



Dialogic® TX 4000 PCI SS7 Network Interface Board Installation Manual

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Revision history

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62334-11	April 2004	SRR, SS7 4.0
62334-12	August 2004	SRR, SS7 4.1
62334-13	April 2005	LBG, SS7 4.2
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64-0429-01	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.

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1 Introduction

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

- Install the TX 4000 PCI SS7 Network Interface board
- Configure the TX 4000 PCI SS7 Network Interface board
- Establish network connections
- Verify the installation

This manual targets developers of telephony and voice applications who use TX 4000 boards with Dialogic® NaturalAccess™ Signaling 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

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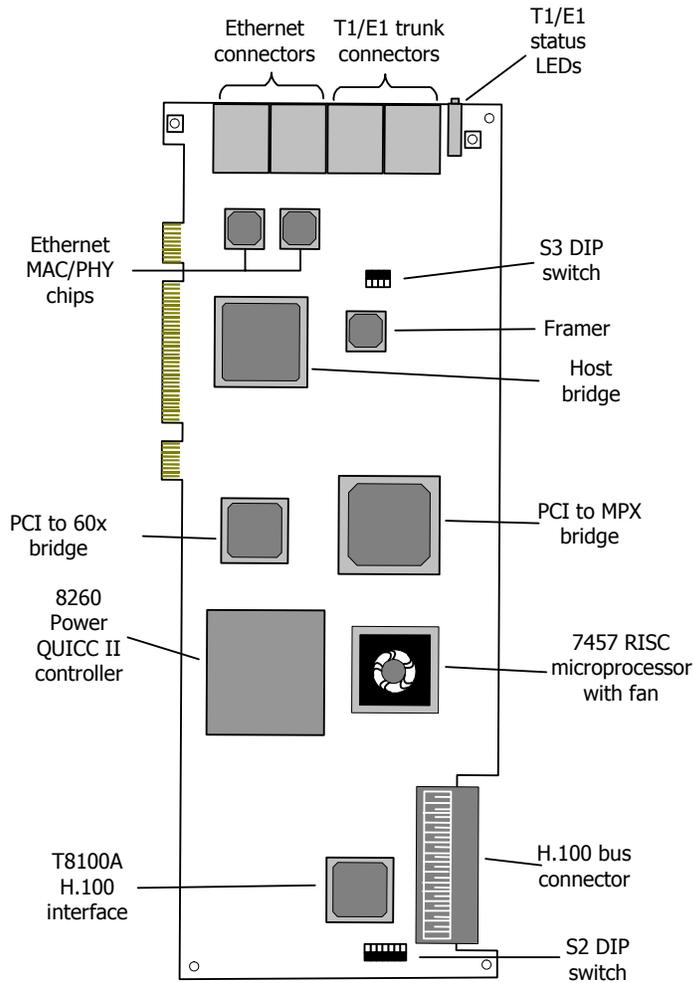
Overview of the TX 4000 board

TX 4000 board features

The Dialogic® TX 4000 PCI SS7 Network Interface board is a PCI board that provides four T1 or E1 digital trunk interfaces and two Ethernet 10/100Base-T interfaces. The TX 4000 design is based on an intelligent communication processor (CP) that plugs into a single PCI bus slot. The CP operates with the PCI bus host processor to form a distributed communications application platform.

The CP features one high-performance Motorola MPC7457 RISC microprocessor and one MPC8260 PowerQUICC II controller with a 32-bit PCI bus interface. Dialogic® NaturalAccess™ Signaling Software packages provide programming capabilities for the TX 4000 board CP.

The following illustration shows the TX 4000 board:



The TX 4000 board provides:

- PCI 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 PCI Local Bus Specification, Revision 2.2. The PCI interface is a 33/66 MHz, 32-bit master/target device.

- H.100 bus connectivity

The TX 4000 board fully supports the H.100 bus specification. The H.100 bus enables boards to share data and signaling information with other boards on the H.100 bus. For example, you can connect two or more TX 4000 boards for applications that perform trunk-to-trunk switching. In addition, you can use H.100 compatible products from other manufacturers with the TX 4000 board.

The H.100 interface supports a full mode stream configuration on the H.100 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 4000 board offers support for the H.100 bus within the H.100 architecture. On the TX 4000 board, switch connections are allowed for a total of 256 half duplex or 128 full duplex connections between local devices and the H.100 bus. Switch connections between local devices are non-blocking.

- Ethernet connectivity

The TX 4000 board supports two 10/100Base-T Ethernet connections. These connections provide Fast Ethernet connectivity and IPv4 support. Ethernet connectivity provides the TX 4000 board with a connection to a redundant mate TX board or to a network of other SIGTRAN devices.

- On-board memory

Each TX 4000 board includes 128 MB of SDRAM.

- Trunk connectivity

The TX 4000 board supports up to four T1 or E1 connectors through two Dialogic® MD1 RJ-45 interfaces. Dialogic® 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 4000 board.

Software components

TX 4000 boards require the following software components:

- NaturalAccess 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. For more information, refer to the *Natural Access Developer's Reference Manual*.
- Dialogic® 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. For more information, refer to the *Dialogic® NaturalAccess™ Signaling Software Configuration Manual*.

Utilities and demonstration programs

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

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

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

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Installing the TX 4000 board

System requirements

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

- An available PCI bus slot.
- At least 8 MB of memory (excluding operating system requirements).
- NaturalAccess software development environment.
- NaturalAccess Signaling Software.
- A chassis with 3.3 V of supplied power to provide a minimum of 6.5 A per TX 4000 board.
- An uninterruptible power supply (UPS). Although a UPS is not strictly required, it is strongly recommended for increased system reliability.
- An H.100 bus connector cable if you are connecting to other H.100 boards.
- Cables to connect the board interfaces to T1 or E1 lines.
- A crossover Ethernet cable if you are connecting two TX 4000 boards for redundancy support.
- 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.	<i>System requirements</i> on page 15
2	Power down the system if it is running.	
3	Configure the TX 4000 board to control H.100 bus termination if applicable.	<i>Configuring H.100 bus termination</i> on page 17
4	Configure the TX 4000 board to enable SS7 Monitor mode if applicable.	<i>Configuring SS7 Monitor mode</i> on page 18
5	Install the TX 4000 board into one of the computer's PCI bus slots.	<i>Installing the board</i> on page 20
6	Power up the system.	
7	Install the NaturalAccess software.	The <i>Natural Access Installation</i> booklet and <i>Natural Access Developer's Reference Manual</i>
8	Install the NaturalAccess Signaling Software.	<i>Installing Dialogic® NaturalAccess™ Signaling Software</i> and <i>Dialogic® NaturalAccess™ Signaling Software Configuration Manual</i>
9	Assign a CP number for each TX 4000 board.	<i>Assigning a CP number</i> on page 22
10	Connect the board interfaces to T1 or E1 trunks.	<i>Connecting to the network</i> on page 31
11	Connect the Ethernet interfaces for board redundancy or to a SIGTRAN network, if applicable.	<i>Connecting TX boards for redundancy</i> on page 34
12	Verify that the TX 4000 board is operational.	<i>Verifying the board installation</i> on page 41
Caution:	The TX 4000 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. Take care not to touch the gold fingers that plug into the PCI bus connectors.	

Configuring the hardware

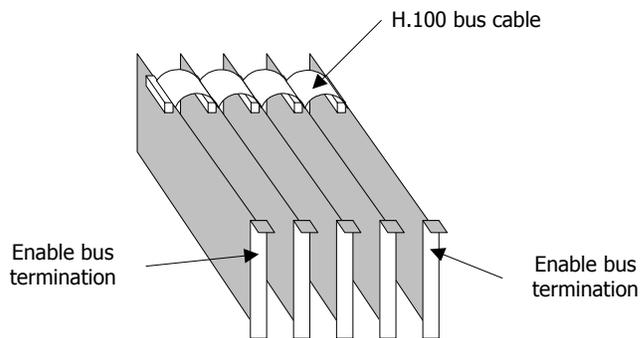
This topic describes the following procedures for configuring the TX 4000 board:

- Configuring H.100 bus termination
- Configuring SS7 Monitor mode
- DIP switch S1

Configuring H.100 bus termination

The TX 4000 board connects to an H.100 bus. Boards on the H.100 bus are connected to one another with an H.100 bus cable. Enable bus termination on the board located on each end of the H.100 bus.

