

D/42 Series User's Guide

☐ D/42 Series User's Guide

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D/42 Series User's Guide

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1. How To Use This Manual

1.1. Audience

This manual is addressed to programmers and engineers who are computer-literate and are interested in using Dialogic's D/42 Series of PBX integration boards and Dialogic's Unified API to develop a computer telephony application for use on a PBX.

When this manual addresses "you," it means "you, the programmer," and when this manual refers to the "user," it means the end-user of your application program.

1.2. Product Terminology

This manual includes information about using your *Private Branch eXchange* (PBX) or *Key Telephone System* (KTS) with a Dialogic D/42 Series PBX Integration circuit card. A PBX is a privately owned, mini version of a telephone company's *central office* (CO) switch. For businesses, the key advantage to owning a PBX is the efficiency and cost savings of sharing a specific number of telephone lines among a large group of users. Grouped with PBXs are KTSs, which are generally smaller versions of a PBX that provides direct access to CO telephone lines. For simplicity, the term PBX will be used to denote both a PBX and KTS.

In the PBX environment a *line* from the CO is called a *trunk* and a phone is called a *line*, *extension*, or *station*.

1.3. PBX Models Covered in this Manual

This manual includes support for the following PBXs and KTSs:

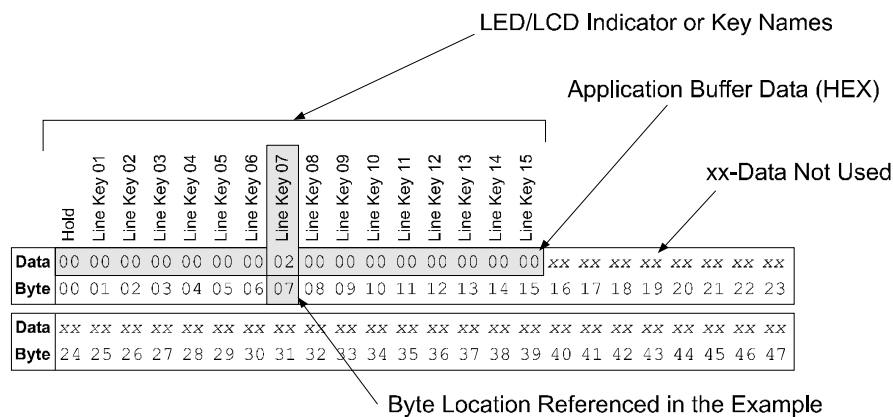
Dialogic PBX Integration Card	PBX or KTS Hardware	PBX or KTS Software
D/42D-SX	MITEL SX-50 MITEL SX-100 MITEL SX-200 MITEL SX-200D MITEL SX-2000	Not applicable - Some PBX configurations (both hardware and software) may effect the capabilities of the D/42D-SX.
D/42D-SL	Northern Telecom PBX with SL-1 Line Circuit Board	Release 19 or greater
D/42-NS	Compact Modular Norstar Plus ICS	DR2*, DR3*, DR5 DR2*, DR3*, DR5 DR5 or later
D/42-NE2	NEAX 2400 ICS NEAX 2000 IVS Electra Professional Level II KTS	5.0 or greater

* These are obsolete software revisions and may contain limitations. Dialogic recommends that switch software be upgraded to the DR5 Maintenance Release.

1.4. Documentation Conventions

The following documentation conventions are used throughout this manual:

- When terms are first introduced, they are shown in italic text.
- Data structure field names and function parameter names are shown in boldface, as in **maxsec**.
- Function names are shown in boldface with parentheses, such as **d42_display()**.
- The MS-DOS function name **dial()** will be used to represent **dial()**, **dl_dial()**, and **dx_dial()** for MS-DOS, OS/2, and Windows NT respectively.
- Names of defines or equates are shown in uppercase, such as **T_DTMF**.
- File names are italicized and in uppercase, such as *D42DRV.EXE*.
- Examples included in this manual show data that is stored in an application buffer. The contents of a buffer is illustrated as follows:



Application buffers are typically 48 bytes long (plus a null). The actual data (in HEX) is shown in the gray area. The byte(s) referenced in the example is shown in boldface.

1.5. Voice Hardware Covered by This Manual

The D/42 Series voice hardware (also referred to as D/42-xx) is designed to provide a set of cost-effective tools for implementing computerized, voice and call processing applications for PBXs and KTSs. It provides the basic voice and call processing capabilities of D/4x voice hardware and adds hardware and firmware that eases integration with supported PBXs and KTSs. The D/42 Series hardware also provides access to PBX functions not normally available. Refer to the *Voice Software Reference* for your particular operating system for more information on voice and call processing.

