Dialogic® TX 5000E PCI Express SS7 Boards Installation Manual

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Revision history

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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 5000E PCI Express SS7 Boards Installation Manual* explains how to perform the following tasks:

- Install a TX 5000E PCI Express SS7 board
- Configure a TX 5000E PCI Express SS7 board
- Establish network connections
- Verify the installation

This manual targets developers of telephony and voice applications who use TX 5000E PCI Express 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 to which this document pertains is part of the NMS Communications Platforms business that was sold by NMS Communications Corporation (“NMS”) to Dialogic Corporation (“Dialogic”) on December 8, 2008. Accordingly, certain terminology relating to the product has been changed. Below is a table indicating both terminology that was formerly associated with the product, as well as the new terminology by which the product is now known. This document is being published during a transition period; therefore, it may be that some of the former terminology will appear within the document, in which case the former terminology should be equated to the new terminology, and vice versa.

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

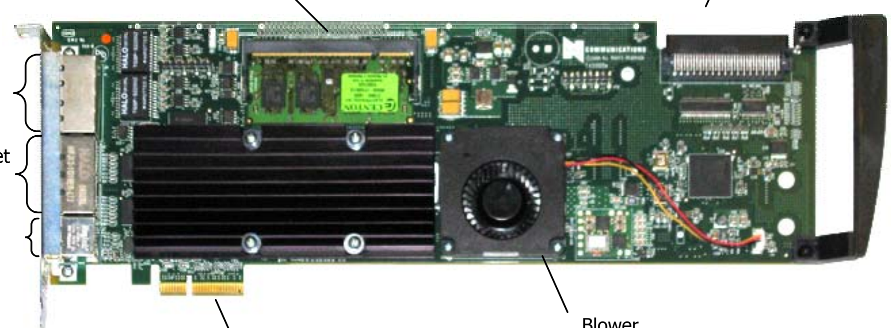
2 Overview of TX 5000E boards

TX 5000E board features

Dialogic® NaturalAccess™ TX 5000E PCI Express (PCIe) SS7 boards provide up to four T1 or E1 digital trunk interfaces, two Ethernet 10/100/1000Base-T interfaces and one Ethernet 10/100Base-T interface. The TX 5000E PCIe design is based on an intelligent communication processor (CP) that plugs into a single x4 PCIe slot. The CP operates with the PCIe host processor to form a distributed communications application platform.

The CP features an on-board Freescale MPC8568E system on a chip with a x4 PCIe interface to support up to 128 SS7 channels. The Dialogic® NaturalAccess™ Signaling Software packages provide programming capabilities for the TX 5000E PCIe board CP.

The following illustration shows a TX 5000E board:



The TX 5000E boards provide:

- PCI Express bus connectivity

  Each TX 5000E board is designed to reside in a single PCIe slot. Each board contains a x4 PCIe interface compliant with the *PCI Express Base Specification, 1.1*.

- H.100 bus connectivity

  TX 5000E boards fully support 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 5000E boards for applications that perform trunk-to-trunk switching. In addition, you can use H.100 compatible products from other manufacturers with a TX 5000E 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.

- Ethernet connectivity

  TX 5000E boards support two 10/100/1000Base-T Ethernet connections. These connections provide Fast Ethernet connectivity for IP network signaling connections. An additional 10/100Base-T Ethernet connector is provided for use as a dedicated connection to a redundant mate TX board.

- On-board memory

  Each TX 5000E board includes 512 MB of SDRAM.

- Trunk connectivity

  The TX 5000E board supports up to four T1 or E1 connectors through two Dialogic® MD1 RJ-45 interfaces. 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 5000E board.

Software components

TX 5000E 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 TX 5000E boards. 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
cpcon	Uses NaturalAccess to manage communication with the TX board. This utility is an operator console run from the command line. To bypass the NaturalAccess 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 NaturalAccess to display and optionally log alarm messages generated by NaturalAccess Signaling Software tasks running on all TX boards. To bypass the NaturalAccess 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	Configures TDM and IP based interfaces on TX 5000E boards. *ss7load* calls *txconfig* at board boot time. For more information, refer to the *Dialogic® TX Series SS7 Boards TDM for SS7 Developer's Reference Manual*.
txcpcfg	Assigns CP numbers to TX boards based on bus and slot.
Txdiag	Performs hardware diagnostic tests on a TX board.
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 in the TX board Flash memory.
txinfo	Obtains detailed TX 5000E board information.
txlocate	Blinks the end bracket LEDs of a TX 5000E 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 5000E 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. For information about these programs, refer to the *Dialogic® TX Series SS7 Boards TDM for SS7 Developer's Reference Manual*.

Program	Demonstrates how to...
t1demo	Test the T1/E1 and H.100 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 5000E board.

3 Installing a TX 5000E board

System requirements

To install and use a TX 5000E board, your system must have the following components:

- A chassis with an available PCIe bus slot with 12 V and 3.3 V of supplied power. The slot width must be x4 or wider.
- At least 8 MB of memory (excluding operating system requirements).
- NaturalAccess Software development environment.
- NaturalAccess Signaling Software.
- 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.
- Ethernet straight-through cables if connecting a TX 5000E board for IP network communication.

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. However, if a site connects to private lines that leave the building, make sure that external protection is provided.

Installation summary

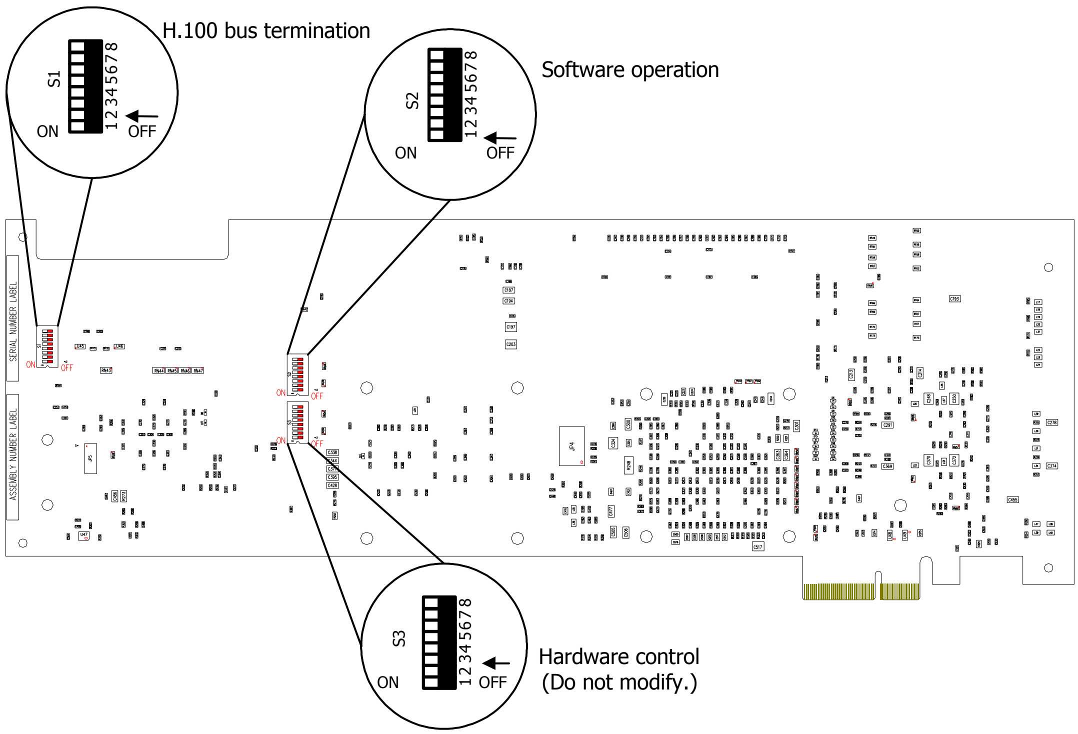
The following table summarizes the steps for initially installing the hardware and software components:

