Tekelec EAGLE® 5 Integrated Signaling System

Release 35.0

Hardware Manual

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TEKELEC

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5,008,929, 5,953,404, 6,167,129, 6,324,183, 6,327,350, 6,456,845, 6,606,379, 6,639,981, 6,647,113, 6,662,017, 6,735,441, 6,745,041, 6,765,990, 6,795,546, 6,819,932, 6,836,477, 6,839,423, 6,885,872, 6,901,262, 6,914,973, 6,940,866, 6,944,184, 6,954,526, 6,954,794, 6,959,076, 6,965,592, 6,967,956, 6,968,048, 6,970,542

Ordering Information
For additional copies of this document, contact your sales representative.

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Introduction

Overview

This manual provides hardware descriptions for Tekelec signaling systems or components based on the EAGLE 5 Integrated Signaling System (ISS) for releases 35.0 and later. For hardware descriptions of earlier releases, contact your sales representative.

This manual provides an overview of each system and its subsystems including details of standard and optional hardware components. In addition, this manual describes basic site engineering for signaling products.

Systems included in this manual are:

- EAGLE 5 ISS Signal Transfer Point (STP)
- Embedded Operations Support System Applications Processor (EOAP)
- Integrated Sentinel Monitoring Systems (EAGLE 5 ISS side)
- Multi-Purpose Server (MPS)
- Probed Sentinel Frames

For additional information on Sentinel components that use the Tekelec 1000 Application Server, see the *Tekelec 1000 Application Server Hardware Manual.* For information on ELAP application using the Tekelec 1100 Application Server, see the *Tekelec 1100 Application Server Hardware Manual.*

Scope and Audience

This manual describes hardware for informational purposes; it does not describe how to install or replace hardware.

For installation information, refer to the *Installation Manual* included in your current documentation suite. For replacement procedures of existing hardware components, refer to the *Maintenance Manual* included in your current documentation suite.

For configuration and provisioning, refer to the *Database Administration Manual – Features* included in your current documentation suite.

This manual is intended for customers, system planners, and personnel requiring detailed hardware information.

Manual Organization and Conventions

This *Hardware Manual* is organized into the following chapters:

- *Chapter 1, "Introduction"*—contains general information about manual organization, the scope of this manual, its targeted audience, brief explanations of the various systems, typical content of a Documentation Suite delivered with each system, how to handle hardware repairs and returns, and how to get technical assistance.
- *Chapter 2, "Systems Overview"*—contains a high-level functional overview of the EAGLE 5 ISS. EAGLE 5 ISS subsystems include Maintenance and Administration, Communication, Application, and Embedded Operations Support System Applications Processor (EOAP) elements. Chapter 2 also describes an overview of OEM-based products.
- *Chapter 3, "Hardware Descriptions — EAGLE 5 ISS"* describes frames, shelves, and cards that make up an EAGLE 5 ISS.
- *Chapter 4, "Hardware Descriptions — OEM-Based Products"* describes frames, shelves, and the Original Equipment Manufacturer (OEM) parts that make up a OEM-based product.
- *Chapter 5, "Hardware Descriptions — Sentinel Products"* — describes Sentinel products from release 8.0 and later. Frames and component configurations are explained.
- *Chapter 6, "Site Engineering — EAGLE 5 ISS"* — Describes installation site requirements, including floor plan requirements, environmental requirements, and power requirements.
- Appendix A, *Hardware Baselines* — Lists in cross-index tabular form the hardware components that can be configured for each system software release. The tables are divided into groups of similar systems for easier use. Use these tables to determine if a specific hardware module or OEM element can be configured.
- Appendix B, *Sentinel 4-Port Monitor Appliques* — This appendix provides reference information on each 4-port monitor applique that Sentinel supports. Also includes instructions for installing the DSCS Bridge Amplifier.

The *Hardware Manual* uses the following conventions:

- Components used only in a specific system are clearly labeled, for example, (EAGLE 5 ISS only).
- Components that are specific to a release are labeled with the system and release number; for example, (EAGLE 5 ISS 27.2 or earlier).

Related Publications

The *Hardware Manual* is part of the EAGLE 5 ISS documentation set and may refer to one or more of the following manuals:

- The *Commands Manual* contains procedures for logging into or out of the EAGLE 5 ISS, a general description of the terminals, printers, the disk drive used on the system, and a description of all the commands used in the system.
- The *Commands Pocket Guide* is an abridged version of the *Commands Manual*. It contains all commands and parameters, and it shows the command-parameter syntax.
- The *Commands Quick Reference Guide* contains an alphabetical listing of the commands and parameters. The guide is sized to fit a shirt-pocket.
- The *Commands Error Recovery Manual* contains the procedures to resolve error message conditions generated by the commands in the *Commands Manual*. These error messages are presented in numerical order.
- The *Database Administration Manual – Features* contains procedural information required to configure the EAGLE 5 ISS to implement these features:
  - — X.25 Gateway
  - — STP LAN
  - — Database Transport Access
  - — GSM MAP Screening
  - — EAGLE 5 ISS Support for Integrated Sentinel
- The *Database Administration Manual - Gateway Screening* contains a description of the Gateway Screening (GWS) feature and the procedures necessary to configure the EAGLE 5 ISS to implement this feature.
- The *Database Administration Manual – Global Title Translation* contains procedural information required to configure an EAGLE 5 ISS to implement these features:
  - — Global Title Translation
  - — Enhanced Global Title Translation
  - — Variable Length Global Title Translation
  - — Interim Global Title Modification
  - — Intermediate GTT Load Sharing
  - — ANSI-ITU-China SCCP Conversion

- The *Database Administration Manual - IP7 Secure Gateway* contains procedural information required to configure the EAGLE 5 ISS to implement the SS7-IP Gateway.
- The *Database Administration Manual – SEAS* contains the EAGLE 5 ISS configuration procedures that can be performed from the Signaling Engineering and Administration Center (SEAC) or a Signaling Network Control Center (SNCC). Each procedure includes a brief description of the procedure, a flowchart showing the steps required, a list of any EAGLE 5 ISS commands that may be required for the procedure but that are not supported by SEAS, and a reference to optional procedure-related information, which can be found in one of these manuals:
  - — Database Administration Manual – Gateway Screening
  - — Database Administration Manual – Global Title Translation
  - — Database Administration Manual – SS7
- The *Database Administration Manual – SS7* contains procedural information required to configure an EAGLE 5 ISS to implement the SS7 protocol.
- The *Database Administration Manual – System Management* contains procedural information required to manage the EAGLE 5 ISS database and GPLs, and to configure basic system requirements such as user names and passwords, system-wide security requirements, and terminal configurations.
- The *Dimensioning Guide for EPAP Advanced DB Features* is used to provide EPAP planning and dimensioning information. This manual is used by Tekelec personnel and EAGLE 5 ISS customers to aid in the sale, planning, implementation, deployment, and upgrade of EAGLE 5 ISS systems equipped with one of the EAGLE 5 ISS EPAP Advanced Database (EADB) Features.
- The *ELAP Administration Manual* defines the user interface to the EAGLE 5 ISS LNP Application Processor on the MPS/ELAP platform. The manual defines the methods for accessing the user interface, menus, screens available to the user and describes their impact. It provides the syntax and semantics of user input, and defines the output the user receives, including information and error messages, alarms, and status.
- The *EPAP Administration Manual* describes how to administer the EAGLE 5 ISS Provisioning Application Processor on the MPS/EPAP platform. The manual defines the methods for accessing the user interface, menus, and screens available to the user and describes their impact. It provides the syntax and semantics of user input and defines the output the user receives, including messages, alarms, and status.

- The *Feature Manual - EIR* provides instructions and information on how to install, use, and maintain the EIR feature on the Multi-Purpose Server (MPS) platform of the EAGLE 5 ISS. The feature provides network operators with the capability to prevent stolen or disallowed GSM mobile handsets from accessing the network.

- The *Feature Manual - G-Flex C7 Relay* provides an overview of a feature supporting the efficient management of Home Location Registers in various networks. This manual gives the instructions and information on how to install, use, and maintain the G-Flex feature on the Multi-Purpose Server (MPS) platform of the EAGLE 5 ISS.

- The *Feature Manual - G-Port* provides an overview of a feature providing the capability for mobile subscribers to change the GSM subscription network within a portability cluster while retaining their original MSISDNs. This manual gives the instructions and information on how to install, use, and maintain the G-Port feature on the Multi-Purpose Server (MPS) platform of the EAGLE 5 ISS.

- The *Feature Manual - INP* provides the user with information and instructions on how to implement, utilize, and maintain the INAP-based Number Portability (INP) feature on the Multi-Purpose Server (MPS) platform of the EAGLE 5 ISS.

- The *FTP-Based Table Retrieve Application (FTRA) User Guide* describes how to set up and use a PC to serve as the offline application for the EAGLE 5 ISS FTP Retrieve and Replace feature.

- The *Hardware Manual* - EAGLE 5 ISS contains hardware descriptions and specifications of Tekelec's signaling products. These include the EAGLE 5 ISS, OEM-based products , Multi-Purpose Server (MPS), and the Integrated Sentinel with Extended Services Platform (ESP) subassembly.

  The Hardware Manual provides an overview of each system and its subsystems, details of standard and optional hardware components in each system, and basic site engineering. Refer to this manual to obtain a basic understanding of each type of system and its related hardware, to locate detailed information about hardware components used in a particular release, and to help configure a site for use with the system hardware.

- The *Hardware Manual - Tekelec 1000 Application Server* provides general specifications and a description of the Tekelec 1000 Application Server (T1000 AS). This manual also includes site preparation, environmental and other requirements, procedures to physically install the T1000 AS, and troubleshooting and repair of Field Replaceable Units (FRUs).

- The *Hardware Manual - Tekelec 1100 Application Server* provides general specifications and a description of the Tekelec 1100 Applications Server (T1000 AS). This manual also includes site preparation, environmental and other requirements, procedures to physically install the T1100 AS, and troubleshooting and repair of Field Replaceable Units (FRUs).
- The *Installation Manual* - EAGLE 5 ISS contains cabling requirements, schematics, and procedures for installing the EAGLE 5 ISS along with LEDs, Connectors, Cables, and Power Cords to Peripherals. Refer to this manual to install components or the complete systems.
- The *Installation Manual - Integrated Applications* provides the installation information for integrated applications such as EPAP 4.0 or earlier (Netra-based Multi-Purpose Server (MPS) platform) and Sentinel. The manual includes information about frame floors and shelves, LEDs, connectors, cables, and power cords to peripherals. Refer to this manual to install components or the complete systems.
- The *LNP Database Synchronization Manual - LSMS with* EAGLE 5 ISS describes how to keep the LNP databases at the LSMS and at the network element (the EAGLE 5 ISS is a network element) synchronized through the use of resynchronization, audits and reconciles, and bulk loads. This manual is contained in both the LSMS documentation set and in the EAGLE 5 ISS documentation set.
- The *LNP Feature Activation Guide* contains procedural information required to configure the EAGLE 5 ISS for the LNP feature and to implement these parts of the LNP feature on the EAGLE 5 ISS:
  - — LNP services
  - — LNP options
  - — LNP subsystem application
  - — Automatic call gapping
  - — Triggerless LNP feature
  - — Increasing the LRN and NPANXX Quantities on the EAGLE 5 ISS
  - — Activating and Deactivating the LNP Short Message Service (SMS) feature
- The *Maintenance Manual* contains procedural information required for maintaining the EAGLE 5 ISS and the card removal and replacement procedures. The *Maintenance Manual* provides preventive and corrective maintenance procedures used in maintaining the different systems.
- The *Maintenance Pocket Guide* is an abridged version of the Maintenance Manual and contains all the corrective maintenance procedures used in maintaining the EAGLE 5 ISS.

- The *Maintenance Emergency Recovery Pocket Guide* is an abridged version of the Maintenance Manual and contains the corrective maintenance procedures for critical and major alarms generated on the EAGLE 5 ISS.
- The *MPS Platform Software and Maintenance Manual* - EAGLE 5 ISS *with Tekelec 1000 Application Server* describes the platform software for the Multi-Purpose Server (MPS) based on the Tekelec 1000 Application Server (T1000 AS) and describes how to perform preventive and corrective maintenance for the T1000 AS-based MPS. This manual should be used with the EPAP-based applications (EIR, G-Port, G-Flex, and INP).
- The *MPS Platform Software and Maintenance Manual* - EAGLE 5 ISS *with Tekelec 1100 Application Server* describes the platform software for the Multi-Purpose Server (MPS) based on the Tekelec 1100 Application Server (T1100 AS) and describes how to perform preventive and corrective maintenance for the T1100 AS-based MPS. This manual should be used with the ELAP-based application (LNP).
- The *Provisioning Database Interface Manual* defines the programming interface that populates the Provisioning Database (PDB) for the EAGLE 5 ISS features supported on the MPS/EPAP platform. The manual defines the provisioning messages, usage rules, and informational and error messages of the interface. The customer uses the PDBI interface information to write his own client application to communicate with the MPS/EPAP platform.
- The *Previously Released Features Manual* summarizes the features of previous EAGLE, EAGLE 5 ISS and it identifies the release number of their introduction.
- The *Release Documentation* contains the following documents for a specific release of the system:
  - *Feature Notice* - Describes the features contained in the specified release. The Feature Notice also provides the hardware baseline for the specified release, describes the customer documentation set, provides information about customer training, and explains how to access the Customer Support website.
  - *Release Notice* - Describes the changes made to the system during the lifecycle of a release. The Release Notice includes Generic Program Loads (GPLs), a list of PRs resolved in a build, and all known PRs.

    NOTE: The *Release Notice* is maintained solely on Tekelec's Customer Support site to provide you with instant access to the most up-to-date release information.
  - *System Overview* - Provides high-level information on SS7, system architecture, LNP, and EOAP.

— *Master Glossary* - Contains an alphabetical listing of terms, acronyms, and abbreviations relevant to the system.

— *Master Index* - Lists all index entries used throughout the documentation set.

- The *System Manual – EOAP* describes the Embedded Operations Support System Application Processor (EOAP) and provides the user with procedures on how to implement the EOAP, replace EOAP-related hardware, device testing, and basic troubleshooting information.

Table 1-1 provides a roadmap of the publications that contain information on Sentinel features, procedures, and components. The table arranges the documents in the following groups: general documents, software manuals, hardware/installation manuals, and technical reference documents.

Table 1-1. Sentinel Publications

Publication	Describes
General Documents	
Sentinel Feature Guide	Provides an overview of the Sentinel System and describes each feature, component, and application of the Sentinel System.
Feature Notice	Describes the features contained in the specified release.
Release Notice	Describes the changes made to the system for the specified release. Includes a report of known and resolved problem reports. The Release Notice also provides a list of run-time software licenses and instructions for accessing the Tekelec Web site.
Software Manuals	
Sentinel User's Manual	Provides procedural information intended for users who do not have administrative privileges to the monitoring functions of Sentinel. The following functions are covered: Base Sentinel Server functions, Protocol Analysis, Traffic Surveillance, Monitor Link Status, and Event Message Reports.
Sentinel System Administrator's Guide	Provides procedures for administering and provisioning the Sentinel system. The manual is divided into sections for Probed Sentinel, Probeless Sentinel, and common components. The manual is intended for system administrators.

Table 1-1. Sentinel Publications (Continued)

Publication	Describes
Data Collection Applications Manual	Provides an overview of the Call Detail Records/Transaction Data Records, Usage Measurement Data Feeds, the Mass Call Detection, and Loop Detection applications. Describes how to provision the above applications and how to generate the reports that the above applications provide.
Alarms Reference and User's Manual	Includes introductory and overview information, lists the various alarms generated by Sentinel, provides system administrator configuration information, contains detailed information about using the SAMS graphical user interface, and describes the optional Alarm Forwarding System.
Sentinel Hardware and Installation Manuals	
EAGLE 5 ISS Integrated Applications Installation Manual	Provides installation information for each system in the Network Signaling Division.
Tekelec 1000 Application Server Hardware Manual	Describes the Application Server hardware. The manual is intended for personnel who install or maintain the Application Server hardware.
Tekelec EAGLE 5 ISS Hardware Manual	Describes each system and subsystem in the Network Signaling Division. Includes details of the standard and optional hardware components in each system.
Signaling/Cellular Generic Hardware Reference	Describes the Basic Hardware Configuration (BHC)/SNAP shelf. The manual is intended for personnel who install or maintain the BHC.
Technical Reference Documents	
Sentinel Data Collection Subsystem: Collection and Delivery	Provides an overview of the Sentinel Data Collection Subsystem and its interface to the Service Application Platform. This is the parent document for the Sentinel Data Collection Subsystem. Child documents (the following four documents listed in this table) that describe the Data Feed formats reference this parent document for common descriptions on Theory of Operation, Interface Descriptions, and Interface Procedures, Performance Characteristics, and Compatibility.
Sentinel Data Collection Subsystem: ANSI ISUP CDR Data Feed	Describes the interface of the ANSI ISUP Data Feed to the Service Application Platform. Also describes the format and parameters of the ANSI ISUP CDR data feed file.

Table 1-1. Sentinel Publications (Continued)

Publication	Describes
Sentinel Data Collection Subsystem: ITU ISUP CDR Data Feed	Describes the interface of the ITU ISUP Data Feed to the Service Application Platform. Also describes the format and parameters of the ITU ISUP CDR data feed file.
Sentinel Data Collection Subsystem: LIDB TDR Data Feed	Describes the interface of the LIDB Data Feed to the Service Application Platform. Also describes the format and parameters of the LIDB TDRs data feed file.
Sentinel Data Collection Subsystem: Usage Measurement Data Feed File Format	Describes the interface of the Peg Counter (Usage Measurement) Data Feed to the Service Application Platform. Also describes the format and parameters of the Peg Counter (Usage Measurement) data feed file.
Sentinel Data Collection Subsystem: ANSI-41 TDR Data Feed	Describes the interface of the ANSI-41 Data Feed to the Service Application Platform. Also describes the format and parameters of the ANSI- 41 TDRs data feed file.
Sentinel Data Collection Subsystem: GSM-MAP TDR Data Feed	Describes the interface of the GSM-MAP Data Feed to the Service Application Platform. Also describes the format and parameters of the GSM-MAP TDRs data feed file.
Sentinel Data Collection Subsystem: TUP CDR Data Feed	Describes the interface of the TUP Data Feed to the Service Application Platform. Also describes the format and parameters of the TUP CDRs data feed file.
Sentinel Data Collection Subsystem: ETSI INAP TDR Data Feed	Describes the interface of the ETSI INAP Data Feed to the Service Application Platform. Also describes the format and parameters of the ETSI INAP TDRs data feed file.

Documentation Packaging, Delivery, and Updates

Customer documentation is provided with each system and is shipped to the sites specified by the customer. The number of documentation sets provided are in accordance with the contractual agreements.

Customer documentation is updated whenever significant changes are made that affect system operation or configuration. Updates may be issued in the form of an addendum or a reissue of the relevant documentation.

The document part number is shown on the title page along with the current revision of the document and the date of publication. The bottom of each page contains the document's date of publication and the document's part number.

When a document is reissued, the following information changes:

- The title page and revision number, the date of publication, and the new software release number, if applicable.
- The date of publication and the document part number, if applicable, on the bottom of each page.

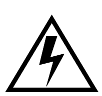
References

The following documents are referenced in this manual:

GR-63-CORE “Network Equipment-Building System (NEBS) Requirements”, Issue 1, October 1995GR-1244-CORE “Clocks for the Synchronized Network Common Generic Criteria”, Issue 2, December 2000GR-376-CORE “Network Data Collection”, Issue 3, December 1998“TL-9000 Quality System Metrics (Book Two, Release 3.0)”

Admonishments and Conventions

Admonishments alert the reader and technical personnel to assure personal safety, to minimize possible service interruptions, and to warn of the potential for equipment damage. This manual has four admonishments, listed in descending order of priority.

	**TOPPLE:** (This icon and text indicate the possibility of ***personnel injury and equipment damage***.)
	**DANGER:** (This icon and text indicate the possibility of ***personnel injury***.)
	**WARNING:** (This icon and text indicate the possibility of ***equipment damage and personnel injury***.)
	**CAUTION:** (This icon and text indicate the possibility of ***service interruption***.)

Customer Care Center

The Customer Care Center offers a point of contact through which customers can receive support for problems that may be encountered during the use of Tekelec's products. The Customer Care Center is staffed with highly trained engineers to provide solutions to your technical questions and issues seven days a week, twenty-four hours a day. A variety of service programs are available through the Customer Care Center to maximize the performance of Tekelec products that meet and exceed customer's needs.

To receive technical assistance, call the Customer Care Center at one of the following locations:

- Tekelec, USA

  Phone (US and Canada) +1 888-FOR-TKLC

  Phone (international) +1 919-460-2150

  Fax +1-919-460-0877

  Email: support@tekelec.com

- Tekelec, Europe and UK

  Phone +44 1784 467 804

  Fax +44 1784 477 120

  Email: ecsc@tekelec.com

Once a Customer Service Request (CSR) is issued, Technical Services, along with the customer, determines the classification of the trouble.

Problems are reported using problem criteria, as defined in the following sections and "TL-9000 Quality System Metrics (Book Two, Release 3.0)" .

Problem – Critical

Critical problems severely affect service, capacity/traffic, billing, and maintenance capabilities and requires immediate corrective action, regardless of time of day or day of the week, as viewed by a customer upon discussion with the supplier. For example:

- A loss of service that is comparable to the total loss of effective functional capacity of an entire switching or transport system.
- A reduction in capacity or traffic handling capacity such that expected loads cannot be handled.
- loss of ability to provide safety or emergency capability (for example, 911 calls).

Problem – Major

Major problems cause conditions that seriously affect system operations, or maintenance and administration, and require immediate attention as viewed by the customer upon discussion with the supplier. Because of a lesser immediate or impending effect on system performance, the urgency is less than in a critical situation. A list of possible examples follows:

- Reduction in any capacity/traffic measurement function
- Any loss of functional visibility and/or diagnostic capability
- Short outage equivalent to system or subsystem outages with accumulated duration of greater than two minutes in any 24-hour period or that continue to repeat during longer periods
- Repeated degradation of DS1 or higher rate spans or connections
- Prevention of access for routine administrative activity
- Degradation of access for maintenance or recovery operations
- Degradation of the system's ability to provide any required critical or major trouble notification
- Any significant increase in product-related customer trouble reports
- Billing error rates that exceed specifications
- Corruption of system or billing databases

Problem – Minor

Other problems that a customer does not view as critical or major are considered minor. Minor problems do not significantly impair the functioning of the system and do not significantly affect service to customers. These problems are tolerable during system use.

Engineering complaints are classified as minor unless otherwise negotiated between the customer and supplier.

Response

If a critical problem exists, emergency procedures are initiated (see "Emergency Response"). If the problem is not critical, information regarding the serial number of the system, Common Language Location Identifier (CLLI), and initial problem symptoms and messages is recorded and a primary Technical Services engineer is assigned to work the Customer Service Request (CSR) and provide a solution to the problem. The CSR is closed when the problem has been resolved.

Emergency Response

In the event of a critical service situation, emergency response is offered by the Tekelec Customer Care Center.

To receive technical assistance, call the Customer Care Center at one of the following locations:

- Tekelec, USA
  Phone (US and Canada) +1 888-FOR-TKLC
  Phone (international) +1 919-460-2150
  Fax +1-919-460-0877
  Email: support@tekelec.com
- Tekelec, Europe and UK
  Phone +44 1784 467 804
  Fax +44 1784 477 120
  Email: ecsc@tekelec.com

Emergency response provides immediate coverage, automatic escalation, and other features to ensure a rapid resolution to the problem.

Hardware Repair and Return

Any system components being returned for repair or replacement must be processed through the Tekelec Return Material Authorization (RMA) procedures. A hardware repair is defined as an item returned to Tekelec due to a failure, with the returned item being repaired and returned to the customer. It is essential that serial numbers are recorded correctly. RMAs cannot be created without a valid serial number. All repair and quality information is tracked by serial number. Table 1-2 lists the basic RMA types.

Table 1-2. Basic RMA Types

Replacement Type	Description	Turnaround
Priority Advance Replacement	Customer requests the URGENT replacement of a damaged product	Same Day Shipment
Advance Replacement	Customer request the replacement of a damaged product	Shipment Within 3 Business Days
Repair / Return	Customer will return a damaged product for repair	Shipment Within 5 Days After Receipt
Expendable	A damaged part, such as a cable, is replaced, but the Customer does not return the damaged product	Depends on Urgency - Shipment Within 3 Business Days

Table 1-3 lists the RMA return reasons.

Table 1-3. RMA Reasons for Return

Reason for Return	Description
Damaged by Environment	Product damaged by environmental phenomena such as water damage or earthquake
Damaged in Shipment	Damaged between shipment from Tekelec and receipt at the Customer's installation site.
DOA – Dead on Arrival	Product is not functional when it is first installed at the Customer's location.
Lab Return	Products returned from lab sites.
Product Capture	Defect to be captured by Quality or Engineering (not Product Recall).
Product Deficiency	Anything wrong with the part that doesn't fall into another category.
Product Recall	Products recalled by divisions for the repair of a defect or replacement of defective products.
Return – No Product Deficiency	Anything returned without the product being defective.

Repair and Return Shipping Instructions

All returned equipment, assemblies, or subassemblies must be shipped to the Tekelec Repair and Return Facility specified by the Technical Services engineer. The item being returned must be shipped in the original carton or in an equivalent container assuring proper static handling procedures and with the freight charges prepaid.

The assigned RMA number must be clearly printed on the "RMA#:" line of the shipping label on the outside of the shipping package. If the RMA number is not placed on the label, the return could be delayed.

Procedure- RMA

1 Obtain and confirm the following information before contacting the Tekelec Customer Contact Center:

- Your name:
- Company name:
- Call-back number:
- Email address:
- Which product you are calling about?
- Site location:
- CLLI number
- System serial number (NT, CE, LM, DS, etc…):
- Complete software release (e.g., 28.0.1-41.53.0):
- Upgrade forms
  WI005153
  WI005154
  WI005218
  WI005219
  WI005220
- Tekelec card type: (e.g., ILA, MPL, DSM, etc.):
- Tekelec card part number (870-####-##):
- Associated serial number (102########):
- Reason for return or replacement (isolated from system):
- Full name of person the replacement card is being shipped to:
- Shipping address:

NOTE: If possible, include associated alarms (UAMs) and a copy of the associated output (capture file).

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2 Contact the Contact Customer Contact Center and request a Return of Material Authorization (RMA).

Reference: "Customer Care Center" on page 1-13.

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3 If the item is a like-for-like advance replacement, the Technical Services engineer arranges for shipment of the replacement item to the customer.

a Wait for the replacement component to arrive.

b Package the defective component in the box of materials you received with your replacement. Use proper static handling procedures.

c Label the outside and inside of the box with your RMA number clearly visible. Place the packing slip from the received replacements on the inside of your box.

d Ship the defective component to the return address listed on the packing slip.

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4 If the item is a repair/return, the Technical Services engineer arranges for shipment of the replacement item to the customer.

a Package the defective component in a suitable package for shipping. Use proper static handling procedures.

b Label the outside and inside of the box with your RMA number clearly visible. Include a packing slip with all the information from Step 1 along with the RMA number.

c Ship the defective component to the following address:

TEKELEC

Attn: RMA Department

5200 Paramount Parkway

Morrisville, NC 27560

RMA#: <assigned by Tekelec>

d Wait for the repaired component to arrive.

Returning a Crate

Use the following procedure to return a shipping crate and dollies to Tekelec.

Procedure — Preparing Crate and Dolly for Return to Tekelec

1. Replace the retaining brace.

2. Replace the shipping container front panel using the bolts saved previously and arrange the return shipment by contacting:

   Shipping Manager
   TEKELEC

   Attn: RMA Department

   5200 Paramount Parkway

   Morrisville, NC 27560

   RMA#: <assigned by Tekelec>

3. After the frame is positioned and the dollies are removed from the frame, the dollies are returned to the same address as the shipping container listed above.

If the equipment is being immediately installed ship the dollies back to Tekelec in the crate after use. After installing the equipment bolt the dollies securely in the crate and return to Tekelec.

OR

If the equipment is not being immediately installed ship the dollies back to Tekelec in the box supplied with the crate. After unpacking the equipment return the crate to Tekelec and retain the box to return the dollies. After installing the equipment remove the dollies and return to Tekelec in the supplied box.

NOTE: It is the site supervisor's responsibility to assure the crate and dollies are returned to Tekelec.

Acronyms

A .... Ampere
ACL .... Application processor Code Loader
ACM .... Applications Communications Module
AIN .... Advanced Intelligent Networks. Set of standards for advanced intelligent services
AINF .... Application Interface Applique
ANSI .... American National Standards Institute.
AP .... Application Processor
APD .... Application Processor DCM bootstrap code
API .... Application Interface
AS .... Application server
ASM .... Application Services Module
ATM .... Asynchronous Transfer Mode
BHCA .... Busy Hour Call Attempts
BITS .... Building Integrated Timing System
BM .... Buss Master (Cognitronics)
BOM .... Bill Of Materials
BP .... Boot Prom
BPDCM .... Boot Prom DCM
Bps .... Bit per second
CAP .... Communication & Application Processor
CAR .... Corrective Action Report
CE CISPR A .... Compliance European, Comite Internationale Special des Perturbations Radioelectrique (European Compliance, International Special Committee on Radio Interference, Class A)
CDR .... Call Detail Record
CDU .... CAP Downloadable Utility
CLEI .... Common Language Equipment Identifier
CF .... Control Frame

CLLI .... Common Language Location Identifier

CNAM .... Calling Name Delivery Service

COTS .... Commercial Off-the-Shelf

CP .... Communications Processor

CSR.................................... Customer Service Request

D1G .... Database Communication 1 Gigabyte Expansion Memory Module

DCM.................................. Database Communications Module

DMS.................................. Disk Management Service

DRAM .... Dynamic Random Access Memory

DS0 .... Digital Signal Level-0 (64 Kbits/sec)

DS1 .... Digital Signal Level-1 (1.544Mbits/sec)

DSM.................................. Database Services Module

E1 .... European Digital Signal Level-1 (2.048 Mbits/sec).

EBI .... Extended Bus Interface

EDCM .... Enhanced Database Communications Module

EF....................................... Extension Frame

EILA .... Enhanced Integrated LIM Applique

EMM................................. Extended Memory Management

EMP................................... EAGLE 5 ISS Monitor Protocol

EOAM............................... Enhanced OAM GPL

EOAP .... Embedded Operation Support System Applications Processor

ESD.................................... Electro-Static Discharge

ESP..................................... Extended Services Platform

FAP .... Fuse and Alarm Panel

FR....................................... Flight Recorder

FTP..................................... File Transfer Protocol

GB .... GigaByte

GLS .... Generic Loader Services

GPL.................................... Generic Program Load

GPLM .... GPL Management

GPSM-II .... General Purpose Service Module

GTT .... Global Title Translation

GWS.................................. GTT Gateway Screening

HCAP .... High-Speed Communications & Applications Processor

HCAP-T .... Improved HCAP card

HCMIM............................. High Capacity Multi-Channel Interface Module

HDLC .... High-Level Data Link Control

HIPR .... High-speed IMT Packet Router

HMUX............................... High-speed Multiplexer

IAD .... Integrated Access Device

ICM................................... IMT configuration manager task

ILA .... Integrated LIM-AINF module

ILDR .... IMT loader task

IMT .... Inter-processor Message Transport

IMTC .... IMT Control task

IP .... Internet Protocol

IP^7 .... Tekelec's Internet Protocol to SS7 Interface

IPD.................................... IMT Processor DCM operational code

IPMX .... IMT Power and Multiplexer card

ISDN................................. Integrated Services Digital Network.

IS-NR................................. In Service – Normal

ISR..................................... Interrupt Service Routine

ITU.................................... International Telecommunications Union

IWF .... Inter-Working Function

KHz .... Kilo Hertz (1000 Hertz)

LAN.................................. Local Area Network.

LFS.................................... Link Fault Sectionalization

LIM .... Link Interface Module

LNP	Local Number Portability
LIM-AINF	A LIM with a software-selectable interface
LOM	Lights out Management
LSMS	Local Service Management System
M256	256 Megabyte Memory Expansion Card
MAS	Maintenance and Administration Subsystem
MASP	Maintenance and Administration Subsystem Processor
MBUS	Maintenance Bus
MCAP	Maintenance Communications & Applications Processor
MDAL	Maintenance, Disk, and Alarm card
MG	Media Gateway
MGB	Master Ground Bar
MGC	Media Gateway Controller
MGCP	Media Gateway Controller Protocol
MIB	Maintenance Information Base utility
MIM	Multi-Channel Interface Module
MPL	Multi-Port LIM
MPS	Multi-Purpose Server
MSU	(SS7) Message Signalling Unit
MS	Media Server
MTOS	Multi-Tasking Operating System, Industrial Programming Inc.
NEBS	Network Equipment Building System
NOC	Network Operations Center
NS	Network Server
OAM	Operations, Administration, & Maintenance
OA&M	Operations, Administration, & Maintenance
OAP	Operations System Support/Applications Processor
OAPF	Operations System Support/Applications Processor Frame

OCU	Office Channel Unit
OEM	Original Equipment Manufacturer
OOS-MT-DSBLD	Out of Service –Maintenance Disabled
PMTC	Peripheral Maintenance task
PSTN	Public Switched Telephone Network
RAID	Redundant Array of Inexpensive Disks
RAM	Random Access Memory
RMA	Return Material Authorization
SAI/P	Serial Asynchronous Interface PCI Adapter
ISS	Integrated Signaling System
SCP	Service Control Point (SS7 Network)
SCCP	Signal Connection Control Part
SCM	System Configuration Manager
SCN	Switched Circuit Network
SCSI	Small Computer Systems Interface
SEAC	Signaling Engineering and Administration Center
SEAS	Signaling Engineering and Administration System
SG	Secure Gateway
SIP	Session Initiation Protocol
SS7	Signaling System Seven
SSP	Service Switching Point (SS7 Network)
STC	Sentinel Transport Card
STP	Signal Transfer Point (SS7 Network)
STPLAN	Signaling Transfer Point Local Area Network
T1	The North American telecommunications standard defining a circuit that multiplexes and switches 24 channels and operates at speeds of 1.544 Mbps
Tekelec 1000	Tekelec 1000 Application Server
TCU	Table Creation Utility
TCP	Transport Control Protocol
TCP/IP	Transmission Control Protocol/Internet Protocol

TDM .... Terminal Disk Module

TEKCC .... Tekelec Composite Clock

TEKOS .... Tekelec Operating System

TMOAP.............................. Texas Micro processor chassis hosting the OAP application

TOS486 .... Tekos Operating System for the 486

TOS4M .... Tekos Operating System for the 486 implemented via MTOS

TSC .... Time Slot Counter

TSM .... Translation Services Module

UAM.................................... Unsolicited Alarm Output

UD1G .... Updated Database Communication 1 Gigabyte Expansion Memory Module

UIM .... Unsolicited Information Messages

V.35 .... ITU Interface Recommendation, V.35

VPN..................................... Virtual Private Network

WAN .... Wide Area Network

2

Systems Overview

Introduction

This chapter introduces the hardware in Tekelec signaling products. **The** hardware components to support its processor and feature applications include the following:

- EAGLE 5 Integrated Signaling System (ISS)
- Sentinel
- Multi-purpose Server (MPS)
- Tekelec 1000 Application Server (T1000 AS)
- Tekelec 1100 Application Server (T1100 AS)
- Embedded Operations Support System Applications Processor (EOAP)

Appendix A, *Hardware Baselines*, in this manual lists specific hardware (required or configurable components) by part number for each system type and release.

> **NOTE: Products are described generally in this chapter and in detail in Chapter 3, *Hardware Descriptions — EAGLE 5 ISS* and Chapter 5, *Hardware Descriptions — Sentinel Products*.**

In this document, modules or components that are used only in specific systems or releases are noted in the following syntax.

- Components used only in EAGLE 5 ISS systems are labeled (EAGLE 5 ISS only).
- Components that are specific to a system and release are labeled with the system name and release number. For example, (Sentinel 8.0 and later).

> **NOTE: The term "module" refers to a hardware card provisioned with software. In some cases, EAGLE 5 ISS cards are referred to by the name of the module in which they function, rather than the card name that appears on the label of the card. For ordering or service purposes, customers should use the card name and part number printed on the card itself.**

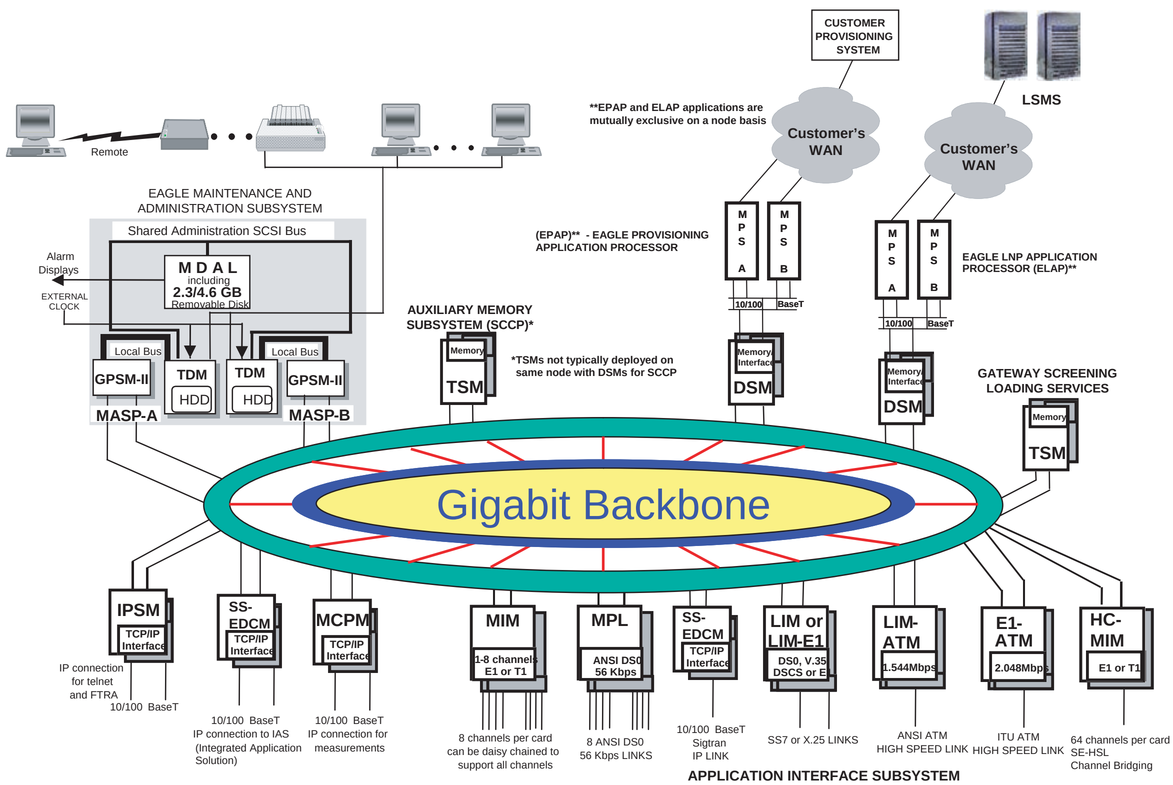
EAGLE 5 ISS

The EAGLE 5 ISS consists of the following subsystems:

- Maintenance and Administration Subsystem (MAS)
- Communication Subsystem (Gigabit backbone)
- Application Subsystem

Figure 2-1provides a high-level overview of the EAGLE 5 ISS subsystems and functions.

Figure 2-1. EAGLE 5 ISS Functional Diagram



Chapter 3, "Hardware Descriptions — EAGLE 5 ISS," explains specific component requirements or configurations in detail.

In addition, EAGLE 5 ISS has a clock derived from the Building Integrated Timing System (BITS). This connects to the 64KHz composite BITS signal and distributes clock signals to the rest of the cards in the systems.

NOTE: See the section "Timing Systems" on page 2-14 for information about High-Speed Master Timing and Time Slot Counter (TSC) Synchronization features.

Maintenance and Administration Subsystem

The Maintenance and Administration Subsystem (MAS) provides services to other subsystems, and consists of the following:

- The General Purpose Service Module (GPSM-II)
- Terminal Disk Module (TDM)
- Maintenance Disk and Alarm (MDAL)

The Maintenance and Administration Subsystem Processor (MASP) function is a logical pairing of the GPSM-II card and the TDM card. The GPSM-II card is connected to the TDM card by means of an Extended Bus Interface (EBI) local bus.

The MDAL card contains the removable cartridge drive and alarm logic. There is only one MDAL card in the Maintenance and Administration Subsystem (MAS) and it is shared between the two MASPs.

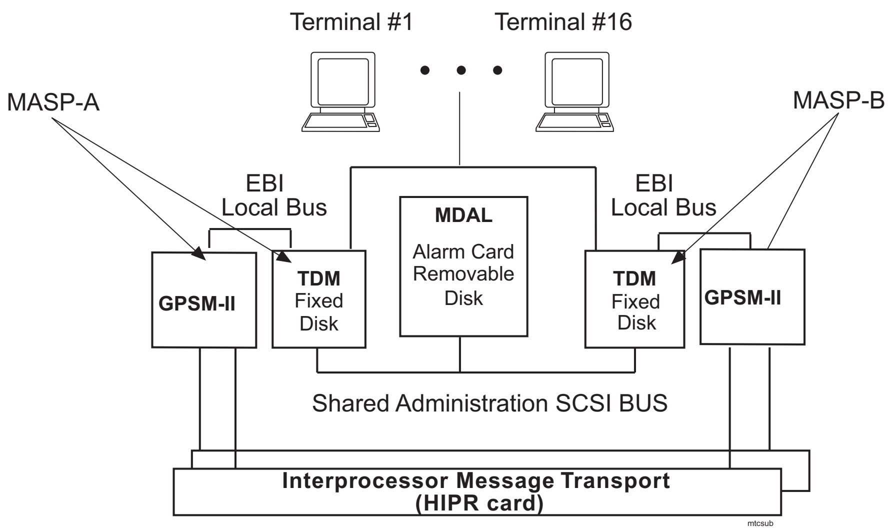
The GPSM-II and TDM card combination performs the following functions:

- Maintenance communication—Maintenance functions poll each application card and receives trouble reports. These are reported to the alarm function in the MASP to generate alarms, or to the event messaging function for output to the printer.
- Measurements—Collection and reporting of system performance data.
- Peripheral services—Provides access to all peripherals attached to the system, terminals, disks, alarms, clocks, and others.
- Alarm processing—Provides audible and visual alarms.
- System disks—Provides for storage of application or system software.

EAGLE 5 ISS architecture provides Inter-processor Message Transport (IMT) connectivity directly to the maintenance and administration subsystem through the GPSM-II card. This allows the MASP to provide maintenance and administrative communication services to application cards.

Figure 2-1, *"Maintenance and Administration Subsystem,"* on page 2-5 shows relationships between different components of the maintenance and administration subsystem.

Figure 2-1. Maintenance and Administration Subsystem



Communication Subsystem

The communication subsystem consists of two separate sets of buses:

- Small Computer System Interface (SCSI) buses
- Inter-processor Message Transport (IMT) buses

Small Computer System Interface Buses

There are two independent Small Computer System Interface (SCSI) buses, one to the fixed disks on TDM cards and the other to the shared administration SCSI bus that runs on the backplane between TDMs and the MDAL card. Each SCSI bus has a block of memory that allows transfers from memory to occur without delaying the application processor.

Inter-processor Message Transport

The Inter-processor Message Transport (IMT) bus is the main communications artery for all subsystems in the system. The IMT bus uses load sharing, so messages from the various subsystems are divided evenly across both buses. If one bus should fail, the other immediately assumes control of all messages.

IMT buses can function as a private LAN assigning internal IP addresses to LIM cards. By addressing cards on an internal LAN, the EAGLE 5 ISS and the Integrated Monitoring feature allows monitoring of SS7 links without external connections. SS7 link information from the EAGLE 5 ISS LIM cards is collected by the Sentinel Transport Cards (STCs) and is transferred to Expanded Service Platform (ESP) subassemblies. After processing in the ESP, the link information is forwarded to a Sentinel server.

High-Speed IMT Packet Router

The High-Speed IMT Packet Router (HIPR) Module provides increased IMT bus bandwidth and individual high-speed card/server links by introducing switched 125 Mbps interfaces to each slot within a shelf. HIPR acts as a gateway between the intra-shelf IMT BUS, running at 125 Mbps, and the inter-shelf ring operating at 1.0625 Gbps. HIPR implements the HMUX scheme of transmitting data between shelves only when necessary. The HIPR plugs into the same slot as an HMUX.

Traffic between cards on the same shelf will be switched directly to the destination slot and is not transmitted to any other cards in the shelf. Traffic between shelves is not required to pass onto an intra-shelf IMT channel.

Two HIPR modules are required in shelves equipped with high-performance LIMs, such as the High-Capacity MIM, and for interfacing to Tekelec 1000 Application Server through IMT Bridge and IMT PCI modules. HIPR requires all other shelves to be equipped with either all HMUX cards or all HIPR cards (shelves cannot contain a mix of HMUX and HIPR).

The HIPR programmable logic is upgradeable and reprogrammable via the IMT inter-shelf interface. Updated images can be downloaded from the OAM to the HIPR and stored in FLASH memory on the HIPR.

With the improved bandwidth from the switched architecture, the HIPR card enables customers to use other higher performance cards from Tekelec such as the High Capacity MIM.

High-Speed Multiplexer

High-Speed Multiplexer (HMUX) cards support requirements for up to 1500 links, allowing communication on IMT buses between cards, shelves and frames. HMUX cards interface to 16 serial links, creating a ring from a series of point to point links. Each HMUX card provides a bypass multiplexer to maintain the ring's integrity as cards are removed and inserted into an operational shelf.

NOTE 1: To maintain integrity of the IMT bus, each extension shelf must contain at least one Translation Service Module (TSM) or Database Communications Module (DCM), or Link Interface Module (LIM). If such cards are present for the purpose of maintaining IMT bus integrity, they do not have to be entered into the system database .

NOTE 2: Control Shelf Backplane (P/N 850-0330-03/04) can be used with the HMUX and HIPR in the EAGLE 5 ISS system with minor modifications and the addition of adapter cable (P/N 830-0857-01). The adapter cable is not necessary for customers not wanting high speed links.

High-Speed Multiplexer (HMUX) card replaces the IPMX card. A mixture of HMUX and HIPR cards within one IMT ring is possible, provided HIPR is installed on both IMT A and IMT B on a given shelf. HMUX and HIPR cards are installed at the factory or by Tekelec Technical Support and are not installed by customers.

Application Subsystem

The application subsystem consists of application cards. Application cards are capable of communicating with other cards through the redundant IMT buses. A Communications Processor (CP) on each application board provides control of communications from the cards to the IMT buses.

Software is downloaded to application cards on initial power-up from the Maintenance and Administration Subsystem Processors (MASP). Once EAGLE 5 ISS is loaded, software is downloaded to cards by the Generic Loader Services (GLS) and Operation Administration and Maintenance (OAM).

An Application Processor (AP) receives the software load on the application card. The type of software the AP receives depends on the function of the application board which is determined by the provisioning of the board. Presently, there are several types of application cards that support network specific functions:

- Link Interface Module (LIM)—SS7 links and X.25 links
- Application Communication Module (ACM)—Transmission Control Protocol/Internet Protocol (TCP/IP) interface over Ethernet for the Signaling Transfer Point Local Area Network (STPLAN) feature.

NOTE: Ethernet is a standard set of specifications for a particular type of LAN that employs baseband signaling (single signal on a cable) and has a transmission rate of 10/100 Mbps

- Database Communications Module (DCM), Enhanced DCM (EDCM and EDCM-A), Sentinel Transport Card (STC)—Transmission Control Protocol/Internet Protocol (TCP/IP) interface over Ethernet for the Signaling Transfer Point Local Area Network (STPLAN) feature.
- Translation Service Module (TSM)—Local Number Portability (LNP)/SCCP (GTT) only
- Database Service Module (DSM)—EAGLE 5 ISS Provisioning Application Processor (EPAP), Global System for Mobile Communications (GSM), EAGLE 5 ISS Local Number Portability (ELAP), and interface to Local Service Management System (LSMS)

  DSM-1G cards based on the GPSM-II card running the IPS GPL function as card type IPSM.
- General Purpose Service Module II (GPSM-II)— The GPSM-II provides two 10/100Base-T Ethernet ports for LAN connections. The GPSM-II does not require additional memory modules when provisioned as a single slot EDCM. The GPSM-II card replaces the MCAP card.

  NOTE: GPSM-II cards are installed at the factory or by Tekelec Technical Support and are not installed by customers.

  When the GPSM-II is combined with one or more Gigabytes of expansion memory (UD1G P/N 850-0527-xx) it becomes the primary board for the following card types. GPSM-II card functionality is primarily determined by the GPL provisioned.

  — When combined with a one Gigabyte (UD1G) expansion memory board in a single-slot assembly and provisioned with IPS GPL, the GPSM-II functions as card type IP Services Module (IPSM).

  — The Measurements Collection and polling Module (MCPM) is derived from EDSM-2G cards with 32 MB FSRAM and 2 GB RAM.

  NOTE: The EDSM-2G card in the MCPM module is a requirement for the FTP measurements feature. The FTP measurements feature uses the MCPM card ethernet ports to transfer measurements information directly to a FTP server.
- Multi-Channel Interface Module—8 HDLC channels for E1 or T1 protocols
- Multi-Port Link Interface Module—SS7 links

Generic Program Loads

Application software is downloaded to individual application cards by means of Generic Program Loads (GPLs). Hardware is defined to EAGLE 5 ISS by means of a series of administration commands. Software is then loaded from the fixed disk over the IMT bus directly to the cards. The type of the GPL loaded depends on the card that is chosen.

GPLs can be any of the following:

- SCCP —Signaling Connection Control Part. This software allows the Translation Service Module (TSM) to be used as a memory board for Global Title Translation (GTT). Inbound SCCP messages from Link Interface Modules (LIMs) are sent to the TSM assigned to the LIM by system software. SCCP software on the TSM performs the translation, and sends messages through the IMT back to the appropriate LIM, which routes messages to the destination. The SCCP application can run on the TSM and DSM cards.

CAUTION: Tekelec recommends that cards running the SCCP application be uniformly distributed in the EAGLE 5 ISS to provide a more even SCCP load distribution. During normal operation unevenly distributed SCCP cards in an EAGLE 5 ISS would not have any network or system impacts. However, should a particular SCCP card database(s) become corrupted, inconsistent, or at a different level, depending on the amount of service provided by that card and the extent of the database issue, network impacts can occur.

- SLAN—Signaling Transfer Point Local Area Network. This software allows the system to support a TCP/IP interface to any external host with ACMs and DCMs.
- SS7—This software provides access to remote SS7 network elements.
- GX25—This software allows the system to send and receive traffic to and from an X.25 network, and convert the packet to an Signaling System #7 Message Signaling Unit (SS7 MSU).
- GLS—Gateway Loading Service (GLS) software controls download of Gateway Screening (GWS) data to Link Interface Modules (LIMs) and TSM when necessary. This ensures a fast download of gateway screening data when a card re-initializes.

  Gateway screening data is downloaded when a card is re-initialized, when Gateway screening is changed by database administration, or when there is manual intervention with commands being entered at a terminal.
- EROUTE—Ethernet Routing transfers link information messaging from the EAGLE 5 ISS LIM cards to the Integrated Sentinel using TCP/IP and EAGLE 5 ISS Monitor Protocol (EMP). Implemented in Sentinel Transport Cards (STC).
- EOAM—Enhanced Operation Administration and Maintenance GPL for GPSM-II cards.

Link Interface Module

The application subsystem provides external services, relying on the Link Interface Module (LIM) as an interface. Each LIM provides one or two SS7 links (depending on configuration), one X.25 link, or IP links. A LIM consists of an application card equipped with a main assembly and an applique. This assembly provides level one and some level two functions on SS7 signaling links.

The types of interfaces presently available through a LIM are:

- DS0A at 56 kbps
- OCU at 56 kbps
- V.35 at 56 kbps and 64 kbps for SS7
- T1-ATM at 1.544 Mbps
- E1-ATM at 2.048 Mbps
- E1 at 2.048 Mbps
- T1 at 1.544 Mbps
- TCP/IP at 10/100 MHz
- FTP at 10/100 MHz

Application Communication Module

The Application Communication Module (ACM) is an application card equipped with a main assembly and an Ethernet applique. It is used by the Signaling Transfer Point Local Area Network (SLAN) feature to access a remote host through an Ethernet LAN using TCP/IP.

The SLAN feature requires the gateway screening feature also be activated to control which messages are copied and sent to the remote host.

Database Communications Module

The Database Communications Module (DCM) requires two slots for mounting and must be assigned to an odd numbered slot in EAGLE 5 ISS.

NOTE: DCMs cannot be configured in any slot reserved for MASP, MDAL, HMUX, and HIPR cards. This applies to all application cards.

DCM cards provide STP Local Area Network function, and 10/100Base-T ethernet links to the STP. DCM cards are compatible with control shelf backplanes (P/N 850-0330-03/04/05/06) and extension shelf backplanes (P/N 850-0356-01/02/03/04/06). DCM cards are provisioned in pairs for redundancy.

NOTE: Unique cabling needs restrict placement of DCM cards in EAGLE 5 ISS systems. The DCM requires a unique cable interface that is not compatible with current LIM cables on fully wired but unequipped shelves.

Double-slot Enhanced Database Communications Module

The double-slot Enhanced Database Communications Module (EDCM) (P/N 870-2197-xx) requires two slots for mounting. Double-slot EDCM cards are plug compatible with existing DCM cards and have improved performance. Double-slot EDCM cards are compatible with control shelf backplanes (P/N 850-0330-02/03/04/05) and extension shelf backplanes (P/N 850-0356-01/02/03). Double-slot EDCM cards are provisioned in pairs for redundancy. Double-slot EDCMs can be configured in any slot except those reserved for MASP, TDM, MDAL, HMUX, and HIPR cards.

Single-slot Enhanced Database Communications Module

The single-slot EDCM (P/N 870-2372-01) and EDCM-A (P/N 870-2359-03) require one slot for mounting and can be assigned to any slot. Single-slot EDCM cards are plug compatible with DCM and Double-slot EDCM cards. Single-slot EDCM cards are compatible with control shelf backplanes (P/N 850-0330-02/03/04) and extension backplanes (P/N 850-0356-01/02/03). Single-slot EDCM and EDCM-A cards can be configured in any slot except those reserved for MASP, TDM, MDAL, HMUX, and HIPR cards.

General Purpose Service Module

The General Purpose Service Module (GPSM-II) (P/N 870-2360-01) has one UD1G expansion memory module. GPSM-II cards are compatible with control shelf backplanes (P/N 850-0330-02/03/04/05) and extension backplanes (P/N 850-0356-01/02/03). The GPSM-II is a required replacement for the MCAP cards to support the large system feature (up to 1500 links) in the EAGLE 5 ISS or to support the Time Slot Counter (TSC) Synchronization and Integrated Sentinel Monitoring features.

NOTE: HMUX, HIPR, and GPSM-II cards are installed at the factory or by Tekelec Technical Support and are not installed by customers.

Measurements Collection and Polling Module

The Measurements Collection and polling Module (MCPM) is an EDSM-2G card with 32 MB FSRAM and 2 GB RAM.

NOTE: The Measurements Platform IP Security feature requires EDSM-2G MCPM cards.

NOTE: The MCPM card is a requirement for the FTP measurements feature. The FTP measurements feature utilizes the MCPM card ethernet ports to transfer measurements information directly to a FTP server.

Sentinel Transport Card

The Sentinel Transport Card (STC) is the DCM card (P/N 870-1945-xx) with the generic program load (GPL) called EROUTE. For more information about DCM cards see the section "Database Communications Module" on page 2-10 of this manual. The STC functions as an IP router between the IMT bus internal to the EAGLE 5 ISS and the ethernet networks used to communicate with the ESP servers.

Database Service Module

The Database Communications Module (DCM) requires two slots for mounting and must be assigned to an odd numbered slot. The DCM card is used as a primary board for the Database Service Module (DSM) cards.

Its primary application, however, is in performing global title functions required for Local Number Portability (LNP). For the EAGLE 5 ISS system to perform LNP functions, all Signaling Connection Control Part (SCCP), which is part of Global Title Translation (GTT), and Generic Load Services (GLS) which is part of Gateway Screening.

Translation Services Module

The Translation Services Module (TSM) (P/N 870-1289-xx) can perform global title operations for both Local Number Portability (LNP) and standard non-LNP functions.

The Translation Services subsystem consists of cards of up to one GByte capacity. Card capacity is increased by addition of 256 MByte appliques. TSM cards in EAGLE 5 ISS systems are:

- TSM-256 with one 256 MByte applique is P/N 870-1289-xx
- TSM-512 with two 256 MByte appliques is P/N 870-1290-xx
- TSM-768 with three 256 MByte appliques is P/N 870-1291-xx
- TSM-1024 with four 256 MByte appliques is P/N 870-1292-xx

E5 Interface Module

The E5 interface module is a link interface card that utilizes an Embedded Processor Module (EPM) with an appliqué card. The E5 card provides the EAGLE system a high performance general purpose-processing platform in a single-slot footprint. The E5 card is used on existing EAGLE 5 control and extension shelves.

The EPM appliqué cards provide LIM functionality such as E1/T1 or IP. The EPM accepts up two single-width or one double width PCI Mezzanine appliqué card(s). The EPM assembly contains all of the necessary logic to perform both application and communication processing of the data streams provided by the appliqué cards such as E1/T1 or IP. All EAGLE System interfacing to the EPM occurs through the EAGLE backplane signals and connects to the appliqué cards through the PCI Mezzanine Card (PMC) interface.

The types of E5 cards presently available are:

- E5-E1T1 (P/N 870-1873-02)
- E5-ENET (P/N 870-2212-02)

E5-E1T1 Module

The E5-E1T1 card (P/N 870-1873-02) is a single slot card providing eight trunk terminations processing up to 32 signaling links of configurable channelized E1 or T1 connectivity. The eight E1/T1 ports reside on backplane connectors A and B. The E5-E1T1 supports only one SE-HSL signaling link on one of the eight ports and it must be A.

All ports on a single board operate in the same trunk format, E1 or T1. However, it is possible to have a mixture of trunk formats in a node with some E5-E1T1s operating in T1 mode with others operating in E1 mode for gateway node scenarios.

E5-ENET Module

The E5-ENET card (P/N 870-2212-02) is a single slot card providing one or more Ethernet interfaces.

- The E5-ENET has 2 physical 10/100 Mbps Ethernet ports.
- The E5-ENET supports protocols as identified below:

  NOTE: The E5-ENET is provisionable for IPLIMx or IPGWx, but does not support both functions on a single card simultaneously.

Table 2-1. E5-ENET Supported Protocols

Feature	Protocols Supported
IPLIM	SCTP, M2PA
IPGWY	SCTP, M3UA, SUA

Timing Systems

EAGLE 5 ISS uses synchronized timing systems to provide accurate reference standards to all cards on the IMT buses.

System Clock

EAGLE 5 ISS connects to the 64KHz composite Building Integrated Time System (BITS) clocks through two DB-15 style connectors on the backplane of the control shelf. The two clocks are labeled primary and secondary and are sent to both MASPs. Each MASP selects between two BITS clock signals to provide a system clock to the rest of the EAGLE 5 ISS. The system clock is used by Link Interface Modules (LIMs) for X.25 and Signaling System #7 (SS7) Digital Service level-0 Applique (DS0A) signaling links, with each LIM selecting either clock A or clock B for its own use.

EAGLE 5 ISS also distributes system clocks to all frames. All shelves, both extension shelves and control shelves, provide "clock in" and "clock out" connections. Clock cables from the control shelf connect to the "clock in" connector on the top shelf of each frame. From the "clock out" connector on the top shelf of each frame, the clock signals are connected to the "clock in" connector of the middle shelf of the frame and from that shelf to the bottom shelf.

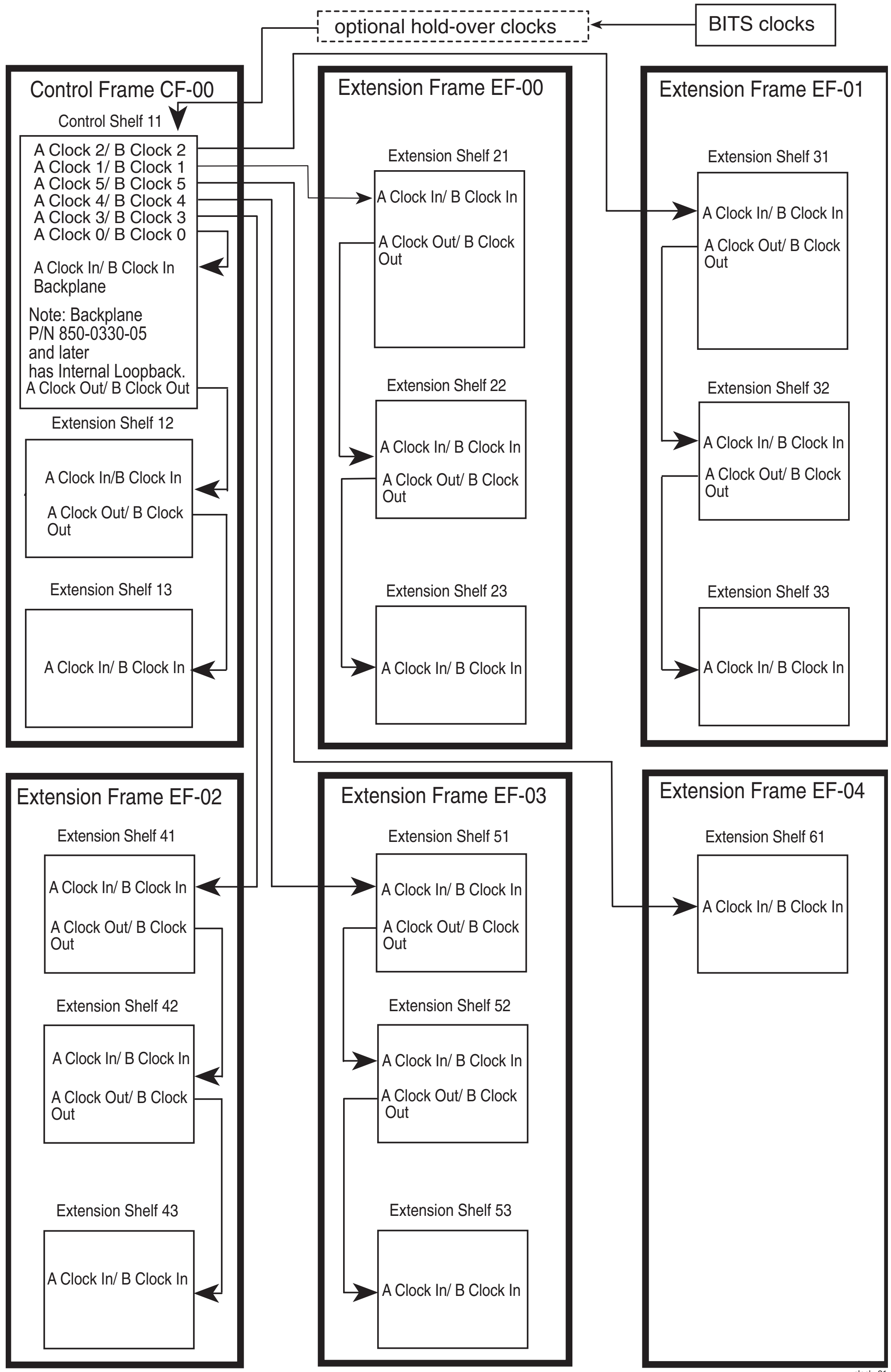
Holdover Clock

An optional holdover clock can maintain clock synchronization for EAGLE 5 ISS DS0A links during brief interruptions of the Building Integrated Timing System (BITS) clock signals. In accordance with Telcordia Technologies GR-1244-CORE, BITS clock outages of up to 15 seconds can be tolerated.

BITS Clock Routing

BITS clock signals A and B are routed through the holdover clock and then to the system, allowing the holdover clock to continue Stratum 3 clock signals to the EAGLE 5 ISS (see Figure 2-2, *"Clock Routing,"* on page 2-15).

Figure 2-2. Clock Routing



High-Speed Master Timing

The EAGLE 5 ISS can be configured with high-speed master timing capabilities. High-speed master timing allows synchronization of LIM cards at E1 or T1 rates. For more information about installing or upgrading to high-speed timing see the section on Master Timing in the "*Installation Manual*".

Time Slot Counter Synchronization

Time Slot Counter Synchronization (TSC) Synchronization allows all cards in the system that contain a Time Slot Counter (TSC) to synchronize with one another. The ability to have synchronized timing between cards is used in applications such as system wide message time stamping. "Time Slot Counter Synchronization" on page 2-16.

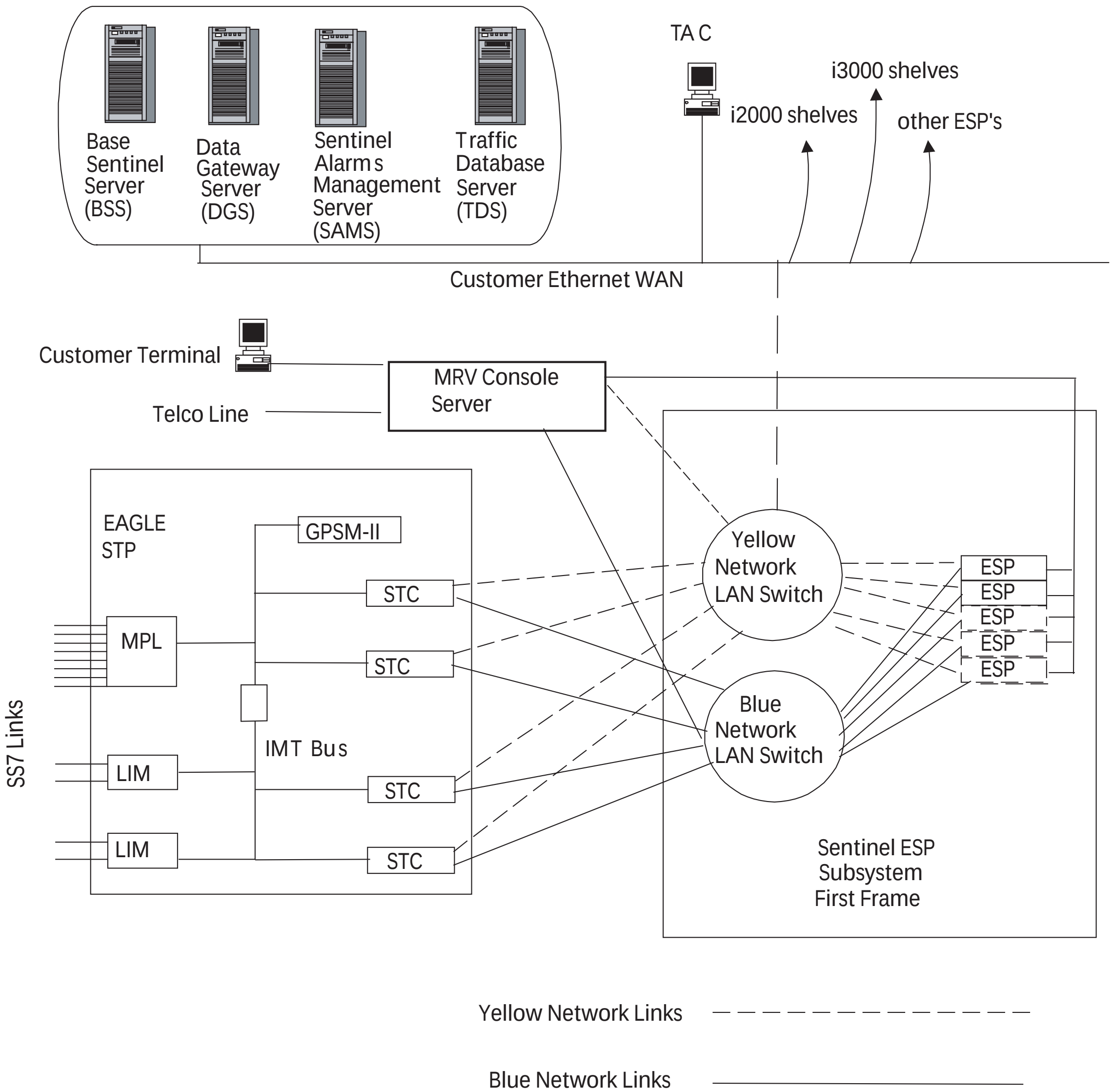
Integrated Sentinel

The Integrated Sentinel product provides monitoring capabilities for up to 1024 Signaling System 7 (SS7) links. Integrated Sentinel includes network surveillance capabilities and fault-management functions. Integrated Sentinel is a complete network monitoring and diagnostic system that gives service providers total visibility of and access to their SS7 networks. Integrated Sentinel features a call detail record (CDR) generation system that uses raw network traffic on the links to generate CDR data for use in various business intelligence applications.

Figure 2-3 shows a block diagram of a SS7 monitoring network incorporating the Integrated Sentinel.

The Integrated Sentinel monitors EAGLE 5 ISS STP links internally to eliminate hardware connections such as cabling, bridge amplifiers, and patch panels. The Integrated Sentinel can receive all acknowledged message signal units (MSU) as well as other important information from the EAGLE 5 ISS.

Figure 2-3. Integrated Sentinel Block Diagram



In the EAGLE 5 ISS, Sentinel Transport Cards (STC) can interface to the LIM cards on the IMT bus as a private LAN subnet. The STCs transfer the information collected from the LIMs by ethernet links to the Extended Services platform (ESP) of the Integrated Sentinel. Refer to "Sentinel Transport Card" on page 2-12 for more information about STCs. Prior to Integrated Sentinel release 8.0, physical connections were required on the signalling links to collect this information.

After processing in the ESP subsystem, the monitored link information is forwarded through isolation routers to Sentinel servers. Refer to "Extended Services Platform" on page 2-18 for more information about the ESP subsystem.

Extended Services Platform

The Extended Services Platform (ESP) is the Integrated Sentinel software bundle and the required software platform that provides the interface to the Integrated Sentinel monitoring system. One Netra 120 or Tekelec 1000 Applications Server running the ESP application is referred to as an ESP server. All ESP servers located at one EAGLE 5 ISS location are an ESP subsystem. Each ESP server is considered a separate processing element with respect to communications to the downstream Sentinel servers and therefore needs its own IP address. As shown in Figure 2-3 on page 2-17, a single demarcation point is provided for the Customer's network at the ESP frame's ethernet switch.

For more information about Sentinel products and a detailed explanation of the ESP frame see Chapter 5, *Hardware Descriptions — Sentinel Products*, in this manual.

The Integrated Sentinel ESP subsystem interfaces to the monitored links in the EAGLE 5 ISS STP through ethernet connections to the Sentinel Transport Cards (STC) located in the EAGLE 5 ISS STP frame. See the section "Sentinel Transport Card" on page 2-12 for information about STCs. In the EAGLE 5 ISS the information being copied from LIM cards and sent to the ESP subassembly is transported by TCP/IP using a custom proprietary protocol called EAGLE 5 ISS Monitor Protocol (EMP).

Site Collector

SS7 traffic is processed by a series of processes collectively referred to as a Sentinel Site Collector. Sentinel products monitor SS7 links by external probe-based connections (non-integrated solution) or internal connections to the EAGLE 5 ISS (integrated solution). A Sentinel Site Collector System consists of user workstations, the EAGLE 5 ISS Shelves, Signaling Transfer Points (STPs) or other SS7 Network Equipment and a Site Collector Frame.

For more information about Non-Integrated Sentinel Frames see Chapter 5, *Hardware Descriptions — Sentinel Products* in this manual.

Flight Recorder

The Tekelec Flight Recorder (FR) is responsible for maintaining a history buffer of MSUs that can be forwarded to the Base Sentinel Server for historical call trace. The Flight Recorder refers to a subsystem composed of hardware and software components that comprise the platform for a particular Sentinel site collector.

The FR prepares MSUs and forwards them to the Data Gateway Server for use in various data collection applications. It is a multiprocessor-based probe used to monitor TALI links carrying SS7 traffic. The flight recorder transmits MSUs to the Base Sentinel Server for real-time link monitoring, Protocol Analysis (PA), and call trace.

An FR connects to a Tekelec i2000 shelf to provide processing and storage for a probed Sentinel solution. Flight Recorders are not used in the Integrated Sentinel. The FR functions are similar to the Integrated Sentinel Extended Services Platform (ESP) server described in the following section.

Multi-Platform Server (MPS) Systems

The MPS system can be configured as an EAGLE 5 ISS Local Number Portability (LNP) Application Processor (ELAP) or EAGLE5 ISS Provisioning Application Processor (EPAP) server.

The MPS provides an interface between the customer provisioning network and the EAGLE 5 ISS DSM cards. As the customer's data is updated, the MPS stores the data and updates the DSM cards. An MPS is usually co-located with an EAGLE 5 ISS. If you need to install an MPS at a distance from the EAGLE 5 ISS, contact " *Tekelec Customer Care Center*" for assistance.

MPS running the EAGLE 5 ISS Provisioning Application Processor (EPAP) software supports the GSM Flexible Numbering (G-Flex), GSM Mobile Number Portability (G-Port), and INAP-based Number Portability (INP) features

These features allow a subscriber to change location, service provider, or service while keeping the same directory number and ensures that subscribers receive the same freedom of choice for local service as they do with long-distance service providers.

MPS running the EAGLE 5 ISS LNP Application Processor (ELAP) software supports the LNP 228 Million Numbers Feature. The Local Number Portability (LNP) 228 Million Numbers feature increases the number of provisionable telephone numbers (TNs) from 18 million to 228 million. The LNP 228 Million Numbers feature also relocates the LNP database from the OAM (Operation Administration and Maintenance) to the MPS.

MPS on the Tekelec 1000 Application Server (T1000 AS) supports the EPAP. The EPAP application includes the INP, G-Flex, and G-Port® . In addition to the software application, additional third-party software may be required to support the application. For hardware information, see the *Tekelec 1000 Application Server Hardware Manual*.