The following illustration shows the H.100 bus configuration:

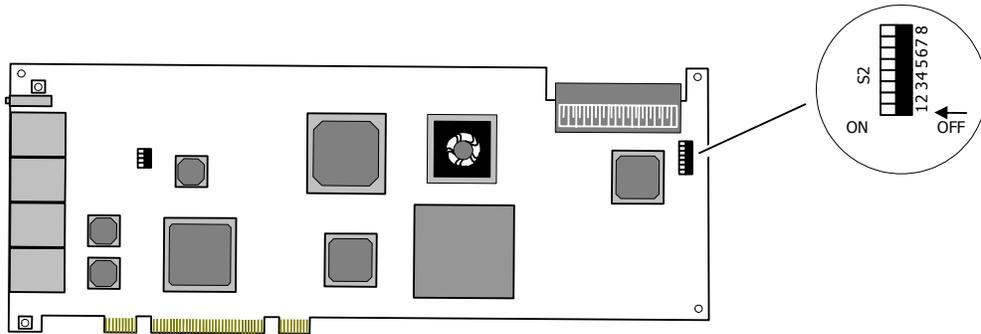


DIP switch S2 on the TX 4000 board controls the H.100 bus termination. The DIP switch is located on the front of the board, below the H.100 bus connector. By default, all S2 switches are set to the OFF position. H.100 bus termination is disabled.

To enable H.100 bus termination, set all S2 switches to the ON position only for the boards that are on the ends of the H.100 bus.

Note: The switches in DIP switch S2 must be set to either all ON or all OFF.

The following illustration shows the H.100 termination DIP switch:



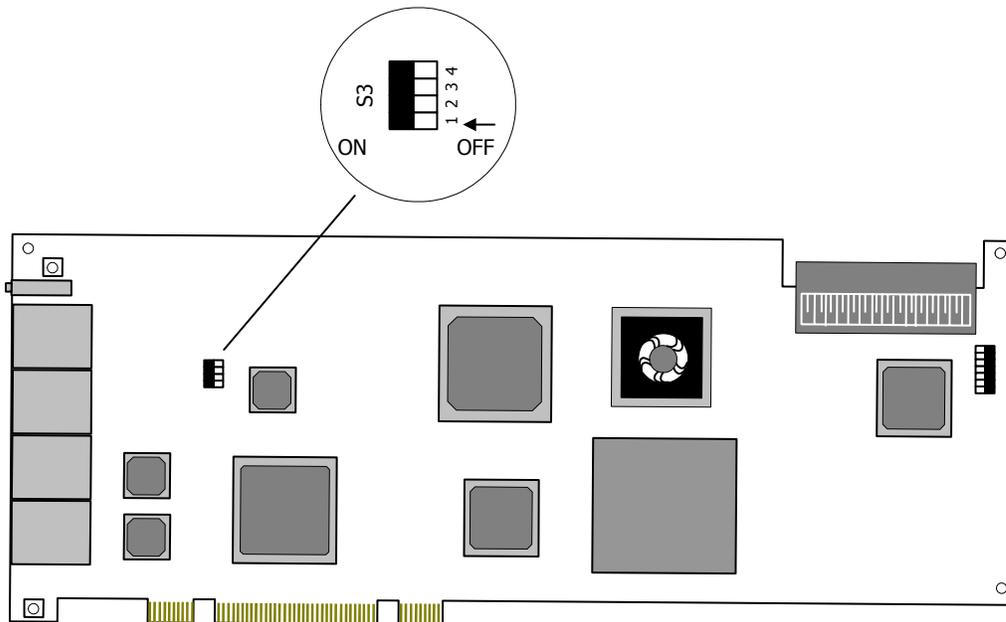
Configuring SS7 Monitor mode

DIP switch S3 controls the SS7 Monitor mode. The DIP switch is located on the front of the board, to the right of the T1/E1 trunk connectors. By default, all S3 switches are set to the ON position. This setting disables SS7 Monitor mode. When SS7 Monitor mode is disabled, the TX board is an active participant in the network.

To enable SS7 Monitor mode, set the S3 switches to the OFF position. In this mode, the board becomes a passive listening device that monitors network traffic. For information on connecting the monitoring server (with an installed TX board) to the network and installing the SS7 Monitor software, refer to the *Dialogic® NaturalAccess™ SS7 Monitor Developer's Reference Manual* and to the *Installing Dialogic® NaturalAccess™ SS7 Monitor Software* instructions.

Note: The switches in DIP switch S3 must be set to either all ON or all OFF.

The following illustration shows the Monitor mode DIP switch:



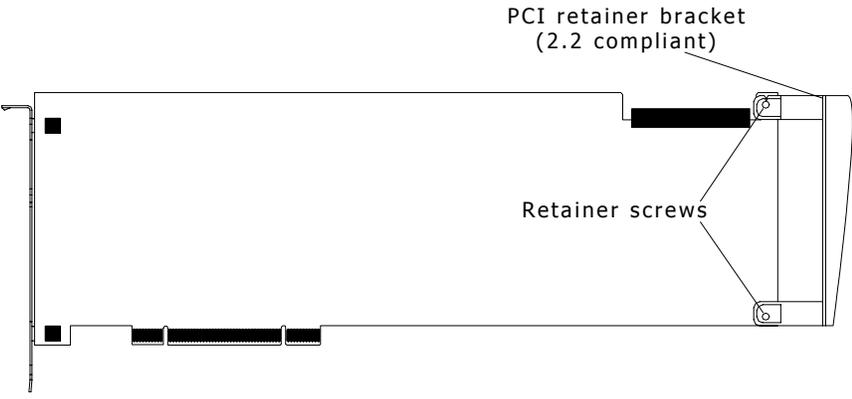
DIP switch S1

DIP switch S1 controls the operation of the board. By default, only switch 2 (AUTOSTART) is set to the ON position; all other S1 switches are set to the OFF position. Switch 5 is reserved for future use. Do not modify the default settings for this switch.

Set switch 8 (SW MIN BOOT) to ON to boot the board to the original software image instead of using the current production software image. This allows for recovery from any condition that resulted in the corruption of the production software image. After setting this switch to ON, use `txreset` to boot the backup software image, and then use `txflash` to burn a clean copy of the production image. Once the production image is completely transferred to the board's flash memory, turn this switch to OFF, and issue `txreset` to boot the board using the newly loaded production software image.

Installing the board

Complete the following steps to install the TX 4000 board in your system:

Step	Action
1	If necessary, configure the board as described in <i>Configuring the hardware</i> on page 17.
2	Power down the computer and disconnect the power cord from the power source.
3	Remove the cover from the computer and set it aside.
4	<p>If you are placing the board into a PCI chassis, remove the PCI retainer bracket by unscrewing it from the board. The bracket is not needed for the board to properly fit into the chassis. Refer to the following illustration of the PCI retainer bracket:</p>  <p>If you are placing the board into an ISA chassis, leave the PCI retainer bracket attached to the board. The bracket is needed for the board to fit properly into the chassis.</p>
5	Remove the blank slot cover from an open PCI bus slot.
6	<p>Arrange the TX 4000 board and other H.100 boards in adjacent PCI bus slots.</p> <p>Insert the TX 4000 board firmly into the slot. Ensure that the gold-striped edge of the board is seated properly in the expansion slot groove and the bracket of the board is seated in the groove that previously held the slot cover.</p>
7	Align the top of the board bracket with the hole on the top of the expansion slot, and replace the screw that previously held the blank slot cover.
8	<p>Connect the H.100 bus cable to the TX 4000 board.</p> <p>If you have multiple H.100 boards, connect the H.100 bus cable to each H.100 board.</p>
9	Replace the cover, and connect the computer to the power source.

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Configuring the TX 4000 board

Using the configuration utility

After you install the TX 4000 board and the NaturalAccess Signaling Software, you must assign a CP number to each TX 4000 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 22.