Step	Description	For details, refer to...
1	Ensure that your system meets the system requirements.	*System requirements* on page 13.
2	Power down the system if it is running.	
3	Configure the hardware to control H.100 bus termination, if applicable.	*Configuring the DIP switches* on page 15.
4	Install the TX 5000E board into one of the PCIe slots.	*Installing the board* on page 18.
5	Power up the system.	
6	Install the NaturalAccess Software.	The *Natural Access Installation* booklet and *Natural Access Developer's Reference Manual.*
7	Install the NaturalAccess Signaling Software.	The *Installing Dialogic® NaturalAccess™ Signaling Software* booklet and the *Dialogic® NaturalAccess™ Signaling Software Configuration Manual.*
8	Assign a CP number for each TX 5000E board.	*Assigning a CP number* on page 20.
9	Connect the board interfaces to T1 or E1 trunks for SS7 connectivity, if applicable.	*Connecting to the network* on page 30.
10	Connect Ethernet interface for SIGTRAN connectivity, if applicable.	*IP network configuration* on page 34.
11	Connect Ethernet interface for board redundancy, if applicable.	*Connecting TX boards for redundancy* on page 33.
12	Verify that the TX 5000E board is operational.	*Verifying the board installation* on page 43.

Caution:	The TX 5000E 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 PCIe connectors.

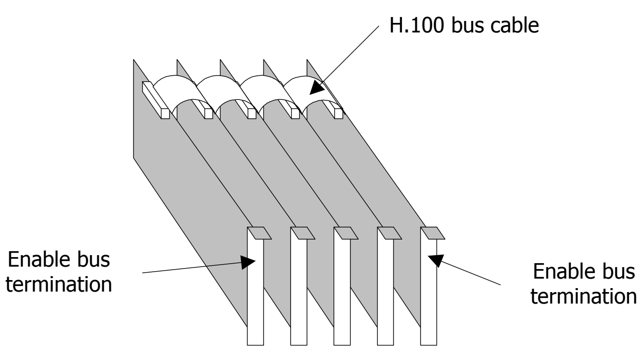
Configuring the DIP switches

TX 5000E boards contain three DIP switches that are used to configure H.100 bus termination, configure the software operation of the board, and control the hardware-level behavior of the board. The following illustration shows the default DIP switch settings (all switches off) for a TX 5000E board:



DIP switch S1: H.100 bus termination

TX 5000E boards connect to an H.100 bus. Boards on the H.100 bus are connected to one another with an H.100 bus cable. The two boards located at either end of the bus must have bus termination enabled, as shown in the following illustration:



DIP switch S1 controls the H.100 bus termination. By default, all S1 switches are set to the OFF position (H.100 bus termination disabled). To enable H.100 bus termination, set all S1 switches to the ON position only for the boards that are on the ends of the H.100 bus.

Note: The switches in the S1 DIP switch must be set to either all ON or all OFF.

DIP switch S2: Software operation

DIP switch S2 controls the operation of the software stored on the board's FLASH memory. By default, all S2 switches are set to the OFF position. The following table describes the S2 switches:

<table>
<tr><th>S2 switch</th><th>Description</th></tr>
<tr><td>1</td><td> Boot with original image. Set this switch 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. </td></tr>
<tr><td>2</td><td> Override Ethernet 3. Set this switch to ON to: Override the default usage of Ethernet 3 LEDs.
Use these LEDs to display the two TX board heartbeat indicators. The TX board has two types of heartbeat indicators: An idle heartbeat LED that toggles to indicate that some processor resources remain available.
A timer heartbeat LED that toggles to indicate that the TX operating system is able to service interrupts. These indications display on the internal LEDs but can be difficult to view when the board is installed. The DIP switch provides a way to view this information externally. To see an illustration of the Ethernet connectors, refer to Connectors and cables on page 27. </td></tr>
<tr><td>3</td><td> Override Ethernet 1 and Ethernet 2. Set this switch to ON to: Override the default usage of Ethernet 1 and Ethernet 2 LEDs.
Use these LEDs to display any error indications presented by the TX operating system. The TX board has four internal LEDs for indicating certain types of error conditions detected by the TX operating system. These error indications include: LOG ERROR LED - Set whenever the TX operating system logs an error to its internal log.
HOST COMMUNICATION ERROR LED
MEMORY FULL LED These indications display on the internal LEDs but can be difficult to view when the board is installed. The DIP switch provides a way to view this information externally. For deployments that do not require the use of the Ethernet 1 and Ethernet 2 connectors (such as a TDM-based installation that is not using IP signaling), set DIP 3 ON to view error indicator LEDs on these Ethernet connectors. To see an illustration of the Ethernet connectors, refer to Connectors and cables on page 27. </td></tr>
</table>

S2 switch	Description
4	**Override trunk connector LED**. Set this switch to ON to: • Override the default usage of the trunk connector LEDs. • Use these LEDs to display any error indications presented by the TX operating system. The TX board has four internal LEDs for indicating certain types of error conditions detected by the TX operating system. These error indications include: • LOG ERROR LED - Set whenever the TX OS logs an error to its internal log. • HOST COMMUNICATION ERROR LED • MEMORY FULL LED These indications display on the internal LEDs but can be difficult to view when the board is installed. The DIP switch provides a way to view this information externally. For deployments that do not require use of the two trunk connectors (such as an IP signaling installation that is not using TDM trunks), set DIP 4 ON to view error indicator LEDs on these trunk connectors.
5	Reserved for future use.
6	Reserved for future use.
7	Reserved for future use.
8	Reserved for future use.

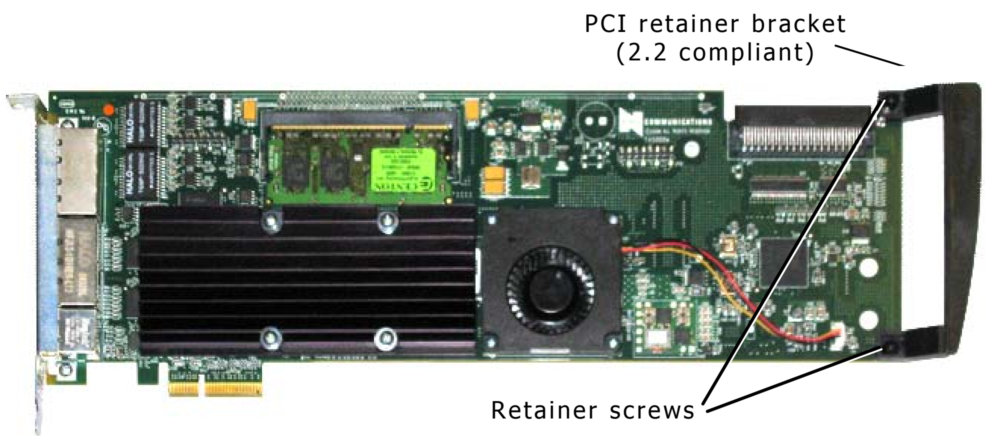
DIP switch S3: Hardware control

DIP switch S3 controls the hardware-level behavior of the board and is used during the manufacturing process. By default, all S3 switches are set to the OFF position. Do not modify any S3 DIP switch settings.

Installing the board

Complete the following steps to install the TX 5000E board in your system:

Warning:	Do not touch, spin, or apply pressure to the rotating part of the fan as this may shorten the operational life of the fan.

