Lucent Technologies
Bell Labs Innovations

WaveStar™ DACS 4/4/1 Digital Access and Cross-Connect System Release 2.1

Installation Assembly Manual

Notice

Every effort was made to ensure that the information in this document was complete and accurate at the time of printing. However, information is subject to change.

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The CE Mark affixed to this equipment means that it conforms to the European Union Electromagnetic Compatibility Directive (89/336/EEC).

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The ordering number for this document is **365-367-304**. For additional ordering information refer to the "*How to Order Documentation*" paragraph.

Customer Assistance and Technical Support

For technical support assistance regarding this document, refer to the *"Technical Support"* paragraph.

How Are We Doing?

Title: *WaveStar*™ **DACS 4/4/1, Installation Assembly Manual**

Identification No.: **365-367-404**   Issue No.: **1.0**   Date: **November 2000**

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LUCENT TECHNOLOGIES
Customer Technical Support Organization
WaveStar™ **DACS 4/14/1 Technical Support Manager**
1600 Osgood Street
North Andover, MA 01845-9985
USA

Contents

About This Document

Purpose

This Initial Installation Assembly Manual provides installation assembly instructions for the *WaveStar* TM DACS 4/4/1 System for initial system installations. This manual contains the following information:

- Brief System Overview

- Detailed product descriptions to the circuit pack level.

- Installation assembly instructions for preconditioning and mechanical assembly.

Since the *WaveStar* TM DACS 4/4/1 System has a phased release plan, this installation manual currently covers software Release 2.1, and will be updated to cover additional releases as they become available. For more information about the *WaveStar* TM DACS 4/4/1 System releases, refer to Document 365-367-400, *WaveStar* TM DACS 4/4/1 System *Applications and Planning Guide*.

Intended Audiences

This document is primarily for end users responsible for maintaining and installing the *WaveStar* ^{TM} DACS 4/4/1 System, including, but not limited to:

- Lucent Technologies Installation Personnel

- Lucent Technologies Field Support Engineers

- Customer Field Technicians

- Customer Office Engineers

Reason for Reissue

New software release.

How to Use This Document

The sections in this manual are marked with tabs, and provide the following information:

— **About This Document**

This section describes the purpose, intended audiences, reason for reissue, and organization of this document. This section also presents safety information, reference documentation, and explains how to make comments or recommendations for changes to this document.

— **Chapter 1, "General Description"**

This chapter describes the training, personnel and equipment required for the Initial Installation of the *WaveStar* ^{TM} DACS 4/4/1 System.

— **Chapter 2, "Pre-conditioning"**

This chapter describes the condition that the site should be in before and during the installation of the *WaveStar* ^{TM} DACS 4/4/1 System.

— **Chapter 3, "System Overview"**

This chapter briefly describes the *WaveStar* ^{TM} DACS 4/4/1 System and provides a brief discussion of the system features and applications.

— **Chapter 4, "Rack Assembly and Station Power"**

This chapter provides information and reference material that is necessary to mount all racks and provide power to all of the *WaveStar* ^{TM} DACS 4/4/1 System.

— **Chapter 5, "Core Complex Installation"**

This chapter provides the installation instructions for the physical installation of the Main Controller Rack and the Matrix and Synchronization Rack.

— **Chapter 6, "Port Complex Installation"**

This chapter provides the installation instructions for the physical installation of the STM-1, STM-0 and STM-4/16 Port Interface Sub-Racks.

— **Chapter 7, "System Cabling Installation"**

This chapter describes procedures for physically installing the Inter-Complex cabling within in the *WaveStar* ^TM DACS 4/4/1 System.

— **Chapter 8, "External Cabling Installation"**

This chapter describes the procedures for physically installing the cabling from other sources to the *WaveStar* ^TM DACS 4/4/1 System.

Safety Instructions

Admonishments

This document may contain admonishments in the form of **DANGERS**, **WARNINGS**, **CAUTIONS**, and **NOTES.** These admonishments, listed in order of priority, have the following definitions:

⚠ **DANGER:**
   *Indicates the presence of a hazard that **will** cause death or severe personal injury if the hazard is not avoided.*

⚠ **WARNING:**
   Indicates the presence of a hazard that ***can*** cause death or severe personal injury if the hazard is not avoided.

⚠ **CAUTION:**
   *Indicates the presence of a hazard that **will** or **can** cause minor personal injury or property damage if the hazard is not avoided. Caution is also used for property-damage-only accidents. This includes equipment damage, loss of software, or service interruption.*

✎ **NOTE:**
   Indicates extra information regarding the current topic.

Lightwave Safety

The *WaveStar* TM DACS 4/4/1 System and associated optical test sets use semi-conductor laser transmitters. The lasers emit lightwaves, at or near infrared wave-lengths, into lightguide cables. This light is at the red end of the visible spectrum. Direct exposure at close distances should be avoided.

> ⚠️ **WARNING:**
> *Never view any unterminated optical connector with optical instruments other than indirect image-converting devices such as the FIND-R-SCOPE, since viewing optics tends to collimate the energy from an optical connector and, hence, increases the potential risk for injury.*

Electrostatic Discharge (ESD) Considerations

To reduce the possibility of ESD damage, subracks are equipped with grounding jacks to enable personnel to ground themselves using wrist straps, while handling circuit packs or working on subracks. The jacks for connection of wrist straps are located on each subrack. These jacks are labeled. When grounding jacks are not provided, an alligator clip adapter enables connection to bay frame ground. The wrist straps should be checked periodically with a wrist strap tester to ensure that they are working properly.

> ⚠️ **CAUTION:**
> *Industry experience has shown that all integrated circuit packs can be damaged by static electricity that builds up on work surfaces and personnel. The static charges are produced by various charging effects of movement and contact with other objects. Dry air allows greater static charges to accumulate. Higher potentials are measured in areas with low relative humidity, but potentials high enough to cause damage can occur anywhere.*

Basic Safety Precautions

When performing procedures on telecommunication equipment, basic safety pre-cautions should always be followed to reduce the risk of fire, electric shock, and injury to persons, including the following:

- Read and understand all instructions.

- Follow all warnings and instructions marked on the product.

- Slots and openings in this product and the back or bottom are provided for ventilation. To protect it from overheating, these openings must not be blocked or covered.

- Never push objects of any kind into this product through slots as they may touch dangerous voltage points or short out parts that could result in a risk of fire or electrical shock.

- Never spill liquid of any kind on the product.

- Never install telecommunication wiring during a lightning storm.

- Never install telecommunication connections in wet locations unless the connection is specifically designed for wet locations.

- Never touch uninsulated telecommunication wires or terminals unless the telecommunications line has been disconnected at the network interface.

- Grounding/bonding circuit continuity is vital for safe operation of this equipment. Installation must include an independent frame ground conductor to building ground. Never operate with grounding/bonding conductor disconnected.

- For continued protection against risk of fire, replace fuses only with equivalent fuses of same type and rating.

- Use only circuit packs manufactured and recognized by Lucent Technologies Inc., in this system. Refer to "Product Description" chapter for list of recognized circuit packs.

- Installation and maintenance procedures must be followed and performed by trained personnel only.

- This product has two input power feeders. Disconnecting one power feeder will not de-energize the product. To reduce the risk of injury, disconnect two power supply cables when removing power from the rack.

Systems Supported

This document contains initial installation assembly instructions for installing the *WaveStar* TM DACS 4/4/1 System using Release 2.1.x Software.

Related Documentation/Training

Documentation

The following Lucent Technologies practices provide reference information about the *WaveStar*^{TM} DACS 4/4/1 System.

- Number: 365-367-400

  TItle: *WaveStar*^{TM} DACS 4/4/1 System *Application and Planning Guide*

  Audience: System planners, engineers, and sales teams.

- Number: 365-367-403

  TItle: *WaveStar*^{TM} DACS 4/4/1 System *Quick Reference Card*

  Audience: System operations, maintenance and support personnel.

- Number: 365-367-405

  TItle: *WaveStar*^{TM} DACS 4/4/1 System *Installation Testing Manual*

  Audience: System installers, maintenance and support personnel.

- Number: 365-367-406

  TItle: *WaveStar*^{TM} DACS 4/4/1 System *Technical Specification Manual*

  Audience: System operations, maintenance and support personnel.

- Number: 365-367-412

  TItle: *WaveStar*^{TM} DACS 4/4/1 System *Provisioning Guide*

  Audience: System operations, maintenance and support personnel.

- Number: 365-367-413

  TItle: *WaveStar*^{TM} DACS 4/4/1 System *Administration and Maintenance Guide*

  Audience: System operations, maintenance and support personnel.

Training Courses

The Lucent Technologies Corporate Education and Training Organization (CE&T) provides training for telecommunications technicians and installers in installation, operations, and maintenance. Suitcases of these courses is negotiable.

Contact the Corporate Education and Training Organization (CE&T) on **1-800-TRAINER (1-800-872-4637)** for information or to enroll in training classes.

Product Courses:

- Number: DG3204

  Title: *WaveStar* ™ DACS 4/4/1 System *Overview Course*

- Number: TR3562

  Title: *WaveStar* ™ DACS 4/4/1 System *Administration, Provisioning and Maintenance Course*

Related Courses:

- Number: TR5901

  Title: *Digital Multiplex System Introduction Course*

- Number: TR5951

  Title: *SDH Introduction Course*

- Number: OC3100

  Title: *Synchronous Digital Hierarchy (SDH) Course*

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Customer Information Center
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P.O. Box 19901
Indianapolis, Indiana 46219
U.S.A.

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Lucent Technologies, Inc.
Customer Technical Support Organization
WaveStar^{TM} DACS 4/4/1 Technical Support Manager
1600 Osgood Street
North Andover, MA 01845

General Description

1

Scope

Description

This Installation Assembly Manual (365-367-404) describes the necessary procedures to perform the hardware installation of the *WaveStar* ^{TM} DACS 4/4/1 System.

This manual provides a source of general information and required procedures necessary to fully install and cable the *WaveStar* ^{TM} DACS 4/4/1 System. The procedures outlined in this manual are to be followed for initial installation of the *WaveStar* ^{TM} DACS 4/4/1 System, and growth installation of port subracks to in-service systems. These installation procedures will only instruct the installation of the *WaveStar* ^{TM} DACS 4/4/1 System as a "stand alone" system, and not the installation of any equipment connecting to any of the external interfaces on the *WaveStar* ^{TM} DACS 4/4/1 System connector panels.

At the completion of all the installation procedures in this manual, all installer provided system hardware (i.e. subracks, units, cables, power, etc.) will have been fully installed.

⚠ **CAUTION:**
*Do **not** alter or change the procedures outlined in this manual, without prior contact with the Lucent-CTS Organization.*

Installation Requirements

Training

The following table defines the installation requirements that the installer must possess in order for this procedure to be implemented on the *WaveStar* TM DACS 4/4/1 System. If you have any questions regarding these requirements, contact your local Lucent Technologies Technical Support Representative.

Knowledge and Experience

It is recommended that the installer complete as many of the following conditions below:

- Successfully completes the *WaveStar* TM DACS 4/4/1 System Overview Course (DG3204)

- Successfully completes the *WaveStar* TM DACS 4/4/1 System Administration, Provisioning and Maintenance course (TR3562)

- Familiar with installation/testing of Lucent Technologies SDH Transmission Equipment

Installer Information

Number of Installers: At least two installers are required to complete the Initial Installation Assembly detailed in this installation manual.

Labor Code: Not applicable

Technical Support

Contacts

If any problems are encountered, or if any of the steps specified in this procedure cannot be completed as indicated, contact the next level of support.

Table 1-**1.**   **Technical Support Contacts**

Customer Location	Lucent Technologies Support Contact
Peoples Republic of China, - Northern Provinces	Lucent Technologies China, Beijing (86) 10 500-4455
Peoples Republic of China, - Southern Provinces	Lucent Technologies China, Guangzhou (86) 20 331-1600
Indonesia	Lucent Technologies Indonesia, Jawabarat (62) 21-898-0840
Japan	Lucent Technologies Japan, Tokyo (81) 3-5561-3000
Saudi Arabia	Lucent Technologies Riyadh, Saudi Arabia (966) 1241-1055
USA and Canada	Lucent Technologies-NS, Merrimack Valley (1) 800-225-4672
Europe, Middle East, and Africa (all countries not listed above)	Lucent Technologies-NSI, Hilversum, The Netherlands (31) 35-87-1555
Asia and Pacific Rim (all countries not listed above)	Lucent Technologies Singapore (65) 390-5450
Central America (all countries not listed above)	Lucent Technologies de Guatemala, Guatemala City (502) 233-4211
South America (all countries not listed above)	Lucent Technologies de Argentina (54) 149-7231

Risk Assessments

Implementation Risk Assessment

Rating

LOW   This procedure has a **LOW** Application risk rating, since there is **NO** potential for a service interruption to the end customer, if any procedural deviations or procedure specific equipment failures occur during the procedure. This procedure can be performed at any traffic period as determined by the Customer.

Service Risk Assessment

Rating

LOW   This procedure has a **LOW** Service risk rating, since there is NO potential service loss if this procedure is not implemented immediately. This procedure can be implemented at any time as desired by the Customer.

Out-Of-Service Time

The following chart provides system out-of-service time or reduced system control time estimates.

System Out-of-Service	none
Controller Out-of-Service	none

Required Items

Items Supplied By Lucent Technologies

Table 1-2.   Required Test Equipment

PART #	QTY	DESCRIPTION
ITE-7110 (108399593)	1	*WaveStar*^{TM} DACS 4/4/1 Test Accessory Kit[a]

a. The contents of kit ITE-7110 are found in Table 1-3.

All of the equipment in the above table is required for verification testing of the *WaveStar* ^{TM} DACS 4/4/1 System. The only equipment needed for the Initial Assembly is found in the Test Accessory Kit, ITE-7110.

All the Installation Test Equipment (ITE) items listed in above table can be acquired from the Lucent Technologies Installation Material Distribution and Repair Center (IMDARC).

<u>Address</u>:

> **Lucent Technologies - IMDARC**
> **1111 Woodsmill Road**
> **Town and Country, MO 63017**
> **Contact: Nancy Downey**
> **(314) 891-3024**

Table 1-3. **Contents of *WaveStar*^{TM} DACS 4/4/1 System Installation Test Accessory Kit (ITE-7110)**

Description	QTY	Installation Code No.	COMCODE
Kit Shipping Case	1	ITE-7110,D11	408060101
"Y" Lan null modem cable	1	ITE-6998	407444645
CIT Adapter (9 pin)	3	ITE-6999	407444652
Lan Hub null modem cable - 10 in.	6	ITE-7002	407444686
RJ45 Coupler	2	ITE-7015	407445386
25 ft. 10 Base T cable	3	ITE-7016	407445477
BNC Barrel Adapter (Female-Female)	2	ITE-7018	407445527
BNC Coax Cable (Male - Male) - 10 ft.	2	ITE-7019	407445535
Coax Loopback Cable - 15 inch (Push-on BNC/Push-on BNC)	17	ITE-8656	106727019
ESD Straps	2	ITE-7029	407446145
Gender Changer Kit (LCOM)	1	ITE-7098	407899210
SC-SC Loopback Adapter	17	ITE-7099	407903186
Fluke 87 Digital Multimeter	1	ITE-6379A	-
Cotton Tipped Swabs (50cnt)	1	R-5998	407903160
Utility Bags (x3)	1	R-5948	407446160
3/16 inch Hex Tipped Screwdriver	1	R-6020	408060119
10 mm Nut Driver	1	R-5954	407495555
Screwdriver Set	1	R-5955	407495639
Specification and Checklist	1	ITE-7110	-

Precautions

Precautions

- Read each step completely before performing the action specified, and perform the steps in the provided sequence.

- ESD wrist straps must be worn during the entire procedure, when touching the *WaveStar* TM DACS 4/4/1 System equipment or handling related system components.

- ESD straps must be tested before starting the procedure.

- All jewelry (rings, watches, etc.) must be removed before starting this procedure.

- Use caution when working near all power cables, shorting these cables could cause a loss of service or personal injury.

Pre-Conditioning

2

Description

This installation manual provides a source of general information, and required procedures to fully install a *WaveStar* ^{TM} DACS 4/4/1 System.

The procedures outlined in this installation manual are to be followed for initial installation of the *WaveStar* ^{TM} DACS 4/4/1 System or growth installation of port subracks to an in-service system.

This chapter will provide information on how the office (site) should be prepared before or upon arrival of the *WaveStar* ^{TM} DACS 4/4/1 System.

This information provided in this chapter is as follows:

- Site Review Checklists

- Cable Racking Requirements

- Power Cabling and Requirements

System Site Review Checklists

Description

A site survey should be completed at each site that a *WaveStar* ^{TM} DACS 4/4/1 System is to be installed. The survey should be completed as far ahead of the installation as possible, this will allow time to make any necessary changes or adjustments to either the system order or the site location.

The survey should be completed as thorough as possible. All applicable items should be completed on the forms. If an item is applicable and the information is not available at the time of the survey, the information should be obtained and entered into the survey as soon as possible.

When the survey is complete for each site location, the survey should be forwarded to the person(s) performing the installation. The survey sheets should also be forwarded to any other people and organizations that are involved in the ordering and installation of the system.

The site review is broken down in to six tables:

- Power Information, Table 2-1. (page 3)

- Cable Rack Information, Table 2-2. (page 4)

- Miscellaneous Information, Table 2-3. (page 5)

- Port Complex Information, Table 2-4. (page 6)

- Required testing conditions, Table 2-5. (page 7)

- Alarm and ITM-2000 Information, Table 2-6. (page 7)

Each table should be filled out as accurately as possible. Comments should be added as required, if there are any questions or concerns on an item, it should be stated very clearly in the comments column.

Table 2-**1.** **Site Survey Power Information**

WaveStar ™ DACS 4/4/1 System Site Survey Checklist Power Information		
Site Name:		
ITEM	Y / N/ NA	Comments
Is fuse (or circuit breaker) distribution bay already in the office assigned for connection to the WaveStar ™ DACS 4/4/1 System.		
Does fuse bay have separate feeds from the source (And B)		
Does fuse bay have enough room for 2 fuse (circuit breakers) positions for EACH rack.		
Can fuse bay handle assigned fuses.		
What is the output voltage of the fuse bay? This must be -48 VDC for the WaveStar ™ DACS 4/4/1 System.		
How far is fuse bay from the WaveStar ™ DACS 4/4/1 System. (Measure actual rack length distance)		
Are separate feeders to the rack from the fuse bay, or are gutter taps used from a central power cables?		
Who will provide power cable? (Lucent Technologies or Customer)?		
Will power cable be installed?		
Is AC power available?, if so what type? (volts/cycles)		

Table 2-2.   Site Survey Cable Rack Information

WaveStar TM DACS 4/4/1 System Site Survey Checklist Cable Rack Information		
Site Name:		
ITEM	Y / N/ NA	Comments
Are overhead cable racks in place? If not, what is proposed location and type of rack?		
Height of cable racks?		
Separate cable racks for: Power cables? Fiber cables? LAN cables?		
Are cable racks high enough to install system underneath? (200mm required clearance for convection cooling)		
How will system racks be secured to the cable racks?		
Who will supply attachment equip-ment? (i.e. angle iron, channel iron, threaded rod, etc.)		
If no cable rack, who will provide? (Lucent Technologies or customer)		
Is floor space sufficient for pro-posed system configuration?		

Table 2-3. **Site Survey Miscellaneous Information**

WaveStar ™ DACS 4/4/1 System Site Survey Checklist Miscellaneous Information		
Site Name:		
ITEM	Y / N/ NA	Comments
Can the racks and equipment be moved into the correct location from the receiving dock? Must the be uncrated first?		
Can elevators (lifts) be used? Enough room for racks?		
Are floors laid out and holes drilled for rack mounting?		
Who will provide floor bolts for mounting racks? (Lucent Technologies, local install-ers or customer)		
Concrete or raised floor?		
Need customer provided floor plan for WaveStar ™ DACS 4/4/1 Sys-tem, DDF/ODF, fuse bay and other associated equipment.		
Can test equipment and tools be stored safely near the system location?		
What hours will testers be allowed to work?		
Will WaveStar ™ DACS 4/4/1 System equipment be in the same room?		
Take accurate cable measure-ments between DDF/ODF and WaveStar ™ DACS 4/4/1 System.		
Will customer terminate the cable to the DDF/ODF?		

Table 2-4.   Site Survey Port Interface Information

WaveStar TM DACS 4/4/1 System Site Survey Checklist Port Interface Information		
Site Name:		
ITEM	Y / N/ NA	Comments
Is there enough DDF/ODF rack for the 2M tributary lines already installed in the office when connected to the _WaveStar_ TM DACS 4/4/1 System?		
How far is DDF/ODF rack from _WaveStar_ TM DACS 4/4/1 System?		
Estimate cable runs required, including cable rack, sub-rack and other distances.		
Will STM-1 subracks be one fiber or two fiber configuration?		
Will STM-1 subracks be electrical, optical or both?		
Will subracks be cabled to DDF, other equipment directly or both?		
Is 2MB timing source available? From where?		

Table 2-5.   Site Survey Testing Conditions

WaveStar TM DACS 4/4/1 System Site Survey Checklist Required Testing Conditions		
Site Name:		
ITEM	Y / N/ NA	Comments
Enough room to set up test equipment? (i.e. computers, test sets, printers, etc.)		
Tables and chairs in front of the system?		
Power outlets and/or strips close to system location? Type of outlets? Voltage / Cycles?		
Phone lines with USA Direct access at system?		
Is local store available for: Tools, computer supplies,etc.		

Table 2-6.   Site Survey Alarm and ITM Information

WaveStar TM DACS 4/4/1 System Site Survey Checklist Alarm and ITM Information		
Site Name:		
ITEM	Y / N/ NA	Comments
What type of alarms to be connected? Suite, station or both? If suite alarms, where are they located with respect to the system?		
Will ITM be connected? If so, in same building? If different location, how far away?		

Cable Racking Requirements

Description

The cable racking and fiber protection system should be carefully thought out and planned during the preconditioning stages of installation.

A fiber protection system should be used to run the fiber cables, this is also used to store any additional fiber cable. A fiber protection is typically a plastic (PVC) channel tray with a cover that attaches to a standard cable rack system.

The exposed fibers from the protection system to the *WaveStar*^{TM} DACS 4/4/1 System should also be protected with a coiled fiber sleeve.

Figure 2-1. (page 8) provides an example of how cable racks should be used to divide the system cabling from the power cables. This figure applies to both overhead and under floor cabled systems. These racks can be side by side as depicted or they can be in a vertical configuration. A variety of cable racks widths could also be used, depending on the space available and the amount of cable. In any of the possible methods, however, some type of fiber protection system should always be used.
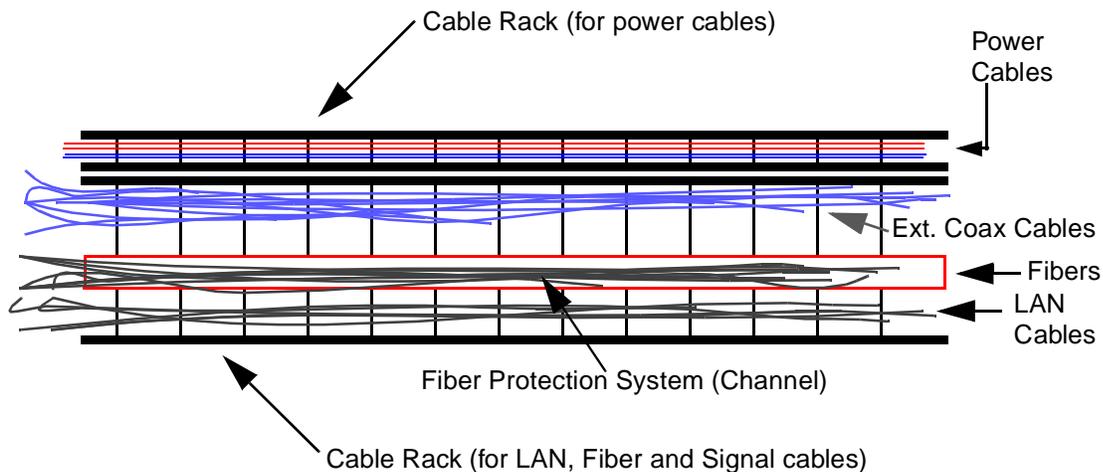
Figure 2-1.   Cabling and Fiber Routing Method

System Power Cable Requirements

Office Power Configurations

There are various methods of cabling power to the *WaveStar* ^{TM} DACS 4/4/1 System from the office battery.

Figure 2-2. (page 9) shows the optimum configuration with two office battery sources (independent of each other) that supply a Battery Distribution Frame Bay (BDFB). The BDFB supplies the *WaveStar* ^{TM} DACS 4/4/1 System rack with power. This is a complete redundant power configuration.

In the MC and MS Subracks, there are two racktop assemblies in each rack, one in the front and one in the rear of the rack. In these cases, these racks will require two "A" feeds, and two "B" feeds.
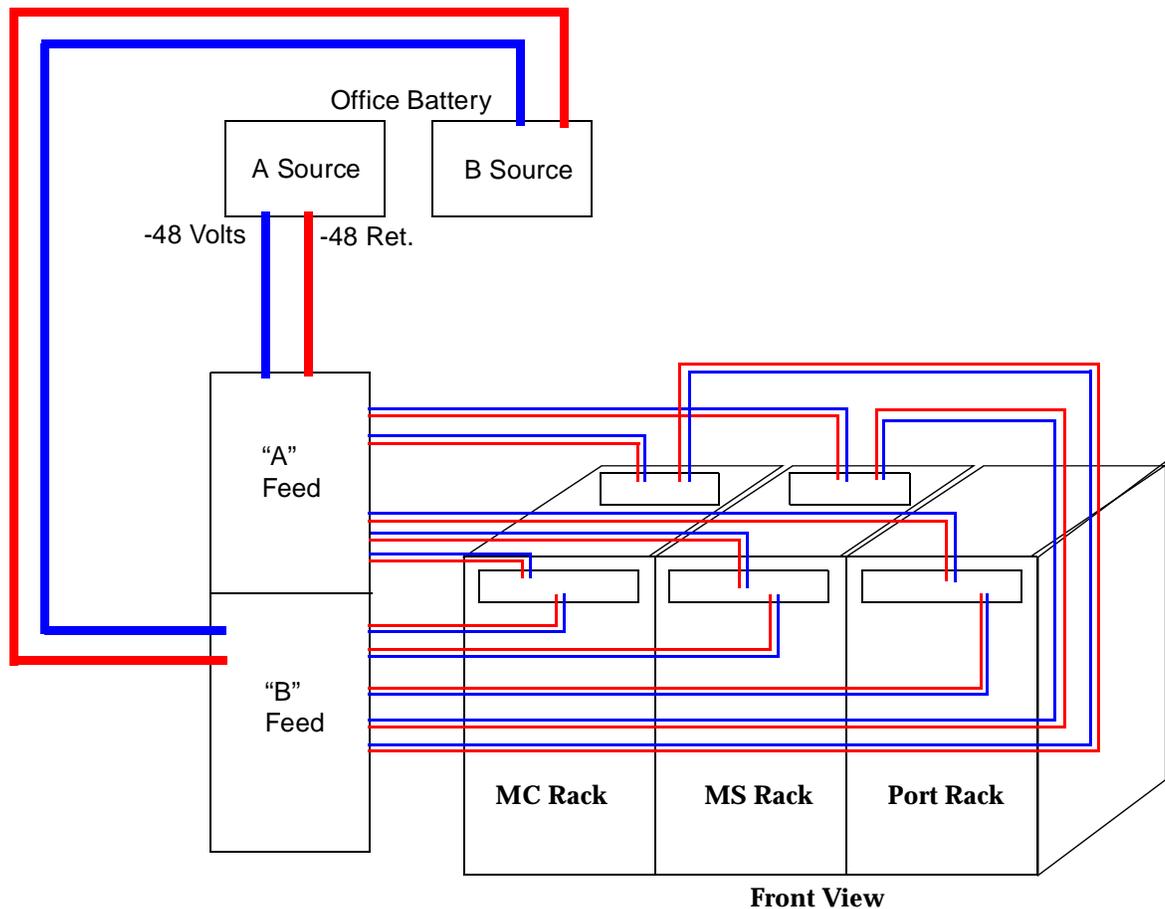
Figure 2-2.   Recommended System Power Configuration

In some offices, two office battery supplies are not available. Figure 2-3. (page 10) shows the suggested configuration when only one office battery is available. This configuration shows the office battery suppling both the A and B feeds on the BDFB.

Office Battery

A Source

-48 Volts   -48 Ret.

"A" Feed

"B" Feed

MC Rack   MS Rack   Port Rack

Front View
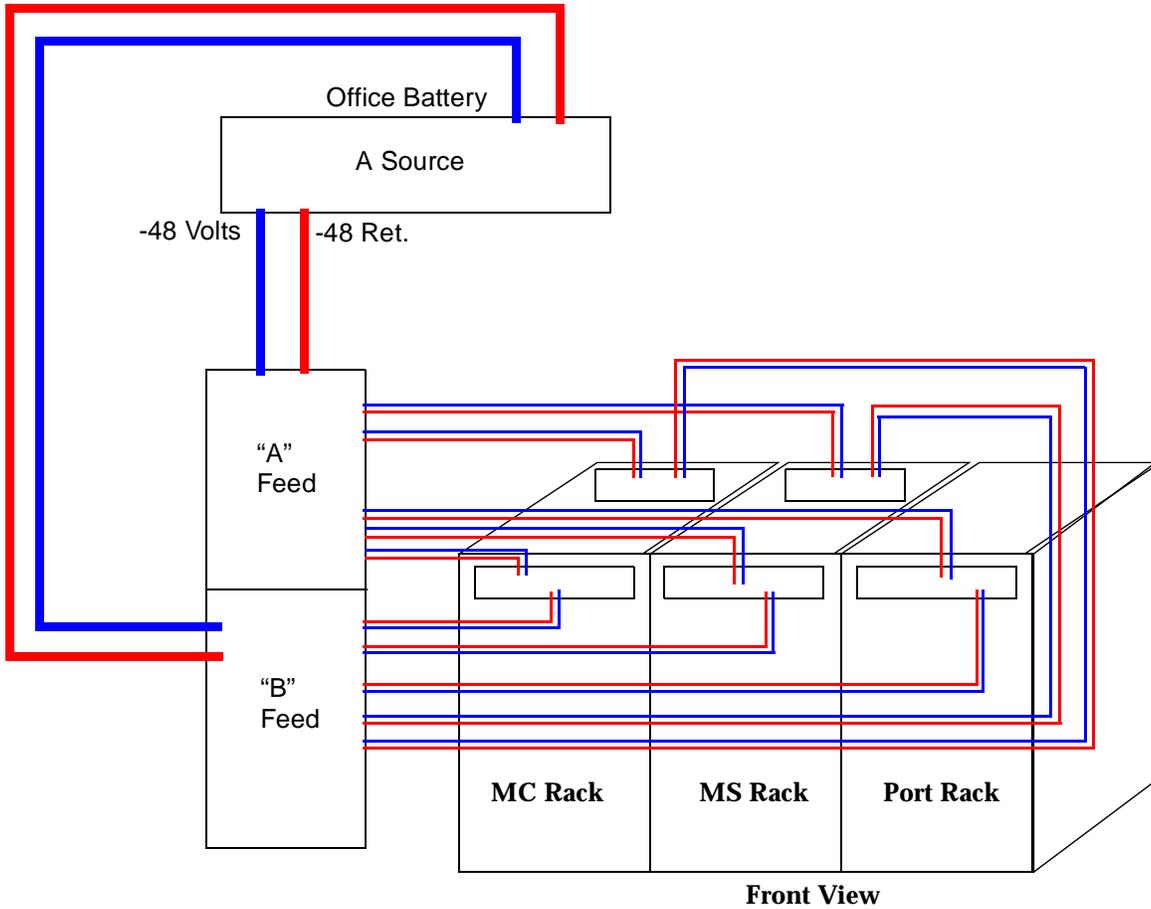
Figure 2-3.   Alternate System Power Configuration

System Overview

3

Purpose

This chapter provides a high-level description of the *WaveStar* TM DACS 4/4/1 System including descriptions of its characteristics, capabilities and possible configurations.

Functional Description

The *WaveStar*TM DACS 4/4/1 System is a large capacity SDH cross-connect system. It can operate in broadband and wideband (4/4/3/1) mode. Figure 3-1. (page 2) shows a block diagram of the *WaveStar*TM DACS 4/4/1 System.

*WaveStar*TM DACS 4/4/1 System has a fully nonblocking N^2 cross-connect matrix. The matrix is compatible with both American National Standards Institute (ANSI) and International Telecommunications Union (ITU) transmission standards and is capable of cross connecting all tributaries defined by them.

The cross-connect matrix and all internal transmission paths are fully protected by a 2:8 protection architecture. This architecture provides triple protection, resulting in very high availability. High availability is important, because a large cross-connect system is capable of carrying very large amounts of traffic.

The matrix and internal transmission paths consist of ten sets of components; eight working sets and two protection sets. Even if there is a problem with two of the working sets of components, traffic will be switched glitchlessly to the protection components.
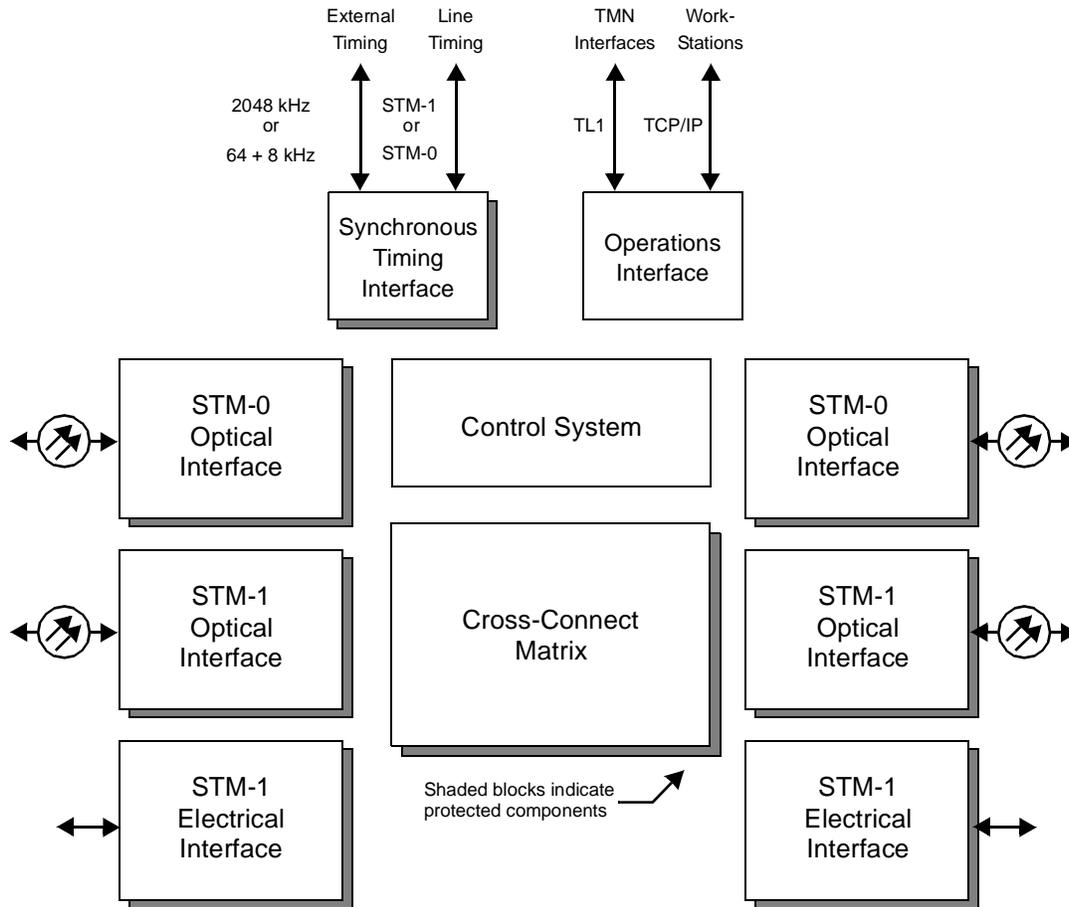
Figure 3-1. *WaveStar*^{TM} **DACS 4/4/1 System Diagram**

Control System

WaveStar^{TM} DACS 4/4/1 System coordination and control is carried out on three levels:

- *Main controller*: provides local and remote interfaces for operations, administration, maintenance, and provisioning. The main controller accepts commands from this interface and translates them into equipment level instructions that are sent to the subrack controllers (see Figure 3-2).