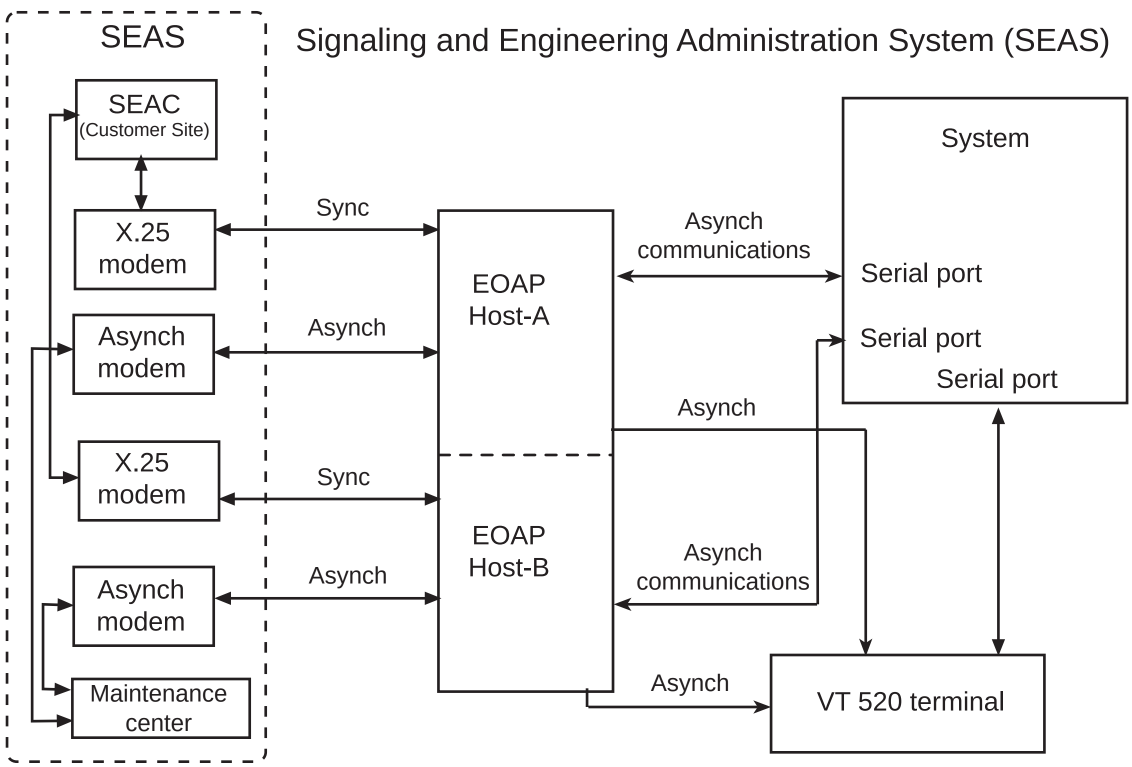
MPS on the Tekelec 1100 Applcation Server (T1100 AS) supports the ELAP. The ELAP application includes support for the Local Number Portability (LNP) 228 Million Numbers feature. For hardware information, see the *Tekelec 1100 Application Server Hardware Manual*.

Embedded Operations Applications Processor

The Embedded Operation Support System Applications Processor (EOAP) is hosted in an assembly mounted in a dedicated OAP Frame (OAPF). The OAP applications run on the EOAP host assembly. More than one EOAP host shelf can be mounted in each OAPF. Each EOAP host shelf contains cards provisioned to support one or two OAP systems. The

OAP application translates and converts higher layer protocols into asynchronous serial communications. The OAP provides translation and async/X.25 conversion as part of the optional Signaling and Engineering Administration System (SEAS) interface for the EAGLE 5 ISS system. The EOAP can also be used to process input from he optional Local Service Management System (LSMS) (see Figure 2-4, *"EOAP Hosts in an EAGLE 5 ISS,"* on page 2-20). An EOAP host shelf communicates with the EAGLE 5 ISS system control shelf through a serial interface port.

Figure 2-4. EOAP Hosts in an EAGLE 5 ISS



OEM Products

OEM-Based Servers

OEM-based products use Commercial Off-The-Shelf (COTS) servers, network elements, and peripheral components. Server hosts provide processing power and database storage capacity to deliver a scalable range of application specific services. Components can be configured redundantly to provide a high level of reliability in processing applications. OEM-based Product servers currently being used are:

- Sun Netra T1 DC200 servers (Used as Extended Services Platform (ESP) servers in the Integrated Sentinel systems).

OEM-based product capabilities are defined by specific application requirements. Optional processing components that provide application specific services can be integrated into OEM-based systems.

OEM-Based Network Elements

OEM-based products are configured as frame-mounted Local Area Networks (LAN) using Commercial Off-The-Shelf (COTS) routers, hubs, and switches. Typically OEM-based products are configured in redundant LANs with isolation and dial-up access IP links to customers networks.

Network components are typically configured in redundant pairs with dual power supply systems for reliability. Network components can include:

- Routers
- Hubs
- Ethernet Switches
- Application Servers
- Optional components

OEM-Based Peripheral Components

OEM-based products use COTS peripheral components to support the server and network elements. Peripheral components can include:

- Breaker panels
- Workstations
- Terminals
- Switch boxes
- Break-out boxes

3

Hardware Descriptions — EAGLE 5 ISS

Introduction

This chapter provides detailed descriptions of the various hardware associated with the EAGLE 5 ISS including MPS and EOAP systems. This chapter is designed to aid personnel in configuration, planning, and replacing components in the systems.

This chapter contains detailed descriptions of the frames, shelves, modules, and power distribution in the systems.

EAGLE 5 ISS

EAGLE 5 ISS is a large-capacity, multi-functional, fully scalable Signaling Transfer Point (STP). The EAGLE 5 ISS is NEBS-compliant (GR-63-CORE, Network Equipment-Building Systems). High capacity and scalability allow the EAGLE 5 ISS to grow from a single-shelf, 80-link STP to a multi-frame, 1500-link STP.

Due to the distributed processor design, EAGLE 5 ISS does not have a separate central processing unit to bottleneck traffic throughput. Application and interface cards are designed to provide plug and play type functionality that facilitates future growth. EAGLE 5 ISS application and interface cards generally do not have specific shelf or frame limitations, allowing you to fully customize and define how your STP is configured. EAGLE 5 ISS also supports a variety of interface cards to support connectivity to a wide range of network elements. EAGLE 5 ISS provides connectivity interfaces for IP, ATM, DS0-A, V.35, OCU, T1, and E1 protocols.

Sentinel provides a Web-based user interface that can be used to view reports and manage most aspects of Sentinel. The interface is supported by Mozilla (version 1.5 or later).

IP Connectivity

The EAGLE 5 ISS provides connectivity between SS7 and IP networks. It receives and sends switched circuit network (SCN) native signaling at the edge of the IP network. The signaling gateway function may relay, translate, or terminate SS7 signaling in an SS7-Internet gateway. The signaling gateway function may also be co-resident with the media gateway function to process SCN signaling associated with line or trunk terminations controlled by the media gateway.

Monitoring

In EAGLE 5 ISS STP, Sentinel Transport Cards (STC) monitor the activity of Link Interface Modules (LIM) and transfer information to the Extended Services Platform (ESP) subassembly. The ESP subassembly processes information from monitored links and forwards the results to a Sentinel server. See *"Hardware Descriptions — Sentinel Products"* on page 5-1 for detailed information.

NOTE: STC cards are based on single-slot EDCM-A cards (P/N 870-2508-02) and can be configured in any slot (except slots reserved for GPSM-II, TDM, MDAL, HMUX, and HIPR cards).

The Integrated Sentinel solution is hosted in a Extended Services Platform (ESP) subassembly frame.

Multi-purpose Server (MPS)

Tekelec's Multi-purpose Server (MPS) is a hardware and software platform that can be configured to support EAGLE STP Local Number Portability Application Processor (ELAP) or EAGLE STP Provisioning Application Processor (EPAP).

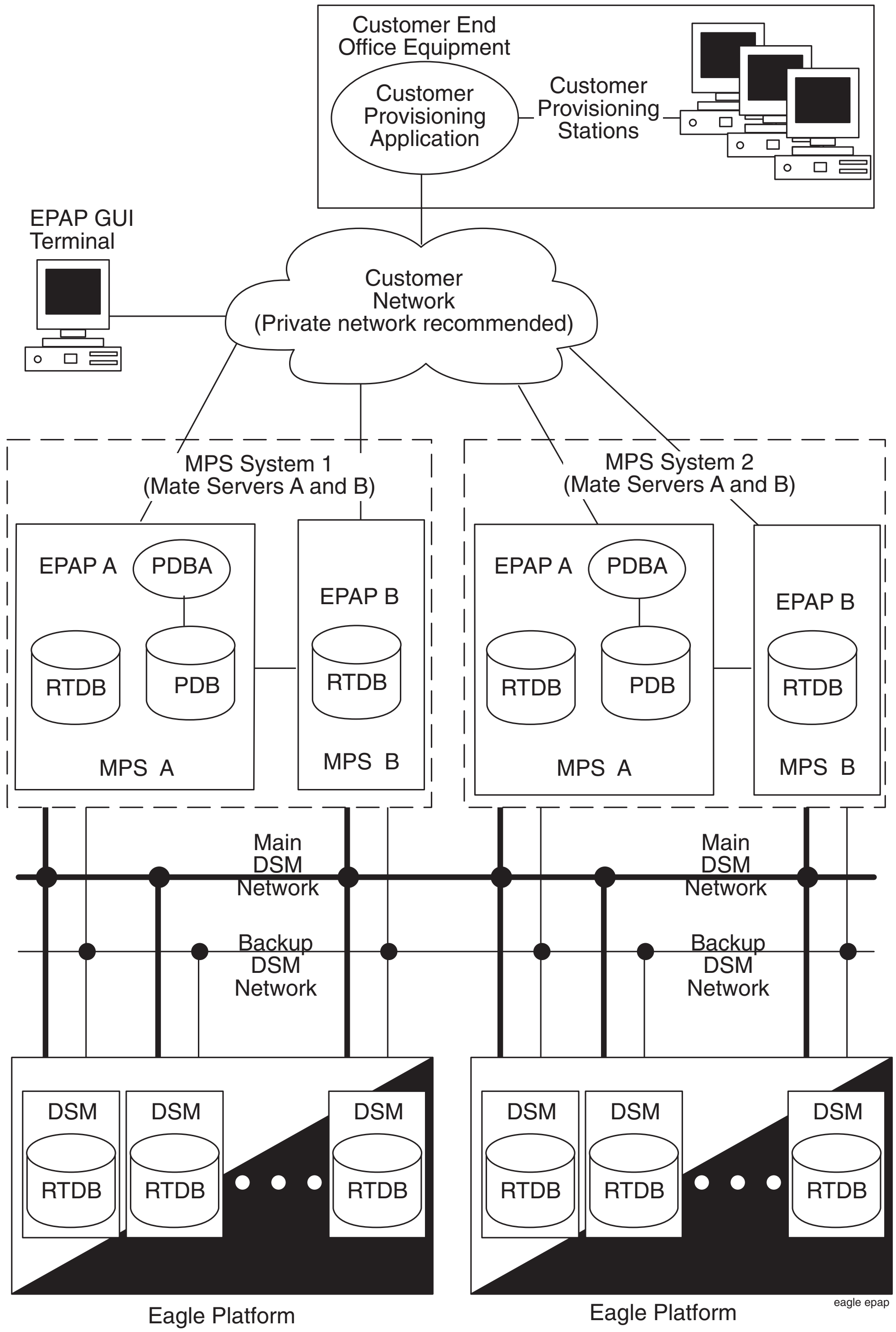
MPS on the Tekelec 1000 Application Server (T1000 AS) supports the EPAP. The EPAP application includes the INP, G-Flex, and G-Port® . In addition to the software application, additional third-party software may be required to support the application. For hardware information, see the *Tekelec 1000 Application Server Hardware Manual*.

MPS on the Tekelec 1100 Applcation Server (T1100 AS) supports the ELAP. The ELAP application includes support for the Local Number Portability (LNP) 228 Million Numbers feature. For hardware information, see the *Tekelec 1100 Application Server Hardware Manual*.

Figure 3-1 on page 3-6 shows an overview of how the MPS on the T1000 AS is used with the EAGLE 5 ISS.

The MPS provides an interface between the customer provisioning network and the EAGLE 5 ISS DSM cards. As the customer's data is updated, the MPS stores the data and updates the DSM cards. An MPS is usually co-located with an EAGLE 5 ISS.

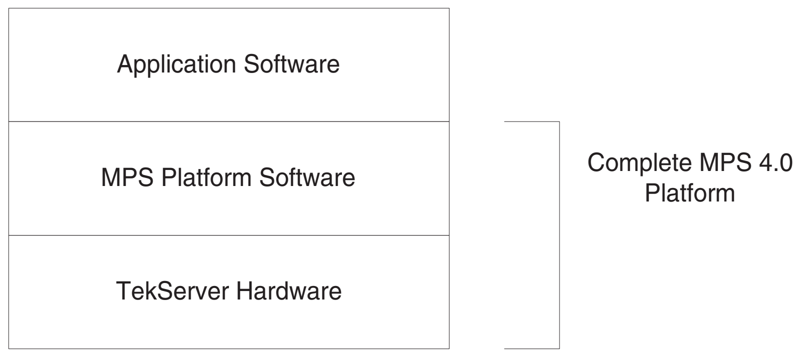
Figure 3-1. MPS on T1000 AS/EAGLE 5 ISS Overview



Layered Design

MPS is based on the T1000 AS and uses a layered design (see Figures 3-1) with defined interfaces to enable application and platform changes to be made independently. This design provides an environment in which changes made to platform components need not cause changes in application.

Figure 3-1. Layered Design for MPS and Applications

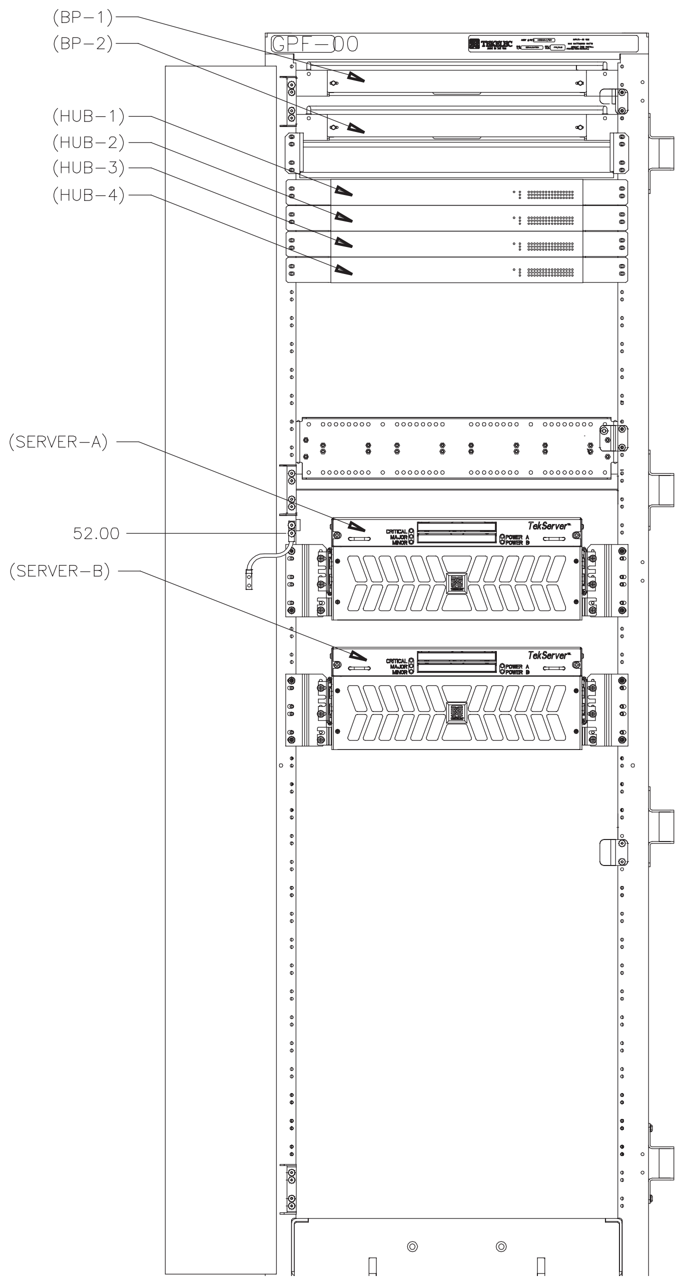


Hardware Components

This section includes a description of MPS hardware components and an overview of the disks and file systems. Figure 3-2 "MPS Hardware Overview" on page 3-8 illustrates the following equipment.

- Two Breaker Panels
- One Drip Tray
- Four Hubs
- Two MPS Servers
- One 8-Port Connector Box (connects by a 40-inch cable the to Sun SAI/P card)
- One General Purpose Frame

Figure 3-2. MPS Hardware Overview



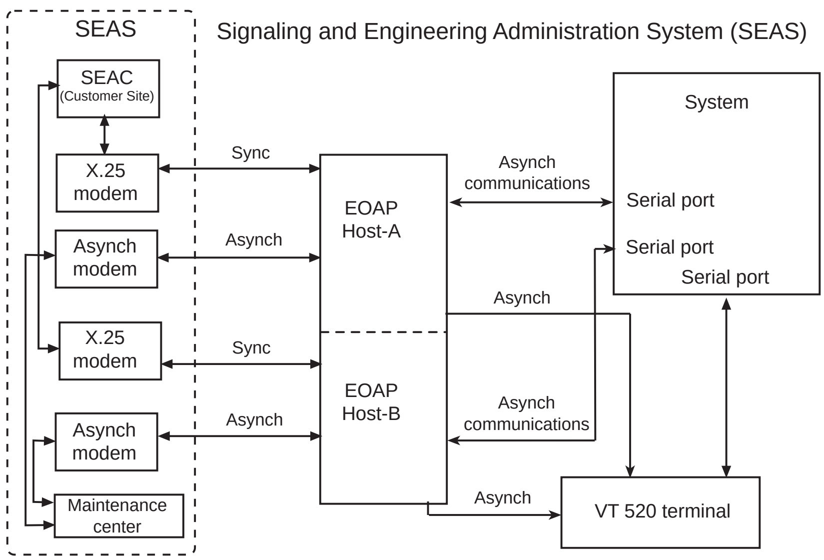
DANGER: DO NOT install AC powered equipment in the MPS frame. No commercially powered AC equipment should be used or placed within 7 feet of -48VDC equipment. Doing so can create a shock hazard to personnel and equipment.

Embedded OSS Application Processor (EOAP)

The Embedded Operations Support System Application Processor (EOAP) is a general purpose interface module that provides the STP system with a generic platform to develop and run software for feature-specific interfaces to the STP. These interfaces, for example, include the optional Signaling and Engineering Administration System (SEAS).

The EOAP translates and converts higher layer protocols into asynchronous serial communication. It communicates with the STP system through a serial interface port. For the SEAS interface, the EOAP provides translation and asynchronous-to-X.25 communication conversion. Refer to Figure 3-3.

Figure 3-3. EOAP Communication



Each EOAP reports to the STP its general status as well as the status of its User Application Layer (UAL), X.25 links, PVCs on those links, and Q.3 associations. The STP can then report the status of the EOAP and its components to the user through the STP's HMI.

You can configure most aspects of the EOAP through the STP terminal. For upgrade, debug, and maintenance functions, use a VT-520 terminal directly connected to the EOAP.

The EOAP is a modular unit with field-replaceable components. For upgrade purposes, the EOAP can replace an existing Texas Micro OAP.

The EOAP shelf is designed for a split system consisting of an EOAP-A and an EOAP-B. Each EOAP system in the dual configuration consists of a processor card, a serial interface card, a power supply card, a removable hard drive, and a removable CD-ROM drive.

A dedicated OAP Frame (OAPF) is used to house one or two EOAP host processor assemblies. The OAPF provides –48VDC to the EOAP from its fuse and alarm panel.

EOAP host assemblies connect to the system control shelf through two serial interface ports that allow the system to send a reset command to the hosts.

The EOAP host is server, Ultrasparc 2I, with 300 MHz processor, and contains the following components:

- 300 MHz Ultrasparc 2I Compact PCI Processor card with 64 MBytes of RAM
- Compact PCI Serial I/O Card with 4RS-232 Sync/Async Ports
- Removable 9Gbyte SCSI Hard Drive Card
- Removable 32X CD-ROM Drive Card

Figure 3-4. Dual EOAP Host Configuration

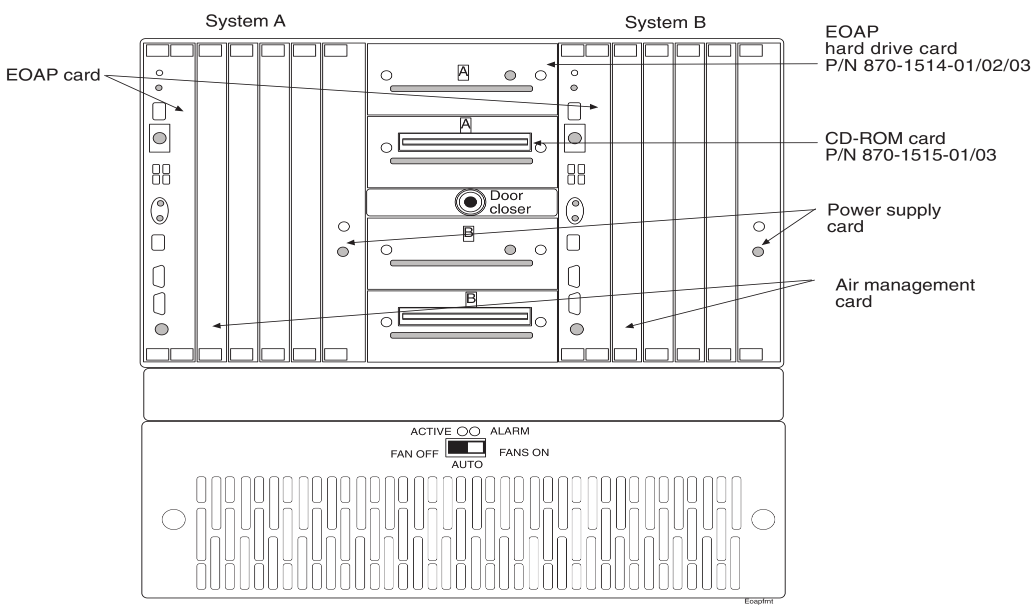


Table 3-1. EOAP Frame Fuse Assignment

FAP Part Numbers	Fuse Number	Current Capacity	Powered Item
870-0243-09	1A	10 AMP	EOAP Host A
	1B	10 AMP	EOAP Host B
870-1606-xx	19A	10 AMP	EOAP Host A
	19B	10 AMP	EOAP Host B

Hardware Baselines

Appendix A, *Hardware Baselines*, contains a complete listing of the hardware available for each software release. The appendix lists configurable modules arranged in alphabetical order indexed to system software releases. For example, all hardware available will have a bold **X** where the hardware module row crosses the release column.

Frames

The system uses standard 7-foot high, 23-inch wide frames (inside dimension). These floor mounted frames are constructed from channel steel and painted with electrostatic powder. Depending on the configuration, the system uses from one to four frames to accommodate a maximum of 1500 SS7 signaling links.

NOTE 1: A heavy-duty frame with the capability to support the greater weight of COTS equipment is shipped with all new systems. The generic frame is no longer being shipped but is supported in the documentation.

NOTE 2: With the large system feature, depending on configuration, the system can accommodate up to 1024 links. The large system feature applies to the EAGLE 5 ISS systems only.

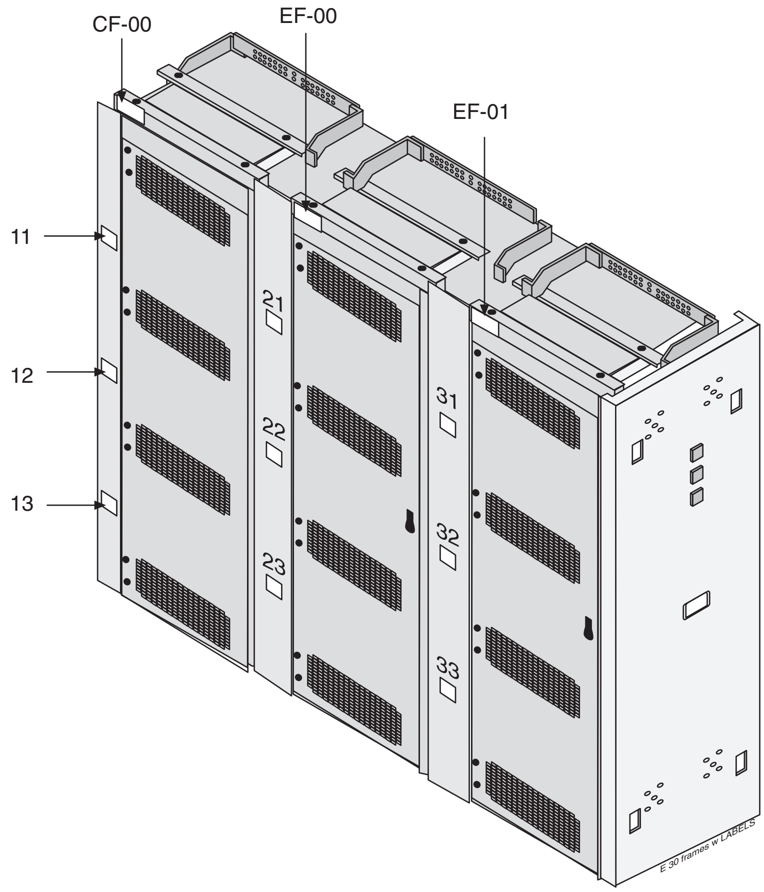
Additional frames may be required for optional items, such as Embedded OAP (EOAP) which are configured in OAP frames (OAPF). Cross-connect panels, spare card storage, modems, and holdover clocks are configured in Miscellaneous Frames (MF).

The system can use five types of frames:

- Control Frame (CF)
- Extension Frame (EF)
- Miscellaneous Frame (MF)
- Operations Support System Application Processor Frame (OAPF)
- General Purpose Frame (GPF)

Figure 3-5 on page 3-12 shows a system with a Control Frame (CF-00) and two Extension Frames (EF-00 and EF-01).

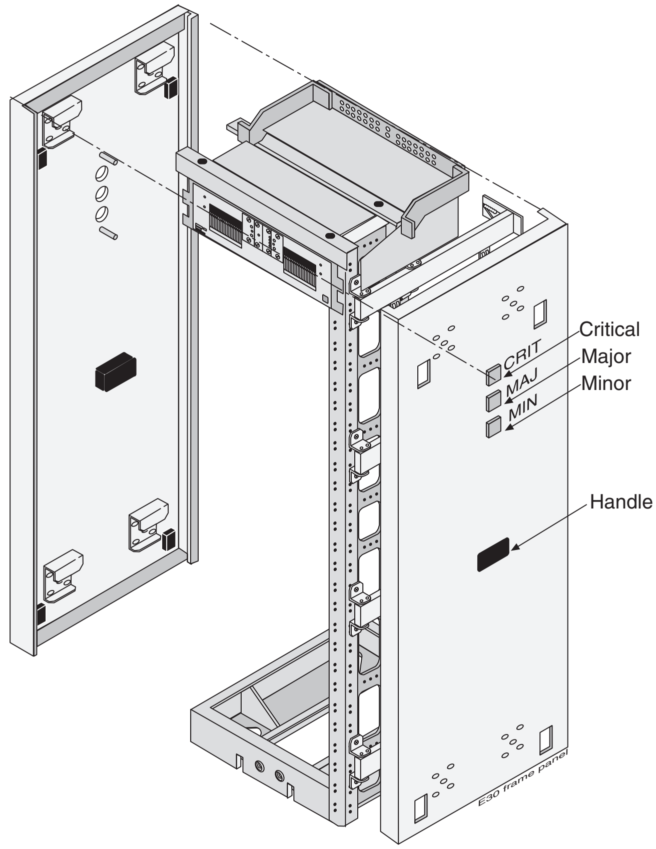
Figure 3-5. Frames



Lamp indicators can be mounted on either side of the row of frames on the end panels (refer to Figure 3-6 on page 3-13), which show three levels of alarm conditions:

- Critical
- Major
- Minor

Figure 3-6. Frame End Panel with Lamp Indicators



The doors on the front of each frame provide electromagnetic interference shielding and lock in place with a screw lock. Mounted on the inside of the doors are card locators, used to record the location of each card in a shelf and important data regarding the application that each card provides. The shelf backplanes are protected at the rear of the frame by removable transparent Plexiglas panels.

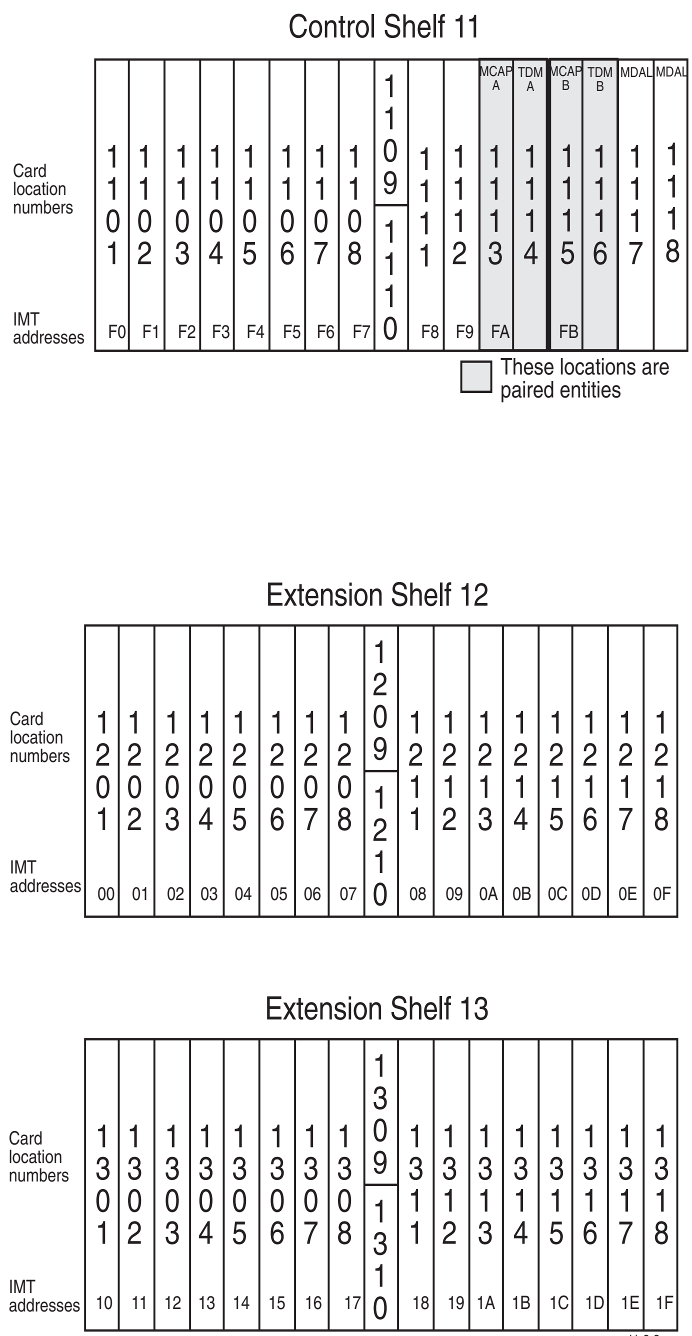
The following lists the part numbers for the panels for the frames:

- P/N 840-0064-01 End row panel, full depth, standard frame, NTW.
- P/N 840-0089-01 End row panel, full depth, heavy-duty NTW.
- P/N 870-2238-02 Extended panel, alarm side, NEBS NTW.
- P/N 870-2278-02 Full depth alarm side panel, heavy-duty frame, NTW.

A Fuse and Alarm Panel (FAP), located at the top of each frame, distributes –48VDC to all the shelves in the frame. Fuses are located on the front of the fuse and alarm panel. For more information on the fuse and alarm panel (refer to *“Fuse and Alarm Panels”* on page 3-118).

The numbering of the shelves, with the shelf identification backplane wiring, circuit card location, and with the Inter-processor Message Transport (IMT) address in small print at the bottom of the faceplates is shown in Figure 3-7. The HMUX or HIPR card provides Inter-processor Message Transport (IMT) bus continuity for all cards connected to the IMT bus.

Figure 3-7. Control Frame CF-00 Numbering Plan



Extension Frame

The Extension Frame (EF) accommodates up to three extension shelves, each shelf is capable of supporting up to 16 Link Interface Modules (LIMs), Multi-Port LIMs (MPLs), E1/T1 MIMs, Translation Service Modules (TSMs), or Applique Communication Modules (ACMs), or Single-slot Enhanced Database Communications Modules, in any combination.

The EAGLE 5 ISS systems are delivered with customer-specific locations for the Database Communications Module (DCM) cards and DCMX cards. DCM and DCMX cards must be inserted into odd numbered slots in EAGLE 5 ISS systems. DCM, double-slot EDCM, single-slot EDCM and EDCM-A cards can be configured in EAGLE 5 ISS systems

The system can have up to five Extension Frames, EF-00 to EF-04. EF-04 supports only one extension shelf. The numbering of the shelves is shown, with the shelf identification backplane wiring, circuit card location, and the Inter-processor Message Transport (IMT) address in small print at the bottom of the faceplate. The numbering of the card locations on the extension frames and the IMT address is shown in Figure 3-8 on page 3-16 through Figure 3-11 on page 3-19.

Figure 3-8. Extension Frame EF-00 Numbering Plan

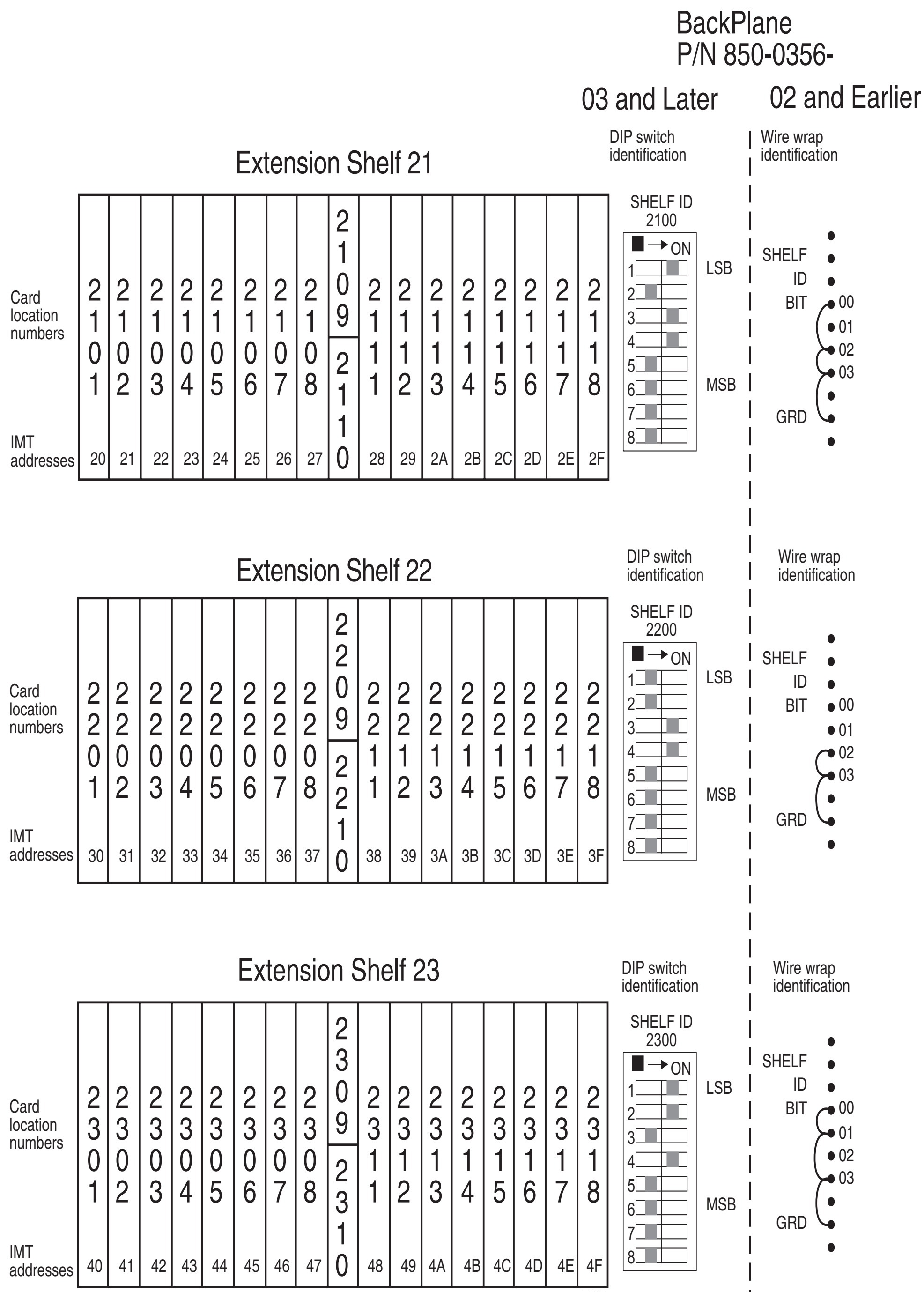


Figure 3-9. Extension Frame EF-02 Numbering Plan

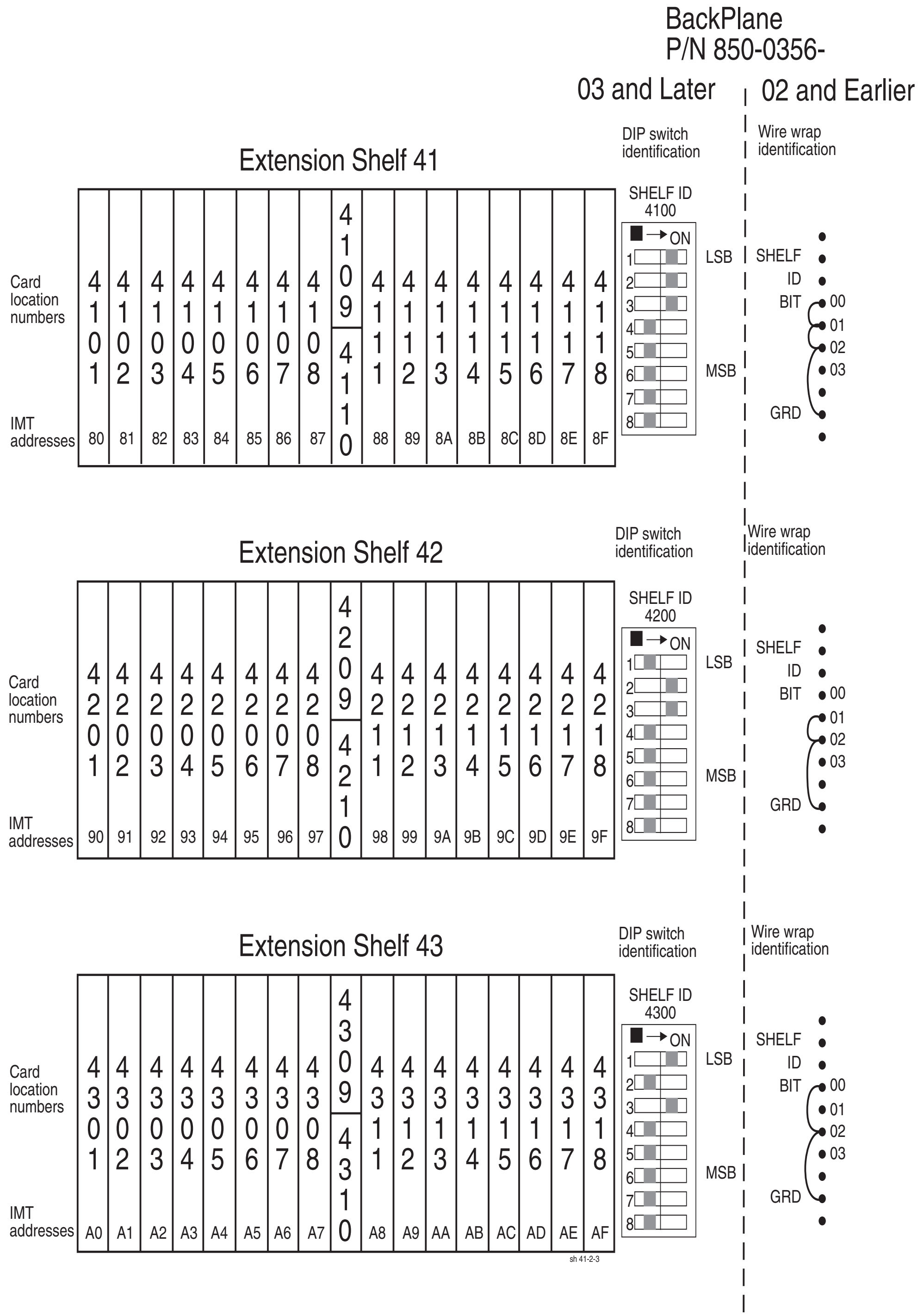


Figure 3-10. Extension Frame EF-03 Numbering Plan

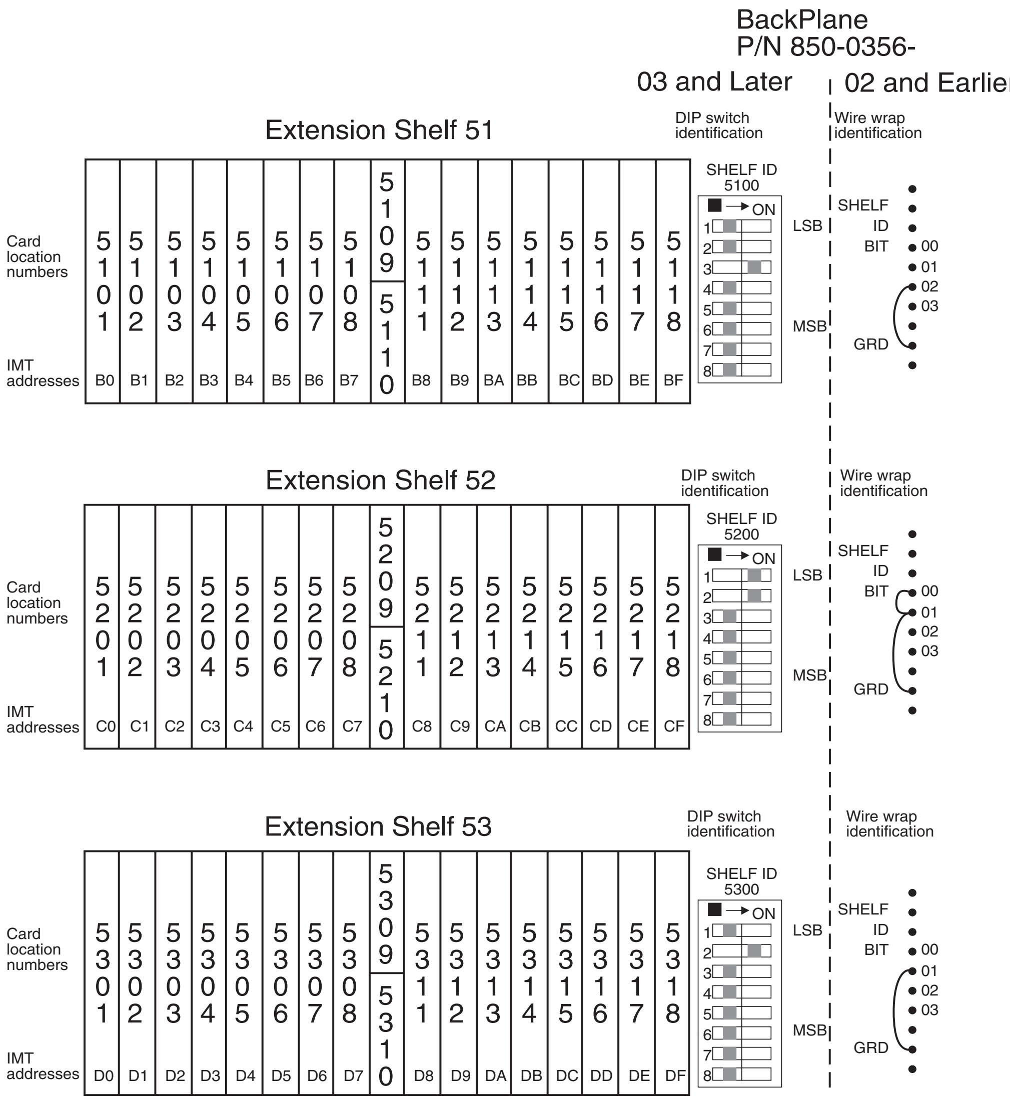


Figure 3-11. Extension Frame EF-04 Numbering Plan

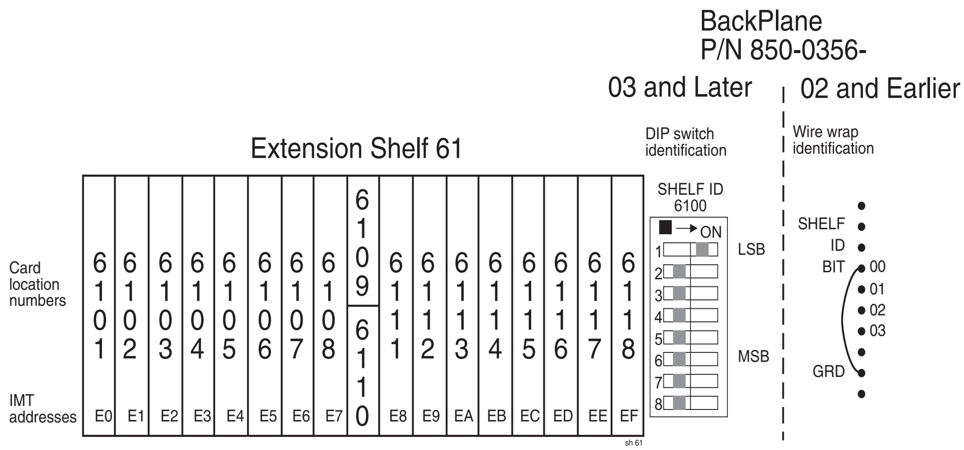
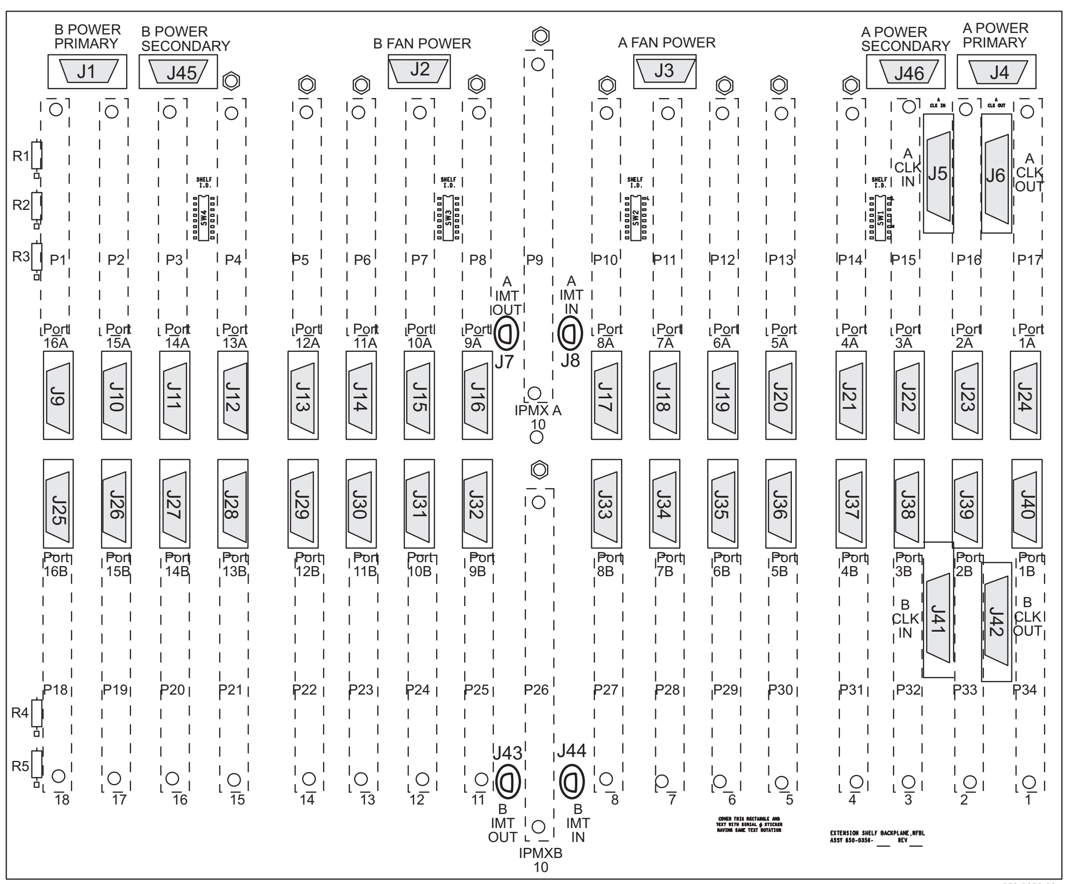
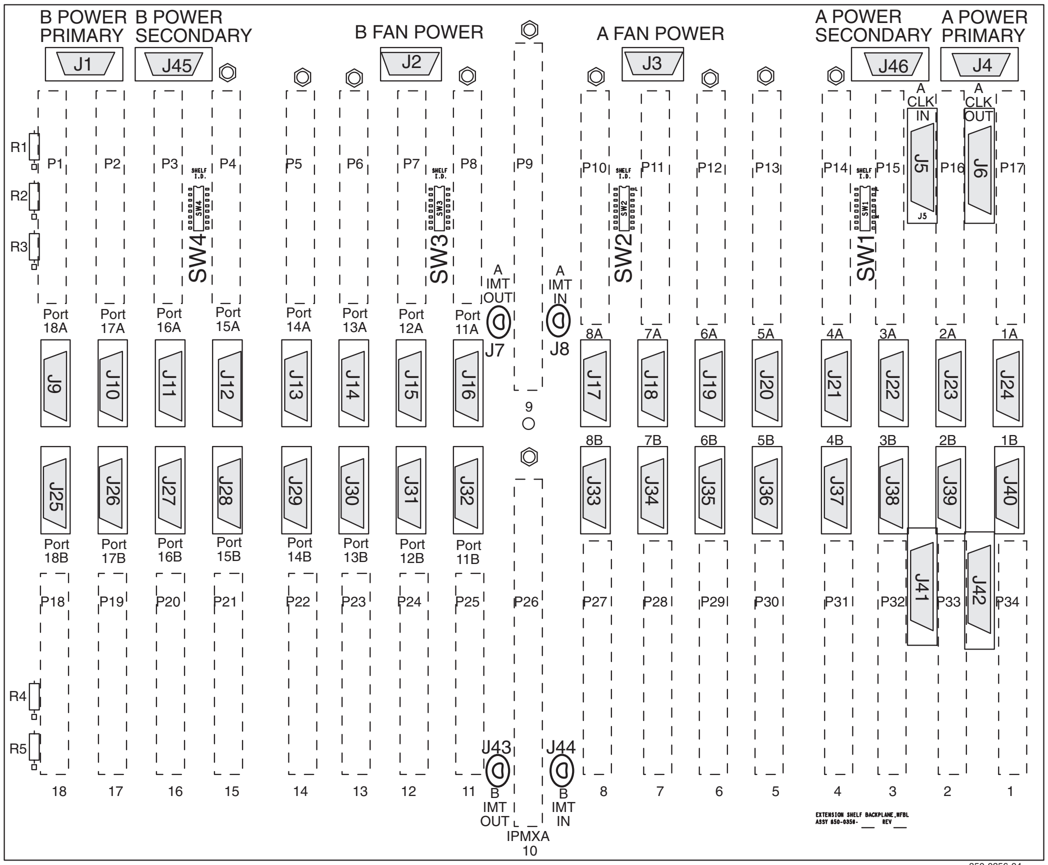


Figure 3-12. Extension Shelf Backplane ID (P/N 850-0356-03)



Warning: ⎔ Conducts -48VDC for the printed circuit board (HOT). Metal points on printed circuit boards conducts -48VDC and can cause shorts, shocks, and damage if not handled properly.

Figure 3-13. Extension Shelf Backplane ID (P/N 850-0356-04/06)



NOTE: Conducts -48VDC for the printed circuit board (HOT)

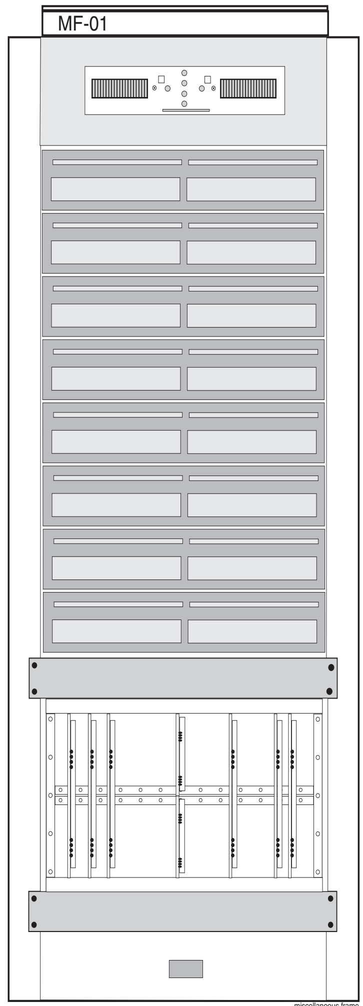
Miscellaneous Frame

The Miscellaneous Frame (MF) is an optional frame that can be used to mount holdover clocks, test equipment, jack panels, spare cards, and other customer-specified accessories or equipment. The optional spare card storage shelf is equipped with card guides and doors for safe storage of all system cards.

The Miscellaneous Frame (MF) is equipped with a Fuse and Alarm Panel (FAP) that can provide fused –48VDC to equipment mounted in the frame.

An example of a miscellaneous frame is shown in Figure 3-14.

Figure 3-14. Miscellaneous Frame

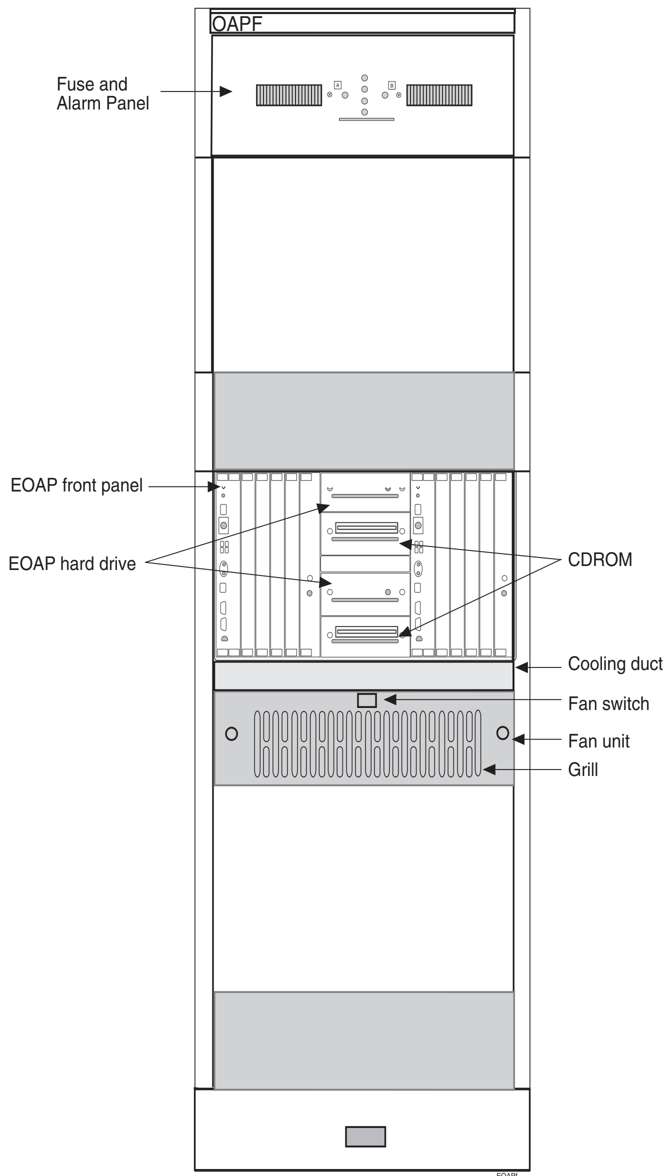


OAP Frame

The Operation Support System Application Processor Frame (OAPF) is an optional frame for mounting the processors hosting optional Embedded Operations Support System Applications Processors (EOAPs). This frame is typically located next to the system's control frame, but may be customer engineered in other locations under special circumstances.

The OAPF is equipped with a Fuse and Alarm Panel (FAP), shown in Figure 3-15, that provides fused –48VDC to equipment mounted in the frame.

Figure 3-15. OAPF Containing Embedded OAP Hosts



Control Frame

The Control Frame (CF) is the principle frame for the system. The top shelf is the control shelf, containing all the components of the Maintenance and Administration Subsystem (MAS), and up to ten additional Link Interface Modules (LIMs), Multi-Port LIMs (MPLs), E1/T1 MIMs, Integrated LIM AINF (ILAs), Translation Service Modules (TSMs), Database Communications Modules (DCMs) or Database Service Modules (DSM) (Both DCMs and DSMs require two card slots), or Application Communications Modules (ACMs).

The control frame can also contain up to two extension shelves. Each extension shelf can accommodate up to 16:

- LIMs or Integrated LIM Applique Interface (ILA) or Enhanced Integrated LIM Applique Interface (EILA) cards
- Application Communications Modules (ACM)
- Single-slot Enhanced Database Communications Modules (EDCM or EDCM-A)
- E5-E1T1
- E5-ENET

Or each extension shelf can accommodate up to eight:

- Database Communications Modules (DCMs) or Database Service Modules (DSM) (Both DCMs and DSMs require two card slots)
- Double-slot Enhanced Database Communications Modules (EDCM) (requires two card slots)

With the exception of DCMs and double-slot EDCMs, all cards can be inserted in any slot except for those locations dedicated to the HMUX, HIPR, MASP, and MDAL cards. In EAGLE5 ISS systems and IP^7 4.0 and earlier systems, DCMs and double-slot EDCMs must be placed into odd-numbered slots, and due to their width the adjoining even-numbered slot will be taken as well.

Control Shelf

The control shelf is divided into two parts. One part is used by the Maintenance and Administration Subsystem (MAS) and contains the following hardware:

- Two Terminal Disk Modules (TDMs)
- Two GPSM-II cards
- One Maintenance Disk and Alarm card (MDAL)

Each TDM/GPSM-II pair makes up a Maintenance and Administration Subsystem Processor (MASP).

Two HIPR or HMUX (EAGLE 5 ISS) cards provide Inter-processor Message Transport (IMT) bus continuity for all cards connected to the IMT bus.

NOTE: HMUX and HIPR cards are installed at the factory or by Tekelec Technical Support and are not installed by customers.

The remainder of the control shelf can be occupied by up to ten of the following cards, in any combination and in any location not dedicated to an MASP pair or HIPR card:

- Integrated LIM AINF (ILA) or Enhanced Integrated LIM AINF (EILA)
- Link Interface Module (LIM)
- Multi-Port Link Interface Module (MPL)
- E1/T1 Multi-Channel Interface Module (MIM)
- Application Communications Module (ACM)
- Translation Service Module (TSM)
- Single-slot Enhanced Database Communications Module (EDCM and EDCM-A)

Database Communications Module (DCM) and Database Service Module (DSM) are only configured in available odd numbered slots, and requires two card slots.

Double-Slot Enhanced DCMs can be configured in any slot where they can physically fit. Double-Slot EDCMs require two card slots.

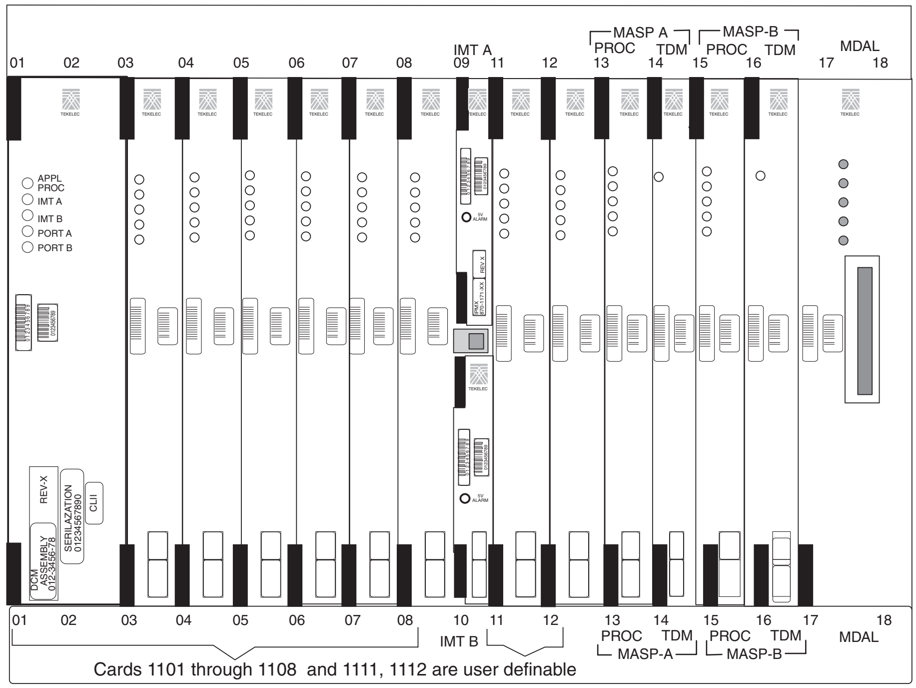
CAUTION: After the frame has been shipped or moved, prior to applying power, remove all cards. Reset all cards carefully to avoid possible faulty connections. All cards are hot swappable

The control shelf, shown in Figure 3-16 "Control Shelf Front, with DCM Card" on page 3-25, consists of top and bottom assemblies with die-formed channel slots to accept the top and bottom edges of the cards. The assemblies are anchored to the sheet steel side panels which are equipped with integral flanges for attaching the shelf to a 23-inch rack. The shelf backplane consists of an epoxy-glass printed circuit board and associated connectors. The section *"Control Shelf Backplanes"* on page 3-25 describes the control shelf backplane.

The control frame can also contain up to two extension shelves. Each extension shelf can accommodate up to 16 Link Interface Modules (LIMs or ILAs), Translation Service Modules (TSMs), or Application Communications Modules (ACMs), in any combination; except for those locations dedicated to the HMUX, HIPR (EAGLE 5 ISS), and MAS cards. All cards can be inserted in any card location.

Database Communications Modules (DCM) are only configured in available odd numbered slots, and require two card slots. Double-slot EDCMs can be configured in any available slot where space allows.

Figure 3-16. Control Shelf Front, with DCM Card



Control Shelf Backplanes

This section describes the control shelf backplanes (P/N 850-0330-03/04/06), all can be used in EAGLE 5 ISS systems.

NOTE 1: Control Shelf Backplane (P/N 850-0330-03/04) can be used with the HMUX and HIPR in the EAGLE 5 ISS system with minor modifications and the addition of adapter cable (P/N 830-1185-01). The adapter cable is not necessary for customers not wanting high speed links.

NOTE 2: The clocking and fan control signals used to support extension frames 6 and 7 are eliminated in the 850-0330-06 version and later of the Control Shelf Backplane because those frames are no longer supported in the EAGLE 5 ISS system.

The control shelf backplane provides connectors for the system circuit cards. These connectors are four column High Density Interconnect (HDI) male headers with shrouds of varying pin quantities, depending on card position.

- EILA, ILA, LIM, MPL, E1/T1 MIM, ACM, TSM, E5-ENET, E5-E1T1, and single-slot EDCM and EDCM-A cards can be used in slots 1, 2, 3, 4, 5, 6, 7, 8, 11, and 12.
- HMUX and HIPR cards are connected in slots 9 and 10.

  NOTE: HMUX, HIPR, and GPSM-II cards are installed at the factory or by Tekelec Technical Support and are not installed by customers.
- TDMs and TDM-GTIs are connected in slots 14 and 16.
- GPSM-II cards are connected in slots 13 and 15.
- The MDAL card is connected in slot 17 and 18.
- The HCMIM, DCM and DSM cards, used in EAGLE 5 ISS systems, are mounted only in available odd numbered slots 1, 3, 5, 7, and 11. The DCM cards and DSM cards are initially provided only in the control frame of the EAGLE 5 ISS but can be configured into extension shelves through contractual and maintenance agreements with Tekelec.

  NOTE: Double-slot EDCMs also require two slots but are not restricted to odd slots.

The control shelf backplane provides –48VDC power and ground to all card positions. The power is distributed into two parts, A and B. Power is brought to the shelf from the Fuse and Alarm Panel (FAP) using two cables. The connectors on the control shelf backplane are DB-26 high density connectors. The power is distributed over two separate pins per power connection to handle the current load. The current capacity of the connector pins is 1.5A per pin for a total of 3A per pair. In the *"Installation manual"* tables list the shelf location, card type, and fuse location in the fuse and alarm panel for the control shelf backplane.

NOTE: Cards that are provisioned in redundant pairs must be on separate power buses. This provides backup processing capabilities with the loss of either the A or B power buses. All MASP, HMUX, and HIPR cards are provisioned in pairs and are redundantly powered from separate power buses.

The control shelf power connectors are designated as:

- J1 (B Power) and J4 (A Power) on control shelf backplane (P/N 850-0330-04)
- J1 (B Power Primary) and J2 (B Power secondary)
  J11 (A Power primary) and J10 (A Power Secondary) on control shelf backplane (P/N 850-0330-06).

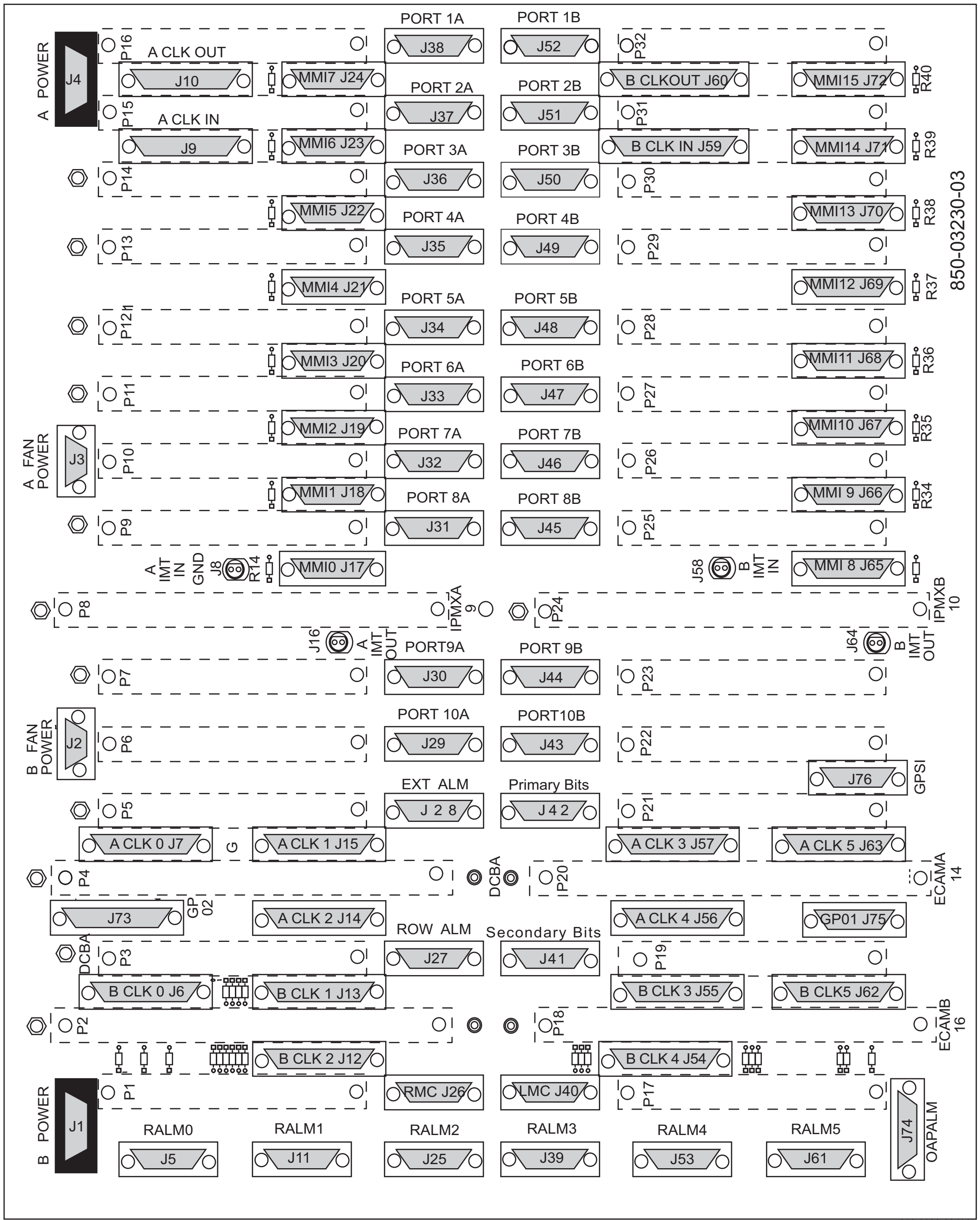
The following Figure 3-18 "Control Shelf Backplane (P/N 850-0330-06)" on page 3-29 show the layouts for the control shelf connectors.

CAUTION: Disconnect both Input and supply sources when repairs require removal of power. This will take the system down.

NOTE 3: Control Shelf Backplane (P/N 850-0330-03/04) can be used with the HMUX and HIPR in the EAGLE 5 ISS system with minor modifications and the addition of adapter cable (P/N 830-1185-01).

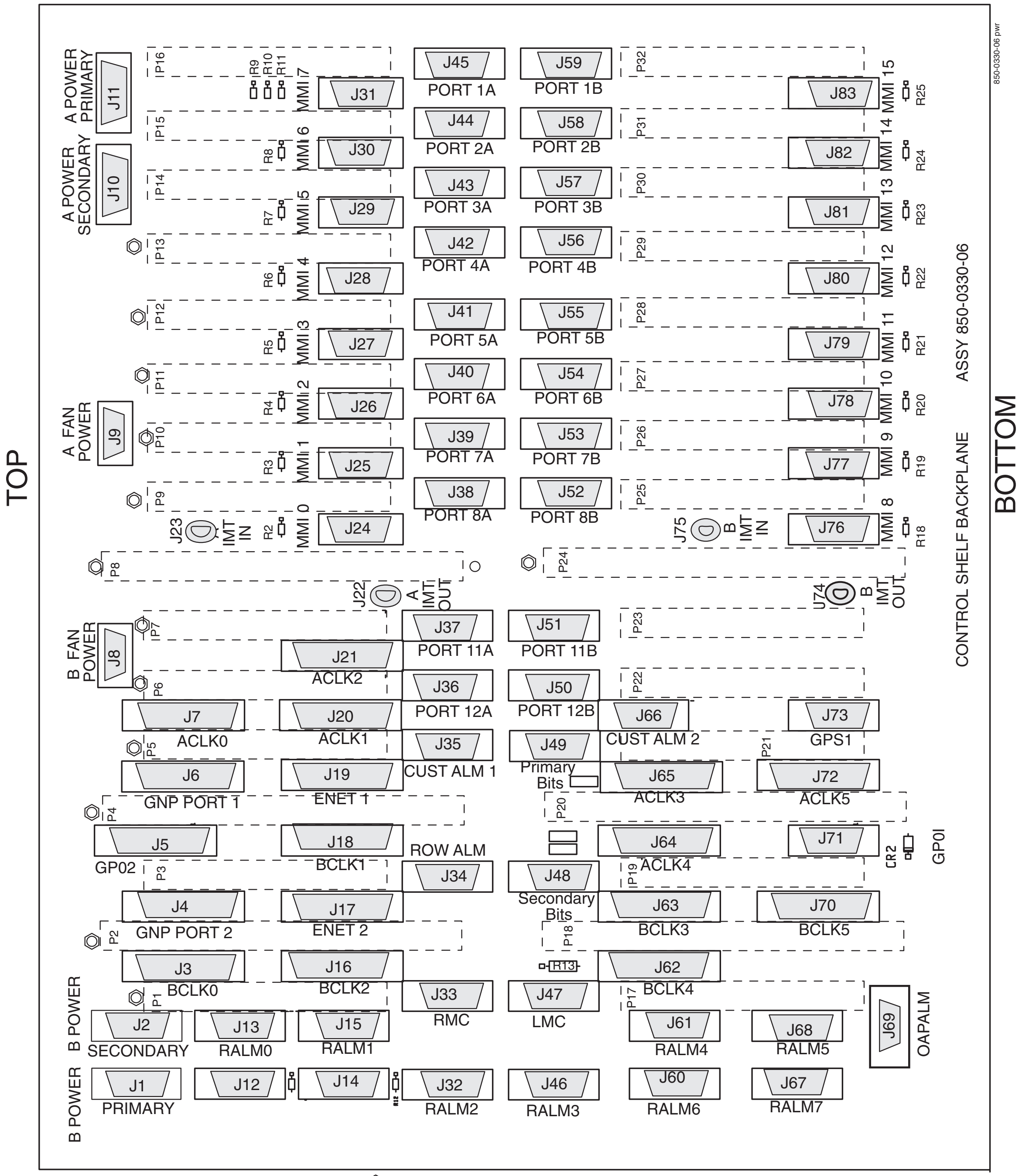
Figure 3-18 depict the various control shelf backplanes. Figure 3-17 on page 3-28 is the rear connector view of control shelf backplane (P/N 850-0330-03/04). Figure 3-18 on page 3-29 illustrates the control shelf backplane (P/N 850-0330-06).

Figure 3-17. Control Shelf Backplane (P/N 850-0330-03/04)



NOTE: ⬡ Conducts -48VDC for the printed circuit board

Figure 3-18. Control Shelf Backplane (P/N 850-0330-06)



NOTE: ⎔ Conducts -48VDC for the printed circuit board (HOT)

Alarm Connectors

The control shelf backplanes (P/N 850-0330-03/04 and P/N 850-0330-06) contain eight types of alarm connectors. The connectors used are the Remote Maintenance Center (RMC), the Local Maintenance Center (LMC), the Rack Alarm (RALMx), the Row Alarm (ROW ALM), the OAP Alarm (OAPALM), and the External Alarm (EXT ALM). The RMC, LMC, RALMx, OAPALM, and ROW ALM functions use DB-15 connectors, and the EXT ALM connector uses a DB-26 connector. The alarm connectors on the control shelf are designated as follows:

- Remote Maintenance Center Alarm Connector (RMC)—J26 on backplane (P/N 850-0330-03/04) or J33 on backplanes (P/N 850-0330-06) provides system alarm condition indicators to the remote maintenance center.
- Local Maintenance Center Alarm Connector (LMC)—J40 on backplane (P/N 850-0330-03/04) or J47 on backplanes (P/N 850-0330-06) provides the system's alarm condition indicators to the local maintenance center.
- Rack Alarm Connectors (RALMx)— J5, J11, J25, J39, J53, and J61 on backplane (P/N 850-0330-03/04) or J13, J15, J32, J46,J60, J61, J67,and J68 on backplanes (P/N 850-0330-06). The output of the rack alarm connectors control the alarm condition indicators on each control or extension frame fuse and alarm panel.
- OAP Alarm Connector (OAPALM)— J74 (P/N 850-0330-03/04) or J69 on backplanes (P/N 850-0330-06). The OAP alarm connector controls the alarm condition indicators on an OAP frame.
- Row Alarm Connector (ROW ALM)— J27 on backplane (P/N 850-0330-03/04) or J34 on backplane (P/N 850-0330-06). The row alarm connector controls the alarm condition indicators on an end panel at the end of a set of the frames.
- External Alarm Connector (EXT ALM)— J28 on backplane (P/N 850-0330-03/04). This connector is also used for alarm condition inputs from an optional holdover clock.
- CUST Alarm 1— J35 on backplanes (P/N 850-0330-06). This connector is used for alarm condition inputs from an optional holdover clock or customer supplied clock source. This connector is not supported at this time.
- CUST Alarm 2— J66 on backplanes (P/N 850-0330-06). This connector provides input to the system for alarms designated by the customer. This connector is not supported at this time.

System Clock Connectors

The control shelf backplane provides system clock output to the rest of the system from the TDMs. Redundancy is accomplished by allowing TDM A and TDM B to distribute clocks independently of each other. These signals are driven to other parts of the system adhering to the RS-485 standard.

The system clock connectors for A Clock 0 through A Clock 5 are J7, J14, J56, J57, and J63 respectively on backplane (P/N 850-0330-03/04) and J7, J20, J21, J65, J64, and J72 on backplanes (P/N 850-0330-06).