Step	Action
1	If necessary, configure the board as described in *Configuring the DIP switches* on page 15.
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	If you are placing the board into a PCI 2.2 compliant 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. 
5	Remove the blank slot cover from an open PCIe slot.
6	Arrange the TX 5000E board and other H.100 boards in adjacent slots. Insert the TX 5000E 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.
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	Connect the H.100 bus cable to the TX 5000E board. If you have multiple H.100 boards, connect the H.100 bus cable to each H.100 board.
9	Replace the cover, and connect the computer to the power source.

4 Configuring a TX 5000E board

Using the configuration utility

After you install a TX 5000E board and the NaturalAccess Signaling Software, you must assign a CP number to each TX 5000E board. Verify that you have completed the steps described in the *installation summary* on page 14 before you proceed to *assigning a CP number* on page 20.

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 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 *TX Utilities Manual*.

Assigning a CP number

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

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>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.</td></tr>
<tr><td>2</td><td>At the prompt, invoke txcpcfg by entering the following command:<pre>txcpcfg</pre>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:<pre>Bus   Slot   CP Number   CP Model
2   2   1   TX 5020E
2   4   2   TX 4000
2   6   UNDEFINED   TX 5500E</pre></td></tr>
<tr><td>3</td><td>Record the bus and slot values for the undefined TX 5000 Series board.</td></tr>
<tr><td>4</td><td>Assign a unique CP number to each undefined board by entering the following command:<pre>txcpcfg   bus   slot   unique_CP_number</pre>where:
bus is the bus number of the TX board that you are configuring.
slot is the slot number of the TX 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:<pre>txcpcfg 2 6 3</pre></td></tr>
<tr><td>5</td><td>Verify the configuration of all of the TX boards by entering the following command:<pre>txcpcfg</pre>In this example, if you assign the new board a unique CP number of 3, the following configuration information displays:<pre>Bus   Slot   CP Number   CP Model
2   2   1   TX 5020E
2   4   2   TX 4000
2   6   3   TX xxxx</pre>where xxxx is 5500E or 5020E for a TX 5000 Series board and 4000 is for a TX 4000 Series board.</td></tr>
<tr><td>6</td><td>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 25.</td></tr>
</table>

Adding a board

Complete the following steps to add a new undefined TX 5000E board:

Step	Action
1	Power down the system if it is running.
2	Insert the TX 5000E board, seating it firmly in an available slot.
3	Power up the system. If you are installing a TX 5000E 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 *Installing Dialogic® NaturalAccess™ Signaling Software*. If you are installing an additional TX 5000E board in a slot that has never held a TX 5000E 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 5020E`
	`2      6       UNDEFINED    TX 5500E`

5	Record the bus and slot values for the new undefined TX 5000E 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 board that you are configuring. • ***slot*** is the slot number of the TX 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 displays:
	`Bus    Slot    CP Number    CP Model`
	`2      2       1            TX 4000`
	`2      4       2            TX 5020E`
	`2      6       `**`3`**`            TX `***`xxxx`***
	where ***xxxx*** is 5500E or 5020E for a TX 5000 Series board and 4000 for a TX 4000 Series board.

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 25.

Changing a CP number

Complete the following steps to change the CP number of a TX 5000E board:

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>At the prompt, invoke txcpcfg by entering the following command:
<pre>txcpcfg</pre>
txcpcfg displays the bus number, slot number, CP number, and CP model of all TX boards that are present and configured.
<pre>Bus   Slot   CP Number   CP Model
2   2   1   TX 4000
2   4   2   TX 5020E
2   6   3   TX xxxx</pre>
where xxxx is 5500E or 5020E for a TX 5000 Series board and 4000 for a TX 4000 Series board.</td></tr>
<tr><td>2</td><td>Record the bus and slot values for the TX 5000 Series board that you are updating.</td></tr>
<tr><td>3</td><td>Change the CP number of a board by entering the following command with the updated CP number:
<pre>txcpcfg   bus   slot   updated_CP_number</pre>
where:

bus is the bus number of the TX board that you are configuring.
slot is the slot number of the TX 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:
<pre>txcpcfg 2 6 4</pre></td></tr>
<tr><td>4</td><td>Verify the configuration change by entering the following command:
<pre>txcpcfg</pre>
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:
<pre>Bus   Slot   CP Number   CP Model
2   2   1   TX 4000
2   4   2   TX 5020E
2   6   4   TX xxxx</pre>
where xxxx is 5500E or 5020E for a TX 5000 Series board and 4000 for a TX 4000 Series board.</td></tr>
<tr><td>5</td><td>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 25.
</td></tr>
</table>

Moving a board

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

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Power down the system if it is running.</td></tr>
<tr><td>2</td><td>Move the TX 5000 Series board from one slot to another slot, seating it firmly in the new slot.</td></tr>
<tr><td>3</td><td>Power up the system.

In a Windows system: If you are installing a TX 5000 Series board in a slot that has never held a TX 5000 Series board, the Windows® New Hardware Wizard appears, finds the required files, and exits.</td></tr>
<tr><td>4</td><td>At the prompt, invoke txcpcfg by entering the following command:

<code>txcpcfg</code>

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:

<code>Bus Slot CP Number CP Model</code>
<code>2 2 1 TX 4000</code>
<code>2 4 2 TX 4000</code>
<code>2 8 UNDEFINED TX 5500E</code></td></tr>
<tr><td>5</td><td>Record the bus and slot values for the TX 5000 Series board that you moved.</td></tr>
<tr><td>6</td><td>Assign a unique CP number to the undefined board by entering the following command:

<code>txcpcfg bus slot unique_CP_number</code>

where:
• bus is the bus number of the TX 5000 Series board that you are configuring.
• slot is the slot number of the TX 5000 Series 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:

<code>txcpcfg 2 8 3</code></td></tr>
<tr><td>7</td><td>Verify the configuration change by entering the following command:

<code>txcpcfg</code>

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:

<code>Bus Slot CP Number CP Model</code>
<code>2 2 1 TX 4000</code>
<code>2 4 2 TX 4000</code>
<code>2 8 3 TX xxxx</code>

where xxxx is 5500E or 5020E for a TX 5000 Series board and 4000 is for a TX 4000 Series board.</td></tr>
<tr><td>8</td><td>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 25.</td></tr>
</table>

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 5000 Series board from the slot.
3	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 5500E`

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 25.

