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Dialogic® TX 4000C CompactPCI SS7 Network Interface Board Installation Manual

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Revision history

Revision	Release date	Notes
62376-10	April 2004	SSR, SS7 4.0
62376-11	August 2004	SRR, SS7 4.1
62376-12	July 2008	LBG, SS7 5.0 Beta
62376-13	September 2008	LBG, SS7 5.0
64-0431-01	July 2009	LBG, SS7 5.1
Last modified: July 7, 2009		

Refer to www.dialogic.com for product updates and for information about support policies, warranty information, and service offerings.

Table Of Contents

1 Introduction

The *Dialogic® TX 4000C CompactPCI SS7 Network Interface Board Installation Manual* explains how to perform the following tasks:

- Install the TX 4000C board
- Configure the TX 4000C board
- Establish network connections
- Verify the installation

This manual targets developers of telephony and voice applications who use TX 4000C boards with NaturalAccess™ SS7 software. This manual defines telephony terms where applicable, but assumes that the reader is familiar with telephony concepts, switching, and the C programming language

Note: The product(s) to which this document pertains is/are among those sold by NMS Communications Corporation ("NMS") to Dialogic Corporation ("Dialogic") in December 2008. Certain terminology relating to the product(s) has been changed, whereas other terminology has been retained for consistency and ease of reference. For the changed terminology relating to the product(s), below is a table indicating the "New Terminology" and the "Former Terminology". The respective terminologies can be equated to each other to the extent that either/both appear within this document.

Former terminology	Current terminology
NMS SS7	Dialogic® NaturalAccess™ Signaling Software
Natural Access	Dialogic® NaturalAccess™ Software

2 Overview of the TX 4000C board

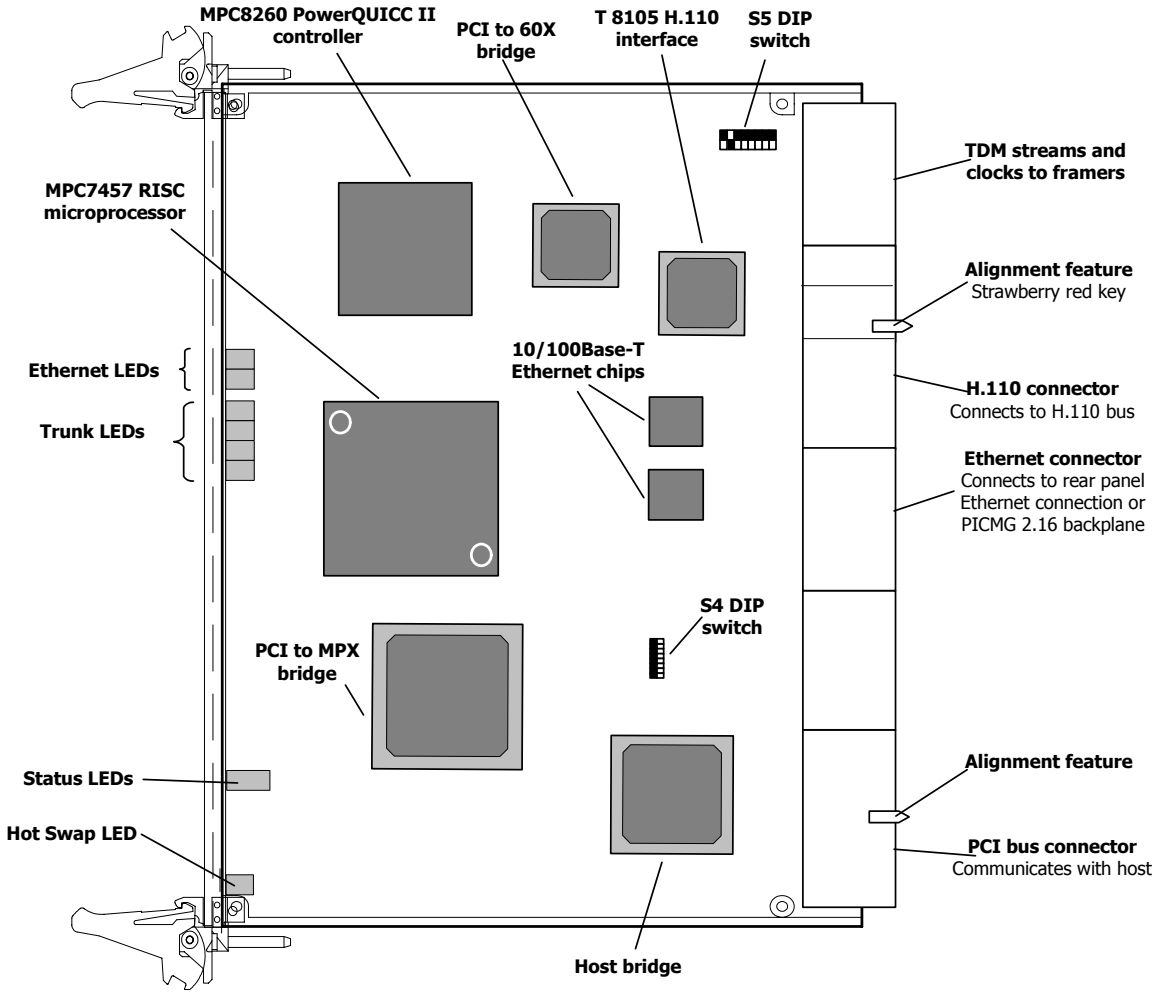
TX 4000C board features

The TX 4000C CompactPCI board provides eight T1 or E1 digital trunk interfaces. The TX 4000C design is based on an intelligent communication processor (CP) that plugs into a single CompactPCI bus slot. The CP operates with the CompactPCI bus host processor to form a distributed communications application platform.

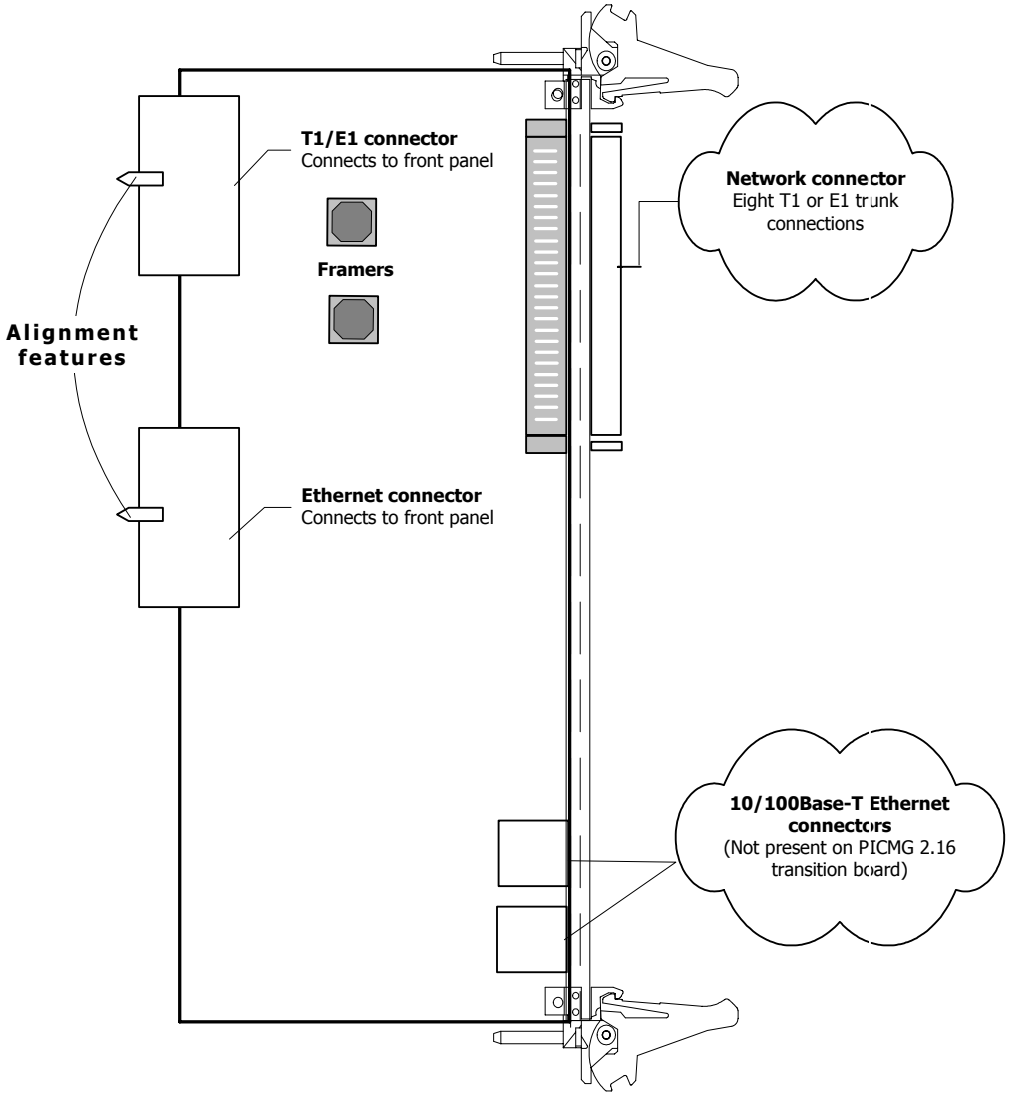
Depending on the chassis type, Ethernet connectivity is provided over a PICMG 2.16 Ethernet bus or by up to two external Ethernet 10/100Base-T interfaces.

The CP features one high-performance Motorola MPC7457 RISC microprocessor and one MPC8260 PowerQUICC II controller. NaturalAccess Signaling Software provides programming capabilities for the TX 4000C board CP.

The following illustration shows the location of the main components on a TX 4000C board:



The following illustration shows the location of the main components on the rear I/O transition board. The transition board is attached to the TX 4000C board and enables the board to support the T1, E1, and Ethernet functionality.



The TX 4000C board provides:

- CompactPCI bus connectivity.

  Each board is designed to reside in a single PCI bus slot. Each board contains a universal (5.0 V or 3.3 V signaling) PCI bus interface that is compliant with the *CompactPCI Specification PICMG 2.0 R3.0*. The CompactPCI interface is a 33/66 MHz, 32-bit master/target device.

- H.110 bus connectivity.

  The TX 4000C board supports the H.110 bus specification. The H.110 bus enables boards to share data and signaling information with other boards on the H.110 bus. For example, you can connect two or more TX 4000C boards for applications that perform trunk-to-trunk switching. In addition, you can use H.110 compatible products from other manufacturers with the TX 4000C board.

  The H.110 interface supports a full mode stream configuration on the H.110 bus with 32 streams at 8 MHz each. Each stream provides 128 timeslots for a total of 4096 timeslots.

