

**Lucent Technologies**  
Bell Labs Innovations



# **WaveStar® TDM 10G (STM-64)**

Installation Manual

365-371-525  
CC109149823  
Issue a  
September 2001



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Installation Manual

365-371-525 Issue a September 2001

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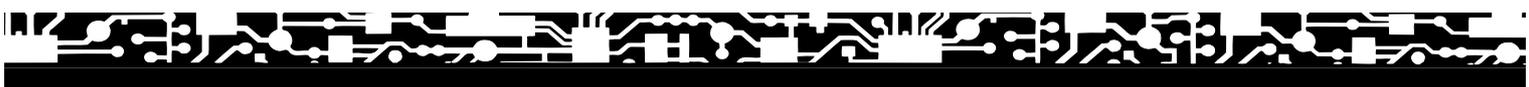
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Level of detail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Readability and clarity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Organization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Completeness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Technical accuracy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Quality of translation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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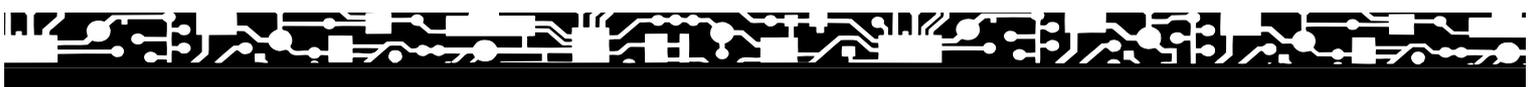
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# About this information product

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- Purpose** This manual provides information on the installation and configuration of a WaveStar® TDM 10G (STM-64) system. Furthermore, all steps for putting the system into operation are also described.
- Reason for reissue** The present Issue a is a revised version of this manual containing adaptations and updates for Release 4.0.
- Safety labels** The present manual contains basic safety instructions which have to be strictly observed when handling the equipments and systems described.
- The most important safety instructions are collected in the chapter “Safety” in Fascicle 1 of this manual.
- Strictly observe the warnings and safety instructions described in Fascicle 1 (“Safety”) before carrying out work of any kind on the equipments and systems described.
- Conventions used** Each fascicle can be identified by its number (see above) and contains a chapter which is numbered accordingly (e.g. Chapter 2 is contained in Fascicle 2). The page numbering begins with “1” in every chapter.
- Cross-reference conventions are identical with those used for page numbering, i.e. the first number in cross-references refers to the corresponding fascicle.

To facilitate the location of specific text passages, the manual contains so-called keyword blocks. These are placed to the left of the main text and contain either a keyword or a word which indicates the contents of a paragraph or group of paragraphs.

Each abbreviation used in this manual is listed in Fascicle “Glossary” unless it can be assumed that the reader is familiar with this abbreviation.



# 1 Safety

## Overview

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**Purpose** This chapter provides important safety instructions.

### Contents

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## General notes on safety

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**Overview** The present chapter on safety *must* be read by the responsible technical personnel before carrying out relevant work on the system. The valid version of this document must always be kept close to the equipment.

Not only must the general instructions in this chapter on safety be observed, but also the specific safety instructions in the individual chapters.

All safety instructions have a uniform appearance. Please refer to “Structure of safety instructions” (1-2).

The WaveStar® TDM 10G (STM-64) equipment has been developed in line with the present state-of-the-art and fulfils the current national and international safety requirements. It is provided with a high degree of operational safety resulting from many years of development experience and continuous stringent quality checks in our company.

**Potential sources of danger** The equipment is safe in normal operation. There are, however, some potential sources of danger that cannot be completely eliminated. In particular, these arise during the

- opening of housings or equipment covers,
- manipulation of any kind within the equipment, even if it has been disconnected from the power supply,
- disconnection of optical or electrical connections,

through possible contact with:

- live parts,
- laser light,
- hot surfaces,
- sharp edges, or
- components sensitive to electrostatic discharge.

**Structure of safety instructions** All safety instructions include a *warning symbol* and a *signal word* that classify the danger and a *text block* that contains descriptions of the type and cause of the danger, the consequences of ignoring the safety instruction and the measures that can be taken to minimise the danger.

**Example:**



**DANGER**

**Arcing on removing or inserting a live power supply plug.**

*Arcing can cause serious burns to the hands and damage to the eyes.*

*Ensure that the line circuit-breaker on the Rack Connection Panel (RCP) is in the “OFF” position before removing or inserting the power supply plug.*

**Danger classification**

There are three classes of safety instructions: “Danger”, “Warning” and “Caution”; which class is relevant depends on the consequences of ignoring the safety instruction:

DANGER	Serious injury is definite or likely.
WARNING	Serious injury is possible.
CAUTION	Minor injury is definite, likely or possible, or material damage to the product or in the product environment is definite or likely.

**Special safety instructions**

The aspects of “laser safety” and “handling of components sensitive to electrostatic discharge (ESD)” are of vital importance for the WaveStar® TDM 10G (STM-64) equipment. Therefore, the key safety instructions for these subjects are summarised in the sections “Laser safety” (1-6) and “Electrostatic discharge” (1-16).

**General safety requirements**

In order to keep the technically unavoidable residual risk to a minimum, it is imperative to observe the following rules:

- Transport, storage and operation of the unit/system must be under the *permissible conditions only*.  
See accompanying documentation and information on the unit/system.
- Installation, configuration and disassembly must be carried out only by *expert personnel* and *with reference to the respective documentation*.  
Due to the complexity of the unit/system, the personnel requires *special training*.
- The unit/system must be operated by *expert and authorised users only*.

The user must operate the unit/system only after having ***read and understood*** the chapter on safety and the parts of the documentation relevant to operation. For complex systems, additional training is recommended. Any obligatory training for operating and service personnel must be carried out and documented.

- The unit/system must not be operated unless it is in perfect working order.  
Any faults and errors that might affect safety must be reported ***immediately*** by the user to a person in responsibility.
- The unit/system must be operated only with the connections and under the environmental conditions as described in the documentation.
- Any conversions or changes to the system or parts of the system (including the software) must be carried out by qualified Lucent Technologies personnel or by expert personnel authorised by Lucent Technologies.  
All changes carried out by other persons lead to a ***complete exemption from liability***.  
No components/spare parts must be used other than those recommended by the manufacturer and those listed in the procurement documents.
- The removal or disabling of safety facilities, the clearing of faults and errors, and the maintenance of the equipment must be carried out by ***specially qualified personnel only***.  
The respective parts of the documentation must be strictly observed. The documentation must also be consulted during the selection of measuring and test equipment.
- Calibrations, special tests after repairs and regular safety checks must be carried out, documented and archived.
- Non-system software is used at one's ***own risk***. The use/installation of non-system software can adversely affect the normal functioning of the unit/system.
- Only use ***tested and virus-free*** floppy disks and streamer tapes.
- Supply circuits to the WaveStar® TDM 10G (STM-64) must be installed in accordance with the National Electrical Code / Canadian Electrical Code when installed, the WaveStar® TDM 10G (STM-64) must be supplied by a DC circuit externally protected by a Listed circuit breaker, rated 40 A (for a

combination of the Main and Expansion Shelf) or 70 A (in case of two Main Shelves), min. 125 V DC. Terminal blocks for connection of DC power, have been evaluated for stranded copper wire, max. 4 AWG, and a tightening torque of 35.5 lb.in. / 4.0 Nm.

□

## Laser safety

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**System design** The Lucent Technologies WaveStar® TDM 10G (STM-64) system complies with FDA/CDRH 21 CFR 1040.10 and 1040.11 as a Class I and with IEC 60825-1 as a Class 1 Optical Fiber Telecommunication laser product. The system has been designed to ensure that the operating personnel is not endangered by laser radiation during normal system operation. The safety measures specified in the Food and Drug Administration's Center for Devices and Radiological Health (FDA/CDRH) regulations and the international standards IEC-60825 or DIN/EN 60825 are met. Please also refer to "Laser product classification" (1-14).

**Potential sources of danger** Beware of the following potential sources of danger which will remain despite all safety measures taken:

- Laser radiation can cause damage to the skin and eyes.
- Laser radiation from optical transmission systems is in a wavelength range that is invisible to the human eye.

**Laser classes** The maximum output power of laser radiation depends on the type of laser diode used. The international standards IEC-60825 or DIN/EN 60825 define the maximum output power of laser radiation for each laser class in accordance with the wavelength.

Laser class	Wavelength	Max. output power of laser radiation
1	1310 nm	8.85 mW
	1550 nm	10 mW
3A	1310 nm	24 mW
	1550 nm	50 mW
3B	1310 nm	0.5 W
	1550 nm	0.5 W

**Laser warning labels** The laser warning labels indicate either only the laser class or both the laser class and the maximum output power of laser radiation. In the following all available laser warning labels are listed.

### Laser warning symbol



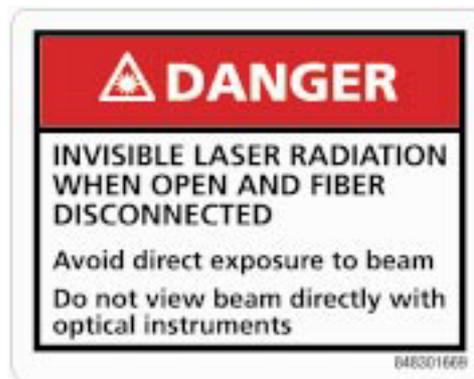
### Class 1 Laser Product Label

That label should be mounted on the front cover outside. It always refers to normal operation.



### Danger Label

That label should be affixed inside the subrack.

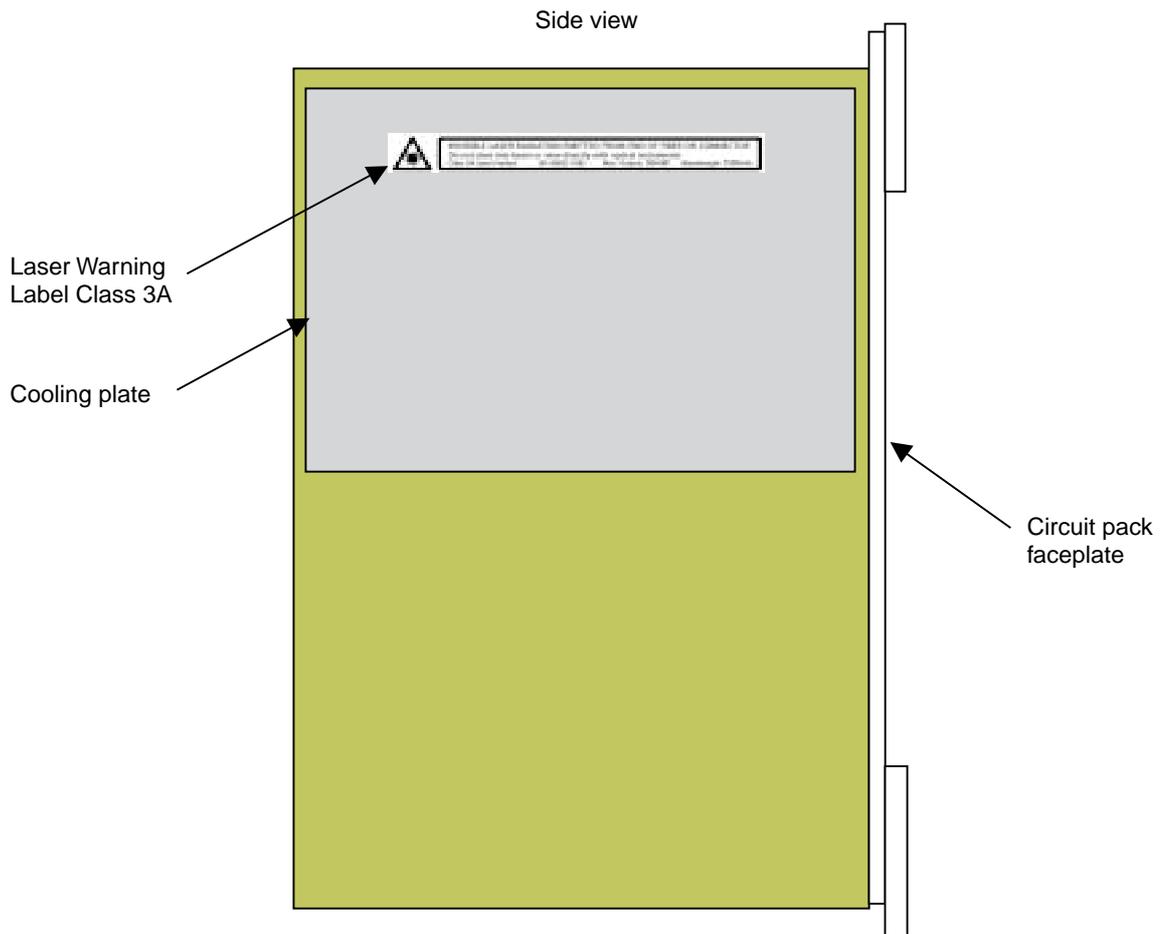


### Laser Warning Label Class 3A

That label should be mounted on the circuit pack top side (e.g. on cooling plate).



Position:



### Laser Caution Label

That label should be mounted on the outside of the system on the covers.



648322767

Position:

Front view



Laser Caution Label

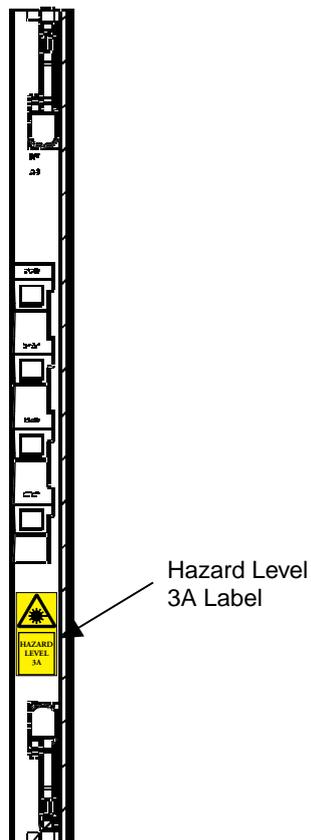
### Hazard Level 3A Label

That label should be mounted on the faceplates of the optical circuit pack.



Position:

Front view



### Laser safety instructions

Observe the following instructions to avoid exposing yourself and others to risk:

- Read the relevant descriptions in the manuals before taking equipment into operation or carrying out any installation and maintenance work on the optical port units, and follow the instructions. Ignoring the instructions can result in exposure to dangerous radiation.
- Do not view directly into the laser beam with optical instruments such as a fiber microscope, because viewing of laser emission in excess of Class 1 limits significantly increases the risk of eye damage.
- Never look into the end of an exposed fiber or an open connector as long as the optical source is still switched on.



## CAUTION

*Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.*

□

## Optical circuit pack specifications

**Specifications** The following table contains the specifications of the optical circuit packs.

Circuit pack	Wavelength [nm]	Fiber type (core/cladding diameter) [μm]	Max. average output (normal operation)	Laser class (IEC / FDA)
<b><i>OC3/STM1 Port Units</i></b>				
1.3SR4, 4 ports (LEY16)	1310	SM (9.0/125)	-8.0 dBm	1 / I
1.3IR-SR8, 8 ports (LEY23)	1310	SM (9.0/125)	-8.0 dBm	1 / I
1.3LR4, 4 ports (LEY15)	1310	SM (9.0/125)	0.0 dBm	1 / I
<b><i>OC12/STM4 Port Units</i></b>				
1.3SR2 (LEY14)	1310	SM (9.0/125)	-8.0 dBm	1 / I
1.3LR2 (LEY13)	1310	SM (9.0/125)	+2.0 dBm	1 / IIIb
1.5LR1 (LEY190)	1550	SM (9.0/125)	+2.0 dBm	1 / I
<b><i>OC48/STM16 Port Units</i></b>				
1.3SR1 (LEY182)	1310	SM (9.0/125)	-1.0 dBm	1 / I
1.3LR1 (LEY7, 307)	1310	SM (9.0/125)	+2.5 dBm	1 / IIIb
1.5LR1 (LEY8, 308)	1550	SM (9.0/125)	+4.0 dBm	1 / I
OLS400G DWDM compatible (LEY101...180)	1530...1565	SM (9.0/125)	-4.8 dBm	1 / I
OLS80G DWDM compatible (LEY50...65)	1530...1565	SM (9.0/125)	-4.8 dBm	1 / I
<b><i>OC192/STM64 Port Units</i></b>				
1.5IR1 (LEY69)	1550	SM (9.0/125)	+2.0 dBm	1 / I
1.5IRS1 (LEY97)	1550	SM (9.0/125)	+2.0 dBm	1 / I
DWDM compatible (LEY201...240)	1530...1565	SM (9.0/125)	-4.8 dBm	1 / I
Passive Optics (LEY284...299)	1530...1565	SM (9.0/125)	+2.0 dBm	1 / I
<b><i>Optical Amplifiers</i></b>				
OBA10G/1.5LR1 (SEN3)	1530 to 1565	SM (9.0/125)	+13 dBm	3A / IIIb
OBPA10G/1.5VR1 (SEN4)	1530 to 1565	SM (9.0/125)	+13 dBm	3A / IIIb
Ditech optical amplifiers	Please refer to the Ditech documentation.			

**Important!** It is the class of the circuit pack, not that of the telecommunications system as a whole, that is specified.

**Connector types** With the exception of the listed port units below, each of the optical circuit packs can be equipped with either of the following connector types:

- ST
- SC
- FC/PC

**OC3/STM1/1.3IR-SR8 port unit**

The 8-port OC3/STM1/1.3IR-SR8 (LEY23) circuit packs are equipped with LC-type connectors.

**DWDM-compatible OC192/STM64 port units**

The DWDM-compatible OC192/STM64 port units (LEY201...240) are equipped with LC-type connectors.

**Optical booster amplifiers**

The optical booster amplifiers (SEN3, SEN4) can be equipped with either of the following connector types:

- SC
- FC/PC.

□

## Laser product classification

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**Standards compliance** The WaveStar® TDM 10G (STM-64) product complies with both IEC standards and the Food and Drug Administration's Center for Devices and Radiological Health (FDA/CDRH) regulations.

**FDA/CDRH regulations** Laser products are classified in accordance with the FDA/CDRH - 21 CFR 1010 and 1040. The classification scheme is based on the ability of the laser emission to cause injury to eye or skin during normal operating conditions.

In the United States, lasers and laser systems in the infrared wavelength range (greater than 700 nm) are assigned to one of the following classes:

- Class I,
- Class IIIb or
- Class IV.

Laser classification is dependent upon operating wavelength, output power and fiber modefield diameter (core diameter).

**IEC requirements** The International Electro-Technical Commission (IEC) establishes standards for the electrical and electronic industries. IEC-60825 has been established for the worldwide safety of laser products.

According to the IEC classification, lasers and laser systems in the infrared wavelength range (greater than 700 nm) are assigned to one of the following classes:

- Class 1,
- Class 3A,
- Class 3B or
- Class 4.

There are some major differences between the FDA/CDRH regulations and IEC:

1. The Accessible Emission Limits (AEL) are different.
2. Class 3A applies to all wavelengths.
3. Class 3B requires strict engineering controls.
4. Classification is under single fault conditions.

**Hazard level assignment** "Hazard level" refers to the potential hazard from laser emission at any location in an end-to-end optical fiber communication system that may be accessible during service or in the event of a failure. The assignment of hazard level uses the AELs for the classes.

Hazard levels for optical transmission equipment are assigned in either of the following two ways:

- actual output power from the connector or fiber cut.
- if automatic power reduction is used, output power at the connector or fiber cut at one second after automatic power reduction takes place provided that maximum output and restart conditions are met.

**Classification of optical telecommunication equipment**

Optical telecommunication equipment is generally classified as IEC Class 1 or FDA/CDRH Class I, because under normal operating conditions, the transmitter ports terminate on optical fiber connectors. These are covered by a front panel to ensure protection against emissions from any energized, unterminated transmitter.

The circuit packs themselves, however, may be IEC Class 1 or 3A or FDA/CDRH Class I or IIIb.

□

## Electrostatic discharge

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**Overview** Electrostatic discharge (ESD), e.g. caused by touching with the hand, can destroy semiconductor components. The correct operation of the complete system is then no longer assured.

*All* semiconductor components are basically sensitive to electrostatic discharge. The electrostatic discharge can also affect the components indirectly via contacts or conductor tracks.

**Barred-hand symbol** Circuit packs containing components that are especially sensitive to electrostatic discharge are identified by warning labels bearing the barred-hand symbol.



**ESD instructions** Observe the following ESD instructions to avoid damage to electrostatic-sensitive components:

- Wear working garment made of 100% cotton to avoid electrostatic discharge.
- Touch the circuit packs at the edges or the insertion and removal facilities only.
- Ensure that the rack is grounded.
- Wear conductively connected wrist straps and connect them to the rack ESD bonding point.
- Work in an area which is protected against electrostatic discharge. Use conducting floor and bench mats which are conductively connected to the rack ESD bonding point.
- Conductively connect all test equipment and trolleys to the rack ESD bonding point.
- Store and ship circuit packs and components in their shipping packing. Circuit packs and components must be packed and unpacked only at workplaces suitably protected against build-up of charge.

□

## Important safety instructions for WaveStar® TDM 10G (STM-64) systems

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**Instructions** Especially observe the following safety instructions, they are of particular importance for WaveStar® TDM 10G (STM-64) systems:

### **Invisible laser radiation**



#### **DANGER**

#### **Injury to eyes caused by invisible laser radiation.**

*WaveStar® TDM 10G (STM-64) systems operate with invisible laser radiation. Laser radiation can cause considerable injuries to the eyes.*

*Never look into the end of an exposed fiber or into an open optical connector as long as the optical source is switched on. Always observe the laser warning instructions (see section “Laser safety” (1-6)).*

### **Power supply plug**



#### **DANGER**

#### **Arcing on removing or inserting a live power supply plug.**

*Arcing can cause serious burns to the hands and damage to the eyes.*

*Ensure that the line circuit-breaker on the Rack Connection Panel (RCP) is in the “OFF” position before removing or inserting the power supply plug.*

### Shielded 10BaseT LAN cables



#### **DANGER**

##### **Risk of electrical shock and/or serious injury**

*There is a risk of electrical shock and/or serious injury if shielded 10BaseT LAN cables are used, and the applicable national safety requirements have not been met.*

*The usage of **shielded** 10BaseT LAN cables is only allowed if the applicable national safety requirements have been met by the user. Otherwise, there is a risk of electrical shock and/or serious injury.*

### Electrostatic discharge (ESD)



#### **CAUTION**

##### **Destruction of components by electrostatic discharge.**

*Electronic components can be destroyed by electrostatic discharge.*

*Plug-in units must therefore always be kept in antistatic covers. Use the original packaging if possible. Always observe the ESD instructions (see section “Electrostatic discharge” (1-16)).*

### Overheating



#### **CAUTION**

##### **Risk of fire due to overheating.**

*Inadequate heat dissipation can cause heat accumulation or even a fire in the network element.*

*Therefore, ensure that the fans of a fan unit are not obstructed and strictly observe the six-month periodic fan filter replacement interval to avoid clogging of the filter and to always ensure a sufficient air flow!*





## 2 Overall installation and test planning

### Overview

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**Purpose** The purpose of this chapter is to provide the information needed to plan the installation of a WaveStar® TDM 10G (STM-64) system.

**Contents**

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Sequence of steps	2-2
Important facts to know	2-5
Required tools and test equipment	2-7



## Sequence of steps

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**Overview** This section provides information about the sequence of steps that should be observed when installing the WaveStar® TDM 10G (STM-64) system. All steps are described in detail in the following chapters.

**Sequence** The following table shows an overview of the installation steps:

<b>Main task</b>	<b>Subtask [section/page]</b>
Rack installation	“Unpacking the racks” (3-3)
	“Fastening the ETSI rack” (3-5)
	“Grounding the racks” (3-7)
	“Mounting the alarm lamps” (3-8)
Mounting the RCP	“Mounting the RCP” (3-18)
Shelf installation	“Unpacking the shelves and circuit packs” (3-23)
	“Mounting the shelves and heat baffles” (3-26)
	“Mounting the fiber tubes” (3-31)
	“Mounting the cable tie bars” (3-33)
	“Installing the plug-in units” (3-51)
	“Mounting the shelf front covers” (3-52)
Mounting the ESD sockets	“Mounting the ESD sockets (for ETSI racks only)” (3-58)
Mounting the rack doors	“Mounting the rack doors (for ETSI racks only)” (3-59)

<b>Main task</b>	<b>Subtask [section/page]</b>
Cabling	“Power cables” (4-4)
	“Alarm power cables” (4-9)
	“Fan power cables” (4-11)
	“Fan alarm cables” (4-14)
	“Office alarm cables” (4-17)
	“Reference timing cables” (4-26)
	“Shelf timing cables” (4-33)
	“Shelf control cables” (4-36)
	“User byte cables” (4-39)
	“Electrical STM cables” (4-43)
	“LAN cable” (4-45)
	“TXI cables” (4-47)
	“Fibre cables” (4-51)
	Putting into operation / NE test
“Testing/switching on the voltage supply lines” (5-4)	
“WaveStar® CIT installation” (5-6)	
“NE software installation” (5-12)	
“Voltage supply test of the circuit packs” (5-18)	
“Connecting the WaveStar® CIT to the NE” (5-19)	
“LED test” (5-25)	
NE provisioning	“Office alarm test” (5-29)
	“Assigning the high speed part of the main shelf” (6-2)
	“Assigning the expansion shelf” (6-4)
	“Setting of the NE date and time” (6-6)
	“Provisioning of the timing references” (6-7)
NE synchronisation test	“Provisioning of the system timing” (6-10)
	“NE synchronisation test” (5-31)
Power on recovery test	“Power on recovery test” (5-34)
Ring establishing	“High level ring connection” (7-3)

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<b>Main task</b>	<b>Subtask [section/page]</b>
Network setup	“Setting up the DCC channels” (7-15) “Setting up a cross connection” (7-17)
Network test	“Control and supervision via remote login” (8-2) “Testing the line timing functionality” (8-6) “Alarm test” (8-8)

□

## Important facts to know

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- Rack installation** The racks require an area of 600 mm/23.6 inch x 600 mm/23.6 inch (width x depth) in accordance with ETSI 300 119-3. This area represents the absolute system limits which must not be exceeded in the operating state by protruding elements such as switches or plugs. The standard height is 2.2m/86.53 inch. In a rack with this height one Main Shelf, one Expansion Shelf and one Rack Connection Panel (RCP) can be mounted. A 2.6 m (102.27 inch) rack must be used to accommodate 2 Main Shelves or 3 Expansion Shelves.
- Network limit** A maximum of 50 WaveStar® TDM 10G NEs can be arranged in one IS-IS routing domain. This is valid for level 1 and level 2.
- Circuit pack handling** The following *ESD instructions* must be observed when handling circuit packs:
- Wear working garment made of 100% cotton to avoid electrostatic discharge.
  - Touch the circuit packs at the edges or the insertion and removal facilities only.
  - Ensure that the rack is grounded.
  - Wear conductively connected wrist straps and connect them to the rack ESD bonding point.
  - Work in an area which is protected against electrostatic discharge. Use conducting floor and bench mats which are conductively connected to the rack ESD bonding point.
  - Conductively connect all test equipment and trolleys to the rack ESD bonding point.
  - Store and ship circuit packs and components in their shipping packing. Circuit packs and components must be packed and unpacked only at workplaces suitably protected against build-up of charge.

**Mounting of an additional NE**

An additional NE (for example, an Expansion Shelf) can be mounted into a rack without affecting traffic. Nevertheless, some points should be observed during the installation.

1. Remove all rack doors before any installation work.
2. All circuit breakers assigned to the new NE should be in the OFF position during cable installation.
3. During installation be careful not to damage already existing equipment. For example, take care that no cable is injured or pulled off.

A maximum of 3 Expansion Shelves can be managed if the circuit packs SWITCH/STS768 and PPROC/STS384 are used (see section “Main Shelf configuration” (3-35)).

□

## Required tools and test equipment

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**Tools** Listed below are the tools needed while installing and testing. Only metric tools should be used.

Tool	Purpose
ESD wrist strap (included in the shelf delivery)	ESD protection
Isopropanol, compressed air and wipes	fibre cleaning
Microscope with a magnification x 200	checking the connector face for impurities
Fiber installation tool (included in the installation kit)	leading the fibre cables through the shelf
Optical fibres (different lengths and attenuations)	optical power measurement
PC (Laptop)	provisioning purposes via WaveStar® CIT

**Test equipment** A variety of test equipment is required to carry out the individual tests. The following table provides an overview of the required equipment. The types listed are suggestions only. Equipment of another type or manufacturer can also be used.

Test equipment	Type	Purpose
PDH/SDH analyzer (STM-1-STM64)	W&G ANT-20 Anritsu MP 1570A HP 37718A	testing different interfaces depending on applications
Optical multi-wavelength meter	HP 86120C	verifying wavelength (in case of interworking with DWDM-systems)
Optical power meter	W&G OLP-15	optical power measurement (if wavelength meter is not required)
Adjustable optical attenuator	W&G OLA-35	optical power measurement
Multimeter	Fluke 8060A	-48V/-60V DC power supply measurement

**WaveStar® CIT requirements**

The minimum requirement for a WaveStar® CIT is a personal computer with the following:

- Pentium® 266-MHz processor (500 MHz or higher recommended) with 128-MB RAM (256 MB recommended)
  - 139 MB (and more) of Virtual Memory
  - Standard floppy drive for 1.44-MB 3.5" floppy disks
  - 150 MB of free hard drive space (for the CIT software only; for the NE software generics and the online help files 120 MB additional free hard drive space should be reserved)
  - CD-ROM drive (16X or higher)
  - PCMCIA (Personal Computer Manufacturer's Card Interface Adapter) slot type II
  - SVGA monitor set with 800x600 resolution or higher and 256 colors (1024x768, 16 million colors recommended)
  - 10/100 BaseT LAN interface built-in or supplied with a PCMCIA card, installed and working
- NOTE:** The PCMCIA slot must be equipped with the 10/100 BaseT LAN interface to support WaveStar® CIT communication with the NE over the OSI LAN via TCP/IP protocol interface.
- Microsoft Windows® NT 4.0 or Windows® 2000 operating system
  - Adobe Acrobat Reader for Windows (version 3.01 or later)
  - Removable hard drive (optional; required only for system backup).

**NOTE:** The minimum requirements are sufficient to run the WaveStar® CIT on a single NE while the recommended requirements should be used to optimize the WaveStar® CIT performance. As the WaveStar® CIT is used with multiple NE connections and multiple NE types, the processor type and speed and the memory size will all factor into WaveStar® CIT performance.

□



# 3 Equipment installation

## Overview

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**Purpose** The purpose of this chapter is to provide the information needed to install all mechanical parts of a WaveStar® TDM 10G (STM-64) system.

**Required area** The racks require an area of 600 mm/23.6 inch x 600 mm/23.6 inch (width x depth). This area represents the absolute system limits which must not be exceeded in the operating state by protruding elements such as switches or plugs. The standard height is 2.0 m (78.66 inch) for a Seismic rack and 2.2 m (86.53 inch) or 2.6 m (102.27 inch) for an ETSI rack.

### Contents

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Mounting the rack doors (for ETSI racks only)	3-59



## Unpacking the racks

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**ETSI rack** The ETSI rack (Comcode 848438974 for 2.2 m, Comcode 848514147 for 2.6 m) is delivered in a pre-assembled version, meaning that all parts of the frame are already mounted. The delivery also includes the following:

- **Cardboard box** contains alarm light assembly (Comcode 848130423), spare parts and assembly kit with 10 hex. bolts M6x16 (Comcode 847079860), 2 clip self-adhesives (Comcode 402185409) and 4 doorstrikes (2 x bottom: Comcode 848302527, 2 x top: Comcode 848302501).
- **Set of cage nuts**  
The cage nuts (Comcode M6: 407568062) are needed to fix accessories (e.g. RCP, shelves and baffles) to the rack. Keep them for later use.
- **2 Indicator strips** (Comcode 848130522)
- **2 ESD sockets** (Comcode 847763315)
- **2 ESD stickers** (Comcode 847047958).

**Seismic rack** The Seismic rack (Comcode 848440376) is delivered in a pre-assembled version, meaning that all parts of the frame are already mounted. The delivery also includes the following:

- **4 Indicator Lamp Assemblies** (Comcode 847895299)
- **2 Indicator strips** (Comcode 848061230)
- **4 Stranded ground wires, 10 gauge** (Comcode 403680382)
- **16 taptite hex screws M6x16** (Comcode 901331421).

**Unpacking** Proceed as follows to unpack the rack:

---

- 1 Put the rack cabinet onto the bottom.  

---
- 2 Uncrate the rack cabinet by removing all screws and take all side and top panels away.  

---
- 3 Cut or unclip the black transport bands.  

---
- 4 Remove any unnecessary packing material.

- 
- 5** In the case of the ETSI rack, remove all stiffener strips (Comcode 848128930) which are installed for transport purposes only.

END OF STEPS

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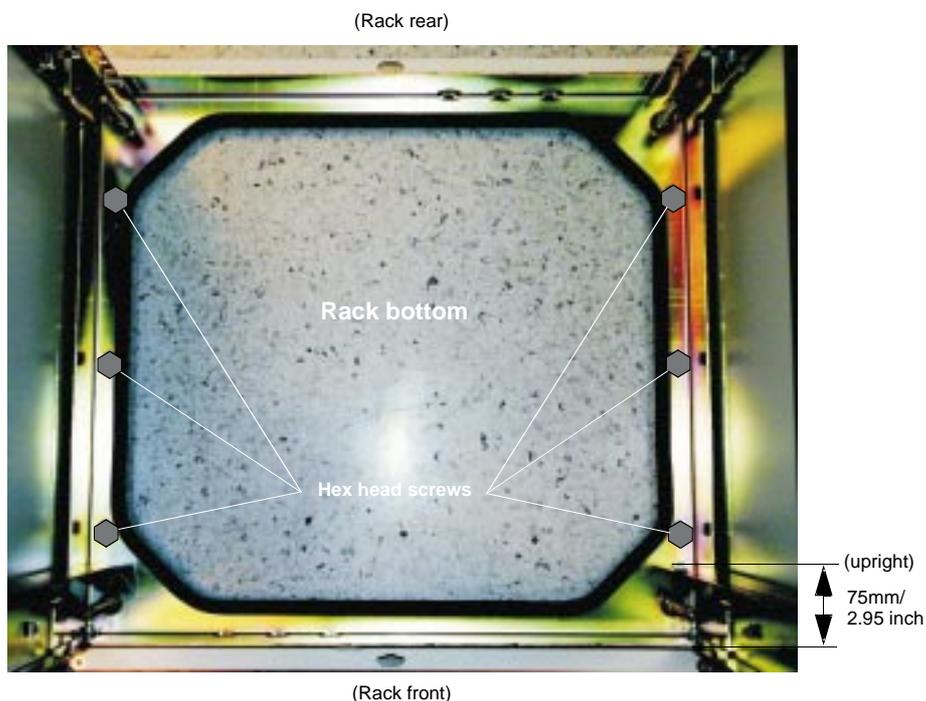
## Fastening the ETSI rack

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**Overview** The ETSI rack (Comcode 848438974) can be affixed to the floor as described below. The rack feet are adjustable allowing for an unevenness of the floor of up to 25 mm/0.98 inch.

**Important!** Due to varying local requirements the mounting material is not part of the rack delivery.

**Floor fixture** Fasten the ETSI rack to the floor with 6 hex head screws (minimum M6) and short floor anchors as shown in the following figure.



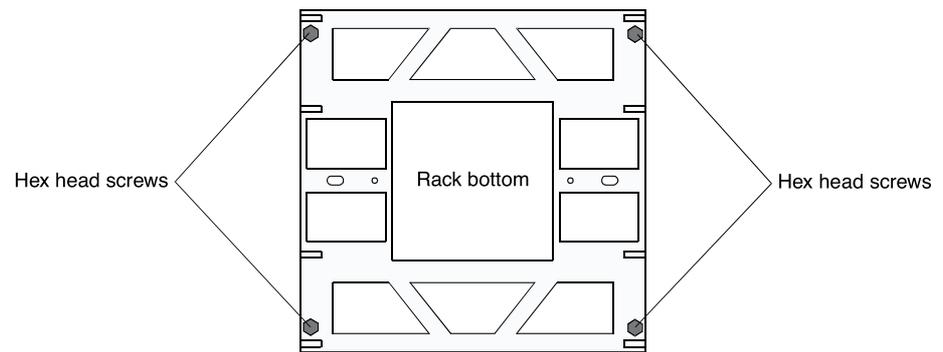
## Fastening the Seismic rack

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**Overview** The Seismic rack (Comcode 848440376) can be affixed to the floor as described below.

**Important!** Due to varying local requirements the mounting material is not part of the rack delivery.

**Floor fixture** Fasten the Seismic rack to the floor with 4 hex head screws (minimum M6) and long floor anchors as shown in the following figure.

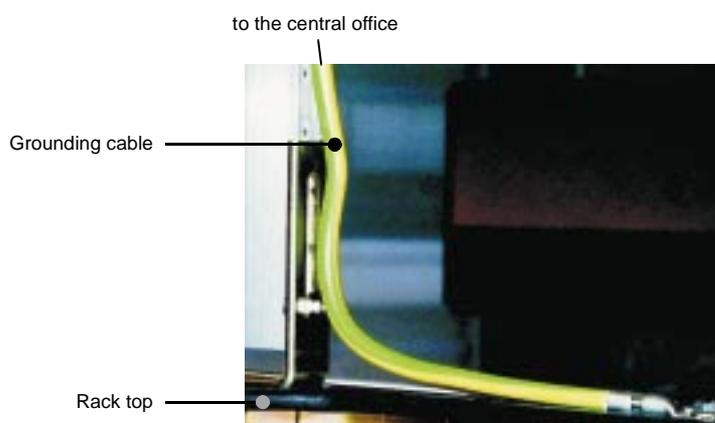
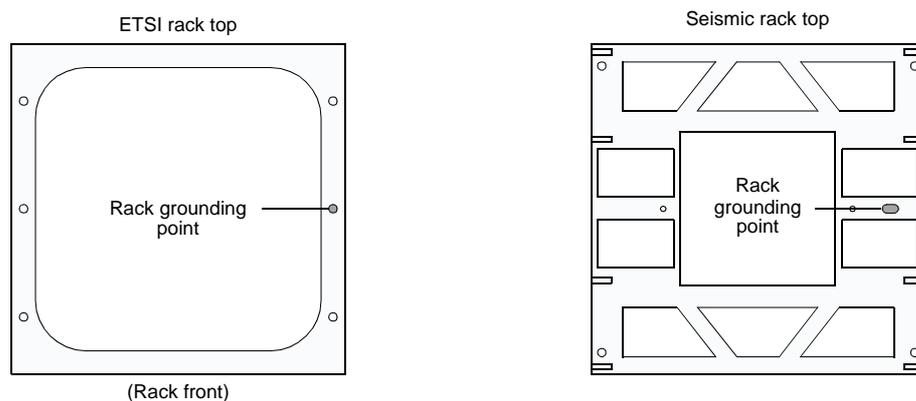


□

## Grounding the racks

**Overview** The rack must be connected, via the shortest route possible, to the available central office. The minimum cross-section of the grounding cable (copper/Cu) must be  $16 \text{ mm}^2 / 6 \text{ AWG}$  (a cross-section of  $25 \text{ mm}^2 / 4 \text{ AWG}$  is recommended).

**Grounding** One grounding point is available on each rack top. To ground the rack, fasten the cable lug at the rack grounding point as shown in the following figure.



### Notes:

The ETSI rack is provided with two M6 holes, on a pitch of 19 mm (3/4"), suitable for single and double hole cable lugs.

The Seismic rack is provided with a single M6 stud, suitable for a single hole cable lug.

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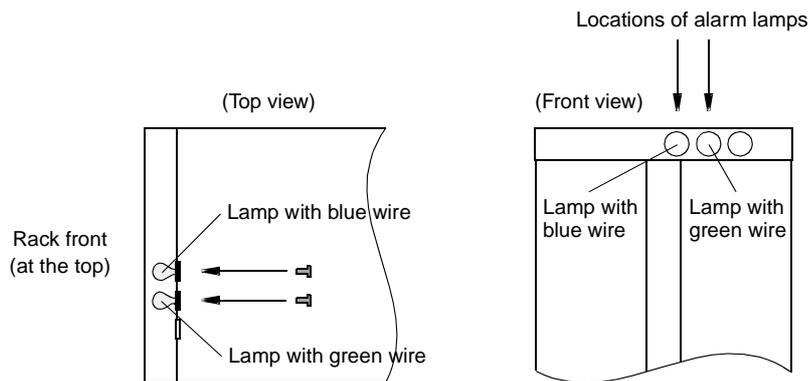
## Mounting the alarm lamps

**Overview** Four alarm lamps which are part of the rack deliveries (ETSI: Comcode 848438974, Seismic: Comcode 848440376) must be mounted at the rack top (two at the rack front and two at the rack rear). They are used for an optical indication of office alarms. The alarm lamps are part of the rack delivery.

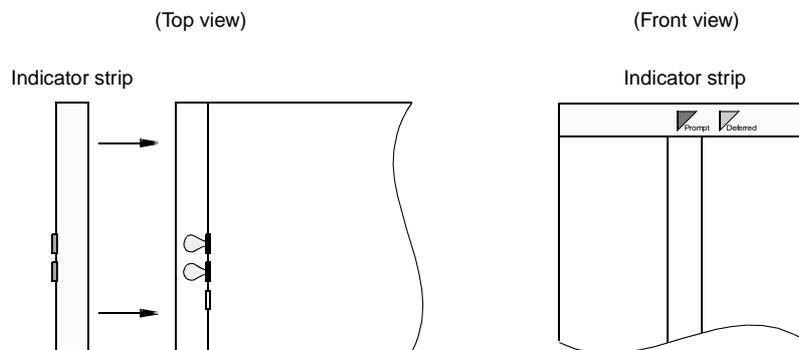
**Important!** The cabling (cable guidance and connection) is described in section “Office alarm cables” (4-17).

**Mounting** Follow the steps below to mount the alarm lamps (ETSI: Comcode 848130423, Seismic: Comcode 847895299) to the rack:

- 1 Fasten two alarm lamps to the rack front with small screws as shown below. Be aware of the correct location.



- 2 Place the indicator strip (ETSI: Comcode 848130522, Seismic: Comcode 848061230) for the alarm lamps onto the top of the rack front as shown below.



- 
- 3** Repeat Steps 1 and 2 at the rack rear.

END OF STEPS

---



## Rack coordination dimensions

---

**Overview** The rack coordination dimensions described below must be observed in order to ensure that there is the necessary space for cabling and heat dissipation of the system. The rack coordination dimensions depend on the specific local characteristics (Overhead structure or Raised floor).

If the span length is beyond 80 km, optical amplifiers in conjunction with DCM boxes are required. The rack coordination dimensions for that case are described in sections “Span length 80 km (OBPA amplifiers)” (3-16) and “Span length 120 km (Ditech amplifiers)” (3-17).

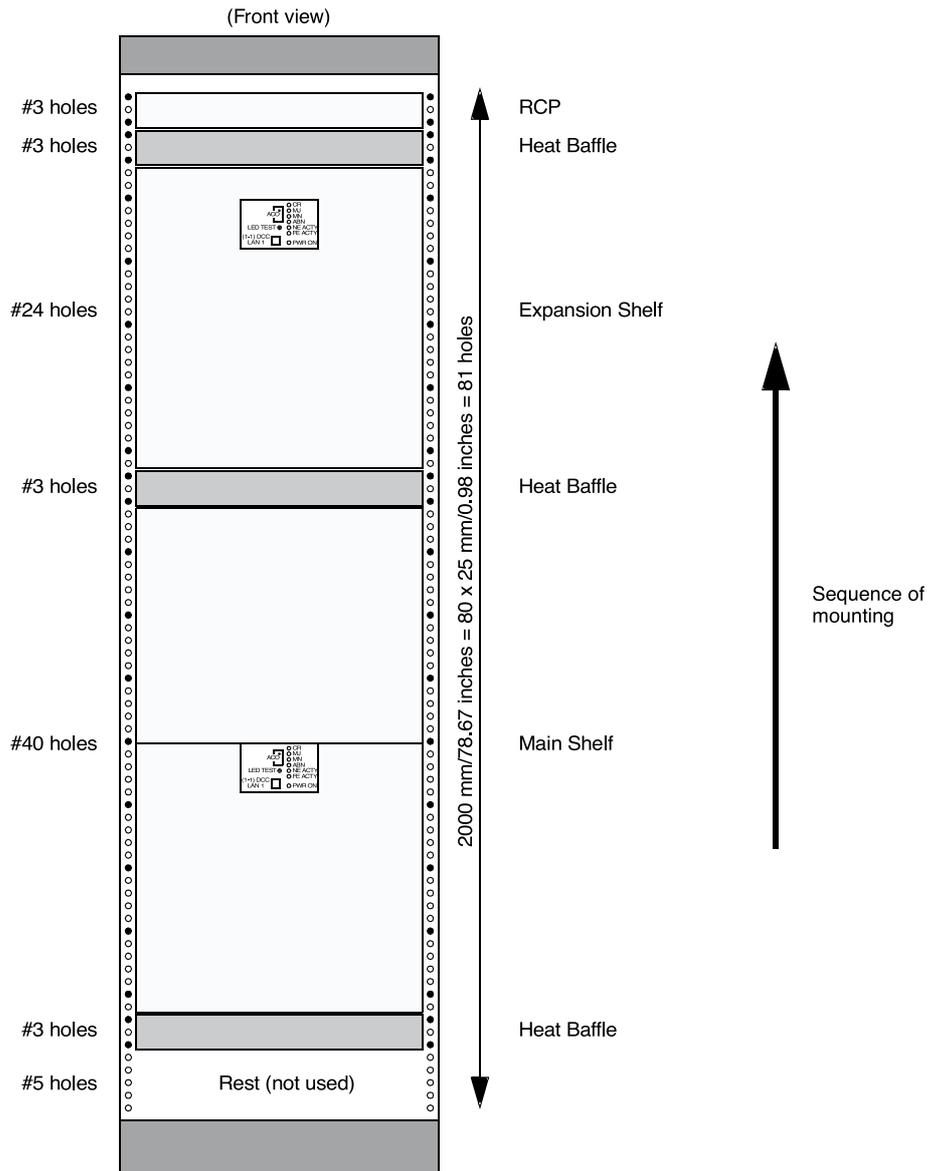
**Overhead structure** If the external cables (e.g. power cables and optical fibres) come from the top, it is recommended that the Main Shelf be mounted below the Expansion Shelf.

**Raised floor** If the external cables (e.g. power cables and optical fibres) come from the bottom, it is recommended that the Main Shelf be mounted above the Expansion Shelf.

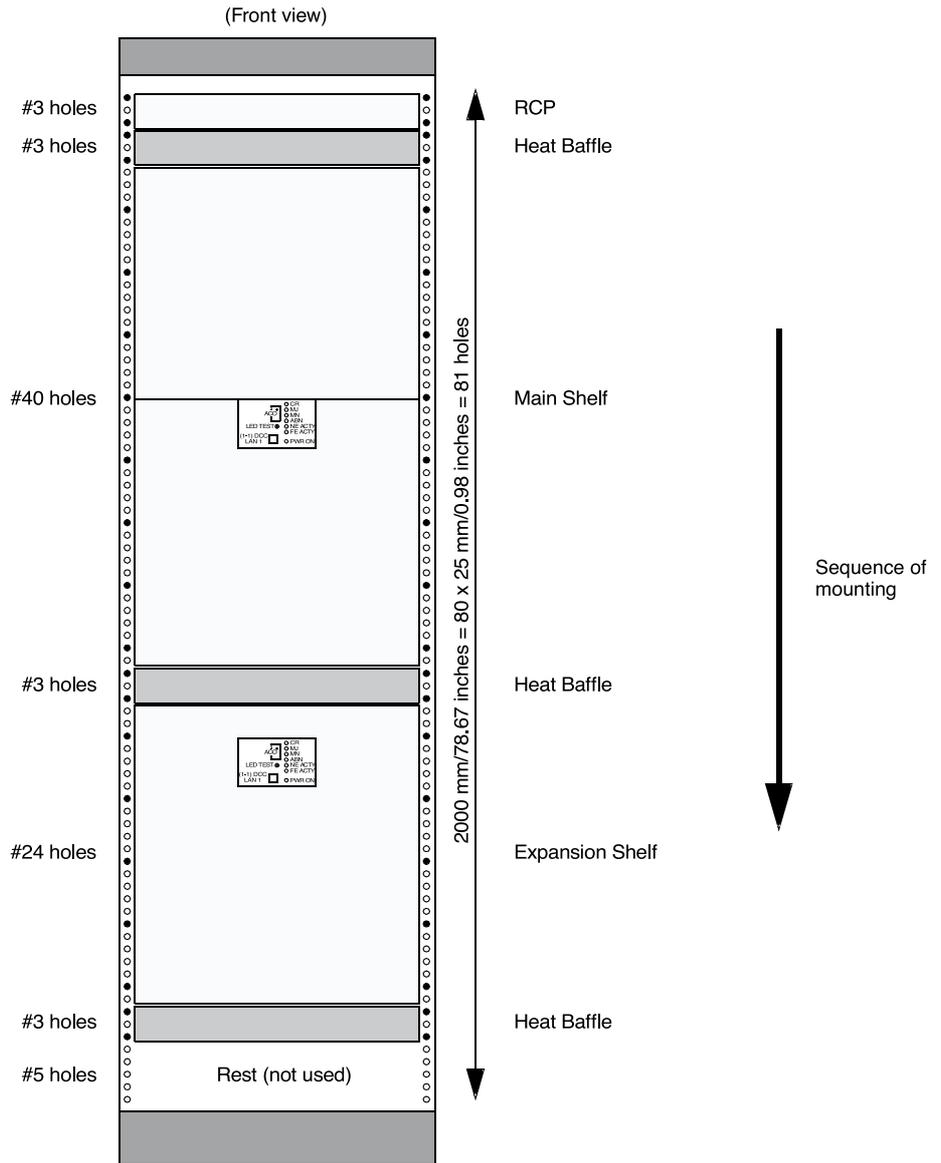
**ETSI rack coordination dimensions** The possible rack coordination dimensions for standard ETSI racks (2.2 m/86.53 inch or 2.6 m/102.27 inch) are illustrated in the following 3 figures.