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	<i>Program Files\Dialogic\tx\bin\</i>
UNIX	<i>/opt/dialogic/tx/bin/</i>

txcpcfg enables you to perform the following types of changes to the configuration:

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

For more information about *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	<p>Power up the system if it is not running.</p> <p>In a Windows system, the Windows® New Hardware Wizard appears and prompts you for the files required to activate the SS7 drivers. Refer to <i>Installing Dialogic® NaturalAccess™ Signaling Software</i> for detailed information.</p>																
2	<p>At the prompt, invoke <code>txcpcfg</code> by entering the following command:</p> <pre>txcpcfg</pre> <p><code>txcpcfg</code> 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:</p> <table border="1"> <thead> <tr> <th>Bus</th> <th>Slot</th> <th>CP Number</th> <th>CP Model</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>2</td> <td>1</td> <td>TX 4000</td> </tr> <tr> <td>2</td> <td>4</td> <td>2</td> <td>TX 4000</td> </tr> <tr> <td>2</td> <td>6</td> <td>UNDEFINED</td> <td>TX 4000</td> </tr> </tbody> </table>	Bus	Slot	CP Number	CP Model	2	2	1	TX 4000	2	4	2	TX 4000	2	6	UNDEFINED	TX 4000
Bus	Slot	CP Number	CP Model														
2	2	1	TX 4000														
2	4	2	TX 4000														
2	6	UNDEFINED	TX 4000														
3	<p>Record the bus and slot values for the undefined TX 4000 board.</p>																
4	<p>Assign a unique CP number to each undefined board by entering the following command:</p> <pre>txcpcfg bus slot unique_CP_number</pre> <p>where</p> <ul style="list-style-type: none"> bus is the bus number of the TX 4000 board that you are configuring. slot is the slot number of the TX 4000 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. <p>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:</p> <pre>txcpcfg 2 6 3</pre>																
5	<p>Verify the configuration of all of the TX boards by entering the following command:</p> <pre>txcpcfg</pre> <p>In this example if you assign the new board a unique CP number of 3, the following configuration information is displayed:</p> <table border="1"> <thead> <tr> <th>Bus</th> <th>Slot</th> <th>CP Number</th> <th>CP Model</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>2</td> <td>1</td> <td>TX 4000</td> </tr> <tr> <td>2</td> <td>4</td> <td>2</td> <td>TX 4000</td> </tr> <tr> <td>2</td> <td>6</td> <td>3</td> <td>TX xxxx</td> </tr> </tbody> </table> <p>where xxxx is 4000 for a TX 4000/C, TX 4000/20, or TX 4000/20C board.</p>	Bus	Slot	CP Number	CP Model	2	2	1	TX 4000	2	4	2	TX 4000	2	6	3	TX xxxx
Bus	Slot	CP Number	CP Model														
2	2	1	TX 4000														
2	4	2	TX 4000														
2	6	3	TX xxxx														
6	<p>Save the configuration changes.</p> <p>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 <code>cpcfg</code> file as described in <i>Saving configuration changes</i> on page 27.</p>																

Adding a board

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

Step	Action																
1	Power down the system if it is running.																
2	Insert the TX 4000 board, seating it firmly in an available slot.																
3	<p>Power up the system.</p> <p>If you are installing a TX 4000 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. For more information, refer to <i>Installing Dialogic® NaturalAccess™ Signaling Software</i>.</p> <p>If you are installing an additional TX 4000 board in a slot that has never held a TX 4000 board, the Windows® New Hardware Wizard appears, finds the required files, and exits.</p>																
4	<p>At the prompt, invoke <i>txcpcfg</i> by entering the following command:</p> <pre>txcpcfg</pre> <p><i>txcpcfg</i> 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:</p> <table border="1"> <thead> <tr> <th>Bus</th> <th>Slot</th> <th>CP Number</th> <th>CP Model</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>2</td> <td>1</td> <td>TX 4000</td> </tr> <tr> <td>2</td> <td>4</td> <td>2</td> <td>TX 4000</td> </tr> <tr> <td>2</td> <td>6</td> <td>UNDEFINED</td> <td>TX 4000</td> </tr> </tbody> </table>	Bus	Slot	CP Number	CP Model	2	2	1	TX 4000	2	4	2	TX 4000	2	6	UNDEFINED	TX 4000
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 4000 board.																
6	<p>Assign a unique CP number to each undefined board by entering the following command:</p> <pre>txcpcfg bus slot unique_CP_number</pre> <p>where</p> <ul style="list-style-type: none"> • bus is the bus number of the TX 4000 board that you are configuring. • slot is the slot number of the TX 4000 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. <p>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:</p> <pre>txcpcfg 2 6 3</pre>																
7	<p>Verify the configuration of all of the TX boards by entering the following command:</p> <pre>txcpcfg</pre> <p>In this example, if you assign the new board a unique CP number of 3, the following configuration information displays:</p> <table border="1"> <thead> <tr> <th>Bus</th> <th>Slot</th> <th>CP Number</th> <th>CP Model</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>2</td> <td>1</td> <td>TX 4000</td> </tr> <tr> <td>2</td> <td>4</td> <td>2</td> <td>TX 4000</td> </tr> <tr> <td>2</td> <td>6</td> <td>3</td> <td>TX xxxx</td> </tr> </tbody> </table> <p>where xxxx is 4000 for a TX 4000/C, TX 4000/20, or TX 4000/20C board.</p>	Bus	Slot	CP Number	CP Model	2	2	1	TX 4000	2	4	2	TX 4000	2	6	3	TX xxxx
Bus	Slot	CP Number	CP Model														
2	2	1	TX 4000														
2	4	2	TX 4000														
2	6	3	TX xxxx														
8	<p>Save the configuration changes.</p> <p>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 <i>cpcfg</i> file as described in <i>Saving configuration changes</i> on page 27.</p>																

Changing a CP number

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

Step	Action																
1	<p>At the prompt, invoke <i>txcpcfg</i> by entering the following command:</p> <pre>txcpcfg</pre> <p><i>txcpcfg</i> displays the bus number, slot number, CP number, and CP model of all the TX boards that are present and configured.</p> <table border="1"> <thead> <tr> <th>Bus</th> <th>Slot</th> <th>CP Number</th> <th>CP Model</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>2</td> <td>1</td> <td>TX 4000</td> </tr> <tr> <td>2</td> <td>4</td> <td>2</td> <td>TX 4000</td> </tr> <tr> <td>2</td> <td>6</td> <td>3</td> <td>TX xxxx</td> </tr> </tbody> </table> <p>where xxxx is 4000 for a TX 4000 board.</p>	Bus	Slot	CP Number	CP Model	2	2	1	TX 4000	2	4	2	TX 4000	2	6	3	TX xxxx
Bus	Slot	CP Number	CP Model														
2	2	1	TX 4000														
2	4	2	TX 4000														
2	6	3	TX xxxx														
2	Record the bus and slot values for the TX 4000 board that you are updating.																
3	<p>Change the CP number of a board by entering the following command with the updated CP number:</p> <pre>txcpcfg bus slot updated_CP_number</pre> <p>where</p> <ul style="list-style-type: none"> bus is the bus number of the TX 4000 board that you are configuring. slot is the slot number of the TX 4000 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. <p>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:</p> <pre>txcpcfg 2 6 4</pre>																
4	<p>Verify the configuration change by entering the following command:</p> <pre>txcpcfg</pre> <p><i>txcpcfg</i> 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:</p> <table border="1"> <thead> <tr> <th>Bus</th> <th>Slot</th> <th>CP Number</th> <th>CP Model</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>2</td> <td>1</td> <td>TX 4000</td> </tr> <tr> <td>2</td> <td>4</td> <td>2</td> <td>TX 4000</td> </tr> <tr> <td>2</td> <td>6</td> <td>4</td> <td>TX xxxx</td> </tr> </tbody> </table> <p>where xxxx is 4000 for a TX 4000/C, TX 4000/20, or TX 4000/20C board.</p>	Bus	Slot	CP Number	CP Model	2	2	1	TX 4000	2	4	2	TX 4000	2	6	4	TX xxxx
Bus	Slot	CP Number	CP Model														
2	2	1	TX 4000														
2	4	2	TX 4000														
2	6	4	TX xxxx														
5	<p>Save the configuration changes.</p> <p>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 <i>cpcfg</i> file as described in <i>Saving configuration changes</i> on page 27.</p>																