- Telephony bus switching

  Switching for the TX 4000C board offers support for the H.110 bus within the H.110 architecture. On the TX 4000C board, switch connections are allowed for a total of 512 half duplex or 256 full duplex connections between local devices and the H.110 bus. Switch connections between local devices are non-blocking.

- Ethernet connectivity

  The TX 4000C board contains up to two external Ethernet 10/100Base-T connections through a rear I/O transition board. These connectors provide Fast Ethernet connectivity and IPv4 support. Ethernet connectivity provides the TX 4000C board with a connection to a redundant mate TX board or to a network of other SIGTRAN devices. If you are using a PICMG 2.16 compliant chassis, a midplane Ethernet bus provides Ethernet connectivity.

- On-board memory

  Each TX 4000C board includes 128 MB of SDRAM.

- Trunk connectivity

  The TX 4000C board includes eight T1 or E1 network interfaces for digital trunk connectivity. NaturalAccess Signaling Software enables you to configure the board as either a T1 or an E1 board.

Refer to www.dialogic.com/declarations for a list of countries where Dialogic has obtained approval for the TX 4000C board, and for product updates.

Software components

TX 4000C boards require the following software components:

- Natural Access software development environment that provides services for call control, system configuration, voice store and forward, and other functions. Each service has a standard programming interface for developing applications. Refer to the *Natural Access Developer's Reference Manual* for more information.
- NaturalAccess Signaling Software that provides SS7 protocol layer executables and program interfaces for developing signaling and management applications. It also provides utilities that download configuration information to the TX boards and that control, monitor, and collect statistics on the SS7 protocol layer. Refer to the *Dialogic® NaturalAccess™ Signaling Software Configuration Manual* for more information.

Utilities and demonstration programs

NaturalAccess Signaling Software provides the following utilities and demonstration programs for the TX 4000C board. Run these utilities and programs from the *\Program Files\Dialogic\tx\bin* directory in Windows or from the */opt/dialogic/tx/bin* directory in UNIX. Refer to the *Dialogic™ TX Series SS7 Boards TX Utilities Manual* for more information about each utility.

Utility	Description
cpcon	Uses Natural Access to manage communication with the TX board. This utility is an operator console run from the command line. *cpcon* supports Hot Swap. If you want to bypass the Natural Access layer, use the *cpcon_* utility to monitor the TX operating system.
cplot	Loads communications processor tasks to TX boards.
cpmodel	Displays the board type for each installed TX board.
pcigetcfg	Obtains bus and slot information during software installation (UNIX only).
txalarm	Uses Natural Access to display and optionally log alarm messages generated by SS7 tasks running on all TX boards. *txalarm* supports Hot Swap. If you want to bypass the Natural Access layer, use the *txalarm_* utility to display and optionally log alarm messages.
txccode	Displays a text description of a completion code (error code) reported by a TX board.
txconfig	Configure TDM-based interfaces on TX 4000C boards. *ss7load* calls *txconfig* at board boot time. Refer to the *Dialogic® NaturalAccess™ Signaling Software Configuration Manual* for more information.
txcpcfg	Assigns CP numbers to TX boards based on bus and slot.
txdiag	Provides diagnostic information about TX boards.
txdump	Dumps the contents of the shared memory used for communication between the TX board and the host driver.
txeeprom	Displays information stored in the EEPROM.
txflash	Updates the operating system stored on the TX board Flash memory.
txinfo	Obtains detailed TX 4000C board information.
txlocate	Blinks the end bracket LEDs of a TX 4000C board.
txreset	Resets a TX board and reboots the board from the operating system image stored in Flash memory.
txsnap	Generates a core dump of a TX 4000C board, creating a snapshot file.
txstats	Displays statistics maintained by the TX device driver.

NaturalAccess Signaling Software provides the following programs in compiled and uncompiled form to demonstrate the usage of the TDM libraries. Refer to the *Dialogic® TX Series SS7 Boards TDM for SS7 Developer's Reference Manual* for information about these programs.

Program	Demonstrates how to...
t1demo	Test the T1/E1 and H.100/H.110 library functions with TX boards in a system.
t1stat	Receive unsolicited T1/E1 status messages and performance reports.
txdynamic	Dynamically switch SS7 links across TDM channels without rebooting the TX boards.
txsdemo	Use the TX SWI library. Use this program as a starting point to control switching on a TX 4000C board.

3 Installing the TX 4000C board

System requirements

To install and use the TX 4000C board, your system must have the following components:

- An available CompactPCI bus slot.
- At least 8 MB of memory (excluding operating system requirements).
- Natural Access software development environment.
- Dialogic™ NaturalAccess™ Signaling Software.
- A CompactPCI chassis with an H.110 compliant backplane.
- An uninterruptible power supply (UPS). Although a UPS is not strictly required, it is strongly recommended for increased system reliability.
- Cables to connect the board interfaces to T1 or E1 lines.
- A crossover Ethernet cable if you are connecting two TX boards for redundancy support using the external Ethernet connectors on a rear I/O transition board.
- Straight through Ethernet cables if you are connecting to an Ethernet hub or switch in a SIGTRAN network.

Warning: 	**Important safety notes for telephony connections:** • Allow only qualified technical personnel to install this board and the associated telephone wiring. • Make sure the PC chassis is grounded through the power cord or by other means before connecting the telephone line. • If your system requires an external power supply, make sure it is grounded through the power cord or by other means. • Never install telephone wiring during a lightning storm. • Never install telephone jacks in wet locations. • Telephone companies provide primary lightning protection for their telephone lines. If your site connects to private lines that leave the building, make sure that external protection is provided.

Installation summary

The following table summarizes the steps for initially installing the hardware and software components:

Step	Description	For details, refer to...
1	Ensure that your system meets the system requirements.	*System requirements* on page 15
2	Power down the system if it is running.	
3	Configure the TX 4000C board to enable Monitor mode if applicable.	*SS7 Monitor mode* on page 18
4	Install the rear I/O transition board into one of your computer's CompactPCI bus slots.	*Installing the board* on page 23
5	Install the TX 4000C board into the corresponding slot in the front of the chassis.	*Installing the board* on page 23
6	Power up the system.	
7	Install the Natural Access software.	The *Natural Access Installation* booklet and *Natural Access Developer's Reference Manual*
8	Install the Dialogic® NaturalAccess™ Signaling Software.	*Installing Dialogic® NaturalAccess™ Signaling Software* and *Dialogic® NaturalAccess™ Signaling Software Configuration Manual*
9	Assign a CP number for each TX 4000C board.	*Assigning a CP number* on page 28
10	Connect the board interfaces to T1 or E1 trunks.	*Connecting to the network* on page 37
11	Connect the Ethernet interfaces for board redundancy or to a SIGTRAN network, if applicable.	*Connecting TX boards for redundancy* on page 40
12	Verify that the TX 4000C board is operational.	*Verifying the board installation* on page 48

Caution:	The TX 4000C board is shipped in a protective anti-static container. Leave the board in its container until you are ready to install it. Handle the board carefully and hold it only by its edges. We recommend that you wear an anti-static wrist strap connected to a good earth ground whenever you handle the board.

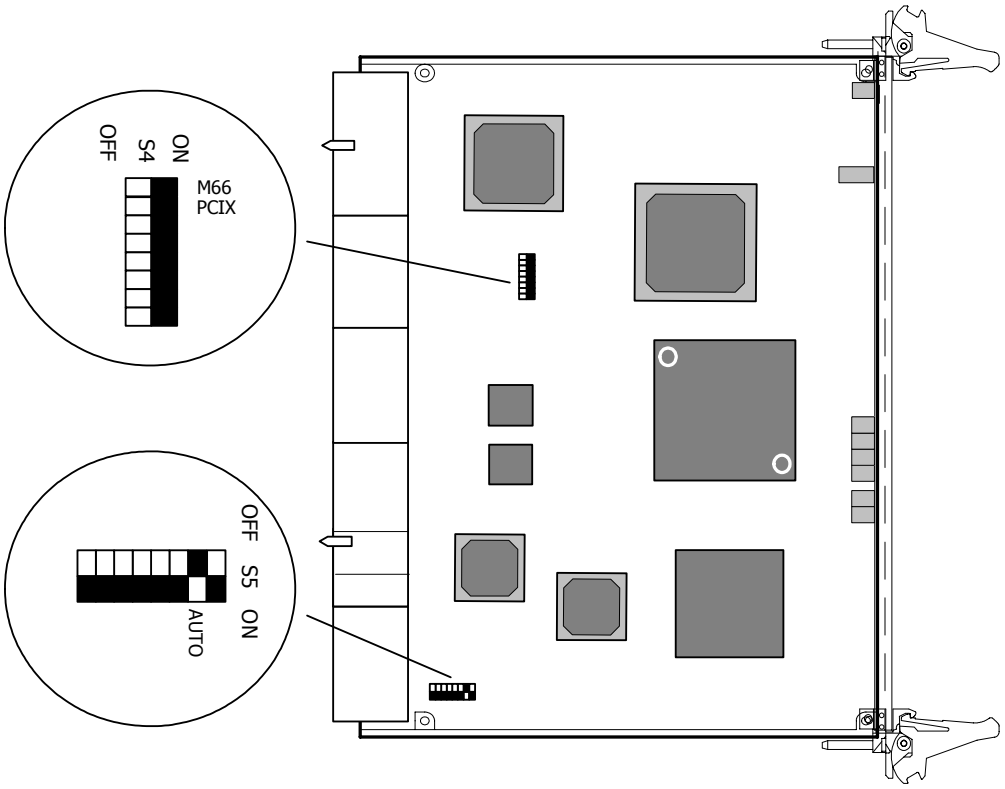
Configuring the hardware

This topic describes the ways in which you can change the TX 4000C board configuration:

- DIP switch S4
- DIP switch S5
- SS7 Monitor mode

DIP switch S4

TX 4000C DIP switches are located on the component side of the board, as shown in the following illustration:



DIP switch S4 enables you to hot swap the TX 4000C into an older CompactPCI chassis. By default, the eight switches of DIP switch S4 are set to the OFF position. For normal board operations, do not modify any of the S4 switch settings.

When switches M66 and PCIX are in the OFF position, the board is compliant with the CompactPCI Hot Swap Specification PICMG 2.1 R2.0. The board polls M66EN# and PCIXCAP# signals on the backplane during a Hot Swap insertion. If PCIXCAP# is logic high on the backplane, the TX 4000C board does not boot, and the blue Hot Swap LED remains illuminated until the PCI bus is reset. After a reset or during a cold boot, the TX 4000C board drives PCIXCAP# low and boots.