The voice hardware models covered by this manual include the following:

- D/42D-SX™** – a 4-channel voice board with station interfaces for connecting directly to a MITEL® SUPERSET 4™ (COV) Line Circuit card in a MITEL SUPERSWITCH® PBX.
- D/42D-SL™** – a 4-channel voice board with station interfaces for connecting to a Northern Telecom Digit Display (QPC 451 or QPC 61) Line Circuit card in a Northern Telecom SL-1 PBX.
- D/42-NS™** – a 4-channel voice board with station interfaces for connecting to a Northern Telecom NORSTAR® key system unit (KSU).
- D/42-NE2™** – a 4-channel voice board with independent digital interfaces for connecting to NEC Electra Professional Level II telephone systems (KTS), as well as the NEAX® 2000 IVS and NEAX 2400 ICS PBXs.
- D/42-NE2 PCI** – a 4-channel voice board with independent digital interfaces for connecting to NEC Electra Professional Level II telephone systems (KTS), as well as the NEAX® 2000 IVS and NEAX 2400 ICS PBXs.

1. How To Use This Manual

1.5.1. Voice Hardware Model Names

Model names for voice boards other than the DIALOG/HD series are based upon the following pattern:

D / x x x y

where:

D/	identifies the board as voice hardware
xxx	identifies the number of channels (2, 4, 8, 12, etc.), followed by a code indicating whether Call Progress Analysis is supported
0	indicates no support for Call Progress Analysis
1	indicates support for Call Progress Analysis
2	indicates PBX support
y	if present, identifies a hardware version (A, B, C, D, etc.)

Sometimes it is necessary to refer to a group of voice boards rather than specific models, in which case an “x” is used to replace the part of the model name that is generic. For example, D/xxx refers to all models of the voice hardware, and D/4x refers to all 4-channel models.

1.6. When To Use This Manual

This *D/42 Series User's Guide* contains information for configuring and using specific PBX hardware for use with D/42-xx products. For information about installing D/42-xx hardware, refer to the *D/42-xx Installation Card* provided with your D/42-xx circuit card. For information about installing D/42-xx software, refer to the *System Release Software Installation Reference* for your particular operating system.

1.7. How This Manual Is Organized

Chapter 1 – How To Use This Manual describes the *D/42 Series User's Guide*.

Chapter 2 – Introduction to PBXs and KTSs provides a brief description of Private Branch Exchanges (PBXs), Key Telephone Systems (KTSs) and hybrid systems.

Chapter 3 – D/42 Series Overview provides information about the voice and PBX-specific features supported by D/42-xx products and a description of the Unified API™.

Chapter 4 – PBX Configuration and Integration contains a general description, capabilities, switch requirements, and direct key dial sequences, for all supported PBX switches.

Appendix A – D/42-xx Specifications contains data sheets for the D/42-xx circuit cards.

Glossary contains a comprehensive list of definitions for commonly used terms.

Index contains an alphabetical index of features and topics.

2. Introduction to PBXs and KTSs

A PBX, or *private branch exchange* is a telephone system that is usually installed in a business. It provides service among many extensions within the business as well as outside lines. Typically, PBXs are used when a large number of extensions are needed. A PBX can be thought of as a mini version of a telephone company's *central office* (CO) switch. Key advantages to owning a PBX are:

- increased efficiency and cost savings because a specific number of CO telephone lines are shared among a large group of users
- special PBXs features.

Grouped with PBXs are *key telephone systems* (KTSs). A KTS is generally a smaller version of a PBX that also provides **direct** access to outside telephone lines (trunks). When you press a "line" key on a KTS you immediately hear a dial tone from the central office. In contrast, on a PBX system, you have to dial a digit, usually "9", to get the dial tone from the central office. Typically, KTSs are used when less than 50 extensions are needed. Advantages of having a KTS are that anyone in your office can answer an incoming call simply by pressing the correct line button and KTSs usually cost less than PBXs.

Systems have been developed that combine PBX and KTS features. These hybrid systems typically serve up to 100 users and contain some features found only in PBXs (the ability to use single line phones) and features typically found in KTSs (hands free announcing and answerback). An example of a hybrid system is the NEC Electra Professional which can connect to a maximum of 64 outside lines and 96 extensions. Some features include least cost routing, call forwarding, call hold, automated attendant, and caller ID.

For simplicity, throughout this manual the term PBX will be used to denote a PBX, KTS, or hybrid system.

Most PBX systems are digital. In a digital system, both the *voice signals* and *control information* transmitted between *station sets* within the PBX are sent as binary data. Analog voice signals received from outside the PBX (usually a CO) are converted to digital voice data and sent through the PBX. Digital voice data

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may be sent outside the PBX if outside networks also use digital circuits, however, they are usually converted back to analog voice signals.

PBXs use control information to instruct their station sets to perform specific functions such as setting the message waiting indicator and call transfer. This control information is sent using proprietary digital *protocols*. A protocol is a set of rules relating to the format and timing of data transmissions. These protocols not only contain control information, but also “message” data that can be used to significantly enhance *computer telephony* (CT) applications that use PBX call control elements such as called/calling number ID.