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 5500E`

2	Using a text editor, open the */opt/dialogic/tx/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.

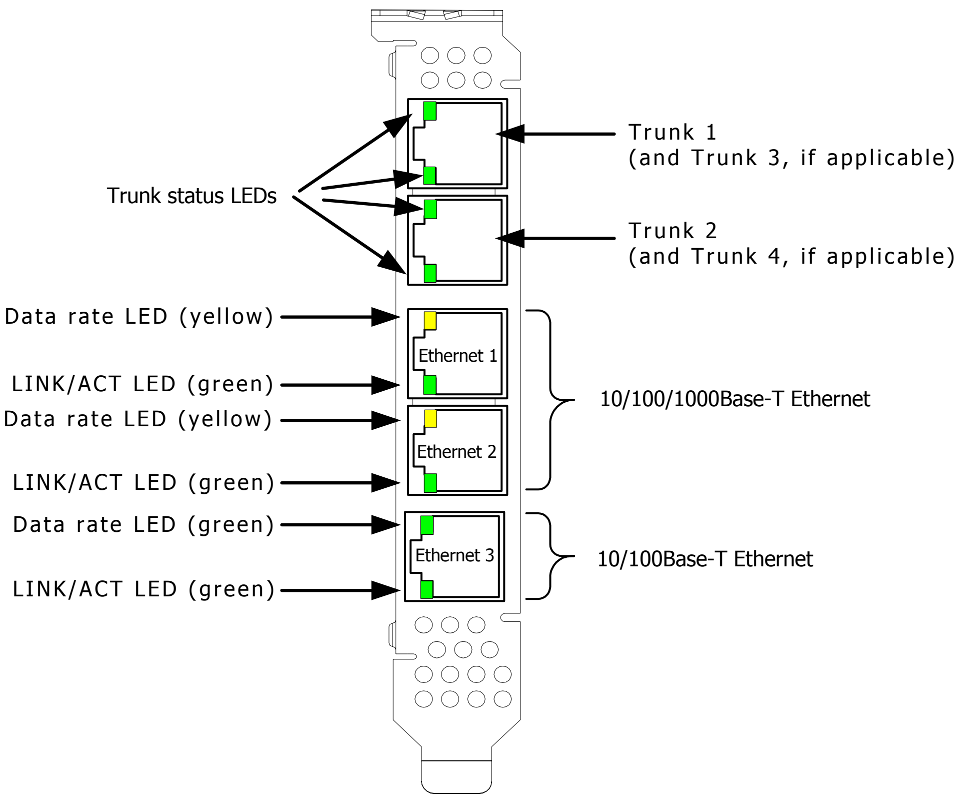
3	Following the *cpcfg* file format, edit the entry in the *cpcfg* file for the TX board CP number that you are updating. If you are adding a new board, add a new *txcpcfg* entry to the *cpcfg* file.
	Continuing with the example in step 1, the board with a CP number of 2 is updated to reflect the new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

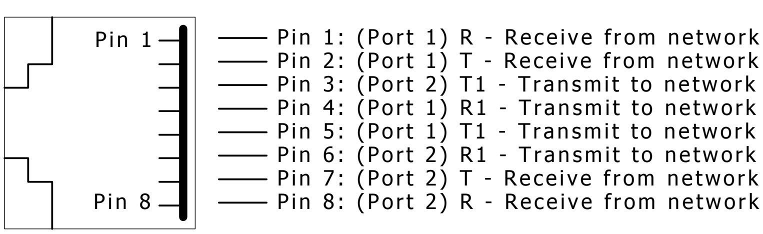
Connectors and cables

TX 5000E boards have two Dialogic® MD1 RJ-45 T1/E1 trunk interfaces and three Ethernet connectors. The following illustration shows these connectors on the TX 5000E board end bracket:



Dialogic® MD1 RJ-45 interface

TX 5000E boards provide Dialogic® MD1 RJ-45 interfaces to connect to a T1 or E1 network. The following illustration shows the Dialogic® MD1 RJ-45 pin assignments:

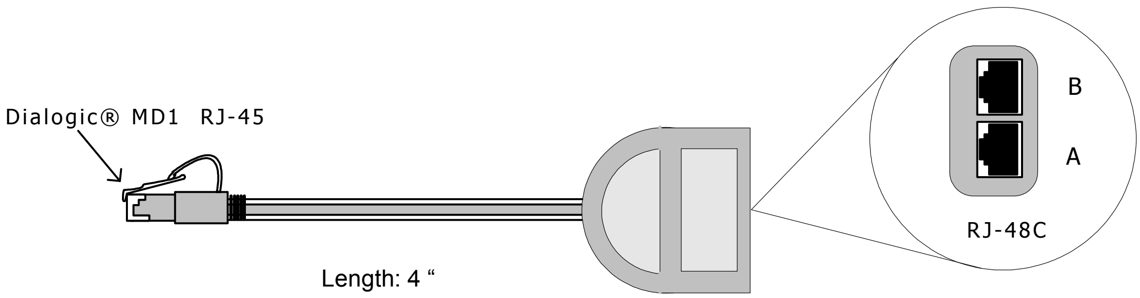


To access Trunk 1, Trunk 2, or both Trunks 1 and 2, connect a shielded T1 or E1 RJ-45 cable to one or both 8-pin modular jacks on the board.

Use dual T1/E1 120 ohm trunk adapter cables to connect Trunk 3 or Trunk 4 to the 8-pin modular jacks on 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. Connect the shielded RJ-45 cables directly to the trunk connector on the board or to the trunk adapter cable.

Dual T1/E1 120 ohm adapter cable

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



Dual T1/E1 120 ohm adapter cables use the following pin assignments:

Dialogic® MD1 RJ-45 plug	RJ-48C (A)	RJ-48C (B)
1: RxR1	1	
2: RxT1	2	
3: TxT2		5
4: TxR1	4	
5: TxT1	5	
6: TxR2		4
7: RxT2		2
8: RxR2		1

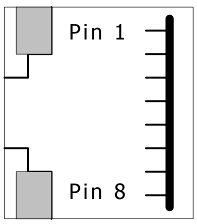
For more information about the trunk connections, refer to the *Dialogic® NaturalAccess™ Signaling Software Configuration Manual*.

Note: TX 5000E boards are configured as a T1/E1 120 ohm board. To connect a TX 5000E 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.

Ethernet interfaces

TX 5000E boards have two 10/100/1000Base-T Ethernet interfaces and one 10/100Base-T Ethernet interface. These interfaces provide Ethernet connections that support auto-negotiation for full duplex/half duplex transmission. The Ethernet interfaces provide a high-speed interface for connecting a TX 5000E board to its redundant mate board. Refer to *Connecting TX boards for redundancy* on page 33 for more information.

The following illustration shows an Ethernet interface:



Ethernet interfaces use the following pin assignments:

Pin	10/100/1000Base-T interface pin assignments	10/100Base-T interface pin assignments
1	MDI0P	MDI0P
2	MDI0M	MDI0M
3	MDI1P	MDI1P
4	MDI2P	No connection
5	MDI2M	No connection
6	MDI1M	MDI1M
7	MDI3P	No connection
8	MDI3M	No connection

M = Minus
P = Plus

Connecting to the network

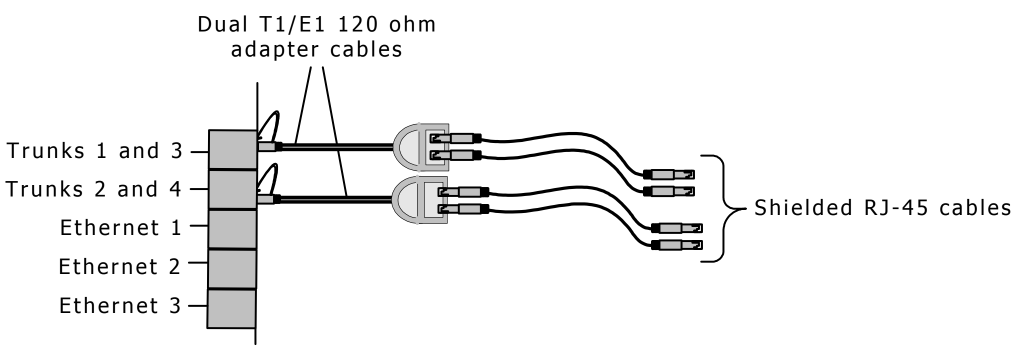
Before connecting a TX 5000E board to the network, ensure that you have properly configured the trunks as either T1 or E1. For configuration information, refer to the *Dialogic® NaturalAccess™ Signaling Software Configuration Manual*. For information about the products and services available for connecting and terminating Dialogic boards, contact a Dialogic Services and Support representative.

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 5000E board to a T1 network or to an E1 120 ohm trunk. Complete the following steps to connect a TX 5000E board to the network:

Step	Action
1	If connecting Trunk 1 or Trunk 2, connect a shielded RJ-45 cable directly to the board. 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.
2	Connect shielded RJ-45 cables directly to the trunk connector on the board or to the dual T1/E1 trunk adapter cable. **Caution:** Failure to use a shielded cable may negate your approval.