To hot swap the TX 4000C board into an older CompactPCI chassis that does not comply with the CompactPCI Hot Swap Specification PICMG 2.1 R2.0 requirements for PCIXCAP# and M66EN#, change switch M66 and switch PCIX to the ON position. Some older CompactPCI chassis do not have M66EN# and PCIXCAP# implemented correctly causing these signals to be high, even though the bus is not running PCI-X at 66 MHz. When switch M66 and switch PCIX are in the ON position, the board ignores M66EN# and PCIXCAP#. The board then boots, regardless of the state of the bus.

Caution:	Use caution when setting switch M66 and switch PCIX to the ON position. Setting these switches to the ON position causes the TX 4000C board to be non-compliant with the Hot Swap specification. The board can disrupt the PCI bus if it is hot swapped into a system with the bus segment running at PCI-X or at the wrong speed.

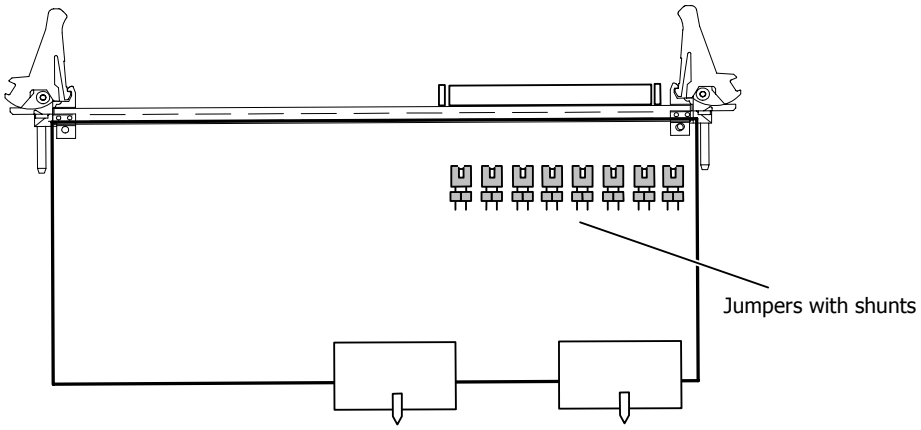
DIP switch S5

DIP switch S5 controls the operation of the board. By default, only switch 2 (AUTO) is set to the ON position; all other S5 switches are set to the OFF position. Switch 5 is reserved for future use. Do not modify the settings for this switch.

SS7 Monitor mode

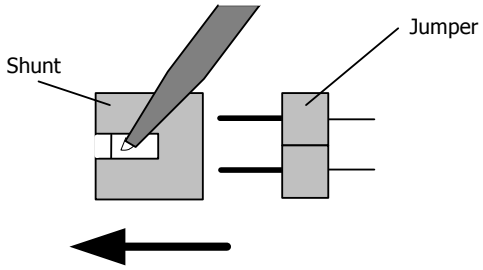
SS7 Monitor mode enables a TX board to become a passive listening device that monitors network traffic. When Monitor mode is disabled, the TX board is an active participant in the network.

The rear I/O transition board has eight jumpers with installed shunts that control the SS7 Monitor mode. The jumpers are located on the solder side of the board beneath the board cover. By default, SS7 Monitor mode on the TX board is disabled and all of the shunts are installed. The following illustration shows a rear I/O transition board with SS7 Monitor mode disabled:



To enable SS7 Monitor mode:

1. Remove the solder side cover from the rear I/O transition board by removing the two screws and releasing the press pins.
2. Remove the shunt from each of the eight jumpers with a small pointed object, such as a pen. Gently insert the point of the object into the small shunt opening, as shown in the following illustration, and disconnect it by moving the shunt away from the jumper.



For information about connecting the monitoring server (with an installed TX board) to the network and installing the SS7 Monitor software, refer to the *SS7 Monitor Developer's Reference Manual* and to the *SS7 Monitor Installation* instructions.

Keying the chassis

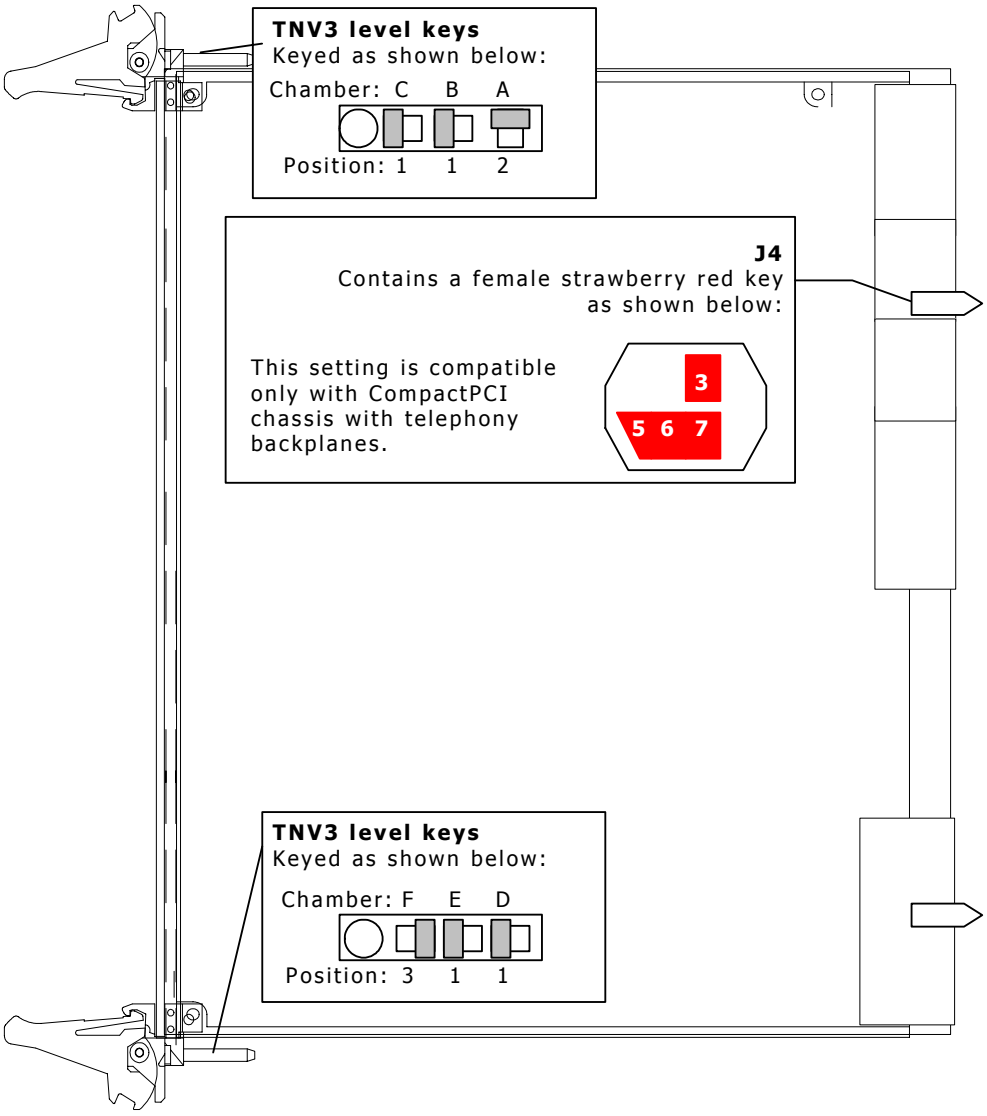
A TX 4000C has several mechanical interlocks, called keys, that prevent the board from being inserted in an incompatible chassis. Keying protects the board and other devices in the chassis from damage.

Before you install TX 4000C boards, configure the keying of your chassis so that it is compatible with the TX 4000C keying. This keying helps ensure that you do not accidentally insert an incompatible board in the chassis.

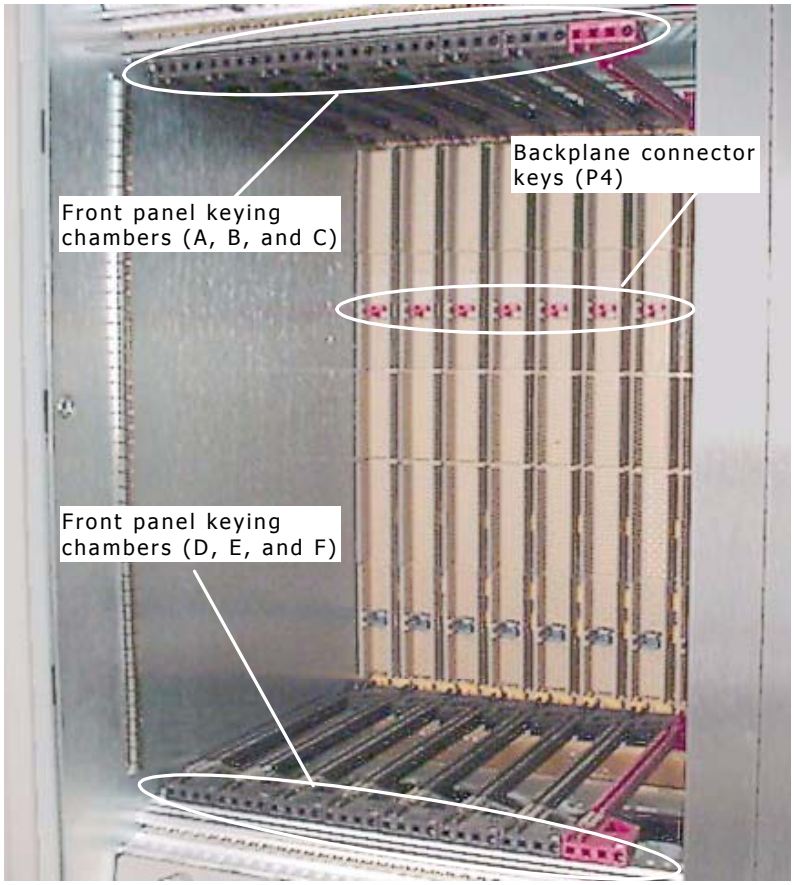
This topic describes how to key the slots in your chassis for TX 4000C boards. For detailed information about CompactPCI chassis keying, refer to the *CompactPCI Computer Telephony Specification PICMG 2.5 R1.0* and to the *IEEE 1101.10*.

Warning: 	To protect yourself and your equipment, allow only qualified personnel to install keying. The personnel must be familiar with the CompactPCI Computer Telephony Specification PICMG 2.5, R1.0 document. Dialogic is not responsible if you install a board and chassis keying has not been properly installed.

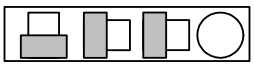
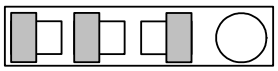
The following illustration shows how the TX 4000C board keys are configured:



The following illustration shows some of the keying chambers in a CompactPCI chassis that you must configure for a TX 4000C. You must also key rear keying chambers A through F that are not shown.