- *Subrack controllers*: perform control processing for most types of subracks. Functions performed by subrack controllers include subrack provisioning and maintenance operations including port performance monitoring and protection switching.

- *Board controllers*: perform control processing for most types of units (circuit packs). Functions performed by board controllers include executing commands received from subrack controllers and relaying maintenance or performance data to subracks controllers.
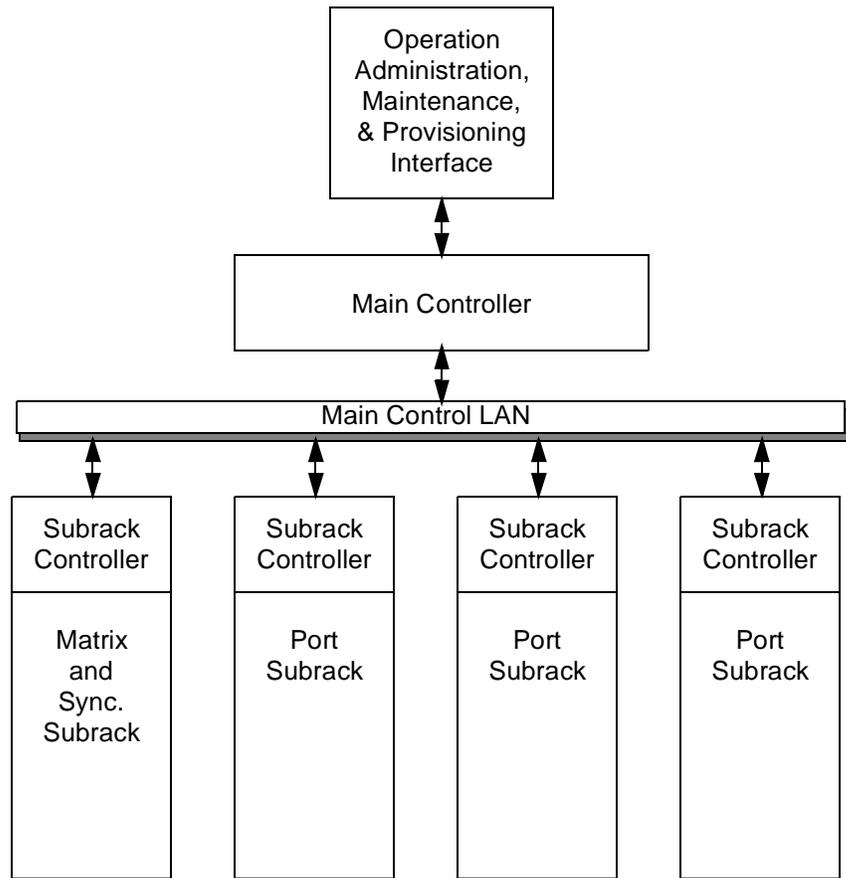
Figure 3-2. *WaveStar*^TM **DACS 4/4/1 System Control Structure**

Software

The software that is required for the *WaveStar*^TM DACS 4/4/1 System is Release 2.1.x, called Core software, is available in broadband and wideband (4/4/3/1).

Future software releases can be downloaded from the Main Controller without interrupting service or management.

Network Management

The *WaveStar*^{TM} DACS 4/4/1 System software is designed to evolve with the Telecommunications Management Network (TMN) standards and is fully compatible with the Integrated Transport Management Network Model (ITM-NM).

Interface Ports

This release of the *WaveStar*^{TM} DACS 4/4/1 System provides the following SDH network interfaces:

- STM-1 electrical
- STM-1 optical designed to ITU specifications
- STM-1 optical designed to Nippon Telegraph and Telephone (NTT) specifications
- STM-0 optical designed to NTT specifications
- STM-4 optical
- STM-16 optical

Optional 1:8 equipment protection is available for STM-1 electrical interfaces. Optional 1+1 Multiplex Section Protection (MSP) switching is available for STM-0 and STM-1 interfaces.

System Timing Unit

The *WaveStar*^{TM} DACS 4/4/1 System has a fully duplicated System Timing Unit (STU) that supplies SDH network synchronization and distribution of system clock signals to transmission hardware within the system. The STU also provides timing reference outputs.

The system timing unit has two functional areas:

- System timing: An ITU G.812 local clock with holdover
- Synchronization: Reference source selection circuitry provides system timing from internal or external sources.

Users can provision as many as four prioritized timing references. Timing can be derived from the following inputs:

- External 2048 kHz sources
- External 64 + 8 kHz sources
- STM-0 and STM-1 ports or MSP pairs

OAM&P Interface

Operations, administration, maintenance, and provisioning (OAM&P) activities can be performed locally from a craft interface terminal (CIT), from a remote V.28 dial-up connection, or from a centralized network manager such as Lucent Technologies' ITM-NM. All OAM&P connections use the TCP/IP protocol.

System Hardware Configurations

Description

The *WaveStar*^{TM} DACS 4/4/1 System is a modular system. It can be configured modularly by adding Port Interface Subracks as additional port interface facilities are desired in the transmission station. This section will describe some of the various configurations and also the more common types of system configurations.

This system can be built to have a 256 STM-1 capacity or a 512 STM-1 capacity.

System Rack Configurations

Minimum Rack Configuration

The system floorplan for a typical system configuration of the *WaveStar*^{TM} DACS 4/4/1 System is shown in Figure 3-3. (page 5). This consists of a Matrix and Control rack, a Matrix and Synchronization rack and one Port rack, equipped with at least one port subrack.

Aisle

Aisle

(top view)
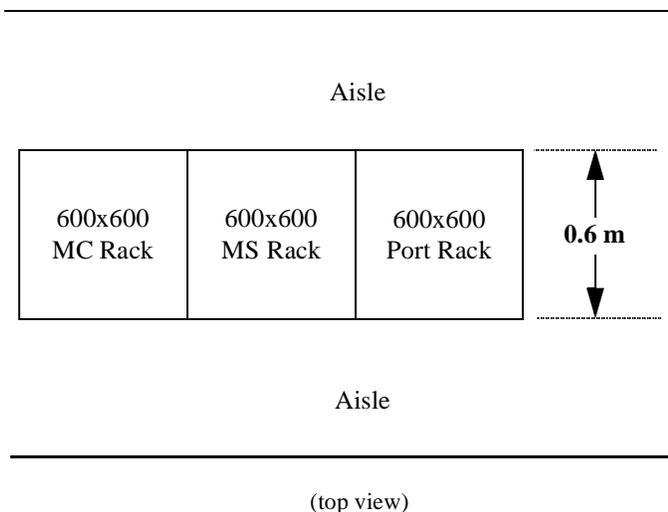
Figure 3-3.   Minimum System Configuration Floorplan

System Hardware Floorplan Configurations

There are many possible different system floorplan configurations for the *Wave-Star*^{TM} DACS 4/4/1 System, various contiguous system configuration and one for a non-contiguous system configuration. The non-contiguous system floorplan consists of Port racks remotely positioned from the Controller and Sync. racks.

Non Contiguous Configuration

Remoting of the port subracks is allowed at a maximum distance 50 meters. A simplified view is shown in Figure 3-4. (page 6).
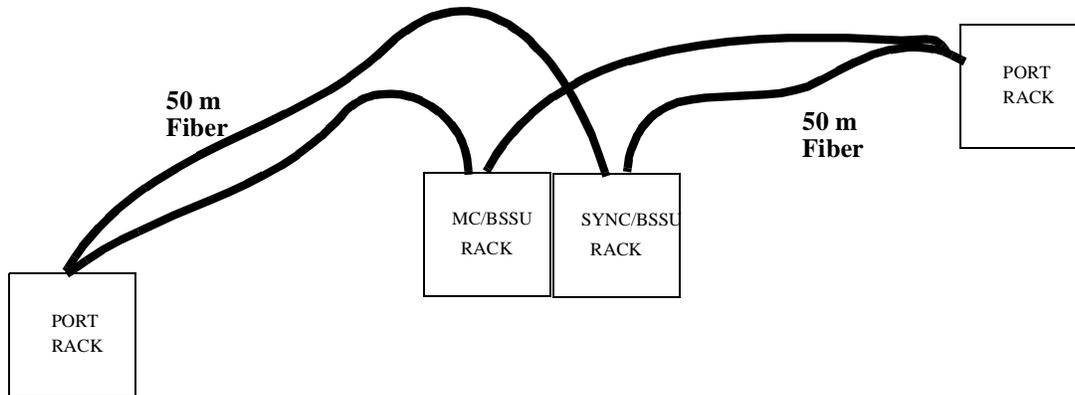
Figure 3-4.   **Remoting of Port Racks**

Typical System Line-up

For reference purposes, Figure 3-5. (page 7) is an illustration of a typical system, shown with the full height double doors. The doors enclose and protect the equipment, while the perforations in the doors allow for heat removal from the system.
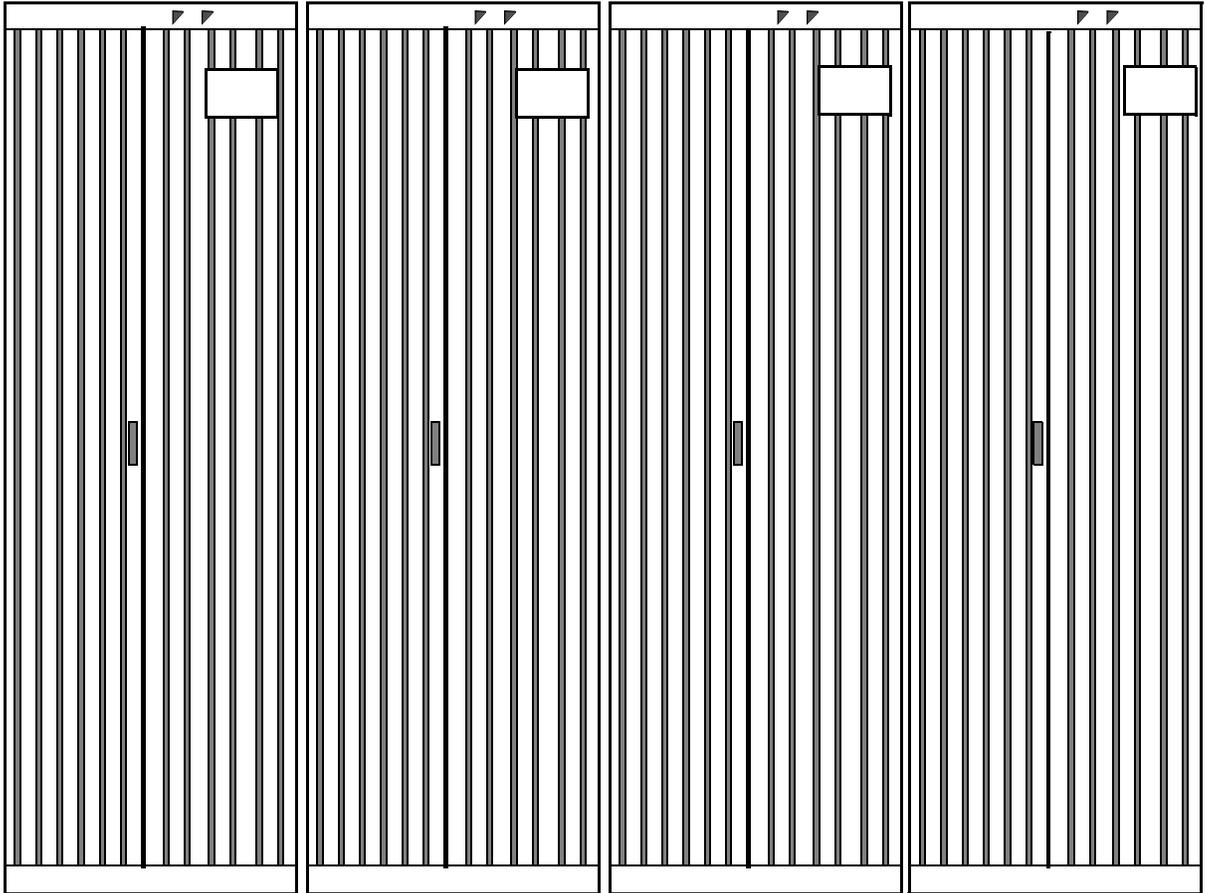
Figure 3-5.   Typical 256 STM-1 Rack Lineup

Aisle Requirement

The expected aisle width for the *WaveStar*^{TM} DACS 4/4/1 System is 750 mm. This is detailed in the ETSI Equipment Practices for Station Telephone Equipment. In addition to this, it is required that any door on the system does not protrude into the aisle more than 150 mm when it is opened for maintenance operations Figure 3-6. (page 8). The doors in the *WaveStar*^{TM} DACS 4/4/1 System swing open 90°. The maximum swing radius of a door in the system is 300 mm.

Aisle

750 mm Typ

Rack (Top View)

Back

Front

300 mm Radius

300 mm Radius
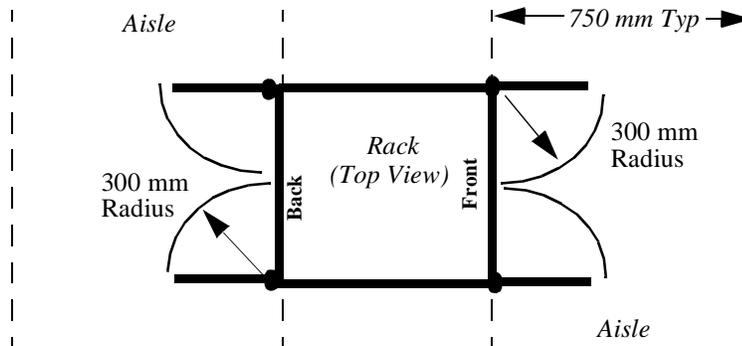
Aisle

Figure 3-6.   Rack Door and Aisle Requirements.

Overhead Requirement

The *WaveStar*^{TM} DACS 4/4/1 System is convection cooled. It is very important that the system configuration in the station allows for the exit of air through the top of the rack. There must be a minimum clearance of 200 mm between the top of the rack and the bottom of any overhead cable tray or ceiling. Also, if the system cabling is routed overhead, the cables must be routed from the racks straight up through the cable outlets at the top of the racks and into the overhead cable trays. Any interference with the exit air from the racks may cause heat induced equipment problems. This requirement is illustrated in Figure 3-7. (page 8).

Cable Tray

200 mm min.

Lucent
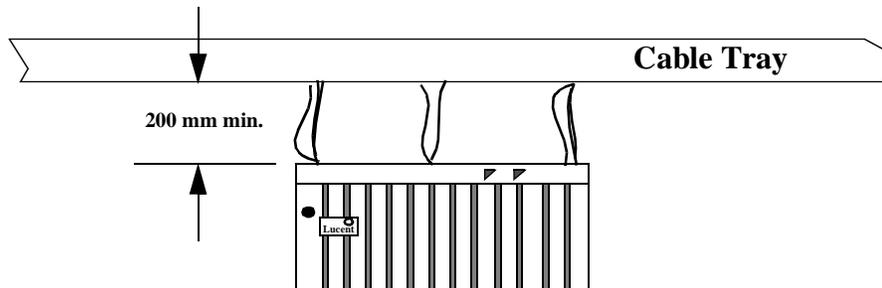
Figure 3-7.   Rack Overhead Requirements.

System Complex Power Dissipations

The power dissipation for the *WaveStar*^{TM} DACS 4/4/1 System has been broken down into three tables. Each table indicates the typical and maximum power dissipations for each particular configuration listed.

Table 3-1. (page 10) shows a breakdown of the power drain at each of the power and alarm panels located at the front and rear locations at the top of each racks in the MS and MC racks, and in the front location at the top of each port rack in the *WaveStar*^{TM} DACS 4/4/1 System. There is only one Power and Alarm Panel in each Port Interface Rack.

Table 3-2. (page 11) shows the breakdown of the *WaveStar*^{TM} DACS 4/4/1 System rack power dissipations at the subrack and rack level.

Table 3-3. (page 12) shows the breakdown of the power dissipation of each of the units at the individual unit and subrack level.

Table 3-1. Power Distribution Panel Power Dissipation Breakdowns

Power and Alarm Panel Location	Typical Power/Current (@-48V)	Calculated Max. Power/Current (@-48V)
Matrix & Sync Rack *Rear* Power Distribution Panel		
2 SYNC Subracks	148 W / 3.1 A	189 W / 3.9 A
1 BSSU Unit	100 W / 2.1 A	130 W / 2.7 A
Total	**248 W / 5.2 A**	**319 W / 6.6 A**
Matrix & Sync Rack *Front* Power Distribution Panel		
4 BSSU Units	400 W / 8.4 A	520 W / 10.8 A
Total	**400 W / 8.4 A**	**520 W / 10.8 A**
Matrix & Control Rack *Rear* Power Distribution Panel		
3 BSSU Units	300 W / 6.3 A	390 W / 8.1 A
Total	**300 W / 6.3 A**	**390 W / 8.1 A**
Matrix & Control Rack *Front* Power Distribution Panel		
1 MC Subrack	130 W / 2.7 A	160 W / 3.3 A
2 BSSU Units	200 W / 4.2 A	260 W / 5.4 A
Total	**330 W / 6.9 A**	**420 W / 8.7 A**
STM-1 Port Rack (E/W 1 Subrack) Power Distribution Panel		
1 STM-1 subrack	532 W / 11.12 A	925 W / 19.1 A
Total	**532 W / 11.12 A**	**925 W / 19.1 A**
STM-1 Port Rack (E/W 2 Subracks) Power Distribution Panel		
2 STM-1 subracks	1065 W / 22.2 A	1850 W / 38.2 A
Total	**1065 W / 22.2 A**	**1850 W / 38.2 A**
STM-0 Port Rack (E/W 1 Subrack) Power Distribution Panel		
1 STM-0 subracks	625 W / 13.2 A	828 W / 17.4 A
Total	**625 W / 13.2 A**	**828 W / 17.4 A**

Table 3-2. *WaveStar*^{TM} DACS 4/4/1 Rack Power Dissipation

Entity	Power / Current (@-48V)		Entities / Rack	Max. Total Power / Current (@-48V) / Rack	
	Typical	Maximum		Typical	Maximum
Matrix and Synchronization Rack					
SYNC Subrack	73.8 W / 1.54 A	94.6 W / 1.98 A	2	147.6 W / 3.1 A	189.2 W / 3.96 A
LAC4 (BSSU)	100 W / 2.08 A	130 W / 2.71 A	5	500 W / 10.4 A	650 W / 13.55 A
			Total	**647.6 W / 13.5 A**	**839.2 W / 17.5 A**
Matrix and Control Rack					
Main Controller Subrack	130 W / 2.7 A	160 W / 3.3 A	1	130 W / 2.7 A	160 W / 3.3 A
5 LAC4 (BSSU)	100 W / 2.08 A	130 W / 2.71 A	5	500 W / 10.4 A	650 W / 13.55 A
			Total	**630 W / 13.1 A**	**810 W / 16.9 A**
STM1 Port Rack (E/W 1 Subrack)					
STM1 Subrack	532.4 W / 11.12 A		1	532.4 W / 11.12 A	925 W / 19.1 A
			Total	**532 W / 11.1 A**	**925 W / 19.1 A**
STM1 Port Rack (E/W 2 Subracks)					
STM1 Subrack	532.4 W / 11.12 A		2	1064.8 W / 22.24 A	1850 W / 38.2 A
			Total	**1065 W / 22.2 A**	**1850 W / 38.2 A**
STM0 Port Rack (E/W 1 Subrack)					
STM0 Subrack	625.2 W / 13.18 A		1	625.2 W / 13.18 A	827.6 W / 17.37 A
			Total	**625 W / 13.2 A**	**828 W / 17.4 A**

Table 3-3.   WaveStar DACS 4/4/1 Subrack Power Dissipation

Unit	Power / Current (@-48V)		Max.Units per Subrack	Max. Total Power / Current (@-48V) / Subrack	
	Typical	Maximum		Typical	Maximum
SYNC Subrack					
LAH49 (SRC)	16.4 W / 0.34 A	22.6 W / 0.47 A	1	16.4 W / 0.34 A	22.6 W / 0.47 A
LAH101 (BSC)	26 W / 0.54 A	31 W / 0.65 A	1	26 W / 0.54 A	31 W / 0.65 A
LAH102 (STU)	16.4 W / 0.34 A	23 W / 0.48 A	1	16.4 W / 0.34 A	23 W / 0.48 A
IMO4 (OLU)	7.5 W / 0.16 A	9 W / 0.19 A	2	15 W / 0.32 A	18 W / 0.38 A
IME2 (PTM)	~ 0	~ 0	2	~ 0	~ 0
			Total	**73.8 W / 1.54 A**	**94.6 W / 1.98 A**
STM1 Subrack					
LAH49 (SRC)	16.4 W / 0.34 A	22.6 W / 0.47 A	1	16.4 W / 0.34 A	22.6 W / 0.47 A
LAH100 (DTU)	13.5 W / 0.28 A	20 W / 0.42 A	2	27 W / 0.56 A	40 W / 0.84 A
IMO3 (BSIU)	6.5 W / 0.14 A	7.2 W / 0.15 A	10	65 W / 1.4 A	72 W / 1.5 A
LAH201 (STM1 PORT UNIT)	16 W / 0.33 A	22.7 W / 0.47 A	18	288 W / 5.94 A	408.6 W / 8.46 A
* IMO1 (STM1-O IU)	4.2 W / 0.09 A	5.9 W / 0.12 A	16	67.2 W/ 1.44 A	94.4 W / 1.92 A
* IMO5 (STM1 -O IU)	4.2 W / 0.09 A	5.9 W / 0.12 A	16	67.2 W/ 1.44 A	94.4 W / 1.92 A
* IME1 (STM1-E IU)	8.5 W / 0.18 A	12.1 W / 0.25 A	16	136 W / 2.88 A	193.6 W / 4.0 A
IME2 (PTM)	~ 0	~ 0	2	~ 0	~ 0
* only 1 of these types of units will be present, therefore IME1 is used to calculate maximums			**Total**	**532.4 W / 11.12 A**	**925.6 W / 19.11 A**
STM0 Subrack					
LAH49 (SRC)	16.4 W / 0.34 A	22.6 W / 0.47 A	1	16.4 W / 0.34 A	22.6 W / 0.47 A
LAH100 (DTU)	13.5 W / 0.28 A	20 W / 0.42 A	2	27 W / 0.56 A	40 W / 0.84 A
IMO3 (BSIU)	6.5 W / 0.14 A	7.2 W / 0.15 A	10	65 W / 1.4 A	72 W / 1.5 A
LAH200 (STM0 PORT UNIT)	22 W / 0.46 A	29.5 W / 0.62 A	16	352 W / 7.36 A	472 W / 9.92 A
IMO2 (STM0-O IU)	10.3 W / 0.22 A	13.8 W / 0.29 A	16	164.8 W / 3.52 A	221 W / 4.64 A
IME2 (PTM)	~ 0	~ 0	2	~ 0	~ 0
			Total	**625.2 W / 13.18 A**	**827.6 W / 17.37 A**

Rack Installation & Station Power

4

Description

In the case of *Wavestar*^{TM} DACS 4/4/1 System, the fuse and alarm distribution panels and the subracks are shipped already mounted in the rack. All of the information in this section pertaining to the fuse and alarm distribution panel is to be used for reference only.

This section will provide details for mounting the *Wavestar*^{TM} DACS 4/4/1 System racks. All of the racks, regardless of the configuration or location will be mounted the same.

This section will cover the following information:

- Rack Installation

    - Equipment Racks

    - Mounting Rack Assemblies

    - Fuse and Alarm Distribution Panel

- System Power and Ground Connections

    - Station Power and Ground Connections

    - Internal Power and Ground Connections

    - Rack Alarm Wiring Information

Rack Installation

Equipment Racks

The equipment racks which are provided with the *Wavestar*TM DACS 4/4/1 System are specific to the system application and meet the requirements of the ETSI equipment practices for transmission station equipment. Although these racks may be used for other system applications, they are not intended to be used as miscellaneous equipment racks (also described in the ETSI equipment practices).

With respect to the actual mounting of the racks, there are only two different racks possible, and they both have the same foot print. The only difference is the height, the heights are 2.2m and 2.6m. The equipment codes for these racks are shown in Table 4-1. (page 2). The comcodes in this table are not orderable, they are listed for reference only.

Additional details and orderable codes with respect to various rack configurations are provided Table 4-2. (page 2)

Table 4-1. Rack Equipment Codes

Equipment Code (non-orderable)	Rack Description
847893823	600 mm **Wide** by 600 mm **Deep** by 2200 mm **High** rack.
848087243	600 mm **Wide** by 600 mm **Deep** by 2600 mm **High** rack.

Table 4-2. Orderable Rack Equipment Codes

Ordering Code	Description
848478301	2.2m Core Complex Rack Assembly
848136396	2.2m STM1 Port Complex Rack - E/W 1 Subrack
848136438	2.2m STM1 Port Complex Rack - E/W 2 Subracks
848136461	2.2m STM0 Port Complex Rack - E/W 1 Subrack
848384392	2.2m STM4/16 Port Complex Rack - E/W 2 Subracks
848384384	2.2m STM4/16 Port Complex Rack - E/W 1 Subrack
848321519	2.6m Rack Extender

Mounting Rack Assemblies to Floor

The racks can be mounted to the floor with floor bolts as well as to the overhead cable tray or ceiling. The racks are designed symmetrically so that the mounting to the floor or overhead is done at the same location. The location of the rack mounting holes for the 600 mm x 600mm rack assembly is shown in Figure 4-1. (page 3).

The racks can be leveled by using the provided shims in the corners as required. It is suggested that an M8 (5/16 inch) bolt be used for securing the racks.

All Dimensions in Millimeters

551 (No Doors)
440
58
32
520
599

12.5 Dia. Mounting Hole (4x)
Cable Routing Channels
Rack Upright
Rack Bottom Plate
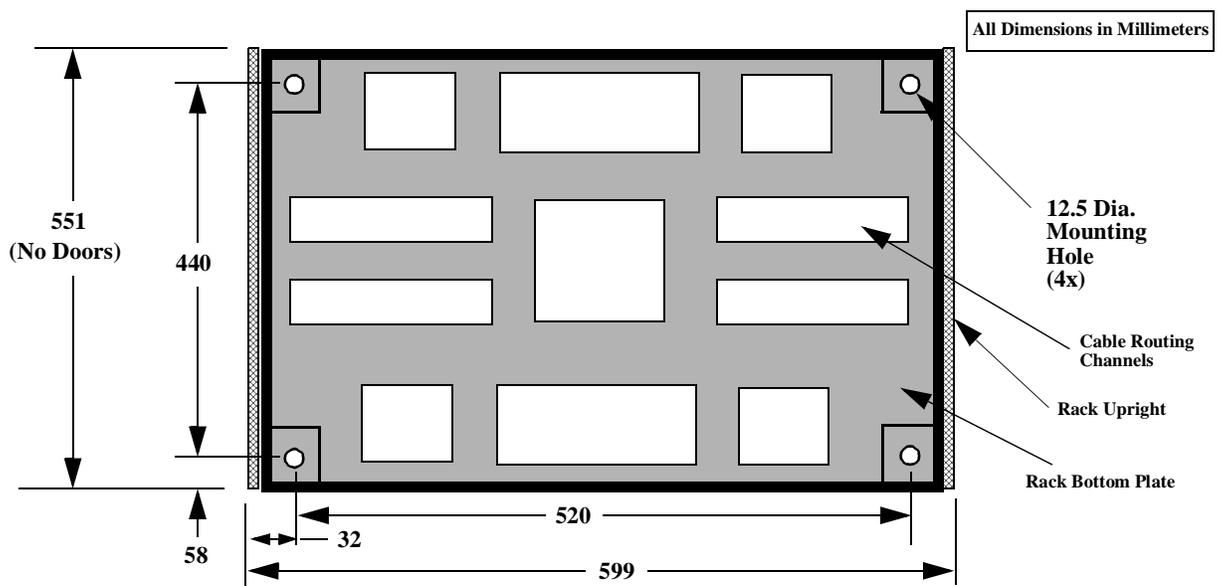
Figure 4-1. *Wavestar*^{TM} DACS 4/4/1 System Rack Footprint

Installing Rack Spacers

There are two types of spacers that must be installed when installing the system racks. These spacers provide a 5 mm gap at the top and bottom of each rack. The bottom spacer is shown in Figure 4-2. (page 4) and the top spacer is shown in Figure 4-3. (page 4). These spacers must be installed in both the front *and* rear of each rack, making a total of 4 spacers between two racks.

WaveStar Rack

Front View

848265765
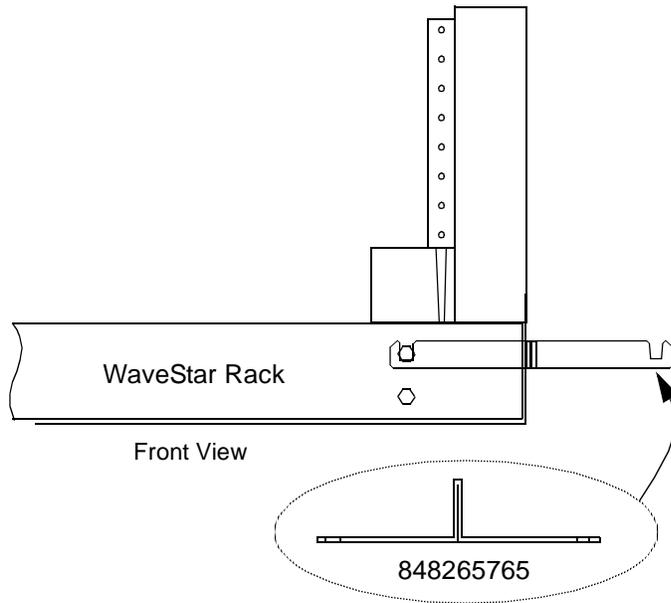
Figure 4-2.   WaveStar Rack Bottom Spacer Installation
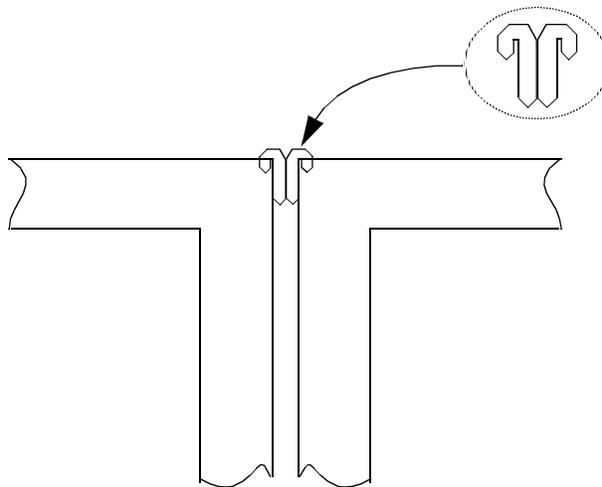
Figure 4-3.   WaveStar Rack Top Spacer Installation

Fuse and Alarm Distribution Panel

The Fuse and Alarm Distribution Panel provides a junction for the power between the rack and the station. The panel is shown in Figure 4-4. (page 5).

The rack top assemblies are mounted in the factory, therefore no mounting instructions are required.

Currently, there are six different types of Rack Top assemblies used, these are listed in Table 4-3. (page 5).

In the Port Racks, each Fuse and Alarm Dist. Panel is located at the top front location of the rack. In the MS and MC racks, there is a Fuse and Alarm Distribution Panel in both the front and the rear of the rack.

Table 4-3.   Rack Top Assembly Equipment Codes

Equipment Code (non-orderable)	Fuse and Alarm Distribution Panel Location
848288023-D	MC Rack, Front position
848288023-B	MS Rack, Front position
848284428-A	MS Rack, Rear position
848284428-B	MC Rack, Rear position
848284428-C	Port Rack with STM-0 Subrack, Front position
848284428-D	Port Rack with STM-1 or STM-4/16 Subracks, Front position

Note: This example illustrates a Port Rack Fuse and Alarm Panel
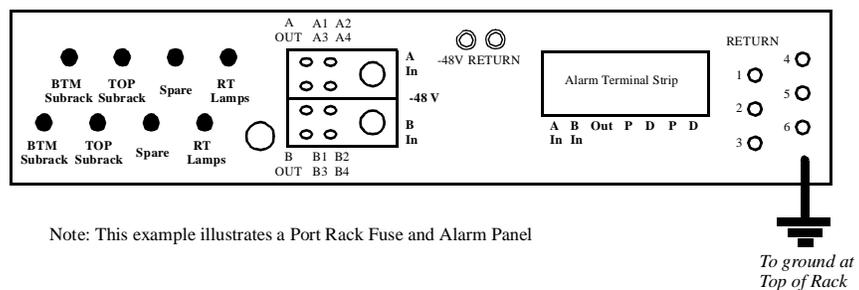
Figure 4-4.   Rack Top Fuse and Alarm Assembly

System Power and Ground

Station Power and Ground Connections

The station power and ground cabling is normally provided by the customer, and must be of 10 AWG cable size.This cabling must be routed to the *Wavestar*[TM] DACS 4/4/1 System from a Power Distribution Fuse Bay (PDFB).

The station power and ground connections to each *Wavestar*[TM] DACS 4/4/1 System rack are located at the fuse and alarm distribution panel at the top of each rack, these connections are as shown in Figure 4-5. (page 6).

Figure 4-6. (page 7) depicts the recommended power configuration from the office power source to the *Wavestar*[TM] DACS 4/4/1 System.

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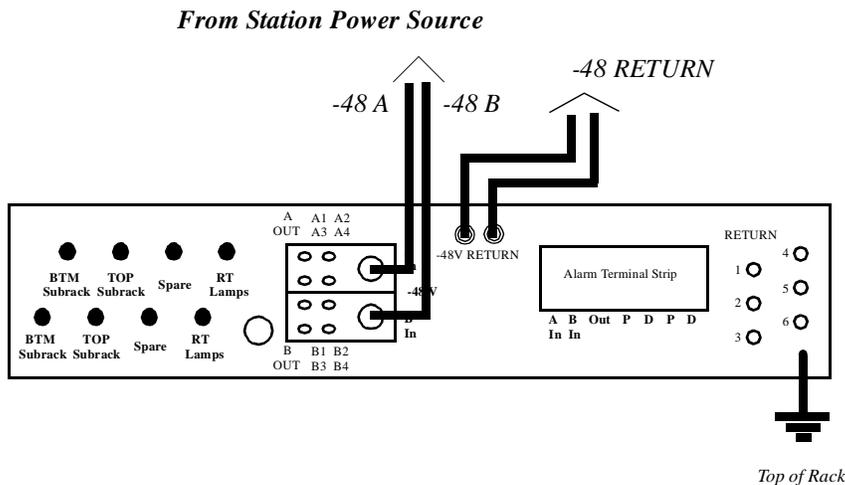
Figure 4-5.   Station Power Connections to Power & Alarm Distribution Panel

Office Battery

A Source

B Source

-48 Volts   -48 Ret.