The term “computer telephony” refers to the ability to interact with computer databases or applications from a telephone. Computer telephony technology supports applications such as:

- automatic call processing
- automatic speech recognition
- text-to-speech conversion for information-on-demand
- call switching and conferencing
- unified messaging that lets you access or transmit voice, fax, and E-mail messages from a single point
- voice mail and voice messaging
- fax systems including fax broadcasting, fax mailboxes, fax-on-demand, and fax gateways
- transaction processing such as Audiotex and Pay-Per-Call information systems
- call centers handling a large number of agents or telephone operators for processing requests for products, services or information

PBXs can communicate with their station sets using in-band or out-of-band signaling. In-band signaling is a method used by analog (2500) telephones (e.g., calling into a PBX and using DTMF to respond to voice prompts). In-band signals use the same band of frequencies as the voice signal. This method provides limited integration because there are no standards and different PBXs provide varying levels of control.

2. Introduction to PBXs and KTSs

Out-of-band signaling is used by PBXs to send and receive data from station sets or a CT computer. This data can include information such as called/calling number ID. Out-of-band signals do not use the band of frequencies used by the voice signals. They can be transmitted using the same wires as the telephone set or separate wires (e.g., RS-232). Because of its versatility, out-of-band signaling is the preferred method.

CT equipment comprises a PC containing a Dialogic D/42 Series PBX integration board (also referred to as D/42-xx) and a software application. D/42-xx boards, together with Dialogic's Unified API™, make it easier to create applications that are tightly integrated with a PBX and take advantage of call control elements.

Below is a list of popular PBX features and functions supported by Dialogic's D/42 Series of PBX integration boards. KTSs and hybrid systems may support only some of these features.

- supervised call transfer
- blind call transfer
- caller ID
- called party ID
- positive disconnect supervision
- in-band signaling
- out-of-band signaling
- read display messages
- “press” programmable keys
- message waiting indication

2.1. Supervised Call Transfer

A supervised transfer is a method of transferring an incoming call to another extension, making use of call progress results (i.e., answered, busy, and ring no answer). This type of transfer is equivalent to the following manual operations:

1. answer a call
2. place the caller on hold
3. press the transfer key (hook flash)
4. dial the destination number
5. if the destination party answers, hang up (the transfer is complete)
6. if the destination party does not answer, switch back to the caller and provide choices to leave voice mail, select another extension, or hang up.

While a supervised transfer can be implemented without a D/42-xx board (using hook flash), the availability and ease of implementation is inconsistent. By using a D/42-xx board and the appropriate dial string, you can initiate a transfer the same way for all supported switches. Also, by incorporating call progress analysis, you can offer consistent, high-performance call transfer features in your applications. For example, if during the transfer the application detects a busy signal, the call is automatically sent to a mailbox.

In a supervised transfer, an incoming call answered by a channel on a D/42-xx will only be transferred after the D/42-xx establishes a connection with another station (the call is not released to the PBX). If the extension is busy or does not answer, the D/42-xx reconnects to original call.

2. Introduction to PBXs and KTSs

2.2. Blind Call Transfer

A blind transfer is initiated the same way as a supervised transfer. However, after dialing the destination number, the extension performing the transfer hangs up and does not wait to determine the outcome of the call. The call is released to the PBX. Blind transfers are used in most voice mail applications. A blind call transfer is equivalent to the following manual operations:

1. answer a call
2. put the call on hold
3. press the transfer key
4. dial the destination number
5. hang up.

The call is immediately sent to the new extension. It is up to the PBX to determine what to do if the transferred call is not answered (because of busy or no answer). Usually, if a transferred call is not answered it is routed back to the voice mail system, and eventually to the operator (or an automated attendant).

The advantage of a blind transfer is that the immediate release to the PBX frees the voice processing resources to handle new calls rather than being used to perform call progress. The only potential drawback of a blind transfer is when phone traffic is heavy, in which case the application may need to handle a call overflow condition.

An application can perform blind transfers without special integration tools. However, by using a D/42-xx board and the Unified API to access the called number ID from the PBX, the application can differentiate between:

- a new call coming in that needs to be processed: “Hello and thank you for calling Dialogic Corporation.”
- a call that was transferred at least once already and is being routed by the PBX into voice mail: “You’ve reached the desk of Marcia Jones in Engineering, please leave a message.”

If the call was transferred, the application can use the called number ID to send the call directly into the appropriate voice mail box, allowing the caller to leave a

message without having to navigate through a series of menus for a second or third time.

2.3. Caller ID

Caller ID is the phone number that identifies the person who is placing the call. These digits are typically transmitted at the beginning of a call, usually between the first and second ring.

