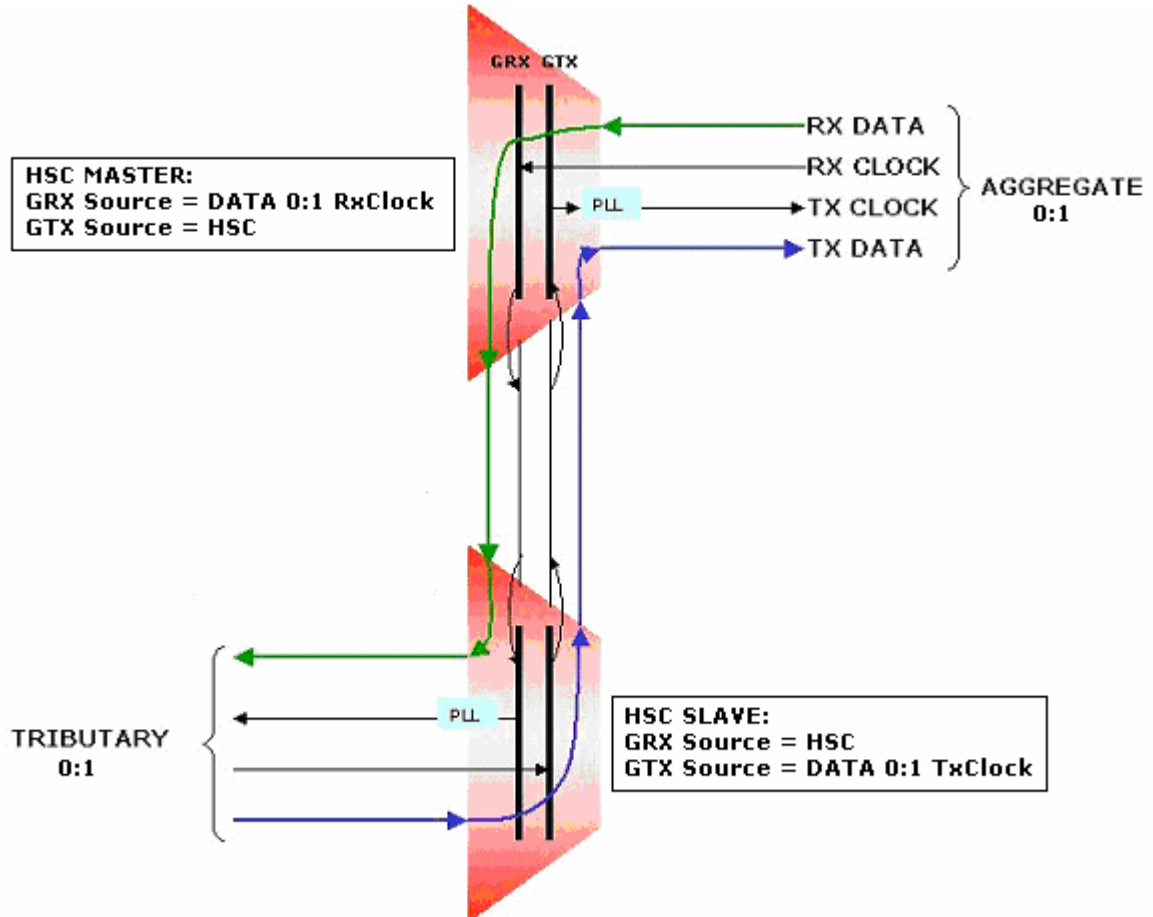
4.10 Async Error-correction and Compression

This feature allows individual async channels to operate error-free over a satellite link. It does not affect or relate in any way to bulk error-correction that may be taking place within the satellite modem or aggregate link.

Asynchronous channels have now been enhanced with the addition of a new configuration item on the DATA CHANNELS menu. A single-character field is now displayed to the right of the "FORMAT" field when the channel is configured into an async mode.

The new field allows three selections as follows:

"R" – Raw	Data is passed without error-correction or compression.
"E" – Error-correction only	Data is error-corrected.
"C" – Compression	Data is error-corrected AND compressed.

In Raw mode, async data is transferred transparently. The compression mode intrinsically uses error-correction, since the compression tables cannot work reliably otherwise.

4.10.1 Error-correction

The error-correction function is based on 100mS time periods. Data received by the tributary port is buffered into a 100mS superframe irrespective of channel rate, which is then split into a number of smaller sub-packets according to Dynamic Bandwidth Allocation (DBA) requirements. For example, if the channel is configured with a baud rate of 115,200bps then there will be approximately 800 characters per superframe buffer, which is then sent as a number of small HDLC frames depending on the internal DBA rate, or the size of the logical connection on the aggregate which is allocated to the channel. The underlying rule here is that no subframe or packet on the aggregate should occupy more than 20mS on the aggregate.

The error-correction has a window size of 128, so it can correct up to 128 100mS buffers of **continuous** data, representing roughly 128Kbytes of data at 115,200bps. For surfing/browsing this would improve, since the data is much more sporadic.

In practice, only 75% of this buffer is used for safety reasons, before flow control is asserted at the port. This means that at worst case, the error-correction can survive up to 9 seconds without receiving a good frame.

The principle used for error-correction uses a NACK-only protocol. This means that a negative acknowledgement packet is sent back whenever a good frame is received out of sequence, since at least one frame in the middle must be missing. This NACK asks for the retransmission of frames starting with the first missing one.

Errors experienced on the link affect the whole 100mS superframe, which has to be retransmitted. When the error rate approaches 1 in 10e4 to 1 in 10e5, the error-correction will start to fail since every superframe will be received in error. The technique therefore starts to reach a useful limit at error rates of around 1 in 10e5.

When the channel input buffer reaches 75%, as caused by a poor link, insufficient bandwidth or loss of carrier, the CTS signal on the port is dropped by the multiplexer. **This signal must be connected to the DTE for the error-correction to work**. Loss of carrier is then handled by asserting flow control to stop the input data. Realistically, this means that a channel should continue without data loss through carrier losses of up to at least 5 seconds PROVIDED it is configured so that it does not lose any data. **NOTE: "The Data Channel Flag" parameter on the SYSTEM menu must be set to "Follows Alarms" for the error-correction to work properly**. If the connection is lost for more than 30 seconds then the channel dumps all data, deletes the compression and restarts.

4.10.2 Compression

The data compression feature uses a derivative of the Lempel-Ziv algorithm with a code size of 12 bits. The algorithm runs above the error-correction layer, which is always enabled when data compression is selected.

The 100mS data buffers are compressed and fed into the error-corrector, which builds up a table of 12-bit codes according to the data coming in. If the code table ever fills up completely (i.e. all 2^{12} Code entries are used) then the table is reset and begins to accumulate all over again. Similarly, the compression is turned off whenever the throughput reaches 100%, in which case there is no gain achievable and the data is passed transparently.

The compressor also stops operating when the channel goes idle for more than 0.5 seconds and drops into transparent mode. This is to optimise the transfer of single characters or sequences of data less than four characters – the compression will only start again when a block of at least four characters are present in a buffer. If for any reason, the compressor turns off, perhaps during a sequence of incompressible data, then it will retry after 5 seconds. This allows it to pick up again to optimise transmission automatically.

4.10.3 General characteristics

Error-correction or compression on channels below 4800bps may start to impose excessive delays. The usefulness of this feature should be carefully assessed before configuration.

The operation of the error-correction facility imposes a processing burden upon the host. Testing has indicated that a safe performance limit of up to four channels per chassis running at 57600bps should be observed to prevent any adverse effects on the normal functioning of the unit. Performance degradation may be indicated by a slowing of the supervisor update speed.

4.11 TDM Data Channels

The V100 TDM Framer card (VI68713) is a multi-purpose adaptor card, which is fitted internally into the Special Options slot of the Rev.C V100 chassis. Into this card, one of three interface modules may be inserted: (i) a TDM Serial Interface (VI68714), (ii) a basic-rate ISDN S0/T0 OEM card (VI68711-SE or – SU), (iii) a basic-rate ISDN U0 OEM card (VI68711-U). With the TDM Serial Interface fitted, the card functions as an aggregate serial interface and framer allowing the V100 to split off TDM bandwidth for other applications. In the second and third applications, the card converts the OEM ISDN modules into a footprint compatible with the existing Rev.C V100 motherboard connectors to allow the modules to plug into an existing Rev.C motherboard. On later motherboards (Rev.D+), the framer card is fully integrated allowing the motherboard to support all modules directly.

4.11.1 Functionality Restrictions

In the case of the ISDN S0/T0 and U0 applications, no other V100 resources are affected. In the case of the TDM framer application, the internal architecture imposes restrictions on the choice of operation. In this case, the High-Speed Channel (HSC) may not be used and the HSC menu items on the SYSTEM SETTINGS page are replaced by two fields for the control of the TDM port interface and Transmit Clock.

However, with the TDM port as the aggregate, both PORT1 and PORT2 may be used as data ports with full functionality, thereby effectively providing an extra channel.

Only transparent synchronous data channels may be operated in TDM mode. The format must be set to "SYNC".

4.11.2 Operation

In the case of the TDM Framer, the serial interface behaves as an aggregate port, with a selectable portion of the bandwidth able to be allocated to any tributaries configured in TDM mode. The remainder of the bandwidth is assigned to all other channels and operates in the same way as a normal V100 aggregate.

The TDM Framer card (VI68713, required in RevC units only) may be fitted with a Vocality TDM Interface card (VI68714) which carries DB15F connector and interface devices to provide the standard range of transparent serial electrical standards. Unlike a standard port however, the TDM port can only be a DTE and the RX clock MUST be supplied by the external DCE. The TX clock may be input externally or looped from the RX clock; in both cases a Terminal Timing clock is always output to the connected DCE. The DB15 pinout is the same as the standard V100 data ports.

The framer/deframer on the TDM Link card may be clocked at any frequency up to 512Kbps. This divides the bandwidth into 32 timeslots, with up to a total of 28 assignable to TDM mode, while the remainder is used for standard V100 packetised connections. A proprietary software protocol runs behind this which time-division multiplexes data from any of the V100 tributary data ports on a byte-interleaved basis, thereby providing optional TDM functionality to any ports configured with the format field set to "TDM".

In operation, the Time Slot Assigner (TSA) is used to separate a number of timeslots for TDM use and the remainder for use by the normal V100 aggregate data stream, which is still available and may be used for any other tributaries. The composite frame consists of 32 timeslots with the first four timeslots assigned to synchronisation and V100 overhead, with the remaining 28 data timeslots allocated either to TDM data or to V100-style packetised data:

S=	Synchronisation byte
O=	Overhead
T=	denotes TDM packetised sub-structure
V=	denotes V100 packetised sub-structure

The allocation of slots defined by the configuration of the units. Sufficient timeslots are allocated to the TDM channels according to the sum of all configured TDM channel rates, rounded up to the nearest timeslot. At startup, all slots are allocated to the V100, allowing units to communicate and exchange management data as normal. A simple protocol checks that both ends of an aggregate will use the same

timeslot allocation map when transferring to TDM operation; if the configurations are different, the units will remain in V100 mode until the discrepancy is resolved. Once agreed, both units will enable their respective TSA and adopt the multiplexed frame structure. If the units fail to resynchronise within their new frame sub-structures, they will revert to V100-only mode, re-establish communications and try again. This process will repeat indefinitely.

Control and management continues to be maintained through the V100 timeslots once the framer/deframers are synchronised. Any subsequent configuration changes are managed using the same technique but the first attempt is made from within the V100 frame sub-structure. On failure, the units again revert to V100-only mode and retry:

Initial slot assignment – V100 only:

S	O	O	O	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V

Final slot assignment – 25% slots allocated to TDM bandwidth:

S	O	O	O	T	T	T	T	T	T	T	T	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V

Byte-interleaved TDM subframes are constructed as a function of link rate and tributary channel rate with padding bytes as necessary. Tributary channel data rates from 50 to 1600bps may be configured at 25bps intervals and in 100bps intervals from 1600bps up to the practical maximum of 448Kbps. By default, the granularity of the TDM submultiplex is 100bps; the 25bps granularity is used only when a rate is configured with this as the highest common factor.

The presence of the TDM card does not preclude tributary operation at low speeds such as 50, 300, 600, 1200 baud since the V100 creates a framed submultiplex beneath the physical 32-timeslot frame. So, despite the fact that, at 128Kbps link rate each primary slot represents 4Kbps, the eventual superframe contains as many 32-byte frames as required to represent all of the TDM octets in the submultiplex (in the above example, the TDM submultiplex occupies 32Kbps out of 128Kbps).

The TDM submultiplex frame is constructed according to an algorithm which allocates 100bps to each slot by default. Thus with 64Kbps available, the framelength would be 640 octets, yielding a frame duration of 80mS. The algorithm then allocates timeslots to tributary channels in a manner proportional to bit rate, with any spare or surplus bandwidth allocated to a "spare" or unused pool. In this way, it is not necessary to transmit length bytes since each member of the submultiplex is allocated its precise bit rate.

Within the TDM bandwidth a submultiplex allocates 100bps to each octet. In this example, channel 1 is configured to 100bps, channel 2 to 9600bps, channel 3 to 16Kbps and channel 4 to 4800bps:

S	P	P	P	P	P	P	P	P	P	P	P	P	P	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

The overall result – mixed V100 and TDM timeslots with TDM channels submultiplexed underneath:

S	O	O	O	S	P	P	P	P	P	P	P	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
S	O	O	O	P	P	P	P	P	P	P	1	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
S	O	O	O	2	2	2	2	2	2	2	2	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
S	O	O	O	2	2	2	2	2	2	2	2	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
S	O	O	O	2	2	2	2	2	2	2	2	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
S	O	O	O	2	2	2	2	2	2	2	2	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
S	O	O	O	2	2	2	2	2	2	2	2	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
S	O	O	O	2	2	2	2	2	2	2	2	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
S	O	O	O	2	2	2	2	2	2	2	2	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
S	O	O	O	2	2	2	2	2	2	2	2	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V

...and so on to the end of the superframe.