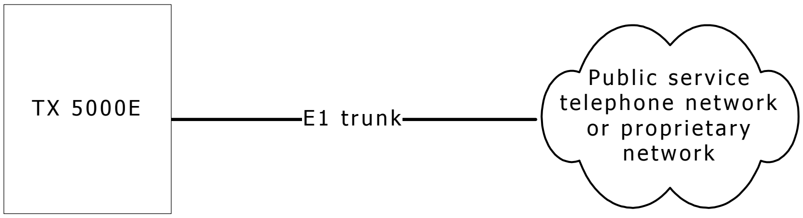
The following illustration shows the cabling required to connect all four trunks on a TX 5000E board:



For more information, refer to *dual T1/E1 120 ohm adapter cable* on page 28.

E1 network considerations

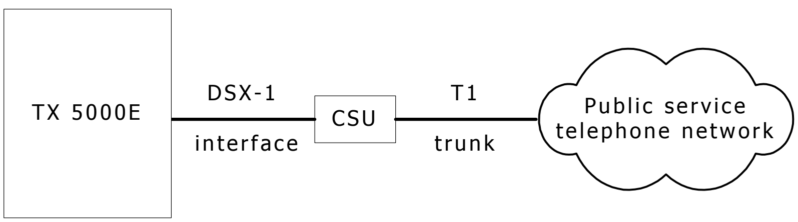
TX 5000E boards can support up to four CEPT E1 trunk interfaces. For typical E1 communications, each E1 interface connects directly to an E1 trunk, as shown in the following illustration:



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 5000E board trunk interface with CSU:



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

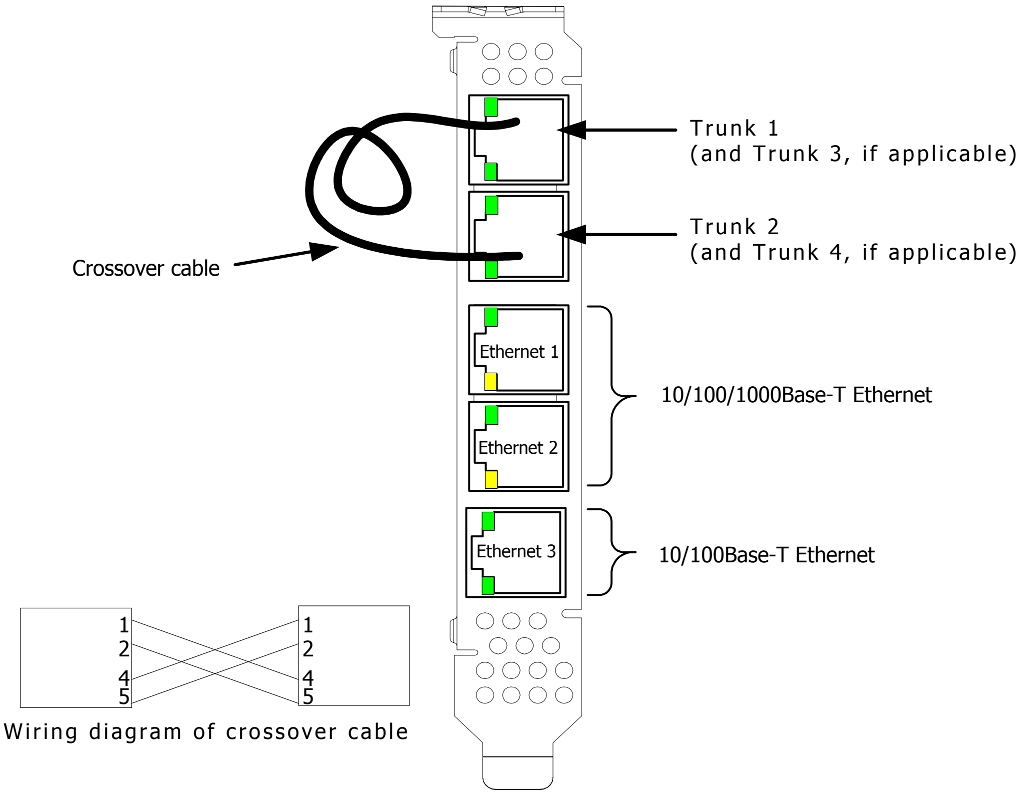
You can purchase or lease the CSU from the telephone company or other vendor.

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 5000E 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.

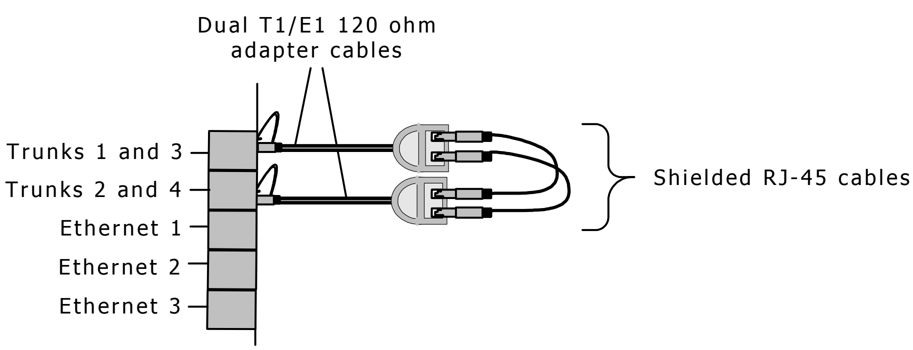
Testing in loopback mode

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 to trunk 2 using a crossover cable on a TX 5000E 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 dual trunk adapters 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 5000E board, the failure of a signaling node, or the failure of the TX 5000E 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.

The Ethernet 3 connector of a TX 5000E board is reserved for redundancy connectivity.

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

- TDM configuration
- IP network configuration

Note: TX 5000E boards support redundancy with other TX 5000E boards. A redundant configuration between a TX 5000E board and a TX 4000 Series board is not supported.

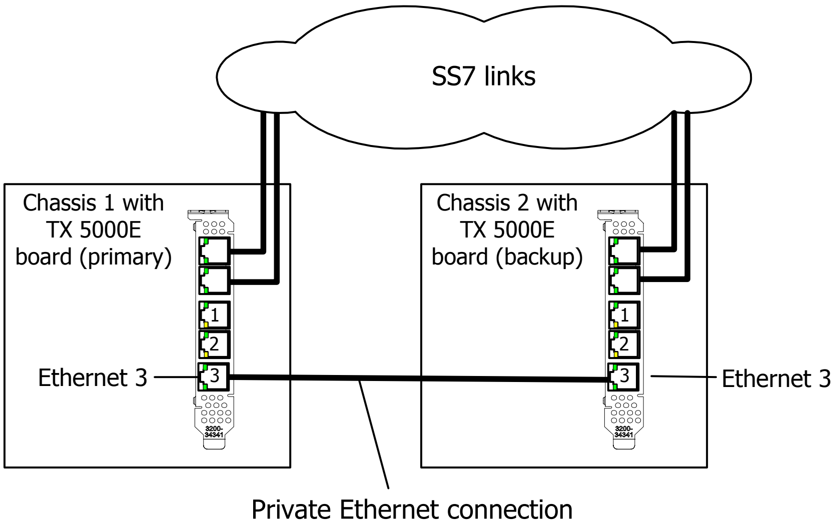
TDM configuration

To connect a TX 5000E board to its redundant mate in a TDM configuration, connect Ethernet 3 on the primary board to Ethernet 3 on the backup board using a Category 5 shielded twisted pair (STP) Ethernet cable.

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*.