While telephone companies are beginning to sell a caller ID service to residential customers, the scope of this commercially available caller ID is different from the caller ID feature available with many PBXs. The caller ID from the telephone company is often referred to as automatic number identification (ANI) and identifies callers whose numbers are assigned by the telephone company. Caller ID from within the PBX identifies callers whose telephone extensions are assigned through the PBX (referred to in this document as calling number ID).

Calling number ID from within the PBX system has powerful business applications. For example, a voice mail application may use calling number ID to let users reach individual mailboxes without having to dial extra digits. Other applications may use calling number ID for screening phone calls, allowing employees to respond to urgent calls first, as well as for automatic voice message reply, without making users redial the caller's extension. Calling number ID is useful whenever you need to know who is calling and from where they are calling.

2.4. Called Number ID

Called number ID is also a feature provided within a PBX system and is usually combined with the calling number ID. Called number ID is the phone number of the extension being called. When a call is from outside the PBX, it is the number of the trunk receiving the call. The called/calling number ID remains the same when a call is routed through the PBX system.

For example, when a call has been routed through the PBX because the first intended extension was not answered or busy, the final destination answering the call can determine the extension that called plus the extension that was originally called.

2. Introduction to PBXs and KTSs

Called number ID can also be used by an application to automatically direct a call to an appropriate extension or group of extensions based on the number called (generally the last four digits).

For example, an application may provide specific information about four different programs through an interactive voice response (IVR) system. Depending on the phone number being called, the application can route the caller directly to the desired program:

Program A: 555-1202 (trunk 01)

Program B: 555-1203 (trunk 02)

Program C: 555-1205 (trunk 03)

Program D: 555-1200 (trunk 04)

Using a D/42-xx board and the Unified API, an application can read the called number ID (the trunk line) and route the call depending on which extension receives the call. If the call is received on trunk line 01 it will be routed to the extension for Program A. Without access to the called number ID information, callers would need to listen to a long list of prompts to obtain the four digit extension code to access Program A.

2.5. Positive Disconnect Supervision

In any PBX phone system, it is important to accurately detect when an outside caller has “hung up” the phone. This capability allows the PBX to also hang up, completing the disconnection. Once the call is fully terminated, not only is the phone line available for other calls, but more importantly the phone company’s billing charge for that call ends. One common way in which a phone or PBX manages call termination is positive disconnect supervision.

In a typical external call scenario (where a call is placed through a CO, not between extensions of the PBX), the CO detects when the caller hangs up and then sends a disconnect signal (loop current drop) to the PBX. The PBX is responsible for detecting and handling the disconnect signal from the CO.

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After receiving a disconnect signal from the CO, the PBX may:

- terminate the outside call immediately and send a disconnect message to the called extension
- send a disconnect message to the called extension and wait for the called extension to hang up before formally terminating the call

In both cases, a disconnect message, not a loop current drop, is sent to the called extension. Standard analog voice boards cannot interpret disconnect messages because these messages are usually digital. D/42-xx boards can, however, detect disconnect messages and send a disconnect event to an application where it is used by Dialogic's standard voice programming mechanisms for handling call termination.

When a call is placed between extensions of the PBX, a disconnect message, not a loop current drop, is also used to indicate when a caller hangs up. In this scenario, the application has no way of knowing when the caller has hung up so it can receive another call. D/42-xx boards can detect the disconnect message and send a disconnect event to an application.

Not all PBXs have positive disconnect supervision. Refer to the documentation for your PBX to determine if your PBX provides positive disconnect supervision.

2.6. In-Band Signaling

PBXs may use a method called in-band signaling to control their station sets. In-band signals use the same band of frequencies as the audio signal; this is usually accomplished with touch-tone signals. This method provides a limited amount of integration because there are no standards and different PBXs provide varying levels of control. Call progress tones that even similar models send can vary. This means that applications, even on identical PBXs, have to be tuned with each installation.

An example of in-band signaling is transferring a call using the flashhook method. There is no data (e.g., caller ID information) passed along when the call is transferred.

2. Introduction to PBXs and KTSs

2.7. Out-Of-Band Signaling

Many PBXs use a method called out-of-band signaling to control their station sets. Out-of-band signals do not use the band of frequencies used by the voice signals. These PBXs transmit control signals and data that can include information such as called/calling number ID. Because of its versatility, out-of-band signaling is the preferred method.

2.8. Read Display Messages

Most PBX station sets have an LCD or LED screen that can display messages. The type of information that is displayed varies with the PBX manufacturer and the programming capabilities of the switch. Typical information includes: calling/ called number ID from within the switch, ANI digits from the CO, hook state, time and length of call, name assigned to the extension, and message waiting notification. With a D/42-xx PBX integration board, this information can be easily passed “unprocessed” to the application. This means that the same data that is sent to the display is captured by the D/42-xx board.

