Doc. No. 78-3369-01

AS5100 Dual E1/PRI Application Card Configuation Note

Product Number: AS51-2P2E-CS

Overview

This document begins with information specific to this initial release of the Dual E1/PRI network application and interface cards, followed by a summary of the contents of each section and information on additional sources for related technical information. An overview of Euro ISDN and a brief discussion of ordering E1 service from your service provider concludes this document.

What's in this Release

Release 1.0 of the Dual E1/PRI network application card (NAC) and the E1 network interface card (NIC) supports Euro ISDN Primary Rate Interface (PRI) call routing protocols. Refer to the "Call Processing and Routing" section in this document for details if you have a need for the following features in your installation:

- Multiple E1 span lines
- Support for analog calls

These features require support by the Quad V.34 Analog/Digital Modem (at least version 3.1). To implement these features from a management station, the network management card and your SNMP management software should also be at compatible release levels (at least version 4.0).

About This Document

This document covers both the hardware and software aspects of the E1 network interface card (NIC) and the Dual E1/PRI network application card (NAC).

Note For additional information, please consult the *Cisco Access Server 5100 User Guide* or your SNMP management software.

The sections of the document are as follows:

- **Overview**

  Provides a general discussion of Euro ISDN service with an emphasis on PRI features along with a discussion of some considerations to take into account when ordering E1/PRI service.

- **Dual E1 Network Interface Card**

  Contains a functional description of the components of this card and a description of the interface connections.

- **Dual E1/PRI Network Application Card**

  Provides a functional description of the components of this card and a description of how to configure hardware switches.

- **Installation**

  Provides instructions for installing the cards, discusses startup issues and chassis configuration and diagnostic information.

- **EIA/TIA-232 Operator Interface**

  Provides information on the user interface connections available to manually configure the cards through software control.

- **Call Processing and Routing**

  Discusses software signaling and routing processes used by the cards to receive, route, and terminate calls.

- **Dual E1/PRI NAC Operator Interface**

  Provides a menu-by-menu description of the operator interface screens used to manually configure the cards through software control and to view the card alarm and status indicators.

- **Technical Specifications**

  Provides detailed information about the interfaces and mechanicals of the cards.

Conventions Used in this Document

Although established international telecommunications standards and nomenclatures are widely used and accepted throughout the world, each country has commonly used words and abbreviations that are unique to that country or area. These terms include the following.

- Telco is a commonly used acronym in the United States, telecom is commonly used in Germany. For consistency in this document, we are using the acronym PTT (Post Telephone and Telegraph) to represent the central switching and service provisioner.
- The terms E1/PRI line or E1 span line are used in this document instead of the European S2M line. The line to the S2M is sometimes referred to as an S2M line.

In order to minimize confusion over common terminology in this document, where possible, such terms are defined when first used.

Euro ISDN Overview

European Integrated Services Digital Network (Euro ISDN) service provides for the transmission of digital data over telephone lines. This section provides general information on the features and capabilities of Euro ISDN with a focus on the ISDN Primary Rate Interface (PRI).

ISDN uses out of band signaling techniques to transmit data and to provide communications networks with universal connectivity over digital lines. Euro ISDN is based on European Telecommunications Standard Institute (ETSI) and International Telephone Union-Telecommunications (ITU-T) standards.

ISDN provides three very broad categories of services that support a variety of user requirements.

- **Bearer Services.** This category supports digital telephony requirements, including inbound/outbound circuit switched, packet switched, and Frame Relay.
- **Teleservices.** This category supports equipment that provides E-mail, videotex, teletex, and facsimile services.
- **Supplementary Service.** This category provides capabilities beyond call setup and tear down, including digital features such as fast dialing, caller line identification (CLID), call waiting/forwarding, and conference calling.

Euro ISDN Service

Euro ISDN provides digital transmission of voice, data, studio-quality sound, and still and moving images. ISDN calls maximize the use of available resources, reduce call setup times, provide flexibility in call routing via software configuration, and minimize the rejection of calls.

Currently, two types of ISDN transmission rates are available—Basic Rate Interface (BRI) and Primary Rate Interface (PRI).

Both BRI and PRI service use two types of channels—B-channels and D-channels. The B-channels (bearer channels) carry user data and the D-channels carry signaling data.

In both BRI and PRI, through the use of inverse multiplexing or bonding, several combinations of B- and D-channels are possible. These multiple channels are called H-channels. Examples of H-channels, carrying both circuit/packed switched user data, include:

H_0 Equal to 6 B-channels
64 Kbps x 6 = 384 Kbps

H_{12} Equal to 30 B-channels
64 Kbps x 30 = 1920 Kbps

Note H_{12} is only possible in services that use multiple E1 lines where signaling is done through another D-channel.

BRI Service

ISDN BRI service transmits digital data by dividing the existing twisted pair local loop into three separate channels—two 64 KbpsB-channels and one 16 KbpsD-channel. This is also referred to as 2B+D service. The B-channels always carry user data and the D-channel carries all signaling information and low-speed packet data.

PRI Service

In countries using E1 span lines, ISDN PRI service provides transmission of digital data over 30 B-channels(64 Kbps)and one D-channel (64 Kbps)plus one framing channel (64 Kbps) for a total bandwidth of 2.048 Mbps using an E1 span line. This is sometimes referred to as 30B+D service.

Note In countries that use T1 span lines, PRI service utilizes 23 B-channels and 1 D-channel (or 23B+D) for a total bandwidth of 1.544 Mbps.

Incoming calls are sensed and routed using device detection schemes to the appropriate devices based on whether they are B-channel user or D-channel signaling calls.

PRI User Data (B-Channels)

The 30 Euro ISDN PRI B-channels each carry user data at transmission speeds of 64 Kbps. ISDN B-channels usage allocations are sometimes aggregated, through software control, into pipes (H-channels) to accommodate various load requirements.

PRI Signaling Data (D-Channels)

The PRI D-channel(s) are used to carry signaling data at 64 Kbpsfor all of the B-channels on an E1 interface. Signaling information includes call setup and tear down messages and out-of band information. This arrangement clears the B-channels to carry only user data.

Setup and tear down information includes called number, bearer capability, B-channel time slot assignment, etc. The D-channel protocol is defined in ITU-T Q.921 and Q.931. This message-based system allows calls to be setup much faster than robbed-bit E1 setup times.

In systems using multiple E1 span lines, the D-channel one span line may be configured to do the signaling for the other span line. For example, with two E1/PRI span line connections, E1/PRI span 1 could have 30B+1D and E1/PRI span 2 could have 31B. In this case, the span 1 D-channel carries the signaling data for both span lines. This configuration is referred to as Nonfacility associated signaling (NFAS).

With E1/PRI service, time slot 0 is used for frame alignment and time slot 16 is used for the D-channel.

PRI Protocols and Standards

Rate adaptation is a process whereby terminal adapters negotiate or adjust bandwidth to meet the requirements of each call. Euro ISDN initiated calls exchange a burst of information to and from the customer site and PTT on the D-channel, including the nature of the call, the type of bearer service requested, and the phone number called. Rate adaptation and signaling protocols, used to standardize the transmission of this information, include:

ETS 300 011	ETSI standard that defines the ISDN PRI user-network Layer 1 specification and test principles.
ETS 300 125	ETSI standard that defines the ISDN user-network interface Layer 2 data link specification.
ETS 300 102-1	ETSI standard that defines the ISDN user-network interface Layer 3 specifications for basic call control.
ETS 300 156	ETSI standard that defines the ISDN attachment requirements for terminal equipment.
I.431	ITU-T standard that defines the ISDN user-network interface Layer 1 specifications.

Q.921	ITU-T standard that defines the D-channel protocol for Layer 2.
Q.931	ITU-T standard that defines the D-channel protocol for Layer 3 and provides out of band signaling on the local loop. Covers call control and call handling services. Q.931 messages are carried over the D-channel.
SS7	Switch to switch signaling standard. Defines the architecture of interswitch signaling. Standards govern message transfer protocol, structure of special signaling network, error and overload recovery, and call-related services out of band signaling.
V.110	Protocol, used primarily in Europe and Japan, that defines the ISDN data terminal equipment (DTE) specifications.

ISDN Information

Additional information on ISDN features and capabilities may be available through your service provider or through the following online resources:

European ISDN User Forum
http://www.dcs.aber.ac.uk/Public/Research/Telematics/EIUF/index.html

Dan Kegel's ISDN Page
http:/ /www.alumni.caltech.edu/~dank/isdn/

Newspage ISDN Update
http: / /www.newspag.com

Ordering E1/PRI Service

This section is designed to prepare you to begin to deal with your E1/PRI provider. If you need additional information, contact Cisco Systems Product Support.

E1/PRI service provisioning requirements may vary according to customer application requirements and the availability of service. There are two major elements that must be considered when ordering E1/PRI service:

- The first is to determine the need for and the number of E1 span lines required to meet your needs.
- The second is to determine the provisioning parameters for Euro ISDN PRI service that are required to accommodate your customized application requirements.