Configure keying in your chassis as described in the following table:

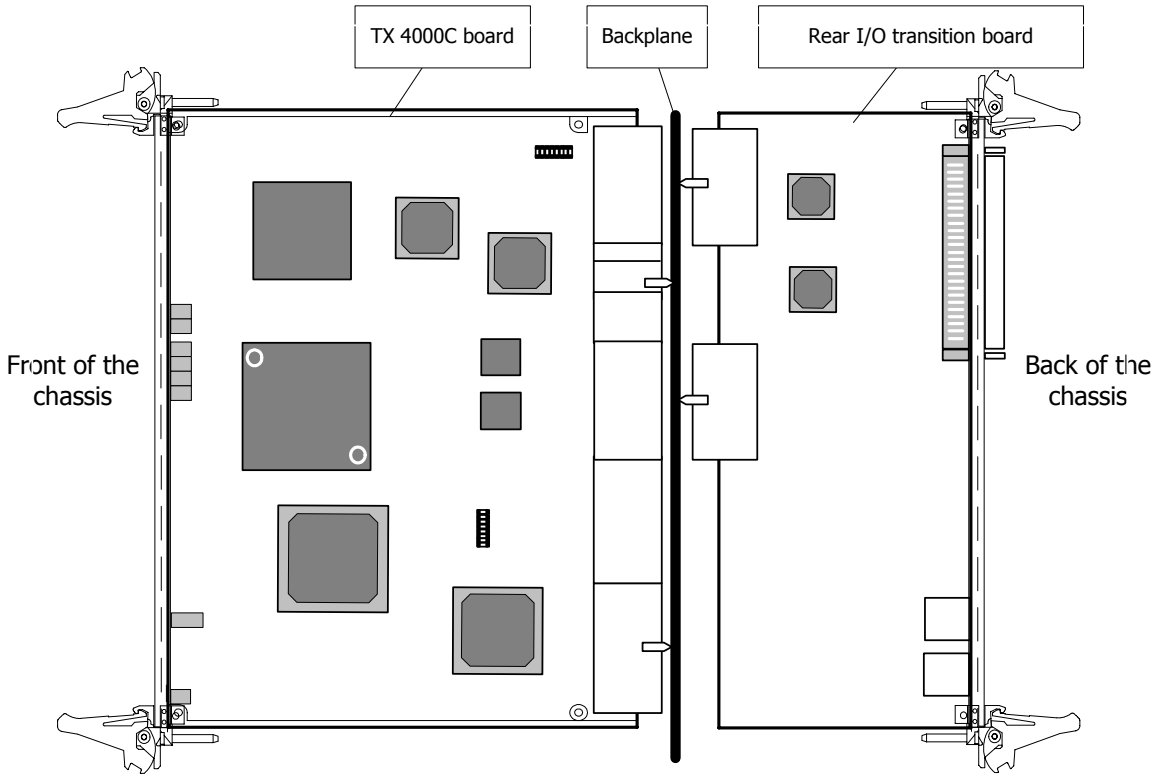
Keying chambers on chassis	Board configuration	Rear I/O transition board configuration
A, B, and C (Front and rear)	Configure as shown: Chamber: A B C  Position: 2 1 1	**A B C** 2 1 1 (on PICMG 2.16 board) 1 4 No key (on rear Ethernet I/O board)
D, E, and F (Front and rear)	Configure as shown: Chamber: D E F  Position: 1 1 3	**D E F** 1 1 3 (on both board types)
P4	Verify that the male strawberry red key is configured as shown: 	

Installing the board

To install a TX 4000C board, complete the following steps:

Step	Action
1	Power down the chassis and disconnect it from the power source. This step is suggested for new configurations.
2	Remove the rear access panel. You must install the rear I/O transition board before installing the TX 4000C board.
3	Verify that the chassis slot has the appropriate keying as described in *Keying the chassis* on page 19.
4	Slide the rear I/O transition board into a slot at the rear of the chassis. **Caution:** Some older CompactPCI chassis may not have a rear connector alignment feature. The rear I/O transition board requires this feature to allow insertion. Contact the chassis manufacturer to find out if your chassis supports this rear alignment feature. Use caution when inserting the board into the backplane mating connector.
5	Seat the rear I/O transition board by rotating the top and bottom handles.
6	Fasten the transition board to the chassis with the screws on the upper and lower handles.
7	Slide the TX 4000C board into the corresponding slot in the front of the chassis.
8	Seat the TX 4000C board into the backplane by rotating the top and bottom handles toward each other.
9	Fasten the board to the chassis with the screws on the upper and lower handles.
10	Replace the covers and connect the chassis to its power source.

The following illustration shows how the TX 40000C board and the rear I/O transition board sit in the chassis:



Using the Hot Swap features

Hot Swap operates only if the Hot Swap Driver and Hot Swap Manager are started. To learn how to start these modules, refer to the *NMS OAM System User's Manual*.

Under some versions of Windows, you must also install additional drivers to allow the Hot Swap drivers to interact properly with Windows Plug and Play functionality. These drivers are available with Natural Access.

Once the Hot Swap Driver and Manager are started, boards defined in the NMS OAM database can be booted, extracted, and reinserted. Boards inserted into a PCI bus and slot for which no logical board definition exists in the database are not recognized. For more information about configuring Hot Swap, refer to the *NMS OAM System User's Manual*.

Caution:	Always remove or power down the TX 4000C board before removing or replacing the rear I/O transition board.

Complete the following steps to extract a TX 4000C board when Hot Swap is active:

Step	Action
1	Remove the cover.
2	Loosen the screws on the upper and lower handles that secure the TX 4000C board to the chassis.
3	Rotate the upper and lower handles of the TX 4000C board away from each other. **Caution:** Before removing the TX board from the slot, wait for the blue Hot Swap LED to illuminate. The blue LED indicates that the system has been notified, and that the TX board can be safely removed.
4	Carefully slide the TX board out of the slot.
5	If you are removing or replacing the rear I/O transition board, loosen the screws on the upper and lower handles and rotate the handles away from each other. Slide the rear I/O transition board out of the slot.

Complete the following steps to reinsert a TX 4000C board:

Step	Action
1	If you removed the rear I/O transition board, slide the rear I/O transition board into the slot at the rear of the chassis, seat it by rotating the upper and lower handles, and tighten the screws that secure the board to the chassis. **Note:** You must reinstall the rear I/O transition board before reinstalling the TX 4000C board.
2	Slide the TX 4000C board into the corresponding slot in the front of the chassis.
3	Seat the TX 4000C board into the backplane by rotating the upper and lower handles toward each other.
4	Fasten the board to the chassis with the screws on the upper and lower handles.
5	Replace the cover.

4 Configuring the TX 4000C board

Using the configuration utility

After you install the TX 4000C board and the NaturalAccess Signaling Software, you must assign a CP number to each TX 4000C board. Verify that you have completed the steps described in the *Installation summary* on page 16 before you proceed to *Assigning a CP number* on page 28.

To assign a CP number, you will use the *txcpcfg* utility. Depending on the operating environment, the *txcpcfg* utility is located in one of the following directories:

Operating system	Directory
Windows	*\Program Files\Dialogic\tx\bin*
UNIX	*/opt/dialogic/tx/bin/*

txcpcfg enables you to make the following types of changes to the configuration information:

- Assign a CP number
- Add a board
- Change a CP number
- Move a board
- Remove a board
- Save configuration changes

For more information on *txcpcfg*, refer to the *Dialogic® TX Series SS7 Boards TX Utilities Manual*.

Assigning a CP number

Complete the following steps to assign a CP number to an installed TX board:

Step	Action
1	Power up the system if it is not running. In a Windows system, the Windows New Hardware Wizard appears and prompts you for the files required to activate the SS7 drivers. Refer to *Installing Dialogic® NaturalAccess™ Signaling Software* for detailed information.

2	At the prompt, invoke *txcpcfg* by entering the following command:
	`txcpcfg`
	txcpcfg displays the bus number, slot number, CP number, and CP model of boards that are present and configured. Only the bus number, slot number, and CP model type identify the board that you are currently configuring. The CP number is undefined. For example:
	`Bus Slot CP Number CP Model`
	`2 2 1 TX 4000`
	`2 4 2 TX 4000`
	`2 6 UNDEFINED TX 4000`

3	Record the bus and slot values for the undefined TX 4000C board.
4	Assign a unique CP number to each undefined board by entering the following command: `txcpcfg` ***bus slot unique_CP_number*** where • ***bus*** is the bus number of the TX 4000C board that you are configuring. • ***slot*** is the slot number of the TX 4000C board that you are configuring. • ***unique_CP_number*** is a number you assign. Valid CP numbers within the system start at 1 and must be unique. They do not have to be consecutive. For example, enter the following command to assign a CP number of 3 for the board with a bus number of 2 and a slot number of 6: `txcpcfg 2 6 3`

5	Verify the configuration of all of the TX boards by entering the following command:
	`txcpcfg`
	In this example if you assign the new board a unique CP number of 3, the following configuration information is displayed:
	`Bus Slot CP Number CP Model`
	`2 2 1 TX 4000`
	`2 4 2 TX 4000`
	`2 6` **`3`** `TX` ***`nnnn`***
	where ***nnnn*** is 4000 for a TX 4000, TX 4000/20, TX 4000C, or TX 4000/20C board.

6	Save the configuration changes. In a Windows system, configuration changes are saved automatically. In a UNIX system, configuration changes are deleted when you restart the system. Save the changes by editing the *cpcfg* file as described in *Saving configuration changes* on page 33.

Adding a board

Complete the following steps to add a new undefined TX 4000C board:

Step	Action
1	Power down the system if it is running.
2	Insert the TX 4000C board, seating it firmly in an available slot.
3	Power up the system. If you are installing a TX 4000C board in a Windows system for the first time, the Windows New Hardware Wizard appears and prompts you for the files required to activate the SS7 drivers. Refer to *Installing Dialogic® NaturalAccess™ Signaling Software* for detailed information. If you are installing an additional TX 4000C board in a slot that has never held a TX 4000C board, the Windows New Hardware Wizard appears, finds the required files, and exits.

4	At the prompt, invoke *txcpcfg* by entering the following command:
	`txcpcfg`
	txcpcfg displays the bus number, slot number, CP number, and CP model of boards that are present and configured. Only the bus number, slot number, and CP model type identify the board that you are currently adding. The CP number is undefined. For example:
	`Bus Slot CP Number CP Model`
	`2 2 1 TX 4000`
	`2 4 2 TX 4000`
	`2 6 UNDEFINED TX 4000`

5	Record the bus and slot values for the new undefined TX 4000C board.
6	Assign a unique CP number to each undefined board by entering the following command: `txcpcfg` ***bus slot unique_CP_number*** where • ***bus*** is the bus number of the TX 4000C board that you are configuring. • ***slot*** is the slot number of the TX 4000C board that you are configuring. • ***unique_CP_number*** is a number you assign. Valid CP numbers within the system start at 1 and must be unique. They do not have to be consecutive. For example, enter the following command to assign a CP number of 3 for the board with a bus number of 2 and a slot number of 6: `txcpcfg 2 6 3`

7	Verify the configuration of all of the TX boards by entering the following command:
	`txcpcfg`
	In this example, if you assign the new board a unique CP number of 3, the following configuration information is displayed:
	`Bus Slot CP Number CP Model`
	`2 2 1 TX 4000`
	`2 4 2 TX 4000`
	`2 6 3 TX nnnn`
	where ***nnnn*** is 4000 for a TX 4000, TX 4000/20, TX 4000C, or TX 4000/20C board.