By capturing the same display messages that a phone set receives, an application can “see” and “record” the display information. This display information (in ASCII format) is especially useful in CT applications because it enables an application to know exactly what state the extension connected to the D/42-xx board is in. Applications used with a PBX that provides ANI digits may process the display data and use those digits to access related database information.

For applications using Dialogic’s D/42-NS to program the Northern Telecom Norstar KSU, display data is indispensable.. Because the programming menus and key functions change at different levels within the KSU software, the only way to know the current menu options is by having display text available.

2.9. “Pressing” Keys

Station sets typically have feature keys that can be programmed to perform specific functions (e.g., transfer, hold, speaker phone, speed dial, or connect to trunk lines). Since a D/42-xx board emulates a station set, applications can “press” these keys. If the station set can be used to program feature keys, an application can also control the assignment of programmable keys. For instance, if a specific

key must be assigned to the transfer function, you can include a sequence of “pressing” keys at the start of the application to ensure that the environment has been set correctly.

2.10. Message Waiting Indication

Most PBX systems turn on message waiting lights on station set phones when messages arrive, and clear the light after messages are retrieved. These tasks can be handled manually, by an attendant, or be automated through a voice mail application. Using a D/42 xx board, an application can also control the state of message waiting indications on other station sets (if this feature is available on your PBX).

2.11. Automated Attendant

An auto attendant is a device connected to a PBX that answers incoming calls. After answering, it may perform functions such as playing a greeting, asking the caller to press a button, or routing the call to the proper destination.

3. D/42 Series Overview

The D/42 Series products, also referred to as D/42-xx products, combine the voice features available in the D/4x product line with the ability to access enhanced PBX features. The voice features include:

- play and record voice messages
- dial and recognize DTMF digits
- detect and answer incoming call
- call progress analysis.

The PBX specific features include:

- retrieve Called/calling number ID
- retrieve LCD/LED prompts and indicators
- read displays
- accessing PBX features using dial strings
- disconnect supervision.

3.1. Voice Features Supported

The D/42 Series PBX boards use a dual-processor architecture comprising a DSP (Digital Signal Processor) and a general purpose microprocessor to handle all voice processing functions. This dual processor approach off loads many low-level decision making tasks from the host computer.

When a D/42-xx system is initialized, firmware is downloaded from the host PC to the firmware RAM and DSP memory on the D/42-xx board. This downloadable firmware gives the board all of its intelligence and enables easy feature enhancement and upgrades. Based on this, the D/42-xx can perform the following operations on incoming calls:

- automatically control the volume of the incoming audio signal
- record and compress the incoming audio voice signal. Sampling rates and coding methods are selectable on a channel by channel basis

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- detect the presence of tones - DTMF, or an application defined signal or dual tone
- perform call progress analysis to determine the state of an incoming call.

For outbound calls, the D/42-xx can perform the following:

- play stored compressed audio files
- adjust the volume and speed of playback upon application or user request
- generate tones - DTMF, or an application defined signal or dual tone.

The D/42-xx board is basically a D/41D board with specialized PBX circuitry replacing the analog front end. The D/42-xx boards perform features available on a D/41D as well as emulate phones connected to a PBX.

When recording speech, the D/42-xx can use different digitizing rates from 24 to 64 Kb/s (Kilobits per second) as selected by the application for the best speech quality and most efficient storage. The digitizing rate is selected on a channel-by-channel basis and can be changed each time a record or play function is initiated. The processed speech is stored on the host PC's hard disk. When playing back a stored file, the voice information from the host PC is passed to the D/42-xx where it is converted into analog voice signals for transmission to the PBX.

The on-board control processor controls all operations of the D/42-xx board via a local bus and interprets and executes commands from the host PC. This processor handles real-time events, manages data flow to the host PC to provide faster system response time, reduces PC host processing demands, processes DTMF and PBX signaling before passing them to the application, and frees the DSP to perform signal processing. Communications between this processor and the host PC is via the shared buffer memory that acts as an input/output buffer and thus increases the efficiency of disk file transfers. This shared buffer memory interfaces to the host PC via the XT/AT bus.

3. D/42 Series Overview

3.2. PBX Integration Features Supported

D/42 Series PBX boards incorporate both circuitry and firmware to integrate applications with specific PBXs. The Unified API, used with the D/42 Series PBX boards, enables programmers to more easily develop a single application capable of supporting multiple manufacturer's PBXs. The Unified API also enables applications to access the important digital information sent between a PBX and its station sets. This information is useful in a variety of applications including Voice Mail and Call Center.

3.2.1. Unified API

The Unified API (Application Programming Interface) allows a single application to function on a variety of manufacturers switches. Functioning as an extension to Dialogic's standard voice API, the Unified API offers a single design model that allows developers to take advantage of advanced PBX features (such as called/calling number ID and ASCII display information).