"A"
Feed

"B"
Feed

MC Rack   MS Rack   Port Rack

Front View
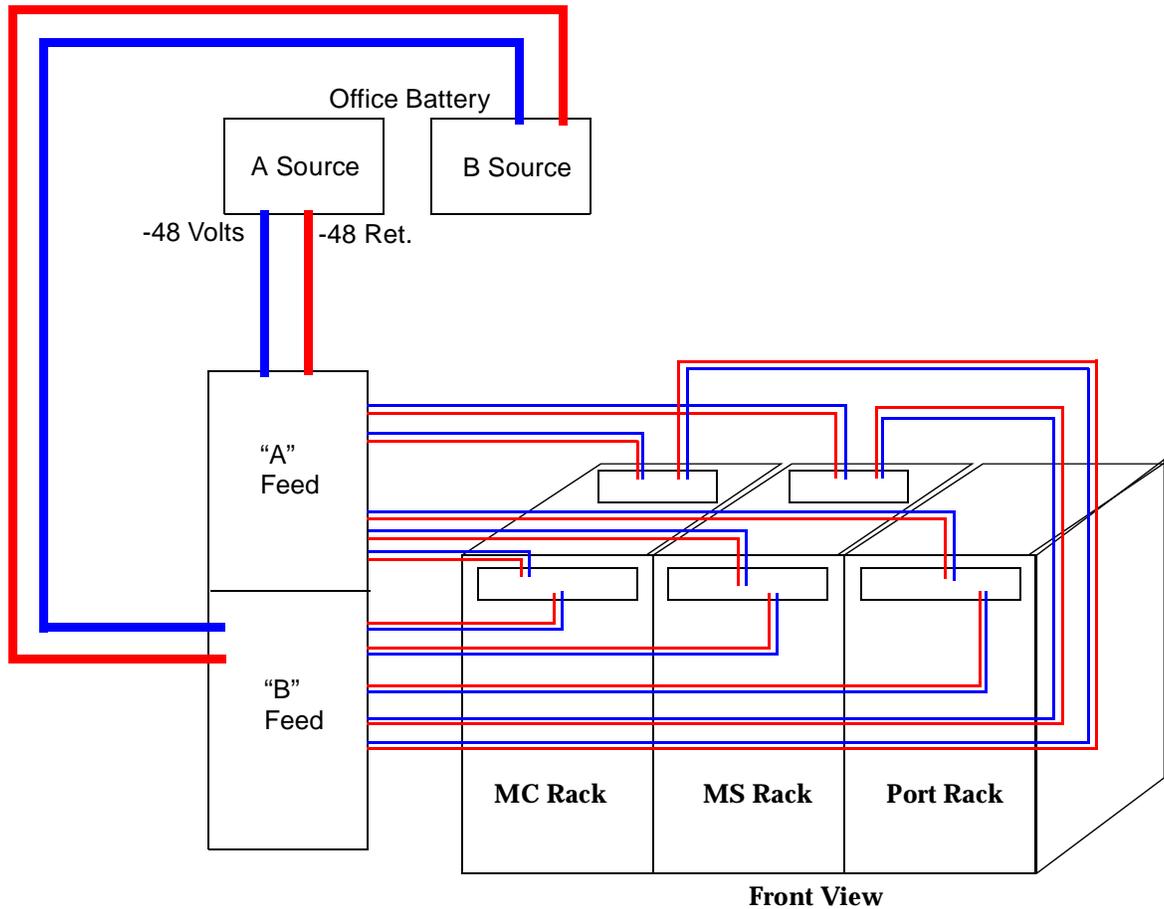
Figure 4-6.   Recommended System Power Configuration

Internal Power and Ground Connections

The following figures will provide reference for the power and ground connections within each available rack configuration.

Figure 4-7. (page 8) reflects the STM-1 port subrack configuration.

Figure 4-8. (page 9) reflects the STM-0 port subrack configuration.

Figure 4-9. (page 10) reflects the BSSU power and ground configuration.

Figure 4-10. (page 11) provides information for the sync power and ground configuration.
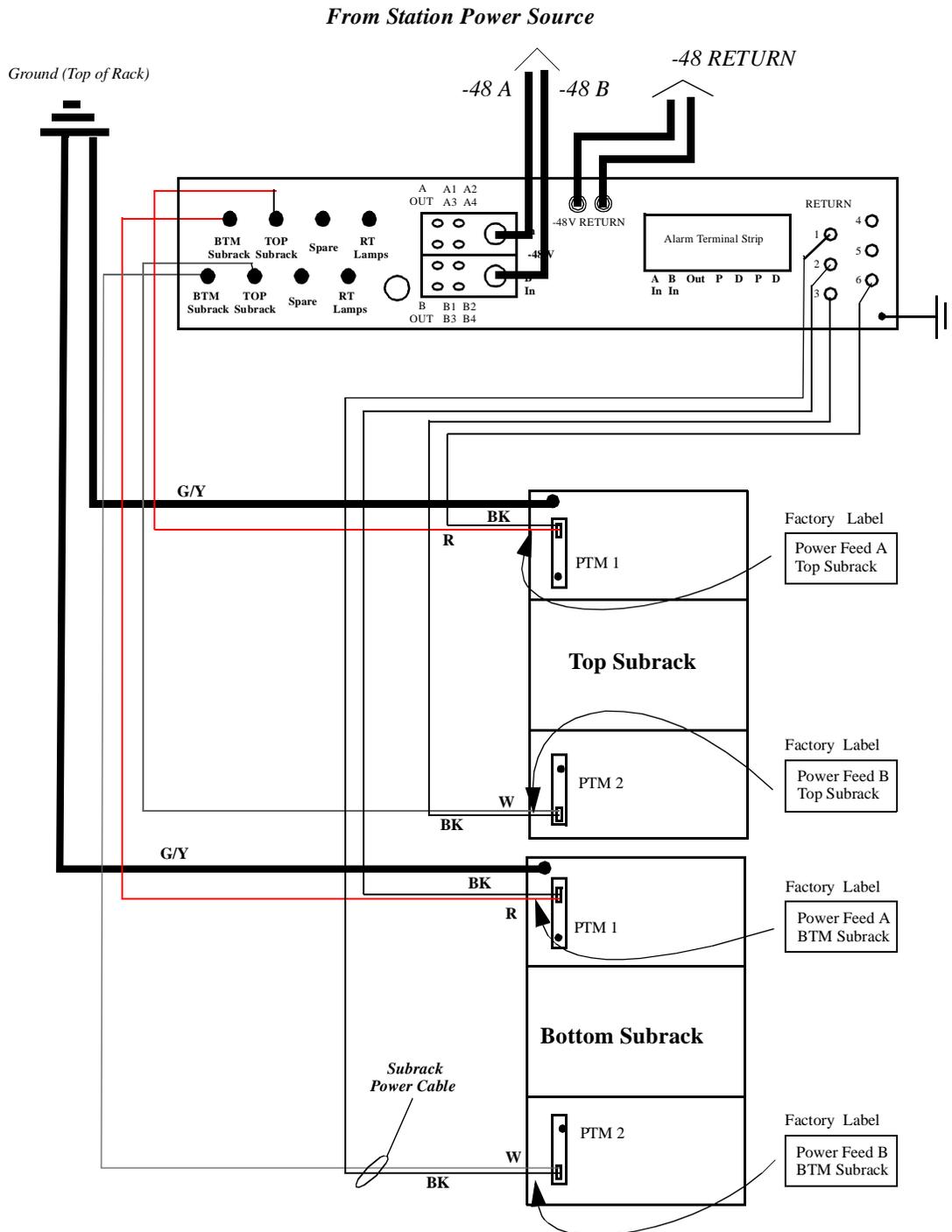
Figure 4-7.   STM-1 Port Subracks Power and Ground Connections

From Station Power Source

Ground (Top of Rack)

-48 RETURN

-48 A   -48 B

A   A1 A2
OUT A3 A4

-48V RETURN

RETURN

Alarm Terminal Strip

BTM   TOP   Spare   RT
Subrack Subrack   Lamps

BTM   TOP   Spare   RT
Subrack Subrack   Lamps

B   B1 B2
OUT B3 B4

-48V

B
In

A B Out P D P D
In In

1
2
3

4
5
6

G/Y

BK

R

PTM 1

Factory Label

Power Feed A

STM-0 Subrack

Factory Label

Power Feed B

PTM 2

W

BK

*Subrack
Power Cable*
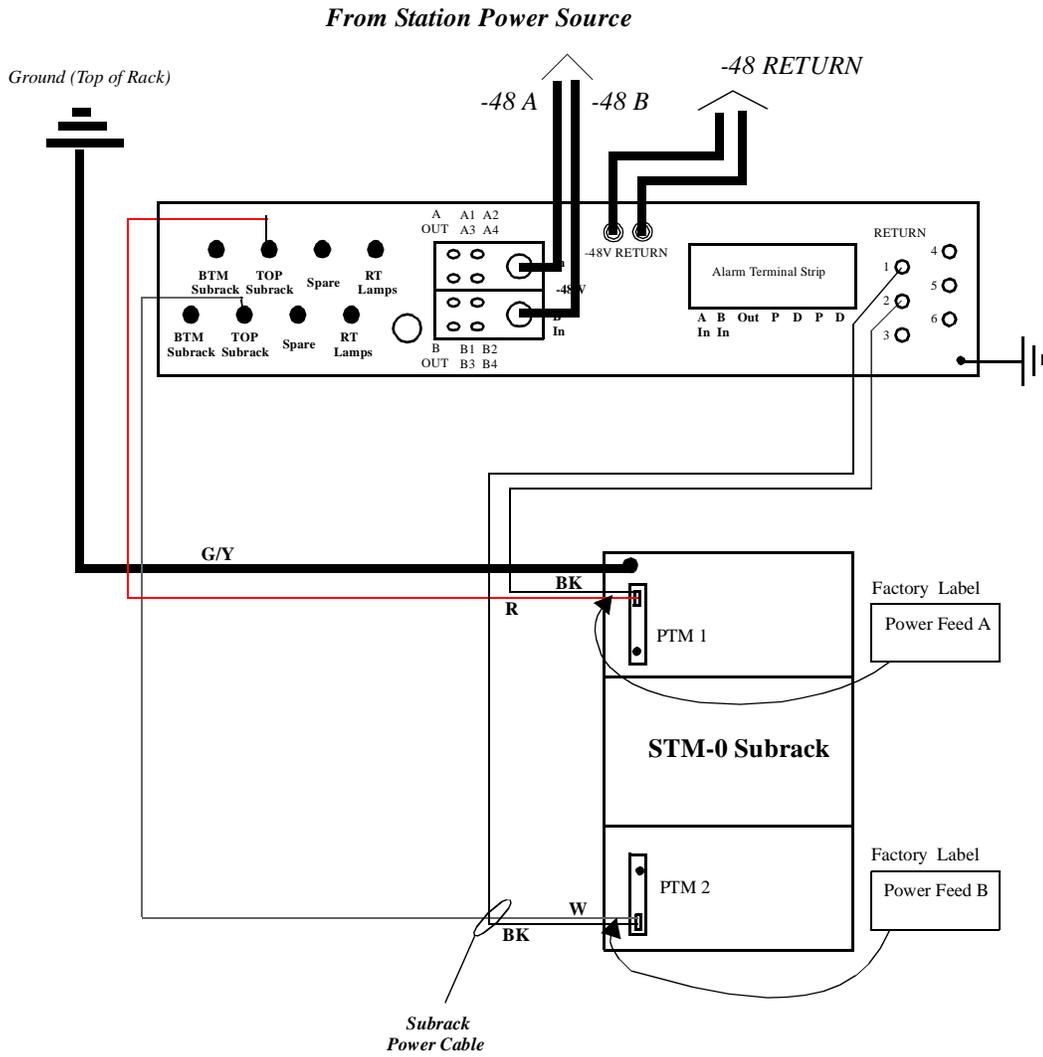
Figure 4-8.   STM-0 Port Subracks Power and Ground Connections
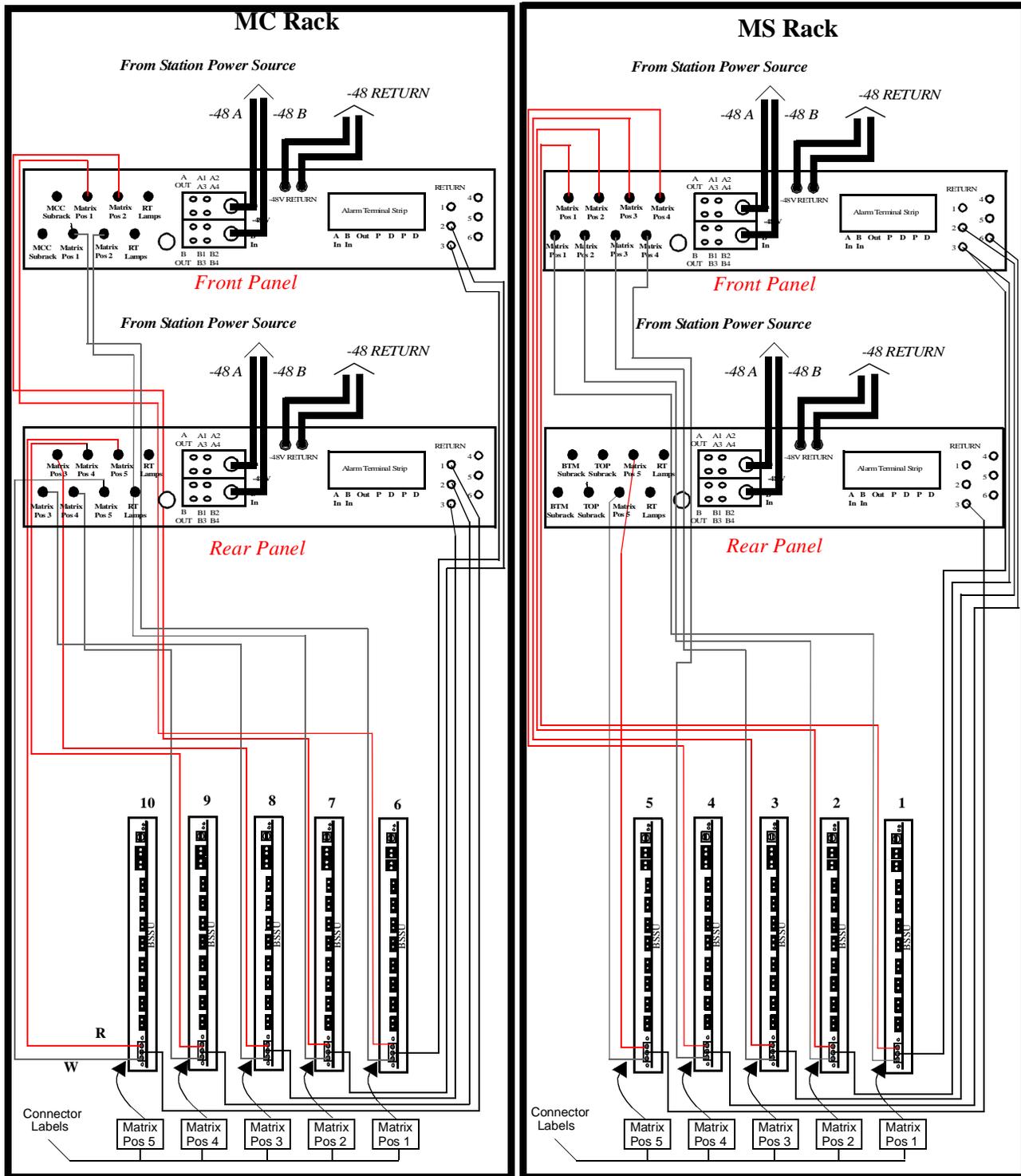
Figure 4-9.   BSSU Power and Ground Wiring
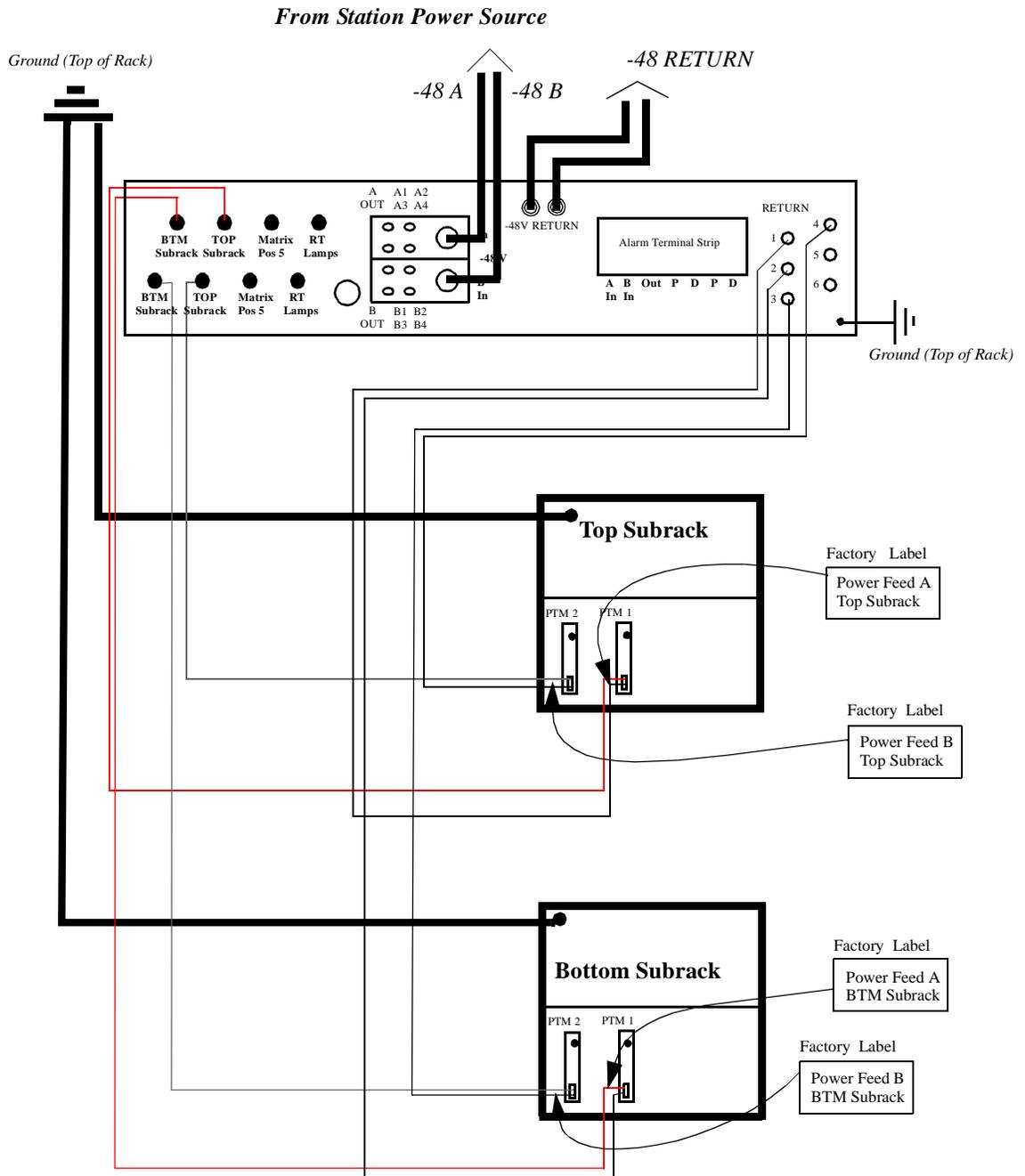
Figure 4-10. SYNC Subrack Power and Ground Wiring

Rack Alarm Wiring Information

This section will provide figures of the alarm wiring for the various rack configurations. These are shown for reference purposes only, since all of the internal wiring connections are made in the factory before shipping to the customer site.

Figure 4-11. (page 13), shows the alarm cabling for the Port and Sync racks, while Figure 4-12. (page 14) shows the power and alarm cabling for the MC rack.
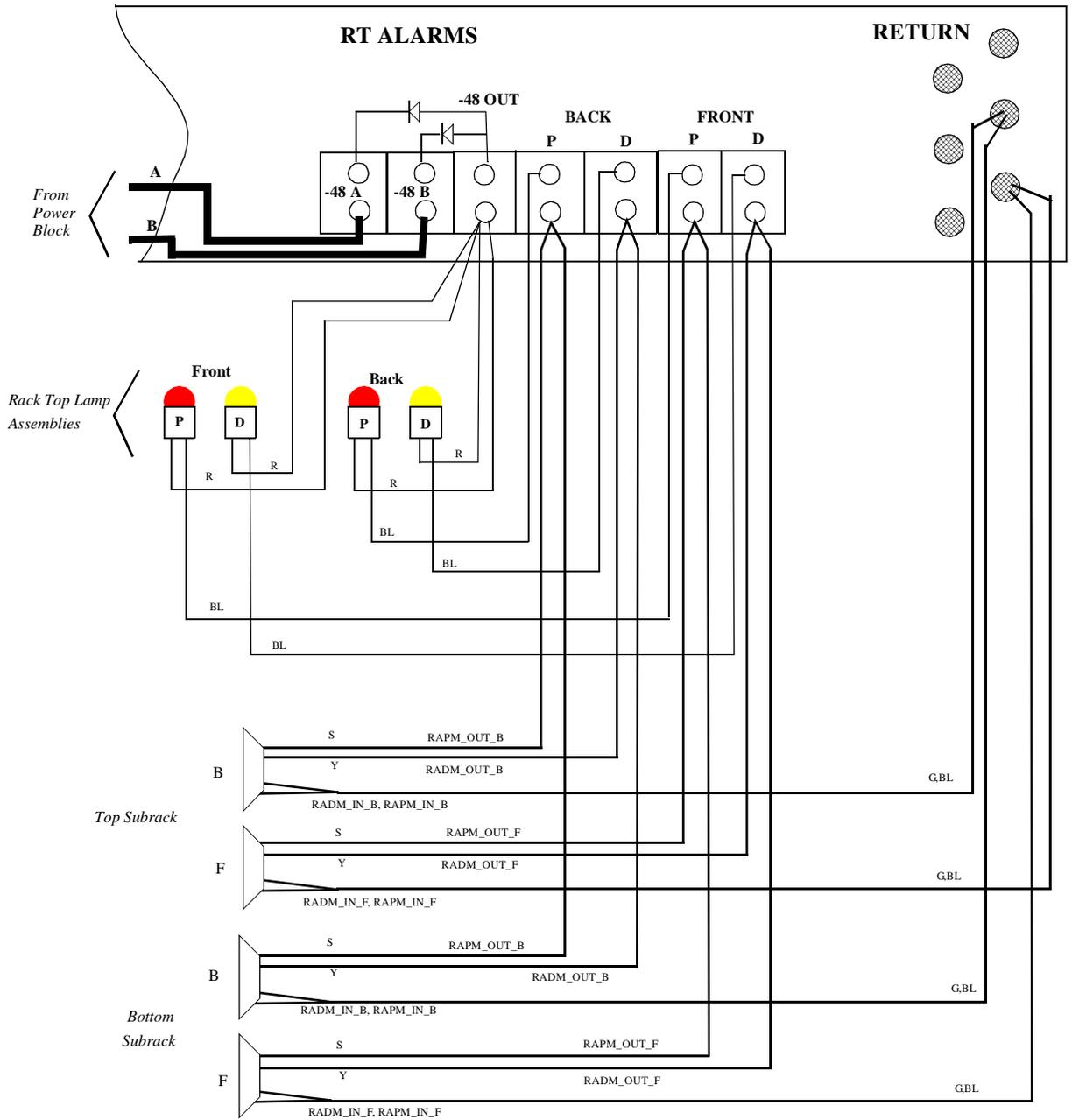
Figure 4-11.   Port and SYNC Subracks Rack Top Alarm Wiring
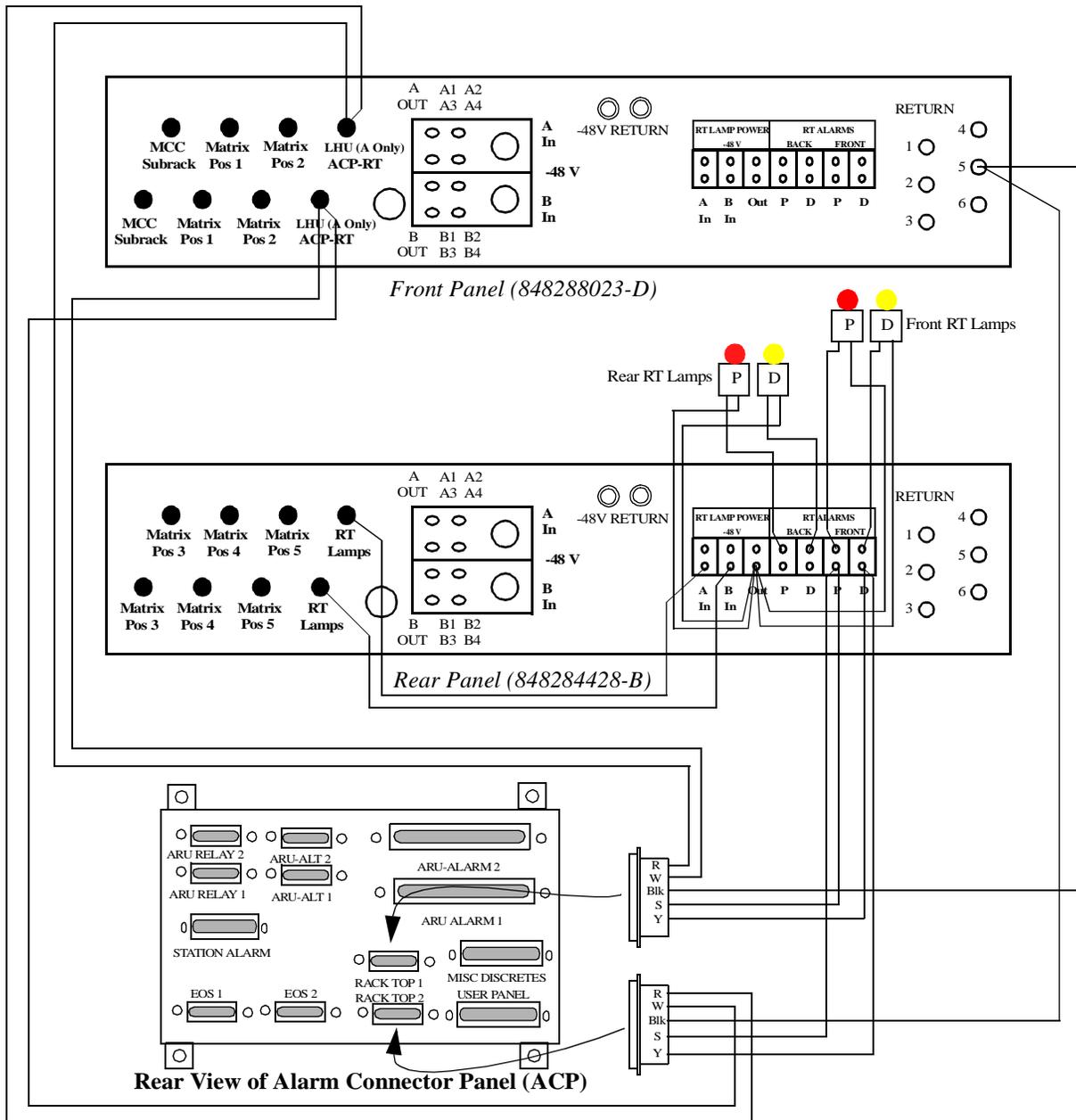
Figure 4-12.   Rack Top Power and Alarm Wiring (MC Rack)

Core Complex Installation

5

Core Complex Information

General Information

The core complex consists of two racks, the Matrix and Synchronization (MS) rack and the Matrix and Control (MC) rack. These racks must always be located next to each other with the MC Rack on the left side, as viewed from the front. This is shown in Figure 5-1. (page 2). The rear view of the core complex is shown in Figure 5-2. (page 3).

The MS rack contains the two Sync subracks (working and protection) and five BSSU's.

The MC rack contains the Motorola Main Controller and five BSSU's.
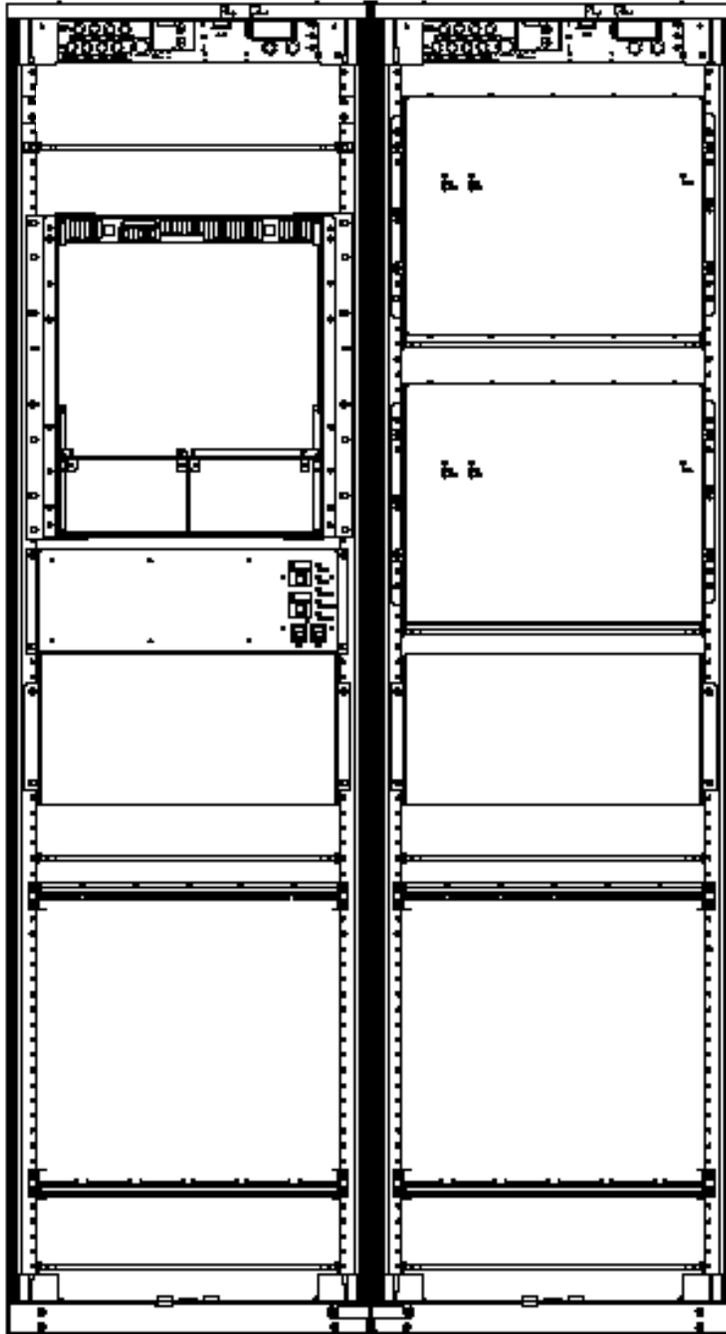
Figure 5-1. Core Complex (Front View: w/EMI Subrack Covers, w/o BSSU units)
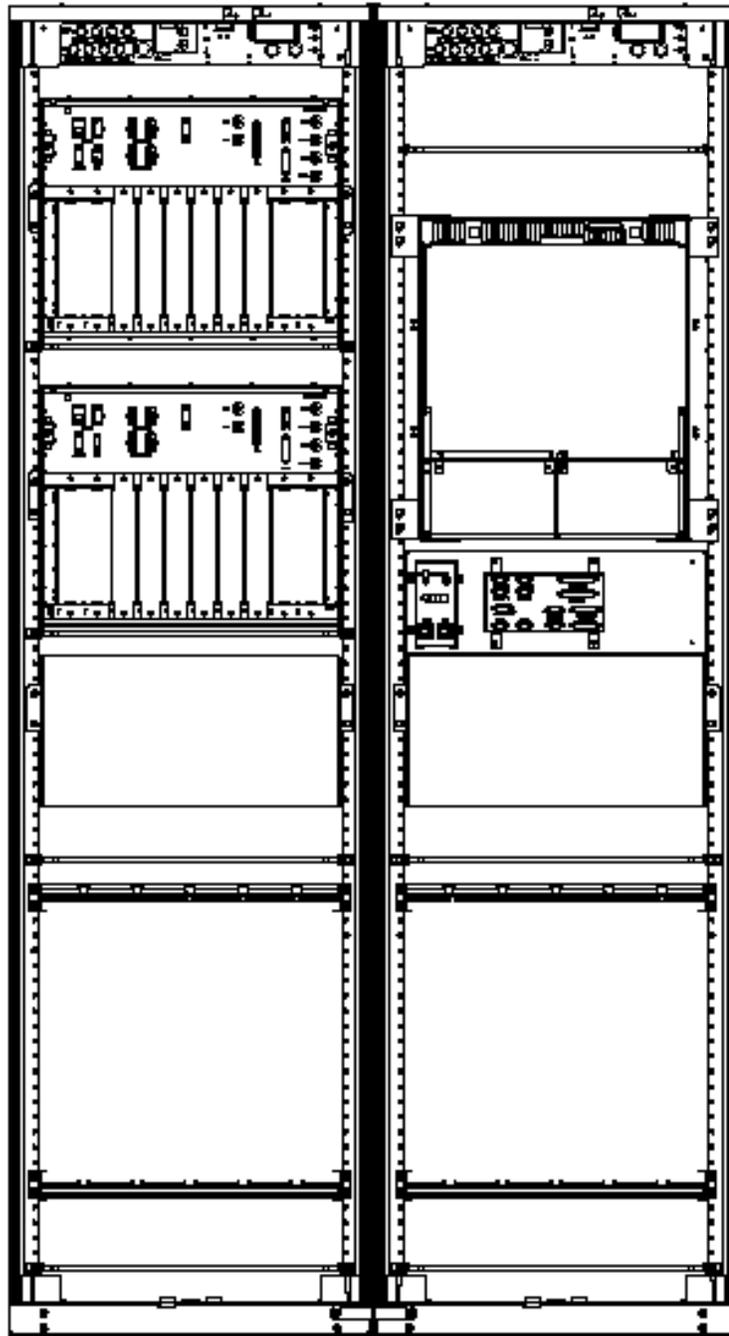
Figure 5-2.   Core Complex (Rear View: w/EMI Covers, w/o BSSU units)

Core Complex Equipment List

There are three different ordering possibilities for the Core Complex. They are the as listed in Table 5-1. (page 4). Table 5-2. (page 5) provides an equipment list for each orderable core complex combination listed below.