Step	Action
8	Save the configuration changes. In a Windows system, configuration changes are saved automatically. In a UNIX system, configuration changes are deleted when you restart the system. Save the changes by editing the *cpcfg* file as described in *Saving configuration changes* on page 33.

Changing a CP number

Complete the following steps to change the CP number of a TX board:

Step	Action

1	At the prompt, invoke *txcpcfg* by entering the following command:
	`txcpcfg`
	txcpcfg displays the bus number, slot number, CP number, and CP model of all the TX boards that are present and configured.
	`Bus  Slot  CP Number  CP Model`
	`2  2  1  TX 4000`
	`2  4  2  TX 4000`
	`2  6  3  TX nnnn`
	where ***nnnn*** is 4000 for a TX 4000, TX 4000/20, TX 4000C, or TX 4000/20C board.

2	Record the bus and slot values for the TX 4000C board that you are updating.

3	Change the CP number of a board by entering the following command with the updated CP number:
	`txcpcfg  bus slot updated_CP_number`
	where
	• ***bus*** is the bus number of the TX 4000C board that you are configuring.
	• ***slot*** is the slot number of the TX 4000C board that you are configuring.
	• ***unique_CP_number*** is a number you assign. Valid CP numbers within the system start at 1 and must be unique. They do not have to be consecutive.
	For example, enter the following command to change a CP number of 3 to a CP number of 4 for the board with a bus number of 2 and a slot number of 6:
	`txcpcfg  2  6  4`

4	Verify the configuration change by entering the following command:
	`txcpcfg`
	txcpcfg displays configuration information for the board. The following example indicates a CP number of 4 for the TX board with a bus number of 2 and a slot number of 6:
	`Bus  Slot  CP Number  CP Model`
	`2  2  1  TX 4000`
	`2  4  2  TX 4000`
	`2  6  4  TX nnnn`
	where ***nnnn*** is 4000 for a TX 4000, TX 4000/20, TX 4000C, or TX 4000/20C board.

5	Save the configuration changes. In a Windows system, configuration changes are saved automatically. In a UNIX system, configuration changes are deleted when you restart the system. Save the changes by editing the *cpcfg* file as described in *Saving configuration changes* on page 33.

Moving a board

Complete the following steps to move a TX board from one slot to another slot:

Step	Action
1	Power down the system if it is running. **Note:** To extract a board when Hot Swap is active, refer to *Using the Hot Swap features* on page 25.
2	Move the TX 4000C board from one slot to another slot, seating it firmly in the new slot.
3	If Hot Swap is not active, power up the system. In a Windows system: If you are installing a TX 4000C board in a slot that has never held a TX 4000C board, the Windows New Hardware Wizard appears, finds the required files, and exits.

4	At the prompt, invoke *txcpcfg* by entering the following command:
	`txcpcfg`
	txcpcfg displays the bus number, slot number, CP number, and CP model of boards that are present and configured. Only the bus number, slot number, and CP model type identify the board that you are currently configuring. The CP number is undefined. For example:
	`Bus Slot CP Number CP Model`
	`2 2 1 TX 4000`
	`2 4 2 TX 4000`
	`2 8 UNDEFINED TX 4000`

5	Record the bus and slot values for the TX 4000C board that you moved.
6	Assign a unique CP number to the undefined board by entering the following command: `txcpcfg` ***bus slot unique_CP_number*** where • ***bus*** is the bus number of the TX 4000C board that you are configuring. • ***slot*** is the slot number of the TX 4000C board that you are configuring. • ***unique_CP_number*** is a number you assign. Valid CP numbers within the system start at 1 and must be unique. They do not have to be consecutive. For example, enter the following command to assign a CP number of 3 for the board with a bus number of 2 and a slot number of 8: `txcpcfg 2 8 3`

7	Verify the configuration change by entering the following command:
	`txcpcfg`
	txcpcfg displays configuration information. The following example indicates a CP number of 3 for the TX board with a bus number of 2 and a slot number of 8:
	`Bus Slot CP Number CP Model`
	`2 2 1 TX 4000`
	`2 4 2 TX 4000`
	`2 8 3 TX nnnn`
	where ***nnnn*** is 4000 for a TX 4000, TX 4000/20, TX 4000C, or TX 4000/20C board.

Step	Action
8	Save the configuration changes. In a Windows system, configuration changes are saved automatically. In a UNIX system, configuration changes are deleted when you restart the system. Save the changes by editing the *cpcfg* file as described in *Saving configuration changes* on page 33.

Removing a board

Complete the following steps to remove a TX board from the system:

Step	Action
1	Power down the system if it is running. **Note:** To extract a board when Hot Swap is active, refer to *Using the Hot Swap features* on page 25.
2	Remove the TX 4000C board from the slot.
3	If Hot Swap is not active, power up the system.

4	Verify the configuration change by entering the following command:
	`txcpcfg`
	For example, if you remove a TX board with a CP number of 2, no configuration information for the removed board is displayed, as in the following example:
	`Bus  Slot  CP Number  CP Model`
	`2  2  1  TX 4000`
	`2  8  3  TX 4000`

5	Save the configuration changes. In a Windows system, configuration changes are saved automatically. In a UNIX system, configuration changes are deleted when you restart the system. Save the changes by editing the *cpcfg* file as described in *Saving configuration changes* on page 33.

Saving configuration changes

In a Windows system, any changes that you make to the configuration information with the *txcpcfg* utility are saved automatically.

In a UNIX system, changes that you make to the configuration information with the *txcpcfg* utility are deleted when you restart the system. Save the changes by editing the *cpcfg* file as described in the following procedure:

Step	Action

1	At the prompt in the UNIX system, view the current configuration updates by entering the following command:
	`txcpcfg`
	txcpcfg displays the bus number, slot number, CP number, and CP model type of each TX board in the system. For example:
	`Bus Slot CP Number CP Model`
	`2 2 1 TX 4000`
	`2 8 3 TX 4000`

2	Using a text editor, open the */opt/nmstx/bin/cpcfg* file. The file contains the original configuration information that existed before you ran the *txcpcfg* utility and made changes. For example:
	`# Command Bus Slot CP Number`
	`txcpcfg 2 2 1`
	`txcpcfg 2 8 2`
	Note: The *cpcfg* file does not specify the CP model type. The model type is automatically determined each time the host operating system is booted.

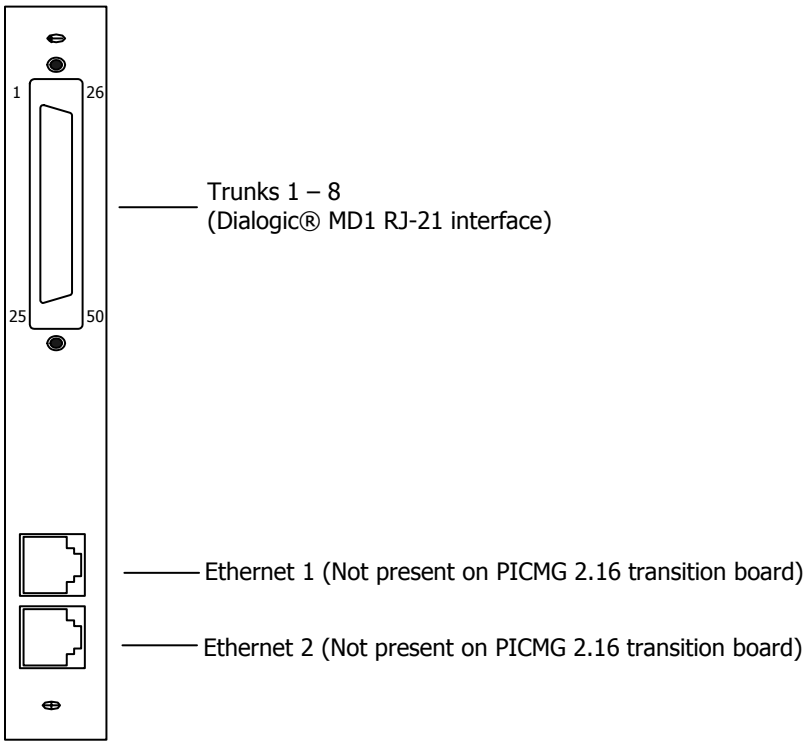
3	Following the *cpcfg* file format, edit the entry in the *cpcfg* file for the TX board CP number that you are updating. If you are adding a new board, add a new txcpcfg entry to the *cpcfg* file.
	Continuing with the example in step 1, the board with a CP number of 2 is updated to reflect the new CP number of 3.
	`# Command Bus Slot CP Number`
	`txcpcfg 2 2 1`
	`txcpcfg 2 8 3`

4	Save and close the *cpcfg* file. The *cpcfg* script executes as part of the boot process and applies the new configuration settings.

5 Establishing network connections

Connectors and cables

The rear I/O transition board associated with the TX 4000C board has a T1/E1 trunk connector and up to two Ethernet interfaces on the end bracket:



Dialogic® MD1 RJ-21 interface

The TX 4000C board uses a Dialogic® MD1 RJ-21 interface to connect the board to the network. The following table provides the Dialogic® MD1 RJ-21 interface pin assignments:

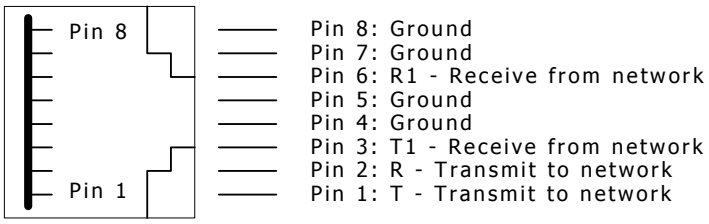
Trunk	Transmit to network pin assignments		Receive from network pin assignments	
	Ring	Tip	Ring	Tip
1 and 9	1	26	2	27
2 and 10	3	28	4	29
3 and 11	5	30	6	31
4 and 12	7	32	8	33
5 and 13	9	34	10	35
6 and 14	11	36	12	37
7 and 15	13	38	14	39
8 and 16	15	40	16	41
Not used	17 through 25 42 through 50			

For more information about trunk connections, refer to the *Dialogic® NaturalAccess™ Signaling Software Configuration Manual*.