When ordering E1/PRI service for use with the E1/PRI NIC and NAC cards, your service provider will probably require information about the following parameters in addition to the D-channel provisioning requirements:

- Switch Type
- Frame Type
- Line Coding

Switch Type

The E1/PRI NIC and NAC cards support the subset of Euro ISDN standardized switch compatibility type known as ETS ICTR-4.

Frame Type

The E1/PRI frame type service that is supported by the E1/PRI cards is common channel signaling (CCS) with CRC-4 error detection. This standard is defined in ITU-T G.704.

The CCS frame type with CRC-4 error detection is recommended because it minimizes potential framing problems and false alarm events. This frame type is also known as CEPT.

Line Coding

Line coding schemes ensure a sufficient density of 1's in the bit stream, as required by the Dual E1/PRI standard for clock synchronization. The Dual E1/PRI software supports the high-density bipolar-3 (HDB3) line coding scheme.

HDB3 is a variant of alternate mark inversion (AMI) line coding. It provides clear unrestricted channel access to both the PRI B- and D-channels. In other words, data may be sent over the B- and D-channels without any restrictions to content.

D-Channel Provisioning

Proper provisioning of the PRI D-channel before installation of the E1/PRI cards will help to ensure that your system properly performs the customized applications for which it is intended.

Before contacting your E1/PRI provider, it is advisable to determine exactly what types of applications you will be using, including:

- The source of incoming calls—analog modems, BRI lines, PRI lines, etc.
- The origination and termination of calls—BRI to PRI, analog modem to PRI, PRI to PRI, etc.
- Whether the calls will be incoming or outgoing.
- The type of equipment or device to which the E1 lines will terminate at your site.
- CLID/ANI options.

Dual E1 Network Interface Card

This section provides information on the features, functions, and connectors available through the Dual E1 network interface card (NIC). This card is a companion card to the Dual E1/PRI network application card (NAC).

The Dual E1 NIC is designed to be inserted in the back of the AS5100 chassis and plugged into the chassis midplane. The midplane provides connectors on the front for NACs and connectors on the back for NICs. The cards communicate through multiple data buses located in the midplane. See the "Installation" section later in this document for information on the location of this card in the chassis.

Dual E1 NIC Features

The Dual E1 NIC is a surface mounted card that provides the following features:

- Responds to PTT alarms for diagnostic purposes.
- Contains two Bantam Monitor jacks used for monitoring line performance (not supported at this time).
- Conforms to EMC directive 89/336/EEC.
- Meets or exceeds G.736, I.431, G.823 for E1 short haul (6 dB) or long haul (43 dB) operations.

- Conforms to ETS 300 046 parts 1, 2, and 3, ISDN PRA Safety and Protection requirements.
- Provides a keepalive signal when a Dual E1/PRI NAC is removed from the chassis.

Dual E1 NIC Functions

The Dual E1 NIC provides the line interface circuitry between the E1 span line(s) and the E1/CEPT frame on the Dual E1/PRI NAC.

Line Interface Unit

The NIC has a built-in line interface unit (LIU) that provides the interface to each E1/PRI span line. The LIU contains automatic gain control (AGC), auto-equalization, and data recovery. It also recovers the E1 2.048 MHznetwork clock, which is used by the E1/PRI NAC to clock the data to the E1 framers. Depending on the configuration, the network clock may be used by the AS5100 chassis as a timing source.

NIC Managed by NAC

The Dual E1 NIC has the drivers and receivers for the EIA-TIA-232 serial interface required to perform a software download. However, there is no software-driven component on the E1 NIC. The card is managed completely by the E1/PRI NAC.

When the Dual E1/PRI NAC is removed, it sends a nonframed all 1’s pattern to the PTT. This is a standard alarm sequence that signals the PTT that the equipment is down.

Note If the NAC is removed for extended periods of time, the PTT may elect to make the span lines inactive. Some PTTs discontinue the signal if the cards are reset, removed, or powered-off three consecutive times.

Dual E1 NIC Connectors

The Dual E1 NIC is a surface mounted card that has both front and rear panel connectors. The front panel connector plugs into the AS5100 chassis midplane when the card is properly inserted in the chassis. The back panel connectors are used for operator interface, troubleshooting, and termination of the E1 span lines.

Figure 1 Dual E1 Network Interface Card

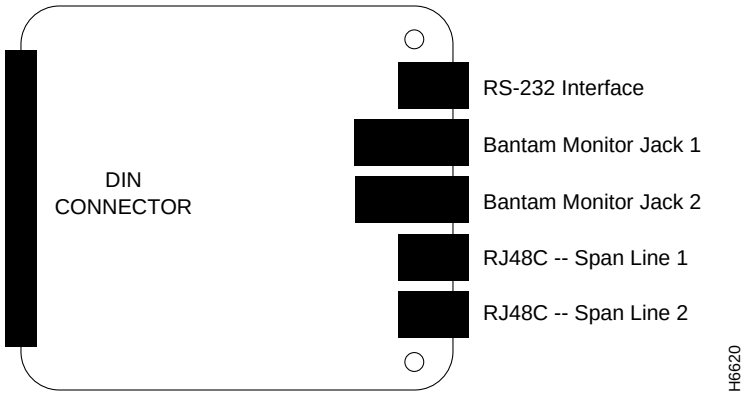


Table 1 Dual E1 NIC Connectors

Connector	Purpose
DIN Connector	Plugs in to the AS5100 chassis midplane
EIA/TIA-232	Connects the card to a PC or a VT100 terminal for operator access, using the interface cable supplied with the system
Bantam Monitor Jack	Used for troubleshooting and monitoring (not supported at this time)
RJ48C	Connects E1 span lines 1 and 2 cables (UTP 0.6 mm (22 AWG) 120 ohm impedance, terminated on one end by the RJ-48C plug and on the other end as specified by country requirements)

Rear Panel Connector Functions

The E1 NIC rear panel has two RJ-48C connectors one for each E1 span line, two Bantam jacks used for testing/troubleshooting, and an EIA/TIA-232 serial port.

RJ-48C Connectors

The RJ-48C connectors provide a G.703/G.704 interface, which recovers clock and data from incoming E1 signals. The recovered data from the E1 NIC passes to the Dual E1/PRI NAC through the midplane connector. The midplane connector also allows the Dual E1/PRI NAC CPU to manage the E1 NIC. The E1 NIC does not have a software-driven component and is managed completely by the Dual E1/PRI NAC.

The RJ-48C connectors are dedicated to the E1 span lines that come into the chassis. The E1 span line cables are UTP 0.6mm (22 AWG) 120 ohm impedance. The cables terminate on one end by the RJ-48C plug and on the other end as determined by country specific requirements. Each E1 spanline provides thirty 64 Kbps B-channels that are multiplexed into the 2.048 Mbps rate.

Table 2 lists the supported pin assignments and functions for the RJ-48C interface of the E1 span lines.

Table 2 RJ-48C Pin Assignments

Pin	Function	E1 NIC <—>PTT
1	Receive Ring	<—
2	Receive Tip	<—
3	None	—
4	Transmit Ring	—>
5	Transmit Tip	—>
6–8	None	—

Bantam Jacks

The two Bantam jacks are used for monitoring and troubleshooting equipment. These jacks (TX and RX) are passively coupled so that the monitoring equipment can be installed while the NIC is powered on, without causing errors.

Note The Bantam jacks are not supported at this time.

EIA/TIA-232 Operator Interface

The E1 NIC EIA/TIA-232 operator interface is an 8-pin connector that is configured as data terminal equipment (DTE).

Use the EIA/TIA-232 cable that is provided with the cards to connect with any of the following devices:

- Modem for remote configuration or software download
- Terminal for local configuration
- PC for local configuration or software download

When connecting a PC to the EIA/TIA-232 operator interface, use the DB-25 female-to-male adapter that is provided with the card.

Note You must supply your own interface adapter if your application uses something other than a DB-25 connector.

Table 3 lists the supported functions and pin assignments of the EIA/TIA-232 interface.

Table 3 EIA/TIA-232 Pin Assignments

Pin	Function	NIC <—> Device
1	Data set ready	<—
2	Data carrier detect	<—
3	Data terminal ready	—>
4	Signal ground	<—>
5	Received data	<—
6	Transmitted data	—>
7	Clear to send	<—
8	Request to send	—>

Dual E1/PRI Network Application Card

This section only discusses Dual E1/PRI network application card configuration prior to installation in the AS5100 chassis. Further configuration of the card is possible after the card is installed through the EIA/TIA-232 operator interface or by using management software.

Note For additional operator interface information, see the "E1/PRI Operator Interface" and "Dual E1/PRI NAC Operator Interface" sections in this document or your SNMP management software.

The Dual E1/PRI network application vard (NAC) is a surface mounted board that is designed to fit in the front portion of the AS5100 chassis and connects to the chassis midplane.

The chassis midplane provides connectors on the front for NACs and connectors on the back for NICs. The cards communicate through multiple data buses located in the midplane.

Note See the "Installation" section later in this document for information on the location of the midplane and of individual cards in the chassis.

Dual E1/PRI NAC Features

The Dual E1/PRI NAC has the following features:

- 64 Kbps circuit switched data (CSD), analog only
- Supports interoperability with existing analog fax and analog data modem calls.
- Supports inbound call routing. Routes analog calls to a pool of modems that support European PTT requirements (A-law complying and call progress tones).
- Provides automatic timing source selection and fallback. If the primary timing source fails, a specified alternate source is engaged automatically.