Table 5-1.   Core Complex Orderable Codes

Orderable Code	Description
848306452	2.2m Core Complex

Table 5-2.   Core Complex Equipment List

2.2m Core 848478301	Sub-Assembly Codes	Description
2	107742322	7.6 m LAN Cable
1	107748071	LAN Cable
1	408067916	Motorola MC Subrack
1	408091775	LAN HUB Unit
1	408091809	Network Management Module for LAN HUB Unit
1	408112357	MCLAN Fiber Label Kit
1	408112365	BSFI Fiber Label Kit
1	408112373	ECI Fiber Label Kit
6	843998188	M6 x 8 Hex Head Screw
2	847893823	2.2 m Rack Assembly
2	847998630	BSSU Support Structure
1	848027991	SYNC Duplication Cable
2	848065108	SYNC Subrack
20	848134177	Timing/Control (BSFI) Optical Fibers (4.5 m)
2	848134185	Timing/Control (BSFI) Optical Fibers (2 m)
4	848137915	RT Alarm Cable
2	848137931	Heat Baffle, Front
2	848137949	Heat Baffle, Rear
-	848149233	2.2 m Rack Assembly (Custom)
4	848149324	Doors (Left and Right), 2200 mm height
-	848149332	Doors (Left and Right), 2200 mm height (Custom)
2	848155321	Matrix and Control ID/Logo Badge
2	848155339	Matrix and Synchronization ID/Logo Badge
4	848156105	Power Block Cover
1	848164984	LAN Hub -48v PWR Cable Assy.
5	848209177	2800mm Ground Cable
5	848209185	750mm Ground Cable
10	848252342	Cable Tie Bar, Front - Rear
7	848253266	Cable Tie Bar
2	848265765	Rack spacer bracket Assy
2	848275491	Rack spacer bracket Assy, Upper
3	848287991	Subrack Power Cable, B Feed
10	848297370	BSSU Power Cable
3	848297396	Subrack Power Cable, A Feed, Filtered
1	848299236	ARU Alt. Cable Assy
1	848299244	ARU Relay Cable Assy
1	848299251	ARU Cable Assy
1	848305645	Rack Top Cable Assy

Table 5-2.   Core Complex Equipment List

2.2m Core 848478301	Sub-Assembly Codes	Description
1	848306486	System User Panel (top level assy)
2	848323705	Mounting Rail Assy.
2	848335634	Front Mounting bracket for LAN Hub Unit
1	848340634	LAN Hub -48v Return Cable Assy.
1	848340642	LAN Hub Ground Cable
1	848362505	SUP Cable Assy.
4	848385613	Fan Power and Grd Cable
8	901270157	Retainer Ring
8	901277988	M5 x 6 PHMS Slotted
102	901331421	M6x16 Thread Forming Screw
20	901340828	M5 x 13 Screw, Hex Hd Cap, SS
8	901352369	#8-32 x .50 in. Hex Wshr Head Screw
7	901365502	M5 x 13 PHMS Slotted
8	901366237	#6 x .25 Countersunk Screw
1	901373365	#10-32 x .50 Phillips Panhead 289 Zinc Screw
1	408067916BAK	Motorola Controller Chassis
1	848284428-A	Fuse and Alarm Distribution Panel, MS Rack, Rear
1	848284428-B	Fuse and Alarm Distribution Panel, MC Rack, Rear
1	848288023-B	Fuse and Alarm Distribution Panel, MS Rack, Front
1	848288023-D	Fuse and Alarm Distribution Panel, MC Rack, Front
1	ED9C154-20 G23	Working Interlock Cable Assy

Core Complex Subracks and Equipment

Main Controller Subrack

The Motorola Main Controller subrack is shown in Figure 5-3. (page 8).

In release 2.1 of *WaveStar*[TM] DACS 4/4/1 System, the Main Controller is only offered in Simplex (unprotected) configuration.

The Motorola MC is not in the MC rack during shipping. Only the required mounting brackets are in the rack. The Motorola MC must be installed in the MC rack after the rack has been installed.
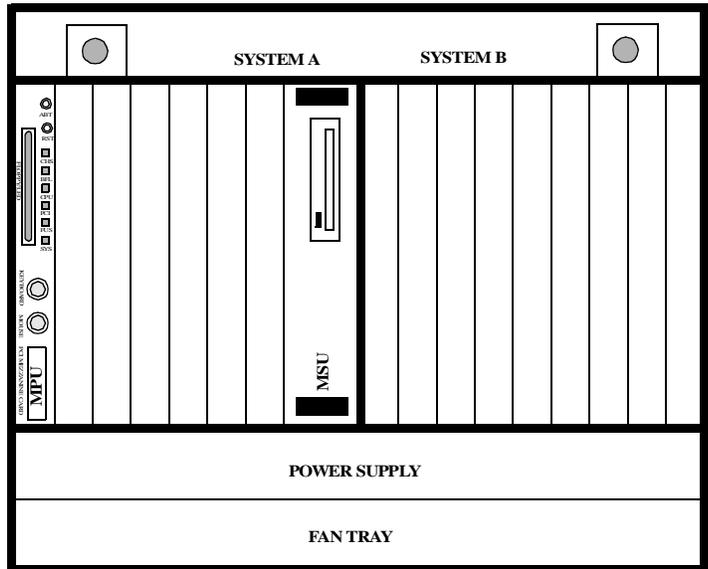
FRONT VIEW
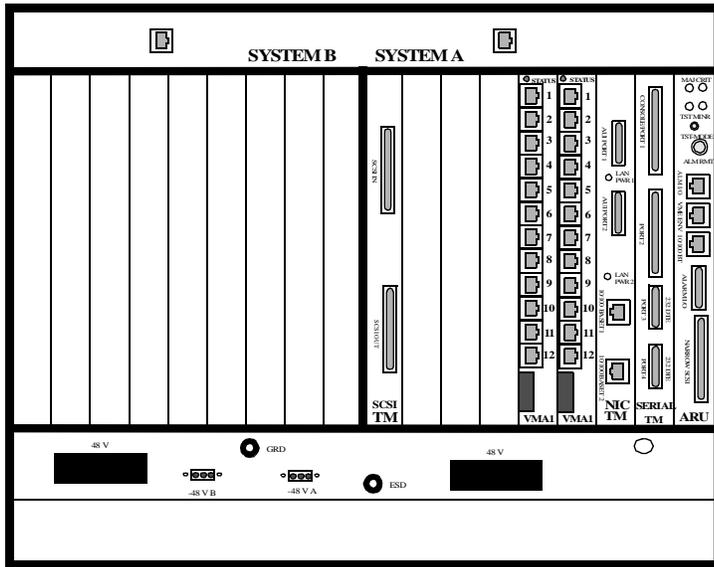
REAR VIEW

Figure 5-3.   Motorola Main Controller

Installing the Motorola MC

The Motorola MC must be installed into the mounting brackets provided in the MC rack. Follow the instructions below to install the Motorola MC subrack.

Step 1: Locate the Motorola MC Subrack

Step 2: From the front of the MC Rack, slide the Motorola MC subrack into position and secure with the 8 provided phillip head screws.

Step 3: Using Table 5-3. (page 9) and Figure 5-4. (page 10) to make the connections to/from the Motorola MC.

Table 5-3.   Motorola MC Connections

Cable	FROM		TO	
	Unit	Port	Unit	Port
848299244	SMM712-129	ALM RMT	IME3	ARU-RELAY 1
848299236	SMM712-129	ALM I/O	IME3	ARU-ALT 1
848299251	SMM712-129	ALARM I/O	IME3	ARU-ALARM 1
848362505	XR 712-121	CONSOLE/PORT 1	SUP	WS1
848317517	IME3	MISC DISCRETES	Loopback Plug	
Amp 30-W2482D07A	SMM712-129	VME ENV	MC (top rear)	"No Phone" Icon
Lan Cable (MCLAN)	SMM712-129	10/100 BT	Lan Hub Unit	1
Amp 32036	SMM712-129	NARROW SCSI	MVME 712-104	SCSI IN
Amp 43278	MVME 712-104	SCSI OUT	Loopback Plug	
LAN Cable (EXLAN)	XR2X 100 BTTM	10/100 BASE T 2	Tele-Pole	3 or 4
MCC POWER FEED A	Power Feed	A	MC	-48v A
MCC POWER FEED B	Power Feed	B	MC	-48v B

SYSTEM A

STATUS   STATUS

1   1
2   2
3   3
4   4
5   5
6   6
7   7
8   8
9   9
10   10
11   11
12   12

SCSI IN

SCSI OUT

AUI PORT 1

LAN PWR 1

AUI PORT 2

LAN PWR 2

10/100 BASET 1

10/100 BASET 2

CONSOLE/PORT 1

PORT 2

PORT 3

232 DTE

PORT 4

232 DTE

MAJ CRIT

TST-MINR

TST-MODE

ALM RMT

ALM I/O

VME-ENV 10/100 ET

ALARM I/O

NARROW SCSI

**SCSI
TM**   VMA1 VMA1   **NIC
TM**   **SERIAL
TM**   **ARU**

48 V

ESD

Main Controller (partial rear view)

ARU RELAY 2   ARU-ALT 2   ARU-ALARM 2

ARU RELAY 1   ARU-ALT 1

                              ARU ALARM 1

STATION ALARM

                    RACK TOP 1   MISC DISCRETES
EOS 1   EOS 2   RACK TOP 2   USER PANEL

ACP

WS 2   WS 1

IME3 (REAR VIEW)

Figure 5-4.   Main Controller Connector Location Diagram

Main Controller Circuit Packs

The circuit packs required in the Main Controller are listed in Table 5-4. (page 11). The quantities in this table represent the required amounts *per subrack*.

Table 5-4.   Main Controller Circuit Pack Codes

Circuit Pack	Qty.	Motorola Part No.	Lucent Comcode	Description
MPU	1	SMMXRCPULUCNT2-K	408091619	2-Slot, 200 Mhz CPU card with 128 MB Dram and Dual NIC-PMC (Dual Ethernet Card)
MPU-DRAM	1	XRECCDRAMSFEE	408091635	128 MB ECC Dram Daughter card
NIC TM	1	SMMXR100BTLUCNT1	408091643	Dual 10/100 Base TX Transition Module for Dual Ethernet Card
Serial TM	1	SMMXR121LUCNT1	408091650	XR712-121 Rear Transition Module (V28-TM) with 2 XRSIM232 DCE modules
ARU	1	SMMXR712129LUCNT	408091668	Rear Transition Module
MSU	1	SMMXRDVLUCNT1	408091601	3-slot card excluding the MO drive (HD included)
MSU (w/MO drive)	1	SMMXRDMOLUCNT1	408151421	3-slot card with HD and MO drive
SCSI-TM	1	MVME712-104	408091676	Rear Transition Module
SCSI-Term	1	P417K	408091718	Active resistor pack
VMA-1	2		108371535	LAN Hub Module

SYNCHRONIZATION (SYNC) Subrack

The front and rear of the SYNC Subrack is shown in Figure 5-5. (page 12), and Figure 5-6. (page 12) respectively.

Two OLU's are required in *each* SYNC subrack, the working pair are in the top SYNC subrack, and the protection pair are in the bottom SYNC subrack.

The units are number from right to left, top to bottom, as viewed from the rear of the system. Therefore, units 1 and 2 reside in the top SYNC subrack and units 3 and 4 reside in the bottom SYNC subrack. There is a visual representation of the OLU locations shown in Figure 5-6. (page 12).

In Release 2.1 of the *WaveStar*TM DACS 4/4/1 System the SYNC subrack is duplicated. The upper SYNC subrack is the working SYNC subrack and the lower SYNC subrack is the protection SYNC subrack.

All units in this subrack are 1+1 protected. Lower order functions are x-coupled by means of the twisted pair **DUP** cable. Higher order functions are x-coupled by two fiber pairs between the two subracks, between the working and protection OLU's.
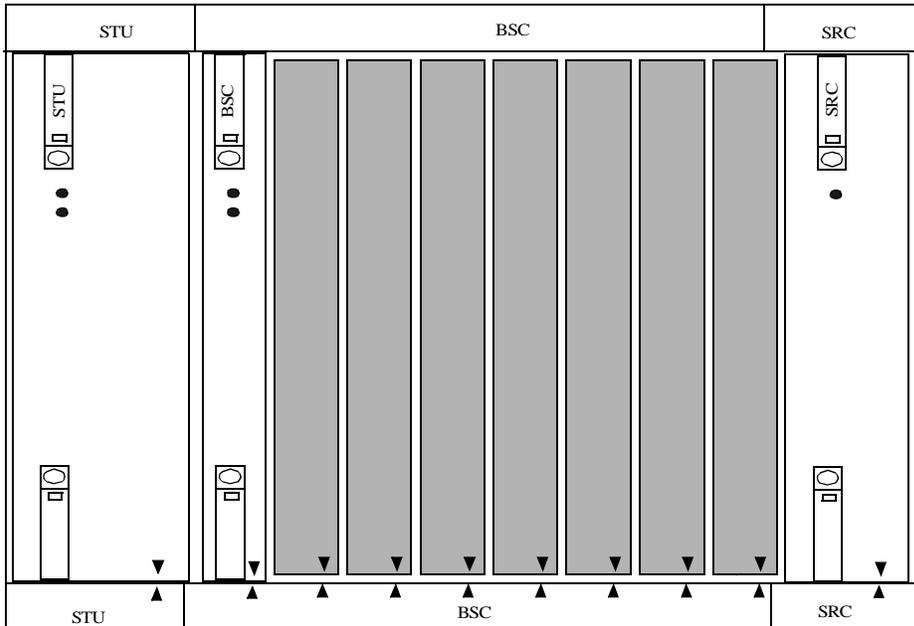
Figure 5-5.   SYNC Subrack - Front View
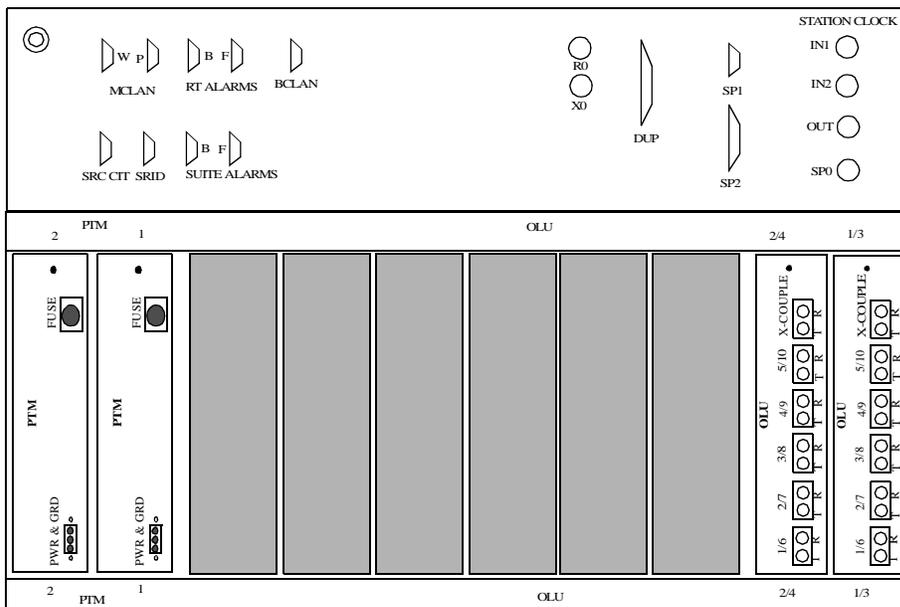
Figure 5-6.   SYNC Subrack - Rear View

SYNC Subrack Circuit Packs

The circuit packs that are located in the SYNC Subrack are listed in Table 5-5. (page 13). This table shows quantities on a *per subrack* basis.

Table 5-5. SYNC Subrack Circuit Pack Codes

Orderable Entity	App. Code	Qty. (per Subrack)	Description
108440157	LAH50	1	Subrack Controller (SRC)
108440124	LAH107	1	Bit Slice Controller (BSC)
108440108	LAH105	1	System Timing Unit (STU)
108001785	IMO4	2	Optical Link Unit (OLU)
108727884	IME2B	2	Power Terminal Module (PTM)
108440116	LAH106	2	System Timing Unit (STU-64) 64 Khz Clock
848125126	-	7	LAH Apparatus Blank

Bit Slice Switch Unit (BSSU)

Release 2.1 supports two different possible BSSU's. The LAC4 (for 256 configurations) and the LAC5 (for 512 configurations). These units cannot be mixed, the system must have 10 of either BSSU unit.

Both BSSU's are shown in Figure 5-7. (page 14). The BSSU's are self contained units that are held in place via the BSSU support structure. The enclosures of the BSSU's act as heat sinks and are crucial to the thermal management of the unit.

The BSSU's are configured in a 2:8 protection scheme in two racks for a total of 10 units per system. The "bit slice" for each BSSU is determined by the position in the core complex. Typically, units 1 thru 8 carry active bit slices, and units 9 and 10 serve as protection. A failure of any unit results in a automatic switch to one of the protection units.

The core complex must be installed so that the MC rack is on the left, as viewed from the front, and the MS rack is on the right as viewed from the front, this is shown in Figure 5-8. (page 15). In this configuration, the system software will number the BSSU's as shown in the same figure.

LED's

Timing/Control
(BSFI)
Optical Transceivers

Transmission
(ECI)
Optical Transceivers

Power Connector

LAC4

LAC5
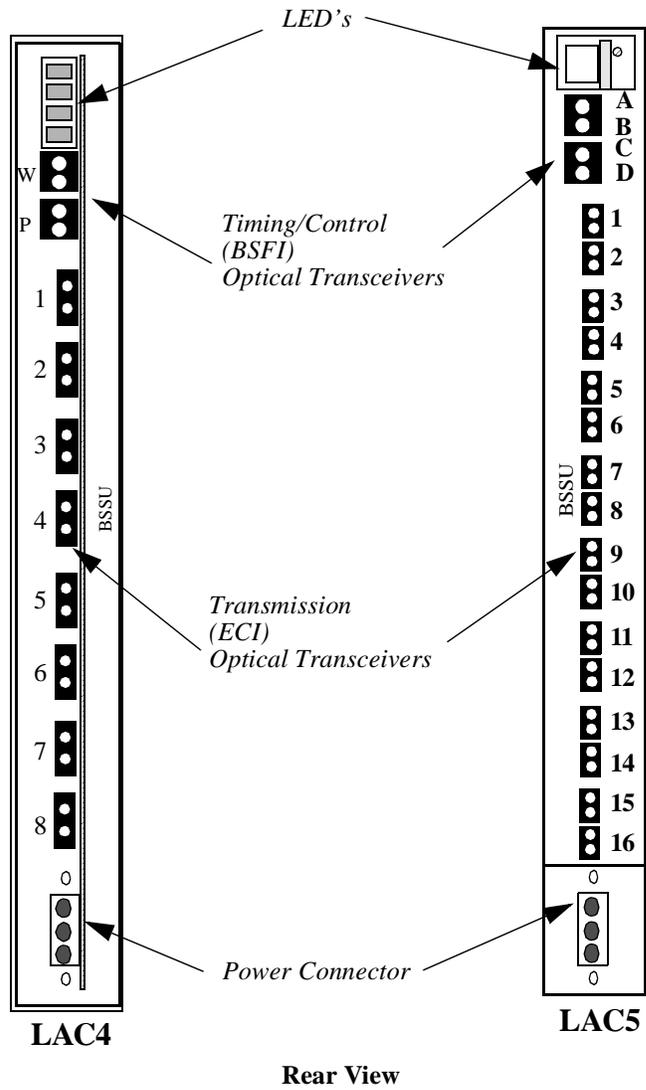
Rear View

Figure 5-7.   Bit Sliced Switch Unit (BSSU)
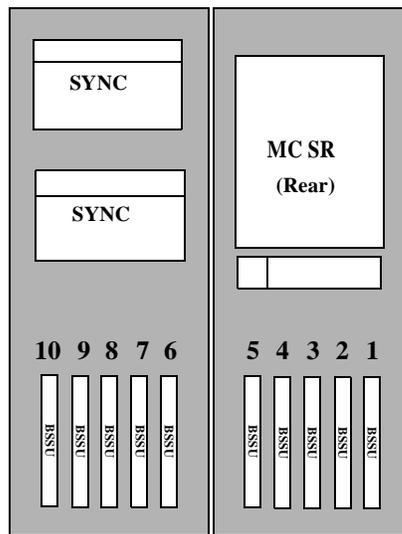
Rear View of System

Figure 5-8.   BSSU "Bit Slice" Assignments

BSSU Circuit Pack Information

The circuit pack information for the BSSU is shown in Table 5-6. (page 15), this table reflects the number of BSSU's required *per system.*

Table 5-6.   BSSU Circuit Pack Codes

Orderable Entity	App. Code	Qty.	Description
108539065	LAC4	10	Bit Slice Switch Unit (BSSU)
108507328	LAC5	10	Bit Slice Switch Unit (BSSU)

System User Panel

The System User Panel (SUP), is located in the MC Rack just below the Main Controller subrack. Figure 5-9. (page 16) illustrates the SUP. The rack doors must be opened to gain access to the SUP.

The SUP provides system alarm information and system maintenance access.

The Alarm Connector Panel (ACP) in located in the rear of the SUP and can be accessed from the rear of the MC rack.
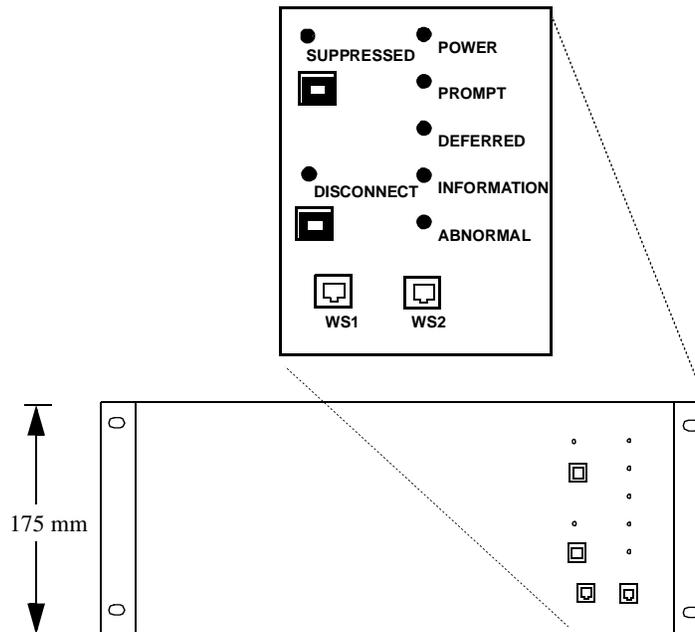
Figure 5-9.   System User Panel

Port Complex Installation

6

Port Complex Information

General Information

The I/O interface for *WaveStar*^{TM} DACS 4/4/1 System is provided via the Port Complex. The rates supported in release 2.1 are STM1, STM0 and STM4/16. Each rate is handled by its own subrack.

In the system software these subracks are referred to as PSA, PSB, and PSC. These are STM1, STM0 and STM4/16 respectively.

Each subrack can be configured as a 1 fiber, 2 fiber or 4 fiber(PSC only) subrack.

In Rel. 2.1, the system may also be configured to have a 256 STM1 capacity, or a 512 STM1 capacity. The default configuration is 256 STM1 capacity.

Port Rack Types

Currently there are three variations of port racks that are orderable in a variety of rack types, these are listed in Table 6-1. (page 2). The only current growth option is an STM1 subrack, this is listed in Table 6-2. (page 2).

Table 6-1.   Port Rack Ordering Codes

Ordering Code	Description	Sub-Assembly Information
848136396	2.2m **STM1** Port Complex Rack - E/W 1 Subrack	Table 6-3. (page 3)
848136438	2.2m **STM1** Port Complex Rack - E/W 2 Subracks	Table 6-4. (page 5)
848384384	2.2m **STM4/16** Port Complex Rack - E/W 1 Subrack	Table 6-5. (page 7)
848384392	2.2m **STM4/16** Port Complex Rack - E/W 2 Subracks	Table 6-6. (page 8)
848136461	2.2m **STM0** Port Complex Rack - E/W 1 Subrack	Table 6-7. (page 9)

Table 6-2.   Orderable Growth Subrack Equipment Codes

Ordering Code	Description	Circuit Pack Information
848065090	STM1 Port Subrack	Table 6-8. (page 15)
848490306	STM4/16 Port Subrack	Table 6-10. (page 22)

Port Rack Equipment Information

The following equipment lists do not include ECI fibers or LAN cables. The proper number and length of fibers must be ordered separately, as a function of the protection scheme chosen by the customer.

The proper length of LAN cable must also be ordered separately, as a function of the type of system lineup (contiguous or remote I/O).

Port Rack with single STM1 Subrack

Table 6-3. (page 3) defines the single STM1 rack configurations. These racks have a 64 STM1 maximum I/O capacity, dependent on protection. In these configurations, the single STM1 port subrack will be mounted in the bottom position in the rack.

Figure 6-1. (page 4) represents the single STM1 subrack configuration, front and rear views.

Table 6-3.   Single STM1 Port Rack Equipment Lists (non-orderable)

2.2 M Port Rack 848136396	Sub-Assembly Codes	Description
1	847893823	Rack Assembly - 2.2 m
8	901331421	M6x16 Hex Washer Head, self tapping screw
2	848149324	Doors (Left and Right), 2.2m height
2	848155347	Port ID/Logo Badge
1	848137931	Heat Baffle Front
1	848137949	Heat Baffle Rear
1	848284428-D	Fuse and Alarm Distribution Panel
1	848156105	Power Block Cover
4	848030680	Subrack Power Cable
4	848137915	RT Alarm Cable
1	848065090	STM1 Subrack Assembly

Front Baffle

Rear Baffle

Front View

Rear View
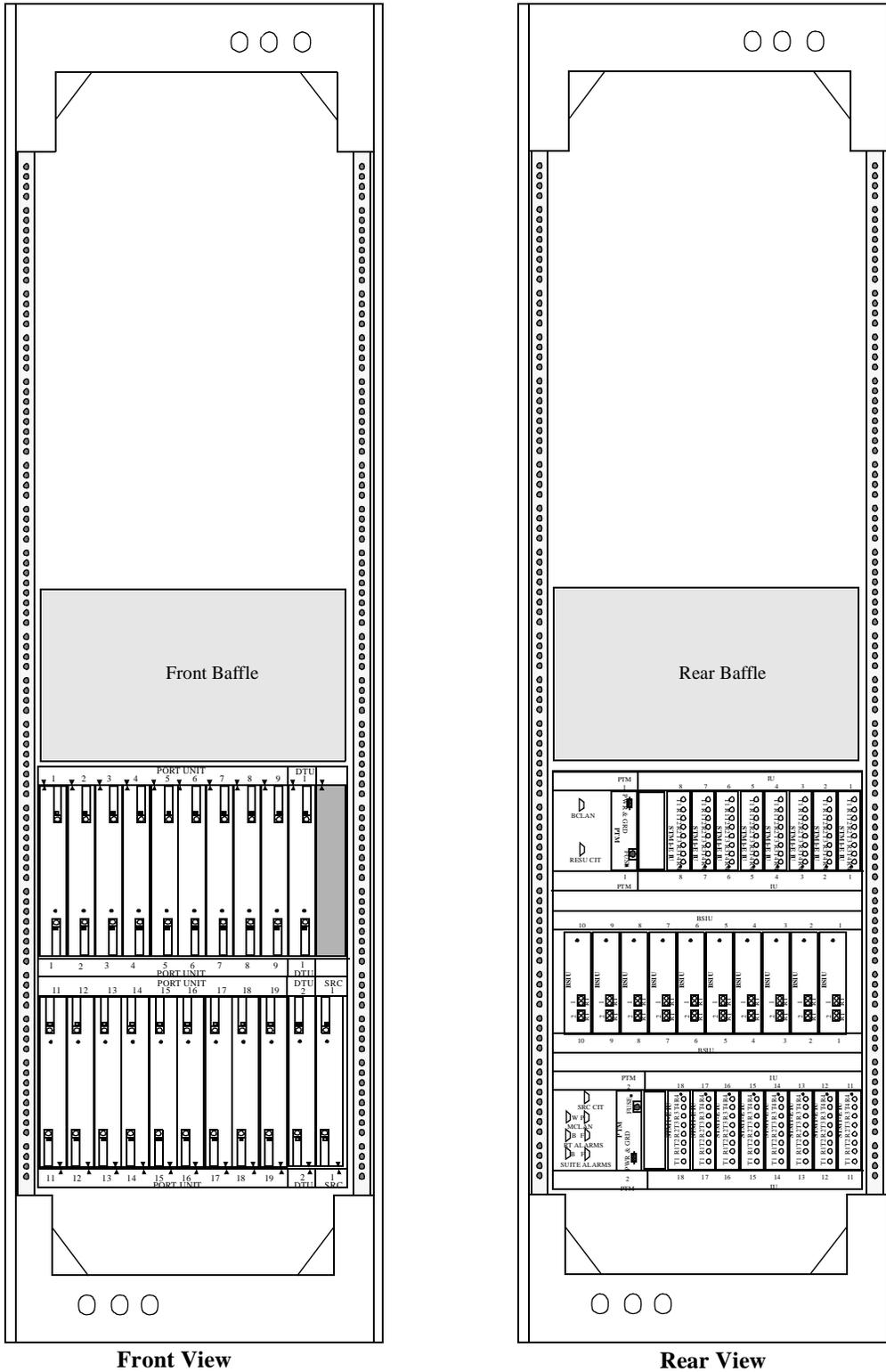
Figure 6-1.   Port Rack Equipped w/ 1 STM1 Port Subrack

Port Rack with two STM1 Subracks

Table 6-4. (page 5) defines the equipment for a rack containing two STM1 port subrack. This rack has a 128 STM1 maximum I/O capacity, dependent on protection.

Figure 6-2. (page 6) represents the dual STM1 subrack configuration, front and rear views.

Table 6-4.   Dual STM1 Port Rack Equipment Lists (non orderable)

2.2 M Port Rack 848136438	Sub-Assembly Codes	Description
1	847893823	Rack Assembly - 2.2 m
8	901331421	M6x16 Hex Washer Head, self tapping screw
2	848149324	Doors (Left and Right), 2.2m height
2	848155347	Port ID/Logo Badge
1	848137931	Heat Baffle Front
1	848137949	Heat Baffle Rear
1	848284428-D	Fuse and Alarm Distribution Panel
1	848156105	Power Block Cover
4	848030680	Subrack Power Cable
4	848137915	RT Alarm Cable
2	848065090	STM1 Subrack Assembly

Front View **Rear View**

Figure 6-2.   Port Rack Equipped w/ 2 STM1 Port Subracks

Growth STM1 Port Subrack

Table 6-2. (page 2) defines the ordering information for a single growth STM1 port subrack. This subrack is for growth of an existing system and has a 64 STM1 maximum capacity, dependent on the protection scheme. This growth subrack includes the 16 required mounting screws.

Table 6-8. (page 15) defines the circuit pack information for this growth option.

Port Rack with single STM4/16 Subrack

Table 6-5. (page 7) defines the single STM1 rack configurations. In this configuration, the single STM4/16 port subrack will be mounted in the bottom position in the rack.

Table 6-5.   Single STM4/16 Port Rack Equipment Lists (non-orderable)

2.2 M Port Rack 848384384	Sub-Assembly Codes	Description
1	847893823	Rack Assembly - 2.2 m
8	901331421	M6x16 Hex Washer Head, self tapping screw
2	848149324	Doors (Left and Right), 2.2m height
2	848155347	Port ID/Logo Badge
1	848137931	Heat Baffle Front
1	848137949	Heat Baffle Rear
1	848284428-D	Fuse and Alarm Distribution Panel
1	848156105	Power Block Cover
4	848030680	Subrack Power Cable
4	848137915	RT Alarm Cable
1	848490306	STM4/16 Subrack Assembly

Port Rack with two STM4/16 Subracks

Table 6-6. (page 8) defines the equipment for a rack containing two STM4/16 port subracks.

Table 6-6.   Dual STM4/16 Port Rack Equipment Lists (non orderable)

2.2 M Port Rack 848384392	Sub-Assembly Codes	Description
1	847893823	Rack Assembly - 2.2 m
16	901331421	M6x16 Hex Washer Head, self tapping screw
2	848149324	Doors (Left and Right), 2.2m height
4	848155347	Port ID/Logo Badge
1	848137931	Heat Baffle Front
1	848137949	Heat Baffle Rear
1	848284428-D	Fuse and Alarm Distribution Panel
1	848156105	Power Block Cover
4	848030680	Subrack Power Cable
4	848137915	RT Alarm Cable
2	848065090	STM4/16 Subrack Assembly

Growth STM4/16 Port Subrack

Table 6-2. (page 2) defines the ordering information for a single growth STM4/16 port subrack. This subrack is for growth of an existing system. This growth subrack includes the 16 required mounting screws.

Table 6-10. (page 22) defines the circuit pack information for this growth option.

Port Rack with single STM0 Subrack

Table 6-7. (page 9) defines the equipment for a rack containing a STM0 port subrack. This rack has a 64 STM1 maximum capacity when configured with no protection, and a 32 STM1 maximum capacity when configured for MSP.

Figure 6-3. (page 10) represents the STM0 subrack configuration, front and rear views. The STM0 Port rack can only accommodate 1 STM0 subrack due to the physical size of the subrack.

Table 6-7.   2.2m Rack with 1 STM0 Port Subrack Equipment List

Sub-Assembly Codes	Qty.	Description
847893823	1	Rack Assembly
901331421	16	M6x16 Hex Washer Head, self tapping screw
848149324	2	Doors (Left and Right), 2200 mm height
848155347	2	Port ID/Logo Badge
848284428-C	1	Fuse and Alarm Distribution Panel
848156105	1	Power Block Cover
848030680	2	Subrack Power Cable
848137915	2	RT Alarm Cable
848065082	1	STM0 Subrack Assembly

Front View
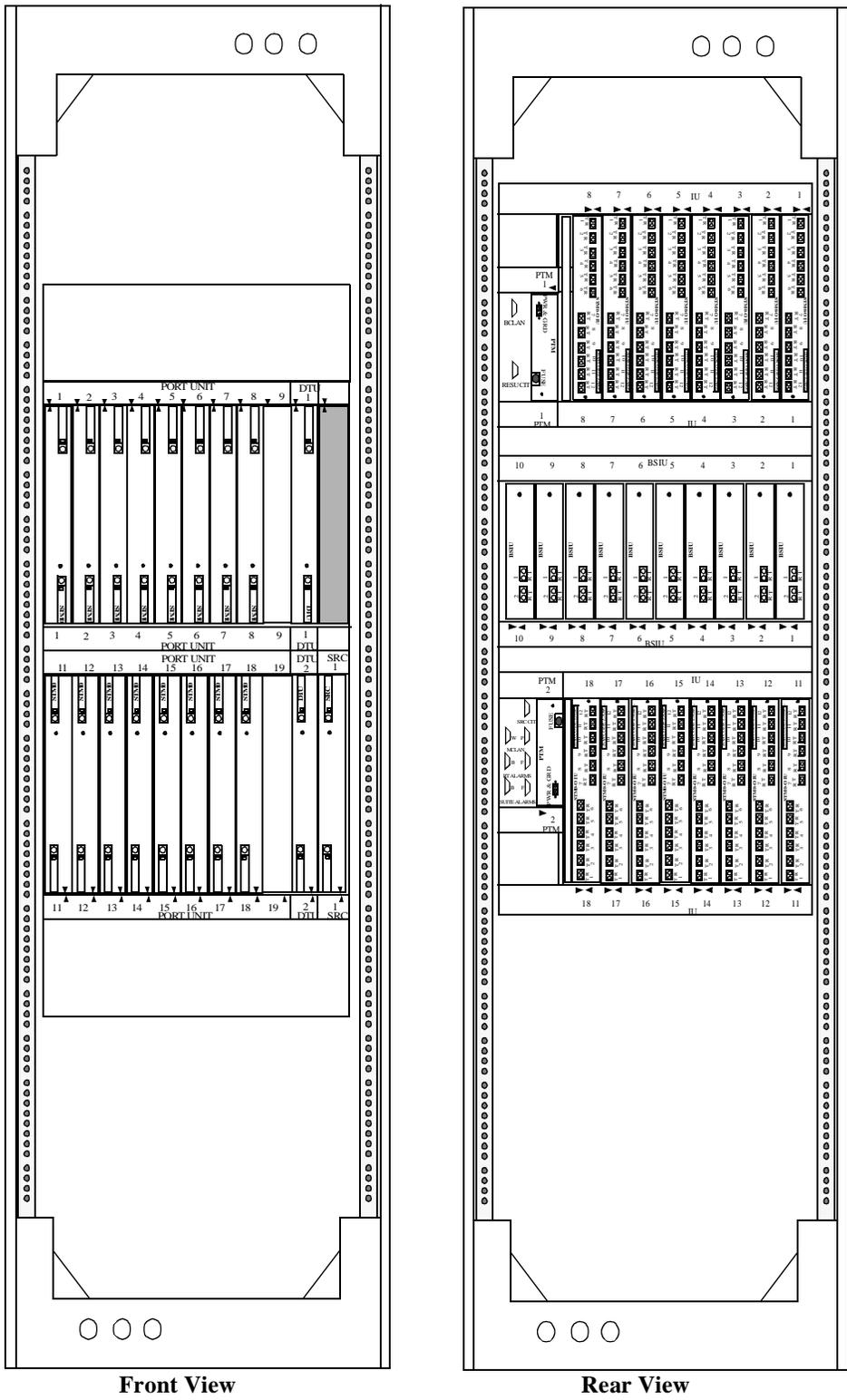
Rear View

Figure 6-3.   Port Rack Equipped with STM0 Port Subrack

STM1 Port Subrack

General

The front view of the STM1 subrack is shown in Figure 6-4. (page 12), the rear view is shown in Figure 6-5. (page 13).