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.																
2	Move the TX 4000 board from one slot to another slot, seating it firmly in the new slot.																
3	Power up the system. In a Windows system, if you are installing a TX 4000 board in a slot that has never held a TX 4000 board, the Windows® New Hardware Wizard appears, finds the required files, and exits.																
4	<p>At the prompt, invoke <code>txcpcfg</code> by entering the following command:</p> <pre>txcpcfg</pre> <p><code>txcpcfg</code> 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:</p> <table border="1"> <thead> <tr> <th>Bus</th> <th>Slot</th> <th>CP Number</th> <th>CP Model</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>2</td> <td>1</td> <td>TX 4000</td> </tr> <tr> <td>2</td> <td>4</td> <td>2</td> <td>TX 4000</td> </tr> <tr> <td>2</td> <td>8</td> <td>UNDEFINED</td> <td>TX 4000</td> </tr> </tbody> </table>	Bus	Slot	CP Number	CP Model	2	2	1	TX 4000	2	4	2	TX 4000	2	8	UNDEFINED	TX 4000
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 4000 board that you moved.																
6	<p>Assign a unique CP number to the undefined board by entering the following command:</p> <pre>txcpcfg bus slot unique_CP_number</pre> <p>where</p> <ul style="list-style-type: none"> bus is the bus number of the TX 4000 board that you are configuring. slot is the slot number of the TX 4000 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. <p>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:</p> <pre>txcpcfg 2 8 3</pre>																
7	<p>Verify the configuration change by entering the following command:</p> <pre>txcpcfg</pre> <p><code>txcpcfg</code> 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:</p> <table border="1"> <thead> <tr> <th>Bus</th> <th>Slot</th> <th>CP Number</th> <th>CP Model</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>2</td> <td>1</td> <td>TX 4000</td> </tr> <tr> <td>2</td> <td>4</td> <td>2</td> <td>TX 4000</td> </tr> <tr> <td>2</td> <td>8</td> <td>3</td> <td>TX xxxx</td> </tr> </tbody> </table> <p>where xxxx is 4000 for a TX 4000, TX 4000/20, TX 4000C, or TX 4000/20C board.</p>	Bus	Slot	CP Number	CP Model	2	2	1	TX 4000	2	4	2	TX 4000	2	8	3	TX xxxx
Bus	Slot	CP Number	CP Model														
2	2	1	TX 4000														
2	4	2	TX 4000														
2	8	3	TX xxxx														
8	<p>Save the configuration changes.</p> <p>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 <code>cpcfg</code> file as described in <i>Saving configuration changes</i> on page 27.</p>																

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.												
2	Remove the TX 4000 board from the slot.												
3	Power up the system.												
4	<p>Verify the configuration change by entering the following command:</p> <pre>txcpcfg</pre> <p>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:</p> <table border="1"> <thead> <tr> <th><u>Bus</u></th> <th><u>Slot</u></th> <th><u>CP Number</u></th> <th><u>CP Model</u></th> </tr> </thead> <tbody> <tr> <td>2</td> <td>2</td> <td>1</td> <td>TX 4000</td> </tr> <tr> <td>2</td> <td>8</td> <td>3</td> <td>TX 4000</td> </tr> </tbody> </table>	<u>Bus</u>	<u>Slot</u>	<u>CP Number</u>	<u>CP Model</u>	2	2	1	TX 4000	2	8	3	TX 4000
<u>Bus</u>	<u>Slot</u>	<u>CP Number</u>	<u>CP Model</u>										
2	2	1	TX 4000										
2	8	3	TX 4000										
5	<p>Save the configuration changes.</p> <p>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 <i>cpcfg</i> file as described in <i>Saving configuration changes</i> on page 27.</p>												

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:

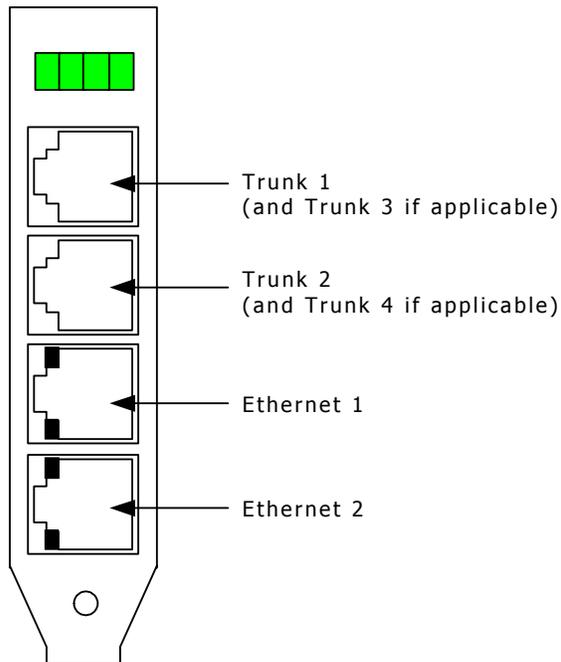
Step	Action															
1	<p>At the prompt in the UNIX system, view the current configuration updates by entering the following command:</p> <pre>txcpcfg</pre> <p><i>txcpcfg</i> displays the bus number, slot number, CP number, and CP model type of each TX board in the system. For example:</p> <table border="1"> <thead> <tr> <th>Bus</th> <th>Slot</th> <th>CP Number</th> <th>CP Model</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>2</td> <td>1</td> <td>TX 4000</td> </tr> <tr> <td>2</td> <td>8</td> <td>3</td> <td>TX 4000</td> </tr> </tbody> </table>	Bus	Slot	CP Number	CP Model	2	2	1	TX 4000	2	8	3	TX 4000			
Bus	Slot	CP Number	CP Model													
2	2	1	TX 4000													
2	8	3	TX 4000													
2	<p>Using a text editor, open the <i>cpcfg</i> configuration file. The file contains the original configuration information that existed before you ran the <i>txcpcfg</i> utility and made changes. For example:</p> <table border="1"> <thead> <tr> <th>#</th> <th>Command</th> <th>Bus</th> <th>Slot</th> <th>CP Number</th> </tr> </thead> <tbody> <tr> <td></td> <td><i>txcpcfg</i></td> <td>2</td> <td>2</td> <td>1</td> </tr> <tr> <td></td> <td><i>txcpcfg</i></td> <td>2</td> <td>8</td> <td>2</td> </tr> </tbody> </table> <p>Note: The <i>cpcfg</i> file does not specify the CP model type. The model type is automatically determined each time the host operating system is booted.</p>	#	Command	Bus	Slot	CP Number		<i>txcpcfg</i>	2	2	1		<i>txcpcfg</i>	2	8	2
#	Command	Bus	Slot	CP Number												
	<i>txcpcfg</i>	2	2	1												
	<i>txcpcfg</i>	2	8	2												
3	<p>Following the <i>cpcfg</i> file format, edit the entry in the <i>cpcfg</i> file for the TX board CP number that you are updating. If you are adding a new board, add a new <i>txcpcfg</i> entry to the <i>cpcfg</i> file.</p> <p>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.</p> <table border="1"> <thead> <tr> <th>#</th> <th>Command</th> <th>Bus</th> <th>Slot</th> <th>CP Number</th> </tr> </thead> <tbody> <tr> <td></td> <td><i>txcpcfg</i></td> <td>2</td> <td>2</td> <td>1</td> </tr> <tr> <td></td> <td><i>txcpcfg</i></td> <td>2</td> <td>8</td> <td>3</td> </tr> </tbody> </table>	#	Command	Bus	Slot	CP Number		<i>txcpcfg</i>	2	2	1		<i>txcpcfg</i>	2	8	3
#	Command	Bus	Slot	CP Number												
	<i>txcpcfg</i>	2	2	1												
	<i>txcpcfg</i>	2	8	3												
4	<p>Save and close the <i>cpcfg</i> file.</p> <p>The <i>cpcfg</i> script executes as part of the boot process and applies the new configuration settings.</p>															

5

Establishing network connections

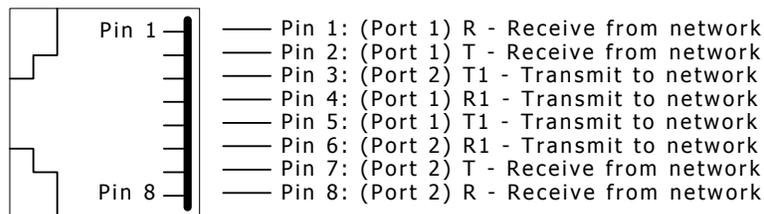
Connectors and cables

The TX 4000 board has two Dialogic® MD1 RJ-45 T1/E1 trunk interfaces and two Ethernet connectors. The following illustration shows these connectors on the TX 4000 end bracket:



Dialogic® MD1 RJ-45 interface

The TX 4000 provides an Dialogic® MD1 RJ-45 interface to connect to a T1 or E1 network. The following illustration shows the Dialogic® MD1 RJ-45 pinouts:

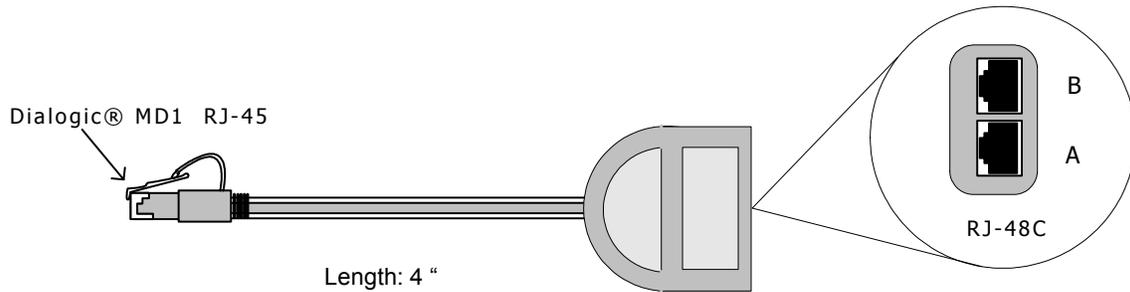


To access Trunk 1, Trunk 2, or both Trunks 1 and 2, connect a shielded T1 or E1 RJ-45 cable to one or both 8-pin modular jacks on the board.

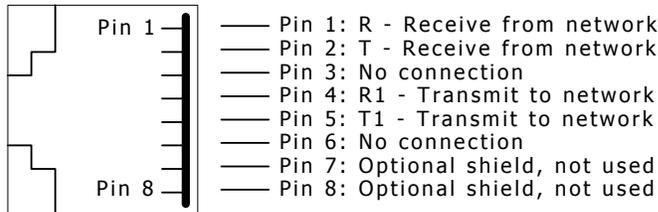
To access all four trunks, use two dual T1/E1 120 ohm trunk adapter cables. Each trunk adapter cable separates the 8-pin modular jack on the board into two RJ-48C interfaces.

Dual T1/E1 120 ohm adapter cable

The following illustration shows a dual T1/E1 120 ohm trunk adapter cable:



The following illustration shows the pinouts of the RJ-48C connectors on the trunk adapter cable:



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

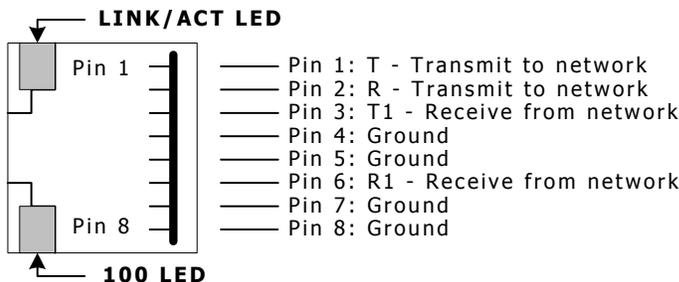
Note: The TX 4000 board is configured as a T1/E1 120 ohm board. To connect the TX 4000 board to a 75-ohm E1 trunk, use a balun. A balun is a transformer that converts the impedance from 120 ohm to 75 ohm. No other configuration changes are required. For more information, contact a Dialogic Services and Support representative.

Ethernet interfaces

The TX 4000 board has two 10/100Base-T Ethernet interfaces. These interfaces provide Ethernet connections that support auto-negotiation for 100Base-T full duplex/half duplex and 10Base-T full duplex/half duplex transmission. Each Ethernet interface can be manually configured if you are not using auto-negotiation.

The Ethernet interfaces provide a high-speed interface for connecting a TX 4000 board to either its redundant mate board or to a network of other SIGTRAN devices. Refer to *Connecting TX boards for redundancy* on page 34 for more information.

The following illustration shows the pinouts of the 10/100Base-T Ethernet RJ-45 interfaces:



Connecting to the network

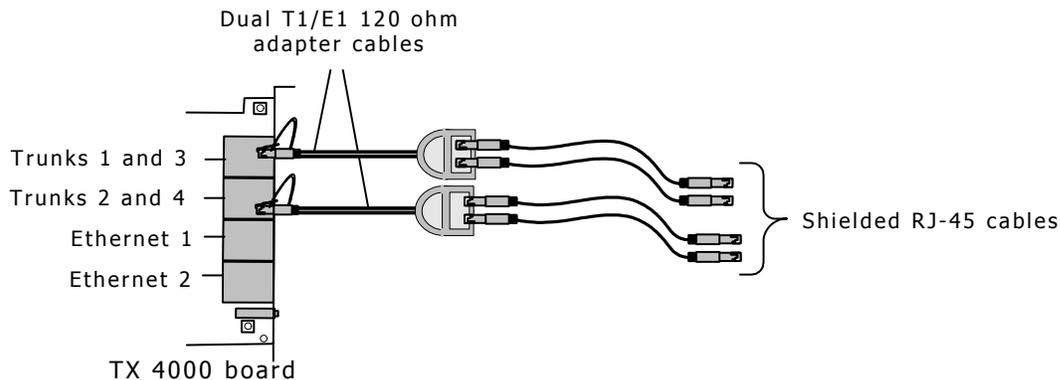
Before connecting a TX 4000 board to the network, ensure that you have properly configured the trunks as either T1 or E1. For configuration information, refer to the *Dialogic® NaturalAccess™ Signaling Software Configuration Manual*.

Caution: Dialogic 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 RJ-45 cable to connect a TX 4000 board to a T1 network or to an E1-120 ohm network. Complete the following steps to connect a TX 4000 board to the network:

Step	Action
1	<p>If connecting Trunk 1 or Trunk 2, connect a shielded RJ-45 cable directly to the board.</p> <p>If connecting Trunk 3 or Trunk 4, use dual T1/E1 120 ohm trunk adapter cables to connect to the board. Each trunk adapter cable divides the 8-pin modular jack on the end bracket into two RJ-48C connectors. If you are connecting both jacks, use two cables, otherwise, just use one.</p> <p>Note: TX 4000 boards are configured as T1/E1 120 ohm boards. To connect a TX 4000 board as an E1 75 ohm board, use a balun transformer to convert the impedance from 120 ohm to 75 ohm. No other configuration changes are required. For more information, contact a Dialogic Services and Support representative.</p>
2	<p>Connect shielded RJ-45 cables directly to the trunk connector on the board or to the dual T1/E1 trunk adapter cable.</p> <p>Caution: Failure to use a shielded cable may negate your approval.</p>

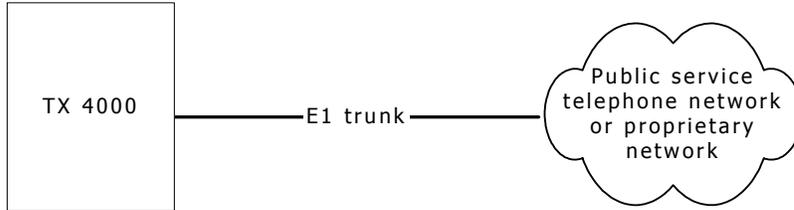
The following illustration shows the cabling required to connect all four trunks on the TX 4000 board:



For more information, refer to *dual T1/E1 120 ohm adapter cable* on page 30.

E1 network considerations

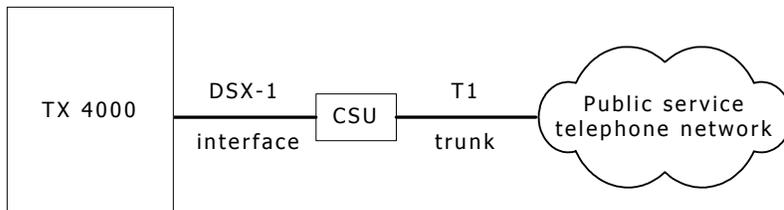
TX 4000 boards can support up to four CEPT E1 trunk interfaces. For typical E1 communications, each E1 interface connects directly to an E1 trunk, as shown in the following illustration:



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

T1 network considerations

For typical T1 communications, each trunk interface connects to a channel service unit (CSU), which 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 4000 trunk interface with 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.