Ethernet interface

The TX 4000C board has two 10/100Base-T Ethernet interfaces that are located on the rear I/O transition board. These interfaces provide Ethernet connections that support auto-negotiation for 100Base-T full duplex/half duplex and 10Base-T full duplex/half duplex transmission. They also provide a high-speed interface for connecting a TX 4000C board to either its redundant mate board or to a network of other SIGTRAN devices. Refer to *Connecting TX boards for redundancy* on page 40 for more information.

The following illustration shows the pinouts of the RJ-45 Ethernet interface:



Pins 4, 5, 7, and 8 are grounded through a spark gap for 100Base-T Ethernet connections

Connecting to the network

Before connecting a TX 4000C board to the network, ensure that you have properly configured the trunks as either T1 or E1 trunks. For configuration information, refer to the *Dialogic® NaturalAccess™ Signaling Software Configuration Manual*.

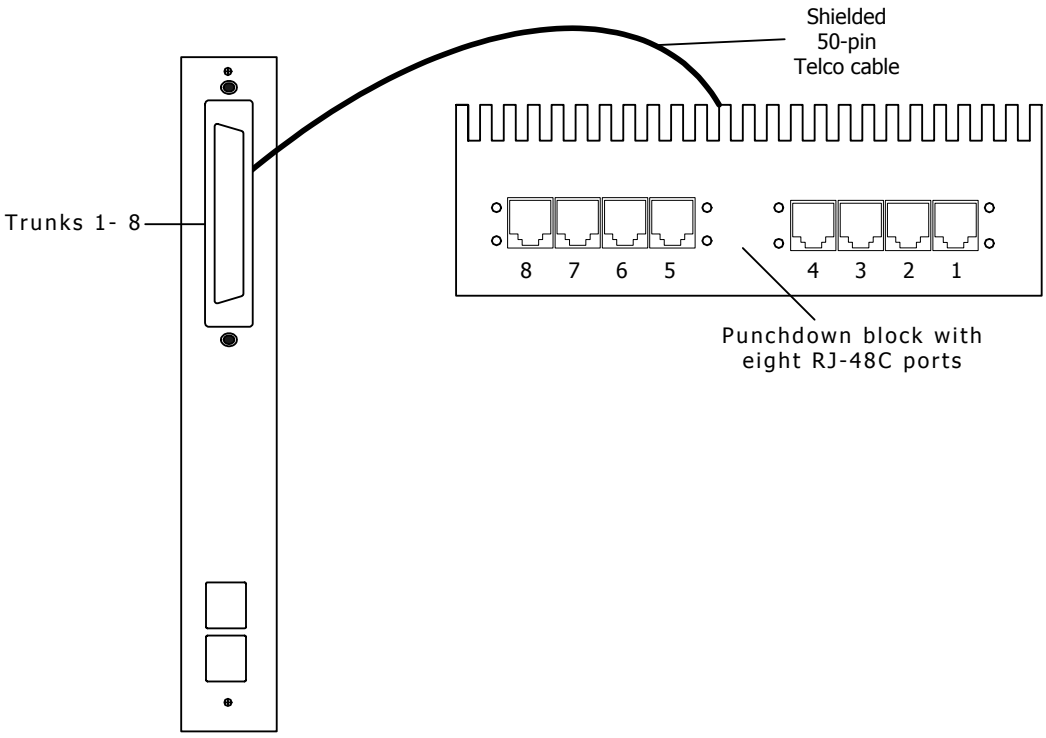
Caution:	Dialogic Corporation obtains board-level approval certificates for supported countries. Some countries require that you obtain system-level approvals for boards connected to the public network. To learn what approvals you require, contact the appropriate regulatory authority in the target country.

Use a shielded 50-pin Telco cable to connect a TX 4000C board to a T1 network or to an E1 120 ohm trunk. Connect the Telco cable to a punchdown block. Failure to use a shielded cable may negate Class B approval.

To connect a TX 4000C board to a 75 ohm E1 trunk, configure the board as E1 120 ohm and connect a shielded 50-pin Telco cable to a punchdown block or SEP. Connect the punchdown block or SEP to a 75 ohm BNC signal entry panel or equivalent to convert the impedance from 120 to 75 ohm.

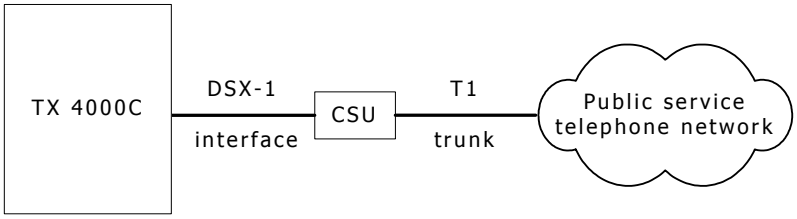
For information about the products available for connecting and terminating Dialogic boards, contact your Dialogic Services and Support representative.

The following illustration shows a TX 4000C board connecting to a punchdown block:



T1 network considerations

For typical T1 communications, each trunk interface connects to a channel service unit (CSU) that is connected to a T1 trunk line. The CSU provides a DSX-1 interface to the T1 line and also contains circuitry that enables the Central Office (CO) to perform diagnostic tests remotely. The following illustration shows the TX 4000C trunk interface with the CSU:



Note: Trunks do not synchronize until the board is booted with a valid T1 configuration.

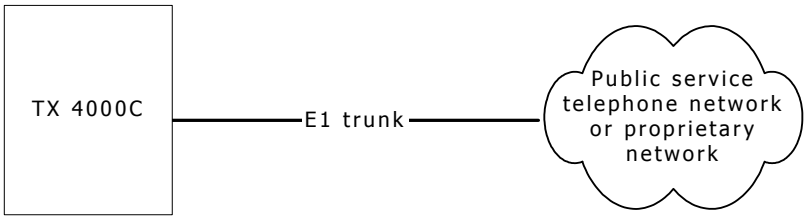
You can purchase or lease the CSU from the telephone company or other vendor. The CSU must be compatible with DSX-1 specifications.

Warning:	**Important safety notes for telephony connections:**
	Use a channel service unit (CSU) to isolate the cables attached to this product before the cables leave the building.

To avoid causing T1 service provider alarms, make sure that the board always sends a valid signal, either by looping back at the CSU or by connecting the CSU to a functioning TX 4000C board. The best way to provide a loopback is to unplug the cable from the TX board to the CSU. The modular connector on most CSUs loops back the transmit signal to the receive signal when nothing is plugged in.

E1 network considerations

TX 4000C boards have as many as eight CEPT E1 trunk interfaces. For typical E1 communications, each E1 interface connects directly to an E1 trunk, as shown in the following illustration:



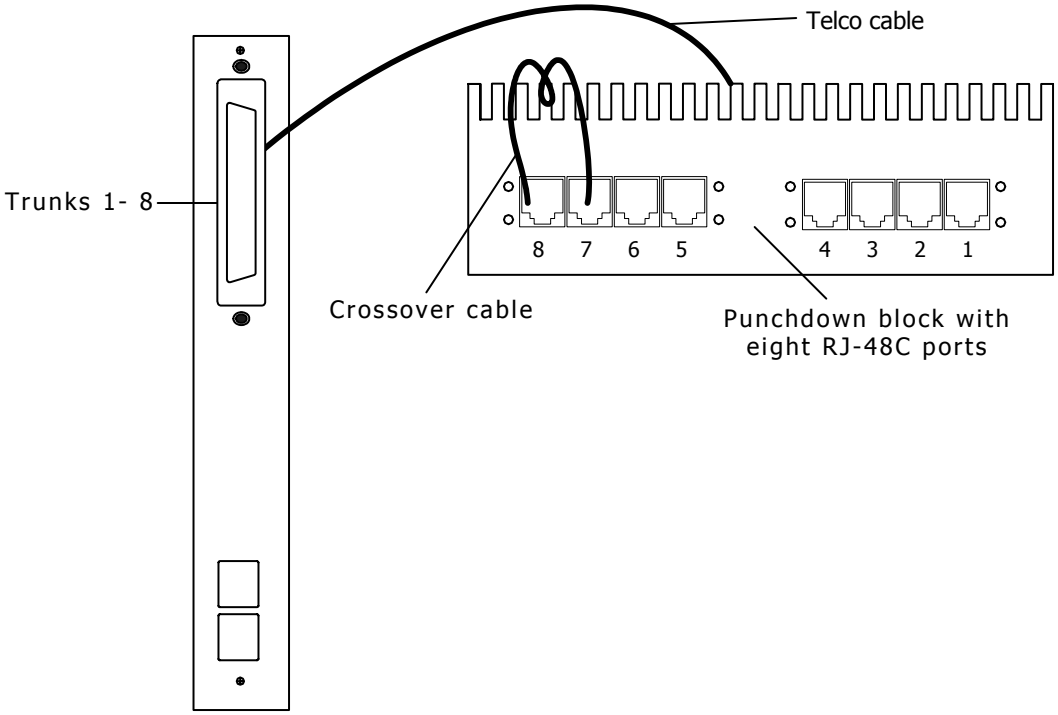
Note: Trunks do not synchronize until the board is booted with a valid E1 configuration.

Testing in loopback mode

Use a loopback configuration for your TX 4000C board to test your digital trunk application without actually connecting to the telephone network.

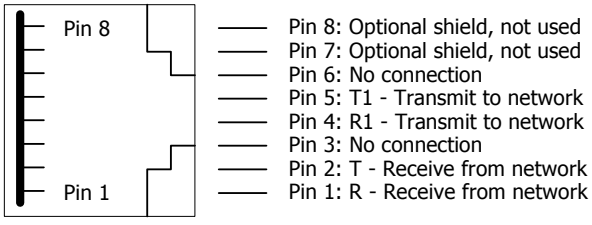
Use a punchdown block with eight RJ-48C trunk connectors and a crossover cable to set up the loopback configuration. Connect the cable from the TX 4000C to the punchdown block and then to the loopback cable on the punchdown block.

The following illustration shows the TX 4000C loopback configuration with a punchdown block connecting trunks 7 and 8 using crossover cables:

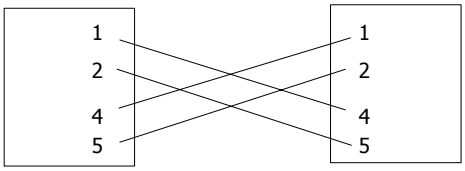


The crossover cable connects the transmit signals from one trunk to the receive signals on another trunk as shown in the illustration.

Each of the RJ-48C trunk interfaces has the pinouts shown in the following illustration:



The following illustration shows how the connector is wired on a loopback cable:



Connecting TX boards for redundancy

Use the redundancy feature to enable the system to detect and recover from the failure of signaling links on a TX 4000C board, the failure of a signaling node, or the failure of the TX 4000C board itself.