Connectors for B Clock 0 through B Clock 5 are J6, J12, J13, J54, J55, and J62 on backplane (P/N 850-0330-03/04) and J3, J18, J16, J63, J62, and J70 on backplanes (P/N 850-0330-06).

NOTE 1: On control shelf backplanes (P/N 850-0330-06) connectors J6 (ACLK6) and J4 (BCLK6) have been modified to support the High-speed Multiplexer (HMUX) card (EAGLE 5 ISS) which is an integral part of the Large System feature. Control shelf backplane (P/N 850-0330-05) can not be used with the HMUX card.

NOTE 2: Control Shelf Backplane (P/N 850-0330-03/04) can be used with the large system feature in the EAGLE 5 ISS system with minor modifications and the addition of adapter cable (P/N 830-1185-01).

BITS Connectors

The system connects to the Building Integrated Timing System (BITS) clocks using two DB-15 style connectors. The two clocks are labeled Primary and Secondary and are supplied from the central office clock. Both clocks go to both TDMs, where one is selected to provide the system clocks used to provide system timing. The system is at the end of the BITS clock chain and therefore provides termination resistors on the backplane. The BITS connectors are designated as J41 and J42 on backplane (P/N 850-0330-03/04) and J48 and J49 on backplanes (P/N 850-0330-06).

Serial Port Connectors

The control shelf backplane provides an interface for 16 separate serial port connections from the TDMs. These connections provide RS-232 interfaces for terminals, printers, and modems. The system is set up as Data Terminal Equipment (DTE). The serial port connectors are designated as J17 through J24 and J65 through J72 on backplane (P/N 850-0330-03/04) and J24 through J31 and J76 through J83 on backplanes (P/N 850-0330-06).

Interface Connectors

For slots 1 through 8, 11, and 12 on the control shelf backplane, there are two associated DB-26 interface connectors for each slot. These provide interfacing to the outside world in the form of Ethernet networks, SS7 links, or X.25 networks. The interface connectors are designated as J29 through J38, and J43 through J52 on backplane (P/N 850-0330-03/04) and J36 through J45, and J50 through J59 on backplanes (P/N 850-0330-06).

IMT Connectors

Inter-processor Message Transport (IMT) connectors on the control shelf backplane provide connections between the system shelves as part of the two high speed IMT buses. The connections use twin-axial type connectors at J8, J16, J58, and J64 on backplane (P/N 850-0330-03/04) and J23, J22, J75, and J74 on backplane (P/N 850-0330-06).

Shelf Clock Connectors

Connectors for both A and B clocks are provided using 25 pin D type connectors at J9, J10, J59, and J60 on backplane (P/N 850-0330-03/04). System clock connectors are used on backplane (P/N 850-0330-06).

General Purpose Relay Connectors

Connectors J75 (GP01) and J73 (GP02) on backplane (P/N 850-0330-03/04) and connectors J71 (GP01) and J5 (GP02) on backplane (P/N 850-0330-006), provide software controlled, general purpose outputs for the system. Currently, Generic Program (GP01) provides reset signals for any optional OAPs that may be present in the system.

General Purpose Serial Interface Connector

Connector J76 on backplane (P/N 850-0330-03/04) and J73 on backplane (P/N 850-0330-06), provides General Purpose Serial Interfaces (GPSI) for the system. The GPSI also provides communications between an optional holdover clock system and the rest of the system.

Extension Shelf

The extension shelf provides the mounting space for up to 16 Link Interface Modules (LIMs), Multi-Port LIMs (MPLs), E1/T1 MIMs, Translation Service Modules (TSMs), Database Communications Modules (DCMs) and Database Service Modules (DSMs) (mounted in odd numbered slots, requiring two slots), or Application Communications Modules (ACMs). The shelf also contains two HMUX (EAGLE 5 ISS) cards, in card locations 9 and 10 (refer to Figure 3-19 on page 3-33 and Figure 3-20, *"Shelves with DCM and LIM Cards in Control Frame,"* on page 3-34).

NOTE: BHMUX and HIPR cards are installed at the factory or by Tekelec Technical Support and are not installed by customers.

Figure 3-19. Extension Shelf with LIMs

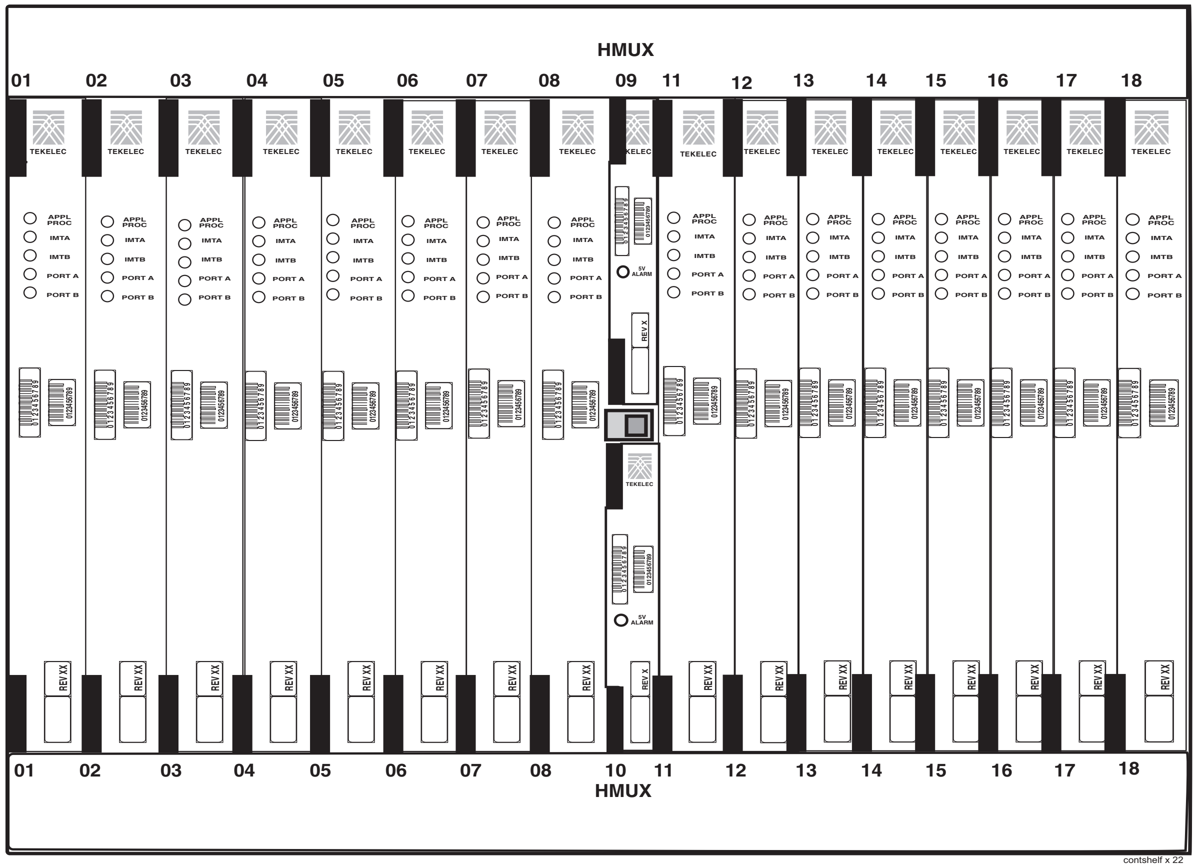
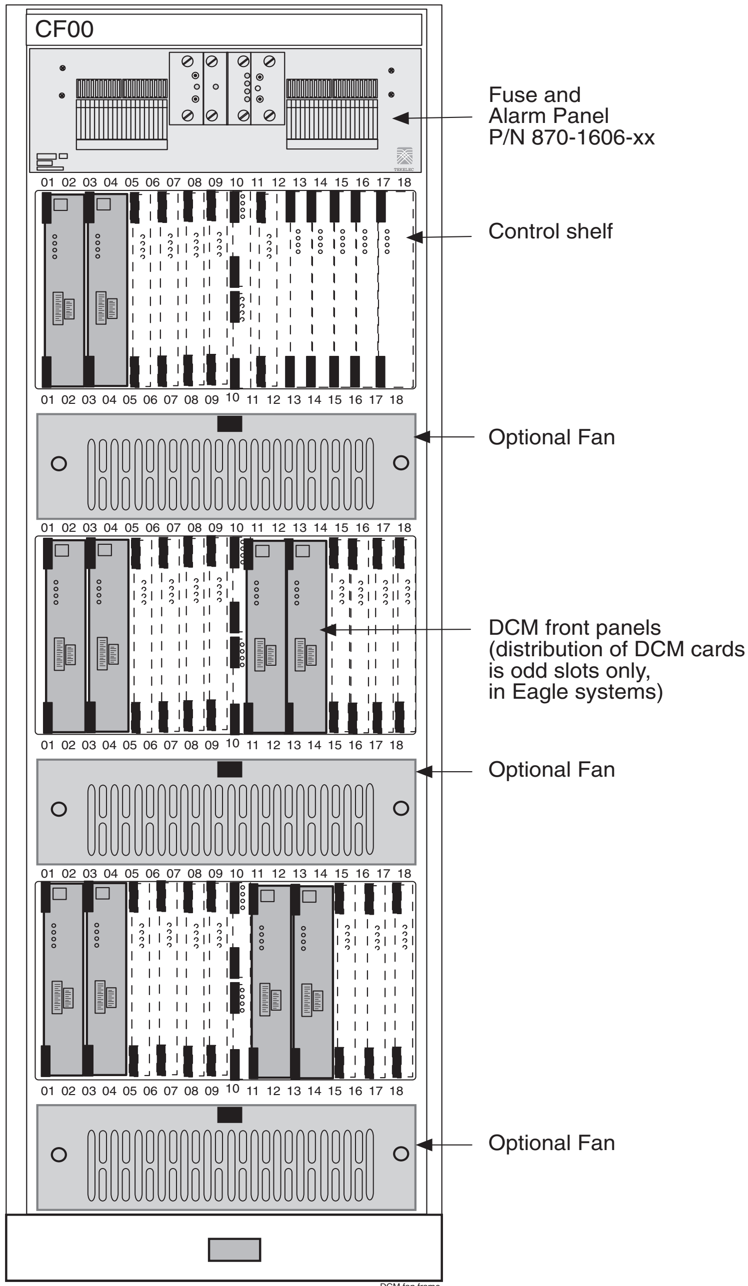


Figure 3-20. Shelves with DCM and LIM Cards in Control Frame



The extension shelf consists of die-formed top and bottom assemblies with die-formed channel slots to accept the top and bottom edges of the cards. The assemblies are anchored to the side panels which are equipped with integral flanges for attaching the shelf to a 23-inch rack in a 26-inch frame. The shelf backplane consists of an epoxy-glass printed circuit board and associated connectors.

The extension shelf backplane is shown in Figure 3-21 "Extension Shelf Backplane (P/N 850-0356-01/02)" on page 3-37. Each card is equipped with a power converter that takes the –48VDC input from the backplane and converts it to +5VDC and/or +3VDC.

Extension Shelf Backplanes

This section discusses the technical aspects of the extension shelf backplanes (P/N 850-0356-03/04/06) and the extension shelf backplanes (P/N 850-0356-01/02) used in the system.

For extension shelf backplanes (P/N 850-0356-01/02) refer to Figure 3-21 "Extension Shelf Backplane (P/N 850-0356-01/02)" on page 3-37

For extension shelf backplanes (P/N 850-0356-03/04/06) refer to Figure 3-22 "Extension Shelf Backplane (P/N 850-0356-03)" on page 3-38 and Figure 3-23 "Extension Shelf Backplane (P/N 850-0356-04/06)" on page 3-39.

The extension shelf backplane provides connectors for 18 circuit cards. These connectors are four column High Density Interconnect (HDI) male headers with shrouds of varying pin quantities depending on card position. The reverse or component side of the backplane contains DB style connectors for interfacing to the rest of the system. The extension shelf backplane provides shielding on all of the interface connectors to prevent Radio Frequency Interference (RFI).

Power Distribution

CAUTION: This is a redundant system to allow service during normal maintenance. When repairs require a total power disconnect both input supply sources must be disconnected. This will cause service interruption and take down the system.

The extension shelf backplane provides –48VDC power and return to all card positions. The power is divided into parts A and B and brought to the shelf from the Fuse and Alarm Panel (FAP) using two cables (P/N 830-0315-xx). The power connectors on the extension shelf backplane are DB-26 high density connectors with two pins per power connection to handle the current load. The current capacity of the connector pins is 1.5A per pin for a total of 3A per pair. The extension shelf primary power connectors are designated as J4 and J1, and the secondary power connection are on backplane (P/N 850-0356-03/04/06) are J45 and J46 secondary.

In the *"Installation manual"* tables list the shelf location, card type, and fuse location in the fuse and alarm panel for the extension shelf backplane.

> **NOTE: Cards that are provisioned in redundant pairs must be on separate power buses. This provides backup processing capabilities with the loss of either A or B buses.**

Interface Connectors

Behind each slot on the extension shelf backplane are two DB-26 connectors. These provide connection to the outside world in the form of TCP/IP networks, SS7 links, or X.25 networks. The interface connectors are designated as J9 through J40.

System Clock Connectors

Each extension shelf receives and passes along Clock signals A (J5 and J6) and B (J41and J42).

IMT Connectors

The extension shelf backplane provides connections for the two high speed Inter-processor Message Transport (IMT) buses. The connections use twin-axial type connectors at J7, J8, J43, and J44.

Figure 3-21. Extension Shelf Backplane (P/N 850-0356-01/02)

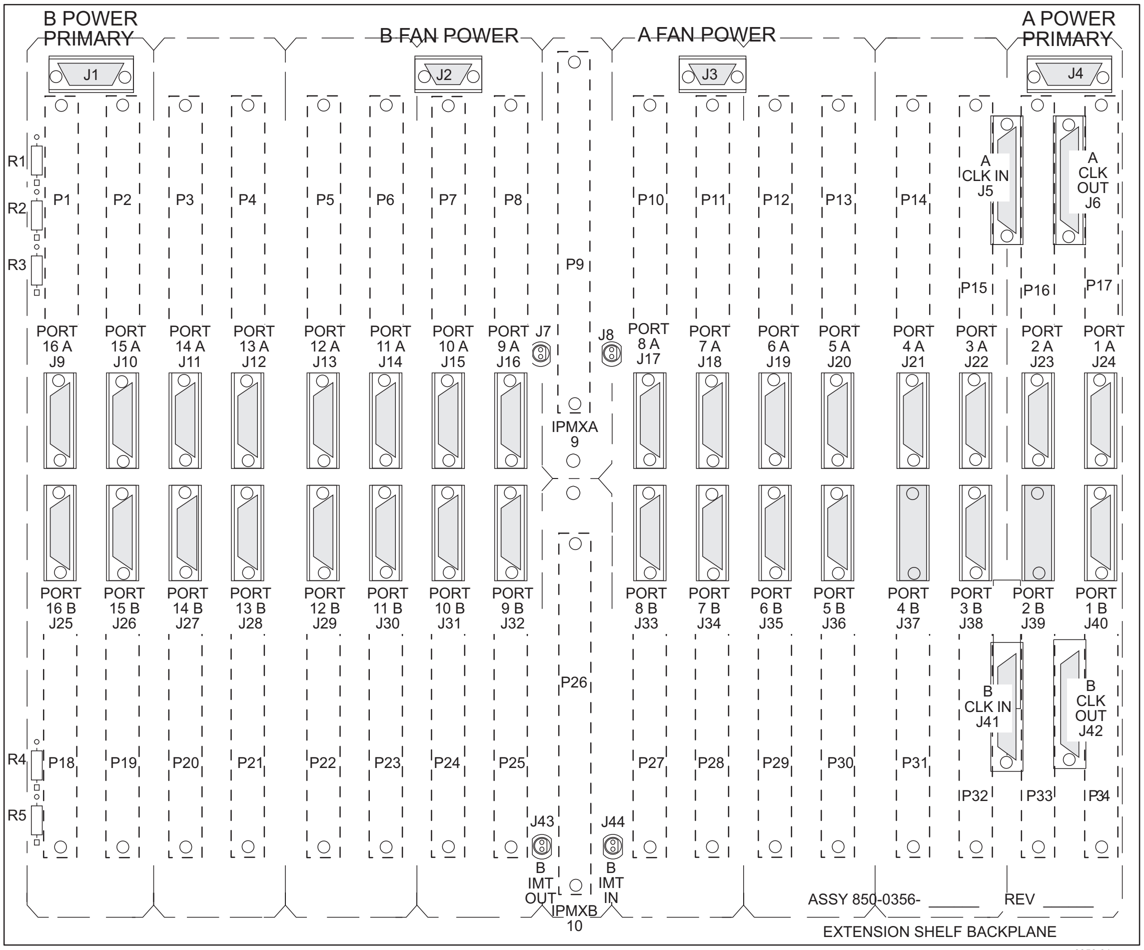
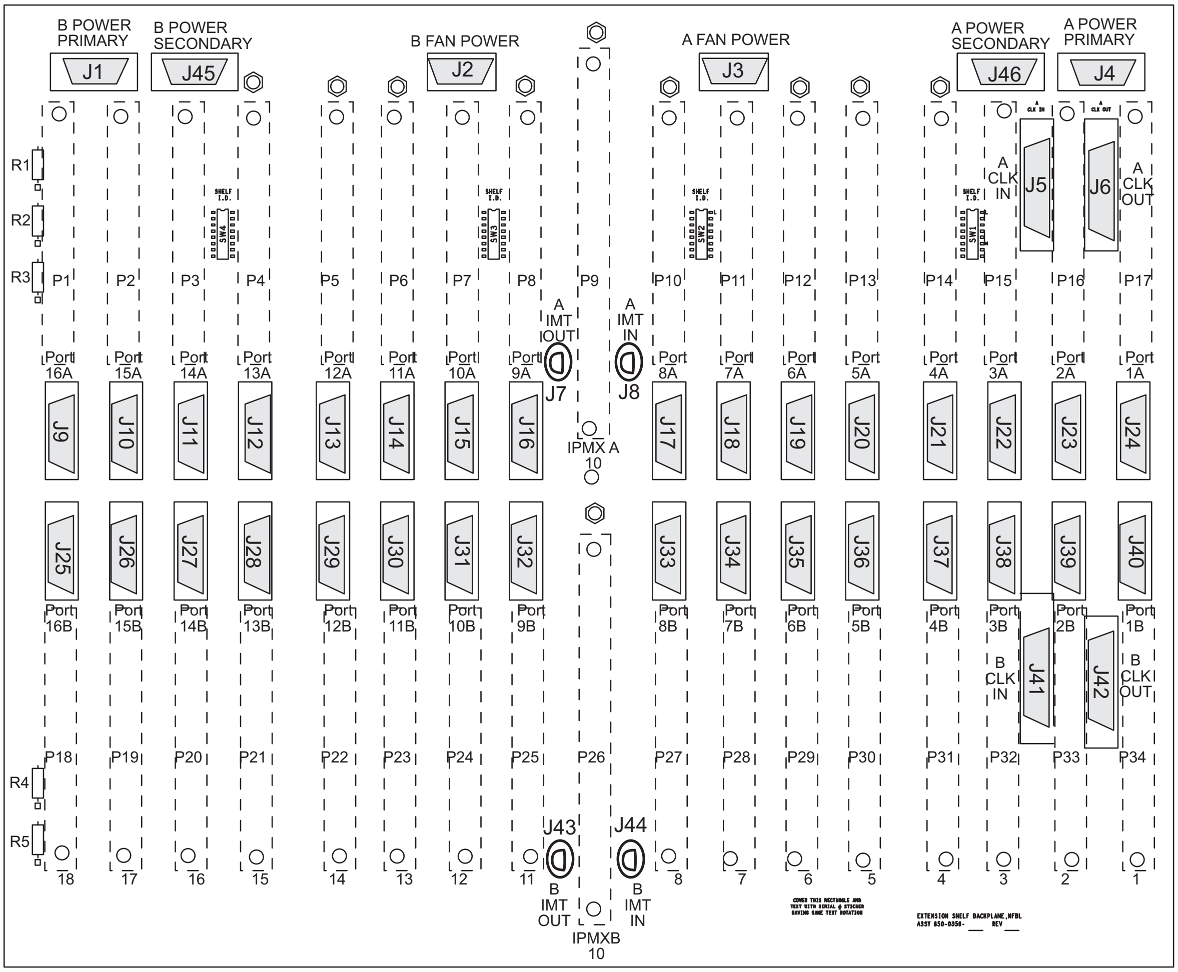


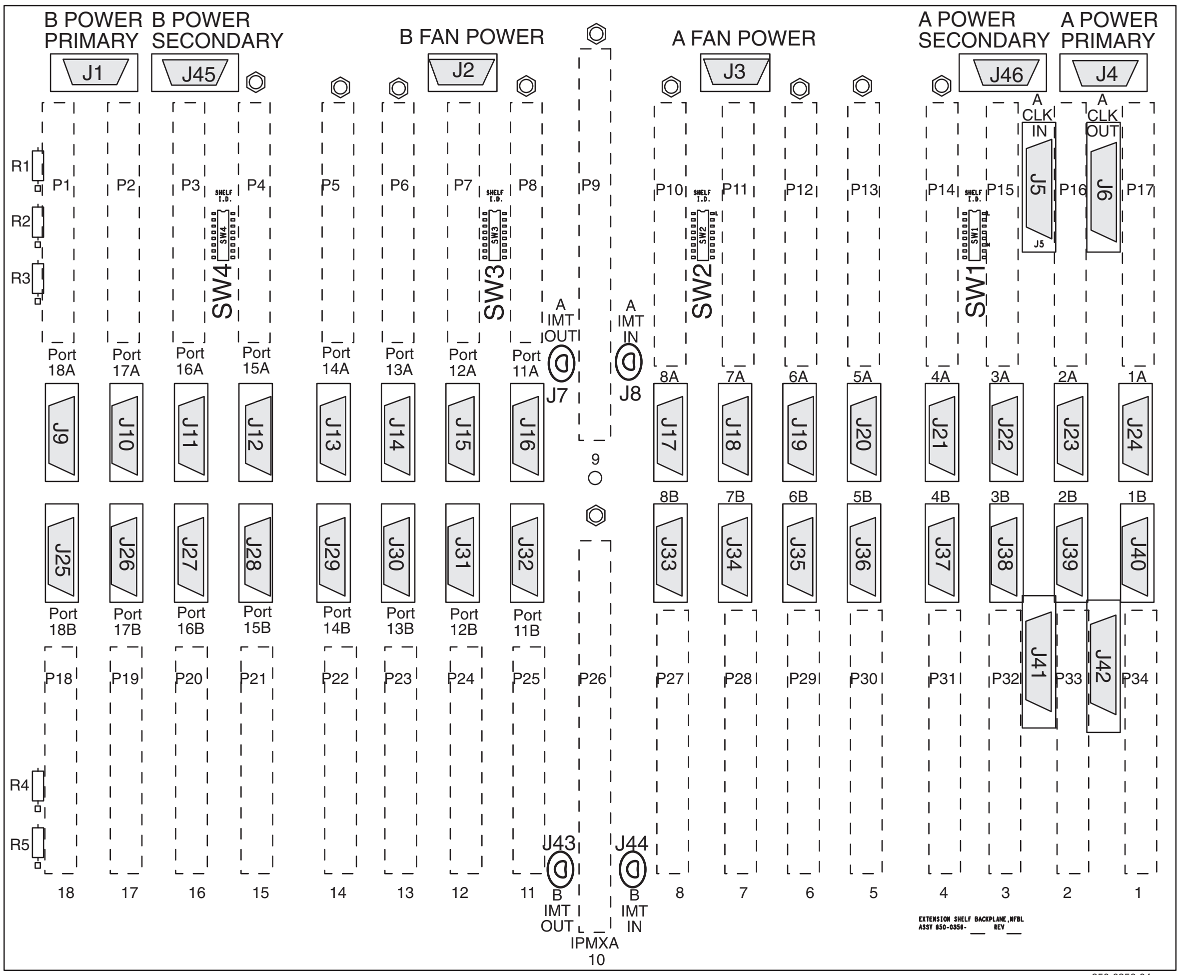
Figure 3-22. Extension Shelf Backplane (P/N 850-0356-03)



850-0356-03

Warning: ⬡ Conducts -48VDC for the printed circuit board (HOT). Metal points on printed circuit boards conducts -48VDC and can cause shorts, shocks, and damage if not handled properly.

Figure 3-23. Extension Shelf Backplane (P/N 850-0356-04/06)



NOTE: Conducts -48VDC for the printed circuit board (HOT)

NOTE 1: The symbols indicate terminals that conduct -48VDC for the printed circuit boards. (HOT)

NOTE 2: Refer to Figures 3-7 through 3-13 for the DIP switch setting on the individual backplanes. The four DIP switches will all be set the same on the individual backplane. The backplanes on different shelves will have different settings.

Technical Specifications

A summary of the technical specifications for the shelf backplanes (P/N 850-0356-01/02 and P/N 850-0356-03/04/06) is provided in Table 3-2.

Table 3-2. Extension Shelf Equipment Specifications

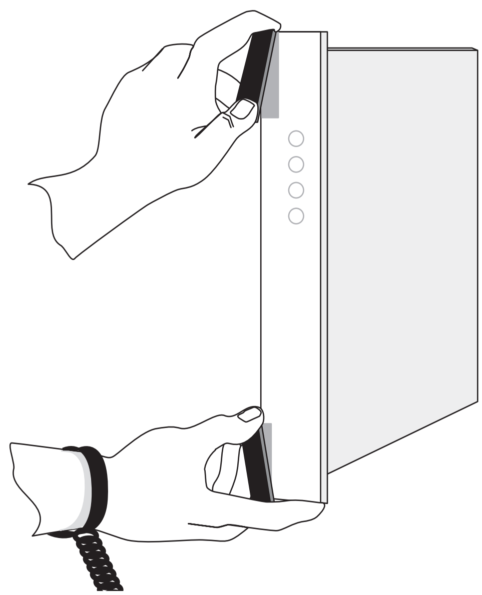
Extension Shelf Dimensions	
Height	15.75 in. (40 cm)
Width	23.00 in. (58.4 cm)
Depth	15.75 in. (40 cm)
Extension Shelf Backplane Dimensions	
Height	15.405 in. (39.1 cm)
Width	21.057 in. (53.5 cm)

Modules

The EAGLE 5 ISS frames are configured with card modules (also known as “cards”) that provide specific functions and services. Cards are connected to the shelf backplane through connectors located on the rear of the card. Cam-out/lock-in levers, mounted on the front edge of the card, assist in insertion and removal of the card. Part numbers, LEDs, and tables are also located on the front of the cards.

NOTE: To remove a card use both hands to toggle the levers out from the face of the card. To insert a card, align the card in the slot, push slowly in until the connectors engage and press both levers in until they lock the card in place. To ensure proper seating, the toggle levers must be held in the release position until the locking tabs can engage the upper and lower flange on the shelf. Once the locking tabs on the levers engage the shelf plane, the levers are pressed in toward the card faceplate, and must be flush with the faceplate when the card is completely seated.

Figure 3-24. Cam-Out/Lock-In Levers on Cards



The modules used in the system are:

- High-Speed IMT Packet Router (HIPR)

  NOTE 1: The HIPR card is installed by the factory or by Tekelec Technical Support, not by the customer.

  NOTE 2: Shelves must contain either HMUX or HIPR cards. A mixture of HMUX and HIPR cards within one IMT ring is possible, provided HIPR is installed on both IMT A and IMT B on a given shelf. HIPR requires all other shelves be equipped with either all HMUX cards or all HIPR cards (shelves cannot contain a mix of HMUX and HIPR).

- High-Speed Multiplexer Card (HMUX)

  NOTE: The HMUX card is installed by the factory or by Tekelec Technical Support, not by the customer.

- Maintenance Disk and Alarm Card (MDAL)
- Terminal Disk Module (TDM)
- General Purpose Service Module (GPSM-II)

  NOTE 1: GPSM-II cards are required for the Integrated Sentinel and Time Slot Counter (TSC) synchronization features.

  NOTE 2: The GPSM-II card is installed by the factory or by Tekelec Technical Support, not by the customer.

- Link Interface Modules (LIM)
- Database Communications Module (DCM) and Database Service Module (DSM) can only be located in odd numbered slots and requires two slots.
- Application Communications Module (ACM)
- Translation Service Module (TSM)
- Integrated LIM Applique Interface (ILA) or Enhanced Integrated LIM Applique Interface (EILA)
- Multi-Port Link Interface Module (MPL) (EAGLE 5 ISS)
- E1/T1 Multi-Channel Interface Module (MIM) (EAGLE 5 ISS)
- High-capacity Multi-Channel Interface Module (HCMIM)
- E5-E1T1
- E5-ENET

The following table summarizes the environmental specifications common to all EAGLE 5 ISS cards. Other technical specifications are listed with the individual card types.

Table 3-3. Card Specifications

Operating Environment	
Operating temperature Short-Term temperature	+ 40° F to + 100° F + 4° C to + 37° C + 23° F to + 120° F –5° C to + 48° C (refer to Note)
Relative Humidity Operating Short-Term	 5% to 85% 0% to 80% (refer to Note)
Altitude	–200 ft. to +13,000 ft. (–61 m to +3962 m)

NOTE: “Short-Term” refers to a period of not more than 96 consecutive hours and a total of not more than 15 days in 1 year. For ambient temperatures above 95° Fahrenheit, relative humidity must be less than 80 percent. At the short-term emergency condition of 120° Fahrenheit, the relative humidity must be below 20 percent.

High Speed IMT Router

The High Speed IMT Packet Router (HIPR, P/N 870-2574-02) interfaces and operates with the high speed fiber channel ring and all EAGLE 5 ISS cards. The HIPR card features a key architectural improvement over existing shelf level switch cards such as HMUX by replacing the legacy low speed shelf ring with a switched design. This move from an intra-shelf ring topology to an inter-shelf switch topology gives a 16 to 1 transmission speed advantage in that a single low speed ring circuit is being replaced with 16 individual switched circuits. The inter-shelf ring connects the shelves together and HIPR acts as a gateway between the intra-shelf IMT BUS, running at 125 Mbps, and the inter-shelf fibre channel ring operating at 1.0625 Gbps.

HIPR feature overview:

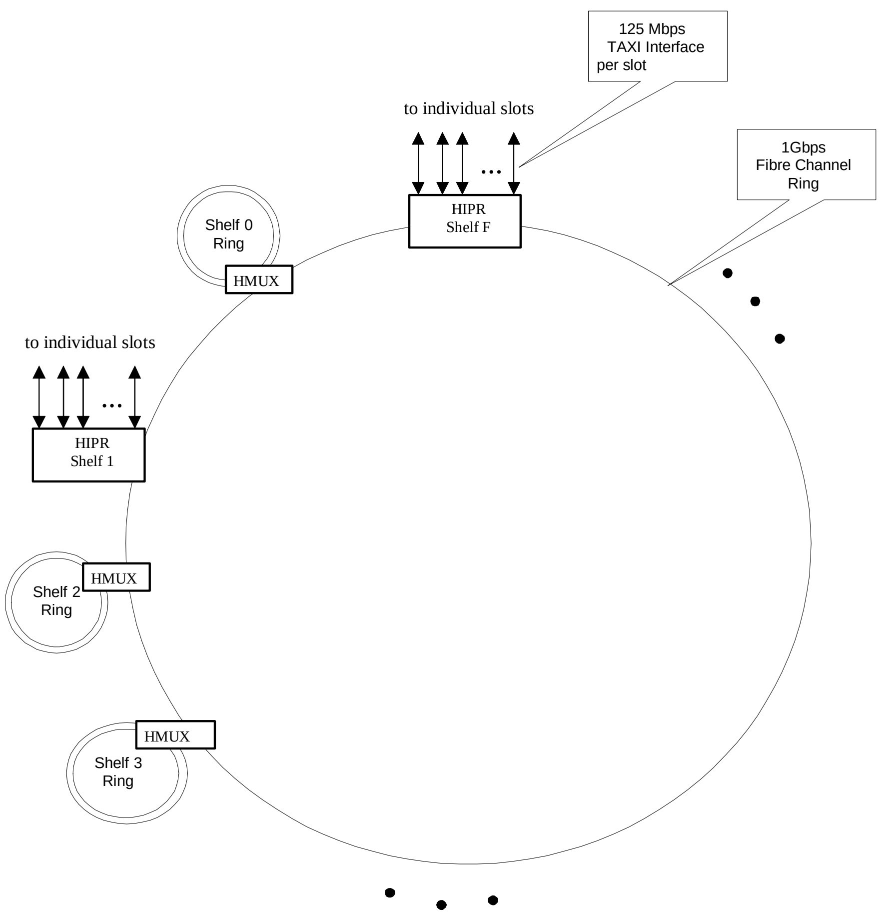
- Switched architecture.
- Serial data transmission rate of 1.0625Gbps for shelf to shelf communications, and 125Mbps on each of 16 switched slots.
- Reprogrammable and upgradeable in the field via software release.
- Fault Tolerance - Errors occurring on a switched slot do not bring down the inter-shelf IMT ring nor affect any other switched slot on its shelf.
- Provides easy upgrade path from HMUX ring architecture.

Switched Architecture

The inter-shelf ring connects the shelves together and HIPR acts as a gateway between the intra-shelf IMT BUS, running at 125 Mbps, and the inter-shelf fibre channel ring operating at 1.0625 Gbps. HIPR retains the high speed 1Gb Fibre Channel ring as a way to ensure interoperability with HMUX equipped shelves. After HIPR recognizes that data from the high speed ring is destined for its shelf address, the data is immediately switched to the correct card within the shelf rather than traversing a 125MB ring.

As shown in Figure 3-25, each HMUX-based intra-shelf ring in an EAGLE 5 ISS is replaced with one HIPR switch, which connects directly to each card in the shelf. This change allows 16 times more bandwidth than in the HMUX-based ring architecture. The fibre-channel inter-shelf ring is the same as for HMUX. In a fully populated EAGLE 5 ISS with HIPR, there are two independent IMT buses.

Figure 3-25. HIPR Switch Topology, Single IMT Bus.



The switched interface to each card is at 125MB, the same speed that the intra-shelf IMT bus runs at. Using this same speed for a switched interface precludes any changes to the existing line cards. Thus, HIPR provides both a speed improvement by switching instead of using a ring, while also minimizes card changes for customers. This switched architecture has an inherent reliability advantage of point to point connections within the shelf. A ring can be broken, potentially causing all cards on the ring to be affected. However, a switched architecture automatically isolates a problem to a specific data path which immediately determines which card is experiencing problems. Trouble shooting and debugging are greatly enhanced. For example, corrupted packets can be isolated quickly because there is only a single path per card rather the multiple paths possible in a ring.

All routing decisions are controlled by the network processor on the HIPR card. A core processor with 6 micro-engines performs the switching function. This software based approach will allow future upgrades without changes to the hardware.

Upgrade Considerations

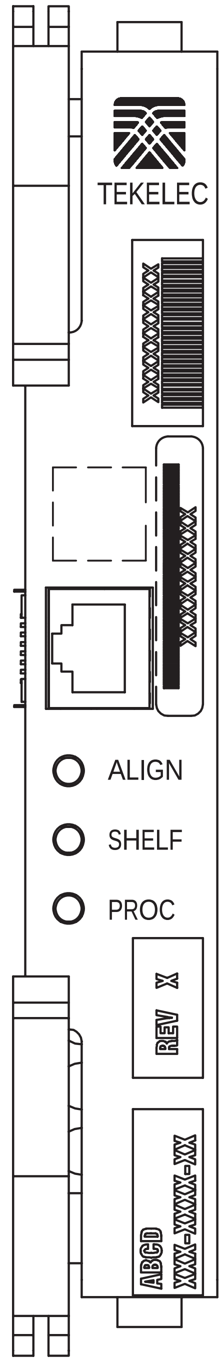
Upgrading a system to use the HIPR card is easy and straight forward. The HIPR card is compatible with the existing HMUX card slot and can be fielded with any version of either the control or extension backplanes compatible with the HMUX. The HIPR card is interoperable with an HMUX in the same shelf when performing upgrades. One bus is taken out of service and upgraded to HIPRs and then brought back online. This upgrade cycle is repeated on the second bus to get both busses upgraded. HIPR interfaces and operates with all the same cards that HMUX is used with.

HIPR is required in shelves equipped with high-performance LIMs, such as the High-Capacity MIM (HCMIM), and for interfacing to Tekelec 1000 Application Servers through IMT Bridge and IMT PCI modules. HIPR requires all other shelves be equipped with either all HMUX cards or all HIPR cards (shelves cannot contain a mix of HMUX and HIPR).

LEDs

Table 3-4 summarizes the use of the front-panel LEDs. Figure 3-26 shows the front faceplate of the HIPR.

Figure 3-26. HIPR LEDs



On the front edge of the HIPR card, there are three Light Emitting Diodes (LED) that provides status. Each HIPR LED has a red, green, or amber illumination state. The ALIGN LED indicates code initialization and programming status. The SHELF LED indicates HIPR running and shelf ID address condition. The PROC LED indicates state of the HIPR processor.

Table 3-4. HIPR front panel LEDs

HIPR State	LED		
	Align (Top)	**HIPR Shelf (Middle)**	**HIPR Processor (Bottom)**
No power	Off	Off	Off
Power on (cold start)	Off	Off	RED
Reset (warm start)	Off	AMBER	RED
Programming FPGA (cold start)	Off	Off	AMBER
Programming FPGA (warm start)	Off	AMBER	AMBER
Programming FPGA Complete	AMBER	AMBER	GREEN
Shelf Address Capture Timer Started	AMBER	AMBER	GREEN
Shelf Address Capture Successful	GREEN	AMBER	GREEN
Shelf Address Capture Unsuccessful	RED	AMBER	GREEN
Code Running	GREEN	Note 2	GREEN

NOTE 1: The Top and Middle LEDs are not accessible to software until the FPGA has been programmed. So for the same point in the HIPR bootstrap sequence, the state of these two LEDs can be different depending on whether a warm or cold start is in progress.

NOTE 2: State depends on the address received from OAM and written to Assigned Shelf Address Register and compared to the value previously read from the Assigned Shelf Address Register:
RED - Does not match
GREEN -Matches

Technical Specifications

Table 3-5. HIPR Technical Specifications

Power Requirements	
Voltage	-48VDC
Current	310mA
Power	15W typical, 22W max.
Physical Characteristics	
Height	7.7 in. (18.3 cm)
Width	1.8 in. (2 cm)
Depth	12.8 in. (32.5 cm)

High-Speed Multiplexer Card

The High-Speed Multiplexer (HMUX) (P/N 870-1965-xx) card, used in EAGLE 5 ISS systems only, supports requirements for more than 1500 links. The HMUX card requires the 850-0330-06 control shelf backplane.

NOTE 1: The HMUX card can be used with Control Shelf Backplane (P/N 850-0330-04) in the EAGLE 5 ISS system with minor modifications and the addition of adapter cable (P/N 830-1185-01).

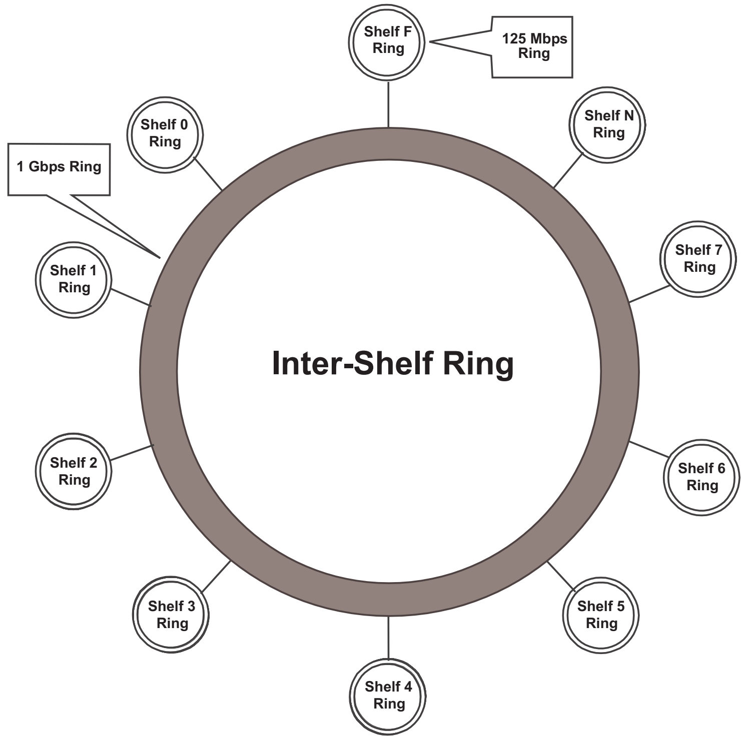
NOTE 2: HMUX cards are required to support the Integrated EAGLE 5 ISS/Sentinel monitoring feature.

NOTE 3: HMUX or HIPR cards are installed at the factory or by Tekelec Technical Support, not by the customer.

With HMUX cards, the IPMX ring topology is broken into separate ring sections, allowing fault tolerance and higher data throughput rates. Each shelf is a separate secondary IMT ring.

The HMUX Card acts as a gateway between the shelf's IMT ring and the inter-shelf ring. Using the HMUX card transforms the EAGLE 5 ISS from a single 125 Mbps ring to a centralized intra-shelf ring running at 1.0625 Gbps, connecting a maximum of sixteen secondary, 125 Mbps shelf rings. Figure 3-27 displays the HMUX ring topology.

Figure 3-27. HMUX Ring Topology



Most messages from one slot to another on the same shelf remain on that shelf's ring. This reduces traffic loading on the high-speed inter-shelf ring. The inter-shelf links form a separate ring used only for inter-shelf communications. The topology changes affect both IMT rings: IMTA and IMTB.

HMUX Addressing

In order to communicate with the GPSM-II card, each HMUX now has its own address in the IMT network. The active OAM selectively sends a physical address shelf ID to each pair (A-bus, B-bus) of HMUX cards on a per-shelf basis. The A-bus and B-bus HMUX cards for a given shelf share the same physical address.

Physical Layout

The HMUX (EAGLE 5 ISS) is designed to plug into the existing shelf backplane, using the same slots the IPMX cards have occupied. Figure 3-28 shows a side view of the HMUX card. Table 3-6 summarizes the technical specifications of the HMUX card.

On the front edge of the HMUX card, there are three Light Emitting Diodes (LED) that provides status. Each HMUX LED has a red, green, or amber illumination state. The HMUX Alignment LED illuminates green when complete code initialization is achieved, amber when programming is complete, and red when failed. The HMUX Shelf identification LED illuminates green when running and ID address matches stored address, amber when complete code initialization is achieved and programming is complete, and red when ID addresses do not match. The Processor health LED illuminates red when power on reset, amber while programming, and green when programming completes, code initialization completes, and code is running.

On the front edge of the HMUX card, there are three Light Emitting Diodes (LED) that provide status. The HMUX LEDs have three illumination states: red, green, or off. The LED illuminates green when the –48VDC is supplied to the card and +5VDC available. If –48VDC is supplied to the card and +5VDC is not available, the LED illuminates red. If –48VDC is not supplied to the card, the LED is off.

Figure 3-28. HMUX Side View HMUX

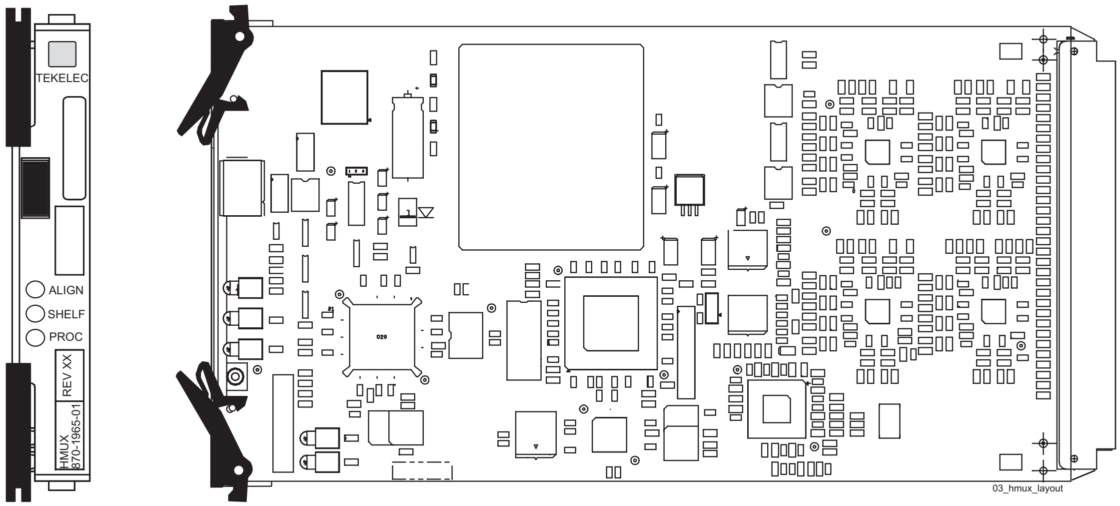


Table 3-6. HMUX Technical Specifications

Power Requirements	
Voltage	-48VDC
Current	3.2A-4.5A
Power	16W typical, 22W max.
Physical Characteristics	
Height	7.7 in. (18.3 cm)
Width	1.8 in. (2 cm)
Depth	12.8 in. (32.5 cm)

Maintenance Disk and Alarm Card

The Maintenance Disk and Alarm (MDAL) card (P/N 870-0773-xx) is a multi-layered circuit card that provides the system with removable cartridge data storage, alarm processing from the currently active MASP, and an audible alarm. A drawing of the MDAL is shown in Figure 3-29 "Maintenance Disk and Alarm Card" on page 3-52.

NOTE: Fan trays are recommended for control shelves on systems implementing large LNP database applications (large means above 1 Gbyte) to prevent overheating of the MDAL card during long backup or restore procedures.

The LEDs on the front faceplate indicate critical, major, and minor alarms and card activity.

Alarm Circuits

The MDAL processes alarms generated from the active MASP and passed to the MDAL on the alarm data bus. The alarm signals are sent as follows.

Critical, major, and minor alarms:

- The fuse and alarm panel of each control or extension rack
- End panel with alarm lamps
- Local Maintenance Center (LMC)
- Remote Maintenance Center (RMC)
- Maintenance Disk and Alarm (MDAL) card

Audible alarm is sent to:

- Local Maintenance Center (LMC)
- Remote Maintenance Center (RMC)
- Maintenance Disk and Alarm (MDAL) card

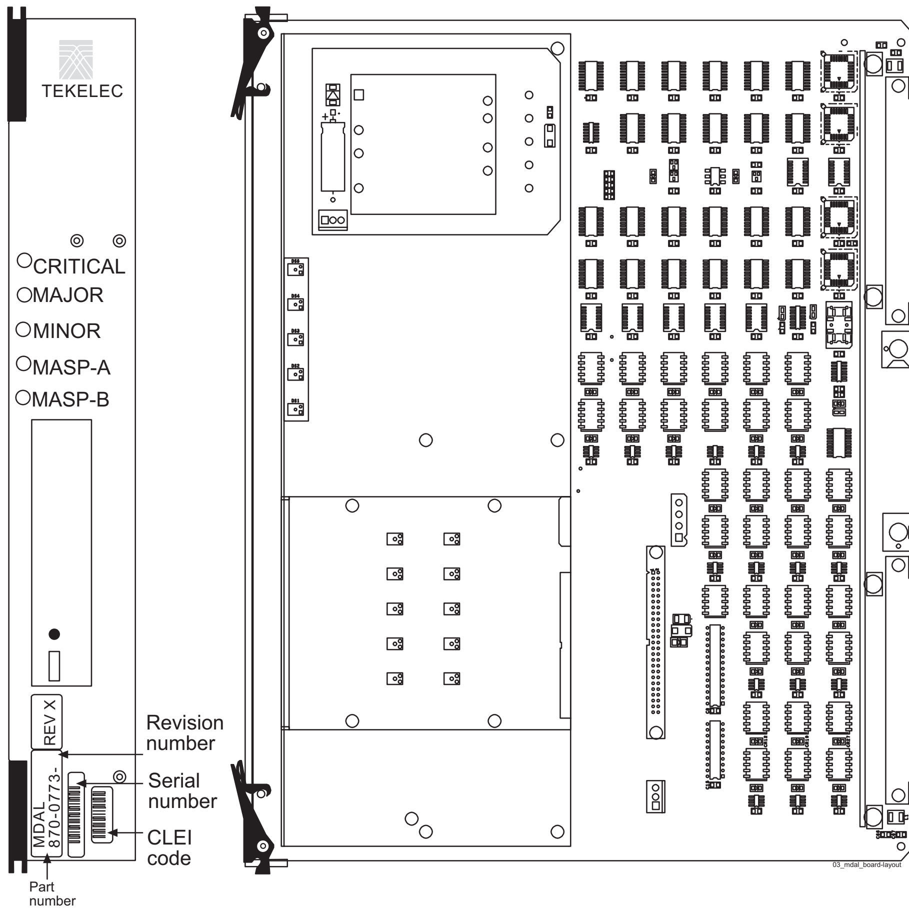
Removable Media Cartridge

The removable media cartridge is a magneto-optical disk used in the MDAL, (P/N 870-0773-04/-05) to install and back up customer data. For larger capacity equipment compliance and to install and back up customer data, a 5.2 Gbyte cartridge magneto-optical disk may be used in MDAL card (P/N 870-0773-06).

Power Converter Unit

MDAL power is provided by a DC to DC converter that converts the –48VDC supplied to the system to the +5VDC needed to power the MDAL components.

Figure 3-29. Maintenance Disk and Alarm Card



Technical Specifications

The following table summarizes the technical specifications of the Maintenance Disk and Alarm Card (MDAL).

Table 3-7. MDAL Technical Specifications

Power Requirements	
Voltage	-48VDC
Current	0.32 A
Power	16 watts
Physical Characteristics	
Height	14.4 in. (36.6 cm)
Width	1.8 in. (2 cm)
Depth	12.8 in. (32.5 cm)

Terminal Disk Module

The Terminal Disk Module (TDM) (P/N 870-0774-xx) provides the following functions for the EAGLE 5 ISS:

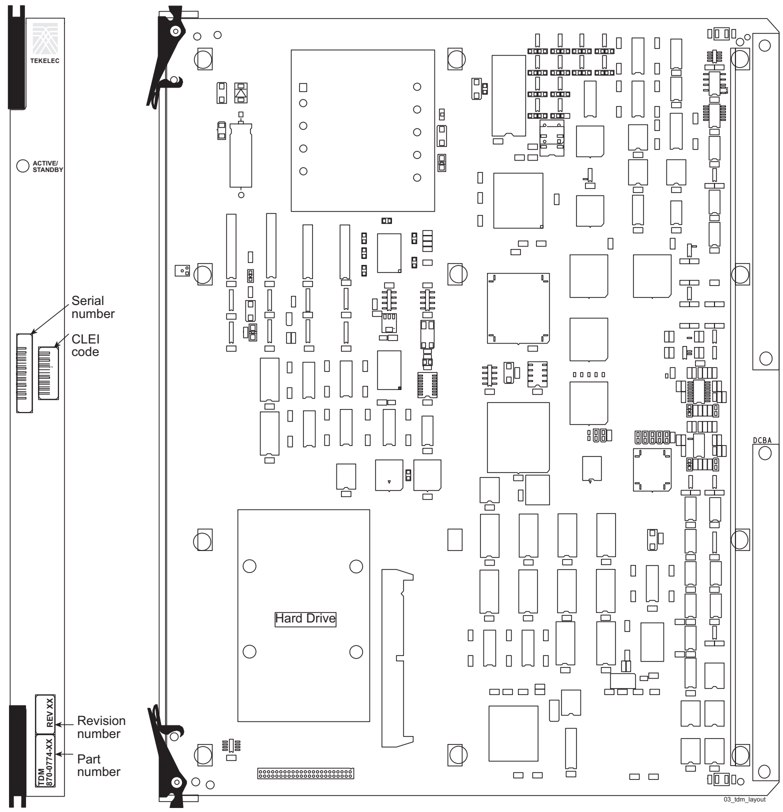
- *Building Integrated Timing System Interfaces*
- *Fuse Alarm Interface*
- *External/Customer Alarm Interface*
- *Maintenance Disk and Alarm Interface*
- *Small Computer System Interface*
- *Terminal Processor*
- *Extended Bus Interface*
- *Global Timing Interface*
- *Hard Drive*
- *Power Converter Unit*

NOTE: The Time Slot Counter (TSC) synchronization capability in the TDM, which is required for the Integrated Sentinel feature, is implemented in TDM board (P/N 870-0774-10 and later).

NOTE: The EAGLE 5 ISS internal composite clock sourced from the high speed clock feature of the TDM-GTI (P/N 870-0774-18) is not available to systems with DS0 cards. Customers with DS0 links can use BITS clocks as the TSC synchronization clock source.

The TDM is shown in Figure 3-30.

Figure 3-30. Terminal Disk Module



Building Integrated Timing System Interfaces

The TDM provides the system's primary and secondary interfaces to Building Integrated Timing System (BITS) composite clocks. The interface is designed to receive composite clock signals that meet the TA-TSY-000378 and TA-TSY-001244 specifications. The positive and negative pulse signals from these interfaces are recovered and used to generate 56 Khz and 8 Khz system clock signals that are driven to the rest of the system. Frequency, pulse width, and bipolar violations are verified for each clock interface and used to determine which composite clock (primary or secondary) is used as the clock source for the 56 Khz and 8 Khz system clocks. Switch-over from the primary to secondary clock and conversely, the switch from secondary to primary clock happens automatically when a verification failure occurs.

Fuse Alarm Interface

The TDM receives fuse alarm signals from the fuse and alarm panels of each frame. Each fuse alarm has two connections, RxFA- and RxFA+. No alarm is indicated with an open circuit between the connections, and an alarm is indicated by a short circuit between the two connections.

External/Customer Alarm Interface

The TDM provides interfacing for up to 10 external/customer alarms. Each alarm has an individual connection along with common contacts through the power ground provided by the control shelf backplane.

Maintenance Disk and Alarm Interface

The interface to the Maintenance Disk and Alarm Interface (MDAL) card consists of an 8-bit bidirectional data bus, five alarm register enable signals, and an alarm clock. The clock Logic Cell Array (LCA) is used to implement the logic for the MDAL card interface.

Small Computer System Interface

The TDM contains two separate Small Computer System Interface (SCSI) buses. Each bus uses an NCR 53C720 SCSI I/O processor as the SCSI bus controller. SCSI Processor A controls the SCSI bus to the fixed disk, which is installed on the TDM. SCSI Processor B controls the SCSI bus connected to the removable disk, which is part of the MDAL card. Both the MASP-A TDM and the MASP-B TDM use this SCSI bus to communicate with the removable drive. The removable drive SCSI bus is always terminated on the MDAL card.

Terminal Processor

The TDM terminal processor interfaces 16 RS-232 terminals to the TDMs associated General Purpose Service Module II (GPSM-II) cards. The core of the TDM terminal processor is an 80C386XL microprocessor. Two 2698 Octal Universal Asynchronous Receiver Transmitter (OCTART) devices are used to interface the 80C386XL microprocessor to the 16 serial terminal ports. The 80C386XL microprocessor receives data from the GPSM-II and transmits it to the terminals.

Extended Bus Interface

The Extended Bus Interface (EBI) links the TDM to its associated General Purpose Service Module II (GPSM-II), in the same Maintenance and Administration Subsystem Processor (MASP), through the EBI host processor bus. The purpose of the TDM is to provide additional logic, memory, and interfacing for the GPSM-II card. The EBI bus interfaces with every function on the TDM, either directly or indirectly.

Global Timing Interface

The EAGLE 5 ISS internal composite clock sourced from the high speed clock feature of the TDM-GTI is not available to systems with DS0 cards. Customers with DS0 links can use the BITS clocks as the TSC clock source.

The TDM Global Timing Interface (TDM-GTI) (P/N 870-0774-18) has enhancements that generate high speed master clocks from a recovered E1/T1 clock and the optional ability to reload the clock's Logic Cell Array (LCA) bitfile when the mated GPSM-II is initialized.

Requirements:

1. The type of external clock introduced into the EAGLE 5 ISS must be compatible with the EAGLE 5 ISS.
2. The location where the external clock is introduced must be recognized by the EAGLE 5 ISS.
3. The external clock must be provisioned to communicate with the EAGLE 5 ISS.

The TDM-GTI has an additional clock feature related to TSC synchronization. The TDM-GTI allows the TSC synchronization feature to be sourced from the high speed clock and to be the master high speed clocking with the following interfaces. The cards use this clock signal to generate a time stamp that is synchronized across the system. This time stamp is required when using the Sentinel monitoring system.

1. New Interfaces:

   a. T1 framed clocking per American Standards National Institute (ANSI)T1.101, Synchronization Interface Standards-1999 .

   b. T1 unframed clocking per section 5 of ITU, Standard G.703. The hardware supports this clock and the FE005011 will be updated to include this clock.

   c. E1 framed clocking per Section 9 of (translation from French, ITU) Consultative Committee on International Telegraphy and Telephone, standard G.703.

   d. E1 unframed clocking per Section 13 of ITU, Standard G.703.

2. Existing Interfaces:

   a. 64/8 Kilo Hertz (KHz) Return To Zero (RTZ) Composite Clock Interface

   b. E1 (2048 KHz) RS-422 Clock Interface

   c. T1 (1544 KHz) RS-422 Clock Interface

Hard Drive

The hard drive on the TDM is used to store primary and backup system databases, measurements, and Generic Program Loads (GPLs). The hard drive capacities are:

- 9GB (TDM 870-0774-10)
- 18GB (TDM 870-0774-11)
- 36GB (TDM-GTI 870-0774-18)

Power Converter Unit

The TDM is powered by an on-board DC to DC converter. The converter accepts –48VDC and supplies +5VDC and +12VDC to the TDM.

Table 3-8. TDM Technical Specifications

Power Requirements	
Voltage	-48VDC
Current	0.46 A
Power	22 Watts
Dimensions	
Height	15.0 in. (38.1 cm)
Width	1.8 in. (2 cm)
Depth	12.8 in. (32.5 cm)

Time Slot Counter Synchronization

The Time Slot Counter (TSC) Synchronization feature is an advanced function enabled in all LIMs. The TSC Synchronization feature does not require any physical hardware changes to any of the boards in the EAGLE 5 ISS. TSC Synchronization is an optional feature for the EAGLE 5 ISS that will allow all cards in the system, which contain a Time Slot Counter, to synchronize with one another. The ability to have synchronized timing between cards is used in applications such as system wide message time stamping.

The TSC Synchronization feature requires the MCAP cards in slots 1113 and 1115 of the control shelf be replaced with GPSM-II cards. The TSC sync feature also requires the associated TDM cards be updated to (P/N 870-0774-10 or later). A typical EAGLE 5 ISS will have two TDMs installed to distribute both the A and B system clocks. The TSC Sync feature has to be enabled on both TDMs. The EAGLE 5 ISS must use an external BITS clock so that the system A and B clocks remain synchronous to each other. If either of the TDMs provides its internal clock to the system instead of the BITS clock, the A and B clocks may drift apart and introduce skew into the system.

After the TSC Sync feature is enabled there may be skew between the A clock and B clock TSC Reset Events. This skew must be detected and eliminated so that cards can switch between the two clocks and stay synchronized to the rest of the system. All cards with a TSC have a Skew Interrupt and the Skew Count register, but the GPSM-II card is unique in that it can communicate with the TDM and adjust the skew.

TSC Sync affects the TDM (P/N 870-0774-10 or later) and all EAGLE 5 ISS cards that contain a Time Slot Counter. This includes:

- E486-based and E586-based cards (ILA, EILA, ILE1, EILA-T, MCAP-256, TSM, E586-T)
- HCAP or HCAP-T
- DCM, DCMX, EDCM and EDCM-A, and GPSM-II (single-slot EDCM)
- MPL, MPL-T, and E1/T1 MIM
- HCMIM, E5-E1T1, E5-ENET

Link Interface Modules

After the frame has been shipped or moved, prior to applying power, remove all cards.
Reset all cards carefully to avoid possible faulty connections.
All cards are hot swappable

The Link Interface Module (LIM) provides access to remote SS7, X.25, IP and other network elements, such as a Signaling Control Point (SCP). The LIMs consist of a main assembly and possibly, an interface applique board. These appliques provide level one and some level two functionality on SS7 signaling links. The types of LIMs presently available are:

- LIM-DS0A is a specialized LIM that provides two Digital Signal Level 0 Applique DS0A interfaces at 56 kbps, (P/N 870-1009-xx). This module uses a DS0A applique. *(This board is no longer shipped but it does exist, in use, in the field, replaced by the LIM-AINF which has been replaced by the Integrated LIM Applique, ILA, and the EILA)*
- LIM-OCU is a specialized LIM that provides two Office Channel Unit (OCU) interfaces at 56 kbps (P/N 870-1010-xx). This module uses an OCU applique.
  (This board is no longer shipped but it does exist, in use, in the field, replaced by the LIM-AINF which has been replaced by the ILA, and the EILA))
- LIM-V.35 is a specialized LIM that provides one V.35 interface at 56 and 64 kbps for SS7 and 4.8, 9.6, 19.2, 56, and 64 kbps for X.25, (P/N 870-1012-xx). This module uses a V.35 applique.
  (This board is no longer shipped but it does exist, in use, in the field, replaced by the LIM-AINF which has been replaced by the ILA, and the EILA)
- LIM, LIM-AINF provides DS0A, OCU, V.35 (software selectable), (P/N 870-1014-xx). This module uses an AINF applique. Some versions of this module are labeled LIM-AINF instead of LIM.
  (This board is no longer shipped but it does exist, in use, in the field, replaced by the ILA, and the EILA)
- LIM-ILA, Integrated LIM Applique, (P/N 870-1484-xx) is an integrated LIM-AINF equal to the same functionality of the LIM-AINF. The difference is the ILA is a single Printed Circuit Board (PCB) without a printed circuit board applique.
- EILA, Enhanced Integrated LIM Applique (P/N 870-2049-xx), is an enhanced integrated LIM-AINF equal to the same functionality of the LIM-AINF. The difference is the larger, 586 processor, of the EILA. In EAGLE 5 ISS release 28.0 an enhanced version of the EILA board (EILA-T) is available.

- The Multi-Port LIM (MPL) (P/N 870-2061-xx), used in EAGLE 5 ISS systems only, provides eight DS0 ports transporting SS7 traffic in a single EAGLE 5 ISS card slot. Ports A and B are backward compatible with the existing two-port LIM card. Additional ports A1, A2, A3, B1, B2, B3 are DS0 interfaces only. In EAGLE 5 ISS release 28.0 an enhanced version of the MPL board (MPL-T) is available.

  The MPL card improves the functionality of SS7 routing within the EAGLE 5 ISS by increasing the number of SS7 links the EAGLE 5 ISS can handle for each LIM card. This allows the EAGLE 5 ISS to interact in larger SS7 networks as well as decreasing the size of an EAGLE 5 ISS (for example, previously 250 cards would be required to support 500 links, now only 63 cards are required).

  NOTE: Link Fault Sectionalization (LFS) logic on the MPL provides diagnostic capabilities though network interfaces on ports A and B. LFS tests sequentially exercise all eight ports.

- The LIM-E1 card, (P/N 870-1379-xx), and the E1 Interface Kit, (P/N 890-1037-06) with backplane module (P/N 850-0459-01) provides a connection point from the system backplane to an external E1 interface. Two E1 backplane modules are located at the rear of the extension shelf, the upper E1 backplane module and the lower E1 backplane module. The upper and lower backplane modules are identical.

- The E1/T1 Multi-Channel Interface Module (MIM) (P/N 870-2198-02 and P/N 870-2198-01), provides a dual-port (A and B), framed, channelized connection to a customer's network. The interface to each port is mapped to the DS0 time-slots in the fractional E1 or T1 data streams. Each E1/T1 MIM supports a maximum of eight High-Level Data Link Control (HDLC) channels that can be provisioned as using either E1 or T1 protocols and assigned to any unused time-slot.

  NOTE: E1/T1 MIM cards do not support internal clocking. E1/T1 MIM cards must be provided with either a composite BITS clock or the High-Speed Master Timing clocks to function properly.

  An extension port is provided to connect other boards in the EAGLE 5 ISS shelf to the E1/T1 data stream such that all channels can be mapped (E1 = 32 channels, T1 = 24 channels). This would require four E1/T1 MIMs to map an entire E1 link or three E1/T1 MIMs to map a T1 link. The two ports (1 and 2) can also be put into an ADD/DROP configuration. The E1/T1 MIM would use a fractional part of the data channel connected to port 1 and forward the remaining channel data through port 2.

  The E1/T1 MIM card requires a new cable T1 MIM LIM (P/N 830-0894-xx) for T1 interface connections. If replacing existing MPL cards with E1/T1 MIM cards the existing T1 interface cables (P/N 830-0772-xx) must be connected to T1 LIM to MPL adapter cables (P/N 830-0895-xx) or replaced with the new cable (P/N 830-0894-xx).

The existing E1 interface cables (P/N 830-0622-xx) can continue to be used with the new E1/T1 MIM card for E1 applications.

The E1/T1 MIM will implement the ANSI T1 standard for 1.544 MHz data transmission and the European (ITU) E1 standard for 2.048 MHz data transmission.

NOTE: Each E1/T1 MIM port will be capable of operation for E1 or T1 line rates but the interfaces will never be mixed on a single circuit card (for example, one port operating at E1 rates and the other port at T1 rates). The E1/T1 MIM does not support clear-channel (no channels) operation.

- LIM-ATM is a specialized LIM that provides one Asynchronous Transfer Mode over T1 Interface at 1.544 Mbps, (P/N 870-1293-xx). This module uses an Asynchronous Transfer Mode Applique (AATM) installed on a High Capacity Application Processor (HCAP or HCAP-T) main assembly.
- E1-ATM LIM provides one Asynchronous Transfer Mode over E1 Interface at 2.048 Mbps, (P/N 870-2455-01). This module uses an E1 Asynchronous Transfer Mode Applique (E1-ATM) installed on a High Capacity Application Processor (HCAP or HCAP-T) main assembly.

NOTE: The LIM-ATM and E1-ATM LIM appliques are not mounted on the 486 based main assembly. See the section *"High-Capacity Application Processor-Based LIMs"* on page 3-70 for more information.

Maximum Numbers of Links

A maximum of 1500 links can be configured in the EAGLE 5 ISS depending on the hardware, software release level, and features that are installed. A mixture of high-speed and low-speed signaling links is supported.

NOTE: If the addition of either a low-speed signaling link or a high-speed signaling link exceeds the total number of low-speed and high-speed signaling links allowed in the system, the ent-slk command is rejected. The addition of a high-speed signaling link decreases the number of low-speed signaling links that can be supported by the system.

Table 3-9, *"Hardware Requirements-Maximum Number of Links,"* on page 3-62 describes the required hardware for the maximum number of links with different configurations.

NOTE: This table lists EAGLE 5 ISS base hardware requirements only. For complete provisioning rules and requirements, including tables listing all link types see the *Database Administration - SS7 Manua*l.

LIM Main Assembly

Table 3-9. Hardware Requirements-Maximum Number of Links

Number of Links	Required Hardware
Up to 500 Links **NOTE: A Maximum of 42 High-speed LIM cards (of which up to 41 can be IPLIMx cards) can be installed**	HMUX cards on the IMT buses 2-port LIM cards or multi-port LIM cards (MPLs) Installed according to the provisioning rules for a system with up to 500 links in the *Database Administration - SS7 Manu*al.
From 501-700 Links **NOTE: A Maximum 100 High-speed LIM cards (of which up to 41 can be IPLIMx cards) can be installed**	HMUX cards on the IMT buses GPSM-II cards installed in card locations 1113 and 1115 TDM cards in locations 1114 and 1116 **NOTE: There are only enough slots to support 500 links using just 2-port LIMs.** Enough multi-port LIMs (MPLs), P/N 870-2061-XX, to bring the total number of signaling links above 500, up to 700. Installed according to the provisioning rules for a system with 700 links in the *Database Administration - SS7 Manu*al.
From 701--1500 Links **NOTE: A Maximum 115 High-speed LIM cards (of which up to 100 can be IPLIMx cards) can be installed**	• HMUX cards on the IMT buses • GPSM-II, P/N 850-0622-XX cards, installed in card locations 1113 and 1115, to run the active OAM • TDM cards installed in card locations 1114 and 1116 **NOTE: There are only enough slots to support 500 links using just 2-port LIMs.** Enough Multi-Port LIMs (MPLs), P/N 870-2061-XX, and/or E1/T1 MIMs, P/N 870-2198-XX, to bring the total number of signaling links to 1500. Installed according to the provisioning rules for a system with 1500 links in the *Database Administration - SS7 Manua*l.

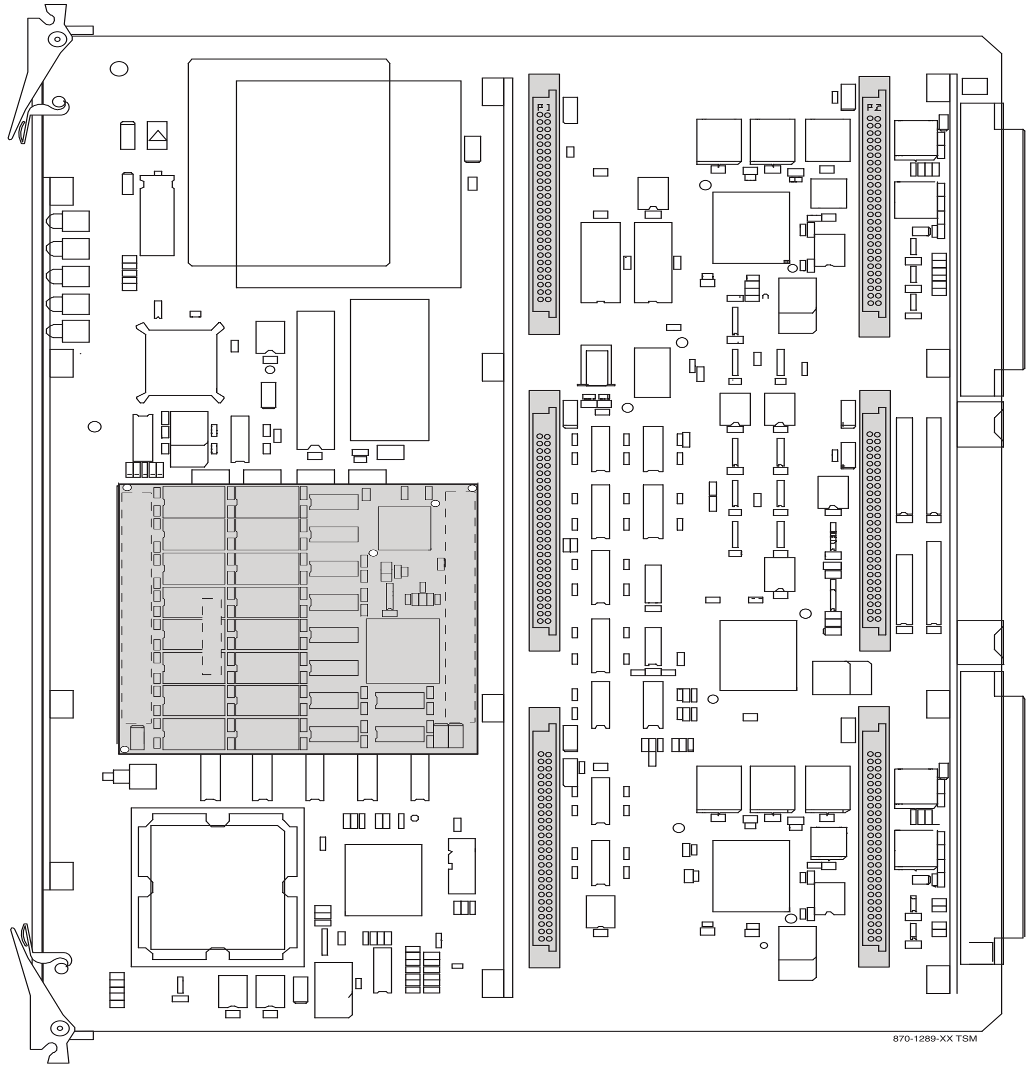
Cam-out/lock-in levers, mounted on the front edge of LIM cards, (the exception being E1) assist in the insertion and the removal of the card from the shelf.

Figure 3-31 shows the LIM Main Assembly card.

The main assembly portion of the LIM contains the following:

- An 80486 applications processor
- An 80386/80486 communications processor that provides a data transmit/receive interface
- An Inter-processor Message Transport (IMT) interface that provides two 125 Mbps communications links that provide communications between modules
- –48VDC/+5VDC and –48VDC/+3VDC DC to DC power converter units

Figure 3-31. Link Interface Module (LIM) Main Assembly



Applications Processor

The Application Processor (AP) section of the LIM interfaces and controls the operation of the interface applique. The AP's operations are controlled by an 80486 processor and peripherals.

Communications Processor

The Communications Processor (CP) is made up of an 80386/80486 microprocessors and peripherals. The CP section of the LIM controls the flow of transmit/receive data to and from the Inter-processor Message Transport (IMT) buses.

In the receive direction, the CP writes a receive initialization command to the IMT bus. The data packet is checked for the destination. If its destination is this LIM, the format is checked and a Cyclic Redundancy Check (CRC) is performed. The packet is then transferred to the CP memory by Direct Memory Access (DMA).

In the transmit direction, the CP forwards a packet along with 2 CRC bytes, calculated by the IMT circuitry, to the HMUX or HIPR cards (EAGLE 5 ISS) for transmission.

The CP also controls the selection of the IMT buses, A or B. In the other direction, the CP forwards data received from the IMT buses through the AP to the interface port (DB15) connector on the shelf backplane.

The CP is interrupt driven. Eight levels of the interrupts initiated by the IMT, the AP, and the MAS, are administered by a Programmable Interrupt Controller (PIC).

Inter-processor Message Transport

Each LIM unit has two Inter-processor Message Transport (IMT) interface circuits, IMT A and IMT B. The redundant IMT buses are used to transport:

- Generic Program Loads (GPLs) to various circuit cards
- All SS7 and traffic between circuit cards
- Maintenance traffic within the system

In the receive direction, a data packet is checked to see if it is destined for this particular LIM. If it is, the packet is checked for format and a cyclic redundancy check is performed. The packet is then transferred to the CP memory by Direct Memory Access (DMA). If the packet is not destined for this LIM, it is sent back onto the IMT bus towards the next module.

In the transmit direction, the Cyclic Redundancy Check (CRC) is calculated for a packet and the packet is transmitted through the HIPR cards (EAGLE 5 ISS) to the IMT bus.

Power Converter Unit

LIM power is provided by two DC to DC converters that convert the –48VDC supplied to the system to +5VDC and +3VDC needed to power the LIM components.

Test and Maintenance Features

Colored LEDs are mounted on the front edge of the printed circuit board as LIM status and alarm indicators.

Digital Signal Level-0 Applique

The DS0A applique is mounted on the LIM main assembly. A 128-pin and a 60-pin connector engage two male connectors on the LIM main assembly. The DS0A's applique primary function is to provide the LIM with access to the DS0 link. Figure 3-32 "Digital Signal Level-0 Applique" on page 3-66 shows the DS0A applique.

The DS0A applique provides two 64 KHz DS0 ports. The microprocessor on the LIM commands the ISCC to operate in the SDLC mode to transmit and receive an SS7 data stream. The ISCC retrieves and stores SS7 messages in the dual port memory locations on the LIM through Direct Memory Access (DMA).