4.11.3 Configuration

With a TDM framer card fitted, the user has the option to operate some data ports in TDM mode and some in standard V100 packetised mode. On the DATA menu, the only configuration needed is therefore to select "TDM" mode for the relevant channels on the "Data Configuration" menu and to ensure the format is set to "SYNC". In the example below, the TDM tributaries generate clocks from their PLLs, which are referenced to the GRX bus:

The TDM card should be configured to drive the GRX bus. The CLOCKING menu is used to configure this:

On the SYSTEM menu, the HSC options have automatically been replaced by the two TDM card options, one of which should be set according to the electrical interface standard to be used; the other of which defines the Transmit Clock source. On the TDM card, the Receive Clock is always input from the network, but the TDM TXC field allows some flexibility in clocking regime for the TX Clock:

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node1                       V100 Multiplexer Supervisor
Agg Status:
------------------------------[ SYSTEM ]------------------------------


   NODE NAME                : Node1_         NODE ID         : 001

   CONFIGURATION BY REMOTE : Enabled         HSC MODE        : Slave
                                             TDM TXC         : Rxc


   ALARM RELAY DELAY        : None           OPTION 0        : TDM
   ALARM RELAY MODE         : Auto

   COUNTRY                  : UK             RW PASSWORD     :
                                             RO PASSWORD     :
   CONNECTION TIMEOUT       : 10 seconds     ACCESS TIMEOUT   : 0 seconds
   RECEIVE READY FILTER     : 1 seconds      ACTIVITY TIMEOUT : 30 seconds
   DATA CHANNEL ACTIVATION  : Auto
   DATA CHANNEL FLAG        : Always On      BACKUP TIMER     : 40 seconds
   TIE-LINE ACTIVATION      : M-Lead         FALLBACK MODE    : 2 Min(No BW)
   ASYNC BUFFER SIZE        : 32 buffers     FALLBACK TIMER   : 40 seconds
-------------------------------------------------------------------------
Enter Text

Connected 00:02:02    Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

On the ROUTING menu, the TDM card must be specified as the primary route to the corresponding V100, which also has the TDM card fitted:

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node0                       V100 Multiplexer Supervisor
Agg Status:
--------------------------------[ ROUTING #1]--------------------------------

Name        Node Slot Chan Agg  Connect Using          Alternate

Node1        1    ANY ANY TDM
SEC: NONE   --------------------------------------------------------------------




<NEW ROUTE>    <DELETE ALL ROUTES>   <TIDY LIST>

--------------------------Configuration #1 is active------------------------
Enter Text

Connected 00:06:52    Auto detect    9600 8-N-1    SCROLL    CAPS    NUM    Capture    Print echo
```

This link may carry all types of traffic since it contains two multiplexes, the TDM for synchronous data and the V100 for any traffic. However, there are no restrictions on the use of the standard data ports as additional V100 aggregates at the same time. Traffic from tributaries will be carried over the link appropriate to their destinations, so in a more complex network there may be a TDM link carrying TDM data channels for error-sensitive traffic while on a second link, a normal V100 aggregate port carries voice, BRI or MPEG packets.

4.12 Switched carrier Operation

Aggregate ports are usually connected via a fixed carrier network, for example a VSAT link. However, the V100 also permits operation over switched carrier links where the circuit is available on a temporary basis such as DAMA or SCADA networks, or to interface with external ISDN Terminal Adaptors. This latter application is useful for connecting to Inmarsat services, where there may be a V100 and an Inmarsat-B terminal (RS449-based switched interface) at a mobile location at one end of a link, talking to a V100 in the customer's premises which is connected directly into the ISDN network using the ISDN Link Interface card:
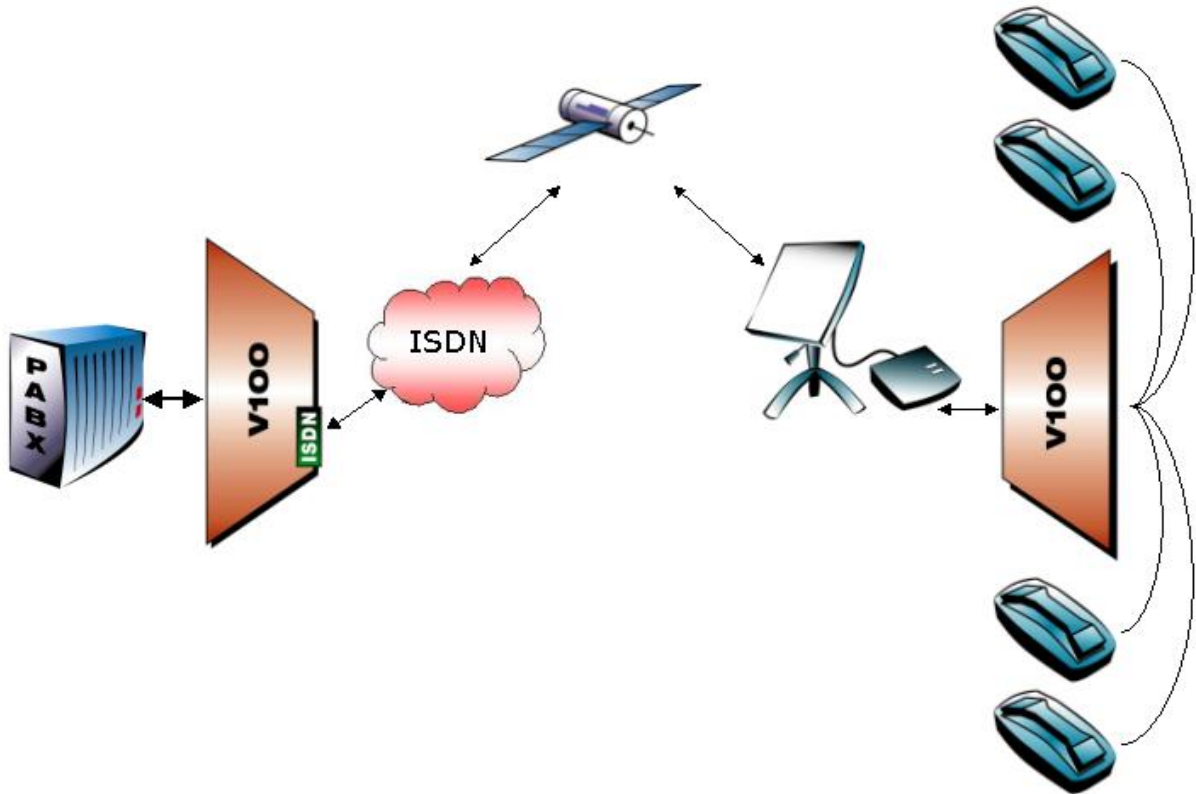
4.12.1 SWITCHED Mode

In this mode the V100 Aggregate port is connected to a switched service such as an Inmarsat-B terminal, where the link is inactive and the V100 has no carrier with the remote unit until the ISDN link is established. The modem needs to be told when to establish carrier by the mux and this will happen when stimulated by a tributary port being activated. For example, when a telephone call is made from a channel on the mobile unit, link bandwidth is required. This causes the aggregate port to raise the "C" or "RTS" signal, which causes the Inmarsat terminal to request service. When the ISDN link is established, the Receiver Ready (RR) signal from the terminal indicates that the connection may proceed, the V100s establish carrier, a call setup packet is sent to the hub unit and the user hears dialtone from the PABX. The call proceeds in the normal way until cleared, either by the mobile V100, which drops the "RTS" signal to the terminal when the handset is replaced or by the hub V100 which clears the ISDN call when the line is dropped by the PABX. In both cases the "RR" signal is dropped by the terminal and carrier is lost.

To configure the V100 to operate in this way, the aggregate port connected to the Inmarsat terminal must be configured with the word "SWITCHED" entered in the destination field. In addition, the "Connection Timeout" and "Receive Ready Filter" fields on the SYSTEM SETTINGS page become relevant. When an Inmarsat terminal establishes carrier, the RR signal can be unstable until the link is securely established. The Receive Ready Filter ensures that the V100 waits for the signal to stabilise before sending its first packet. The ISDN system connection time can be quite long (up to 30 seconds is quite common on

Inmarsat networks) and so the Connection Timeout may be adjusted to ensure the V100 does not give up too soon.

One final point to note is the clocking regime used with the switched system. Inmarsat terminals commonly maintain a 64Kbps clock at all times irrespective of the connection state; in this case the conventional scheme is used where the RX Clock is driven on to the GRX bus. With DAMA modems, since the carrier is not permanently present, the mux must provide a TX clock to the modem at the intended rate. This must also be used as the reference for the voice card, which generates call progress tones during the connection sequence. A standard configuration is shown below:

```
🌑 V100 - HyperTerminal                                                    _ □ ✕
File  Edit  View  Call  Transfer  Help
 🗋 🖆  🕮 🍃  🗈 🖺  🖳

 Node0                        V100 Multiplexer Supervisor
 Agg Status: 0:1 Lost
 -------------------------------[ DATA #1]-------------------------------


                             ----RX clock---- ----TX clock----
 Channel Iface Mode Type Format Rate    Src  Ref Rate    Src  Ref Destination
  0:1    RS449 Agg  DTE  NRZ    0       Ext   -  0       Rxc   -  SWITCHED
  0:2    RS449 Trib DCE  NRZ    0       Ext   -  0       Ext   -