**Important!** The black filled holes always represent the mounting positions.

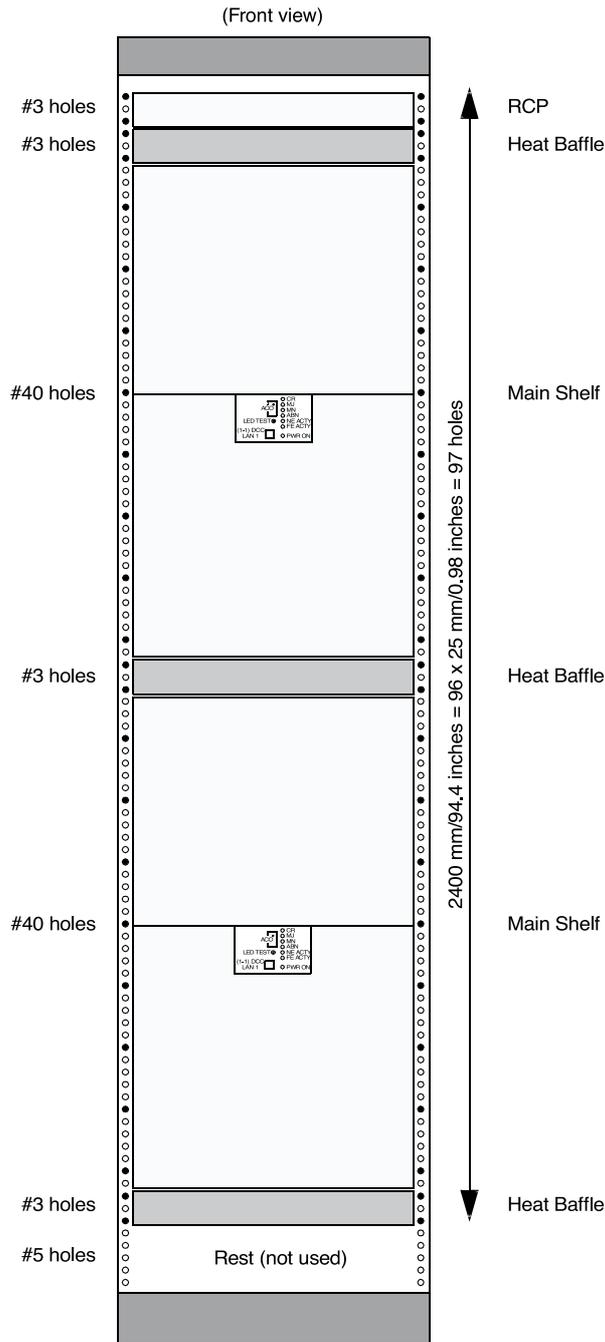
### 2.2 m with Overhead structure (ETSI)



**2.2 m with Raised floor  
(ETSI)**



**2.6 m with 2 Main Shelves (ETSI)**

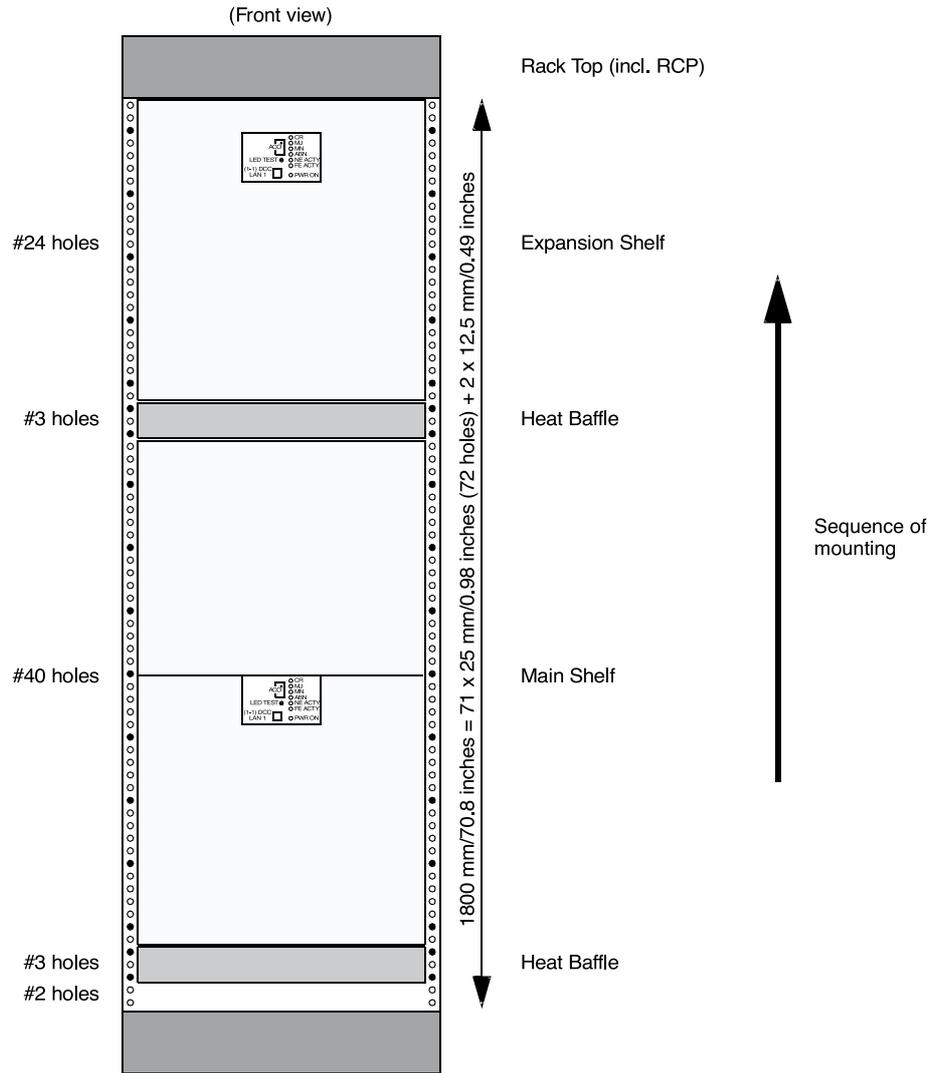


**Seismic rack coordination dimensions**

The possible rack coordination dimensions for a standard Seismic rack (2.0 m) are illustrated in the following 2 figures.

**Important!** The black filled holes always represent the mounting positions.

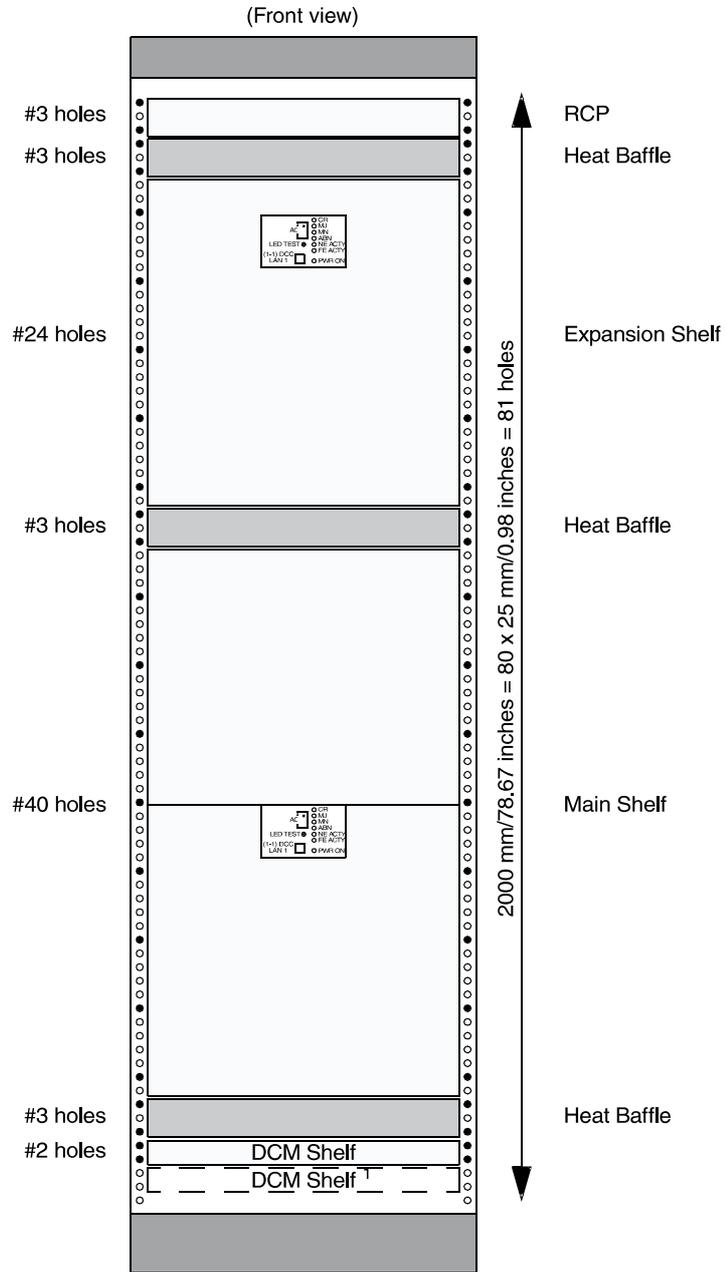
**2.0 m with Overhead structure (Seismic)**





**Span length > 80 km  
(OBPA amplifiers)**

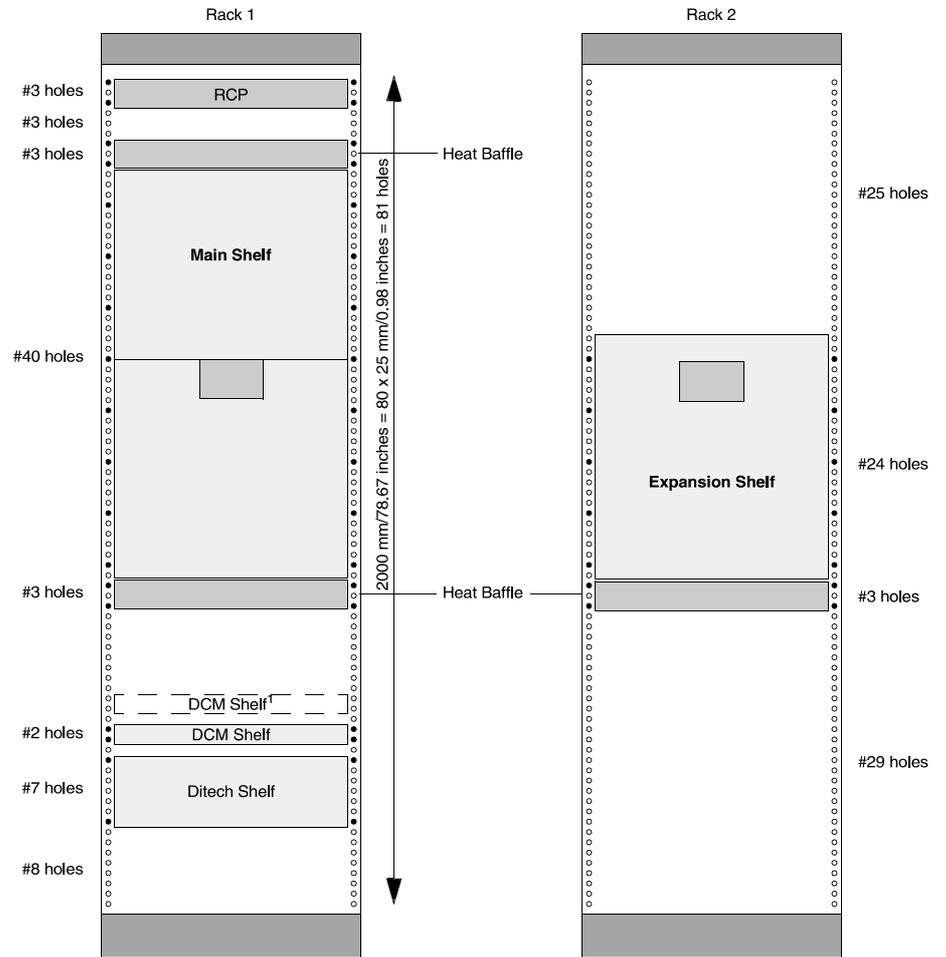
If the span length is beyond 80 km, OBPA amplifiers in conjunction with a DCM shelf (contains the needed DCM boxes) are required. This makes the following rack configuration mandatory.



<sup>1</sup> necessary, if both STM-64 port units are used (“(1-2) trw” and “(1-2) tre”)

**Span length > 120 km  
(Ditech amplifiers)**

If the span length is beyond 120 km, Ditech amplifiers in conjunction with a DCM shelf (contains the DCM boxes needed) are required. This makes the following rack configuration mandatory.



<sup>1</sup> necessary, if both STM-64 port units are used ("(1-2) trw" and "(1-2) tre")



## Mounting the RCP

---

**Overview** The RCP represents the interface between the central office battery and the shelves. With the help of the RCP a redundant power supply to the shelves can be established. Additionally, the RCP contains an alarm panel for connecting optical and acoustic alarm cables. Two 2.5 A circuit breakers for the alarm panel are already inserted.

**RCP types** There are the following RCP types:

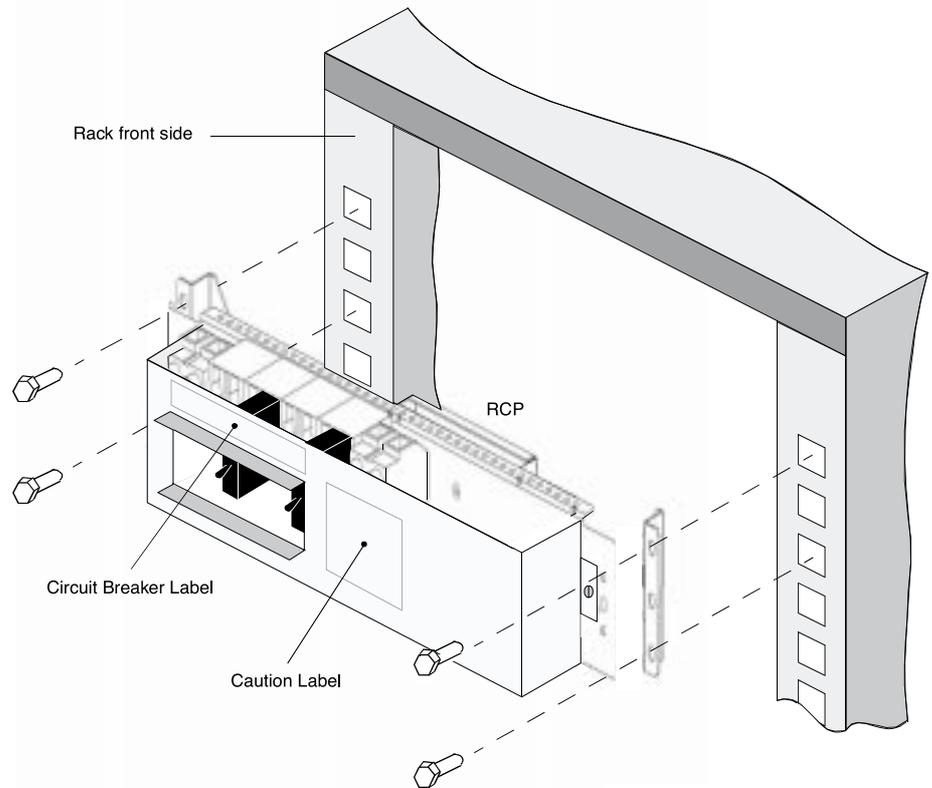
- **Single MESH** (Comcode 848447231)  
This RCP is used for Mesh Ground Networks and supports the standard rack configuration (1 Main Shelf + 1 Expansion Shelf).
- **Dual MESH** (Comcode 848447306)  
This RCP is used for Mesh Ground Networks and supports the rack configuration with 2 Main Shelves. It provides separated dual power feeds for each single shelf.

**Delivery** The RCP delivery includes the following:

- 2 Alarm circuit breakers, 2.5A (Comcode 408232064, are already inserted)
- 2 Alarm power cables (Comcode 848482493)
- 1 Grounding cable, 0.5m/19.67 inch (Comcode 848506069)
- 6 Taptite hex head screws M6x16 (Comcode 901331421)
- 1 Label set (Comcode 848724472).

**Mounting to an ETSI rack**

The following figure shows the RCP mounting to an ETSI rack in principle.

**Procedure**

Follow the steps below in the given order for mounting the RCP to an ETSI rack:

- 1 On each side of the RCP, insert 2 cage nuts into the first and third 9x9 rack holes from the top.  
.....
- 2 Fasten the RCP to the rack using 4 hex head screws (M6) as shown in the figure above.

- 3 Affix the Circuit Breaker Label and the Caution Label to the RCP as shown in the figure above.

Circuit Breaker Label

MAIN SUBRACK #1	EXP SUBRACK #1	ALARM PANEL	MAIN SUBRACK #1	EXP SUBRACK #1	ALARM PANEL
HS LS	#1		HS LS	#1	

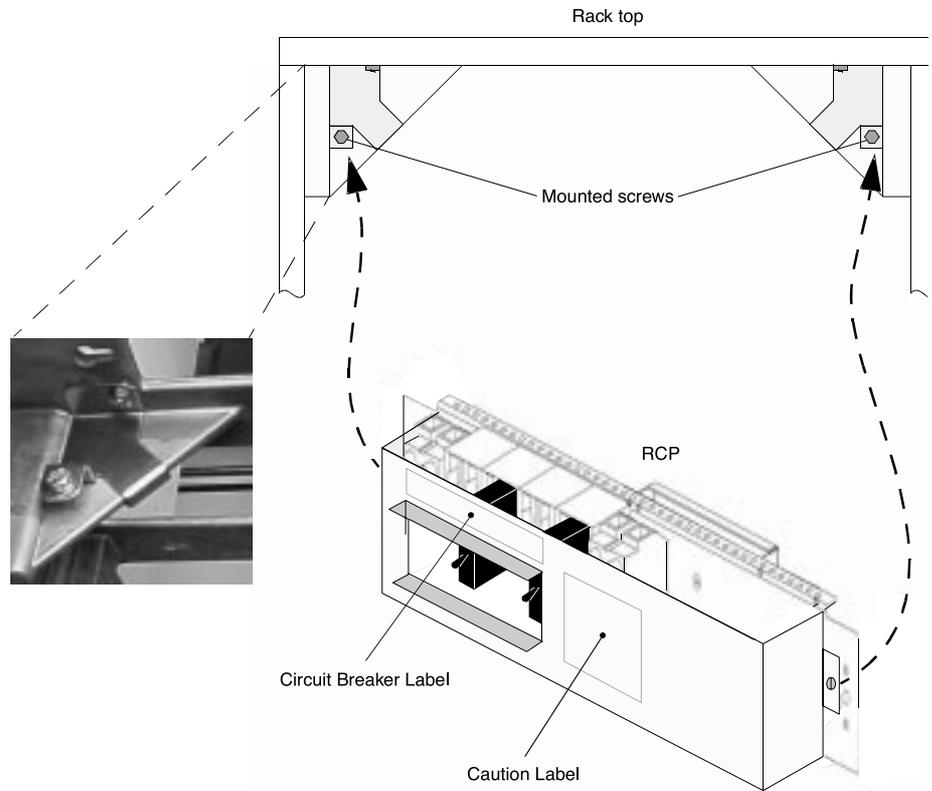
Caution Label

<b>⚠ CAUTION</b>
<p>This Equipment has a connection between the earthed conductor of the d.c. supply circuit and the earthing conductor. This equipment shall be connected directly to the d.c. supply system earthing electrode conductor or to a bonding jumper from an earthing terminal bar or bus to which the d.c. supply system earthing electrode conductor is connected.</p> <p>This equipment shall be located in the same immediate area (such as adjacent cabinets) as any other equipment that has a connection between the earthed conductor of the same d.c. supply circuit and the earthing conductor, and also the point of earthing of the d.c. system. The d.c. system shall not be earthed elsewhere.</p> <p>The d.c. supply source is to be located within the same premises as this equipment.</p> <p>Switching or disconnecting devices shall not be in the earthed circuit conductor between the d.c. source and the point of the connection of the earthing electrode conductor.</p>
<b>⚠ ATTENTION</b>
<p>Cet appareil comporte une connexion entre le conducteur relié à la terre du circuit d'alimentation c.c. et son conducteur de terre.</p> <p>Ce matériel doit être raccordé directement au conducteur de la prise de terre du circuit d'alimentation c.c. ou à une tresse de mise à la masse reliée à une barre omnibus de terre laquelle est raccordée à l'électrode de terre du circuit d'alimentation.c.c.</p> <p>Les appareil don't les conducteurs de terre respectifs sont raccordés au conducteur de terre du même circuit d'alimentation c.c. Doivent être installés à proximité les uns des autres (p.ex., dans des armoires adjacentes) et à proximité de la prise de terre du circuit d'alimentation c.c. ne doit comporter aucune autre prise de terre.</p> <p>La source d'alimentation du circuit c.c. doit être située dans la même pièce que le matériel.</p> <p>Il ne doit y avoir aucun dispositif de commutation ou de sectionnement entre le point de raccordement au conducteur de la source d'alimentation c.c. et le point de raccordement à la prise de terre.</p>

END OF STEPS

**Mounting to a Seismic rack**

The following figure shows the RCP mounting to a Seismic rack in principle.

**Procedure**

Follow the steps below in the given order for mounting the RCP to a Seismic rack:

- 1 Fasten the RCP to the rack via two screws which are already mounted in the rack (see figure above).

- 2 Affix the Circuit Breaker Label and the Caution Label to the RCP as shown in the figure above.

Circuit Breaker Label

MAIN SUBRACK #1 HS LS	EXP SUBRACK #1	ALARM PANEL	MAIN SUBRACK #1 HS LS	EXP SUBRACK #1	ALARM PANEL
--------------------------------	----------------------	----------------	--------------------------------	----------------------	----------------

Caution Label

<b>⚠ CAUTION</b>
<p>This Equipment has a connection between the earthed conductor of the d.c. supply circuit and the earthing conductor. This equipment shall be connected directly to the d.c. supply system earthing electrode conductor or to a bonding jumper from an earthing terminal bar or bus to which the d.c. supply system earthing electrode conductor is connected.</p> <p>This equipment shall be located in the same immediate area (such as adjacent cabinets) as any other equipment that has a connection between the earthed conductor of the same d.c. supply circuit and the earthing conductor, and also the point of earthing of the d.c. system. The d.c. system shall not be earthed elsewhere.</p> <p>The d.c. supply source is to be located within the same premises as this equipment.</p> <p>Switching or disconnecting devices shall not be in the earthed circuit conductor between the d.c. source and the point of the connection of the earthing electrode conductor.</p>
<b>⚠ ATTENTION</b>
<p>Cet appareil comporte une connexion entre le conducteur relié à la terre du circuit d'alimentation c.c. et son conducteur de terre.</p> <p>Ce matériel doit être raccordé directement au conducteur de la prise de terre du circuit d'alimentation c.c. ou à une tresse de mise à la masse reliée à une barre omnibus de terre laquelle est raccordée à l'électrode de terre du circuit d'alimentation.c.c.</p> <p>Les appareil don't les conducteurs de terre respectifs sont raccordés au conducteur de terre du même circuit d'alimentation c.c. Doivent être installés à proximité les uns des autres (p.ex., dans des armoires adjacentes) et à proximité de la prise de terre du circuit d'alimentation c.c. ne doit comporter aucune autre prise de terre.</p> <p>La source d'alimentation du circuit c.c. doit être située dans la même pièce que le matériel.</p> <p>Il ne doit y avoir aucun dispositif de commutation ou de sectionnement entre le point de raccordement au conducteur de la source d'alimentation c.c. et le point de raccordement à la prise de terre.</p>

END OF STEPS



## Unpacking the shelves and circuit packs

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### **Main Shelf delivery (Comcode 848738357)**

Each main shelf is mounted with (comcodes in brackets):

- 1 User Panel (Comcode 848427548)
- 1 Alarm I/O Panel (108515842)
- 1 LAN I/O Panel (108516428)
- 2 TXI I/O Panels (848485538)
- 2 Power Filter Units (108542366)
- 1 Air filter (408108033)
- 2 Fan Units (408165009).

Additionally, the main shelf delivery contains the following:

- 4 Circuit breakers, 25A (408232072)
- 4 Fan power cables, 1.0 m/39.33 inch (848440665)
- 2 Fan alarm cables, 1.0 m/39.33 inch (848440673)
- 4 Shelf power cables, 3.0 m/118 inch (848440731)
- 1 Office alarm cable, 3.0 m/118 inch (848440723)
- 1 Ground cable, 2.5 m/98.33 inch (848506077)
- 1 ESD wrist strap (405254103)
- Mounting hardware (e.g. M6x16 threadforming screws (901331421)).

### **Main Shelf installation kit (Comcode 848469805)**

One installation kit is required for each main shelf. The installation kit contains the following (comcodes in brackets):

- 1 Heat baffle (848369567)
- 2 Cable tie bars (848463980)
- 4 long fiber tubes (848445599)
- 1 Pair of installation brackets (left: NB-113, right: NB-251)
- 1 Pair of rear support brackets (left: NB-205, right: NB-207)
- 1 Fiber installation tool (848439543)
- Mounting hardware (e.g. M6x16 threadforming screws (901331421)).

Please note that additional heat baffles must be ordered individually for specific rack arrangements as shown in section “Rack coordination dimensions” (3-10).

**Expansion Shelf delivery  
(Comcode 848738316)**

Each expansion shelf is mounted with (comcodes in brackets):

- 1 User Panel (848427548)
- 1 Alarm I/O Panel (108515842)
- 1 LAN I/O Panel (108516428)
- 2 TXI I/O Panels (848464004)
- 1 CTL EX I/O Panel (108516410)
- 1 TMG EX I/O Panel (108542382)
- 1 Power Filter Unit (108542366)
- 1 Air filter (408108033)
- 1 Fan Unit (408165009).

Additionally, the expansion shelf delivery contains the following:

- 2 Circuit breakers, 25A (408232072)
- 2 Fan power cables, 1.0 m/39.33 inch (848440665)
- 1 Fan alarm cable, 1.0 m/39.33 inch (848440673)
- 2 Shelf power cables, 3.0 m/118 inch (848440731)
- 1 Office alarm cable, 3.0 m/118 inch (848440723)
- 1 Ground cable, 2.5 m/98.4 inch (848506077)
- 1 ESD wrist strap (405254103)
- Mounting hardware (e.g. M6x16 threadforming screws (901331421)).

**Exp. Shelf installation kit  
(Comcode 848469797)**

One installation kit is required for each expansion shelf. The installation kit contains the following (comcodes in brackets):

- 1 Heat baffle (848369567)
- 1 Cable tie bar (848463980)
- 4 short fiber tubes short (848445581)
- 1 Pair of installation brackets (left: NB-113, right: NB-251)
- 1 Pair of rear support brackets (left: NB-205, right: NB-207)
- 1 Fiber installation tool (848439543)
- Mounting hardware (e.g. M6x16 threadforming screws (901331421)).

Please note that additional heat baffles must be ordered individually for specific rack arrangements as shown in section "Rack coordination dimensions" (3-10).

**DCM shelf and mounting hardware kit**

DCM shelves and the respective mounting hardware kits can be ordered separately:

- DCM shelf (Comcode: 84876522)
- Mounting hardware kit (Comcode: 848762530)

**Circuit pack delivery**

The circuit packs are packed in antistatic covers and delivered in cardboard boxes.

Please note that you have to keep the circuit packs in the original packaging until insertion into the shelf becomes necessary (see section “Installing the plug-in units” (3-51)).

**Unpacking**

Proceed as follows to unpack a shelf:

.....

- 1** Cut or unclip the black transport bands.
- .....

- 2** Take the side panels away.
- .....

- 3** Remove any unnecessary packaging material.

END OF STEPS

.....



## Mounting the shelves and heat baffles

---

**Overview** The following information describes how to install WaveStar® TDM 10G shelves and heat baffles in the rack. One heat baffle as well as the needed installation and rear support brackets are part of the Main Shelf and Expansion Shelf installation kits (Comcodes 848469805 and 848469797).

**Important!** Due to its weight, at least two persons are required for lifting a shelf.

**Rack requirements** The shelves are provided for standard mounting into a rack of the size 2000 mm/78.67 inch (or higher) x 600 mm/23.6 inch x 600 mm/23.6 inch (height x width x depth). A rack of this size can accommodate one Main Shelf as well as one Expansion Shelf. A 2.6 m (102.27 inch) rack must be used to accommodate 2 Main Shelves or 3 Expansion Shelves.

**Mounting** Follow the steps below in the given order for mounting shelves and heat baffles in the rack:

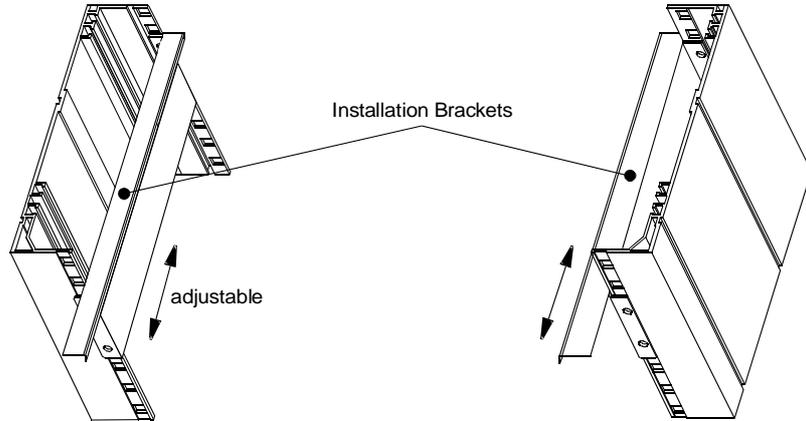
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- 1 Observe the rack coordination dimensions described in section “Rack coordination dimensions” (3-10).  

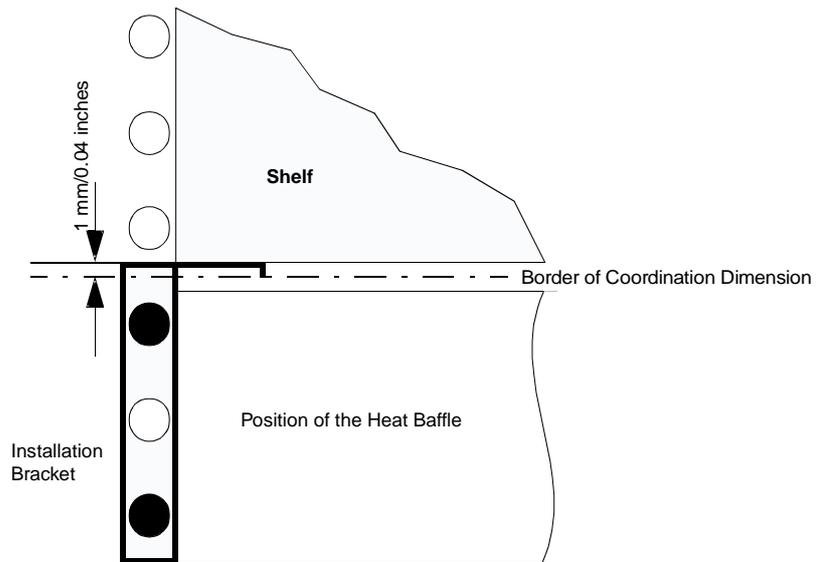
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- 2 In the case of an ETSI rack insert cage nuts into the 9x9 rack holes at all mounting positions for shelves and heat baffles.  

---
- 3 Attach each installation bracket with four M6 screws.  
Positions (hole numbers from the bottom):
  - 2.2 m ETSI rack with Overhead Structure:
    - holes #6 and #8 for the Main Shelf
    - holes #49 and #51 for the Expansion Shelf
  - 2.2 m ETSI rack with Raised Floor:
    - holes #33 and #35 for the Main Shelf
    - holes #6 and #8 for the Expansion Shelf
  - 2.6 m ETSI rack with 2 Main Shelves:
    - holes #5 and #6 for the first Main Shelf
    - holes #49 and #51 for the second Main Shelf
  - 2.0 m Seismic rack with Overhead Structure:
    - holes #3 and #5 for the Main Shelf
    - holes #46 and #48 for the Expansion Shelf
  - 2.0 m Seismic rack with Raised Floor:

- holes #30 and #32 for the Main Shelf
- holes #3 and #5 for the Expansion Shelf.



To avoid collision with the neighbouring equipment observe the borders of the coordination dimension as shown below.



- 
- 4** Set the Main Shelf onto the installation brackets and then push it backward into its final position in the rack.

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  - 5** Fasten the Main Shelf by using the supplied sixteen M6 screws.

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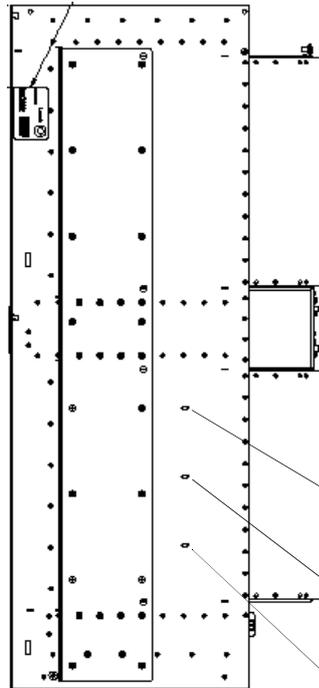
  - 6** Fasten the fiber tubes (see section “Mounting the fiber tubes” (3-31)).

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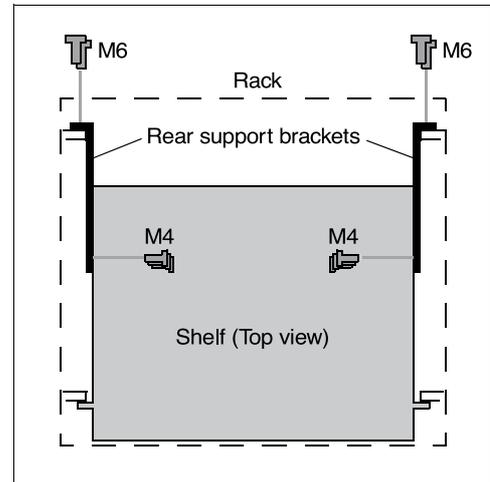
  - 7** In the case of an ETSI rack insert cage nuts into the 9x9 rack holes at the mounting positions for the rear support brackets.

- 8 To improve the stability screw the rear support brackets to the Main Shelf using three M4 screws at each side and then to the rack using four M6 screws. The accessibility for screwing the M4 screws must be guaranteed.

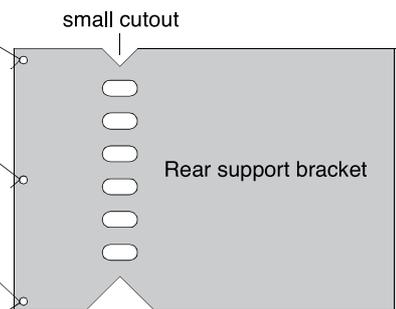
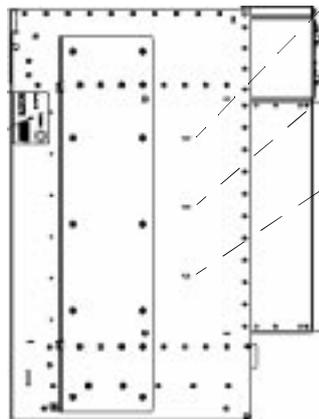
Main Shelf (side view):



(Top view)



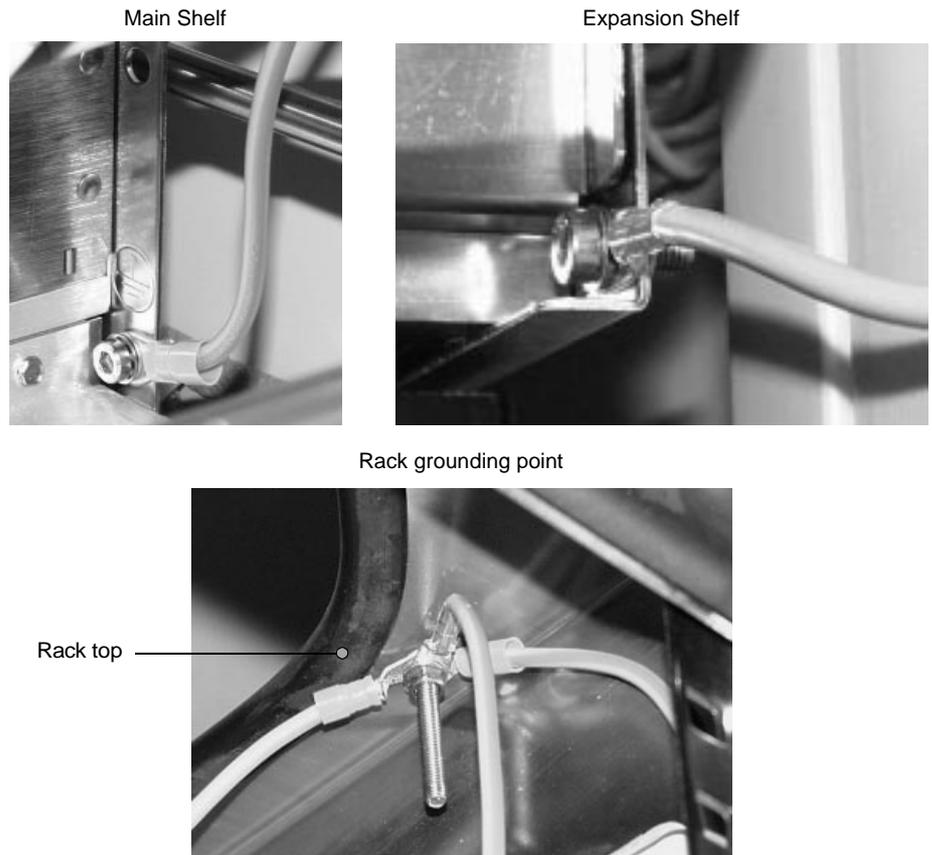
Expansion Shelf (side view):



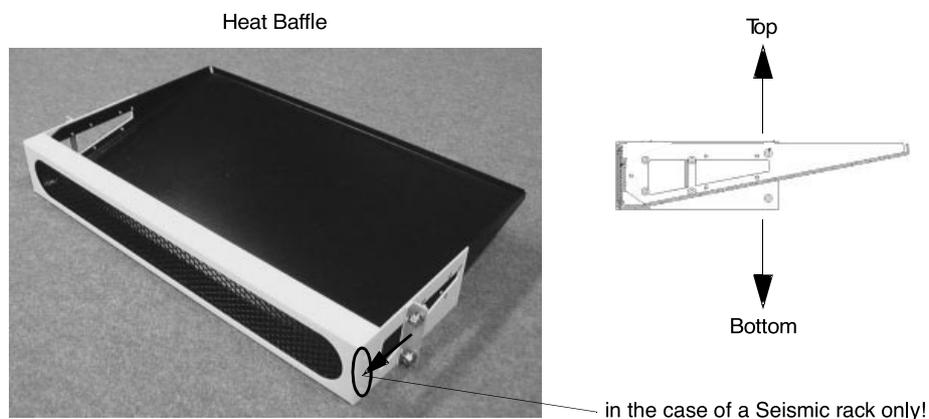
**Important!** Please note that there are two different rear support brackets, one for the left and one for the right side. The small cutouts must always point to the top.

- 9 Remove the installation brackets.

- 
- 10** Mount the Expansion Shelf in the same way as the Main Shelf.
- 
- 11** Connect the Main Shelf as well as the Expansion Shelf grounding contact which are located at the shelf rear side with the rack grounding point (see also section “Grounding the racks” (3-7)) by means of 4.65 mm<sup>2</sup> (10AWG, stranded) grounding wire (Comcode 848506077).



- 
- 12** Mount the heat baffles (Comcode 848369567) by using the supplied four M6 screws. The open side must always point upwards as shown below.



**Important!** In the case of a Seismic Rack, the flanges of the heat baffles have to be moved to the front (see figure above).

The heat baffles must be installed for air guidance and fire protective reasons.

END OF STEPS

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## Mounting the fiber tubes

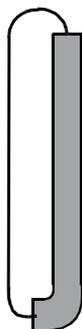
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**Overview** The fiber tubes (Comcode Main Shelf: 848445599, Comcode Expansion Shelf: 848445581) are part of the Main Shelf and Expansion Shelf installation kits (Comcodes 848469805 and 848469797). They are used for better optical fibre guidance (see Chapter 4, “Cable installation”). Four fiber tubes are needed for one shelf, two at each side. The long fiber tubes should be mounted beside a Main Shelf, the short fiber tubes beside an Expansion Shelf.

**Mounting** Follow the steps below to mount the fiber tubes.

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- 1 Thread one cord in each fiber tube as shown below. The cords are necessary for leading the fibres through the fiber tubes (see Chapter 4, “Cable installation”).



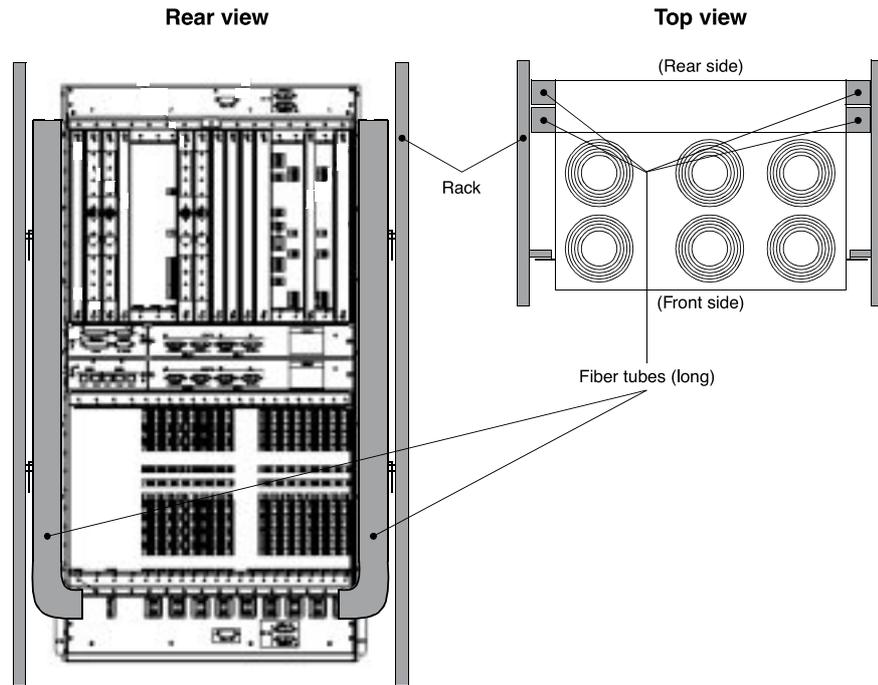
- 2 For each shelf hook two fiber tubes inside each rack. The exact positions are shown in the following figure.

**Important!** The clips can be moved for reaching the hooking points.

END OF STEPS

---

**Result**



**Important!** The mounting to an Expansion Shelf can be done in the same way.

□

## Mounting the cable tie bars

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**Overview** The cable tie bars (Comcode 848463980) are part of the Main Shelf and Expansion Shelf installation kits (Comcodes 848469805 and 848469797). They are used for better cable guidance at the rear side of a shelf. Two cable tie bars are needed for a Main Shelf, one for an Expansion Shelf.

**Positions** For a Main Shelf two cable tie bars must be fixed to the rack rear, one on a level with the shelf top and one on a level with the shelf bottom.

For an Expansion Shelf only one cable tie bar must be fixed to the rack rear, either on a level with the shelf top (if the Expansion Shelf is located above the Main Shelf) or on a level with the shelf bottom (if the Expansion Shelf is located below the Main Shelf).

**Mounting** Follow the steps below in the given order for mounting the cable tie bars to the rack.

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- 1** In the case of an ETSI rack, insert cage nuts into the 9x9 rack holes at all mounting positions for the cable tie bars.
- 

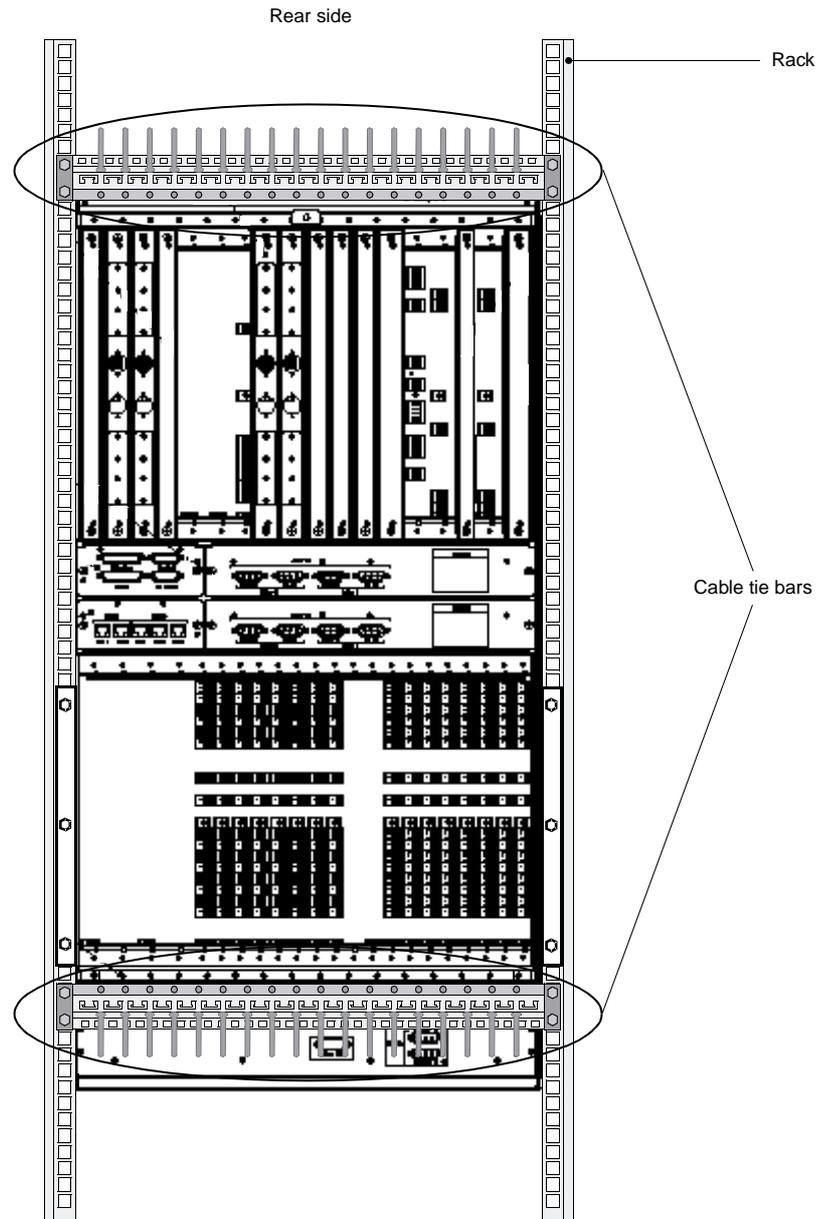
- 2** Screw each cable tie bar to the rack using four M6 screws.