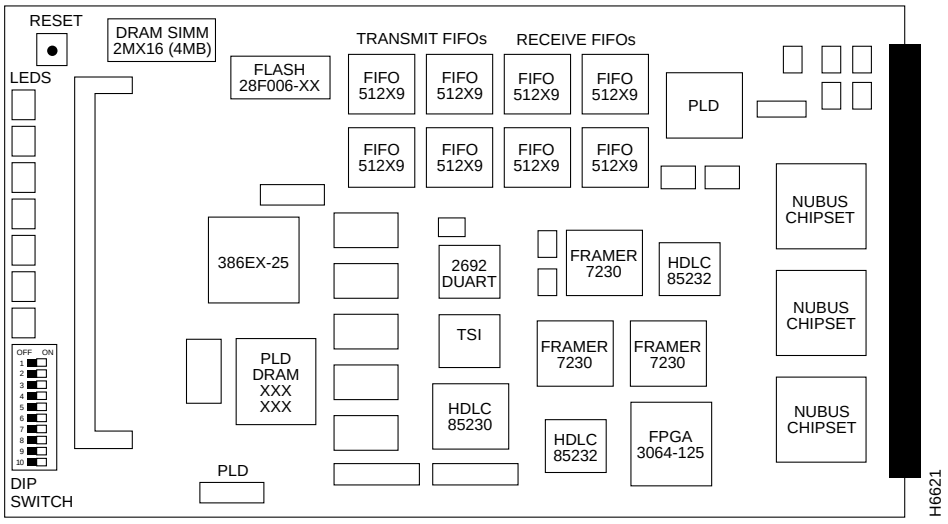
- Provides for full network management and local console support.
- Supports coexistence with quad modem cards (QBCH-mdm).
- Provides software downloads into onboard Flash ROM via the network management card (NMC) and local console support. The operator can easily add features and software upgrades.
- Provides a full array of front panel LEDs. Indicates the status of the Dual E1/PRI NAC and E1 span lines.
- Supports an asynchronous out-of-band management port, which enables local status monitoring and configuration with a PC, VT100 terminal, or remote modem.
- Provides for PRI access for telecommuting, Internet access, transaction processing, high speed file transfer, LAN interconnectivity/remote LAN access, and casual access.

Dual E1/PRI NAC Functions

The Dual E1/PRI NAC allows signaling information to be communicated out of band over the PRI D-channels and thereby provides full 64 Kbps for the transmission of user data. The Dual E1/PRI NAC signaling uses a message based system to communicate signaling information for each channel and interfaces with and distributes calls either to the quad modem with a software update cards (QCBH-mdm) by way of the time division multiplex (TDM) bus or to a gateway card.

The Dual E1/PRI NAC standard configuration includes 4 MBof DRAM SIMM. Although 1 MBand 16 MB configurations are possible for customized applications, the DRAM SIMMs are not field upgradable.

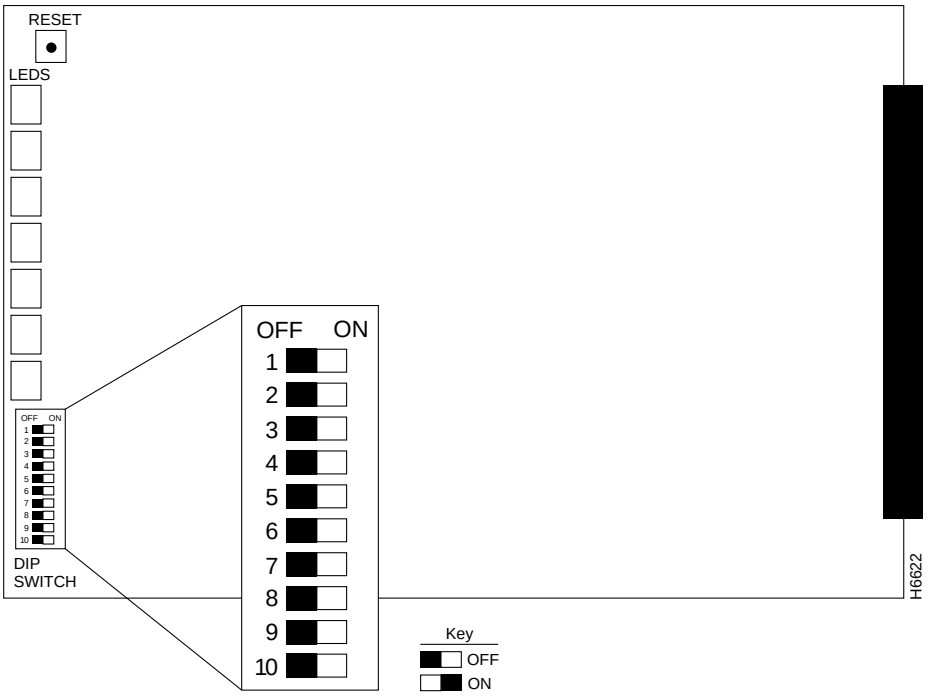
Figure 2 Dual E1/PRI Network Application Card



DIP Switches

Ten DIP switches are located below the indicator LEDs on the Dual E1/PRI NAC (Figure 3). Of these, only DIP switches 1, 2, and 3 are functional at this time. DIP switches 1 and 2 are used to set the serial port rate of the EIA/TIA-232 interface. DIP switch 3 is used to enable or disable hardware flow control for the user interface port.

Figure 3 E1/PRI DIP Switches



The DIP switches are numbered from 1 on the top to 10 on the bottom. Slide the switch to the right to turn it ON.

Warning Make sure the DIP switches are set to your required specifications before installing the Dual E1/PRI NAC. See Table 4 for additional information.

Table 4 Dual E1/PRI NAC.DIP Switches

Switch	Factory Setting	Function		
1, 2	OFF, OFF	EIA/TIA-232 Serial Port Rate Select		
		DIP 1	**DIP 2**	**Selects**
		OFF	OFF	9600 bps
		OFF	ON	19.2 Kbps
		ON	OFF	38.4 Kbps
		ON	ON	Reserved
3	OFF	Hardware Flow Control		
		OFF	Enabled	
		ON	Disabled	
4–10[1]	OFF	Reserved		

[1] Do not change settings of reserved DIP switches unless directed by Cisco Systems Product Support.

The operator interface for the E1/PRI NAC is accessed by attaching either a PC or a VT100 terminal to the EIA/TIA-232 serial port on the E1 NIC. From this interface, the operator is able to:

- Configure the Dual E1/PRI NAC.
- View B-channel and modem status.
- Perform software downloads (requires a PC).

See “Dual E1 Network Interface Card” and “E1/PRI Operator Interface” sections for additional information on using the EIA/TIA-232 port features.

Warning Check your PC or terminal documentation in order to determine the maximum serial port rate your equipment supports. Do this before installing the card so that you can make the proper DIP switch settings.

Note If you are using a portable/notebook computer, note that many of the provided serial ports do not support data rates over 19.2 Kbps. If you are losing characters at 38.4 Kbps, drop to either 19.2 Kbps or to 9600 bps. Remember to change the DIP switches and set your PC to the specified baud rate.

Front Panel LEDs

The Dual E1/PRI NAC has seven indicator LEDs that are visible on the front panel. The LEDs are labeled as:

- Run/Fail (1)
- Carrier (2, one for each E1 line)
- Alarm (2)
- Loopback (2)

The Dual E1/PRI NAC LEDs provide startup, alarm (RAI, OOF, LOS, AIS, CRC errors, etc.), and physical layer state status (F0 through F6) information. See Table 5 for a brief description of the physical layer states, F0 through F6, as described in ITU-T I.431.

Note This section provides information on operating and alarm/event LED status information. For LED startup sequence and information see the “Installation” section later in this document.

The operating LED status can be viewed and monitored directly from the front panel. In addition, the LED status can be viewed from within your SNMP management software.

Figure 4 Dual E1/PRI Front Panel LEDs

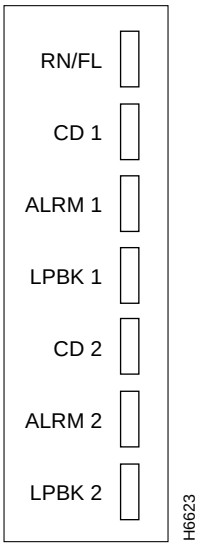


Table 5 E1 Physical Layer Status

Physical Layer Status	Description
F0	Off (no power)
F1	Operational
F2	Received RAI
F3	OOF or LOS
F4	Received AIS
F5	Receive RAI and CRC errors
F6	Power up (transient state)

Five of the seven LEDs on the Dual E1/PRI NAC provide the physical layer status and alarm information. They are: RN/FL, CAR 1, ALM 1, CAR 2, and ALM 2 (where CAR 1 and ALM 1 represent span line 1, and CAR 2 and ALM 2 represent span line 2).

To determine alarm and physical layer status check the LED condition and refer to Table 6.

