

T1 Digital Trunk Connectivity Manual

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About This Manual

This manual describes how to configure T1 in any of these NuPoint Messenger™ servers:

- Model 640
- Model 120
- Model 70

Who Should Read This Manual

This manual is intended for technicians and administrators who are responsible for configuring T1 on the NuPoint Messenger server.

How to Use This Manual

This manual contains detailed reference information, a list of tasks that you can perform, a collection of procedures for performing the tasks, and reader aids.

Reference Chapters

Use the material in chapter 1 for background on T1 connectivity. These chapters discuss how components are related, elaborates on concepts, gives operational details, and contains all necessary tables and figures about configuration. Use the *Installation and Service Manual* appropriate for your platform for an actual server installation and the *Reference and Configuration Manual* for NuPoint Voice™ software configuration.

Task Lists

The task list is located in the Configuration section. Use the task list, starting with a principal task (shown in boldface), to configure T1. Each task listed is described in more detail in a procedure. The task list is alphabetized, which helps most readers find the desired task (and procedure) quickly.

Procedures

Procedures follow the task list in the Configuration section. Follow the steps in the procedures (CPs) to accomplish the desired tasks. Readers familiar with a NuPoint Messenger server can use the CPs as a checklist if desired, while new users can use CPs for step-by-step instructions.

A reference line in each CP contains pointers, when necessary, to supplemental information such as another procedure, another manual, a technical reference, or a menu map.

Each CP is numbered for document identification and referencing; numbering does not indicate a sequence of performance. A numerical list of all CPs in this manual is also provided. It gives each CP's number and title.

This manual also contains a Technical Reference (TR). The TR provide details on hardware configuration of T1 connectivity.

Conventions Used in This Manual

The procedures in this manual use the following conventions to describe how you enter T1 configuration information and how information appears on the server console:

Press Enter Press the **Enter** key. For example, "Press **Enter** if the current number is correct." On some keyboards, this key is labeled "Return" or has a return arrow on it.

Enter Type the text shown, then press the **Enter** key. For example, "Enter the line **number** (1-24)" means type a number from 1 through 24, and then press the **Enter** key.

bold Words or characters in bold type indicate either a value to be entered by you exactly as shown or, when used to indicate a variable entry, describe the type of value to be supplied by you.

Note: Unless otherwise stated, press Enter after each response you type.

Reader Advisories

Reader advisories used in this manual are shown below.

Note: Information especially useful in relation to this procedure.



CAUTION!

Information that helps you prevent equipment or software damage.



CAUTION!

Information that helps you avoid electrostatic discharge (ESD) damage to the equipment.



WARNING!

Information that helps you prevent an interruption to telecommunications traffic.



WARNING!

A hazard that can cause you personal injury.



DANGER!

Warns of a condition that could severely injure or kill you.

Before You Start

This manual assumes that you are familiar with using a console and keyboard. This section describes how to use the server effectively.

Console Tips and Techniques

The tips and techniques offered in the following paragraphs can make configuration entry sessions at the server console more productive.

Viewing Menus

- When you finish entering a parameter, the server displays an abbreviated form of the current menu, called the "short menu." To view the complete current menu when a short menu appears, just press Enter.
- To return to the Main Menu from any NuPoint Voice configuration menu, press X (Exit) until the Main Menu appears.

Accepting Defaults

- To accept a default displayed in a *prompt*, just press Enter.
- To accept a default displayed in a *menu*, no action is necessary.

Quitting an Entry Session

At any point during entry of offline or online parameters, you can quit. Quitting discards all entries you have made and leaves the NuPoint Voice configuration the way it was before you started entering parameters.

To quit from the NuPoint Voice Configuration Offline or Online Menu:

Select: (Q) Quit -- Forget Changes
Prompt: Quit and forget changes? (y/n) =
Response: Y to return to the NuPoint Voice Configuration Main Menu.

Shortcut Commands

You can use the Ctrl (Control) key or the / (slash) key while simultaneously pressing another key to execute shortcut commands at the server console.

| To do this... | Type... |
|---|----------------------------|
| Exit from the offline or online menus, or FCOS, LCOS, GCOS menus, and save any entries. | X |
| Exit from the offline or online menus, or FCOS, LCOS, GCOS menus, without saving any entries. | Q Y |
| Stop scrolling a displayed report. | Ctrl-S |
| Resume scrolling a displayed report. | Ctrl-Q |
| Return to the NuPoint Voice application when a # or \$ prompt appears. | Ctrl-D <i>or type</i> exit |

1 T1 Digital Trunk Connectivity

This chapter is an overview of the T1 digital trunk connectivity feature available for the NuPoint Messenger server. It provides background information for T1-related Procedures (CPs) and Technical Reference (TR).

Overview

The server includes T1 digital trunk connectivity as a standard feature. This feature is available on all server models (70, 120, and 640). T1 connectivity allows the server to integrate with switches that connect to a telephone network through T1 digital trunks.

The T1 connectivity feature consists of telephony cards and supporting system software. The number and type of telephony cards depends on the server model and the type of signaling used. The cards support Channel Associated Signaling (CAS), which supports different signaling protocols.

Dual T1 Digital Trunk Interface Card

The basic telephony card required for T1 connectivity is the Dual T1 Digital Trunk Interface card (Dual T1 card). The Dual T1 card is the interface for up to two T1 1.544 Mbps T1 trunks. The card conforms to de facto North American standards for T1 transmission.

The Dual T1 card is AT bus-compatible and plugs into the server backplane. The Dual T1 card connects to other telephony cards through a Multi-Vendor Integration Protocol (MVIP) bus.

Briefly, the Dual T1 card and the switch exchange information encapsulated in T1 frames. The information includes framing bits, call control signals, and voice data (digitized from analog signals). Depending on the frame format used, the frames may also contain error-checking bits. The error-checking and framing bits (bits that determine the beginning or end of a frame) are processed by the Dual T1 card. Signaling and voice information is passed to other telephony cards through the MVIP bus.

Each Dual T1 card provides up to 48 Pulse Code Modulation (PCM) channels (24 per trunk). The PCM channels act as conduits for voice data. As described later, server models differ in the number of PCM channels supported.

During T1 transmission, the PCM channels are multiplexed and passed in time slots of T1 frames. As described later, call control signals sometimes also are passed in time slots.

Supporting Telephony Cards

In addition to the Dual T1 card, T1 connectivity requires one or more digital signal processing (DSP) line cards. Like the Dual T1 card, the line cards are AT bus-compatible and plug into the server backplane. The cards interconnect through the MVIP bus.