          |




 -------------------------Configuration #1 is active-------------------------

Connected 00:00:34    VT100      9600 8-N-1   SCROLL  CAPS  NUM  Capture  Print echo
```

4.12.2 SCADA Mode

The aggregate port should be configured with the word "SCADA" entered in the destination field. This causes the port to adopt the SCADA packetised frame structure which supports the connection protocol of the RF terminal to which it is connected:

The terminals are referred to as "RT" (or Remote Terminal) units. It is essential that on the ROUTING page, a route to each potential destination RT is entered explicitly, so that the unit knows which address to transmit when establishing a call. This is done in the "Connect Using…" field on the ROUTING page and must be of the format "RTnnn" where nnn is a numeric field. It may contain up to 14 digits and will be transmitted to the local RT when the call is established:

Notice that all RTs are accessed over the primary route 0:1. This is because in our example, Port 1 of the chassis is used as the aggregate port in SCADA mode and is connected to the local RT unit. All other units must be programmed in a similar way (they will of course contain a route to Node 0, our local node) and then voice calls may be made between any stations.

As with the standard fixed-link mode of operation, destination channels for voice calls may be either entered as specific channel numbers for hotline operation or left in "AUTO" mode, when the V100 destination channel number is dialled on the telephone. Thus, to place a telephone call to voice channel 3 in Option Card 1 of Node 2 from anywhere in the network, pick up the receiver and dial "213". The routing menu tells the unit how to reach Node 2 and which destination RT number to transmit to the local RT to establish the link. Once the link is established, the rest of the dialled number tells the receiving unit which channel to route the call to.

During placement of the call it is normal to hear a succession of rapid beeps denoting establishment of the link. This will then be followed by a ringing tone when the connection is made. If the link cannot be established due to network congestion, the user will hear the normal "busy" tone in the handset.

All of the normal V100 voice channel facilities are still available in SCADA mode and so for example may be used to connect to PABX extension ports in FXO mode or between PABXs over the 4-wire Tie-line interface. Group III FAX machines or modems may also be used.

To prevent any unintended call or bandwidth charges, Voice Activation may be utilised.

4.12.2.1   Spanning Tree Protocol

The spanning tree protocol is an implementation of IEEE802.1d. The protocol may be enabled on individual bridge ports by changing the Bridge mode in the networks menu (see section 3.4.9.2). The spanning tree protocol is used to detect and prevent loops in bridged networks. If the V100 is bridging in a network topology that contains loops then the Bridge mode should be set to STP on each port that makes up part of the looped network - the port takes part in the spanning tree protocol and forwards bridged traffic when the spanning tree protocol determines the port is in a forwarding state. If the V100 is bridging in a network topology that does not contain loops then the Bridge mode should be set to On – the port does not take part in the spanning tree protocol and forwards bridged packets.

The spanning tree protocol operates between the bridges in a looped network, and produces a tree structure of bridge ports. Ports that would complete network loops are put in a blocking mode and do not actively forward bridged packets. The tree topology is determined by the relative priority of each bridge in the network and the relative path cost assigned to bridge hops. The V100 bridge priority can be configured here in the GENERAL menu. The port priority is set to a default of 128 and cannot be altered. The relative path cost assigned to each bridge port is calculated as 19 for the Ethernet port and (1000000000/assigned dba rate) for V100 tributary ports. Note that the spanning tree protocol relies on the periodic sending of "hello" bridge protocol data packets. When the V100 is determined to be the root bridge in the spanning tree network, the period of sending these "hello" packets is set to the HELLO TIME

configured in the general menu. This periodic sending of spanning tree protocol packets makes the use of STP undesirable is dial-up networks.

4.13 The Integrated IP Router

4.13.1 Overview

This section describes the basic concepts behind the integrated IPV4 router available on Revision D and later V100 platforms. It is assumed that the reader has a basic understanding on the operation of an IP router and the operation of other services in the V100. The section includes configuration examples for typical installations and troubleshooting tips – however, it is not intended to fully describe the user interface – please refer to the MENUs section for these details.

4.13.2 Basic IPV4 Routing

The V100 integrated IP router forwards data from one LAN to another across a V100 WAN link. This is achieved by establishing a connection from one node to another and assigning it a maximum bandwidth over the aggregate in a similar way to a DBA data channel. Once this is established, the IP router at each end performs the filtering or forwarding of all traffic relevant to the remote network according to a manually entered static route table. The router may act as a local DHCP server and supports UDP broadcasts to support Windows^{TM} applications.

4.13.3 Network Configuration

The V100 includes routing software for forwarding IP data between the 10/100base-T Ethernet port and aggregate ports. To utilize this facility, the V100 must be configured with information about the IP sub-networks that the V100 network is interconnecting. All configurations must include at least:

IP address and subnet mask for the Ethernet port

Configuration of how the IP router connects to the V100 network

Configuration of static IP routes

Configuration of the first two components is done through the NETWORKS screen of the IP sub-menu. The NETWORKS screen describes how the IP router connects to both the local LAN and the V100 WAN network.

The Ethernet is represented in the user interface with the port name "ENET". The Ethernet must be configured with the IP address of the Ethernet port on the local network, and the mask of the local subnet. Any host stations (PCs), or routers on this local network, must be configured to use the IP address of the V100 Ethernet as the next-hop gateway for all IP networks that the V100 is providing interconnect services for. In the example below, the Ethernet port has been configured with the address 192.168.1.1, and the mask 255.255.255.0 – this mask will allow the configuration of 253 other IP stations on the local network (two addresses are also reserved for broadcast use). The Maximum Transmission Unit (MTU) in bytes is typically left at the default value of 1514 for the Ethernet port. The UDP Gateway (UDPGw) option

is discussed later in the UDP relay section. The DBA and Destination fields are not used for the Ethernet port. The IP field is be fixed at NUM (for standard numbered packet support) for the Ethernet port.

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node0                        V100 Multiplexer Supervisor
AGGREGATE STATUS         : 0:1 Carrier 1024000 ISDN B2 Carrier Lost
------------------------------[ NETWORKS #1]------------------------------

Chan DBA      IP  Address        Mask            MTU  UDPGw TCPGw Bridge Dest
ENET          NUM 192.168.001.001 255.255.255.000 1514  ON






<NEW SUBNET>    <DELETE ALL SUBNETS>
                         Type <ctrl d> to delete selected entry
------------------------Configuration #1 is active------------------------
Use <SPACE>/+ or - to select

Connected 03:03:08    Auto detect    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

Example of IP Subnet configuration for Ethernet

With just a single IP network entity configured on the Ethernet port, the V100 can communicate with IP stations on the locally connected network, but will not yet route IP traffic over the V100 network. Further network entries must be configured for this – however, unlike traditional wide-area network routers, IP networks are not configured directly for the aggregate ports to the V100 network as this would by-pass the V100 bandwidth management facilities provided by the V100 data router. Instead, the concept of virtual ports (see below) is used to represent the wide area networks of the IP router.

4.13.4 Virtual Ports

IP connectivity is provided across the V100 network as a set of point-to-point connections between V100s with integrated IP capability. The IP router forwards traffic between the Ethernet ports of pairs of V100s via the V100 network. A point-to-point connection between the IP router on a V100 and the corresponding IP router on a peer V100 is represented by a **virtual port**, which works in the same way as any other V100 channel but does not have a physical connector.

The IP router is fully integrated with the other V100 services. It interfaces to the V100 Data Router for interconnectivity across the V100 network. The V100 Data Router is built on the concept of connecting peer logical ports across the V100 network via aggregate links. Each tributary has a port number that is unique within the V100 network. The diagram below shows how the integrated IP router interfaces with the V100 Data Router via these tributary ports, and includes a voice card for comparison.
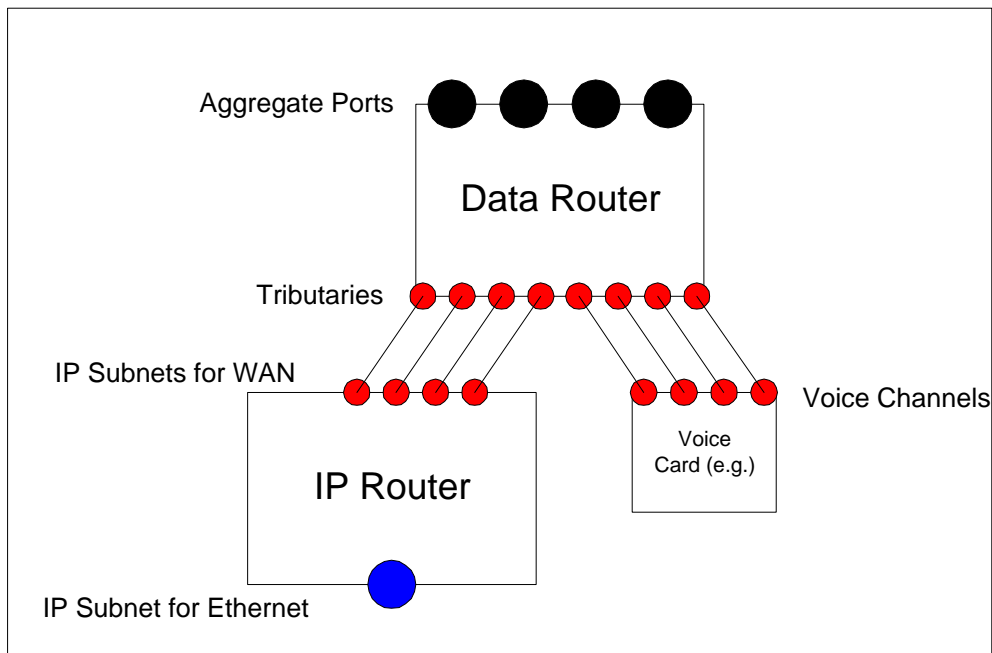
The Interaction of the IP Router with Data Router

Tributary ports are represented by a port number. These typically provide information about the location of the tributary port – the 4 voice ports on a voice card are represented as $n{:}s{:}c$, where n is the node number, s is the slot number that the voice card is inserted in, and c is the channel number within the voice card. A set of special virtual ports has been reserved to represent the IP router WAN ports. These follow the standard V100 port terminology of $n{:}s{:}c$. As there is no plug-in hardware module for the integrated IP router, the slot number component (s) of the channel identifier is always 0. Channels 10 to 31 have been allocated for IP router operation. A separate channel is required for each integrated IP V100 router that this unit peers with. The network configuration requires that the peer channel is configured for each channel configured on the local router. In the example below, Node1 is connected to both Nodes 2 and 3. Channel 0:10 on Node 1 is peered with channel 0:10 on Node2. Channel 0:11 on Node1 is peered with Channel 0:10 on Node 3.
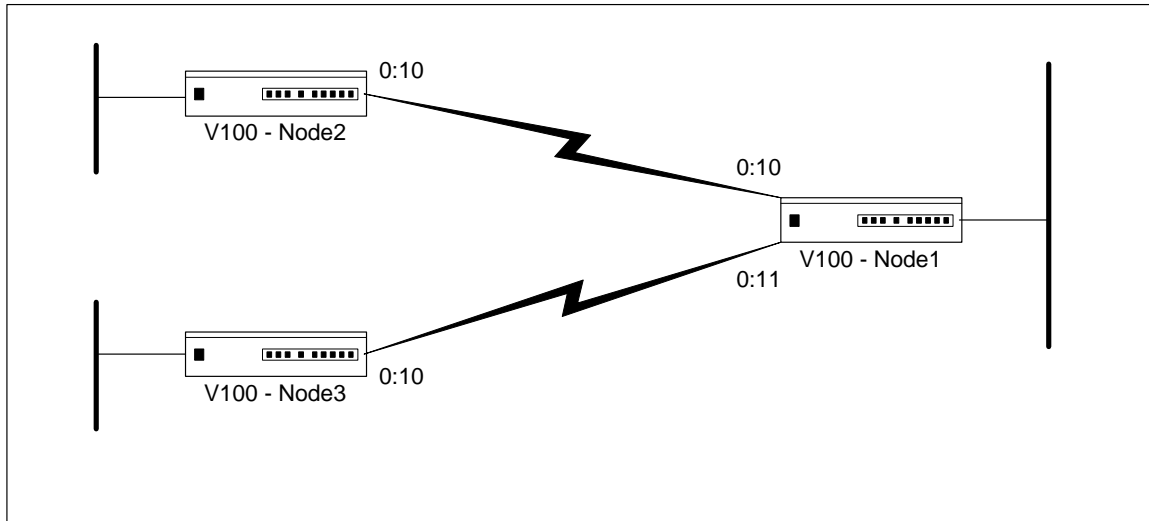
Example of virtual port use

4.13.5 Unnumbered IP

The integrated IP router acts as a half-router – a pair of IP routers connected via the V100 network provide the full router operation. To preserve IP addresses, the point-to-point link between the V100s does not require an IP subnet configuration. When IP traffic is routed over the point-to-point connection, it can only be received by the peer unit, and therefore IP addressing is not necessary. If host IP services are run from the V100 across the V100 network, then the IP address on the Ethernet port can be used as the source address for host communications. The sample IP,NETWORKS menu page below shows the configuration of the IP virtual ports for Node1 from the earlier example.

Example configuration of IP virtual ports

Each virtual port requires a DBA (Dynamic Bandwidth Allocation) and Destination configured. The DBA is the maximum bandwidth (in bits per second) of IP traffic that can be sent to the peer V100 – the actual amount is determined by the data routers in the V100 network according to other offered loads). The destination is the virtual port identifier on the remote device that we are peering with.

The IP field indicates that we are running unnumbered IP across this link – the IP address and mask should match the ENET address and mask to allow for host operations from this virtual port. The MTU (maximum transmission unit) is discussed below.

One quirk of IP unnumbered operation is that IP routes that are configured for IP networks across the V100 network must be configured with a next-hop that identifies the unnumbered link to transfer that data across, instead of an IP address of the next-hop gateway. This is discussed further in the section on Static Routes.

4.13.6 MTUs

The Maximum Transmission Unit or MTU for an IP network specifies the largest datagram that may be transmitted onto that network. Routed packets that exceed the MTU for the onward network are fragmented before transmission over the V100 network and are reassembled by the peer V100 unit. The default MTU for the Ethernet is 1514 – this allows transmission of the maximum sized Ethernet frame (the 4-byte CRC is not included in the MTU).

Most servers are on segments with large MTUs, but it is increasingly common for internet users to be connected via links with reduced MTUs, so it is becoming common for some packets to be too big. How the problem of oversize packets has been handled has evolved considerably over time. The original approach was to send only small packets corresponding to the TCP/IP default MTU (576 bytes). (To this day, a sending system needs permission from the receiving system to send larger packets, but that permission is given as a matter of routine.) For some packets, especially those sent by older equipment, an oversize packet can be sent by breaking it into fragments and sending the fragments as smaller packets. The fragments can be reassembled downstream to reconstruct the original large packet, but this packet fragmentation has several problems involving both efficiency and security.

Newer servers try to optimise their transmissions by discovering the path MTU and sending packets of the maximum size when there's enough data to fill them. The procedure for doing this was standardized and published as RFC 1191 in 1990, but it did not become widely deployed until years later. By mid 2002, 80% to 90% of computers on the internet used Path MTU Discovery.

The basic procedure is simple - send the largest packet you can, and if it won't fit through some link get back a notification saying what size will fit. The notifications arrive as ICMP (Internet Control Message Protocol) packets known as "fragmentation needed" ICMPs (ICMP type 3, subtype 4). The notifications are requested by setting the "do not fragment" (DF) bit in packets that are sent out.

Some network and system administrators view all ICMPs as risky and block them all, disabling path MTU discovery, usually without even realizing it. Of the several dozen ICMP types and subtypes, some do pose

some risk, but the risk is mostly mild and is of the "denial of service" nature. That is, an attacker can use them to interfere with service on and from the network.

By blocking all ICMPs the administrator himself interferes with service on and from his own network. Unless he also turns off path MTU discovery on his network's servers, he makes his servers unusable by users with reduced-MTU links in their paths. Because service is affected only in relatively unusual cases, it can be difficult to convince the administrator that a problem exists. The prevalence of such "unusual" cases is growing rapidly though. Administrators who want to block all ICMPs should disable path MTU discovery on their computers, especially on their servers. It makes no sense to ask for ICMP notifications and then refuse to accept them. In addition, doing so opens the server to a special type of distributed denial of service attack based on resource exhaustion from a large number of fully-open connections.

Clearly all of the above requires careful setup by the network administrator but it can still lead to basic incompatibility when trying to access certain internet servers. The other disadvantage is that even if reduced MTUs are allowed, the fragmentation potentially resulting from it causes a significant additional overhead due to the increased number of packet headers (each typically containing 20 bytes in an IP packet) and ultimately reduced throughput due to the burden of additional packet processing. **The V100 IP Router avoids this** by providing its own proprietary fragmentation over the V100 WAN network, which uses only a 4-byte header to optimise throughput, while appearing to pass the original packets sent by the network transparently. Setting the V100 MTU requires some care in configuration to avoid degradation of the quality of voice channels (or other services) that are multiplexed across the same aggregates as the IP traffic. It is recommended that a value for the V100 MTU is calculated which avoids the creation of any packets that will take longer than 20ms on the slowest aggregate between the local V100 and its peer. The MTU should be set according to:

$$MTU = LS/400$$

where LS is the slowest link speed (in bits per second) on the aggregate link to the peer. If the calculated MTU exceeds the MTU for the Ethernet, then the MTU for the V100 channel should also be set to 1514. In the case of a link running at 64Kbps, the MTU should therefore be set to $(64000/400) = 160$.

Note that fragmentation has an overhead in both the computation required on the V100, and the bandwidth required to send data (each fragment carries an IP header), and you should avoid setting the MTU below the recommended value unnecessarily.

4.13.7 Static Routes

Each V100 IP router must be configured with static routes to tell it how to reach IP networks other than the one that it is locally attached to. An IP STATIC ROUTE TABLE menu screen is provided under the IP sub-menu to do this. Each configured route consists of a description, a destination address, a mask for the destination address and a next-hop. The "Description" is a text field used to identify a route in the configuration. The "Next-hop" is either the IP address of the next-hop gateway on the local Ethernet network, or the channel number for a unnumbered link to a peer V100 across the IP network. When a route lookup matches more than one configured route, the one with the longest mask (i.e. the most

specific) is used to route the packet. A default route (one to use if all other route lookups fail) can be configured by using a destination and mask value of 0.0.0.0. The following example shows a route table that will send all traffic to network 192.168.0.1/255.255.255.0 via the unnumbered link 0:10, and all other traffic to the next-hop gateway 192.168.3.100:

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node0                       V100 Multiplexer Supervisor
AGGREGATE STATUS        : 0:1 Carrier 1024000 ISDN B2 Carrier Lost
--------------------------[ IP STATIC ROUTE TABLE #1]--------------------------

Description          Destination      Mask             NextHop
Default              000.000.000.000  000.000.000.000  192.168.003.100
Officeserver         192.168.000.001  255.255.255.000  0:10




<NEW ROUTE>    <DELETE ALL ROUTES>
                         Type <ctrl d> to delete selected entry
--------------------------Configuration #1 is active--------------------------
Press <SPACEBAR> to activate

Connected 03:03:08    Auto detect    9600 8-N-1    SCROLL   CAPS  NUM  Capture  Print echo
```

Example of IP Static Route Configuration

4.13.8 Example Configuration

Portions of example configurations have been given in the above sections. This section gives a complete example IP configuration for a simple 3-node network. Three remote networks are interconnected with V100s. Node 1 is connected to the 1.1.1.0/255.255.255.0 network. Node 2 is connected to the 1.1.2.0/255.255.255.0 network. Node 3 is connected to the 1.1.3.0/255.255.255.0 network. The V100 network provides connections between Node1 and Node2, and Node1 and Node 3. Virtual ports 0:10 and 0:11 on Node 1 have been configured to communicate with Nodes 2 & 3 respectively. A default network is not defined at Node1, so traffic from Node 2 and Node 3 networks will only communicate with stations on the 1.1.1.0, 1.1.2.0 and 1.1.3.0 networks, and nothing beyond. The dynamic bandwidth allocation and MTU for all V100 channels is set at 256000. A network diagram of this example configuration network is given below:
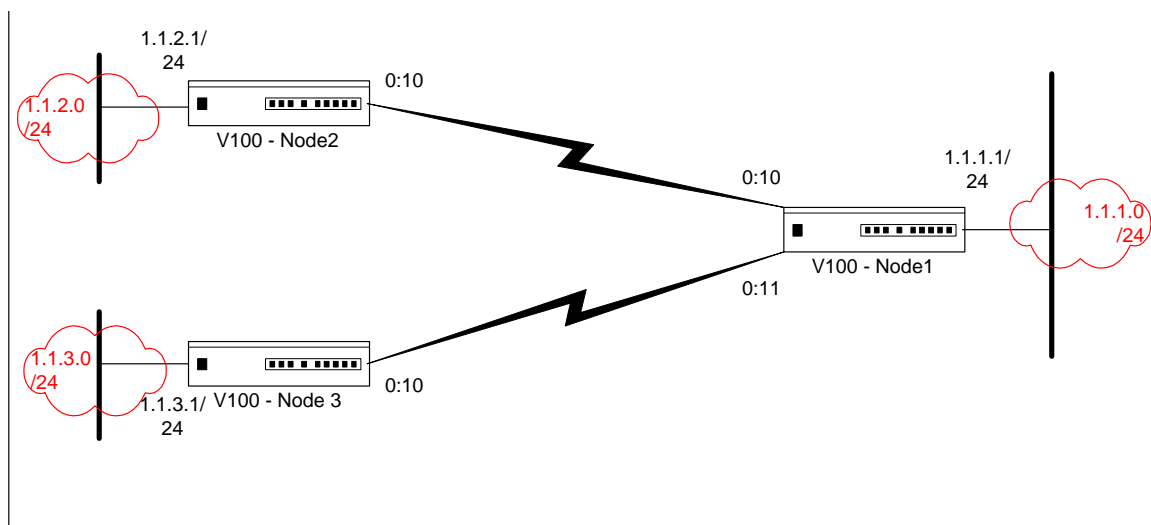
Example configuration network diagram