**Important!** In the case of a Main Shelf, the cable tie bar on the bottom level has to be fixed in the opposite direction (see figure below).

END OF STEPS

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**Result**



## Main Shelf configuration

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**Overview** This section describes how a Main Shelf has to be equipped with WaveStar® TDM 10G circuit packs and interface panel boards.

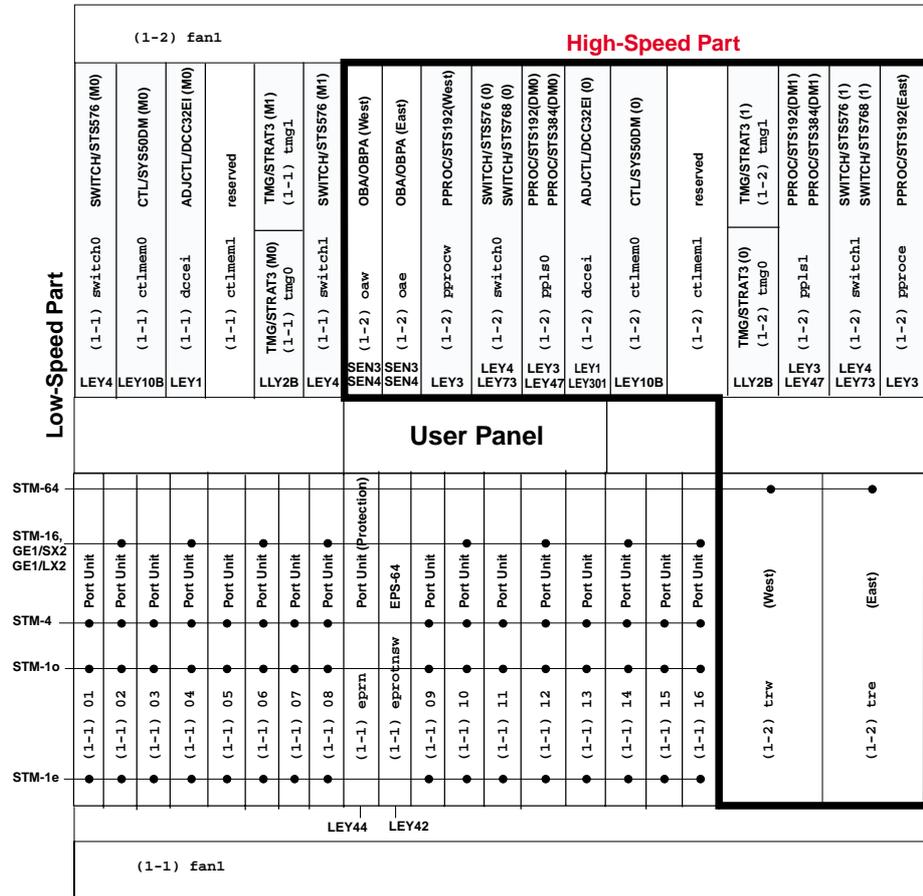
**Minimum required circuit packs** The following table lists the minimum required circuit packs to put a WaveStar® TDM 10G Main Shelf into operation.

<b>Circuit Pack</b>	<b>App. Code</b>	<b>Quantity</b>
<i>SWITCH/STS576</i>	LEY4	4 (two in low speed part, two in high speed part)
<i>CTL/SYS50DM</i>	LEY10B	2 (one in low speed part, one in high speed part)
<i>ADJCTL/DCCEI</i>	LEY1 or LEY301	2 (one in low speed part, one in high speed part)
<i>TMG/STRAT3</i>	LLY2	4 (two in low speed part, two in high speed part)
<i>PPROC/STS192</i>	LEY3	4 (four in high speed part)

**Important!** A shelf equipped with these circuit packs and the two STM64 port units would have no add/drop capability but would be fully functional. Other essential parts of the system which always have to be installed in the shelf are the Power Filter Units (PFUs), the Fan Units (two) and the User Panel.

**Layout (front view)**

The following figure depicts the WaveStar® TDM 10G Main Shelf plug-in units and circuit pack slots (front view), including the 16 slots used for STM-1(o), STM-1(e), STM-4, STM-16, GE1/SX2 or GE1/LX2 (Gigabit Ethernet) tributary port units. The minimum required circuit packs are highlighted.



Explanation of the switching and PPROC circuit pack designation extensions:

- (DM0): Delay Management, main
- (DM1): Delay Management, protection
- (0): Second stage switch (high speed part), main
- (1): Second stage switch (high speed part), protection
- (M0): First stage switch (low speed part), main
- (M1): First stage switch (low speed part), protection

**NOTE:** For configurations with 2 or 3 Expansion Shelves the SWITCH/STS576 (0/1) circuit packs in high-speed part of the main shelf and also the corresponding PPROC/STS192 (DM0/1) circuit packs have to be replaced by the SWITCH/STS768 and PPROC/STS384 circuit packs.

The following table lists all possible tributary port units.

Port unit with	Apparatus Code	Description
STM-64	LEY69	OC192/STM64/1.5IR1
	LEY97	OC192/STM64/1.5IRS1
	LEY201–240	OC192/STM64/WDM9580–9190
	LEY284–299	OC192/STM64/POU9590–9210
STM-16	LEY7	OC48/STM16/1.3LR1
	LEY307	OC48/STM16/1.3LR1
	LEY8	OC48/STM16/1.5LR1
	LEY308	OC48/STM16/1.5LR1
	LEY50–65	OC48/STM16/DWDM01–16
	LEY101–180	OC48/STM16/WDM9585–9190
	LEY182	OC48/STM16/1.3SR1
GE1/SX2	LEY309	1 Gigabit Ethernet
GE1/LX2	LEY310	1 Gigabit Ethernet
STM-4	LEY13	OC12/STM4/1.3LR2
	LEY14	OC12/STM4/1.3SR2
	LEY190	OC12/STM4/1.5LR2
STM-1o	LEY15	OC3/STM1/1.3LR4
	LEY16	OC3/STM1/1.3SR4
	LEY23	OC3/STM1/1.3SR8
STM-1e	LEY44	STM1E/4

Depending on the distance, different transmitter/receiver types are required. The following table gives an overview of the STM-64 port units needed.

Distance [km]	STM-64 Port Unit	in conjunction with
0 – 40	LEY97	—
40 – 60	LEY69	—
60 – 80	LEY69	SEN3 (OBA10G/1.5LR1)

(valid for single mode *and* dispersion shifted fibres)

<b>Distance [km]</b>	<b>STM-64 Port Unit</b>	<b>in conjunction with</b>
80 – 120 (single mode fibres)	LEY228	SEN4 (OBPA10G/1.5VR1) and the following DCM boxes: – DCM 40km (precompensation) – DCM 50km (postcompensation)
80 – 120 (dispersion shifted fibres)	LEY228	SEN4 (OBPA10G/1.5VR1) and one LBO on the LEY228 receiver to have incoming signal level between –21 dBm and –13 dBm
120 – 500	LEY228	1–5 cascaded Ditech amplifiers and DCM boxes

**Circuit pack slots** The following table identifies the circuit packs used in the Main Shelf of the WaveStar® TDM 10G. The slots designations in the low speed part of the shelf begin with the string “(1-1)”. The high speed part of the shelf is referred to as “(1-2)”. Refer to the port unit descriptions in Appendix B of the “Applications, Planning, and Ordering Guide” for additional information about the transmission interface circuit packs.

Slot designation	Slot equipage
<p><i>(1-1) 01 to (1-1) 16</i></p> <p>STM1e: LEY44</p> <p>STM1o: LEY15, 16, 23</p> <p>STM4: LEY13, 14, 190</p> <p>STM16: LEY7, 8, 101-180, 182, 307, 308</p>	<p>Any mix of transmission interface circuit packs (optical and electrical):</p> <ul style="list-style-type: none"> <li>• STM-1(e) port units (STM1E/4)</li> <li>• STM-1(o) port units (STM1)</li> <li>• STM-4 port units (STM4)</li> <li>• STM-16 port units (STM16), incl. 16 colours DWDM interfaces for OLS80G and 80 colours for OLS400G.</li> <li>• GE1/SX2 and GE1/LX2 (Gigabit Ethernet) port units.</li> </ul> <p>Each of the STM-16 and Gigabit Ethernet port units requires two slots. Allowed slots are: 02, 04, 06, 08, 10, 12, 14, 16.</p> <p>If the slot (1-1)16 is configured for an optical port unit (STM-1(o), STM-4 or STM-16), no 1:N equipment protection of the STM-1(e) port units is possible.</p> <p>If 1:N equipment protection of the STM-1(e) port units is configured, slot (1-1)16 must be left empty.</p>
<p><i>(1-2) trw (1-2) tre</i></p> <p>LEY69, 97, 201-240, 284-299</p>	<p>STM-64 port units (STM64), incl. 40 colours DWDM interfaces and 32 interfaces for passive WDM. Depending on the distance, different STM-64 port units are required (see table above).</p>
<p><i>(1-1) eprn</i></p> <p>LEY44</p>	<p>Electrical protection. Equipped with an STM1E/4 circuit pack to protect STM1E/4 port units. This slot can also be left empty if no protection is required.</p>
<p><i>(1-1) eprotsw</i></p> <p>LEY42</p>	<p>Electrical protection switch. Equipped with an EPS-64 protection switching circuit pack to provide the 1:N switching function for protected STM1E/4 port units. This slot can also be left empty, if no protection is required.</p>
<p><i>(1-1) switch0</i></p> <p>LEY4</p>	<p>Fabric switch 0. The SWITCH/STS576 circuit pack in this slot can make cross-connections for 192 STM-1 equivalent circuits. This switch is paired with fabric (1-1) switch 1 in a 1+1 non-revertive protection mode configuration.</p>

<b>Slot designation</b>	<b>Slot equipage</b>
<i>(1-1) ctlmem0</i> LEY10B	Controller for the system including non-volatile memory. The CTL/SYS50DM circuit pack in this slot is the working controller for the low speed part of the shelf and additionally the system controller for the whole shelf.
<i>(1-1) dccei</i> LEY1	Adjunct controller, DCC and external interface. The ADJCTL/DCC32EI circuit pack in this slot terminates up to 32 data communications channels and interfaces them to the shelf 10Base-T LAN.
<i>(1-1) ctlmem1</i>	The slot is left empty for the current release of WaveStar® TDM 10G.
<i>(1-1) switch1</i> LEY4	Fabric switch 1. The SWITCH/STS576 circuit pack in this slot can make cross-connections for 192 STM-1 equivalent circuits. This switch is paired with fabric (1-1) switch 0 in a 1+1 non-revertive protection mode configuration.
<i>(1-1) tmg1</i> <i>(1-1) tmg0</i> LLY2	Two half-height Stratum 3 timing generator circuit packs are located one above the other in this slot. They are the master TMGs in the shelf (and also for the Expansion Shelf). When WaveStar® TDM 10G is initially powered on after shipment from the factory, the lower TMG/STRAT3 is the active circuit pack and the upper TMG/STRAT3 is the standby circuit pack. However, both circuit packs are of equal level and protection switching is non-revertive, so there is no default configuration.
<i>(1-2) oaw</i> <i>(1-2) oae</i> SEN3 or SEN4	OBAs or OBPA's (depending on the optical distance, see table above).
<i>(1-2) pprocw</i> LEY3	The PPROC/STS192 circuit pack in this slot supports the STM64 port unit function assigned to the western aggregate port. The CP is responsible for pointer processing and synchronisation to the system clock and for POH monitoring.
<i>(1-2) switch0</i> LEY4 or LEY73	Fabric switch 0. The circuit pack in this slot can make cross-connections for 192 (SWITCH/STS576) or 256 (SWITCH/STS768) STM-1 equivalent circuits. This switch is paired with fabric (1-2) switch 1 in a 1+1 non-revertive protection mode configuration.

<b>Slot designation</b>	<b>Slot equipage</b>
(1-2) <i>ppls0</i> LEY3 or LEY47	The circuit pack in this slot (PPROC/STS192 or PPROC/STS384) provides frame delay management between the switch functions of the low speed part of the shelf and the high speed part ((1-1) sw. 0).
(1-2) <i>ctlmem0</i> LEY10B	The CTL/SYS50DM circuit pack in this slot is the working shelf controller for the high speed part. The system controller for the whole shelf is located in slot (1-1) <i>ctlmem0</i> .
(1-2) <i>dccei</i> LEY1	Adjunct controller, DCC and external interface. The ADJCTL/DCC32EI circuit pack in this slot terminates up to 32 data communications channels and interfaces them to the shelf 10Base-T LAN. If Orderwire support is required, use LEY301 instead.
(1-2) <i>ctlmem1</i>	The slot is left empty for the current release of WaveStar® TDM 10G.
(1-2) <i>switch1</i> LEY4 or LEY73	Fabric switch 1. The circuit pack in this slot can make cross-connections for 192 (SWITCH/STS576) or 256 (SWITCH/STS768) STM-1 equivalent circuits. This switch is paired with fabric (1-2) switch 0 in a 1+1 non-revertive protection mode configuration.
(1-2) <i>tmg1</i> (1-2) <i>tmg0</i> LLY2	Two half-height Stratum 3 timing generator circuit packs are located one above the other in this slot. They are slave TMGs. Their function is to distribute the system clock from the active master TMG to the circuit packs in the high speed part of the shelf or to the Expansion Shelf. When WaveStar® TDM 10G is initially powered on after shipment from the factory, the lower TMG/STRAT3 is the active circuit pack and the upper TMG/STRAT3 is the standby circuit pack. However, both circuit packs are of equal level and protection switching is non-revertive, so there is no default configuration.
(1-2) <i>ppls1</i> LEY3 or LEY47	The circuit pack in this slot (PPROC/STS192 or PPROC/STS384) provides frame delay management between the switch functions of the low speed part of the shelf and the high speed part ((1-2) sw. 1).

Slot designation	Slot equipage
(1-2) <i>pproce</i> LEY3	The PPROC/STS192 circuit pack in this slot supports the STM64 port unit function assigned to the eastern aggregate port. The CP is responsible for pointer processing and synchronisation to the system clock and for POH monitoring.

### Interface panels

A variety of interface panel boards are available to be connected in between customer cabling and the backplane. All interface panel boards are inserted from the rear.

The interface panel boards contain the physical connectors and, if applicable, hardware to adjust the impedance.

The following interface panel boards must be ordered:

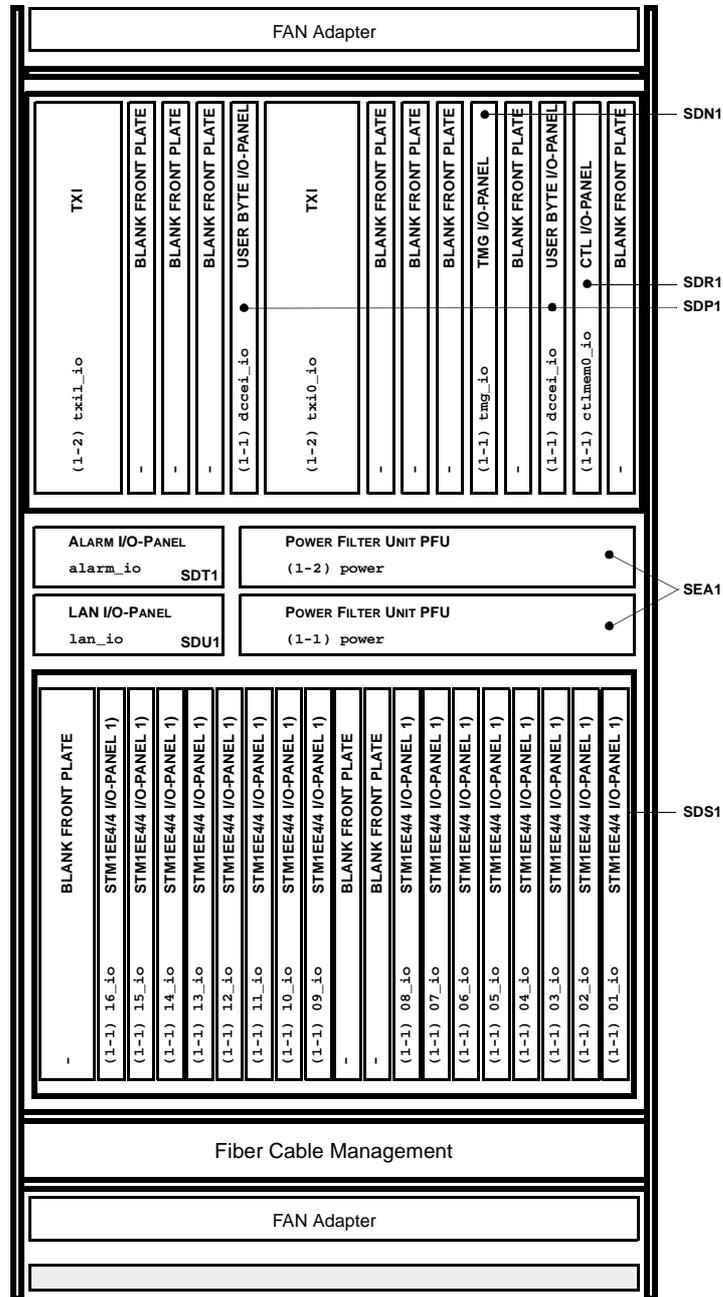
- ***STMIEE4/4 I/O panel*** (SDS1), provides STM-1(e) physical interfaces
- ***TMG I/O panel*** (SDN1), provides external timing inputs/outputs
- ***CTL I/O panel*** (SDR1), to connect control signals of Main Shelf to Expansion Shelf
- ***User byte I/O panel*** (SDP1), provides interfaces for user data channels and external orderwire equipment.

The interface panel boards listed below are already mounted at the Main Shelf:

- ***LAN I/O panel*** (SDU1), provides the external LAN interface
- ***Alarm I/O panel*** (SDT1), provides office alarm and remote I/O interfaces.
- ***TXI I/O panel***, provides interfaces for the TXI cables (see section “TXI cables” (4-47)).

**Layout (rear view)**

The following figure shows the interface panels mounted on a WaveStar® TDM 10G Main Shelf (rear view). All TXI and blank front panels are factory equipped.



1) only equipped if STM1EE4/4 circuit pack is equipped, otherwise a Blank Front Plate is mounted

# Expansion Shelf configuration

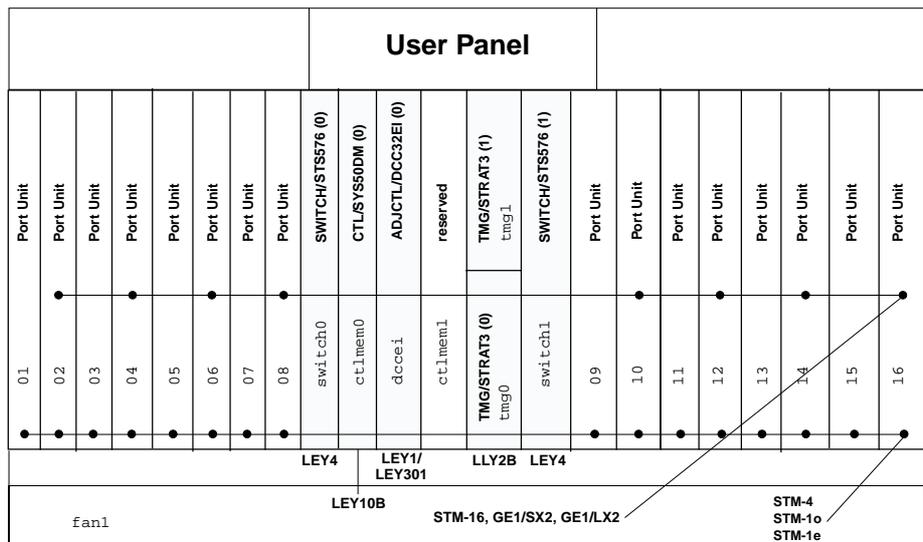
**Overview** This section describes how an Expansion Shelf has to be equipped with WaveStar® TDM 10G circuit packs.

**Minimum required circuit packs** The following table lists the minimum required circuit packs to put a WaveStar® TDM 10G Expansion Shelf into operation.

Circuit pack	App. code	Quantity
<i>SWITCH/STS576</i>	LEY 4	2
<i>CTL/SYS50DM</i>	LEY10B	1
<i>ADJCTL/DCCEI</i>	LEY1 or LEY301	1
<i>TMG/STRAT3</i>	LLY2B	2

A shelf equipped with these circuit packs would have no add/drop capability but would be fully functional together with an associated Main Shelf. Other essential parts of the system which always have to be installed in the shelf are the Power Filter Unit (PFU), the Fan Unit and the User Panel.

**Layout (front view)** The following figure depicts the WaveStar® TDM 10G Expansion Shelf plug-in units and circuit pack slots (front view), including the 16 slots used for STM-1(o), STM-1(e), STM-4, STM-16, GE1/SX2 or GE1/LX2 (Gigabit Ethernet) tributary port units. The minimum required circuit packs are highlighted.



The following table lists all possible tributary port units.

Port unit with	Apparatus Code	Description
STM-16	LEY7	OC48/STM16/1.3LR1
	LEY307	OC48/STM16/1.3LR1
	LEY8	OC48/STM16/1.5LR1
	LEY308	OC48/STM16/1.5LR1
	LEY50–65	OC48/STM16/DWDM01–16
	LEY101–180	OC48/STM16/WDM9585–9190
	LEY182	OC48/STM16/1.3SR1
GE1/SX2	LEY309	1 Gigabit Ethernet
GE1/LX2	LEY310	1 Gigabit Ethernet
STM-4	LEY13	OC12/STM4/1.3LR2
	LEY14	OC12/STM4/1.3SR2
	LEY190	OC12/STM4/1.5LR2
STM-1o	LEY15	OC3/STM1/1.3LR4
	LEY16	OC3/STM1/1.3SR4
	LEY23	OC3/STM1/1.3SR8
STM-1e	LEY44	STM1E/4

**Circuit pack slots**

The following table identifies the circuit packs used in the WaveStar® TDM 10G. Refer to the port units descriptions in Appendix B of the “Applications, Planning, and Ordering Guide” for additional information about the transmission interface circuit packs.

Slot designation	Slot equipage
<i>01 to 16</i>	Any mix of transmission interface circuit packs:
STM1e:	<ul style="list-style-type: none"> <li>• STM-1(e) port units (STM1E/4)</li> </ul>
LEY44	<ul style="list-style-type: none"> <li>• STM-1(o) port units (STM1)</li> </ul>
STM1o:	<ul style="list-style-type: none"> <li>• STM-4 port units (STM4)</li> </ul>
LEY15, 16, 23	<ul style="list-style-type: none"> <li>• STM-16 port units (STM16).</li> </ul>
STM4:	<ul style="list-style-type: none"> <li>• GE1/SX2 and GE1/LX2 (Gigabit Ethernet) port units.</li> </ul>
LEY13, 14, 190	Each of the STM-16 and Gigabit Ethernet port units requires two slots. Allowed slots are: 02, 04, 06, 08, 10, 12, 14, 16.
STM16:	
LEY7, 8, 101–180, 182, 307, 308	

Slot designation	Slot equipage
<i>switch0</i> LEY4	Fabric switch 0. The SWITCH/STS576 circuit pack in this slot can make cross-connections for 192 STM-1 equivalent circuits. This switch is paired with fabric switch 1 in a 1+1 non-revertive protection mode configuration.
<i>ctlmem0</i> LEY10B	The CTL/SYS50DM circuit pack in this slot is the working controller for the shelf. It can be used for CIT and EMS connections. Furthermore it collects all alarms and signals them on the User Panel and the office alarm interface.
<i>dccei</i> LEY1	Adjunct controller, DCC and external interface. The ADJCTL/DCC32EI circuit pack in this slot terminates up to 32 data communications channels and interfaces them to the shelf 10Base-T LAN. If Orderwire support is required, use LEY301 instead.
<i>ctlmem1</i>	The slot is left empty for the current release of WaveStar® TDM 10G.
<i>tmg1, tmg0</i> LLY2	Two half-height Stratum 3 timing generator circuit packs are located one above the other in this slot. They are slave TMGs. Their function is to distribute the system clock from the active master TMG (Main Shelf) to the circuit packs in the Expansion Shelf. When WaveStar® TDM 10G is initially powered on after shipment from the factory, the lower TMG/STRAT3 is the active circuit pack and the upper TMG/STRAT3 is the standby circuit pack. However, both circuit packs are of equal level and protection switching is non-revertive, so there is no default configuration.
<i>switch1</i> LEY4	Fabric switch 1. The SWITCH/STS576 circuit pack in this slot can make cross-connections for 192 STM-1 equivalent circuits. This switch is paired with fabric switch 0 in a 1+1 non-revertive protection mode configuration.

### Interface Panels

A variety of interface panel boards are available to be connected in between customer cabling and the backplane. All interface panel boards are inserted from the rear.

The interface panel boards contain the physical connectors and, if applicable, hardware to adjust the impedance.

The following interface panel boards must be ordered:

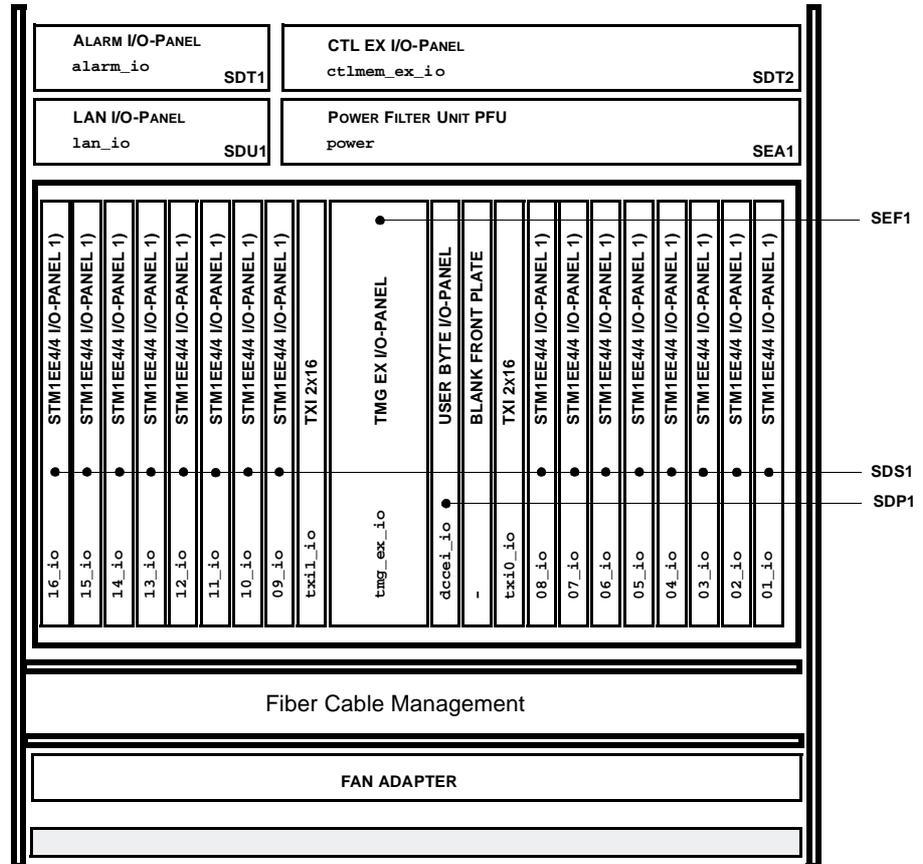
- ***STM1EE4/4 I/O panel*** (SDS1), provides STM-1(e) physical interfaces
- ***TMG-EX I/O panel*** (SEF1), to connect timing signals of the Main Shelf to the Expansion Shelf
- ***CTL-EX I/O panel*** (SDT2), to connect control signals of the Main Shelf to the Expansion Shelf.
- ***User byte I/O panel*** (SDP1), provides interfaces for user data channels and external orderwire equipment.

The interface panel boards listed below are already mounted on the Expansion Shelf:

- ***LAN I/O panel*** (SDU1), provides the external LAN interface
- ***Alarm I/O panel*** (SDT1), provides office alarm and remote I/O interfaces.
- ***TXI I/O panel***, provides interfaces for the TXI cables (see section “TXI cables” (4-47)).

**Layout (rear view)**

The following figure shows the interface panels mounted on a WaveStar® TDM 10G Expansion Shelf (rear view).



1) only equipped if STM1EE4/4 circuit pack is equipped, otherwise a Blank Front Plate is mounted



## Protection configurations

---

**Overview** This section describes the shelf configuration guidelines that have to be observed in the case of the following protection mechanisms:

- 2-fiber MS-SPRing
- 1+1 MSP.
- 1:N STM-1(e) equipment protection

All protection mechanisms are only supported within one shelf, so it is not possible to have a circuit pack in the Main Shelf protected by a circuit pack in the Expansion Shelf.

Please note that the STM-16 circuit packs always occupy two slots in the shelf, i.e. 01 and 02, 03 and 04, etc. The physical and logical connections, however, are to the even slot number (02, 04, etc.).

**2-fiber MS-SPRing** The MS-SPRing related STM-16 circuit pack pairs have to be plugged into the following dedicated port unit slot pairs: 02 and 04, 06 and 08, 10 and 12, 14 and 16 *or* 02 and 16, 04 and 14, 06 and 12, 08 and 10.

**1+1 MSP** MSP can only be established between two separate circuit packs (which are of the same type), i.e. it is not allowed to establish MSP between 2 ports on the same circuit pack. MSP between different ports on different circuit packs can be configured independently, e.g. one port of circuit pack 1 can be protected with one port of circuit pack 2 while the second port on circuit pack 1 is protected by circuit pack 3. The MSP related circuit packs are not restricted to specific slots.

For 1+1 Terminal Multiplexer MSP, both STM-64 port units must be plugged in slots “(1-2) tre” and “(1-2) trw”.

For STM-16 port units, any pair combination of allowed slot positions can be applied: 02, 04, 06, 08, 10, 12, 14, 16.

For optical STM-1 and STM-4 port units, any pair combination of allowed slot positions can be applied: 01...16.

Also the DCC can be protected together with the MSP. As the number of ports which can be configured as DCC ports is limited, this enhances the possibilities with regard to protected ports carrying DCC, because the protecting port does not count into this number.

**1:N electrical tributary port protection** The 1:N equipment protection of the STM1E/4 circuit packs can be configured in the Main Shelf only.

The desired number of working circuit packs can be plugged in slots “(1-1) 01” to “(1-1) 16”. The standby circuit pack has to be plugged

in slot “(1-1) eprn”. Furthermore the Electrical Protection Switch circuit pack (EPS-64) is necessary for the equipment protection and has to be plugged in slot “(1-1) eprotnsw”.

All inserted STM1E/4 circuit packs automatically belong to the protection group. A manual lockout for individual circuit packs is possible to exclude these from the protection group.

**Protection group example**

The following figure illustrates the grouping of protected ports. The apparatus codes of the circuit packs are given in section “Circuit pack slots” (3-39).

1+1 OC3/STM1 port protection	(1-1) 01	OC3/STM1	(1-1) switch0	SWITCH/STS576 (M0)
	(1-1) 02	OC3/STM1 (Protection)	(1-1) ct1mem0	CTL/SYS50DM (M0)
	(1-1) 03	OC3/STM1	(1-1) dccei	ADJCTL/DCC32EI (M0)
	(1-1) 04	OC3/STM1 (Protection)	(1-1) ct1mem1	reserved
	(1-1) 05	OC48/STM16		
	(1-1) 06			
	(1-1) 07	OC48/STM16 (Protection)	TMGSTRAT3 (M0) (1-1) tmg0	TMGSTRAT3 (M1) (1-1) tmg1
	(1-1) 08		(1-1) switch1	SWITCH/STS576 (M1)
	(1-1) eprn	STM1E/4 (Protection)	(1-2) oaw	OBA (West)
	(1-1) eprotnsw	EPS-64	(1-2) oae	OBA (East)
	(1-1) 09	STM1E/4	(1-2) pprocw	PPROC/STS192(West)
	(1-1) 10	STM1E/4	(1-2) switch0	SWITCH/STS576 (0)
	(1-1) 11	STM1E/4	(1-2) pp1s0	PPROC/STS192(DM0)
	(1-1) 12	STM1E/4	(1-2) dccei	ADJCTL/DCC32EI (0)
	(1-1) 13	STM1E/4	(1-2) ct1mem0	CTL/SYS50DM (0)
	(1-1) 14	STM1E/4	(1-2) ct1mem1	reserved
(1-1) 15	STM1E/4	TMGSTRAT3 (0) (1-2) tmg0	TMGSTRAT3 (1) (1-2) tmg1	
(1-1) 16	STM1E/4	(1-2) pp1s1	PPROC/STS192(DM1)	
(1-2) trw	OC192/STM64 (West)	(1-2) switch1	SWITCH/STS576 (1)	
(1-2) tre	OC192/STM64 (East)	(1-2) pproce	PPROC/STS192(East)	

## Installing the plug-in units

---

- Overview** This section describes handling and installation of the plug-in units.
- ESD instructions** It is essential to observe the following ESD instructions when handling the plug-in units:
- Wear working garment made of 100% cotton to avoid electrostatic discharge.
  - Touch the circuit packs at the edges or the insertion and removal facilities only.
  - Ensure that the rack is grounded.
  - Wear conductively connected wrist straps and connect them to the rack ESD bonding point.
  - Work in an area which is protected against electrostatic discharge. Use conducting floor and bench mats which are conductively connected to the rack ESD bonding point.
  - Conductively connect all test equipment and trolleys to the rack ESD bonding point.
  - Store and ship circuit packs and components in their shipping packing. Circuit packs and components must be packed and unpacked only at workplaces suitably protected against build-up of charge.
- STM16 port units** If STM16 port units are used, be aware that each of them requires two port unit slots.
- STM1E/4 port units** It is usually practical to fill one side of the shelf (slots (1-1) 01-08 or slots (1-1) 09-16) with STM1E/4 port units before placing any in the other side.
- Installation** Insert all plug-in units into the WaveStar® TDM 10G shelf by using the insertion and removal facilities. The sections “Main Shelf configuration” (3-35) and “Expansion Shelf configuration” (3-44) show how to do this. Due to air leakage all unused slots must be covered with blank front and rear plates. To secure a plug-in unit, turn the latches simultaneously towards each other.
- Important!** Make sure that all plug-in units are firmly seated!



## Mounting the shelf front covers

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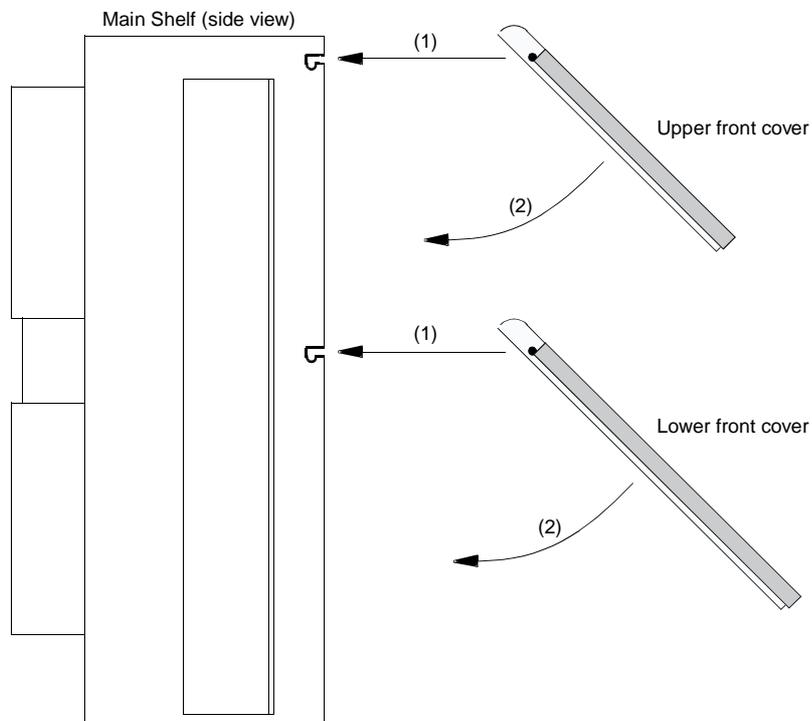
**Overview** Shelf front covers are used for better electromagnetic compatibility and also for protection. The Main Shelf requires one upper (Comcode 848400867) and one lower (Comcode 848400875) front cover. The Expansion Shelf requires one lower front cover only.

**Important!** Because the front covers are the front EMC borders of the shelves, do not remove them during normal operation.

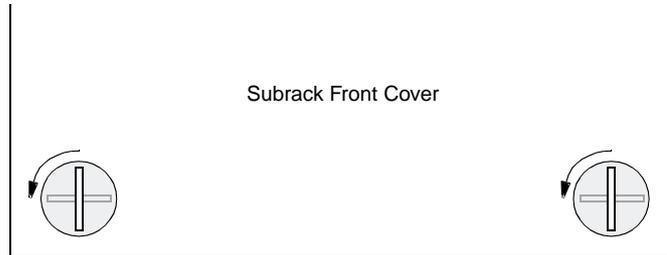
**Mounting** Follow the steps below to mount the shelf front covers:

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- 1 Slide the shelf front covers into the cutouts of the shelf (1) and swing them downwards (2).



- 
- 2** For EMC purposes, lock the shelf front covers by using a screwdriver or coin.



END OF STEPS

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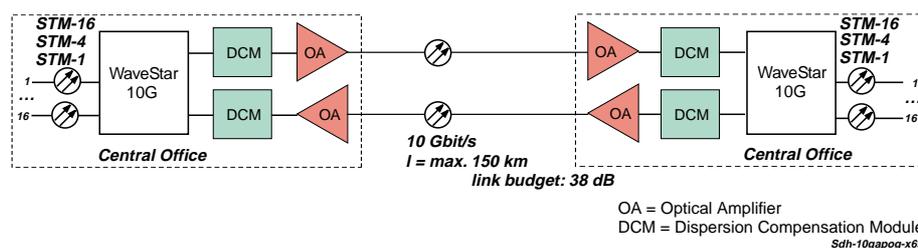


## Increased Span Length: OBPA and Ditech Amplifiers

**Overview** If the span length is beyond 80 km, OBPA (distance 80 – 120 km) or Ditech amplifiers (distance > 120 km) must be used. This section describes network solutions which comprise the use of these amplifiers.

**Concept** The amplifiers consist of one booster and one pre-amplifier part. The booster part is always connected via a Dispersion Compensation Module (DCM) to the transmit interface of the respective STM-64 port unit (see Chapter 4, sections “OBPA cabling” (4-60) and “Ditech cabling” (4-62)). The STM-64 port unit used together with an OBPA or Ditech amplifier has to have a dedicated wavelength of 1549.32 nm. This requirement is met by the LEY228. The pre-amplifier part is always connected via a Dispersion Compensation Module to the receive interface of the respective STM-64 port unit.

**Single span application** An example of a single span application is shown in the following figure.



### Use of Ditech amplifiers (single span application)

The following paragraphs provide all the information which is necessary for building up a single span application with Ditech amplifiers.

#### Needed optical units (central office)

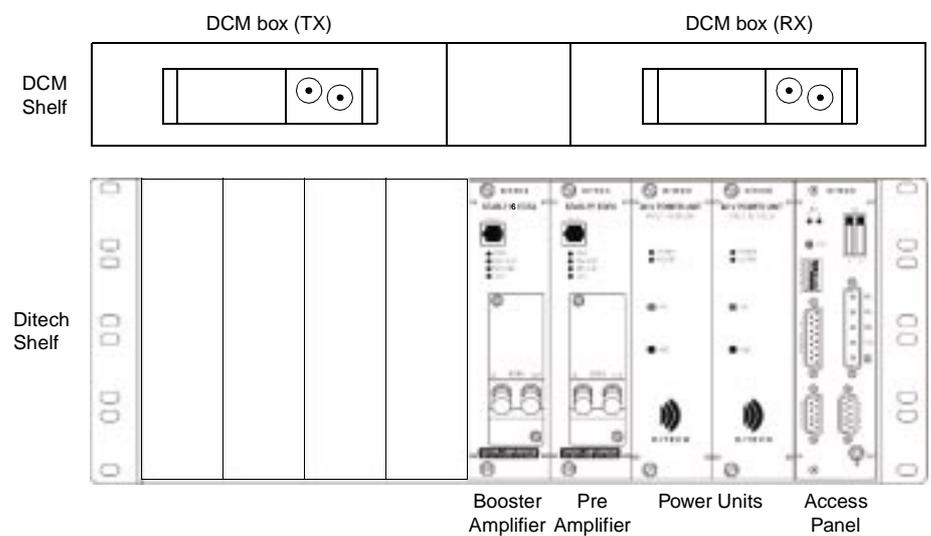
The table below lists the quantity of optical units which are needed for each central office.

Unit	Quantity
LEY228 (STM-64 port unit)	1
Booster Amplifier (STAR-T16)	1
Pre Amplifier (STAR-PFG)	1
48V Power Unit	2
Access Panel	1
Ditech Shelf	1

Unit	Quantity
DCM Shelf	1
DCM box for pre-compensation (TX)	1
DCM box for post-compensation (RX)	1

### Ditech and DCM shelf configurations

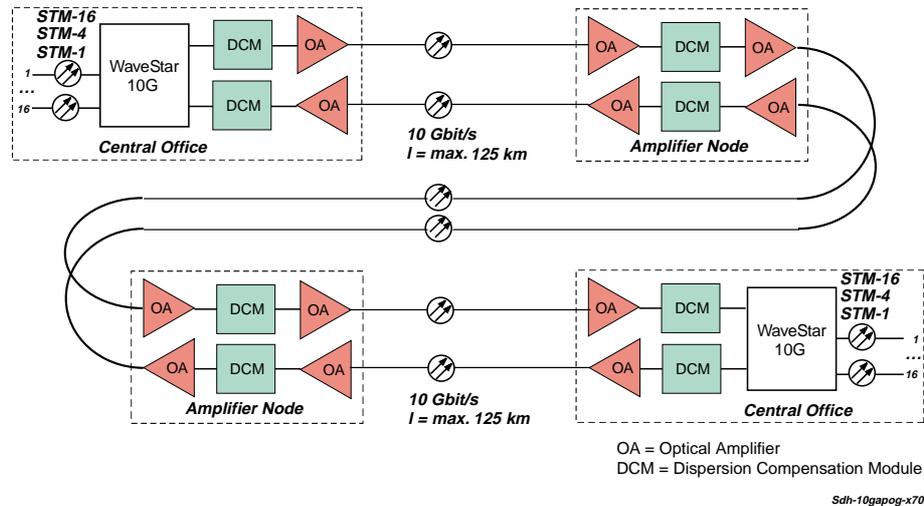
The following figure shows the Ditech and DCM shelf configuration for one central office. The rack positions of the shelves are shown in section “Span length 120 km (Ditech amplifiers)” (3-17), the cabling is described in Chapter 4, section “Ditech cabling” (4-62).



### Multiple span application

For long distances beyond 150 km, Ditech line amplifiers have to be used. A line amplifier is a two-stage amplifier. It is mandatory to build the DCM between the two stages for best amplification and highest SNR (Signal Noise Reduction). In the amplifier nodes, one line amplifier is needed for each direction. Up to 5 spans can thus be combined to a multispan connection of up to 5 x 100 km.

An example of a 3-hop multispan application is shown in the following figure.



**Use of Ditech amplifiers (multiple span application)**

The table below lists the quantity of optical units which are needed for each amplifier node. Section “Needed optical units (central office)” (3-54) shows the quantity needed for one central office.

Unit	Quantity
Line Amplifier (STAR LMA19)	2
48V Power Unit	2
Access Panel	1
Ditech Shelf	1
DCM Shelf	1
DCM box	2

The Ditech and DCM shelf configuration is similiar as described in section “Ditech and DCM shelf configurations” (3-55).

**Available DCM boxes**

The following DCM boxes can be ordered:

DCM box	Comcode
DCM-2.5 (2.5 km)	108402595
DCM-5 (5 km)	108402603
DCM-7.5 (7.5 km)	108402611
DCM-10 (10 km)	108402629
DCM-20 (20 km)	108402637
DCM-30 (30 km)	108402645

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<b>DCM box</b>	<b>Comcode</b>
DCM-40 (40 km)	108402652
DCM-50 (50 km)	108402660
DCM-60 (60 km)	108402678
DCM-70 (70 km)	108402686
DCM-80 (80 km)	108402694
DCM-90 (90 km)	108402702

**NOTE:** It is possible to create a DCM value also by connecting several DCM boxes (up to 3) in series. For example, a DCM-77.5 value can be implemented with DCM-70 and DCM-7.5 in series.

□

## Mounting the ESD sockets (for ETSI racks only)

---

**Overview** The ESD sockets (Comcode 847763315) and stickers (Comcode 847047958) are part of the ETSI rack delivery (Comcode 848438974). They are used for avoiding electrostatic discharge (ESD).

**Important!** It is recommended that ESD sockets be mounted at the rack rear side.

**Mounting** Follow the steps below to mount the ESD sockets and stickers on the rack.

---

**1** Insert two cage nuts into the 9x9 rack holes. The location depends on your preferences and on the available space.

---

**2** Screw in the ESD sockets.

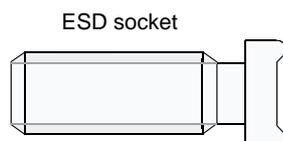
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**3** Affix the ESD stickers directly above the ESD sockets (see figure below).

END OF STEPS

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### Result



□

## Mounting the rack doors (for ETSI racks only)

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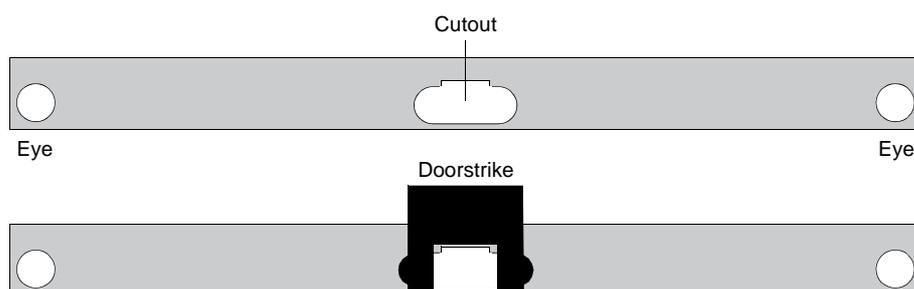
**Overview** The forced convection cooling of the NEs (two fan units for push/pull) requires that air flows unhindered from the front into the rack. A completely closed front door therefore poses a severe obstacle to the necessary air stream. Fans do not prevent the rack from overheating in such a case and the usage of such doors is not permitted.

**Important!** Rack doors for the 2.0 m/78.67 inch Seismic rack are not available yet. Rack doors shouldn't be used if two Main Shelves are mounted in a 2.6 m/102.27 inch ETSI rack.

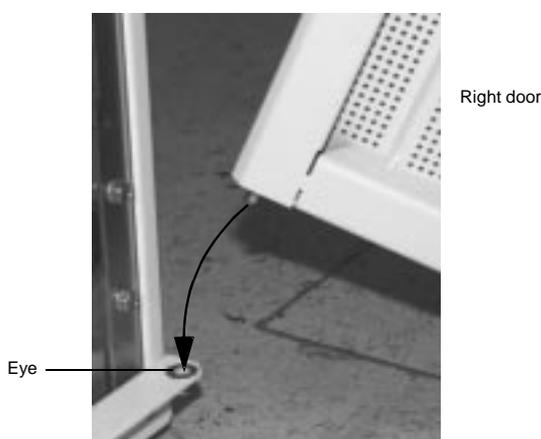
**Mounting** Follow the steps below to mount the doors (Comcode 848170601) to an ETSI rack:

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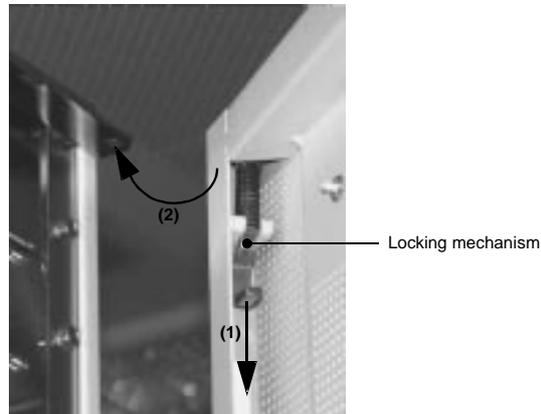
- 1 Push one black doorstrike into the cutout located in the middle of the rack bottom and another one into the cutout located in the middle of the rack top.