DSP 8 and DSP 24/30 Line Cards

The DSP 8 and DSP 24/30 line cards process digital information extracted from the PCM channels by the Dual T1 card. With CAS signaling, the information consists of voice data and call

control signals.

For T1 connectivity, each DSP 24/30 card supports voice and signal processing for up to 24 ports (each port corresponds to one T1 channel). The DSP 8 card supports the same type of processing for eight ports. You can mix the two types of line cards, though certain constraints apply to CAS signaling, described later in this chapter.

The DSP line cards interpret call signals and compress and expand voice data. The line cards and CPU work together to prompt callers, play mailbox greetings, and store messages.

NuPoint Voice Software

In addition to telephony cards, T1 digital trunk connectivity requires support from NuPoint Voice software. The support includes administrative processes and maintenance and configuration utilities. Online and offline maintenance and configuration tasks are described in procedures, later in this manual.

Protocols Supported

The T1 digital trunk connectivity feature supports widely-used protocols for T1 transmission. As a result, the server can integrate with switches in a wide range of T1 environments. The supported protocols can be subdivided into three categories: frame format, signaling, and line coding (Table 1-1).

Following paragraphs summarize each protocol. For additional information, refer to the many reference books available on telephony and digital transmission.

| Item | Protocols Supported |
|--------------|--|
| Frame Format | D4 Superframe, Extended Superframe (ESF) |
| Signaling | CAS (Loopstart, Groundstart, DID, E&M) |
| Line Coding | AMI, ZCS, B8ZS |

Following paragraphs summarize each protocol. For additional information, refer to the many reference books available on telephony and digital transmission.

Note: You cannot use Extended Superframe format and Groundstart signaling together.

Frame Format

The NuPoint Messenger server supports D4 Superframe and ESF frame formats. The basic unit of each is a D4 frame. Each D4 frame contains 24 8-bit time slots and a framing bit (193 bits total). A D4 Superframe consists of 12 D4 frames (Figure 1-1). The ESF frame (not shown), is an extension of D4 Superframe, containing 24 rather than 12 D4 frames. The D4 frame rate is 8,000 frames/s, yielding a T1 throughput of 1.544 Mbs.

With CAS signaling, the least significant bit in each time slot of every sixth D4 frame is a signaling bit. This is true regardless of whether the D4 frames are part of an ESF or a D4 Superframe. This form of signaling is called "robbed bit," because the signaling bit overwrites a voice data bit. At the T1 transmission frequency, omission of a data bit from each time slot cannot be detected

by the human ear.

Within each ESF frame, six framing bits are actually used for error-checking (CRC checking). There are no error-checking bits in a D4 Superframe (all framing bits are used for framing purposes).

Figure 1-1 D4 Superframe T1 Frame Format

Signaling

In telephony, signaling is the transfer of information needed to control a call connection. It is a coordinated process between a remote switch and the signaling resources on the MVIP bus. As mentioned, the T1 digital trunk connectivity feature supports CAS that allows specific signaling protocols.

With CAS signaling, signaling bits are carried inside the PCM channels (signaling "robs" bits from the voice data). As described earlier, the signaling is carried in every sixth frame of a D4 Superframe or ESF.

Currently, the server supports four CAS signaling protocols: Loopstart, Groundstart, DID, and E&M. Each protocol is a carryover from analog telephony; they are used by a large proportion of telephone equipment worldwide.

Both ends of a T1 transmission must employ identical signaling protocols. If they do not, there is no means for call control; that is, calls cannot be established and serviced.

Line Coding

Line coding is a process to encode/decode trunk signals transferred to/from the transmission medium. Line coding facilitates long-distance transmission of T1 signals and counteracts transmission impairments. One such impairment is "signal jitter." Signal jitter is the short-term variation (drift) of signal voltage levels from their ideal positions in time.

The T1 digital trunk connectivity feature supports three line coding protocols:

- Alternate Mark Inversion (AMI)
- Zero Code Suppression (ZCS)
- Binary with Eight Zeroes Suppression (B8ZS)

AMI is a simple technique that encodes a unipolar signal as a bipolar signal with alternate mark inversion (Figure 1-2). With alternate mark inversion, every other mark (one) is inverted.

Figure 1-2 T1 Line Coding (AMI Shown)

B8ZS introduces a code, recognizable to a data receiver, that changes a bit from a zero to a one. B8ZS deliberately introduces a known bipolar violation (BPV) into the data bitstream. The receiver recognizes the violation and substitutes the proper data in its place. Because of the predictable nature of B8ZS encoding, it does not interfere with the transmitted data.

ZCS is an extension to AMI. With ZCS, the eighth zero bit in a string of zeroes is converted to a

one. ZCS interferes with the data when all zeroes are transmitted; however, it is not a significant problem for voice data (where reversal of a few bits is not apparent).

Functional Description

This section describes functional characteristics of server T1 connectivity, including a quick briefing on operation of T1 connectivity with CAS signaling and information on T1 clocking, events and alarms, and online maintenance tasks.

Operating With CAS

The Dual T1 card and the supporting telephony cards interconnect through the MVIP bus (Figure 1-3). Configuration and line group assignments for both are handled through the configuration utility (Resource Manager). Supporting cards may include NuPoint Fax™ cards as well as DSP 24/30 or DSP 8 cards.

Figure 1-3 NuPoint Messenger Server T1 Connectivity – CAS Mode

On the receive side of the trunk, the Dual T1 card decodes trunk signals and demultiplexes PCM channels. It passes the PCM channel content, signaling and voice information, to supporting telephony cards on the MVIP bus. Recall that, with CAS signaling, signaling is included in every sixth D4 frame. This is "robbed bit" signaling, because each signal bit overwrites a voice data bit.

Each line card runs software that detects call events based on the signal pattern it receives from the Dual T1 card. The event can be, for example, a busy signal, ring/no answer, or a reorder tone.

Line card software interprets call events based on de facto North American signaling standards. The software interacts with the application(s) that execute in the server CPU (the application or applications that are associated with the line groups assigned to the T1 trunk channels). Together, the line card and the CPU process the call.

In a typical processing scenario, an outside caller calls the voice mail system. The call is signaled on the trunk, and the signal passes from the Dual T1 card to the line card. The line card prompts the CPU to start the system greeting.

On the transmit side, the greeting is passed to the Dual T1 card, signal bits are added, and the greeting is multiplexed with voice data from other channels. The multiplexed channel information is interleaved with framing bits and the resulting T1 frames are encoded as trunk signals. The signals are put on the trunk.