Note Although the loopback 1/2 LEDs (LPBK 1/2) are operational and function during startup, they do not currently provide physical layer and alarm status information.

Table 6 Dual E1/PRI NAC Physical Layer Status LEDs

RN/FL LED	CAR 1/2 LEDs	ALM 1/2 LEDs	Physical State
Blank	Blank	Blank	F0
Green	Green	Blank	F1
Green	Red	Blank	F2
Green	Blank	Red	F3
Green	Green	Red	F4
Green	Red	Red	F5
Red	Blank	Blank	F6
Red	Red	Red	Diagnostic error

Dual E1/PRI Interfaces

Through the AS5100 chassis midplane connector, the dual E1/PRI NAC has access to the following interfaces:

- Time division multiplex (TDM) Bus Interface.
- Packet bus interface (NuBus) used to transfer call setup and tear down information, and also for clock loss detection, Bus time out generation, and Packet Bus Clock generation between the E1/PRI and other devices in the chassis.
- Management bus interface used to communicate to the Network management card (NMC) located in chassis slot 17 for management support.
- Line interface units (LIU) interface between the NIC and NAC used to control the E1 NIC's line interface units.

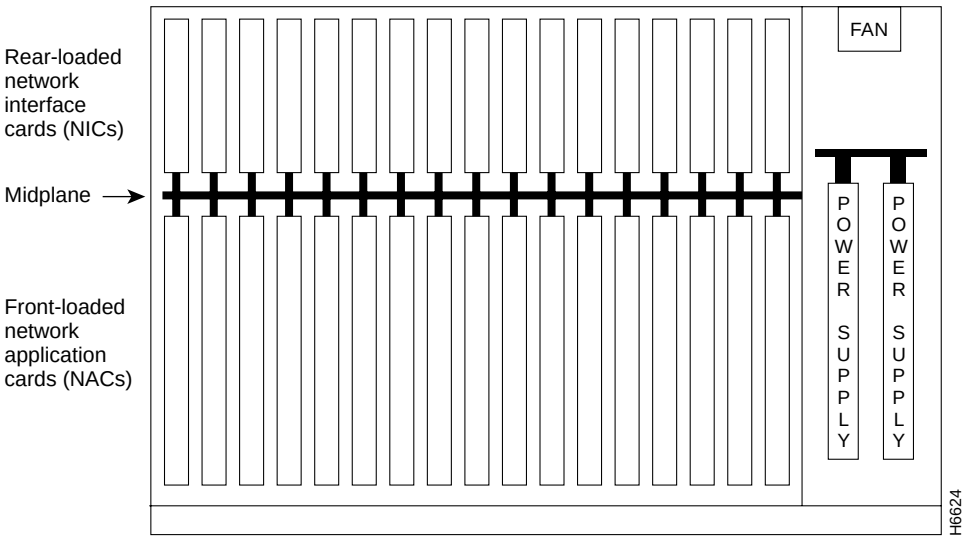
Installation

This section contains information on the AS5100 chassis configurations required when using the E1 cards, the procedures for installing the Dual E1 NIC and the Dual E1/PRI NAC in the chassis, and the LED startup sequence and diagnostics.

Chassis Configuration

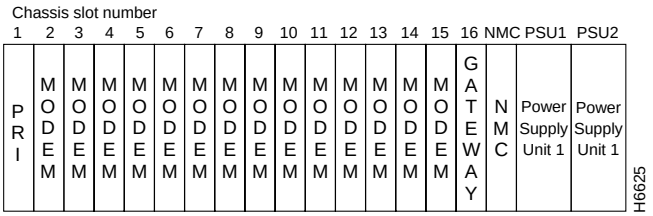
The AS5100 chassis (Figure 5) has 17 slots available for combinations of NAC and NIC cards. A network management card is typically located in slot 17. The NACs and NICs connect through the chassis midplane. The midplane provides multiple data buses that enable the NACs to communicate with each other and the NMC.

Figure 5 AS5100 Chassis (Top View)



The Dual E1/PRI NAC and E1 NIC share the front and back slots and connect through the midplane. Currently, the E1/PRI chassis configuration requires that the E1 cards occupy chassis slot 1.Modems cards may be installed in slots 2 through 15; a gateway card, if used, must occupy slot 16; and the last slot contains the network management card, as shown in Figure 6. This chassis configuration provides compatibility with analog fax and analog modem devices from the Public Switched Telephone Network (PSTN).

Figure 6 Dual E1/PRI Chassis Configuration



PRI Analog Originated Configuration

The chassis arrangement (Figure 6) allows the Dual E1/PRI card to terminate analog calls to either an EIA/TIA-232 or a gateway card. Modem calls are routed to a pool of quad modems, using a round-robin distribution pattern.

Note See the “Call Processing and Routing” section later in this document for additional information on the round-robin distribution pattern.

This configuration supports a maximum of 60 analog calls out of a possible 61 for E1 NFAS. However, if a gateway card is used, then a maximum of 56 calls may be terminated with this configuration.

Installing the Dual E1 NIC

Caution Always use ESD protection when working with electrostatic sensitive components.

Step 1 Remove the safety panel from the selected slot at the back of the chassis by unscrewing the top and bottom screws.

Step 2 With the E1 RJ-48C and EIA/TIA-232 interfaces facing out, slide the E1 NIC into the upper and lower card guides of the slot. Push firmly on the NIC until the midplane connector snaps into position in the chassis midplane.

Step 3 Tighten the thumbscrews that are attached to the E1 NIC rear panel. Pay careful attention to the alignment of the screws before tightening them. Problems could arise if the screws are not threaded properly.

Step 4 Attach the serial port cable (supplied with the card) and the E1 span line cables.

Installing the Dual E1/PRI NAC

Caution Always use ESD protection when working with electrostatic sensitive components.

Cards may be inserted and removed while the chassis is powered-on. This is called hot-swapping. After the dual E1/PRI NAC is successfully inserted into a powered on chassis, the indicator LEDs will begin to flash in sequence during a power-up self test.

Step 1 Make sure all DIP switches are set to your specifications.

See the “Dual E1/PRI Network Application Card” section earlier in this document for specific DIP switch information.

Step 2 Unscrew and remove the cover panel from the desired slot at the front of the chassis. Save the panel and screws.

Step 3 Then, with the DIN connector facing the rear of the chassis and the LEDs facing the front, lift the ejector tabs while sliding the modem card into the slot’s upper and lower card guides. Push firmly on the NAC until the rear connector is firmly positioned in the chassis midplane.

Step 4 Make sure the ejector clips are secure clips by pressing on the tabs until they click into position.

Step 5 After the DIN connector is plugged in and the E1/PRI NAC has power, the front panel LEDs light up in sequence during a series of diagnostic or power-up self tests. The power-up sequence may take over a minute to complete.

See the “LED Diagnostics” section later in this document for more information on these tests.

Step 6 Replace the front panel and tighten the captive screws that secure the panel to the chassis. Pay careful attention to the alignment of the screws before tightening them. Problems could arise if these screws are not threaded properly.

LED Diagnostics

When the dual E1/PRI NAC is installed in a powered-on chassis, the boot code performs various initializations and power-up self-tests that are specific to the chipset. The sequence of events varies depending on whether the startup is a standard power-up or if new software is being downloaded. The LED sequence for these scenarios varies.

See the "Dual E1/PRI Network Application Card" section earlier in this document for additional information on the indicator LEDs.

Normal Start-up Power-up Self-Test LED Sequence

During the standard power-up self-tests, all of the front panel LEDs light up in sequence: red, then amber, then green. Next the Run Fail (RN/FL) LED turns red then amber then green. This process takes about 20 seconds to complete.

Then, as the software is loaded from ROM to RAM, the RN/FL LED alternates between off and green. The time required to complete this portion of the LED sequence varies, depending on the amount of software being loaded.

Software Download LED Sequence

When new software is being downloaded, the LED sequence during power-up is similar to the standard power-up sequence except that the time required varies according the amount of software being downloaded. At the end of the new software download, the card reboots and the normal LED sequence during power-up repeats.

Ready for Operation

After all the tests are performed and, if no failures are found, the RN/FL LED turns solid green, indicating that the card is properly installed and is ready for operation.

Failures During Power-up

If a critical failure is detected, the RN/FL LED turns solid red or amber and the card reboots. A failure is considered critical if it affects execution. Any critical failure is likely to be a hardware problem. If one occurs, contact Cisco Systems Technical Support.

Debug Procedure

Take the following steps if critical failure occurs.

Step 1 Undo the ejector clips and pull the card forward to unplug it from the midplane. Then reseat the card and secure the clips. This may resolve the problem.

Step 2 If reseating the card does not resolve the critical failure, try re-downloading the software.

Step 3 If neither reseating the card in the midplane nor re-downloading the software resolves the critical failure, contact Cisco Systems Product Support.

Note on Shipping

Dual E1/PRI NACs and NICs are shipped in one of three ways, depending on the ordering specification:

- As part of a pre-assembled system—a AS5100 chassis with all of the components factory-installed
- As part of a set (one NAC and one NIC)
- As a separate component that you install in the AS5100 chassis

E1/PRI Operator Interface

This section provides information on managing the dual E1/PRI NAC through either the EIA/TIA-232 serial port interface using either a PC or VT100 terminal or through your SNMP management software. In addition, it describes the steps required to connect a VT100 terminal or PC to the E1 EIA/TIA-232 interface located on the dual E1 NIC in order to perform configuration and software download tasks on the Dual E1/PRI NAC.