- 2 Insert the right door (with handle) into the eye located at the rack bottom.



- 
- 3** Pull the upper locking mechanism (1) and lock the door into the top guide (2).



- 
- 4** Repeat Steps 2 and 3 for the left door.

- 
- 5** Repeat Steps 1 to 4 for mounting the doors on the other rack side.

END OF STEPS





# 4 Cable installation

## Overview

---

**Purpose** This chapter provides information on installing cables for the WaveStar® TDM 10G (STM-64) shelf. The examples show the cabling for an Overhead Structure.

**Sequence of steps** It is recommended that the sequence of steps as described in this chapter be observed.

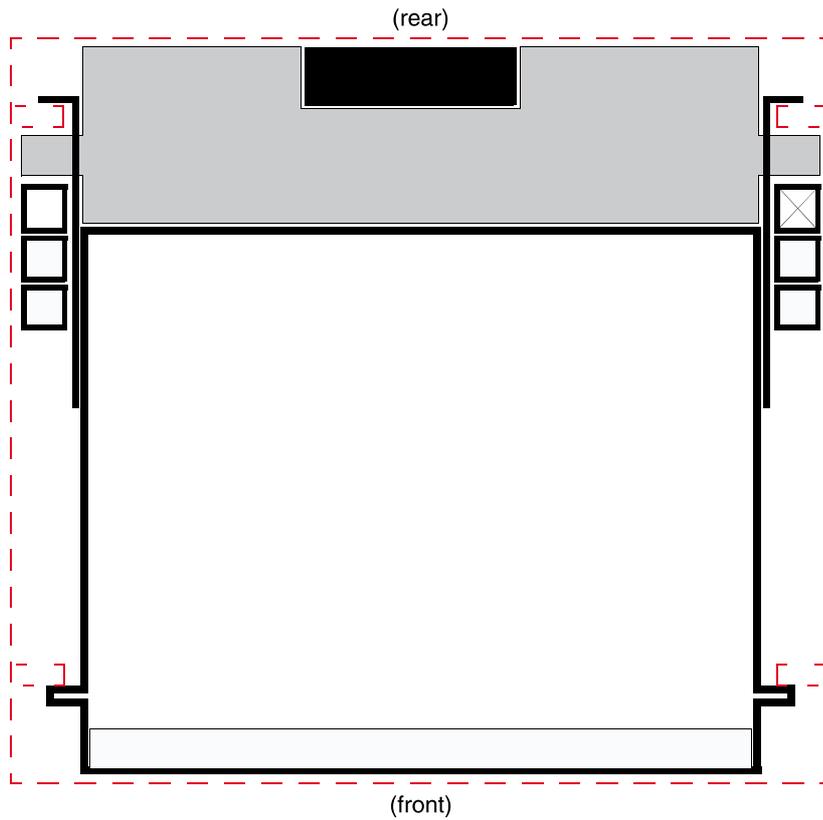
**Cable kits** There are 3 cable kits for various purposes:

- ***Comcode 848472742***  
This cable kit is needed if the Expansion Shelf is in the same rack as the Main Shelf. It contains the following cables:
  - 2 Shelf timing cables, 2m/78.67 inch (Comcode 848445672)
  - 2 Shelf control cables, 2m/78.67 inch (Comcode 848440681)
  - 2 TXI cables, 1.4m/55.1 inch (Comcode 848440707)
- ***Comcode 848472759***  
This cable kit is needed if the Expansion Shelf is not in the same rack as the Main Shelf. It contains the following cables:
  - 2 Shelf timing cables, 7m/275.33 inch (Comcode 848445664)
  - 2 Shelf control cables, 7m/275.33 inch (Comcode 848440699)
  - 2 TXI cables, 7.35m/289.1 inch (Comcode 848440715)
- ***Comcode 848472767***

This cable kit should be used if the Expansion Shelf is located above the Main Shelf. It contains the following cables:

- 2 Power cables short, 1.5m/59 inch (Comcode 848466751)
- 1 Office alarm cable short, 1.5m/59 inch (Comcode 848466744).

**Cable management** The following figure gives an overview of the cable management between the shelves and an ETSI rack. These cabling principles can also be applied to a Seismic rack.



-  Shelf and Fan Power Cables
-  Fan and Office Alarm Cables, LAN Cables, MDIO Cable
-  Interface Cables (Electrical STM Cables, Timing Cables, Shelf Control Cables)
-  TXI Cables
-  Fibre Cables

**Contents**

Power cables	4-4
Alarm power cables	4-9

---

Fan power cables	4-11
Fan alarm cables	4-14
Office alarm cables	4-17
MDIO cable	4-22
Reference timing cables	4-26
Shelf timing cables	4-33
Shelf control cables	4-36
User byte cables	4-39
Electrical STM cables	4-43
LAN cable	4-45
TXI cables	4-47
Fibre cables	4-51

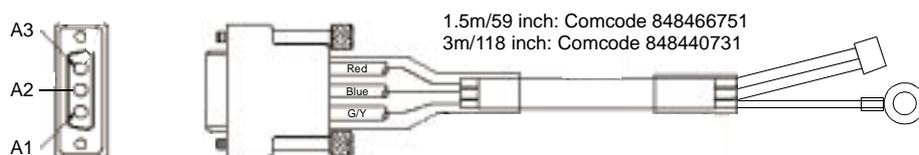
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## Power cables

**Overview** The WaveStar® TDM 10G shelf uses a distributed powering system. It distributes -48V/-60V power throughout the shelf, and each circuit pack uses its own onboard power converter to derive the necessary operating voltages.

**Powering Concept** The office power feeders of the RCP are filtered and protected by circuit breakers. In the Main Shelf, two sets of office power feeders are used, one for the low speed part and one for the high speed part. The -48V/-60V supplies are then filtered by the Power Filter Units (PFUs) to meet the ETSI requirements. After that, the supplies are distributed separately to each circuit pack, where they are filtered again and fused before being converted to the circuit pack working voltages.

### Cable



The following table shows the pin assignment of a shelf power cable.

Pin	Colour	Signal	Meaning
A1	Green/Yellow	GND	Ground
A2	Blue	-	-48V/-60V
A3	Red	+	+48V/+60V

**Available Lengths** The shelf power cables are available in the following lengths:

- 3 m/118 inch (Comcode 848440731)  
These cables are part of the shelf deliveries (Comcodes 848438370 and 848438388).
- 1.5 m/59 inch (Comcode 848466751)  
These cables are part of the cable kit (Comcode 848472767) and should be used if the Expansion Shelf is located above the Main Shelf. The cable kit has to be ordered separately.

**DANGER**

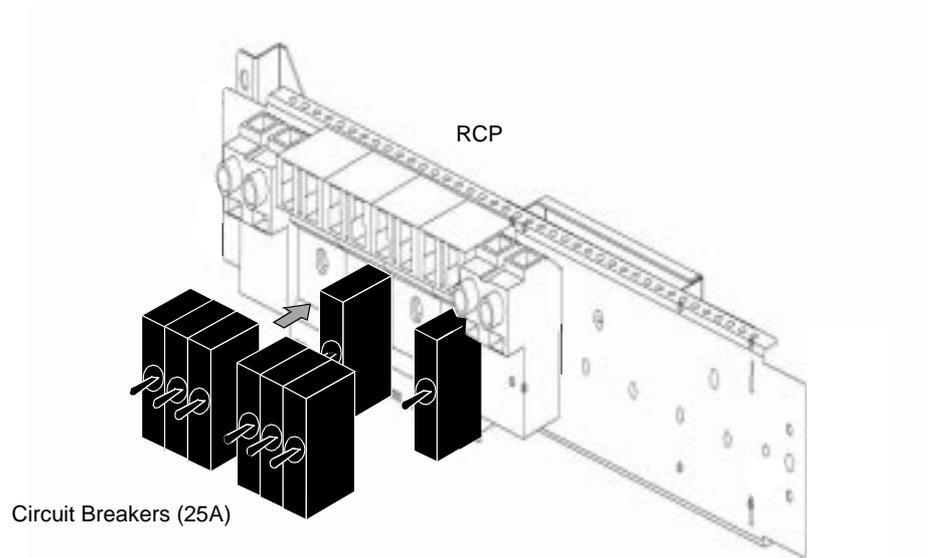
*Arcing can cause burns to the hands and damage to the eyes. Ensure that the circuit breakers on the RCP are in the "OFF" position before inserting the power supply plugs.*

**CAUTION**

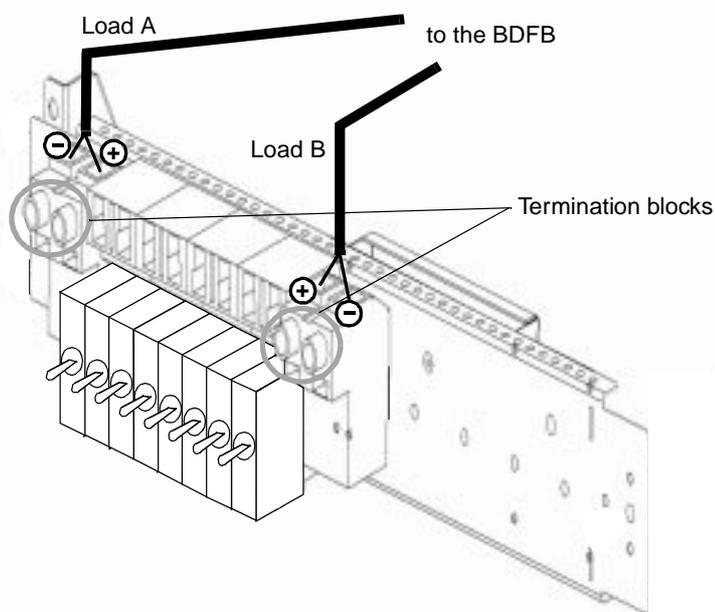
*Condensation can occur in the network element during transport, especially when moving from outside to closed rooms; this can cause malfunctioning of the circuit packs. Ensure that circuit packs and shelves have reached room temperature and are dry before taking them into operation.*

**Powering** Proceed as follows to power the shelves:

- 1 Screw off the RCP cover.  
.....
- 2 Plug all supplied 25 A circuit breakers into the RCP.



- 
- 3 Verify the following:
- all packing material has been removed from the shelf.
  - all circuit breakers at the external Battery Distribution and Fuse Bay (BDFB) are in the **OFF** position or **fuses on the BDFB are not installed**.
  - all circuit breakers on the RCP are in the **OFF** position.
- 
- 4 Connect the power supply lines coming from the BDFB to the RCP. To do this, insert the feeder cables into the provided clamps and secure them by tightening the screws. The minimum tightening torque should be 4 Nm.



**Important!** The minimum cross-section of the power supply lines must be 16 mm<sup>2</sup> / 6 AWG (a cross-section of 25 mm<sup>2</sup> / 4 AWG is recommended).

- 
- 5 Insert a 40 A fuse for each supply line into the BDFB in case of a combination of the Main and Expansion Shelf and a 70 A fuse in case of two Main Shelves. If circuit breakers are being used, put both of them in the **ON** position.
- 
- 6 Using a volt/ohm meter verify the voltage at the termination blocks of the RCP. **Requirement:** The voltage should be -48 V/-60 V (between

-40.5 V DC and -72 V DC) at each side.

**If the voltage requirement...**

**then**

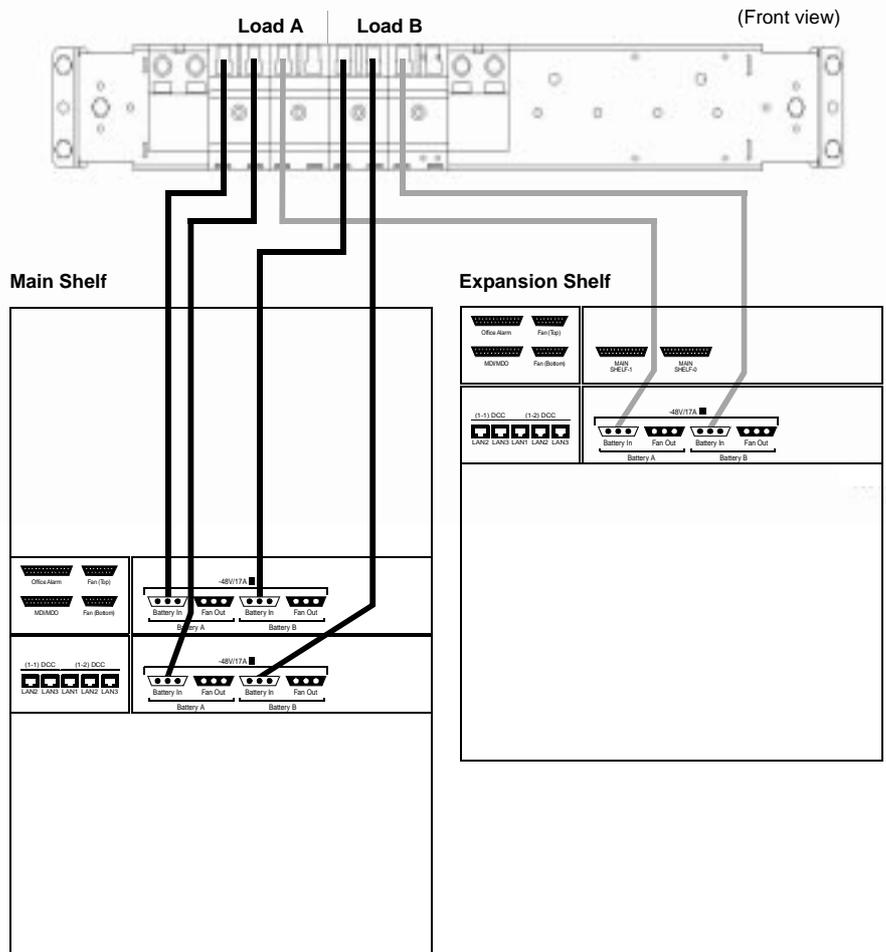
is met,

proceed to Step 7.

is not met,

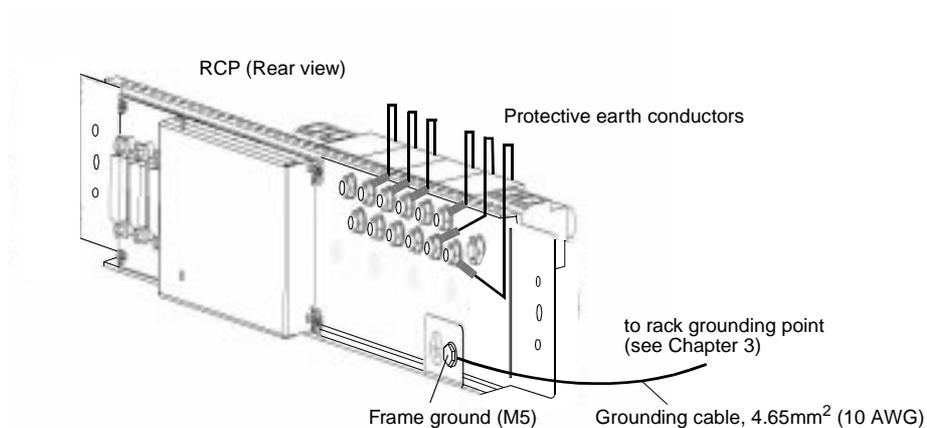
proceed to Chapter 9, section “Power failure” (9-2).

- 7 Remove the 40/70 A fuses from the BDFB. If circuit breakers are being used, put both of them in the **OFF** position.
- 8 Connect the shelf power cables as shown below. Lead the cables through the cable compartment at the right side of the rack.



**Important!** Make sure the cables are tight, but due to limited torque do not tighten the connector screws too much!

- 
- 9 The protective earth conductors have to be connected to the rear of the RCP and the grounding cable (Comcode 848506069) which is part of the RCP delivery to the rack grounding point.



END OF STEPS

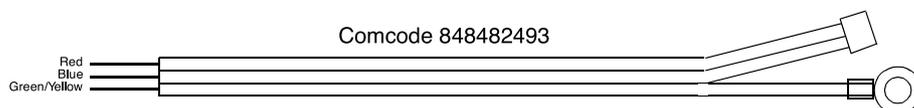
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## Alarm power cables

**Overview** The alarm power cables are used for powering the office alarms system (optical and acoustic alarms).

### Cable



The following table shows the signals of an alarm power cable.

Colour	Signal	Meaning
Red	+	+48V/+60V
Blue	-	-48V/-60V
Green/Yellow	FGRD	Ground

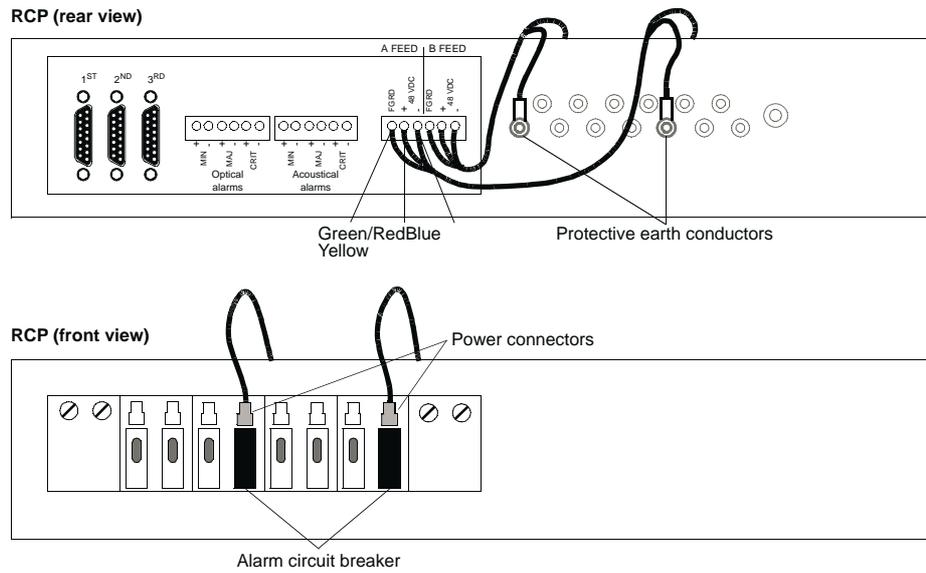
**Length** The alarm power cables (Comcode 848482493) are part of the RCP delivery (see section “Mounting the RCP” (3-18)) and have a length of 0.3 m/11.8 inch.

**Connection** Proceed as follows to connect the alarm power cables (see also the figure below):

- 1 Loosen the screws of the cover on the RCP backplane and take the cover away. Do not screw off the screws completely.
- 2 Connect the first alarm power cable to the **A FEED** power connector on the RCP backplane.
- 3 Connect the other end of the cable to the 4th power connector (“ALARM PANEL”) at the RCP front.
- 4 Connect the protective earth conductor to a grounding point on the RCP backplane.
- 5 Connect the second alarm power cable to the **B FEED** power connector on the RCP backplane.

- 
- 6 Connect the other end of the cable to the 8th power connector (“ALARM PANEL”) at the RCP front.
- 
- 7 Connect the protective earth conductor to the grounding point on the RCP backplane.
- END OF STEPS
- 

**Result**

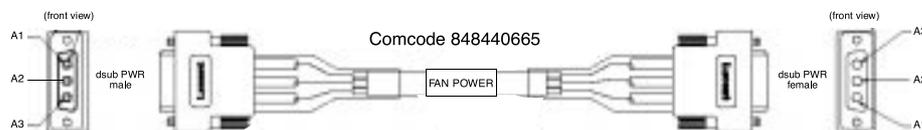


□

## Fan power cables

**Overview** The fan power cables are used for powering the fans.

### Cable



The following table shows the pin assignment of a fan power cable.

Pin	Colour	Signal	Meaning
A1	Green/Yellow	GND	Ground
A2	Blue	-	-48V/-60V
A3	Red	+	+48V/+60V

**Length** The fan power cables (Comcode 848440665) are part of the shelf deliveries (Comcodes 848438370 and 848438388) and have a length of 1 m/39.33 inch.

**Connection** Proceed as follows to connect the fan power cables (see also the figure below):

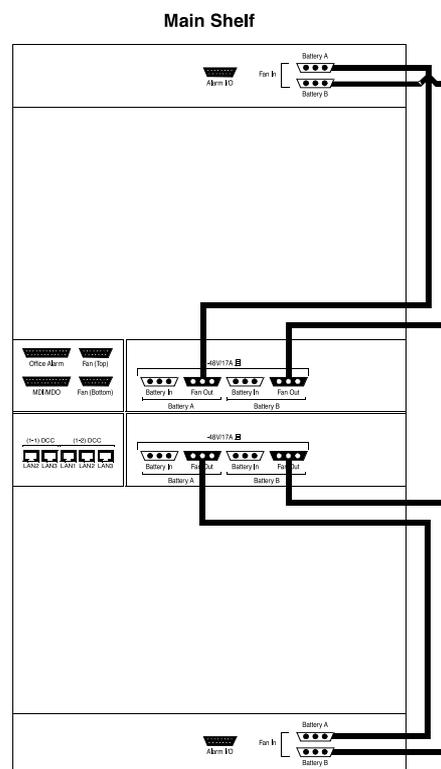
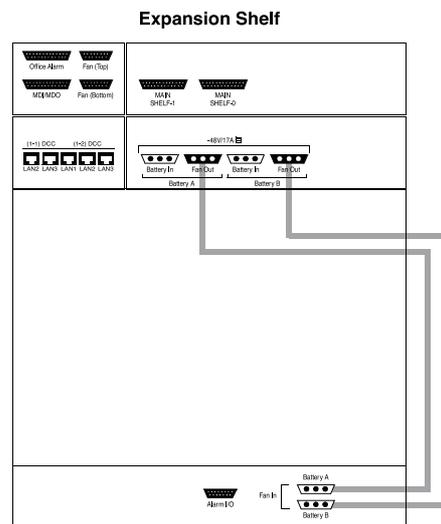
- 1 Connect the first fan power cable to the “Fan Out” (**Battery A**) connector of the *upper* Main Shelf **Power Filter Unit**.
- 2 Lead the cable into the cable compartment at the right side of the rack, and then upwards.
- 3 Connect the other end of the cable to the “Fan In” (**Battery A**) connector of the *top* located **Fan Unit**.
- 4 Connect the second fan power cable to the “Fan Out” (**Battery B**) connector of the *upper* Main Shelf **Power Filter Unit**.
- 5 Lead the cable into the cable compartment at the right side of the rack, and then upwards.

- 6 Connect the other end of the cable to the “Fan In” (**Battery B**) connector of the *top* located **Fan Unit**.
- 7 Connect the third fan power cable to the “Fan Out” (**Battery A**) connector of the *lower* Main Shelf **Power Filter Unit**.
- 8 Lead the cable into the cable compartment at the right side of the rack, and then downwards.
- 9 Connect the other end of the cable to the “Fan In” (**Battery A**) connector of the *bottom* located **Fan Unit**.
- 10 Connect the fourth fan power cable to the “Fan Out” (**Battery B**) connector of the *lower* Main Shelf **Power Filter Unit**.
- 11 Lead the cable into the cable compartment at the right side of the rack, and then downwards.
- 12 Connect the other end of the cable to the “Fan In” (**Battery B**) connector of the *bottom* located **Fan Unit**.
- 13 Connect the fifth fan power cable to the “Fan Out” (**Battery A**) connector of the **Expansion Shelf**.
- 14 Lead the cable into the cable compartment at the right side of the rack, and then downwards.
- 15 Connect the other end of the cable to the “Fan In” (**Battery A**) connector of the *bottom* located **Fan Unit**.
- 16 Connect the sixth fan power cable to the “Fan Out” (**Battery B**) connector of the **Expansion Shelf**.
- 17 Lead the cable into the cable compartment at the right side of the rack, and then downwards.

- 18 Connect the other end of the cable to the “Fan In” (*Battery B*) connector of the *bottom* located *Fan Unit*.

END OF STEPS

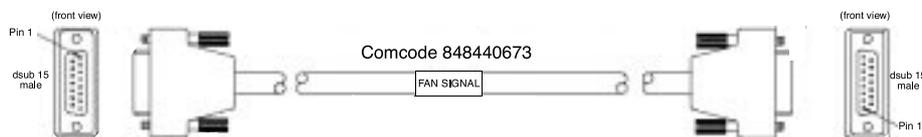
Result



## Fan alarm cables

**Overview** The fan alarm cables are used to transmit fan alarms from the fans to the shelves.

### Cable



The following table shows the pin assignment of a fan alarm cable.

Pin	Colour	Signal	Meaning
1	BL-W	SENS1IN	symmetrical counterpart of pin 9
2	O-W	SENS2IN	symmetrical counterpart of pin 10
3	G-W	SENS3IN	symmetrical counterpart of pin 11
4	BR-W	SENS4IN	symmetrical counterpart of pin 12
5	S-W	NFILT	static signal
6	BL-R	FANFAULT1	static signal
7	O-R	EQUIP0	static signal
8	G-R	NFILT_RTN	static signal
9	W-BL	SENS1OUT	symmetrical counterpart of pin 1
10	W-O	SENS2OUT	symmetrical counterpart of pin 2
11	W-G	SENS3OUT	symmetrical counterpart of pin 3
12	W-BR	SENS4OUT	symmetrical counterpart of pin 4
13	W-S	FANFAULT2	static signal
14	R-BL	PWRALM	static signal
15	R-O	ALMEQPCOM	static signal

**Length** The fan alarm cables (Comcode 848440673) are part of the shelf deliveries (Comcodes 848438370 and 848438388) and have a length of 1 m/39.33 inch.

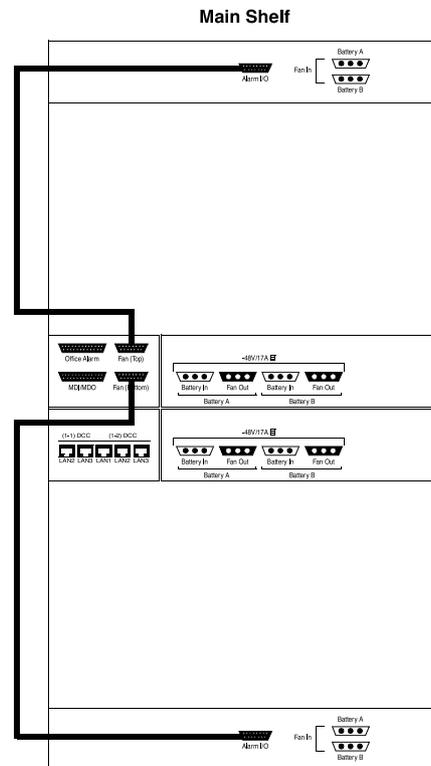
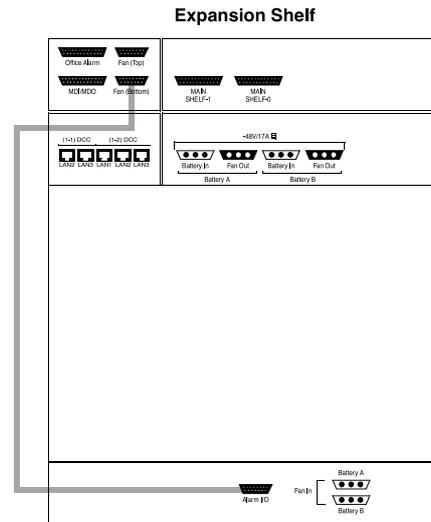
**Connection** Proceed as follows to connect the fan alarm cables (see also the figure below):

- 1 Connect the first fan alarm cable to the “Fan (Top)” connector of the Main Shelf *Alarm I/O-Panel*.

- .....
- 2** Lead the cable into the cable compartment at the left side of the rack, and then upwards.  
.....
  - 3** Connect the other end of the cable to the “Alarm I/O” connector of the *top* located *Fan Unit*.  
.....
  - 4** Connect the second fan alarm cable to the “Fan (Bottom)” connector of the Main Shelf *Alarm I/O-Panel*.  
.....
  - 5** Lead the cable into the cable compartment at the left side of the rack, and then downwards.  
.....
  - 6** Connect the other end of the cable to the “Alarm I/O” connector of the *bottom* located *Fan Unit*.  
.....
  - 7** Connect the third fan alarm cable to the “Fan (Bottom)” connector of the Expansion Shelf *Alarm I/O-Panel*.  
.....
  - 8** Lead the cable into the cable compartment at the left side of the rack, and then downwards.  
.....
  - 9** Connect the other end of the cable to the “Alarm I/O” connector of the *bottom* located *Fan Unit*.

.....  
E N D O F S T E P S  
.....

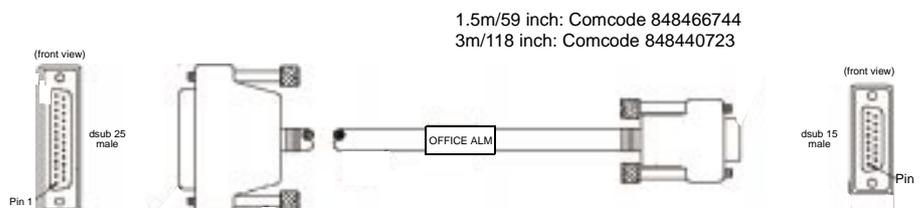
Result



## Office alarm cables

**Overview** The office alarm cables are used to transmit the alarms from the shelves to the RCP. Via its alarm panel an optical and/or an acoustic alarm equipment can be connected (e.g. alarm lamps).

### Cable



The following table shows the pin assignment of an office alarm cable at the **RCP side** (dsub 15 M).

Pin	Colour	Signal	Meaning
1	not used		
2	W-O	CRAUDNO	counterpart of pin 10
3	W-G	CRVISNO	counterpart of pin 11
4	W-BR	MJAUDR	counterpart of pin 12
5	W-S	MJVISNO	counterpart of pin 13
6	R-BL	MNAUDNO	counterpart of pin 14
7	R-O	MNVISNO	counterpart of pin 15
8	R-G	GND	Ground/Shield
9	not used		
10	O-W	CRAUDR	counterpart of pin 2
11	G-W	CRVISR	counterpart of pin 3
12	BR-W	MJAUDNO	counterpart of pin 4
13	S-W	MJVISR	counterpart of pin 5
14	BL-R	MNAUDR	counterpart of pin 6
15	O-R	MNVISR	counterpart of pin 7

The following table shows the pin assignment of an office alarm cable at the **shelf side** (dsub 25 M).

Pin	Colour	Signal	Meaning
1	not used		

Pin	Colour	Signal	Meaning
2	W-O	CRAUDNO	counterpart of pin 15
3	W-G	CRVISNO	counterpart of pin 16
4	W-BR	MJAUDR	counterpart of pin 17
5	W-S	MJVISNO	counterpart of pin 18
6	R-BL	MNAUDNO	counterpart of pin 19
7	R-O	MNVISNO	counterpart of pin 20
8	R-G	GND	Ground
9		GND	Ground
10		GND	Ground
11		GND	Ground
12		GND	Ground
13		GND	Ground
14	not used		
15	O-W	CRAUDR	counterpart of pin 2
16	G-W	CRVISR	counterpart of pin 3
17	BR-W	MJAUDNO	counterpart of pin 4
18	S-W	MJVISR	counterpart of pin 5
19	BL-R	MNAUDR	counterpart of pin 6
20	O-R	MNVISR	counterpart of pin 7
21		GND	Ground
22		GND	Ground
23		GND	Ground
24		GND	Ground
25		GND	Ground

**Available lengths** The office alarm cables are available in the following lengths:

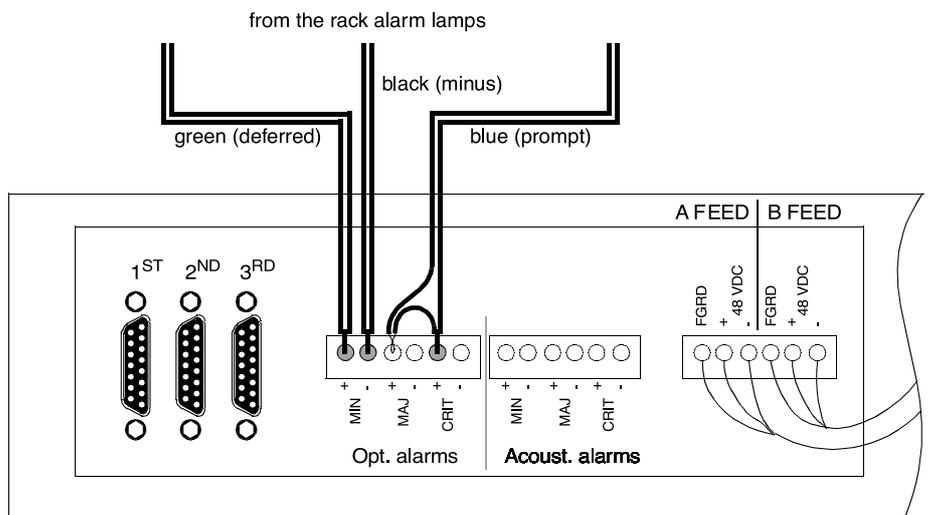
- 3 m/118 inch (Comcode 848440723)  
These cables are part of the shelf deliveries (Comcodes 848438370 and 848438388).
- 1.5 m/59 inch (Comcode 848466744)  
This cable is part of the cable kit (Comcode 848472767) and should be used if the Expansion Shelf is located above the Main Shelf. The cable kit has to be ordered separately.

**Connection** Proceed as follows to connect the office alarm cables and the cables of the rack alarm lamps (see section “Mounting the alarm lamps” (3-8)):

- 1 Lead the cables of the rack alarm lamps along the insides of the rack top and fix them with clamps as shown below.



- 2 Connect the cables to the “OPTICAL ALARMS” connector located on the RCP backplane as shown below. The alarms CRITICAL (*CRIT*) and MAJOR (*MAJ*) have to be mapped to *PROMPT*, MINOR (*MIN*) to *DEFERRED*.



**Important!** One line of the blue wire has to be stripped on a length of 1 cm. The stripped part must then be twisted and connected to the MAJ+ terminal.

.....

- 3** Connect the first office alarm cable with the dsub 15 M connector to the *1<sup>ST</sup> Office Alarm* connector on the RCP backplane.
- .....

- 4** Lead the cable into the cable compartment at the left side of the rack, and then downwards.
- .....

- 5** Connect the dsub 25 M connector of the office alarm cable to the “Office Alarm” connector of the *Main Shelf*.
- .....

- 6** Connect the second office alarm cable with the dsub 15 M connector to the *2<sup>ND</sup> Office Alarm* connector on the RCP backplane.
- .....

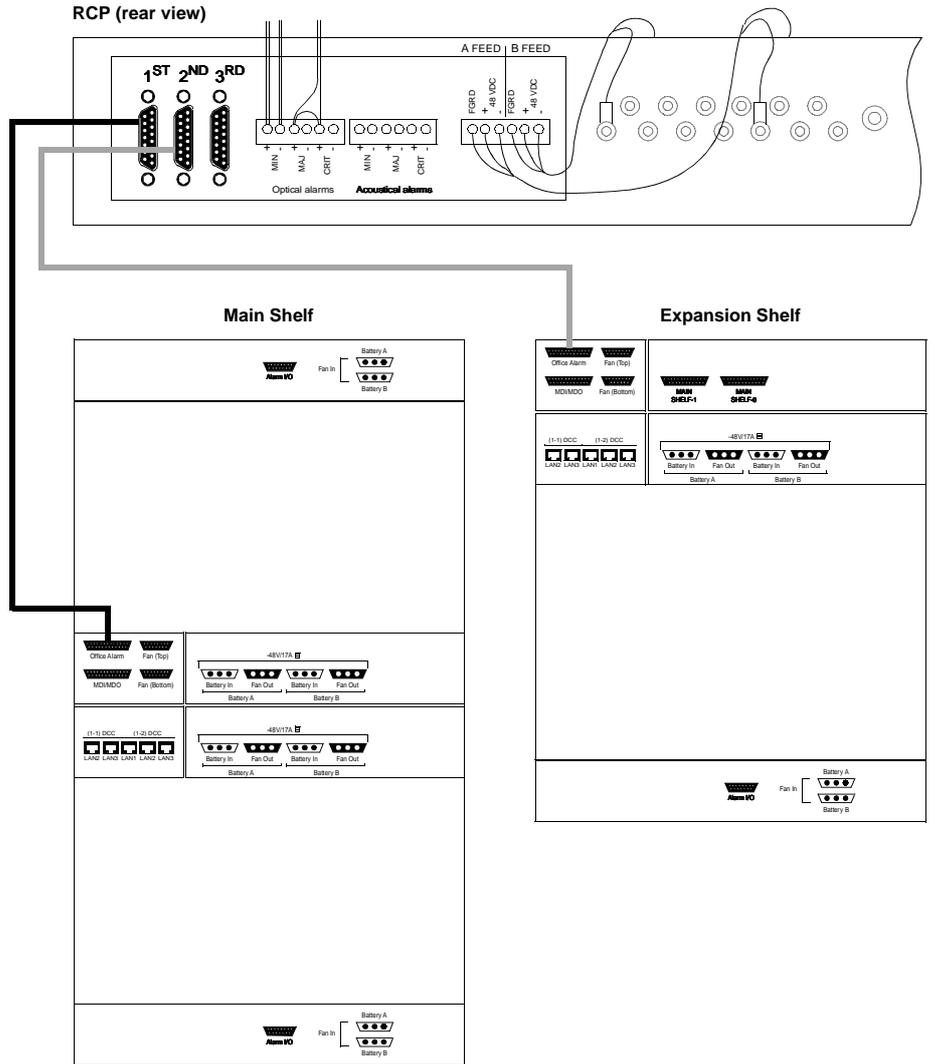
- 7** Lead the cable into the cable compartment at the left side of the rack, and then downwards.
- .....

- 8** Connect the dsub 25 M connector of the office alarm cable to the “Office Alarm” connector of the *Expansion Shelf*.
- .....

- 9** Fasten the cover on the RCP backplane.

.....  
E N D O F S T E P S  
.....

**Result**



## MDIO cable

**Overview** Miscellaneous discrete inputs and outputs allow the network provider to use the system to monitor and control other equipment co-located with the system. For example, a Miscellaneous Discrete Input (MDI) can be connected to monitor a temperature sensor, and a Miscellaneous Discrete Output (MDO) can be connected to control a fan or generator. The system provides 8 MDIs and 8 MDOs. The MDIs accept an isolated signal up to -72 V DC (15mA) and have a common pin (5). The MDOs are isolated relay contacts (2 pins). All MDIs/MDOs can be configured by the user. This means, that the user can determine which entities shall be wired to the MDIs/MDOs.

The following should be observed in general:

- The voltage on the individual MDIs should be positive with respect to the common pin to operate properly.
- The common pin should be connected to -48V/-60V (with respect to GND). Each MDI will be activated when it is connected to GND (by closing a door or alarm contact to GND).

**LEY301 circuit pack** The LEY301 circuit pack provides some special features on the MDIs via two 3-pin headers (P3 and P4). The default jumper positions for both headers are 1–2.

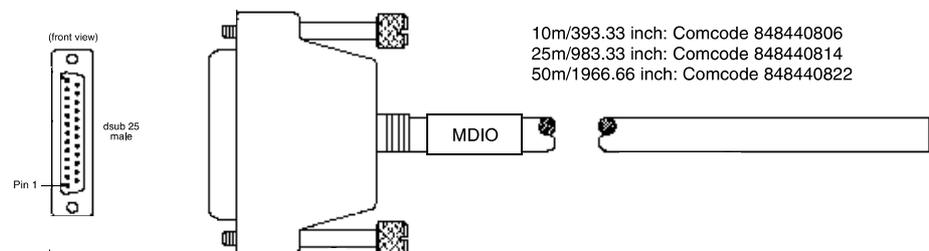
### Jumper position 1–2

The MDIs work as described above. That means, the common pin should be connected to -48V/-60V with respect to GND and the MDIs should be connected to GND for getting active.

### Jumper position 2–3

The own system voltage (-15V) is used. In this situation the common pin is providing a GND. When one of the MDIs is connected to GND or to the common pin (also GND) the MDI gets active.

### Cable



The following table shows the pin assignment of an MDIO cable.

Pin	Colour	Signal	Meaning
1	BL-W	MDIN0	input 0
2	O-W	MDIN2	input 2
3	G-W	MDIN4	input 4
4	BR-W	MDIN6	input 6
5	S-W	MDINCOM0, MDINCOM1	common pin for all inputs (return)
6	BL-R	MDOUT0	output 0 (relay contact 0), symmetrical counterpart of pin 18
7	O-R	MDOUT1	output 1 (relay contact 1), symmetrical counterpart of pin 19
8	G-R	MDOUT2	output 2 (relay contact 2), symmetrical counterpart of pin 20
9	BR-R	MDOUT3	output 3 (relay contact 3), symmetrical counterpart of pin 21
10	S-R	MDOUT4	output 4 (relay contact 4), symmetrical counterpart of pin 22
11	BL-BK	MDOUT5	output 5 (relay contact 5), symmetrical counterpart of pin 23
12	O-BK	MDOUT6	output 6 (relay contact 6), symmetrical counterpart of pin 24
13	G-BK	MDOUT7	output 7 (relay contact 7), symmetrical counterpart of pin 25
14	W-BL	MDIN1	input 1
15	W-O	MDIN3	input 3
16	W-G	MDIN5	input 5
17	W-BR	MDIN7	input 7
18	R-BL	MDOUT0R	output 0 (relay contact 0), symmetrical counterpart of pin 6
19	R-O	MDOUT1R	output 1 (relay contact 1), symmetrical counterpart of pin 7
20	R-G	MDOUT2R	output 2 (relay contact 2), symmetrical counterpart of pin 8
21	R-BR	MDOUT3R	output 3 (relay contact 3), symmetrical counterpart of pin 9

Pin	Colour	Signal	Meaning
22	R-S	MDOOUT4R	output 4 (relay contact 4), symmetrical counterpart of pin 10
23	BK-BL	MDOOUT5R	output 5 (relay contact 5), symmetrical counterpart of pin 11
24	BK-O	MDOOUT6R	output 6 (relay contact 6), symmetrical counterpart of pin 12
25	BK-G	MDOOUT7R	output 7 (relay contact 7), symmetrical counterpart of pin 13

**Available lengths** The MDIO cable is available in the following lengths:

- 10 m/393.33 inch (Comcode 848440806)
- 25 m/983.33 inch (Comcode 848440814)
- 50 m/1966.66 inch (Comcode 848440822).

**Connection** Proceed as follows to connect the MDIO cable (see also the figure below):

.....

**1** Connect the MDIO cable to “MDI/MDO” connector of the Main Shelf *Alarm I/O-Panel*.

.....

**2** Lead the cable into the cable compartment at the left side of the rack, and then down- or upwards.

.....

**3** Connect the other end of the cable (open end) to an external equipment. Pay attention to the correct in/out cabling.

.....

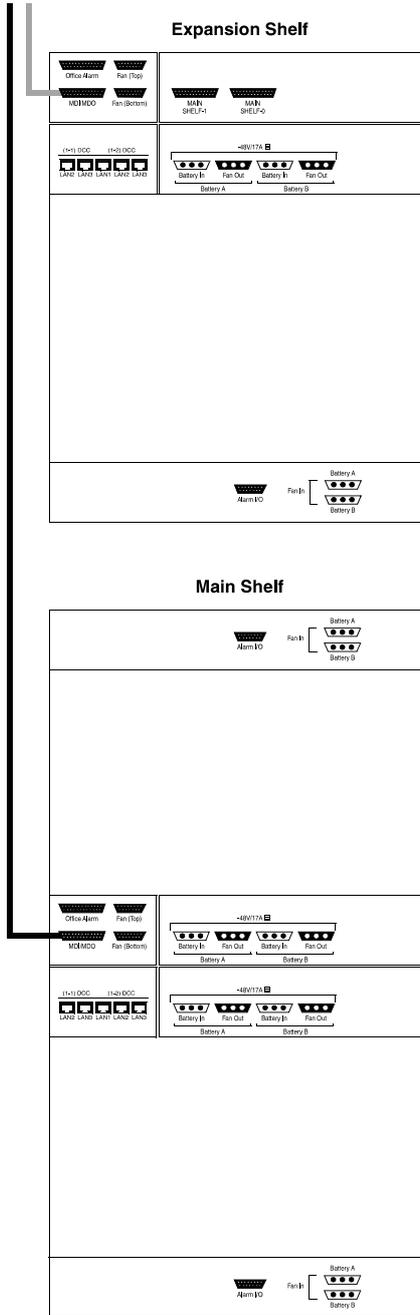
**4** Repeat steps 1 to 3 for the Expansion Shelf.

END OF STEPS

.....

### Result

to/from external equipment



## Reference timing cables

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**Overview** The reference timing cables are used to provide external clock sources to the Main Shelf for locked timing operations. Via jumpers the input and output impedances of the external reference in/outputs can be adjusted (120  $\Omega$  balanced or 75  $\Omega$  unbalanced). The next two figures show the two possible configurations.

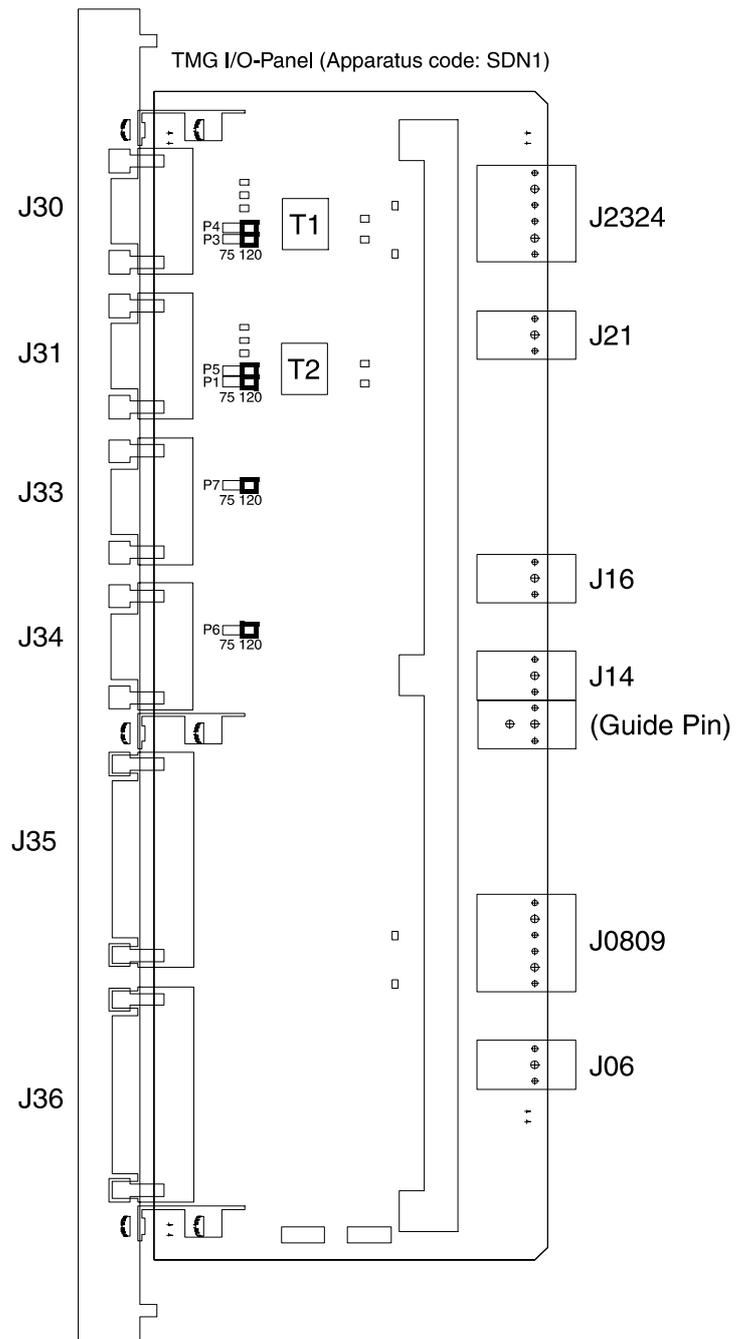
**120  $\Omega$  Configuration** The 120  $\Omega$ -Configuration must be used in conjunction with the following Reference Timing Cables:

- ***Reference Timing IN (120  $\Omega$ ):***  
Comcodes 84844049, 848440756 and 848440764
- ***Reference Timing OUT (120  $\Omega$ ):***  
Comcodes 848440772, 848440780 and 848440798.