The following six screen samples show the IP network and static route configuration for all three nodes to achieve this topology:

Screen #1: IP Network Configuration for Node 1

Screen #2: IP Route Configuration for Node 1

Screen #3: IP Network Configuration for Node 2

Screen #4: IP Route Configuration for Node 2

Screen #5: IP Network Configuration for Node 3

Screen #6: IP Route Configuration for Node 3

4.13.9 UDP Relay

Standard IPV4 router operation does not allow for the forwarding of subnet broadcasts. However certain network applications rely on the relay of UDP packets sent to the subnet broadcast address. For example Windows™ browsing service relies on Netbios datagram service packets (addressed to UDP port 138 and the IP subnet broadcast address) reaching all stations within the browsing domain. To allow seamless operation of such applications across the IP ports of a V100 network, the ability to relay UDP subnet broadcasts has been provided. To enable such operation the UDPGw configuration must be turned to "On" for each port that we wish the relay operation to work on. Additionally, an entry in the UDP relay table must be added for each service that must be relayed. Some well-known service types are pre-configured for addition to this table – other services require the appropriate UDP port number to be configured. The example configurations shown in below show the configuration required to relay NetBIOS datagrams (UDP port 138) and subnet broadcasts to UDP port 200 between the Ethernet and V100 channel 0:11 (but not to 0:10). Note the "NetBIOS Name" and "Domain Name" ports have also been included since they will be required to get legacy Windows™ networking working smoothly:

Example IP Network configuration for UDP relay

When using UDP relay care must be taken to ensure that broadcast loops are not introduced into the network. The V100 will ensure that the affects of such loops are minimized through TTL reduction, but network operation will still be adversely affected.

Example UDP Relay Table configuration

4.13.10 TCP Gateway –(TCP PEP)

The TCP gateway provides a TCP performance enhancing proxy (PEP) providing optimization of TCP traffic carried over high latency aggregates. To enable the optimization the TCP gateway function must be enabled on the IP network entries that the traffic is routed through. Up to 32 simultaneous TCP connections may be optimized at any one time.

Note that the optimization feature only applies to TCP traffic that is routed through the V100, If the TCP traffic is bridged, or the TCP traffic is encrypted within an IPSec tunnel then the optimization is not performed.

4.13.11 DHCP Server/Relay

The V100 has three modes of operation for DHCP (Dynamic Host Configuration Protocol). The mode and other DHCP parameters are configurable on the GENERAL page from the IP sub-menu.

The default mode is OFF – in this mode the V100 does not take part in DHCP operation – it is assumed that all stations on the local network have a static IP configuration, or that a separate DHCP server is available on the local network, or an externally routed network.
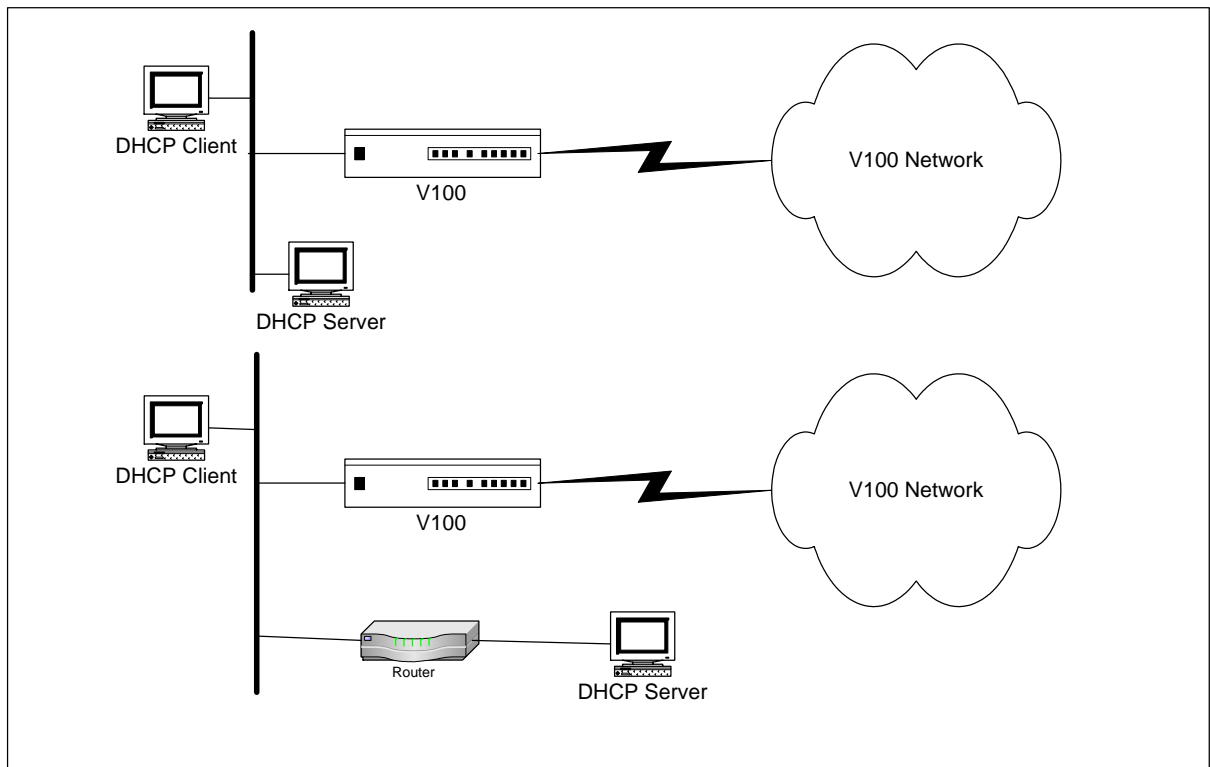
Network configuration when V100 DHCP server mode is OFF

In SERVER mode, the V100 has an embedded DHCP server that will respond to received requests from clients:
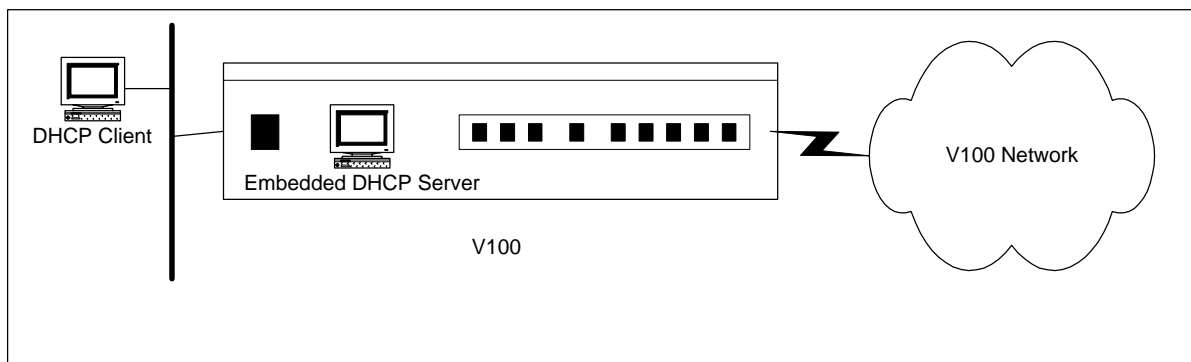
Example network configuration for DHCP SERVER mode

The embedded DHCP server can provide the following host configuration parameters in response to received DHCP requests:

IP Address, Lease Time, WINS Server, Domain, DNS Server Address

The IP address is assigned from the (inclusive) range configured in the GENERAL parameters – the address range should be from the range of addresses on the subnet configured on the ENET port of the V100. This range should not contain the address configured for the ENET port itself however. The DNS

Server address sent to the DHCP client (the other side of the V100 network) must be entered into the "DNS SERVER" address configured on the GENERAL page of the IP configuration. A secondary server address can also be entered. Finally, the IP address of the WINS server and its domain name should be entered. Note that these fields are used by the V100 in its name lookup for ping requests. An example of the GENERAL page configured for DHCP server operation is shown below:

Example GENERAL page for DHCP mode

In RELAY mode, DHCP requests are relayed to a remote DHCP server through the V100 – requests are relayed to the addresses configured in the primary and secondary server addresses in the DHCP server configuration:
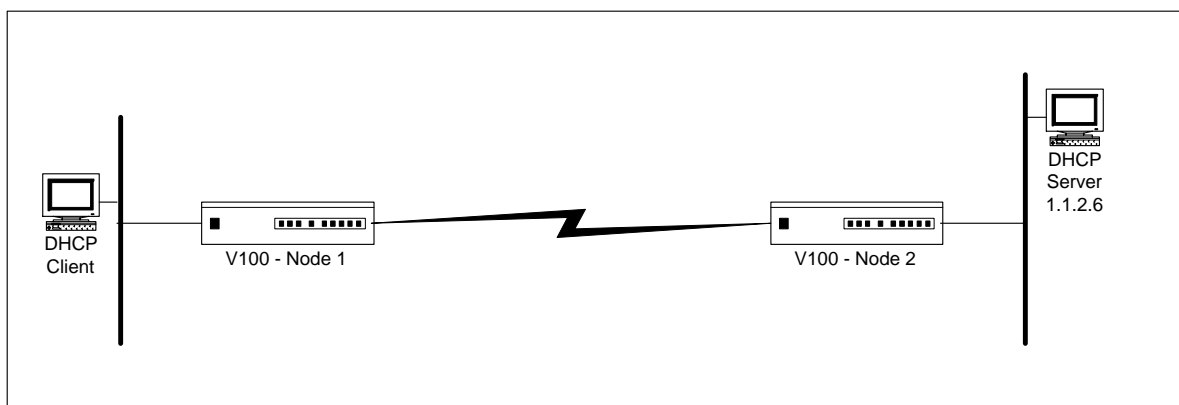
Example network configuration for DHCP Relay mode

For this example network, the DHCP relay parameters would be set as follows:

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Node0                    V100 Multiplexer Supervisor
Agg Status: 0:1 Lost
-------------------------------[ GENERAL #1]-----------------------------

     ETHERNET MODE       : AUTONEGOTIATE

     DNS SERVER          :
        PRIMARY          : 192.168.000.001
        SECONDARY        : 000.000.000.000

     DHCP SERVER         :
        MODE             : RELAY
        PRIMARY ADDRESS  : 192.168.000.001
        SECONDARY ADDRESS: 000.000.000.000




     SPANNING TREE       :
        BRIDGE PRIORITY  : 32768
        HELLO TIME(secs) : 10

------------------------Configuration #1 is active-----------------------
Enter Value between 1 and 10

Connected 00:10:29    VT100    9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

Example configuration of DHCP Relay parameters

Note that this configuration is required on both Node 1 and Node 2.

4.13.12 Telnet Access

The integration of an IP stack into the V100 allows the supervisor configuration screens to be accessed through the 10/100base-T port using the telnet protocol. Telnet access is possible once IP has been configured. To provide additional security to ensure that telnet access is only granted to the appropriate parties, an Access Table has been provided. The Access Table must be configured to specify which station or group of stations are allowed access to IP host facilities on the V100. Each access table entry comprises a description (simple text – not used in the access decision), an IP address, an IP mask, and a service definition. When an attempt is made to access the host service (e.g. a telnet connection is requested), the access table is checked to ensure that an entry matches the requesting host. An IP address/mask pair of 0.0.0.0/0.0.0.0 will allow access from any station to the configured service. The services that are controlled through this access are currently (i) the embedded telnet server, and (ii) "Chargen" (character generator) TCP server.

The following example configuration shows two entries – one is allowing telnet access from any station – the second is allowing Chargen access only from station 1.1.1.6:

Example configuration of the Access Table

Chapter

5

5 Applications Examples

Four common applications are given here: Back-to-back testing, use with a satellite modem, use with an Inmarsat M4 terminal, and use with an IP aggregate. A full set of Application Notes are available on the Vocality International support website www.vocality.com/support.