For a detailed description of the menu structure that displays when a either PC or terminal connection is made via the EIA/TIA-232 serial port, refer to the “Dual E1/PRI NAC Operator Interface” section later in this document.

Note A PC, and not a VT100 terminal, must be used to perform a software download.

If you wish, a dedicated PC may be connected to the EIA/TIA-232 port. When performing configuration tasks, simply run a terminal emulation program to make your PC act like a terminal. Windows offers a terminal option, and many communications software programs allow you to establish a TTY connection.

Connecting to the EIA/TIA-232 Port

An EIA/TIA-232 cable and a DB-25 female to DB-25 null modem are provided with your Dual E1/PRI package.

- If you intend to connect either a terminal or a PC to the Dual E1/PRI EIA/TIA-232 port use both the EIA/TIA-232 cable and the DB-25 female-to-DB-25 null modem.
- If you intend to configure the Dual E1/PRI Card from a remote site, a modem can be connected to the E1/PRI EIA/TIA-232 interface using the EIA/TIA-232 cable provided.

You must supply your own interface adapter if your hardware uses something other than a DB-25 connector.

See the “Dual E1 Network Interface Card” section earlier in this document for additional information on the EIA/TIA-232 serial port.

EIA/TIA-232 Serial Port Settings

The default serial port rate at the E1/PRI NIC EIA/TIA-232 port is set at 38400 bps. The baud rate can be changed by adjusting the settings of DIP switches 1 and 2 on the dual E1/PRI NAC, as shown in Table 7.

See the “Dual E1/PRI Network Application Card” section earlier in this document for additional information on adjusting the DIP Switch settings.

Table 7 DIP Switch Serial Port Rate

DIP 1	DIP 2	Selects
OFF	OFF	9600 bps (default)
OFF	ON	19200 bps
ON	OFF	38400 bps
ON	ON	Reserved

The data format is 8 data bits, no parity, and 1 stop bit.

Note When performing a software download, we recommend that hardware flow control be enabled at the port. This requires that DIP switch 3 on the E1/PRI NAC be set to OFF (default setting) position.

Call Processing and Routing

This section provides information on the call signaling, processing, and routing functions of the dual E1/PRI NAC. Call signaling permits the Dual E1/PRI call to identify, setup, and tear down calls between the PTT and the QBCH-mdm cards in the chassis. Call processing involves establishing B-channel connections based on the signaling information received over the D-channels. Call routing is a scheme for sending the calls to the first available modem or appropriate device.

Call Signaling

The primary function of the Dual E1/PRI NAC is to setup and tear down calls between the PTT and the QBCH-mdm cards. This is done through the D-channel which is dedicated to providing signaling for the B-channels (user channels).

The D-channel signaling software utilizes standard signaling software messages including Q.921 (layer 2) and Q.931 (layer 3). This makes it compatible with the European Telecommunications Standard (ETS) collection of standards for ICTR-4. PRI.

Call Processing and Routing

Call routing involves sending a call to another network application card (NAC) device and establishing the data path connection between the B-channel and the chosen TDM time slot for the call. The way a call is processed or routed is determined by the type of call, either analog or digital, and the available device configuration.

The Dual E1/PRI NAC communicates with the PTT over the 64 Kbps D-channel on each PRI span line. Setup and tear down information, including called number, bearer capability, and TDM time slot is sent to an application NAC over the packet bus. After a call is setup, the E1/PRI establishes a full duplex 64 Kbpsconnection between the PRI B-channel and the TDM time slot in the NAC that

is being used for the call. While a call is established, the D-channel monitors only itself and the packet bus until it receives a tear down message. Other than establishing calls, the D-channel does not get involved with B-channel data.

When the NAC receives a dial in call, it interprets the Q.931 call setup messages and communicates the information to the appropriate NAC via the packet bus.

Circuit Switched Call with Analog Modem or Fax

The E1/PRI is capable of handling setup circuit switched calls with an analog modem/fax in the Public Switched Telephone Network (PSTN). This type of circuit switched call, made between the PRI interface and an analog fax modem/fax on the Public Switched Telephone Network (PSTN), is not end-to-end ISDN.

A Q.931 message communicates the nature of the call to the Dual E1/PRI NAC and informs it when certain tones may be available on the B-channel. The ISDN cuts through the B-channel to let an audible ringing tone be sent from the far end. The Dual E1/PRI NAC, based on bearer capability (3.1 kHz audio or voice), routes the call to an available QBCH-mdm.

The Dual E1/PRI NAC in chassis slot 1 is configured to route analog modem calls. The dual E1/PRI NAC recognizes and routes incoming analog calls to a pool of modems and/or a gateway card.

Note For additional information on chassis configuration requirements, see the “Installation” section earlier in this document.

Call Recognition

The D-channel Q.931 setup message contains setup information that identifies the type of call. Incoming analog calls are routed to a modem or a gateway card. The QBCH-mdm is the default setting for analog calls.

Analog Calls

Typically, incoming analog calls that originate from a modem are either speech or 3.1 kHz audio. Sometimes an incoming digital originated call will be transmitted as speech or as 3.1 kHz audio. This may occur when the originated digital call requests speech or 3.1 kHzaudio in order to pass the data at a lower tariff rate.

Routing Decisions

Calls to the Dual E1/PRI NAC are routed based on call type, either analog or digital, and chassis device configuration.

Incoming call Q.931 setup messages are used to direct the call to the appropriate device or reject the call if the call type is not supported. Analog calls, speech or 3.1 kHz audio, are routed to the modem pool.

Analog Modem Call Routing

The Dual E1/PRI NAC in chassis slot 1 routes analog calls to a configured pool of modem cards. Incoming calls are distributed in a round-robin manner starting with the lowest idle modem slot/channel.

In the following example, there is a dual E1/PRI NAC in chassis slot 1 and 12 modems starting in slot 2.

Note If the modem rejects an incoming call, the Dual E1/PRI NAC will try other modems in the pool. If none of the modems respond, the call is dropped.

Table 8 First Call Routed to Lowest Slot/Channel Modem (2/1)

Current Route Index	Modem Slot Number	Modem Channel Number	Modem Status
—>	2	1	Idle
–	2	2	Busy
–	2	3	Busy
–	2	4	Idle
–	3	1	Idle
–	3	2	Idle
–	3	3	Idle
–	…	…	…
–	13	4	Idle

Table 9 Second Call Routed to Next Lowest Idle Slot/Channel Modem (2/4)

Current Route Index	Modem Slot Number	Modem Channel Number	Modem Status
–	2	1	Busy
–	2	2	Busy
–	2	3	Busy
—>	2	4	Idle
–	3	1	Idle
–	3	2	Idle
–	3	3	Idle
–	…	…	…
–	13	4	Idle

Table 10 Third Call Routed to Next Lowest Idle Slot/Channel Modem (3/1)

Current Route Index	Modem Slot Number	Modem Channel Number	Modem Status
–	2	1	Idle
–	2	2	Busy
–	2	3	Busy
–	2	4	Busy
—>	3	1	Idle
–	3	2	Idle
–	3	3	Idle
–	…	…	…
–	13	4	Idle

Dual E1/PRI NAC Operator Interface

Connecting a VT100 terminal or a PC using a terminal emulation program to the EIA/TIA-232 operator interface port on the dual E1 NIC allows an operator to configure and manage the dual E1/PRI NAC via menu-driven screens. After the PC or terminal is connected, press the Return key to display the operator interface main menu that follows.

Note A remote operator can dial in to a modem connected to the EIA/TIA-232 interface and configure the E1/PRI NAC. After the modems have connected, press the Return key to display the following main menu on the remote terminal screen.

```
Cisco Systems, Ins. (c) 1996

Dual E1/PRI Application Card Revision 1.0.1
Boot Code Linked Date     : Thurs Feb  1 09:00:00 1996
Operation Code Linked Date: Thurs Feb  1 09:18:23 1996

Main Menu

1) Command
2) Status
3) Card Configuration
4) Span Line 1 Configuration
5) Span Line 2 Configuration
6) SW Fault Manger Event Logging

Enter menu selection and press Return.

Menu Selection (1-6):_
```

To select an option from the main menu, type the number of the desired selection and press Return. At any point in the menu structure, press Esc to return to the previous menu.