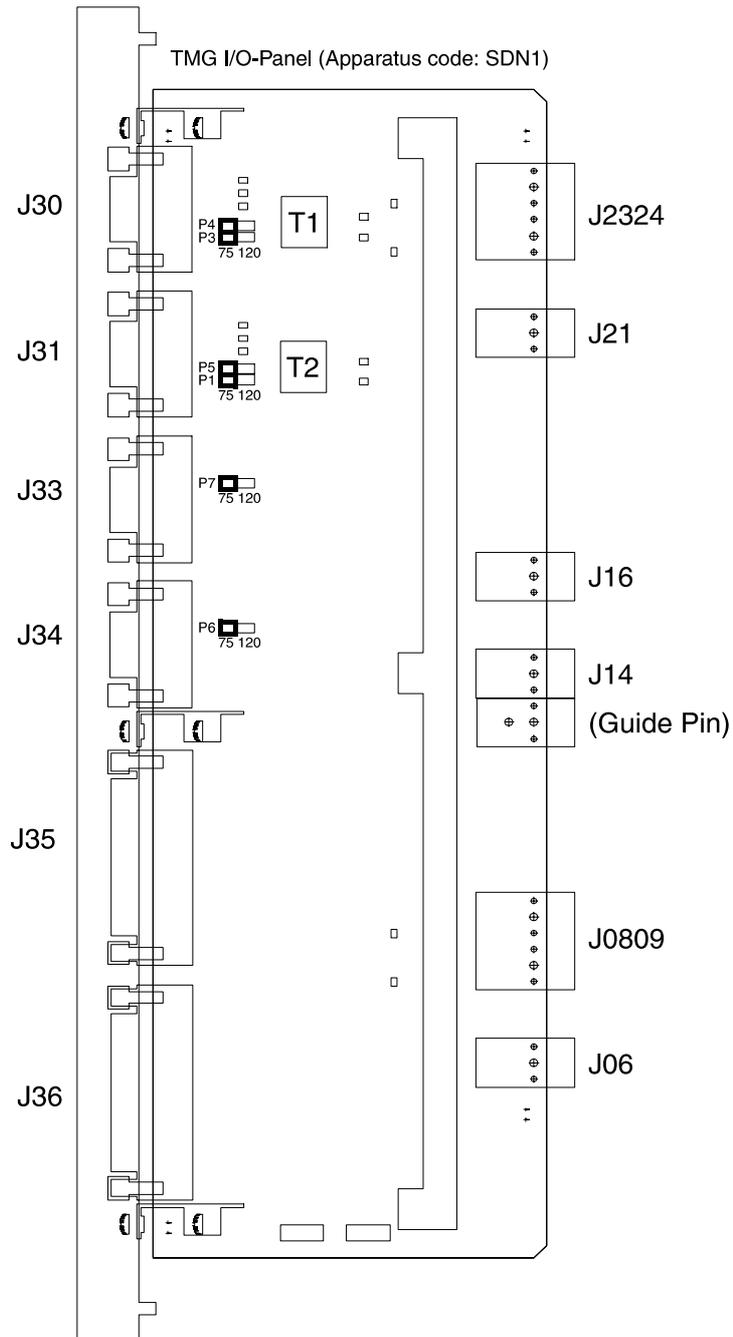
**75  $\Omega$  Configuration** The 75  $\Omega$ -Configuration must be used in conjunction with the following Reference Timing Cables:

- ***Reference Timing IN (75  $\Omega$ ):***  
Comcodes 848495842, 848495859 and 848495867
- ***Reference Timing OUT (75  $\Omega$ ):***  
Comcodes 848495875, 848495883 and 848495891.

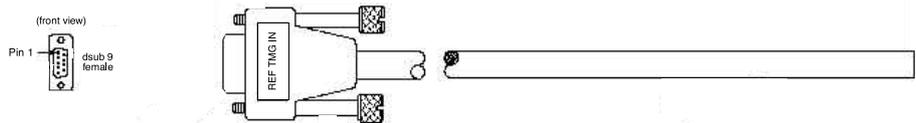
**Jumper setting 120 Ω**



**Jumper setting 75 Ω**



**REF TMG IN cable**



The following table shows the pin assignment of a reference timing in cable (120 Ω, balanced).

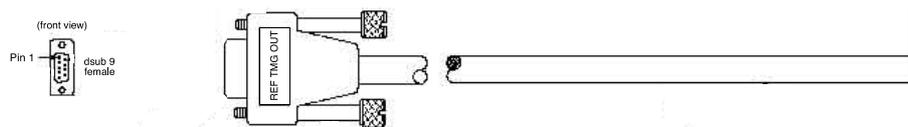
Pin	Colour	Signal	Meaning
1		GND	Ground/Shield
2	no connection		
3		GND	Ground
4	W-BL	REFIN_A	2.048 MHz / Mb/s for NE synchronisation; counterpart of pin 8
5	no connection		
6	no connection		
7		GND	Ground
8	BL-W	REFIN_B	2.048 MHz / Mb/s for NE synchronisation; counterpart of pin 4
9	no connection		

The following table shows the pin assignment of a reference timing in cable (75  $\Omega$ , unbalanced).

Pin	Colour	Signal	Meaning
1		GND	Ground/Shield
2	no connection		
3		GND	Ground
4	W-BL	REFIN_A	2.048 MHz / Mb/s for NE synchronisation (center conductor of coax)
5	no connection		
6	no connection		
7		GND	Ground
8	per jumper connected to GND		
9	no connection		

The Reference Timing In cables are *available* in the following *lengths*:

- 10 m/393.33 inch  
(120  $\Omega$ : Comcode 848440749, 75  $\Omega$ : Comcode 848495842)
- 25 m/983.33 inch  
(120  $\Omega$ : Comcode 848440756, 75  $\Omega$ : Comcode 848495859)
- 50 m/1966.66 inch  
(120  $\Omega$ : Comcode 848440764, 75  $\Omega$ : Comcode 848495867).

**REF TMG OUT cable**

The following table shows the pin assignment of a reference timing out cable (120  $\Omega$ , balanced).

Pin	Colour	Signal	Meaning
1		GND	Ground/Shield
2	W-BL	REFOUT_A	2.048 MHz / Mb/s for NE synchronisation; counterpart of pin 6
3		GND	Ground
4	no connection		
5	no connection		
6	BL-W	REFOUT_B	2.048 MHz / Mb/s for NE synchronisation; counterpart of pin 2
7		GND	Ground
8	no connection		
9	no connection		

The following table shows the pin assignment of a reference timing out cable (75  $\Omega$ , unbalanced).

Pin	Colour	Signal	Meaning
1		GND	Ground/Shield
2	W-BL	REFOUT_A	2.048 MHz / Mb/s for NE synchronisation (center conductor of coax)
3		GND	Ground
4	no connection		
5	no connection		
6	per jumper connected to GND		
7		GND	Ground
8	no connection		
9	no connection		

The Reference Timing Out cables are *available* in the following *lengths*:

- 10 m/393.33 inch  
(120  $\Omega$ : Comcode 848440772, 75  $\Omega$ : Comcode 848495875)
- 25 m/983.33 inch  
(120  $\Omega$ : Comcode 848440780, 75  $\Omega$ : Comcode 848495883)
- 50 m/1966.66 inch  
(120  $\Omega$ : Comcode 848440798, 75  $\Omega$ : Comcode 848495891).

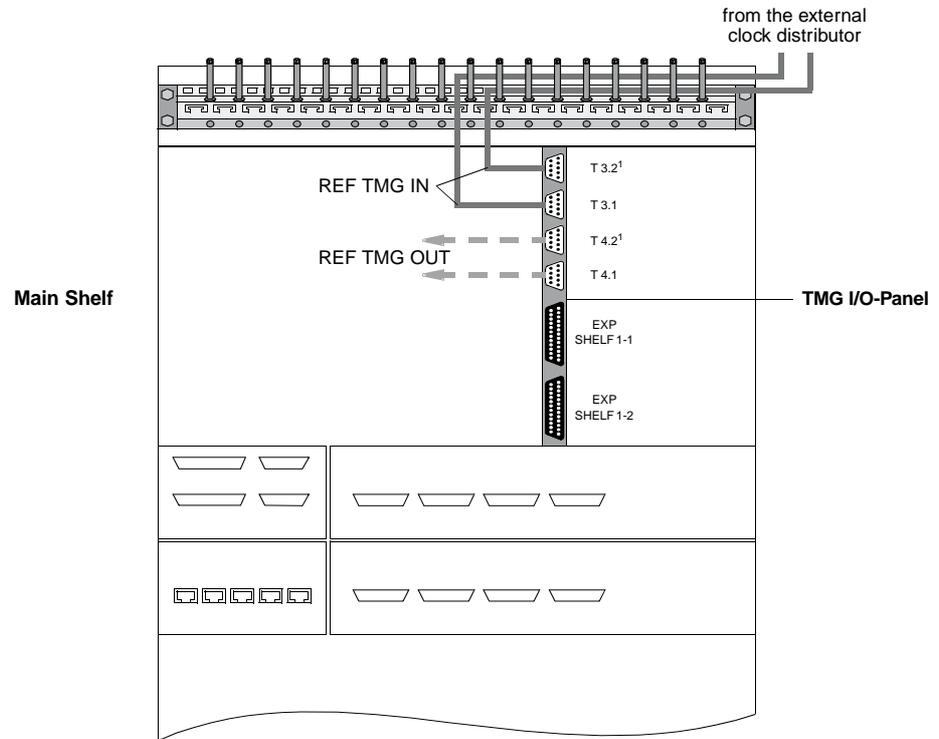
**Connection** Proceed as follows to connect the reference timing cables (see also the figure below):

- 1 Connect the first Reference Timing In cable to the “T3.1” connector of the *TMG I/O-Panel* plugged in the Main Shelf.
- 2 Lead the cable straight up to the cable tie bar. After passing the cable tie bar lead the cable into the cable compartment at the right side of the rack, and then down- or upwards (depending on the rack configuration).
- 3 Connect the unterminated end of the cable to the external clock distributor.
- 4 Connect the second Reference Timing In cable to the “T3.2” connector of the *TMG I/O-Panel* plugged in the Main Shelf.
- 5 Lead the cable straight up to the cable tie bar. After passing the cable tie bar lead the cable into the cable compartment at the right side of the rack, and then down- or upwards.
- 6 Connect the unterminated end of the cable to the external clock distributor.

END OF STEPS

**Additional note:**

If reference timing output signals are needed, you can connect the REF TMG OUT cables to the connectors “T4.1” and “T4.2” of the *TMG I/O-Panel* plugged in the Main Shelf.

**Result**

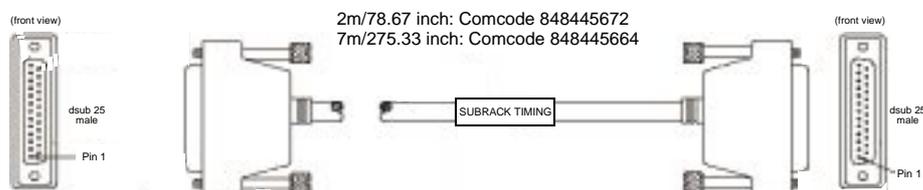
<sup>1</sup> optional (for redundant purposes only)

□

## Shelf timing cables

**Overview** The shelf timing cables are used to transmit the external timing signals from the Main Shelf to the Expansion Shelf.

### Cable



The following table shows the pin assignment of a shelf timing cable.

Pin	Colour	Signal	Meaning
1	BL-BK	GND	Ground
2	BL-W	CK8DOT3N	symmetrical counterpart of pin 14
3	O-W	CK8DOT4P	symmetrical counterpart of pin 16
4	G-W	RAC3IN1P	symmetrical counterpart of pin 17
5	BR-W	RAC3IN0P	symmetrical counterpart of pin 18
6	S-W	RAC3IN0P	symmetrical counterpart of pin 19
7	no connection		
8	BL-R	RAC3IN1N	symmetrical counterpart of pin 20
9	O-R	CK8DOT5N	symmetrical counterpart of pin 21
10	G-R	CK8DOT6N	symmetrical counterpart of pin 22
11	BR-R	CK8DOT7N	symmetrical counterpart of pin 23
12	S-R	CK8DOT8P	symmetrical counterpart of pin 25
13	BK-BL	GND	Ground
14	W-BL	CK8DOT3P	symmetrical counterpart of pin 2
15	O-BK	GND	Ground
16	W-O	CK8DOT4N	symmetrical counterpart of pin 3
17	W-G	RAC3IN1N	symmetrical counterpart of pin 4
18	W-BR	RAC3IN0N	symmetrical counterpart of pin 5
19	W-S	RAC3IN0N	symmetrical counterpart of pin 6
20	R-BL	RAC3IN1P	symmetrical counterpart of pin 8
21	R-O	CK8DOT5P	symmetrical counterpart of pin 9
22	R-G	CK8DOT6P	symmetrical counterpart of pin 10

Pin	Colour	Signal	Meaning
23	R-BR	CK8DOT7P	symmetrical counterpart of pin 11
24	BK-O	GND	Ground
25	R-S	CK8DOT8N	symmetrical counterpart of pin 12

**Available lengths** The shelf timing cables are available in the following lengths:

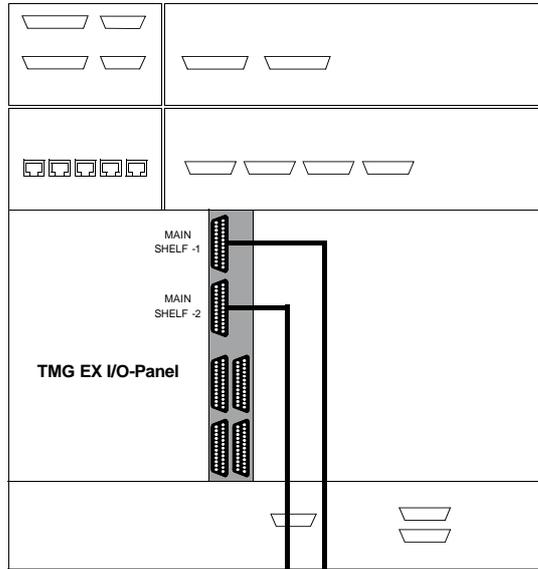
- 2 m/78.67 inch (Comcode 848445672)  
These cables are part of the cable kit (Comcode 848472742) and are needed if the Expansion Shelf is in the same rack as the Main Shelf.
- 7 m/275.33 inch (Comcode 848445664)  
These cables are part of the cable kit (Comcode 848472759) and are needed if the Expansion Shelf is not in the same rack as the Main Shelf.

**Connection** Proceed as follows to connect the shelf timing cables (see also the figure below):

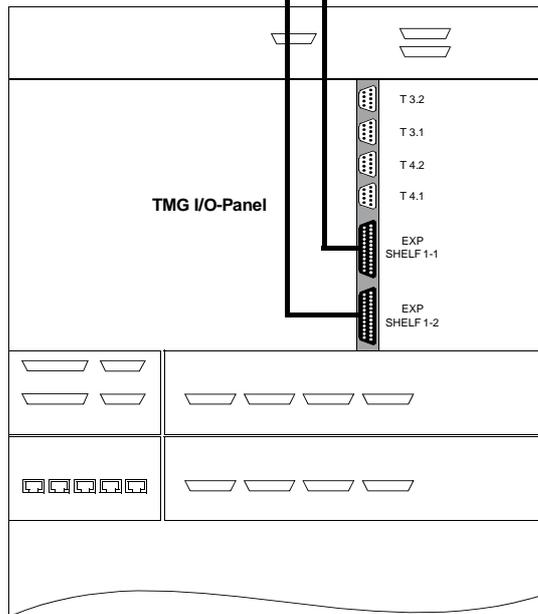
- 1 Connect the first shelf timing cable to the “EXP SHELF 1-1” connector of the *TMG I/O-Panel* plugged in the Main Shelf.
  - 2 Lead the cable straight up or down (depending on the rack configuration) to the Expansion Shelf.
  - 3 Connect the other end of the cable to the “MAIN SHELF -1” connector of the *TMG EX I/O-Panel* plugged in the Expansion Shelf.
  - 4 Connect the second shelf timing cable to the “EXP SHELF 1-2” connector of the *TMG I/O-Panel* plugged in the Main Shelf.
  - 5 Lead the cable straight up or down to the Expansion Shelf.
  - 6 Connect the other end of the cable to the “MAIN SHELF -2” connector of the *TMG EX I/O-Panel* plugged in the Expansion Shelf.
- END OF STEPS

### Result

#### Expansion Shelf



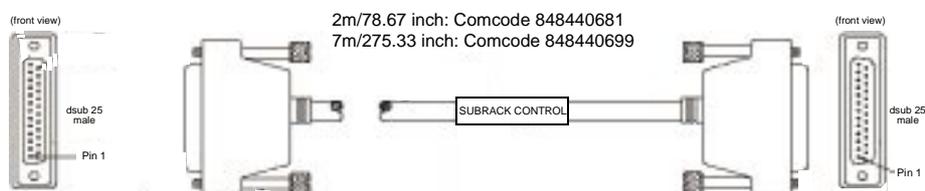
#### Main Shelf



## Shelf control cables

**Overview** The shelf control cables are used to control the Expansion Shelf via the Main Shelf.

### Cable



The following table shows the pin assignment of a shelf control cable.

Pin	Colour	Signal	Meaning
1		no connection	
2	BL-W	C1D7IN	symmetrical counterpart of pin 14
3	BL-BK	GND	Ground
4	O-W	C1D7ON	symmetrical counterpart of pin 16
5	G-W	PWRRST7	static signal
6	BR-W	BPID0	static signal
7	S-W	BPID2	static signal
8	BL-R	BPID4	static signal
9	O-R	PWRRST8	static signal
10	BR-R	C1D8ON	symmetrical counterpart of pin 23
11	BK-BL	GND	Ground
12	S-R	C1D8IN	symmetrical counterpart of pin 25
13	BK-O	GND	Ground/Shield
14	W-BL	C1D7IP	symmetrical counterpart of pin 2
15	O-BK	GND	Ground
16	W-O	C1D7OP	symmetrical counterpart of pin 4
17	W-G	EQP7	static signal
18	W-BR	PRE7COM	static signal
19	W-S	BPID1	static signal
20	R-BL	BPID3	static signal
21	R-O	LOPALM4	static signal
22	R-G	EQP8	static signal

Pin	Colour	Signal	Meaning
23	R-BR	C1D8OP	symmetrical counterpart of pin 10
24	R-G	GND	Ground
25	R-S	C1D8IP	symmetrical counterpart of pin 12

**Available lengths** The shelf control cables are available in the following lengths:

- 2 m/78.67 inch (Comcode 848440681)  
These cables are part of the cable kit (Comcode 848472742) and are needed if the Expansion Shelf is in the same rack as the Main Shelf.
- 7 m/275.33 inch (Comcode 848440699)  
These cables are part of the cable kit (Comcode 848472759) and are needed if the Expansion Shelf is not in the same rack as the Main Shelf.

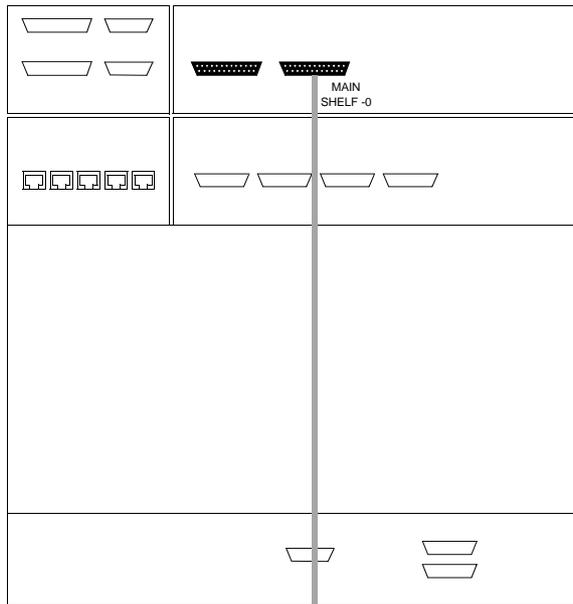
**Connection** Proceed as follows to connect the shelf control cables (see also the figure below):

- 1 Connect the shelf control cable to the “EXP SHELF 1” connector of the right *CTL I/O-Panel* plugged in the Main Shelf.
- 2 Lead the cable straight up or down to the Expansion Shelf.
- 3 Connect the other end of the cable to the “MAIN SHELF -0” connector of the *CTL EX I/O-Panel* plugged in the Expansion Shelf.

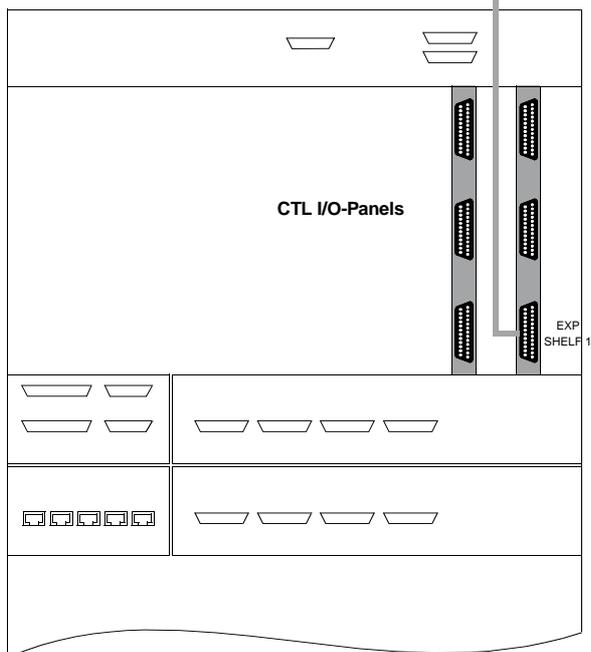
END OF STEPS

### Result

Expansion Shelf



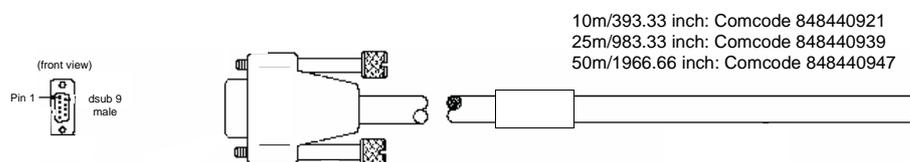
Main Shelf



## User byte cables

**Overview** User byte I/O-panels provide interfaces (V.11 and G.703) for user data channels and external orderwire equipment.

### G.703 Cable



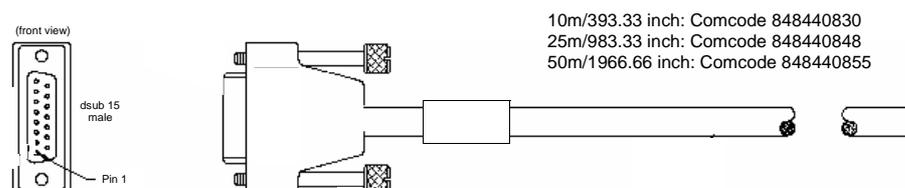
The following table shows the pin assignment of a G.703 user byte cable.

Pin	Colour	Signal	Meaning
1	BL-W	DinPos (Input)	symmetrical counterpart of pin 6; user byte data upstream
2	G-W	GND	Ground/Shield
3	no connection		
4	no connection		
5	O-W	DoutNeg (Output)	symmetrical counterpart of pin 9; user byte data downstream
6	W-BL	DinNeg (Input)	symmetrical counterpart of pin 1; user byte data upstream
7	no connection		
8	no connection		
9	W-O	DoutPos (Output)	symmetrical counterpart of pin 5; user byte data downstream

The G.703 user byte cables are *available* in the following *lengths*:

- 10 m/393.33 inch (Comcode 848440921)
- 25 m/983.33 inch (Comcode 848440939)
- 50 m/1966.66 inch (Comcode 848440947).

### V.11 Cable



The following table shows the pin assignment of a V.11 user byte cable.

<b>Pin</b>	<b>Colour</b>	<b>Signal</b>	<b>Meaning</b>
1	R-O	GND	Ground/Shield
2	W-BL	Clock_DoPos (Output)	symmetrical counterpart of pin 9; user byte clock downstream
3	W-O	Frame_DoPos (Output)	symmetrical counterpart of pin 10; user byte frame downstream
4	W-G	Data_DoPos (Output)	symmetrical counterpart of pin 11; user byte data downstream
5	W-BR	Clock_UpNeg (Output)	symmetrical counterpart of pin 13; user byte clock upstream
6	W-S	Frame_UpNeg (Output)	symmetrical counterpart of pin 14; user byte frame upstream
7	R-BL	Data_UpNeg (Input)	symmetrical counterpart of pin 15; user byte data upstream
8	O-R	GND	Ground
9	BL-W	Clock_DoNeg (Output)	symmetrical counterpart of pin 2; user byte clock downstream
10	O-W	Frame_DoNeg (Output)	symmetrical counterpart of pin 3; user byte frame downstream
11	G-W	Data_DoNeg (Output)	symmetrical counterpart of pin 4; user byte data downstream
12	R-G	GND	Ground
13	BR-W	Clock_UpPos (Output)	symmetrical counterpart of pin 5; user byte clock upstream
14	S-W	Frame_UpPos (Output)	symmetrical counterpart of pin 6; user byte frame upstream

Pin	Colour	Signal	Meaning
15	BL-R	Data_UpPos (Input)	symmetrical counterpart of pin 7; user byte data upstream

The V.11 user byte cables are *available* in the following *lengths*:

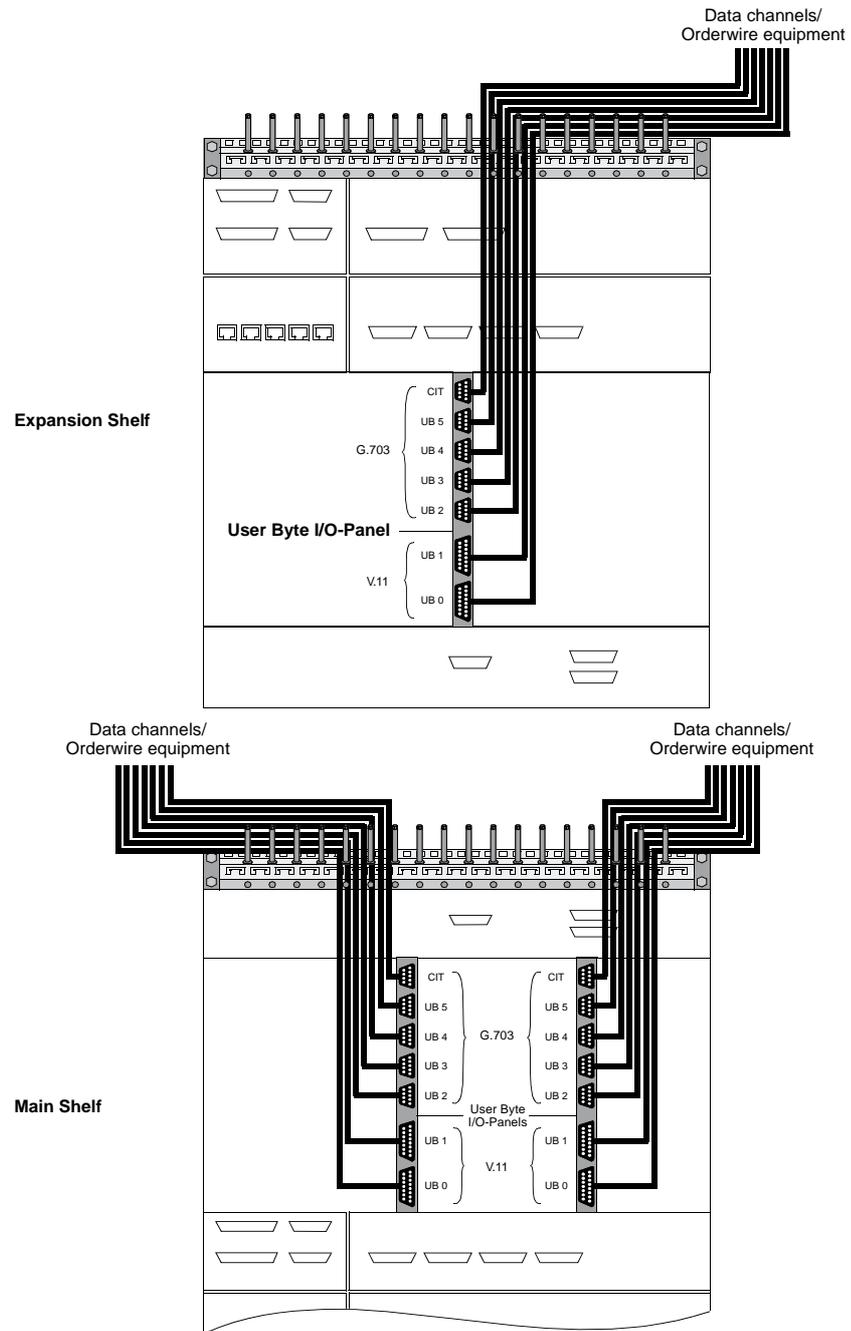
- 10 m/393.33 inch (Comcode 848440830)
- 25 m/983.33 inch (Comcode 848440848)
- 50 m/1966.66 inch (Comcode 848440855).

**Connection** Proceed as follows to connect the user byte cables (see also the figure below):

- 1 Connect all user byte cables (G.703 and V.11) to the *User Byte I/O-Panels* plugged in the Main and Expansion shelves as shown below.
- 2 Lead the cables straight up to the cable tie bars. After passing the cable tie bars lead the cables into the cable compartment of the rack, and then down- or upwards (depending on the rack configuration).
- 3 Connect the other end of the cables to the external data channels or an orderwire equipment.

END OF STEPS

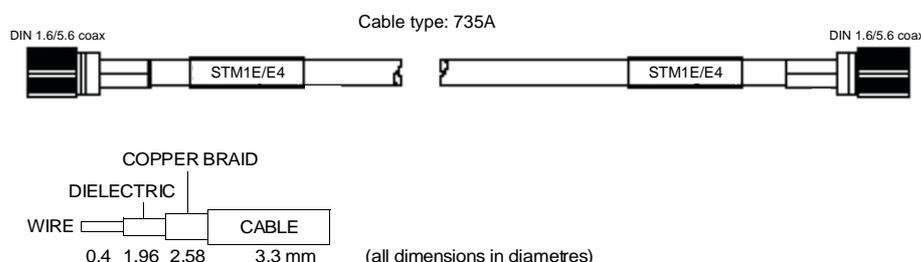
### Result



## Electrical STM cables

**Overview** The electrical STM cables (STM1E/4) are used to transmit the STM tributary signals.

### Cable



**Available lengths** The electrical STM cables are available in the following lengths:

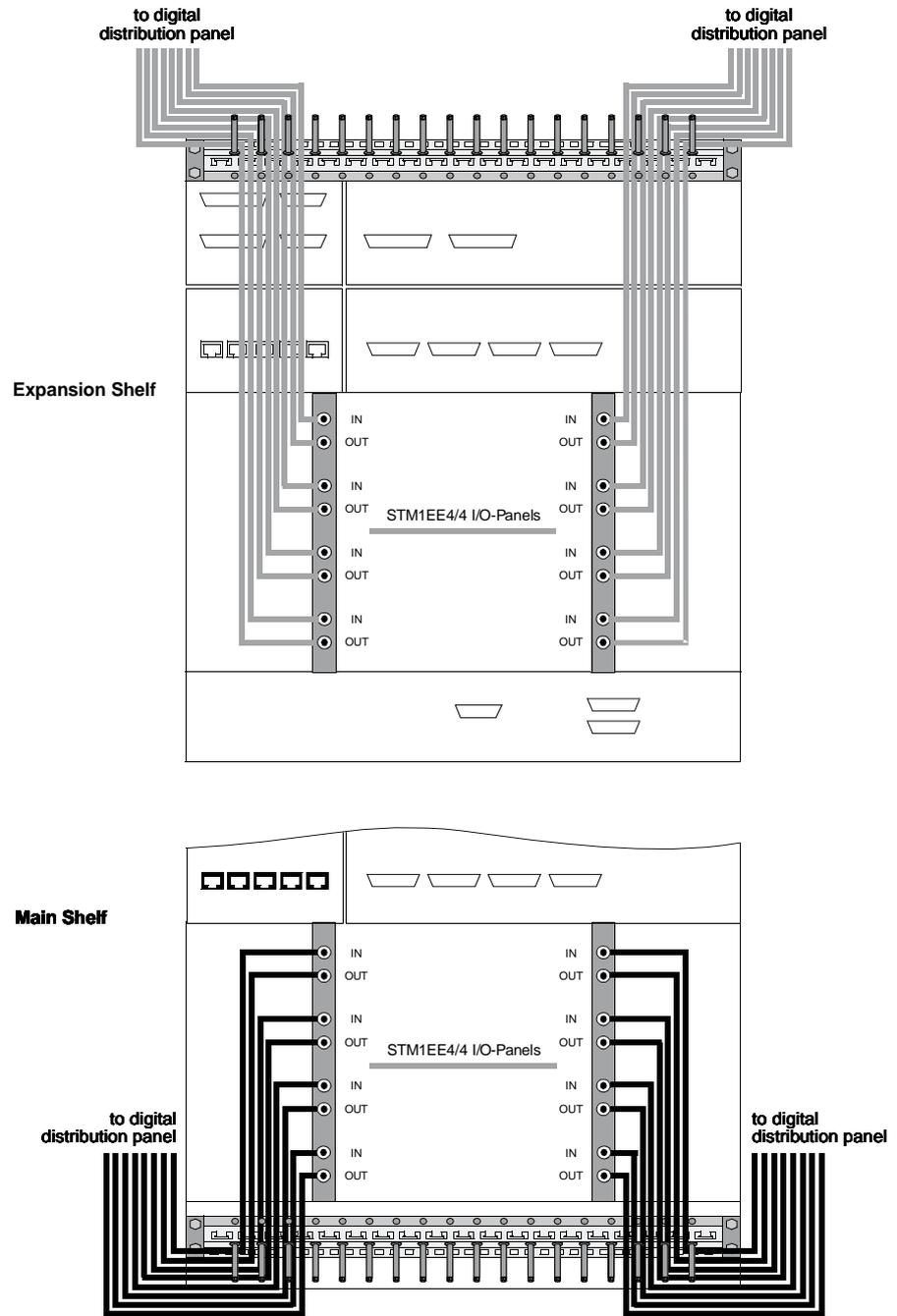
- 10 m/393.33 inch (Comcode 848440897)
- 25 m/983.33 inch (Comcode 848440905)
- 50 m/1966.66 inch (Comcode 848440913).

**Connection** Proceed as follows to connect the electrical STM cables (see also the figure below):

- 1 Cut through each electrical STM cable (in the middle) to obtain 2 cables for one port (IN/OUT). Take into consideration that the cables are then only half as long as before.
- 2 Connect all electrical STM cables with the coax connector (DIN 1.6/5.6) to the *STM1EE4/4 I/O-Panels* plugged in the Main and Expansion shelves.
- 3 Lead the cables straight up to the cable tie bars. After passing the cable tie bars lead the cables into the cable compartment of the rack, and then down- or upwards (depending on the rack configuration).
- 4 Connect the other end of the cables (open end) to the external digital distribution panel (customer side). Pay attention to the correct in/out cabling.

END OF STEPS

### Result

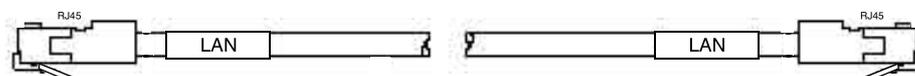


## LAN cable

---

**Overview** The LAN cable is used to connect a shelf to an external LAN for the purpose of exchanging management information.

### Cable



**Available lengths** The LAN cable is available in the following lengths:

- 10 m/393.33 inch (Comcode 848440863)
- 25 m/983.33 inch (Comcode 848440871)
- 50 m/1966.66 inch (Comcode 848440889).

**Connection** Proceed as follows to connect the LAN cable (see also the figure below):

---

- 1** Connect the LAN cable to “LAN2” of the “(1-1) DCC” connector of the Main Shelf *LAN I/O-Panel*.

---

- 2** Lead the cable into the cable compartment at the left side of the rack, and then down- or upwards.

---

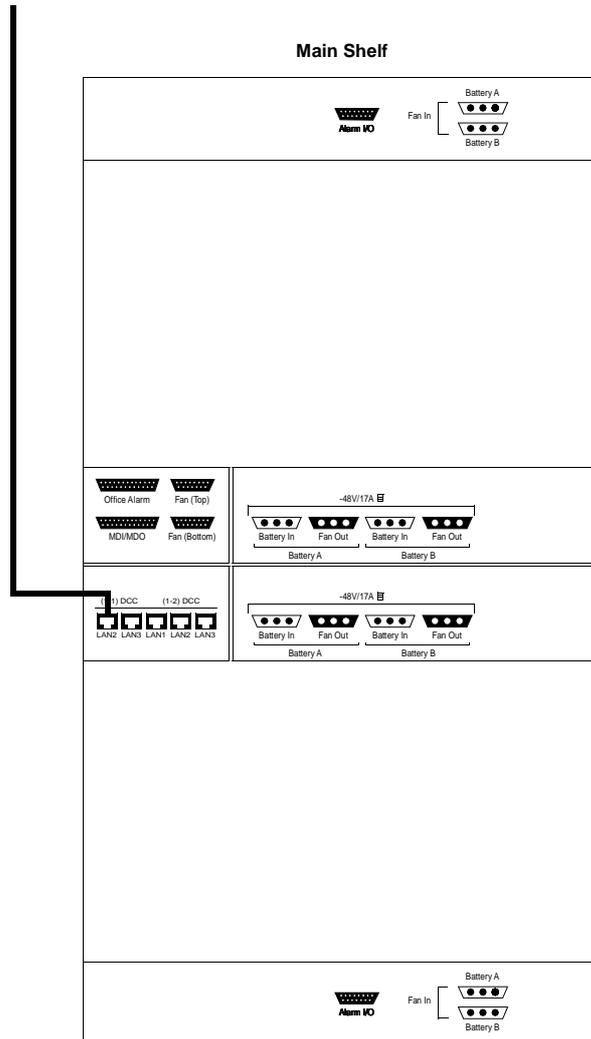
- 3** Connect the other end of the cable to an external LAN.

END OF STEPS

---

### Result

to an external LAN

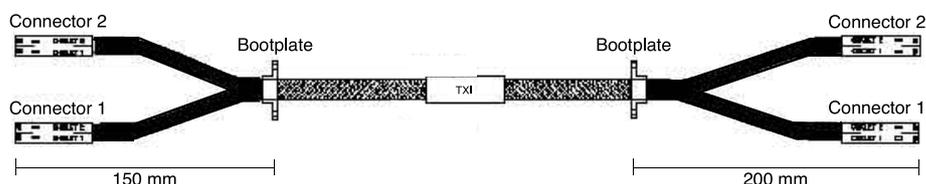


## TXI cables

---

**Overview** The TXI cables are used to transport transmission payloads between Main and Expansion Shelves.

### Cable



**Available lengths** The TXI cables are available in the following lengths:

- 1.4 m/55.1 inch (Comcode 848440707)  
These cables are part of the cable kit (Comcode 848472742) and are needed if the Expansion Shelf is in the same rack as the Main Shelf.
- 7.35 m/289.1 inch (Comcode 848440715)  
These cables are part of the cable kit (Comcode 848472759) and are needed if the Expansion Shelf is not in the same rack as the Main Shelf.

**Connection** Proceed as follows to connect the TXI cables:

---

- 1 To get more space, remove the two circuit packs which are located directly to the right of all TXI I/O panels.

---

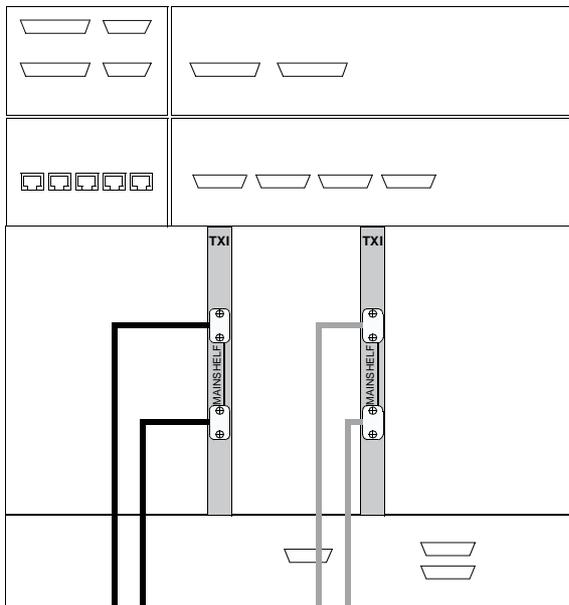
- 2 Screw off the covers of the “EXP SHELF 1” connectors (located on the TXI I/O panels of the Main Shelf) and all covers of the “MAINSHELF” connectors (located on the TXI I/O panels of the Expansion Shelf).

---

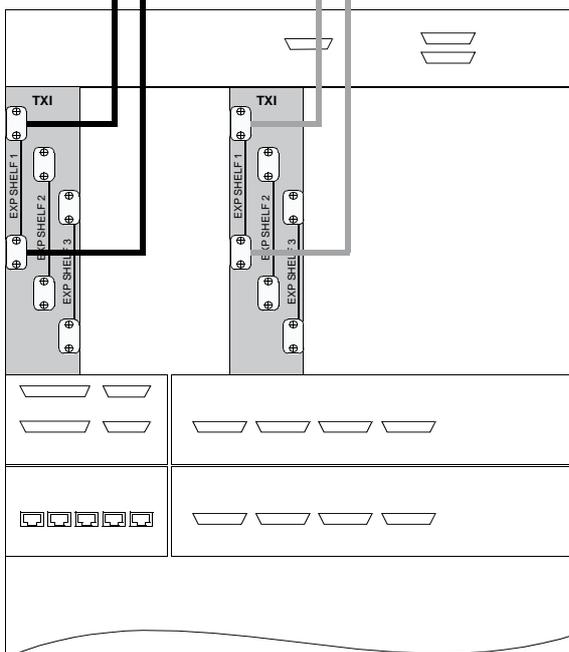
- 3 Screw on/Connect the bootplates of the TXI cables to the TXI I/O panels as shown below. The short ends of the TXI cables (150 mm)

must be connected to the Expansion Shelf, the long ends (200 mm) to the Main Shelf.

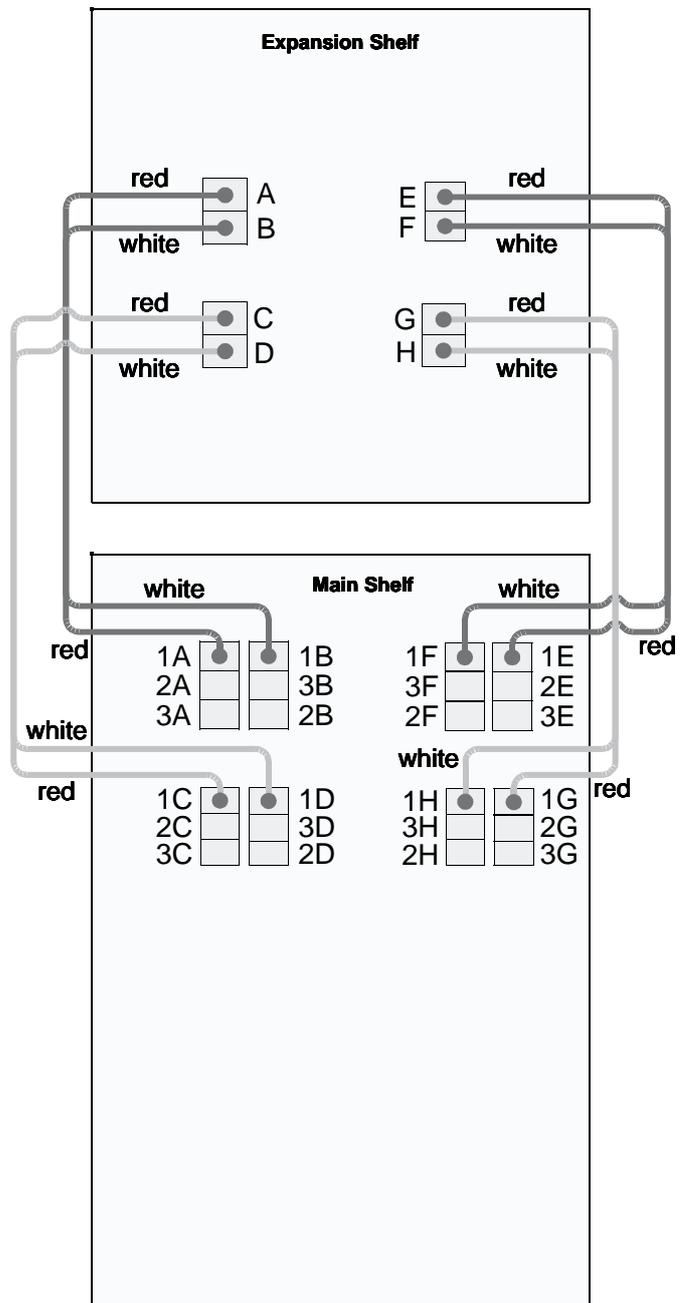
**Expansion Shelf**



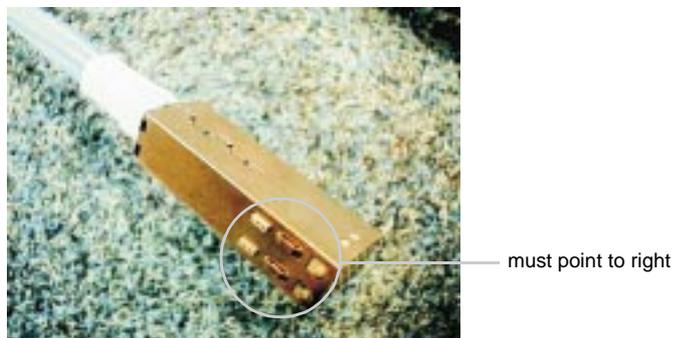
**Main Shelf**



- 4 Connect each connector of the TXI cables as shown below.



Pay attention to the correct colour mapping (red/white) and the mechanical orientation. The following figure shows the right side of the TXI connector.



- 
- 5** Re-insert the circuit packs which have been removed.

END OF STEPS

---



## Fibre cables

---

**Overview** This section describes the cable guidance and mounting of optical fibre cables in general. The establishment of a fibre network is described in section “High level ring connection” (7-3).



### DANGER

*Never look into the end of an exposed fiber or into an open optical connector as long as the optical source is switched on. This applies particularly to the connections of the optical plug-in units.*



### CAUTION

*To avoid a cable break, ensure that the bending radius of optical fibre cables is not less than 30 mm.*

**Important!** Two persons are necessary for mounting the fibres.

**LEY23 (OC3/STM1/1.3SR8)** Special patchcords are required for the LEY23 circuit pack. The following patchcords can be ordered:

- LC-LC patchcord (Comcode: 848787628)
- LC-FC patchcord (Comcode: 848787636)
- LC-SC patchcord (Comcode: 848787644)
- LC-ST patchcord (Comcode: 848787651)
- LC-APC patchcord (Comcode: 848797189).

All patchcords have a standard length of 25 meters (other lengths can also be ordered) and should comply with the following specifications:

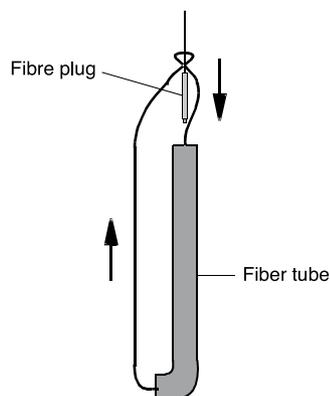
- Fibre cable shall be simplex, single mode, depressed clad.  
cordage 2.0 mm, halogene free, UL listed
- Optical performances:
  - Insertion loss equal to or less than 0.5 dB
  - Reflection loss equal to -55 dB
  - Tuned connectors
- APC connector should have an angle of 9 degrees.

**Before you begin** The procedure below describes the fibre cabling in general. If Ditech amplifiers are required (span length > 120 km), proceed to section “Ditech cabling” (4-62).

**Fibre connection (general)**

Proceed as follows to connect the optical fibre cables:

- 1 To get more space, remove the fan unit and the heat baffle which are located below the Main Shelf.
- 2 Lead the fibre cables for the Main Shelf into the cable compartment of the rack at the rear side. The fibres which will be connected in the right half of the shelf should be led into the right side (ports 01-08, oaw and oae), the rest of the fibres to the left side (ports 09-16, trw and tre).
- 3 Lead one fibre through the fiber tube. To do this, lead a loop around the fibre plug and pull the plug through the fiber tube as shown below.