Warning: **Important safety notes for telephony connections:**

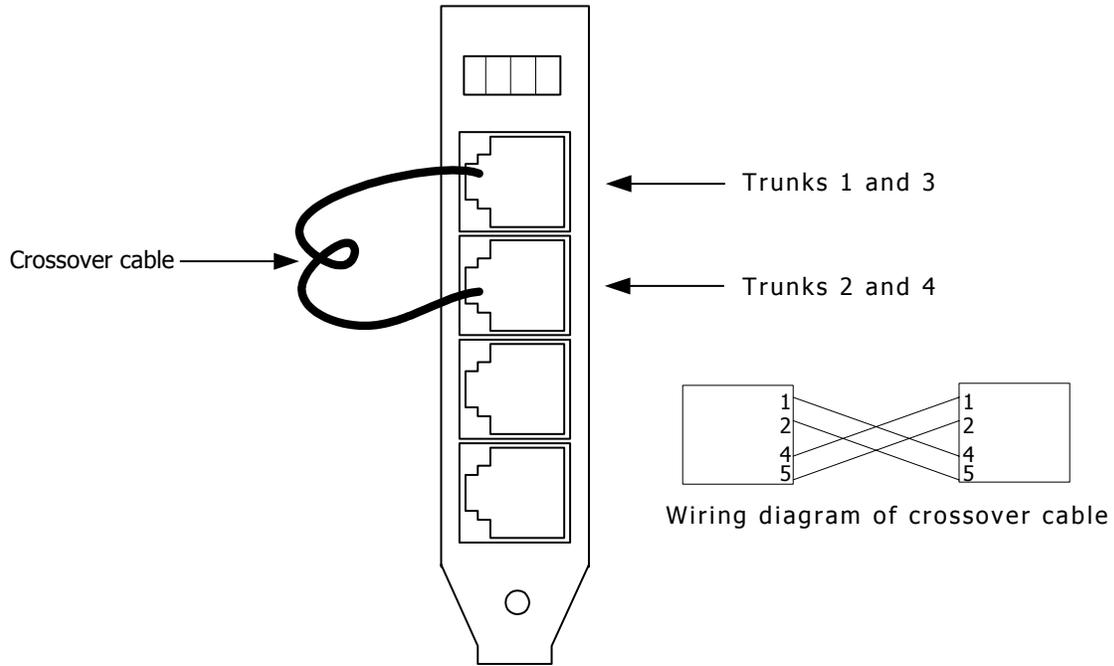


Use a channel service unit (CSU) to isolate the cables that are attached to this product before the cables leave the building.

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 4000 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.

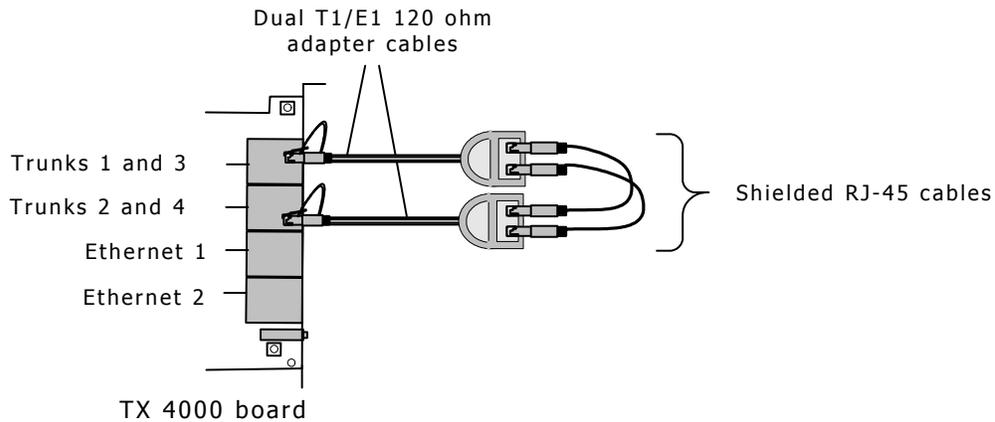
Testing in loopback mode

You can connect the board in loopback mode to test the digital trunk application without connecting to the telephone network. The following illustration shows the loopback configuration that connects trunk 1 and trunk 2 with crossover cable on a TX 4000 board:



The crossover cable connects the transmit signals from one trunk to the receive signals on another trunk by connecting the pins as shown.

If your board configuration uses two optional trunk adapter cables to access trunks 3 and 4, you can connect the adapter cables in loopback mode. Use the crossover cable to connect the transmit signals on one of the adapter cables to the receive signals on the second adapter cable as shown in the following illustration:



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 4000 board, the failure of a signaling node, or the failure of the TX 4000 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

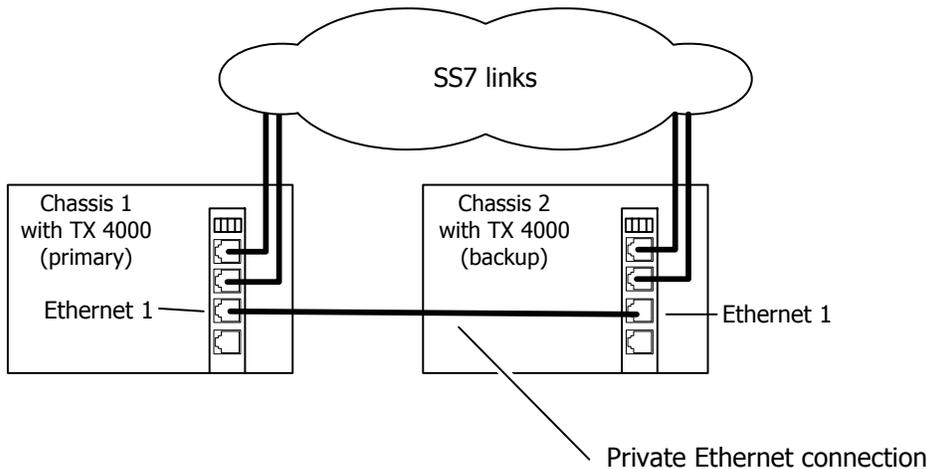
TDM configuration

To connect a TX 4000 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. You must also define the IP interface address using the *ifcreate* command (for interface 1) in the *txconfig* utility. For more information, refer to the *Dialogic® NaturalAccess™ Signaling Software Configuration Manual*.

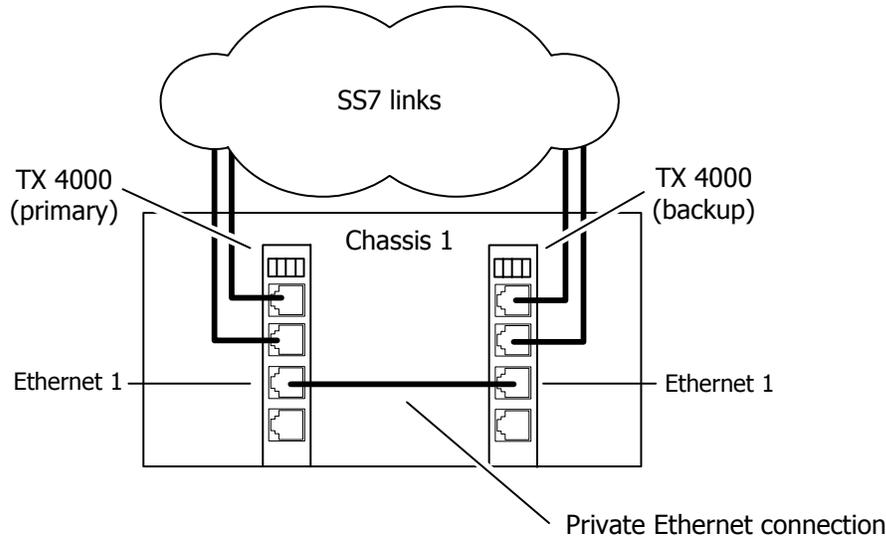
Dual-node redundant signaling server

The following illustration shows how to set up two TX 4000 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 4000 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