Command

When you select the Command option from the main menu, the following menu appears. This menu provides command options to perform specific functions on the individual E1 span lines and B-channels.

```
Command

1) Reset to Highest Priority Timing Source
2) Reset PRI NAC
3) Force Receiver Reframe on Span Line 1
4) Disconnect Call on Span Line 1 B-CHANNEL(s)
5) Force Receiver Reframe on Span Line 2
6) Disconnect Call on Span Line 2 B-CHANNEL(s)
7) Force TDM-Bus Mastership on Card


Enter menu selection and press Return or press Esc to exit.

Menu Selection (1-7):_
```

Reset to Highest Priority Timing Source. Select option 1 to reset the E1/PRI NAC timing source to the next highest priority. The possible choices are span line 1 or span line 2. The reset sequence may take more than a minute to complete.

```
Timing source has been set to:  Span Line 1.
                                <Span Line 2>

Press Esc to exit.
```

Reset PRI NAC. Select option 2 to reset the E1/PRI NAC and restore the factory configuration. This action takes place immediately and does not prompt for confirmation.

```
Reset PRI NAC
```

- **Force Receiver Reframe on Span Line 1<2>.** Select options 3 or 5 to force the E1 frame for either span line 1 or span line 2 to reframe. This screen indicates whether the receiver reframe was successful or unsuccessful.

```
Force Receiver Reframe on Span Line 1<2> Successful.
                                         <Unsuccessful.>

Press Esc to exit.
```

Disconnect Call on Span Line 1<2> B-Channel(s). Selecting this option allows an operator to disconnect an individual B-channel or a range of B-channels. Type the desired entries, separated by a comma. Use a hyphen to indicate a range of B-channels.

```
Disconnect Call on Span Line 1 <2> B-CHANNEL(s)

Enter B-CHANNEL(s)s to be disconnected and press Return.

Separate all entries with a comma (,), where each entry can
either be an individual B-CHANNEL or a range of (1-32)
B-CHANNEL(s) separated by a dash (-).

B-Channels  1-15 correspond to DS0s  2-16
B-Channels 16-30 correspond to DS0s 18-32

>:_
```

Force TDM Bus Mastership on Card. Selecting this option allows an operator to manage the TDM bus via the E1/PRI NAC.

```
Force Bus Mastership on Card

Press Esc to exit.
```

Status

The status menu provides information on the current status of the cards in the chassis, the configuration, and alarm event information. Select main menu option 2, status, to display the status menu.

```
Status

1 Power-up Self-test Status
2 Card Status
3 Chassis Slot Device Configuration Status
4 Quad B-channel/Modem Device Status
5 Span Line 1 DS0 Status
6 Span Line 1 Alarm/Event Status
7 Span Line 2 DS0 Status
8 Span Line 2 Alarm/Event Status

Enter menu selection and press Return or press Esc to exit.

Menu Selection (1-8):_
```

The eight status options report on various status conditions on the E1/PRI NAC and E1 span line(s) and alarms or events taking place. The displayed status is a snapshot of the events and/or conditions at the time the operator requests the status report.

Power-up Self-test Status. During power-up, the E1/PRI NAC software performs a variety of tests to ensure proper-operation of the hardware. Select option 1 from the status menu to display the test results.

```
Power-up Self-test Status

RAM: Passed
Flash ROM: Passed
Non-maskable Interrupt: Passed
Watch Dog: Passed
Management UART: Passed
User Interface UART: Passed
Time/space Switch: Passed
Framer 1: Passed
Framer 2: Passed
Line Interface Unit 1: Passed
Line interface Unit 2: Passed
HDLC Channel 1: Passed
HDLC Channel 2: Passed
```

The possible Power-up self-test status results are:

- **RAM**. This test fills the SRAM of the NAC with a pattern sequence and then performs a comparison check. The failure level for this test is critical.
- **Flash ROM**. This test performs a CRC check on the Flash ROM. The failure level for this test is critical.

- **Non-maskable Interrupt.** This is a write-to-ROM test, which should result in a nonmaskable interrupt (NMI). Any attempt to write to ROM should cause the NMI test code to run. The failure level for this test is noncritical.
- **Watch Dog.** This test verifies the watchdog circuitry on the E1/PRI NAC. The failure level for this test is noncritical.
- **Management UART.** This is a simple loopback test to verify the UART that communicates with the management bus. The failure level for this test is noncritical.
- **User Interface UART.** This is a simple loopback test to verify the UART that communicates with the user interface port. The failure level for this test is noncritical.
- **Time/space Switch.** The E1/PRI software runs two built-in self-tests of the time space interchange (TSI) and a write/read test of the TSI registers. The failure level for this test is noncritical.
- **Framer 1/2.** The E1/PRI software performs various diagnostic exercises to test the frame chips. The failure level for this test is noncritical.
- **Line Interface Unit 1/2.** The power-up code first checks for the presence of the E1 NIC, and then configures the CSU on the NIC to local loopback mode. The failure level for this test is noncritical.
- **HDLC Channel 1/2.** The code checks the HDLC controller channels 1 and 2. The HDLC controller is used for D-channel signaling. The failure level for this test is pass/fail.

Card Status. Select status menu option 2 to view the current timing source, the type of NIC installed with the E1/PRI NAC, the slot in which the E1/PRI NAC is installed, and the size of the installed DRAM and Flash ROM. If the timing source is set to either span line 1 or 2, then the EI/PRI is a slave.

```
Card Status

Current Timing Source:      Span Line 1
Current PBus Timing Source: Slave
NAC Type:                   Dual E1
PRI NAC Slot Number  :      01
DRAM Installed       :      4 M
FLASH ROM Installed  :      1 M

Press Esc to exit.
```

Chassis Slot Device Configuration Status. Select Status menu option 3 to obtain information on the current chassis slot device configuration. The possible device type configurations are None (no device installed), dual PRI (Dual E1/PRI card), or QBCH-mdm (Quad B-Channel Modem).

```
Chassis Slot Device Configuration Status

        Device
 Slot#  Type

  1     Dual-PRI
  2     QBCH-mdm
  3     QBCH-mdm
  4     QBCH-mdm
  5     QBCH-mdm
  6     QBCH-mdm
  7     QBCH-mdm
  8     QBCH-mdm
  9     QBCH-mdm
 10     QBCH-mdm
 11     QBCH-mdm
```

```
12     QBCH-mdm
13     QBCH-mdm
14     NONE
15     NONE
16     NONE

Press Return to update status or press Esc to exit.
```

Quad B-channel/Modem Device Status. Select option 4 to monitor the status of the installed modems (QBCH-mdm). Each modem slot/channel indicates whether a modem is available (AVAIL); a modem is not available (Un-Avail); or a modem is currently active and not available (In use).

```
Quad B-channel Modem Device Status

ID Slot/Status  ID Slot/Status ID Slot/Status ID Slot/Status
   Chan            Chan            Chan           Chan
 1 1/1 Un-Avail 17 5/1 In-Use  33  9/1 AVAIL   49 13/1 Un-Avail
 2 1/2 Un-Avail 18 5/2 In-Use  34  9/2 AVAIL   50 13/2 Un-Avail
 3 1/3 Un-Avail 19 5/3 AVAIL   35  9/3 AVAIL   51 13/3 Un-Avail
 4 1/4 Un-Avail 20 5/4 AVAIL   36  9/4 AVAIL   52 13/4 Un-Avail
 5 2/1 In-Use   21 6/1 AVAIL   37 10/1 AVAIL   53 14/1 Un-Avail
 6 2/2 In-Use   22 6/2 AVAIL   38 10/2 AVAIL   54 14/2 Un-Avail
 7 2/3 In-Use   23 6/3 AVAIL   39 10/3 AVAIL   55 14/3 Un-Avail
 8 2/4 In-Use   24 6/4 AVAIL   40 10/4 AVAIL   56 14/4 Un-Avail
 9 3/1 In-Use   25 7/1 AVAIL   41 11/1 AVAIL   57 15/1 Un-Avail
10 3/2 In-Use   26 7/2 AVAIL   42 11/2 AVAIL   58 15/2 Un-Avail
11 3/3 In-Use   27 7/3 AVAIL   43 11/3 AVAIL   59 15/3 Un-Avail
12 3/4 In-Use   28 7/4 AVAIL   44 11/4 AVAIL   60 15/4 Un-Avail
13 4/1 In-Use   29 8/1 AVAIL   45 12/1 AVAIL   61 16/1 Un-Avail
14 4/2 In-Use   30 8/2 AVAIL   46 12/2 AVAIL   62 16/2 Un-Avail
15 4/3 In-Use   31 8/3 AVAIL   47 12/3 AVAIL   63 16/3 Un-Avail
16 4/4 In-Use   32 8/4 AVAIL   48 12/4 AVAIL   64 16/4 Un-Avail

Press Return to update status or press Esc to exit.
```