In a redundant configuration, each pair of TX boards is connected through a private Ethernet connection. If other devices are connected to the private Ethernet link, avoid overloading the link. Packets can be lost between the redundant TX boards if the connection is overloaded.

This topic describes dual-node redundant signaling and single-node redundant signaling for the following types of configurations:

- TDM configuration
- IP network configuration

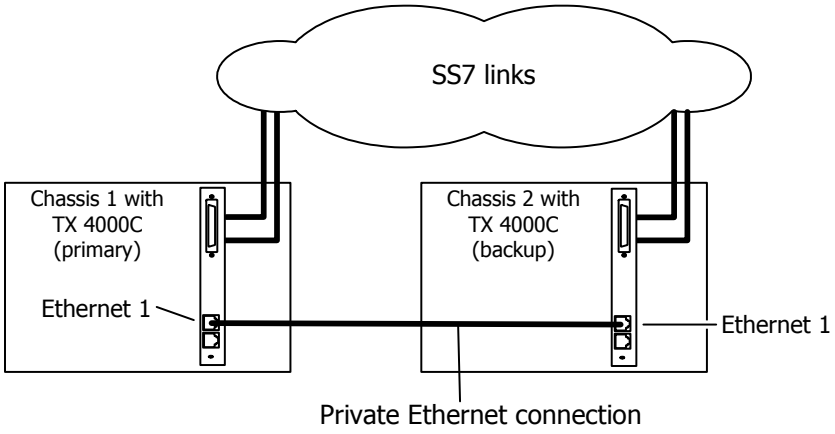
TDM configuration

To connect a TX 4000C board to its redundant mate in a TDM configuration, use a Category 5 shielded twisted pair (STP) crossover cable. With the crossover cable, connect Ethernet 1 on the primary board to Ethernet 1 on the backup board.

You must specify the IP address of the TX board's redundant mate using the mate command in the *txconfig* utility. For more information, refer to the *Dialogic® NaturalAccess™ Signaling Software Configuration Manual*.

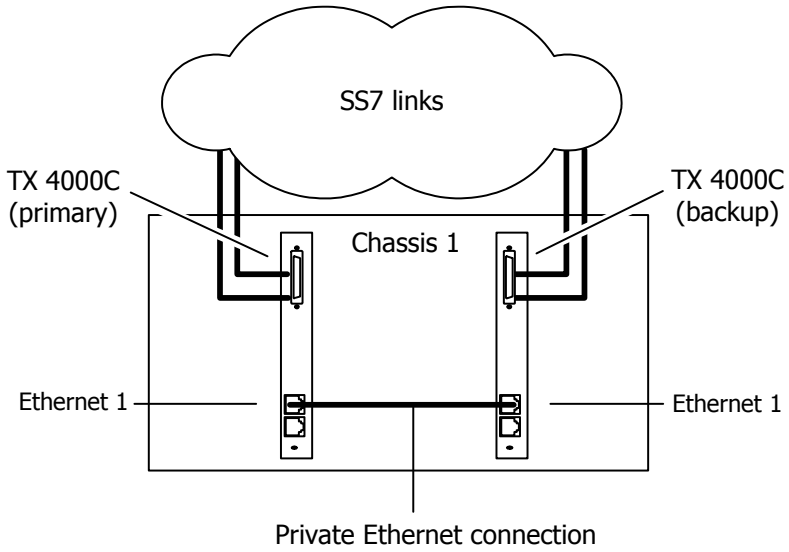
Dual-node redundant signaling server

The following illustration shows how to set up two TX 4000C boards based on a dual-node redundant signaling server in a TDM configuration. The boards are located in two separate chassis to ensure board-level and system-level redundancy.



Single-node redundant signaling server

The following illustration shows how to set up two TX 4000C boards based on the single-node signaling server in a TDM configuration. The boards are located in the same chassis to ensure board-level redundancy.



IP network configuration

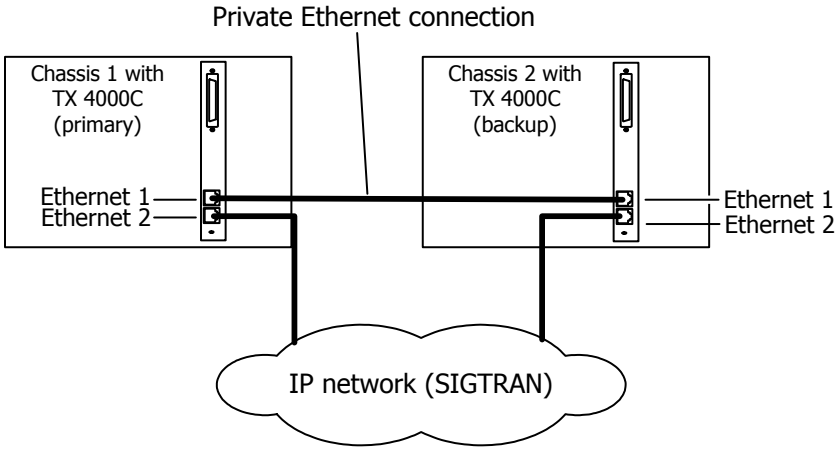
To connect a TX 4000C board to its redundant mate in an IP network configuration, use a Category 5 shielded twisted pair (STP) crossover cable. Using the crossover cable, connect Ethernet 1 on the primary board to Ethernet 1 on the backup board. Using standard Ethernet cables, connect the Ethernet 2 connectors on both boards to the IP network connectors.

Note: Dialogic recommends using a private Ethernet link to connect the redundant boards to avoid loss or delay of vital checkpoint messages. However, if each board in the redundant pair requires multi-homing, you can use Ethernet 1 for both the redundant pathway and for SIGTRAN network access. In this configuration, the Ethernet 1 on each board is connected to what is shown as an IP network cloud in the illustrations that follow (just as the Ethernet 2 connectors are). Be aware that this greatly increases the chance of lost or delayed checkpoint messages which can result in the backup having outdated information.

You must specify the IP address of the TX board's redundant mate using the mate command in the *txconfig* utility. For more information, refer to the *Dialogic® NaturalAccess™ Signaling Software Configuration Manual*.

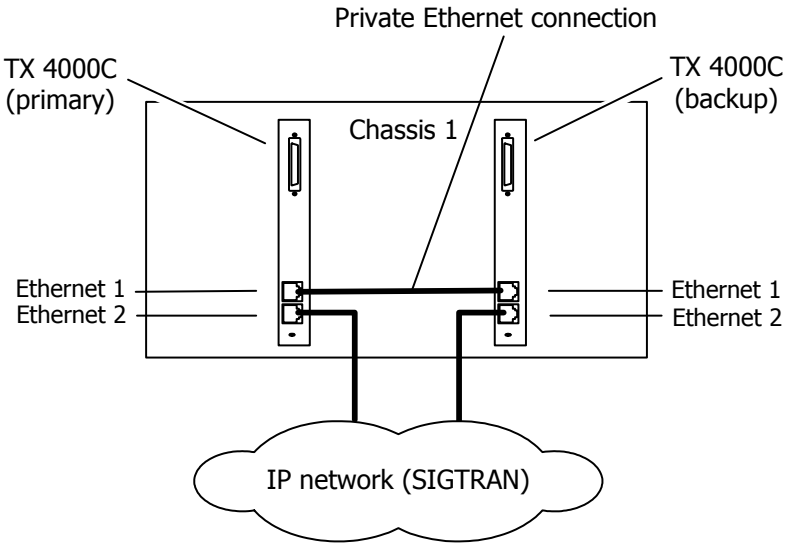
Dual-node redundant signaling server

The following illustration shows how to set up two TX 4000C boards based on a dual-node redundant signaling server in an IP network configuration. The boards are located in two separate chassis to ensure board-level and system-level redundancy.



Single-node redundant signaling server

The following illustration shows how to set up two TX 4000C boards based on a single-node signaling server in an IP network configuration. The boards are located in the same chassis to ensure board-level redundancy.

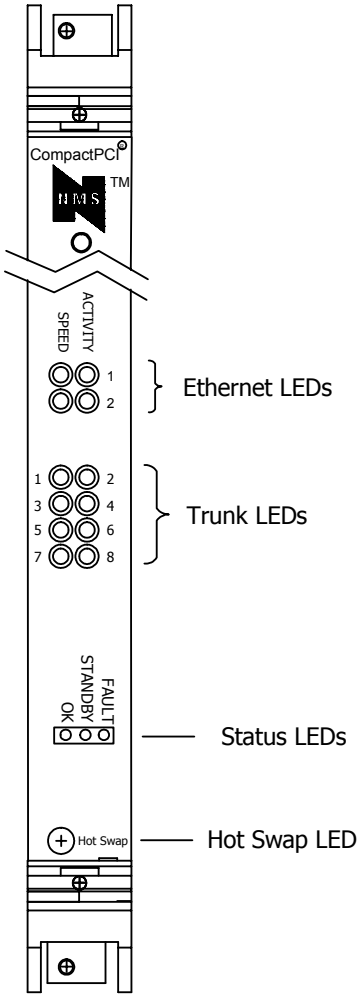


For more information on SS7 redundancy, refer to the *Dialogic® TX Series SS7 Boards Health Management Developer's Reference Manual*.

6 Verifying the installation

End bracket LEDs

The following illustration shows the TX 4000C end bracket LEDs:



Ethernet LEDs

The TX 4000C board provides two LEDs to indicate the status of each Ethernet interface. The following table describes the functionality of each LED:

LED	Description
ACTIVITY	Indicates the status of the Ethernet link. When the Ethernet link has established link integrity, the LED is on and steady. It also indicates the transmitting and receiving activity on the link. When activity is present on the Ethernet link, the LED flickers.
SPEED	Indicates the data rate of the Ethernet link. When the LED is on, the data rate is 100 Mb. When the LED is off, the data rate is 10 Mb. The LED is used only when a reliable Ethernet connection has been established. (The ACTIVITY LED is on.)

Trunk LEDs

The TX 4000C board has one green indicator (LED) for each trunk on the end bracket of the board. Only LEDs for available trunks are lit. The green LED indicates that proper frame synchronization between the trunk and network has been established: all required framing alignment has been found. This LED blinks if one or more of the following conditions exist:

- All ones alarm (AIS)
- Loss of frame
- Loss of signaling multiframe
- CRC errors (when the board is configured for HDB3)
- Red or yellow alarm of a Status LED

Status LEDs

The status LEDs indicate the state of the board. The following table describes the function of each LED:

LED label	Description
OK	Illuminated green and steady. The board is functioning as expected.
Standby	Illuminated yellow during board initialization. When the board is successfully initialized, the LED turns off.
Fault	Illuminated red. An error condition exists.