The caller receives the system greeting, which asks for the called (mailbox) number. In response, the caller keys in the mailbox number. The response is put on the trunk. The Dual T1 card picks up the response and passes it to the line card. The line card extracts Dual-tone Multifrequency (DTMF) signals indicating the mailbox number. The line card passes the DTMF signals to the CPU. The CPU has the mailbox greeting transferred from hard disk to the line card. The line card passes the greeting to the Dual T1 card, which puts it onto the trunk.

When the caller responds to the mailbox greeting, the response is passed from the Dual T1 card to the line card. The line card compresses the response and signals the application. The CPU, notified that a response is waiting, stores the response in the desired mailbox on the hard disk.

Synchronizing the MVIP Clock

The digital network worldwide is synchronized to several atomic clocks. Signals derived from those clocks are passed through the network to synchronize frame alignment in T1 transmissions. Each device connected to the network attempts to synchronize with a device upstream (to which it communicates). Within the server, the process of synchronizing to a T1 clock (T1 clocking) is handled by MVIP bus architecture.

MVIP architecture defines a master clock and a master clock reference. The master clock provides a clock signal used by all cards on the MVIP bus. The clock reference is the signal to which the master clock is set. At any time, the MVIP bus can have only one master clock and only one active clock reference.

Physically, the master clock is an oscillator circuit contained on a Dual T1 card (each Dual T1 card has several oscillator circuits, one of which is used as the MVIP master clock). The master clock circuit includes a phase-lock loop, allowing it to be phase-locked to a software-selected clock reference. The clock reference can be either:

- A signal extracted from a trunk RxD line.
- A signal provided by a free-running oscillator on the Dual T1 card.

A clock reference from an incoming trunk signal is referred to as an external reference. A clock reference from the free-running oscillator is referred to as an internal reference. You select the master clock and clock reference using the Resource Manager, as described in TR 1905 (Dual T1 Digital Trunk Interface Card).

If you select an external clock reference, MVIP architecture provides for a backup reference should the primary reference fail. In this case, the MVIP bus automatically switches over to the second trunk on the same Dual T1 card (assuming a second trunk is operating). The clock signal extracted from the second trunk now becomes the reference for the master clock.

Clock reference switchover is "hitless;" that is, the clock reference can be manually or automatically switched from the primary to the secondary reference source without affecting channel traffic. Note that reference switchover is possible only if both the trunks terminate on a single Dual T1 card.

Detecting and Reporting Carrier Events

The Dual T1 card and software detect and report T1 connectivity events. Events are abnormal conditions on incoming or outgoing trunk lines. Events are recorded in the system event log. In addition, you can view a statistical display (count) of events using the Digital Connectivity Status/Maintenance Menu. Event counters for the display can be reset anytime.

The events that are reported are:

- Loss of frame (LOS)
- Frame slips
- Alarm indication signal (AIS)
- Local alarms
- Remote alarms
- Bit errors

- Errored seconds
- Failed seconds

Loss of Frame

LOS results from loss of frame synchronization; when a given time slot on the receiving end is not aligned with the corresponding time slot at the transmitting end. The condition is indicated when the Dual T1 card detects two or more framing bit errors out of sixteen or fewer consecutive framing bits within a 3-millisecond period.

LOS is also referred to as an out-of-frame (OOF) condition. As described later, if an OOF condition persists for a specified time period, the software issues a local alarm and terminates calls associated with the trunk.

Frame Slip

Frame slip results when a full frame (D4 Superframe or ESF) is dropped or repeated without loss of frame synchronization. Frame slip results in garbled communication but does not cause an alarm or termination of calls in progress.

Alarm Indication Signal

AIS results when the carrier far end goes out-of-service for testing or maintenance. When this occurs, the carrier far end replaces the normal traffic signal with a continuous string of unframed ones. The transmission of all ones allows the Dual T1 card to continue extracting a clock reference from the that trunk, despite the loss of normal channel traffic.

Remote and Local Alarms

Remote alarms are alarms detected on the network receive line (RxD) line. One type of remote alarm is the AIS, described above. Another type of remote alarm occurs when the far end detects an OOF condition that persists for a specified time.

Local alarms are alarms sent on the network transmit line (TxD). Local alarms result when the near end detects an OOF condition that persists for a specified time.

Bit Errors

Bit errors result when the voltage level of an incoming bipolar signal drifts from the level expected at a particular point in time. This is referred to as "signal jitter." The Dual T1 card can identify and correct most bit errors, but bit errors are an indication of a fault within the network or in transmission equipment at the far end.

Errored Seconds and Failed Seconds

An errored second is every second of transmission for which, during that second, some transmission impairment is detected. A failed second is when a transmission impairment detected within a second lasts the entire duration of the second.

Handling Alarms

When an OOF condition persists for more than 2.5 seconds, the software generates an alarm which is transmitted on the trunk TxD line. In addition, the software informs the application that channels on the failed digital trunk are unavailable. As a result, all in-process calls associated

with those channels are terminated. Only after a trunk is restored for 15 seconds are the affected channels again made available.

Note: An AIS from the far end can result in a prolonged OOF condition and subsequent local alarm.

Performing Online Maintenance

The software provides a utility for online maintenance of digital trunk activity. Accessible through the Digital Connectivity Status/Maintenance Menu, the utility allows:

- Changing the MVIP clock reference
- Monitoring trunk activity
- Removing trunks from service
- Putting trunks back into service

Following is a brief summary of each procedure. Step-by-step instructions are provided in the procedures, later in this manual.

Changing the MVIP Clock Reference

Under certain circumstances, you might want to change the MVIP clock reference online. For example, if a module contains two Dual T1 cards, and the card that contains the trunk from which the clock reference is derived will be removed, you could switch the reference to the second card. For the procedure to change the MVIP clock online, see CP 3152.

Monitoring Trunk Activity

At any time, you can monitor activity of any or all trunks. A trunk status display gives a summary of trunk configuration, state, and error (event) counts. The display is dynamic, updated every second by the server. For the procedure to monitor trunk activity, see CP 3153.

Trunks are either in a normal (in-synch) state or in an alarm state. In-synch indicates that the trunk is functioning normally, with undisturbed transmission of PCM content. Alarm indicates the trunk has shutdown due to OOF condition.

Placing Trunks In and Out of Service

T1 trunks can be placed into and out-of-service (OOS) for maintenance purposes. When a trunk is placed OOS, the digital trunk interface card automatically turns on the AIS to the far end to indicate the OOS state of the trunk. For the procedure to place trunks in and out of service, see CPs 3154 and 3155.