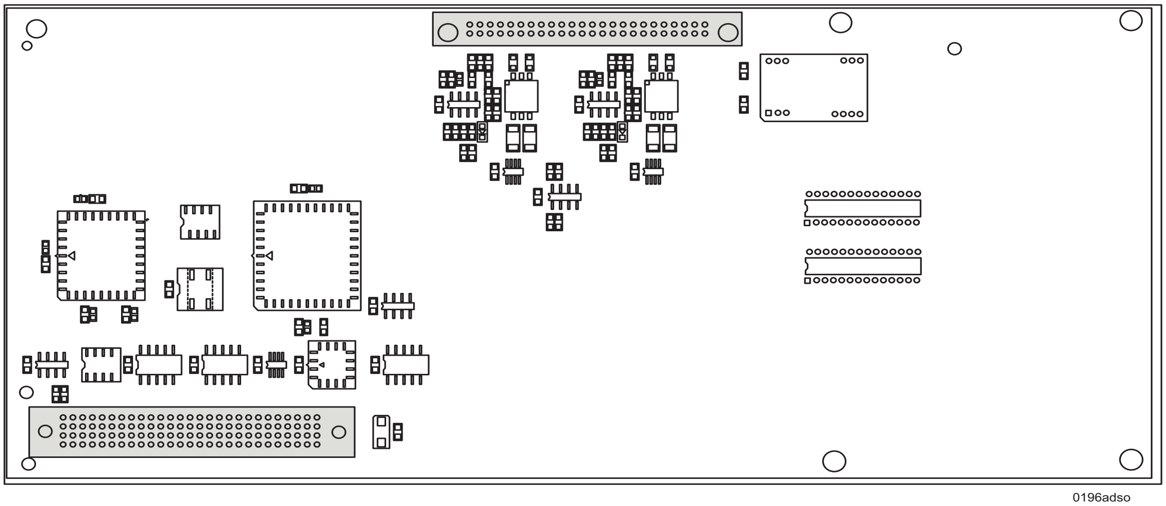
The signal clocking for the DS0A card is provided by system clocks derived from the Building Integrated Timing System (BITS) composite clock signal.

Each DS0 interface has one balanced pair for each direction of transmission and reception. The transmitted data from the ISCC is converted to the bipolar data format before being transmitted to a DS0 link. The received DS0 signal is converted to the NRZ data format before arriving at the ISCC.

The transmitted data is read from the LIM's memory into the Integrated Serial Communications Controller (ISCC) by way of DMA, and a proper data frame, with self-calculated CRC bits, is then transmitted. The DMA method is also used to store good data frames to the LIM's memory.

The ISCC is programmed to assert interrupt in four situations: transmit interrupt, external status interrupt, receive interrupt, and DMA terminal count interrupt.

Figure 3-32. Digital Signal Level-0 Applique



OCU Applique

The Office Channel Unit (OCU) applique is mounted on the LIM main assembly. The OCU applique's primary function is to provide the LIM with access to the OCU link. A 128-pin and a 60-pin connector engage two male connectors on the LIM main assembly.

The OCU applique of the LIM provides two OCU ports. Each OCU port is able to transmit and receive data on 56 kbps OCU channels.

The main components of the OCU applique are:

- Integrated Serial Communications Controller (ISCC)
- Office Channel Unit Logic Cell Array (OCU LCA)
- LXT400, Level 1
- Interfaces A and B

The ISCC works between the applications processor on the main assembly and the OCU LCA to transmit and receive data.

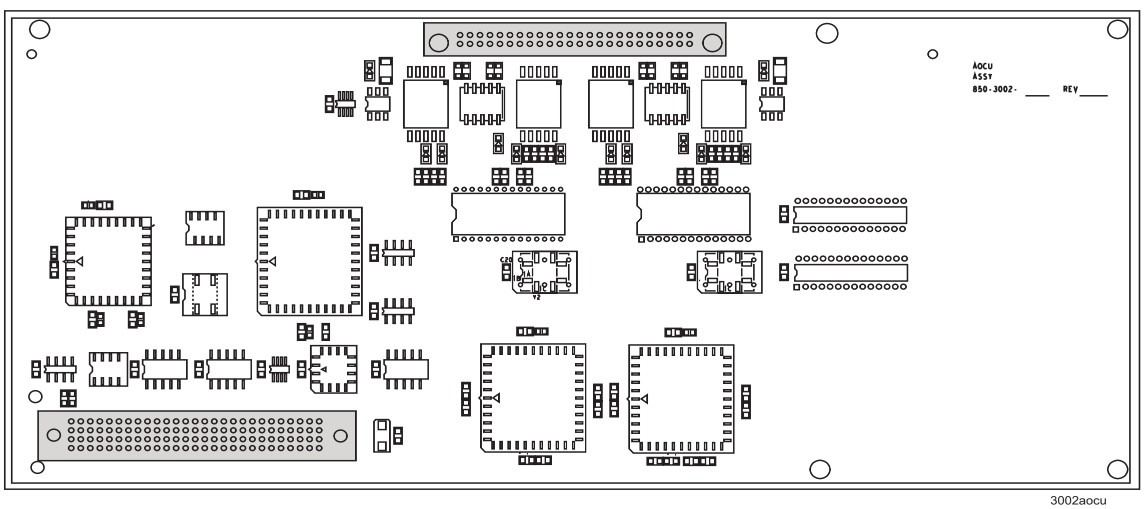
The OCU LCA takes commands from the applications processor on the LIM main assembly, controls the LXT400 Level 1 chip and the interface circuitry, and also reports the status of the OCU link.

The LXT400 Level 1 chip provides the following functions:

- Single chip that includes a transmitter, receiver, and timing recovery for a Dataphone Digital System (DDS) 4-wire telephone line
- Transparent to coding and framing
- Line rate configured for 56 kbps
- Receive equalizer filters are designed to handle up to 49 db at the Nyquist frequency for 56 kbps
- Single master clock input frequency at 4.096 MHz
- Digital back end loopback

The interfaces A and B consist of transformers, relays, relay-drivers, and simplex current generation and detection circuitry. The applique provides connection between the OCU links and the LXT400. The applique contains a voltage converter that converts 5VDC to 15VDC and a current limiter that limits converter output to 20 mA (15VDC).

Figure 3-33. Office Channel Unit Applique



V.35 Applique

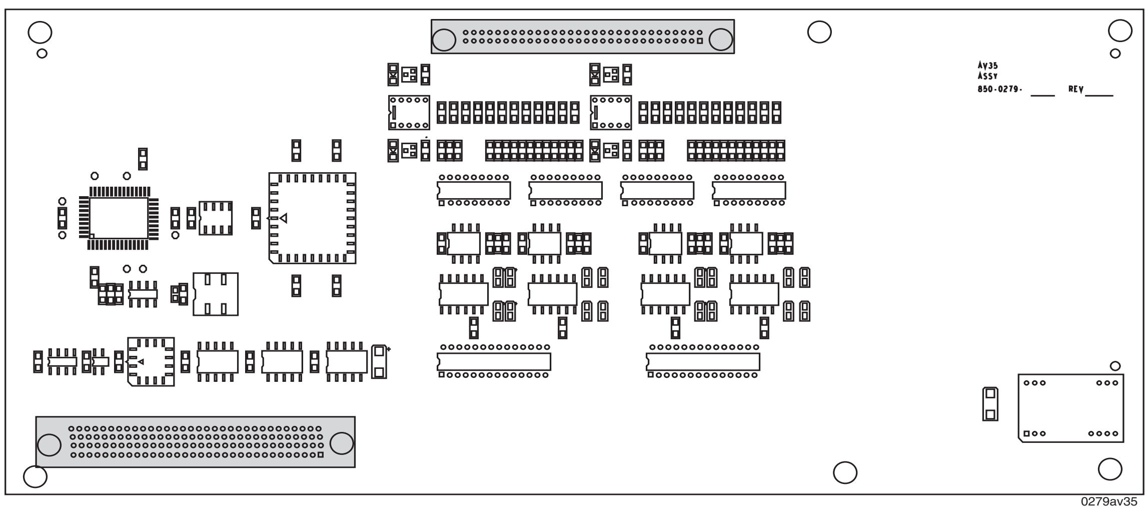
The V.35 applique is mounted on the LIM main assembly. A 128-pin connector and a 60-pin connector engage two male connectors on the LIM main assembly. The V.35 applique's primary function is to provide the LIM with access to devices conforming to ITU-TSS, formerly CCITT, Recommendation V.35.

The V.35 applique of the LIM provides two V.35 ports that can be configured as Data Terminal Equipment (DTE) or Data Communication Equipment (DCE) and has an independent baud rate generator, which is configured using system administration commands at a terminal. When configured as DTE, Request To Send (RTS) is normally high and Data Terminal Ready (DTR) is normally low. When configured as Data Communication Equipment (DCE), Data Carrier Detect (DCD) Receive Line Signal Detect (RLSD) is normally high, while Data Set Ready (DSR) and Clear To Send (CTS) are normally low.

An Integrated Serial Communications Controller (ISCC) is used as the link's controller. The application microprocessor on the LIM main assembly controls the ISCC.

The LIM V.35 applique supports baud rates of 56 kbps and 64 kbps. Figure 3-34 shows the V.35 applique.

Figure 3-34. V.35 Applique



Application Interface Applique

The Application Interface (AINF) applique is mounted on the LIM main assembly. A 128-pin connector and a 60-pin connector engage two male connectors on the LIM main assembly. The AINF combines on a single applique interfaces to DS0A, OCU, or V.35 links.

The AINF applique of the LIM provides one or two OCU, DS0A, or V.35 interfaces for SS7 links. The type of interface provided by the AINF applique is specified by the *ent-card* command (refer to the *Commands Manual)* that is entered during the configuration of the system.

Figure 3-35 "Application Interface Applique" on page 3-69 shows the AINF applique.

The main components of the AINF applique are:

- Integrated Serial Communications Controller (ISCC)
- Application Interface (AINF) Logic Cell Array (LCA)
- Two DS0A interfaces
- Two V.35 interfaces
- Two Office Channel Unit (OCU) interfaces
- Relays for switching between different interface types

An Integrated Serial Communications Controller (ISCC) is used as the link's controller. The application microprocessor on the LIM main assembly controls the ISCC.

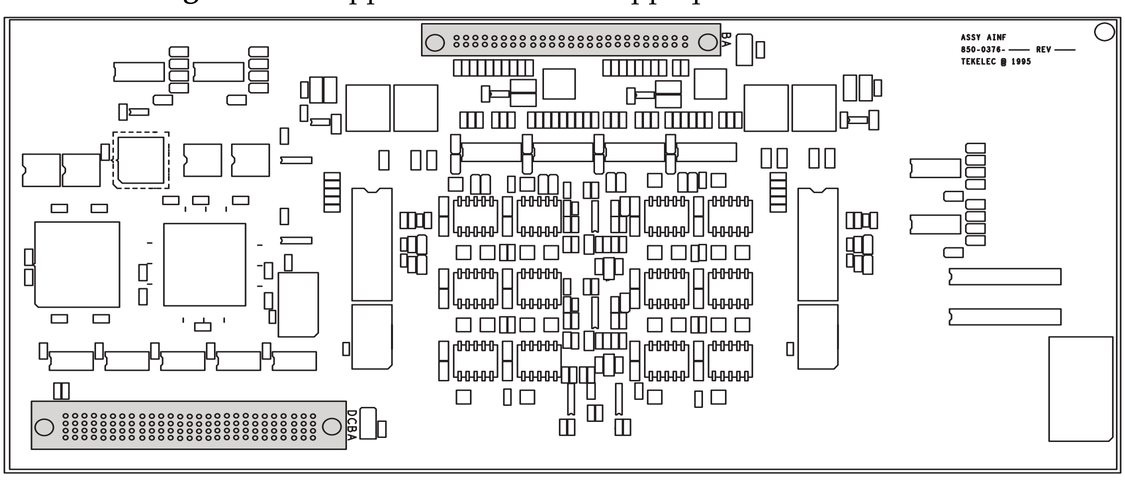
The transmitted data is read from the LIM's memory into the ISCC through Direct Memory Access (DMA) and is then transmitted. The DMA method is also used to store receive data frames to the LIM's memory.

The AINF LCA takes commands from the applications processor on the LIM main assembly to control the interface circuitry, and also reports on the status of the links.

The applique supports line rates of 56 kbps for DS0A, OCU, and V.35 links, and also supports 64 kbps for V.35 links.

The signal clocking for the DS0A type interface is provided by system clocks derived from the Building Integrated Timing System (BITS) composite clock signal.

Figure 3-35. Application Interface Applique



High-Capacity Application Processor-Based LIMs

The HCAP-T (P/N 850-0615-xx) is an improved version of the HCAP main assembly card (P/N 850-0419-xx) that uses less power and has more on-board memory. The HCAP-T is plug-compatible with existing HCAP cards. LIM-ATM and LIM-E1 appliques function the same with either card.

LIM-ATM

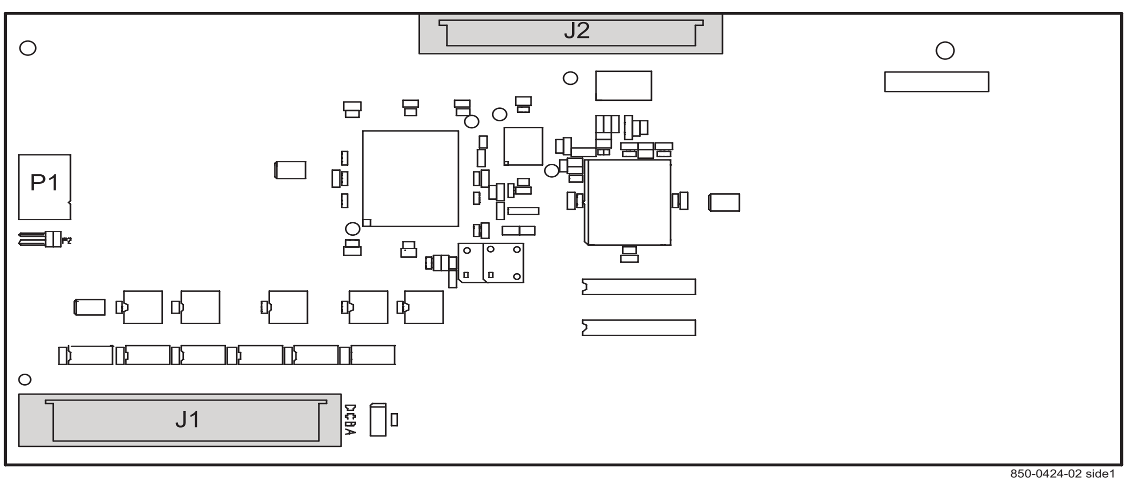
LIM-ATM is a specialized LIM that provides one Asynchronous Transfer Mode over T1 Interface at 1.544 Mbps. This module uses an Asynchronous Transfer Mode Applique (AATM) installed on a High Capacity Application Processor or HCAP-T main assembly. See *"HCAP or HCAP-T Main Assembly"* on page 3-72.

The AATM applique is shown in the following figure and provides one interface for SS7 links.

The main components of the AATM are:

- One Transmission 1.544 MB (T1) Framer Transceiver
- ATM User network Interface
- AATM LCA (Asynchronous Transfer Mode Applique Logic Cell Array)
- One Transmission 1.544 MB (T1) Interface

Figure 3-36. AATM Applique (T1)



E1-ATM

E1-ATM LIM provides one Asynchronous Transfer Mode over E1 Interface at 2.048 Mbps. This module uses an E1 Asynchronous Transfer Mode Applique (E1-ATM) installed on a High Capacity Application Processor (HCAP or HCAP-T) main assembly. The E1-ATM applique provides a new communications capability on the EAGLE 5 ISS, a High Speed Link (HSL) using ATM over E1.

The E1-ATM capability supports a single ATM Virtual Channel Connection (VCC) at a line speed of 2.048 Mbps. To the GLS, LSL LIM, SLAN and SCCP cards, the E1-ATM card looks and operates similar to any other LIM but has increased data throughput. The E1-ATM can perform gateway screening, copy and redirect, conversion and any of the other EAGLE 5 ISS features that an ANSI LIM can perform with the exception of Link Fault Sectionalization (LFS) which is not a requirement for E1 links.

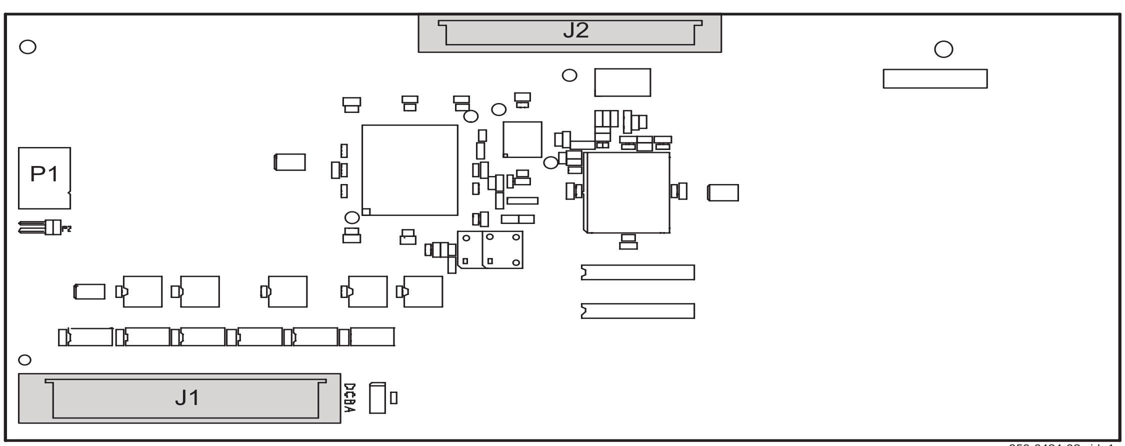
The E1-ATM applique is based upon the ATMANSI feature, which provided ATM communications over T1 links. The E1-ATM supports (2.048 Mbps) link speed instead of T1 link speed (1.544 Mbps), and ITU protocol support instead of ANSI protocols. See the following Figure 3-37 and Figure 3-38 "HCAP Main Assembly (P/N 850-0419-xx)" on page 3-72.

The E1-ATM applique provides one interface for SS7 links.

The main components of the E1-ATM are:

- One Transmission 2.048 MBps (E1) Framer Transceiver
- ATM User network Interface
- One Transmission 2.048 MBps (E1) Interface

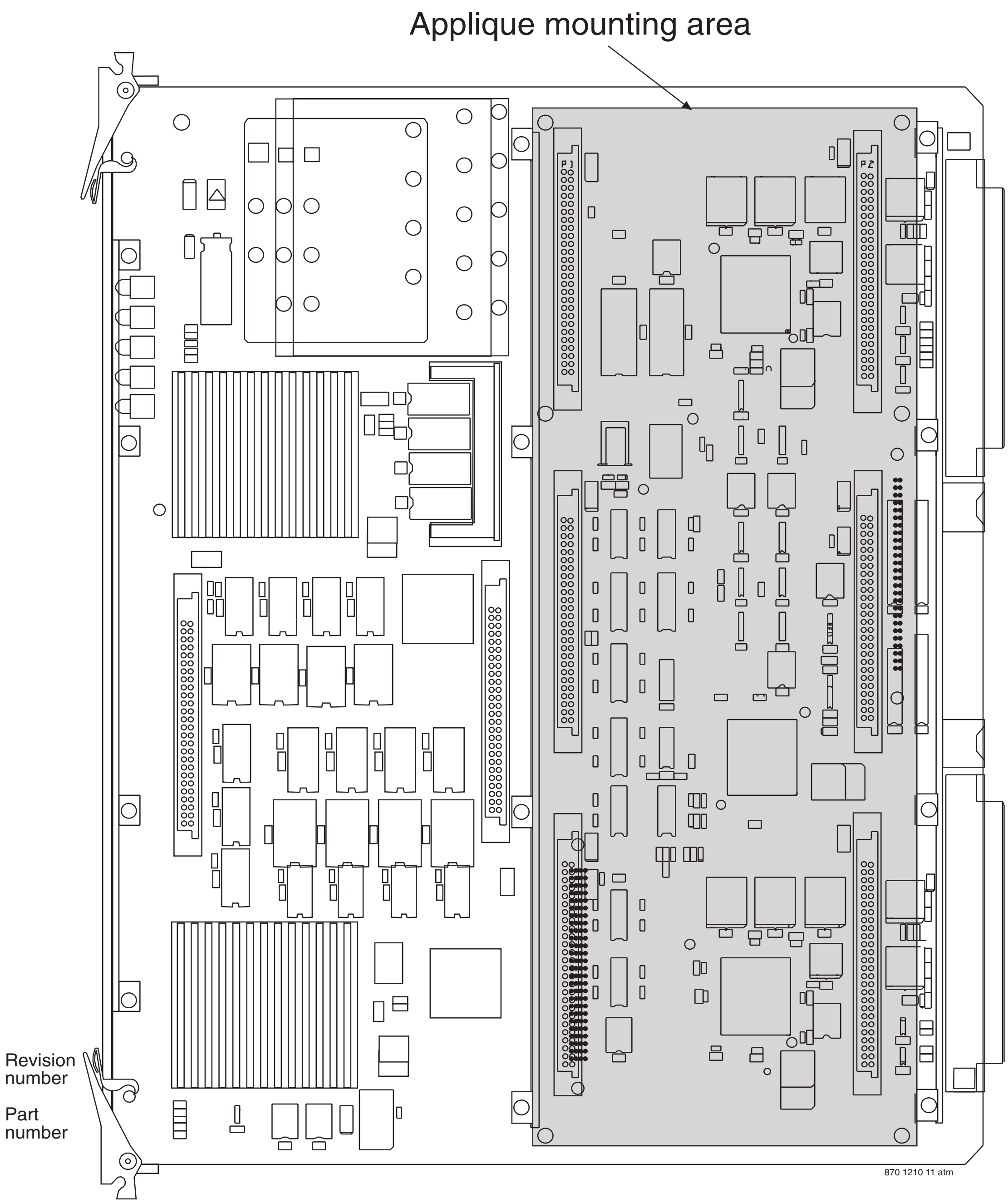
Figure 3-37. E1-ATM Applique



HCAP or HCAP-T Main Assembly

The High-Capacity Application Processor (P/N 850-0419-xx) or HCAP-T (P/N 850-0615-xx) provides the interface between the IMT bus and LIM-ATM or E1-ATM appliques.

Figure 3-38. HCAP Main Assembly (P/N 850-0419-xx)



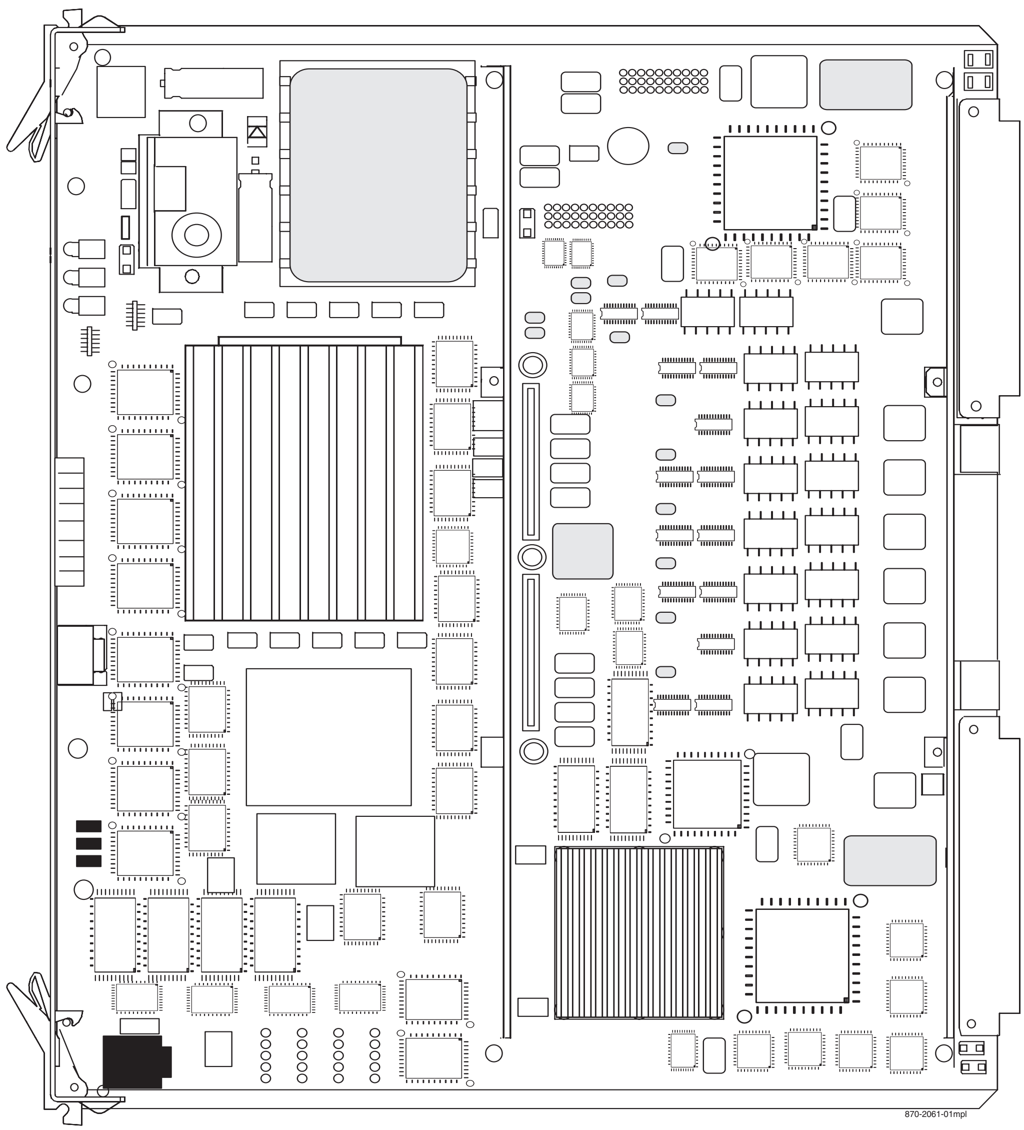
Multi-Port Link Interface Module (MPL)

The MPL card (P/N 870-2061-01) provides eight-port DS0 functionality in a single card slot. The existing two-port (A and B) LIM capabilities are supported with six additional DS0 only ports (A1, A2, A3, B1, B2, B3).

NOTE 1: The MPL is backward compatible with existing two-port DS0 LIMs. Attempts to provision the MPL ports as any type other than a DS0 interface will be rejected. The MPL card is used in EAGLE 5 ISS systems only.

NOTE 2: The MPL card can be replaced with the enhanced performance MPL-T card (P/N 870-2061-02). The MPL-T card is plug compatible with existing MPL cards.

Figure 3-39. Multi-Port Link Interface Module (MPL) (P/N 870-2061-01)



LIM Cards Technical Specifications

The technical specifications of the LIM cards are listed in Table 3-10.

Table 3-10. LIM Card Specifications

Power Requirements	
Voltage	-48VDC
Current	0.6 A
Power	LIM-DS0 (P/N 870-1009-xx) –16 watts LIM-OCU (P/N 870-1010-xx) –17 watts LIM-V.35 (P/N 870-1012-xx) –20 watts LIM, LIM-AINF (P/N 870-1014-xx) –20 watts LIM-E1 (P/N 870-1379-01) –16 watts E1/T1 LIM (P/N 870-2198-01) –20 watts ATM (T1) (P/N 870-1293-xx) –14 watts E1-ATM (P/N 870-1379-01) –14 watts ILA (P/N 870-1484-xx) –20 watts MPL, MPL-T(P/N 870-2061-xx) –20 watts EILA (P/N 870-2049-01) –20 watts
Interfaces	
DS0A	64 and 56 kbps
OCU	64 and 56 kbps
V.35	64 and 56 kbps
ATM (T1)	1.544 Mbps
E1 ATM	2.048 Mbps
E1	2.048 Mbps
T1	1.544 Mbps
HMUX	125 Mbps and 1 Gbps
HIPR	125 Mbps and 1 Gbps
Dimensions	
Height Length	14.4 in. (36.6 cm) 12.8 in. (32.5 cm)

Database Communications Module

The Database Communications Module (DCM) provides the following functions for the system:

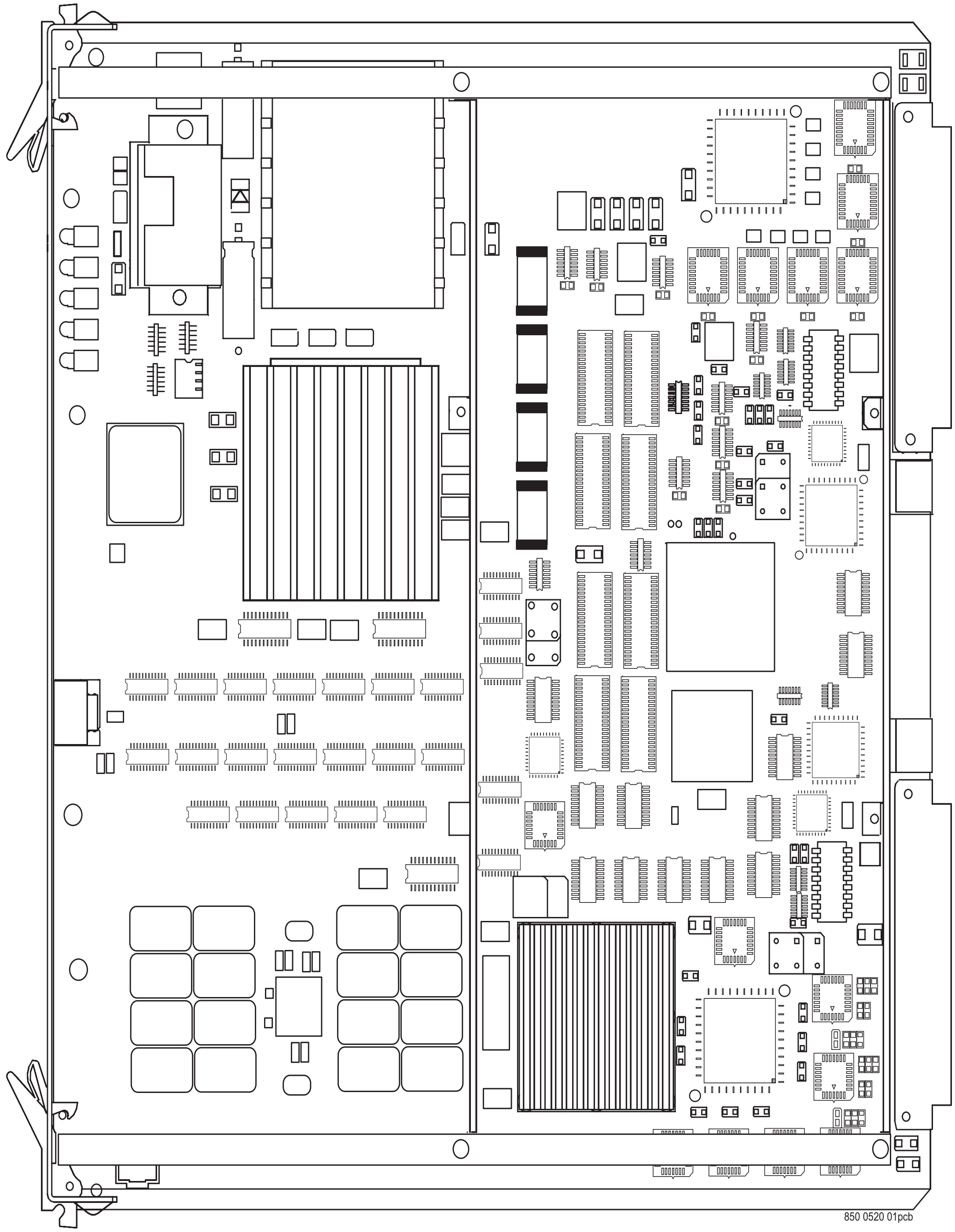
- Signaling Transfer Point, Local Area Network (SLAN) function
- ISUP protocol data exchange between the IMT and the IP network
- SS7 traffic exchange between B,C,D links and the IP network
- Enhanced bulk download
- When configured as a Sentinel Transport Card (STC) provides TCP/IP interfaces to the Extended Services Platform (ESP).
- When configured as an IPLIMx provides a point to point TCP/IP connection to be used to carry SS7 traffic over B, C and D links. This feature will allow multiple point to point connections and not point to multi-point connections. Point to multi-point connectivity is provided by the SS7IPGW GPL.

The DCM card (P/N 870-1984-01) supports one to four plug-in memory cards. The primary board DCM with the addition of memory boards and software creates the Database Service Modules (DSMs).

The DCM card and DSM card can be mounted in the control shelf, require two slots for mounting, and must be assigned to an odd numbered slots with the next higher-numbered even slot left open. The DCM card and the DSM card are compatible with control shelf backplanes (P/N 850-0330-04/06) and extension backplanes (P/N 850-0356-04/06).

A DCM card is shown in Figure 3-40 "Database Communications Module" on page 3-76 .

Figure 3-40. Database Communications Module



Database Service Module

In the EAGLE 5 ISS system primary board DCMX (P/N 870-1984-01) plus memory boards equal Database Service Modules (DSMs). Memory Boards are stacked as indicated in Figure 3-41.

- P/N 870-1984-02 DSM-1G
- P/N 870-1984-03 DSM-2G
- P/N 870-1984-04 DSM-3G
- P/ N 870-1984-05 DSM-4G

Figure 3-41. DSMs with Memory Boards

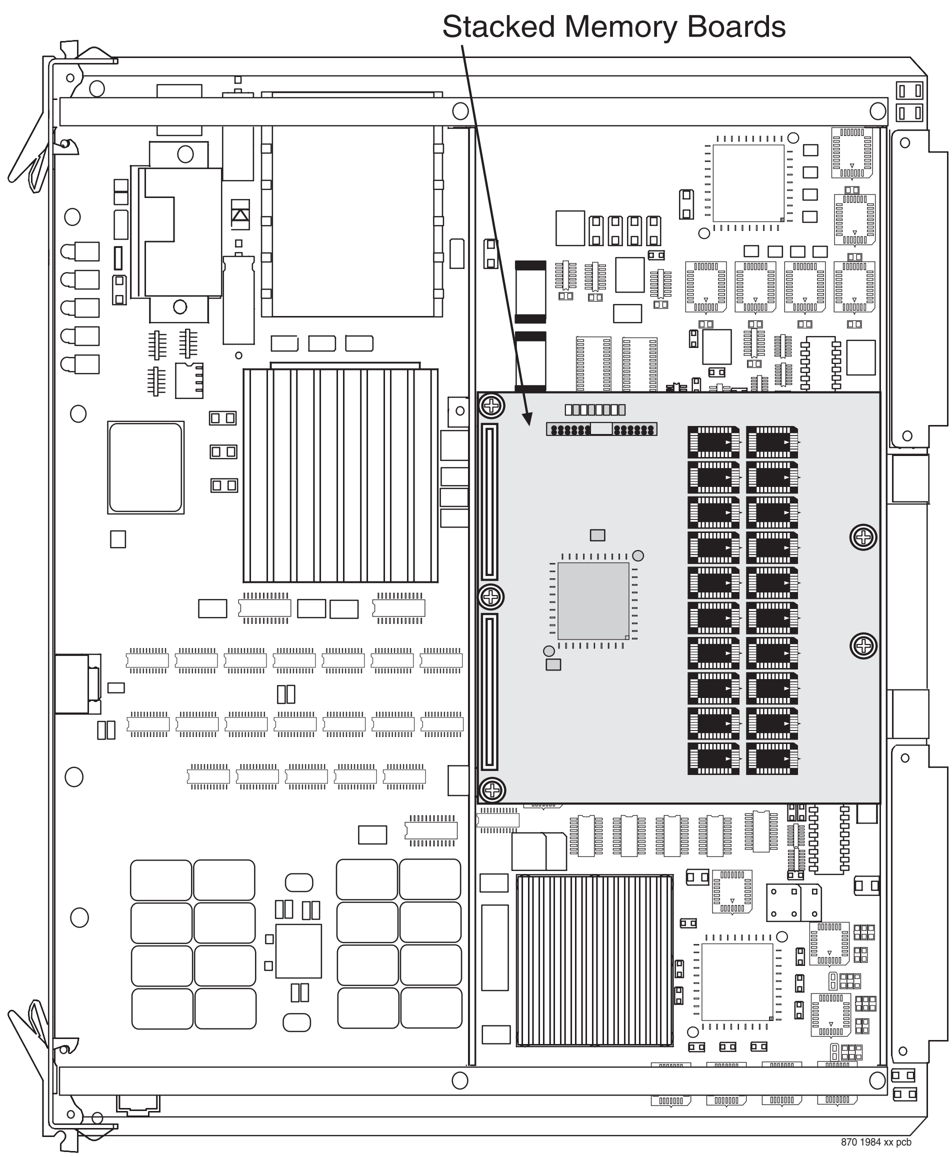


Table 3-11. DCM and DSM Technical Specifications

Power Requirements	
Voltage	-48VDC
Current	0.32A
Power	21 watts
Dimensions	
Height	14.4 in. (36.6 cm)
Width	1.8 in. (2 cm)
Depth	12.8 in. (32.5 cm)

Double-Slot EDCM

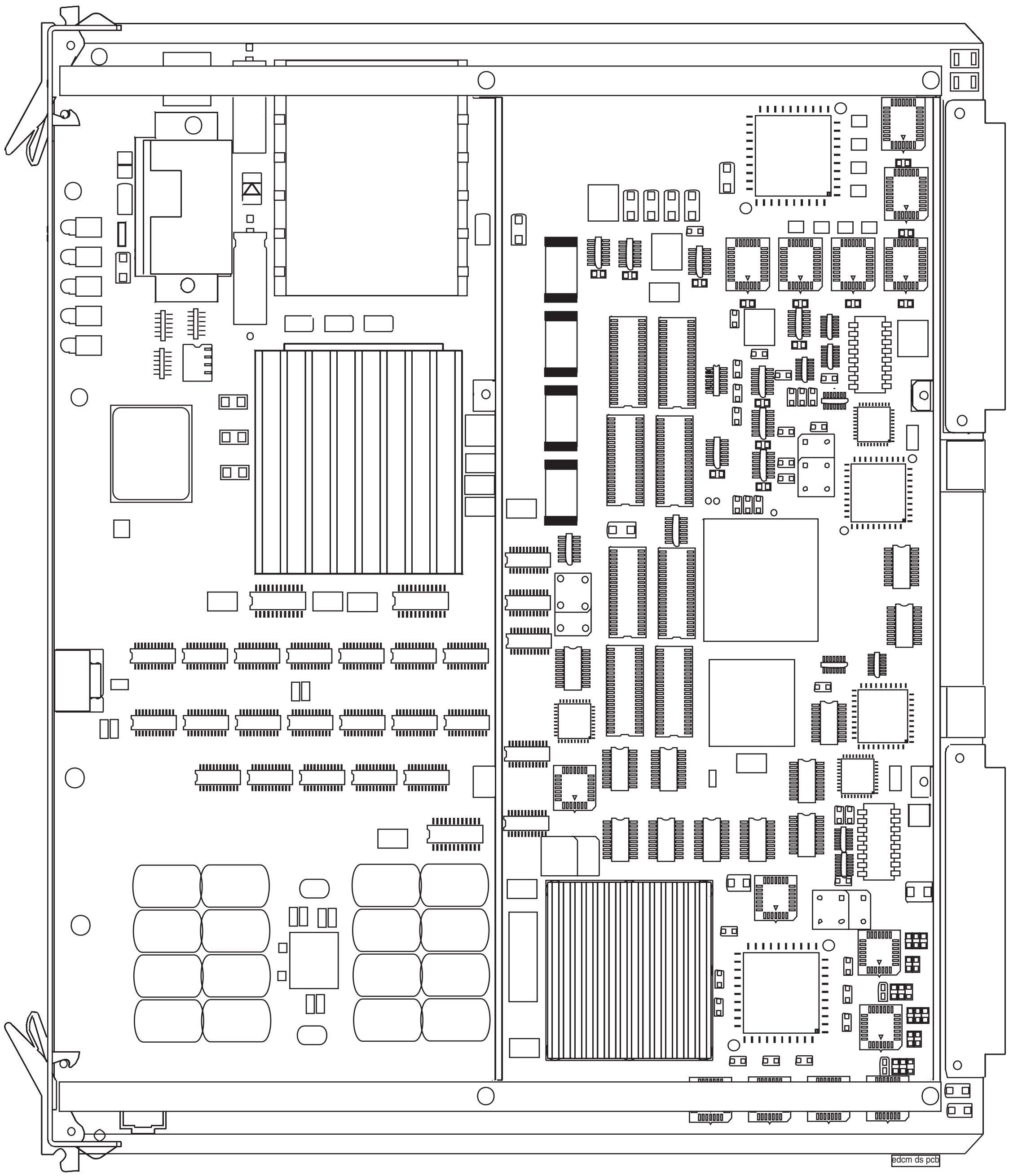
The Double-Slot Enhanced Database Communications Module (P/N 870-2197-01) is a version of the DCM that includes more main memory and better processing performance. The double-slot EDCM can be placed in any slot odd or even that is provisioned. Physically the next higher slot can not be provisioned for a card because of the double-slot EDCM card width. The following list highlights the changes embodied by the Double-Slot EDCM:

- An additional 16 MByte of main SRAM is added to the application processor for a total of 32 MByte.
- 256KByte of dual port memory is used between the Application and Communication processors rather than the 2 MByte of shared memory of the DCM.
- The application processor bus frequency is increased from 50 MHz to 66 MHz.
- The application processor is the AMD K6-IIIe+, an embedded version of the AMD K6-III high-performance processor that is used on the DCM P/N 870-1945-xx.
- The application processor operates at an internal clock frequency of 396 MHz.
- A hardware assist is added such the communications processor can copy packets simultaneously to an IMT Tx FIFO and to main memory.
- Both Ethernet interfaces (A and B) operate at 100 MByte.

The following elements of the Double-Slot EDCM are unchanged from the DCM:

- The Double-Slot EDCM requires two frame slots, just like the DCM.
- The communication processor is unchanged.
- The amount of communication processor main memory is unchanged (2MB).

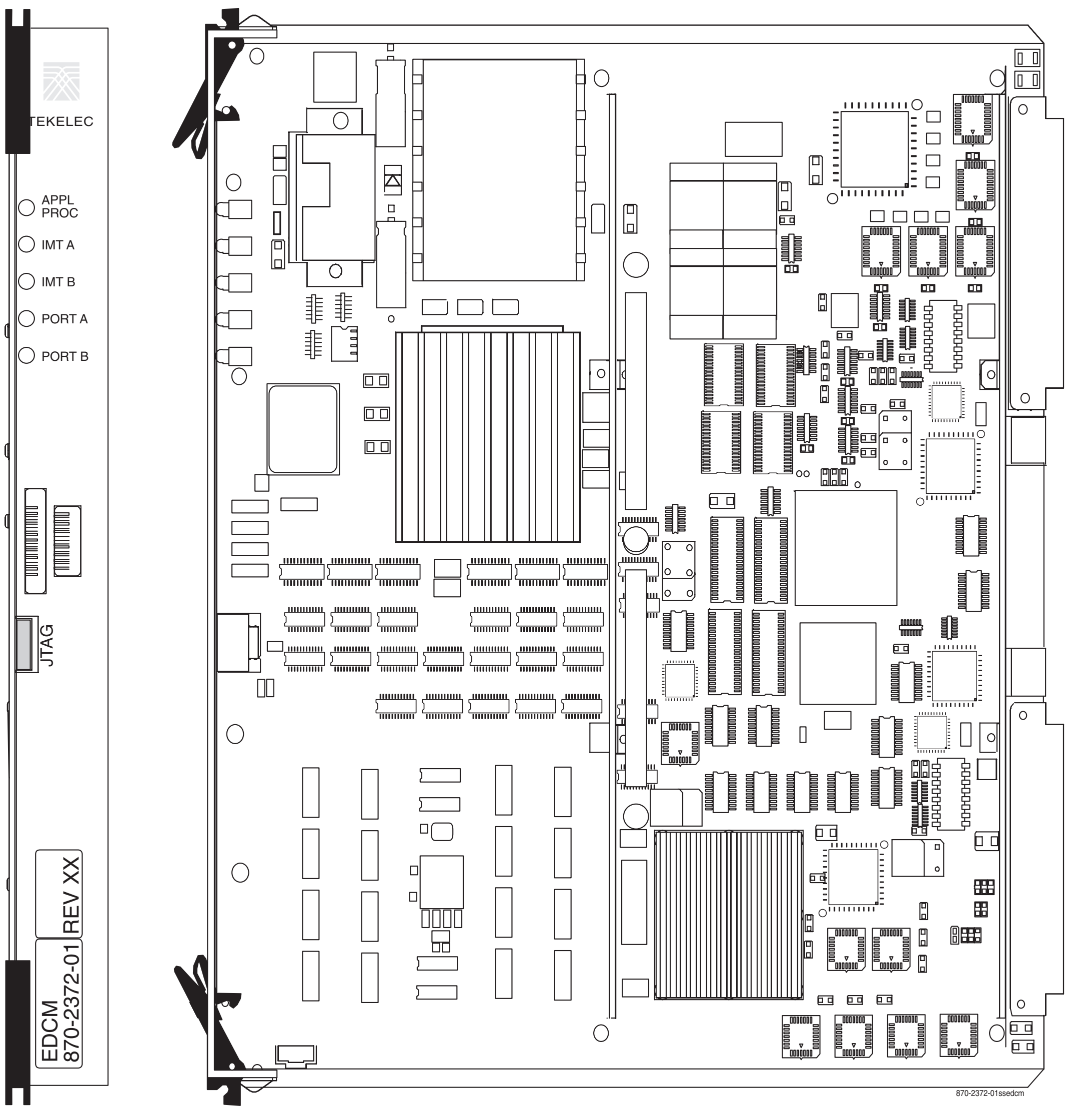
Figure 3-42. Double-Slot Enhanced Database Communications Module



Single-Slot EDCM and EDCM-A

The single-slot EDCM (P/N 870-2372-01) is a version of the EDCM which requires only a single frame slot. It can be placed in any slot, odd or even, which has been provisioned for DCM.

Figure 3-43. Single-Slot Enhanced Database Communications Module



The single-slot EDCM is the base for the following card types:

- Sentinel transport card (STC)
- General Purpose Service Module (GPSM-II)
- Measurements Collection and Polling Module (MCPM)
- IPLIMx feature with eight point capabilities
- IPGW

EDCM-A Replacement Cards

Any EDCM cards that needs to be replaced will be replaced with EDCM-A cards (P/N 870-2508-02). The front of the card and LEDs are the same as the EDCM card. The following performance parameters are applicable for the EDCM-A:

- STC - No change from EDCM (870-2372-01)
- STPLAN - No change from the EDCM (870-2372-01)
- IPLIMx:

  IPLIMx M2PA performance on the EDCM-A (870-2508-02) card can only be guaranteed under the following conditions:

  – 2,000 Transactions/Second (TPS)

  – Up to 4 Associations

  – Average MSU size of 140 Bytes or less.

  If the number of associations or average MSU size is increased above these limits, then performance may fall below 2,000 TPS.

- IPGWx:

  IPGWx performance on the EDCM-A (870-2508-02) card can only be guaranteed under the following conditions:

  – M3UA and TALI only (SUA protocol is not supported)

  – 1,700 TPS

  – Up to 8 Connections

  – Average MSU size of 140 Bytes or less.

  If the number of connections or average MSU size is increased above these limits, then performance may fall below 1,700 TPS.

To maximize throughput per IPGWx card, Tekelec recommends deployment of the same type of DCM cards within a single linkset. For example, EDCM-A cards in a linkset with only EDCM-A cards, and EDCM (870-2372-01/08) cards in a linkset with only EDCM cards. EDCM-As can be deployed within the same linkset with EDCMs; however, if EDCMs and EDCM-As are mixed in a linkset all IPGWx cards within the linkset should be assumed to have a maximum of 1,700 TPS.

Sentinel Transport Card

The Sentinel Transport Card (STC) is a DCM card with an "eroute" generic program load (GPL) installed. The STC is based on the single-slot EDCM card. The STC card functions as an IP router between the IMT bus internal to an EAGLE 5 ISS and the ethernet networks used to communicate with an associated Sentinel Extended Services Platform (ESP).

NOTE: The STCs provide the IP interface between the LIM cards on the IMT bus and the Sentinel Extended Services Platform (ESP) subassembly.

For more information see Chapter 5, *Hardware Descriptions — Sentinel Products*.

General Purpose Service Module

On the front edge of the GPSM-II card, there are five Light Emitting Diodes (LED) that provide status. The GPSM-II LEDs have four illumination states: red, amber, green, or off. The Application processor LED is off if -48VDC is not supplied. The Application Processor LED is red while booting, amber while loading, and green when the application is running. The IMT A and B LEDs indicate whether the GPSM-II is active on the A or B buses. IMT LED red—the card is off the bus, IMT LED amber—testing not complete, IMT LED green—the card is active on the bus. The PORT A and PORT B LEDs are not used in the GPSM-II.

NOTE 1: GPSM-IIs are required replacements for the MCAP cards. The installation is done at the factory or by Tekelec Technical Support, not by the customer.

Measurements Collection and Polling Module

The MCPM is an EDSM-2G card with 32 MB FSRAM and 2 GB RAM.

NOTE: The MCPM card is a requirement for the FTP measurements feature. The FTP measurements feature uses the MCPM ethernet ports to transfer measurements information directly to a FTP server.

On the front edge of the MCPM card, there are five Light Emitting Diodes (LED) that provide status. The MCPM LEDs have four illumination states: red, amber, green, or off. The Application processor LED is off if -48VDC is not supplied. The Application Processor LED is red while booting, amber while loading, and green when the application is running. The IMT A and B LEDs indicate whether the MCPM is active on the A or B buses. IMT LED red—the card is off the bus, IMT LED amber—testing not complete, IMT LED green—the card is active on the bus. The PORT A and PORT B LEDs are illuminated green when the A or B port is active.

IPLIMx with Eight-Point Capability

The IPLIMx to eight points feature provides the ability to support up to eight point to point TALI socket connections on an IPLIMx Single-slot EDCM card. Both ANSI and ITU links are supported.

This feature builds upon on the previous Multipoint IPLIMx feature. The Multipoint IPLIMx feature provided the capability of multiple point to point connections (limited to 2) on an IPLIMx GPL. Multipoint IPLIMx capability was implemented on DCM and double-slot EDCM cards. The IPLIMx to eight Point feature expands the Multipoint IPLIMx capability to support eight signaling link ports. Only SAAL/TALI signaling links are expanded. The presence of any M3UA/SCTP signaling links on an IPLIMx card will result in the enforcement of two signaling links maximum per IPLIMx card.

Application Communications Module

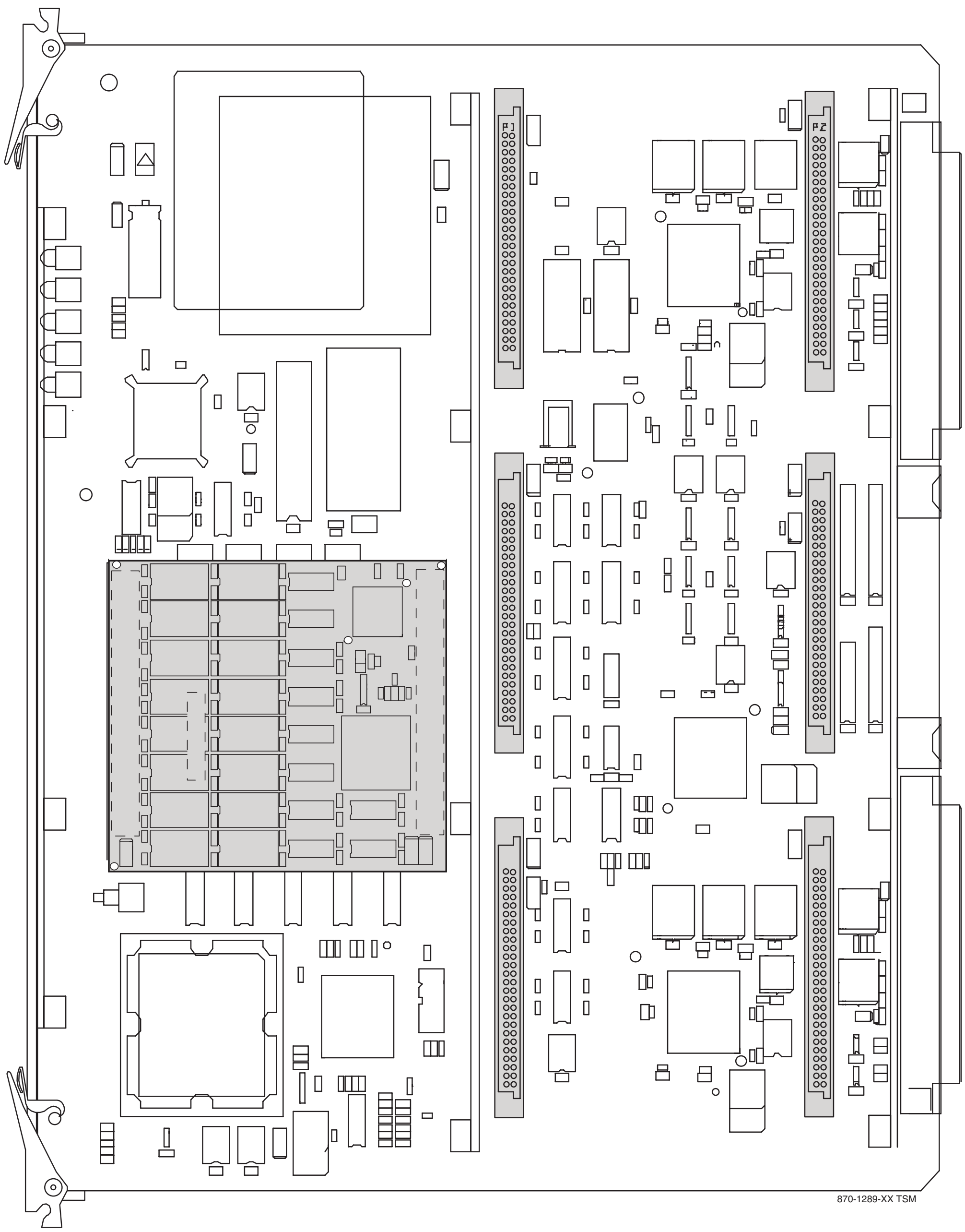
The Application Communications Module (ACM)(P/N 870-1008-xx), provides the system with ethernet 10Base-T access to remote hosts. The ACM consists of a 80486-based main assembly and an applique. Figure 3-44 "Application Communications Module Main Assembly" on page 3-84 shows the ACM card main assembly.

The main assembly portion of the ACM contains the following:

- An 80486 applications processor
- An 80386 communications processor
- An Inter-processor Message Transport (IMT) interface that provides two 125 Mbps communications links which provide communications between modules.
- –48VDC/+5VDC and –48VDC/+3VDC DC to DC power converter units

CAUTION: It is Tekelec's recommendation that cards running the SCCP application be uniformly distributed in the EAGLE 5 ISS to provide a more even SCCP load distribution. During normal operation unevenly distributed SCCP cards in an EAGLE 5 ISS would not have any network or system impacts. However, should a particular SCCP card database(s) become corrupted, inconsistent, or at a different level, depending on the amount of service provided by that card and the extent of the database issue, network impacts can occur.

Figure 3-44. Application Communications Module Main Assembly



Ethernet Applique

The Application Communications Module (ACM) Ethernet applique is attached to the ACM main assembly and provides a communication interface between the ACM and an external host system across an Ethernet LAN. Figure 3-45 "Application Communications Module Ethernet Applique" on page 3-85 shows the applique.

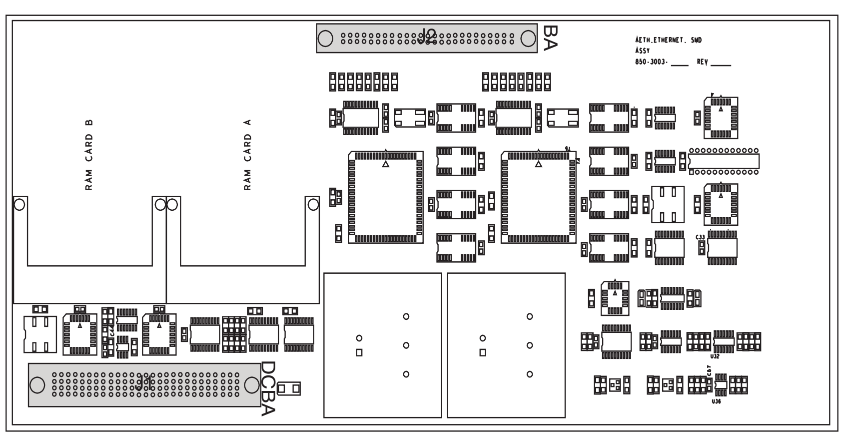
This Ethernet applique receives and transmits signals through a 60-pin application connector on the main assembly. Control of the Ethernet applique is the responsibility of the applications processor. Each ACM is connected, through the backplane, to a single port Media Access Unit (MAU) that is attached to the backplane interface connector for that ACM.

Each applique has a dedicated two-part memory buffer. The top 2K bytes are used as the transmit buffer to stores packets waiting for transmission. The remaining 62K bytes, the receive buffer, is used to receive packets.

Signal manipulation is the responsibility of an Ethernet controller and the supporting components. These components include:

- Ethernet controller—The Ethernet controller is an integrated local area network controller that supports the IEEE 802.3 Carrier Sense Multiple Access CSMA/10 Mbps protocols. This Ethernet controller equips the buffer manager, which arbitrates data access to its dedicated 64K bytes of Dynamic Random Access Memory (DRAM).
- Ethernet Encoder/Decoder (EED)—The EED functions to provide the encoding or decoding of the IEEE Ethernet signals. This circuit also features collision and carrier detection.
- Memory buffers.
- The Ethernet applique receives +5VDC from the ACM main assembly. A DC to DC converter produces +12V from the +5VDC to power the MAU.

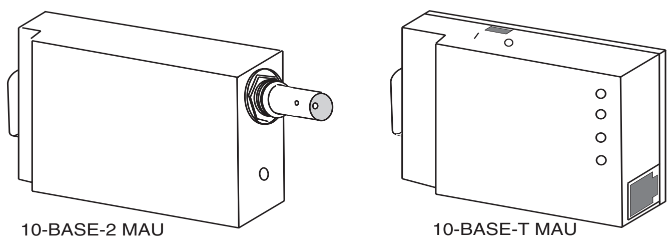
Figure 3-45. Application Communications Module Ethernet Applique



Media Access Unit

The Media Access Unit (MAU)(P/N 804-0059-01 for 10-BASE-2 and P/N 804-0144-01 for 10-BASE-T) used by the Application Communication Module (ACM) is a single-port Ethernet transceiver. Each single port MAU is connected, through an adapter (P/N 830-0425-01) to the backplane interface connector associated with an ACM. Each single port MAU has a single BNC or RJ45-type connector that is used to connect the system to an Ethernet network through 10-BASE-2 or 10-BASE-T media. Refer to Figure 3-46 for an illustration of a MAU.

Figure 3-46. Single-port Ethernet Transceivers, Media Access Unit



Application Processor

The Application Processor (AP) section of the ACM interfaces and controls the operation of the Ethernet applique.

The AP interfaces the Communication Processor (CP) to transfer interface data to and from the IMT buses. Message transfer between the two processors is arbitrated by a 256 kbyte dual memory port.

Communication Processor

The Communication Processor (CP) is made up of an 80386 processor and peripherals. The CP section of the ACM controls the flow of transmit/receive data to and from the IMT buses.

In the receive direction, the CP writes a receive initialization command to the IMT. The data packet is checked for the destination. If its destination is this ACM, the format is checked and a Cyclic Redundancy Check (CRC) is performed. The packet is then transferred to the CP memory by Direct Memory Access (DMA).

In the transmit direction, the CP forwards a packet along with 2 CRC bytes, calculated by the IMT circuitry, to the HIPR (EAGLE 5 ISS only) for transmission.

The CP also controls the selection of the IMT, A or B. In the other direction, the CP forwards data received from the IMT through the AP to the interface port DB15 connector on the extension shelf backplane.

The CP is interrupt driven. Eight levels of the interrupts initiated by the IMT, the AP, and the MAS, are administered by a Programmable Interrupt Controller (PIC).

Inter-processor Message Transport

Each Application Communication Module (ACM) unit has two Inter-processor Message Transport (IMT) interface circuits, IMT A and IMT B. Each IMT interface circuit provides a direct access to another 125 Mbps communications link.

In the receive direction, a data packet is checked to see if it is destined for this particular ACM. If it is, the packet is checked for format and a cyclic redundancy check is performed. The packet is next transferred to the CP (80C386) memory by Direct Memory Access (DMA).

If the packet is not destined for this ACM, it is sent back onto the IMT bus towards the next module.

In the transmit direction, the Cyclic Redundancy Check (CRC) is calculated for a packet, and the packet is transmitted through the HIPR (EAGLE 5 ISS systems only) to the Inter-processor Message Transport (IMT) bus.

Power Converter Unit

ACM power is provided by two DC to DC converters that convert the –48VDC supplied to the system to +5VDC and +3VDC needed to power the ACM components.

Test and Maintenance Features

Colored LEDs are mounted on the front edge of the printed circuit board, ACM status and alarm indicators.

ACM Technical Specifications

Table 3-12 summarizes the technical specifications of the Application Communications Module.

Table 3-12. ACM Technical Specifications

Power Requirements	
Voltage	-48VDC
Current	0.4 A
Power	21 watts
Interfaces	
Ethernet	10 Mbps
HMUX	125 Mbps
HIPR	125 Mbps
Clock	64 and 56 kbps
Dimensions	
Height Length	14.4 in. (36.6 cm) 12.8 in. (32.5 cm)

Translation Service Module

The Translation Service Module (TSM) provides translation capability and Global Title Translation (GTT) implementation for the Local Number Portability (LNP) function by means of one or more identically configured cards per STP node. If more than one TSM is provided in each shelf, they must be powered from different fuse positions and power feeds.

The E586 and E586-T primary boards provide all logic required to support the TSM MCAP-256 functions. The E586 functions will include:

- An Applications Processor for MCAP applications in the EAGLE 5 ISS.
- A Communication Processor for the high speed bus interface (IMT bus).
- Four Expansion Memory Interfaces to allow additional memory for applications.
- It communicates with the MCAP (GPSM II) in the MASP by the IMT bus.
- The TSM can plug into any LIM slot.
- A dual port memory to allow information to be passed between the Application and Communications Processors.
- A boot EPROM for initialization software of both the Application and Communications Processors.

TSMs can have one to four M256 memory modules provisioned. Part numbers for the TSMs are:

- TSM with one M256 (P/N 870-1289-xx)
- TSM with two M256 (P/N 870-1290-xx)
- TSM with three M256 (P/N 870-1991-xx)
- TSM with four M256 (P/N 870-1292-xx)

For an illustration of the TSM with one M256 installed refer to Figure 3-47 "Translation Service Module (P/N 870-1289-xx)" on page 3-90. For an illustration of a TSM with four M256s installed refer to Figure 3-48 "Translation Service Module (P/N 870-1292-xx)" on page 3-91.

The main assembly portion of the TSM consists of:

- An 80486DX5 applications processor
- An 80386 communications processor
- An Inter-processor Message Transport (IMT) interface that provides two 125 Mbps communications links providing communications between modules

CAUTION: It is Tekelec's recommendation that cards running the SCCP application be uniformly distributed in the EAGLE 5 ISS to provide a more even SCCP load distribution. During normal operation unevenly distributed SCCP cards in an EAGLE 5 ISS would not have any network or system impacts. However, should a particular SCCP card database(s) become corrupted, inconsistent, or at a different level, depending on the amount of service provided by that card and the extent of the database issue, network impacts can occur.

Figure 3-47. Translation Service Module (P/N 870-1289-xx)

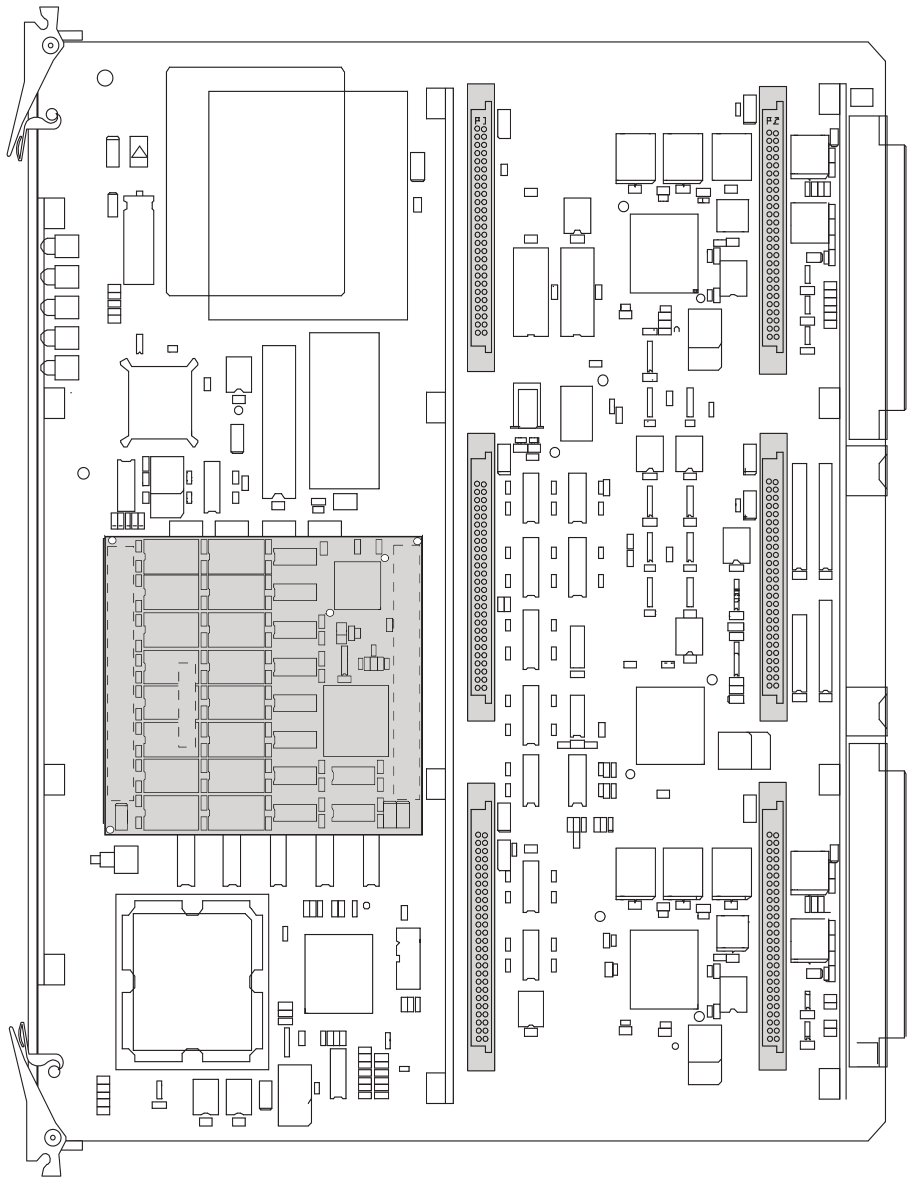
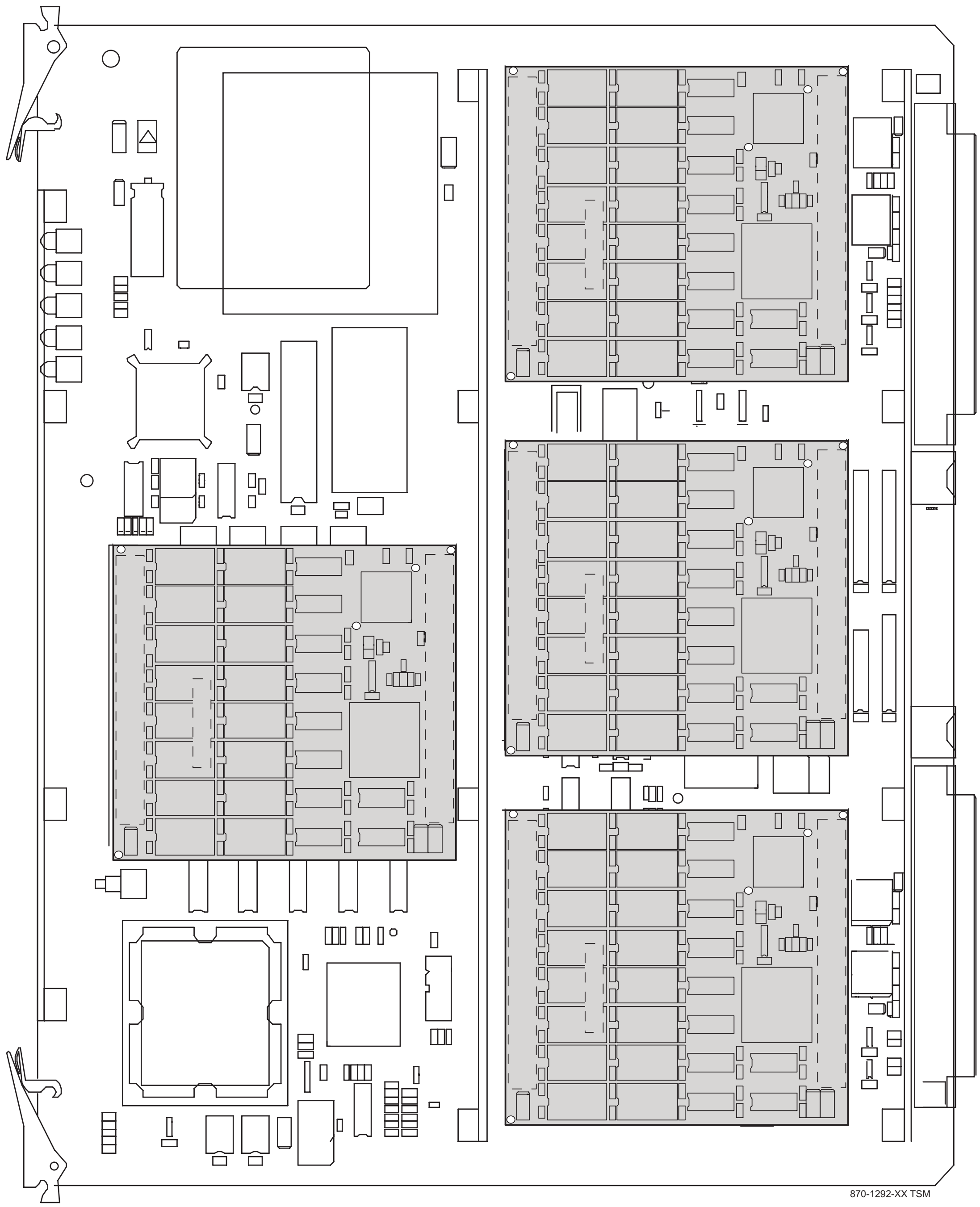


Figure 3-48. Translation Service Module (P/N 870-1292-xx)



E1 Interface Backplane Module

This section contains a general description of the hardware necessary to support the E1 Interface application. Systems ordered with the E1 Interface will have this hardware installed at the factory.

The E1/Channel applique provides a physical interface to the system. The applique terminates or distributes E1 facility signals for the purpose of processing the SS7 signaling links carried by the E1 carrier. The applique can be configured as an E1 card or as a channel card, as shown in Figure 3-49 "E1 Card (P/N 870-1379-xx)" on page 3-92. The implementation is configured by way of switch settings on the applique.

Figure 3-49. E1 Card (P/N 870-1379-xx)

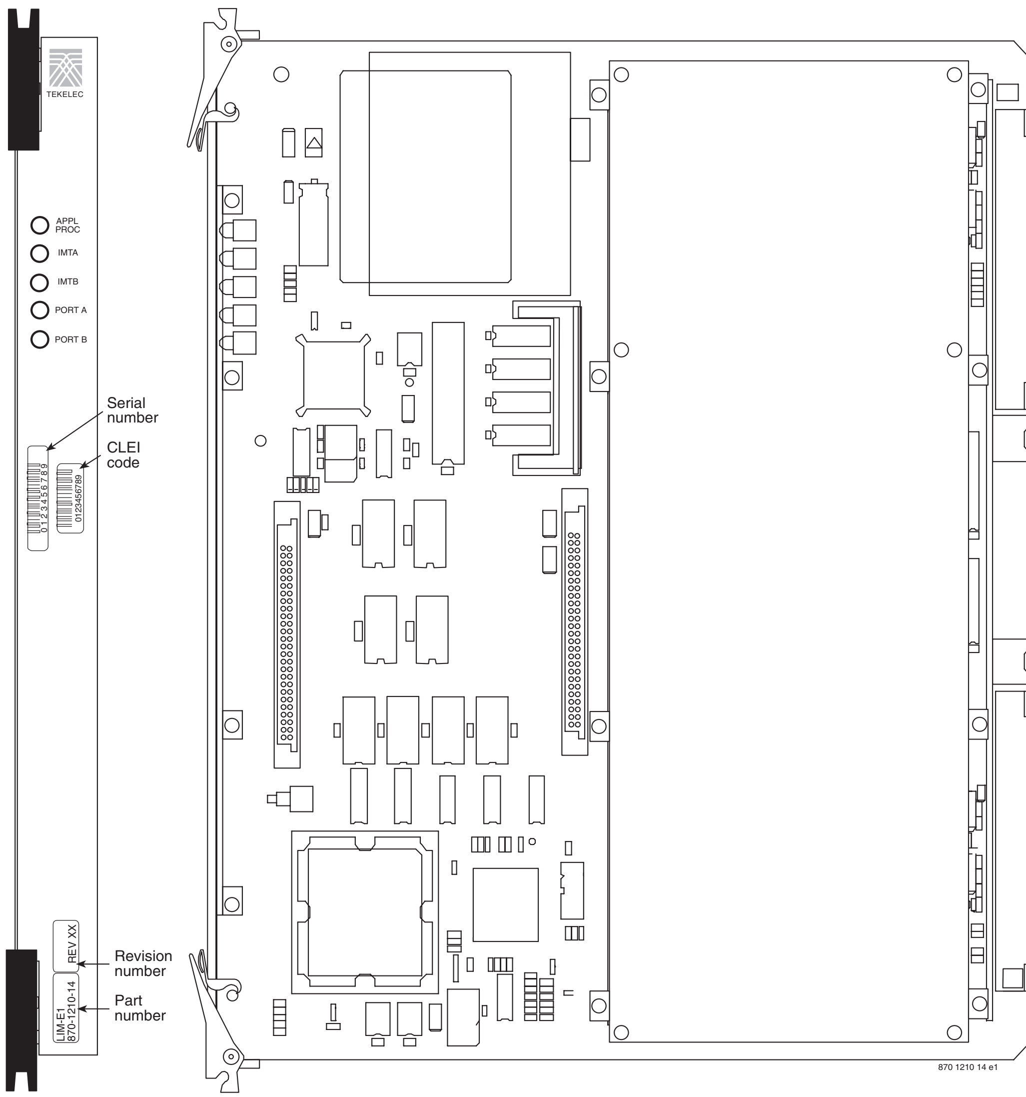


Table 3-13 provides an overview of the functions of the E1 card and the channel card.

Table 3-13. E1 Card and Channel Card

Card	Function
E1	• Connectivity of both E1 interfaces to a 120 Ohm or 75 Ohm E1 interface. An external adapter is required for the 75 Ohm interface. • Processing of a total of two time slots from the E1 interfaces • Interface E1 port 1 through an external backplane module to Channel cards for processing of additional time slots
Channel	• Processing of two time slots from the E1 interface • Interface through an external backplane module to an E1 card to process two time slots

NOTE: Although the E1 extension backplane will work with either control or extension shelf, it is recommended that it be installed in an extension shelf. There may be an issue of cable congestion if it is installed in a control shelf.