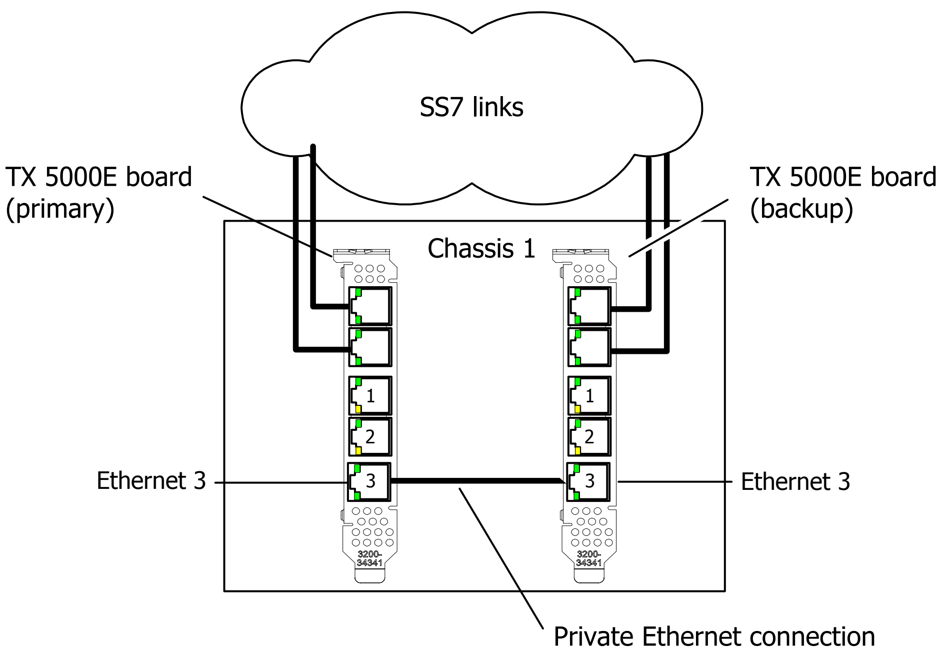
Dual-node redundant signaling server

The following illustration shows how to set up two TX 5000E 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 5000E 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

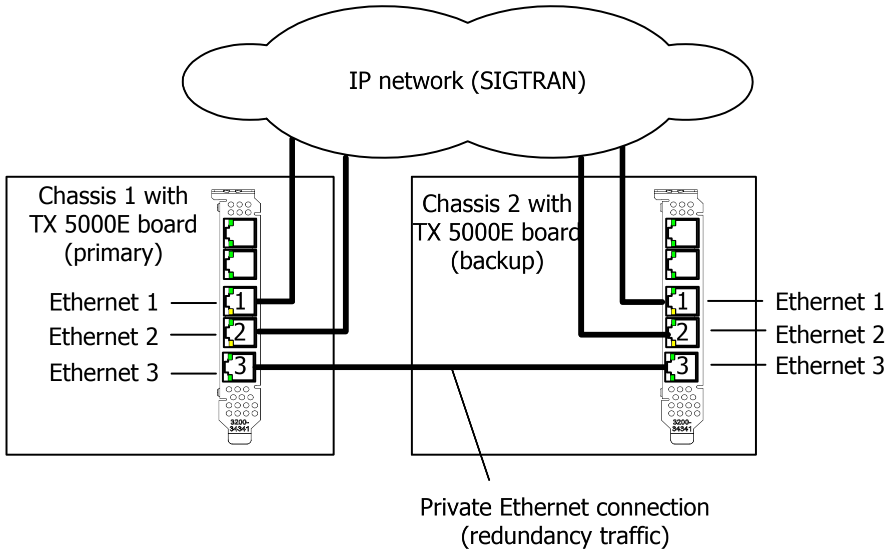
To connect a TX 5000E board to its redundant mate in an IP network configuration, connect Ethernet 3 on the primary board to Ethernet 3 on the backup board using a Category 5 shielded twisted pair (STP) Ethernet crossover cable. Then connect the Ethernet 1 and Ethernet 2 connectors on both boards to the IP network connectors using standard Ethernet cables.

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 a multi-homing configuration in which each board provides three separate network connections, then you can use Ethernet 3 for both the redundant pathway and for SIGTRAN network access. In this configuration, the Ethernet 3 on each board is connected to what is shown as an IP network cloud in the illustrations that follow (just as the Ethernet 1 and 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 specify the IP address and network mask of Ethernet interface 3 using the ifcreate command in the *txconfig* utility. For more information, refer to the *Dialogic® NaturalAccess™ Signaling Software Configuration Manual*.

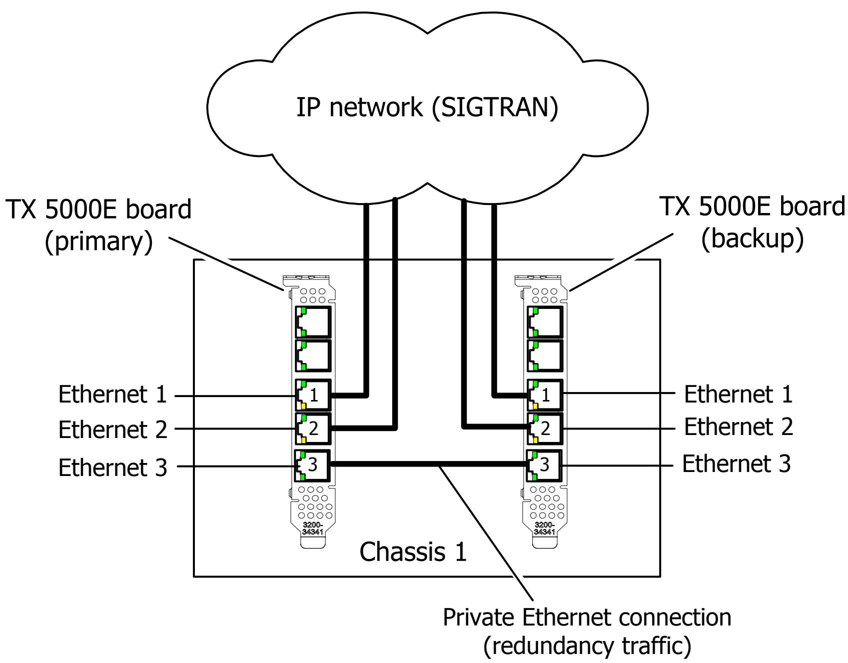
Dual-node redundant signaling server

The following illustration shows how to set up two TX 5000E 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 5000E 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.