Because of the architecture of the *WaveStar*^{TM} DACS 4/4/1 System, it is necessary to rotate the circuit packs 180 degrees before inserting into the upper shelf. Triangle shaped orientation marks (arrow heads) are provided on both the subrack and the circuit packs to aid in alignment. These marks are shown in Figure 6-4. (page 12). This also applies to the interface units located in the rear of the subrack, this is shown in Figure 6-5. (page 13).

✎ **NOTE:**
The numbering of the units in the front of the subrack is from left to right, and in the rear of the subrack it is from right to left.
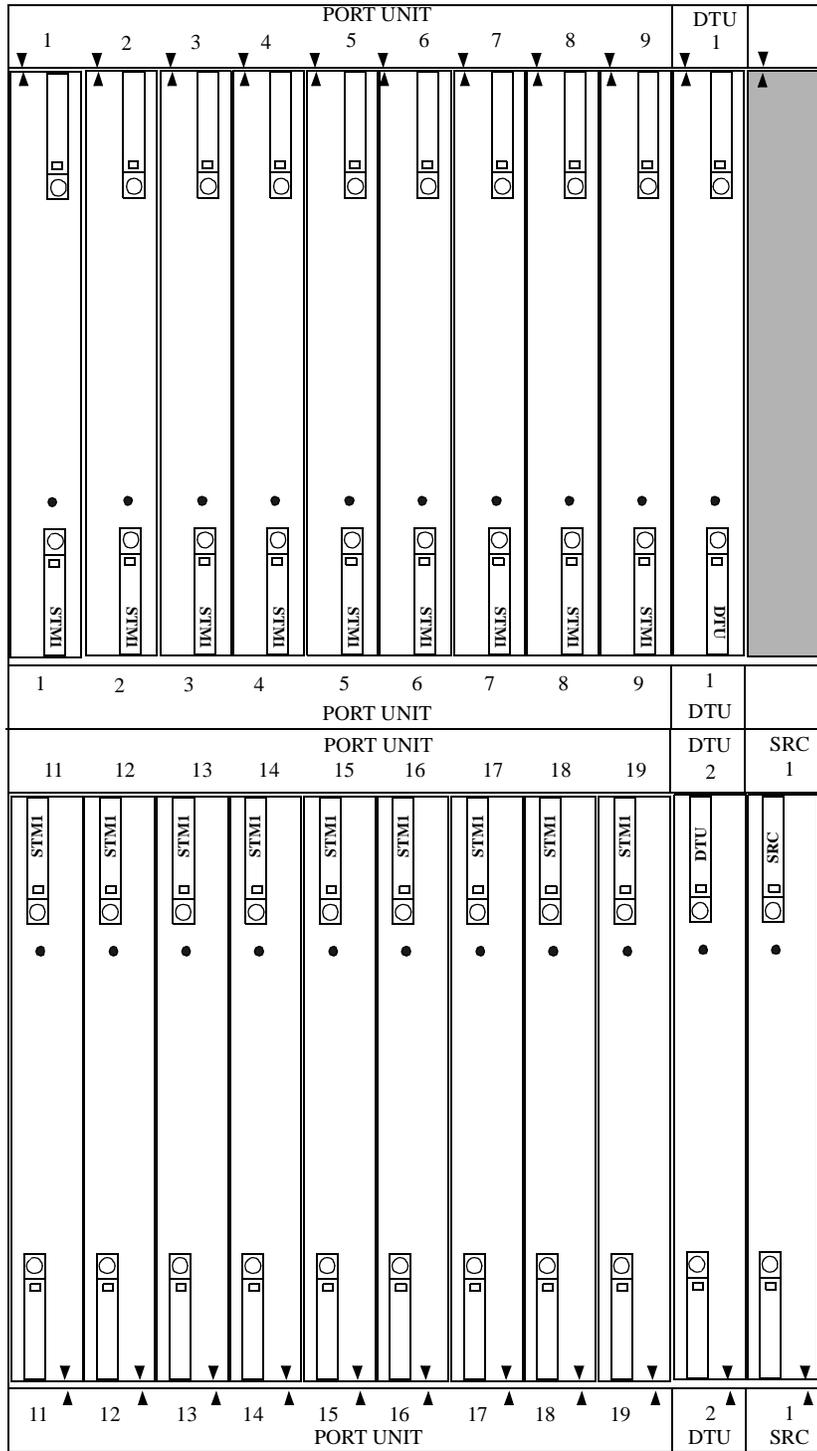
Figure 6-4.   STM1 Port Subrack - Front View
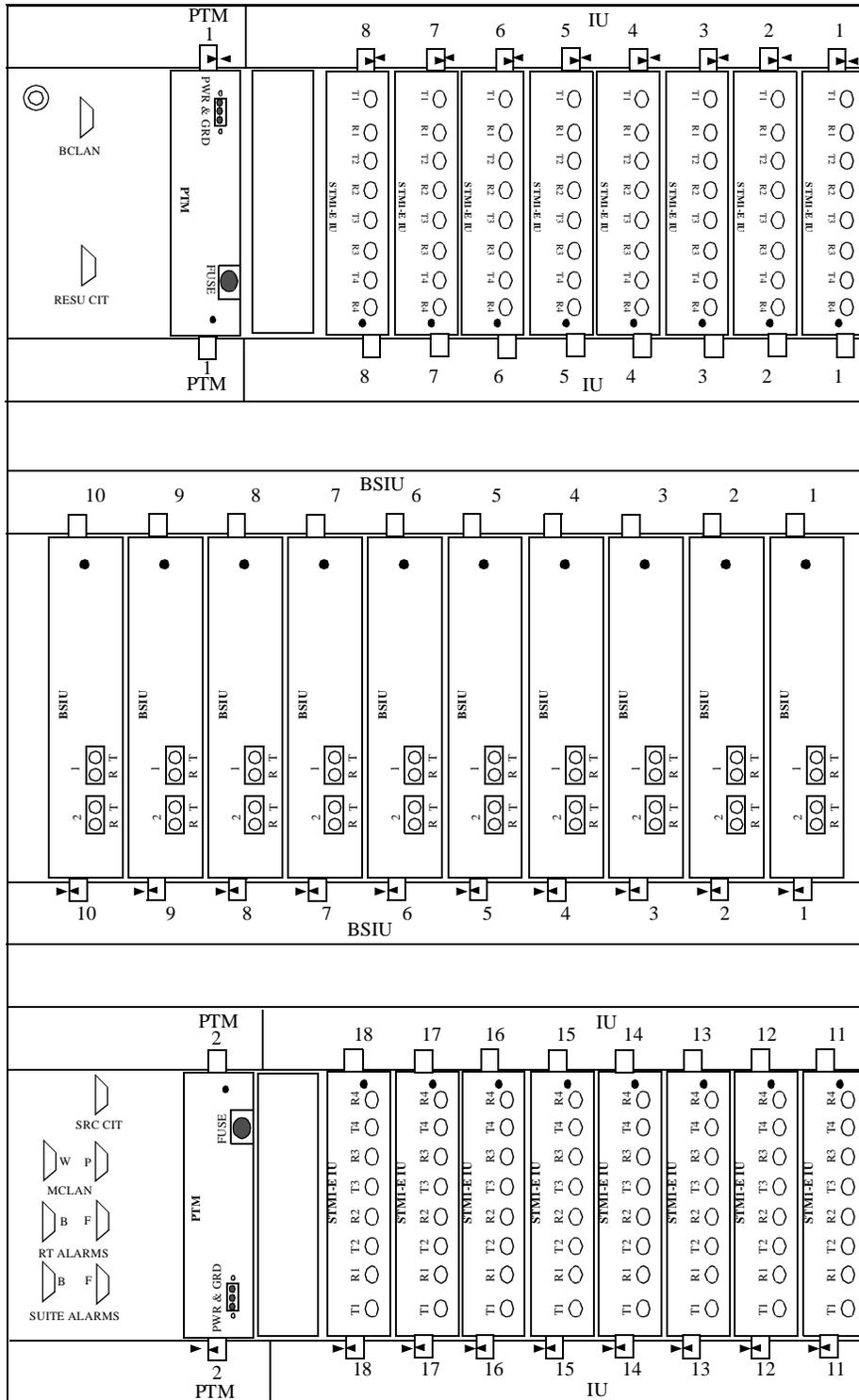
Note: Subrack Shown with STM1 Electrical Interface Units

Figure 6-5.   STM1 Port Subrack - Rear View

STM1 Port Subrack Duplication and Protection

In the Port subrack the SRC unit is not protected. Loss of function of the unit will result in loss of control function at the subrack level. Transmission through the subrack will not be affected. The subrack control will be restored when the failed unit has been replaced.

The DTU is fully duplicated in the subrack.

The BSIU is 2:8 protected in conjunction with the BSSU's in the core complex.

STM1 Port Subrack Protection Configurations

There are three possible subrack protection configurations for the STM1 port sub-rack. These are as follows:

— STM1 Electrical Equipment Protection

— STM1 Optical - Single Fiber

— STM1 Optical - Dual Fiber

These three configurations will be discussed in more detail in the next three headings.

STM1 Electrical Equipment Protection (EEPS)

This configuration **requires the two fiber installation** method, and has a maximum capacity of 64 STM1 equivalents.

MSP operation is not possible in this configuration.

Slots 1 to 8 and 11 to 18 are reserved for working port interfaces. Slots 9 and 19 are reserved for protection port interface units. It is recommended that the working slots be filled sequentially from 1 to 8 then 11 to 18.

STM1 Optical - Single Fiber Configuration

This configuration uses the one fiber wiring method, and has a maximum of 32 STM1 equivalents.

In this configuration, only optical port units can be used, they can be used in either unprotected operation or in MSP line protection operation.

If MSP is used, the odd numbered slots 1,3,5,7,11,13,15,17(except for 9 & 19), are reserved as the working port interface units. The even number slots are reserved for the protection port interface units. MSP works in pairs, therefore, if you provision a MSP pair, the odd number pack is the working unit, and the even number pack to the right is the protection unit.

If there is no MSP protection, then each odd slot (1,3,5,7,11,13,15,17) is capable of providing 4 STM1 equivalents

Slots 9 and 19 are not used in any optical configuration and should be filled with LAH apparatus blanks.

It is recommended that the slot pairs be filled sequentially.

STM1 Optical - Dual Fiber Configuration

This configuration requires the two fiber installation method and can provide a maximum of 64 STM1 equivalents.

In this configuration, only optical port units can be used, they can be used in either unprotected operation or in MSP line protection operation.

If no MSP is used (unprotected), any odd or even slot, except for 9 & 19, can be used as a working port unit. In this configuration, if all (1-8 & 11-18) are used the subrack has 64 STM1 equivalents.

When provisioning an MSP pair, the working unit will always be the odd numbered slot and the even numbered slot to the right will be the protection unit.

✎ **NOTE:**
In this configuration, there can be a maximum of 64 STM1 equivalents only if there is no MSP pairs. For each MSP pair provisioned, you will drop 4 STM1 equivalents.

Slots 9 and 19 are not used in this configuration and should be filled with LAH apparatus blanks. It is recommended that the slot pairs be filled sequentially.

STM1 Port Subrack Circuit Packs

The STM1 subrack circuit packs are listed in Table 6-8. (page 15). This table shows the quantity of circuit packs required *per STM1 subrack*. Each working Port Unit requires an Interface Unit, the interface unit can be either electrical or optical, they are shown in Figure 6-6. (page 16).

Table 6-8. STM1 Port Subrack Circuit Packs (per subrack)

Orderable Code	App. Code	Qty.	Description
108440157	LAH50	1	Subrack Controller (SRC)
108440090	LAH104	2	Digital Timing Unit (DTU)
108727884	IME2B	2	Power Terminal Module (PTM)
107899437	IMO3	10	Bit Slice Interface Unit (BSIU)
108440140	LAH203	1 to 18	STM1 Port Unit
848125126	-	17 to 0	LAH Apparatus Blank[*]
847997111	-	15 to 0	STM1 IU Blank
108168212	IMO5 [++]	1 to 16	STM1 Optical Interface Unit (STM1-O IU)
108349473	IMO6 [++]	1 to 16	STM1 Optical (NTT) Interface Unit (STM1-O IU)
108349481	IMO7 [++]	1 to 16	STM1 Optical (ITU) Interface Unit (STM1-O IU)
108597618	IMO9 [++]	1 to 16	STM1 Optical Interface Unit (STM1-LH)
107899403	IME1 [++]	1 to 16	STM1 Electrical Interface Unit (STM1-E IU)

[++]*The type of customer interface determines the type of Interface Unit required*
* *For MSP configurations, install blanks into slots 9 & 19*
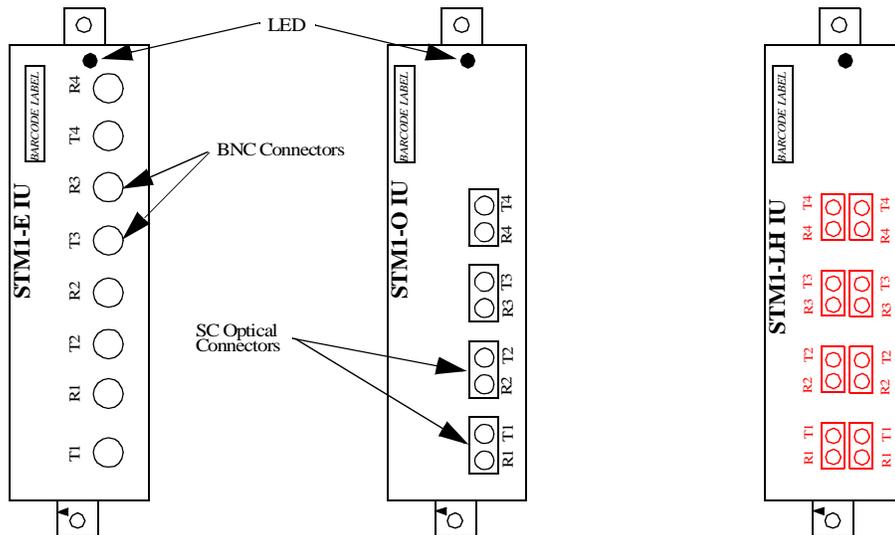
Figure 6-6. **STM1 Port Interface Units**

STM0 Port Subrack

General

The front view of the STM0 port subrack is shown in Figure 6-7. (page 17) and the rear view is shown in Figure 6-8. (page 18). Due to the size of the STM0 subrack only one subrack can physically fit into a *WaveStar*^{TM} DACS 4/4/1 System rack.

Because of the architecture of the *WaveStar*^{TM} DACS 4/4/1 System, it is necessary to rotate the circuit packs 180 degrees before inserting into the upper shelf. Triangle shaped orientation marks are provided on both the subrack and the circuit packs to aid in alignment. These marks are shown in Figure 6-7. (page 17).

This orientation also applies to the interface units located in the rear of the subrack.
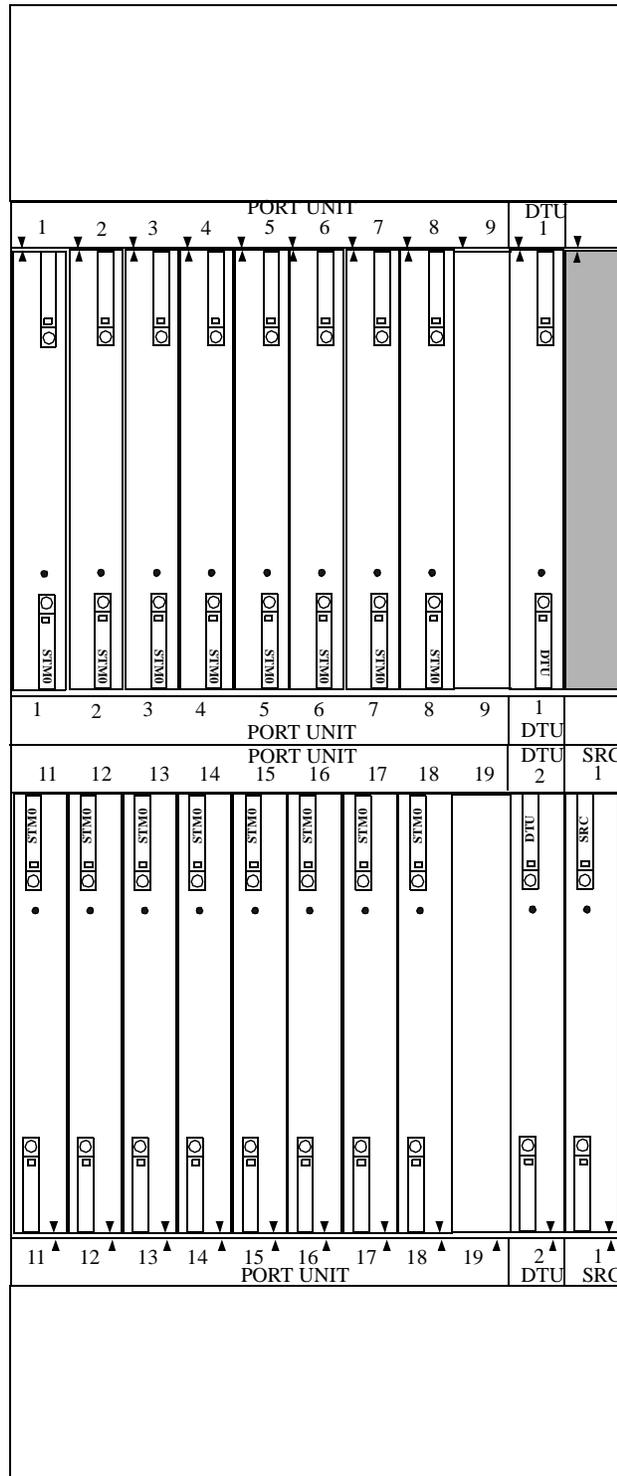
Figure 6-7.   STM0 Subrack - Front View
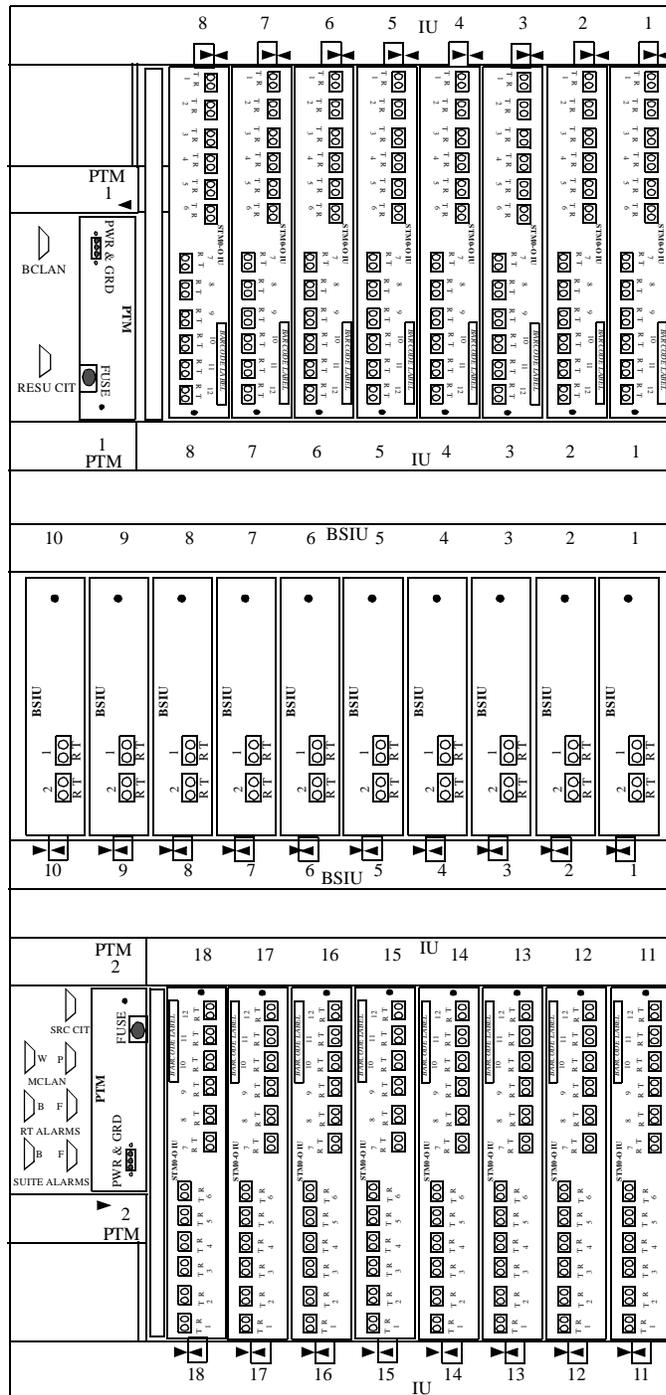
Figure 6-8.   STM0 Subrack - Rear View

STM0 Port Subrack Duplication and Protection

In the port subrack the SRC unit is not protected. Loss of function of the unit will result in loss of control function at the subrack level. Transmission through the subrack will not be affected. The subrack control will be restored when the failed unit has been replaced.

The DTU unit is fully duplicated in the subrack.

The BSIU is 2:8 protected in conjunction with the BSSU's in the core complex.

STM0 Port Subrack Protection Configurations

There are two possible subrack protection configurations that can be provisioned for the STM0 subrack.

STM0 Optical Single Fiber

This configuration required the one fiber installation method and can handle up to a maximum of 32 STM1(96 STM0) equivalents.

This subrack can only use optical port units in either unprotected operation or in MSP line protection operation.

If no MSP(unprotected) is desired. The odd numbered slots (1,3,5,7,11,13,15,17) are used. The even numbered slots can be filled with blanks (filler plates)

If MSP is used, the odd numbered slots will be the working units, and the even numbered slots will be the protection.

In growth situations, it is recommended that the slots be filled sequentially.

STM0 Optical Dual Fiber

This configuration requires the two fiber installation method and can provide up to a maximum of 64 STM1(192 STM0) equivalents. This subrack configuration only uses optical STM0 port interface units in either unprotected operation or MSP line protection operation.

If no MSP(unprotected) is desired, any slot, odd or even, can be used as a working port unit. If all port units are used, a maximum of 192 STM0 ports are created.

When configuring an odd/even MSP pair, the odd numbered unit will be the working unit and the even numbered unit to the right will be the protection unit. This pair would constitute one MSP pair. For each MSP pair configured, the subrack capacity decreases by 12 STM0(4 STM1) equivalents.

In growth situations, it is recommended that the slots be filled sequentially.

STM0 Port Subrack Circuit Packs

The STM0 subrack circuit packs are listed in Table 6-9. (page 20).

One Interface Unit is required for every working port unit in the subrack. The STM0 optical interface unit uses SC optical connectors.

Table 6-9.   STM0 Port Subrack Circuit Packs (per Subrack)

Orderable Comcode	App. Code	Qty.	Description
108440157	LAH50	1	Subrack Controller (SRC)
108440090	LAH104	2	Digital Timing Unit (DTU)
108727884	IME2B	2	Power Terminal Module (PTM)
107899437	IMO3	10	Bit Slice Interface Unit (BSIU)
108440132	LAH202	1 to 16	STM0 Port Unit
848125126	-	15 to 0	LAH Apparatus Blank
848137923	-	15 to 0	STM0 IU Blank
108349499	IMO8	1 to 16	STM0 Optical Interface Unit (STM0-O IU)

STM4/16 Port Subrack

General

The Port Subrack C (PSC) has front and rear sections that are partitioned for plug-in units. The units plug into a midplane that separates the front and rear sections and provides the interconnections between units. The PSC can be equipped with STM-16 or STM-4 optical port units. For this release, STM-16 and STM-4 port units cannot be mixed in the same PSC subrack

STM4/16 Port Subrack Duplication and Protection

In the PSC port subrack the SRC unit is not protected. Loss of function of the unit will result in loss of control function at the subrack level. Transmission through the subrack will not be affected. The subrack control will be restored when the failed unit has been replaced.

The DTU unit is fully duplicated in the subrack.

The BSIU is 2:8 protected in conjunction with the BSSU's in the core complex.

STM4/16 Port Subrack Protection Configurations

There are three possible subrack protection configurations that can be provisioned for the STM4/16 subrack.

STM4/16 Optical Single Fiber

This configuration requires only one of the four possible fiber pairs are connected between the BSIU's and the BSSU's.

This configuration uses only the odd slots #1 and #3, these can be used to produce 2 STM-16 equivalents *or* 8 STM-4 equivalents. The Even slots could be left blank or be used to create an MSP pair with the working unit in the odd slots.

In growth situations, it is recommended that the slots be filled sequentially.

STM4/16 Optical Dual Fiber

This configuration requires two of the four possible fiber pairs are connected between the BSIU's and the BSSU's.

This configuration uses only the odd slots (1,3,5,7) can be used to produce 4 STM-16 equivalents *or* 16 STM-4 equivalents. The Even slots could be left blank or be used to create an MSP pair with the working unit in the odd slots.

In growth situations, it is recommended that the slots be filled sequentially.

STM4/16 Optical Quad Fiber

This configuration requires all four of the fiber pairs are connected between the BSIU's and the BSSU's.

In Unprotected mode, this configuration can produce 8 STM-16 equivalents, *or* 32 STM-4 equivalents.

For *each* MSP group provisioned, one STM-16 (or four STM-4) will be lost.

In growth situations, it is recommended that the slots be filled sequentially.

STM4/16 Port Subrack Circuit Packs

The STM-4/16 subrack circuit packs are listed in Table 6-10. (page 22).

Table 6-10.   STM4/16 Port Subrack Circuit Packs (per Subrack)

Orderable Comcode	App. Code	Qty.	Description
108440157	LAH50	1	Subrack Controller (SRC)
108568106	LAH108	2	Digital Timing Unit (DTU)
108727884	IME2B	2	Power Terminal Module (PTM)
108505264	LAL65	10	Bit Slice Interface Unit (BSIU)
108904020	LAC8B	1 to 8	STM-16 Interface / Port Unit
108904012	LAC6B	1 to 8	STM-4 Interface / Port Unit
	-	15 to 0	Apparatus Blank
	-	15 to 0	IU Blank

System Cable Installation

7

System Cabling

The system cabling is defined as the cabling contained within the envelope of the *WaveStar*^{TM} DACS 4/4/1 System (i.e. non-station cabling).This cabling provides connectivity within the Core Complex and between the Core Complex and the Port Complexes.

This chapter will provide information for installing the MC LAN cables, all fiber connections and any remaining misc. system cables.

MC LAN Connections

General Information

The controller interface between the MC subrack and the SYNC and PORT subracks is provided via a data cord using RJ45 modular connectors. A list of the available data cord lengths is shown in Table 7-1. (page 2)

Table 7-1.   MCLAN Data Cords

Equipment Code	Description	Quantity
	7.6 m LAN Cable	
108566530	15 m LAN Cable	1 LAN Cable required per subrack
108566548	30.5 m LAN Cable	
108566555	61m LAN Cable	

The 15m length are typically used for a contiguous system, the 31.5m and the 61m lengths are used for the remoted Port Racks. The 7.6m length is used solely for the core complex connection to the SYNC subracks. However, these are already provided as part of the core complex rack equipment.

An illustration of these connections is shown in Figure 7-1. (page 2)
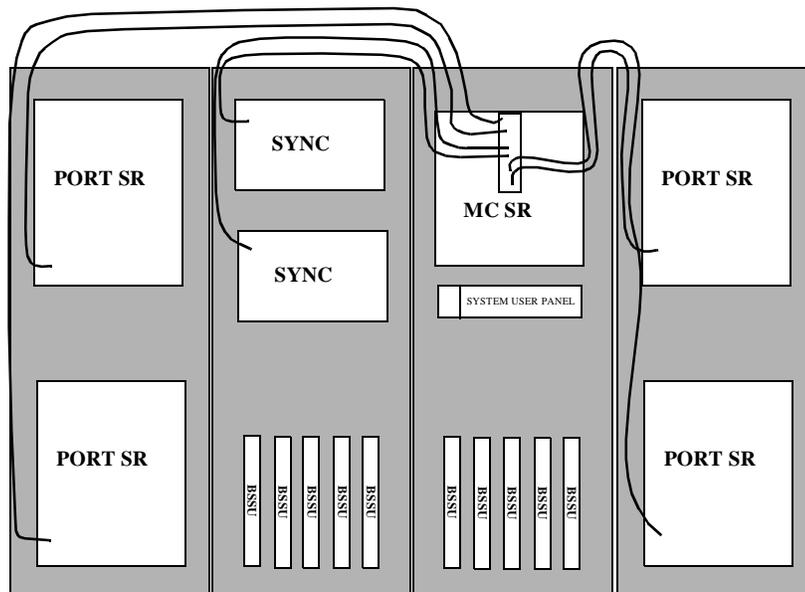
Rear View **of System**

Figure 7-1.   MCLAN Connections

Making MC Connections

The MC LAN connections go from the LAN Hub card located in the main controller, to the connector panel on the rear of each subrack.

The LAN Hub card is shown in detail in Figure 7-2. (page 4).

The MC LAN connector on each subrack is shown in Figure 7-3. (page 4). The connector panels are on the subracks are located at the lower left portion of the subrack as viewed from the rear of the rack.

Labelling Kit 408112357 is included with each system to properly label each end of the MC Lan cables.

Installing MC LAN Cables

Step 1: Using Table 7-2. (page 5) and labeling kit 408112357, *label <u>each end</u> of all the MC Lan cables* to be installed.

Step 2: If using an Overhead cable rack, follow step 2-a, if system is mounted in a raised floor environment and underfloor cabling is used, follow step 2-b.

Step 2-a: **Overhead Cable Rack**: As viewed from the rear of the MC rack, run the MC Lan cable down from the cable tray, down the *right* side of the MC rack to the LAN Hub connector panel and make the connection at the appropriate LAN Hub location at the front of the LAN Hub unit. Figure 7-2. (page 4) provides a visual reference.

As view from the rear of the connecting port rack, run the other end of the MC Lan cable down from the cable tray, down the *left* side of the appropriate port rack and make the connection to the MC Lan working connector.

If possible, store any extra length of the MC Lan cable in the overhead cable tray.

Step 2-b: **Under Floor Cable Rack**: As viewed from the rear of the MC rack, run the MC Lan cable up from the cable tray, up the *right* side of the MC rack to the LAN Hub Unit and make the connection to the appropriate connector at the front of the LAN Hub unit. Figure 7-2. (page 4) provides a visual reference.

As view from the rear of the connecting port rack, run the other end of the MC Lan cable up from the cable tray, up the *left* side of the appropriate port rack and make the connection to the MC Lan working connector.

If possible, store any extra length of the MC Lan cable in the cable tray.

Step 3: Repeat step 2 until all MC Lan cables are installed
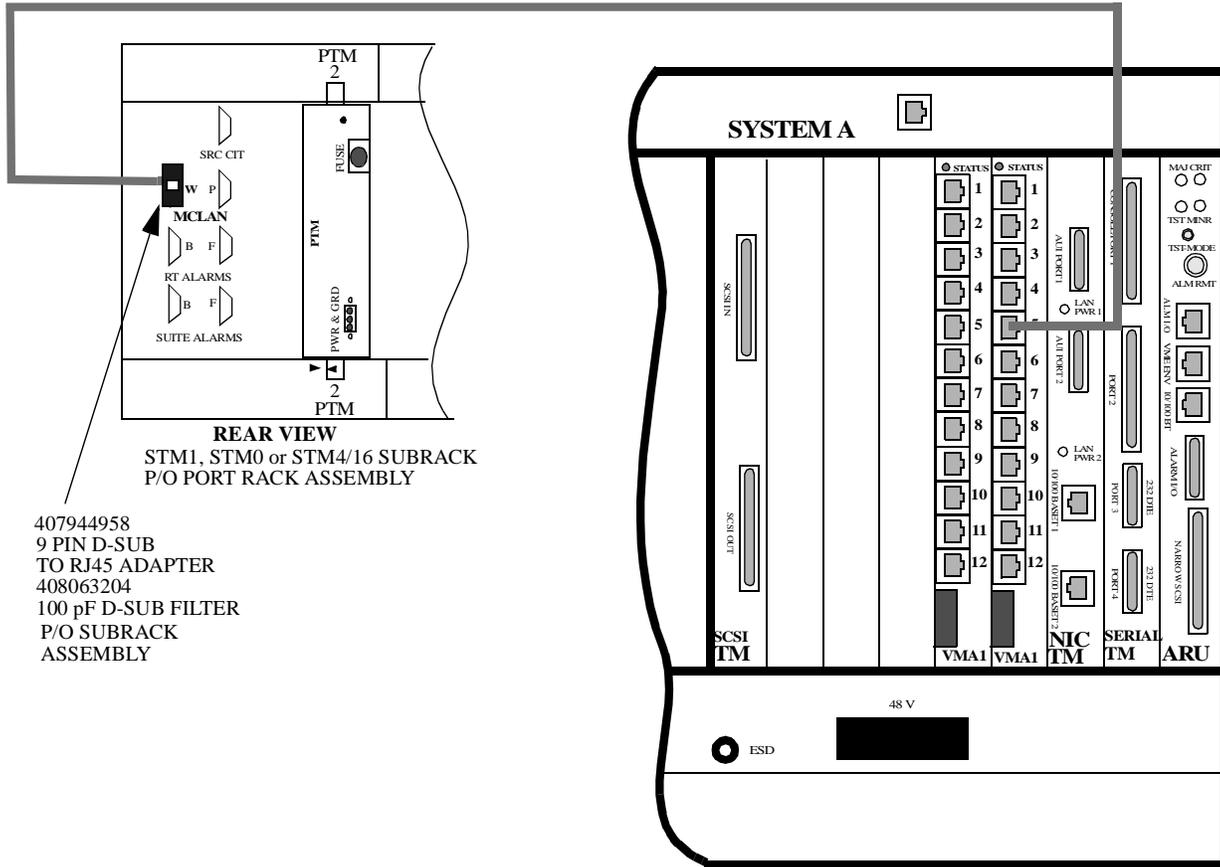
Figure 7-2.   LAN Hub Unit - MCLAN Port Connections
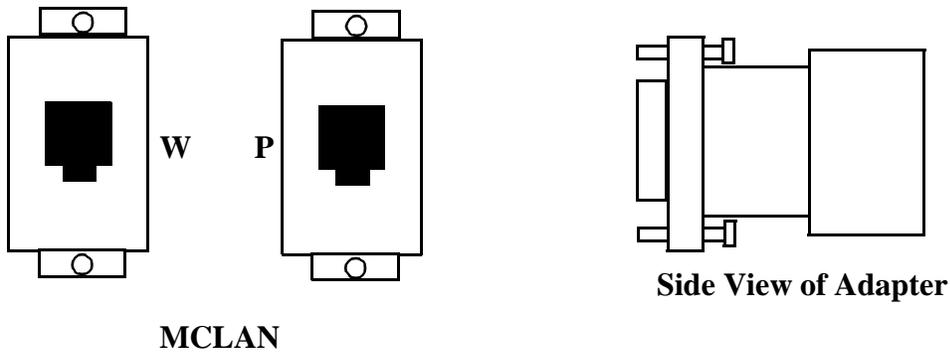
**Figure 7-3.   Subrack MCLAN Connector
(Rear View Of Subrack)**

Table 7-2.   MC LAN Connection Label and Fill Sequence

MC Lan Port	Subrack	Cable Label (Kit 408112357)
LHU1, Port-1	*MC Subrack (working)*	MC-W
LHU1, Port-2	*MC Subrack (protection)*	MC-P
LHU1, Port-3	*MS Subrack (working)*	MS-W
LHU1, Port-4	*MS Subrack (protection)*	MS-P
LHU1, Port-5	*1st* Port Subrack	Port 1
LHU1, Port-6	*2 nd* Port Subrack	Port 2
LHU1, Port-7	*3 rd* Port Subrack	Port 3
LHU1, Port-8	*4 th* Port Subrack	Port 4
LHU1, Port-9	*5 th* Port Subrack	Port 5
LHU1, Port-10	*6 th* Port Subrack	Port 6
LHU1, Port-11	*7 th* Port Subrack	Port 7
LHU1, Port-12	*8 th* Port Subrack	Port 8
LHU2, Port-1	*9 th* Port Subrack	Port 9
LHU2, Port-2	*10 th* Port Subrack	Port 10
LHU2, Port-3	*11 th* Port Subrack	Port 11
LHU2, Port-4	*12 th* Port Subrack	Port 12
LHU2, Port-5	*13 th* Port Subrack	Port 13
LHU2, Port-6	*14 th* Port Subrack	Port 14
LHU2, Port-7	*15 th* Port Subrack	Port 15
LHU2, Port-8	*16 th* Port Subrack	Port 16
LHU2, Port-9	Not Used at this time.	
LHU2, Port-10	Not Used at this time.	
LHU2, Port-11	Not Used at this time.	
LHU2, Port-12	Not Used at this time.	