Configured as an E1 Card

Configured as an E1 card, two separate and independent E1 inputs can be terminated on an E1/Channel card. From one or two bidirectional E1 facility inputs, one or two bidirectional 64K bits/sec. channels are extracted and processed as SS7 signaling links. Implemented as E1 Link Interface Modules, up to 32 separate and independent E1 inputs can be terminated in an system extension shelf.

Configured as a Channel Card

In an system extension shelf equipped with an E1 cabling backplane module, an E1-configured card terminates one or two E1 inputs and connects the E1 port one input to one of eight available buses on the E1 cabling backplane module. Other E1/Channel appliques configured as channel cards also connected to the E1 Cabling backplane module are able to extract any two 64 Kbit/sec. signaling channels from the same E1 port one input. In this manner, up to 31 E1 channels can be used for signaling. The 32nd channel is reserved for E1 synchronization.

If the installation is performed on existing equipment, the hardware consisting of the E1 Interface backplane modules and E1 patch cables can be installed without affecting system service as long as the cables between the E1 Interface backplane module and the system backplane are not connected.

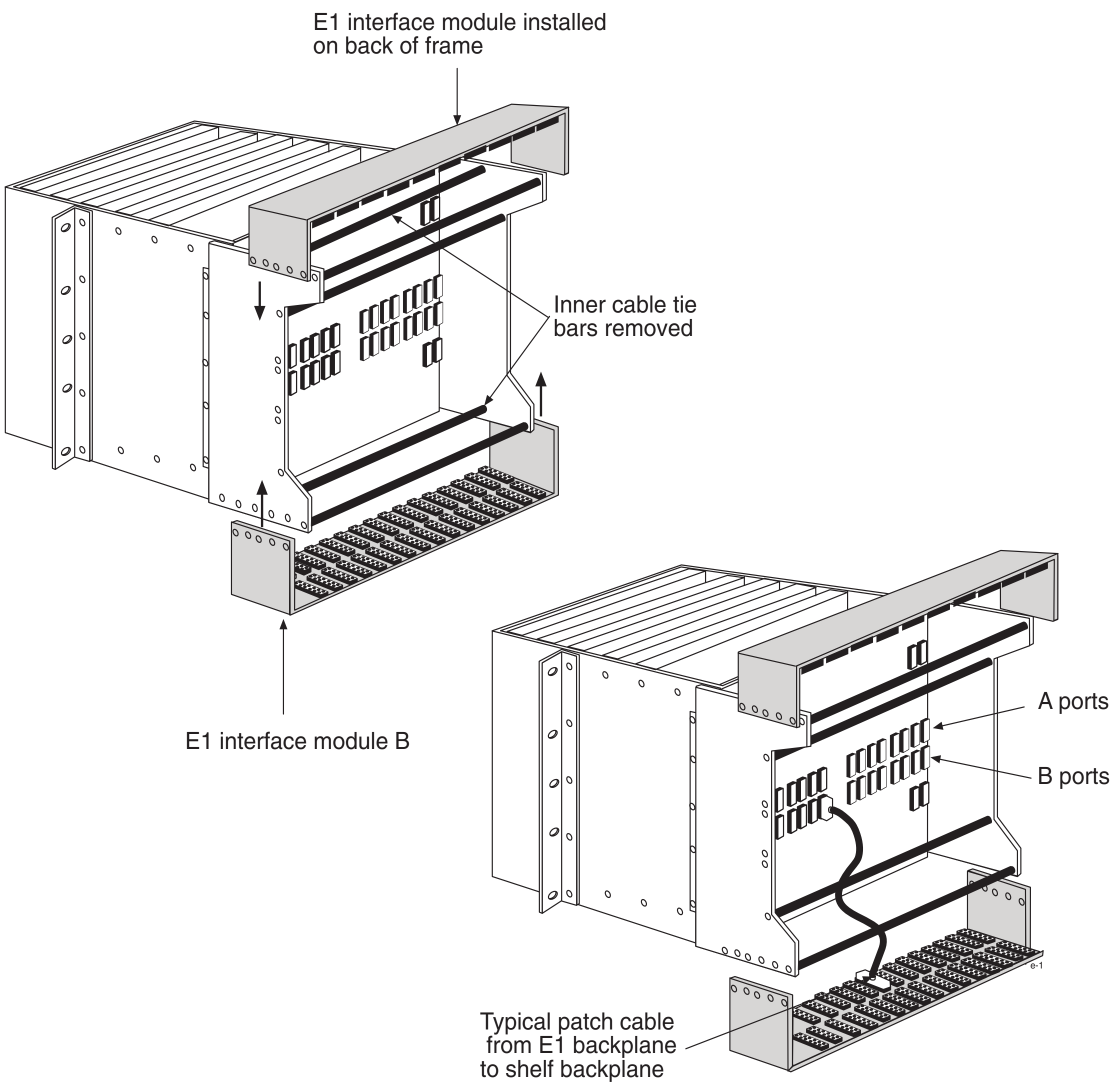
The hardware installation consists of:

- E1 Interface backplane modules (P/N 890-1037-06)
- E1 Interface patch cables (P/N 830-1156-02)

If the site does not require more than two E1 channels in any E1 interface, the E1 Interface backplane modules may not need to be installed. The E1 Interface Kit consists of E1 patch cables, two backplane modules, and attaching hardware.

The E1 Interface backplane module in Figure 3-50 is shown as it is installed on a system extension shelf. Notice the upper and lower backplane modules are identical. The cable shown connects the system port B on the extension shelf backplane module to the appropriate connectors on the E1 interface B.

Figure 3-50. E1 Interface Backplane Module (P/N 890-1037-06)



External Interface Descriptions

The E1 Interface backplane module provides a method for extending individual E1 channels from the E1-configured cards to any channel-configured cards in use.

NOTE: The following issues regarding the E1 backplane module:

- Only one E1 trunk can be terminated on each bus on the backplane module.
- When installing non-E1 cards on the shelf equipped with the E1 interface backplane module, ensure that none of the slots to be used are cabled to the backplane module. If a non-E1 card is installed in a slot that is connected to the E1 backplane module, all E1 cards on that bus may fail.

The E1 backplane module is impedance-controlled for 120 Ohms and is designed for use with RS-485 transmission characteristics.

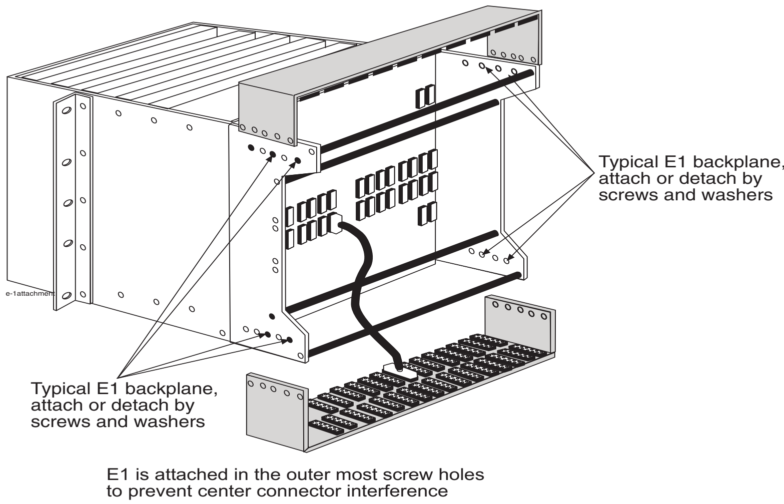
Possible Configurations

The E1 backplane module was designed to allow the maximum number of possible customer setups. It allows the customer to choose between several levels of diversity and convenience. Configurations depend on the number of cards configured as E1 cards versus the number of cards configured as channel cards. All signals labeled “E1 input” may be one or two E1 ports depending on the cable used.

High Level Functional Description

The E1 interface backplane module provides a connection point from the system backplane to an external E1 interface. The backplane module is populated with 64 high density connectors and 64 terminating resistors. For a method of connecting the backplane module and possible configurations on the board (refer to Figure 3-53 "E1/T1 Interface Backplane Module Connector Diagram" on page 3-97). Notice that each row is bused together and each column lines up with a system slot. Also note there are always two E1 backplane modules available at the rear of the system shelf. The upper and lower backplane modules are identical. Refer to Figure 3-51 "E1 Backplane Module and Screws and Washers" on page 3-96.

Figure 3-51. E1 Backplane Module and Screws and Washers



The E1 interface patch cables are installed in the locations specified on the “Installers Cable Running List” in the Equipment Specification specific to this site. The E1 Patch cables (P/N 830-1156-02) are connected to the E1 backplane module connectors J1 through J64 and the backplane port B per your provisioning documents. Refer to Figure 3-52 for details.

Actual cable configuration is determined by the installation and customer requirements. Cabling for T1 is the same as the cabling for E1.

Figure 3-52. E1 Backplane Modules Patch Cables

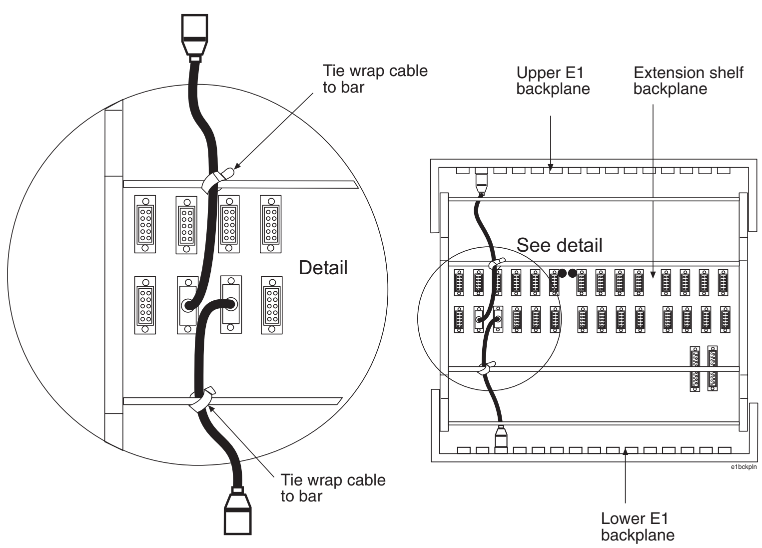
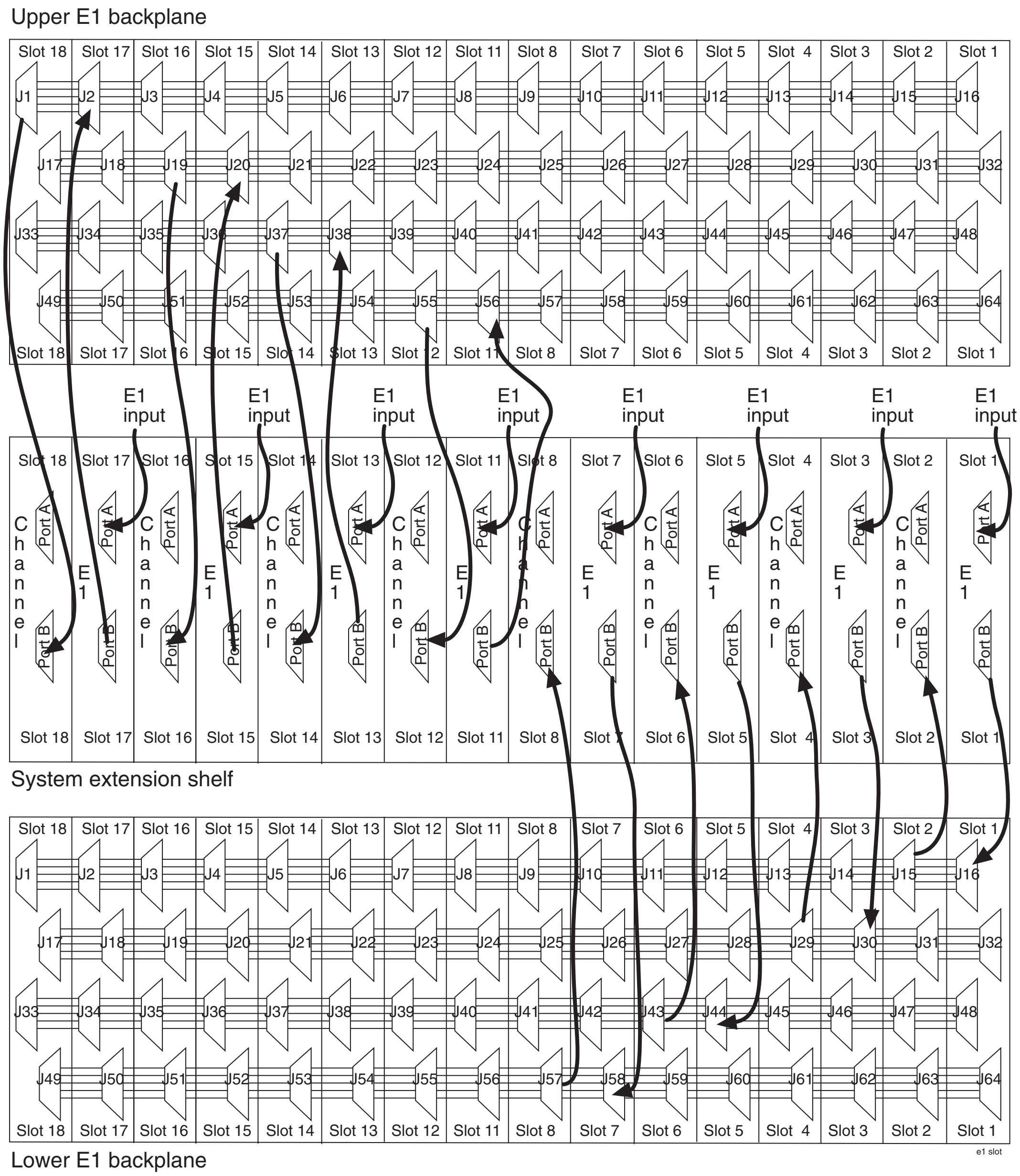
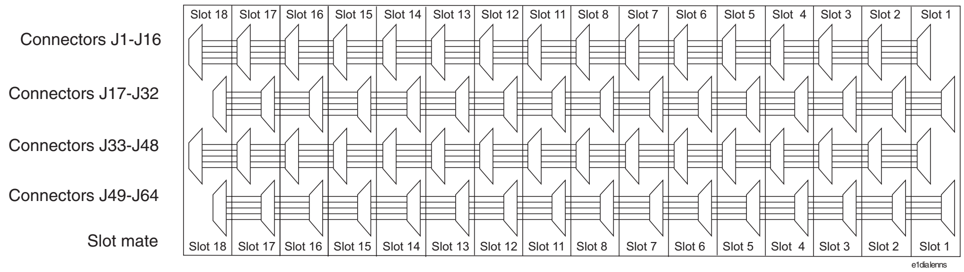


Figure 3-53. E1/T1 Interface Backplane Module Connector Diagram



When mounting E1 backplane modules, be aware the card slots are marked on the board as J1-J16, J17-J32, J33-J48, and J49-J64 should be positioned so the E1 board card slot numbers match the shelf card slot number on both the top and bottom boards. For this to be accomplished, the top E1 board must be turned 180 degrees from the bottom board (refer to Figure 3-54 "E1 Interface Backplane Module Connections" on page 3-98).

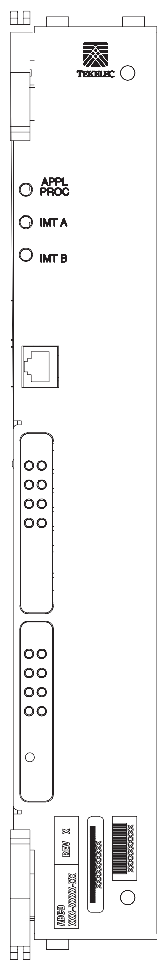
Figure 3-54. E1 Interface Backplane Module Connections



High-Capacity Multichannel Interface Module

The High-Capacity Multichannel Interface Module (HCMIM P/N 870-2671-01) is a dual slot card providing eight trunk terminations processing up to 64 signaling links of configurable channelized E1 or T1 connectivity. The eight E1/T1 ports reside on backplane connectors A and B.

Figure 3-55. HCMIM Module



All ports on a single board operate in the same trunk format, E1 or T1. However, it is possible to have a mixture of trunk formats in a node with some HCMIMs operating in T1 mode with others operating in E1 mode for gateway node scenarios.

HCMIM has the following requirements and dependencies:

- Any shelf that contains an HCMIM module must also be equipped with the two HIPR modules to manage the increased traffic capacity.
- HCMIM modules require a fan tray assembly for thermal management. Be sure to install the fan assembly 890-0001-04 before installing the HCMIM card.
- Any unused slots (that is, empty slots where no cards are populated) in shelves with HCMIMs must have Air Management cards, P/N 870-1824-02, to ensure proper air flow and fan tray efficiency.
- Frames where HCMIMs are to be deployed must be equipped with 60 Amp power circuits. The associated FAP for the frame must accommodate 60 Amp feeds (refer to *"Fuse and Alarm Panels"* on page 3-118).
- The HCMIM is a double-slot module but can only be plugged into odd numbered slots; the module will not power-up if plugged into an even numbered slot.

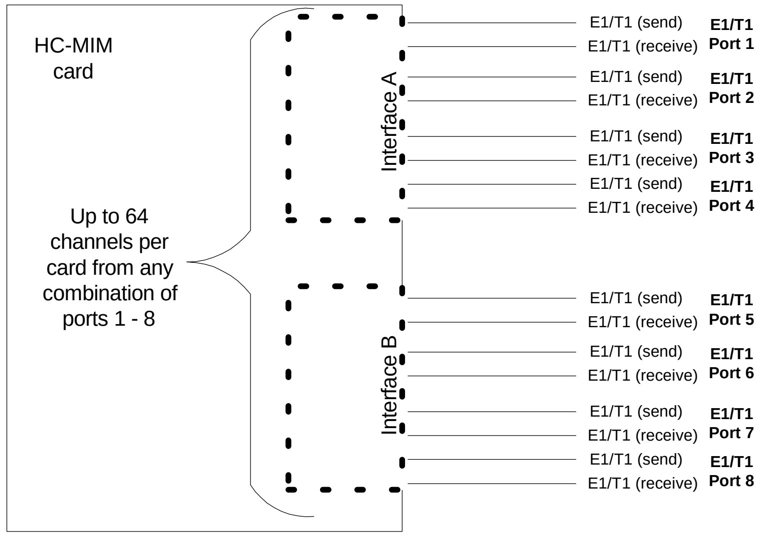
Total system signaling link capacity depends on other cards within the system and must not exceed the provisioning limit of the EAGLE 5 ISS. Since the HCMIM has the capacity to process a full T1 or E1 on a single card, daisy chaining or channel card operation is not needed. Interoperation with LIM-E1 or E1/T1 MIMs operating in channel mode is not supported.

Channelized Mode

The HCMIM provides access to eight E1/T1 ports residing on backplane connectors A and B. Each data stream consists of 24 T1 or 31 E1 DS0 signaling links assigned in a time-division multiplex (TDM) manner. Each channel occupies a unique timeslot in the data stream and can be selected as a local signaling link on the interface card. Each card can select up to a total of 64 signaling links. The default configuration is 16 signaling links.

The HCMIM card's I/O signals are routed to only the odd backplane slot. External interfaces (the E1/T1 trunks) use both backplane interfaces of the single backplane slot used, each terminating four E1/T1 ports (trunks). These two backplane interfaces will be referred to in this section as interfaces A and B. Interface A terminates E1/T1 ports 1-4, while Interface B terminates E1/T1 ports 5-8. Refer to Figure 3-56.

Figure 3-56. Channelized HCMIM Interfaces

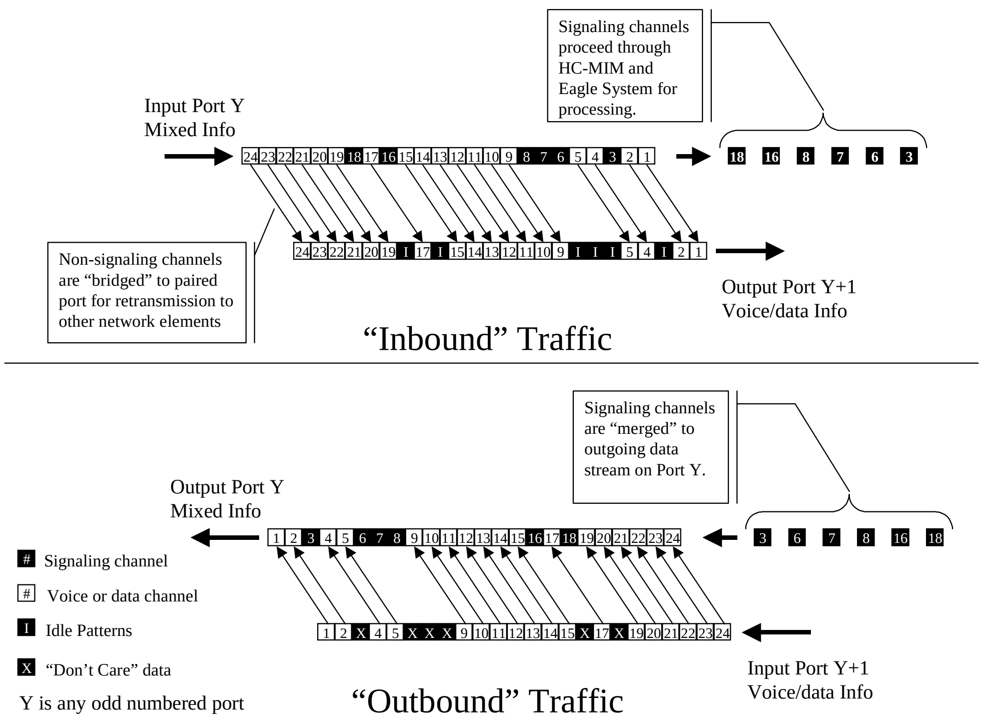


NOTE: All ports on a single board must operate in the same trunk format, E1 or T1, and that the total number of channels utilized as signaling links must not exceed the maximum allowable number in accordance with a Feature Access Key defining total channel capacity.

Channel Bridging

Channel Bridging is the processing of signaling channels that are intermixed on trunks with voice or data channels. The HCMIM provides Channel Bridging which allows for better utilization of bandwidth without dedicating entire trunks to signaling.Non-signaling channels are bridged to an adjacent E1/T1 port for transport to other network devices. Likewise, signaling channels are merged to non-signaling data for transmission back to the mixed network. In this configuration, the High-speed Master Timing option can only apply to one trunk format since only one high-speed clock rate can be provided. Channel bridging is available only in the channelized mode.

Figure 3-57. Channel Bridging Schematic



NOTE: Channel Bridging is unique to the HCMIM card and is not available on other E1 or T1 modules. Software must enable and manage this feature.

Timeslots located on the bridging slave E1/T1 port, (timeslots that have been dropped from the bridging master E1/T1 port), contain idle patterns provided by the EAGLE 5 ISS. All other idle timeslots that are not dropped must contain an idle pattern provided by the remote network elements connected to both E1/T1 ports (bridging master and slave). Without these patterns on the idle timeslots, instability of the E1/T1 may occur.

NOTE: Provisioning of signaling links on the bridging slave E1/T1 port is not allowed while channel bridging is activated.

Channel Bridging is implemented by pairing E1/T1 ports; this pairing limits provisioning to odd E1/T1 ports only (1,3,5,7) when channel bridging is enabled. The adjacent even numbered E1/T1 ports (2, 4, 6, 8) are used to allow the original non-signaling data received on the bridging master (odd) E1/T1 port to reach downstream network elements. This is a bi-directional interface so data is also able to enter the bridging slave E1/T1 port and leave through the bridging master E1/T1 port. This feature may be independently selected on E1/T1 ports 1, 3, 5, and/or 7. When selected, the bridging slave (even) E1/T1 port would be provisioned as the pass-through E1/T1 port. On ports operating in Channel Bridging mode, all time-slots not provisioned for signaling are handled as active data and not overwritten by the HCMIM.

Table 3-14. Channel Bridging E1/T1 Port Pairing

Primary E1/T1 Port		**Paired E1/T1 Port**	
Number	**Payload Contents**	**Number**	**Payload Contents**
1	Signaling Processed	2	Unprocessed
3	Signaling Processed	4	Unprocessed
5	Signaling Processed	6	Unprocessed
7	Signaling Processed	8	Unprocessed

Timing

In order to use channel bridging without facility errors, both bridging master and bridging slave E1/T1 ports must be synchronous; that is, both master and slave must be timed off the same clock source. This synchronization may be accomplished two ways:

- The bridging master E1/T1 port may use the timing recovered from the bridging slave E1/T1 port or visa versa.
- Both the bridging master and bridging slave E1/T1 ports are using an external clock source (the EAGLE 5 ISS's MASTER option for the E1/T1 port provisioning).

Any other methods used for timing could cause problems on the E1/T1 trunk and are not supported.

Alarms and LEDs

The channel bridging functionality requires no additional statistics collection for the bridging slave E1/T1 port; however, standard statistics/measurements are made on the bridging master E1/T1 port. Alarms for the bridging slave E1/T1 port are limited to trunk-level synchronization and framing alarms. Channel alarm LEDs for the bridging slave E1/T1 port are amber to indicate the Channel Bridging mode of operation.

Three LEDs provide conventional EAGLE 5 ISS card indications of APPL Proc operation, and IMT A and IMT B operation. Sixteen (16) LEDs, two for each E1/T1 port are used to indicate port and channel (signaling link) status. One LED per E1/T1 port indicates E1/T1 port Status and one LED per E1/T1 port indicates aggregated channel status.

Table 3-15. Channelized HCMIM LEDs

Color	Port Status LED	Aggregated Channel Status LED
Green	No alarms, port has acquired timing and framing synchronization	All channels provisioned =ISNR
Amber blinking	Loss of Frame Synchronization	Any channels provisioned = OOS
Amber	Remote alarm condition	Indicates port is the “reflected” port in Channel Bridging mode of operation. Applies only to “even” numbered ports
Red blinking	Loss of signal and remaining errors	All channels provisioned = OOS
Red	Port not provisioned	No channels are provisioned

Technical Specifications

Table 3-16. HCMIM Technical Specifications

Power Requirements	
Voltage	-48VDC
Current	1.3A-1.55A
Power	65W typical, 70W max.
Physical Characteristics	
Height	14.43 in. (36.65 cm)
Width	2.06 in. (5.23 cm)
Depth	12.80 in. (32.51 cm)

HCMIM Cable

The cable designed for the HCMIM card is the T1 MIM LIM P/N 830-0948-XX. When upgrading from a E1/T1 MIM to an HCMIM, a cable adapter is not required. However, if you are replacing a MPL with an HCMIM, a port adapter is required.

NOTE: There will be a 830-0948-XX cable terminated on the odd shelves A and B backplane interfaces. Each cable provides four E1/T1 ports.

E5 Interface Module

The E5 interface module (card) is a link interface card that utilizes an Embedded Processor Module (EPM) with an appliqué card. The E5 card provides the EAGLE system a high performance general purpose-processing platform in a single-slot footprint. The E5 card is used on existing EAGLE 5 control and extension shelves.

The EPM appliqué cards provide LIM functionality such as E1/T1 or IP. The EPM accepts up two single-width or one double width PCI Mezzanine appliqué card(s). The EPM assembly contains all of the necessary logic to perform both application and communication processing of the data streams provided by the appliqué cards such as E1/T1 or IP. All EAGLE System interfacing to the EPM occurs through the EAGLE backplane signals and connects to the appliqué cards through the PCI Mezzanine Card (PMC) interface.

The types of E5 cards presently available are:

- E5-E1T1 (P/N 870-1873-02)
- E5-ENET (P/N 870-2212-02)

E5-E1T1 Module

The E5-E1T1 card (P/N 870-1873-02) is a single slot card providing eight trunk terminations processing up to 32 signaling links of configurable channelized E1 or T1 connectivity. The eight E1/T1 ports reside on backplane connectors A and B. The E5-E1T1 supports only one SE-HSL signaling link on one of the eight ports and it must be A.

All ports on a single board operate in the same trunk format, E1 or T1. However, it is possible to have a mixture of trunk formats in a node with some E5-E1T1s operating in T1 mode with others operating in E1 mode for gateway node scenarios.

The E5-E1T1 has the following requirements and dependencies:

- Requires HIPR to be active on both IMT buses in the shelf where the E5-E1T1 will reside.

  NOTE: HIPR in one bus and HMUX in the other bus for that shelf is not a supported configuration and will be treated as no HIPR cards being present in the shelf.

- The E5-E1T1 will not support channel cards as it uses all connections on the backplane.
- E5 modules do not require a fan tray assembly for thermal management.
- The E5-E1T1 is a single-slot module that can be used in any slot that a LIM can be configured.

Total system signaling link capacity depends on other cards within the system and must not exceed the provisioning limit of the EAGLE system. Since the E5-E1T1 has the capacity to process a full T1 or E1 on a single card, daisy chaining or channel card operation is not needed. Interoperation with LIM-E1 or E1/T1 MIMs operating in channel mode is not supported.

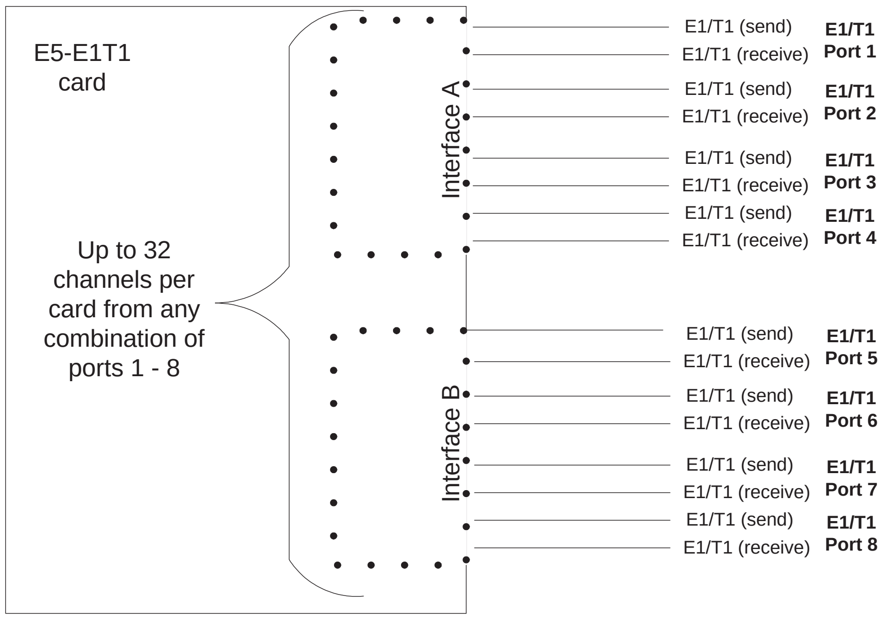
The maximum provisionable links for the E5-E1T1 will be 32 links. If the E5-E1T1 has more than 32 links provisioned, it will auto-inhibit. The fan feature is ignored for the E5-E1T1.

Channelized Mode

The E5-E1T1 provides access to eight E1/T1 ports residing on backplane connectors A and B. Each data stream consists of 24 T1 or 31 E1 DS0 signaling links assigned in a time-division multiplex (TDM) manner. Each channel occupies a unique timeslot in the data stream and can be selected as a local signaling link on the interface card. Each card can select up to a total of 64 signaling links. The default configuration is 16 signaling links.

External interfaces (the E1/T1 trunks) use both backplane interfaces of the single backplane slot used, each terminating four E1/T1 ports (trunks). These two backplane interfaces will be referred to in this section as interfaces A and B. Interface A terminates E1/T1 ports 1-4, while Interface B terminates E1/T1 ports 5-8. Refer to Figure 3-58.

Figure 3-58. Channelized E5-E1T1 Interfaces



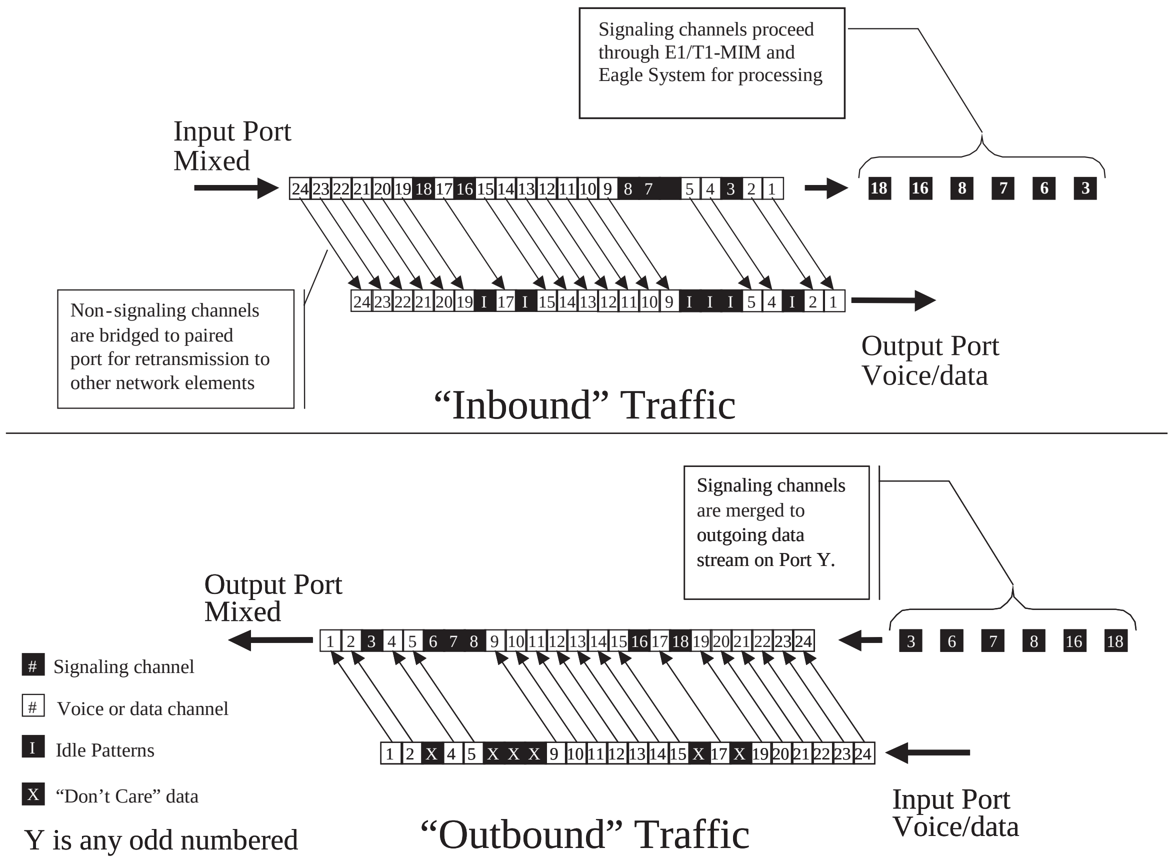
NOTE: All ports on a single board must operate in the same trunk format, E1 or T1, and that the total number of channels utilized as signaling links must not exceed the maximum allowable number in accordance with a Feature Access Key defining total channel capacity.

Channel Bridging

Channel Bridging is the processing of signaling channels that are intermixed on trunks with voice or data channels. The HCMIM provides Channel Bridging which allows for better utilization of bandwidth without dedicating entire trunks to signaling. Non-signaling channels are bridged to an adjacent E1/T1 port for transport to other network devices. Likewise, signaling channels are merged to non-signaling data for transmission back to the mixed network.

In this configuration, the High-speed Master Timing option can only apply to one trunk format since only one high-speed clock rate can be provided. Channel bridging is available only in the channelized mode. Refer to Figure 3-59.

Figure 3-59. Channel Bridging Schematic



Timeslots located on the bridging slave E1/T1 port, (timeslots that have been dropped from the bridging master E1/T1 port), contain idle patterns provided by the EAGLE. All other idle timeslots that are not dropped must contain an idle pattern provided by the remote network elements connected to both E1/T1 ports (bridging master and slave). Without these patterns on the idle timeslots, instability of the E1/T1 may occur.

> **NOTE: Provisioning of signaling links on the bridging slave E1/T1 port is not allowed while channel bridging is activated.**

Channel Bridging is implemented by pairing E1/T1 ports; this pairing limits provisioning to odd E1/T1 ports only (1,3,5,7) when channel bridging is enabled. The adjacent even numbered E1/T1 ports (2, 4, 6, 8) are used to allow the original non-signaling data received on the bridging master (odd) E1/T1 port to reach downstream network elements. This is a bi-directional interface so data is also able to enter the bridging slave E1/T1 port and leave through the bridging master E1/T1 port. This feature may be independently selected on E1/T1 ports 1, 3, 5, and/or 7. When selected, the bridging slave (even) E1/T1 port would be provisioned as the pass-through E1/T1 port. On ports operating in Channel Bridging mode, all time-slots not provisioned for signaling are handled as active data and not overwritten by the E5-E1T1.

Table 3-17. Channel Bridging E1/T1 Port Pairing

Primary E1/T1 Port		**Paired E1/T1 Port**	
Number	**Payload Contents**	**Number**	**Payload Contents**
1	Signaling Processed	2	Unprocessed
3	Signaling Processed	4	Unprocessed
5	Signaling Processed	6	Unprocessed
7	Signaling Processed	8	Unprocessed

Timing

In order to use channel bridging without facility errors, both bridging master and bridging slave E1/T1 ports must be synchronous; that is, both master and slave must be timed off the same clock source. This synchronization may be accomplished two ways:

- The bridging master E1/T1 port may use the timing recovered from the bridging slave E1/T1 port or visa versa.
- Both the bridging master and bridging slave E1/T1 ports are using an external clock source (the EAGLE's MASTER option for the E1/T1 port provisioning).

Any other methods used for timing could cause problems on the E1/T1 trunk and are not supported.

Alarms and LEDs

The channel bridging functionality requires no additional statistics collection for the bridging slave E1/T1 port; however, standard statistics/measurements are made on the bridging master E1/T1 port. Alarms for the bridging slave E1/T1 port are limited to trunk-level synchronization and framing alarms. Channel alarm LEDs for the bridging slave E1/T1 port are amber to indicate the Channel Bridging mode of operation.

Three LEDs provide conventional EAGLE card indications of APPL Proc operation, and IMT A and IMT B operation. Up to sixteen (16) LEDs, two for each E1/T1 port, are used to indicate port and channel (signaling link) status. One LED per E1/T1 port indicates E1/T1 port Status and one LED per E1/T1 port indicates aggregated channel status. See Figure 3-60.

Figure 3-60. E5-E1T1

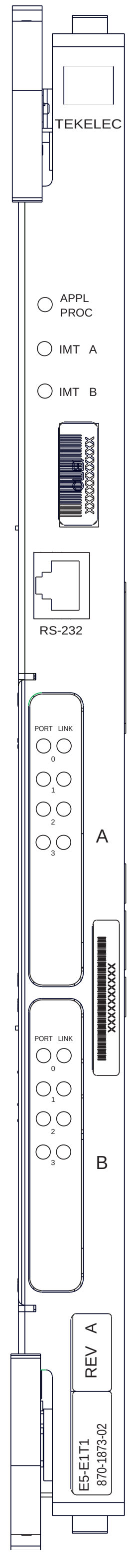


Table 3-18. E5-E1T1 LEDs

Color	Port Status LED	Aggregated Channel Status LED
Green	No alarms, port has acquired timing and framing synchronization	All channels provisioned =IS-NR
Amber blinking	Loss of Frame Synchronization	Any channels provisioned = OOS
Amber	Remote alarm condition	Indicates port is the “reflected” port in Channel Bridging mode of operation. Applies only to “even” numbered ports
Red blinking	Loss of signal and remaining errors	All channels provisioned = OOS
Red	Port not provisioned	No channels are provisioned

Technical Specifications

Table 3-19. E5-E1T1 Technical Specifications

Power Requirements	
Voltage	-48VDC
Current	1.3A-1.55A
Power	23.9W typical, 27.3W max.
Physical Characteristics	
Height	14.43 in. (36.65 cm)
Width	2.06 in. (5.23 cm)
Depth	12.80 in. (32.51 cm)

E5-ENET Module

The E5-ENET card (P/N 870-2212-02) is a single slot card providing one or more Ethernet interfaces. The E5-ENET card has the following requirements and dependencies:

- The E5-ENET has 2 physical 10/100 Mbps Ethernet ports.
- The E5-ENET supports protocols as identified below:

  NOTE: The E5-ENET is provisionable for IPLIMx or IPGWx, but does not support both functions on a single card simultaneously.

Table 3-20. E5-ENET Supported Protocols

Feature	Protocols Supported
IPLIM	SCTP, M2PA
IPGWY	SCTP, M3UA, SUA

Table 3-21. E5-ENET Capacities

Parameter	IPLIM	IPGWY
E5-ENET cards per node	100	64
SCTP entities per E5-ENET module	16 SCTP/IP Associations	50 SCTP Connections
The maximum possible connections is (100*16) + (64*50) = 4800. EAGLE currently supports 4000 in the link table.		

- Requires HIPR to be active on both IMT buses in the shelf where the E5-ENET will reside.

  NOTE: HIPR in one bus and HMUX in the other bus for that shelf is not a supported configuration and will be treated as no HIPR cards being present in the shelf.

- An adapter cable per Ethernet port. See “Interface Cable Differences” on page 3-115.
- Maximum number of cards per shelf is 10 for the control shelf and 16 for the extension shelf.
- Mix of E5-ENET/HCMIM on a shelf can be any up to shelf and power capacity. Note: It is not recommended that customers mix SS-EDCM and DCM cards with E5-ENET cards within a linkset due to differences in performance and N+1 redundancy.

- The E5-ENET platform does not preserve memory across boots (no "dual-port memory"). As a result the connection manager client mode flags are not stored. There is no post-mortem data beyond what is provided with ATH obit data.

Thermal Management

The E5-ENET includes thermal management and alarming provisions to protect the card from damage if environmental conditions hinder thermal stability. Table 3-22 identifies the appropriate responses.

Table 3-22. Thermal Alarm Conditions

Board Temperature	Actions
Temp1 Exceeded	Major alarm raised
Temp2 Exceeded	Critical alarm raised; failover initiated, traffic rerouted
Temperature abated	Normal operation restored
Thermtrip - shutdown temperature exceeded	CPU shuts down automatically. Card must be reseated to restore operation once temperature returns to normal operating conditions

Configurable SCTP Buffers

The default SCTP buffer configuration for connections is 16k bytes for IPGWx and 200k bytes for IPLIMx. When a previous release is upgraded to the current release supporting this feature, the IPAPSOCK database table will insert this value into the table since no value will exist. The OAM database code will have to be modified to accommodate the upgrade table change.

There is a minimum and maximum SCTP buffer configuration per connection (8192 bytes and 3.125Mbytes, respectively). The card maximum is 3.125Mbytes, so if a connection has that size buffer configuration, there can be only 1 connection on the card. Conversely, if each connection had 8192 byte buffers, all 16 or 50 connections could be supported with memory to spare.

LED Indicators

The E5-ENET includes three front panel indicators (LEDs) for APPL Proc operation, IMT A, and IMT B status. In addition, four front panel LED Link/Activity indicators (two for each IP port used). The Link indicator will illuminate Green when the interface is connected to an active Ethernet device and OFF when not connected. The Activity indicator will be GREEN when the IP signaling links are active and synchronized and RED otherwise. See Figure 3-61.

Figure 3-61. E5-ENET

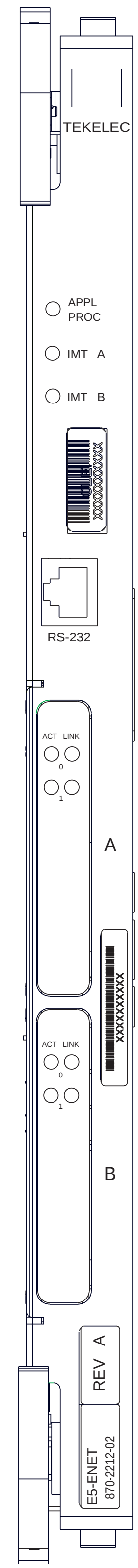


Table 3-23. Front Faceplate LED Indicators

LED	ACT	LINK
RED	Signaling links inactive, or 1 or more active links are out-of-service	N/A
GREEN	All active links are in-service	Ethernet signal detected
OFF	Card nonfunctional	No Ethernet signal detected

Table 3-24. ACT Status LED states for IPLIMx

IPLIMx SLK States (Port A or Port B)	ACT Status LED
None configured	Red
All are OOS-MT-DSBLD	Red
None are OOS-MT and at least one is IS-NR or IS-ANR	Green
At least 1 is OOS-MT	Red

Table 3-25. ACT Status LED states for IPGWx

IPGWx SLK PST	ACT Status LED	
	A0	B0
None configured (card must be inhibited)	Red	Red
OOS-MT-DSBLD	Red	Green
IS-NR or IS-ANR	Green	Green

Interface Cable Differences

The Ethernet cable pinouts differ between the E5-ENET card and the DCM/SSEDCM cards.

- Adapter P/N 830-1103-02 is required for each E5-ENET interface used when using the existing DCM cable (P/N 830-0978-xx). The adapter is connected between the backplane connector and the existing DCM cable for the card..
- Adapter P/N 830-1102-02 is required for installation of the E5-ENETwhen the DCM cable is replaced with an RJ-45 CAT-5E cable (P/N 830-0724-xx). The adapter is connected to the backplane and the RJ-45 CAT 5E cable is connected from the other side of the adapter to a switch, or a hub, or a patch panel (same place the DCM cable was terminated).

If the card inserted into the slot does not match the backplane connector, the interface will not function.

Technical Specifications

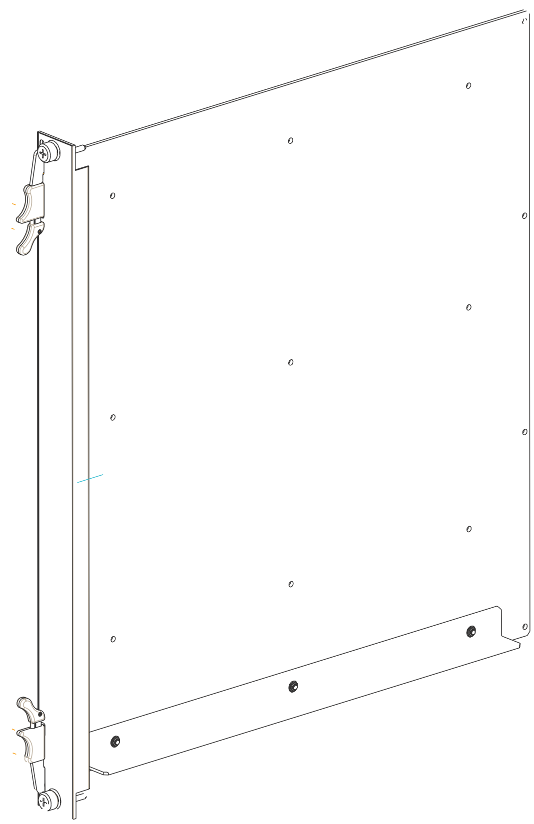
Table 3-26. E5-ENET Technical Specifications

Power Requirements	
Voltage	-48VDC
Current	1.3A-1.55A
Power	29.2W typical, 30.2W max.
Physical Characteristics	
Height	14.43 in. (36.65 cm)
Width	2.06 in. (5.23 cm)
Depth	12.80 in. (32.51 cm)

Air Management Card

The Air Management (P/N 870-1824-02) card is an unpowered filler card used to ensure efficient air flow in shelves equipped with fans. Air Management cards are required in all empty slots in the shelf above the 890-0001-04 fan assembly used with HCMIM cards.

Figure 3-62. Air Management card

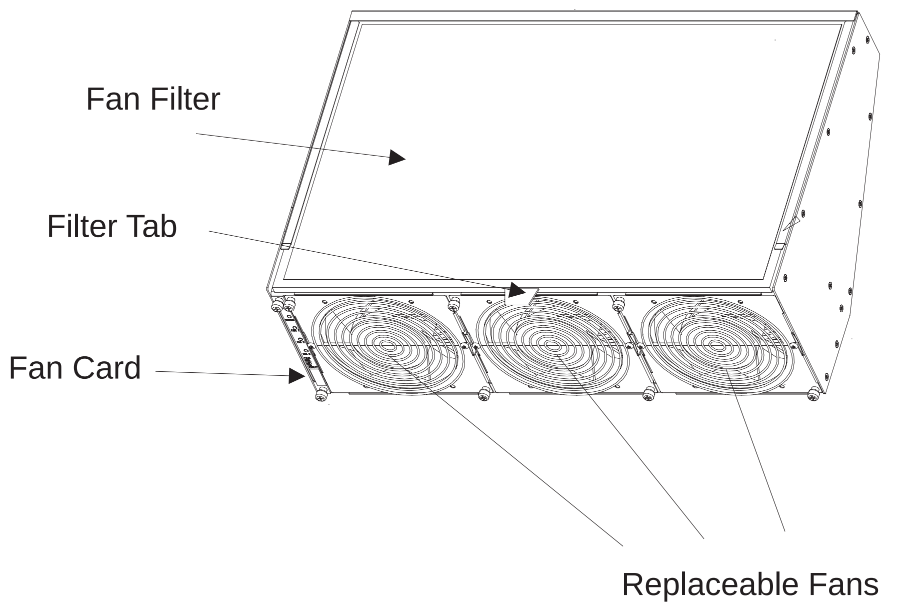


Fan Tray

The EAGLE 5 ISS fan tray P/N 890-0001-04 contains three -48V fans that provide a redundant airflow for thermal management of the shelf. The EAGLE 5 ISS fan tray is powered by –48 VDC, at a fused rating of 3A. It has redundant power inputs (A and B). Each input is provided by a DB-9, keyed, positive locking connector. The contacts have 30 micro-inches of gold plating.

NOTE: Shelves with HCMIM cards are required to be cooled by fan tray P/N 890-0001-04.

Figure 3-63. Fan Tray



Failover is governed by a fan controller card on the fan tray. The fan tray will provide adequate airflow if there is a single fan failure or during replacement of one of the three fans while the EAGLE 5 ISS fan tray is operational. The control card bracket provides mounting for the control PCB (P/N 850-0703-01). The control PCB inserts into the front face of the fan tray on card guides mounted to the left side wall, and is intended to be a field replaceable item.

The EAGLE 5 ISS fan tray is designed to be field installable, with mounting brackets, in both a Tekelec Heavy Duty frame and a standard frame. There is one disposable air filter in the assembly (P/N 551-0032-01). The filters should be changed once a month.

The EAGLE 5 ISS fan tray is designed to be compliant to Bellcore Standards GR-63-CORE [4], GR-78-CORE [5], and GR-1089-CORE [6] when mounted in a Tekelec Heavy Duty Frame or standard frame. The EAGLE 5 ISS fan tray is also designed to be UL and CE compliant. The EAGLE 5 ISS fan tray is designed to operate in a Central Office environment with continuous operation at -5C to 50C and 5% to 90% RH in compliance with GR-63-CORE.

Fuse and Alarm Panels

The Fuse and Alarm Panel (FAP) provides protected distribution of –48VDC power to the shelves in the frame. Allowing for the full population of a frame and for the failure of one primary supply, new installations of Control and Extension frames require two 60A feeds. Frames with EOAPs require 30A.

The FAP is installed at the top of the frame and uses two cables to bring A and B power to the frame. The FAP contains two separate circuits, A and B. Current flows from the input terminals to the fuse bus. Protection is provided by fuses placed in fuse holders on the front panel. When a fuse is installed in a fuse holder, the circuit is completed to the output connector.

WARNING: Existing frames that are fused at 40 amps may be upgraded to support 60 amps with a FAP upgrade kit. Frames that contain HC-MIMs must be upgraded to support 60 amps. Customers do not perform a FAP upgrade; these upgrades are performed by Tekelec personnel.

WARNING: The FAP P/N 870-1606-02 Revs A-B can be upgraded to FAP P/N 870-1606-02 Rev C with FAP upgrade kit P/N 870-1831-01. The FAP P/N 870-2320-01 Revs A-I can be upgraded to FAP P/N 870-2320-01 Rev J with FAP upgrade kit P/N 870-1831-02.

CAUTION: All personnel associated with the installation of this system must adhere to all safety precautions and protection equipment required to avoid the possibility of injury to personnel, service degradation, and/or service interruption.

CAUTION: This is a redundant system to allow service during normal maintenance. When repairs require a total power disconnect, both input supply sources must be disconnected. This will cause service interruption and take down the system.

Fuses

The fuse and alarm panel uses GMT-type fuses of different amperage ratings (refer to Table 3-27) for individual circuit protection. If a frame circuit fuse is blown the alarm is indicated by an LED on the front panel and a small colored flag on the fuse shows the fuse that has failed (refer to Figure 3-64). Refer to the *Maintenance Manual* for procedures on replacing fuses and the FAP assembly.

CAUTION: Always use a fuse of the same type and amperage rating when replacing a failed fuse.

Figure 3-64. Fuse (GMT Brand Shown)

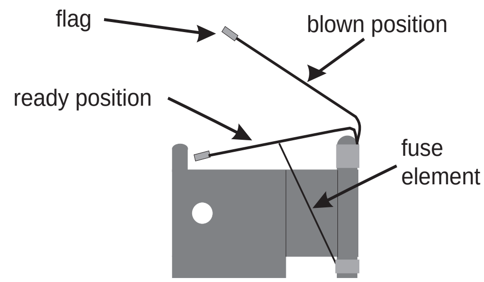


Table 3-27. Fuse Color Codes of Alarm Flags

Fuse Amp	Fuse Flag Color		Fuse Amp	Fuse Flag Color
0.18A	Orange-Red		2A	Orange
0.2A	Black-Red		2.5A	White-Orange
0.25A	Violet		3A	Blue
0.33A	Yellow-Green		3.5A	White-Blue
0.375A	White-Green		4A	White -Brown
0.5A	Red		5A	Green
0.65A	Black		7.5A	Black-White
0.75A	Brown		10A	Red-White
1A	Gray		12A	Yellow-Green
1.33A	White		15A	Red-Blue
1.5A	White-Yellow			

Fuse and Alarm Panel (P/N 870-1606-xx/870-2320-xx)

The FAP P/N 870-1606-xx can be installed in standard frames. The FAP P/N 870-2320-xx can be installed in heavy duty frames.

The FAP contains an alarm board, two diode boards, and a jumper board. These boards are located at the front center of the FAP. The fuse holders are to the left and right of these boards as shown in Figure 3-65.

The alarm board contains a FUSE LED to indicate a failed fuse (for either bus A or B) and LEDs to indicate Critical, Major, and Minor alarms generated by the system that are applicable to that frame which the FAP is installed.

There are two diode boards in the FAP, one for bus A and one for bus B. Each diode board contains power diodes and circuitry which allow one bus to pick up the entire load when there is a loss of input power on the other bus. An LED indicates the input power state to the FAP. The LED is green when input power is applied to that bus of the FAP and is red when there is no input power to that bus of the FAP.

The Maintenance (Jumper) board allows the removal of one or both diode boards without taking down the system. The Jumper board has two connectors and a connector plug. During normal operation, the connector plug is seated on the first connector. For maintenance operation, the jumper board has to be removed and the connector plug moved to the second connector. In the maintenance position, the connector plug connects both A and B power feeds to the fuse panels so one or both diode boards can be safely removed. The OP/MAINT LED is green when the Jumper board is in normal operational mode and is red when in the maintenance mode of operation. Refer to the *Maintenance Manual* for additional information to place the FAP into Maintenance Mode of operation.

An unlit LED indicates a failed LED or no power to the FAP.

Figure 3-65 and Table 3-28 describes the front panel configuration of the fuse and alarm panel (P/N 870-1606-xx/870-2320-xx).

Figure 3-65. Fuse and Alarm Panel (P/N 870-1606-xx/870-2320-xx) Front

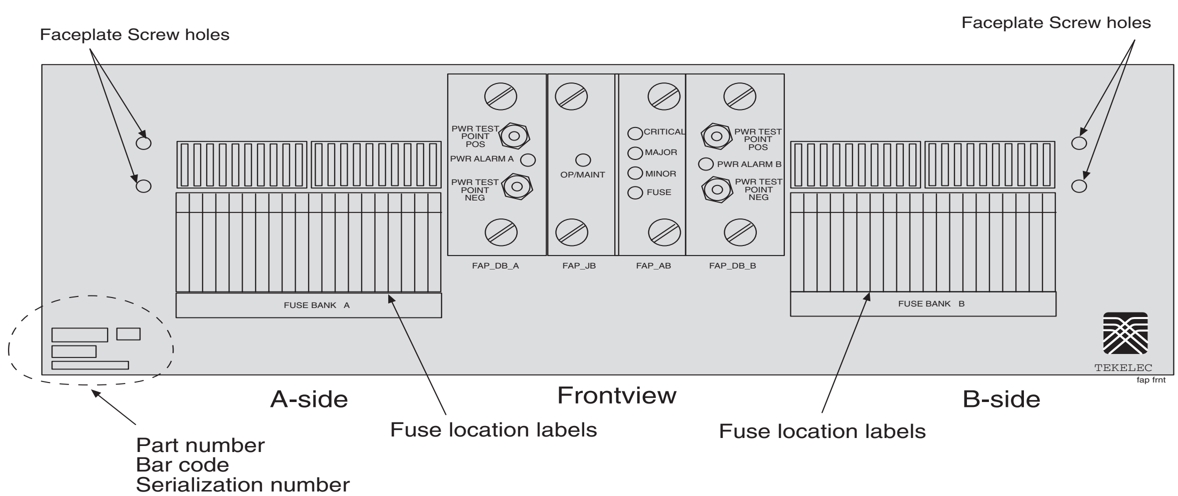


Table 3-28. Fuse and Alarm Panel c Front Items

Fuse Panel Item	Description
Fuse Positions	Two groups of 20 GMT fuses
PWR ALARM	LED indicator for A or B diode board input power • Green - input power applied • Red - no input power to board
OP/MAINT	LED indicator for mode of operation • Green - normal • Red - maintenance
FUSE	LED indicator for fuse fail alarm • Green - normal • Red - blown fuse
CRITICAL	LED indicator for frame critical alarm
MAJOR	LED indicator for frame major alarm
MINOR	LED indicator for frame minor alarm

Figures 3-66 and Table 3-29 describes the rear panel configuration of fuse and alarm panel (P/N 870-1606-xx). Refer to the *Installation Manual* for cabling connection information.

Figure 3-66. Fuse and Alarm Panel (P/N 870-1606-xx/870-2320-xx) Rear

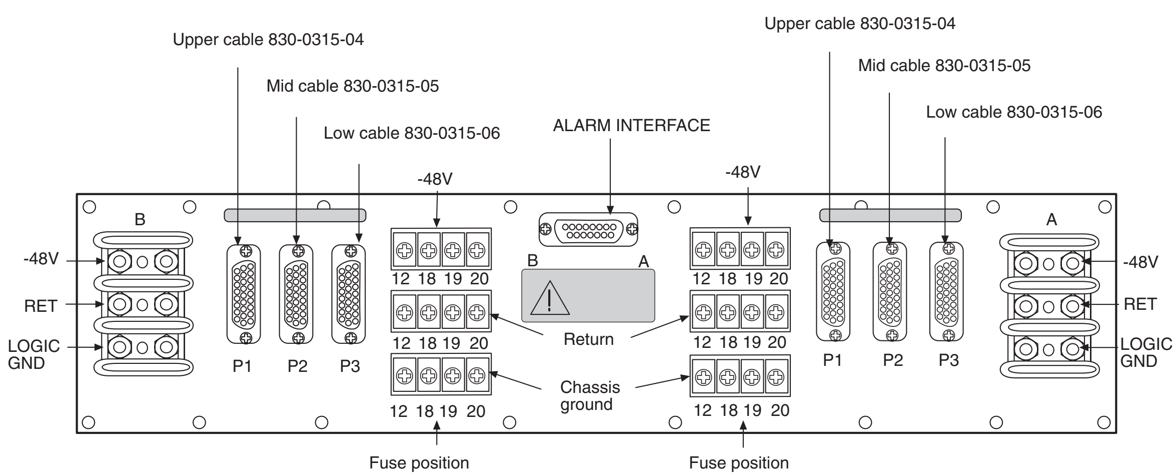


Table 3-29. Fuse and Alarm Panel (P/N 870-1606-xx/870-2320-xx) Rear

Fuse Panel Item	Description
Input Terminal Block A	Logic Ground, Return, and Input for power source A
Input Terminal Block B	Logic Ground, Return, and Input for power source B
Output Terminal Block A	–48VDC, Chassis Ground, and RTN for Fuse location 12, 18, 19, and 20 for side A. These are miscellaneous extra capacity fuses refer to *"Provision Rules for FAP Fuse Locations"* on page 3-123
Output Terminal Block B	–48VDC, Chassis Ground, and RTN for Fuse location 12, 18, 19, and 20 for side B. These are miscellaneous extra capacity fuses refer to *"Provision Rules for FAP Fuse Locations"* on page 3-123
–48VDC, Chassis Ground, and RTN Outputs A	26-pin "D" connectors, P1, P2, and P3 for A-side outputs.
–48VDC, Chassis Ground, and RTN Outputs B	26-pin "D" connectors, P1, P2, and P3 for B-side outputs.

Table 3-30. Fuse and Alarm Panel (P/N 870-1606-xx/870-2320-xx) Specifications

Power Requirements	
Voltage	–48VDC
Current Capacity	40 amp "A" or "B" for P/N 870-1606-01 40 amp "A" or "B" for P/N 870-1606-02 Rev A and B 40 amp "A" or "B" for P/N 870-2320-01 Rev A through H 60 amp "A" or "B" for P/N 870-1606-02 Rev C 60 amp "A" or "B" for P/N 870-2320-01 Rev J
Power Dissipation	8 W, no fuse load
Dimensions	
Height Width Depth	3 inches (7.6 cm) 17 inches (43.2 cm) 10.25 inches (26 cm)

Provision Rules for FAP Fuse Locations

These provisioning rules for fuse placement apply to FAPs P/N 870-1606-xx and P/N 870-2320-xx.

- Maximum fuse size 3 amp for Fuse one through Fuse 18 when P1, P2, or P3 are used for power output
- P2 cannot be used if the Terminal Strip (output) position 12 is used
- P3 cannot be used if the Terminal Strip (output) position 18 is used
- Fuse maximum of 15 amp for fuse positions 12, 18, 19, and 20, all other fuse positions are 3 amp

  NOTE: For fuse locations 12, 18, 19, and 20, the fuse maximum is 10 amp when adjacent locations are used.
- Power feed must originate from the same power source
- Fuse and Alarm Panel, Jumper Board (P/N 870-1641-01) fuse size on boards 40 amp per side for P/N 870-1606-02 Rev A and B, and for P/N 870-2320-03 Rev A through I. Fuse size on boards 60 amp per side for P/N 870-1606-02 Rev C and 870-2320-03 Rev J.
- Fuse and Alarm Panel, Jumper board in maintenance mode must be less than 40 amp per distributed output side.

Label Kit for FAP (P/N 870-1606-xx/870-2320-xx)

Label Kit (P/N 870-1915-02) contains large sheets of die-cut stick-on labels for the appropriate frames. There are three large sheets of die-cut, stick-on labels:

- Sheet (P/N 658-0604-01) is for FUSE BANK A, CONTROL FRAME through EF-04
- Sheet (P/N 658-0604-02) is for FUSE BANK B, CONTROL FRAME through EF-04
- Sheet (P/N 658-0604-03) is for MISC FRAME

Also included in the Label Kit (P/N 870-1915-02) are smaller die-cut stick-on labels for different fuses relating to different amps and individual pieces of site-specific equipment; these are to be pressed into fuse OPEN spaces.

Procedure – Faceplate Labels

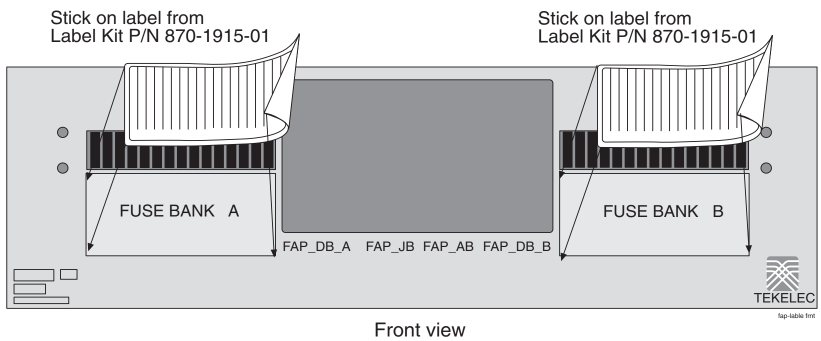
1. Peel the individual die-cut label that designates a specific frame from one of the three large die-cut sheets of labels.

2. Press the sticky side of the label into the silk screened area on the front of the faceplate of the Fuse and Alarm Panel (P/N 870-1606-xx) for the specific frame (refer to Figure 3-67 "FAP, Fuse Label Kit (P/N 870-1915-02)" on page 3-124). The left side of the faceplate is marked A and the right side of the faceplate is marked B.

3. The label designates CONTROL FRAME or EF-00 through EF-04. There are also labels for the MISC FRAME.

The labels must be pressed into place on the front faceplate of the correct frame.

Figure 3-67. FAP, Fuse Label Kit (P/N 870-1915-02)



Fuse Assignments

Refer to the *Installation Manual*, “Fuse and Card Locations” section for information on the fuse assignments for the Control Frame, CF-00 and five Extension Frames, EF-00 through EF-04.

The power distribution for the control frame and the extension frame are shown in the following figures:

- Control frame, Figure 3-68, *“Control Frame FAP (P/N 870-0243-08 and P/N 870-1606-xx),”* on page 3-125
- Extension frame, Figure 3-69 "Extension Frame FAP (P/N 870-0243-08 and P/N 870-1606-xx)" on page 3-126

Figure 3-68. Control Frame FAP (P/N 870-0243-08 and P/N 870-1606-xx)

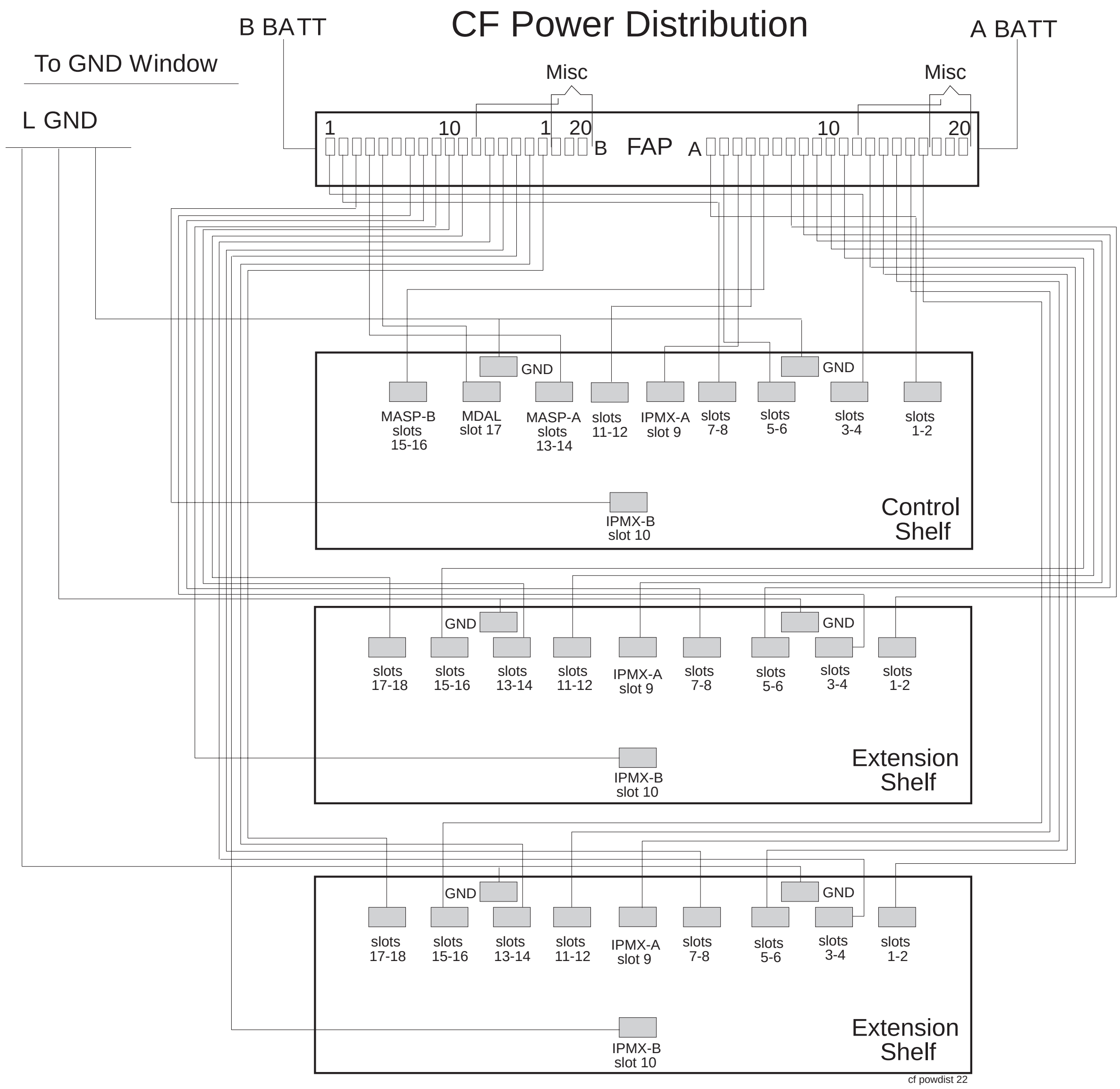
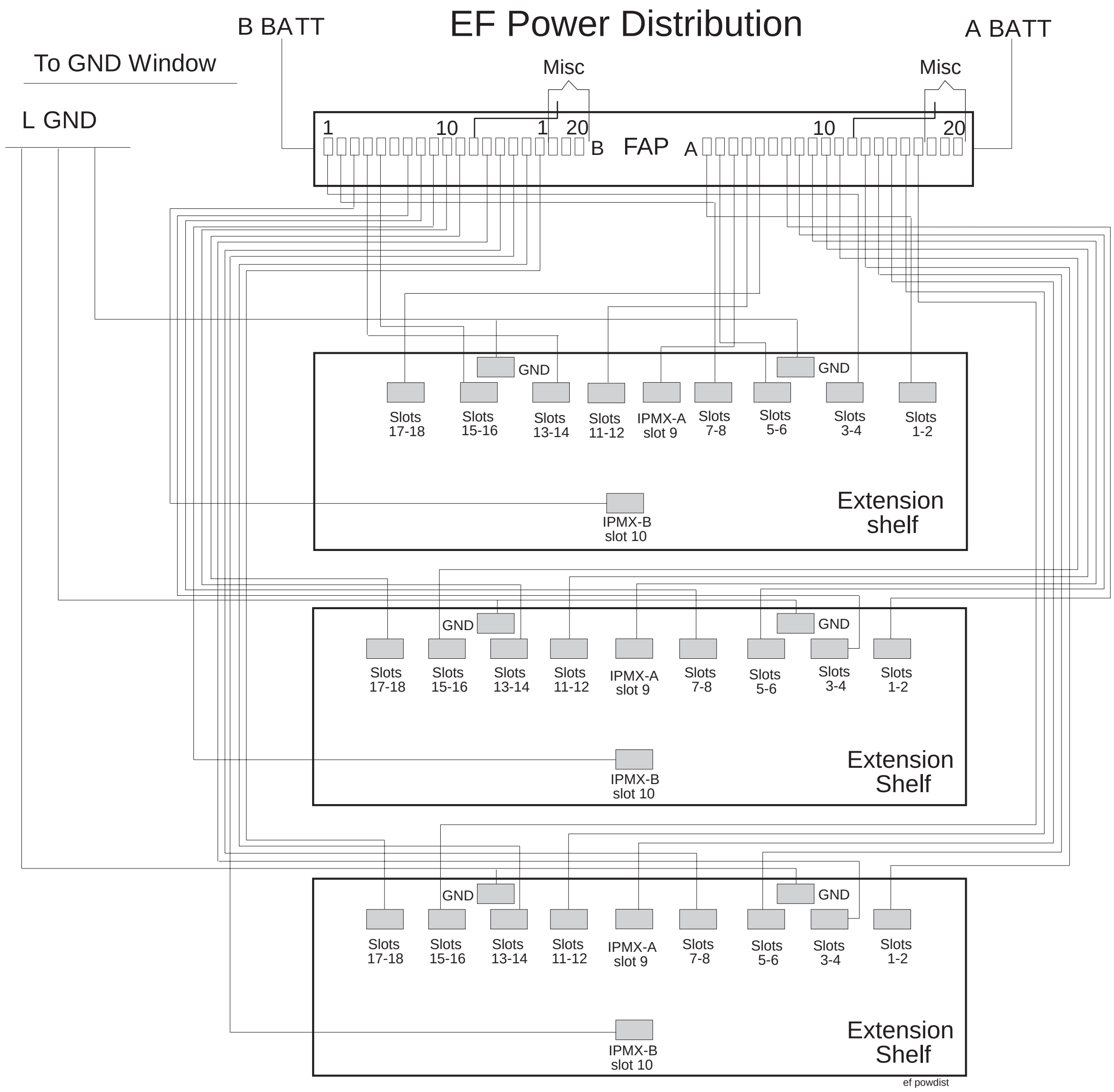


Figure 3-69. Extension Frame FAP (P/N 870-0243-08 and P/N 870-1606-xx)



Holdover Clock

The holdover clock (refer to Figure 3-70 "Holdover Clock" on page 3-128) is an optional device that can maintain clock synchronization for system Digital Signal Level-0 Applique (DS0A) links during brief (up to 15 seconds) Building Integrated Timing System (BITS) clock signal outages. This follows Telcordia Technology requirements as specified in GR-1244-CORE.

The holdover clock is connected to the BITS clock source in the system. The BITS clock inputs to the system through the control shelf. The device is located in, and receives –48VDC power from, a miscellaneous frame (refer to Figure 3-71 "Holdover Clock" on page 3-128).

Connections from the holdover clock to the system control shelf consist of two clock cables and a cable to signal holdover clock alarm conditions to other parts of the system.

The holdover clock contains the following:

- Maintenance Interface System (MIS) (P/N 804-0175-01) card system alarm interface which provides alarms output to the system control shelf.
- Two Critical Status Indicators (CI) (P/N 804-0165-01) cards for clock inputs A and B.
- Two Signal Transfer, Stratum-3 (ST-3) (P/N 804-0173-01) cards for clocks A and B.
- Three Timing Output Composite Clock Automatic (TOCA) (P/N 804-0166-01) cards, clock outputs (TO1 and TO2) for A and B through the system control shelf.

  NOTE: The TOCA cards my be replaced with TOLA cards. For wiring information on TOLA cards see the Installation Manual.
- One Matrix Controller Automatic-5 (MCA)(P/N 804-0251-01) card controls the output protection switch matrix just above the Data Carrier Detect (DCD) DCD-523 shelf card slots.

The outputs of the TOCA cards are connected to a wire-wrap panel mounted on top of the holdover clock. The clock inputs on the system's control shelf are connected to the holdover clock wire-wrap panel.