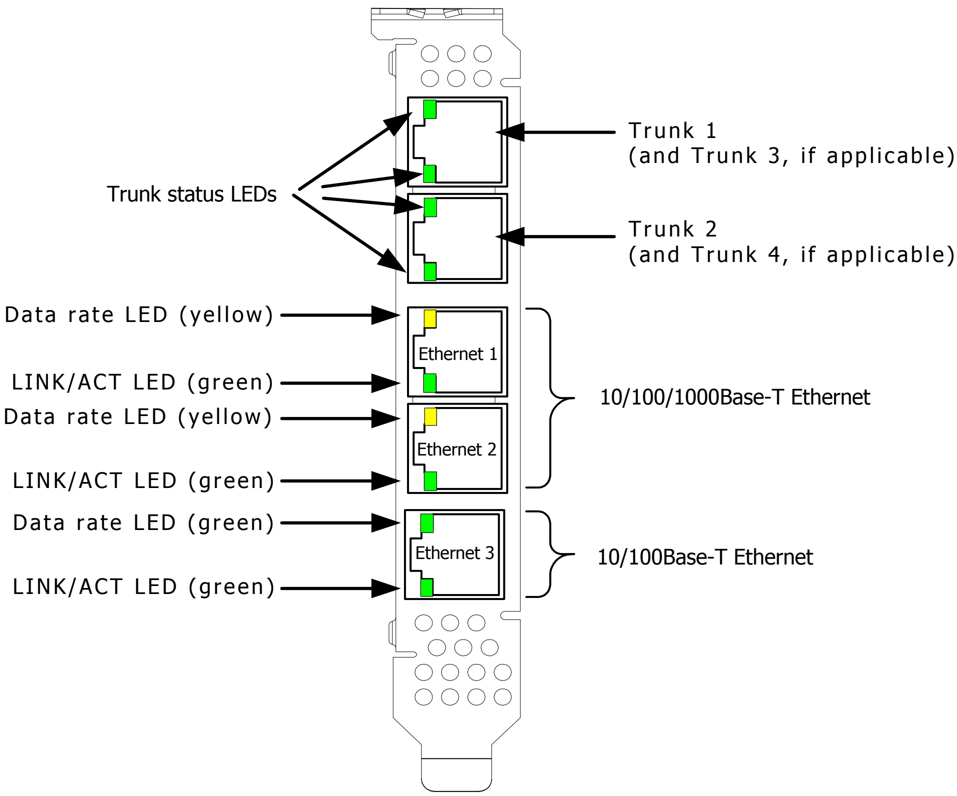


For more information on SS7 redundancy, refer to the *Dialogic® TX Series SS7 Boards Health Management Developer's Reference Manual*.

6 Verifying the installation

Interface status LEDs

The TX 5000E boards provide LEDs to indicate the status of the Ethernet interfaces and the trunk interfaces. The following illustration shows the location of the LEDs:



Trunk status LEDs

TX 5000E board end brackets have one green LED for each trunk. The trunk LEDs provide the following indications:

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

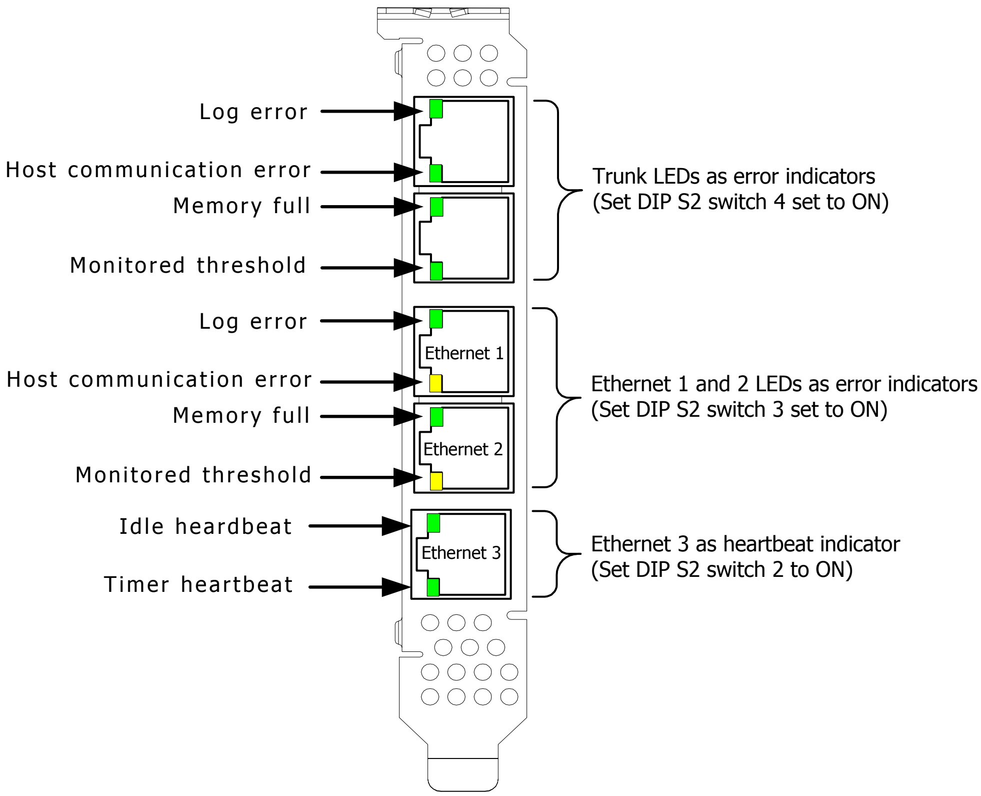
Ethernet LEDs

TX 5000E boards provide LEDs to indicate the status of each Ethernet interface. The following table describes the functionality of each LED:

LED	Description
LINK/ACT	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	Data rate of the Ethernet link. When the LED is on, the data rate is 100 Mbit/s. When the LED is off, the data rate is 10 Mbit/s. The LED is used only when a reliable Ethernet connection has been established. (The LINK/ACT LED is on.)

Alternative uses for faceplate LEDs

TX 5000E boards provide a set of DIP switches that you can use to override the default LED usage. By setting these switches, you can substitute TX operating system diagnostic information for the standard TDM trunk status, Ethernet connectivity status, or both. The following illustration shows the location of the LEDs and the alternative usage options:

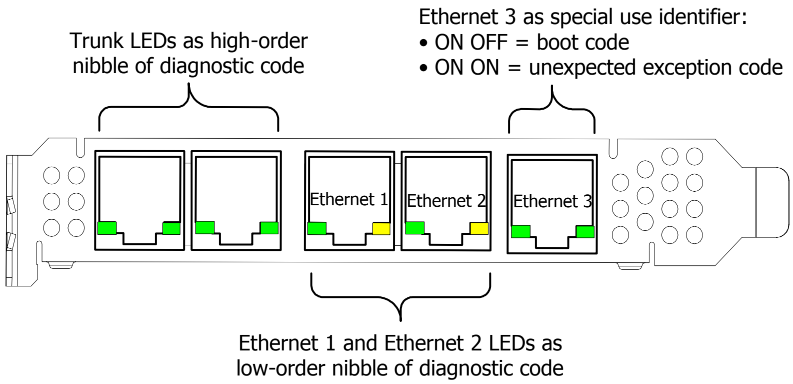


Boot codes and unexpected exception codes

The faceplate LEDs also show boot codes and unexpected exception codes that may occur. During initial system power-up or after a TX board is reset (using the *txreset* utility or the *txflash* –s option) the faceplate LEDs hold an 8-digit code. This code can be used if the board fails to help identify the root cause of the failure.