SYNC Duplication Connection

General Information

The working (top) and protection (bottom) SYNC subracks are linked together via the SYNC duplication cable. The main function of this cable is to allow the two SYNC subracks to share state-of-health information.

The SYNC duplication cable code is shown in Table 7-3. (page 6).

Figure 7-4. (page 6), depicts the SYNC duplication cable, this is factory installed, this figure should be used as a reference.

Table 7-3.   SYNC Duplication Cable

Equipment Code	Description
848027991	SYNC Duplication Cable (1.3 m long)

SYNC Subracks located in MS Rack (rear view)
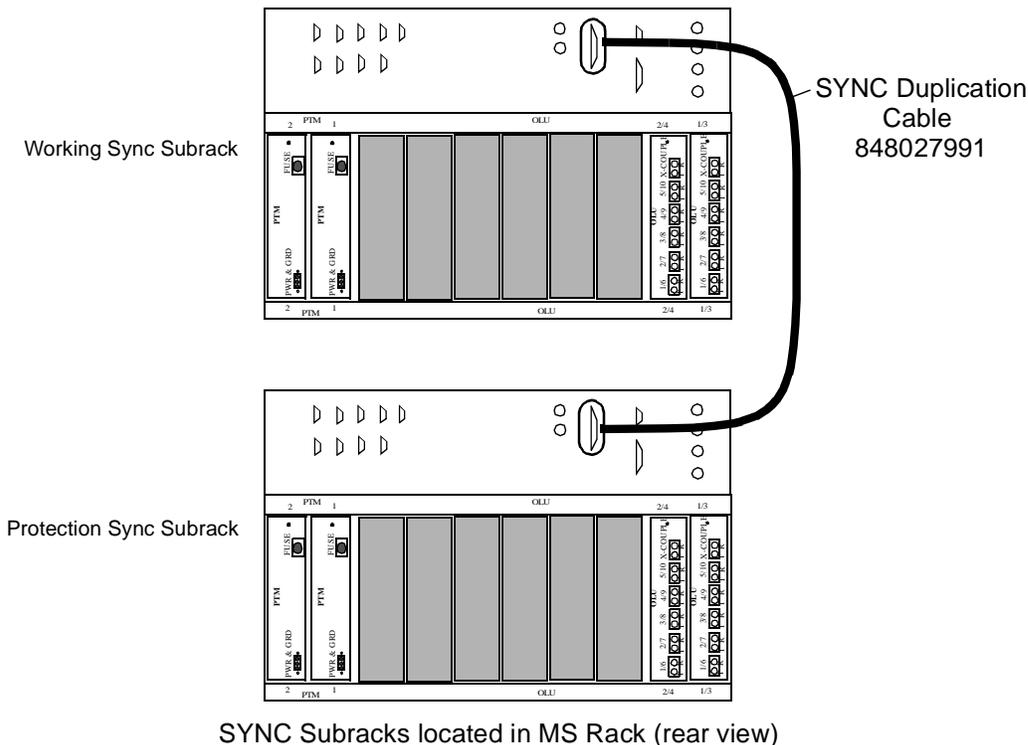
Figure 7-4.   SYNC Subrack Duplication Connection

Internal Fiber Connections

This section will describe the installation of the BSC X-couple fibers, the Bit Slice Fiber Interface (BSFI) fibers, and the Equipment Core Interface (ECI) fibers. The details will include the labeling, installation, routing and connections. Each possible configuration will have its own instruction set.

BSC X-Couple Connections

The BSC's are cross-coupled via a duplex plastic fiber optic cable between the OLU units located in the working and protection SYNC subracks. The 2m cables listed in Table 7-4. (page 7) are used for this connection, 2 of these cables are required.

Table 7-4.   BSFI Optical Cable Code (OLU X-Couple)

Equipment Code	Description
848134185	BSFI Duplex Optical Cable (2 m long)

Installing X-Couple fibers

Using Figure 7-5. (page 8), label and Install the BSC X-coupled cables as shown. The labels show in Figure 7-5. (page 8) are found in label kit 408112365.

Carefully coil and store excess cable in right side channel of MS rack, as viewed from the rear.
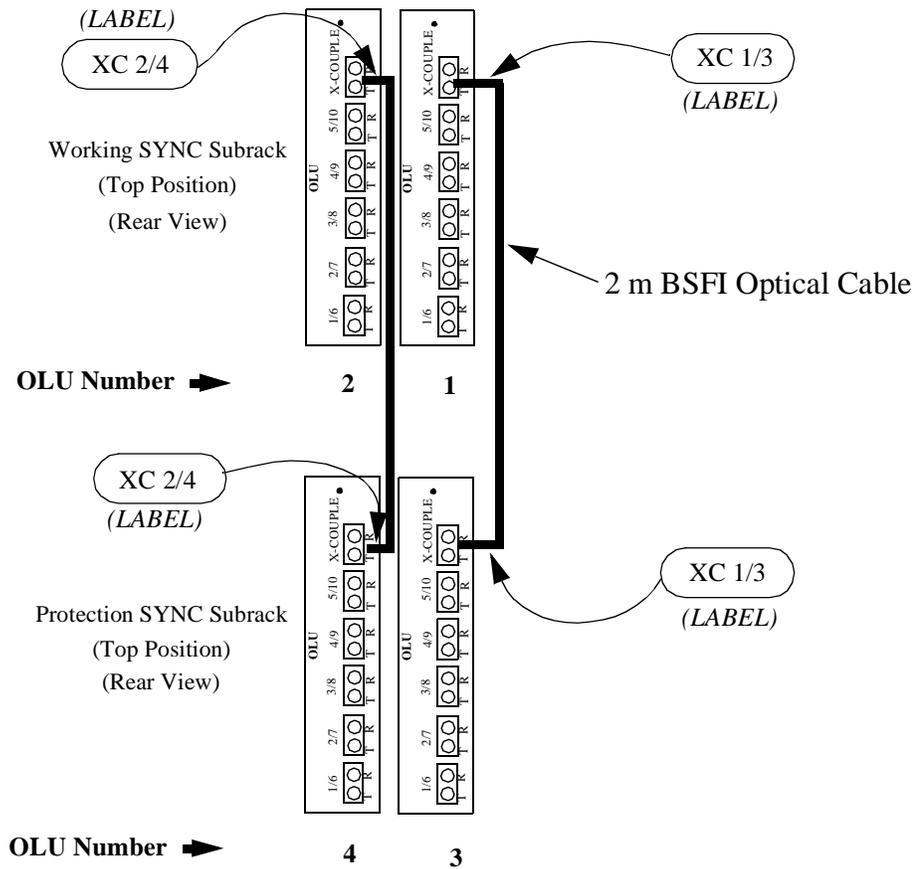
Figure 7-5.   BSC (OLU) Cross-Couple Connections

Bit Slice Fiber Interface (BSFI) Connections

The BSFI is the timing and control link between the BSC and the BSSU's. These are fiber links using a duplex plastic fiber optical cable. The actual link occurs between the BSSU's and the OLU's located in the rear of the MS rack, in the SYNC subracks. The cables used for this connection are listed in Table 7-5. (page 9), 20 of these cables are required.

Table 7-5.   BSFI Optical Cable Code (OLU to BSSU)

Equipment Code	Description
848134177	BSFI Duplex Optical Cable (4 m long)

Installing BSFI Fibers

Figure 7-7. (page 10), provides an example of the names and locations of the required connections, this figure also provides an example of the required cable labels on each end of each cable. These labels are part of label kit 408112365.

Figure 7-8. (page 11), illustrates all of the necessary OLU to BSSU connections.

Table 7-6. (page 12), is a table containing all of the connections shown in Figure 7-8. (page 11), this also includes the necessary cable tag or label information.

Using the example shown in Figure 7-7. (page 10), the actual connections shown in Figure 7-8. (page 11) and Table 7-6. (page 12), label and install the BSFI fiber cables as shown.

When selecting the fibers to label and install, use the 4m fibers listed in Table 7-4. (page 7) for all of the OLU to BSSU connections.

Figure 7-6. (page 9) depicts the BSFI cable dressing to the OLU's.
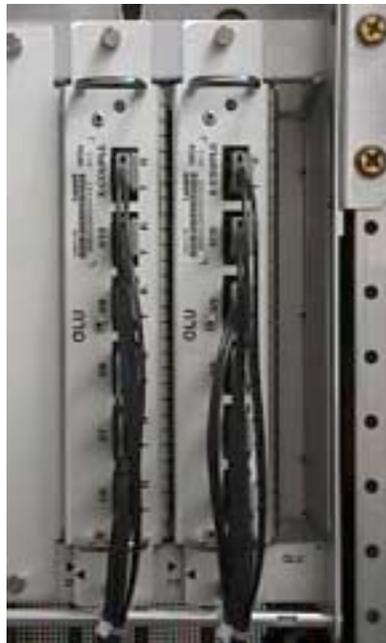
Figure 7-6.   BSFI Cable routing to OLU's
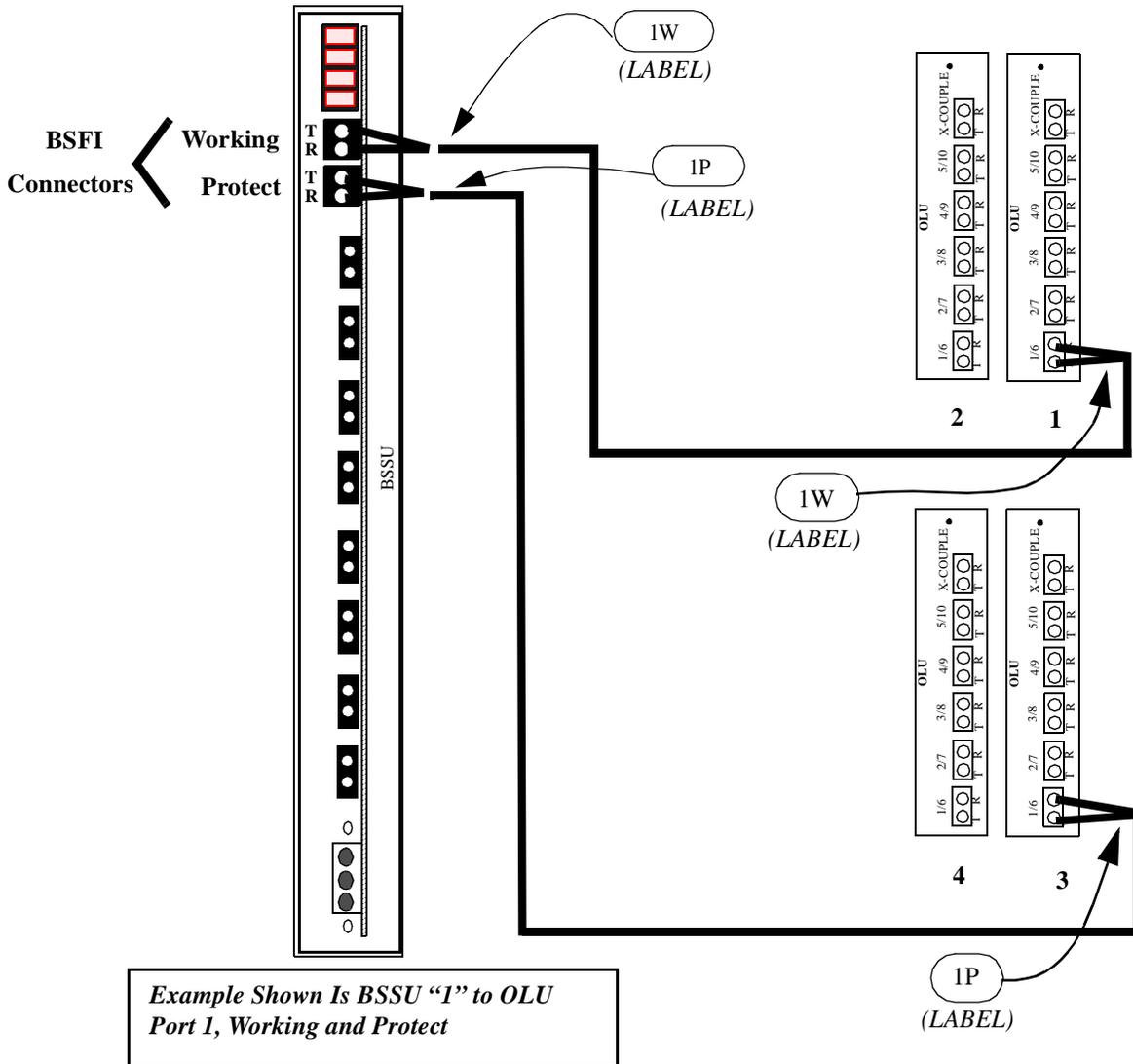
Figure 7-7.   Example of BSSU to OLU Fiber Link
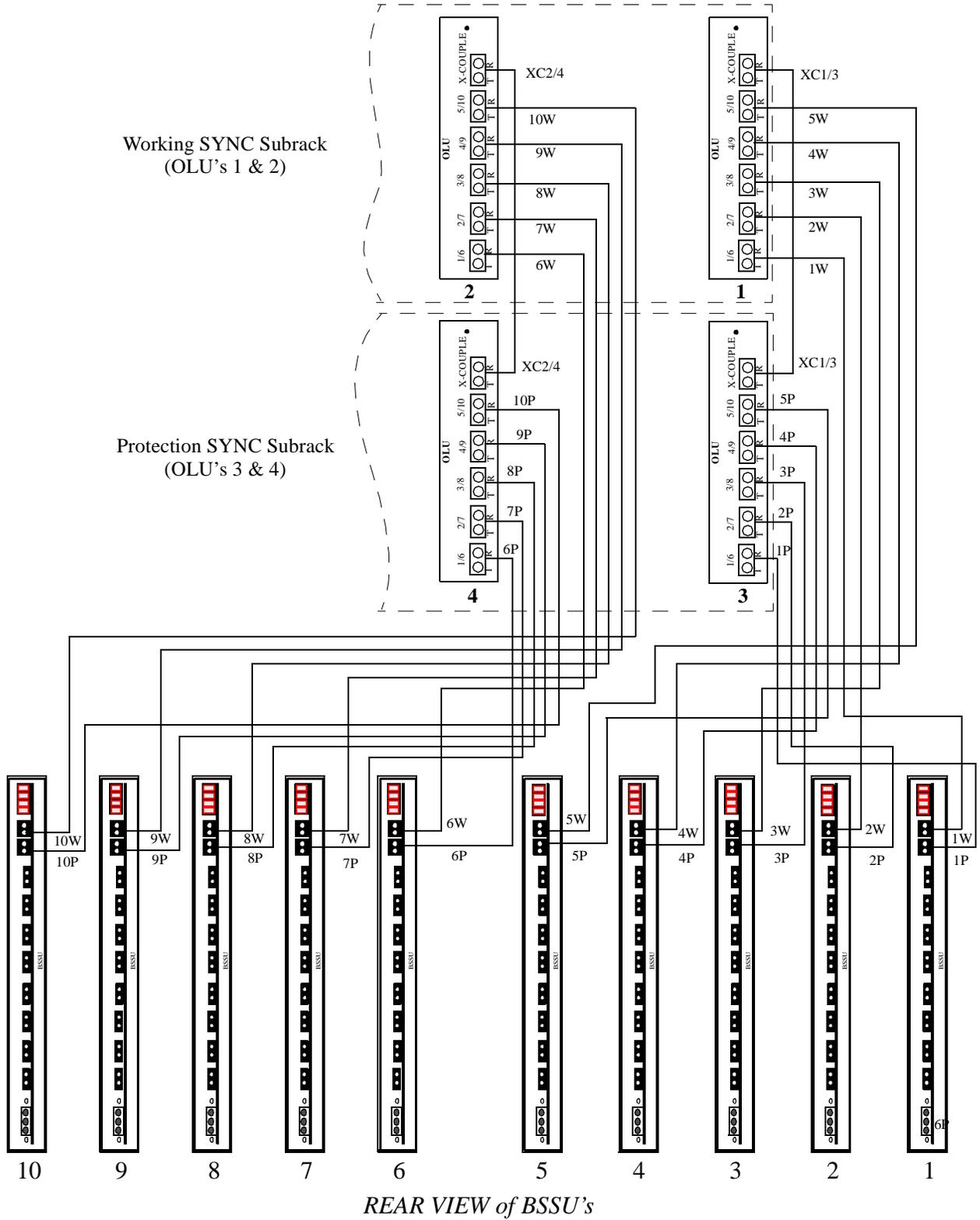
Figure 7-8.   OLU to BSSU Fiber Connections

Table 7-6. BSFI Fiber Connections (OLU to BSSU)

From:		To:		Label (Both Ends) Label Kit 408112365
OLU Number	Port Number	BSSU Number	BSFI Port	
1	1	1	W	1W
1	2	2	W	2W
1	3	3	W	3W
1	4	4	W	4W
1	5	5	W	5W
2	6	6	W	6W
2	7	7	W	7W
2	8	8	W	8W
2	9	9	W	9W
2	10	10	W	10W
3	1	1	P	1P
3	2	2	P	2P
3	3	3	P	3P
3	4	4	P	4P
3	5	5	P	5P
4	6	6	P	6P
4	7	7	P	7P
4	8	8	P	8P
4	9	9	P	9P
4	10	10	P	10P

Equipment Core Interface (ECI) Connections

General Information

The ECI is the 622 Mb/s transmission interface between the BSIU units, located in port subracks, and the BSSU's located in the Core Complex. These are fiber links using glass fiber optic cables with LC and/or SC connectors. Various lengths and versions of these cables are listed in Table 7-7. (page 13).

The 12m length are used for the contiguous system lineups, while the 50m lengths are used for the remoting of port subracks.

Table 7-7.   ECI Optical Cable Codes (BSIU to BSSU)

Equipment Code	Description	Associated Software Release	Qty Req'd for 1 Fiber Subrack	Qty Req'd for 2 Fiber Subrack
106908767	ECI Fiber Cable Length: 12m Connectors: SC-SC Fiber: Simplex multimode 3.0mm standard cable	1.0 1.1	20	40
106473523	ECI Fiber Cable Length: 50m Connectors: SC-SC Fiber: Simplex multimode 3.0mm standard cable	1.0 1.1	20	40
848548160	512 Upgrade Jumper (ECI fiber cable) Length: 10 inches Connectors: LC-SC (with SC adapter) Fiber: Duplex multimode 1.6mm mini-cord cable	2.0	10	20
108027475	ECI Fiber Cable Length: 12m Connectors: LC-SC Fiber: Duplex multimode 1.6mm mini-cord cable	2.0	10	20
848548186	ECI Fiber Cable Length: 50m Connectors: LC-SC Fiber: Duplex multimode 1.6mm mini-cord cable	2.0	10	20
107737009	ECI Fiber Cable Length: 12m Connectors: LC-LC Fiber: Duplex multimode 1.6mm mini-cord cable	2.1 (09/2000)	10	20

The BSIU's for the STM1 subrack can accommodate 1 or 2 pair of fibers. The BSIU's for the STM4/16 subrack can accommodate 1,2 or 4 pair of fibers.

These configurations are listed in Table 7-8. (page 14).

Table 7-8.   Subrack Cabling Configurations

Subrack Type	Fiber Method	Subrack STM1 Equivalents
STM1 Electrical	2 Fiber	64
STM1 Optical	1 Fiber	32
	2 Fiber	64
STM0 Optical	1 Fiber	32
	2 Fiber	64
STM4/16 Optical	1 Fiber	32
	2 Fiber	64
	4 Fiber	128

Labeling ECI Fibers

When Labeling the ECI fibers, either for a "1 fiber" or "2 fiber" system, you must follow the same labeling scheme, The labeling for these fibers are dependent upon where the connection terminates on each BSSU. Once it has been determined how many subracks are being used, and what the protection scheme is, you will be able to determine which labels to use on the fibers to be installed, based on what BSSU port they terminate on.

Use the Figure 7-9. (page 15) to determine what the fiber numbers are, then label each end of the fiber the same. Use label kit 408112373 to put the fiber numbers on each of the fiber cables.

Once you've determined what numbers you are using, it will be very helpful to create bundles of 10 fiber cables (i.e. numbers 1-10, 11-20, 21-30....151-160). The numbers you use, as mentioned above will depend on the location of the fibers in the BSSU's.

If the system is using LAC5 BSSU units, the number scheme will remain the same, except you will be able to number up to 320.
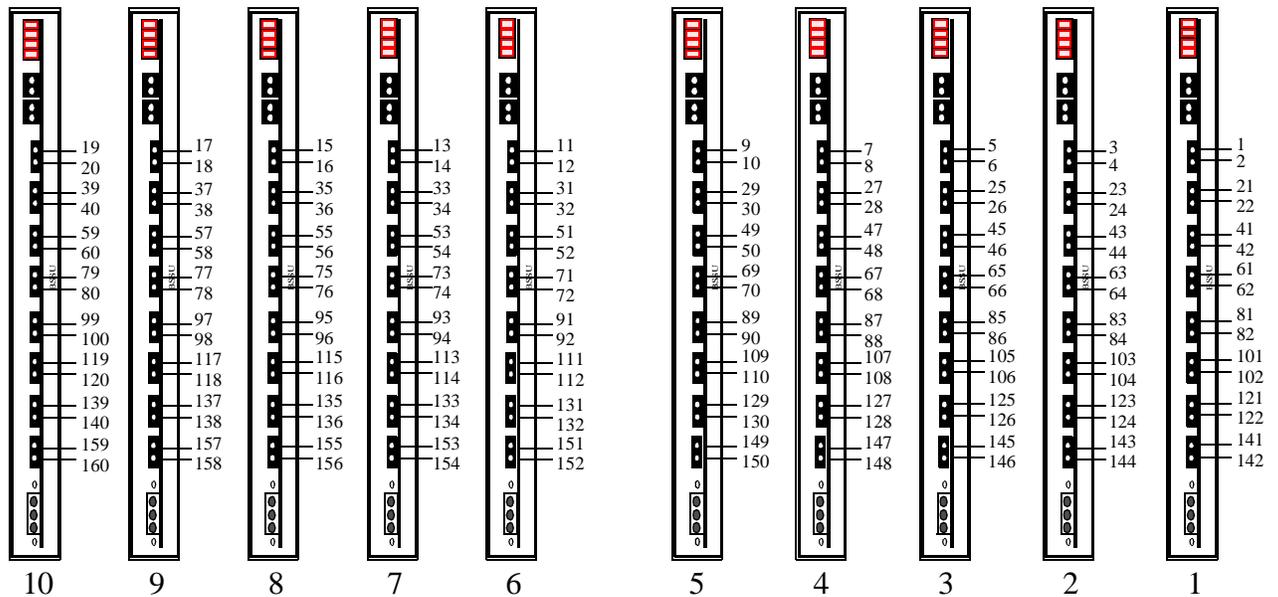
Rear View of BSSU's (256 Capacity Configuration)

NOTE: IF the system is configured as a 512 Capacity system, this number would stay the same, only it would increase to 320

Figure 7-9.   ECI Fiber Numbering Diagram

Routing ECI Fibers

Regardless of a "2 Fiber" or "1 Fiber" system, the routing will follow the same scheme for all subracks. In either subrack, PSA or PSB, the first 5 BSIU's (BSIU's 1-5) worth of fibers must be run down the right side of the rack, as viewed from the rear, and the second 5 BSIU's (BSIU's 6-10) must be run down the left side of the rack, as viewed from the rear. Figure 7-10. (page 16) depicts this fiber routing method.

At the BSSU end of the ECI fibers, all the ECI fibers should be run down the left side of the rack, as viewed from the rear, the dressed to their exact position. This applies to both the MC and MS racks. Figure 7-11. (page 16) depicts this routing method.
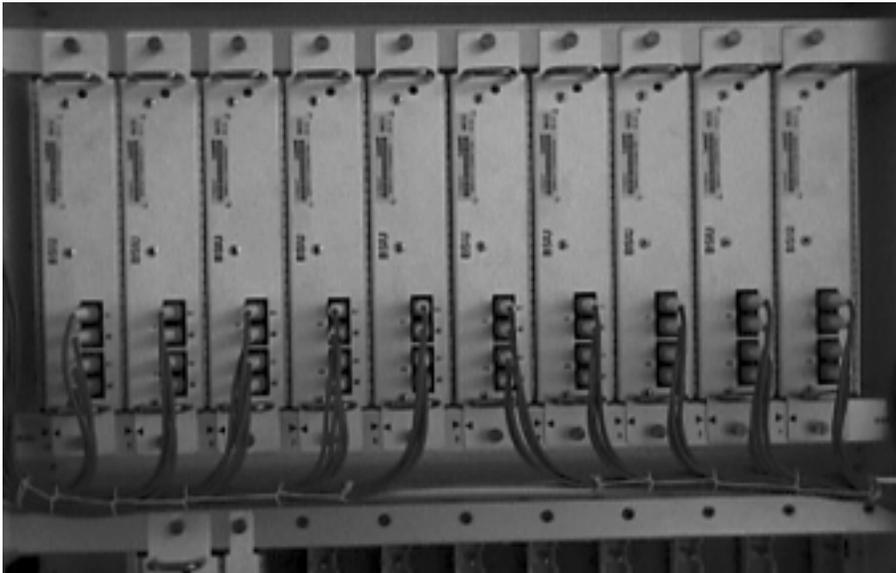
Figure 7-10.   ECI Cable Routing to the BSIU's

Figure 7-11.   ECI Cable Routing to the BSSU's

2 Fiber Subrack Configuration

In a 2 fiber subrack, there are two pairs of fibers per "bit slice", for a total of 40 fibers from the subrack (BSIU's) distributed to the BSSU's. For ease of installation, make 4 bundles of 10 each fibers, and label them appropriately as discussed earlier. This can be done by using Figure 7-9. (page 15) and Table 7-9. (page 19) to determine the correct fiber label numbers.

There can be a maximum of 4 two fiber subracks in a system.

With this fibering configuration you must use the same pair of ECI connections on each BSSU, this is shown in Figure 7-12. (page 17).

A typical ECI link showing the first 2 Bit Slices of a port subrack number "n" is shown in Figure 7-13. (page 18).

The ECI fibering for a 256 STM1 maximum I/O capacity system using 2 fiber subracks is shown in Table 7-9. (page 19). This table is 4 pages long, providing "from/to" and labeling information for each of the 4 possible 2 fiber subracks. The first subrack being "n" and the 4th subrack being "n+3"
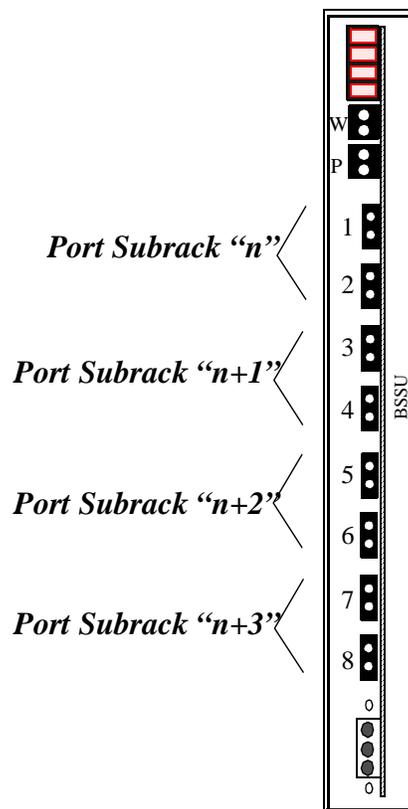
Figure 7-12.   ECI Connector Assignments - 2 Fiber Subrack

SUBRACK "n"

"Bit Slice" 2   "Bit Slice" 1
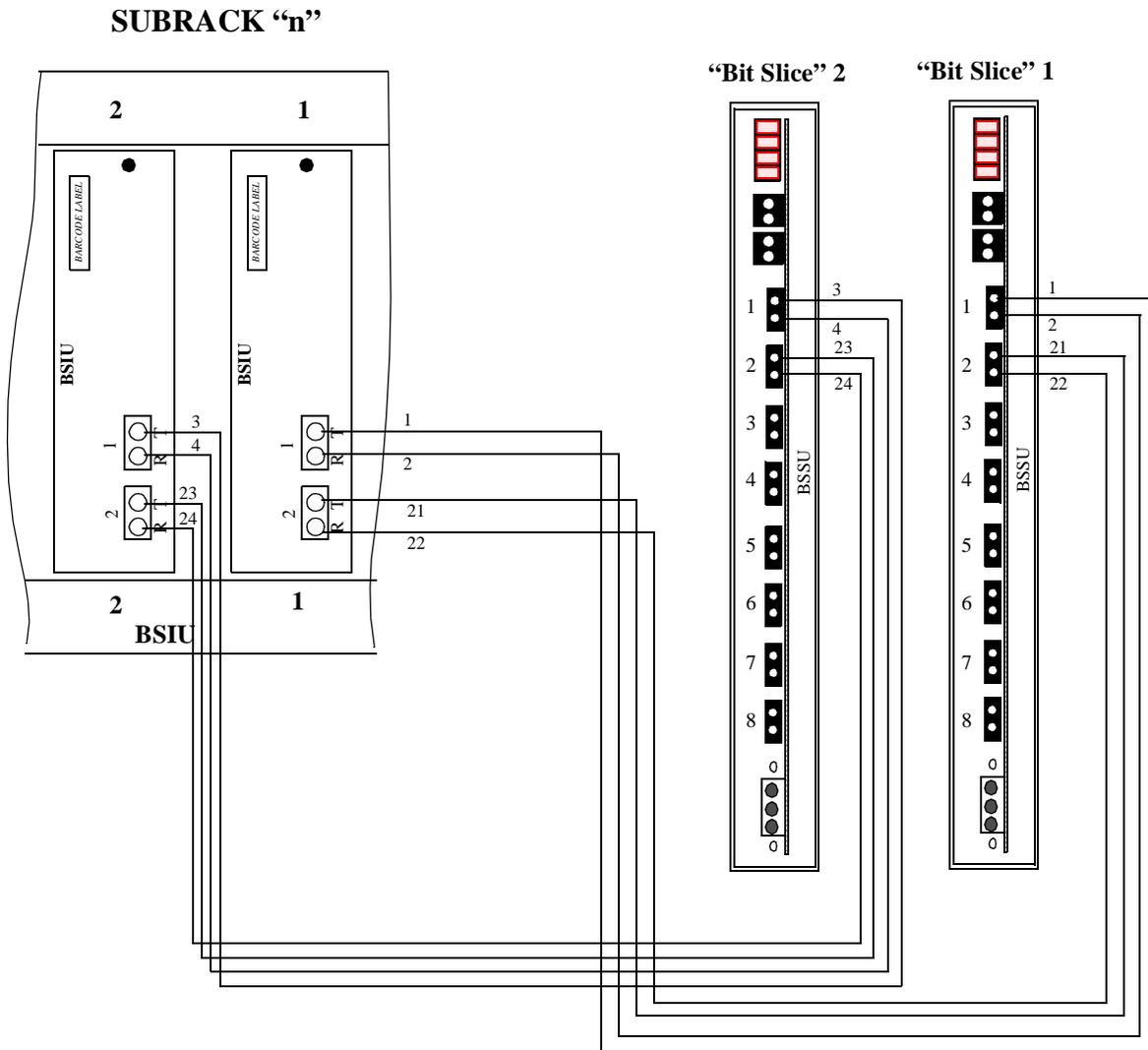
Figure 7-13.   Typical 2 Fiber ECI Link (BSIU to BSSU)

Table 7-9.   Recommended 2 Fiber ECI Connections - BSIU to BSSU

FROM			TO		Label (Both Ends)
Subrack Number	BSIU Number	BSIU Connector Number	BSSU Number	ECI Connector Number	
n	1	1T	1	1R	1
		1R		1T	2
		2T		2R	21
		2R		2T	22
	2	1T	2	1R	3
		1R		1T	4
		2T		2R	23
		2R		2T	24
	3	1T	3	1R	5
		1R		1T	6
		2T		2R	25
		2R		2T	26
	4	1T	4	1R	7
		1R		1T	8
		2T		2R	27
		2R		2T	28
	5	1T	5	1R	9
		1R		1T	10
		2T		2R	29
		2R		2T	30
	6	1T	6	1R	11
		1R		1T	12
		2T		2R	31
		2R		2T	32
	7	1T	7	1R	13
		1R		1T	14
		2T		2R	33
		2R		2T	34
	8	1T	8	1R	15
		1R		1T	16
		2T		2R	35
		2R		2T	36
	9	1T	9	1R	17
		1R		1T	18
		2T		2R	37
		2R		2T	38
	10	1T	10	1R	19
		1R		1T	20
		2T		2R	39
		2R		2T	40

Table 7-9.   Recommended 2 Fiber ECI Connections - BSIU to BSSU

FROM			TO		Label (Both Ends)
Subrack Number	BSIU Number	BSIU Connector Number	BSSU Number	ECI Connector Number	
n+1	1	1T	1	3R	41
		1R		3T	42
		2T		4R	61
		2R		4T	62
	2	1T	2	3R	43
		1R		3T	44
		2T		4R	63
		2R		4T	64
	3	1T	3	3R	45
		1R		3T	46
		2T		4R	65
		2R		4T	66
	4	1T	4	3R	47
		1R		3T	48
		2T		4R	67
		2R		4T	68
	5	1T	5	3R	49
		1R		3T	50
		2T		4R	69
		2R		4T	70
	6	1T	6	3R	51
		1R		3T	52
		2T		4R	71
		2R		4T	72
	7	1T	7	3R	53
		1R		3T	54
		2T		4R	73
		2R		4T	74
	8	1T	8	3R	55
		1R		3T	56
		2T		4R	75
		2R		4T	76
	9	1T	9	3R	57
		1R		3T	58
		2T		4R	77
		2R		4T	78
	10	1T	10	3R	59
		1R		3T	60
		2T		4R	79
		2R		4T	80

Table 7-9.   Recommended 2 Fiber ECI Connections - BSIU to BSSU

FROM			TO		Label (Both Ends)
Subrack Number	BSIU Number	BSIU Connector Number	BSSU Number	ECI Connector Number	
n+2	1	1T	1	5R	81
		1R		5T	82
		2T		6R	101
		2R		6T	102
	2	1T	2	5R	83
		1R		5T	84
		2T		6R	103
		2R		6T	104
	3	1T	3	5R	85
		1R		5T	86
		2T		6R	105
		2R		6T	106
	4	1T	4	5R	87
		1R		5T	88
		2T		6R	107
		2R		6T	108
	5	1T	5	5R	89
		1R		5T	90
		2T		6R	109
		2R		6T	110
	6	1T	6	5R	91
		1R		5T	92
		2T		6R	111
		2R		6T	112
	7	1T	7	5R	93
		1R		5T	94
		2T		6R	113
		2R		6T	114
	8	1T	8	5R	95
		1R		5T	96
		2T		6R	115
		2R		6T	116
	9	1T	9	5R	97
		1R		5T	98
		2T		6R	117
		2R		6T	118
	10	1T	10	5R	99
		1R		5T	100
		2T		6R	119
		2R		6T	120

Table 7-9. **Recommended 2 Fiber ECI Connections - BSIU to BSSU**

FROM			TO		Label (Both Ends)
Subrack Number	BSIU Number	BSIU Connector Number	BSSU Number	ECI Connector Number	
n+3	1	1T	1	7R	121
		1R		7T	122
		2T		8R	141
		2R		8T	142
	2	1T	2	7R	123
		1R		7T	124
		2T		8R	143
		2R		8T	144
	3	1T	3	7R	125
		1R		7T	126
		2T		8R	145
		2R		8T	146
	4	1T	4	7R	127
		1R		7T	128
		2T		8R	147
		2R		8T	148
	5	1T	5	7R	129
		1R		7T	130
		2T		8R	149
		2R		8T	150
	6	1T	6	7R	131
		1R		7T	132
		2T		8R	151
		2R		8T	152
	7	1T	7	7R	133
		1R		7T	134
		2T		8R	153
		2R		8T	154
	8	1T	8	7R	135
		1R		7T	136
		2T		8R	155
		2R		8T	156
	9	1T	9	7R	137
		1R		7T	138
		2T		8R	157
		2R		8T	158
	10	1T	10	7R	137
		1R		7T	138
		2T		8R	159
		2R		8T	160

1 Fiber Subrack Connections

In a 1 fiber subrack there is a single pair of fibers per "bit slice". This produces 20 fibers from each subrack to the BSSU's located in the core racks. For ease of installation, make 2 bundles of 10 each fibers, and label them appropriately as discussed earlier. This can be done by using Figure 7-9. (page 15) and Table 7-10. (page 25) to determine the correct fiber label numbers.