Span Line 1<2> DS0 Status. Select Status menu options 6 or 8 to view a snapshot of DS0 status for span lines 1 or 2.

```
Span Line 1<2> DS0 Status

DS0 DS0          Device   Slot/ DS0 DS0          Device   Slot/
    Status       Type     Chan      Status       Type     Chan

 1  FRAMING      QBCH-MDM 16/-  17  D-CHANNEL     N/A       -/-
 2  IDLE         NONE      -/-  18  CONNECTED-IN  QBCH-MDM  5/2
 3  DIALING-IN   QBCH-MDM 15/-  19  CONNECTED-IN  QBCH-MDM  5/3
 4  DIALING-IN   QBCH-MDM  7/1  20  CONNECTED-IN  QBCH-MDM 16/-
 5  DIALING-IN   QBCH-MDM  -/-  21  CONNECTED-IN  QBCH-MDM  -/-
 6  CONNECTED-IN QBCH-MDM  6/2  22  CONNECTED-IN  QBCH-MDM 16/-
 7  DISCONN      QBCH-MDM  -/-  23  CONNECTED-IN  QBCH-MDM  9/3
 8  DIALING-IN   QBCH-MDM  -/-  24  CONNECTED-IN  QBCH-MDM  9/4
 9  DISCONN      QBCH-MDM  7/3  25  CONNECTED-IN  QBCH-MDM  9/1
10  CONNECTED-IN QBCH-MDM  7/4  26  CONNECTED-IN  QBCH-MDM  9/2
11  CONNECTED-IN QBCH-MDM  8/4  27  CONNECTED-IN  QBCH-MDM 15/-
12  CONNECTED-IN QBCH-MDM 16/-  28  CONNECTED-IN  QBCH-MDM 15/-
13  IDLE         NONE      -/-  29  CONNECTED-IN  QBCH-MDM 15/-
14  DIALING-IN   QBCH-MDM 15/-  30  CONNECTED-IN  QBCH-MDM  5/3
15  DIALING-IN   QBCH-MDM  7/1  31  CONNECTED-IN  QBCH-MDM 16/-
16  DIALING-IN   QBCH-MDM  -/-  32  IDLE          NONE      -/-

Press Return to update status or press Esc to exit.
```

The possible DS0 Status options are:

- **Connected-In.** The B-channel line is in use with a call originating from a remote device through the PTT.
- **Disconn**. The call on the B-channel is disconnecting.
- **D-Channel**. The DS0 is carrying signaling data. No device is associated with this activity.
- **Idle.** The DS0 line is available and waiting for a call.

Alarm/Event Status. Select status menu options 7 or 9 to view a snapshot of alarm/event status for each span line.

```
Span Line 1<2> Alarm/Event Status

Receiver Gain: 0.0 dB

Errored Seconds: xxxxx seconds
Severely Errored Seconds: xxxxx seconds
Failed Seconds: xxxxx seconds

Bipolar Violations: xxxxx
FAS Errors: xxx
Change in Frame Alignment: xxx
Frame Slips: xxx

Bursty Errored Seconds: xxxxx seconds
CRC Errors: xxxxx
Excessive CRC Error: xxx

Loss of Signal: y/n            Loss of Signal: (NOS): y/n
Out of Frame: y/n              Out of Frame: (LOF): y/n
Remote Frame Alarm: y/n        Remote Frame Alarm:(RAI): y/n
Alarm Indication Signal: y/n   Alarm Indication Signal(AIS): y/n
Continuous CRC Error: y/n      Continuous CRC Error: y/n
Physical State: F0
D-Channel Operational: Up

Press Return to update status, press Ctrl-R to reset counters
or press Esc to exit.
```

The following list describes each status condition reported on this screen.

- **Receiver Gain.** This is a function of the line interface units (LIUs) and indicates E1 span line signal attenuation in 7.5 dB increments: 0 dB, 7.5 dB, 15 dB and 22.5 dB.
- **Errored Seconds**. Depending on framing format, this indicates OOF conditions, frame slip conditions, or error events.
- **Severely Errored Seconds**. This reports error events or frame slip conditions in seconds.
- **Failed Seconds**. This indicates the number of seconds spent in a failed state. A failed state is defined as 10 consecutive seconds during which severe error seconds occur.
- **Bipolar Violations.** This indicates bipolar violations (BPV) in the line format being used. For HDB3 line coding, it indicates any invalid BPVs. The count of the BPVs detected from both span lines is reported.
- **FAS Errors.** This indicates an error in the frame alignment sequence (FAS) in time slot 0 of the CEPT multiframe sequence. The count of FAS errors is reported.

- **Change in Frame Alignment (CFA)**. This indicates that a receiver has reframed on a new framing pattern and has synchronized at a new frame alignment because of an Out of Frame (OOF) condition. A counter records the number of times this has occurred since the last counter reset. The status report indicates whether or not a CFA has occurred.
- **Frame Slips.** These can be caused either by frames that are repeated because of buffer overflow (BOF) or frames that are deleted because of buffer underflow (BUF). The status report indicates if either a BOF or BUF condition has occurred. A counter records the number of times this has occurred since the last counter reset.
- **Bursty Errored Seconds**. This reports CRC error conditions in seconds.
- **CRC Errors.** This occurs when a CRC bit is in error. The count of CRC errors is reported.
- **Excessive CRC Error Indication (ECRCEI).** This indicates a sustained streak of CRC errors. This condition exists when A=1 and E=0 are continuously received for a minimum of 10 milliseconds and not longer than 450 milliseconds. The status report indicates if this has occurred. A counter records the number of times this has occurred since the last counter reset.
- **Loss of Signal (LOS).** This occurs when the there is a loss of signal by a remote terminal. Loss of Signal is the reception of a signal strength of less than 20 dB of nominal strength for at least 1 millisecond.The condition is valid only until the loss of frame alignment (OOF) condition has occurred. The local terminal notifies the remote terminal by sending an AIS (all ones) signal within 12 milliseconds.
- **Out of Frame (OOF).** This indicates that a framing pattern for an E1 line has been lost and data cannot be extracted properly. There is a signal, but it is out of synchronization. This is also referred to as a loss of frame (LOF) alarm. The status indicates whether or not out of frame conditions are present.
- **Remote Frame Alarm (RFA).** This is also known as a remote alarm indication (RAI). It indicates that an OOF condition has occurred at the remote end. The status report indicates whether or not a remote frame alarm condition is present.
- **Alarm Indication Signal (AIS)**. This is also known as an AIS alarm. It indicates to the remote end a loss of the received signal. It is used as a keepalive signal for data on a connection with an alarm condition sent by the network. An AIS occurs when a stream of 1’s is received. The status report indicates the presence of an AIS condition.
- **Continuous CRC Error.** This is a remote frame alarm condition in which at least 915/1000 CRC errors occur per second. This indicates a local equipment problem.
- **Physical State**. This indicates the state of the user interface as defined in ITU-T I.431. The options are F0 through F6.
- **D-Channel Status.** D-channel status up indicates that E1/PRI NAC is sending Layer 2 activity. D-channel status down indicates the E1/PRI NAC is not operational, there is no communication between the PTT and the card.

Card Configuration

When you select card configuration, option 3 from the main menu, the following menu appears. The configuration options available from this screen pertain to the E1/PRI NAC as a whole. From the card configuration menu the default configuration can be changed, saved, and restored. In addition, the timing source priority and the chassis slot configuration can be assigned from this menu.

To return to the card configuration menu from one of the card configuration submenus, press Esc.

```
Card Configuration                          Current Setting

1) Save Current Configuration to NVRAM
2) Restore NVRAM Configuration
3) Restore Default Configuration
4) Timing Source Priority Assignment   Span-1=1 Span-2=2
5) Chassis Slot Device Configuration


NOTE: Changing configuration parameters may affect calls
in progress.)

Enter menu selection and press Return or press Esc to exit

Menu Selection (1-5):_
```

Save Current Configuration to NVRAM. To save changes you made to the default configuration of the E1/PRI NAC, select option 1. This will save the new configuration to NVRAM. You will be prompted to confirm the operation.

```
Saving Current Configuration Settings

1 Save Current Configuration

Enter menu selection and press Return or press Esc to exit.

Menu Selection (1):_
```

Restore NVRAM Configuration. If you made and saved changes to the NVRAM settings, and you wish to reset the E1/PRI NAC to its previous settings, select option 2. You will be prompted to confirm the operation.

Note If you made changes to the NVRAM settings and selected option 1 **Save Current Configuration** to NVRAM, you cannot restore the previous NVRAM configuration.

```
Restore NVRAM Configuration

1 Restore NVRAM Configuration

Enter menu selection and press Return or press Esc to exit.

Menu Selection (1):_
```

Restore Default Configuration Select option 3 to reload all factory configuration defaults. You will be prompted to confirm the operation.

```
Restore Default Configuration Settings

1 Restore Default Configuration

Enter menu selection and press Return or press Esc to exit.

Menu Selection (1):_
```

Timing Source Priority Assignment. A number from 1 (highest priority) to 2 (lowest priority) is assigned to the timing sources. The timing source with the highest priority clocks data on the span line(s). Any timing source can be disabled by assigning a priority of 0. If not disabled, two or more timing sources cannot be assigned the same priority. Priority assignment of timing sources allows switching to the next highest timing source if the current source fails.

```
Timing Source Priority Assignment

Span Line 1 (S-1): 1
Span Line 2 (S-2): 2

Enter the desired priority (0-2) beneath each timing source
and press Return or press Esc to exit.

0 = Disabled, 1 = Highest Priority, 2 = Lowest Priority

Timing Source Priority Assignment

Example: 2 1   changes S-1=2 and S-2=1
Timing Source Priority:_
```

The timing source does not switch unless a failure is detected on the current choice. For example, if the primary timing source fails, the secondary timing source takes over. The secondary source remains active as long as it does not fail, even if the primary source returns. From the Command Menu, select **Reset to Highest Priority Timing Source**. The primary timing source once again becomes active. See a full description earlier in this section.