- **Called/calling number ID** - usually two sets of digits representing either a trunk line or an extension. This is not to be confused with caller ID received from a CO which provides the telephone number of an outside caller. It is important for an application to know where a call originated and to what extension it is intended. When a call is transferred (or "bounced") through a PBX, this information may be needed by an application at the final destination. If it is not present, the originator (if they are still connected) will have to re-enter the information.
- **Retrieve LCD/LED prompts and indicators** - different PBXs have different types of prompts and indicators that relay status information of the station set. By capturing and processing this data, an application can "see" what prompts or indicators have been set.
- **Read displays** - there are many types of information displayed on a phone; hook state, messages, features, and any other ASCII text. By capturing and processing this data, an application can "see" what is on the display. This is useful for determining the state of the D/42-xx board. Also, when ANI and DNIS digits are available through the PBX, the CO caller ID can be obtained. Display data is also useful when programming a PBX. Because the D/42-xx boards allow applications to "press" buttons, applications can be written to program the PBX in the same way as using a station set to program the PBX.

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- **Accessing PBX features using dial strings** - The D/42-xx boards allow applications to access features that are available through a station set. These functions include call transfer, hold, setting the message waiting indicator, and dialing programmable keys.
- **Disconnect supervision** - Not always available or not well supported. When a PBX detects a hang-up from one of its extensions, information is passed to the CO, which in turn hangs up. Typically this is accomplished using a loop current drop. However, if the CO hangs up first, a loop current drop is sent to the PBX but is not passed to the station set. Instead, the station set receives a disconnect message. The D/42-xx boards interpret this disconnect message as a loop current drop event. Not all PBXs support disconnect supervision.

Utility functions included in the Unified API allow programmers to control the D/42 Series board. Your application can retrieve the D/42-xx channel and board type, obtain and set D/42-xx channel and board parameters, start and stop the D/42 driver, retrieve D/42 firmware/driver/library version numbers, and retrieve error information.

By using the Unified API to determine the type of switch that the D/42-xx board is connected to, programmers can create an application that can provide specific control for each PBX or KSU. Specific control is accomplished using dial strings. Some examples are: call transfer, call forward, message waiting light manipulation, and pressing console buttons. The D/42 Series boards are capable of performing any function that is available to a telephone connected to the PBX or KSU.

Developers who wish to continue designing switch-specific applications can continue to do so, as the Unified API also provides access to lower-level function calls made available through each individual switch protocol. And for customers unwilling to shift from older PBX integration development models, the Unified API provides for backward compatibility, preserving their development investment.

3.3. D/42D-SX Description

The D/42D-SX™ is a PC AT® compatible voice processing board that interfaces directly to COV Line cards in a MITEL SUPERSWITCH® PBX. The D/42D-SX emulates four SUPERSET 4 electronic telephones. Application programs using

3. D/42 Series Overview

the D/42D-SX board can answer incoming calls, place outbound calls, record and playback voice files, detect and generate tones, access the called/calling number ID for calls forwarded or transferred from within the PBX, access trunk ID for calls originating outside the PBX, and control SUPERSET LCD message notification. The D/42D-SX board also provides positive disconnect supervision to immediately detect when a caller has hung up.

When used with the MITEL SUPERSWITCH, the D/42D-SX board provides a flexible platform for developing integrated computer telephony applications. Dialogic developers can integrate current D/4x applications on the D/42D-SX board with minimal software modifications and create more efficient applications for the PBX by offering value-added features.

A D/42D-SX board has four channels that can be connected directly to a MITEL COV Line card in a MITEL SUPERSWITCH PBX. The COV Line cards support MITEL's SUPERSET 4 telephones, which have a 16 character display screen used to display status messages, and feature keys for accessing advanced features.

3.3.1. Features

- voice board with four independent four-wire interfaces to MITEL SUPERSWITCH PBX that reduces the cost and complexity of application integration with a Mitel system
- interfaces directly to a MITEL COV Line card in a MITEL SUPERSWITCH PBX
- emulates 4 SUPERSET 4 telephones
- automatically answers calls
- detects Touch Tones
- plays voice messages to a caller
- digitizes, compresses and records voice signals
- places outbound calls and automatically reports the result
- retrieves called/calling number ID to enable calls to be intelligently handled
- activates/deactivates message waiting indicators to provide message notification

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- allows supervised (recommended) and blind transfers for automated attendant applications
- provides positive disconnect supervision to immediately detect when a caller has hung up (when in speakerphone mode)
- enables development of applications across a variety of PBX systems using the Unified API.

3.3.2. Functional Description

The D/42D-SX board connects to a MITEL COV Line card that supports MITEL SUPERSET 4 telephones. These telephones have a 16-character display and feature keys for accessing advanced features of the PBX.

Each of four line interfaces on the D/42D-SX board receives analog voice and digital signaling information from the PBX.