Configuration

Configuration of the T1 digital trunk connectivity feature involves hardware and software procedures. The hardware procedure includes setting DIP switches and jumpers on the Dual T1 card and installing the card in the server backplane (typically done at the factory). The software procedure includes assigning each Dual T1 card an AT-bus slot and I/O address, configuring trunk protocols, and setting the MVIP clock.

Step-by-step hardware and software procedures are provided later in this document (TR1905 for

hardware, CP3150 for software). Following are some additional considerations, and some points covered in the procedures but deserving extra emphasis.

Slot Assignment and I/O Address

Models 70 and 120R each support only one Dual T1 card. Models 120S and 640 support up to two Dual T1 cards. Table 1-2 shows the slot assignments for each type of NuPoint Messenger model.

| Card Number | Model 70 Slot Number | Model 120R Slot Number | Model 120S Slot Number | Model 640 Slot Number |
|-------------|----------------------|------------------------|------------------------|-----------------------|
| 0 | 2 | 6 | 6 | 9 |
| 1 | — | — | 8 | 11 |

The Dual T1 card can occupy one of two possible AT bus addresses: 0x300h and 0x2300h (where address 0x300h is the default address occupied by the first card, and 0x2300h is the address occupied by the second card, if present). The address entered during software configuration must match the address for which the card is physically jumpered.

Note: Either of the two addresses listed above also can be assigned to a Smartcard. To prevent an address conflict, ensure that each card is set to a unique address.

Channel Capacity

Recall that each Dual T1 card provides connection to up to two T1 trunks (24 PCM channels per trunk). The servers differ in the number of PCM channels supported (Table 1-3). The constraint on channel support is a system limitation.

| Model | Channels/Module | Total Channels |
|-------|-----------------|----------------|
| 70 | 24 | 24 |
| 120R | 32 | 32 |
| 120S | 60 | 60 |
| 640 | 60 | 240 |

Assignment of Channels to Line Groups

In addition to configuring the T1 digital trunk connectivity feature, you need to assign trunk channels to line groups (in the same manner as assigning ports to line groups for analog trunks). Assigning line groups is part of the configuration process for applications on the server, not covered in this manual. For information on line group configuration, refer to CP 5010 in the *Reference and Configuration Manual*.

Note: Only channels assigned to line groups can be activated. No DSP resources are allocated, and no signaling is processed, for channels that are not part of a line group. The transmitted signaling pattern for unassigned channels is a busy signal.

Integration with Analog Trunks

T1 digital trunks can coexist with analog trunks in the same server. In such configurations, the line cards are a mix of DSP cards and LC8 line cards (used with the analog trunks). Configuration and line group assignments for both are handled through Resource Manager.

Fractional T1

The T1 feature supports fractional T1, which uses 8 or 16 of the 24 channels provided by a trunk, on Models 70 and 120. Pair one or two DSP 8 cards with the T1 card. Do not use fractional T1 with full T1 (pairing 24 T1 channels with a DSP 24 card) in a Model 120S. The Model 640 does not support fractional T1.

Protocol Types

T1 and fractional T1 can support up to two protocol types (Loopstart, DID, E&M, or Groundstart) per Model 70 or 120 or Model 640 module. A Model 640 with two or more modules can support up to four protocol types.

Connection to Multiple COs/PBXs

Clock references are independent for each server module. As a result, a Model 640 can connect multiple COs, a CO/PBX combination, or multiple PBXs. The different connections, however, must go to different server modules (clock synchronization is on an MVIP bus basis, and each module supports only one MVIP bus).

List of Procedures and References

| | |
|--|---------|
| Change the Digital Trunk Connectivity Clock Reference----- | CP 3152 |
| Dual T1 Card Offline Configuration ----- | CP 3150 |
| Monitor Digital Trunk Statistics ----- | CP 3153 |
| Place a Digital Trunk Into Service----- | CP 3155 |
| Put Digital Trunk Out of Service----- | CP 3154 |
| Dual T1 Digital Trunk Reference Card----- | TR 1905 |

CP 3152 Change the Digital Trunk Connectivity Clock Reference

In addition to the clock reference selection in the offline digital trunk configuration, the clock reference can be changed through the Digital Connectivity Maintenance menu.

Procedure Steps

1. Reach the Digital Connectivity Status/Maintenance Menu. The pathway from the System Maintenance Menu is O>G.
2. Change the module (host) clock reference.
Select: (C) Change host clock reference
Prompt: Host Holding digital board(s) :
Response: The number of the host in which the affected card is installed.
Prompt: Host clock reference: (I,0-3)

Response: I for internal, or the number 0, 1, 2, or 3 which corresponds to the trunk to which you want the clock reference derived.

3. Monitor all trunks to verify that the clock reference has changed to the reference you selected in step 2.

Select: (A) Monitor all trunks

Prompt: Host holding digital board(s):

Response: The number of the host.

The system presents a statistics display such as the following:

```
DIGITAL CARRIER STATUS DISPLAY: Tue Aug 1 12:28:03 1995
```

```
TRUNK NO:0 CUR STATE:IN-SYNC CONFIG:CEPT, HDB3, CCS CLK REF: TRUNK0
```

```
Error Counters - Error Sec.: 0000 OOF: 0004 Slip: 0000 AIS: 0000  
11:10:23 08/01/95 Fail Sec.: 0000 Bit Err:0000 Lcl. Alm:0000 Rem  
Alm:0000
```

4. Check the CLK REF to ensure that it is the clock reference you chose. If it is not, repeat step 2 to reselect the clock reference. If the trunk reference does not change, refer to the *Diagnostics Manual* for troubleshooting information.
5. After you have selected the system clock reference you want, exit to the Main Menu.

CP 3150 Dual T1 Card Offline Configuration

Though typically a factory-installed standard feature, T1 digital trunk connectivity may be retrofitted to a system in the field. Use this procedure if you are adding a Dual T1 Digital Trunk Interface card (Dual T1 card) to an existing server.

Configuration involves a hardware and a software procedure. The hardware procedure includes setting DIP switches and installing the card in the server backplane. For the hardware procedure, refer to Technical Reference TR 1905.

The software procedure is done offline with the Resource Manager. At the maintenance console, you reach the Resource Manager through the System Maintenance menu. The software procedure includes:

- Assigning the Dual T1 card to a slot.
- Changing the slot I/O address to match DIP switch settings on the card (if necessary).
- Configuring T1 trunk frame format and line coding.
- Configuring T1 trunk signaling.
- Configuring the MVIP clock source and reference.