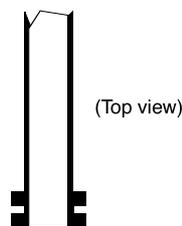


- 4 Repeat Step 3 for all the other fibres.
- 5 Remove all U-shaped fibre holders and fixing parts.

U-shaped fibre holder



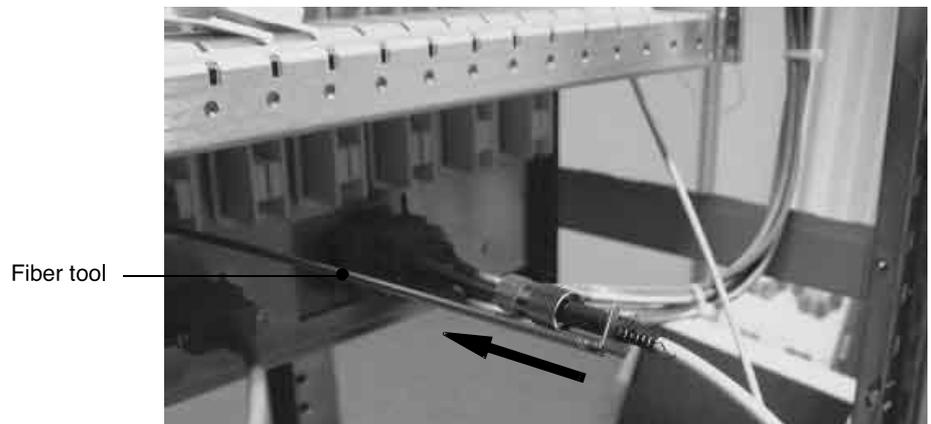
Fixing part



(Top view)

- 
- 6 The fibre has to be led to the front of the shelf by a second person (must be at the shelf front side) using the fiber tool (Comcode 848469060) which is located at the inside of the shelf front cover.

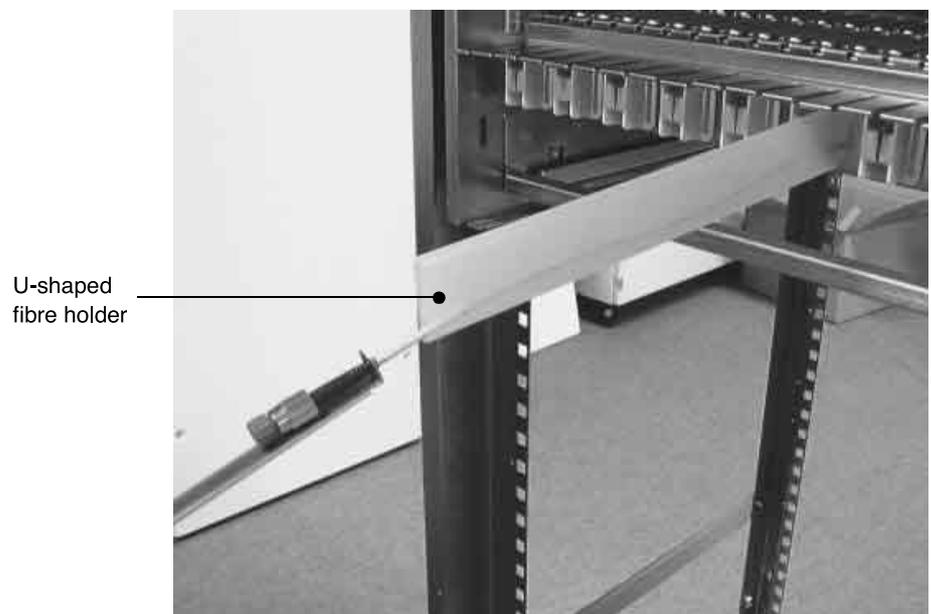
(Shelf rear side)



**Important!** Be sure to lead the fibre through the correct cutouts!

- 
- 7 Put the fibre into the U-shaped fibre holder (max. 8 fibres; 16 fibres for the LEY23 due to smaller fibre diameter).

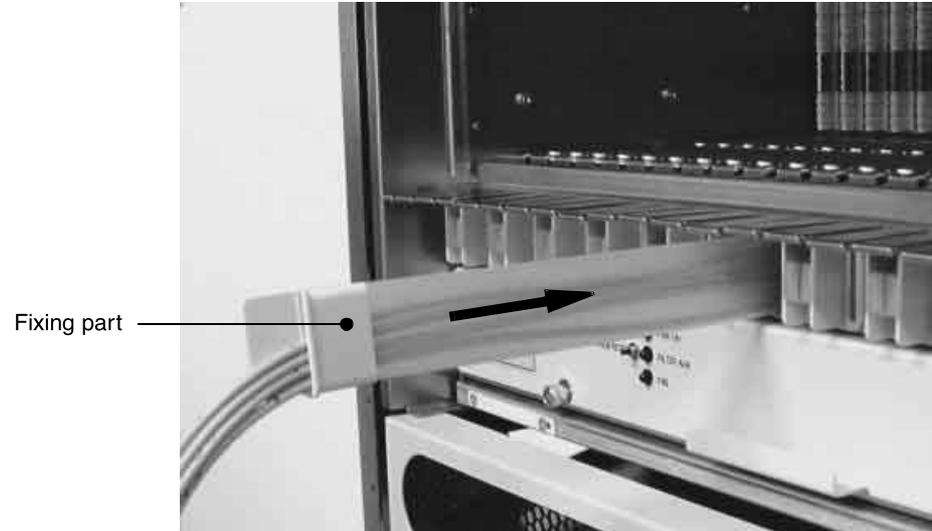
(Shelf front side)



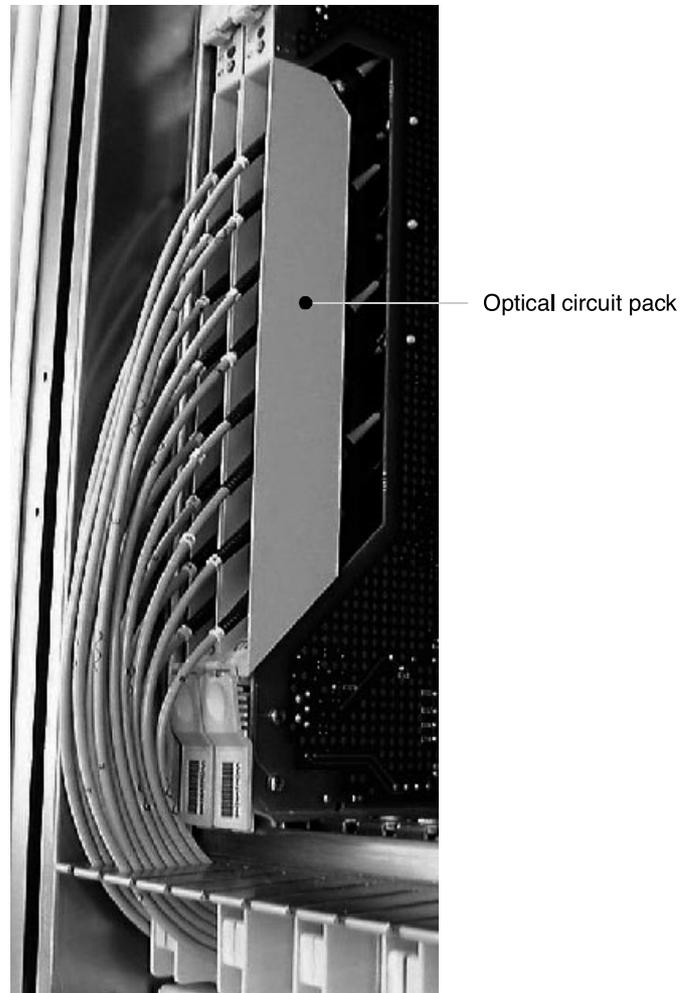
- 
- 8 Repeat Steps 6 and 7 for all fibres needed for one optical circuit pack (max. 8 fibres; 16 fibres for the LEY23 due to smaller fibre diameter).

- 
- 9 Slide the U-shaped fibre holder back into the shelf and fasten it with the help of the fixing parts to the glass fibre tray.

(Shelf front side)

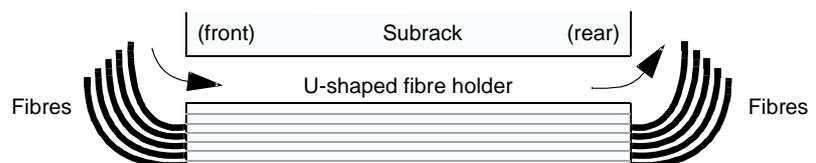


- 
- 10** Connect the fibres to the circuit pack in the order as shown below using the fiber installation tool (Comcode 848439543). The use of this tool is described in section “Use of the fiber installation tool” (4-57).



**Important!** Due to the bending radius it is recommended to use thin optical cables with short strain relief boots.

- 
- 11** To reduce the cable excess lengths slip the fibres back through the U-shaped fibre holder, then through the fiber tubes and at least through the cable compartment of the rack.



**Important!** The fibres should be held quite straight and not too loose.

.....

**12** Repeat Steps 6 to 11 for all the other optical circuit packs.

.....

<b>13</b>	<b>IF ...</b>	<b>THEN ...</b>
	OBA circuit packs are required,	<p>proceed to section “OBA cabling” (4-58).</p> <p><b>NOTE:</b> OBA circuit packs must always be used in conjunction with LEY69 transmitters (STM64) and are only necessary if span lengths of 60–80 km are required.</p>
	OBPA circuit packs are required,	<p>proceed to section “OBPA cabling” (4-60).</p> <p><b>NOTE:</b> OBPA circuit packs must always be used in conjunction with LEY228 transmitters (STM64) and are only necessary if span lengths of 80–120 km are required.</p>
	Neither OBA nor OBPA circuit packs are required,	proceed to Step 14.

.....

**14** Insert all unused U-shaped fibre holders and fixing parts into the shelf.

**Important!** To avoid air leakage and to guarantee proper thermal management all slots must be equipped with two U-shaped fibre holders and two pairs of fixing parts front to rear.

.....

**15** Re-insert the fan unit and the heat baffle which has been removed.

.....

**16** Repeat Steps 1 to 12, 14 and 15 for the Expansion Shelf.

END OF STEPS

.....

**Use of the fiber installation tool**

The fiber installation tool (Comcode 848439543) which is part of the shelf installation kits (Comcodes 848469805 and 848469797) is used to make the mounting of fibres and LBOs (see Chapter 7, section “LBO selection and mounting” (7-9)) easier. Proceed as follows to connect fibres via the fiber installation tool:

---

- 1 Slide the fibre through the slot opening on the tool.  

---
- 2 Put the fibre connector into the tool, locating the alignment key.  

---
- 3 Slide the outer sleeve of the tool up to firmly grasp the connector plug.  

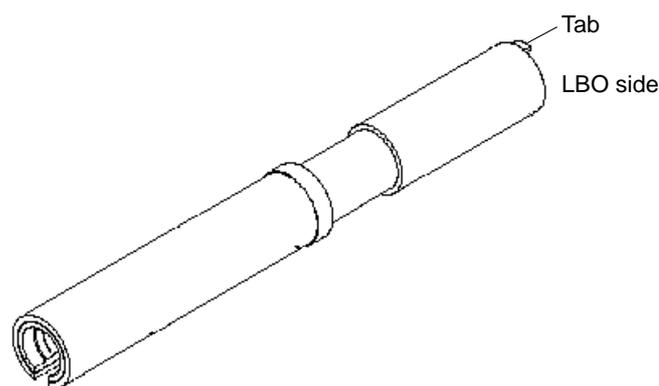
---
- 4 Install the connector by pushing on the tool and turning tool and fibre clockwise.  

---
- 5 Slide the outer sleeve of the tool down to loosen the tool’s grasp on the connector plug.  

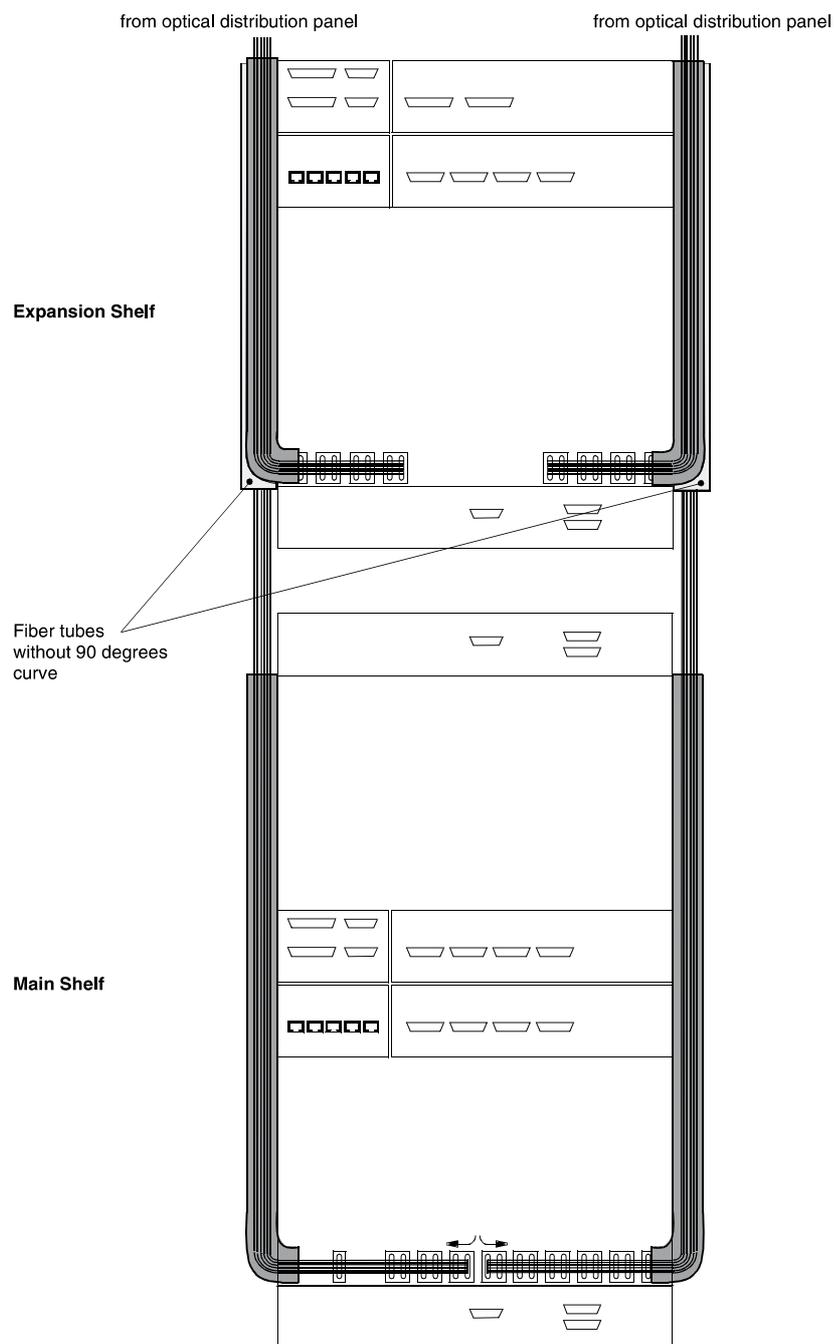
---
- 6 Remove the tool from the connector plug by pulling it straight back.

END OF STEPS

---

**Fiber installation tool**

**Result**



**OBA cabling** Proceed as follows to connect the optical fibres with OBA circuit packs:

- 1 Connect the STM64 receiver fibre to the IN port of the STM64 port unit in slot “(1-2) tre”.

*Cable guidance:* see section “Fibre connection (general)” (4-52).

- 
- 2** Connect the OUT port of the STM64 port unit in slot “(1-2) tre” with the IN port of the OBA in slot “(1-2) oae”.

**Cable guidance:** see figure below.

---

- 3** Connect the STM64 transmitter fibre to the OUT port of the OBA in slot “(1-2) oae”.

**Cable guidance:** see section “Fibre connection (general)” (4-52).

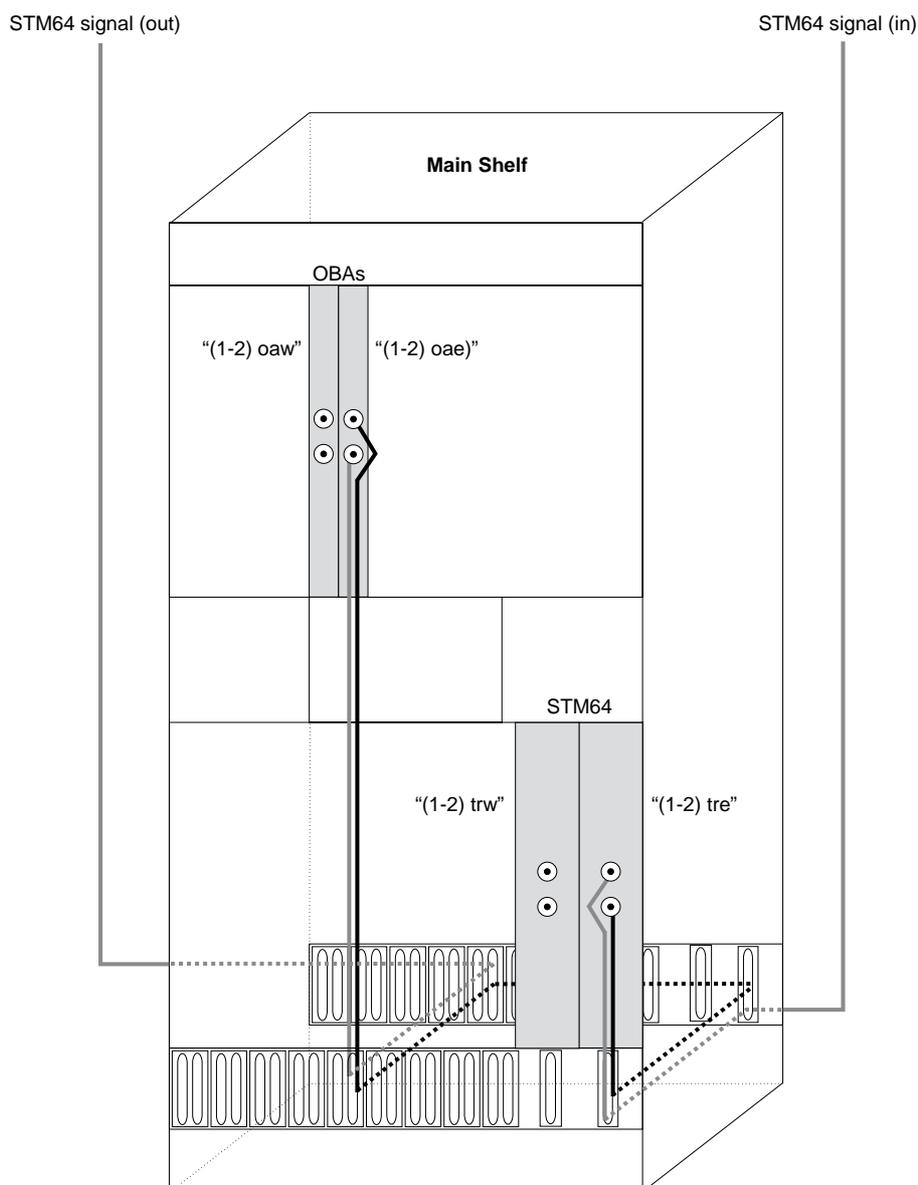
END OF STEPS

---

**Note:**

If both STM-64 port units are needed (i.e. the NE is used in a ring configuration), repeat the procedure described above with the second STM-64 port unit.

**Result:**



**OBPA cabling** Proceed as follows to connect the optical fibres with OBPA circuit packs:

- 1 Connect the STM64 receiver fibre to the OPA1-IN port of the OBPA in slot “(1-2) oae”.

*Cable guidance:* see section “Fibre connection (general)” (4-52).

- 2 Connect the OPA1-OUT port of the OBPA in slot “(1-2) oae” with one optical port of the DCM RX box.

*Cable guidance:* see figure below.

- 
- 3** Connect the IN port of the STM64 port unit in slot “(1-2) tre ” with the other optical port of the DCM RX box.

**Cable guidance:** see figure below.

---

- 4** Connect the OUT port of the STM64 port unit in slot “(1-2) tre ” with one optical port of the DCM TX box.

**Cable guidance:** see figure below.

---

- 5** Connect the OBA-IN port of the OBPA in slot “(1-2) oae” with the other optical port of the DCM TX box.

**Cable guidance:** see figure below.

---

- 6** Connect the transmitter fibre with the OBA-OUT port of the OBPA in slot “(1-2) oae”.

**Cable guidance:** see section “Fibre connection (general)” (4-52).

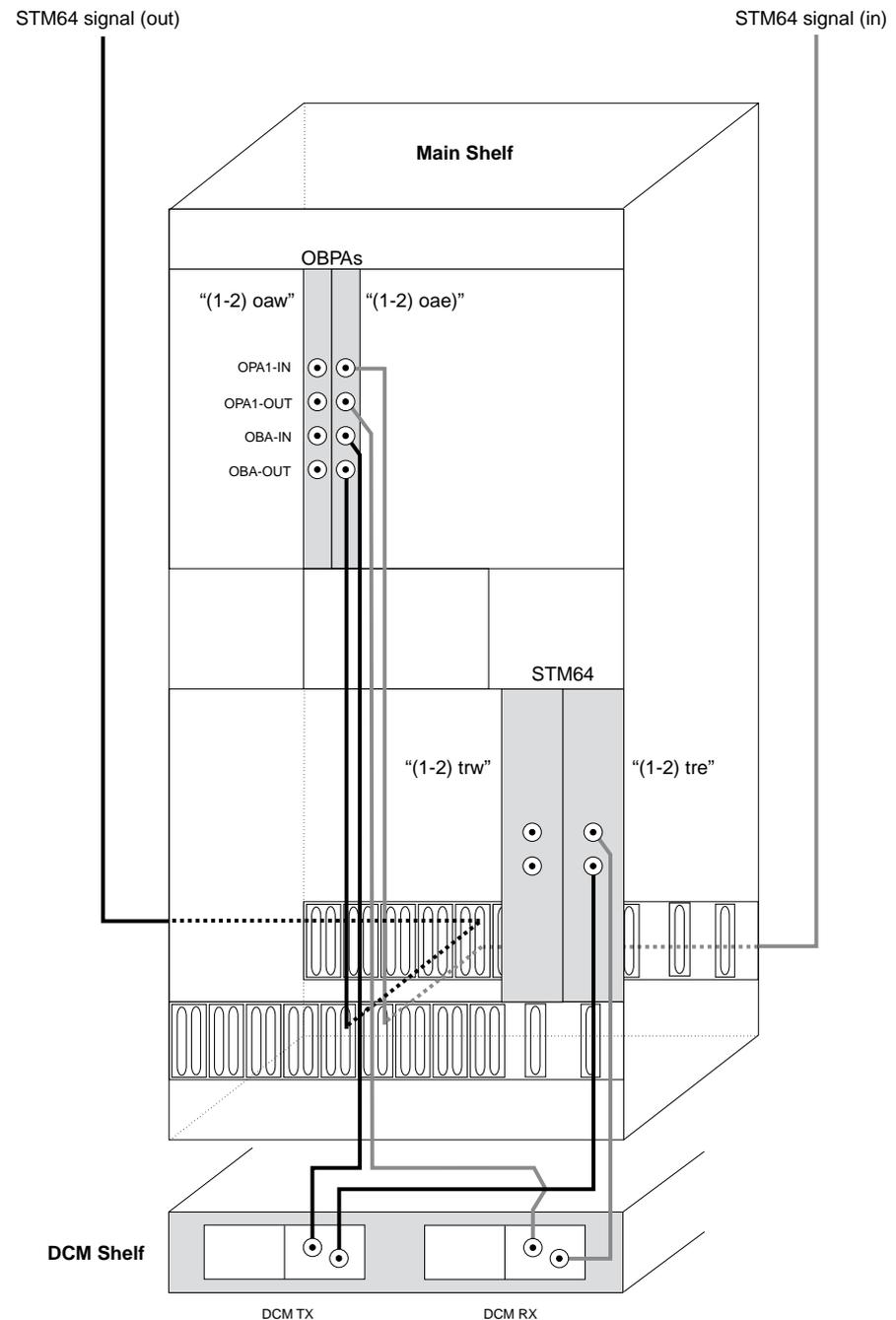
END OF STEPS

---

**Note:**

If both STM-64 port units are needed (i.e. the NE is used in a ring configuration), repeat the procedure described above with the second STM-64 port unit. In this case, two additional DCM boxes will be necessary.

**Result:**



**Ditech cabling**

If the span length is beyond 120 km, Ditech amplifiers must be used. The following procedure describes the internal rack cabling of the Ditech amplifiers and power supply modules for a central office.

- 1 Connect the 5-pin connector of the Ditech power cable to the power connector of the access panel and secure the screws on the connector. The pin-out for the power cable is shown in the following table:

Pin 1 (red)	48A
Pin 2 (white)	48B
Pin 3 (black)	48R
Pin 3 (green)	48R
Pin 4 (orange)	Ground
Pin 5A (blue)	C ground

**NOTE:** Both ground wires (pin 4 and 5A) should be connected to a point that provides common access to an earth or ring ground.

- .....
- 2 The connection of the power cable to a -48 V DC power supply (voltage input ratings of the Ditech amplifier: -36 to -60 V DC) must be in accordance with the National Electrical Code / Canadian Electrical Code. The -48 V DC inputs must be provided with a Listed branch circuit breaker rated 5 A, min. 60 V DC.

.....

  - 3 Connect the OUT port of one STM-64 port unit (LEY228) with one port of the DCM TX box.

.....

  - 4 Connect the other port of the DCM TX box with the IN port of the booster amplifier (STAR-T16 EDFA).

.....

  - 5 Connect the outgoing fibre to the OUT port of the booster amplifier (STAR-T16 EDFA).

.....

  - 6 Connect the incoming fibre to the IN port of the pre-amplifier (STAR-PFG EDFA).

.....

  - 7 Connect the OUT port of the pre-amplifier (STAR-PFG EDFA) with one port of the DCM RX box.

.....

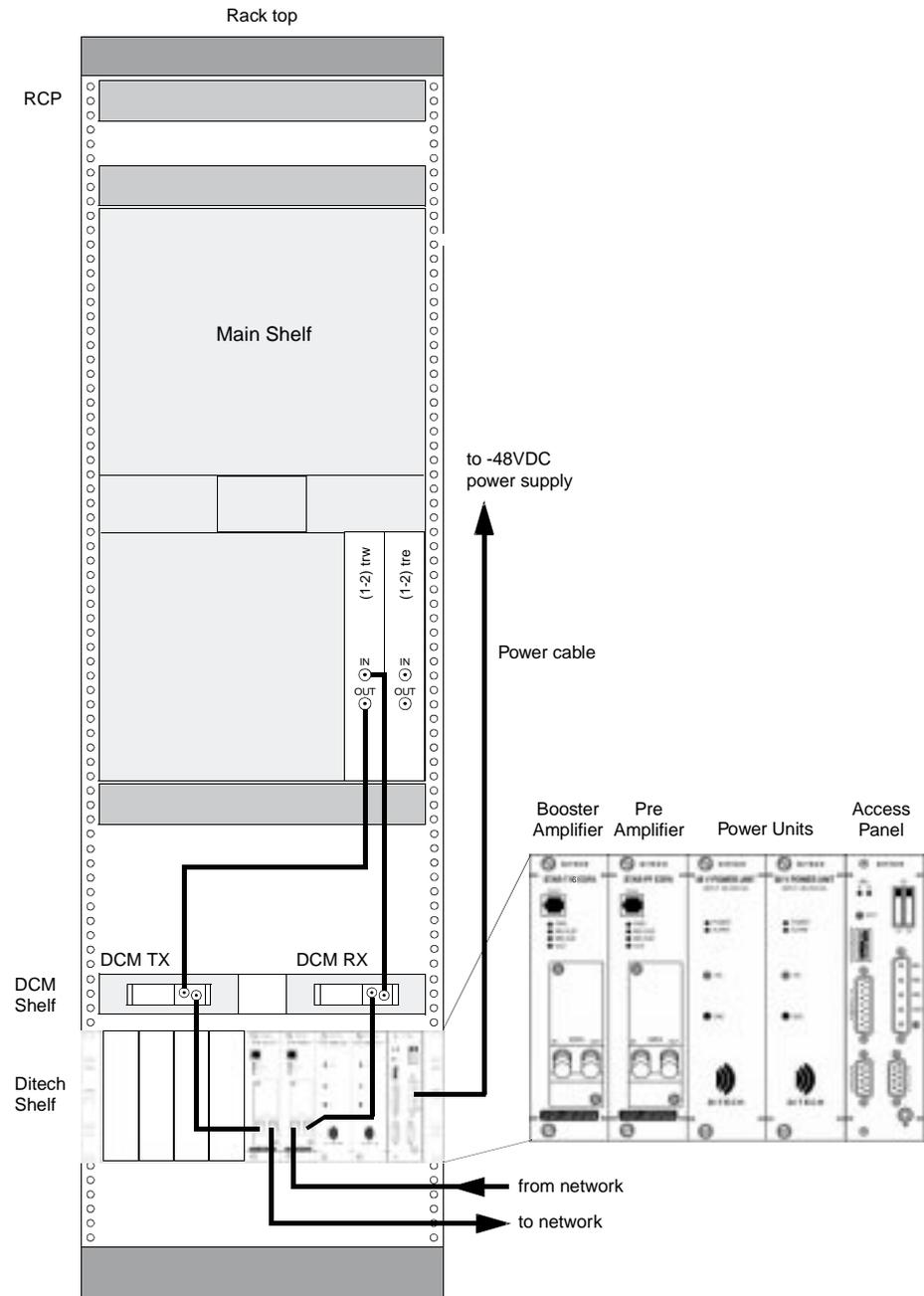
  - 8 Connect the other port of the DCM RX box with the IN port of the STM-64 port unit (LEY228).

.....  
 END OF STEPS  
 .....

**Note:**

If both STM-64 port units are needed (i.e. the NE is used in a ring configuration), repeat the procedure described above with the second STM-64 port unit. In this case, two additional amplifiers and DCM boxes will be necessary.

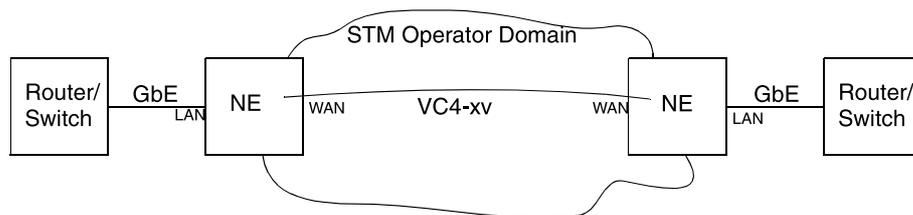
**Result**



**1 Gigabit Ethernet interface**

Each Gigabit Ethernet port unit (GE1/SX2 and GE1/LX2) offers two 1000BASE-SX/LX optical Ethernet LAN ports. Each port supports two bidirectional Ethernet lines (one transmit and one receive). Each line can be associated with a WAN link. The capacity per Gigabit Ethernet line is user provisionable to a maximum of 7 VC-4s. All connections to the 1000BASE-SX/LX Ethernet interface on the Gigabit Ethernet port unit require dual SC Connectors.

The following figure shows a point-to-point Gigabit Ethernet network application.



□





# 5 NE testing

## Overview

---

**Purpose** This chapter describes all the NE tests that should be carried out prior to NE provisioning via WaveStar® CIT (Exception: Power on recovery test).

**Assumptions** It is assumed that the persons carrying out the tests are familiar with SDH and the operation of the WaveStar® TDM 10G (STM-64), the WaveStar® CIT software and the handling of the test equipment.

### Contents

---

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---

Power on recovery test

5-34



## Physical installation check

---

**Overview** Each component must undergo a visual check by a qualified person to ensure that all components are complete and the cables are correctly connected.

**Checks** Check that

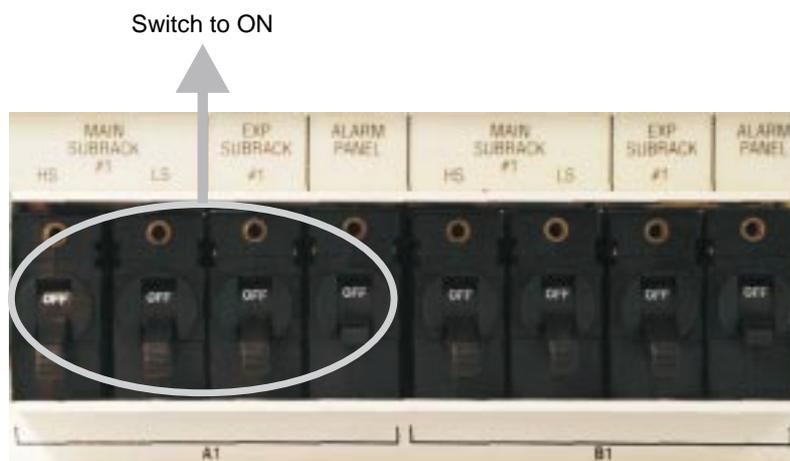
- there are no visible defects
- the mechanical parts are secured
- all cables are assembled correctly
- the optical couplings are affixed to the optical circuit packs
- all circuit packs are situated in the slots according to the guidelines described in Chapter 3.

□

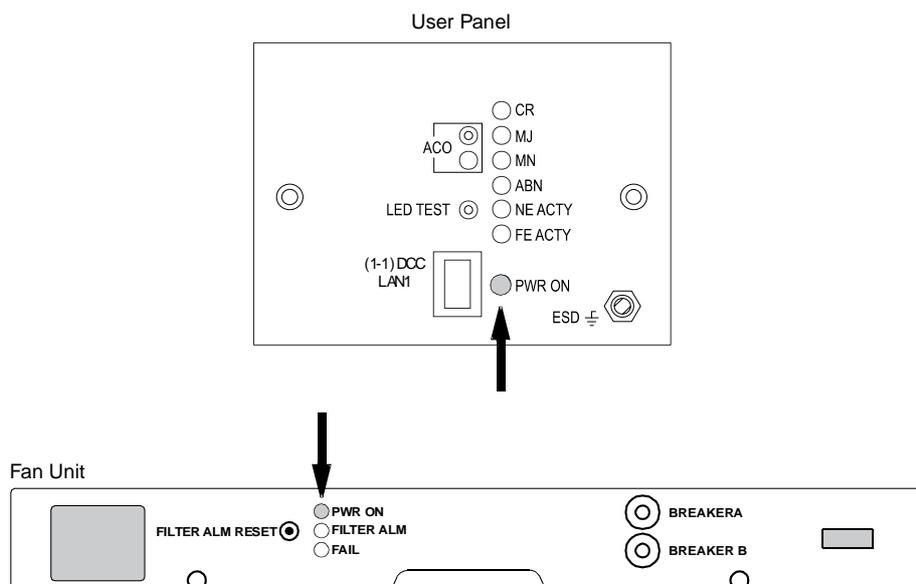
## Testing/switching on the voltage supply lines

**Procedure** Proceed as follows to test and switch on the voltage supply lines:

- 1 Insert a 63 A fuse for each supply line into the BDFB. If circuit breakers are being used, put both of them in the **ON** position.
- 2 Operate all “Load A” (A1) circuit breakers on the RCP to the **ON** position.



**Requirement:** The PWR ON LEDs on the user panels as well as on the fan units must be lit.



- 
- 3** Operate all “Load A” (A1) circuit breakers on the RCP to the **OFF** position.

**Requirement:** The PWR ON LEDs on the user panels as well as on the fan units are extinguished.

---

- 4** Repeat Steps 2 and 3 for “Load B” (B1).
- 

- 5** Operate all circuit breakers on the RCP (A1 and B1) to the **ON** position.

END OF STEPS

---



## WaveStar® CIT installation

---

**Overview** Use this procedure to:

- Install the WaveStar® CIT software onto a new system.
- Upgrade/change an existing WaveStar® CIT to a new software version.

**Required equipment** The minimum requirement for a WaveStar® CIT is a personal computer with the following:

- Pentium® 266-MHz processor (500 MHz or higher recommended) with 128-MB RAM (256 MB recommended)
- 139 MB (and higher) of Virtual Memory
- Standard floppy drive for 1.44-MB 3.5" floppy disks
- 150 MB of free hard drive space (for the CIT software only; for the NE software generics and the online help files 120 MB additional free hard drive space should be reserved)
- CD-ROM drive (16X or higher)
- PCMCIA (Personal Computer Manufacturer's Card Interface Adapter) slot type II
- SVGA monitor set with 800x600 resolution or higher and 256 colors (1024x768, 16 million colors recommended)
- 10/100 BaseT LAN interface built-in or supplied with a PCMCIA card, installed and working
- Microsoft Windows® NT 4.0 or Windows® 2000 operating system
- Adobe Acrobat Reader for Windows (version 3.01 or later)
- Removable hard drive (optional; required only for system backup).

**NOTE:** The minimum requirements are sufficient to run the WaveStar® CIT on a single NE while the recommended requirements should be used to optimize the WaveStar® CIT performance. As the WaveStar® CIT is used with multiple NE connections and multiple NE types, the processor type and speed and the memory size will all factor into WaveStar® CIT performance.

**Before you begin** A user who has Windows® NT / Windows® 2000 System Administration privileges must install the software. That same user, then, becomes the WaveStar® CIT **System Administrator**. The WaveStar® CIT System Administrator sets up the operating

environment for other users. Some of these administration functions include:

- Assigning login IDs
- Assigning an initial password for each login ID
- Customising the access privileges and security attributes for each login ID, etc.

The installation program cannot install system files or update shared files if they are in use by other programs. For this reason you should close as many Windows® NT/ Windows® 2000 applications as possible before starting with the installation procedure.

**Installation** Complete the following steps to install the WaveStar® CIT software on your PC:

.....

**1** Insert the WaveStar® CIT CD-ROM (Comcode 109074641) into the appropriate drive of your PC.

.....

**2** Autorun will start the install process. If autorun does not start, start the program manually by clicking **Start** → **Run**, click **Browse**, select the CD-ROM drive, select **setup.exe**, click **Open** and then **OK**.

**Result:**

The *WaveStar CIT CD Browser* appears.

.....

**3** Click on *continue*.

.....

**4** Choose the entry *CIT Software*.

.....

**5** Select the *WaveStar CIT* area on the right.

.....

**6** Follow the on-screen instructions. Select **Full Install** when prompted.

.....

**7** If there are 2 or more LAN cards on the PC, select the LAN card with the IP Address that corresponds to the OSI LAN, otherwise if there is only 1 LAN card, WaveStar® CIT will select it automatically.

.....

**8** If not yet available on your PC, install the *Acrobat Reader* by selecting the respective area below the entry *CIT Software*.

- 
- 9** The PC will have to be rebooted if the OSILLC driver is installed. This is installed on the initial WaveStar® CIT installation. Subsequent upgrades do not require OSILLC driver installation.
- 

- 10** Click on *Exit*.

END OF STEPS

---



## WaveStar® CIT login/logout procedure

---

**Overview** Some procedures throughout this document require the user to login to and logout of the WaveStar® CIT. The following procedure describes how this is accomplished. This procedure requires the WaveStar® CIT to be already loaded on the PC (see section “WaveStar® CIT installation” (5-6)).

**Login procedure** Complete the following steps to login to the WaveStar® CIT:

---

- 1 Start the WaveStar® CIT software by double clicking on the WaveStar® icon.

IF ...	THEN ...
it is the first WaveStar® CIT installation on the respective PC,	login to WaveStar® CIT with <i>User Id:</i> “LUC01” or “LUC02” and the associated <i>Password:</i> “LUC+01” or “LUC+02”.
a previous WaveStar® CIT version had already been installed on the respective PC,	login to WaveStar® CIT with <i>User Id:</i> “LUC01” or “LUC02” and the last used password.

---

- 2 Click **OK** to connect. WaveStar® CIT will be “initializing views” for about 3 minutes. Click **OK** to the legal notice.

IF ...	THEN ...
it is the first WaveStar® CIT session,	proceed to Step 3.
it is not the first WaveStar® CIT session,	END OF STEPS

---

- 3 In the WaveStar® CIT Main Window, choose the option **Administration** → **Data Communications...**
- 

- 4 Make sure that the **Auto-Learn NSAP** box is not checked.
- 

- 5 Change your user password on the WaveStar® CIT (see section “Changing the user password on the WaveStar® CIT” (5-11)).

END OF STEPS

---

**Logout procedure** Complete the following steps to logout from the WaveStar® CIT:

---

**1** Click *File* → *Exit*.

---

**2** Click *Yes* in the confirmation window.

**Important!** If there are still connections to NEs established from this CIT session, an alert window appears which shows the currently established connections.

END OF STEPS

---



## Changing the user password on the WaveStar® CIT

---

**Instructions** Complete the following steps to change your password:

---

- 1 From the WaveStar® CIT main window, select **Administration** → **Change Password...**

**Result:**

The **Change Password** form is displayed.

---

- 2 Place the cursor into the **Old Password** field and enter the password you are currently using.
- 

- 3 Place the cursor into the **New Password** field and enter the new password.

**Note:**

Passwords are case sensitive and must start with a letter.

The new password cannot be a password used for this login in the past.

---

- 4 Place the cursor into the **Confirm Password** field and enter the new password a second time.
- 

- 5 Click **OK**.

**Result:**

The password is updated and the **Change Password** form is dismissed.

The changed password will take effect the next time you log into the WaveStar® CIT.

END OF STEPS

---



## NE software installation

---

**Overview** The NE software is initially delivered via CD-ROM (Comcode 109074625). The software generic has to be copied from the CD-ROM to the WaveStar® CIT PC and then to the empty PCMCIA (Personal Computer Manufacturer's Card Interface Adapter) card via WaveStar® CIT. Afterwards, the PCMCIA card is being inserted into the NE.

**Required equipment** The following equipment is required to install the NE software:

- Empty PCMCIA card 220 MB (as delivered from manufacturer)
- CD-ROM that contains the new generic/version of the NE software
- WaveStar® CIT with PCMCIA slot.



### CAUTION

#### Electrostatic discharge damage to sensitive components

*Handling circuit packs or working on a WaveStar® CIT can cause electrostatic discharge damage to sensitive components.*

*Use a static ground wrist strap whenever handling circuit packs or working on a WaveStar® CIT, to prevent electrostatic discharge damage to sensitive components.*



### CAUTION

*Improper removal of a PCMCIA card can result in damaged files and the generation of information messages such as "lost clusters" and/or "missing/damaged sectors".*

*Do not ever remove a PCMCIA card when the CTL/SYS50DM circuit pack's GREEN LED is ON (either steady ON or blinking).*

**SW installation** To install the NE software (delivered on a CD-ROM), proceed as follows:

---

- 1 Power up the WaveStar® CIT PC and login to Windows® NT / Windows® 2000 as Administrator. If you are already logged into Windows® NT/ Windows® 2000, close any open window.
- 

- 2 Install the NE software onto your PC. To do this, use one of the following two methods (automatic or manual installation):

***Automatic Installation:***

- Insert the WaveStar® CD-ROM with the new NE software and wait for the welcoming screen to appear. If your PC does not start the CD-ROM automatically, perform the following:
  - Doubleclick ***My Computer*** on your desktop
  - Right click on your CD-ROM drive's icon
  - Click on ***Auto Play***.

If ***Auto Play*** is not available in this menu list, you have to start the ***setup.exe*** file in the root directory of your CD-ROM.

- Click the ***Next*** button.
- Wait for the software transfer to complete. You will notice that the "Decompressing Files In ..." message and also the InstallShield Wizard disappears when this operation has completed.

***Manual Installation:***

- Insert the WaveStar® CD-ROM with the new NE software. If the welcoming screen appears, select ***Cancel*** to exit from the automatic installation procedure.
- Open the Windows® NT / Windows® 2000 Explorer on your desktop.
- Select the harddisk drive where the WaveStar® CIT is installed and click through to ***Program Files*** → ***Lucent Technologies*** → ***WaveStar CIT*** → ***generics***.

***NOTE:*** If the subdirectory ***generics*** does not exist, you must create it!

- In the ***generics*** directory, create a new folder, preferably stating the new software version in its name.
- In the Windows® NT / Windows® 2000 Explorer, right click the CD-ROM drive of your computer and select ***Explore***. Go to the ***generics*** directory. This directory contains two subdirectories: ***p*** and ***up***.

- Select the complete *up* and *p* directories and copy them to the folder you created two steps before.
- To install *Acrobat Reader* on your system, go to the *AcrobatReader* subdirectory on your CD-ROM drive and double click the *AcrobatReader40.exe* file.
- The SRD is located in the *Documentation* subdirectory of the CD. You can read it by double clicking the *.pdf* file in this subdirectory.

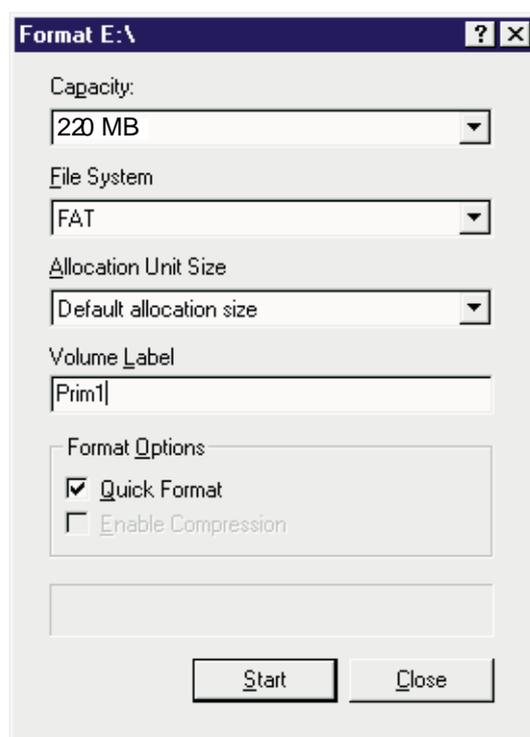
---

3 Insert the empty PCMCIA card into the PCMCIA slot of the WaveStar® CIT PC.

---

4 Format the PCMCIA card by performing the following:

- Doubleclick the *My Computer* icon on your desktop
- Select the harddisk drive where the PCMCIA card is plugged and click through to *File* → *Format...*
- Select *FAT* in the *File System* selection box
- Enter *Prim1* in the *Volume Label* field
- Select *Quick Format*
- Click *Start*.



.....

**5** Start WaveStar® CIT.

.....

**6** In the WaveStar® CIT Main Window, choose the option *Administration* → *Prepare PCMCIA Disks...*

**Result:**

The *Prepare PCMCIA Disk* window appears.

.....

**7** In the left list, under *Available Generics*, click the NE software version you are installing.

.....

**8** In the right list, click on the drive letter that represents the PCMCIA slot that holds the flash disk.

.....

**9** Click the *Copy Generic* button. The file copy function will begin and you will see a “Copying files...” message.

.....

**10** The “Copying files...” message will disappear and a *Done* button will appear when the file transfer is complete. Click on *Done* to exit the *Prepare PCMCIA Disk* window.

.....

**11** Check if all files in the *GEN0* and *GEN1* folders are set to “not write protected”.

<b>IF ...</b>	<b>THEN ...</b>
that is the case	proceed to Step 12.
that is not the case	set all files to “not write protected”.

.....

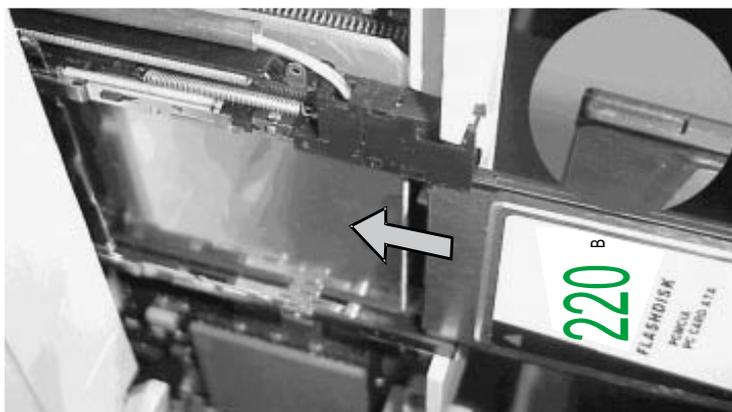
**12** If the PCMCIA driver software you are using requires you to stop the PCMCIA card before ejecting it, stop the card now. If the software you are using does not allow for this procedure, make sure that the PCMCIA slot is not being accessed (the LED is not flashing) before continuing.

.....

**13** Eject the PCMCIA card from the PCMCIA slot of the PC.

.....