5.1 Back-to-back testing

Before commissioning the V100, it can be very useful to configure a pair of multiplexers in a back-to-back configuration to gain familiarity with their setup and operation. In the example below, two units are connected on Port1 using cable VI68726A (see appendix). The System settings for the units are as follows:

```
V100 - HyperTerminal                                                    _ □ X
File  Edit  View  Call  Transfer  Help
D ☞   ☎ ⅗   ⅅ ⅉ   ☞

 Unit0                    V100 Multiplexer Supervisor
 Agg Status: 0:1 Lost
 ---------------------------------[ SYSTEM ]---------------------------------

  NODE NAME             : Unit0         NODE ID             : 000

  CONFIGURATION BY REMOTE : Enabled     HSC MODE            : Slave



  ALARM RELAY DELAY     : None          OPTION 0            : None
  ALARM RELAY MODE      : Auto

  COUNTRY               : UK            RW PASSWORD         :
                                        RO PASSWORD         :
  CONNECTION TIMEOUT    : 10 seconds    ACCESS TIMEOUT      : 0 seconds
  RECEIVE READY FILTER  : 1 seconds     ACTIVITY TIMEOUT    : 30 seconds
  DATA CHANNEL ACTIVATION : Auto
  DATA CHANNEL FLAG     : Always On     BACKUP TIMER        : 40 seconds
  TIE-LINE ACTIVATION   : M-Lead        FALLBACK MODE       : 2 Min(No BW)
  ASYNC BUFFER SIZE     : 32 buffers    FALLBACK TIMER      : 40 seconds
 ---------------------------------------------------------------------------
 Enter Text

Connected 10:38:24    Auto detect    9600 8-N-1    SCROLL  CAPS  NUM  Capture  Print echo
```
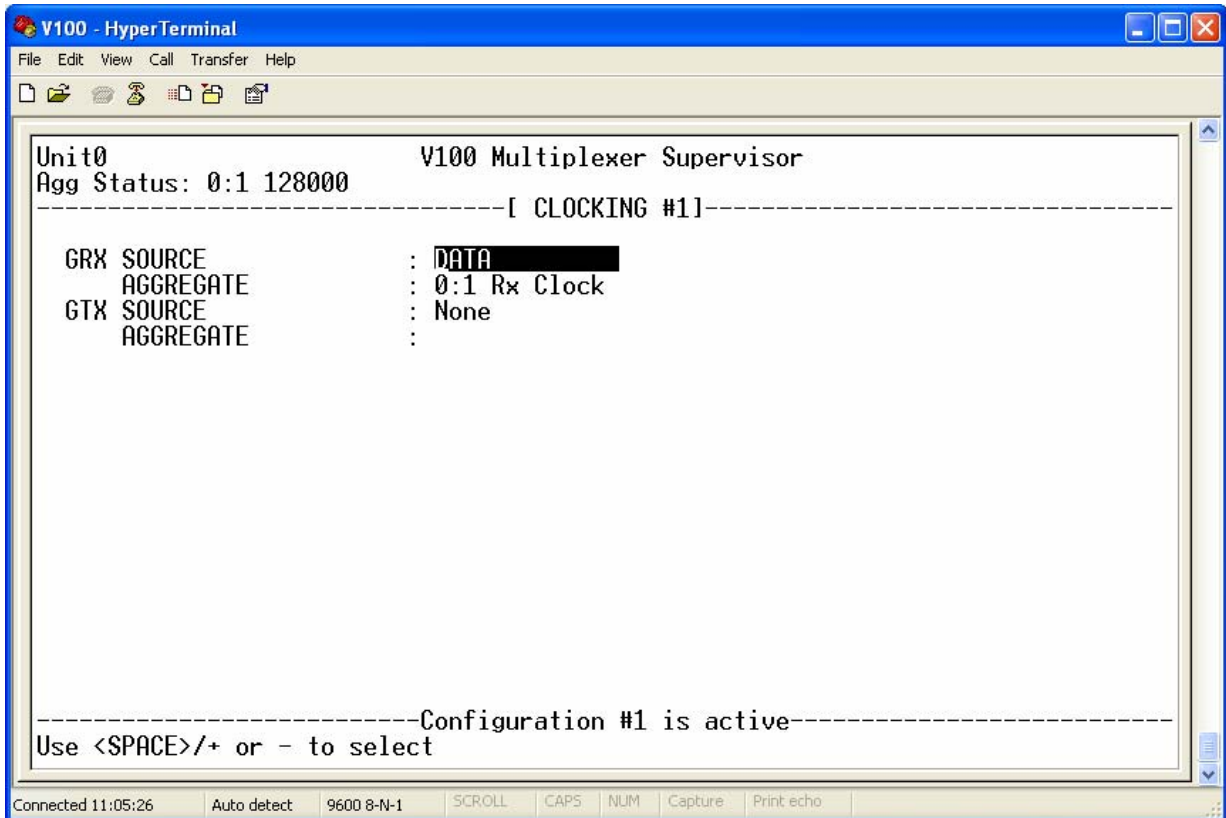
..and for the other unit:

The settings for Node I.D. are critical – they must be set to different values for the units to communicate correctly. The Clocking Configuration settings for the units are as follows:

The Data Configuration settings for the units are as follows:

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Unit1                    V100 Multiplexer Supervisor
Agg Status: 0:1 128000
-----------------------------[ DATA #1]------------------------------


                           -----RX clock----- -----TX clock-----
Channel Iface Mode Type Format Rate    Source Ref Rate    Source Ref Destination
  0:1   RS449 Agg  DTE  NRZ    0       Ext    -   0        Rxc    -
  0:2   V.11  Trib DCE  NRZ    64000   Dba  <GRX








                         -----Configuration #1 is active-------------------------

Connected 10:52:42     Auto detect   9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

Note that Unit 0 is configured to generate a transmit link clock of 128Kbps ("Int"), which is used internally as the GRX reference (CLOCKING menu GRX source) and also received by Unit 1 and used as the GRX reference (CLOCKING menu GRX source). Unit 1 then turns the clock around (TX clock set to "RXC") and it is received back at Unit 0, which uses it as the RX clock source.

The programming of the clock references is essential to all tributary channels, since they must use a clock reference to generate all local bit rates. In this example, the Global Receive clock bus ("GRX") takes the Port 1 Aggregate RX clock and Port 2, which will be used to connect a router, uses the GRX as its reference for generating the RX router clock. To go one stage further and operate Port 2 dynamically, the RX clock source is set to "DBA". This allows the V100 to smoothly vary the RX clock on Port 2 according to traffic demand. Finally, a destination address must be entered for Port 2.
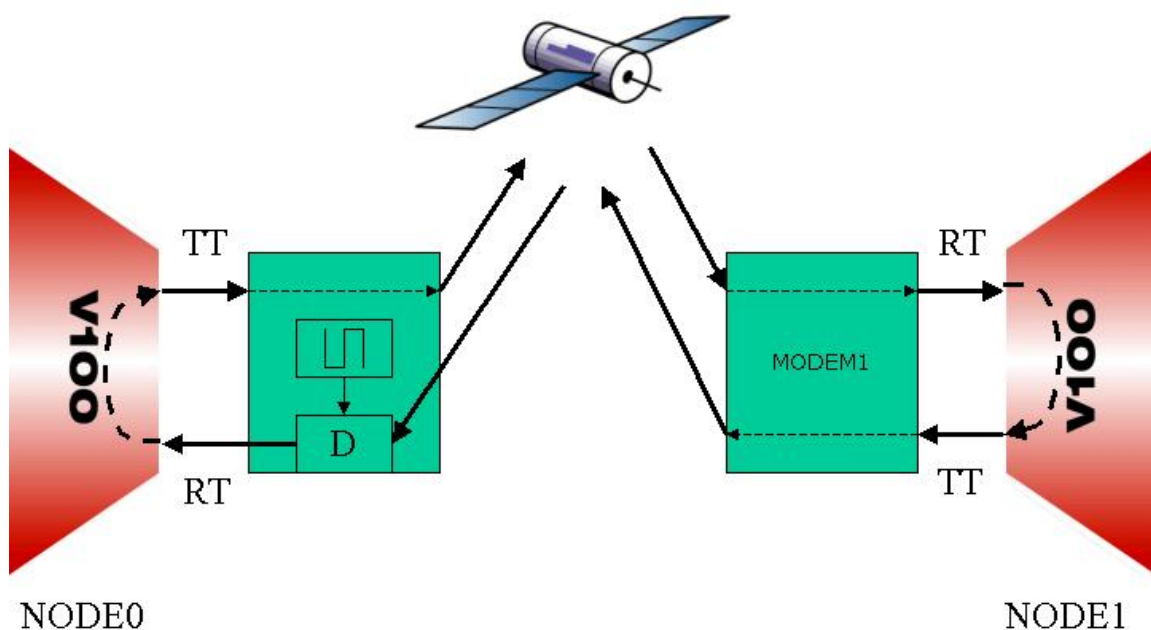
5.2 Use with Satellite Modems

The V100 multiplexer is often used in combination with satellite modems to provide telecommunications links between remote sites. This example describes the use of the V100 with a Paradise Datacom P300 modem that is fitted with the standard P1440 interface in RS422 mode, thereby allowing the use of the standard RS422/RS449 cable (part number VI68723A, Appendix C4) at both ends of the link. It is also applicable to the P400 modem when fitted with the P1448 interface, but in this case the cable number VI68723B/P1448 should be used, to operate the interface in Direct mode. The standard cable should be used with all other modems.

Disclaimer:

This example uses settings for the modems, which have been tested and proven to work. There are other settings, which may be used according to the application. With other manufacturers' equipment or when using other settings, the validity of this example cannot be guaranteed.

The configuration concept is to use one unique clock in the system as generated by Modem0 (connected to the V100 with Node I.D. "0"), with all other clocks derived from this:

The System settings for the units are as follows:

...and for the other unit:

The settings for Node I.D. are critical – they must be set to different values for the units to communicate correctly. The Clocking Configuration settings for the units are as follows:

The Data Configuration settings for the units are as follows:

Unit 0 is configured to accept the stable receive link clock of 128Kbps ("Ext") from Modem0, which is used to clock data out of the Doppler buffer. This is turned around as the transmit clock ("RXC") and given back to modem as Terminal Timing, it is then sent over the satellite link to Modem1, which recovers the receive clock and outputs it to V100 Unit1. Unit1 is configured to accept this receive clock ("Ext"), to use it as the GRX reference (GRX source in C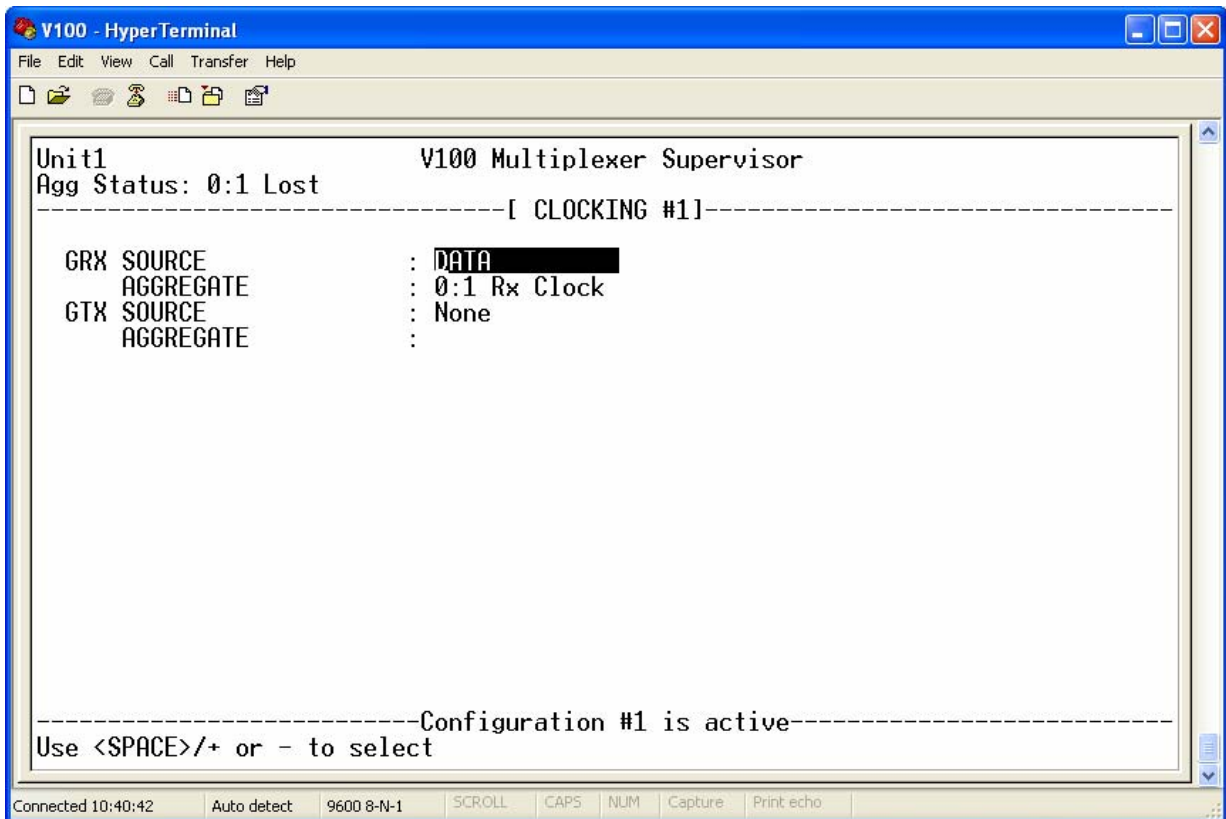LOCKING menu) and then turn it around (TX clock set to "RXC") and output it back to Modem1 as Terminal Timing ("TT"). Modem1 sends this back via the satellite to Modem0 which recovers the receive clock and uses it to clock the Doppler buffer.

Once again, the programming of the clock references is essential to all tributary channels, since they must use a clock reference to generate all local bit rates. In this example, the Global Receive clock bus ("GRX") takes the Port 1 Aggregate RX clock and Port 2, which will be used to connect a router, uses the GRX as its reference for generating the RX router clock. To go one stage further and operate Port 2 dynamically, the RX clock source is set to "DBA". This allows the V100 to smoothly vary the RX clock on Port 2 according to traffic demand.

NOTE: **In order to generate a Terminal Timing ("TT") clock from pins 8 and 15 on the V100 DB15 Data Port 1 and 2 connectors, jumper links JP4 and JP5 on the V100 motherboard must be set to position 1-2 (i.e. towards the front of the unit). This is their factory default setting, so in most cases there is no need to remove the lid.**

Modem Settings:

In the example above, two Paradise Datacom P300 modems may be used. Modem0 is used to generate the network clock, since it has a stable +/- 1ppm reference. On the "Change, Tx, Baseband" menu, select "Continuous Data" then enter the baseband data rate, in this case "128000". On the "Change, Tx, Clocking" menu, the TX clock should be set to "TX CLOCK IN" which expects the transmit clock on the TT clock pair. On the "Change, Rx, Buffer/Clocking" menu, the RX clock should be set to "INTERNAL". This will enable the "Change, Rx, Buffer/Clocking,Buffer Size" menu, which allows the user to select a buffer to accommodate the incoming Doppler shift. Normally, 4mS per satellite transition is sufficient, i.e. a total of 8mS.

Modem1 recovers the clock from the satellite. On the "Change, Rx, Buffer/Clocking" menu, the RX clock should be set to "SATELLITE" which will disable the Doppler buffer and output the RX clock on the "RT" clock pair. On the "Change, Tx, Clocking" menu, the TX clock should be set to "TX CLOCK IN" so as to accept the TT clock back in from the V100.