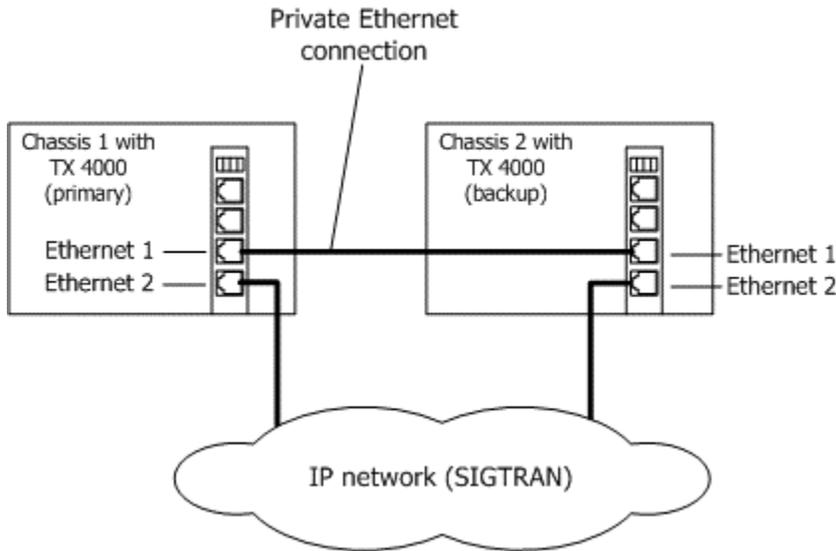
To connect a TX 4000 board to its redundant mate in an IP network configuration, use a Category 5 shielded twisted pair (STP) crossover cable. Using the crossover cable, connect Ethernet 1 on the primary board to Ethernet 1 on the backup board. Using standard Ethernet cables, connect the Ethernet 2 connectors 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. You must also define the IP interface address using the *ifcreate* command (for interface 1) in the *txconfig* utility. For more information, refer to the *Dialogic® NaturalAccess™ Signaling Software Configuration Manual*.

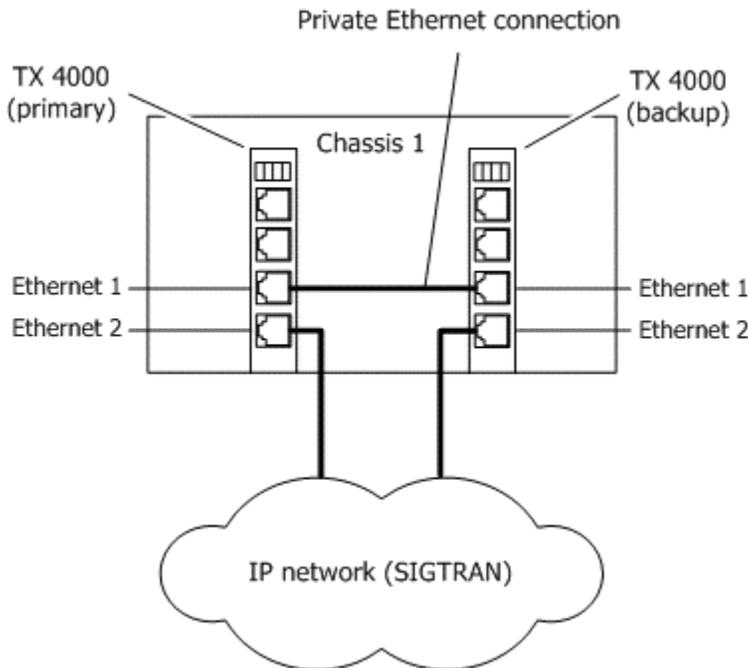
Dual-node redundant signaling server

The following illustration shows how to set up two TX 4000 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 4000 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.



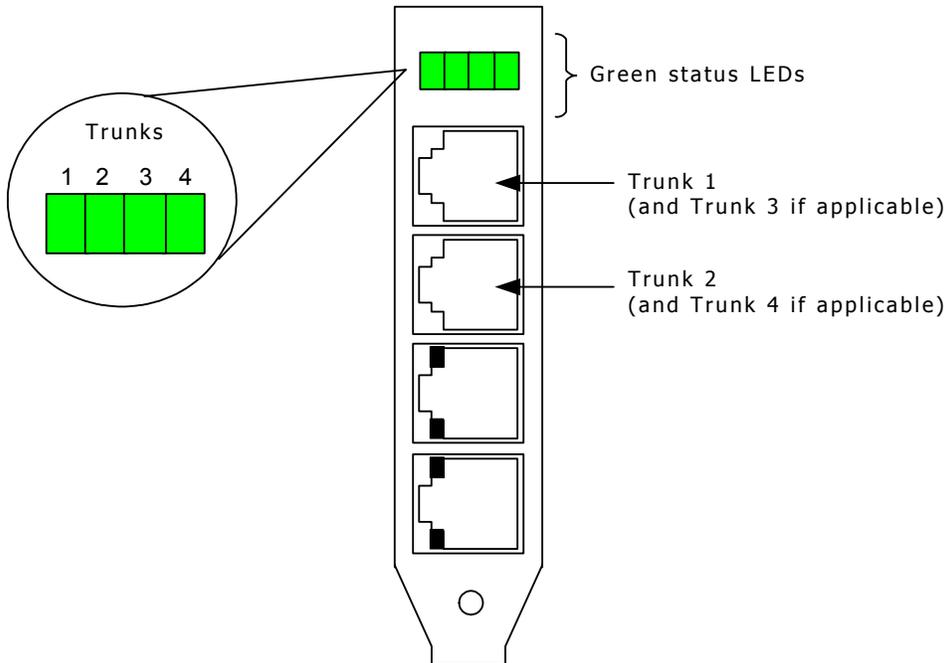
For more information on SS7 redundancy, refer to the *Dialogic® TX Series SS7 Boards Health Management Developer's Reference Manual*.

6

Verifying the installation

External connection status LEDs

The TX 4000 board provides LEDs to indicate the status of the trunk interfaces. The location of the LEDs is shown in the following illustration:

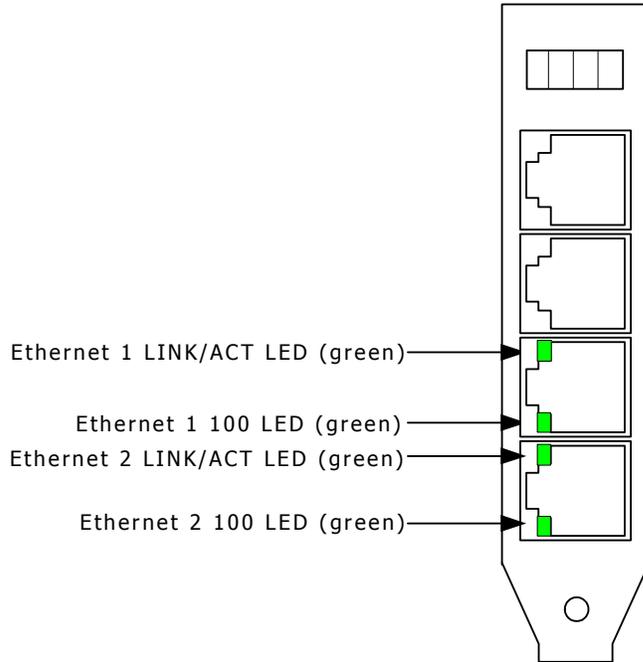


The TX 4000 board end bracket has one green LED for each trunk. The trunk LEDs provide the following indications:

LED	Description
Off	Trunk has not been configured.
Slow blinking green	Indicates loss of signal.
Fast blinking green	Indicates loss of frame or loss of signaling multiframe.
Steady green	Indicates that proper frame synchronization between the trunk and network has been established. All required framing alignment has been found.