Table 11 presents a summary of the options and defaults for the timing source priority.

Table 11 Timing Source Priority

Parameter	Options	Default
Span Line 1	0 (Disabled) 1 (Highest priority) 2 (Lowest priority)	1
Span Line 2	0 (Disabled) 1 (Highest priority) 2 (Lowest priority)	2

Chassis Slot Device Configuration Selecting this option allows the operator to assign device types to chassis slot numbers. Each slot on the chassis is assigned a number from 1 to 16. To assign a device type to a specific slot, use the following numbers:

1 Quad modem (QBCH-MDM)

2 NONE (no device installed)

Note If you receive the error message: “Ring No Answer,” check the chassis slot device configuration status to ensure that the modem settings on screen reflect the placement in the chassis.

```
Chassis Slot Device Configuration Status

Current Configuration Status

       Device                Device
Slot#  Type          Slot # Type

1      Dual PRI       9     QBCH-MDM
2      QBCH-MDM      10     QBCH-MDM
3      QBCH-MDM      11     QBCH-MDM
4      QBCH-MDM      12     QBCH-MDM
5      QBCH-MDM      13     QBCH-MDM
6      QBCH-MDM      14     NONE
7      QBCH-MDM      15     NONE
8      QBCH-MDM      16     NONE

Assign device types to chassis slot numbers given the format
below:

      DEVICE_TYPE#:S#[,S#]

where, DEVICE_TYPE# ->  q - QBCH-MDM, n- NONE (no ISDN
                            Device in slot)
                        S# -> Chassis Slot# (1-16)

Example: 1:4,5 assigns the QBCH-MDM NAC device type to slots
         4 and 5

>:_
```

Span Line 1/2 Configuration

When you select span line 1/2 configuration. from the main menu, the following menu appears. To return to the span line 1/2 configuration menu from one of these submenus, press Esc.

```
Span Line 1 <2> Configuration    Current Setting

1)Framing Mode                   G.704 (with CRC-4)
2)Line Coding                    HDB3
3)Remote Loopback                Disable
4)Jitter Attenuation             Receiver
5)Switch Type (Boot time)        Config=ICTR-4, Act.=ICTR-4
6)Idle Byte Sent to PTT          7E Hex

(NOTE: Changing configuration parameters may affect calls in
 progress)

Enter menu selection and press Return or press Esc to exit

Menu Selection (1-6):_
```

Table 12 summarizes the options and defaults for parameters configurable per span line.

Table 12 Parameters Configurable per E1 Span Line

Parameter	Options	Default
Framing Mode	G.704 (with CRC-4)	G.704 (with CRC-4)
Line Coding	High Density Bipolar (HDB3)	HDB3
Remote Loopback	Disable Enable	Disable
Jitter Attenuation	Receiver Transmitter	Receiver
Switch Type	ICTR-4	ICTR-4
Idle Byte	Hexadecimal value	7E Hex

Framing Mode. Allows an operator to specify the framing format to use. Currently, G.704 with CRC-4 is supported for span line 1/2.

```
Span Line 1 <2> Framing Mode

G.704 with CRC-4

Note: Only G.704 (with CRC-4) is supported at this time.

Press Esc to exit.
```

Line Coding. Allows an operator to select a line coding scheme for Span line 1/2. A line coding scheme ensures a sufficient density of 1's in the bit stream, required by the E1 standard for clock synchronization. High density bipolar-3 (HDB3) is the only line coding supported for E1/PRI NAC service.

```
Span Line 1<2> Line Coding

High Density Bipolar-3 (HDB3)

Note: Only HDB3 line coding is supported at this time.

Press Esc to exit.
```

Locally Initiated Remote Loopback. Allows an operator to enable or disable the remote loopback mode for span lines 1/2. This is a troubleshooting utility that loops back DS0 32 upon itself. It is initiated at the EIA/TIA-232 local interface. The operator must initiate this feature locally at the user interface. While in loopback mode, the LPBK LED for the appropriate E1 line is green. The normal state is disabled.

```
Span Line 1<2> Locally Initiated Remote Loopback

1) Enable
2) Disable

Enter menu selection and press Return or press Esc to exit.

Menu Selection (1-2):_
```

Jitter Attenuation. The E1 NIC hardware provides a 193-bit frame buffer to compensate for low frequency jitter with the synchronization to the E1 network. This buffer can be placed in either the receive or transmit data path. The default setting is the receiver.

```
Span Line 1<2> Jitter Attenuation

1) Attenuate Jitter on Receiver
2) Attenuate Jitter on Transmitter

Enter menu selection and press Return or press Esc to exit.

Menu Selection (1-2):_
```

Span Line 1/2 Switch Type. The switch type can be set to accommodate the Euro ISDN ETS ICTR-4 switch standard.

```
Span Line 1<2> Switch Type

ICTR-4

Note: Only ICTR-4 is supported at this time.

Press Esc to exit.
```

Idle Byte Pattern. E1 equipment requires a sufficient number of 1’s in the bit stream to derive clock synchronization. This parameter can be set to send to the PTT on idle B-channels. The parameter is configurable so that it can be adjusted to satisfy the 1’s density required by the PTT. Use a byte in the hexadecimal ranges from 00 to FF.

```
Span Line 1<2> Idle Byte Sent to PTT

Enter a 2 Digit Idle byte (hexadecimal).

>:_
```

Software Fault Manager Event Logging

The software fault manager event logging provides a record of software fault events. The event logging feature may either be enabled or disabled. In addition, two types of displays, either an online or historical record, can be maintained.

```
Software Fault Manager                Current Setting

1 SW Fault Manager Event Logging      Enabled
2 SW Fault Online Display             Disabled
3 SW Fault History Display            Disabled

Enter menu selection and press Return or press Esc. to exit.

Menu Selection (1-3) : _
```

Event Logging. Selecting the software fault manager event logging option allow the operator to enable or disable the software fault manager event logging program. The choices are 1 to enable or 2 to disable the event logging feature.

```
Software Fault Manager Event Setting

1 Enable
2 Disable

Enter menu selection and press Return or press Esc to exit.

Menu Selection (1-2): _
```

Online Display. Selecting this option allows the operator to enable or disable the online display of software faults. The choices are 1 to enable or 2 to disable the online display feature.

```
Software Fault Manager Online Setting

1 Enable
2 Disable

Enter menu selection and press Return or press Esc to exit.

Menu Selection (1-2): _
```

History Setting. Selecting this option allows the operator to enable or disable the software fault manager history setting. The choices are 1 to enable or 2 to disable the history setting feature.

```
Software Fault Manager History Setting

1 Enable
2 Disable

Enter menu selection and press Return or press Esc to exit.

Menu Selection (1-2): _
```

Technical Specifications

Table 13 lists the E1/PRI technical specifications.

Table 13 E1/PRI Technical Specifications

Specification	Description
E1/PRI Interface	Dual E1/PRI Interface supports up to 60 B-channels
	G.704 with CRC-4 frame format
	HDB3 line coding
	Line rate: E1 (2.048 Mbps)
	Input signal: DS1 to –43 dB typical per ITU-T G.703, G.736, I.431, and G.823
	Output signal: Automatic gain control (AGC)
	Configuration: Stored in NVRAM
	Loop timing source from either span line
	Automatic fallback to alternate timing sources
	Address signaling (CLID/ANI)
AS5100 Chassis Interfaces	Supports QBCH Modem Cards (Quad Modem Cards with software upgrade)
	Dynamic modem configuration based on CLID/ANI information
Management	SNMP-based, Windows compatible software for configuration management, status reporting, operator commands and software download
	TTY EIA/TIA-232 Operator Interface for direct connection interface to perform the features of the Management Station
	Software upgradable using onboard Flash memory
Monitoring	Data storage: Information accessible through user interface
	DS0/modem status: Alarm, Available, Idle, Test, Unavailable
	Alarm/event status: Errored seconds, severely errored seconds, failed seconds, bipolar violations, FAS errors, change in frame alignment, frame slips, bursty errored seconds, CRC errors, excessive CRC error, loss of signal (LOS), out of frame (OOF), remote frame alarm (RAI), alarm indication signal (AIS), continuous CRC error, physical state (F0 to F6), D-channel status
LEDs	Run/Fail
	Carrier (one for each span line)
	Loopback (one for each span line)
	Alarm (one for each span line)
Interfaces	To terminate E1 span lines, 2 RJ-48C connectors for E1 NIC
	2 Bantam Monitor jacks for E1 NIC (not supported at this time)
	EIA/TIA-232D modular 8 RJ-48C connector for configuration and software download with a PC, terminal, or modem
	DIN connector to chassis midplane
	Menu-driven operator interface via the EIA/TIA-232 port

Specification	Description
Mechanicals	
Dimensions	E1/PRI NAC 31.62 cm x 16.26 cm (12.45" x 6.4") E1/PRI NIC 12.32 cm x 16.26 cm (4.85" x 6.4")
Power	7 watts
Heat	24 BTUs
Mean Time Between Failure	75,000 hours
Operating Environment	Temperature 0–40 C, 32–104 F

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This document is to be used in conjunction with the *AS5100 Dual E1/PRI Application Card Configuration Note* publication.