Figure 3-70. Holdover Clock

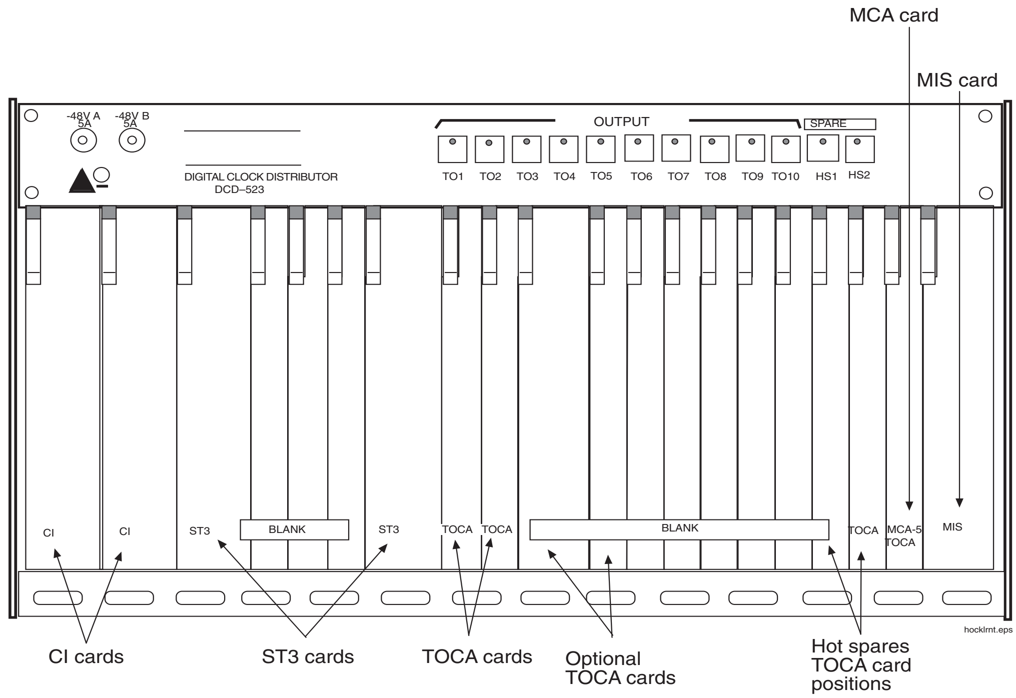
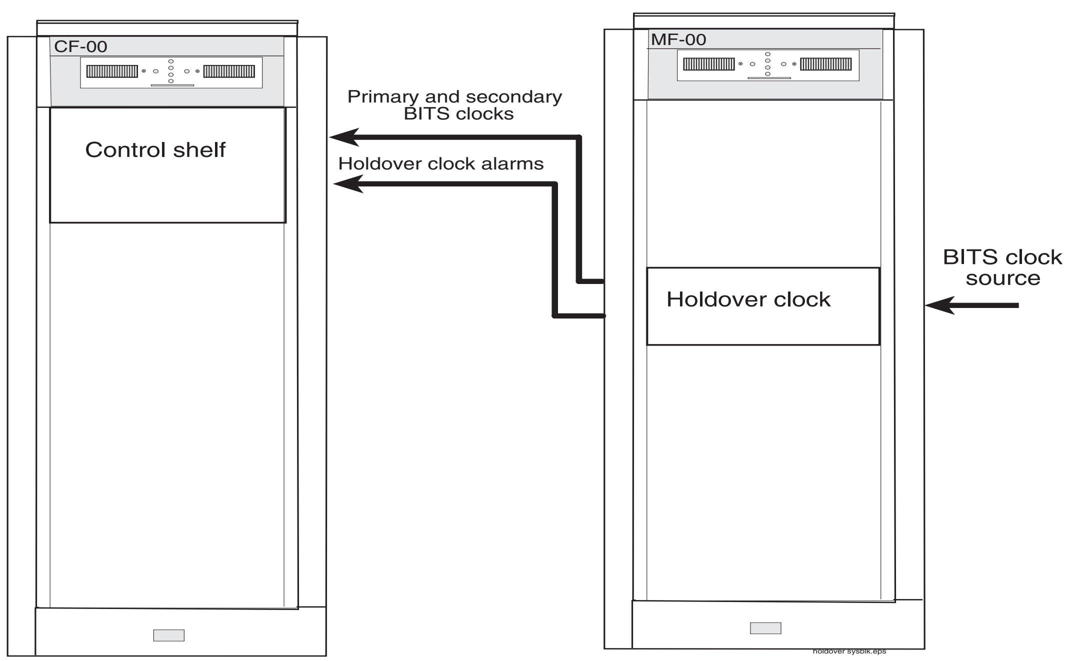


Figure 3-71. Holdover Clock



Maintenance Interface System Card

The Maintenance Interface System (MIS)(P/N 804-0175-01) card provides local and remote command and control for the holdover clock. The MIS card is installed in the far right slot of the holdover clock shelf (refer to Figure 3-72 "Maintenance Interface System Card Block Diagram" on page 3-129 for an MIS card block diagram).

The MIS provides Data Carrier Detect (DCD) alarm summary with office and remote alarm relay closures and status indicators, as well as remote RS-232 communication.

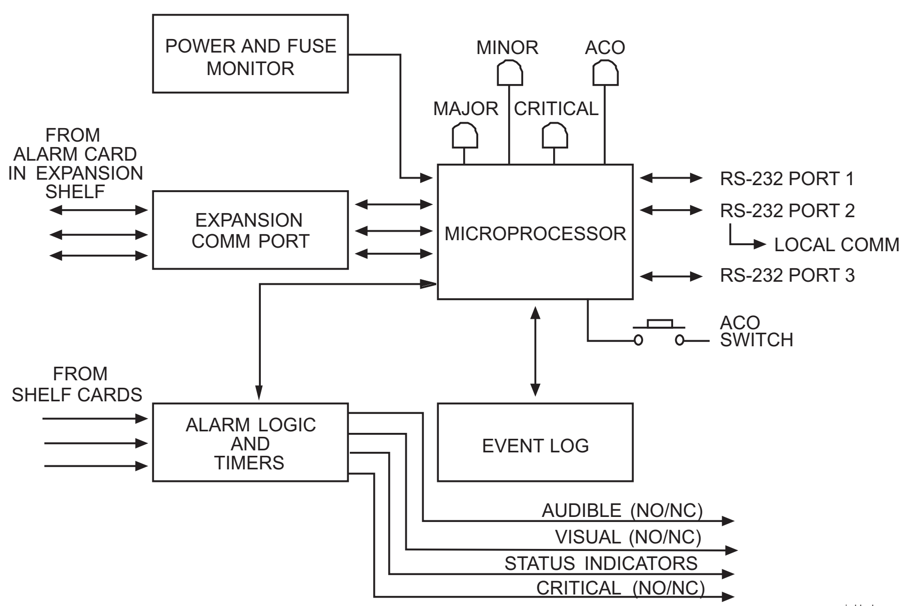
Output alarms from the Timing Output Composite Clock Automatic (TOCA) cards, input reference alarms from the clock inputs, and failure alarms from any card in the shelf are sent to the MIS card. Status indications including clock loss and port alarms are also monitored by the MIS card.

Depending on which alarms are received, the MIS activates audible and visual alarm and Status Indicator (SI) outputs. An additional set of status leads on the back enables either a major, minor, or critical alarm in the event of the failure of a battery or blown fuse.

NOTE: Major, minor, and critical alarm leads have both Normally Open (NO) and Normally Closed (NC) dry relay contacts. Major, minor, and critical status indicators have NO relay contacts only. All other Status Indicators are open-collector outputs between the SI lead and battery return.

Alarm battery supply is not required for the system. When DC power is lost to the shelf, the normally open relays close, initiating an office alarm (refer to Figure 3-72).

Figure 3-72. Maintenance Interface System Card Block Diagram



A front-panel Alarm Cut Off (ACO) push button, when pressed, silences the audible alarm and lights the ACO lamp. The ACO push buttons on all shelves in the system have the same effect. An external lead on the shelf backplane is provided for remote ACO operation.

The status of the shelf is available at the front panel lamps. A Major, Minor, or Critical lamp lights to indicate that one of those alarms exists on the shelf. The Fail lamp lights to indicate the MIS card has failed. The Alarm Cut Off (ACO) lamp lights when the ACO push button, is pressed to silence an audible alarm, before the alarm is cleared.

Critical Status Indicators Card

Two Card Indicator (CI)(P/N 804-0165-01) cards, provide input signal redundancy. Each CI card uses one Common Channel (CC) or one Digital Signal Level 1 (DS1) input as its timing reference. A switch on the CI card selects the type of input and the framing format, if DS1, of the input timing signal. Front panel lamps (CC and DS1) show which type of input is present.

Under normal operating conditions, CI A drives clock card A, and CI B drives clock card B. Both input reference signals are simultaneously monitored, and if an input fails, the clock card automatically switches to the other CI card, which then supplies both clock cards until the failed reference is restored. The SOURCE ACTIVE lamp on the front panel indicates which CI card is on-line.

The CI card contains a source control circuit that causes the card to switch to the redundant CI card if the primary card, defined as the card currently in operation, fails.

Transfer between CI cards can be manually initiated by pressing the front-panel XFR switch on either CI card.

Switching activity between CI A and CI B will not cause the timing outputs to transmit phase hits, as the phase information of the active signal is transferred to the redundant CI card before switching. A Phase Locked Crystal Oscillator (PLXO) keeps the CI output stable while the transfer takes place. The PLXO also removes any phase jitter from the incoming signal before it passes the reference to the Timing Output Composite Clock Automatic (TOCA) cards.

If both CI cards fail, the clock cards go into holdover mode, and the system automatically uses the active clock card.

Stratum-3 Card

The Signal Transfer, Stratum-3 (ST-3) (P/N 804-0173-01) clock card provides timing signals at Stratum-3 accuracy to the TOCA cards. Select logic on each TOCA card automatically chooses the input timing signal of the highest priority.

The ST-3 card is based on Phase Lock Loop (PLL) filtering and VXCO technology. The ST-3 is a relatively wide-bandwidth, fast-tracking clock that provides the necessary jitter attenuations and holdover stability. The PLL output is compared to a Temperature-Compensated Oscillator (TCXO), and an offset is generated to phase lock to the clock input, A or B.

If an input source is unavailable or has failed, the circuit goes into clock holdover mode at the frequency of the last valid input. If the holdover clock is started without an input reference, the ST-3 maintains accuracy at a predetermined rate.

If both ST-3 cards fail, a major system alarm is issued and the TOCA cards use the output of the clock input cards.

A phase build out circuit between the two clock input cards, A and B, and each ST-3 clock prevents transients from being transmitted to the Timing Output (TOCA) cards when there is a transfer between the two ST-3 cards.

TOCA and TOLA Cards

A Timing Output Composite Clock Automatic (TOCA)(P/N 804-0166-01) card, provides 10 composite clock timing outputs. There is a third TOCA card in the hot spare slot.

A source select circuit obtains the timing signal from either ST-3 clock card A or B. If no input timing signals are present, the TOCA card turns off both its ST-3 and INPUT lamps, lights the FAIL lamp, and mutes the outputs.

A Phase Lock Loop (PLL) circuit reconstitutes the internal timing signal. The reconstituted Computer and Communications (CC) timing signal is then applied to each port driver and sent through an impedance matching transformer.

The outputs are fed to the interface panel.

If the TOCA card fails or the output monitor determines that one to five output drivers have failed or are shorted, the front panel PORT ALM lamp lights, and a minor alarm is generated.

Whenever manual or automatic protection switching takes place, the TOCA cards automatically transfer option switch settings to the hot spare, TOCA card.

NOTE: An OEM purchased Timing Output Logic Automatic (TOLA) can be used as a composite clock source. The output cable connections are different from the TOCA card pin outs. See the Installation Manual for instructions about cabling both the TOCA and TOLA clock outputs.

MCA Card

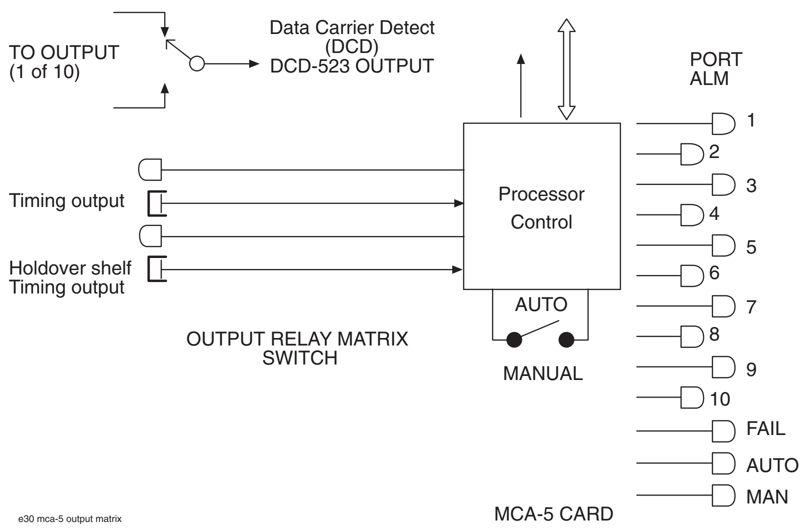
The Matrix Controller Automatic-5 card (MCA)(P/N 804-0251-01) controls the output protection switch matrix just above the holdover shelf and card slots on the hold over clock. It monitors the protection matrix push-button for activation. The MCA card requires the presence of at least one Hot Spare (HS) TOCA card in the slots provided immediately to the left of the MCA. Each holdover clock shelf contains slots for two hot spare TOCA cards.

The MCA card monitors the protection matrix for activation and the TO cards for port and fail alarms. When an active TO card indicates a failure or is removed, the MCA activates the relays and lamps in the protection matrix and switches in the appropriate hot spare TOCA card, if installed.

To ensure that a hot spare TOCA card cannot be accidentally placed in service or accidentally taken out of service, activating the hot spare TOCA card requires that the MCA detect a timing output failure or the front panel be pressed in the correct sequence. In addition, no switch occurs if the MCA card is physically removed from the shelf.

NOTE: The MCA-5 can only switch from one TOCA to a hot spare TOCA at a time. There are six different TOCA card types and two hot spare TOCA slots per shelf.

Figure 3-73. MCA-5 Card and Output Protection Matrix



4

Hardware Descriptions — OEM-Based Products

OEM-Based Product Descriptions

Original Equipment Manufacturer (OEM)-based products use Common Off-The-Shelf (COTS) components configured in a Tekelec standard or heavy-duty frame. Systems are configured at Tekelec for NEBS compliance and typically have redundant components for reliability and maintainability. OEM-based products support application specific services that interact with the SS7 and IP networks.

NOTE: Elements used in OEM-based products have components configured by Tekelec to conform to Network Equipment-Building System (NEBS) generic equipment requirements.

TOPPLE DANGER: Systems with slide shelf mounted equipment must also be anchored to the overhead cable racks. Before beginning installation, ensure the frame is properly secured to the floor and overhead cable racks to prevent the frame from tipping over when the server slide shelves are extended.

Extended Services Platform (ESP) Host Servers

This section describes the parts of the ESP server nodes. An ESP server can monitor a maximum of 32 SS7 links. ESP server nodes are populated in an N + 1 configuration for redundancy to a maximum of 17 in an ESP subassembly frame. ESP server nodes are rack mounted in heavy-duty frames.

The ESP server node is a one-processor device and has no frame buffer, audio capability, mouse port, or keyboard port. The console ports and Ethernet ports are the primary interfaces of model 120 server.

The server node provides the following:

- High performance processor.
- Modular internal design.
- High performance disk, system, memory and I/O subsystems.
- High performance Peripheral Component Interconnect (PCI)/Serial Asynchronous Interface connection I/O (8 port break-out box).
- Redundant hot swap power supply units.
- Powered by redundant –48VDC supplies.

Server Model 120 Features

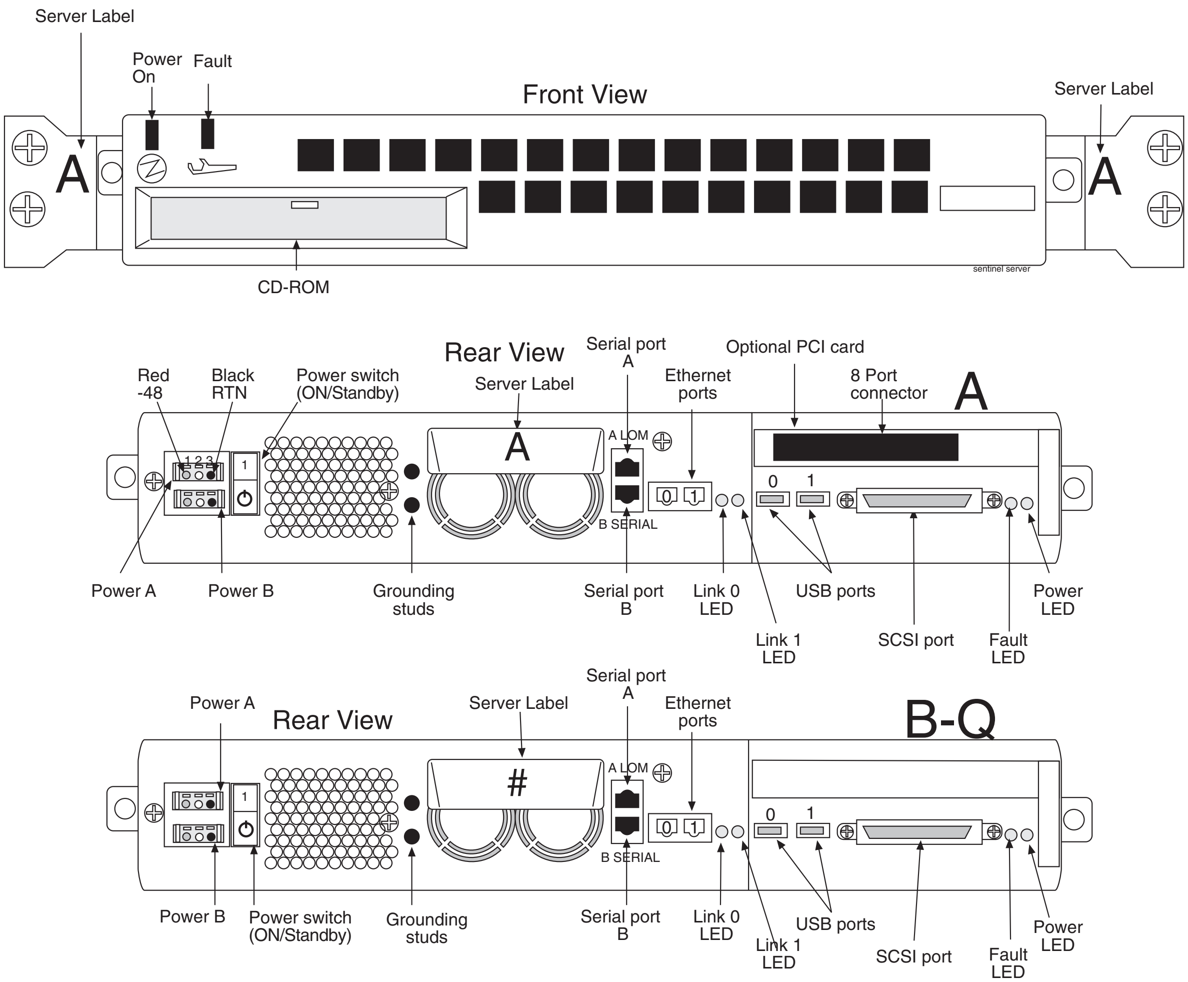
The server primary board contains the Central Processing Unit (CPU) module, memory, system control Application-Specific Integrated Circuits (ASICs) and I/O ASICs.

Table 4-1. System Specifications.

Server Node Specifications	
Dimensions and Weight Height Width Depth Weight (unpackaged but fully configured)	 44.0 mm (1.73 in.) 437.2 mm (17.21 in.) 487.4 mm (19.19 in.) 10kg (22 lbs.)
CPU Processor type Clock rate CPUs provided Cache on module	 UltraSPARC-II 650 MHz One Processors (NEBS level 3 compliant) 256 Kbyte Internal
Memory Size Memory type	 4 GB maximum PC133 standard Registered DIMMs
Storage (Internal) Bus Disks CD-ROM	 66 MB/second UltraSCSI Two 3.5x1-in. disks (36GB); disk bays are front accessible and support hot-plug 644 MB Slim line CD-ROM drive; 24X speed or DVD-ROM
I/O Architecture PCI Interface/Serial Asynchronous Interface connection Serial ports I/O ports	**See Note:** Two RS-232C/RS-423 serial ports (RJ45) Expansion Serial port interface. Two Ultra-SCSI port Two standard 10/100BASE-T ports
Operating System	Solaris 8

NOTE: ESP server 1A (top server) has an expansion serial board connected by cable to the serial break-out box. ESP server 1B through 1-Q are accessible only though the standard Ethernet ports and serial ports.

Figure 4-1. ESP Server Front and Rear Views



ESP Server LEDs

The following table lists the LED indicators of the ESP servers. The LEDs are located on the front and back of the ESP servers.

Table 4-2. ESP Server LEDs

Location	LED Name	Color	Description
Front and Rear Panel	Power	Green	Power feed available and Standby/on switch ON
Front and Rear Panel	Fault	Yellow	• ON Operating system stopped • OFF No faults detected • Blinking — Fault detected
Rear Panel	Link Activity	Green	One LED for each standard IP interface (two)

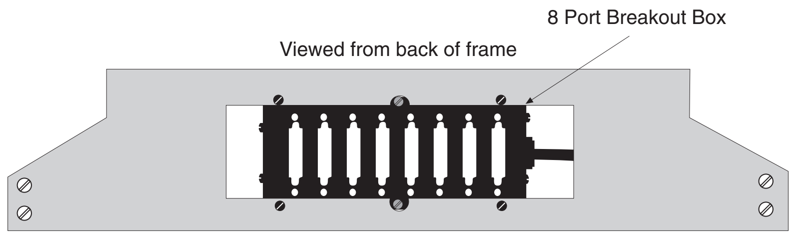
SAI/P Card

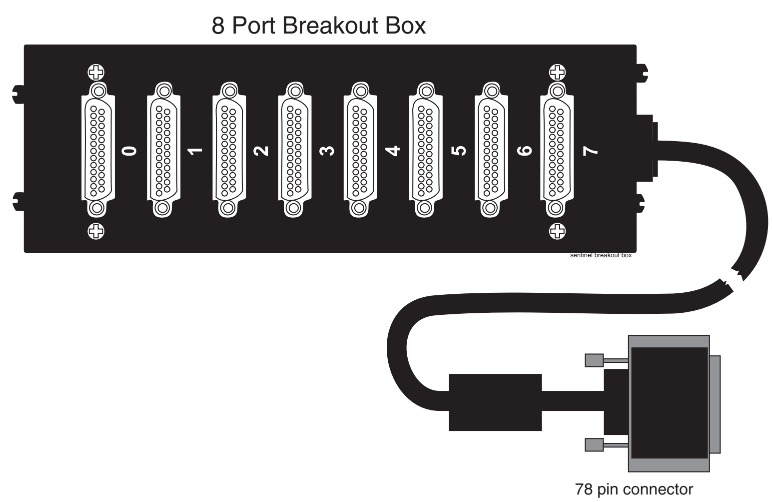
The Sun SAI/P card (Serial Asynchronous Interface PCI Adapter) is used with the 8-Port Connector Box to provide eight programmable ports for low-speed devices for 50 bps to 115,200 bps transmission for the ESP subsystem. This module is installed in the expansion slot in ESP server 1A only.

8-Port Connector Box

The 8-Port Connector Box segments the output of the Sun SAI/P card into eight ports for the ESP subsystem. This box connects to the Sun SAI/P card with a 78-pin plug on a 40-inch cable in ESP server 1A only. Figure 4-2 shows the details of the Connector Box.

Figure 4-2. 8-Port Connector





OEM-Based Networking Elements

This section describes the common networking elements that can be used in OEM-based products. Networking elements of OEM-based products provide the connections and communications links for interworking between the SS7 networks, local customer networks, and the Internet.

NOTE: Some OEM-based products do not use all of the networking components, for example, the MPS systems. Use Appendix A, *Hardware Baselines*, to determine the specific components that can be configured in system releases.

Common networking components described in this section include:

- *"Ethernet Hubs"* on page 4-6
- *"Routers"* on page 4-7
- *"Ethernet Switches"* on page 4-9
- *"OEM-Based Peripheral Elements"* on page 4-11

Ethernet Hubs

The following section provides an overview of the Ethernet hubs used in OEM-based products. The hubs cross-connect the components in OEM-based products functioning as an internal Local Area Network (LAN). The hubs support domain-switched dual-speeds and a maximum of sixteen RJ45 ports each. The chip technology enables hubs to identify and accept either 100 Mbps or 10 Mbps LAN interfaces on a per-port basis. Figures 4-3 and 4-4 show the front and rear views of a hub.

Figures 4-3 and 4-4 show the front and rear views of the hub.

Figure 4-3. Hub Front View

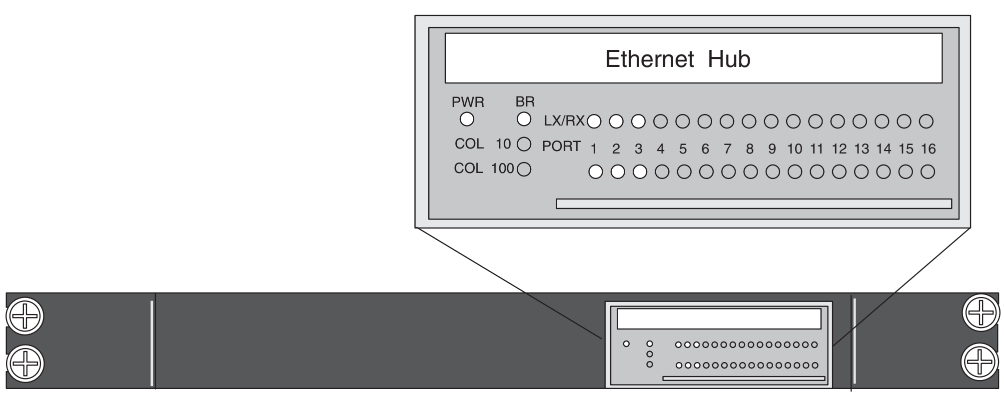


Figure 4-4. Hub Rear View

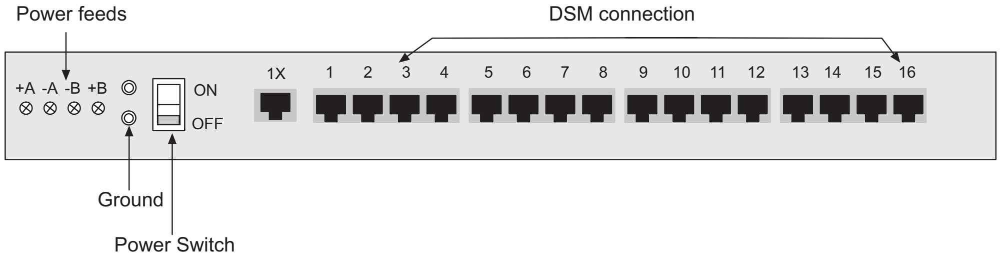


Table 4-3 describes the LEDs located on the front of the hubs.

Table 4-3. Hub LEDs

LED	Color	Description
PWR	Green	Lights whenever the power is applied
COL 10	Red	Intermittent blink during a 10Mbps domain collision
COL 100	Red	Intermittent blink during a 100Mbps domain collision
BR	Green	Lights whenever the bridge module is installed
100/AUTO (Per Port)	Green	• Lights whenever speed is 100 Mbps • Unlit whenever speed is 10 Mbps • Blinks whenever a link is not connected or when auto-negotiating
LK/RX (Per Port)	Green	• Lights steadily whenever port is operational • Blinks whenever port is receiving data

Routers

The routers used in OEM-based products are configured by Tekelec for NEBS compliancy. Two types can be configured; isolation routers and dial-in routers.

NOTE: Some OEM-based products do not use routers, for example, the MPS systems. Use Appendix A, *Hardware Baselines*, to determine the specific components that can be configured in system releases.

The isolation routers provide 10/100Mbps communications between the customer LAN or dedicated network and the IP^7 Front End, hubs, and host servers. The dial-in router allows remote dial-up access to the internal AS*i* 4000 SCP LAN. Figure 4-5 shows the front view of the routers and Table 4-4 describes the LED indicator functions on the front of the router.

Figure 4-5. Front View Routers

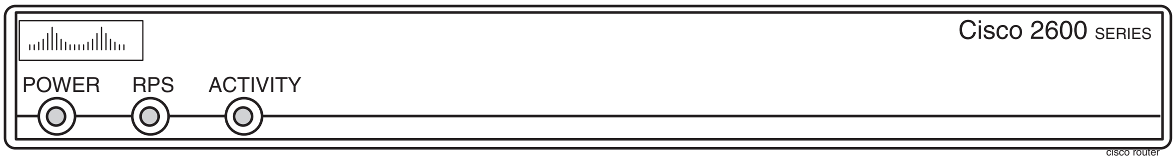


Table 4-4. Router Front LEDs

LED	Description
PWR	Indicates when power is present to the router and the power switch is in the ON position.
RPS (Always OFF)	Off when the redundant power supply is not present. On redundant power supply is present and functional.
Activity	Off-No network activity Blink-Network activity

Figures 4-6 and 4-7 show rear views of the Isolation and Dial-In routers. Link (LNK) and activity (ACT) LEDs are located near each ethernet port at the rear of the routers. Table 4-5 describes the LED indicators on the rear of the routers.

Figure 4-6. Rear View Isolation Router

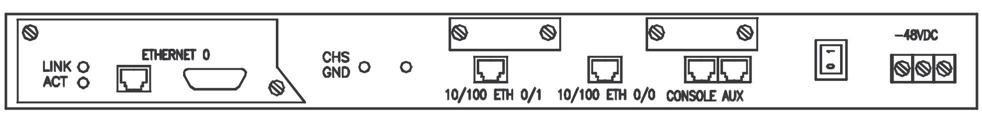


Figure 4-7. Rear View Dial-in Router

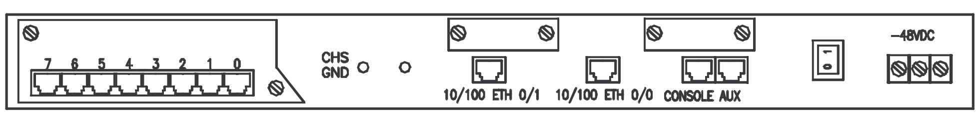


Table 4-5. Router Rear LEDs

LED	Description
LNK	Indicates link is established to far end connection.
ACT	Blink-indicates data activity on the link.

Ethernet Switches

The following section provides an overview of the Ethernet LAN switches used in some OEM products. The ethernet switches cross-connect the components in the frames functioning as an internal Local Area Network (LAN). The switches support 24 auto-sensing 10/100Mbps ports each.

Figure 4-8 illustrates the front and rear of the Ethernet switch.

Figure 4-8. Ethernet Switch

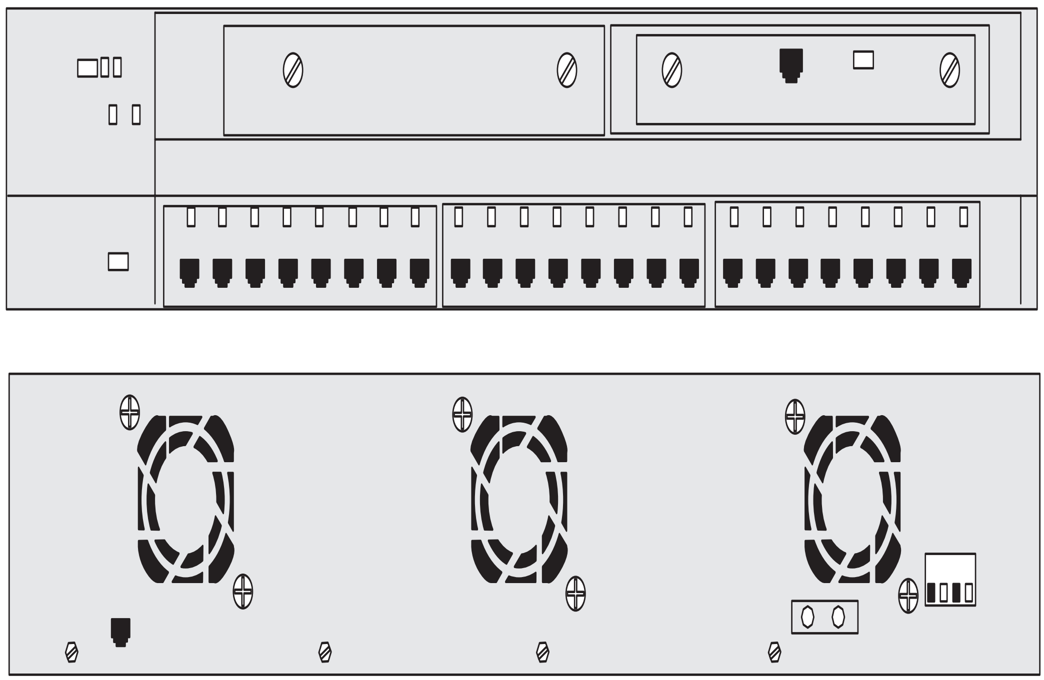


Table 4-6 describes the LEDs located on the front of the switches.

Table 4-6. Ethernet Switch LEDs

LED	Description
System	Green-Indicates when power is present to the switch and the power switch is in the ON position. Amber-Indicates power is present but system is not functioning properly
1 and 2	Indicates expansion boards WS-X2932-XL are installed and functioning LED 1 (Left board) LED 2 (Right board)
RPS (Always OFF)	Off when the redundant power supply is not present. Redudant power supply is not configured

Table 4-6. Ethernet Switch LEDs (Continued)

LED	Description
Pressing the MODE switch on the front of the WS-C2924-XL-EN changes the per-port LED indications to the following.	
STAT (port status) Default	Off-No link. Solid green-Link present. Flashing green-Activity. Port is transmitting or receiving data. Alternating green/amber-Link fault. Error frames can affect connectivity, and errors such as excessive collisions, CRC errors, and alignment and jabber errors are monitored for a link-fault indication. Solid amber-Port is not forwarding. Port was disabled by management or an address violation or was blocked by Spanning Tree Protocol (STP). **NOTE: After a port is reconfigured, the port LED can remain amber for up to 30 seconds as STP checks the switch for possible loops.**
UTL (utilization)	Green-The LEDs display backplane utilization on a logarithmic scuffle all port LEDs are green, the switch is using 50 percent or more of its total bandwidth capacity. If the right-most LED is amber, the switch is using less than 50 percent of its total bandwidth. If the LED to the left of the right-most LED is amber, the switch is using less than 25 percent of its total capacity, and so on.
FDUP (port full-duplex)	Off-Port is operating in half duplex. Green-Port is operating in full duplex.
100 (port speed)	Off-Port is operating at 10 Mbps. Green-Port is operating at 100 Mbps.

OEM-Based Peripheral Elements

Peripheral elements used in the OEM-based products are common components required to provide service functionality. Peripheral components described in this section are:

- *"Breaker Panels"* on page 4-11
- *"Eight-Port Connector Box"* on page 4-13
- *"8-Port Connector Box"* on page 4-5

Breaker Panels

The following section describes the components of the Telect Breaker Panels (BP) used in OEM-based products. The BPs provide the following features:

- Dual-feed power inputs (Input A and Input B) to each breaker panel, totalling four breakers for the system. (30-amp domestic or 32-amp international)
- Maximum of fourteen breakers each breaker panel
- Breaker panels accept circuit breakers up to 20 ampere rating
- Visual A and B input power alarms with single remote dry contact indicator
- Replaceable alarm card

  NOTE: The drip tray, located under the breaker panels, is designed to assure compliance with NEBS, UL, and CE safety requirements, aiding damage control in the event of a fire. See Figure 4-9 for the location of the breaker panel drip tray.

Figure 4-9 shows the details of the front view of the breaker panel

Figure 4-9. Telect Breaker Panel Front View

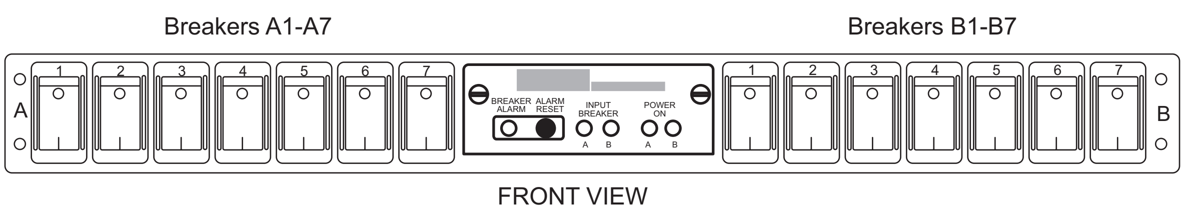
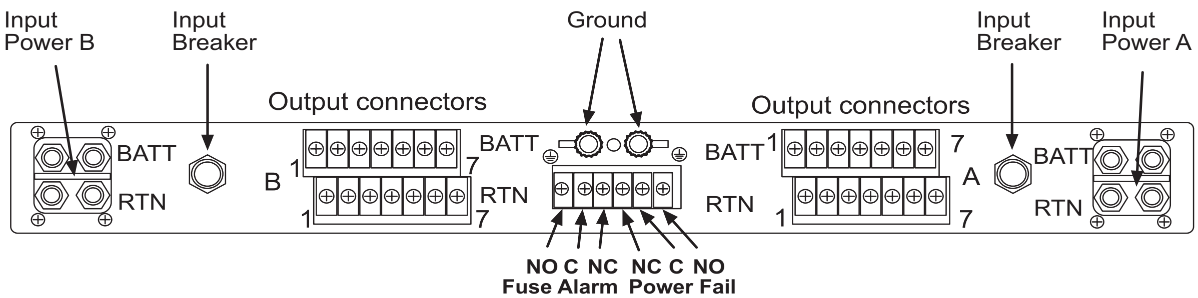


Figure 4-10 shows the rear details of the breaker panel.

Figure 4-10. Telect Breaker Panel Rear View



NOTE: When breakers trip to the half-way position as a result of an overload they must be switched completely OFF then ON to reset.

Figure 4-11 provides details of the alarm panel on the Telect Breaker Panel.

Figure 4-11. Telect Breaker Panel Alarms

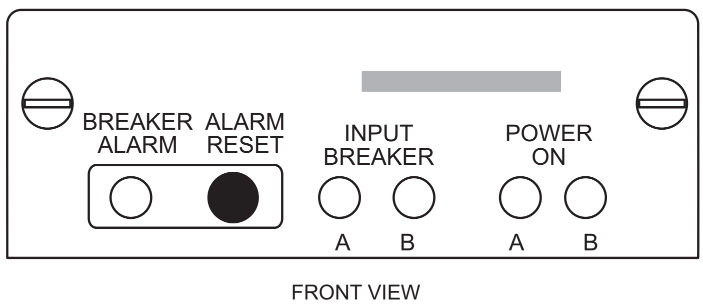


Table 4-7 lists the status LEDs on the Telect Breaker Panel.

Table 4-7. Breaker Panel LEDs

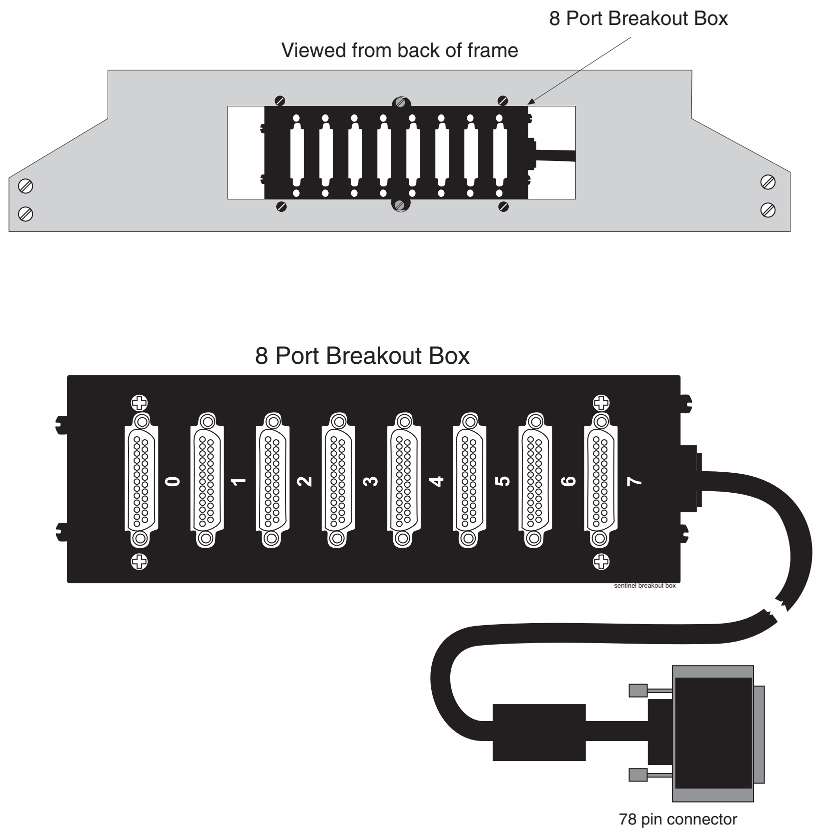
LED	Color	Description
Power On A	Green	Lights whenever Side A is receiving input power (LED will remain lit even if the input breaker has tripped)
Power On B	Green	Lights whenever Side B is receiving input power (LED will remain lit even if the input breaker has tripped)
Breaker Alarm	Red	Lights whenever an output circuit breaker has tripped or turned off
Input Breaker A/B	Green	Lights whenever Side A/B is receiving input power (Not lit if input breaker is tripped)

NOTE: If all breakers are not turned on, the alarm LED will light. To turn off the alarm LED, press RESET and the alarm LED will reset and turn off.

Eight-Port Connector Box

This sections shows the Eight-Port Connector Box used in the Sentinel and AX*i* systems.

Figure 4-12. Eight Port Breakout Box



5

Hardware Descriptions — Sentinel Products

Sentinel Product Descriptions Overview

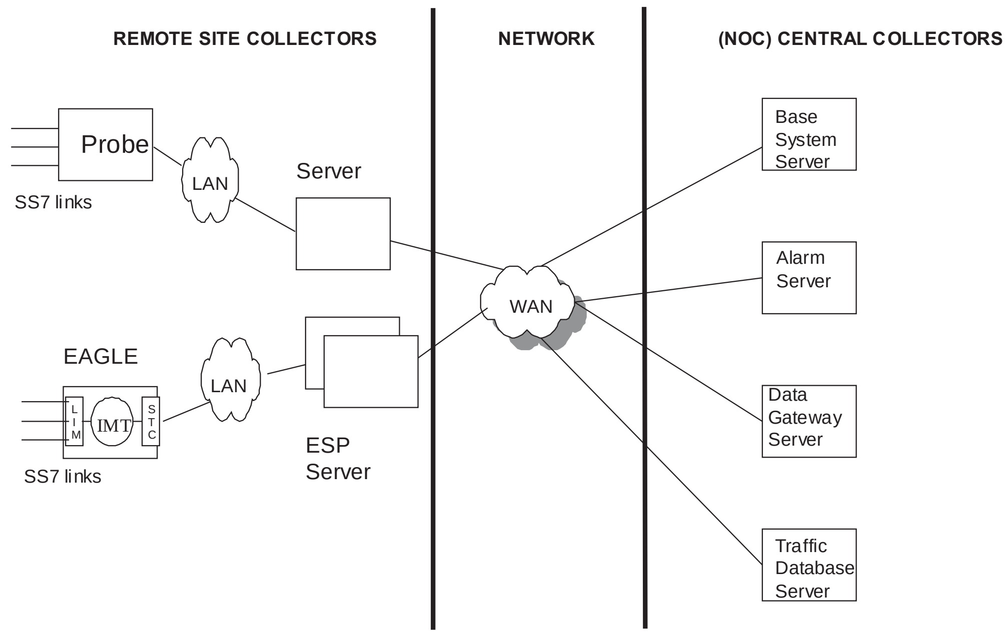
This chapter documents Sentinel hardware products from Sentinel Release 8.1 and later. Sentinel products use some commercial off-the-shelf components and Tekelec proprietary products configured in heavy-duty frames.

Some of the hardware server components are based upon the Tekelec 1000 Applications Server (Tekelec 1000 APS) introduced with Sentinel Release 11.x. For information on Sentinel components that are based on the Tekelec 1000 platform, including assembly drawings, interconnect diagrams, and installation instructions, see the *Tekelec 1000 Applications Server Hardware Manual*.

A Sentinel system is comprised of two major system components: distributed site collectors located at remote sites and centralized servers located at the Network Operations Center (NOC). Site collectors are for remote deployments within a carrier's switching offices. For a probe-based configuration, one or more Probe and server systems are deployed at remote sites as site collectors. For the probe-less (Integrated) configuration, EAGLE 5 ISS and the ESP servers are the site collectors. Typically, Sentinel includes a Base System Server, Alarm Server and optional Traffic Database Server as well as one or more Data Gateway Servers in the NOC. User workstations are typically located either in the NOC or in a Technical Assistance Center (TAC). The Site Collectors are connected to the NOC via the customer WAN.

The Sentinel system can simultaneously support both probe-based and probe-less configurations. In a combined probe-based and probe-less configuration, the same NOC can be used to simultaneously monitor MSU data sent by an EAGLE 5 ISS or via the probes as shown in the Figure 5-1 on page 5-4.

Figure 5-1. NOC in a Combined Probe-based and probe-less Configuration



Sentinel Frames

Sentinel systems are mounted in standard seven-foot high, 23-inch wide frames. Sentinel frames typically are configured with dual breaker panels and are cabled with redundant power busses for reliability. Sentinel products support application specific services that monitor SS7 network links. For information on unpacking and installation of Sentinel frames see the *Installation Manual* and *Tekelec 1000 Applications Server Hardware Manual* included in this documentation set.

The defined types of Sentinel Frame configurations include:

- Sentinel Servers (e.g. BSS, AS, DGS, TDS)
- i2000/FR Site Collector
- Flight Recorder
- Extended Services Platform (ESP)

Table 5-1. Sentinel Frame Types and Configurations

Sentinel Frame Type	Configuration Details
Sentinel Central Server Frame	This frame contains the centralized Sentinel Servers including: • one or more Base Sentinel Servers • one or more Data Gateway Servers. • one Alarm Server (only one per system) • one Traffic Database Server (only one per system) The Sentinel central server frame described in this manual operates in conjunction with Sentinel site collectors. **NOTE 1: Multiple Base Sentinel Servers are supported with Sentinel Release 10.0.** **NOTE 2: Multiple frames are supported (for example, in cases where there are multiple BSS and DGS servers).** For a detailed description refer to *"Sentinel Central Server Frames"* on page 5-22
i2000 Frame	This frame contains i2000 probes without Flight Recorder servers. This frame configuration depends on the equipage of an associated Flight Recorder Frame.
Flight Recorder Frame	This frame contains Flight Recorder servers and associated network gear required to connect the site collector to the Sentinel central server complex across the WAN. This frame configuration is supplanted with the combined i2000/FR frame configuration.
Combined i2000/FR Site Collector Frame	This frame contains the i2000 probe shelves, Netra Flight Recorder, and associated network gear required to connect the site collector to the Sentinel central server complex across the WAN.

Table 5-1. Sentinel Frame Types and Configurations (Continued)

Sentinel Frame Type	Configuration Details
Sun Netra ESP Subsystem Frame	This frame configuration contains the Sun Netra based Extended Services Platform (ESP) servers that provide the process and storage functions for this type of site collector. Each Netra Server can handle 32 equivalent low speed links of MSU data for processing and storage. Data acquisition is supported by the system transport cards (STC) that are equipped in the EAGLE 5 ISS and connect to the ESP Subsystem via a redundant LAN. This frame also contains associated network gear required to connect the site collector to the Sentinel central server complex across the LAN/WAN.
Tekelec 1000 ESP Subsystem Frame	This frame configuration contains the Tekelec 1000 based Extended Services Platform (ESP) servers that provide the process and storage functions for this type of site collector. Each Tekelec 1000 can handle 128 equivalent low speed links of MSU data for processing and storage. Data acquisition is supported by the system transport cards (STC) that are equipped in the EAGLE 5 ISS and connect to the ESP Subsystem via a redundant LAN. This frame also contains associated network gear required to connect the site collector to the Sentinel central server complex across the LAN/WAN.

Site Collector Frames

SS7 MSU traffic is processed at a remote site by hardware that is collectively referred to as a Sentinel site collector. Site collectors can be a single i2000 shelf monitoring and processing a small number of SS7 low-speed links (LSL) or an Integrated (probe-less) site collector that scales to larger system configurations with multiple frames monitoring up to 1500 low-speed link equivalents.

Sentinel integrates both probed and probe-less architecture into a single coherent network monitoring system. Flexible configurations are designed to meet customer link monitoring requirements. Site collectors ensure that monitored SS7 link data is transported, processed, and forwarded to central Sentinel Servers for further processing and presentation.

All Sentinel site collectors consist of the following three basic functional components:

- Data Acquisition - External probe-based connections to SS7 links using monitoring shelves (non-integrated solution) or internal connections to the EAGLE 5 ISS (integrated solution).
- LAN/WAN Transport - Connects all components of a Sentinel site collector, routers, ethernet switches, hubs, and servers.
- Processing and Storage - Site collector servers process monitored SS7 link information and message signalling units (MSU), storing data and forwarding to Base Sentinel Servers.

Flight Recorders

The Flight Recorder (FR) server provides the extended processing and storage server functions for a probe based site collector in conjunction with the i2000 probe shelf. The Flight Recorder server connects to one or more i2000 probe shelves via LAN to provide processing and storage. Refer to the section, *"Sentinel Probe Based Site Collector"* on page 5-18 for a complete description.

> **NOTE: See the Signaling/Cellular Generic Hardware Reference Manual (P/N 910-2277-01) for i2000 product information.**

Extended Services Platform (ESP)

For the integrated (probe-less) site collector there are two different frame configurations; one with Sun Netra servers and the other with Tekelec 1000 servers. For a complete description of the Netra-based ESP frame refer to the section, *"Integrated Sentinel (probe-less Solution)"* on page 5-7. For Tekelec 1000-based Sentinel hardware, refer to the *Tekelec 1000 Applications Server Hardware Manual*. For additional information about EAGLE 5 ISS hardware components required for the Integrated Sentinel solution refer to the sections *"Integrated Sentinel"* on page 2-16 and Chapter 3, *Hardware Descriptions — EAGLE 5 ISS*, of this manual.

Integrated Sentinel (probe-less Solution)

The Integrated Sentinel feature with the Extended Services Platform (ESP) provides a probe-less site collector solution for monitoring EAGLE 5 ISS low-speed links and high-speed ATM links without using external probes. The feature eliminates the need for cabling and some hardware to monitor the EAGLE 5 ISS SS7 links. It also enables the EAGLE 5 ISS links to be presented in Integrated Sentinel in familiar terms as they are provisioned in the EAGLE 5 ISS. Link information is passed from the EAGLE 5 ISS to Sentinel via Sentinel Transport Cards (STC) in the EAGLE 5 ISS.

Integrated Sentinel Hardware Overview

In Integrated Sentinel, site collector processing and storage tasks are hosted on ESP servers, providing all of the relevant site collector functions for data processing and storage of collected SS7 data. Integrated Sentinel ESP servers are connected to an associated EAGLE 5 ISS using redundant LAN interfaces. The internal local area network (LAN) traffic is isolated to keep monitored data separate from the customer's wide area network (WAN).

The EAGLE 5 ISS monitors SS7 links internally (probe-less), at the LIM, and connects to ESP LAN interfaces using the dual-port Sentinel Transport Card (STC). The STC card acts as a router to route TCP/IP traffic from EAGLE 5 ISS ports to ESP servers.

Table 5-2. Sentinel Release Application Notes

Sentinel Release	Note
Sentinel Release 9.0	The Sentinel Server Frame was introduced containing up to four Netra 20s configured as Sentinel servers. A Sentinel Server Frame can be configured with one to four servers to support: • Alarm Server • Base Sentinel Server • Data Gateway Server • Traffic Database Server For more information about Sentinel Server Frames see *"Sentinel Central Server Frames"* on page 5-22.
Sentinel Release 10.0	For Netra-based ESPs, a maximum of two ESP frames can be configured. A maximum of 1024 links can be monitored with two Netra-based ESP frames. Remote Dial-up access is configured in the first ESP frame with a Cisco modem card in the Yellow router. For remote access to Netra ESP servers in the ESP subsystem access is provided by the addition of a modem card to the yellow router. The NetGear RM356 Modem router is no longer configured in systems but is supported for older system configurations. For more information refer to *"Netra-based ESP Frame Components Release 10.0"* on page 5-14.

Table 5-2. Sentinel Release Application Notes

Sentinel Release	Note
Sentinel Release 11.0	The Tekelec 1000 based ESP Subsystem was introduced. Tekelec 1000 based ESPs can be configured with a maximum of two ESP frames to provide the capability of monitoring 1152 SS7 equivalent low-speed links. Dial-up access is configured in the first ESP frame with a modem in the MRV console server. For more information on Tekelec 1000 based ESPs, see the "Tekelec 1000 Applications Server Hardware Manual."
Sentinel Release 11.3	Beginning in Sentinel 11.3, the TDS can be Tekelec 1000 based. For more information about Sentinel Server Frames see *"Sentinel Central Server Frames"* on page 5-22.

Figure 5-2 shows a block diagram of connections between an EAGLE 5 ISS and the ESP subsystem and between the ESP subsystem and the Sentinel central servers in the probe-less Integrated Sentinel solution.

Figure 5-3 shows a block diagram of connections between an EAGLE 5 ISS and the Tekelec 1000 based ESP subsystem and between the ESP subsystem and the Sentinel servers in the probe-less Integrated Sentinel solution.

Figure 5-4, *"Integrated Sentinel Netra-based ESP Frame Front View,"* on page 5-12 and Figure 5-5, *"Integrated Sentinel Tekelec 1000-based ESP Frame Front View,"* on page 5-13 shows the component locations for a single ESP frame.

Figure 5-2. Integrated Sentinel with Netra-based ESPs Block Diagram

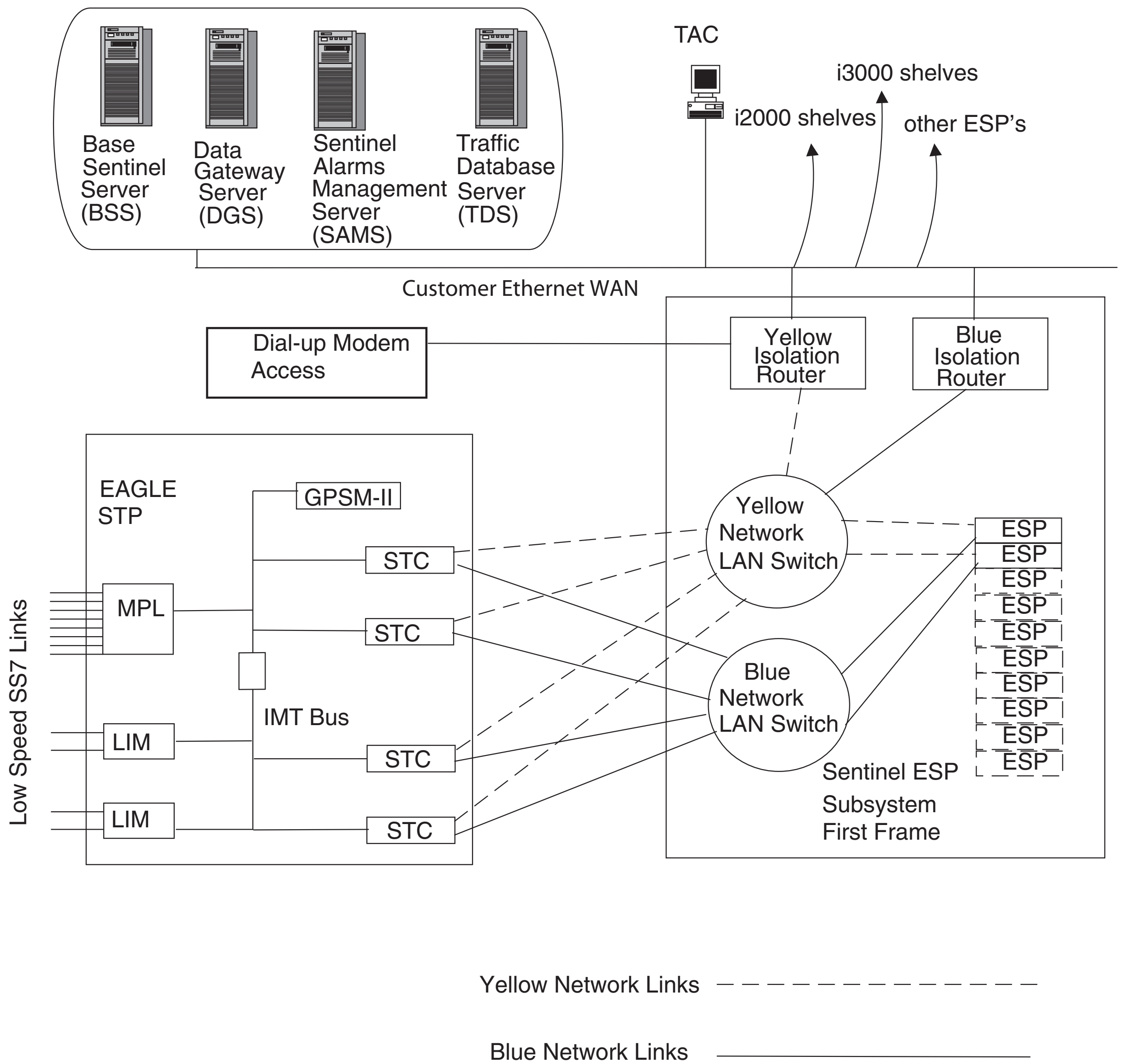


Figure 5-3. Integrated Sentinel with Tekelec 1000-based ESPs Block Diagram

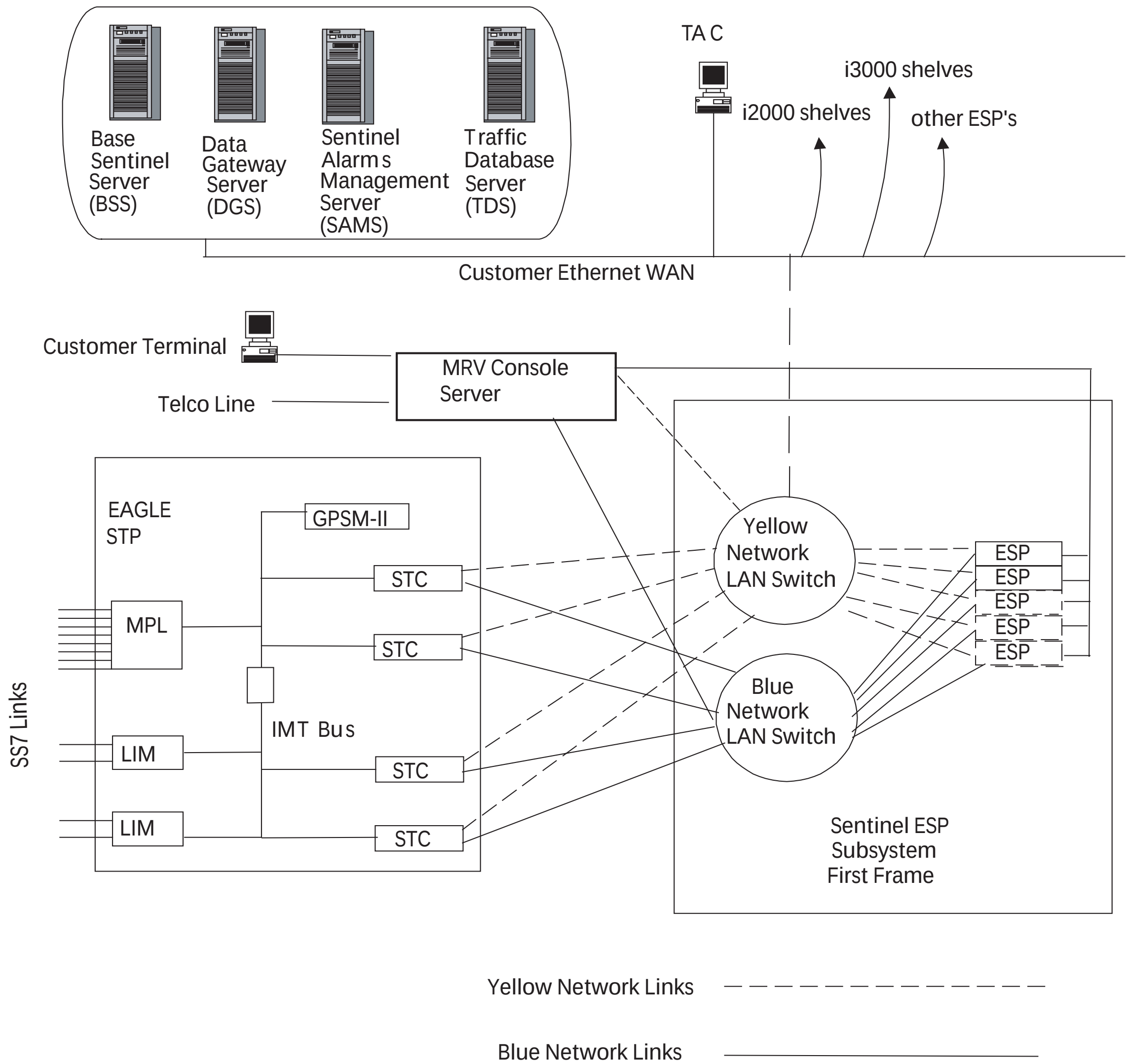


Figure 5-4. Integrated Sentinel Netra-based ESP Frame Front View

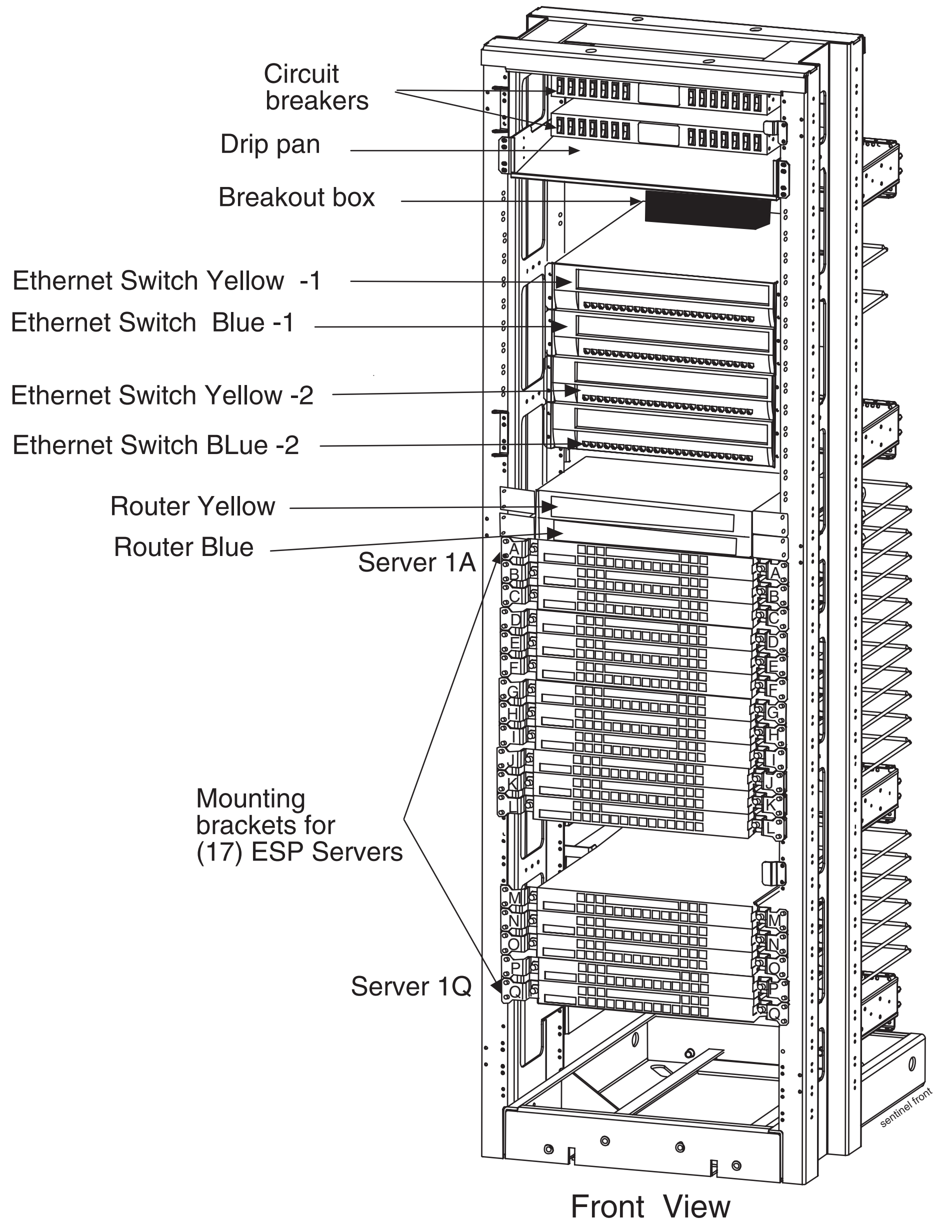
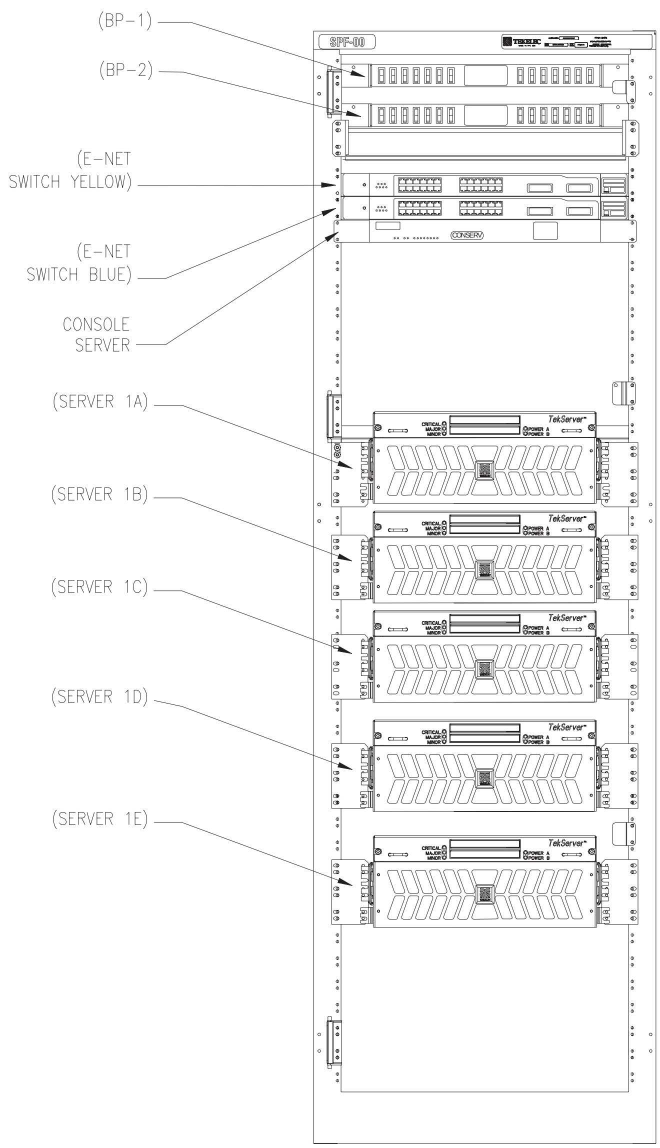


Figure 5-5. Integrated Sentinel Tekelec 1000-based ESP Frame Front View



All ESP servers are configured for industry-standard Network Time Protocol (NTP) and synchronize with the system NTP server. The NTP server is typically the primary Base Sentinel Server (BSS).

ESP Subsystem

ESP servers in the Integrated Sentinel are provisioned in an n+1 configuration for redundancy. The n+1 backup ESP server does not monitor any EAGLE 5 ISS ports during normal operation. The backup ESP server can be configured to replace any failed server. A major alarm will be raised when an Integrated Sentinel ESP server fails.All ESP servers plus the LAN equipment located at one EAGLE 5 ISS location are collectively called an "ESP Subsystem."

The ESP subsystem supports multiple frames. The server installed at the top of the first frame is referred to as ESP 1A; the next lower server is ESP 1B, then ESP 1C continuing down to the final server. Labeling of ESP servers in the 2nd frame of an ESP subsystem begins with ESP 2A.

ESP Subsystem Hardware Components

The following sections describes ESP Subsystem hardware.

Netra-based ESP Frame Components Release 10.0

For Netra-based ESPs starting with Release 10.0, ESP servers in the first frame are designated from 1A through 1Q. ESP servers in the second frame are designated 2A through 2Q. See Figure 5-6, *"Sentinel Netra-based ESP Rear View 1500 Links,"* on page 5-15 shows the component locations of all three frames.

Table 5-3 lists the components configured in each frame for Sentinel release 10.0. See Table 5-4 on page 5-16 and Table 5-5 on page 5-17 for individual ESP server components for release 10.0.

NOTE: While Netra-based ESP Subsystem hardware design was completed to be able to handle a third frame, the three frame (1500 link) configuration has not yet been tested by Tekelec Product Verification.

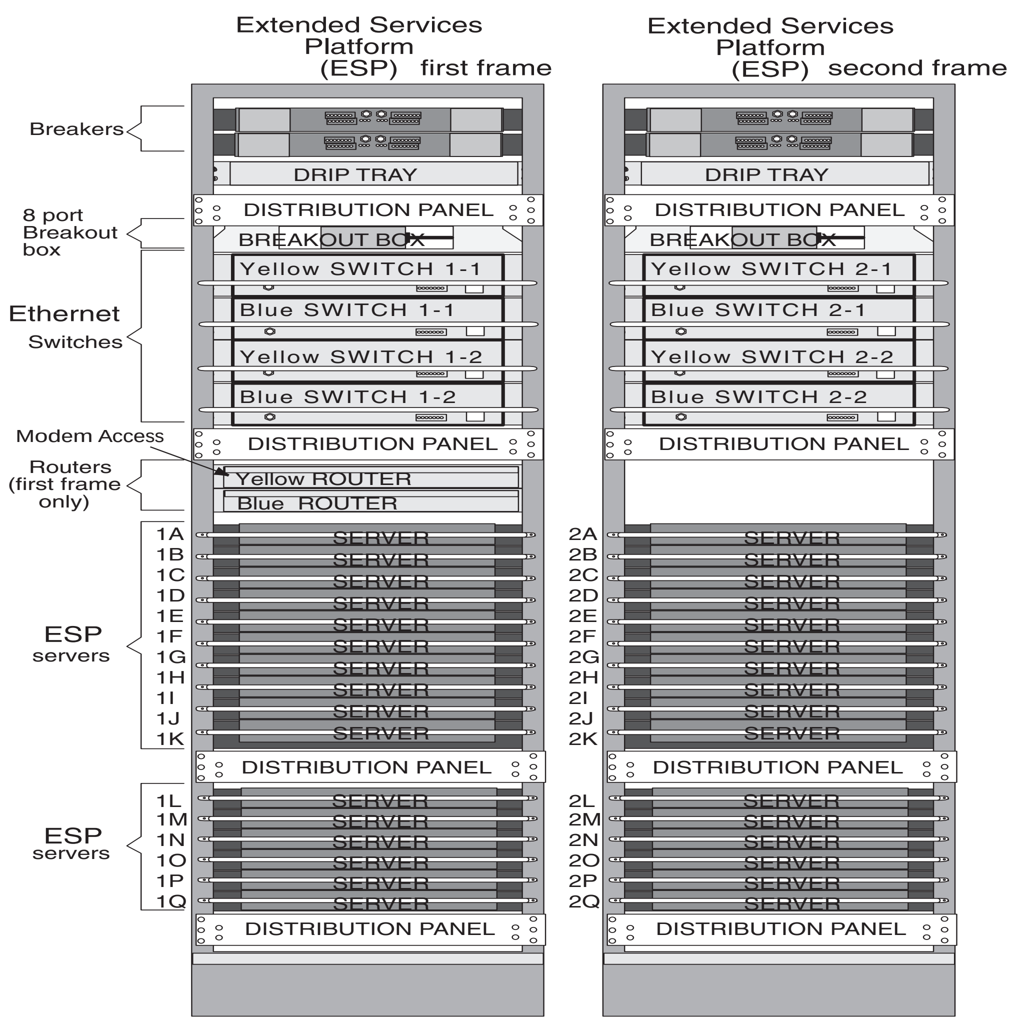
Table 5-3. Netra-based ESP Frame Components Release 10.x and Higher

Component	Quantity First Frame	Quantity Three Frame System
Frame Assembly	One	Two
Breaker Panels	Two	Four
Routers **NOTE: Dial-up modem access card is in the Yellow router.**	Two	Two - Only required in first frame
24-Port DC ENET Switches	Two or Four	Eight Maximum

Table 5-3. Netra-based ESP Frame Components Release 10.x and Higher

Component	Quantity First Frame	Quantity Three Frame System
Two additional switches are required for ESP servers L though Q. Additional Gigabyte interface cards are also required, see Figure 5-16, *"Ethernet Switch,"* on page 5-34 **for requirements.**		
ESP Servers 1A, 2A, and 3A (With PCI card)	One	Two
ESP Servers 1B through 1Q, 2B through 2Q (Without PCI card)	One to 16	32 Maximum

Figure 5-6. Sentinel Netra-based ESP Rear View 1500 Links



ESP servers have specific configurations determined by the location in the frame, Table 5-4 lists components for servers in locations 1A or 2A.

Table 5-4. ESP Servers 1A and 2A Release 10.0

Server	Sub-Component Description
Netra 120	1x 650-MHz UltraSPARC-IIi CPU w/512-KB eCache, 1x512-MB Memory, 1x 36-GB 10000 UltraSCSI Disk, 2x 10/100 Mbit Ethernet, 2x USB Ports, UltraSCSI Port, Removable System Config Card, 19-in Rackmount Kit, Solaris 8 & LomLite2 DC Power Supply
	(2x 512-MB DIMM) PC133 ECC Reg/Buffered Memory Expansion PC133 ECC DIMM, Reg/Buffered
	HARD DISK 36.4 GB NEBS USCSI
	CDROM DRIVE
	PCI SERIAL ASYNCHRONOUS INTERFACE ADAPTER CARD (INCLUDES 8 PORT DB-25 BREAKOUT BOX) ASSY and cable

ESP servers have specific configurations determined by the location in the frame. Table 5-5 lists components for servers in locations 1B through 1Q (Frame 1) and 2B through 2Q (Frame 2).

Table 5-5. ESP Servers 1B and 2B through 1Q and 2Q release 10.0

Server	Sub-Component Description
Netra 120	1x 650-MHz UltraSPARC-IIi CPU w/512-KB eCache, 1x512-MB Memory, 1x 36-GB 10000 UltraSCSI Disk, 2x 10/100 Mbit Ethernet, 2x USB Ports, UltraSCSI Port, Removable System Config Card, 19-in Rackmount Kit, Solaris 8 & LomLite2 DC Power Supply
	(2x 512-MB DIMM) PC133 ECC Reg/Buffered Memory Expansion PC133 ECC DIMM, Reg/Buffered
	HARD DISK 36.4 GB NEBS USCSI
	CDROM DRIVE

Integrated Sentinel Tekelec 1000-based ESP Frame Components Release 11.0

Beginning with Sentinel Release 11.0, ESP servers can be Tekelec 1000-based or Netra-based. ESP servers in the first frame are designated from 1A through 1E. ESP servers in the second frame are designated 2A through 2E. For more details on the Tekelec 1000-based Frame assemblies, including interconnect diagrams, see the *TekServer Platform Services Hardware Manaul*.