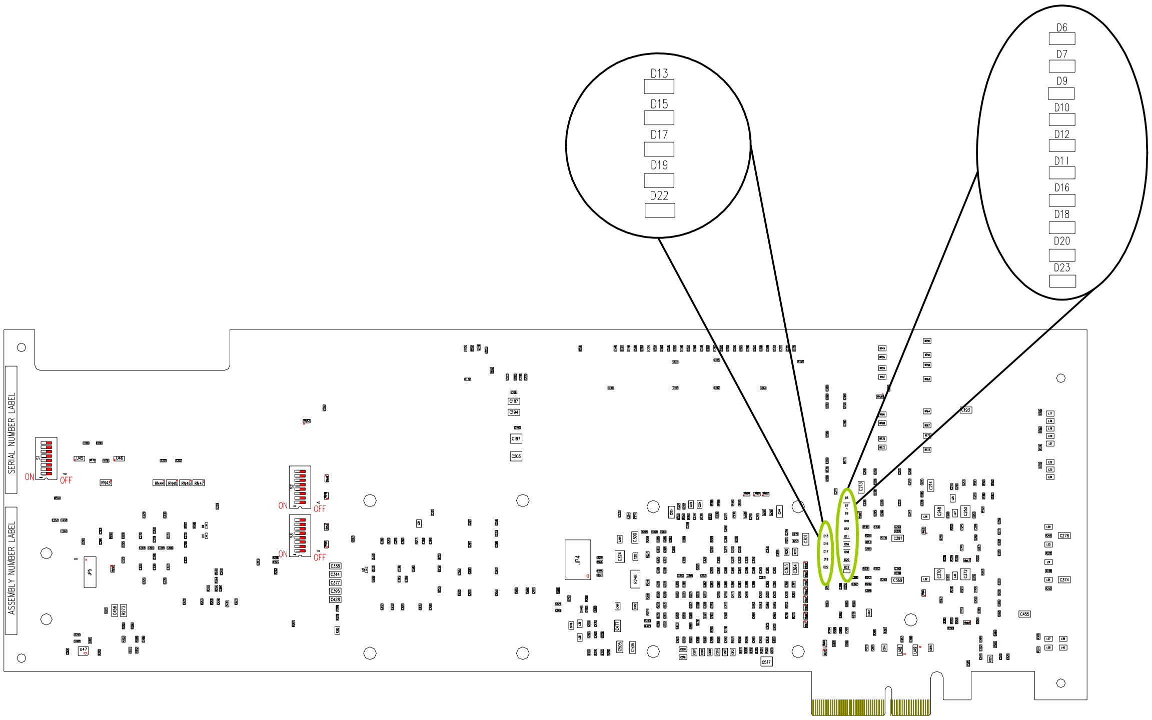
A boot code is identified when the Ethernet 3 LINK/ACT LED is ON and the Ethernet 3 Data rate LED is OFF. When both Ethernet 3 LEDs are ON, it indicates an unexpected exception code.

For these special cases, read the 8-bit diagnostic code from left to right with the first trunk connector to the left and the third Ethernet connector on the right. The trunk LEDs provide the high-order nibble of the code and the middle Ethernet connectors provide the low-order nibble of the code as shown:


Trunk LEDs as high-order nibble of diagnostic code
Ethernet 3 as special use identifier:
• ON OFF = boot code
• ON ON = unexpected exception code
Ethernet 1
Ethernet 2
Ethernet 3
Ethernet 1 and Ethernet 2 LEDs as low-order nibble of diagnostic code

Board status LEDs

On the back of a TX 5000E board, two banks of green LEDs indicate the current status of the board. The following illustration shows the board status LEDs:



The following table provides a description of the board status LEDs:

LED	Status when illuminated
D6	Kernel detected a problem. Use the *cpcon* utility's log command to view error information. For more information on *cpcon*, refer to the *Dialogic® TX Series SS7 Boards TX Utilities Manual*.
D7	Kernel detected a host communication error.
D8	Reserved for future use.
D9	Memory full condition occurred on the board.
D10	Reserved for future use.
D11	Reserved for future use.
D12	Idle task controlled heartbeat. The LED flickers to indicate that the on-board operating system is operational.
D13	Power Error: Over/Under voltage or overcurrent condition has occurred on board. Board power is turned off.
D14	The TX board is actively burning a new image to the on-board flash memory.
D15	Reserved for future use.
D16	Board is executing in snapshot mode: the board is resetting or *txsnap* is running. For more information on *txsnap*, refer to the *Dialogic® TX Series SS7 Boards TX Utilities Manual*.
D17	Reserved for future use.
D18	TX board is currently booting (see faceplate for boot code identifying specific phase of TX boot process).

LED	Status when illuminated
D19	3.3 V from PCIe connector is present.
D20	Unexpected exception occurred on the board.
D22	12 V from PCIe connector is present.
D23	Timer interrupt controlled heartbeat. The LED flickers to indicate that the timer interrupts are operating properly.

Verifying the board installation

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

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Display a list of all of the TX boards detected in the system by entering the following command:
<code>txcpcfg</code>
txcpcfg displays the bus number, slot number, CP number, and CP model type of each detected TX board. For example:<pre>
Bus   Slot   CP Number   CP Model
5   7   1   TX 4000
5   8   2   TX 5000E
</pre>If the CP number is listed as undefined, assign a CP number. For more information, refer to Assigning a CP number on page 20.</td></tr>
<tr><td>2</td><td>Ensure that each installed and configured board in the system appears in the list of boards.</td></tr>
<tr><td>3</td><td>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:
<code>cpmodel</code>
cpmodel displays each TX board by model type and assigned CP number. For example:<pre>
Board #1 is a TX 4000
Board #2 is a TX 5000E
</pre></td></tr>
<tr><td>4</td><td>Ensure that the boards listed by the txcpcfg utility in Step 1 are the same boards listed by the cpmodel utility in step 3.</td></tr>
<tr><td>5</td><td>Perform board-level diagnostic tests on each new board to verify the installation by entering the following command at the prompt:
<code>txdiag   -b</code>   boardnum
where boardnum is the CP number of the board.
txdiag indicates the successful installation of the CP 1 board.<pre>
CP 1:MEMORY SWEEP TEST - Starting test...
CP 1:SP ACCESS TEST - Starting test...
CP 1:SP ACCESS TEST - Successfully executed
CP 1:INTERRUPT VERIFICATION TEST - Starting test...
CP 1:INTERRUPT VERIFICATION TEST - Successfully executed
CP 1:NMI VERIFICATION TEST - Starting test...
CP 1:NMI VERIFICATION TEST - Successfully executed
</pre></td></tr>
</table>

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

Feature	Specification
PCIe bus	x4 PCI Express
Digital trunk interface connector	Two Dialogic® MD1 RJ-45 interfaces
Board weight	0.65 lb (0.29 kg)

Host interface

Feature	Specification
Electrical	PCIe bus designed to *PCI Express Base Specification, Revision 1.1*
Mechanical	Designed to *PCI Express standard-height/full-length form factor*
Bus speed	2.5 Gbit/s lane speed
Maximum number of boards per chassis	16
Maximum number of SS7 links per board	128 per TX 5500 board 32 per TX 5020 board
PCI mapped memory	Memory mapped interface for efficient block data transfers

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 Linux

Power requirements

State	Requirements
TX 5000E PCI Express Board (active) at 55 °C CPU ambient temperature	1.3 A maximum @ 12.0 V 2.2 A maximum @ 3.3 V

Note: Voltage tolerances are +/- 5% of nominal.

Cooling requirements

Ambient temperature	CFM (per board)	Altitude
35 °C	1.46	Sea level
45 °C	2.54	1000 m (3481 ft)

Connectivity

Feature	Description
Two Ethernet interfaces	Two 10/100/1000Base-T Ethernet interfaces (IP/SIGTRAN)
Single Ethernet interface	One 10/1000base-T Ethernet interface for redundancy
PSTN network connectivity	Two T1/E1 Dialogic® MD1 RJ-45 interfaces
Intra-chassis connectivity	H.100 bus

CEPT E1 G.703 telephony interface

Feature	Specification
Interface	G.703 2048 kbit/s trunk interface.
Framing	CEPT G.704.
Line code	HDB3 or AMI (in zero code suppression).
Zero bits	Selectable B8ZS, jammed bit (ZCS) or no zero code suppression.
Alarm signal capabilities	Loss of frame alignment, loss of signaling multiframe alignment and loss of CRC multiframe alignment (red), remote alarm and remote multiframe alarm (yellow), alarm indication signal (AIS) (blue).
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, B8ZS
Zero bits	Selectable B8ZS, jammed bit (ZCS) or no zero code suppression
Alarm signal capabilities	Loss of signaling multiframe alignment and loss of CRC multiframe alignment (red), remote alarm and remote multiframe alarm (yellow), alarm indication signal (AIS)
Counts	Bipolar violation, F(t) error, and CRC error
Loopback	Per channel and overall 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).
Maximum cable length	655 feet of 22 AWG twisted pair

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