Following is a step-by-step breakdown of the software procedure. You can follow the procedure as a whole or skip to steps that cover each item listed above.

Note: After you have done the software configuration procedure, you must activate the configuration at the Configuration Main menu.

Procedure Steps

Steps 1 through 5 cover **assigning a card to a slot**.

1. Reach the Resource Manager (Resource Configuration menu). From the System Maintenance menu, the pathway is R>R>B>R.
2. At the Resource Configuration Menu, the current module number is indicated in the first line:
(M) set Module number [x]
(where *x* is the number of the current module).
If this is the module in which you want to install the card, skip to step 4. If you want to work with another module, go to step 3.

3. At the Resource Configuration menu, indicate that you want to change the current module.

Select: (M) set Module number

Prompt: Current Module #: *x* (where *x* is the current module)
Save Current Configuration? (Y/N) [N]

Response: Enter **Y** to save any changes to the current configuration (made in this console session). Enter **N** if you do not want to save any changes. After you have made your selection, the Input Module #: prompt appears. Enter the number of the desired current module (1, 2, 3, or 4).

4. At the Resource Configuration Menu, indicate that you want to add a resource card.

Select: (A) Add resource card

Prompt: Available slots ar,N 0 1 2... (lists available slots)
Input your choice:

Response: The **slot number** of the card. For Model 640, Dual T1 cards can occupy slots 9 and 11; for Model 120S, slots 6 and 8; for Model 120R, slot 6; for Model 70, slot 2.

5. At the Add Resource Card menu, indicate that you want to add a Dual T1 card.

Select: (B) Dual T1

Prompt: You get the confirmation message:
Board [DUAL T1] is added to slot *x*
IO port address of Board *x* is set to 0X*yyyy*
where "*x*" is the slot number you input in step 3, and "0X*yyyy*" is the I/O address assigned to that slot. The I/O address should match card DIP switch settings.

Response: Verify that the card type and slot number are correct. If not, repeat steps 3 and 4. If you want to change the assigned I/O address, do steps 6 and 7. If the I/O address is correct, skip to step 8.

Steps 6 and 7 cover **changing the card I/O address**.

6. At the Resource Configuration menu, reach the Configuration Menu for Board [Dual T1] in AT slot *x* (where *x* is the slot number entered in step 4).

Select: (C) Configure resource card

Prompt: Occupied slots are:
Slot Card
====
x DUAL T1 (where *x* is slot number)
Input your choice:

Response: The **slot number** of the card you want to work with.

7. At the Configuration Menu for Board [DUAL T1] in AT slot *x*, reach the Select IO Port Address menu.

Select: (A) change IO port Address

Prompt: IO port address of Board *x* is 0Xyyyy,
where "*x*" is the slot number and "0Xyyyy" is the I/O address
configured in software. Immediately after this prompt, the IO Port
Address menu appears.

Response: Enter the correct **IO port address** for the card.

Steps 8 through 12 cover **configuring trunk framing and line coding**.

8. If you are at the Resource Configuration menu, reach the Configuration Menu for Board [Dual T1] in AT slot *x* menu (where *x* is the slot number of the card you want to work with). If you are continuing from step 7, you are already at this menu.

9. At the Configuration Menu for Board [Dual T1] in AT slot *x*, indicate that you want to configure a T1 trunk.

Select: (C) Configure T1 carrier

Prompt: You get the Configuration Menu for T1 Carrier at trunk *x* (where *x* is the number of the current trunk).

Response: If the current trunk is the one you want to work with, skip to step 11. If the current trunk is not correct, do step 10.

10. At the Configuration Menu for T1 Carrier at trunk *x*, indicate that you want to change the current trunk.

Select: (T) set Trunk number

Prompt: Enter the trunk number [0-1]:

Response: The desired **trunk number**.

11. At the Configuration Menu for T1 Carrier at trunk *x*, indicate that you want to configure frame format.

Select: (F) configure Framing format

Prompt: (A) D3/D4 framing

(B) ESF framing

(x) eXit

Input your choice, ? for help

(A/B/X/?)::

Response: The desired **frame format**. After your response, a confirmation message appears showing current trunk settings (including any defaults). If frame format is correct, exit the Configure Frame Format menu.

12. At the Configuration Menu for T1 Carrier at trunk *x*, indicate that you want to configure line coding.

Select: (C) configure Coding format.

Prompt: (A) AMI coding

(B) AMI with ZCS coding

(B) B8ZS coding

(x) eXit

Input your choice, ? for help

(A/B/X/?)::

Response: The desired **line coding**. A confirmation message appears. If line coding is correct, exit the Configure Line Coding menu.

Steps 13 through 16 cover **configuring trunk signaling**.

13. If you are at the Resource Configuration menu, reach the Configuration Menu for T1 Carrier at trunk *x* (where *x* is the number of the current trunk). If you are continuing from step 12, you are already at this menu.

14. At the Configuration Menu for T1 Carrier at trunk *x* (where *x* is the current trunk number), indicate that you want to configure trunk signaling.

Select: (S) configure Signaling type

Prompt: (A) CAS signaling
 (B) CCS signaling
 (C) none
 (x) eXit
 Input your choice, ? for help
 (A/B/C/X/?):

Response: The desired **signaling type**.

Note: This step sets signaling type on a per-trunk basis. You also need to select a specific signaling protocol for each channel in the trunk. To work with signaling protocols on a per-channel basis, do step 15.

- Reach the Configuration Menu for Board [Dual T1] in AT slot *x* menu (where *x* is the slot number of the card you are working with). Indicate that you want to set trunk signaling (on a per-channel basis).

Select: (T) set Trunk signaling type

Prompt: You get a display of channel configuration for both trunks on the card (Figure 1). This is followed by a prompt:
 Input a range of channels (0-4 or 1,4,7, etc):

Response: The **channel(s)** for which you want to set signaling.

```
T1/E1 Carrier configuration:
Trunk: 0           Configuration: D3/D4, B8ZS, CAS
Trunk: 1           Configuration: D3/D4, AMI ZCS, CAS
-----
Trunk Type for each channel:
Chnl: 00 01 02 03 04 05 06 07 08 09 10 11
Type: E&M E&M E&M E&M E&M LS LS LS LS LS LS LS

Chnl: 12 13 14 15 16 17 18 19 20 21 22 23
Type: LS LS LS LS LS LS LS LS LS LS LS LS

Chnl: 24 25 26 27 28 29 30 31 32 33 34 35
Type: LS LS LS LS LS LS LS LS LS LS LS LS

Chnl: 36 37 38 39 40 41 42 43 44 45 46 47
Type: LS LS LS LS LS LS LS LS LS LS LS LS
```

Figure 1 Typical T1 Trunk Configuration List

- At the Trunk Type menu, select the desired signaling protocol for the channel(s) specified in step 15. You get a confirmation indicating your selection.