5.3　Use with Inmarsat M4 Terminals

The V100 multiplexer is often used in combination with Inmarsat M4 terminals, using the integral ISDN2 adaptor (Part number VI68711) to interface directly with the terminal. In the example below, the V100 units are equipped with 4 voice channels and the standard 2 data ports. The aggregate port is the ISDN service, which is dialled whenever a voice call is active. The Inmarsat terminal is an M4 and calls are made from mobile to fixed using the satellite:
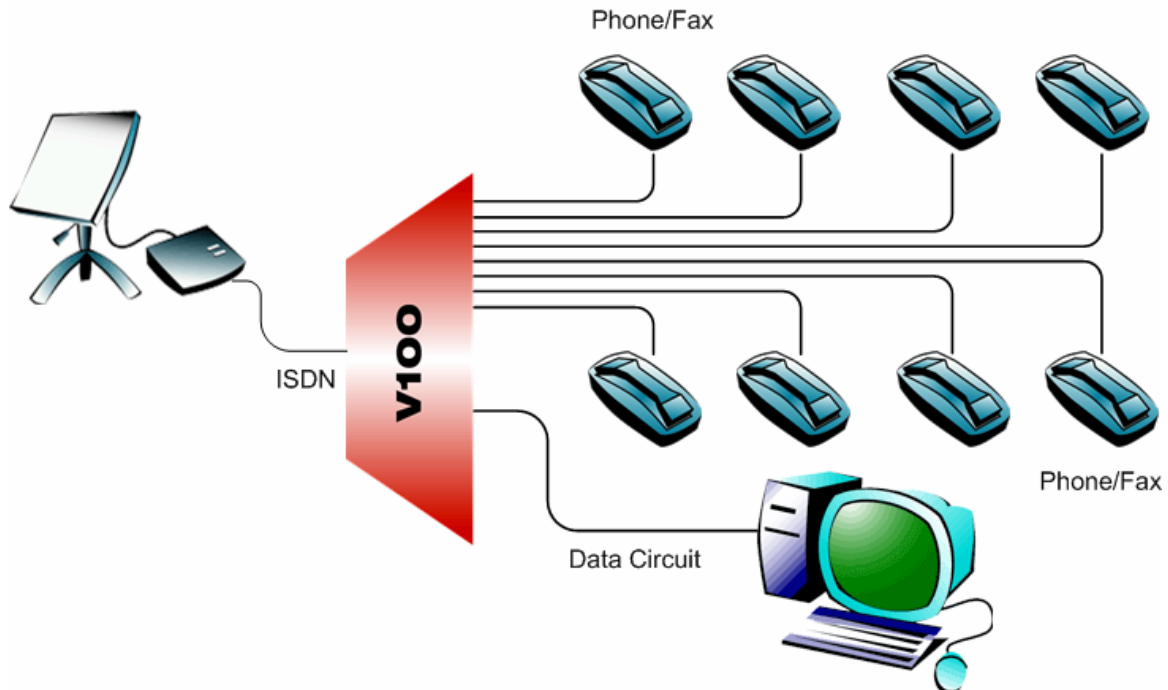
Firstly, the Inmarsat terminals should be aligned with the strongest spot beam, using the standard technique as published in the relevant equipment handbook. In order to support a 64Kbps ISDN call, minimum signal strength of 550 is required on both terminals; this means the antenna must be positioned with clear line-of-site to the satellite.
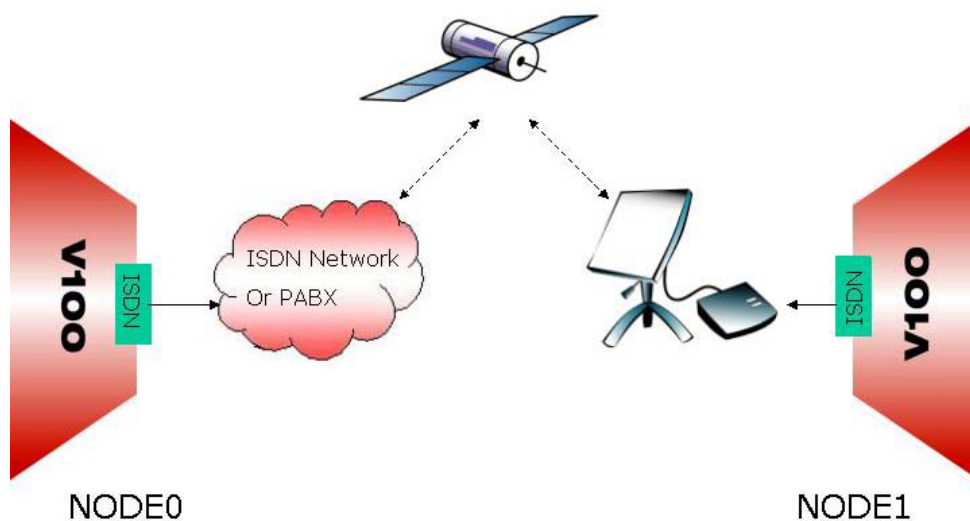
The V100 equipment should now be configured as in previous examples, with one unit as Unit0 and the other as Unit1:

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Unit0                    V100 Multiplexer Supervisor
Agg Status: ISDN B1 Down     ISDN B2 Down
------------------------------[ SYSTEM ]------------------------------

  NODE NAME               : Unit0          NODE ID          : 000

  CONFIGURATION BY REMOTE : Enabled


  ALARM RELAY DELAY       : None           OPTION 0         : ISDN
  ALARM RELAY MODE        : Auto

  COUNTRY                 : US             RW PASSWORD      :
                                          RO PASSWORD      :
  CONNECTION TIMEOUT      : 100 seconds    ACCESS TIMEOUT   : 0 seconds
  RECEIVE READY FILTER    : 0 seconds      ACTIVITY TIMEOUT : 30 seconds
  DATA CHANNEL ACTIVATION : Auto
  DATA CHANNEL FLAG       : Always On      BACKUP TIMER     : 40 seconds
  TIE-LINE ACTIVATION     : M-Lead         FALLBACK MODE    : 2 Min(No BW)
  ASYNC BUFFER SIZE       : 32 buffers     FALLBACK TIMER   : 40 seconds
  ------------------------------------------------------------------
Enter Text

Connected 11:18:18   Auto detect   9600 8-N-1   SCROLL   CAPS   NUM   Capture   Print echo
```

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Unit1                    V100 Multiplexer Supervisor
Agg Status: ISDN B1 Down     ISDN B2 Down
------------------------------[ SYSTEM ]------------------------------

  NODE NAME               : Unit1          NODE ID          : 001

  CONFIGURATION BY REMOTE : Enabled


  ALARM RELAY DELAY       : None           OPTION 0         : ISDN
  ALARM RELAY MODE        : Auto

  COUNTRY                 : US             RW PASSWORD      :
                                          RO PASSWORD      :
  CONNECTION TIMEOUT      : 100 seconds    ACCESS TIMEOUT   : 0 seconds
  RECEIVE READY FILTER    : 0 seconds      ACTIVITY TIMEOUT : 30 seconds
  DATA CHANNEL ACTIVATION : Auto
  DATA CHANNEL FLAG       : Always On      BACKUP TIMER     : 40 seconds
  TIE-LINE ACTIVATION     : M-Lead         FALLBACK MODE    : 2 Min(No BW)
  ASYNC BUFFER SIZE       : 32 buffers     FALLBACK TIMER   : 40 seconds
  ------------------------------------------------------------------
Enter Text

Connected 11:19:16   Auto detect   9600 8-N-1   SCROLL   CAPS   NUM   Capture   Print echo
```

Call setup can take up to 30 seconds from mobile to mobile; note the Connection Timeout setting. The Receive ready filter should be set to zero.

The ISDN configuration page for each unit should be set as shown below:

In the example above, the terrestrial end (Node0) is the USA and the ISDN Link Interface Card is loaded with the appropriate US protocols, in this case National ISDN 1 has been selected. A Call Timer value of 10 minutes ensures that no single ISDN call lasts for longer than 10 minutes. This is a safety valve feature to prevent large dial-on-demand costs when a unit or network is configured incorrectly. This safety valve can be disabled by setting the Call Timer value to permanent.

It is also important to set the GRX and GTX clock references to be driven by the ISDN adaptor to ensure that the system clocks at each end are locked at all times. The clocking menu at each end should be configured as follows:

In order for the system to use the ISDN adaptor as its aggregate, the implicit routing is not sufficient, since the unit cannot communicate with any other nodes without any permanent aggregates set. It is therefore necessary to set the ROUTING pages as follows: .

The routing page contains the the complete ISDN number for the remote terminal entered for dialling. This must include an Inmarsat Global Area Network (GAN) prefix as well as a # to initiate the call, as shown. A corresponding number should be entered in the return route to node 0 on the other unit.

NOTE: **When dialling a fixed ISDN (terrestrial) ISDN number from an Inmarsat terminal, the prefix "902" must be used, followed by the complete destination number with the international dialling code. In this case, the international dialing prefix for the USA must be entered at Node1.**

The V100 data channels should now be configured. In this example, the ISDN service is used as the sole aggregate and so ports 0:1 and 0:2 should be configured as Tributaries and left unmapped. If they are permanently mapped, they will cause the ISDN service to be dialled. The menus for both units should be set as follows:

Finally, the V100 voice channels should be configured. In the following example, all ports are in FXS mode to drive telephones directly. The destination numbers of the remote channels are entered to provide a "hotline" service:

For UNIT0:

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Unit0                        V100 Multiplexer Supervisor
AGGREGATE STATUS        : ISDN B1 Carrier Lost   ISDN B2 Carrier Lost
------------------------------[ VOICE #1]----------------------------------


Channel   ClkRef   SigType   Interface   Algorithm       I-Gain-O      Destination
  1:1     GRXCLK   DTMF      FXS         NetCode 9.6K    0dB   0dB     1:1:1
  1:2       "      DTMF      FXS         NetCode 9.6K    0dB   0dB     1:1:2
  1:3       "      DTMF      FXS         NetCode 9.6K    0dB   0dB     1:1:3
  1:4       "      DTMF      FXS         NetCode 9.6K    0dB   0dB     1:1:4
  1:5       "      DTMF      FXS         NetCode 9.6K    0dB   0dB     1:1:5
  1:6       "      DTMF      FXS         NetCode 9.6K    0dB   0dB     1:1:6
  1:7       "      DTMF      FXS         NetCode 9.6K    0dB   0dB     1:1:7
  1:8       "      DTMF      FXS         NetCode 9.6K    0dB   0dB     1:1:8




--------------------------Configuration #1 is active--------------------------
Enter mapping, format:- 'CHASSIS:Device:Port'

Connected 03:03:08    Auto detect   9600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

and for UNIT1, the channels are configured in exactly the same way, but with destination mappings back to UNIT0.

Once a suitable signal is acquired on the Inmarsat terminal and the V100 equipment is configured, the ISDN port should be connected to the RJ45 port of the V100 ISDN terminal adaptor using a straight 8-way CAT5 cable.

When a telephone handset is lifted at either multiplexer, the ISDN number of the remote will be dialled, the ISDN call will be made via the Inmarsat terminal and the multiplexers will establish carrier over the ISDN service. The TEST LED (or Option 0 LED on RevD units) will illuminate GREEN to indicate an active ISDN call and the telephone at the remote site will ring. Note also that the remote logon facility will also cause the ISDN service to be used, as will the mapping of a data channel from one unit to the other. The latter will cause the ISDN call to be permanently active unless the channel is async with infrequent data, allowing the ISDN call to be dropped in between bursts of data.

5.4   Use with IP Aggregates

The following example shows a unit with node number 0 connected to a unit with node number 1 over an IP aggregate. Unit0 is configured with an IP address of 1.1.1.2/24. It is configured on an IP network with a default gateway of 1.1.1.1. Unit1 is configured with an IP address of 2.2.2.2/24. It is configured on an IP network with a default gateway of 2.2.2.1.
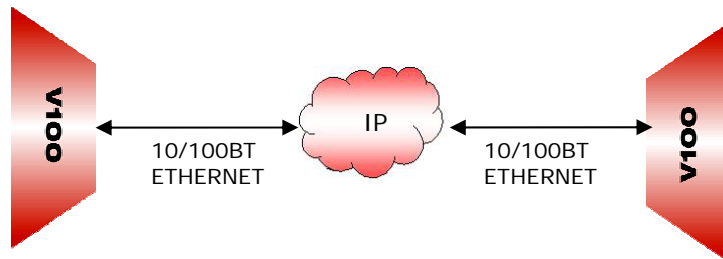
Before the IP aggregate itself is configured the system node numbers and base IP configuration should be completed.

The System settings for the units are as follows:

The IP Networks menus for the units are as follows:

```
Unit1                    V100 Multiplexer Supervisor
Agg Status:
------------------------------[ NETWORKS #1]----------------------------------

Chan DBA     IP  Address        Mask              MTU UDPGw TCPGw Bridge Dest
ENET         NUM 002.002.002.002 255.255.255.000 1514 OFF         OFF




<NEW SUBNET>    <DELETE ALL SUBNETS>
                          Type <ctrl d> to delete selected entry
-----------------------------Configuration #1 is active-----------------------
Use <SPACE>/+ or - to select
```

The IP static route table settings for the units are as follows:

```
Unit0                    V100 Multiplexer Supervisor
Agg Status:
------------------------------[ IP STATIC ROUTE TABLE #1]---------------------

Description          Destination     Mask            NextHop
Default              000.000.000.000 000.000.000.000 001.001.001.001




<NEW ROUTE>     <DELETE ALL ROUTES>
                          Type <ctrl d> to delete selected entry
-----------------------------Configuration #1 is active-----------------------
Enter Text
```

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Unit1                    V100 Multiplexer Supervisor
Agg Status:
-------------------------[ IP STATIC ROUTE TABLE #1]-------------------------

Description           Destination     Mask             NextHop
Default               000.000.000.000 000.000.000.000  002.002.002.001




<NEW ROUTE>    <DELETE ALL ROUTES>
                          Type <ctrl d> to delete selected entry
-------------------------Configuration #1 is active-------------------------
Enter Text

Connected 12:07:45   Auto detect   9600 8-N-1   SCROLL  CAPS  NUM  Capture  Print echo
```

The IP aggregate is configured to provide a 64000bps aggregate to multiplex over. Clock synchronization is required between the two units. Unit0 is configured to provide its internal clock source as a reference for Unit1. The IP Aggregate settings specify the characteristics of the IP aggregate as follows:

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Unit0                    V100 Multiplexer Supervisor
Agg Status:
-------------------------[ IP AGGREGATES #1]-------------------------

            Peer           UDP      Mux   Reseq Tx
Description IP Address      Port TOS Delay Delay Clock         Rate    IP CIR
Unit1       002.002.002.002 10000 0  20    0     Master        64000   65400




<NEW AGGREGATE>    <DELETE ALL AGGS>
                          Type <ctrl d> to delete selected entry
-------------------------Configuration #1 is active-------------------------
Enter Text

Connected 12:14:22   Auto detect   9600 8-N-1   SCROLL  CAPS  NUM  Capture  Print echo
```

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Unit1                     V100 Multiplexer Supervisor
Agg Status:
-----------------------------[ IP AGGREGATES #1]-----------------------------

                 Peer              UDP      Mux   Reseq Tx
Description  IP Address      Port TOS Delay Delay Clock          Rate    IP CIR
Unit0        001.001.001.002 10000 0  20    0     -              64000   65400














<NEW AGGREGATE>      <DELETE ALL AGGS>
                          Type <ctrl d> to delete selected entry
-----------------------------Configuration #1 is active----------------------
Enter Text

Connected 12:24:01    Auto detect   9600 8-N-1   SCROLL  CAPS  NUM  Capture  Print echo
```

A V100 routing table entry is required on both units to activate the IP aggregate. Note that the name used in the route configuration must match the name assigned in the IP aggregate configuration:

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Unit0                     V100 Multiplexer Supervisor
Agg Status: IP AGG:  UP
-----------------------------[ ROUTING #1]-----------------------------

Name         Node Slot Chan Agg  Connect Using        Alternate

Unit1         1    ANY ANY IP    Unit1
SEC: NONE    -----------------------------------------------------------










<NEW ROUTE>     <DELETE ALL ROUTES>    <TIDY LIST>

-----------------------------Configuration #1 is active----------------------
Enter Text

Connected 12:20:14    Auto detect   9600 8-N-1   SCROLL  CAPS  NUM  Capture  Print echo
```

To complete this IP aggregate configuration the clocking configuration on both units should be updated to drive GRX from the IP aggregate:

```
V100 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Unit1                    V100 Multiplexer Supervisor
Agg Status:
--------------------------[ CLOCKING #1]---------------------------

   GRX SOURCE            : IP AGG
       AGGREGATE         : Unit0
   GTX SOURCE            : None
       AGGREGATE         :




                       --Configuration #1 is active--------------------
Use <SPACE>/+ or - to select

Connected 12:24:59    Auto detect   9600 8-N-1    SCROLL  CAPS  NUM  Capture  Print echo
```

Normal IP Tributary traffic can be routed across the IP aggregate in the normal way and is the preferred configuration where no QoS is available.