NOTE 1: Starting with Sentinel Release 11.0, new installations of integrated Sentinel ESPs are configured with Tekelec 1000 hardware. However, extensions for existing site collectors with Netra-based ESP servers are still supported.

NOTE 2: While Tekelec 1000-based ESP Subsystem hardware design was completed to be able to handle a third frame, the three frame (1500 link) configuration has not yet been tested by Tekelec Product Verification.

Table 5-6. Tekelec 1000-based ESP Frame Components Release 11.0 and Higher

Component	Quantity First Frame	Quantity Two Frame System
Frame Assembly	One	Two
Breaker Panels	Two	Four
MRV Console Servers (including RAS modem)	One	Two
24-Port DC ENET Switches	Two	Four
Tekelec 1000 ESP Servers 1A and 2A (With 2 Port Ethernet card and 4 port serial expansion card)	One	Two
ESP Servers 1B through 1E, 2B through 2E (with 2 port Ethernet Card)	One to Four	Eight Maximum

Sentinel Probe Based Site Collector

See Figure 5-7 "Probe Based Sentinel System Configuration" on page 5-19 for an overview of the probe based Sentinel solution using the combined i2000/FR Site Collector Frame.

The i2000/FR probe based Site Collector frames consist of the following hardware components:

- Breaker Panels
- Hubs
- Flight Recorders (Netra 120 servers)
- i2000 probes

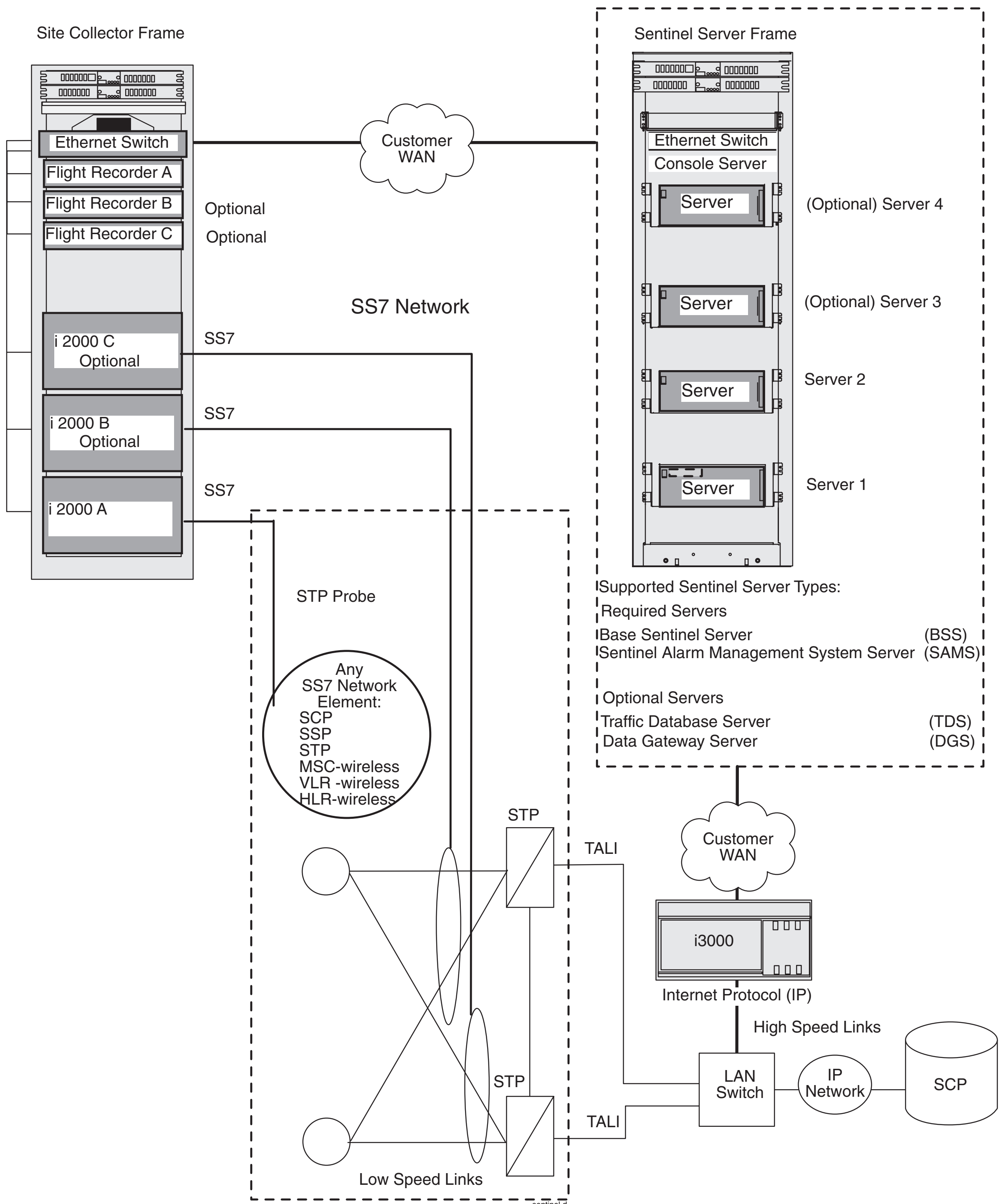
See Figure 5-8 for the location of the components in the Site Collector frame.

NOTE 1: For more information about the i2000 shelf refer to the Signaling/Cellular Generic Hardware Reference Manual (P/N 910-2277-01). This manual is included with this Documentation suite.

NOTE 2: The i2000 shelf (P/N 890-1028-02) described in this document is -48 VDC powered. Some i2000 shelves documented in the Signaling/Cellular Generic Hardware Reference Manual were AC powered.

Various types of link interface module (LIM) cards are available for different probe shelves. For information about link interface modules (LIM) in the i2000 see Chapter B, *Sentinel 4-Port Monitor Appliques*, in this manual.

Figure 5-7. Probe Based Sentinel System Configuration

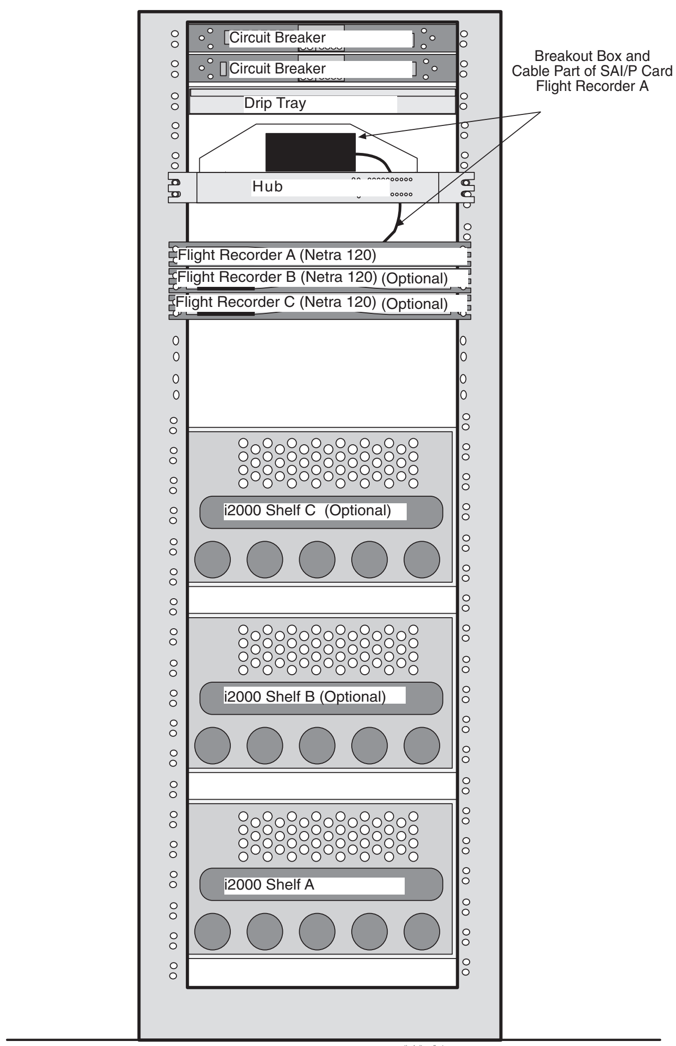


Site Collector Frames

The frame configuration for a combined i2000/FR probe based site collector was introduced with Sentinel Release 9.0. Along with this change the Flight Recorder (FR) hardware selected was the same Netra 120 used in the integrated Sentinel configuration. This Netra based FR borrowed specific functionalities from the Netra ESP server design for the processing, database, and site collector storage functions. For the i2000/FR probe based site collector, the i2000 probe shelf provides the data acquisition function via a direct physical tap of the external SS7 links connecting to the STP. Link taps are typically made at the DSX panel. For the case of E1, T1, or DSCS taps that are some distance from the i2000 probe shelf a bridge amplifier may be used to provide a "non-intrusive" tap of the SS7 link.

Figure 5-8 on page 5-20 describes the frame layout for the i2000/FR Site Collector frame.

Figure 5-8. Site-Collector Frame



Site Collector Frame Hardware Components

Table 5-7, *"Site Collector Frame Components,"* on page 5-21 lists the components configured in the Site Collector frames.

Table 5-7. Site Collector Frame Components

Component	Quantity/Each Frame
Frame Assembly	One
Breaker Panel	Two
Hub	One
i2000 Shelf	One to Three
Flight Recorder A (Netra 120) (With PCI card) see Table 5-8 on page 5-21	One
Flight Recorder B and C (Netra 120) (Without PCI card) see Table 5-9 on page 5-24	One or Two

Sentinel Site Collector Frame servers have specific configurations determined by the location in the frame, Table 5-8 lists components for host server A, and Table 5-9 on page 5-22 lists components for host servers B and C.

Table 5-8. Sentinel Site Collector Server A

Server	Sub-Component Description
Netra 120	1x 650-MHz UltraSPARC-IIi CPU w/512-KB eCache, 1x512-MB Memory, 1x 36-GB 10000 UltraSCSI Disk, 2x 10/100 Mbit Ethernet, 2x USB Ports, UltraSCSI Port, Removable System Config Card, 19-in Rackmount Kit, Solaris 8 & LomLite2 DC Power Supply
	(1x 1024-MB DIMM) PC133 ECC Reg/Buffered Memory Expansion 1GB PC133 ECC DIMM, Reg/Buffered
	Hard Disk 36.4 GB NEBS USCSI
	CDROM Drive
	PCI Serial Asynchronous Interface Adapter Card (includes 8 Port DB-25 Breakout Box) Assembly with cable

Table 5-9. Sentinel Site Collector Servers B and C

Server	Sub-Component Description
Netra 120	1x 650-MHz UltraSPARC-IIi CPU w/512-KB eCache, 1x512-MB Memory, 1x 36-GB 10000 UltraSCSI Disk, 2x 10/100 Mbit Ethernet, 2x USB Ports, UltraSCSI Port, Removable System Config Card, 19-in Rackmount Kit, Solaris 8 & LomLite DC Power Supply
	(1x 1024-MB DIMM) PC133 ECC Reg/Buffered Memory Expansion 1GB PC133 ECC DIMM, Reg/Buffered
	HARD DISK 36.4 GB NEBS USCSI
	CDROM DRIVE

Sentinel Central Server Frames

The Sentinel Central Server Frame, typically located at the Network Operations Center (NOC) or other central location, is configured with one to four servers. The Sentinel Central Server Frame contains the following:

- one or more Base Sentinel Servers (BSS)
- one or more Data Gateway Servers (DGS)
- one Sentinel Alarm Management System (SAMS) server (only one per system)
- one Traffic Database Server (only one per system)

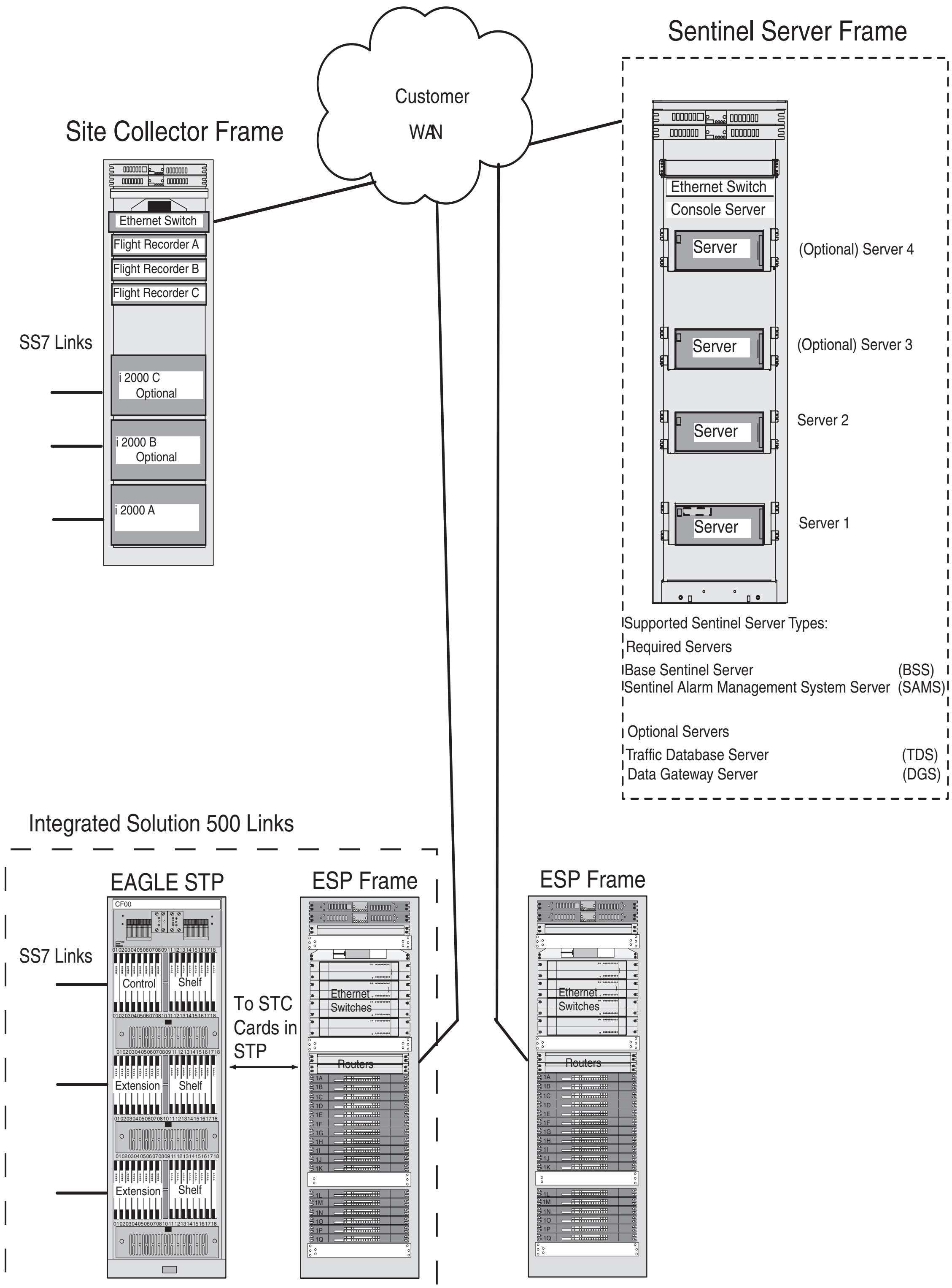
The BSS, SAMS, and DGS are supported by Netra 20 servers. More than one Sentinel Central Server Frame can be equipped in the system to support additional BSS.

For releases prior to Sentinel Release 11.3 the Traffic Database Server used the Oracle database and was supported on older legacy server hardware. Starting with Release 11.3 the TDS is supported on the DC powered Tekelec 1000 server. No AC configuration is supported. See the *Tekelec 1000 Applications Server Hardware Manual* for more information on Tekelec 1000-based TDS.

Figure 5-9, on page 5-24 illustrates all types of Sentinel site collectors and the interconnections through the customer's WAN to a Sentinel server frame. The block diagram shown in Figure 5-9 depicts system configuration with the possible site collector configurations and the connections between the monitored SS7 links, site collectors, and a Sentinel server frame.

NOTE: In all of the site collector configurations except the probe-less connections in the "Integrated Solution" the probe connections are physically tapped to SS7 links. In the "Integrated Solution" the probed link data acquisition is handled by the EAGLE 5 ISS.

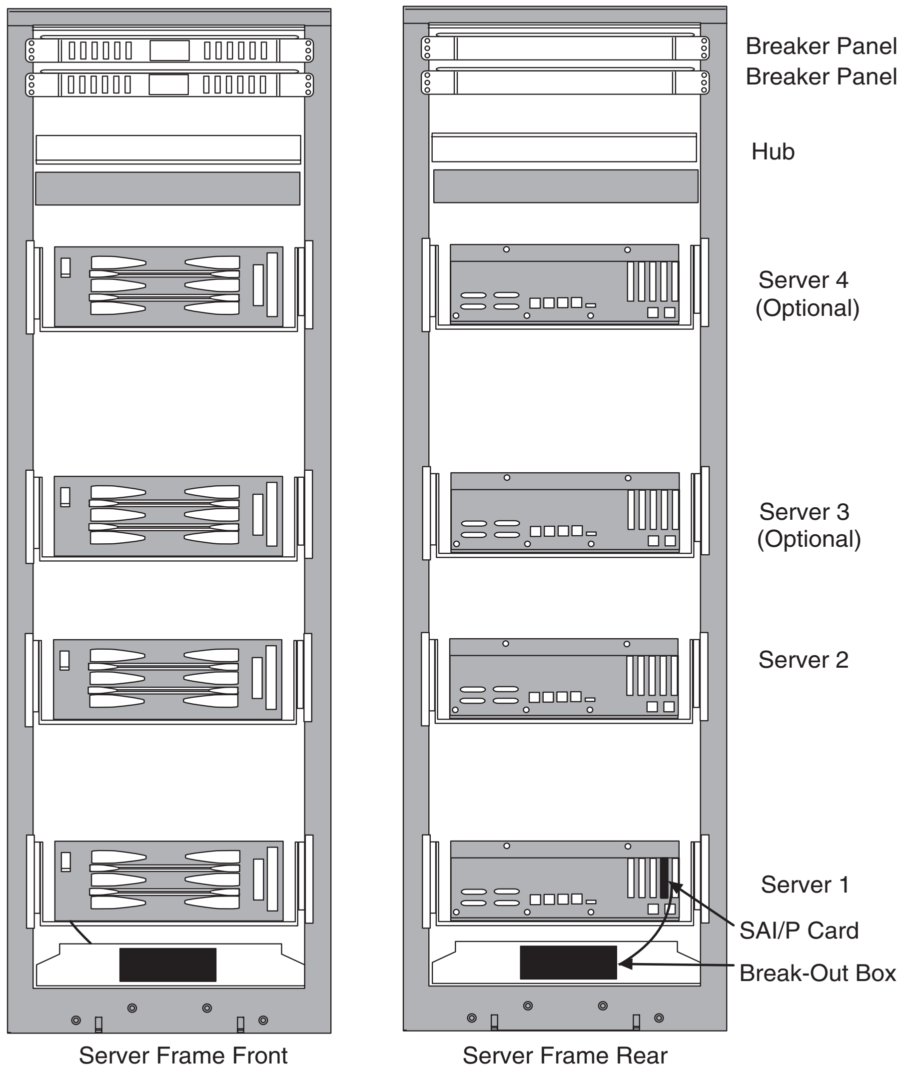
Figure 5-9. Site Collectors Connections to a Sentinel Central Server Frame



Sentinel Central Server Frame Hardware Components

Sentinel central server frames can be configured with one to four servers as shown in the following figures. Figure 5-10 illustrates the Sentinel server frames configuration prior to release 10.0.

Figure 5-10. Sentinel Server Frame Prior to Release 10.0 (First Frame)

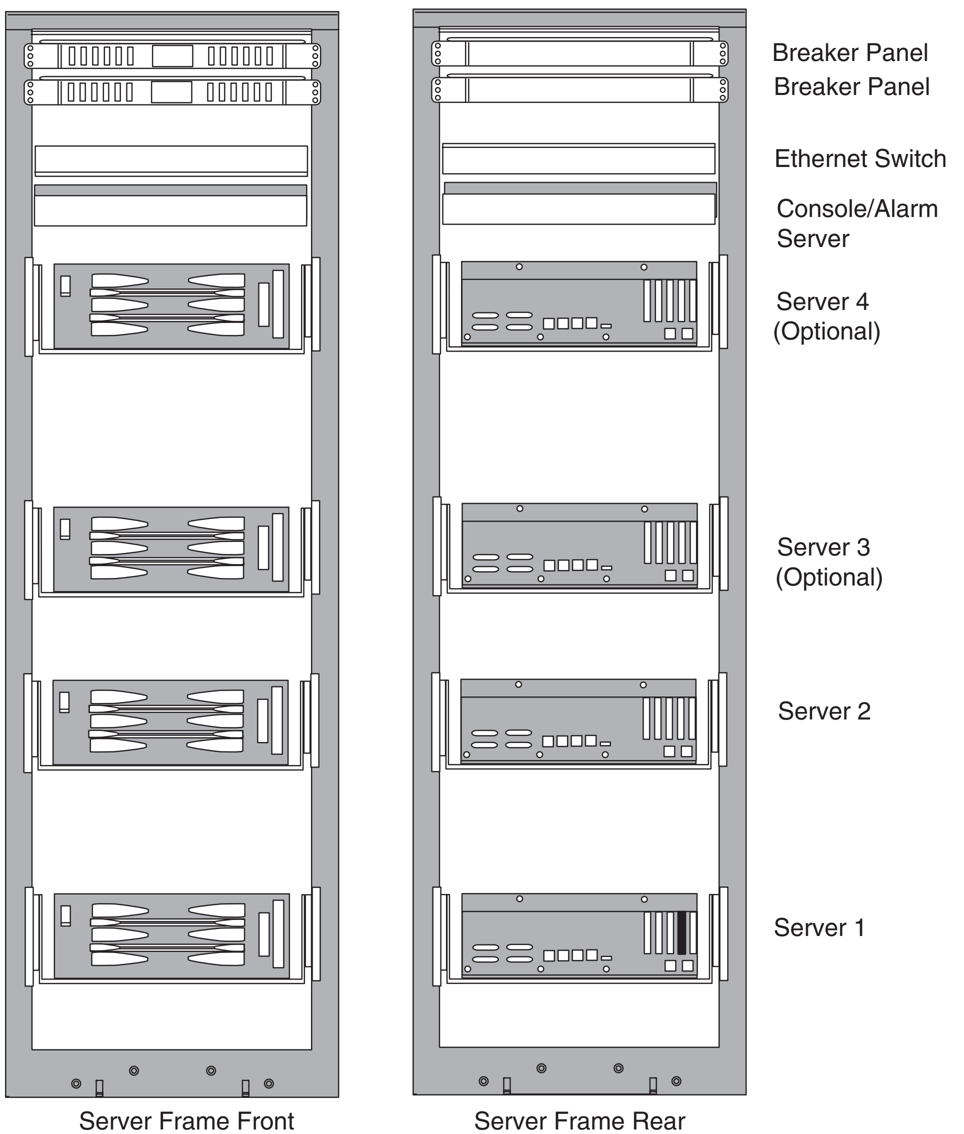


Supported Sentinel Server Types:

Base Sentinel Server	(BSS)
Sentinel Alarm management Server	(SAMS)
Data Gateway Server	(DGS)
Traffic Database Server	(TDS)

Several changes were made to the Sentinel sever frames in release 10.0. The hub component for the internal LAN was changed to an ethernet switch. Also the external remote access server (RAS) function was replaced with a console/alarm (CAS) server configured in the frame. The CAS provides interconnectivity to all frame components and dial-up modem service access to the frame. Release 10.0 changes are listed in Table 5-14, *"Sentinel Central Server Components Release 10.0,"* on page 5-29.

Figure 5-11. Sentinel Central Server Frame Release 10.0 (First Frame)



Supported Sentinel Server Types:

Base Sentinel Server	(BSS)
Sentinel Alarm management Server	(SAMS)
Traffic Database Server	(TDS)
Data Gateway Server	(DGS)

Sentinel Central Server Frames Prior to Release 10.0

Table 5-10 lists the components that can be configured in the Sentinel central server frame prior to release 10.0.

Table 5-10. Sentinel Central Server Frames Prior to Release 10.0

Component	Quantity/Each Frame
Frame Assembly	One
Breaker Panels	Two
Hub	One
Server 1 (With SAI/P card) see Table 5-11 on page 5-28	One
Servers 2, 3, and 4 (Without SAI/P card) see Table 5-12 on page 5-28.	Zero to Three
Remote Access Server (RAS)	Not configured in frame

In Sentinel central server frames prior to release 10.0, servers have specific configurations determined by the location in the frame. Table 5-11 lists the components specific to server number 1.

Table 5-11. Sentinel Central Server 1 Prior to Release 10.0

Server	Sub-Component Description
Netra 20	DC Power
	1x 900-MHz UltraSPARC-III CPU w/8MB eCache, **NOTE: One processor card standard for TDS, DGS, and BSS servers. Additional processor card required for SAMS server.**
	2GB (4x512-MB) DIMMS Memory Expansion
	HARD DISK 73 GB NEBS Hot Swap Capability
	Single Fast Ethernet, PCI
	DVD/ROM DRIVE
	SERIAL ASYNCHRONOUS INTERFACE PCI (SAI/P) ADAPTER CARD (INCLUDES 8 PORT DB-25 BREAKOUT BOX) ASSY and cable

Table 5-12. Sentinel Central Servers 2, 3, 4 Components Prior to Release 10.0

Server	Sub-Component Description
Netra 20	DC Power
	1x 900-MHz UltraSPARC-III CPU w/8MB eCache, **NOTE: One processor card standard for TDS, DGS, and BSS servers. Additional processor card required for SAMS server.**
	2GB (4x512-MB) DIMMS Memory Expansion
	HARD DISK 73 GB NEBS USCSI
	Single Fast Ethernet, PCI
	DVD/ROM DRIVE

Sentinel Central Server Frames Release 10.0

Table 5-13 lists the components that can be configured in all Sentinel central server frames in release 10.0.

Table 5-13. Sentinel Central Server Frames Release 10.0

Component	Quantity/Each Frame
Frame Assembly	One
Breaker Panel	Two
Console/Alarm Server (CAS)	One
Ethernet Switch	One
Netra 20 Servers	One to Four

Beginning in Sentinel release 10.0 all servers in Sentinel Central Server frames are configured with the components listed in Table 5-14.

Table 5-14. Sentinel Central Server Components Release 10.0

Server	Sub-Component Description
Netra 20	DC Power
	2x 1200-MHz UltraSPARC-III CPU w/8MB eCache, **NOTE: Two processor cards standard.**
	2GB (4x512-MB) DIMMS Memory Expansion
	Two Hard Disks 73 GB NEBS with Hot Swap Capability
	Single Fast Ethernet, PCI
	DVD ROM DRIVE

Table 5-14. Sentinel Central Server Components Release 10.0 (Continued)

Server	Sub-Component Description
Netra 20	DC Power
	2x 1200-MHz UltraSPARC-III CPU w/8MB eCache, **NOTE: Two processor cards standard.**
	2GB (4x512-MB) DIMMS Memory Expansion
	Two Hard Disks 73 GB NEBS with Hot Swap Capability
	Single Fast Ethernet, PCI
	DVD ROM DRIVE

Table 5-15. Traffic Database Server Release 11.3

Server	Sub-component Description
Tekelec 1000	DC Power **NOTE: See Tekelec 1000 Applications Server Hardware Manual for details**

Sentinel Frames Common Components

This section describes the common components that can be used in Sentinel-based products.

Common components described in this section include:

- Breaker Panels
- Serial Interface cards
- Breakout Boxes
- Ethernet Switches
- Routers
- Hubs
- Console Servers
- Link Interface Cards (Monitoring)

Breaker Panels

The following section describes the components of the Telect

Breaker Panels (BP) used in Sentinel products. The BPs provide the following features:

- Dual-feed power inputs (Input A and Input B) to each breaker panel, totalling four breakers for the system. (40-amp domestic or 32-amp international)
- Maximum of fourteen breakers each breaker panel
- Visual A and B input power alarms with single remote dry contact indicator
- Replaceable alarm card (Hot swappable with power ON at the frame)

The drip tray, located under the breaker panels, is designed to assure compliance with NEBS, UL, and CE safety requirements, aiding damage control in the event of a fire. Figure 5-12 "Telect Breaker Panel Front View" on page 5-31 shows the details of the front view of the breaker panel.

NOTE: A Breaker is labeled with the component designation that is powered by it. Components are typically redundantly powered from both the A and B buses. Breakers on both buses must be turned OFF before removing this type of component.

Figure 5-12. Telect Breaker Panel Front View

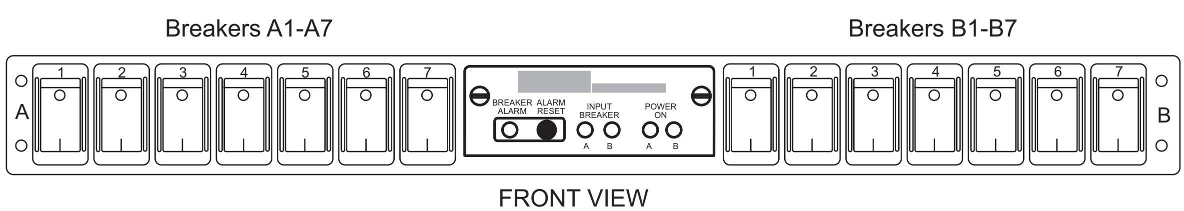
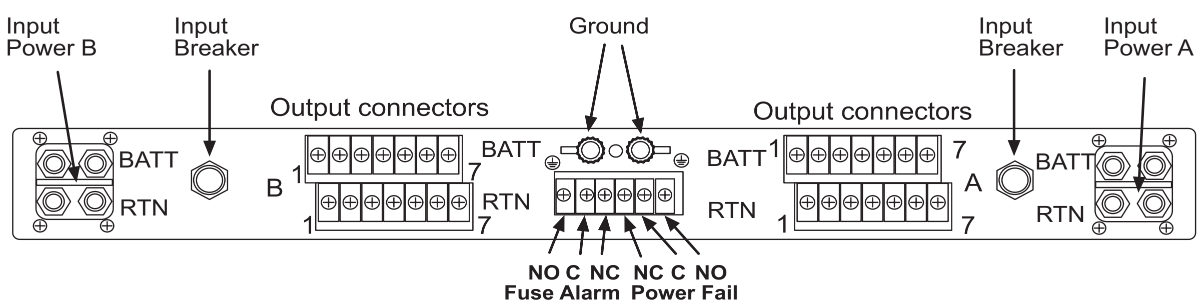


Figure 5-13 shows details of the rear of the breaker panel.

Figure 5-13. Telect Breaker Panel Rear View



NOTE: When breakers trip to the half-way position as a result of an overload they must be switched completely OFF then ON to reset.

Figure 5-14 shows details of the alarm panel on the Telect Breaker Panel.

Figure 5-14. Telect Breaker Panel Alarms

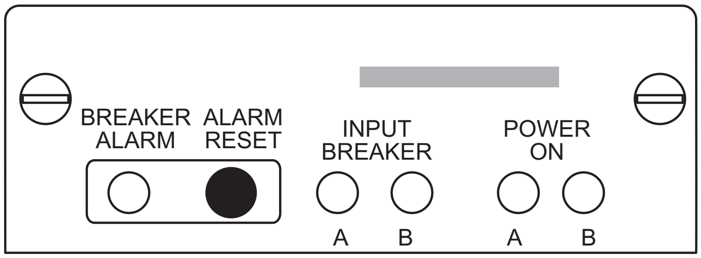


Table 5-17 on page 5-36 lists the status LEDs on the Telect Breaker Panel

Table 5-16. Breaker Panel (BP) LEDs

LED	Color	Description
Power On A	Green	Lights whenever Side A is receiving input power (LED will remain lit even if the input breaker has tripped)
Power On B	Green	Lights whenever Side B is receiving input power (LED will remain lit even if the input breaker has tripped)
Breaker Alarm	Red	Lights whenever an output circuit breaker has tripped or turned off
Input Breaker A/B	Green	Lights whenever Side A/B is receiving input power (Not lit if input breaker is tripped)

NOTE: If all breakers are not turned on, the alarm LED will light. To turn off the alarm LED, press RESET and the alarm LED will reset and turn off.

SAI/P Card

The SAI/P card (Serial Asynchronous Interface PCI Adapter) is used with the 8-Port Break-Out Box to provide eight programmable ports for low-speed devices for 50 bps to 115,200 bps transmission for the subsystem.

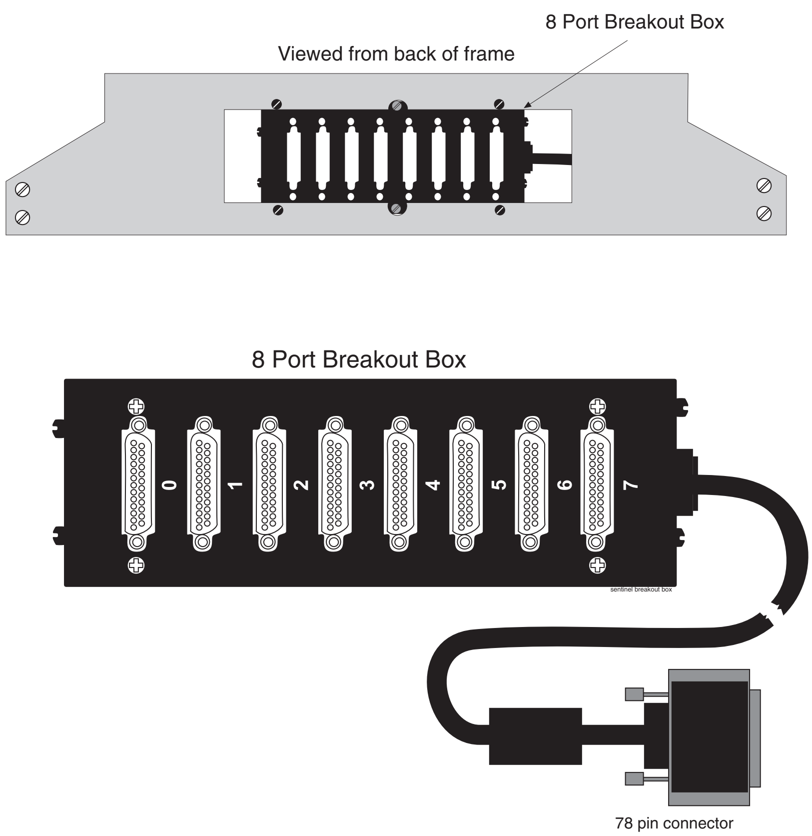
8-Port Break-Out Box

The 8-Port Break-Out Box segments the output of the SAI/P card into eight DB-25 ports for the Sentinel subsystem. This box connects to the SAI/P card with a 78-pin plug on a 40-inch cable. See Figure 5-15 "8-Port Break-Out Box" on page 5-33 for a view of the Break-Out Box.

Ethernet Interface Cards

Provide interfaces to local area networks (LAN) connecting servers, routers, ethernet switches, and hubs internally and to other frames or networks. Ethernet cards support 10/100 Mbyte connections.

Figure 5-15. 8-Port Break-Out Box



Ethernet Switches

The following section provides an overview of the Ethernet LAN switches used in some Sentinel products. The ethernet switches cross-connect the components in the frames functioning as an internal LAN. The switches support 24 auto-sensing 10/100Mbps ports each.

Cisco 2900 Ethernet Switches

See Figure 5-16 and refer to Table 5-17 on page 5-35 for definitions of the LEDs. Four configurations are shown with the optional Gigabit ethernet cards installed. These yellow and blue switch 2 cards are configured when additional optional servers are installed in the frame.

Figure 5-16. Ethernet Switch

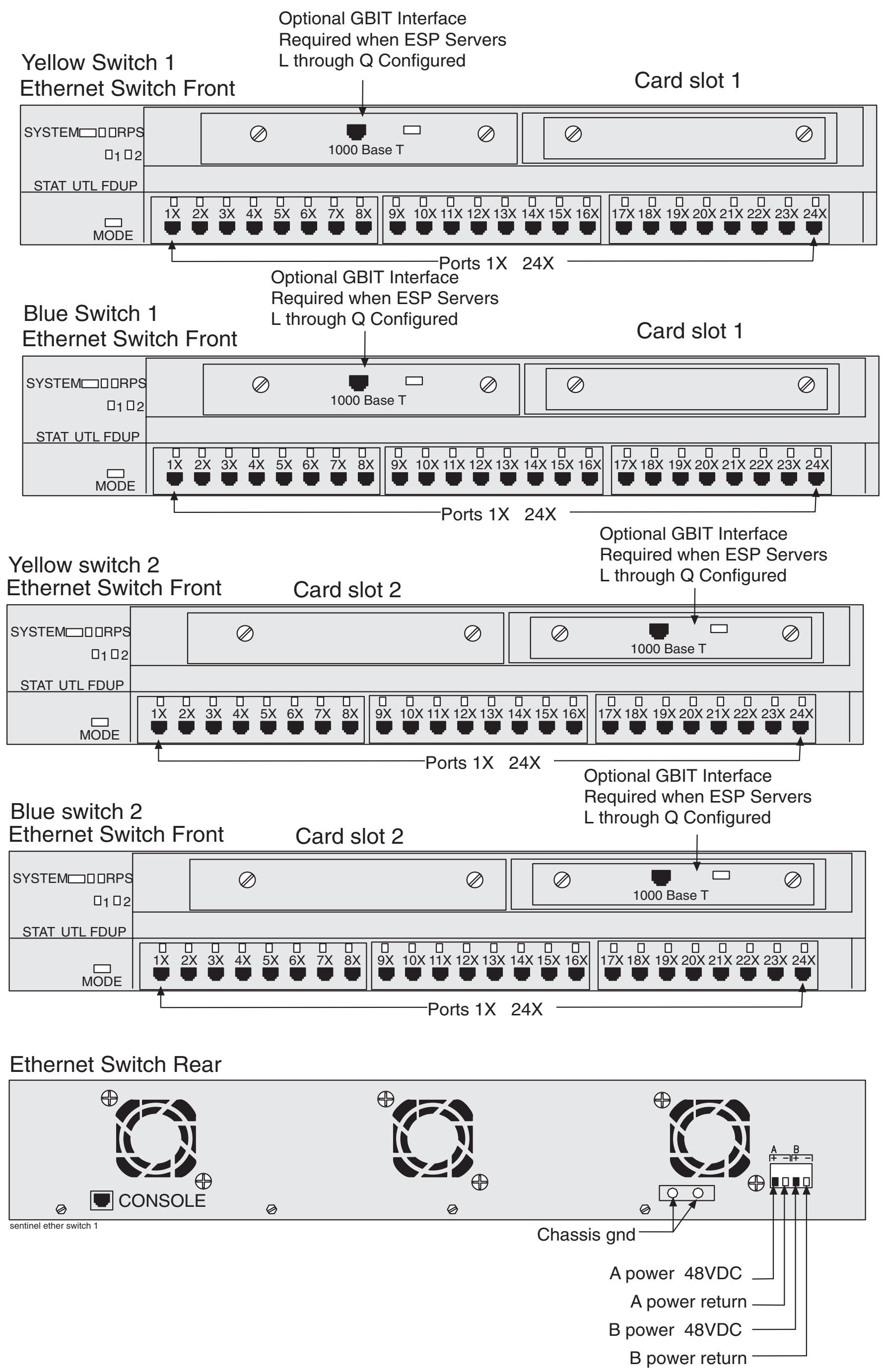


Table 5-17 describes the LEDs located on the front of the switches.

Table 5-17. Ethernet Switch LEDs

LED	Description
System	Green-Indicates when power is present to the switch and the power switch is in the ON position. Amber-Indicates power is present but system is not functioning properly.
1 and 2	Indicates expansion boards WS-X2932-XL are installed and functioning LED 1 (Left board) LED 2 (Right board).
RPS (Always OFF)	Off when the redundant power supply is not present. Redundant power supply is not configured.
Pressing the MODE switch on the front of the WS-C2924-XL-EN changes the per-port LED indications to the following.	
STAT (port status) Default	Off-No link. Solid green-Link present. Flashing green-Activity. Port is transmitting or receiving data. Alternating green/amber-Link fault. Error frames can affect connectivity, and errors such as excessive collisions, CRC errors, and alignment and jabber errors are monitored for a link-fault indication. Solid amber-Port is not forwarding. Port was disabled by management or an address violation or was blocked by Spanning Tree Protocol (STP). **NOTE: After a port is reconfigured, the port LED can remain amber for up to 30 seconds as the STP checks the switch for possible loops.**
UTL (utilization)	Green-The LEDs display backplane utilization on a logarithmic shuffle all port LEDs are green, the switch is using 50 percent or more of its total bandwidth capacity. If the right-most LED is amber, the switch is using less than 50 percent of its total bandwidth. If the LED to the left of the right-most LED is amber, the switch is using less than 25 percent of its total capacity, and so on.
FDUP (port full-duplex)	Off-Port is operating in half duplex. Green-Port is operating in full duplex.
100 (port speed)	Off-Port is operating at 10 Mbps. Green-Port is operating at 100 Mbps.

Garrettcom Ethernet Switch

Ethernet Switch with 24 RJ-45 ports, each auto-sensing for 10Mbps/100Mbps FDX/HDX operation. Optional fiber ports may be configured. Each RJ-45 port is switched and provides a full-speed traffic domain with non-blocking performance. LEDs are located in the front of the switch, power input and port connections are in the rear. See Figure 5-17, *"Ethernet Switch,"* on page 5-36 and reference Table 5-18, *"Ethernet Switch LEDs Each Port,"* on page 5-36.

Figure 5-17. Ethernet Switch

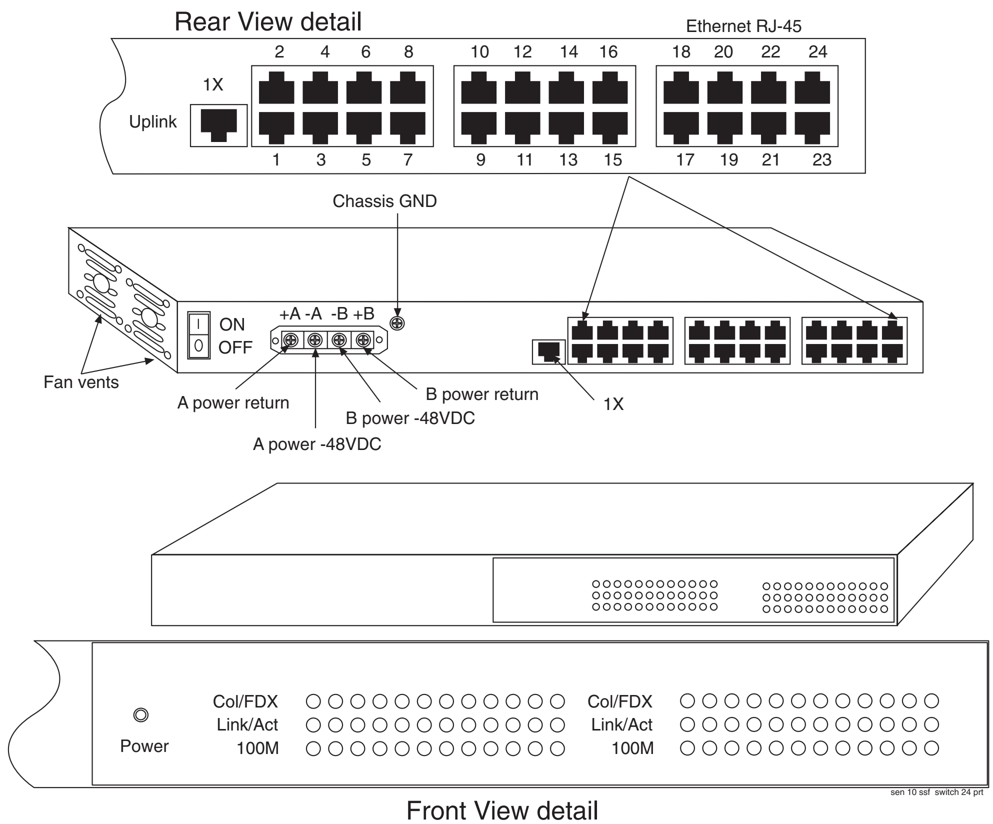


Table 5-18. Ethernet Switch LEDs Each Port

LED	Description
LNK/ACT	Link active - ON for Link with no traffic, blinking indicates port is transmitting and receiving.
FDX/COL	ON = Full-Duplex Mode BLINKING = Half-Duplex Collision
100/10	ON = 100 Mbps speed OFF = 10 Mbps

Routers

The routers used in Sentinel products are configured by Tekelec for NEBS compliancy.

The isolation routers provide 10/100Mbps communications between the customer LAN or dedicated network and the Sentinel servers. The dial-in router allows remote dial-up access to the internal Sentinel LAN. Figure 5-18 shows the front view of the routers and Table 5-19 describes the LED indicator functions on the front of the router. Also see Figure 5-19, *"Rear View Dial-in Router,"* on page 5-37 for the location of the modem connection and Table 5-20 for rear LED information.

Figure 5-18. Front View Routers

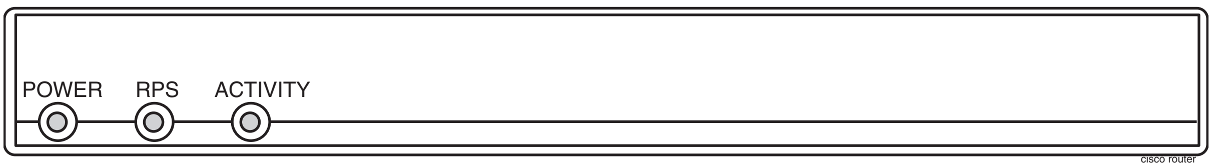


Table 5-19. Router Front LEDs

LED	Description
PWR	Indicates when power is present to the router and the power switch is in the ON position.
RPS (Always OFF)	Off when the redundant power supply is not present. On redundant power supply is present and functional.
Activity	Off-No network activity Blink-Network activity

Figure 5-19. Rear View Dial-in Router

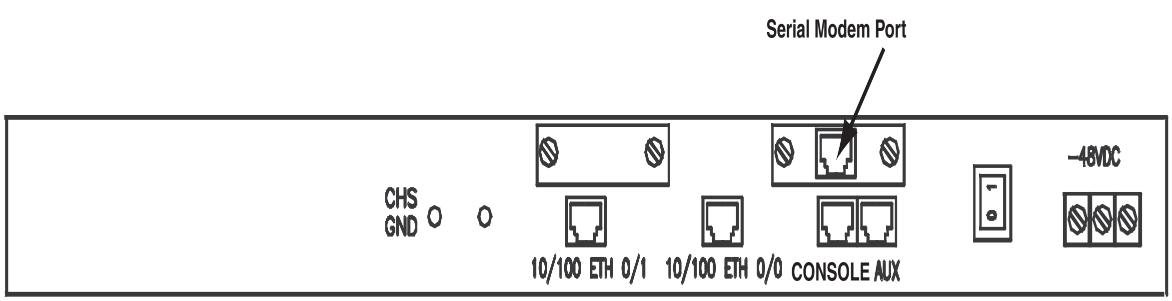


Table 5-20. Router Rear LEDs

LED	Description
LNK	Indicates link is established to far end connection.
ACT	Blink-indicates data activity on the link.

Hubs

The following section provides an overview of the Ethernet hubs used in Sentinel products. The hubs cross-connect the components in Sentinel frames functioning as an internal Local Area Network (LAN). The hubs support self sensing dual-speeds and a maximum of sixteen RJ-45 ports each. The chip technology enables hubs to identify and accept either 100 Mbps or 10 Mbps LAN interfaces on a per-port basis. See Figure 5-20 "Hub Front View" on page 5-38 and Figure 5-21 "Hub Rear View" on page 5-38.

Figure 5-20. Hub Front View

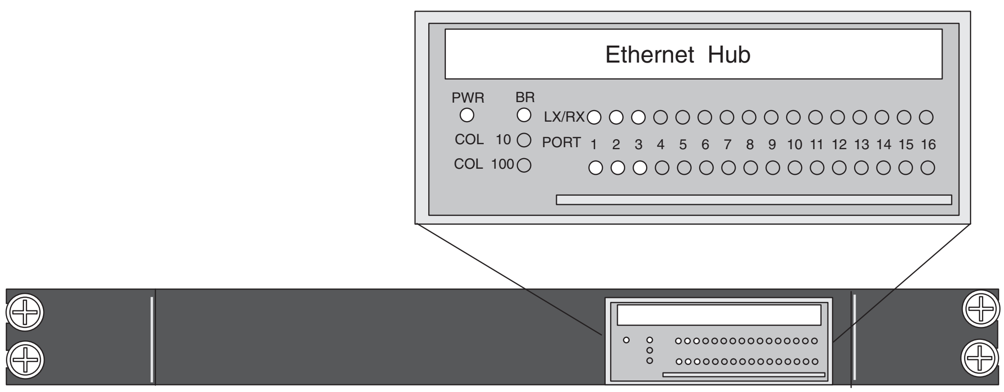


Figure 5-21. Hub Rear View

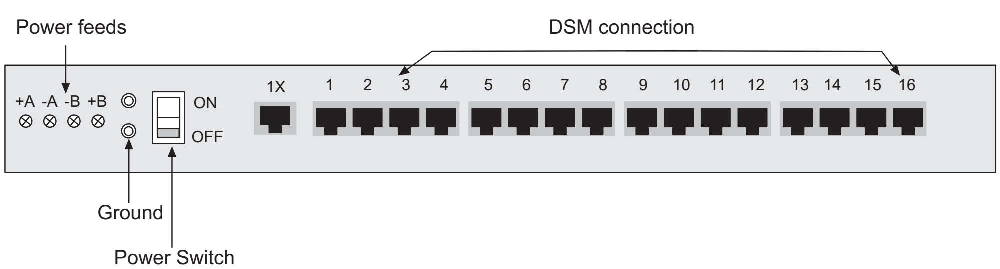


Table 5-21 describes the LEDs located on the front of the hubs.

Table 5-21. Hub Front LEDs

LED	Color	Description
PWR	Green	Lights whenever the power is applied

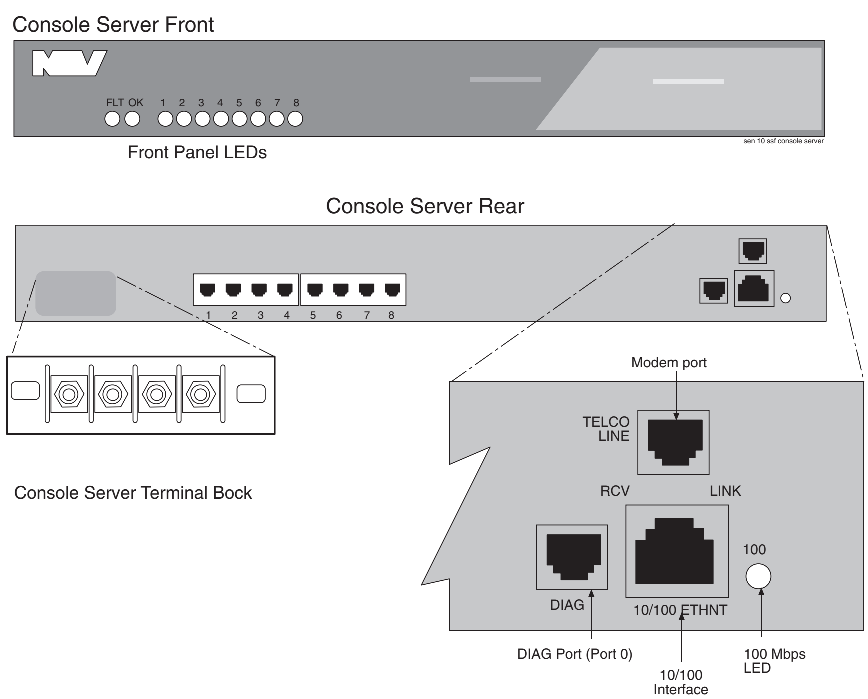
Table 5-21. Hub Front LEDs

LED	Color	Description
COL 10	Red	Intermittent blink during a10MB domain collision
COL 100	Red	Intermittent blink during a100MB domain collision
BR	Green	Lights whenever the bridge module is installed
100/AUTO (Per Port)	Green	• Lights whenever speed is 100 Mbps • Unlit whenever speed is 10 Mbps • Blinks whenever a link is not connected or when auto-negotiating
LK/RX (Per Port)	Green	• Lights steadily whenever port is operational • Blinks whenever port is receiving data

Console/Alarm Servers

Beginning in Sentinel release 10.0 the MRV Communications LX-4008S console/alarm server (CAS) with eight serial ports and an internal V.90 modem is configured with Sentinel server frames. The CAS connects all Sentinel servers and breaker panel alarm connections that was previously connected by the SAI/P card in the first server and the connected breakout box. The CAS also provide dial-up service access to the components in the Sentinel server frames. See Figure 5-22 for front and rear views of the CAS.

Figure 5-22. Console/Alarm Server (CAS)



6

Site Engineering – EAGLE 5 ISS

Safety and Cautionary Information

DANGER: At least two people are required to safely move and position the frames.

DANGER: No commercially AC powered equipment may be used or placed within 7 ft. of –48VDC equipment. This may create a shock or current loop that can be severely hazardous to personnel and equipment.

TOPPLE: Frames with sliding shelves must be securely anchored to the floor and overhead frame racks. Extending a shelf without correctly anchoring the frame can cause it to topple, endangering personnel and damaging equipment.

Introduction

This chapter contains procedures for preparing the site for the installation of Tekelec signaling products and is intended for use by personnel involved in planning and executing an installation. This chapter also provides power, environmental, and floor plan requirements relating to that installation.

This chapter covers only those areas unique to Tekelec systems and does not cover common telecommunications installation requirements.

Location

The system is designed to be installed and operated in a central office environment.

Local fire protection codes must be satisfied in the equipment room where the system is to be located.

Space Requirements

This system equipment is housed in 7 foot high, 23 inch wide, floor supported, unequal flange upright frames. Separator panels, and end panels add to the width of multiple frame systems.

The floor area taken up by this system is:

- 1 frame = 30 inches wide by 22 inches deep = 660 square inches (4.6 square feet)
- 2 frames = 62 inches wide by 22 inches deep = 1364 square inches (9.5 square feet)
- 3 frames = 94 inches wide by 22 inches deep = 2068 square inches (14.4 square feet)
- 4 frames = 126 inches wide by 22 inches deep = 2772 square inches (19.3 square feet)
- 5 frames = 158 inches wide by 22 inches deep = 3476 square inches (24.1 square feet)
- 6 frames = 190 inches wide by 22 inches deep = 4180 square inches (29 square feet)

The number of frames required for an installation is described in the Initial Sales Order for that site. The number of frames is determined by the space required by the module population of the system and optional items such as OAPs and holdover clocks. See the *Planning Guide, STP, LNP, and LSMS* for information on populating the system.

When planning the installation, be sure to take into account spare module storage, modems, terminals, printers, cross connect panels, and all other items that might require space in a system.

Lighting

Adequate lighting should be provided in the room where the equipment is to be located. Lighting fixtures must be far enough from the equipment and cables to prevent heat damage and to allow safe access to equipment and cables.

Building Requirements

The building requirements for this system are standard telephony industry requirements for equipment installation.

The building must provide a clear, uncluttered route between the loading/receiving dock and the planned system location. In order to move the equipment to the proper location, recommended hall clearance is at least 4.5 feet (1.4 meters) wide by 8 feet (2.4 meters) tall.

Four foot, (1.2 meter) side aisles should be used to allow maneuvering frames into place and provide ample work space around the equipment.

The room selected for system installation should be large enough so the system frames can be at least 2.5 feet (76 cm) from the walls for front and rear access and at least 12 inches (31 cm) for side access.

Earthquake Resistance

All of the configurations are designed to assure the system remains operational during and after an earthquake, even when the system is located on the upper floors of a zone 4 central office.

Environmental Requirements

The environmental conditions for the system must be maintained to the following ambient temperature and humidity specifications:

- Normal operating temperature — +41° F to +104° F, (+5° C to +40° C)
- Short-term temperature range — +23°F to +122° F, (-5° C to +50° C)
- Maximum rate of temperature change — 15° F, (8° C)/hour
- Normal operating relative humidity — 5% to 85%
- Short-term relative humidity — 5% to 90% (not to exceed 0.024 kg of water per kg of dry air)
- Altitude — 200 feet (60 meters) below to 13,000 feet (3,900 meters) above sea level

NOTE 1: Short-term is a period of not more than 96 consecutive hours and a total of not more than 15 days in one year.

NOTE 2: Ambient is to conditions at a location 1.5 m (59 in) above the floor and 400 mm (15.8 in) in front of equipment.

Heating Ventilation and Air Condition Requirements

To maintain the required temperature range, Heating, Ventilation, and Air Conditioning (HVAC) equipment should have the capacity to compensate for up to 1230 BTUs/hr for each installed system shelf.

The required HVAC capacity to compensate for a miscellaneous frame varies depending on the customer previously installed equipment. To calculate needed HVAC capacity, determine the wattage of the installed equipment and use the following formula: watts x 3.413 = BTUs/hr.

Floor Loading

It is recommended the floor or raised sub-flooring have a distributed load capacity of no less than 100 pounds per square foot (453 kg/m^2). The floor loading is determined by using the following equation:

Total equipment weight/floor area = distributed floor capacity.

Following are the maximum weights of Tekelec frames:

- Maximum weight of EAGLE 5 ISS Control or Extension frames: 850 lbs (386 kg).
- Maximum weight of a two T1000/T1100 server frame (for example, the MPS frame), including AC and DC LSMS frames: 600 lbs (273 kg).
- Maximum weight of the EOAP frame: 450 lbs (205 kg).
- Maximum weight of an application frame with up to six T1000/T1100 servers: 925 lbs (421 kg).

See *"Space Requirements"* on page 6-2 for the floor area of the combined system.

Grounding

The system operates as a digital isolated ground plane system in a central office environment and requires a single connection to the central office ground window. The system's ground bars and ground cables must provide the sole grounding connection between the entire system and the central office grounding.

The system uses three types of grounding paths:

- Battery return
- Frame/chassis ground
- Logic ground

Non-oxidizing grease will be applied to all lugs terminated on a copper, system ground bar (see Figure 6-1).

The power return grounding path is the return path for all –48VDC loads in the system. This path is isolated from other system grounds and connects to the rest of the central office through the –48VDC return connections located on the Fuse and Alarm Panel (FAP) of each frame.

The frame/chassis ground path provides a low impedance connection for all metal parts of the entire system, including the frame, doors, card cages, and end panels. Each frame/chassis connection within the system lineup terminates to the frame and connects to the main ground bar by way of Htaps, #6 American Wire Gauge (AWG) to 1/0 cable.

The logic ground path provides a common voltage reference point between all circuit boards of an system. Each connection terminates to the system ground bar on the control frame.

The frame/chassis and logic ground paths are both noncurrent carrying paths.

WARNING: The power (-48 VDC) and return connections of FAP (P/N 870-0243-08) and (P/N 870-1606-xx) are physically reversed at the input terminal, See Figure 6-1 and Figure 6-2 for wiring information.

Figure 6-1. Logic Grounding with FAP (P/N 870-0243-08)

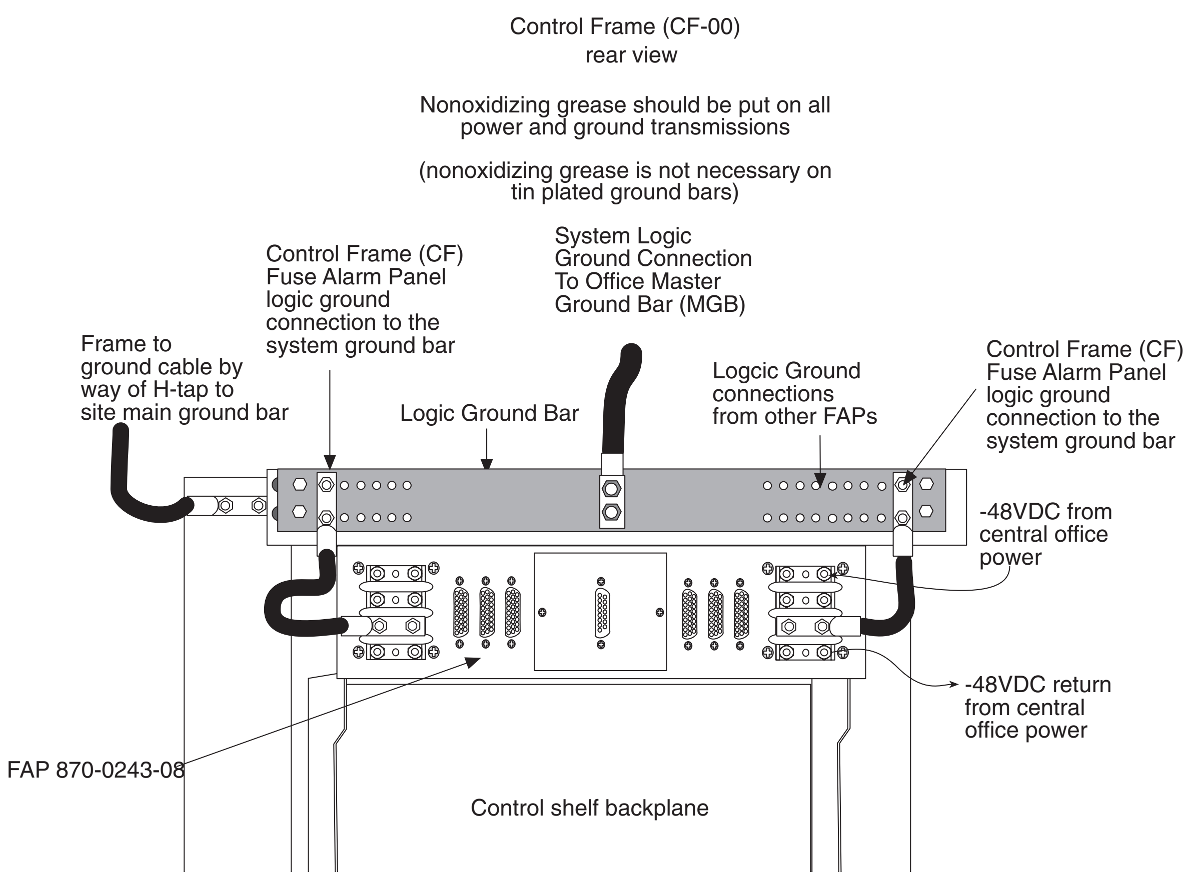
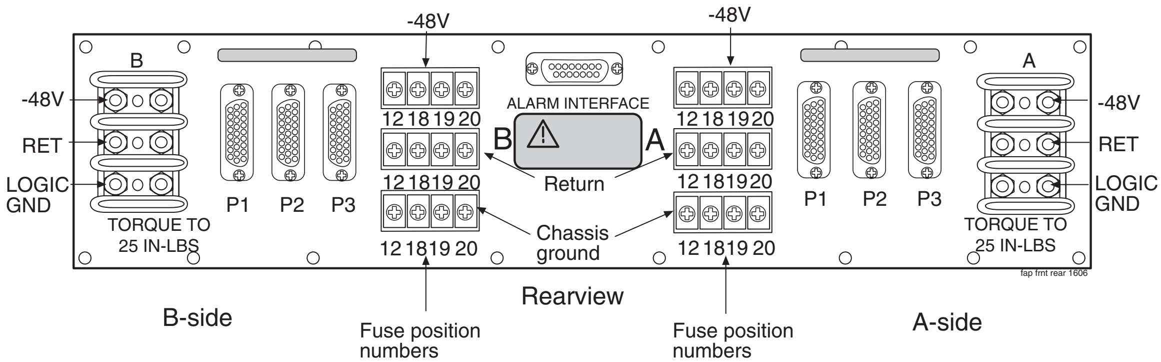
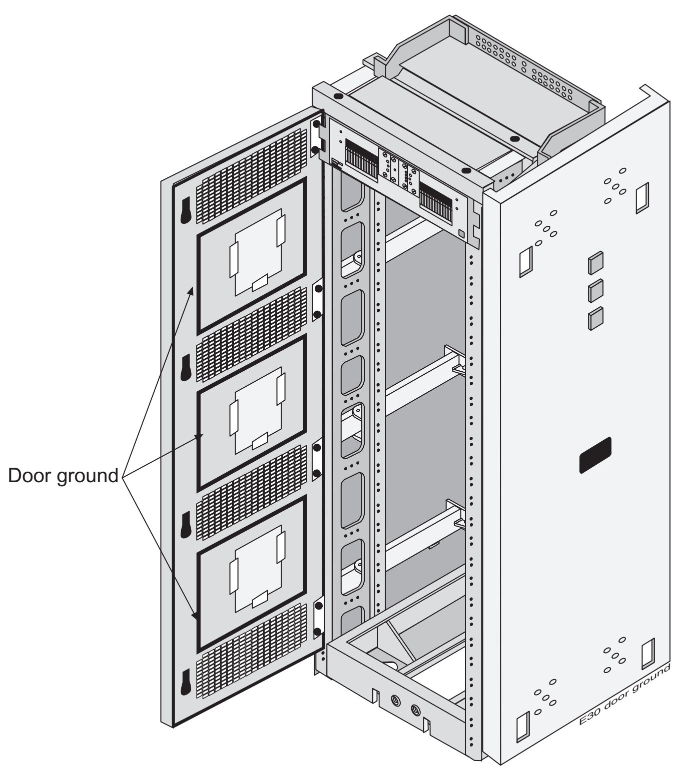


Figure 6-2. Logic Grounding with FAP (P/N 870-1606-xx/870-2320-xx)



The doors installed are grounded to the frame through a double lug ground wire (see Figure 6-3) and through a screw-down latch.

Figure 6-3. Door Grounding



Power Requirements

Each frame requires that power be provided from two fuses/breakers at –48VDC. Additional peripherals that require alternating current (for example but not limited to, terminals, printers, and modems) must be compatible with the system and have a separate ground from the frames.

Each frame is divided into A and B power buses. In the event of loss of power on one of the buses, the other bus must be able to supply current for the entire frame. Therefore, each bus requires wiring sized to handle up to the maximum amps at –48VDC, with a maximum voltage drop of 0.6 volts. To meet this specification you must:

- For new installations of Control and Extension Frames (as of Release 34.0) use 60 amp breakers (see note), the EOAP Frames use 30 amp breakers, the ELAP frames use 30 amp and 60 amp breakers, and the EPAP frames use 30 amp breakers. Local Alarms for the Frame's Power Distribution System are provided at each frame.

NOTE: Existing frames that are fused at 40 amps can be upgraded to support 60 amps with a FAP upgrade kit. 60 amps is required for frames that contain HC-MIMs.

- Use #6, two-hole, #10 Bolt, 5/8" on center lug with windows (P/N 502-0085-01) for fuse and alarm panel connectors.

NOTE: If breakers are tripped by an overload, they must be switched completely OFF and then ON to reset.

Populating the System

The number of frames, shelves, and modules needed to populate the system can be determined using the following procedures.

Link Interface Module (LIM) Requirements

Procedure – Link Interface Module Requirements

Total the following items to determine LIM requirements; any fractional items should be rounded up to the next whole number.

Low-Speed Link Interface module (LSLIM):

- SS7 DSOA links/2
- SS7 OCU links/2
- SS7 V.35 links/2
- E1 links/2
- X.25 DSOA links
- X.25 OCU links

+1 ILA +1= total LIM requirements

High Speed Link Interface Module (HSLIM):

- SS7 ATM/T1 links

+1= total LIM requirements

Cards Type Requirements for SCCP Application with Group Ticket Voucher (TVG)

Group Ticket Voucher (TVG) allows the EAGLE 5 ISS to assign transactions to available resources. With TVG, EAGLE 5 ISS provisioning for SCCP cards is defined on a transactions per second (TPS) basis, where the desired TPS of the system will be determined by the amount of TSM and DSM cards configured. For example, if the user needs 10,000 TPS (regardless of the number of links) 12 (10,000/850) TSM cards or six (10,000 / 1700) DSM cards should be configured. TPS values for individual LIM card types are.

- 53 TPS for low-speed links
- 480 TPS for ATM links
- 1000 TPS for IPMLIM links

The number of TVG requests that can be made per card is a function of the number of cards in the system, and decreases as the number of active cards increase. It is approximately 1/(Nx10-6) for N cards. For a system with 250 cards, it is limited to about 3300 TVG requests/second. With the introduction of the MPL card, in a non-HMUX system, there cannot be more than 131 cards (MPL, SCCP, and SLAN) in the system.

CAUTION: It is Tekelec's recommendation that cards running the SCCP application be uniformly distributed in the EAGLE 5 ISS to provide a more even SCCP load distribution. During normal operation unevenly distributed SCCP cards in an EAGLE 5 ISS would not have any network or system impacts. However, should a particular SCCP card database(s) become corrupted, inconsistent, or at a different level, depending on the amount of service provided by that card and the extent of the database issue, network impacts can occur.

NOTE: The MPL card improves the functionality of SS7 routing within the EAGLE5 ISS by increasing the number of SS7 links the EAGLE 5 ISS can handle for each LIM card. This allows the EAGLE 5 ISS to interact in larger SS7 networks as well as decreasing the size of an EAGLE 5 ISS (for example, previously 250 cards would be required to support 500 links, now only 63 MPL cards are required).

Database Communications Module (DCM) and Double-Slot Enhanced DCM (EDCM)

The Database Communications Module (DCM) (P/N 870-1671-xx or P/N 870-1945-01) can be used in EAGLE 5 ISS or IP^7 GW systems). The Double Slot EDCM (P/N 870-2197-01) is used in IP^7 SG release 4.0 systems and later. Both cards provide the following functions for the systems:

- Signaling Transfer Point, Local Area Network (SLAN) function, port to DCM or Double Slot EDCM
- Enhanced Bulk Download

NOTE: The DCM card requires two slots for mounting and must be assigned to an odd numbered slot with the next even slot left open on EAGLE 5 ISS systems.

The DCM card is compatible with EAGLE 5 ISS control shelf backplanes P/N 850-0330-03/04/05/06 and extension backplanes P/N 850-0356-01/02/03/04/06. The Double-Slot EDCM is compatible with IP^7 SG control shelf backplanes P/N 850-0330-03/04/05 and extension shelf backplanes P/N 850-0356-01/02/03. These cards are provisioned in pairs for redundancy with mated pairs mounted in shelves. Size places some restrictions on the placement of DCM or Double-Slot EDCM cards.

The DCM cards require a unique cable interface that is not compatible with current LIM cables on a fully wired but unequipped shelf. The location of the DCM cards must be to odd numbered slots, requiring two slots with the next higher-numbered even slots left open.

Cabling DCM and Double-Slot EDCM Cards

The DCM and EDCM support only Category 5 (100-Ohm) shielded twisted pair cables. In order to meet Electromagnetic Interference (EMI) requirements, the DCM or Double-Slot EDCM may require a point-to-point connection or a connection to a hub/router. This must be identified to the customer who may be preparing the location. See Figure 6-4 "Database Communications Module Cabling in System" on page 6-12, for cable types and part numbers.

The maximum cable length has not been determined but will be less than 100 meters.

Three specific DCM cables are required:

- Customer patch panel “straight through” (P/N 830-0788-xx)
- Customer patch panel “crossover” (P/N 830-0789-xx)
- 100-BASE TX interface to unterminated (P/N 830-0711-xx)

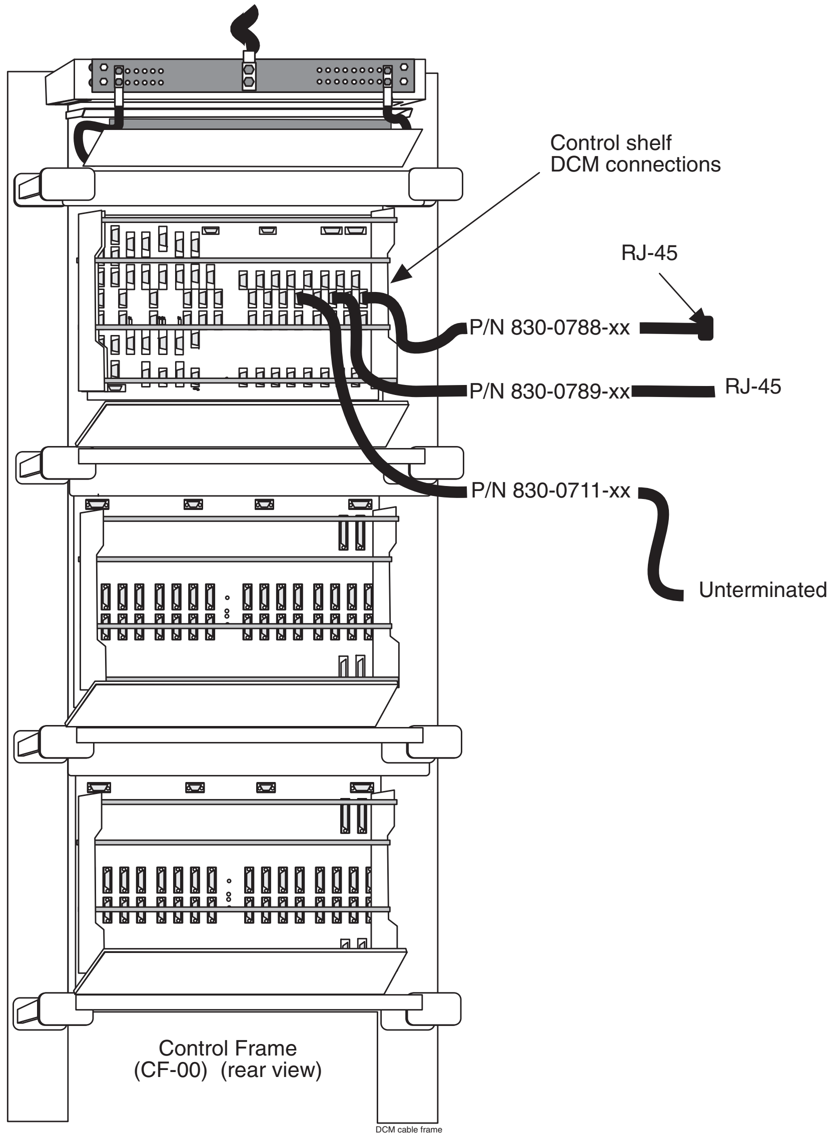
Hardware

The systems support a maximum of six DCMs or Double-Slot EDCMs for Internet Protocol Link Interface Module (IP LIM) application.

If more than one DCM or Double-Slot EDCM is provisioned, each must be powered from different fuse positions and distributed evenly among “A” and “B” power feeds.

CAUTION: In EAGLE 5 ISS systems care must be taken to be sure the DCM card is inserted into the correct odd numbered slots. In IP^7 SG systems there is no slot provisioning requirements. Cards may be provisioned in any slot where they physically fit except for the HMUX and MAS dedicated card slots.

Figure 6-4. Database Communications Module Cabling in System



Single-Slot EDCM and EDCM-A

The Single-Slot Enhanced Data Communications Module EDCM (P/N 870-2372-01) and EDCM-A (P/N 870-2508-02) require only a single frame slot. It can be placed into any slot, odd or even, which has been provisioned for an Enhanced Data Communications Module (EDCM). Otherwise it duplicates the performance of the Double-Slot EDCM.