Note: For CAS configurations, T1 channels can be assigned to any of the four supported protocols (E&M, DID, Loopstart, Groundstart) only if all line cards in the module are DSP 24/30 cards. If one or more of the line cards are DSP 8 cards, the T1 channels can be assigned to a maximum of two of the four supported protocols. This restriction is true for all T1 channels associated with the module.

For example, suppose a module contains a single Dual T1 card with both trunks operating in CAS mode. One trunk is configured as fractional T1 with only eight channels activated and supported by a single DSP 8 card. The second trunk is not fractional T1 (all channels are used) and is supported by a DSP30 card. In this case, a maximum of two of the CAS protocols can be used on both trunks.

Steps 17 and 18 cover **configuring the MVIP clock source (master clock) and reference.**

17. From the Resource Configuration menu, reach the MVIP Configuration menu.

Select: (K) configure MVIP clock

Prompt: The MVIP Configuration Menu appears with the following selections:

(C) set clock source
(R) set clock reference
(D) set to default configuration
(S) show current configuration
(F) show default configuration
(x) eXit
Input your choice, ? for help
(C/R/D/S/F/X/?):

Response: Enter **C** to configure the master clock. You are prompted to select the Dual T1 card to act as the master clock source (the master clock is actually an oscillator circuit on the card).

18. At the MVIP Configuration menu, indicate that you want to configure a reference for the master clock.

Select: (R) set clock reference

Prompt: You are prompted to select the Dual T1 card from which a reference is derived. After you do so, the Digital Clock Reference Configuration menu appears with the following selections:

(A) Network interface on trunk 0
(B) Network interface on trunk 1
(C) Internal free running oscillator
(x) eXit
Input your choice, ? for help
(A/B/C/X/?):

Response: Enter your choice of a **reference** for the master clock. You can choose either an external reference or an internal reference. The external reference is an 8kHz signal extracted from a network RxD line on any trunk of any Dual T1 card in the module. The internal reference is derived from a free-running oscillator on any Dual T1 card in the module.

Note: The free-running oscillator on a Dual T1 card is not the same oscillator that is available as a master clock.

19. If you have completed your Dual T1 card software configuration, you must activate the configuration. To do so, you select "Activate Configuration" under the Configuration Main menu. From the System Maintenance menu, the pathway is R>R.

20. At the NuPoint Voice Configuration Main menu, select G to reach the NuPoint Voice Configuration Offline menu.

21. At the NuPoint Voice Configuration Offline menu, indicate that you want to duplicate the active configuration.

Select: (B) Duplicate Active Configuration

Prompt: The system duplicates the active configuraton and prompts you with a message when it is finished.

Response: Exit to the VoiceMemoConfiguration Main menu.

22. At the NyPoint Voice Configuration Main Mmnu, activate the configuration just duplicated.

Select: (A) Activate Configuration

Prompt: The system prompts you with a message when it is finished.

Response: Exit to the System Maintenance menu.

CP 3153 Monitor Digital Trunk Statistics

The ability to monitor digital trunks gives statistical data on trunk operation as it affects voice messaging. This data is valuable for network management and for server maintenance.

The trunk monitor display gives performance statistics totals for the most recent second as indicated by the time and date stamp on the display. The display is dynamic, updated every second by the server. As required for your data collection task, you can reset the counters before you begin monitoring trunk statistics. This feature can be useful for verifying trunk operation after reconfiguring a trunk or replacing a digital trunk interface card.

The trunk information presented and the statistics collected include:

- Current state of the trunk (in-sync, out-of-sync, and so forth)
- Trunk configuration (framing, line code, and signaling)
- Source of the system clock reference
- Errored seconds (ES)
- Out-of-frame conditions (OOF)
- Frame slips
- AIS
- Failed seconds (FS)
- Bit errors
- Local alarm totals
- Remote alarm totals

Procedure Steps

1. Reach the Digital Connectivity Status/Maintenance menu. The pathway from the System Maintenance menu is O>G.
2. Monitor a selected digital trunk.

Select: (B) Monitor a single trunk
Prompt: Host holding digital board(s):
Response: The number of the module.
Prompt: Reset counters (Y/N):
Response: As required, Y
Prompt: Trunk number:
Response: The number of the trunk you want to monitor.

The system presents a statistics display such as the following:

DIGITAL CARRIER STATUS DISPLAY: Tue Aug 1 12:28:03 1995

TRUNK NO:0 CUR STATE:IN-SYNC CONFIG:CEPT, HDB3, CCS CLK REF: TRUNK0

Error Counters - Error Sec.: 0000 OOF: 0004 Slip: 0000 AIS: 0000
11:10:23 08/01/95 Fail Sec.: 0000 Bit Err:0000 Lcl. Alm:0000 Rem Alm:0000

Enter X to return to the Digital Connectivity Status/ Maintenance menu.

Monitor all digital trunks.

Select: (A) Monitor all trunks.
Prompt: Host holding digital board(s) :
Response: The number of the module.
Prompt: Reset counters (Y/N) :
Response: As required, Y

*The system presents a statistics display for all trunks.
When done monitoring the trunks, exit to the Main Menu.*

CP 3155 Place a Digital Trunk Into Service

Digital trunks can be placed into and out-of-service (OOS) for maintenance purposes. When a trunk is placed OOS, the digital trunk interface card automatically turns off the AIS to the far end to indicate the OOS state of the trunk and restores traffic.

Procedure Steps

1. Reach the Digital Connectivity Status/Maintenance menu. The pathway from the System Maintenance Menu is O>G.
2. Place a trunk into service.

Select: (E) Place trunk in-service
Prompt: Host holding digital board(s) :
Response: The number of the host (module).
Prompt: Trunk number :
Response: The number of the trunk you want to place in-service.

Monitor a selected digital trunk to verify that the trunk is in service.

Select: (B) Monitor a single trunk
Prompt: Host holding digital board(s) :
Response: The number of the module.
Prompt: Reset counters (Y/N) :
Response: N
Prompt: Trunk number :
Response: The number of the trunk selected in step 2.