Chapter

6

6 Appendix A : Safety and Approvals

WARNING:

This unit contains hazardous voltages.

There are no user-serviceable parts inside.

In the event of failure, the unit should only be repaired by qualified personnel or returned to the factory.

WARNING: THIS EQUIPMENT MUST BE EARTHED

This equipment relies on the EARTH connection to ensure safe operation such that the user and TELECOM Network are adequately protected. It must not under any circumstances be operated without an earth connection, which could nullify its safety approval for connection to a network.

WARNING: INSTALLATION OF EQUIPMENT

This equipment must only be installed by suitably trained service personnel.

WARNING: CONNECTION OF OTHER EQUIPMENT

This equipment allows connection only of suitably approved equipment to its ports, the safety status of which is defined below.

SELV Ports:

i)   Supervisor/Alarm Port
ii)   High Speed Channel Port
iii)   Data Ports
iv)   MPEG Audio Ports (when fitted)

The above named ports are classified as SELV (Safety Extra Low Voltage) in accordance with in Clause 2.3 of EN60950 (BS7002, IEC950 as applicable), and must only be connected to equipment which similarly complies with the SELV safety classification.

TNV Ports:

i)   ISDN port (when fitted)

ii)   Voice ports (PBX extension, trunk ports, telephones or Tie-line connections) (when fitted)

The above named ports classified as TNV (Telecom Network Voltage) in accordance with clause 6.2 of EN60950 (BS7002, IEC950 as applicable) must only be connected to circuits complying with the requirements therein.

The unit complies with EMC emissions standards EN55022 and immunity standards EN50082-1 and 50082-2. In order to meet the requirements of these standards it must be operated with screened link, channel and supervisor cables. Failure to do so may result in non-compliance.

ESD PRECAUTIONS AND STATIC SENSITIVE CARD HANDLING

Vocality International Ltd. observe the general requirements of BS EN 100015-1 (1992) in all matters relating to the handling and storage of electrostatic sensitive devices (ESDs) and assemblies. We recommend strict observance of this standard during the installation of all Option Cards.

All cards are assumed to contain at least one ESD and therefore all subassemblies containing PCBs should be handled in the same way. Products are designed with protection components on external and internal connectors where appropriate. User manuals, applications notes and modification instructions contain warnings where an ESDs may become exposed to ESD. The packaging of Vocality International Ltd. products is classified as secondary, for physical protection only.

Cards should be handled in an ESD Protected Area (EPA) using approved materials (wrist straps, bonding cords etc) from recognized suppliers.

ESDs should always be protected by primary packaging when moving between EPAs or EPA and field sites. Equipment containing ESDs devices in primary packaging (e.g. the metal enclosure) are moved off-site using additional secondary packaging for mechanical protection. Within the EPA, cards should be stored in their primary packaging in electrostatic dissipative bags.

6.1   DECLARATION OF CONFORMITY

Vocality International Ltd, Lydling Barn, Lydling Farm, Puttenham Lane, Shackleford, Surrey GU8 6AP, UK

$$C\,E$$

EC DECLARATION OF CONFORMITY

THIS IS TO CERTIFY:

V100 Versatile Multiplexer, manufactured by Vocality International Ltd

CONFORMS WITH THE PROTECTION AND ELECTROMAGNETIC COMPATIBILITY REQUIREMENTS OF THE FOLLOWING STANDARDS:

BS EN 60950-1: 2001 Safety Standard
BS EN 61000-6-3: 2001 Emission Standard
> *BS EN 55022 (conducted emissions)*
> *BS EN 55022 (radiated emissions)*

BS EN 61000-6-1: 2001 Immunity Standard
> *BS EN 61000-4-2*
> *BS EN 61000-4-3*
> *BS EN 61000-4-4*
> *BS EN 61000-4-5*
> *BS EN 61000-4-6*
> *BS EN 61000-4-8*
> *BS EN 61000-4-11*

Signed .... M.P.SAUNDERS
(Group Technical Director)

Date ....

Chapter

7

7 Appendix B: Port Numbering

The V100 uses a node:slot:channel port name representation. These port names appear in the user interface (often just as slot:channel when dealing with local ports). Some port numbers are obvious - 1:1 when a voice card is in slot 1, is voice port 1 on that voice card – others are less obvious and are based on internal virtual representations. The following table provides a complete list of the port numbers that are used in the V100.

Slot Number	Slot Type	Channel Number	Use
0	Motherboard	0	Local supervisor channel – used as the source port in remote supervisor connections
		1	Data port 1
		2	Data port 2
		3	HSC channel
		4	ISDN option card channel
		5	ISDN option card channel
		6	TDM option card aggregate channel
		7	TDM option card management channel
		8	E1 link option card aggregate channel
		9	Remote supervisor port
		10-31	IP/bridge tributaries from embedded bridge router
1 or 2	Quad Data	1-4	Quad data ports 1 to 4
1 or 2	Voice	1-2/4/8	Voice ports 1 to 2, 4 or 8 depending on card type
1 or 2	BRI Extender	1	Tributary for D channel extension
		2	Tributary for B1 channel extension
		3	Tributary for B2 channel extension
		4	Tributary for BRI extender control
1 or 2	MPEG Audio	1	Tributary for audio channel
		2	Tributary for digital data channel
3	Virtual	0-31	IP aggregate OR Virtual port for ISDN aggregate OR Virtual port for BoD aggregate OR Virtual port for switched aggregate

Chapter

8

8 Appendix C: Pin Assignments

8.1 Supervisor/Alarm Port

Pin #	Signal Name			Direction
	RS485	RS232	Alarm	
Shield	Shield	Shield	-	Common
1	RXDB	DCD	-	Output
2	RXDA	RXD	-	Output
3	TXDA	TXD	-	Input
4	TXDB	DTR	-	Input
5	GND	GND	-	Common
6	-	-	Normally Open	I/O
7	-	-	Common	I/O
8	-	CTS	-	Output
9	-	-	Normally closed	I/O

8.2 High Speed Channel (HSC) Port

Pin #	Signal Name	Direction
Shield	Shield	Common
1	TXCA	Input/Output
2	RXCA	Input/Output
3	MASTER TXDA/SLAVE RXDA	Input/Output
4	MASTER RXDA/SLAVE TXDA	Input/Output
5	GND	Common
6	TXCB	Input/Output
7	RXCB	Input/Output
8	MASTER TXDB/SLAVE RXDB	Input/Output
9	MASTER RXDB/SLAVE TXDB	Input/Output

8.3   Data Ports

All data ports are presented with a DB15F interface:

Pin #	Signal Name					DTE	DCE
	V.11	RS449	V.35	RS530	V.24		
Shield	Shield	Shield	Shield	Shield	Shield	C	C
1	GND	GND	GND	GND	GND	C	C
2	T(A)	SDA	SDA	SDA	TXD	O	I
9	T(B)	SDB	SDB	SDB	-	O	I
3	C(A)	RTSA	DTR	RTSA	DTR	O	I
10	C(B)	RTSB	-	RTSB	-	O	I
4	R(A)	RDA	RDA	RDA	RXD	I	O
11	R(B)	RDB	RDB	RDB	-	I	O
5	I(A)	RRA	DCD	RRA	DCD	I	O
12	I(B)	RRB	-	RRB	-	I	O
6	S(A)	RTA	SCRA	SCRA	RXC	I	O
13	S(B)	RTB	SCRB	SCRB	-	I	O
7	-	STA	SCTA	SCTA	TXC	I	O
14	-	STB	SCTB	SCTB	-	I	O
8	-	TTA	SCTEA	SCTEA	EXTXC	O	I
15	-	TTB	SCTEB	SCTEB	-	O	I

8.4   Analogue Voice Ports

8-way RJ45-Type Analogue voice port				
Pin Connections				
	4-wire Tie-line mode		2-wire FXS/FXO mode	
Pin No.	Signal Name	Signal Type	Name	Type
1	MREF	Reference	-	-
2	M	Current Detector	-	-
3	RXA	Input	-	-
4	TXRXA	Input/Output	TIP	Input/Output
5	TXRXB	Input/Output	RING	Input/Output
6	RXB	Input	-	-
7	E	Contact Closure	-	-
8	EREF	Reference	-	-

WARNING:

LINE VOLTAGES ARE PRESENT ACROSS TIP AND RING IN FXS MODE. CONNECT ONLY TELEPHONE APPLIANCES IN THIS MODE. DAMAGE COULD RESULT FROM CONNECTION TO A PABX PORT.

8.5 MPEG Audio

3-way XLR-Type Audio port Pin Connections – Left channel				
	Left In		Left Out	
Pin No.	Signal Name	Type	Signal Name	Type
1	GND	Common	GND	Common
2	Audio+/AES+	Input	Audio+/AES+	Output
3	Audio-/AES-	Input	Audio-/AES-	Output

3-way XLR-Type Audio port Pin Connections – Right channel				
	Right In		Right Out	
Pin No.	Signal Name	Type	Signal Name	Type
1	GND	Common	GND	Common
2	Audio+	Input	Audio+	Output
3	Audio-	Input	Audio-	Output

8.6 BRI Extender

Connect to the ISDN network or appliance using a straight 8-way RJ45 cable.

8.7 10/100base-T Port

The 10/100base-T Router Port is only available on RevD and later units. The pinouts are as follows:

8-way RJ45 10/100base-T Port Connections		
Pin No.	Signal Name	Signal Type
1	TX+	Input
2	TX-	Input
3	RX+	Output
4	Shield	-
5	Shield	-
6	RX-	Output
7	Shield	-
8	Shield	-

8.8   E1 Link Interface

The E1 Link interface presents both BNC connectors and an RJ45 for UTP. The format of the UTP port is as follows:

8-way RJ45 UTP Interface		
Pin No.	Signal Name	Signal Type
1	RRING	Receive RING
2	RTIP	Receive TIP
3	GND	Ground
4	TRING	Transmit RING
5	TTIP	Transmit TIP
6	-	-
7	-	-
8	-	-

Chapter

9

9 Appendix D : Cables

9.1 V.11 Cables

X.21/V.11 STRAIGHT 15-way Multiplexer Aggregate DTE to Network DCE Cable (Part Number VI68720A)		
MUX 15-way Male Connector UNC 4/40 Screws	Network 15-way Male Connector M3 Screws[1]	Signal Name
Shield	Shield	SHIELD
1	1	GND
2	2	T(A)
9	9	T(B)
3	3	C(A)
10	10	C(B)
4	4	R(A)
11	11	R(B)
5	5	I(A)
12	12	I(B)
6	6	S(A)
13	13	S(B)
7	7*	ST(A)
14	14*	ST(B)
8	8*	Output clock A
15	15*	Output clock B

Notes:

- V.11 Male for connection to NTU must have M3 Screws unless national regulations permit the use of UNC 4/40. Mux end has 4/40 screws. Each cable end must be clearly identifiable.
- Dashed lines show wires to be twisted pairs.
- Cable type: Belden 9508, 8 wire twisted pair overall screen (or equivalent). Maximum length 100 Metres.
- Use metal headshells and connect the overall screen to the tinning on the connector.
- *Additional connections which may be used if required.

9.2 V.24 Cables

X.21 bis/V.24 STRAIGHT 15-way Multiplexer Aggregate DTE to Network DCE Cable (Part Number VI68721A)		
MUX 15-way Male Connector UNC 4/40 Screws	Network 25-way Male Connector UNC 4/40 Screws	Signal Name
Shield	Shield	SHIELD
1	7	COMMON
2	2	TXD
9	-	-
3	4	RTS
10	-	-
4	3	RXD
11	-	-
5	8	DCD
12	-	-
6	17	RXC
13	-	-
7	15	TXC
14	-	-
8	24	EXTXC
15	-	-

Notes:

- Cable type: Belden 8 separate conductors, overall screen (or equivalent). Maximum length 10 metres.

V.24/RS232 STRAIGHT 15-way Multiplexer Tributary DCE to PC DTE Cable (Part Number VI68721B)		
MUX 15-way Male Connector UNC 4/40 Screws	Terminal 9-way Female Connector UNC 4/40 Screws	Signal Name
Shield	Shield	SHIELD
1	5	COMMON
2	3	TXD
3	4	DTR
4	2	RXD
5	1,6,8	DCD,DSR,CTS

Notes:

- Cable type: 5-core overall screened. Maximum length 10 metres at speeds up to 19,200bps.

V.24/RS232 STRAIGHT 15-way Multiplexer Tributary DCE to 9-way PC DTE Cable (Part Number VI68721C)		
MUX 15-way Male Connector UNC 4/40 Screws	PC 9-way Female Connector UNC 4/40 Screws	Signal Name
Shield	Shield	SHIELD
1	5	GROUND
2	3	TXD
-	1,4,6,8	DCD,DTR,DSR,CTS
4	2	RXD

V.24/RS232 CROSSOVER 15-way Multiplexer Tributary DCE to Modem DCE Cable (Part Number VI68721D)		
MUX 15-way Male Connector UNC 4/40 Screws	Modem 25-way Male Connector UNC 4/40 Screws	Signal Name
Shield	Shield	SHIELD
1	7	GROUND
2	3	RXD
-	4,6,20	RTS,DSR,DTR
4	2	TXD

Notes:

- Cable type: 3-core overall screened. Maximum length 10 metres at speeds up to 19,200bps.
- These cables are recommended only for applications where hardware flow-control is not possible, such as internet access.

9.3   V.35 Cables

X.21bis/V.35 STRAIGHT 15-way Multiplexer Aggregate DTE to Network DCE Cable (Part Number VI68722A)		
MUX 15-way Male Connector UNC 4/40 Screws	Network 34-way Male Connector (MRA)	Signal Name
Shield	A	SHIELD
1	B	GND
2	P	TXDa
9	S	TXDb
3	C	RTS
10	H	DTR
4	R	RXDa
11	T	RXDb
5	F	DCD
12	E	DSR
6	V	RXCa
13	X	RXCb
7	Y	TXCa
14	AA	TXCb
8	U	EXTXCa
15	W	EXTXCb

Notes:

- Dashed lines show wires to be twisted pairs.
- Cable type: Belden 9509, 9 twisted pair overall screen (or equivalent). Maximum length 100 metres.