- 
- 14** Insert the PCMCIA card with the new software version into the CTL/SYS50DM circuit pack located in the low speed part of the Main Shelf (red arrow on card down and facing left). Make sure that it is firmly seated in the CTL/SYS50DM.



**Result:**

The system automatically starts the download. After resetting the system controller the red LED will just be illuminated for a brief moment and after that the green LED starts flashing. When the download has completed, all circuit packs should have the green LEDs illuminated.

If the system does not automatically start the download, remove both DCC controllers (ADJCTL/DCC32EI) of the Main Shelf and insert them again. Their positions within the shelf are described in Chapter 3, section “Main Shelf configuration” (3-35).

END OF STEPS

---

**Additional note:**

The high speed part of the Main Shelf as well as the Expansion Shelf are not affected by this action. They have to be assigned manually via WaveStar® CIT (see sections “Assigning the high speed part of the main shelf” (6-2) and “Assigning the expansion shelf” (6-4) of Chapter 6).

**PCMCIA card**

The PCMCIA card has to remain in the CTL/SYS50DM circuit pack during normal operation.

**Download failure** In the case of a download failure (red LEDs are still lit), please refer to Chapter 9, section “SW download failure” (9-6).

□

## Voltage supply test of the circuit packs

---

**Overview** The current operating state of the circuit packs is displayed by means of 2 diagnostic LEDs (red and green).

**Before you begin** In order to check the LED status it is necessary that the NE front panels are removed.

**Check** Check that on each circuit pack only the green LED is lit up. This is the case if there are no alarms present on the circuit packs. Otherwise, the red LED is lit up or flashing.

**Important!** In the case of a Main Shelf only the LEDs in the low speed part of the shelf are lit up. After assigning the high speed part (see Chapter 6, section “Assigning the high speed part of the main shelf” (6-2)) and assigning the Expansion Shelf (see Chapter 6, section “Assigning the expansion shelf” (6-4)) also all the other LEDs will be lit up. The LEDs of the protection cards are off as long as they are in the standby mode.

□

## Connecting the WaveStar® CIT to the NE

---



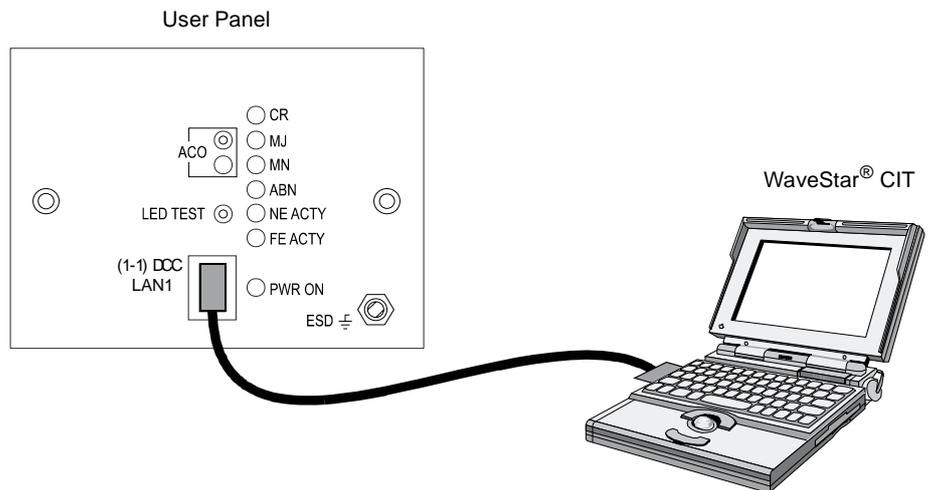
### DANGER

*The usage of **shielded** 10BaseT LAN cables is only allowed if the applicable national safety requirements have been met by the user. Otherwise, there is a **risk of electrical shock and/or serious injury**.*

### Connection

---

- 1 Connect the WaveStar® CIT (LAN card) to the WaveStar® TDM 10G (STM-64) via the “CIT” port of the user panel or through a backplane connector (LAN I/O Panel). Use an Ethernet LAN cable (10BaseT) with 4-wire RJ-45 connectors for this connection.



END OF STEPS

---



## NE login/logout procedure

---

**Overview** This section describes the login and logout procedures to/from an NE. It is necessary that the WaveStar® CIT is already connected to the NE (see section “Connecting the WaveStar® CIT to the NE” (5-19)).

**Important!** The WaveStar® CIT association to an NE will be possible after the LED at the system controller in the low speed part of the NE stops flashing (about 6 minutes after power on).

**Initial login procedure** Complete the following steps to login to an NE:

---

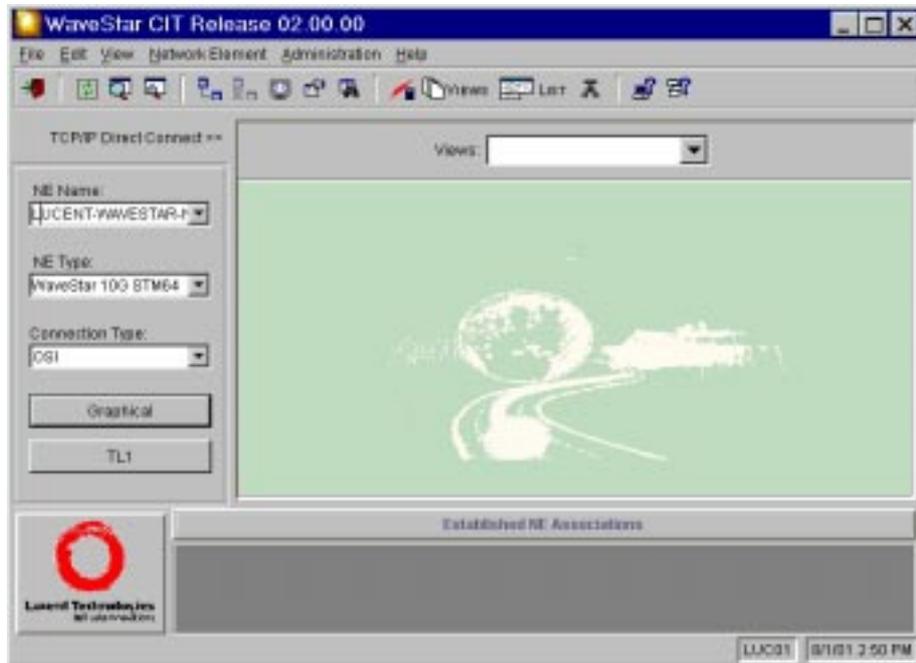
- 1 Login to WaveStar® CIT as described in section “WaveStar® CIT login/logout procedure” (5-9).

---

- 2 Enter the target identifier (TID) in the *NE Name* box. The default TID (= default name of the NE) is: “LUCENT-WAVESTAR-NE”.

---

- 3 Select *WaveStar 10G STM64* in the drop-down list box *NE type* and *OSI* as *Connection Type*. Then click on *Graphical*.



- 4 Login with *UserId* “LUC01” or “LUC02” and the associated *Password* “LUC+01” or “LUC+02”.
-

- 
- 5 Click **OK** to connect, then **OK** to the legal notice.

**Result:**

The *System View* window appears for the selected NE.

---

- 6 Change your user password on the NE (see section “Changing the user password on the NE” (5-22)).
- 

- 7 Change the NE name (see section “Changing the NE name (TID)” (5-23)).

END OF STEPS

---

**Logout procedure** Complete the following steps to logout from an NE:

---

- 1 Click **File** → **NE Disconnect**.
- 

- 2 Click **Yes** in the confirmation window.

END OF STEPS

---

## Changing the user password on the NE

---

**Procedure** Complete the following steps to change your password.

---

- 1 From the *System View* or *Shelf View* main menu, select *Administration* → *Security* → *Change Superuser Login ID...*

**Result:**

The *Change Superuser Login ID* form is displayed.

---

- 2 Select the super user Login ID you want to change. Click on the respective radio button.
- 

- 3 Key in the new Login ID.

*NOTE:* Login IDs are case sensitive and must start with a letter.

---

- 4 Click *OK*.

**Result:**

The super user Login ID is updated and the *Change Superuser Login ID* form is dismissed.

The changed super user Login ID will take effect the next time you log into the NE.

END OF STEPS

---



## Changing the NE name (TID)

---

**Procedure** Complete the following steps to change a network element's name:

---

- 1 From the *System View* main menu, select *Fault* → *Enter/Exit Maintenance Condition ...* → *Enter Maintenance Condition ...*.

---

- 2 Confirm the resulting system message by clicking *Yes*.

---

- 3 Invoke the *Provision TID/NE Name* window from the *System View* main menu via *Administration* → *Set TID...*.

---

- 4 Place the cursor in the *New TID/NE Name* text box and key in the new TID observing the following configuration rules:
  - Each NE name must be unique within the network.
  - The following characters are allowed in an NE name:
    - Upper-case letters (“A” .. “Z”),
    - Lower-case letters (“a” .. “z”),
    - Special characters (“-”, “+”, “\_”, “.”, “/”),
    - Digits (“0” .. “9”).
  - An NE name must not end and begin with a special character.
  - Each NE name must be maximally 20 characters in length.
  - The NE name may contain segments separated by hyphens (“-”) or slashes (“/”), but each segment must begin with a letter.

Please note that NE names are case-insensitive.

---

- 5 Make sure that the new TID is correct.

IF ...	THEN ...
the new TID is correct,	continue with Step 6.
the new TID is not correct,	correct the entry in the <i>New TID/NE Name</i> text box and continue with Step 6.

---

- 6 Place the cursor in the *Confirm TID/NE Name* text box and key in the new TID again.

**Important!** Take a note of the TID you are going to assign to the NE!

.....

- 7 Click **OK** to assign the new TID and to dismiss the window.

.....

- 8 From the *System View* main menu, select **Fault** → **Enter/Exit Maintenance Condition ...** → **Exit Maintenance Condition ...**.

.....

- 9 Confirm the resulting system message by clicking **OK**.

**Result:**

The WaveStar® TDM 10G NE will now perform a system reset. As a consequence, the management association between the WaveStar® CIT and the NE will be lost.

After the system reset has finished, you can re-establish the management association by again connecting the WaveStar® CIT to the NE, now using the new TID.

Make sure that the WaveStar® CIT's static routing table (Address List) always reflects the correct assignment of NE names to NSAP addresses.

END OF STEPS

.....



## LED test

---

**Overview** This test ensures the functionality of the LEDs on all circuit packs as well as on the user panel. The PWR ON LED on the user panel and the fan unit LEDs are not affected by the LED test.

**Test with WaveStar® CIT** The LED test can be performed using both a hardware and a software test (via WaveStar® CIT). It is recommended that both be used upon initial installation. Complete the following steps to test the LEDs in the shelf:

---

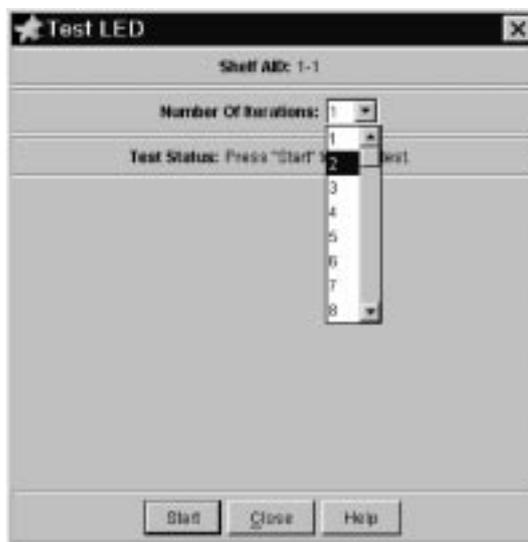
- 1 Login to the NE as described in section “NE login/logout procedure” (5-20).

---

- 2 Select *Fault* → *Test* → *LED...* in the System View.

---

- 3 Double click on *Shelf 1* (low speed shelf with AID: 1-1).  
Select the *Number Of Iterations*. A suggested number of iterations is 2. Click on the arrow and select the correct number of iterations.



- 4 Click *Start*, then *Yes* in the confirmation window.

**Result:**

The following should happen:

1. The LEDs on the user panel (except the PWR ON LED) turn on for 2 seconds and then off for 2 seconds three times in sequence.
2. The LEDs on the circuit packs of the low speed shelf turn on for 2 seconds and then off for 2 seconds three times in sequence.
3. If the high speed shelf is already assigned (see Chapter 6, section “Assigning the high speed part of the main shelf” (6-2)), the LEDs on the circuit packs of the high speed shelf turn on for 2 seconds and then off for 2 seconds three times in sequence.

This will repeat the number of iterations chosen. The **Test LED** window will automatically be closed when the LED test has finished.

- 
- 5** Repeat Steps 2 to 4 with the high speed shelf (**Shelf 2** with AID: 1-2).

**Important!** This test can only be done if the high speed shelf is already assigned (see Chapter 6, section “Assigning the high speed part of the main shelf” (6-2)). Only the LEDs of the high speed shelf’s circuit packs are affected by this test.

- 
- 6** Repeat Steps 2 to 4 with the Expansion Shelf (**Shelf 3** with AID: 1-3).

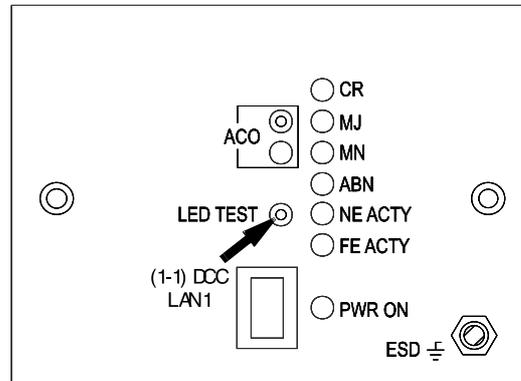
**Important!** This test can only be done if the Expansion Shelf is already assigned (see Chapter 6, section “Assigning the expansion shelf” (6-4)). Only the user panel and the circuit packs of the Expansion Shelf are affected by this test.

END OF STEPS

---

## Test via the LED TEST button

- 1 Push the LED button on the user panel to test the circuit pack and user panel LEDs.



The number of test cycles for the LED test initiated via the LED TEST button is limited to one.

END OF STEPS

## Sequence of LED indications

When the LED TEST button on the Main Shelf's user panel was pushed, the sequence of LED indications should be as follows:

1. The LEDs on the main shelf's user panel (except the PWR ON LED) turn on for 2 seconds and then off for 2 seconds three times in sequence.
2. The LEDs on the circuit packs of the low-speed part of the main shelf turn on for 2 seconds and then off for 2 seconds three times in sequence.
3. If the high speed shelf is already assigned (see Chapter 6, section "Assigning the high speed part of the main shelf" (6-2)), the LEDs on the circuit packs of the high-speed part of the main shelf turn on for 2 seconds and then off for 2 seconds three times in sequence.

When the LED TEST button on the Expansion Shelf's user panel was pushed and the Expansion Shelf is already assigned, the sequence of LED indications should be as follows:

1. The LEDs on the Expansion Shelf's user panel (except the PWR ON LED) turn on for 2 seconds and then off for 2 seconds three times in sequence.
2. The LEDs on the circuit packs of the Expansion Shelf turn on for 2 seconds and then off for 2 seconds three times in sequence.

**LED test failure** In the case of a LED test failure (LEDs are not lit), please refer to Chapter 9, section “LED test failure” (9-7).



## Office alarm test

---

**Overview** The alarm test verifies the connection of the alarming equipment, including external office alarm equipment.

**Procedure** Proceed as follows to complete the alarm test:

---

- 1 Login to the NE as described in section “NE login/logout procedure” (5-20).

---

- 2 Select *Fault* → *Test* → *Office Alarm...* in the System View.

---

- 3 Double click on *Shelf 1* (low speed shelf with AID: 1-1).  
Select the *Number Of Iterations*. A suggested number of iterations is 2. Click on the arrow and select the correct number of iterations.



- 4 Click *Start*, then *Yes* in the confirmation window.

**Result:**

The alarm LEDs on the user panel as well as the rack alarm lamps turn on for five seconds in the following order:

1. *Critical* + *Major* (user panel) simultaneously with *Prompt* (rack alarm lamp)
2. *Minor* (user panel) simultaneously with *Deferred* (rack alarm lamp).

This sequence will repeat for the number of iterations.

Please note that before as well as at the end of the alarm test, no alarm LEDs/lamps turn on for 5 seconds.

The *Test Office Alarm* window will automatically be closed when the test has finished.

- 
- 5 Repeat Steps 2 to 4 with the Expansion Shelf (*Shelf 3* with AID: 1-3).

**Important!** This test can only be done if the Expansion Shelf is already assigned (see Chapter 6, section “Assigning the expansion shelf” (6-4)).

END OF STEPS

---

**Office alarm test failure**

In the case of an office alarm test failure (rack alarm lamps are not lit), please refer to Chapter 9, section “Office alarm test failure” (9-8).



## NE synchronisation test

---

**Overview** This test ensures protected synchronisation of the NE to external clock sources.

**Important!** Before performing this test, it is necessary to read the sections “Provisioning of the timing references” (6-7) and “Provisioning of the system timing” (6-10) of Chapter 6.

**Procedure** Proceed as follows to complete the synchronisation test:

---

**1** Check that two external 2 MHz signals are connected to the TMG I/O-Panel (connectors T3.1 and T3.2).

---

**2** Login to the NE as described in section “NE login/logout procedure” (5-20).

---

**3** Assign the clock sources.

To do this, select *Configuration* → *Timing/Sync* in the System view, then the tab *Timing Reference*.

- Set the priority of the first clock source (EXTREF1) to “1.”
- Set the priority of the second clock source (EXTREF2) to “2.”
- Select for both clock sources “AUTO” in the *QL Provisioned* field.

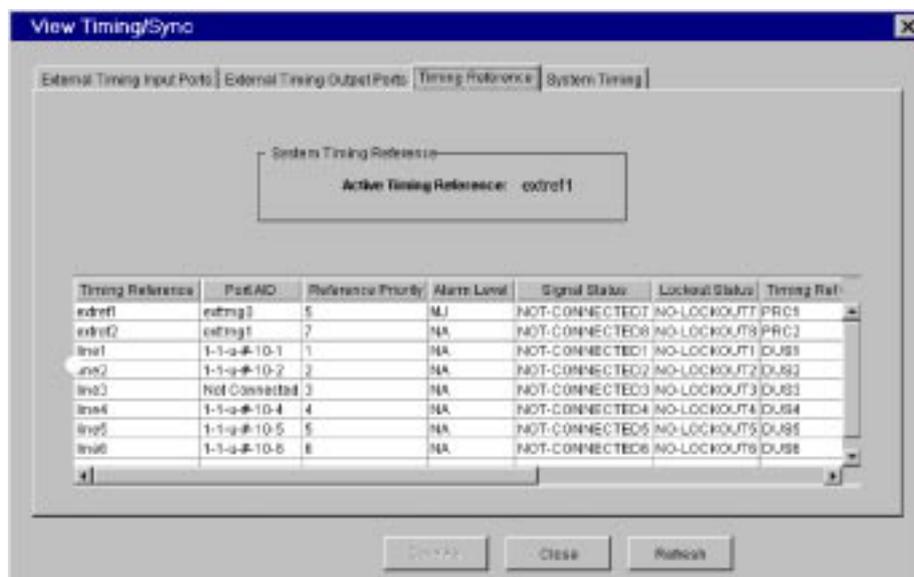
Select the tab *System Timing*.

- Set the WTR (Wait To Restore) time to “1 Minute”.
  - Set the Provisioned Clock Mode to “Locked”.
- 

**4** Verify that the NE is synchronising onto the first external clock source for at least 7 minutes. To do this, select *View* → *Timing/Sync...*, then the tab *Timing Reference*.

**Result:**

The active timing reference is *extref1*.



- 5 Disconnect the connection of the first clock source and click *Close*.  
Select *View* → *Timing/Sync...*, then the tab *Timing Reference*.

**Result:**

The second clock source should become active.

- 6 Reconnect the first clock source.

**Result:**

The first clock source should become active again after WTR time has expired.

END OF STEPS

**NE synchronisation failure** In the case of an NE synchronisation failure (NE cannot synchronise to an external clock source), please refer to Chapter 9, section “NE synchronisation failure” (9-4).

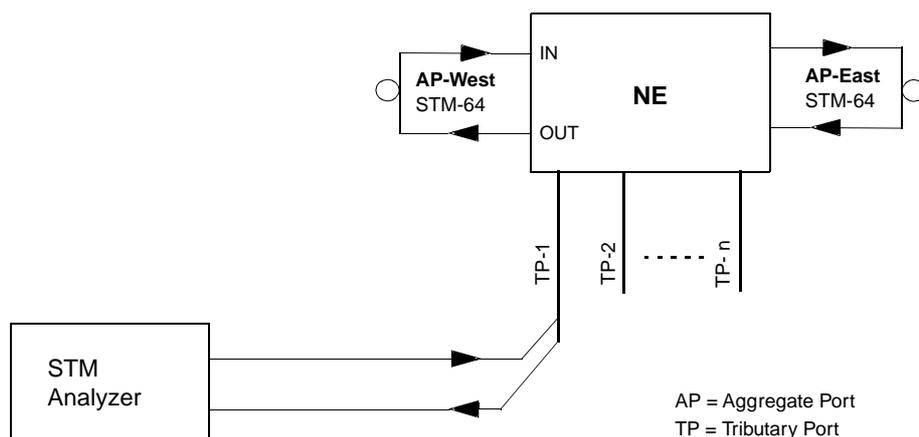
□

## Power on recovery test

**Overview** This test ensures the proper recovery of the NE after a power failure.

**Important!** This test can only be done after the NE has been provisioned via WaveStar® CIT (see Chapter 6, “Required NE provisioning”).

### Test setup



### Procedure



#### **DANGER**

*Never look into the end of an exposed fiber or into an open optical connector as long as the optical source is switched on. This applies particularly to the connections of the optical plug-in units.*



#### **CAUTION**

*Use a static ground wrist strap whenever handling circuit packs or working on a WaveStar® CIT, to prevent electrostatic discharge damage to sensitive components.*



#### **CAUTION**

*Use an optical attenuator pad of approx. 15 dB when establishing connections over short distances for test purposes.*

**CAUTION**

*To avoid cable break ensure that the bending radius of optical fibre cables is not less than 30 mm.*

Complete the following steps to perform the power on recovery test:

- 1 Connect the STM Analyzer to any tributary interface provided by the NE.  
.....
- 2 Establish a bidirectional connection between the selected tributary port and one of the aggregate ports (see Chapter 7, section “Setting up a cross connection” (7-17)).  
.....
- 3 Loop back the optical fibres at the selected aggregate port (from OUT to IN).  
**Important!** Make sure sufficient optical attenuation (15dB) is provided when looping optical interfaces.  
.....
- 4 Check the connection for no bit errors via the STM Analyzer.  
.....
- 5 Switch off the power of the NE, wait about 2 minutes before switching on the system again.  
.....
- 6 Check the NE regarding:
  - LED status of circuit packs (only the green LEDs should light up)
  - External clock synchronisation (see section “NE synchronisation test” (5-31))
  - Test traffic for no bit errors.

END OF STEPS  
.....

**Result** After finished NE recovery the system must return into the normal operating mode and the traffic must be restored (no bit errors at the STM Analyzer should be observed).

**Important!** The complete recovery takes up to 10 minutes, the traffic is back after 3-5 minutes and the NE becomes accessible for CIT after approximately 5 minutes.

□



# 6 Required NE provisioning

## Overview

---

**Purpose** This chapter describes how to provision each WaveStar® TDM 10G (STM-64) NE in a network so that network installation can be completed.

### Contents

---

Assigning the high speed part of the main shelf	6-2
Assigning the expansion shelf	6-4
Setting of the NE date and time	6-6
Provisioning of the timing references	6-7
Provisioning of the system timing	6-10



## Assigning the high speed part of the main shelf

---

**Overview** Without configuration stored on the PCMCIA card, only the low speed part of the Main Shelf will be established during the system's boot phase. The high speed part has to be assigned via WaveStar® CIT.

**Procedure** Follow the steps as described below to assign the high speed part:

---

1 Login to the NE as described in Chapter 5, section "NE login/logout procedure" (5-20).

---

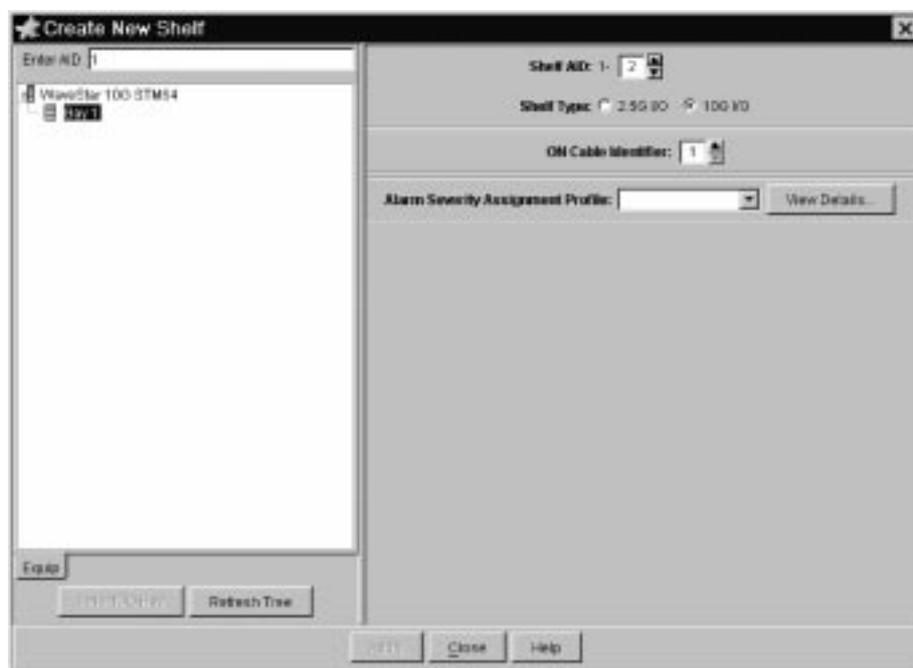
2 Select *Configuration* → *Create New* → *Shelf...* in the System View.

---

3 Double click on *Bay 1*.

Select "10G I/O" for *Shelf Type* and "2" for *Shelf AID*.

Set the *ON Cable Identifier* to "1".



Click *Apply* and then *Yes* in the confirmation window. Click *Close* when the Apply button becomes gray.

- 
- 4 The assigning of the high speed part needs about 10 minutes. When it has finished, the green LEDs of the high speed part circuit packs should light up and both LEDs of circuit packs used for card protection (like timing packs and switches) must be off.

An additional icon of the “High Speed Shelf” (Shelf 2) should be displayed as shown below. After double clicking *Shelf 2*, the high speed shelf with all equipped circuit packs will be displayed.



END OF STEPS



## Assigning the expansion shelf

---

**Overview** Without configuration stored on the PCMCIA card, only the low speed part of the Main Shelf will be established during the system's boot phase. The Expansion Shelf has to be assigned via WaveStar® CIT.

**Important!** Wait about 10 minutes after the high speed part of the Main Shelf has been assigned (see section “Assigning the high speed part of the main shelf” (6-2)) before establishing the Expansion Shelf.

**Procedure** Follow the steps as described below to assign the Expansion Shelf:

---

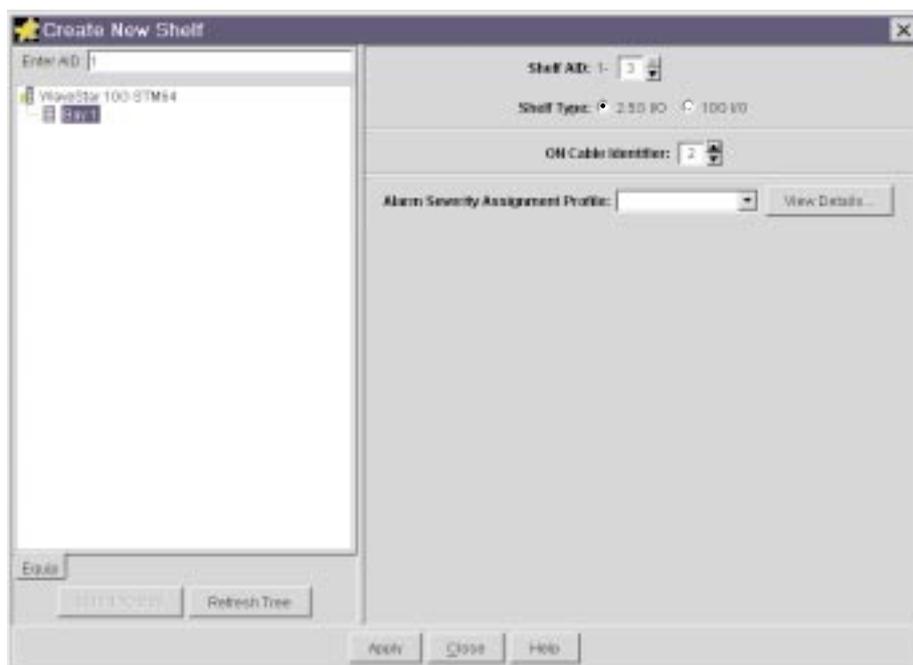
- 1 Login to the NE as described in Chapter 5, section “NE login/logout procedure” (5-20).

---

- 2 Select *Configuration* → *Create New* → *Shelf...* in the System View.

---

- 3 Double click on *Bay 1*.  
 Select “2.5G I/O” for *Shelf Type* and “3” for *Shelf AID*.  
 Set the *ON Cable Identifier* to “2”.



Click **Apply** and then **Yes** in the confirmation window. Click **Close** when the Apply button becomes gray.

---

- 4** The assigning of Expansion Shelf needs about 10 minutes. When it has finished, the green LEDs of the circuit packs should light up.

An additional icon of the “Expansion Shelf” (Shelf 3) should be displayed as shown below. After double clicking **Shelf 3**, the Expansion Shelf with all equipped circuit packs will be displayed (similarly as described in section “Assigning the high speed part of the main shelf” (6-2)).

END OF STEPS

---



## Setting of the NE date and time

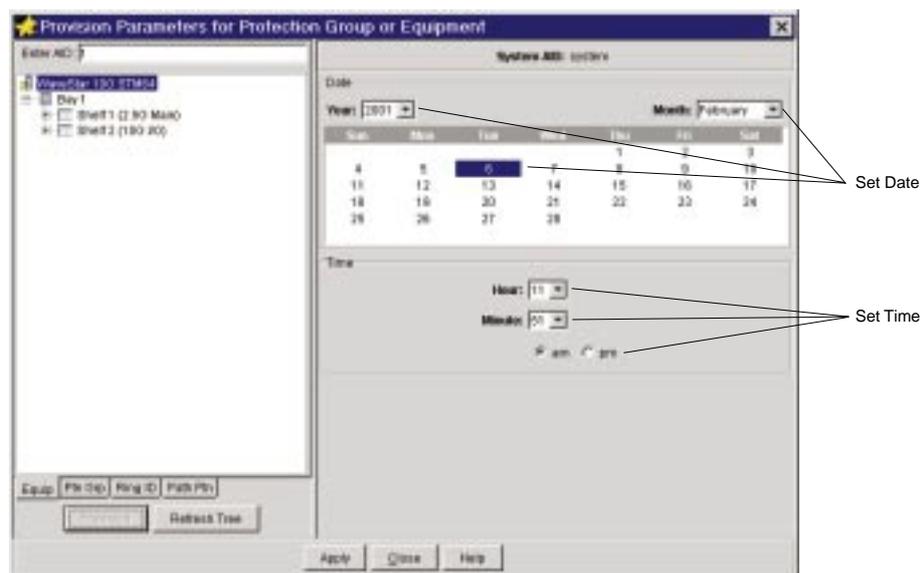
**Overview** This section provides a procedure for setting up the NE date and time.

**Important!** The NE clock must be set after each power on or reboot. Changes of the NE name will also cause a loss of time.

**Procedure** Follow the steps as described below to set the NE date and time:

- 1 Login to the NE as described in Chapter 5, section “NE login/logout procedure” (5-20).
- 2 Select *Configuration* → *Provision...* in the System View.
- 3 Click on *WaveStar 10G STM64* and then *Provision*.

### Result:



- 4 Set the current date and time as shown above.
- 5 Click *Apply* and then *Yes* in the confirmation window.
- 6 Click *Close* when the Apply button becomes gray.

END OF STEPS



## Provisioning of the timing references

---

**Overview** This section provides information about selecting the external clock sources, the ports and the port priorities for the NE synchronisation.

**Procedure** Follow the steps as described below to select and provision the external clock sources:

---

- 1 Check that two external clock sources are connected to the TMG I/O-Panel (connectors T3.1 and T3.2).

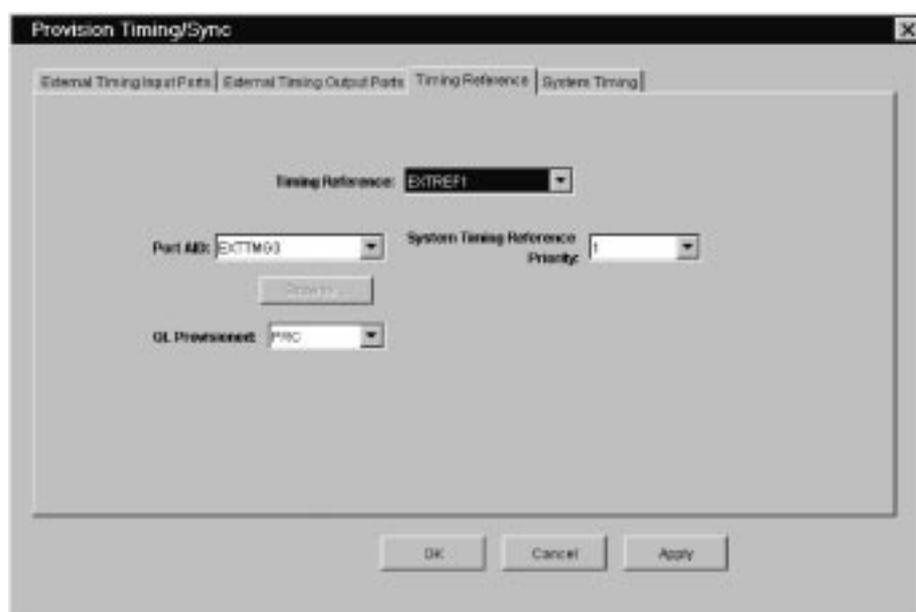
---

- 2 Login to the NE as described in Chapter 5, section “NE login/logout procedure” (5-20).

---

- 3 Select *Configuration* → *Timing/Sync* in the System View, then the tab *Timing Reference*.

**Result:**



- 4 Select the clock source which you wish to configure in the drop-down list box *Timing Reference*. You can select an external timing signal (*EXTREF1* or *EXTREF2*) or an internal timing signal (*LINE1* to *LINE6*).

---

- 5 Select the port AID in the drop-down-list box *Port AID*.

IF...	THEN...
the selected timing reference shall not be used,	select <b>NOT-CONNECTED</b>
the selected timing reference is <b>EXTREF1</b> ,	select <b>EXTTMG0</b>
the selected timing reference is <b>EXTREF2</b> ,	select <b>EXTTMG1</b>
the selected timing reference is <b>LINE1</b> to <b>LINE6</b> and the corresponding SDH port is not yet assigned,	click on <b>Browse...</b> and select the SDH port which shall be used as timing reference. <b>Important!</b> The timing references can be assigned only for even slots, and 1st port of these slots only.  <b>Result:</b> The window <b>Select Line Timing Port AID</b> opens.
the selected timing reference is <b>LINE1</b> to <b>LINE6</b> and the corresponding SDH port is already assigned,	—  <b>Result:</b> The respective port AID is displayed in the drop-down list box <b>Port AID</b> .
the selected timing reference is <b>LINE1</b> or <b>LINE2</b> and you want to assign a new SDH signal as timing reference,	select <b>NOT-CONNECTED</b> first in order to disable the currently assigned SDH port, and then select the new SDH port via <b>Browse...</b>

- 6 Select the timing quality belonging to the timing reference in the drop-down list box **QL Provisioned**. For **LINE1** and **LINE2** select **AUTO**. This means that the timing marker is evaluated. For **EXTREF1** and **EXTREF2** assign the actual quality level of the external timing source. If the input format is 2mbit-framed (SSM supported) also select **AUTO**.

**Result:**

The timing references are now used in the order of their quality level.

- 7 Select in the drop-down list box **System Timing Reference Priority** the priority of the selected timing reference. The values can be
- **Disable** (initial value)
  - **1** upto **8**.

Make sure that all configured timing references have different priorities assigned.

**Result:**

A priority list is created for the configured timing reference signals. Initially the signal with the highest quality level is used as timing reference signal. If it fails, the system switches to the signal with the next lower quality level. If there are several timing references with the same quality level, they are used according to the priority list. If all possible timing reference signals fail, the timing generator enters the holdover mode.

- 
- 8** Apply the changes by clicking on *Apply*. If you wish to discard the changes click on *Cancel*.

- 
- 9** Repeat Steps 4 to 8 until all timing references are configured. Click on *OK* to close the window.

END OF STEPS



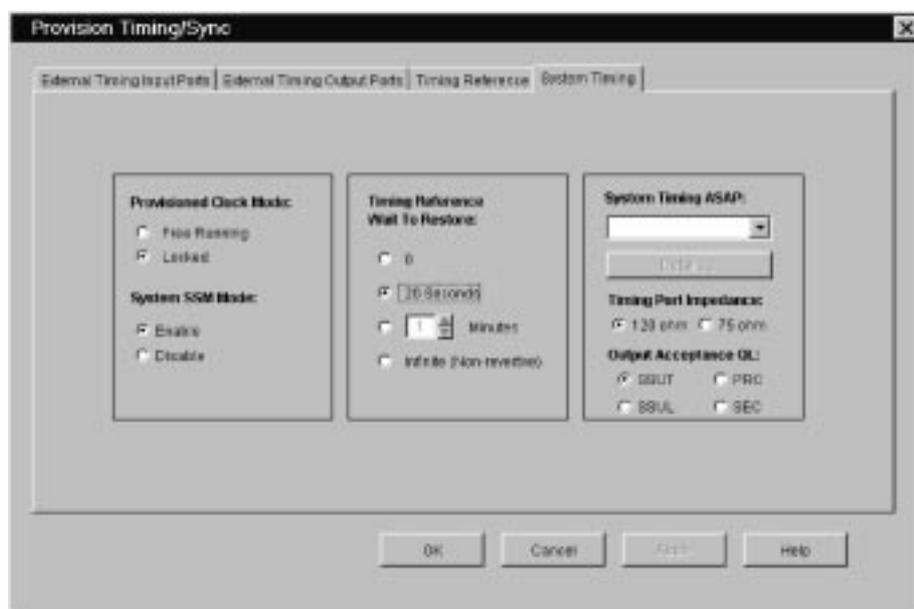
## Provisioning of the system timing

**Overview** This section provides a procedure for setting up the system timing in the NE.

**Procedure** Follow the steps as described below to provision the system timing:

- 1 Login to the NE as described in Chapter 5, section “NE login/logout procedure” (5-20).
- 2 Select *Configuration* → *Timing/Sync* in the System View, then the tab *System Timing*.

**Result:**



- 3 Select the clock mode in the group box *Provisioned Clock Mode*. Click on the respective radio button. You can select the following values:
  - **Free Running** (The system is synchronised to the internal oscillator.)
  - **Locked** (The system is synchronised to a timing reference signal.)

During normal operation in a network, the timing generator should be locked to a timing reference signal as far as available. Normally the free-running mode is used directly after the system start.

- 
- 4 Enable or disable the use of the timing marker for the system timing in the group box *System SSM Mode*. This means that the selection of timing reference for the system timing is either determined only by the provisioned priority list or by the quality level given by the timing marker (SSM, Synchronization Status Message) and secondly by the priority list. Click on the respective radio button.

The values can be

- *PRC*
- *SSUT*
- *SSUL*
- *SEC*.

- 
- 5 Select the wait-to-restore time in the group box *Timing Reference Wait To Restore*. Click on the respective radio button. The values can be:

- *0* (initial value)
- *20 Seconds*
- *1 Minute ... 60 Minutes* (selectable via a spin box)
- *Infinite*.

The wait-to-restore time is the wait which is made before every single switching from one timing reference to another.

- 
- 6 Select the impedance of the external timing output ports in the group box *Timing Port Impedance*. Click on the respective radio button.

- 
- 7 Select the quality level of the derived timing output signal below which AIS is inserted (in a framed 2 Mbit/s signal) or the signal is quelched respectively (2 Mhz or unframed 2 Mbit/s signals). Click on the respective radio button in the group box *Output Acceptance QL*.

- 
- 8 Apply the changes by clicking on *OK*. If you wish to discard the changes, click on *Cancel*.

END OF STEPS

---

**Note:**

The synchronisation test procedure is described in Chapter 5, section “NE synchronisation test” (5-31).





# 7 Fiber connection and network setup

## Overview

---

**Purpose** This chapter describes how to establish a network with optical fibre connections. It provides procedures for directly connecting the WaveStar® TDM 10G (STM-64) NEs and should be used for high-level network connection. Furthermore, some WaveStar® CIT procedures are described which will be needed for network tests (see Chapter 8, “Network testing”).

**Assumptions** Be sure all listed assumptions described below are fulfilled before establishing the network:

- Each NE has completely passed all the tests described in Chapter 5, “NE testing” and are provisioned as described in Chapter 6, “Required NE provisioning”.
- The persons setting up the network should be familiar with the SDH functionality and WaveStar® CIT.

**Related information** In this chapter all procedures are described for a protected STM64 ring topology. In the “WaveStar® TDM 10G (STM-64) Applications, Planning, and Ordering Guide” also other possible topologies are described.

An overview about all WaveStar® CIT related tasks is given in the “WaveStar® TDM 10G (STM-64) User Operations Guide”.

### Contents

---

High level ring connection	7-3
LBO selection and mounting	7-9

---

Setting up the DCC channels	7-15
Setting up a cross connection	7-17



## High level ring connection

---

**Overview** This section describes all steps which are necessary to establish a ring topology with optical fibre connections. Some steps represent complete procedures. In such a case they are described in a separate section.

**Related Information** In the following procedure slot designations are used. An overview about the slot designations is given in Chapter 3, "Equipment installation".

The cable management for optical fibres within an NE is described in Chapter 4, section "Fibre cables" (4-51).



### **DANGER**

*Never look into the end of an exposed fiber or into an open optical connector as long as the optical source is switched on. This applies particularly to the connections of the optical plug-in units.*



### **CAUTION**

*Use a static ground wrist strap whenever handling circuit packs or working on a WaveStar® CIT, to prevent electrostatic discharge damage to sensitive components.*



### **CAUTION**

*To avoid cable break ensure that the bending radius of optical fibre cables is not less than 30 mm.*

**Procedure** Perform the following procedure to establish a protected STM64 ring connection:

---

1

<b>IF ...</b>	<b>THEN ...</b>
OBA amplifiers are used,	at the first node, clean and connect the fibre to the OUT port of the OBA in slot "(1-2) oaw".  <b>Reference:</b> Chapter 4, section "Fibre connection (general)" (4-52) and Chapter 9, section "Fibre cleaning" (9-12).
OBPA amplifiers are used,	at the first node, clean and connect the fibre to the OBA-OUT port of the OBPA in slot "(1-2) oaw".  <b>Reference:</b> Chapter 4, section "Fibre connection (general)" (4-52) and Chapter 9, section "Fibre cleaning" (9-12).
Ditech amplifiers are used,	at the first node, clean and connect the fibre to the OUT port of the first booster amplifier (STAR-T16 EDFA).  <b>Reference:</b> Chapter 4, section "Ditech cabling" (4-62) and Chapter 9, section "Fibre cleaning" (9-12).
no optical amplifiers are used,	clean and connect the fibre to the OUT port of the STM64 port unit in slot "(1-2) trw".  <b>Reference:</b> Chapter 4, section "Fibre connection (general)" (4-52) and Chapter 9, section "Fibre cleaning" (9-12).

.....

**2** Move to the next adjacent node in the east.

.....

<b>IF ...</b>	<b>THEN ...</b>
OBA or no optical amplifiers are used,	follow the LBO selection procedure to determine the correct attenuation value for the IN port of the STM64 port unit in slot "(1-2) tre".  <b>Reference:</b> Section "LBO selection and mounting" (7-9).

<b>IF ...</b>	<b>THEN ...</b>
OBPA amplifiers are used,	follow the LBO selection procedure to determine the correct attenuation value for the OPA1-IN port of the OBPA in slot "(1-2) oae".  <b>Reference:</b> Section "LBO selection and mounting" (7-9).
Ditech amplifiers are used,	follow the LBO selection procedure to determine the correct attenuation value for the IN port of the first pre amplifier (STAR-PF EDFA).  <b>Reference:</b> Section "LBO selection and mounting" (7-9).

- 4 Clean and connect the fibre to the respective port.

**Reference:**

Chapter 9, section "Fibre cleaning" (9-12)

- 5 Repeat Steps 1-4 until you have gone all the way around the ring.

<b>IF ...</b>	<b>THEN ...</b>
OBA amplifiers are used,	at the first node, clean and connect the fibre to the OUT port of the OBA in slot "(1-2) oae".  <b>Reference:</b> Chapter 4, section "Fibre connection (general)" (4-52) and Chapter 9, section "Fibre cleaning" (9-12).
OBPA amplifiers are used,	clean and connect the fibre to the OBA-OUT port of the OBPA in slot "(1-2) oae".  <b>Reference:</b> Chapter 4, section "Fibre connection (general)" (4-52) and Chapter 9, section "Fibre cleaning" (9-12).

<b>IF ...</b>	<b>THEN ...</b>
Ditech amplifiers are used,	clean and connect the fibre to the OUT port of the second booster amplifier (STAR-T16 EDFA).  <b>Reference:</b> Chapter 4, section “Ditech cabling” (4-62) and Chapter 9, section “Fibre cleaning” (9-12).
no optical amplifiers are used,	clean and connect the fibre to the OUT port of the STM64 port unit in slot “(1-2) tre”.  <b>Reference:</b> Chapter 4, section “Fibre connection (general)” (4-52) and Chapter 9, section “Fibre cleaning” (9-12).

7 Move to the next adjacent node in the east.

<b>IF ...</b>	<b>THEN ...</b>
OBA or no optical amplifiers are used,	follow the LBO selection procedure to determine the correct attenuation value for the IN port of the STM64 port unit in slot “(1-2) trw”.  <b>Reference:</b> Section “LBO selection and mounting” (7-9).
OBPA amplifiers are used,	follow the LBO selection procedure to determine the correct attenuation value for the OPA1-IN port of the OBPA in slot “(1-2) oaw”.  <b>Reference:</b> Section “LBO selection and mounting” (7-9).
Ditech amplifiers are used,	follow the LBO selection procedure to determine the correct attenuation value for the IN port of the second pre amplifier (STAR-PF EDFA).  <b>Reference:</b> Section “LBO selection and mounting” (7-9).

.....  
**9** Clean and connect the fibre to the respective port.

**Reference:**

Chapter 9, section "Fibre cleaning" (9-12)

.....  
**10** Repeat Steps 6-9 until you have gone all the way around the ring.

.....  
**11** Set-up far-end communications.

**Reference:**

Section "Setting up the DCC channels" (7-15)

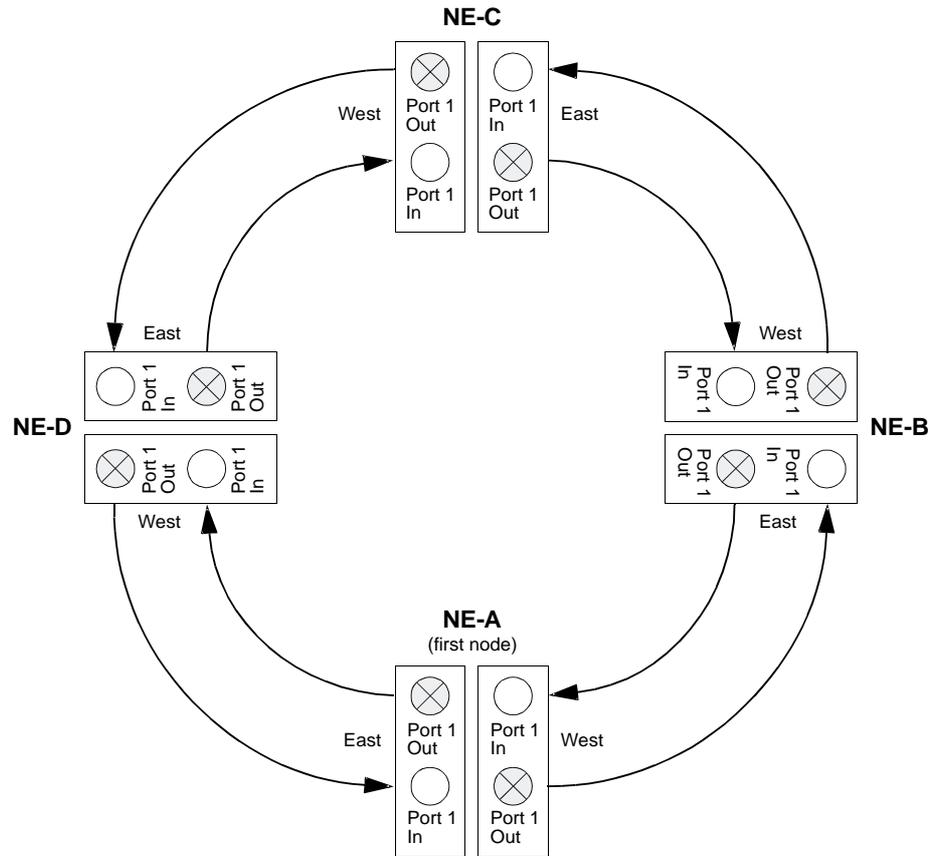
.....  
**12** Set-up cross connections.