The system presents a statistics display such as the following:

```
DIGITAL CARRIER STATUS DISPLAY: Tue Aug 1 12:28:03 1995
```

```
TRUNK NO:0 CUR STATE:IN-SYNC CONFIG:CEPT, HDB3, CCS CLK REF: TRUNK0
```

```
Error Counters - Error Sec.: 0000 OOF: 0004 Slip: 0000 AIS: 0000  
11:10:23 08/01/95 Fail Sec.: 0000 Bit Err:0000 Lcl. Alm:0000 Rem Alm:0000
```

4. Check the CUR STATE of the trunk to ensure that it is in service. If it is not, repeat Step 2 to set it in service. If the trunk status does not change, refer to the *Diagnostics Manual* for troubleshooting information.
5. After you have changed the status of the selected trunk to out-of-service, exit to the Main Menu.

CP 3154 Put Digital Trunk Out of Service

Digital trunks can be placed into and out-of-service (OOS) for maintenance purposes. When a trunk is placed OOS, the digital trunk interface card automatically sends an AIS to the far end to indicate the OOS state of the trunk.

Procedure Steps

1. Reach the Digital Connectivity Status/Maintenance menu. The pathway from the System Maintenance menu is O>G.

2. Place a trunk out-of-service.

Select: (D) Place trunk out-of-service

Prompt: Module holding digital board(s):

Response: The number of the module.

Prompt: Trunk number:

Response: The number of the trunk you want to place out-of-service.

Monitor a selected digital trunk to verify that the trunk is OOS.

Select: (B) Monitor a single trunk

Prompt: Module holding digital board(s):

Response: The number of the module.

Prompt: Reset counters (Y/N):

Response: N

Prompt: Trunk number:

Response: The number of the trunk selected in step 2.

⌘ system presents a statistics display such as the following:

```
DIGITAL CARRIER STATUS DISPLAY: Tue Aug 1 12:28:03 1995
```

```
TRUNK NO:0 CUR STATE:OOS CONFIG:CEPT, HDB3, CCS CLK REF: TRUNK0
```

```
Error Counters - Error Sec.: 0000 OOF: 0004 Slip: 0000 AIS: 0000  
11:10:23 08/01/95 Fail Sec.: 0000 Bit Err:0000 Lcl. Alm:0000 Rem Alm:0000
```

Check the CUR STATE of the trunk to ensure that it is out-of-service. If it is not, repeat Step 2 to set it out-of-service. If the trunk status does not change, refer to the *Diagnostics Manual* for troubleshooting information.

After you have changed the status of the selected trunk to out-of-service, exit to the Main Menu.

TR 1905 Dual T1 Digital Trunk Interface Card Technical Reference

This document provides information on the Dual T1 Digital Trunk Interface card (Dual T1 card) used in NuPoint Messenger servers. It provides a brief description of the card, configuration data, and installation guidelines. The card can be used in all server models (70, 120, and 640).

1 Introduction

The Dual T1 card (P/N 2410-0193-01) provides access to two T1 digital trunks. The Dual T1

card connects to supporting telephony cards through the Multi-Vendor Integration Protocol (MVIP) bus. Supporting telephony cards include DSP 8 and DSP 24/30 digital line cards.

The Dual T1 card decodes incoming trunk signals and demultiplexes frames into individual channels. It extracts signaling and voice information and converts it into MVIP format for the other telephony cards.

In addition, trunk hybrids on the card derive an 8 kHz clock reference from one of the network Rx/D signals. The preferred network signal, trunk 0 or trunk 1, can be selected through the Resource Manager (Resource Configuration menu) for T1 connectivity.

The line driver of each trunk hybrid connects through an output transformer to a transmit equalization network. The transmit equalization hybrid conditions the Tx/D signals to optimize the signals for transmission over standard ABAM 100Ω twisted pair cable. Switches on the card allow various amounts of equalization to be selected to compensate for differing T1 span lengths.

Card Features

The Dual T1 card, shown in Figure 1, has these features:

- Two T1 (card type MB89110) primary-rate RJ-48C interfaces
- Multi-Vendor Integration Protocol (MVIP) Bus
- ESF or D3/D4 framing
- CAS or CCS extraction
- Channel loopbacks
- US Federal Communications Commission (FCC) approved
- Canadian Department of Communications (DOC) approved

Figure 1 Dual T1 Interface Card Layout

Regulatory Compliance Information

FCC

The Dual T1 card complies with Part 68 of the FCC Rules. The FCC Registration Number for this card is:

2AHCAN-65489-XD-N

The card is designed for connection to circuit termination panels (DSXs) equipped with RJ-48C jacks. The applicable FCC Facility Interface Codes (FIC) is 04DU9-BN and the Service Order Code (SOC) is 6.0N for all applicable connections. These connections can be 1.544 Mbps rate T1 signals without line power. Framing can be SF or ANSI ESF.

Industry Canada

Industry Canada approved.

The Dual T1 card meets the Class A limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard entitled "Digital Apparatus," IECS-003 of the

Department of Communications.

2 Configuration Data

The Dual T1 card contains the option switch settings and jumper settings shown in Figure 1. When replacing the Dual T1 card, ensure that the switch and jumper settings on the replacement card match those of the card being removed from the server.

MVIP Clock Termination P1

The MVIP connector is a direct card-to-card bus used by the Dual T1, DSP, LC, and fax cards to communicate. The jumpers at connector P1 terminate the MVIP clock signals (Table 1) on the bus to prevent ringing. Install these jumpers whenever the Dual T1 card is at one end of the MVIP bus. If the card is not the last card on the MVIP bus, do not install these jumpers.

| Table 1 MVIP Clock Termination Jumper Settings | | |
|--|--------|----------|
| Jumper P1 (MVIP Clock Termination) | | |
| Position | Jumper | Status |
| 1 | ON | C4 |
| 2 | ON | FP |
| 3 | ON | C2 |
| 4 | ON | C8 |
| 5 | OFF | Not used |
| 6 | OFF | Not used |

I/O Address Switch S4

The Dual T1 card is allocated AT bus base addresses 0300h (the default address) and 2300h. By convention, set the first Dual T1 card (the one nearest the CPU) for 0300h, and the second card, if present, for 2300h (Table 2). However, whenever replacing a card, always set the address of the replacement to match the settings of the card you are removing.

| Table 2 Address Switch Settings | | | |
|--|---------|--|---------|
| DIP Switch S4 (Card Number 0 Addr-0300h) | | DIP Switch S4 (Card Number 1 Addr-2300h) | |
| Segment | Setting | Segment | Setting |
| SW1 | 0 | SW1 | 0 |
| SW2 | 0 | SW2 | 0 |
| SW3 | 0 | SW3 | 1 |
| SW4 | 0 | SW4 | 0 |
| 0 = closed or on; 1 = open or off | | | |