9.4 RS422/449 Cables

RS422/RS449 STRAIGHT 15-way Multiplexer Aggregate DTE to Satellite Modem DCE Generic Cable (Part Number VI68723A)		
MUX 15-way Male Connector UNC 4/40 Screws	Modem 37-way Male Connector UNC 4/40 Screws	Signal Name
Shield	Shield	SHIELD
1	19	GND
2	4	SDA
9	22	SDB
3	7	RTSA
10	25	RTSB
4	6	RDA
11	24	RDB
5	13	RRA
12	31	RRB
6	8	RTA
13	26	RTB
7	5	STA
14	23	STB
8	17	TTA
15	35	TTB

Notes:

- Refer to Section 5.2 "Use with Satellite Modems" for both V100 and modem configuration settings.
- Cable type: Belden 9508, 8 twisted pair overall screen (or equivalent). Maximum length 100 Metres.
- Use metal headshells and connect the overall screen to the tinning on the connector.

RS422/RS449 STRAIGHT 15-way Multiplexer Aggregate DTE to Paradise P400 Satellite Modem DCE Cable (P.N. VI68723B/P1448)		
MUX 15-way Male Connector UNC 4/40 Screws	Modem 37-way Male Connector UNC 4/40 Screws	Signal Name
Shield	Shield	SHIELD
1	2,18,19,36,37[4]	GND
2	4	SDA
9	22	SDB
3	7	RTSA
10	25	RTSB
4	6	RDA
11	24	RDB
5	13	RRA
12	31	RRB
6	8	RTA
13	26	RTB
7	5	STA
14	23	STB
8	17	TTA
15	35	TTB

Notes:

- Refer to Section 5.2 "Use with Satellite Modems" for both V100 and modem configuration settings.
- Cable type: Belden 9508, 8 twisted pair overall screen (or equivalent). Maximum length 100 Metres.
- Use metal headshells and connect the overall screen to the tinning on the connector.
- Pins 2,18,36 and 37 are used to define the operating mode of the P1448 interface.

9.5 RS530 Cables

RS530 STRAIGHT 15-way Multiplexer Aggregate DTE to 25-way Modem DCE Cable (Part Number VI68725B)		
MUX 15-way Male Connector UNC 4/40 Screws	Modem 25-way Male Connector UNC 4/40 Screws	Signal Name
Shield	Shield	SHIELD
1	7	GND
2	2	SDA
9	14	SDB
3	4,20	RTSA
10	19,23	RTSB
4	3	RDA
11	16	RDB
5	8	RRA
12	10	RRB
6	17	RTA
13	9	RTB
7	15	STA
14	12	STB
8	24	TTA
15	11	TTB

Notes:

- Dashed lines show wires to be twisted pairs.
- Cable type: Belden 9507, 7 wire twisted pair overall screen (or equivalent). Maximum length 100 Metres.
- Use metal headshells and connect the overall screen to the tinning on the connector.

9.6 Supervisor Cables

RS232/V.24 STRAIGHT 9-way Multiplexer Supervisor DCE to Terminal DTE Cable (Part Number VI68724A)			
MUX 9-way Male Connector UNC 4/40 Screws	Terminal 9-way Female Connector UNC 4/40 Screws	Signal Name	Signal Type (at mux end)
Shield	Shield	SHIELD	SHIELD
1	1	DCD	Output
2	2	RXD	Output
3	3	TXD	Input
4	4	DTR	Input
5	5	GND	Ground
8	8	CTS	Output

Notes:

- Cable type: Belden 6 separate conductors, overall screen (or equivalent). Maximum length 5 metres.
- For automatic use in Teletype Mode, connections to pins 4 and 8 should be omitted and a shorting link fitted between them at the MUX end.

RS232/V.24 STRAIGHT 9-way Multiplexer Supervisor DCE to Modem DCE Cable (Part Number VI68724B)			
MUX 9-way Male Connector UNC 4/40 Screws	Modem 9-way Male Connector UNC 4/40 Screws	Signal Name	Signal Type (at mux end)
Shield	Shield	SHIELD	SHIELD
2	2	RXD	Output
3	3	TXD	Input
5	5	GND	Ground

Notes:

- Cable type: Belden 3 separate conductors, overall screen (or equivalent). Maximum length 5 metres.

9.7 Back to Back Cable

15-way Multiplexer Aggregate Back-to-Back Cable (Part Number VI68726A)		
MUX 15-way Male Connector UNC 4/40 Screws	MUX 15-way Male Connector UNC 4/40 Screws	Signal Name
Shield	Shield	SHIELD
1	1	GND
2	4	SDA/RDA
9	11	SDB/RDB
3	5	RTSA/RRA
10	12	RTSB/RRB
4	2	RDA/SDA
11	9	RDB/SDB
5	3	RRA
12	10	RRB
6	8	RTA/TTA
13	15	RTB/TTB
8	6	TTA/RTA
15	13	TTB/RTB

Notes:

- Dashed lines show wires to be twisted pairs.
- Cable type: Belden 9507, 7 wire twisted pair overall screen (or equivalent). Maximum length 100 Metres.
- Use metal headshells and connect the overall screen to the tinning on the connector.

9.8   High Speed Channel Cable

9-way HSC Interconnection Cable (Part Number VI68728A)		
MUX 9-way Female Connector UNC 4/40 Screws	MUX 9-way Female Connector UNC 4/40 Screws	Signal Name
Shield	Shield	SHIELD
1	1	TXCA
6	6	TXCB
2	2	RXCA
7	7	RXCB
5	5	GND
3	3	MASTER TXDA/SLAVE RXDA
8	8	MASTER TXDB/SLAVE RXDB
4	4	MASTER RXDA/SLAVE TXDA
9	9	MASTER RXDB/SLAVE TXDB

Notes:

Cable type: Belden 9505, 5 twisted pair overall screen (or equivalent). This interface operates at 4.096Mbps; cable length must not exceed 1 metre.

Use metal headshells and connect the overall screen to the tinning on the connector.

Chapter

10

10 Appendix E: Specifications

CHASSIS UNIT

Data Ports
Presentation	DTE(Aggregate) or DCE(Tributary)
Interface	Selectable V.24, V.11, V.35, RS449 on DB15F
Format	Synchronous Transparent/HDLC or Asynchronous
Data Rates	Sync: 50bps to 2Mbps
	Async: 50, 75, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200bps
	Selected word structure combinations with optional error-correction and compression
Clock sources	TXC: INT, EXT, RXC, DBA by phase-locked loop
	RXC: INT, EXT, TXC, DBA by phase-locked loop

IP Router Port
Presentation	10/100base-T on RJ45 Ethernet connector
Facilities	Ipv4 Static Router with DHCP Server/Relay

Supervisor
Presentation	DCE
Interface	RS232 or RS485 on DB9F with autodetect
Format	Asynchronous
Data Rate	9600bps, 8 bits, no parity, one stop bit
Flow Control	None
Mode	Formatted terminal display or Teletype M&C
Emulations	Automatic support of most common terminals
Alarms	Voltage-free changeover contacts

High-Speed Channel
Presentation	Proprietary RS485 on DB9F
Format	Synchronous HDLC
Data Rate	4Mbps
Clock sources	TXC: Internal, External
	RXC: Internal, External

Physical (Rev.D+)
Front Panel	Standard Version: 5 LED indicators only
Dimensions	438mmx405mmx44mm(1U)19" rackmount
Weight	3-5Kg
Environment	0-40degC operating, 0-90%RH non-condensing
Power Supply	100-250V AC, 60 Watts, 50/60Hz, 20mm 2A A/S fuse

OPTION MODULES

Two option slots, (One Compact) each of which can house one of the following:

4-channel data card:
Presentation	DTE(Aggregate) or DCE(Tributary)
Interface	Selectable V.24, V.11, V.35, RS449 on DB15F
Format	Synchronous Transparent/HDLC or Asynchronous

Data Rates | Sync: | 50bps to 2Mbps
Async: | 50, 75, 300, 600, 1200, 2400, 4800, 9600,
19200, 38400, 57600, 115200bps

Selected word structure combinations with optional error-correction and compression

Clock sources | TXC: INT, EXT, RXC, DBA by phase-locked loop
RXC: INT, EXT, TXC, DBA by phase-locked loop

4-channel analogue voice/FAX:

Presentation	8-way RJ45
Interface	2-wire FXS for connection to telephone/trunk port with ring voltage/cadence generation and dial pulse/ring trip detection
	2-wire FXO for connection to extension port with ring detection, loop hold and programmable impedance and termination for international compliance
	4-wire Tie-line with E&M type I or V signalling
Compression	G.723.1 (5.3/6.3Kbps MP-MLQ),
	G.729 Annex A (8Kbps CS-ACELP),
	G.726 (16-40Kbps ADPCM),
	G.727 (16-40Kbps E-ADPCM),
	.711 (64Kbps PCM) µ-law or A-law
	Proprietary NetCoder® (6.4,7.2,8.0,8.8,9.6Kbps)
Relays	Group 3 FAX relay at 2400-14400bps
	V.32bis Modem relay up to 14400bps
	STU-IIB/STU-III Secure Voice Relay
Signalling	MFR1, R1, R2, SS4, SS5, AC15, Call Progress
Echo cancellation	G.168 adaptive (16/32mS tail)
Coding delay	Per algorithm
Gain	±31dB programmable in 1dB steps

8-channel analogue voice/FAX:

Specifications as 4-channel voice/FAX card

2-channel analogue voice/FAX:

Specifications as 4-channel voice/FAX card except no 4-wire Tie-line interfaces

Secure Voice Relay Card:

Relays	STU-IIB, STU-III
Rates	2400, 4800, 9600bps secure or non-secure
No of channels	Up to four simultaneously per card

MPEG audio card:

Codec	MPEG-1&2 layers 1&2, G722, G711 Sampling	
	MPEG-1:	32KHz, 44.1KHz, 48KHz
	MPEG-2:	16KHz, 22.05KHz, 24KHz
	G.722:	16KHz
	G.711:	8KHz
Bitrates	MPEG-1:	32Kbps to 448Kbps.
	MPEG-2:	8Kbps to 256Kbps.
	G.722:	64Kbps
	G.711:	64Kbps
Modes	Mono, Dual Mono, Joint stereo or Stereo modes	
Coding Delay	75mS (MPEG), 30mS (G.722)	
Audio Interface	20-bit dynamic range	
Peak Level	+18dBV	
I/P Impedance	>20KOhm (balanced)	
O/P Impedance	<100Ohm (balanced)	
SNR	>88dB	

Interface   L/R in/out analogue ports, digital AES/EBU on XLR

ISDN BRI Extender Card:

Interface	Basic Rate ISDN S/T bus on RJ45
Presentation	NT or TE
Protocol	Internationally compliant
Structure	2x64K 'B' channels, 9.6K 'D' channel

One Special Option slot, which can house one of the following:

TDM Interface:

Presentation	DTE Aggregate
Interface	Selectable V.24, V.35, RS449 on DB15F
Data Rates	Sync only at 4800bps to 512Kbps
Clock sources	TXC: EXT, RXC
	RXC: EXT only

ISDN S0/T0 interface:

Interface	Basic rate ISDN2 S/T-bus on RJ45
Protocols	EURO-ISDN NET3,US National-1 ISDN, US Nortel DMS-100,US AT&T

ISDN U0 interface:

Interface	Basic rate ISDN2 U-bus on RJ45
Protocols	EURO-ISDN NET3,US National-1 ISDN, US Nortel DMS-100,US AT&T

11 Appendix F: Part Codes

V100 Chassis	VI68700
AC Power Supply	VI68740
V100 Compact Chassis	VI68800

Option Cards

2-channel Analogue Voice/FAX Motherboard	VI68801
4-channel Analogue Voice/FAX Motherboard	VI68701
4-channel Analogue Voice/FAX Daughterboard	VI68702
PSU for Analogue Voice Card VI68701	VI68703
MPEG High-quality Audio Card	VI68704
Quad High-speed Data Card	VI68705
ISDN BRI Network Extension Card	VI68706
E1/T1/J1 Digital Voice Card (10 channels)	VI68707/10
E1/T1/J1 Digital Voice Card (30 channels)	VI68707/30
E1/T1/J1 Link Card	VI68708
Secure Voice Relay Card	VI68709
V100 Universal Interface	VI68710
ISDN Basic Rate Interface Link Card (S0/T0) Euro	VI68711-SE
ISDN Basic Rate Interface Link Card (S0/T0) US	VI68711-SU
ISDN Basic Rate Interface Link Card (U0)	VI68711U
TDM Framer card	VI68713
TDM Serial Interface Card	VI68714
E1/T1/J1 Digital Voice Expansion Card (inc in 68707/30)	VI68715
Digital Voice Extender Card	VI68716
Integrated Card Converter	VI68717

Cables

X.21/V.11 Multiplexer Aggregate DTE to Network DCE Cable	VI68720A
X.21bis/V.24 Aggregate DTE to Network DCE Cable	VI68721A/B/C/D
X.21bis/V.35 Aggregate DTE to Network DCE Cable	VI68722A
RS422/RS449 Aggregate DTE to Satellite Modem DCE Cable	VI68723A
RS422/RS449 Aggregate DTE to Paradise P1448 Cable	VI68723B/P1448
RS232 straight DB9-DB9 Supervisor cable	VI68724A
RS530 Aggregate DTE to 25-way Modem DCE Cable	VI68725B
15-way Multiplexer Aggregate Back-to-Back Cable	VI68726A
ISDN Cable	VI68727A
High-Speed Channel Cable	VI68728A
Inline Surge Protector (supervisor)	VI68729

Software Features

Performance Enhancing Proxy	68700/SWF/PEP

Chapter

12

12 Appendix G: Abbreviations

Agg	Aggregate Port
ARP	Address Resolution Protocol
BoD	Bandwidth on Demand
Bps(Kbps)	Bits per Second (Kilobits per second)
CIR	Committed Information Rate
DBA	Dynamic Bandwidth Allocation
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name Service
GRX	Global Receive Clock
GTX	Global Transmit Clock
HSC	High-Speed Channel
ICMP	Internet Control Message Protocol
IETF	Internet Engineering Task Force
ISDN	Integrated Services Digital Network
IP	Internet Protocol
LAN	Local Area Network
LDN	Local Directory Number
MAC	Media Access Control
MTU	Maximum Transmission Unit (bytes)
PEP	Performance Enhancing Proxy
PLL	Phase-Locked Loop
QoS	Quality of Service
RFC	Request For Comments
RXC	Receive Clock
RXD	Receive Data
SPID	Service Profile Identifier
STP	Spanning Tree Protocol
TCP	Transmission Control Protocol
TCPGw	TCP Gateway
TOS	Type of Service
Trib	Tributary port
TXC	Transmit Clock
TXD	Transmit Data
UDP	User Datagram Protocol
UDPGw	UDP Gateway
WAN	Wide Area Network