In a 1 fiber system, there can be a maximum of 8 subracks in one system.

With this fibering configuration the you must use the same pair of ECI connections on each BSSU, this is shown in Figure 7-14. (page 23).

A typical ECI link showing the first 2 Bit Slices of port subrack numbers "n" and "n+1" are shown in Figure 7-15. (page 24).

The ECI fibering for a 256 STM1 maximum I/O capacity system using 1 fiber subracks is shown in Table 7-10. (page 25). This table is 4 pages long, providing "from/to" and labeling information for each of the 8 possible 1 fiber subracks. The first subrack being "n" and the 8th subrack being "n+7"
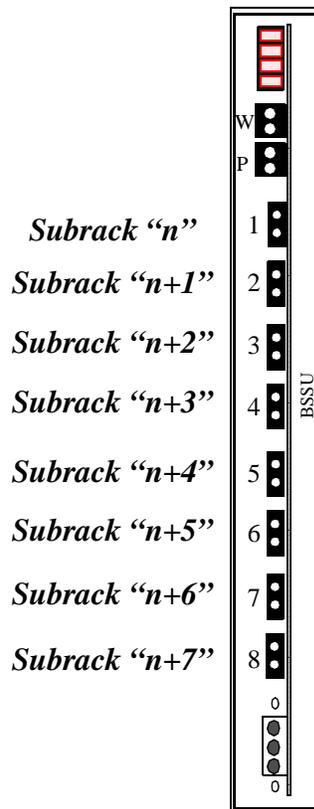

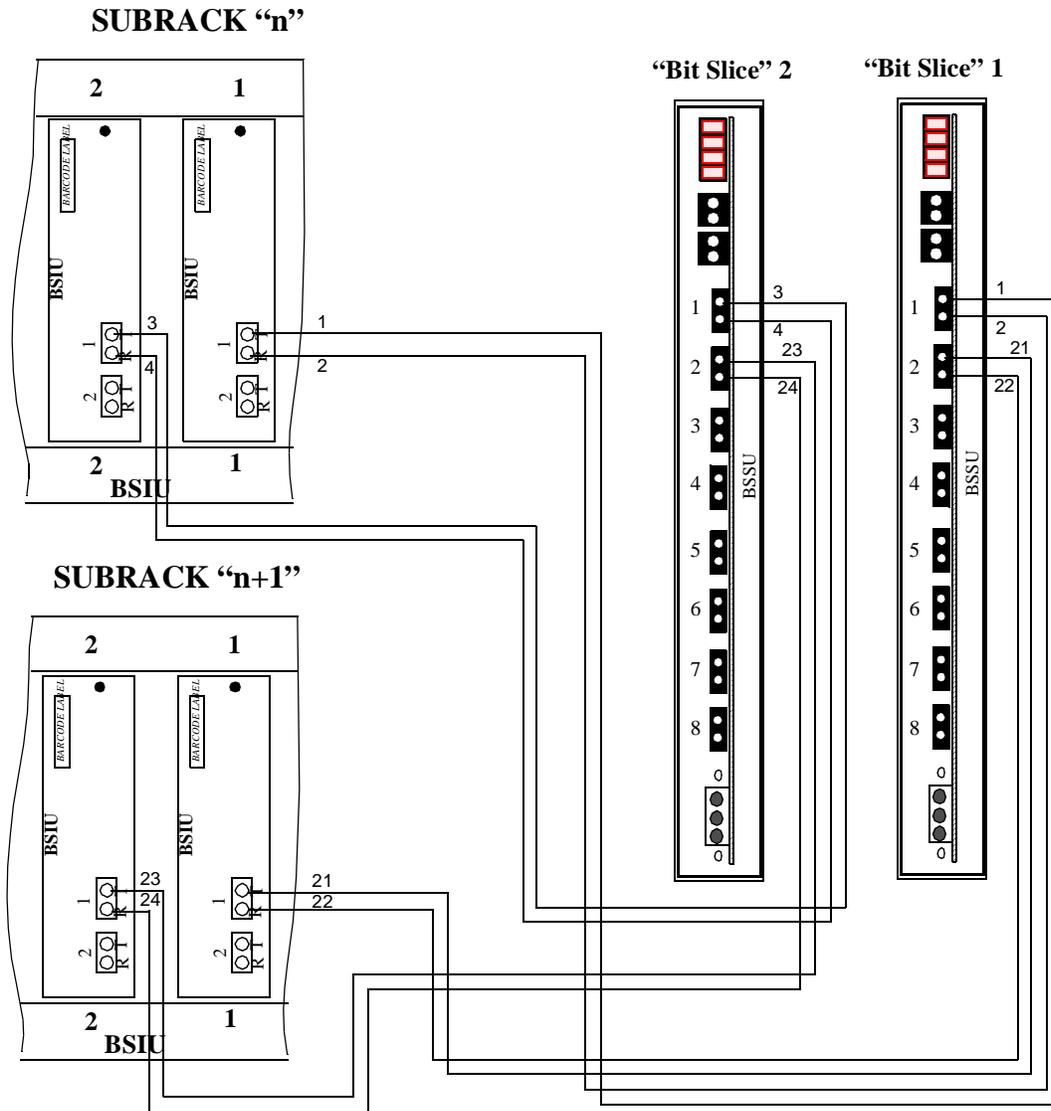**Figure 7-14.   Recommended ECI Connector Assignments - 1 Fiber Subrack**

Figure 7-15.   Typical Recommended 1 Fiber ECI Link (BSIU to BSSU)

Table 7-10.   Recommended 1 Fiber ECI Connections - BSIU to BSSU

FROM			TO		Label (Both Ends)
Subrack Number	BSIU Number	BSIU Connector Number	BSSU Number	ECI Connector Number	
n	1	1T	1	1R	1
		1R		1T	2
	2	1T	2	1R	3
		1R		1T	4
	3	1T	3	1R	5
		1R		1T	6
	4	1T	4	1R	7
		1R		1T	8
	5	1T	5	1R	9
		1R		1T	10
	6	1T	6	1R	11
		1R		1T	12
	7	1T	7	1R	13
		1R		1T	14
	8	1T	8	1R	15
		1R		1T	16
	9	1T	9	1R	17
		1R		1T	18
	10	1T	10	1R	19
		1R		1T	20
n+1	1	1T	1	2R	21
		1R		2T	22
	2	1T	2	2R	23
		1R		2T	24
	3	1T	3	2R	25
		1R		2T	26
	4	1T	4	2R	27
		1R		2T	28
	5	1T	5	2R	29
		1R		2T	30
	6	1T	6	2R	31
		1R		2T	32
	7	1T	7	2R	33
		1R		2T	34
	8	1T	8	2R	35
		1R		2T	36
	9	1T	9	2R	37
		1R		2T	38
	10	1T	10	2R	39
		1R		2T	40

Table 7-10.   Recommended 1 Fiber ECI Connections - BSIU to BSSU

FROM			TO		Label (Both Ends)
Subrack Number	BSIU Number	BSIU Connector Number	BSSU Number	ECI Connector Number	
n+2	1	1T	1	3R	41
		1R		3T	42
	2	1T	2	3R	43
		1R		3T	44
	3	1T	3	3R	45
		1R		3T	46
	4	1T	4	3R	47
		1R		3T	48
	5	1T	5	3R	49
		1R		3T	50
	6	1T	6	3R	51
		1R		3T	52
	7	1T	7	3R	53
		1R		3T	54
	8	1T	8	3R	55
		1R		3T	56
	9	1T	9	3R	57
		1R		3T	58
	10	1T	10	3R	59
		1R		3T	60
n+3	1	1T	1	4R	61
		1R		4T	62
	2	1T	2	4R	63
		1R		4T	64
	3	1T	3	4R	65
		1R		4T	66
	4	1T	4	4R	67
		1R		4T	68
	5	1T	5	4R	69
		1R		4T	70
	6	1T	6	4R	71
		1R		4T	72
	7	1T	7	4R	73
		1R		4T	74
	8	1T	8	4R	75
		1R		4T	76
	9	1T	9	4R	77
		1R		4T	78
	10	1T	10	4R	79
		1R		4T	80

Table 7-10.   Recommended 1 Fiber ECI Connections - BSIU to BSSU

FROM			TO		Label (Both Ends)
Subrack Number	BSIU Number	BSIU Connector Number	BSSU Number	ECI Connector Number	
n+4	1	1T	1	5R	81
		1R		5T	82
	2	1T	2	5R	83
		1R		5T	84
	3	1T	3	5R	85
		1R		5T	86
	4	1T	4	5R	87
		1R		5T	88
	5	1T	5	5R	89
		1R		5T	90
	6	1T	6	5R	91
		1R		5T	92
	7	1T	7	5R	93
		1R		5T	94
	8	1T	8	5R	95
		1R		5T	96
	9	1T	9	5R	97
		1R		5T	98
	10	1T	10	5R	99
		1R		5T	100
n+5	1	1T	1	6R	101
		1R		6T	102
	2	1T	2	6R	103
		1R		6T	104
	3	1T	3	6R	105
		1R		6T	106
	4	1T	4	6R	107
		1R		6T	108
	5	1T	5	6R	109
		1R		6T	110
	6	1T	6	6R	111
		1R		6T	112
	7	1T	7	6R	113
		1R		6T	114
	8	1T	8	6R	115
		1R		6T	116
	9	1T	9	6R	117
		1R		6T	118
	10	1T	10	6R	119
		1R		6T	120

Table 7-10.   Recommended 1 Fiber ECI Connections - BSIU to BSSU

FROM			TO		Label (Both Ends)
Subrack Number	BSIU Number	BSIU Connector Number	BSSU Number	ECI Connector Number	
n+6	1	1T	1	7R	121
		1R		7T	122
	2	1T	2	7R	123
		1R		7T	124
	3	1T	3	7R	125
		1R		7T	126
	4	1T	4	7R	127
		1R		7T	128
	5	1T	5	7R	129
		1R		7T	130
	6	1T	6	7R	131
		1R		7T	132
	7	1T	7	7R	133
		1R		7T	134
	8	1T	8	7R	135
		1R		7T	136
	9	1T	9	7R	137
		1R		7T	138
	10	1T	10	7R	139
		1R		7T	140
n+7	1	1T	1	8R	141
		1R		8T	142
	2	1T	2	8R	143
		1R		8T	144
	3	1T	3	8R	145
		1R		8T	146
	4	1T	4	8R	147
		1R		8T	148
	5	1T	5	8R	149
		1R		8T	150
	6	1T	6	8R	151
		1R		8T	152
	7	1T	7	8R	153
		1R		8T	154
	8	1T	8	8R	155
		1R		8T	156
	9	1T	9	8R	157
		1R		8T	158
	10	1T	10	8R	159
		1R		8T	160

Quad Fiber Subrack Connections

A four fiber subrack is only possible in a STM4/16 subrack.

In a 4 fiber subrack, there are four pairs of fibers per "bit slice", for a total of 80 fibers from the subrack (BSIU's) distributed to the BSSU's. For ease of installation, make 8 bundles of 10 each fibers, and label them appropriately as discussed earlier. This can be done by using Figure 7-9. (page 15) to determine the correct fiber label numbers.

✎ **NOTE:**
> If the fibers are already paired (duplex), then make 8 bundles of 5pairs each. This should be equal to 80 single (simplex) fibers.

With this fibering configuration you must use the same pair of ECI connections on each BSSU, this is shown in Figure 7-16. (page 29).

A typical ECI link showing the first 4 Bit Slices of a port subrack number "n" is shown in Figure 7-17. (page 30).
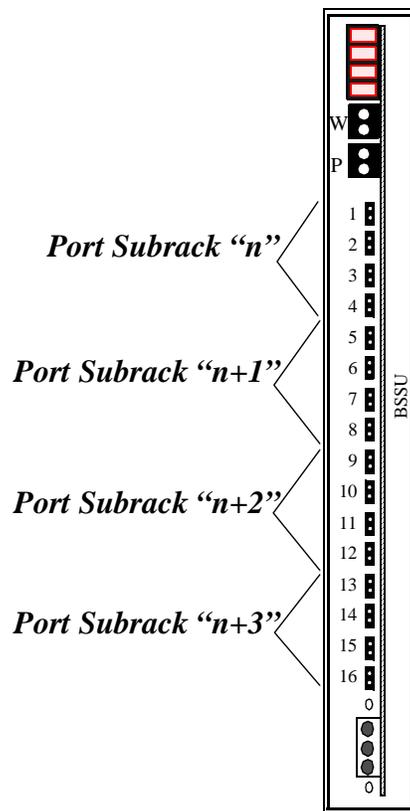
Figure 7-16.   ECI Connector Assignments - 4 Fiber Subrack

PSC SUBRACK "n"
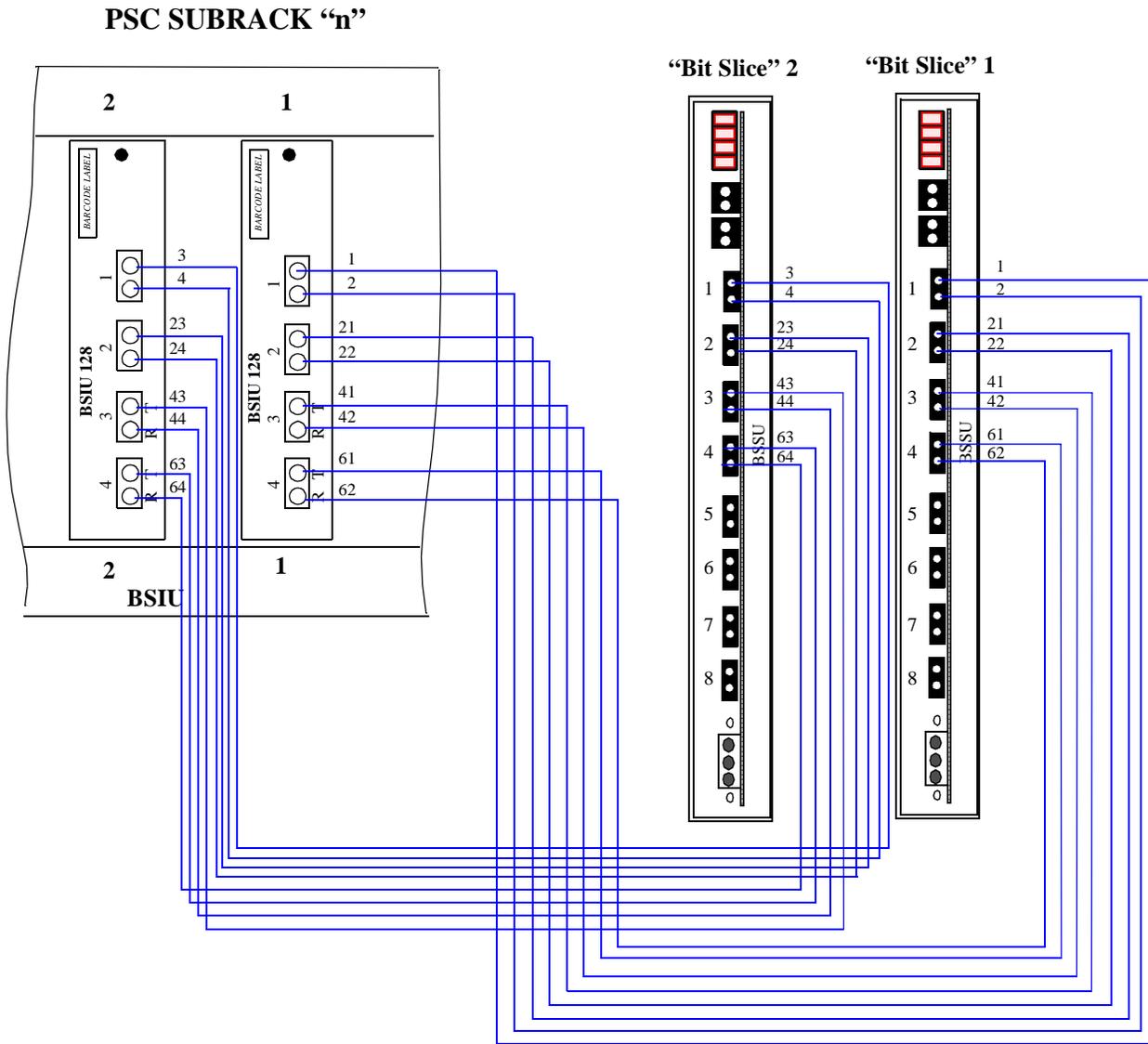
Figure 7-17.   Typical 4 Fiber ECI Link (BSIU to BSSU)

External Cable Installation

8

External Cabling Information

This chapter will provide the information required to establish all the external connections associated with the *WaveStar*^{TM} DACS 4/4/1 System.

- Station Clock Interfaces
- Alarm Interfaces
- Communication Interfaces
- Transmission Interfaces

Station Clock Interfaces

The station clock interfaces are found on the rear shield of each of the SYNC subracks. Additional details of the station clock interfaces are listed in Table 8-1. (page 2).

Table 8-1.   Station Clock Interface Descriptions

Connector Label	Connector Type	Description	Associated Figure
IN 1	75 Ohm BNC	2Mhz Station Clock Input	Figure 8-1. (page 2)
IN 2	75 Ohm BNC	2Mhz Station Clock Input	Figure 8-1. (page 2)
OUT	75 Ohm BNC	Station Clock Output	Figure 8-3. (page 4)
SP 0	75 Ohm BNC	This connection is not currently supported	
SP 1	120 Ohm DB-9 Female	64 Khz Station Clock Input	Figure 8-2. (page 3)
SP 2	120 Ohm DB-25 Female	This connection is not currently supported	

2Mhz Station Clock Input

The 2Mhz station clock inputs are a 75 Ohm BNC connector located at the rear of the SYNC subracks, this is shown in Figure 8-1. (page 2).

There is a 75 Ohm splitter also located at the rear of each subrack for sharing of a single station clock input among the two SYNC subracks.
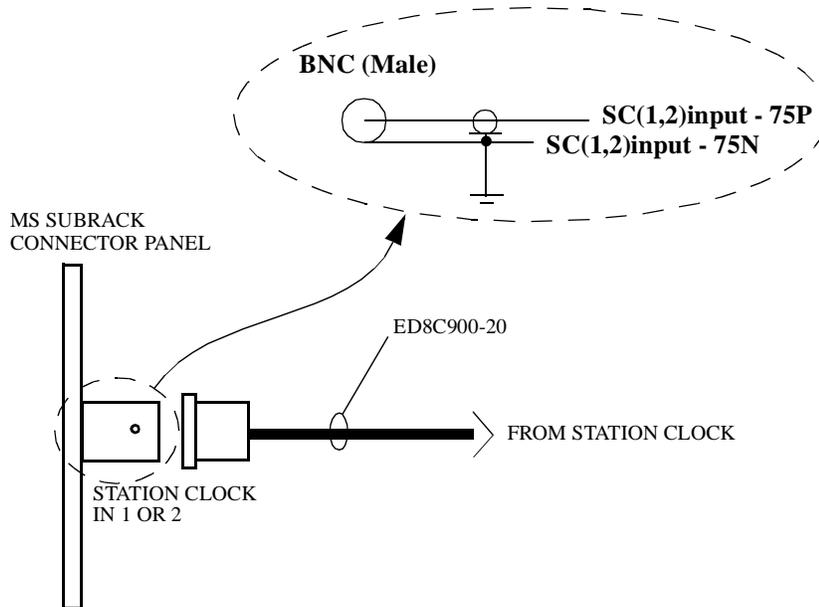
Figure 8-1.   2Mhz Station Clock Input

64 Khz Station Clock Input

The 64 Khz station clock input is a 120 Ohm DB-9 female connector located at the rear of the MS Subracks, this is shown in Figure 8-2. (page 3).
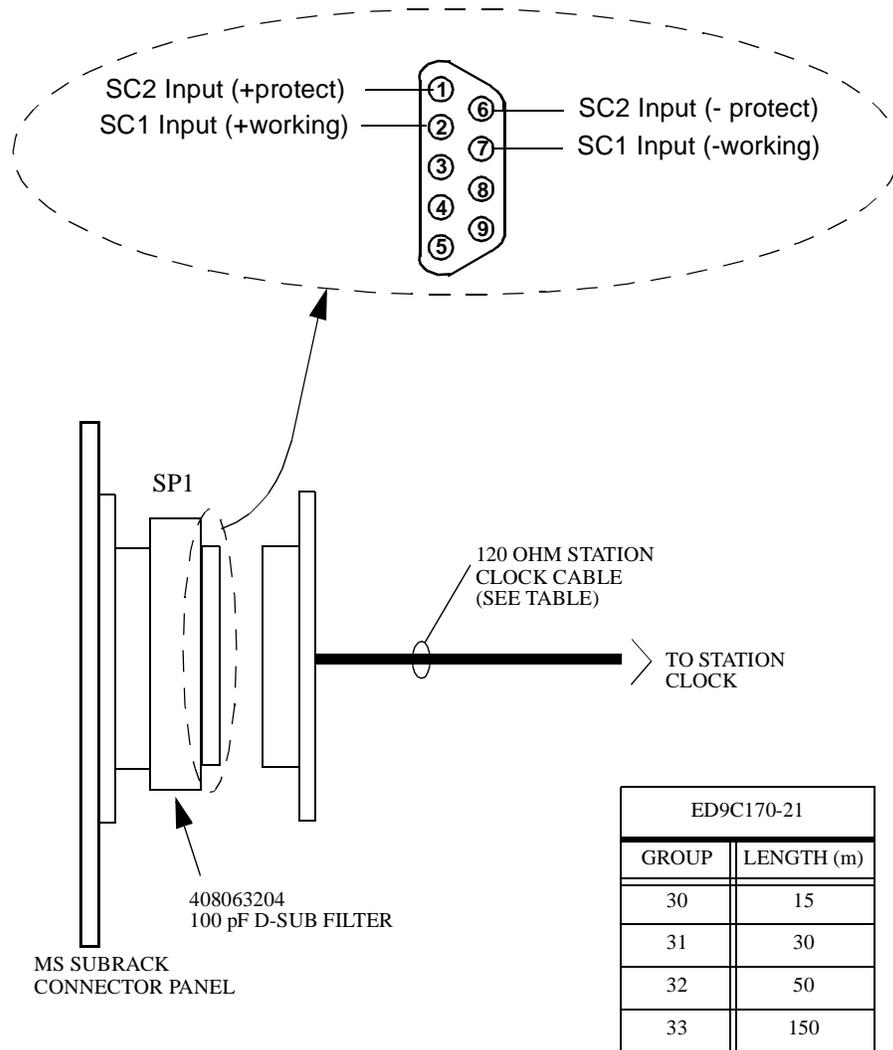

| SC2 Input (+protect) | ① | | ⑥ | SC2 Input (- protect) |
| SC1 Input (+working) | ② | | ⑦ | SC1 Input (-working) |

SP1

120 OHM STATION
CLOCK CABLE
(SEE TABLE)

TO STATION
CLOCK

408063204
100 pF D-SUB FILTER

MS SUBRACK
CONNECTOR PANEL

ED9C170-21	
GROUP	LENGTH (m)
30	15
31	30
32	50
33	150

Figure 8-2.   64 Khz Station Clock Input

Station Clock Output

The station clock output connection is a 75Ohm BNC connector located at the connector panel at the rear of the MS Subrack, this is shown in Figure 8-3. (page 4).
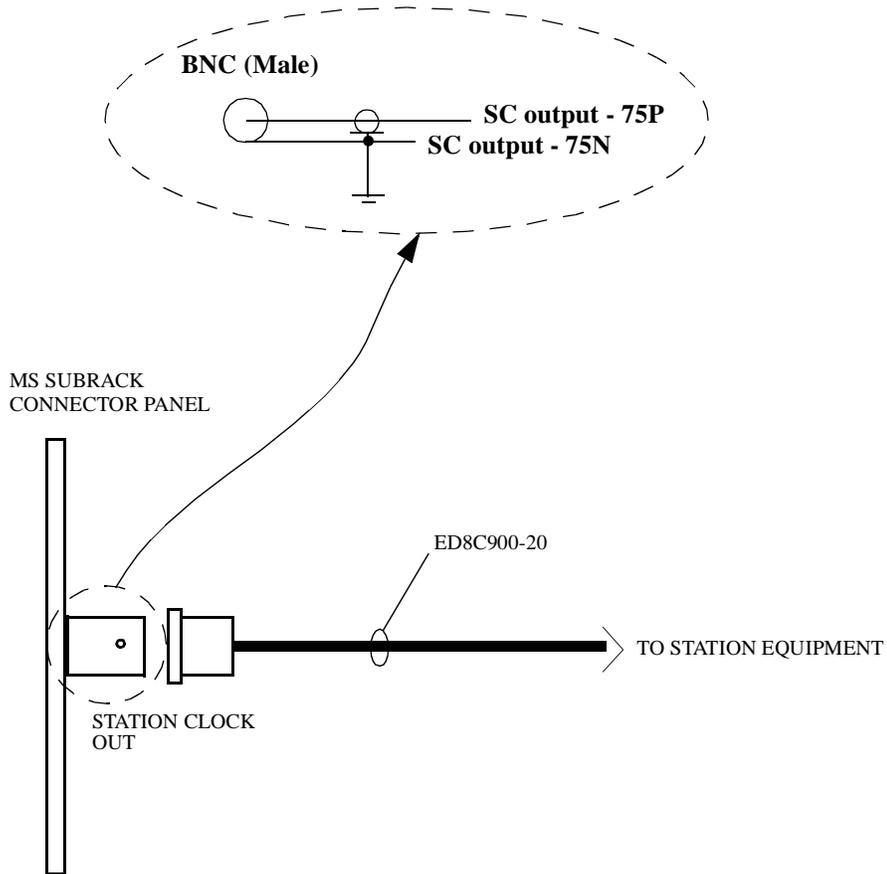
Figure 8-3.   Station Clock Output

Alarm Interfaces

End of Suite Alarm Interface (EOS)

The end of suite alarm connector information is shown in Figure 8-4. (page 5). This connector can be found at the connector panels of the ACP, MS Subrack, and both Port Subracks.
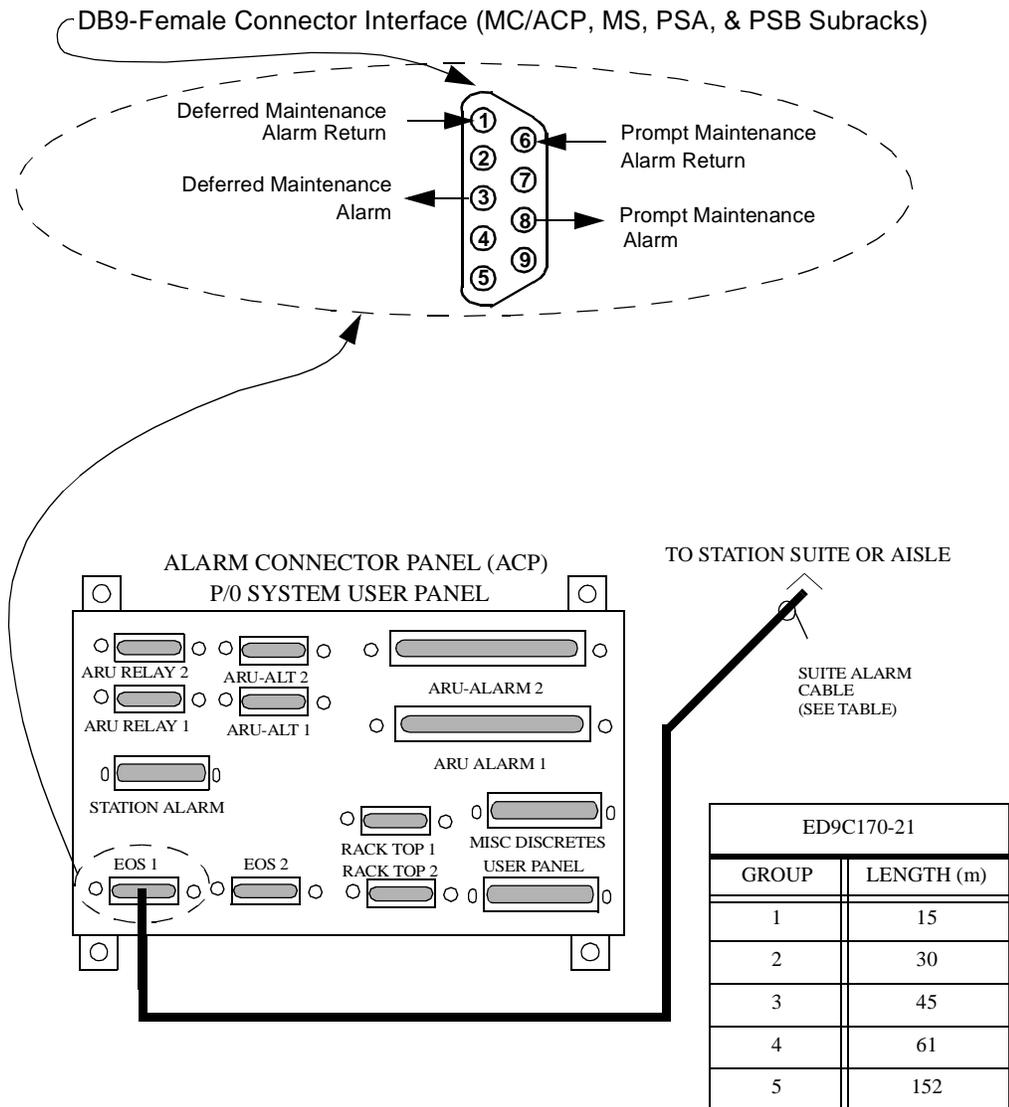
Figure 8-4.   End of Suite (EOS) Alarm Information

Station Alarm Interface

The station alarm connection is located the ACP, in the rear of the system user panel. The cabling and pin information are shown in Figure 8-5. (page 6).
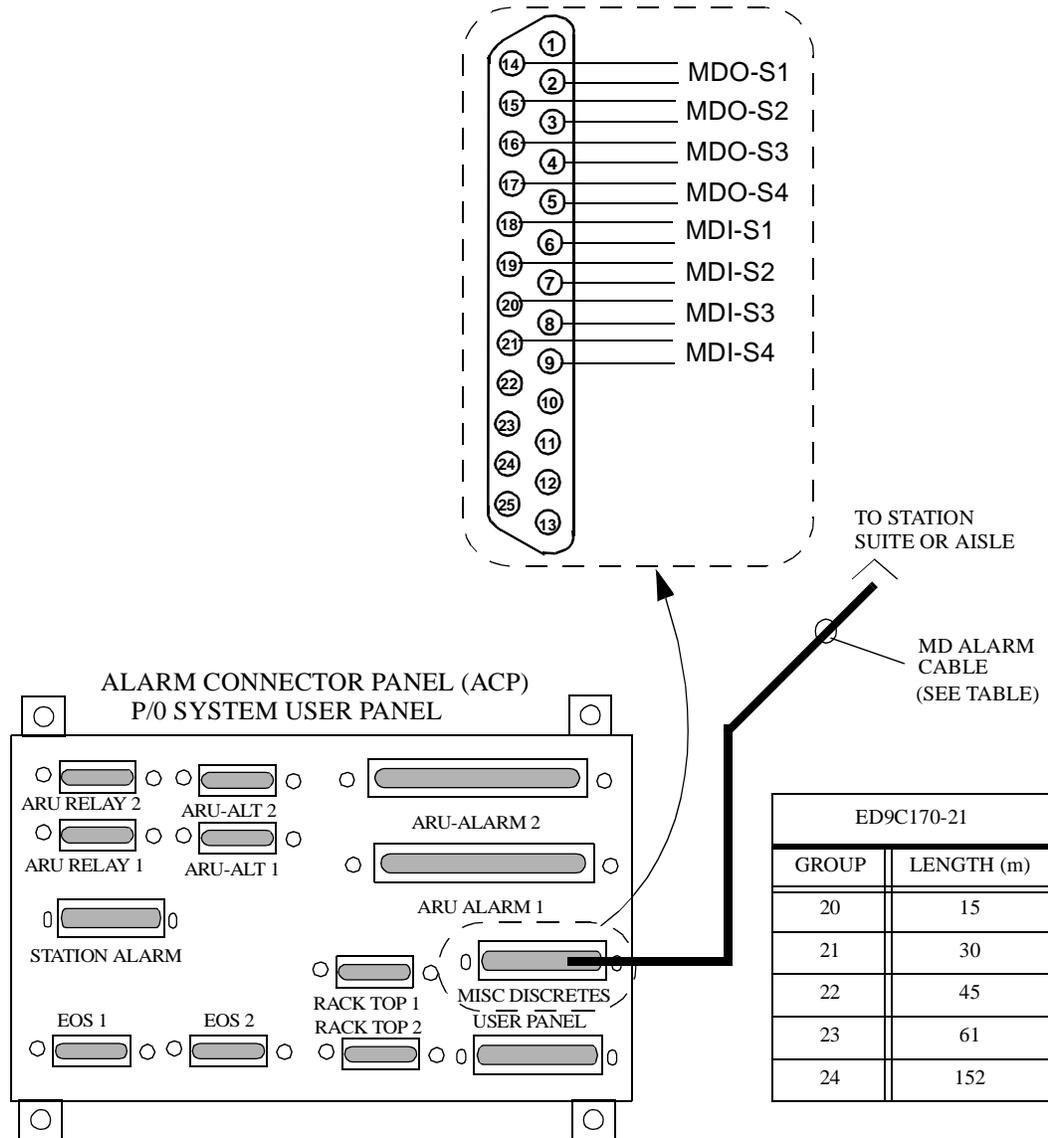