Ethernet LEDs

The TX 4000 board provides two LEDs to indicate the status of each Ethernet interface. The LEDs are located in the RJ-45 connectors as shown in the following illustration:



The following table describes the functionality of each LED:

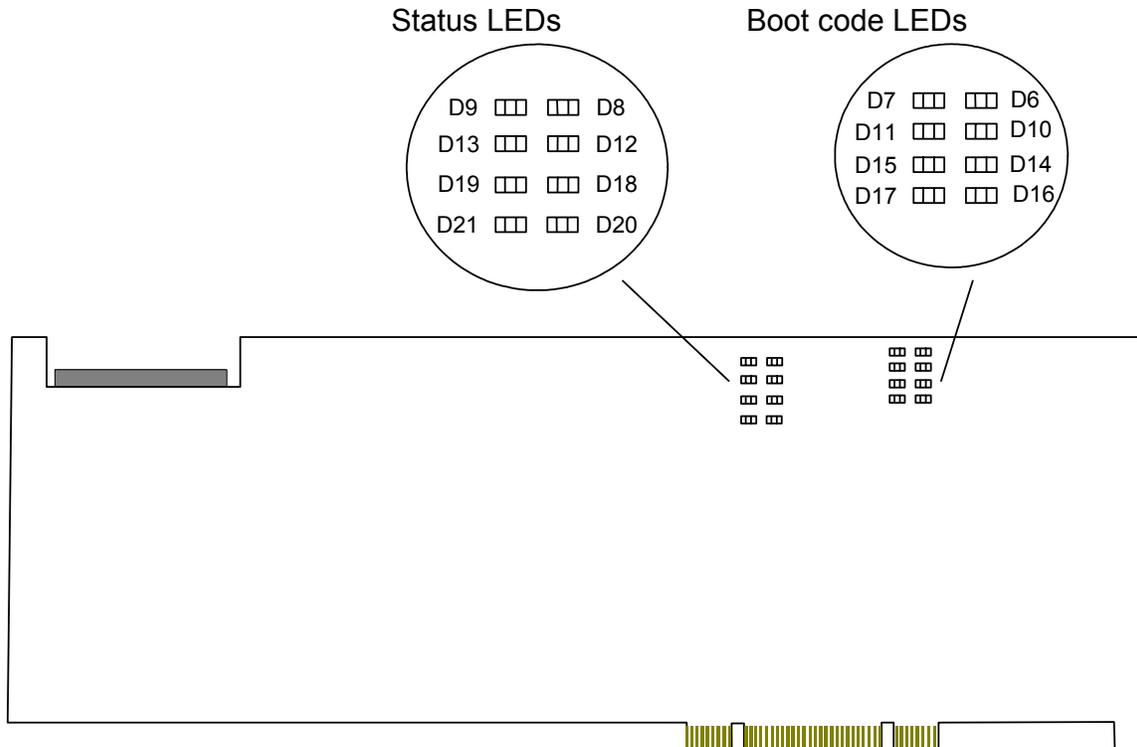
LED	Description
LINK/ACT	Indicates the status of the Ethernet link. When the Ethernet link has established link integrity, the LED is on and steady. It also indicates the transmitting and receiving activity on the link. When activity is present on the Ethernet link, the LED flickers.
100	Indicates the 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 LINK/ACT LED is on.)

Board status LEDs

In addition to external connection status LEDs and Ethernet LEDs, the following banks of LEDs (D6-D21) located on the back of the TX 4000 board indicate the current status of the board:

- Boot code LEDs
- Status LEDs

The following illustration shows the TX 4000 board status LEDs:



Boot code LEDs

The boot code LEDs are active when the TX 4000 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 levels may be too low, or the power supply may not be providing enough 3.3 V or 5 V of current to power up the TX 4000 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
D8	Green	Timer interrupt controlled heartbeat. The LED flickers to show that the timer interrupts are operating properly.
D9	Green	Idle task controlled heartbeat. The LED flickers to show that the on-board operating system is operational.
D12	Red	The board is executing in snapshot mode: the board is resetting or <i>txsnap</i> is running.
D13	-----	Reserved for internal use.
D18	Red	The kernel detected a host communication error.
D19	Red	A memory full condition occurred on the board.
D20	Red	An unexpected exception occurred on the board.
D21	Red	The kernel detected a problem. Use the <i>cpcon</i> utility's <i>log</i> command to view logged error information. For information about using <i>cpcon</i> , refer to the <i>Dialogic® TX Series SS7 Boards TX Utilities Manual</i> .

Verifying the board installation

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

Step	Action												
1	<p>Display a list of all of the TX boards detected in the system by entering the following command:</p> <pre>txcpcfg</pre> <p><i>txcpcfg</i> displays the bus number, slot number, CP number, and CP model type of each detected TX board. For example:</p> <table border="1"> <thead> <tr> <th>Bus</th> <th>Slot</th> <th>CP Number</th> <th>CP Model</th> </tr> </thead> <tbody> <tr> <td>5</td> <td>7</td> <td>1</td> <td>TX 4000</td> </tr> <tr> <td>5</td> <td>8</td> <td>2</td> <td>TX 4000</td> </tr> </tbody> </table> <p>If the CP number is listed as undefined, assign a CP number. For more information, refer to <i>Assigning a CP number</i> on page 22.</p>	Bus	Slot	CP Number	CP Model	5	7	1	TX 4000	5	8	2	TX 4000
Bus	Slot	CP Number	CP Model										
5	7	1	TX 4000										
5	8	2	TX 4000										
2	<p>Ensure that each installed and configured board in the system appears in the list of boards.</p>												
3	<p>Display a list by CP number and board type of all the TX boards in the system by entering the following command at the prompt:</p> <pre>cpmodel</pre> <p><i>cpmodel</i> displays each TX board by model type and assigned CP number. For example:</p> <pre>Board #1 is a TX 4000 Board #2 is a TX 4000</pre>												
4	<p>Ensure that the boards listed by the <i>txcpcfg</i> utility in Step 1 are the same boards listed by the <i>cpmodel</i> utility in step 3.</p>												
5	<p>Perform board-level diagnostic tests on each new board to verify the installation by entering the following command at the prompt:</p> <pre>txdiag -b boardnum</pre> <p>where boardnum is the CP number of the board.</p> <p><i>txdiag</i> indicates the successful installation of the CP 1 board.</p> <pre>TXDIAG V2.0: (c)Copyright 1998-2009 Dialogic Corporation. All Rights Reserved. CP 1: NMI - Resetting... CP 1: NMI - ...Reset Complete CP 1: NMI - Starting test... CP 1: NMI - SUCCESS CP 1: MEMSWEEP - Resetting... CP 1: MEMSWEEP - ...Reset Complete CP 1: MEMSWEEP - Starting test... CP 1: MEMSWEEP - SUCCESSCP 1: INTR - Resetting... CP 1: INTR - ...Reset Complete CP 1: INTR - Starting test... CP 1: TXDIAG - Resetting... CP 1: TXDIAG - ...Reset Complete</pre>												

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

7

Hardware specifications

General hardware specifications

This topic describes the following types of hardware specifications:

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

Physical

Feature	Specification
Form factor	Standard length PCI board
PCI bus	33/66 MHz, 32-bit master/target or slave 5.0 V or 3.3 V signaling compatible slot
Input/output	PCI end bracket
Board weight	0.40 lb (0.20 kg)

Host interface

Feature	Specification
Electrical	PCI bus designed to <i>PCI Local Bus Specification Revision 2.2</i>
Mechanical	Designed to <i>PCI Local Bus Specification Revision 2.2</i>
Bus speed	DC to 66 MHz
Maximum number of boards per chassis	16
Maximum number of SS7 links per board	32 per TX 4000 board 16 per TX 4000/20 board
I/O mapped memory	Memory mapped interface for efficient block data transfers
Plug and play	Compatible (Windows only)

H.100 compliant interface

H.100 compliant interface has the following features:

- Flexible connectivity between T1 and E1 trunks and the H.100 bus
- Access to any of 4096 H.100 timeslots
- Compatible with any H.100 compliant telephony interface
- H.100 clock master or clock slave
- H.100 bus termination capability

Environment

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

Software environment

Feature	Description
Development environment	NaturalAccess Software
Operating system	Windows UNIX

Power requirements

State	Requirements
TX 4000	0.1 A maximum @ 12.0 V 0.5 A maximum @ 5.0 V 6.5 A maximum @ 3.3 V

Connectivity

Feature	Description
Ethernet connectivity	Two 10/100Base-T Ethernet interface 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	Two T1/E1 Dialogic® MD1 RJ-45 interfaces
Intra-chassis connectivity	H.100 bus. Lucent Ambassador T8100A with 256 half duplex or 128 full duplex timeslots

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, out of frame conditions, 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	Two Dialogic® MD1 RJ-45 interfaces that can support up to four 120 ohm RJ-48C trunk connectors (using two dual T1/E1 trunk adapter cables).

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	Two Dialogic® MD1 RJ-45 interfaces that can support up to four 120 ohm RJ-48C trunk connectors (using two dual T1/E1 trunk adapter cables).
Maximum cable length	655 feet of 22 AWG twisted pair

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