Line Pairing Jumpers P8-P10

Jumpers P8 and P9 establish line pairing for transmit and receive for trunk connection A. P10 and P11 establish line pairing for trunk B. Setting the jumpers vertically as listed in Table 3

selects the RJ-48C connector pins 1 and 2 for receive (input) and pins 4 and 5 for transmit (output). Use this configuration, since the server is on the "user" side of the network.

| Table 3 Line Pair Jumpers | | | |
|--|----------|------------|----------|
| Line Pair Jumpers (Transmit on pins 1 and 2, and Receive on pins 4 and 5 of the RJ48C connectors J1 and J2) | | | |
| T1 Trunk A | | T1 Trunk B | |
| P8 | P9 | P10 | P11 |
| Vertical | Vertical | Vertical | Vertical |

RJ-48C T1 Network Connectors

The T1 line connectors are ISDN standard 8-pin RJ-48C jacks. The connector closer to the "lip" on the end plate of the card is the trunk A interface (Figure 1). The second connector is the trunk B interface.

The trunk A interface is the lower-ordered trunk connection, and the trunk B interface is the higher-ordered connection. Thus, for configuration purposes, the trunk A interface becomes trunk 0, and the trunk B trunk interface becomes trunk 1. For Model 640 and Model 120S servers, if a second Dual T1 card is installed, its trunk A interface becomes trunk 2, the trunk B trunk interface becomes trunk 3.

When fabricating interface cables, the server Transmit connections go to the Receive connections on the switch, PBX, and CSU equipment (Figure 2). Similarly, the switch, PBX, and CSU equipment Transmit connections go to the server Receive connections. Table 4 lists the connector pin assignments. Use the provided 3-foot (0.9m) cable terminated at both ends in RJ-48C connectors (P/N 1911-0014-01). This cable can be used to connect to a local DSX patch panel.

Figure 2 Tip and Ring Turnover between Server and Switch / PBX and CSU

| Table 4 Network Connector Pin Assignments | | |
|--|--------------------------------|---------------|
| Function | | |
| Pin | PBX/Switch/ Network | Server |
| 1 | TxD | RxD |
| 2 | TxD | RxD |
| 3 | Not Used | Not Used |
| 4 | RxD | TxD |
| 5 | RxD | TxD |
| 6 | Not Used | Not Used |
| 7 | Not Used | Not Used |
| 8 | Not Used | Not Used |

Line Equalization Switches S2 and S3

The transmit hybrids on the Dual T1 card pre-condition the output signals for transmission over 100Ω twisted pair copper cable. Eight-pole switches S2 and S3 select various levels of attenuation for differing T1 span lengths. Switch S2 sets the equalization for the trunk A interface, and S3 sets the equalization for the trunk B interface. The output pulse from the T1 equalization hybrid meets DSX-1 requirements (ANSI T1.102 — 1987, Section 2) for a specific length of cable. When using standard 22 AWG ABAM cable, you can use the settings listed in Table 5.

| Sections for Switch S2 or S3 | 0–150 ft. | 150–450 ft. | 450–655 ft. |
|------------------------------|-----------|-------------|-------------|
| SW1 | On | — | — |
| SW2 | — | On | — |
| SW3 | — | — | On |
| SW4 | — | On | — |
| SW5 | — | — | On |
| SW6 | — | On | — |
| SW7 | — | — | — |
| SW8 | — | — | On |

IRQ Jumpers and Handset Connector

The interrupt request jumpers at P3 and P5 and the handset connectors are not used. As shown on Figure 1, these jumpers are not installed.

Pre-Installation Considerations

By convention, the Dual T1 card installs in these slots in the Model 70, 120, and 640 servers:

| Card Number | Model 70 Slot Number | Model 120R Slot Number | Model 120S Slot Number | Model 640 Slot Number |
|-------------|----------------------|------------------------|------------------------|-----------------------|
| 0 | 2 | 6 | 6 | 9 |
| 1 | — | — | 8 | 11 |

The nature of the system AT bus does not require cards to be installed in particular slots. However, the MVIP bus clock signals must be terminated to ensure reliable data transfer across the bus. The above conventional slot assignments for the Dual T1 card ensure that the MVIP bus clock signal is terminated properly. This installation arrangement also ensures a standard system configuration for communication with your support representative. A typical T1 digital trunk connectivity configuration has a card equipped with MVIP clock termination jumpers installed at each end of the MVIP bus (Figure 3).

Note: The last cards on the ends of the MVIP bus cable must have their MVIP clock termination jumpers installed.

Digital trunk PCM channels correlate directly to analog ports. Line groups are configured for a system connected through digital trunks in the same manner as for analog trunks. The DSP

digital line card ports are assigned by the slot number of the related trunk interface card, trunk number, and PCM channels. These assignments are done in triplet using the form xx:yy:zz, where xx is the server module number, yy is the card slot number, and zz is the channel (port) number. Port numbers begin with 0 on trunk A of the lower order Dual T1 card and continue in sequence from one trunk to another. For example, trunk A on the first Dual T1 card is configured as trunk number 0. Given that all PCM channels are used, these channels number from 0–23. The channels on trunk B (trunk number 1) continue numbering with 24 through 47.

Tip: To ensure fault tolerance, use several digital trunks to share the load of traffic-bearing channels. If available, reserve several channels in each trunk as spares.

Figure 3 Typical System Configurations With Digital Connectivity

3 Installation Guidelines



CAUTION!

Unless you are highly experienced with NuPoint Messenger servers, do not attempt to remove, replace, or install this hardware component without first consulting your server's *Installation and Service Manual*.

This card is pre-configured at the factory and it is ready to install. However, it is a good field practice to double-check the card hardware configuration. Before you install a new card, you should follow these guidelines.

1. Refer to the *Service Card Hardware Configuration Technical Reference* for your specific server. For the Model 70, see TR 1922, for the Model 120, see TR 1902, for the Model 640, see TR 1920. That section provides:
 - An overview of your server.
 - A description of your server's architecture.
 - Card configuration and installation guidelines.
 - Card configuration rules and maps.
2. Read the "Configuration Data" section above. That section provides:
 - Jumper and switch setting information specific to your card.
 - If applicable, interface requirements.
3. Refer to your server's *Installation and Service Manual* for instructions on how to remove and replace cards.