ED9C170-21	
GROUP	LENGTH(m)
10	15
11	30
12	45
13	61
14	152
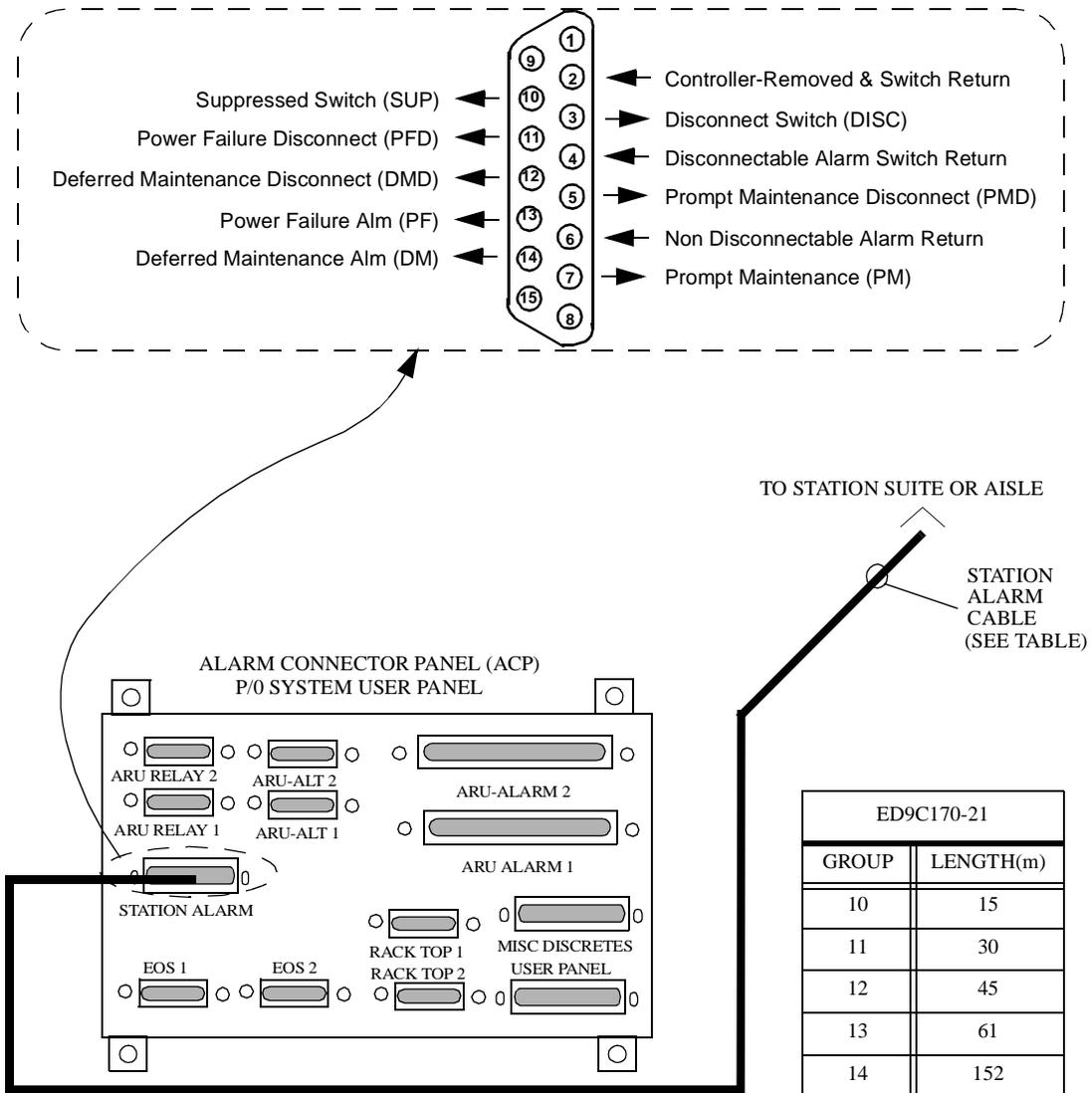
Figure 8-5. **Station Alarm Interface Information**

Miscellaneous Discrete Alarm Interfaces

The station alarm connection is located the ACP, in the rear of the system user panel. The cabling and pin information are shown in Figure 8-6. (page 7).

ED9C170-21	
GROUP	LENGTH (m)
20	15
21	30
22	45
23	61
24	152

Figure 8-6. **Misc. Discrete Alarm Information**

Communication Interfaces

EXLAN Ports Interface

The EXLAN port is located at the rear of the Main Controller as shown in Figure 8-7. (page 8) and Figure 8-8. (page 8). This port can be used to communicate with a workstation or ethernet device as shown in both above mentioned figures.
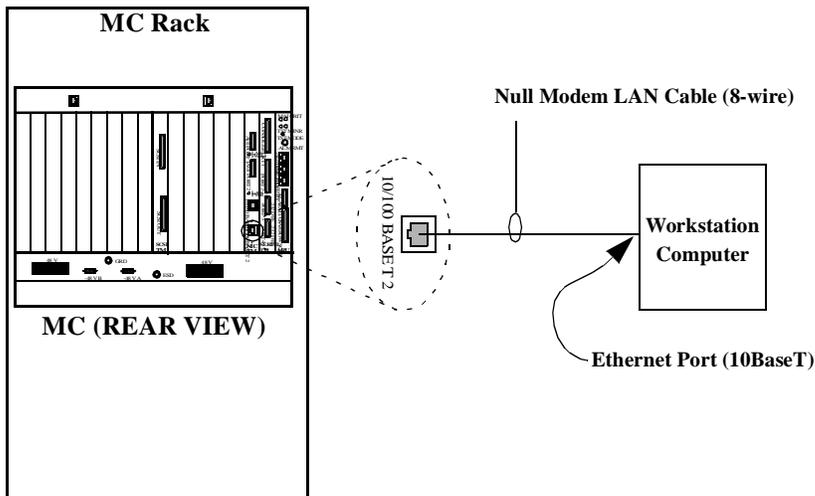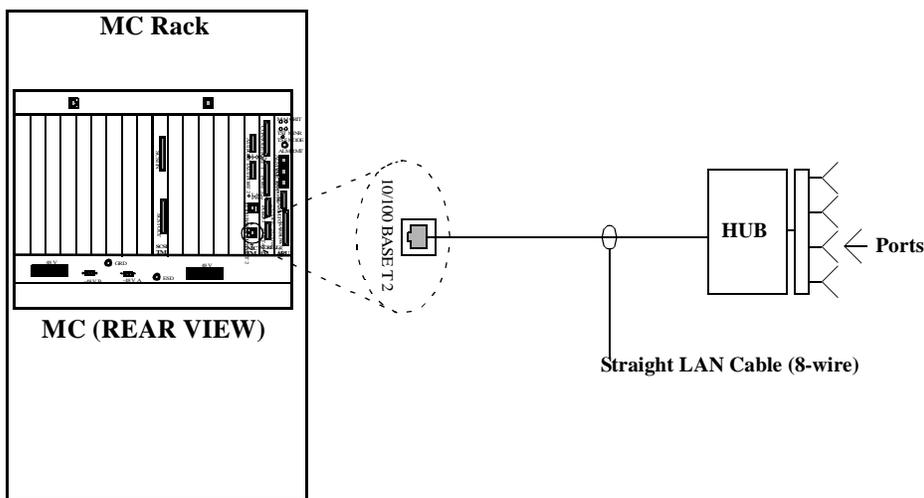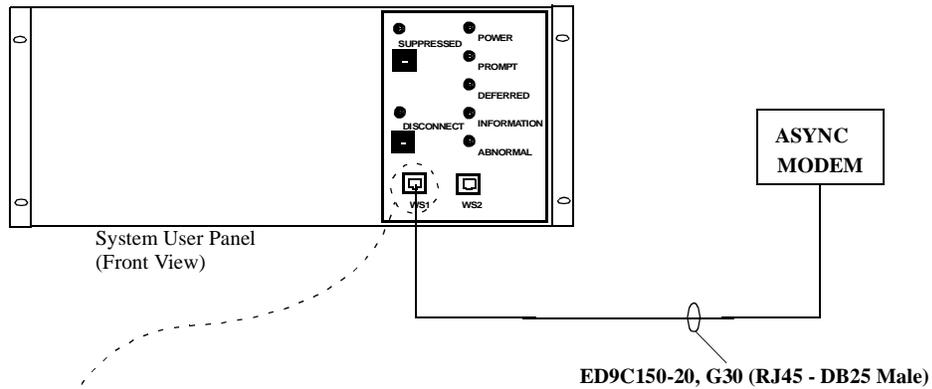
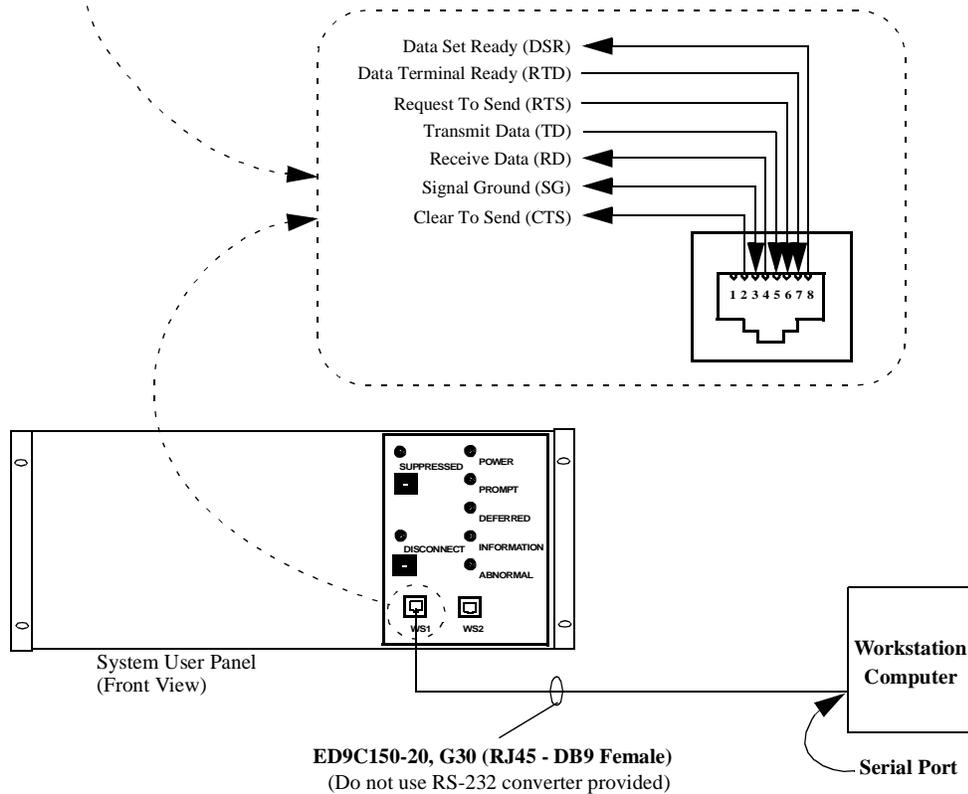**Figure 8-7.** **Workstation (Ethernet) Interface Diagram**

Figure 8-8. **Customer HUB Interface Diagram**

Console Port Interfaces

The workstation console port (WS 1) is located on the front of the system user panel (SUP) which is in the MC rack. External connections to serial devices are made at this location, this is shown in Figure 8-9. (page 9) and Figure 8-10. (page 9).
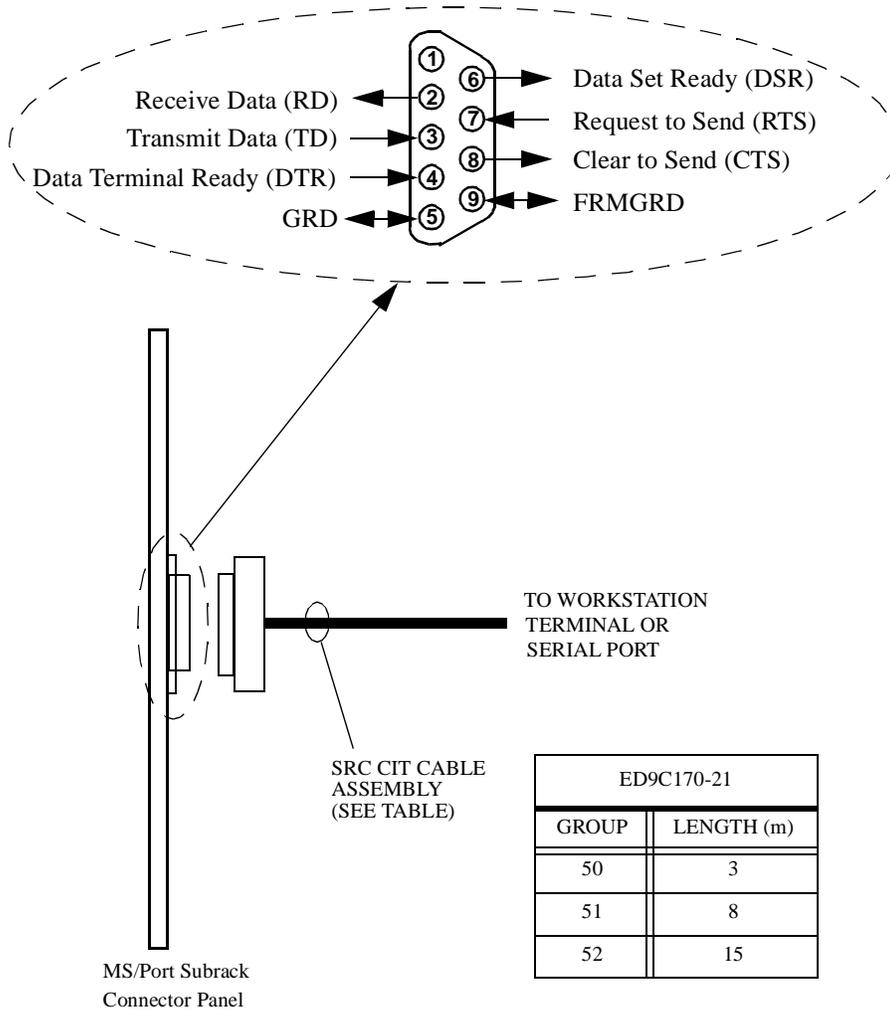
Figure 8-9. **Async Modem Interface Diagram**

Figure 8-10. **Workstation (Serial) Interface Diagram**

SRC Craft Interface Terminal (SRC-CIT)

The pin assignments and connecting information for the SRC CIT connector are shown in Figure 8-11. (page 10). This is an DB9 female connector and is located on the rear shield of the SYNC and Port Subracks.

Receive Data (RD)
Transmit Data (TD)
Data Terminal Ready (DTR)
GRD

Data Set Ready (DSR)
Request to Send (RTS)
Clear to Send (CTS)
FRMGRD

TO WORKSTATION
TERMINAL OR
SERIAL PORT

SRC CIT CABLE
ASSEMBLY
(SEE TABLE)

ED9C170-21	
GROUP	LENGTH (m)
50	3
51	8
52	15

MS/Port Subrack
Connector Panel

Figure 8-11.   SRC-CIT Connector Pin Assignments

Transmission Interface

Transmission Cable Routing

There are two types of transmission cable that could be used, fiber optic or coaxial. In the case of the STM-1 subrack, either could be used. In the STM-0 and STM4/16 subracks only fiber optic cable is used.

In some possible configurations, the external cabling can be very congested. The worst case is the port rack with two STM-1 subracks both fully configured and using coaxial cable.

Figure 8-12. (page 12) depicts the worst case configuration. All transmission cable routing can be derived from Figure 8-12. (page 12).

There are four (4) cable tie bars used to dress the transmission cable.

Using Figure 8-12. (page 12) as a reference for STM1 subrack, and use Figure 8-13. (page 13) as a reference for STM4/16 subracks.

Route the transmission in the following manner:

For the bottom portion of the bottom subrack, route the left half of the transmission cables down the left side of the rack to the bottom of the subrack, dress them up to the correct location on the interface units, using the cable tie bar to dress them to the left. Then route the right half of the cables down the right side of the rack to the bottom of the subrack, dress them up to the correct location on the interface units, using the cable tie bar to dress them to the right.

For the top portion of the bottom subrack, route the left half of the cables down the left side of the rack. Feed the cables through the gap between the heat baffle and the top of the subrack, dress the cables on the tie bar at the top of the subrack and waterfall the connections down to the proper locations, being careful not to obstruct the insertion or removal of any other units. Then route the right half of the cables down the right side of the rack. Feed the cables through the gap between the heat baffle and the top of the subrack, dress the cables on the tie bar at the top of the subrack and waterfall the connections down to the proper locations.

For the bottom portion of the top subrack, route the left half of the cables down the left side of the rack to the bottom of the subrack, dress the cables along the tie bar at the bottom of the subrack, and waterfall them up to the proper connections, being careful not to obstruct the insertion or removal of any other units. Then route the right half of the cables down the right side of the rack to the bottom of the subrack. Dress the cables along the tie bar and waterfall them up to the proper locations.

For the top portion of the top subrack, route all cables in the top of the rack so that they are over the tie bar located inside the top of the rack, make all the required connections and dress the cables to the tie bar so that they waterfall down to the correct interface unit.

Cable Tie Bars

Rear Baffle
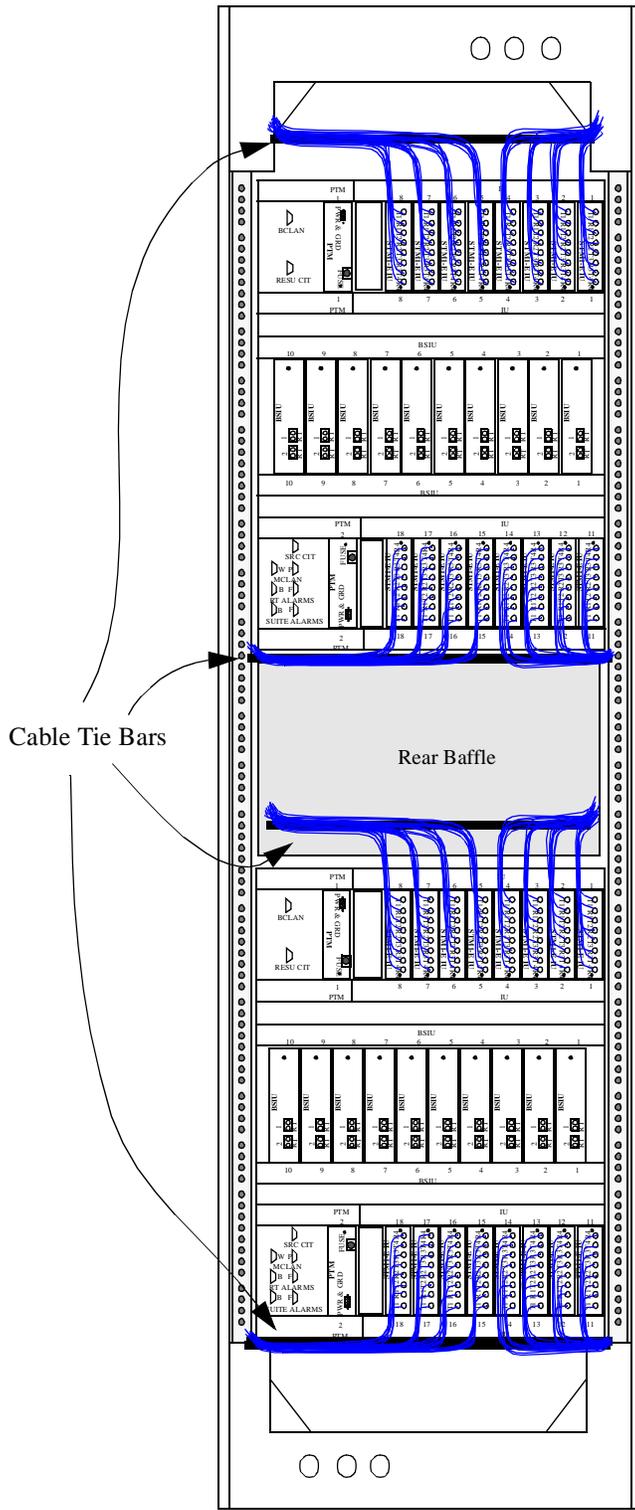
Rear View

Figure 8-12.   STM1 Transmission Cable Routing Diagram

**STM4/16
Transmission
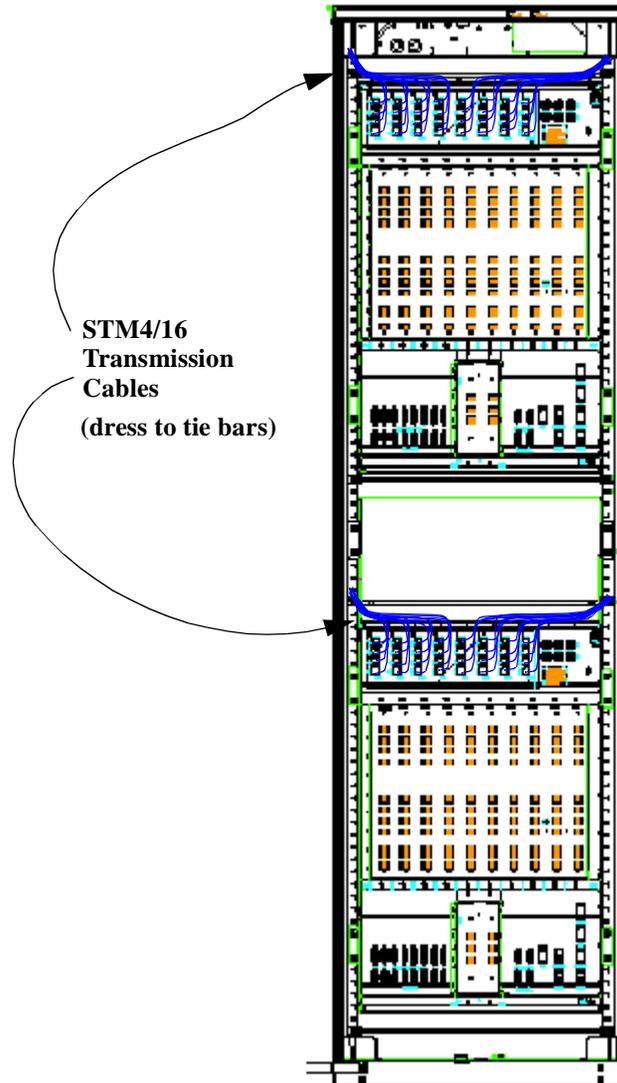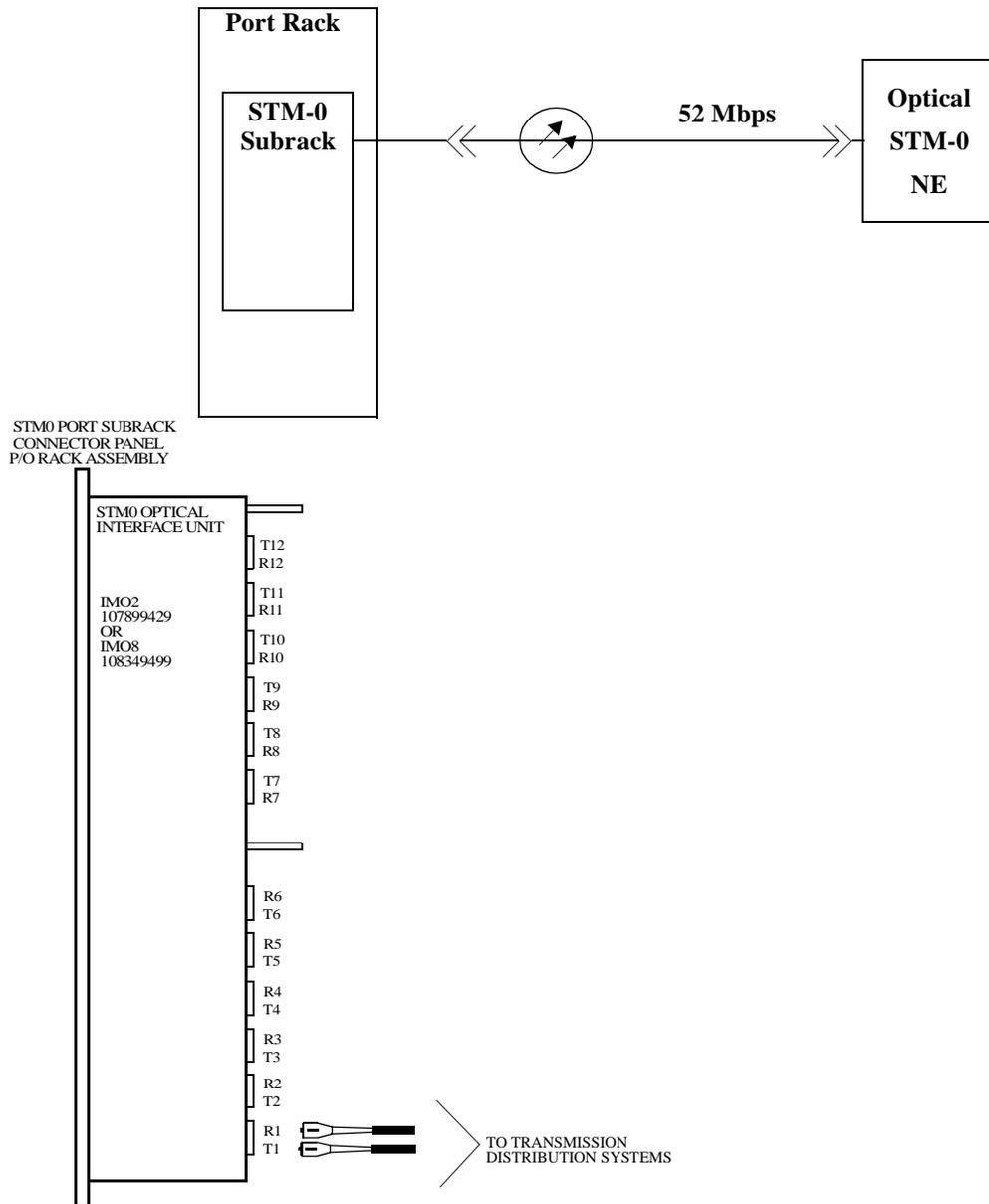Cables**

(dress to tie bars)

Figure 8-13.   STM 4/16 Transmission Cable Routing Diagram

STM-0 (52 Mbps) Line Port Interfaces

For the STM-0 interface there are currently two versions, the IMO2 and the IMO8, the IMO2 uses single mode fiber with SC connectors, and the IMO8 uses single mode fiber with LC connectors. This is shown in Figure 8-14. (page 14).

Figure 8-14.   STM-0 (52 Mbps) Transmission Interface Diagram

STM-1 (155 Mbps) Line Port Interfaces

There are two possible types of STM-1 signals, optical or electrical. These are both shown in Figure 8-15. (page 15).
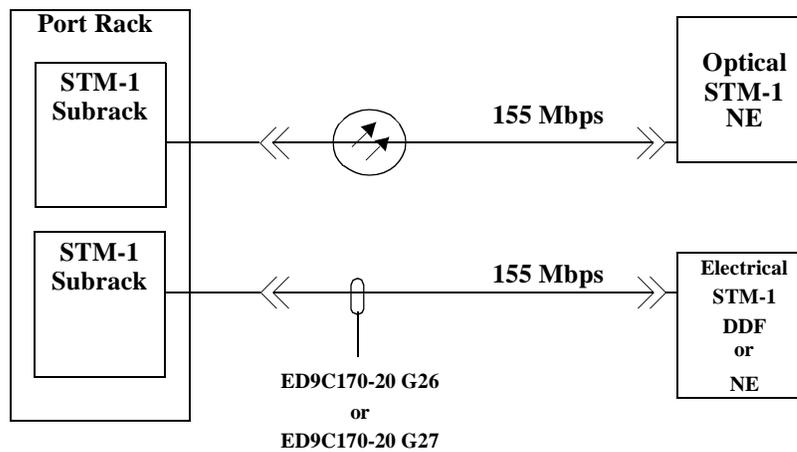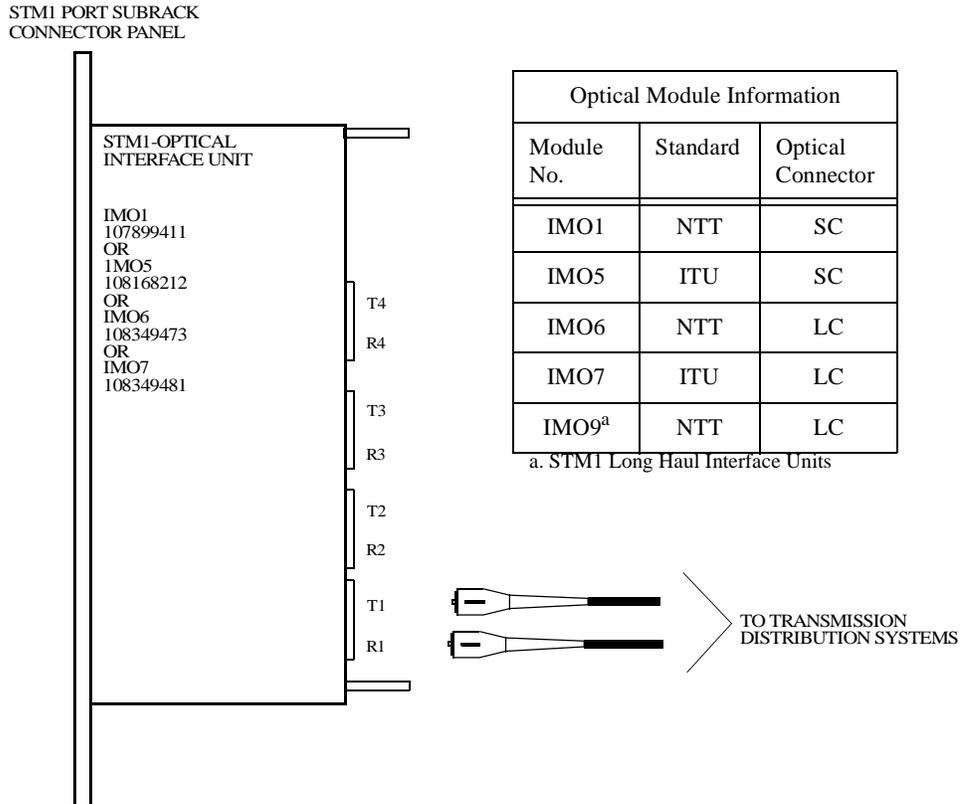

Figure 8-15.   STM-1 (155 Mbps) Transmission Interface Diagram

STM-1 Optical

The Optical Interface modules used in the STM-1 subrack are shown in Figure 8-16. (page 16), the various possibilities are shown and listed in the associated figure.

STM1 PORT SUBRACK
CONNECTOR PANEL

STM1-OPTICAL
INTERFACE UNIT

IMO1
107899411
OR
1MO5
108168212
OR
IMO6
108349473
OR
IMO7
108349481

T4
R4

T3
R3

T2
R2

T1
R1

TO TRANSMISSION
DISTRIBUTION SYSTEMS

Optical Module Information		
Module No.	Standard	Optical Connector
IMO1	NTT	SC
IMO5	ITU	SC
IMO6	NTT	LC
IMO7	ITU	LC
IMO9[a]	NTT	LC

a. STM1 Long Haul Interface Units

Figure 8-16.   STM-1 Optical Interface Module

STM-1 Electrical

The STM-1 electrical interface modules are shown in Figure 8-17. (page 17).

The cable must be ED8C900-20.

There are only two possible cable/connector combinations that are supported:

Lucent 735A coaxial cable with 75-Ohm, right angle male BNC connectors, KS-23626,L16 (407013945).
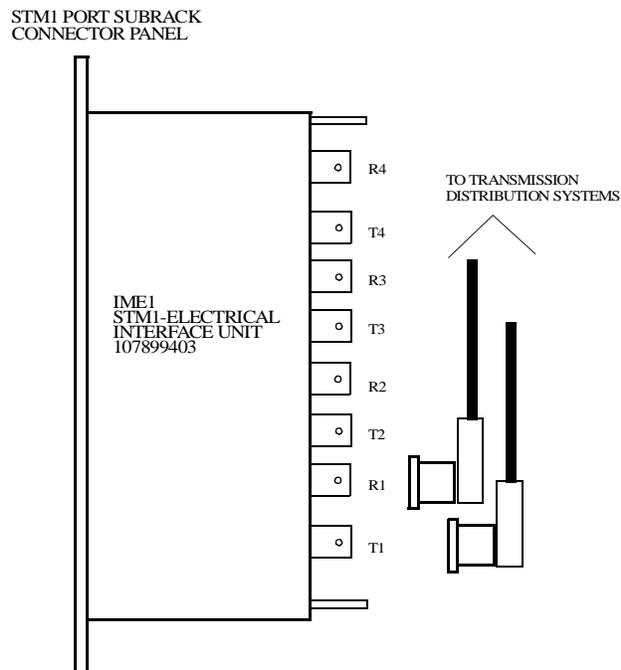
or

Lucent 734D coaxial cable with 75-Ohm, right angle male BNC connectors, KS-23626,L15 (407013929).

The maximum length allowed for 735A cable is 80 meters, the maximum length allowed for the 734D cable is 165 meters.

✎ **NOTE:**
Lucent 735A coaxial cable has a much smaller diameter than the Lucent 734D coaxial cable.

Figure 8-17.   STM-1 Electrical Interface Module

STM-4/16 Line Port Interfaces

The STM-4 and STM-16 port units do not have separate interface units. This function is built into the circuit pack itself.

The external cable, either STM-4 or STM-16 plugs through the backplane into the actual circuit pack.

On the STM-4 units there are 4 STM-4 ports on each circuit pack.

On the STM-16 units there is only 1 STM-16 port on each circuit pack.

The connector for the external optical interface is a LC Backlight connector, this is very similar to a LC connector, but is longer, the LC connector will NOT work in a LC Backlight connector.