**Reference:**

Section "Setting up a cross connection" (7-17)

.....  
E N D O F S T E P S  
.....

**Result**



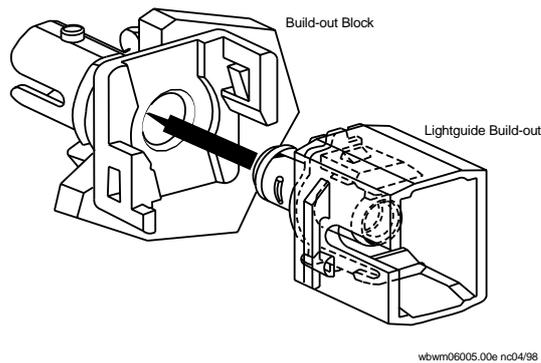
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## LBO selection and mounting

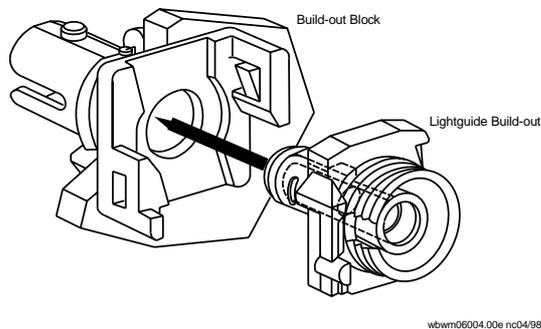
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**LBO types** If required, WaveStar® TDM 10G provides optical attenuation using LBOs (Lightguide Build-Outs) on the optical port units. All port units (except the coloured interfaces for OLS 400G and the STM1o-8-port unit; these units use the LC connector) are capable of operating with the following three connector types:

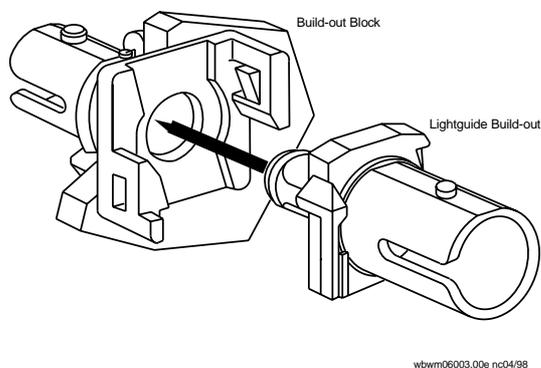
**- SC-type**



**- FC-type**



**- ST-Type (should not be used)**



With the exception of the coloured interfaces for OLS 400G and the STM1o-8-port units (these units use the LC connector) all optical interfaces are factory-equipped with 0-dB SC type connectors. The optical attenuation and connector type can be changed by replacing the LBO (see sections “LBO removal” (7-12) and “LBO installation” (7-13)). That is not valid for LC connector types. Only with special patchcords a conversion can be made to different connector types.

The following patchcords can be ordered:

Type	Comcode
LC-LC, 25 m	848787628
LC-FC, 25 m	848787636
LC-SC, 25 m	848787644
LC-ST, 25 m	848787651
LC-APC, 25 m	848797189

### Ordering information

The optical attenuation and connector type can be changed by replacing the LBO. The following LBOs can be ordered (valid for 1310 nm and 1550 nm).

Type	Comcode	Loss (dB)
SC	106708951	0 dB
SC	108538760	1 dB
SC	108538778	2 dB
SC	108314469	3 dB
SC	108314485	4 dB
SC	108314501	5 dB
SC	108314527	6 dB
SC	108314543	7 dB
SC	108314568	8 dB
SC	108314584	9 dB
SC	108314600	10 dB
SC	108440496	11 dB
SC	106440504	12 dB
SC	106440512	13 dB
SC	106440520	14 dB
SC	106708985	15 dB
FC	106795404	0 dB

Type	Comcode	Loss (dB)
FC	108385493	1 dB
FC	108385501	2 dB
FC	108107053	3 dB
FC	108107079	4 dB
FC	108107095	5 dB
FC	108107111	6 dB
FC	108107137	7 dB
FC	108107152	8 dB
FC	108107178	9 dB
FC	108107194	10 dB
FC	108107202	11 dB
FC	108107210	12 dB
FC	108107228	13 dB
FC	108107236	14 dB
FC	107406241	15 dB

**LBO selection** This section covers the selection of LBOs to be used on the input to the long reach STM64 based on the received optical power. It is recommended that the LBO be placed on the INPUT port since this is the furthest physical point on the fibre line from the OUTPUT port and takes all connector losses into account. Perform the steps as described below to choose and install the appropriate LBO for all port units:

- 1 At the input of the receiver measure the received optical power from the far-end transmitter. Be sure to set the optical power meter for the wavelength of the light to be measured (i.e. 1310 nm or 1550 nm).
- 2 Check that the measured value is within the range shown below “LBO value range” (7-12)).

IF...	THEN...
the measured value is within the range,	END OF STEPS
the measured value is not within the range,	choose the appropriate LBO value.

- 
- 3** Remove the 0-dB LBO in the faceplate IN port of the optical port unit (see section “LBO removal” (7-12)).
- 

- 4** Install the chosen LBO (see section “LBO installation” (7-13)).
- 

END OF STEPS

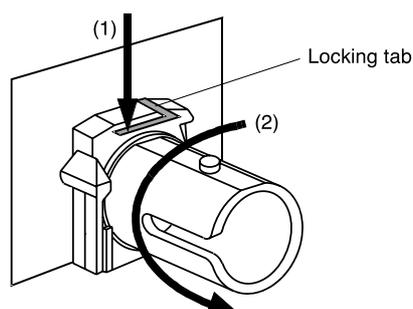
---

### LBO value range

The following table helps you to check the LBO value.

Port Unit	Range (dBm)
STM64/1.5IR1 (LEY69)	-3.0 ... -14.0
STM64/1.5IRS1 (LEY97)	-3.0 ... -14.0
OBPA (SEN4)	+2.0 ... -15.0
STAR-PF EDFA	-20.0 ... -40.0
STM64/DWDM01-40 (LEY201...240)	-3.0 ... -14.0

- LBO removal** To remove an LBO, deflect the locking tab on the top of the buildout (1) and rotate the buildout counterclockwise slightly (2) as shown in the following figure. Slide the buildout out along the angle it is installed in the faceplate.



### LBO removal (ST Connectors)

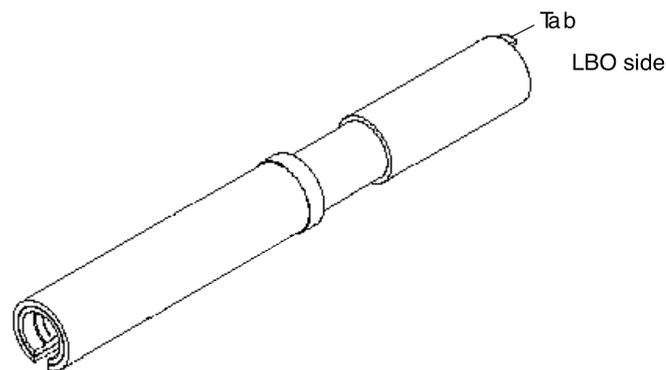
The steps described below can only be done in case of ST-type connectors and the help of the fiber installation tool (Comcode 848439543, see “Fiber installation tool” (7-13)). Perform the steps as described below to remove an LBO:

---

- 1** Insert the tool with the LBO side over the LBO in the faceplate, being sure to align the tab on the tool with the top surface of the LBO.
-

- 
- 2 Using the tool turn the LBO counterclockwise approximately 30 degrees. Verify that the LBO locking tab has unlatched from the LBO.
- 
- 3 Remove the LBO from the faceplate by pulling back on the tool.
- 
- 4 Rotate the LBO to realign the tab on the tool with the top surface of the LBO.
- 
- 5 Remove the LBO from the tool by gently pulling on the tool.
- END OF STEPS
- 

### Fiber installation tool

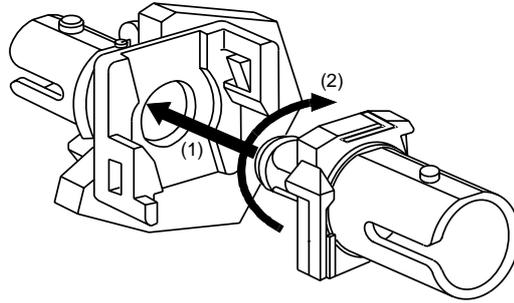


**LBO installation** Perform the steps as described below to install an LBO:

---

- 1 Remove the protective covers from the chosen buildout.
- 
- 2 Clean the buildout connection of any material or dust using alcohol and wipes (see Chapter 9, section “Fibre cleaning” (9-12)).
- 
- 3 With the locking tab facing up towards you, slide the buildout into the faceplate of the IN jack at the angle of the connector block in the faceplate (1). The buildout can only be fully inserted when the locking

tab is very slightly rotated counterclockwise. To lock the buildout in position, rotate the buildout clockwise until a small click is heard (2).



END OF STEPS

---



## Setting up the DCC channels

---

**Overview** The DCC works according the master/slave principle. That means the LAPD role (Link Access Procedure - D channel) of two connected SDH ports must be set in different modes. For WaveStar® TDM 10G these modes are named “User Side” and “Network Side”. The default setting for all SDH ports is “User Side”.

**Important!** A remote login is only possible if the LAPD mode setting (see procedure below) is different at both ends of a DCC link. One end of the DCC link must be configured as “User Side”, the other end as “Network Side”.

### Preconditions for enabling a DCC

You are permitted to enable a DCC if all of the following preconditions are fulfilled:

- The corresponding optical interface port is provisioned (configured) or at least pre-provisioned.
- The type of DCC (DCC-R or DCC-M) is supported on the corresponding optical interface.
- The DCC is not already enabled.
- There are LAPD channels available. Please refer to “Max. number of active DCC links” (7-15) below.

### Max. number of active DCC links

The maximum number of simultaneously supported LAPD channels per DCC controller is 32. Each DCC controller can thus support up to 32 active DCC links.

### Before you begin

Upon circuit pack insertion, DCCs will automatically be enabled and an LAPD channel assigned as long as LAPD channels are available. Therefore, all corresponding DCCs of each provisioned optical port must be disabled. Afterwards only those channels (up to a maximum of 10) should be enabled that are really needed.

### Procedure

The following procedure describes the setup of DCC communications in an STM64 ring. The establishment of a DCC communication via the STM64 ports serves as an example.

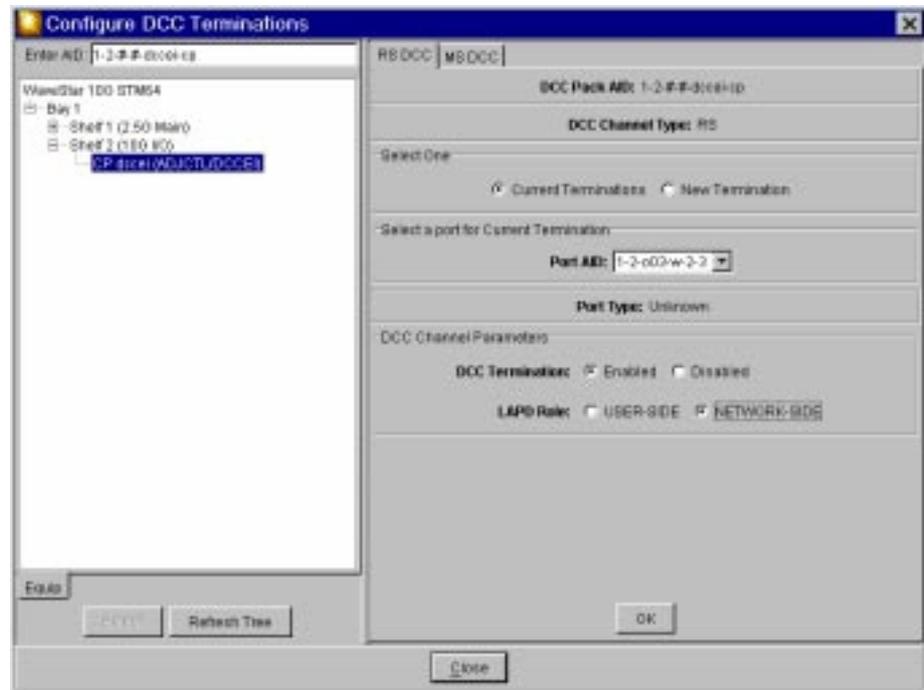
---

- 1 Login to the NE as described in Chapter 5, section “NE login/logout procedure” (5-20).

---

- 2 Select *Configuration* → *DCC Terminations...* in the System View.

- 3 Double click on *Shelf 2* (high speed shelf) and then also on *CP dceei (ADJCTL/DCCEI)*.



- Select *Current Terminations*.
- Select a *Port AID* (for example the west port: *1-2-003-w-2-3*).
- Set the *DCC Termination* to *Enabled*.
- Set the *LAPD Role* to *NETWORK-SIDE*.
- Click *OK* and then *Yes* in the confirmation window.

- 4 Click *Close* and disconnect the NE from WaveStar® CIT.

- 5 Repeat Steps 1 to 4 for the next NE in the ring located on the west side until all NEs in the ring are provisioned.

END OF STEPS



## Setting up a cross connection

---

**Overview** This section gives information about setting up cross connections. As an example, in the procedure described below a non-path protected bidirectional VC-4 cross connection between the low speed shelf and the high speed shelf will be established.

**Procedure** Proceed as follows to setup the VC-4 cross connection:

---

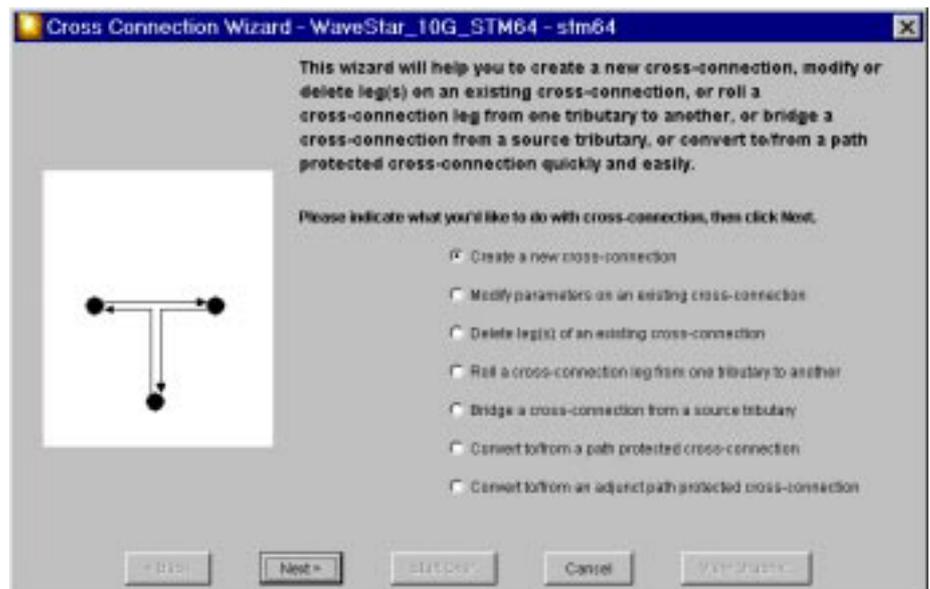
- 1 Login to the NE as described in Chapter 5, section “NE login/logout procedure” (5-20).

---

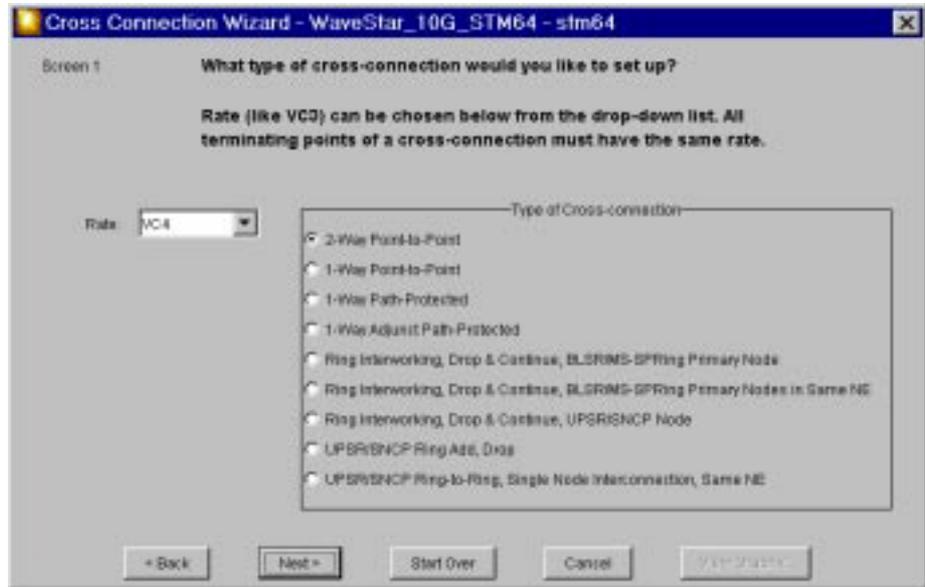
- 2 Select *Configuration* → *Cross-Connection...* in the System View.

---

- 3 Click on the radio button *Create a new cross-connection* and then on *Next>*.



- 4 Select **VC-4** in the drop-down list box **Rate:** and **2-Way Point-to-Point** in the group box **Type of Cross-connection**.



Click **Next**>.

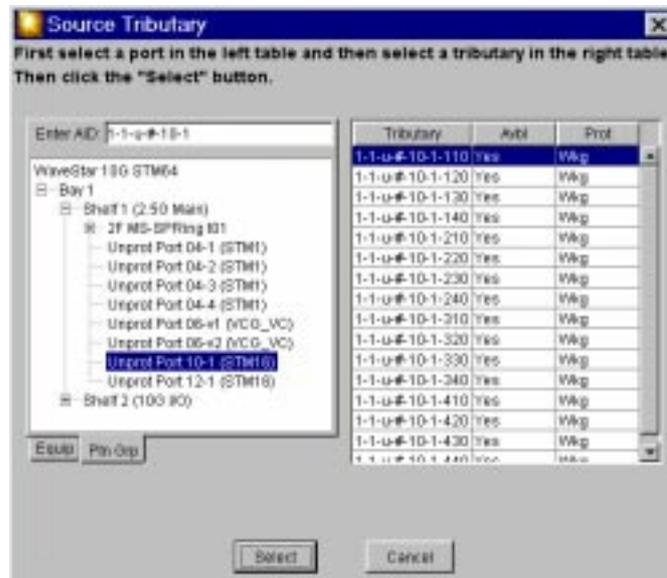
- 5 Click on the left **Select...** button (Source).



- 6 Double click on **Shelf 1** (low speed shelf) and select one port in the list.

**Result:**

In the *Tributary* list box on the right the AIDs of all VC-4s belonging to the respective port are displayed.



- 
- 7 Select one available VC-4 (indicated by “Yes”) which shall be used as source and click *Select*.

---

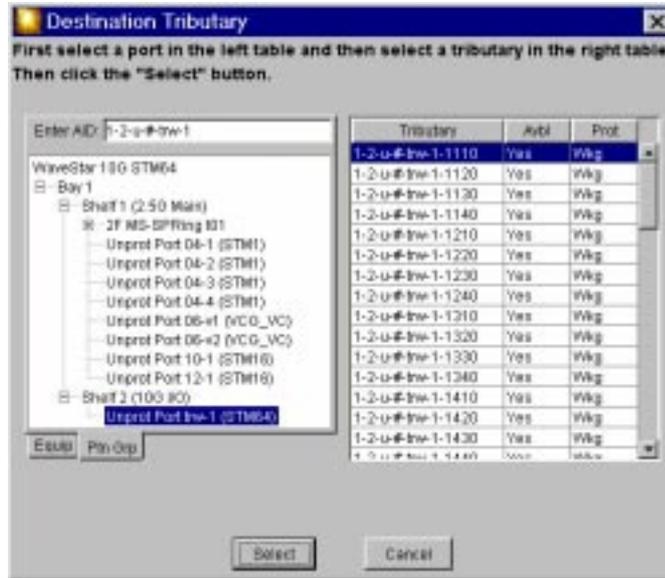
  - 8 Click on the right *Select...* button (Destination).

---

  - 9 Double click on *Shelf 2* (high speed shelf) and select one destination port.

**Result:**

In the *Tributary* list box on the right, the AIDs of all VC-4s belonging to the respective port are displayed.



- 10 Select the VC-4 which shall be used as destination and click *Select*.

- 11 Click *Next>* and in the following window *Finish*.

**Result:**

The window disappears automatically after a short time.

- 12 Click *Close* and then *Yes* in the confirmation window.

END OF STEPS





# 8 Network testing

## Overview

---

**Purpose** This chapter describes all the tests that should be carried out in order to check the operation of the overall system.

**Before You begin** Be sure all listed assumptions are fulfilled before performing any tests.

- All fibres have been connected at each NE.
- Each NE has completely passed all of the tests in the previous chapters of this manual.
- The persons setting up the network should be familiar with the WaveStar® CIT GUI.

**Related information** In this chapter all procedures are described for a protected STM64 ring topology. In the “WaveStar® TDM 10G (STM-64) Applications, Planning, and Ordering Guide” other possible topologies are also described.

An overview about all WaveStar® CIT related tasks is given in the “WaveStar® TDM 10G (STM-64) User Operations Guide”.

### Contents

---

Control and supervision via remote login	8-2
Testing the line timing functionality	8-6
Alarm test	8-8

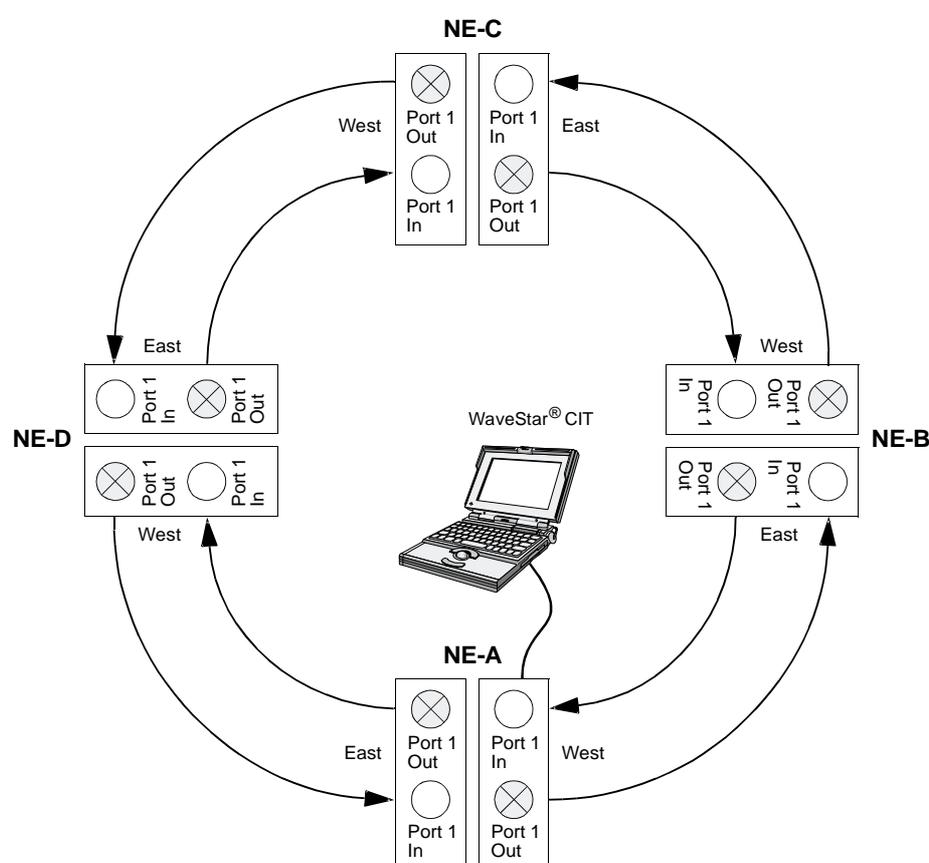


## Control and supervision via remote login

**Overview** **Important!** This test can only be done after the DCC channels have been configured correctly (see Chapter 7, section “Setting up the DCC channels” (7-15)).

The test ensures the accessibility to all NEs via remote login. In the test procedure a protected STM64 ring configuration will be used as example. However, the described procedure is in principle also valid for other network topologies.

### Test setup



**Procedure** Perform the following procedure to test the NE control and supervision functionality via remote login:

- 1 Login to the NE-A as described in Chapter 5, section “NE login/logout procedure” (5-20).
- 2 Set the NE-A time to the actual value (see Chapter 6, section “Setting of the NE date and time” (6-6)).

- 
- 3 Start a remote login to NE-B.

---

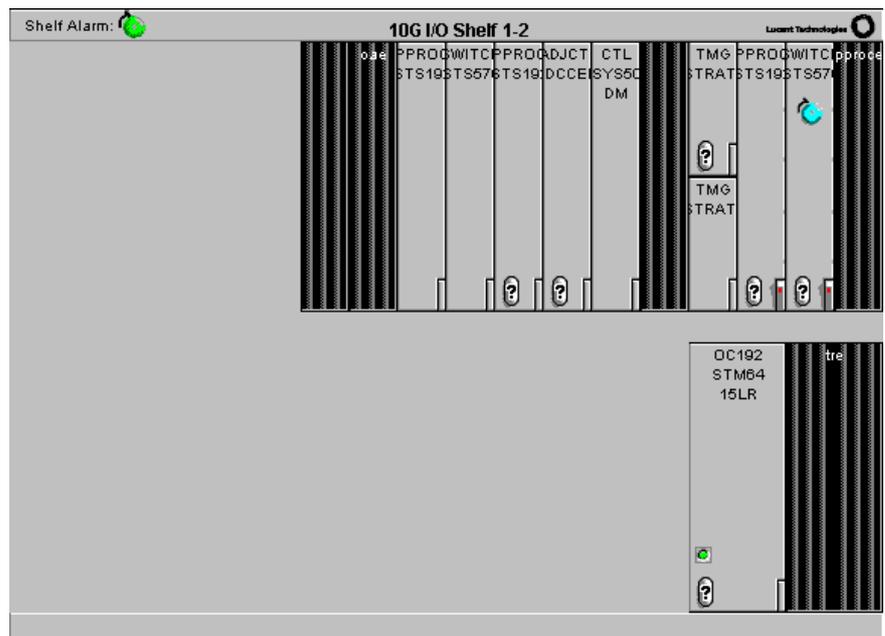
  - 4 Set the NE-B time to the actual value.

---

  - 5 Read out the high speed part of NE-B by double clicking on *Shelf 2*.

**Result:**

The high speed part with all equipped units will be displayed.



- 
- 6 Read out the inventory data by double clicking on a unit.

**Result:**

The inventory data window (Pack Data) for the selected board will be opened.

Tab Pack Data



Tab Status



- 
- 7 Select *Close* and then *View* → *System View Display*.
- 
- 8 Repeat Steps 5 to 7 for the low speed part of NE-B by double clicking on *Shelf 1*.
- 
- 9 In the case of an existing Expansion Shelf, repeat Steps 5 to 7 by double clicking on *Shelf 3*.
- 
- 10 Repeat Steps 3 to 9 for NE-C and NE-D.
- END OF STEPS
-

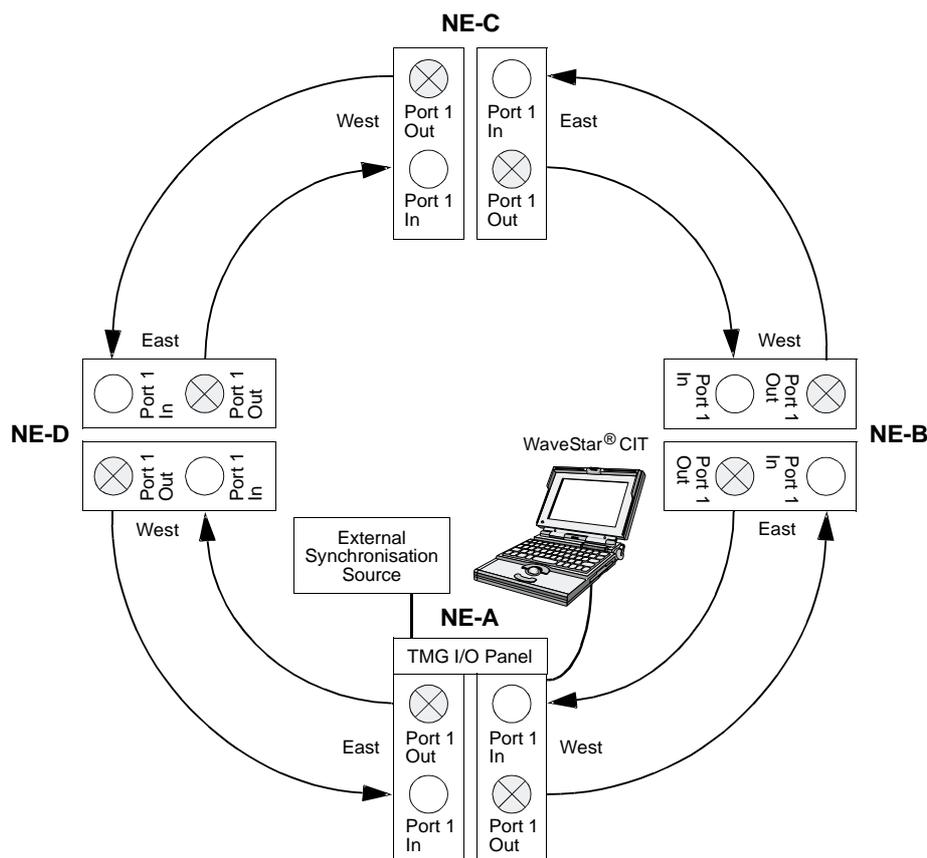
**Remote login failure** In the case of a remote login failure, please refer to Chapter 9, section “Remote login failure” (9-10).

□

## Testing the line timing functionality

**Overview** This test checks that all NEs can be synchronised using the line timing function. In the test procedure a protected STM64 ring configuration will be used as example. However, the described procedure is in principle also valid for other network topologies.

### Test setup



**Procedure** Perform the following procedure to test the line timing functionality:

- 1 Connect an external synchronisation source to the TMG I/O panel of NE-A (see Chapter 4, section “Reference timing cables” (4-26)).
- 2 Login to the NE-A as described in Chapter 5, section “NE login/logout procedure” (5-20).
- 3 Check that NE-A is synchronised onto the external synchronisation source (see Chapter 5, section “NE synchronisation test” (5-31)).

.....  
**4** Start a remote login to NE-B.  
.....

**5** Check that NE-B is synchronised onto the internal line clock source  
(see Chapter 5, section “NE synchronisation test” (5-31)).  
.....

**6** Repeat Steps 4 and 5 for NE-C and NE-D.  
.....

END OF STEPS  
.....



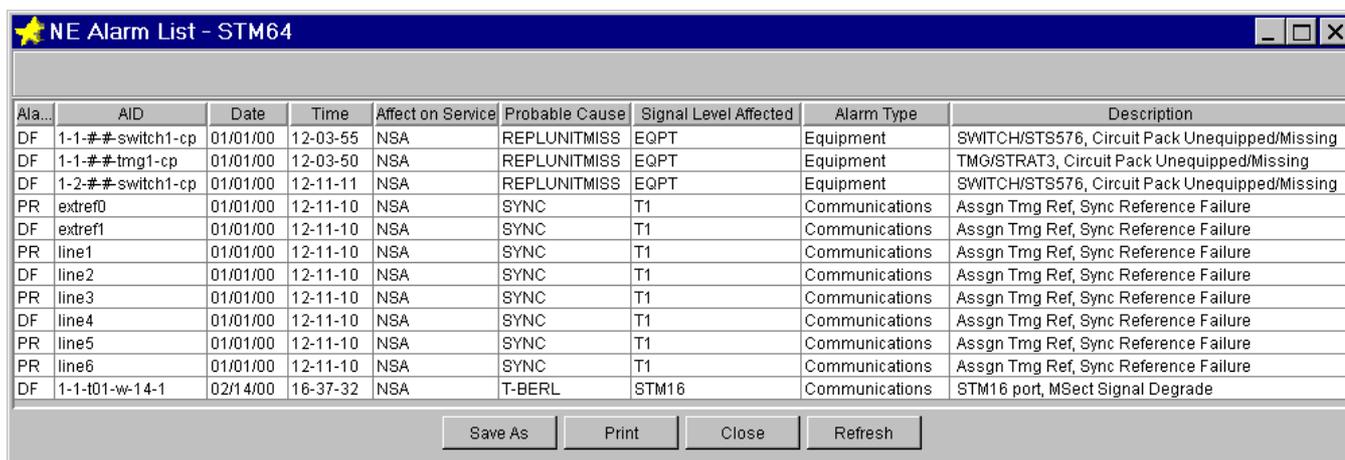
## Alarm test

**Overview** This test verifies that there are no active alarms in the net.

**Procedure** Proceed as follows to perform an alarm test:

- 1 Verify that only green LEDs are lit on each NE in the net.
- 2 Login to one NE as described in Chapter 5, section “NE login/logout procedure” (5-20).
- 3 Select *Fault* → *NE Alarm List...* from the CIT interface.

### Result:



Ala...	AID	Date	Time	Affect on Service	Probable Cause	Signal Level Affected	Alarm Type	Description
DF	1-1-##-switch1-cp	01/01/00	12-03-55	NSA	REPLUNITMISS	EQPT	Equipment	SWITCH/STS576, Circuit Pack Unequipped/Missing
DF	1-1-##-tmg1-cp	01/01/00	12-03-50	NSA	REPLUNITMISS	EQPT	Equipment	TMG/STRAT3, Circuit Pack Unequipped/Missing
DF	1-2-##-switch1-cp	01/01/00	12-11-11	NSA	REPLUNITMISS	EQPT	Equipment	SWITCH/STS576, Circuit Pack Unequipped/Missing
PR	extref0	01/01/00	12-11-10	NSA	SYNC	T1	Communications	Assgn Tmg Ref, Sync Reference Failure
DF	extref1	01/01/00	12-11-10	NSA	SYNC	T1	Communications	Assgn Tmg Ref, Sync Reference Failure
PR	line1	01/01/00	12-11-10	NSA	SYNC	T1	Communications	Assgn Tmg Ref, Sync Reference Failure
DF	line2	01/01/00	12-11-10	NSA	SYNC	T1	Communications	Assgn Tmg Ref, Sync Reference Failure
PR	line3	01/01/00	12-11-10	NSA	SYNC	T1	Communications	Assgn Tmg Ref, Sync Reference Failure
DF	line4	01/01/00	12-11-10	NSA	SYNC	T1	Communications	Assgn Tmg Ref, Sync Reference Failure
PR	line5	01/01/00	12-11-10	NSA	SYNC	T1	Communications	Assgn Tmg Ref, Sync Reference Failure
PR	line6	01/01/00	12-11-10	NSA	SYNC	T1	Communications	Assgn Tmg Ref, Sync Reference Failure
DF	1-1-t01-w-14-1	02/14/00	16-37-32	NSA	T-BERL	STM16	Communications	STM16 port, MSect Signal Degrade

- 4 Click *Refresh* to get the actual view of alarms and check that there are no active alarms in the NE.

- 5 Repeat Steps 2 to 4 for all other NEs in the net (via remote login).

END OF STEPS

**Alarm handling** If there are active alarms in the NE, please refer to Chapter 9, section “Alarm handling” (9-11). □





# 9 Installation troubleshooting

## Overview

---

**Purpose** This chapter provides basic installation troubleshooting information for the WaveStar® TDM 10G system.

### Contents

---

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## Power failure

---

**Overview** The procedures described below should be performed if the subrack powering procedure (see Chapter 4, section “Power cables” (4-4)) was unsuccessful.

Procedure 1 should be used if the measured voltage at the termination blocks of the RCP does not lie between -40.5 and -72 V.

Procedure 2 should be used if the PWR ON LEDs do not light up on the user panels.

Procedure 3 should be used if the PWR ON LEDs do not light up on the fan units.

**Procedure 1** Follow the steps below if the measured voltage at the termination blocks of the RCP does not lie between -40.5 and -72 V:

---

**1** Disable the fuses or circuit breakers at the BDFB.

---

**2** Replace the power supply lines between BDFB and the termination blocks of the RCP. Make sure the cables are tight afterwards.

---

**3** Enable the fuses or circuit breakers at the BDFB.

---

**IF ...**

the measured voltage does not lie between -40.5 and -72 V,

the measured voltage lies between -40.5 and -72 V,

**THEN ...**

check the exchange battery.

END OF STEPS

END OF STEPS

---

**Procedure 2** Follow the steps below if the PWR ON LEDs do not light up on the user panels:

- 1 Operate all circuit breakers on the RCP to the **OFF** position.
- 2 Replace the shelf power cables between “Load A/B” of the RCP and the “Battery A/B” inputs of the Power Filter Units. Make sure that the cables are tight afterwards.
- 3 Operate all circuit breakers on the RCP to the **ON** position.

<b>IF ...</b>	<b>THEN ...</b>
the PWR ON LEDs do not light up on the user panels,	replace the Power Filter Units.
the PWR ON LEDs light up on the user panels,	END OF STEPS

END OF STEPS

**Procedure 3** Follow the steps below if the PWR ON LEDs do not light up on the fan units:

- 1 Operate all circuit breakers on the RCP to the **OFF** position.
- 2 Replace the fan power cables between the Power Filter Units and the Fan Units. Make sure that the cables are tight afterwards.
- 3 Operate all circuit breakers on the RCP to the **ON** position.

<b>IF ...</b>	<b>THEN ...</b>
the PWR ON LEDs do not light up on the Fan Units,	replace the Fan Units.
the PWR ON LEDs light up on the Fan Units,	END OF STEPS

END OF STEPS



## NE synchronisation failure

---

**Overview** The procedure described below should be performed if no valid timing reference signal is received at the respective external synchronisation input.

**Procedure** Follow the steps below in the case of an NE synchronisation failure:

---

- 1 Check for correct cabling and change as necessary (see Chapter 4, section “Reference timing cables” (4-26)).

---

<b>IF ...</b>	<b>THEN ...</b>
the NE does not synchronise to the external clock source,	proceed to Step 2.
the NE synchronises to the external clock source,	END OF STEPS

---

- 2 Check for correct input impedance (75  $\Omega$ /120  $\Omega$ ) and change as necessary.

---

<b>IF ...</b>	<b>THEN ...</b>
the NE does not synchronise to the external clock source,	proceed to Step 3.
the NE synchronises to the external clock source,	END OF STEPS

---

- 3 Check for an external fault: input/output reversed or exchange supply defect.

---

<b>IF ...</b>	<b>THEN ...</b>
the NE does not synchronise to the external clock source,	proceed to Step 4.
the NE synchronises to the external clock source,	END OF STEPS

---

- 4 Replace the currently active Timing Generator Unit.
-

---

<b>IF ...</b>	<b>THEN ...</b>
the NE does not synchronise to the external clock source,	proceed to Step 5.
the NE synchronises to the external clock source,	END OF STEPS

---

**5** Replace the TMG I/O Panel.

END OF STEPS

---



## SW download failure

---

**Overview** The procedure described below should be performed if the circuit packs have the red LEDs illuminated (instead of the green LEDs) after the reset of the System Controller. This indicates a software download failure.

**Procedure** Follow the steps below in the case of a software download failure:

---

**1** Replace the PCMCIA card.

<b>IF ...</b>	<b>THEN ...</b>
the circuit packs do not have the green LEDs illuminated,	proceed to Step 2.
the circuit packs have the green LEDs illuminated,	END OF STEPS

---

**2** Replace the System Controller.

END OF STEPS

---



## LED test failure

---

**Overview** The procedure described below should be performed if some LEDs do not light up during an LED test (see Chapter 5, section “LED test” (5-25)).

**Procedure** Follow the steps below in the case of an LED test failure:

---

- 1 Check that the circuit packs are plugged in correctly and the power supply is on.

<b>IF ...</b>	<b>THEN ...</b>
circuit pack LEDs do not light up,	replace the respective circuit packs.
LEDs of the User Panel do not light up,	replace the User Panel.
all LEDs light up,	END OF STEPS
END OF STEPS	

---



## Office alarm test failure

---

**Overview** The procedure described below should be performed if the rack alarm lamps do not light up during an office alarm test via WaveStar® CIT (see Chapter 5, section “Office alarm test” (5-29)).

**Procedure** Follow the steps below in the case of an office alarm test failure:

---

- 1 Check for correct power cabling and change as necessary (see Chapter 4, section “Alarm power cables” (4-9)).

IF ...	THEN ...
the rack alarm lamps do not light up during an office alarm test,	proceed to Step 2.
the rack alarm lamps light up during an office alarm test,	END OF STEPS

---

- 2 Check for correct signal cabling and change as necessary (see Chapter 4, section “Office alarm cables” (4-17)).

IF ...	THEN ...
the rack alarm lamps do not light up during an office alarm test,	proceed to Step 3.
the rack alarm lamps light up during an office alarm test,	END OF STEPS

---

- 3 Replace the office alarm cables.

IF ...	THEN ...
the rack alarm lamps do not light up during an office alarm test,	proceed to Step 4.
the rack alarm lamps light up during an office alarm test,	END OF STEPS

---

- 4 Replace the rack alarm lamps.
-

---

<b>IF ...</b>	<b>THEN ...</b>
the rack alarm lamps do not light up during an office alarm test,	proceed to Step 5.
the rack alarm lamps light up during an office alarm test,	END OF STEPS

---

**5** Replace the Alarm Panel of the shelf.

END OF STEPS

---



## Remote login failure

---

**Overview** The procedure described below should be performed if no remote login is possible (see Chapter 8, section “Control and supervision via remote login” (8-2)).

**Procedure** Follow the steps below in the case of a remote login failure:

---

- 1 Check that the DCC channels are configured correctly (see Chapter 7, section “Setting up the DCC channels” (7-15)).

<b>IF ...</b>	<b>THEN ...</b>
a remote login is not possible,	proceed to Step 2.
a remote login is possible,	END OF STEPS

---

- 2 Replace the Communication Controller (ADJCTL/DCC32EI circuit pack) of the high speed part in the near-end NE.

<b>IF ...</b>	<b>THEN ...</b>
a remote login is not possible,	proceed to Step 3.
a remote login is possible,	END OF STEPS

---

- 3 Replace the Communication Controller of the high speed part in the far-end NE.

<b>IF ...</b>	<b>THEN ...</b>
a remote login is not possible,	proceed to Step 4.
a remote login is possible,	END OF STEPS

---

- 4 Replace the STM64 Transmitter in the near-end NE.

<b>IF ...</b>	<b>THEN ...</b>
a remote login is not possible,	proceed to Step 5.
a remote login is possible,	END OF STEPS

---

- 5 Replace the STM64 Receiver in the far-end NE.

END OF STEPS

---

## Alarm handling

---

**Overview** The procedure described below should be performed if there are active alarms after an alarm test via WaveStar® CIT (see Chapter 7, section “High level ring connection” (7-3)).

**Procedure** Follow the steps below in the case of active alarms:

---

**1** Note all active alarms.

---

**2** Follow the trouble clearing tasks described in the “WaveStar® TDM 10G (STM-64) Alarm Messages and Trouble Clearing Guide”.

END OF STEPS

---



## Fibre cleaning

---

**Overview** This procedure describes the Lucent recommended method for the cleaning and inspection of optical connectors using specific tools and materials that have been proven to be effective in the assembly and testing of optical transmission equipment. It is critical that the connector endfaces are clean and free from particular contamination to assure proper performance and reliability of lightwave systems. With the modern high-speed, high-power and wider bandwidth optical transmission systems, clean connectors along the optical path are absolutely essential for successful operation.

Before working with optical fibre cables please observe the following safety warnings:



### **DANGER**

*Never look into the end of an exposed fiber or into an open optical connector as long as the optical source is switched on. This applies particularly to the connections of the optical plug-in units.*



### **CAUTION**

*To avoid cable break ensure that the bending radius of optical fibre cables is not less than 30 mm.*

**Cleaning of Optical Connectors** Optical connectors are only to be cleaned in accordance with the cleaning instructions listed below.

If impurities are assumed, the use of a microscope is recommended in order to check the connector face for impurities (e.g. fluff, dust particles). A microscope with a magnification x 200 is preferred.

**Connectors** If impurities are discovered, the optical connector must be cleaned in accordance with the following rules:

---

- 1 Wipe off the connector face **lengthwise** (not with a circular motion!) using a **smooth** tissue (**moistened** with isopropanol).

---

- 2 Wipe off the connector face **lengthwise** (not with a circular motion!) using a **dry and smooth** tissue.

- .....
- 3 Then let the connector face air-dry (the isopropanol must evaporate completely!). As an option, purified compressed air can also be used for drying.
- .....
- 4 If necessary, the connector face can additionally be dabbed on the tape dispenser.
- .....
- 5 Finally check the connector face for cleanliness using the microscope. If the connector impurities were not removed completely during the first cleaning procedure, repeat steps 1-5 until the result is satisfactory.
- .....
- END OF STEPS
- .....

**Note:**

Do not connect the optical connectors without checking them for impurities under the microscope!

**Coupling** Impurities caused by dust particles or fluff etc. can also occur on the optical coupling. To clean the coupling follow the instructions below:

.....

- 1 Soak the coupling cleaner in isopropanol and move it back and forth in the coupling several times.
- .....
- 2 Blow purified compressed air through the coupling and visually check for residual impurities by holding it to the light.

**Important!** Lightguide Build-Outs (LBOs) may be damaged when compressed air is used for drying. Therefore, do not use compressed air for drying LBOs.

END OF STEPS

.....







# Glossary

**A AID**  
Access Identifier

**AP**  
Aggregate Port

**AWG**  
American Wire Gauge

---

**B BDFB**  
Battery Distribution and Fuse Bay

---

**C CIT**  
Craft Interface Terminal

**CP**  
Circuit Pack

---

**D DC**  
Direct Current

**DCC**  
Data Communications Channel

---

**E EMS**  
Element Management System

**ESD**  
Electrostatic Discharge

---

**G GUI**  
Graphical User Interface

---

**H HS**  
High Speed

---

**I IP**  
Internet Protocol

---

**L LAN**  
Local Area Network

**LAPD**  
Link Access Procedure - D channel

**LBO**  
Lightguide Build-Out

**LED**  
Light-Emitting Diode

**LOS**  
Loss of Signal

**LS**  
Low Speed

---

**M MESH-BN**  
MESH-Bonded Network

**MESH-IBN**  
MESH-Isolated Bonded Network

**MS-SPRing**  
Multiplex Section Shared Protection Ring

**MSP**  
Multiplex Section Protection

---

---

**N NE**  
Network Element

---

**O OSI**  
Open Systems Interconnect

---

**P PC**  
Personal Computer

**PCMCIA**  
Personal Computer Manufacturer's Card Interface Adapter

**PFU**  
Power Filter Unit

**POH**  
Path Overhead

**PWR ON**  
Power On

---

**R RAM**  
Random Access MemoryRCP

**RCP**  
Rack Connection Panel

---

**S SDH**  
Synchronous Digital Hierarchy

**SNR**  
Signal Noise Reduction

**STM**  
Synchronous Transport Module

---

**T TID**  
Target Identifier

**TMG**  
Timing

**TP**

Tributary Port

**TXI**

Transmission Exchange Interface

---

**V VC**

Virtual Container

---

**W WaveStar® TDM**

WaveStar Time Division Multiplexing

**WTR**

Wait To Restore



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