Digital data received from the PBX by the D/42D-SX passes through a digital duplexer and is demodulated by a COV (carrier over voice) modem. The resulting serial bit stream is converted by a UART (universal asynchronous receiver/transmitter) into a parallel bit stream that is sent via the local bus to the control processor which either acts on the information or passes the event to the application - refer to Figure 1.

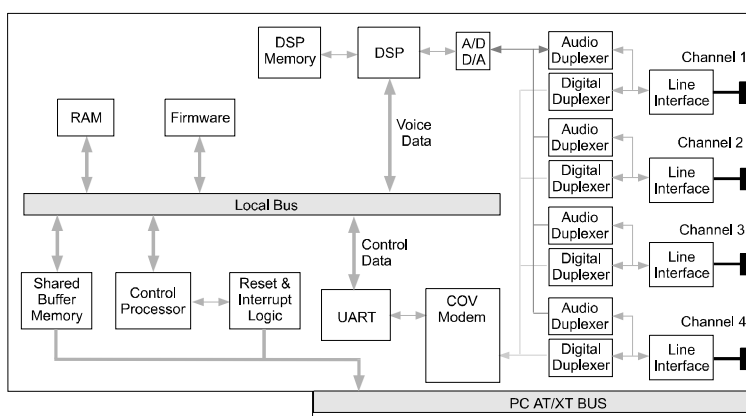


Figure 1. D/42D-SX Functional Block Diagram

3. D/42 Series Overview

Analog voice signals received by the D/42D-SX pass through a audio duplexer and are converted to digital data by an A/D converter. The raw digital data is then compressed by the DSP and sent to the PC for storage. When sending stored voice data to the PBX, the digital voice data is sent from the PC to the DSP where it is uncompressed. It is then converted back to an analog voice signal by the D/A converter and sent to the PBX via the audio duplexer.

In addition to having all the standard features of a Dialogic D/41D board, the D/42D-SX board can access enhanced PBX features such as:

- call transfer/conference
- turn phone message waiting indicators on or off
- callback request
- calling number identification (Calling Number ID).

The D/42D-SX has an on-board microprocessor and a high speed Digital Signal Processor (DSP) to provide voice and call processing. SpringWare™ voice processing firmware is downloaded from the host computer to RAM and DSP memory when the D/42D-SX board is started. SpringWare offers several features including PerfectPitch™ Speed Control, PerfectLevel™ Volume Control, Global Tone Detection™, and Positive Voice Detection™. Global Tone Detection allows applications to detect special intercept tones, fax tones, modem tones, non-standard PBX tones, or user-defined tones, such as tones in international networks.

Other DSP-based SpringWare features include variable voice sampling rates of 24 and 32 Kb/s ADPCM, and 48 and 64 Kb/s μ -law PCM. An application may dynamically switch between sampling rates and coding methods to meet specific requirements for voice quality and data storage. Enhanced algorithms provide reliable DTMF detection, DTMF cut-through, and talk off/play off suppression.

3.3.3. Configurations

The D/42D-SX board connects to a MITEL SUPERSET 4 COV Line Circuit board in a MITEL SUPERSWITCH PBX (check specific PBX models and software releases for compatibility) to build sophisticated, computer telephony systems. The D/42D-SX board installs in IBM® PC XT®/AT® (ISA bus) and compatible computers (8088, 80286™, 80386™, 80486™ or Pentium™-based

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PC platforms). The D/42D-SX board occupies a single expansion slot, and up to 16 boards can be configured in a system with each board sharing the same interrupt level. The maximum number of lines that can be supported is dependent on the application, the amount of disk I/O required, and the host computer's CPU.

The D/42D-SX board shares a common hardware and firmware architecture with other Dialogic products for maximum flexibility and scalability. Features can be added or systems can grow while protecting investment in hardware and application code. With only minimum modifications, applications can be easily ported to lower or higher line-density platforms.

3.3.4. Software Support

For information on other operating system support, contact your Dialogic Sales Engineer. The development package includes all required libraries, drivers and headers for simplified and seamless PBX integration. Diagnostics and demo programs provide additional tools and examples that allow developers to create complex multichannel voice applications.

3.4. D/42D-SL Description

The D/42D-SL™ is a PC AT® compatible voice processing board that interfaces directly to SL-1 Line Circuit boards in a Northern Telecom SL-1 PBX. The D/42D-SL emulates four Digit Display electronic telephones. Application programs using the D/42D-SL board can answer incoming calls, place outbound calls, record and playback voice files, detect and generate tones, access the called/calling number ID for calls forwarded or transferred from within the PBX, access trunk ID for calls originating outside the PBX, and control message waiting notification. The D/42D-SL board also provides positive disconnect supervision to immediately detect when a caller has hung up.

When used with the Northern Telecom SL-1, the D/42D-SL board provides a flexible platform for developing integrated computer telephony applications. Dialogic developers can integrate current D/4x applications on the D/42D-SL board with minimal software modifications and create more efficient applications for the PBX by offering value-added features.