Hot Swap LED

The Hot Swap LED (blue) illuminates when it is safe to remove the TX 4000C board from the system. The LED illuminates under one of the following conditions:

- If the board is fully inserted when the backplane is powered up, the blue LED momentarily flashes. This is a normal part of the initialization process.
- After you open the handles during the extraction process, the blue LED illuminates to indicate that it is safe to remove the board. Do not remove the board until the LED illuminates. This LED illuminates only if Hot Swap software is present and enabled.
- If the blue LED remains illuminated after you insert the board and close the handles, the board failed to successfully perform its primary hardware initialization. It is safe to remove the board; however this condition indicates a problem. Refer to *DIP switch S4* on page 17 and verify the settings.

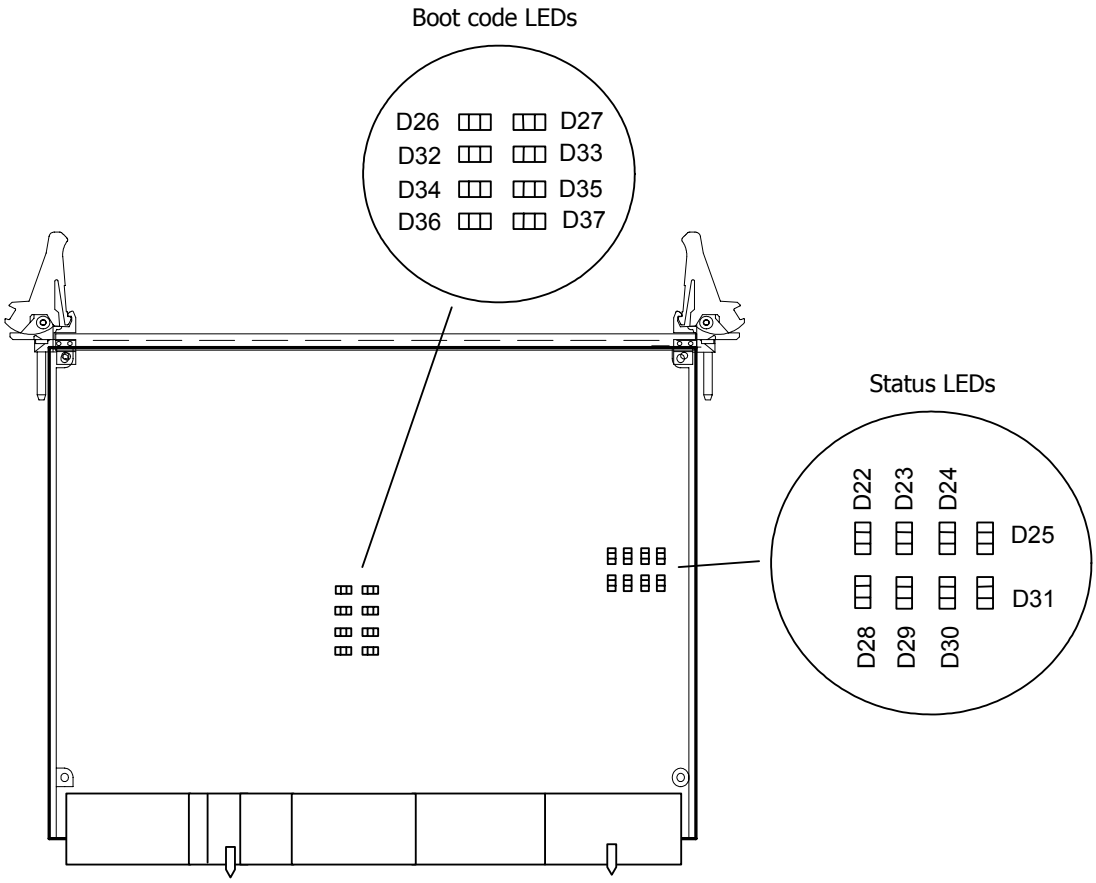
The Hot Swap operation is defined in the *CompactPCI Hot Swap Specification PICMG 2.1 R1.0*.

Caution:	Always remove or power down the TX 4000C board before removing or replacing the rear I/O transition board.

Board status LEDs

In addition to end bracket LEDs, the following banks of LEDs (D22-D37) located on the solder side of the TX 4000C board indicate the current status of the board:

- Boot code LEDs
- Status LEDs



Boot code LEDS

The boot code LEDs are active when the TX 4000C board is powered up. These LEDs progress through a series of red codes. If the power up is successful, these LEDs turn green. If no LEDs illuminate, the voltage level may be too low or the power supply may not be providing enough 3.3 V or 5 V current to power up the TX 4000C board.

Status LEDs

After the boot code LEDs become green, the status LEDs are active and indicate the current board status as described in the following table:

LED number	Color	Status when illuminated
D31	Green	Timer interrupt controlled heartbeat. The LED flickers to show that the timer interrupts are operating properly.
D30	-------	Reserved for internal use.
D29	Red	The kernel detected a host communication error.
D28	Red	The kernel detected a problem. Use the *cpcon* utility's log command to view logged error information. For information about using *cpcon*, refer to the *Dialogic® TX Series SS7 Boards TX Utilities Manual*.
D25	Green	Idle task controlled heartbeat. The LED flickers to show that the on-board operating system is operational.
D24	Red	The board entered the System Management Interrupt (SMI) routine, which is part of the TX reset procedure.
D23	Red	A memory full condition occurred on the board.
D22	Red	An unexpected exception occurred on the board.

Verifying the board installation

Complete the following steps to verify that each board is successfully installed:

Step	Action

1	Enter the following command to display a list of all of the TX boards detected in the system:
	`txcpcfg`
	txcpcfg displays the bus number, slot number, CP number, and CP model type of each detected TX board. For example:
	`Bus Slot CP Number CP Model`
	`5 7 1 TX 4000`
	`5 8 2 TX 4000`
	If the CP number is listed as undefined, assign a CP number. Refer to *Assigning a CP number* on page 28 for more information.

2	Ensure that each installed and configured board in the system appears in the list of boards.

3	Enter the following command to display a list by CP number and board type of all the TX boards in the system:
	`cpmodel`
	cpmodel displays each TX board by model type and assigned CP number. For example:
	`Board #1 is a TX 4000`
	`Board #2 is a TX 4000`

4	Ensure that the boards listed by the *txcpcfg* utility in step 1 are the same boards listed by the *cpmodel* utility in Step 3.

5	Enter the following command at the prompt to perform board-level diagnostic tests on each new board to verify the installation:
	`txdiag -b` ***boardnum***
	where ***boardnum*** is the CP number of the board.
	txdiag indicates the successful installation of the CP 1 board.
	`CP 1: NMI - Resetting...`
	`CP 1: NMI - Starting test...`
	`CP 1: NMI - SUCCESS`
	`CP 1: MEMSWEEP - Resetting...`
	`CP 1: MEMSWEEP - Starting test...`
	`CP 1: MEMSWEEP - SUCCESS`
	`CP 1: INTR - Resetting...`
	`CP 1: INTR - Starting test...`
	`CP 1: INTR - Entering Polling Loop...`
	`CP 1: INTR - SUCCESS`

For detailed information about *txcpcfg*, *cpmodel*, and *txdiag*, refer to the *Dialogic® TX Series SS7 Boards TX Utilities Manual*.

7 Hardware specifications

General hardware specifications

This topic describes the following types of hardware specifications:

- Physical
- Connectivity
- Software environment
- Host interface
- H.100 compliant interface
- Environment
- Power requirements

Physical

Feature	Specification
Form factor	Standard 6U CompactPCI board per PICMG 2.0
PCI bus	33/66 MHz, 32-bit master/target or slave 5.0 V or 3.3 V signaling compatible slot
T1/E1 input/output	Eight T1/E1 interfaces with RJ-48T connectors on the rear I/O transition board
Ethernet input/output	Two 10/100Base-T Ethernet interfaces with RJ-45 connecters through a rear I/O transition board or through a PICMG 2.16 backplane
Board weight	Main board: 0.75 lb (0.36 kg) Rear I/O transition board: 0.55 lb (0.24 kg)

Connectivity

Feature	Description
Ethernet connectivity	Through a rear I/O transition board or a PICMG 2.16 backplane - Two 10/100Base-T Ethernet interfaces with RJ-45 connectors for connecting to either a network of other SIGTRAN devices or for connecting to a redundant mate board.
PSTN network connectivity	Through a rear I/O transition board
Intra-chassis connectivity	H.110 bus. Lucent Ambassador T8105 with 512 half duplex or 256 full duplex timeslots

Software environment

Feature	Description
Development environment	Natural Access NaturalAccess Signaling Software
Operating system	Windows UNIX

Host interface

Feature	Specification
Electrical	CompactPCI bus designed to *CompactPCI Specification PICMG 2.0 R3.0*
Mechanical	Designed to CompactPCI Specification PICMG 2.0 for 6U style boards
Bus speed	DC to 66 MHz
Maximum number of boards per chassis	16
Maximum number of SS7 links per board	32 per TX 4000C board 16 per TX 4000/20C board
I/O	PCI bus master/slave with DMA
Plug and play	Compatible (Windows only)

H.100 compliant interface

- Flexible connectivity between T1 and E1 trunks and the H.110 bus
- Access to any of 4096 H.110 timeslots
- Compatible with any H.110 compliant telephony interface
- H.110 clock master or clock slave

Environment

Feature	Description
Operating temperature	0 to 50 degrees C
Storage temperature	-20 to 70 degrees C
Humidity	5 to 80%, non-condensing

Power requirements

State	Requirements
TX 4000C	10.00 mA maximum @ 12.0 V 1.25 A maximum @ 5.0 V 6.00 A maximum @ 3.3 V

CEPT E1 G.703 telephony interface

Feature	Specification
Interface	G.703 2048 kbit/s trunk interface
Line code	HDB3 (in zero code suppression) or AMI
Alarm signal capabilities	Loss of frame alignment (OOF), loss of signaling multiframe alignment and loss of CRC multiframe alignment (red), remote alarm and remote multiframe alarm (yellow), alarm indication signal (AIS)
Counts	Bit error rate, CRC errors, slips, line code violations, far-end block errors
Loopback	Per channel and across channels under software control
Connectors	One Dialogic® MD1 RJ-21 interface

DSX-1 telephony interface

Feature	Specification
Interface	ANSI T1.102, T1.403
Framing	D4, ESF
Line code	AMI
Zero bits	Selectable B8ZS, jammed bit (ZCS) or no zero code suppression
Alarm signal capabilities	Yellow and red
Counts	Bipolar violation, F(t) error, and CRC error
Loopback	Per channel and overall under software control. Automatic remote loopback with CSU option.
Connectors	One RJ-48T connector
Maximum cable length	655 feet of 22 AWG twisted pair

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