NOTE: Cards may be provisioned in any slot where they physically fit except for the HMUX and MAS dedicated card slots.

The following cards can be configured from the single-slot EDCM and have these provisioning requirements:

- Sentinel Transport Cards (STC) can be provisioned in any slot to support the Integrated Sentinel. Only three STC cards may be provisioned on each shelf.
- General Purpose Service Modules (GPSM-II) cards can be provisioned in card slots (1113 and 1115).
- Measurements Collection and Polling Modules (MCPM) can be provisioned an any slot.

Application Communications Module Requirements

Procedure – Application Communications Module Requirements

1. If the Signal Transfer Point (STP), Local Area Network (SLAN) feature is not required for this system, no ACMs are needed.
2. If the Signal Transfer Point (STP), Local Area Network (SLAN) feature is required for this system, one ACM is required for each 30 LIMs in the system (refer to the previous procedure) plus one spare ACM. (LIMs) /30 round up to next whole number +1=ACM needed in a system.

Procedure – Translations Services Module for Local Number Portability

Each Translations Service Module (TSM) is capable of 850 translations per second for up to 16 LIMs. For reliability, the number of TSMs equipped should be “N + 1,” where “N” represents at least one TSM for each 16 LIMs, or at most 25 TSMs to achieve a full 20 (400 translations per second) per system node.

To calculate N (number of TSMs):

1. Calculate the number of TSMs per 16 LIMs and add one.
2. Calculate the number of TSMs per 2 LIM ATMs and add one.
3. Choose whichever number is the greater of the two calculations (N+1)

OAP and Embedded OAP

These rules apply to populating the OAP or EOAP for Local Number Portability (LNP):

- For LNP, two OAPs or a dual EOAP is required and can be installed in the same OAP frame
- If an OAP frame with two OAPS already exists for Signaling Engineering and Administration System (SEAS), then it will be used for LNP
- If an OAP frame with only one OAP or EOAP already exists for SEAS, then one additional OAP or EOAP will be required for LNP

A

Hardware Baselines

Baseline Tables

The following tables list the configurable hardware components for each release. A bold **X** in a table cell indicates the component listed on the left is valid for the release indicated at the top of the column. To obtain configuration information about hardware and release compatibility for each release use:

- Eagle 5 ISS Release 30.0 through 31.6 in Table A-1, "*Hardware Baseline EAGLE 5 ISS Release 30.0 through 31.6,*" on page A-3
- Eagle 5 ISS Release 32.0 through 34.0 in Table A-2, "*Hardware Baseline EAGLE 5 ISS Release 32.0 through 35.0,*" on page A-9
- EAGLE 5 ISS Cable Assemblies and Adapters:
  - Table A-3, "*E1 Cable Assemblies,*" on page A-16
  - Table A-4, "*T1 MIM LIM Cable Assemblies,*" on page A-16
  - Table A-5, "*Terminal/Printer Cables and Adapters,*" on page A-17
  - Table A-6, "*Modem Cables and Adapters,*" on page A-17
  - Table A-7, "*Tekelec 1000 Site Specific Cables,*" on page A-17
- Sentinel systems use the following:
  - Table A-8, "*ESP Frame Baseline and Required EAGLE 5 ISS Baseline.,*" on page A-18
  - Table A-9, "*Integrated Sentinel ESP Frame Releases 8.0, 8.1, 8.1.x, 9.0, 10.x, 11.x,*" on page A-19
  - Table A-10, "*Integrated Sentinel ESP Expansion Frame Releases 8.1.x, 9.0, 10.0,*" on page A-23
  - Table A-11, "*Sentinel Server Frame Releases 8.1.x, 9.0, 10.0, 11.x,*" on page A-24
  - Table A-12, "*Site Collector Frame Releases 8.1.x and 9.0.,*" on page A-25
  - Table A-13, "*AC Servers Releases 8.1.x and 9.0,*" on page A-25.

NOTE: Exceptions, additions, and clarifications to the following tables are by superscript numeric notation relating to the listed notes located at the end of each table. For example, a table cell with $X^{1,2}$ would indicate that notes 1 and 2 are applicable to that component being configurable in that release.

EAGLE 5 ISS Release 30.0 Through 31.6

Table A-1. Hardware Baseline EAGLE 5 ISS Release 30.0 through 31.6 (Sheet 1 of 6)

NAME	PART NUMBER	REV	30.0	30.1	31.0	31.3	31.6
ACM	870-1008-02	D	X	X	X	X	X
ACM	870-1008-03	A	X	X	X	X	X
ACM	870-1008-04	A	X	X	X	X	X
ACM	870-1008-05	A	X	X	X	X	X
ASM	870-1011-02	D	X	X	X	X	
ASM	870-1011-03	A	X	X	X	X	
ASM	870-1011-04	B	X	X	X	X	
ASM	870-1011-05	B	X	X	X	X	
ASM	870-1011-06	A	X	X	X	X	
ASM	870-1011-07	A	X	X	X	X	
Air Management Card	870-1824-02	A					
CTRL SHELF	870-0775-03	E	X[1]	X[1]	X[1]	X[1]	X[14]
CTRL SHELF	870-2321-08	A	X[2]	X[2]	X[2,7]	X[2,7]	X[2,7]
CTRL SHELF	870-2321-04	A			X[2,7]	X[2,7]	X[2,7]
CTRL SHELF	870-2377-02	A	X[3]	X[3]	X[3,7]	X[3,7]	X[3,7]
DCM	870-1671-02	B	X	X	X	X	
DCM	870-1671-04	A	X	X	X	X	
DCM	870-1945-01	A	X	X	X	X	X
DCM	870-1945-02	A	X	X	X	X	X
DCM	870-1945-03	A	X	X	X	X	X
DCMX	870-1984-01	A	X	X	X	X	X
DSM, (1) GB MEM	870-1984-02	A3	X	X	X	X	X
DSM, (1) GB MEM	870-1984-08	A	X[21]	X[21]	X[21]	X[21]	X[21]
DSM, (1) GB MEM	870-1984-15	A	X[21,22]	X[21,22]	X[21,22]	X[21,22]	X[21,22]
DSM, (1) GB GPSM-II Based	870-2371-02	A	X	X	X	X	X

Table A-1. Hardware Baseline EAGLE 5 ISS Release 30.0 through 31.6 (Sheet 2 of 6)

NAME	PART NUMBER	REV	30.0	30.1	31.0	31.3	31.6
DSM, (1) GB GPSM-II Based	870-2371-06	A	X[21]	X[21]	X[21]	X[21]	X[21]
DSM, (1) GB GPSM-II Based	870-2371-13	A	X[21,22]	X[21,22]	X[21,22]	X[21,22]	X[21,22]
DSM, (2) GB MEM	870-1984-03	A	X	X	X	X	X
DSM, (2) GB GPSM-II Based	870-2371-03	E	X	X	X	X	
DSM, (3) GB MEM	870-1984-04	A	X	X	X	X	X
DSM, (4) GB MEM	870-1984-05	A	X	X	X	X	X
DSM, (4) GB MEM	870-1984-06	A	X[21]	X[21]	X[21]	X[21]	X[21]
DSM, (4) GB MEM	870-1984-13	A	X[21,22]	X[21,22]	X[21,22]	X[21,22]	X[21,22]
E1/T1 MIM	870-2198-01	G	X	X	X	X	X
E1/T1 MIM	870-2198-02	A	X	X	X	X	X
E1/T1 MIM	870-2198-03	A	X[21]	X[21]	X[21]	X[21]	X[21]
E1/T1 MIM	870-2198-07	A	X[21,23]	X[21,23]	X[21,23]	X[21,23]	X[21,23]
E1-ATM	870-2455-01	B	X[8]	X[8]	X[8]	X[8]	X
E1-ATM	870-2455-02	B			X	X	X
E1-ATM	870-2455-05	A	X[22]	X[22]	X[22]	X[22]	X[22]
E5-E1T1	870-1873-02	A					
E5-ENET	870-2212-02	A					
EDCM (Single-slot)	870-2372-01	E	X	X	X	X	X
EDCM (Single-slot)	870-2372-13	A	X[22,25]	X[22,25]	X[22,25]	X[22,25]	X[22,25]
EDCM-A (Single-slot)	870-2508-02	A	X	X	X	X	X
EDSM-2G (MCPM)	870-2372-03	A	X	X	X	X	X
EDSM-2G (MCPM)	870-2372-07	A	X[21]	X[21]	X[21]	X[21]	X[21]

Table A-1. Hardware Baseline EAGLE 5 ISS Release 30.0 through 31.6 (Sheet 3 of 6)

NAME	PART NUMBER	REV	30.0	30.1	31.0	31.3	31.6
EDSM-2G (MCPM)	870-2372-13	A	X[21,22]	X[21,22]	X[21,22]	X[21,22]	X[21,22]
EILA	870-2049-01	A	X	X	X	X	X
EILA w/DIMM	870-2049-02	A	X	X	X	X	X
EXTN SHELF	870-0776-02	C5			X	X	X
EXTN SHELF	870-0776-03	D			X	X	X
EXTN SHELF	870-0776-06	A			X	X	X
EXTN SHELF	870-0776-07	A			X	X	X
EXTN SHELF	870-0776-08	A	X	X	X	X	X
EXTN SHELF	870-0776-11	A	X	X	X	X	X
EXTN SHELF	870-2378-02	A	X	X	X[5]	X[5]	X[5]
FAP	870-1606-01	A			X	X	X
FAP	870-1606-02	A	X[4]	X[4]	X[4]	X[4]	X[4]
FAP	870-1606-02	C					
FAP	870-2320-03	A	X[5]	X[5]	X[5]	X[5]	X[5]
FAP	870-1823-01	A					
FAP	870-2320-03	J					
FAP- CF/EF	870-0243-08	C	X	X	X	X	X
FAP- MISC	870-0243-09	C	X	X	X	X	X
GPSM-II	870-2360-01	E	X[11]	X[11]	X[11]	X[11]	X[11]
GPSM-II	870-2360-05	A	X[21]	X[21]	X[21]	X[21]	X[21]
GPSM-II	870-2360-06	A	X[21,22]	X[21,22]	X[21,22]	X[21,22]	X[21,22]
HCMIM	870-2671-01	P					
HCMIM	870-2671-03	B					
HIPR	870-2574-02	D					
HMUX	870-1965-03	A	X[12]	X[12]	X[12]	X[12]	X[12]
LIM-AINF	870-1014-01	D	X	X	X	X	X
LIM-AINF	870-1014-02	A	X	X	X	X	X

Table A-1. Hardware Baseline EAGLE 5 ISS Release 30.0 through 31.6 (Sheet 4 of 6)

NAME	PART NUMBER	REV	30.0	30.1	31.0	31.3	31.6
LIM-AINF	870-1014-03	B	X	X	X	X	X
LIM-AINF	870-1014-04	A	X	X	X	X	X
LIM-AINF	870-1014-05	A	X	X	X	X	X
LIM-AINF	870-1014-06	A	X	X	X	X	X
LIM-AINF	870-1488-01	A	X	X	X	X	X
LIM-AINF	870-1488-02	A	X	X	X	X	X
LIM-AINF	870-1488-03	A	X	X	X	X	X
LIM-AINF	870-1488-04	A	X	X	X	X	X
LIM-AINF	870-1488-05	A	X	X	X	X	X
LIM-AINF	870-1488-06	A	X	X	X	X	X
LIM-ATM (1) 4Mb RAM	870-1293-02	A	X[8]	X[8]	X[8]	X[8]	X[8]
LIM-ATM (2) 4Mb RAM	870-1293-03	A	X[8]	X[8]	X[8]	X[8]	X[8]
LIM-ATM	870-1293-06	A	X[9]	X[9]	X[9]	X[9]	X[9]
LIM-ATM	870-1293-07	A	X[9]	X[9]	X[9]	X[9]	X[9]
LIM-ATM	870-1293-08	A				X[9]	X[9]
LIM-ATM	870-1293-13	A				X[9,23]	X[9,23]
LIM-DS0	870-1009-02	D	X	X	X	X	X
LIM-DS0	870-1009-03	A	X	X	X	X	X
LIM-DS0	870-1009-04	A	X	X	X	X	X
LIM-DS0	870-1485-01	A	X	X	X	X	X
LIM-DS0	870-1485-02	A	X	X	X	X	X
LIM-DS0	870-1485-03	A	X	X	X	X	X
LIM-E1	870-1379-01	A	X	X	X	X	X
LIM-ILA	870-1484-01	E	X	X	X	X	X
LIM-ILA	870-1484-02	C	X	X	X	X	X
LIM-OCU	870-1010-03	D	X	X	X	X	X
LIM-OCU	870-1010-04	A	X	X	X	X	X

Table A-1. Hardware Baseline EAGLE 5 ISS Release 30.0 through 31.6 (Sheet 5 of 6)

NAME	PART NUMBER	REV	30.0	30.1	31.0	31.3	31.6
LIM-OCU	870-1010-05	A	X	X	X	X	X
LIM-OCU	870-1486-02	A	X	X	X	X	X
LIM-OCU	870-1486-03	A	X	X	X	X	X
LIM-OCU	870-1486-04	A	X	X	X	X	X
LIM-V.35	870-1012-02	D	X	X	X	X	X
LIM-V.35	870-1012-03	A	X	X	X	X	X
LIM-V.35	870-1012-04	A	X	X	X	X	X
LIM-V.35	870-1487-01	A	X	X	X	X	X
LIM-V.35	870-1487-02	A	X	X	X	X	X
LIM-V.35	870-1487-03	A	X	X	X	X	X
MDAL	870-0773-04	B	X	X	X	X	X
MDAL	870-0773-05	A	X	X	X	X	X
MDAL	870-0773-06	A	X	X	X	X	X
MDAL	870-0773-09	A			X	X	X
MPL	870-2061-01	A	X	X	X	X	X
MPL	870-2061-03	A	X[21]	X[21]	X[21]	X[21]	X[21]
MPL	870-2061-06	A	X[21,23]	X[21,23]	X[21,23]	X[21,23]	X[21,23]
MPL-T	870-2061-02	C	X	X	X	X	X
TDM-10	870-0774-10	A	X[6,7,13]	X[6,7,13]	X[6,7,13]	X[6,7,13]	X[6,7,13]
TDM-11	870-0774-11	A	X[13]	X[13]	X[13]	X[13]	X[13]
TDM-15	870-0774-18	A	X[13]	X[13]	X[13]	X[13]	X[13]
TSM-256	870-1289-02	A	X	X	X	X	X
TSM-256	870-1289-03	A	X	X	X	X	X
TSM-256	870-1289-06	A	X	X	X	X	X
TSM-512	870-1290-02	A	X	X	X	X	X
TSM-512	870-1290-03	A	X	X	X	X	X
TSM-512	870-1290-04	A	X	X	X	X	X
TSM-768	870-1291-02	A	X	X	X	X	X

Table A-1. Hardware Baseline EAGLE 5 ISS Release 30.0 through 31.6 (Sheet 6 of 6)

NAME	PART NUMBER	REV	30.0	30.1	31.0	31.3	31.6
TSM-768	870-1291-03	A	X	X	X	X	X
TSM-768	870-1291-04	A	X	X	X	X	X
TSM-1024	870-1292-02	A	X	X	X	X	X
TSM-1024	870-1292-03	A	X	X	X	X	X
TSM-1024	870-1292-04	A	X	X	X	X	X
Dual EOAP	890-1050-01	K	X	X	X	X	X
Dual GR376 EOAP	890-1050-02	G	X	X	X	X	X
Single EOAP	890-1050-03	H	X	X	X	X	X
FAN ASSY	890-1038-01	D	X	X	X	X	X
FAN ASSY	890-0001-01	A					
FAN ASSY	890-0001-04	A					
KIT, E1	890-1037-06	A	X	X	X	X	X
KIT, HLDOVR CLK ASSY	890-1013-01	A	X	X	X	X	X
MPS in Heavy Duty Frame	890-1801-02	E		X	X	X	X
MPS DC Frame	890-1843-03	C					
Tekelec 1000	870-2640-03	F			X	X	X
Tekelec 1100	870-2754-04	P					
MPS Netra-to-Tekelec 1000 Field Upgrade Kit	870-2735-02	A			X	X	X
MPS RAM and CPU Upgrade Kit (two for each frame)	870-2669-02	A					X
MPSW O/RAIDS	890-1277-03	H	X				
MPSW O/RAIDS	890-1277-04	G	X				
MPSW O/RAIDS	890-1374-03	E	X				
MPSW O/RAIDS	890-1374-04	E	X				
MPSW / 1 GB RAM	890-1374-05	A	X				
MPSW / 2 GB RAM	890-1374-06	A	X				

EAGLE 5 ISS Release 32.0 Through 35.0

Table A-2. Hardware Baseline EAGLE 5 ISS Release 32.0 through 35.0 (Sheet 1 of 6)

NAME	PART NUMBER	REV	32.0	33.0	34.0	35.0
ACM	870-1008-02	D	X	X	X	X
ACM	870-1008-03	A	X	X	X	X
ACM	870-1008-04	A	X	X	X	X
ACM	870-1008-05	A	X	X	X	X
ASM	870-1011-02	D				
ASM	870-1011-03	A				
ASM	870-1011-04	B				
ASM	870-1011-05	B				
ASM	870-1011-06	A				
ASM	870-1011-07	A				
Air Management Card	870-1824-02	A		X[18]	X[18]	X[18]
CTRL SHELF	870-0775-03	E	X[14]	X[14]	X[14]	X[14]
CTRL SHELF	870-2321-08	A	X[2,7]	X[2,7]	X[2,7]	X[2,7]
CTRL SHELF	870-2321-04	A	X[2,7]	X[2,7]	X[2,7]	X[2,7]
CTRL SHELF	870-2377-02	A	X[3,7]	X[3,7]	X[3,7]	X[3,7]
DCM	870-1671-02	B				
DCM	870-1671-04	A				
DCM	870-1945-01	A	X	X	X	X
DCM	870-1945-02	A	X	X	X	X
DCM	870-1945-03	A	X	X	X	X
DCMX	870-1984-01	A	X	X	X	X
DSM, (1) GB MEM	870-1984-02	A3	X	X	X	X
DSM, (1) GB MEM	870-1984-08	A	X[21]	X[21]	X[21]	X[21]
DSM, (1) GB MEM	870-1984-15	A	X[21,22]	X[21,22]	X[21,22]	X[21,22]
DSM, (1) GB GPSM-II Based	870-2371-02	A	X	X	X	X

Table A-2. Hardware Baseline EAGLE 5 ISS Release 32.0 through 35.0 (Sheet 2 of 6)

NAME	PART NUMBER	REV	32.0	33.0	34.0	35.0
DSM, (1) GB GPSM-II Based	870-2371-06	A	X[21]	X[21]	X[21]	X[21]
DSM, (1) GB GPSM-II Based	870-2371-13	A	X[21,22]	X[21,22]	X[21,22]	X[21,22]
DSM, (2) GB MEM	870-1984-03	A	X	X	X	X
DSM, (2) GB GPSM-II Based	870-2371-03	E				
DSM, (3) GB MEM	870-1984-04	A	X			
DSM, (4) GB MEM	870-1984-05	A	X	X	X	X
DSM, (4) GB MEM	870-1984-06	A	X[21]	X[21]	X[21]	X[21]
DSM, (4) GB MEM	870-1984-13	A	X[21,22]	X[21,22]	X[21,22]	X[21,22]
E1/T1 MIM	870-2198-01	G	X	X	X	X
E1/T1 MIM	870-2198-02	A	X	X	X	X
E1/T1 MIM	870-2198-03	A	X[21]	X[21]	X[21]	X[21]
E1/T1 MIM	870-2198-07	A	X[21,23]	X[21,23]	X[21,23]	X[21,23]
E1-ATM	870-2455-01	B	X	X	X	X
E1-ATM	870-2455-02	B	X	X	X	X
E1-ATM	870-2455-05	A	X[22]	X[22]	X[22]	X[22]
E5-E1T1	870-1873-02	A				X[24]
E5-ENET	870-2212-02	A				X[24]
EDCM (Single-slot)	870-2372-01	E	X	X	X	X
EDCM (Single-slot)	870-2372-13	A	X[22,25]	X[22,25]	X[22,25]	X[22,25]
EDCM-A (Single-slot)	870-2508-02	A	X	X	X	X
EDSM-2G (MCPM)	870-2372-03	A	X	X	X	X
EDSM-2G (MCPM)	870-2372-07	A	X[21]	X[21]	X[21]	X[21]

Table A-2. Hardware Baseline EAGLE 5 ISS Release 32.0 through 35.0 (Sheet 3 of 6)

NAME	PART NUMBER	REV	32.0	33.0	34.0	35.0
EDSM-2G (MCPM)	870-2372-13	A	x[21,22]	x[21,22]	x[21,22]	x[21,22]
EILA	870-2049-01	A	x	x	x	x
EILA w/DIMM	870-2049-02	A	x	x	x	x
EXTN SHELF	870-0776-02	C5	x	x	x	x
EXTN SHELF	870-0776-03	D	x	x	x	x
EXTN SHELF	870-0776-06	A	x	x	x	x
EXTN SHELF	870-0776-07	A	x	x	x	x
EXTN SHELF	870-0776-08	A	x	x	x	x
EXTN SHELF	870-0776-11	A	x	x	x	x
EXTN SHELF	870-2378-02	A	x[5]	x[5]	x[5]	x[5]
FAP	870-1606-01	A	x	x	x	x
FAP	870-1606-02	A	x[4]	x[4]	x[4]	x[4]
FAP	870-1606-02	C		x[16]	x[16]	x[16]
FAP	870-2320-03	A	x[5]	x[5]	x[5]	x[5]
FAP	870-1823-01	A		x	x	x
FAP	870-2320-03	J		x[15]	x[15]	x[15]
FAP- CF/EF	870-0243-08	C	x	x	x	x
FAP- MISC	870-0243-09	C	x	x	x	x
GPSM-II	870-2360-01	E	x[11]	x[11]	x[11]	x[11]
GPSM-II	870-2360-05	A	x[21]	x[21]	x[21]	x[21]
GPSM-II	870-2360-06	A	x[21,22]	x[21,22]	x[21,22]	x[21,22]
HCMIM	870-2671-01	P		x[17]	x[17]	x[17]
HCMIM	870-2671-03	B		x[17]	x[17]	x[17]
HIPR	870-2574-02	D		x	x	x
HMUX	870-1965-03	A	x[12]	x[12]	x[12]	x[12]
LIM-AINF	870-1014-01	D	x	x	x	x
LIM-AINF	870-1014-02	A	x	x	x	x

Table A-2. Hardware Baseline EAGLE 5 ISS Release 32.0 through 35.0 (Sheet 4 of 6)

NAME	PART NUMBER	REV	32.0	33.0	34.0	35.0
LIM-AINF	870-1014-03	B	X	X	X	X
LIM-AINF	870-1014-04	A	X	X	X	X
LIM-AINF	870-1014-05	A	X	X	X	X
LIM-AINF	870-1014-06	A	X	X	X	X
LIM-AINF	870-1488-01	A	X	X	X	X
LIM-AINF	870-1488-02	A	X	X	X	X
LIM-AINF	870-1488-03	A	X	X	X	X
LIM-AINF	870-1488-04	A	X	X	X	X
LIM-AINF	870-1488-05	A	X	X	X	X
LIM-AINF	870-1488-06	A	X	X	X	X
LIM-ATM (1) 4Mb RAM	870-1293-02	A	X[8]	X[8]	X[8]	X[8]
LIM-ATM (2) 4Mb RAM	870-1293-03	A	X[8]	X[8]	X[8]	X[8]
LIM-ATM	870-1293-06	A	X[9]	X[9]	X[9]	X[9]
LIM-ATM	870-1293-07	A	X[9]	X[9]	X[9]	X[9]
LIM-ATM	870-1293-08	A	X[9]	X[9]	X[9]	X[9]
LIM-ATM	870-1293-13	A	X[9,23]	X[9,23]	X[9,23]	X[9,23]
LIM-DS0	870-1009-02	D	X	X	X	X
LIM-DS0	870-1009-03	A	X	X	X	X
LIM-DS0	870-1009-04	A	X	X	X	X
LIM-DS0	870-1485-01	A	X	X	X	X
LIM-DS0	870-1485-02	A	X	X	X	X
LIM-DS0	870-1485-03	A	X	X	X	X
LIM-E1	870-1379-01	A	X	X	X	X
LIM-ILA	870-1484-01	E	X	X	X	X
LIM-ILA	870-1484-02	C	X	X	X	X
LIM-OCU	870-1010-03	D	X	X	X	X
LIM-OCU	870-1010-04	A	X	X	X	X

Table A-2. Hardware Baseline EAGLE 5 ISS Release 32.0 through 35.0 (Sheet 5 of 6)

NAME	PART NUMBER	REV	32.0	33.0	34.0	35.0
LIM-OCU	870-1010-05	A	X	X	X	X
LIM-OCU	870-1486-02	A	X	X	X	X
LIM-OCU	870-1486-03	A	X	X	X	X
LIM-OCU	870-1486-04	A	X	X	X	X
LIM-V.35	870-1012-02	D	X	X	X	X
LIM-V.35	870-1012-03	A	X	X	X	X
LIM-V.35	870-1012-04	A	X	X	X	X
LIM-V.35	870-1487-01	A	X	X	X	X
LIM-V.35	870-1487-02	A	X	X	X	X
LIM-V.35	870-1487-03	A	X	X	X	X
MDAL	870-0773-04	B	X	X	X	X
MDAL	870-0773-05	A	X	X	X	X
MDAL	870-0773-06	A	X	X	X	X
MDAL	870-0773-09	A	X	X	X	X
MPL	870-2061-01	A	X	X	X	X
MPL	870-2061-03	A	X[21]	X[21]	X[21]	X[21]
MPL	870-2061-06	A	X[21,23]	X[21,23]	X[21,23]	X[21,23]
MPL-T	870-2061-02	C	X	X	X	X
TDM-10	870-0774-10	A	X[6,7,13]	X[6,7,13]	X[6,7,13]	X[6,7,13]
TDM-11	870-0774-11	A	X[13]	X[13]	X[13]	X[13]
TDM-15	870-0774-18	A	X[13]	X[13]	X[13]	X[13]
TSM-256	870-1289-02	A	X	X	X	X
TSM-256	870-1289-03	A	X	X	X	X
TSM-256	870-1289-06	A	X	X	X	X
TSM-512	870-1290-02	A	X	X	X	X
TSM-512	870-1290-03	A	X	X	X	X
TSM-512	870-1290-04	A	X	X	X	X
TSM-768	870-1291-02	A	X	X	X	X

Table A-2. Hardware Baseline EAGLE 5 ISS Release 32.0 through 35.0 (Sheet 6 of 6)

NAME	PART NUMBER	REV	32.0	33.0	34.0	35.0
TSM-768	870-1291-03	A	X	X	X	X
TSM-768	870-1291-04	A	X	X	X	X
TSM-1024	870-1292-02	A	X	X	X	X
TSM-1024	870-1292-03	A	X	X	X	X
TSM-1024	870-1292-04	A	X	X	X	X
Dual EOAP	890-1050-01	K	X	X	X	X
Dual GR376 EOAP	890-1050-02	G	X	X		
Single EOAP	890-1050-03	H	X	X	X	X
FAN ASSY	890-1038-01	D	X	X	X	X
FAN ASSY	890-0001-01	A		X[19]	X[19]	X[19]
FAN ASSY	890-0001-04	A		X[19]	X[19]	X[19]
KIT, E1	890-1037-06	A	X	X	X	X
KIT, HLDOVR CLK ASSY	890-1013-01	A	X	X	X	X
MPS in Heavy Duty Frame	890-1801-02	E	X	X	X	X
MPS DC Frame	890-1843-03	C			X	X
Tekelec 1000	870-2640-03	F	X	X	X	X
Tekelec 1100	870-2754-04	P			X[20]	X[20]
MPS Netra-to-Tekelec 1000 Field Upgrade Kit	870-2735-02	A	X	X	X	X
MPS RAM and CPU Upgrade Kit (two for each frame)	870-2669-02	A	X	X	X	X
MPSW O/RAIDS	890-1277-03	H				
MPSW O/RAIDS	890-1277-04	G				
MPSW O/RAIDS	890-1374-03	E				
MPSW O/RAIDS	890-1374-04	E				
MPSW / 1 GB RAM	890-1374-05	A				
MPSW / 2 GB RAM	890-1374-06	A				

NOTE 1: Control shelf P/N 870-0775-03 with backplane P/N 850-0330-04 can be used with minor modifications and addition of adapter cable P/N 830-1185-01.

NOTE 2: Control shelf P/N 870-2321-08 with backplane P/N 850-0330-06 can be used with HMUX cards in Tekelec standard frames.

NOTE 3: Control shelf P/N 870-2377-02 with backplane P/N 850-0330-06 can be used in Tekelec heavy-duty frames.

NOTE 4: Required for Tekelec standard frames. Rev. C required for HCMIM shelves.

NOTE 5: Required for Tekelec heavy-duty frames. Rev. J required for HCMIM shelves.

NOTE 6: Required for Master Timing Feature (T1 clocking).

NOTE 7: Required for HMUX cards.

NOTE 8: Uses HCAP (P/N 850-0419-xx) main assembly board

NOTE 9: Uses HCAP-T (P/N 850-0615-xx) main assembly boards

NOTE 10: Does not support E1 Master Timing

NOTE 11: Beginning with EAGLE 5 ISS Software Release 30.0 all MCAP cards must be replaced by GPSM-II cards (P/N 870-2360-01). GPSM-II cards are installed at the factory or by Tekelec Technical Support and are not installed by customers.

NOTE 12: Beginning with EAGLE 5 ISS Software Release 30.0 all IPMX cards must be replaced by High-Speed Multiplexer (HMUX) cards (P/N 870-1965-03). Beginning with EAGLE 5 ISS software release 33.0, all IPMX cards must be replaced by either HMUX cards or High-Speed IMT Router (HIPR) Cards (P/N 870-2574-02). A mixture of HMUX and HIPR cards within one IMT ring is possible, provided HIPR is installed on both IMT A and IMT B on a given shelf. HMUX and HIPR cards are installed at the factory or by Tekelec Technical Support and are not installed by customers.

NOTE 13: Beginning with EAGLE 5 ISS Software Release 30.0 Terminal Disk Module (TDM) cards must be P/N 870-0774-10 and later.

NOTE 14: NEBS will support HMUX with minor modifications and cable 830-1185-01. NEBS will support Master Timing with adapter 830-1183-01.

NOTE 15: 60 Amp FAP required for Tekelec Heavy-duty frames that contain shelves with HCMIM modules.

NOTE 16: 60 Amp FAP required for standard frames that contain shelves with HCMIM modules.

NOTE 17: Requires two HIPR modules for each shelf containing HCMIM, and requires fan tray 890-0001-04.

NOTE 18: Required in all empty slots in shelves that contain HCMIM modules.

NOTE 19: Required for shelves that contain HCMIM modules.

NOTE 20: Required for ELAP 4.0

NOTE 21: Has K6 II processor.

NOTE 22: Has COMM processor adapter.

NOTE 23: Has PQFP processor.

NOTE 24: Requires HIPR 870-2574-02.

NOTE 25: Has K6 III processor.

EAGLE 5 ISS Cable Assemblies and Adapters

Table A-3. E1 Cable Assemblies

Tekelec P/N	Description
830-1233-XX	E1 Dual TX/RX, XX ft., NTW
830-1256-XX	E1 Patch, D26M to D26M, 120 OHM, XX ft., NTW

Table A-4. T1 MIM LIM Cable Assemblies

Tekelec P/N	Description
830-0894-XX	T1 MIM Lim, XX ft., DB26M/unterminated, NTW
830-0895-01	T1 MIM Lim to MPL Cable Adapter, NTW
830-1198-01	T1 LIm to MPL Cable Adapter
830-1197-XX	T1 MIM Lim XX ft. Unterminated
830-1185-01	Adapter A Clk in HMUX
830-1183-01	DB-25M to DB-25F and DB-15F Y Clk / HS Timing

Table A-5. Terminal/Printer Cables and Adapters

Tekelec Cable P/N	Necessary Adapter
830-0394-XX	830-1153-02

Table A-6. Modem Cables and Adapters

Tekelec Cable P/N	Necessary Adapter
830-0394-XX	830-1153-03
830-1154-XX	830-1153-04

Table A-7. Tekelec 1000 Site Specific Cables

Tekelec P/N	Description
830-1201-XX	Optional DB9F/DB25M Serial w/Flow Control
830-1177-XX	DB26-RJ45 Site Specific Straight Through Cable
830-1178-XX	DB26-RJ45 Site Specific Crossover Cable
830-1204-XX	DB26-RJ45 Site Specific Straight Through Cable - Non Shielded
830-1205-XX	DB26-RJ45 Site Specific Crossover Cable - Non Shielded
830-1202-XX	DB9/DB25 M/M Site Specific Null Modem Serial Cable

Integrated Sentinel ESP Releases 8.0, 8.1, 8.1.x, 9.0, 10.0, 11.x

In addition to the following **Integrated Sentinel ESP Frame** release information, the baseline for an **Integrated Sentinel ESP** release also requires a specific minimum baseline EAGLE 5 ISS release.

Table A-8. ESP Frame Baseline and Required EAGLE 5 ISS Baseline.

ESP Frame Baseline	Minimum Required EAGLE 5 ISS Baseline
ESP 8.0	EAGLE 5 ISS 28.0
ESP 8.1	EAGLE 5 ISS 28.2
ESP 9.0	EAGLE 5 ISS 28.2
ESP ATM and EAGLE 5 ISS Time Stamping	EAGLE 5 ISS 28.1
ESP 10.0 and higher	EAGLE 5 ISS 28.2

The following notes apply to Tables A-9, A-10, A-11, A-12, and A-13.

NOTE 1: Two (2) per Base System.

NOTE 2: One (1) per NETRA T1.

NOTE 3: Two (2) per NETRA T1.

NOTE 4: One (1) per Breaker Panel.

NOTE 5: One (1) installed in Server, provides 8-port breakout box for alarms and console access.

NOTE 6: Contains four (4) CISCO 1000BASE Network Cards. The base system switches will require one (1) in each base switch and one (1) in each of the expansion switches.

NOTE 7: Expansion I2000 shelf (950-1003-02) maximum is three (3) per frame; one (1) in the Base System and configurable up to two (2) additional I2000 DC shelves.

NOTE 8: One (1) supplied with Base System; configurable up to three (3) additional servers for a maximum of four (4).

NOTE 9: Contains two (2) 24-port DC ENET Switch and two (2) 1000 base T network cards. Required when installing the 12th server in any frame.

NOTE 10: Frame assembly includes cables for maximum configuration and circuit breaker only. Maximum four (4) servers, one (1) switch, and one (1) console server ordered separately.

NOTE 11: Configuration is four (4) maximum, none supplied with base frame assembly.

Table A-9. Integrated Sentinel ESP Frame Releases 8.0, 8.1, 8.1.x, 9.0, 10.x, 11.x

Assembly	Sub-Assembly	Description	8.0	8.1	8.1.x	9.0	10.x	11.x
890-1516-01		**Sentinel Base System**	X					
	804-1578-01	24-Port DC ENET Switch, CISCO, NEBS	X[1]					
	804-1573-01	NETRA, T1 DC200, 256MB, 1 X 18 GB	X[1]					
	804-1575-01	NETRA, T1 CD ROM Drive	X[2]	X[2]	X[2]	X[2]	X[2]	X[2]
	804-1282-01	Drive Fixed Disk, Internal, SCSI, 18.2 GB	X[2]					
	804-1576-01	NETRA, T1 512MB KIT	X[3]					
	804-1426-01	PCI Serial ASYNC Interface Adapter Card	X[5]					
	804-1423-02	Breaker Panel	X[1]					
	804-1489-01	Breaker Panel Alarm Card	X[4]					
	804-1199-01	Router, 2 Ethernet Ports	X[1]					
	809-0065-01	Remote Access Server	X					
890-1516-02		**Sentinel Base System**		X				
	804-1578-01	24-Port DC ENET Switch, CISCO, NEBS		X[1]				
	804-1573-02	NETRA, T1 DC200, 256MB, 1 X 500MHz CPU		X[1]				
	804-1575-01	NETRA, T1 CD ROM Drive		X[2]	X[2]	X[2]	X[2]	X[2]
	804-1312-02	Drive Hard Disk, SCSI, 36.4 GB (QTY 2)		X[3]				
	804-1576-01	NETRA, T1 512MB KIT		X[3]				
	804-1576-02	Memory Module, 256MB, PC133 ECC DIMM		X[2]				
	804-1426-01	PCI Serial ASYNC Interface Adapter Card		X[5]				
	804-1423-02	Breaker Panel		X[1]				
	804-1489-01	Breaker Panel Alarm Card		X[4]				
	804-1199-01	Router, 2 Ethernet Ports		X[1]				
	809-0065-01	Remote Access Server		X				
890-1516-03		**Sentinel Base System, First Frame**			X	X		
	804-1578-01	24-Port DC ENET Switch, CISCO, NEBS			X[1]	X[1]		
	804-1573-03	Server, SUN, NETRA 120 1X650MHz 1X512MB 1X36GB			X	X		
	804-1575-01	NETRA, T1 CD ROM Drive			X[2]	X[2]	X[2]	X[2]

Table A-9. Integrated Sentinel ESP Frame Releases 8.0, 8.1, 8.1.x, 9.0, 10.x, 11.x (Continued)

Assembly	Sub-Assembly	Description	8.0	8.1	8.1.x	9.0	10.x	11.x
	804-1312-02	Drive Hard Disk, SCSI, 36.4 GB (QTY 2)			X	X		
	804-1576-01 or 804-1576-03	512MB (QTY 2) or 1024MB (QTY 1)			X	X		
	804-1426-01	PCI Serial ASYNC Interface Adapter Card			X[5]	X[5]		
	804-1423-02	Breaker Panel			X[1]	X[1]		
	804-1489-01	Breaker Panel Alarm Card			X[4]	X[4]		
	804-1199-01	Router, 2 Ethernet Ports			X[1]	X[1]		
	809-0065-01	Remote Access Server			X	X		
870-2739-01		**Router, Modem Assembly**			X	X		
	804-1836-01	Modem Card (809-0065-01 RAS is end-of-life. Replacement is this card installed in the blue router.)			X	X		
890-1516-06		**Sentinel Base System, First Frame**				X	X	X
	804-1578-01	24-Port DC ENET Switch, CISCO, NEBS				X[1]	X[1]	X[1]
	804-1573-03	Server, SUN, NETRA 120 1X650MHz 1X512MB 1X36GB				X	X	X
	804-1575-01	NETRA, T1 CD ROM Drive				X[2]	X[2]	X[2]
	804-1312-02	Drive Hard Disk, SCSI, 36.4 GB				X	X	X
	804-1576-01 or 804-1576-03	512MB (QTY 2) or 1024MB (QTY 1)				X	X	X
	804-1426-01	PCI Serial ASYNC Interface Adapter Card				X[5]		
	804-1423-02	Breaker Panel				X[1]	X[1]	X[1]
	804-1489-01	Breaker Panel Alarm Card				X[4]	X[4]	X[4]
	804-1199-01	Router, 2 Ethernet Ports				X[1]	X[1]	X[1]
	804-1836-01	Modem Card, 1-Port Analog CISCO Router				X	X	X
890-1832-01	**890-1832-02**	**Sentinel Base System, First Tekelec 1000 Frame**						X
	870-2758-03	24-Port DC ENET Switchmen						X
	870-2640-03	Server, Tekelec 1000 AS						X
	870-2706-01	Dual Port Ethernet PCI Interface (1 per Tekelec 1000)						X
	870-2721-05	250 GB Drive Hard Disk						X
	870-2733-02	2GB SDRAM (1 per Tekelec 1000)						X
	870-2708-02	PCI Serial Interface Adapter Card (1 per Tekelec 1000)						X

Table A-9. Integrated Sentinel ESP Frame Releases 8.0, 8.1, 8.1.x, 9.0, 10.x, 11.x (Continued)

Assembly	Sub-Assembly	Description	8.0	8.1	8.1.x	9.0	10.x	11.x
	870-2742-02	8 Port Console Server (1 per ESP Frame)						X
	804-1706-01	Mounting Kit (1 per ESP Frame)						X
890-1516-04		**Sentinel Base System, Second Frame**				X	X	X
	804-1578-01	24-Port DC ENET Switch, CISCO, NEBS				X[1]	X[1]	X[1]
	804-1579-01	1000BASET,Uplink, GB, CISCO Switch				X[1]	X[1]	X[1]
	804-1573-03	Server, SUN, NETRA 120 1X650MHz 1X512MB 1X36GB				X	X	X
	804-1575-01	NETRA, T1 CD ROM Drive				X[2]	X[2]	X[2]
	804-1312-02	Drive Hard Disk, SCSI, 36.4 GB				X	X	X
	804-1576-01 or 804-1576-03	512MB (QTY 2) or 1024MB (QTY 1)				X	X	X
	804-1426-01	PCI Serial ASYNC Interface Adapter Card				X[5]		
890-1516-05		**Sentinel Base System, Third Frame**				X	X	X
	804-1578-01	24-Port DC ENET Switch, CISCO, NEBS				X[1]	X[1]	X[1]
	804-1579-01	1000BASET,Uplink, GB, CISCO Switch				X[1]	X[1]	X[1]
	804-1573-03	Server, SUN, NETRA 120 1X650MHz 1X512MB 1X36GB				X	X	X
	804-1575-01	NETRA, T1 CD ROM Drive				X[2]	X[2]	X[2]
	804-1312-02	Drive Hard Disk, SCSI, 36.4 GB				X	X	X
	804-1576-01 or 804-1576-03	512MB (QTY 2) or 1024MB (QTY 1)				X	X	X
	804-1426-01	PCI Serial ASYNC Interface Adapter Card				X[5]		
	804-1423-02	Breaker Panel				X[1]	X[1]	X[1]
	804-1489-01	Breaker Panel Alarm Card				X[4]	X[4]	X[4]
860-0456-01		**Assembly Kit, Switch, Expansion**	X	X				
	804-1578-01	24-Port DC ENET Switch, CISCO, NEBS	X[1]	X[1]				
	804-1579-01	1000BASET,Uplink, GB, CISCO Switch	X[6]	X[6]				
870-2439-01		**Assembly Kit, NETRA, T1 DC200, Expansion**	X					
	804-1573-01	NETRA, T1 DC200, 256MB, 1 X 18 GB	X					
	804-1575-01	NETRA, T1 CD ROM Drive	X[2]					
	804-1282-01	Drive Fixed Disk, Internal, SCSI, 18.2 GB	X[2]					

Table A-9. Integrated Sentinel ESP Frame Releases 8.0, 8.1, 8.1.x, 9.0, 10.x, 11.x (Continued)

Assembly	Sub-Assembly	Description	8.0	8.1	8.1.x	9.0	10.x	11.x
	804-1576-01	NETRA, T1 512MB KIT (QTY 2)	X					
870-2439-03		**Assembly Kit, NETRA, T1 DC200, Expansion**		X				
	804-1573-02	NETRA, T1 DC200, 256MB, 1 X 500MHz CPU (QTY 2)		X				
	804-1575-01	NETRA, T1 CD ROM Drive		X				
	804-1312-02	Drive Hard Disk, USCSI, 36.4 GB (QTY 2)		X				
	804-1576-01	NETRA, T1 512MB KIT (QTY 2)		X				
	804-1576-02	Memory Module, 256MB, PC133 ECC DIMM		X				

Integrated Sentinel ESP Expansion Frame Releases 8.1.x, 9.0, 10.0

Table A-10. Integrated Sentinel ESP Expansion Frame Releases 8.1.x, 9.0, 10.0

Assembly	Sub-Assembly	Description	8.1.x	9.0	10.0
870-0117-01		**Kit, ESP Interframe Expansion, Sentinel**	X	X	X
	804-1578-01	24-Port DC ENET Switch, CISCO, NEBS	X[9]	X[9]	X[9]
	804-1579-01	1000BASET,Uplink, GB, CISCO Switch	X[6]	X[6]	X[6]
870-0118-01		**Kit, 2nd and 3rd ESP Interframe Expansion, Sentinel**	X	X	X
	804-1579-01	1000BASET,Uplink, GB, CISCO Switch		X[6]	X[6]
870-2655-05		**Server (NETRA 120), Expansion**	X	X	X
	804-1573-03	Server, SUN, NETRA 120 1X650MHz 1X512MB 1X36GB	X	X	X
	804-1312-02	Drive Hard Disk, USCSI, 36.4 GB	X	X	X
	804-1575-01	NETRA, T1 CD ROM Drive	X	X	X
	804-1576-01 or 804-1576-03	512MB (QTY 2) or 1024MB (QTY 1)	X	X	X

Sentinel Server Frame and Site Collector Frame Release 8.1.x, 9.0, 10.0

Table A-11. Sentinel Server Frame Releases 8.1.x, 9.0, 10.0, 11.x

Assembly	Sub-Assembly	Description	8.1.x	9.0	10.0	11.x
890-1774-01		**Final Server Frame Assembly**	X	X		
	804-1695-01	Base System, NETRA 20, DC Power	X[8]	X[8]		
	804-1312-02	Drive Hard Disk, SCSI, 36.4 GB (QTY 2)	X	X		
	804-1696-01	CPU 900 MHz (One per server, Alarm Server requires 2)	X	X		
	804-1697-01	2GB (4 x 512MB DIMM)	X	X		
	804-1601-02	Disk Drive, 73GB (QTY 2 per server)	X	X		
	804-1585-01	Single Ethernet Card (QTY 1 per server)	X	X		
	804-1426-01	PCI Serial ASYNC Interface Adapter Card	X[5]	X[5]		
	804-1423-06	Circuit breaker	X[1]	X[1]		
	804-1489-01	Breaker Panel Alarm Card	X[1]	X[1]		
890-1774-02		**Assembly, Final Server**		X[10]	X[10]	X[10]
	804-1423-06	Circuit breaker		X[1]	X[1]	X[1]
	804-1489-01	Breaker Panel Alarm Card		X[1]	X[1]	X[1]
870-2656-01		**Netra 20 Expansion Server**	X	X		
	804-1695-01	Base System, NETRA 20, DC Power	X[8]	X[8]		
	804-1696-01	CPU 900 MHz (One per server, Alarm Server requires 2)	X	X		
	804-1697-01	2GB (4 x 512MB DIMM)	X	X		
	804-1601-02	Disk Drive, 73GB (QTY 2 per server)	X	X		
	804-1585-01	Single Ethernet Card (QTY 1 per server)	X	X		
870-2656-02		**Netra 20 Server**		X		
	804-1695-05	Server, SUN, NETRA 20 2X1200MHz 4X512MB 2X73GB		X[11]	X[11]	X[11]
	804-1545-01	Drive 14X Max/10X Min DVD-ROM (Netra Server)		X	X	X
	804-1585-01	Single Ethernet Card (QTY 1 per server)		X	X	X
870-2640-03		**Tekelec 1000 Traffic Database Server**				X
804-1696-01		**CPU 900 MHz (One per server, Alarm Server requires 2)**	X	X		
870-2441-01		**24-Port ENET GarrettCom Switch (One required per frame, not supplied with base frame assembly)**		X	X	X
	804-1580-01	ENET Switch, 24-Port		X	X	X
870-2742-02		**Console Server, 8-Port (One required per frame assembly)**		X	X	X
	804-1808-03	Console Server, MRVLX 8 port with Modem DC power		X	X	X

Table A-12. Site Collector Frame Releases 8.1.x and 9.0.

Assembly	Sub-Assembly	Description	8.1.x	9.0
890-1772-01		**Assembly, Final Flight Recorder Frame**	X	X
	804-1312-02	Drive Hard Disk, USCSI, 36.4 GB	X	X
	804-1573-03	Server, SUN, NETRA 120 1X650MHz 1X512MB 1X36GB	X	X
	804-1575-01	NETRA, T1 CD ROM Drive	X	X
	804-1576-01	NETRA, T1 512MB KIT (QTY 2)	X	X
	804-1426-01	PCI Serial ASYNC Interface Adapter Card	X[5]	X[5]
	804-1198-01	10/100 Switching DC Hub with Bridge	X	X
	955-1003-02	I200 Snap Shelf DC power with power supply	X	X
	950-2150-01	Power Supply, 48V DC Snap		
	804-1423-05	Circuit breaker	X[1]	X[1]
	804-1489-01	Breaker Panel Alarm Card	X[1]	X[1]
870-2655-05		**Expansion, Flight Recorder**	X	X
	804-1573-03	Server, SUN, NETRA 120 1X650MHz 1X512MB 1X36GB	X	X
	804-1312-02	Drive Hard Disk, USCSI, 36.4 GB	X	X
	804-1575-01	NETRA, T1 CD ROM Drive	X	X
	804-1576-01	NETRA, T1 512MB KIT (QTY 2)	X	X
955-1003-02		**I2000 Snap Shelf DC power wish power supply**	X[7]	X[7]
	950-2150-01	Power Supply, 48V DC Snap	X[7]	X[7]

Table A-13. AC Servers Releases 8.1.x and 9.0

Assembly	Sub-Assembly	Description	8.1.x	9.0
870-2692-01		**Server, SUN, V120 1X650MHz 2X36GB Disks 1536MB MEM CDROM AC Power Cord**	X	X
	804-1172-02	Power cord, SUN North America to IEC 6.6FT	X	X
	804-1312-02	Drive Hard Disk, USCSI, 36.4 GB	X	X
	804-1575-01	NETRA, T1 CD ROM Drive	X	X
	804-1576-01	NETRA, T1 512MB KIT (QTY 2)	X	X
	804-1772-02	Server, SUN V120 1X650MHz 1X512MB 1X36GB	X	X

B

Sentinel 4-Port Monitor Appliques

Introduction

This appendix provides reference information on each 4-port monitor applique that Sentinel supports:

- 4-Port T1 Monitor Applique
- 4-Port E1 Monitor Applique
- 4-Port DS0 Monitor Applique
- 4-Port V.35 Monitor Applique
- 4-Port DSCS Monitor Applique

Hardware options on an applique can be set using shelf configuration software, as described in the section *Configuring a Sentinel Shelf* in Chapter 3, *Configuring and Administering Sentinel* of the *Sentinel 9.0 User's Manual* P/N 910-4377.

This chapter includes instructions for installing the DSCS Bridge Amplifier.

4-Port T1 Monitor Applique

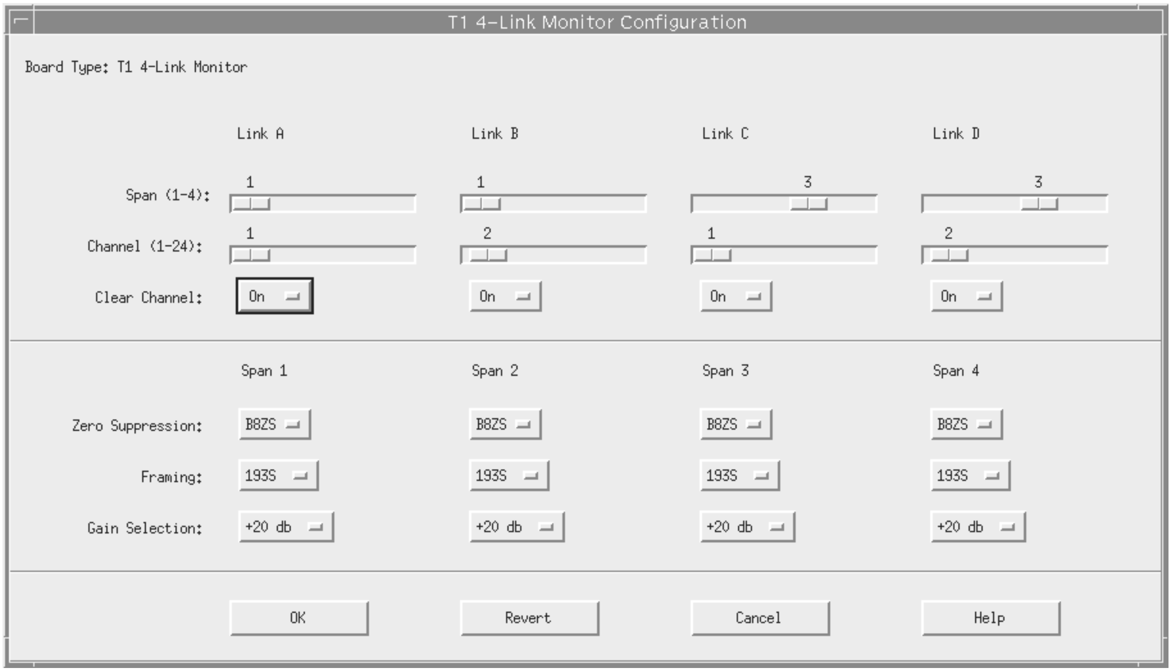
The 4-Port T1 Monitor applique (part number 850-0463-02) increases the monitoring link density offered by a single shelf from 16 links to 64 links per single 23" shelf (P/N 955-2002-01) or per Signaling Node Application Platform (SNAP). The applique allows monitoring of T1 spans in the following configurations:

- Four T1 spans each with a single signaling channel
- A single T1 span with a maximum of four signaling channels
- A single T1 span monitoring two signaling channels and two other T1 spans monitoring one signaling channel each
- A single T1 span monitoring three signaling channels and a single T1 span monitoring one signaling channel
- Two T1 spans monitoring two signaling channels each

NOTE: The monitored T1 span can be located up to a maximum of 500 ft. from the shelf.

Each monitoring port within the 4-Port T1 Monitor applique provides non-intrusive high impedance bidirectional monitoring for T1 (100 Ohm) links. All hardware options on the T1 Monitor applique can be set using shelf configuration software. See Figure B-1 for an example of the 4-Link T1 Monitor Configuration window.

Figure B-1. T1 4-Link Monitor Configuration Window



Use the two slider bars on the T1 4-Link Monitor Configuration Screen to map the physical T1 **span** and channel selection to the **link** A,B,C, or D.

Each T1 span has various configuration parameters that you may set with the toggle buttons shown in Figure B-1. They are described briefly in the following paragraphs.

Zero Suppression: AMI or B8ZS. B8ZS is Binary (or Bipolar) Eight Zero Suppression. A data transmission format used to solve certain bandwidth signaling problems. B8ZS coding enables interface equipment to recognize an *all zeroes* condition in a data byte. The equipment substitutes a B8ZS code for the all-zero byte; the code contains intentional violations of the AMI format. The violation is sent across the network. It contains sufficient *ones* to allow the system to remain in synchronization. The destination CSU replaces the code with the all-zeroes byte.

AMI is a formatting code for T1/E1 transmissions over twisted-pair copper cable. T1 transmissions are in bipolar form. AMI represents a zero (or space) by the absence of a voltage; a one (or mark) is represented by a positive or negative pulse, depending on whether the preceding one was negative or positive; that is, marks are inverted on an alternating basis.

Framing: Selects the framing option, 193S or 193E. With 193S framing, a superframe is made up of 12 frames. With a 193E framing, a superframe is made up of 24 frames.

Gain Selection: 0db or +20db. When set to 0db, the connection to the monitored T1 span is assumed to be made via a direct connection to the T1 span. When set to +20db, the connection to the monitored T1 span is assumed to be made using a patch panel with 20db of attenuation at the monitor position (for example, 470 Ω resistors in series with tip/ring).

NOTE: Spans originating from another LIC (for example, port B of LIC 1 daisy-chained into port A of LIC 2) are considered a direct connection; therefore, set the Gain Selection to 0db.

4-Port E1 Monitor Applique

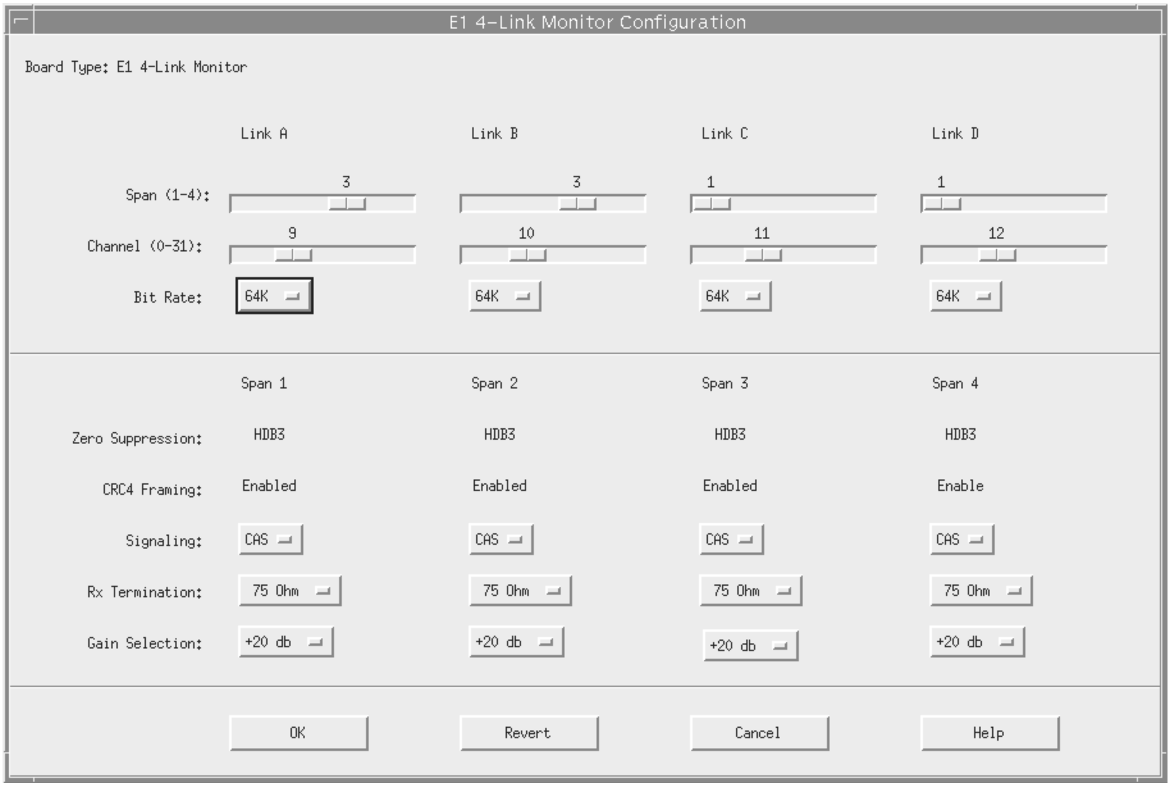
The 4-Port E1 Monitor appliques (part number 850-0463-01) increase the monitoring link density offered by a single shelf from 16 links to 64 links per single 23” shelf (P/N 955-2002-01) or per Signaling Node Application Platform (SNAP). The applique allows monitoring E1 spans in the following configurations:

- Four E1 spans each with a single signaling channel
- A single E1 span with a maximum of four signaling channels
- A single E1 span monitoring two signaling channels and two other E1 spans monitoring one signaling channel each
- A single E1 span monitoring three signaling channels and a single E1 span monitoring one signaling channel
- Two E1 spans monitoring two signaling channels each

NOTE: The monitored E1 span can be located up to a maximum of 500 ft. from the shelf.

Each monitoring port within the 4-Port E1 Monitor applique provides non-intrusive high impedance bidirectional monitoring for E1 (75 and 120 Ohm) links. All hardware options on the applique can be set using shelf configuration software. See Figure B-2 for an example of the 4-Link E1 Monitor Configuration window.

Figure B-2. E1 4-Link Monitor Configuration Window



Use the two slider bars on the E1 4-Link Monitor Configuration Screen to map the physical E1 **span** and channel selection to the **link** A,B,C, or D.

Each E1 span has various configuration parameters that may be set with the toggle buttons shown in Figure B-2.

Zero Suppression: HDB3 or AMI

CRC4 Framing: Enabled or Disabled

Signaling: CAS or CCS. Channel Associated Signaling (CAS) or Common Channel Signaling (CCS).

RX Termination: 120/75 Ohm. Selects the type of E1 span monitored.

Gain Selection: 0db or +20db. When set to 0db, the connection to the monitored E1 span is assumed to be made via a direct connection to the E1 span. When set to +20db, the connection to the monitored E1 span is assumed to be made using a patch panel with 20db of attenuation (for example, 470 Ω resistors in series with tip/ring).

> **NOTE: Spans originating from another LIC (for example, port B of LIC 1 daisy-chained into port A of LIC 2) are considered a direct connection; therefore, set the Gain Selection to 0db.**

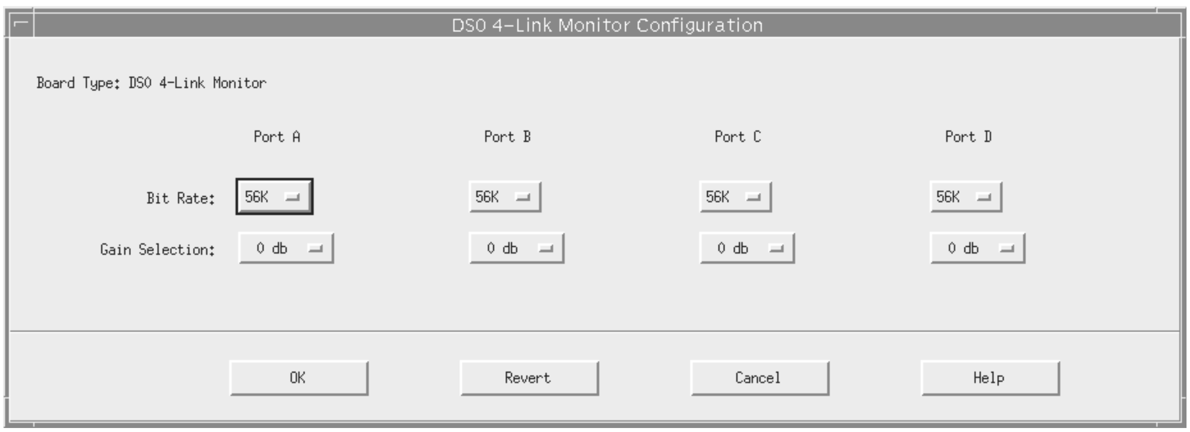
4-Port DS0 Monitor Applique

The 4-Port DS0 Monitor applique (part number 850-0481-01) increases the monitoring link density offered by a single shelf from 16 links to 64 links per single 23” shelf (P/N 955-2002-01) or per Signaling Node Application Platform (SNAP). The applique allows monitoring DS0 spans in the following configuration:

- Four DS0 spans each providing a single signaling channel

Each monitoring port within the 4-Port DS0 Monitor applique provides non-intrusive high impedance bidirectional monitoring for DS0 links. All hardware options on the applique can be set using shelf configuration software. See Figure B-3 for an example of the 4-Link DS0 Monitor Configuration window.

Figure B-3. DS0 4-Link Monitor Configuration Window



Each DS0 span has various configuration parameters that may be set with the toggle buttons shown in Figure B-3.

Bit Rate: 56K or 64K. This selection determines if the clock used to capture data from the DS0 signaling link is the 56Kbs or 64Kbs clock generated on the clock card.

Gain Selection: 0db or +20db. When set to 0db, the connection to the monitored DS0 span is assumed to be made using a direct connection to the span. When set to +20db, the connection to the monitored span is assumed to be made using a patch panel with 20db of attenuation (e.g. 470 Ω resistors in series with tip/ring).

> **NOTE: Spans originating from another LIC (for example, port B of LIC 1 daisy-chained into port A of LIC 2) are considered a direct connection; therefore, set the Gain Selection to 0db.**

4-Port V.35 Monitor Applique

The 4-Port V.35 Monitor applique enables the receive only monitoring of protocol messages on up to four bi-directional signaling links, without adversely affecting the signaling links. The system uses this applique to provide the electrical interface to the V.35 SS7 links. Each of the eight incoming V.35 data and clock lines are received using the line interface section of the applique.

The 4-Port V.35 Monitor applique (part number 850-0530-01) increases the monitoring link density offered by a single shelf from 16 links to 64 links per single 23” shelf (P/N 955-2002-01) or per Signaling Node Application Platform (SNAP). The applique allows monitoring V.35 spans in the following configuration:

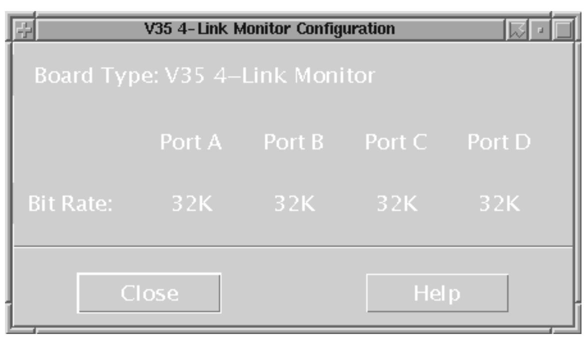
- Four V.35 spans each providing a single signaling channel
- Automatic support for bit rates from 64Kbs down to 2.4 Kbs

Each monitoring port within the 4-Port V.35 Monitor applique provides non-intrusive high impedance bidirectional monitoring for V.35 links. For the 4-Port V.35 Monitor applique, read the bit rate from the shelf as shown in Figure B-4.

NOTE: You cannot edit the information in the V.35 4-Link Monitor Configuration Window.

See Figure B-4 for an example of the 4-Link V.35 Monitor Configuration window.

Figure B-4. V.35 4-Link Monitor Configuration Window



4-Port DSCS Monitor Applique

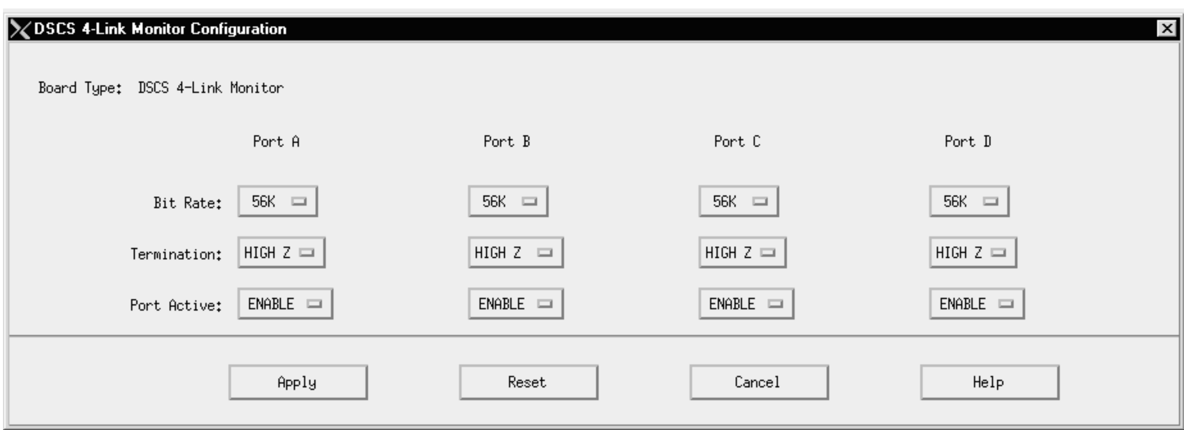
The 4-Port DSCS Monitor applique provides an electrical and physical interface for up to 4 DSCS links. DB25 connectors on the rear of the MGTS shelf provide the mechanical interface to the DSCS links. The 4-Port DSCS Monitor applique uses the "A" and "B" DB25 connector ports of the ALICE LIC as the interface to four duplex ports per DB25 connector. Each duplex port requires four signals on the DB25 connector.

4-Port DSCS Monitor applique configuration options include the following:

- The 4-Port DSCS Monitor applique supports up to four bidirectional channels operating at a maximum of 56 Kbits/sec with 0 - 100% message signal unit occupancy
- The Sentinel shelf must be within 35 feet of the monitored link

See Figure B-5 for an example of the 4-Link DSCS Monitor Configuration window.

Figure B-5. 4-Link DSCS Monitor Configuration Window



The cable connections for the DSCS Monitor applique are the same as for the T1, E1, and DS0 Monitor appliques. Please refer to Appendix A of the *Signaling/Cellular Generic Hardware Reference* manual for information on the cable connections.

The Digital Signal Customer Service (DSCS) interface supports the non-intrusive monitoring of switching events. This interface requires:

- One 4-port DSCS Monitor Applique for each four links monitored
- One 16-port DSCS Bridge Amplifier (described in the following section) for every four DSCS Monitor Appliques

DSCS Bridge Amplifier

The DSCS Bridge Amplifier is a hardware device used with a monitoring system to create a monitor bridge and amplify the link signals. A monitor bridge is necessary to isolate the monitored link from the monitoring system. The amplification is necessary to allow the Sentinel shelf to be in excess of the standard 35-foot limitation and up to 1500 feet from the DSCS Bridge Amplifier.

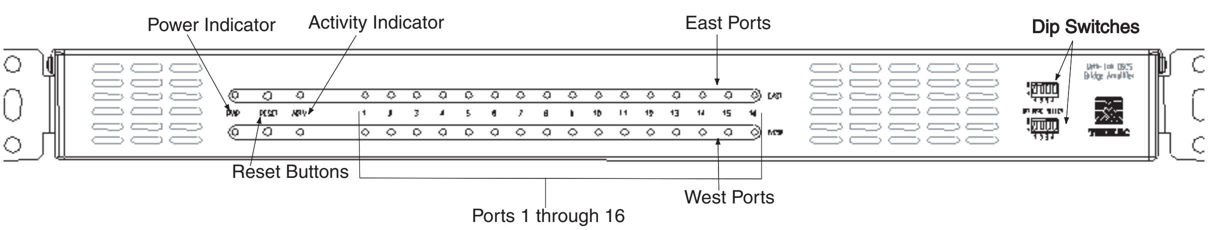
The DSCS Bridge Amplifier features are as follows:

- Can be installed into a standard 19-inch or 23-inch shelf
- Uses -48 VDC power
- 16 bidirectional ports are available for amplification

Hardware Description

The front of the DSCS Bridge Amplifier contains LEDs to provide information about the amplifier activity and a Reset push button. Figure B-6 shows a front view of the Bridge Amplifier. The PWR LED (power indicator) indicates power is on.

Figure B-6. DSCS Bridge Amplifier (Front View)



The DSCS Bridge Amplifier has 4-bit DIP switches located on the front of the unit (see Figure B-6). Use these 4-bit DIP switches to set the DSCS bit rate according to the following table.

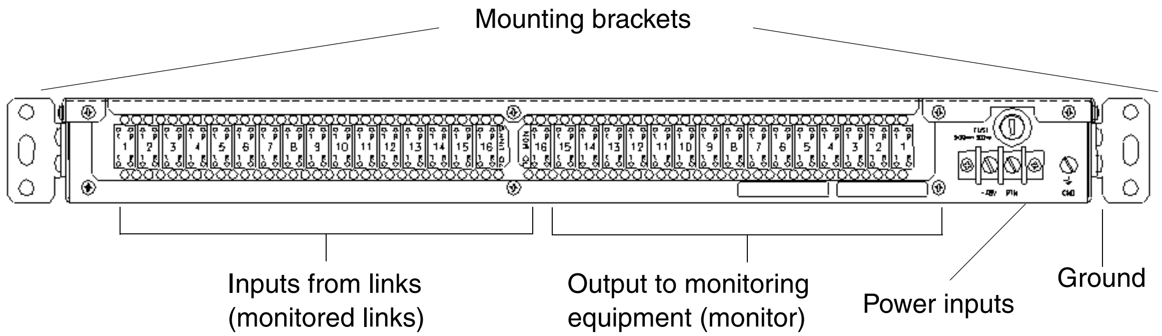
NOTE: Only the 64 Kbits/sec rate is available at this time.

Table B-14. DSCS DIP Switch Settings

Sw1	Sw2	Sw3	Sw4	Data Rate
Off	On	On	Off	64.0 Kbits/sec
NOTE: Switch up = OFF and Switch down = On.				

The rear of the DSCS Bridge Amplifier supports the power inputs and port accessibility shown in Figure B-7. A DC 2 terminal barrier strip, chassis ground screw, and a fuse are located on the right side of the back of the amplifier.

Figure B-7. DSCS Bridge Amplifier (Rear View)



The link inputs are on the left and they are labeled “To Links.” The monitor outputs to the monitoring equipment are on the right rear and they are labeled “To MON.” Each link incorporates a Transmit and Receive Tip and Ring pair. Because the terms transmit and receive depend on the perspective, and each pair is monitored the same way, the terms *East* and *West* are used to signify the direction.

East pairs are wire-wrapped to Tip (labeled “T”) and Ring (labeled “R”) pins on *top* of the rear of the amplifier. West pairs are wire-wrapped to the Tip and Ring pins on the *bottom*. See Figure B-7 for a rear view of the amplifier.

Figure B-7 also shows the mounting brackets used to mount the Bridge Amplifier in the 23-inch rack.

Installation

The DSCS Bridge Amplifier can be mounted in a standard 19-inch or 23-inch shelf. Mounting holes are located on each side of the amplifier. Use the following procedure to make all the connections and configure the amplifier for first use.

Procedure — Install DSCS Bridge Amplifier

1 Make sure the mounting brackets are properly attached to fit your rack configuration. The DSCS Bridge Amplifier accommodates either a 19- or 23-inch shelf

2 Use the mounting holes located on either side of the DSCS Bridge Amplifier to rack mount the amplifier.

3 Connect monitored links of the device(s) under test (DUT) to the appropriate wire-wrap pins on the rear panel of the amplifier. The inputs are on the left rear and are labeled “To Links.”

4 Connect the monitoring equipment inputs to the appropriate wire-wrap pins on the rear panel of the amplifier. The monitor outputs to the monitoring equipment are on the right rear and are labeled “To MON.”

5 Connect a safety ground wire to the ground (GND) screw on the rear panel.

6 Connect the DC power cable to the power inputs.

Part Number

Use the following part numbers to order:

Table B-15. DSCS Bridge Amplifier Part Numbers

Part Number	Description
977-2019-04	DSCS Bridge Amplifier

Limitations

The following limitations apply to the DSCS Bridge Amplifier installation:

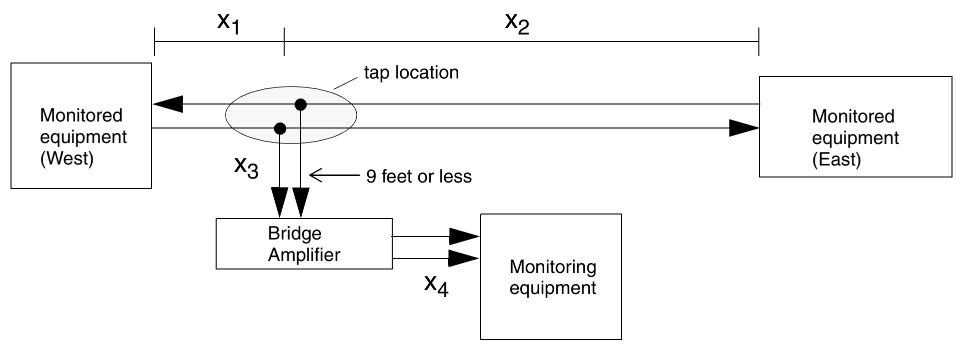
- The cable lengths connecting the Bridge Amplifier and the monitored and monitoring equipment must adhere to the following conditions. Also, see Figure B-8.

  — x_3 must be less than or equal to 9 feet . . . *AND*

  — $x_1 + x_4$ must be less than 2000 feet . . . *AND*

  — $x_2 + x_4$ must be less than 2000 feet

Figure B-8. DSCS Bridge Amplifier Installation



Legend:

x_1 - distance (ft.) between *West* monitored equipment and Bridge Amplifier *tap location*

x_2 - distance (ft.) between *East* monitored equipment and Bridge Amplifier *tap location*

x_3 - distance (ft.) from tap location to Bridge Amplifier

- When using the DSCS monitor amplifier with a 4 port DSCS applique, the applique must be set to 0db gain for correct operation.

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