3. D/42 Series Overview

A D/42D-SL board has four channels that connect directly to Northern Telecom SL-1 Line Circuit boards in a Northern Telecom SL-1 PBX. The SL-1 Line Circuit boards support Northern Telecom's Digit Display telephone, which has a 16 character display and feature keys for accessing advanced features.

3.4.1. Features

- voice board with four independent four-wire interfaces to Northern Telecom's SL-1™ PBX that enables tight application integration with the SL-1 System
- interfaces directly to a Northern Telecom SL-1 Line Circuit board in a Northern Telecom SL-1 PBX
- emulates four SL-1 digit display telephones
- automatically answers calls
- detects Touch Tones
- plays voice messages to a caller
- digitizes, compresses and records voice signals
- places outbound calls and automatically reports the result
- retrieves called/calling number ID to enable calls to be intelligently handled
- activates/deactivates message waiting indicators to provide message notification
- allows supervised (recommended) and blind transfers for automated attendant applications
- provides positive disconnect supervision to immediately detect when a caller has hung up
- enables development of applications across a variety of PBX systems using the Unified API.

3.4.2. Functional Description

The D/42D-SL board connects to line circuit boards that support Northern Telecom's Digit Display Telephone. These telephones have a 16-character display and feature keys for accessing advanced features of the PBX.

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Each of four line interfaces on the D/42D-SL board receive analog voice and digital signaling information from the PBX SL-1 line circuit board.

Digital data received from the PBX by the D/42D-SL passes through a digital duplexer to a command format converter where it is converted from SL-1 format to D/41D format. A UART (universal asynchronous receiver/transmitter) then converts this serial bit stream into a parallel bit stream that is sent via the local bus to the control processor which either acts on the information or passes the event to the application - refer to Figure 2.

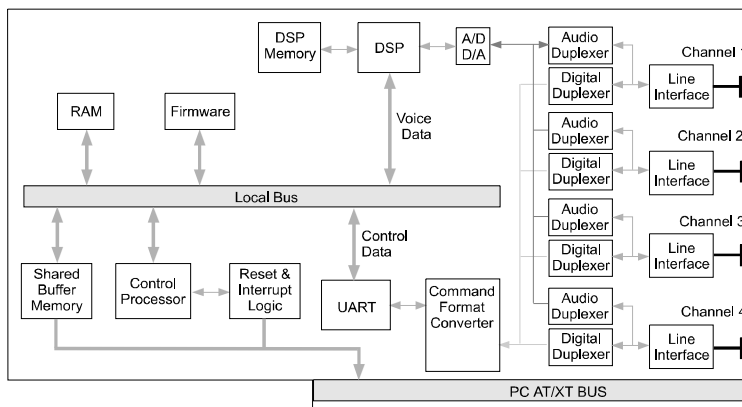


Figure 2. D/42D-SL Functional Block Diagram

Analog voice signals received by the D/42D-SL pass through an audio duplexer and are converted to digital data by an A/D converter. The raw digital data is then compressed by the DSP and sent to the PC for storage. When sending stored voice data to the PBX, the digital voice data is sent from the PC to the DSP where it is uncompressed. It is then converted back to an analog voice signal by the D/A converter and sent to the PBX via the audio duplexer.

In addition to having all the standard features of a Dialogic D/41D board, the D/42D-SL board can access enhanced PBX features such as:

- call transfer
- turn phone message waiting indicators on or off
- calling number identification (Calling Number ID).

3. D/42 Series Overview

The D/42D-SL has an on-board microprocessor and a high speed Digital Signal Processor (DSP) to provide voice and call processing. SpringWare™ voice processing firmware is downloaded from the host computer to the microprocessor and DSP when the D/42D-SL board is started. SpringWare offers several features including PerfectPitch™ Speed Control, PerfectLevel™ Volume Control, Global Tone Detection™, and Positive Voice Detection™. Global Tone Detection allows applications to detect special intercept tones, fax tones, modem tones, non-standard PBX tones, or user-defined tones, such as tones in international networks.

Other DSP-based SpringWare features include variable voice sampling rates of 24 and 32 Kb/s ADPCM, and 48 and 64 Kb/s μ -law PCM. An application may dynamically switch between sampling rates and coding methods to meet specific requirements for voice quality and data storage. Enhanced algorithms provide reliable DTMF detection, DTMF cut-through, and talk off/play off suppression.

3.4.3. Configurations

The D/42D-SL board connects to a Northern Telecom SL-1 Line Circuit board in a Northern Telecom SL-1 PBX (check specific PBX models and software releases for compatibility) to build sophisticated, computer telephony systems. The D/42D-SL board installs in IBM® PC XT®/AT® (ISA bus) and compatible computers (8088, 80286™, 80386™, 80486™ or Pentium™-based PC platforms). The D/42D-SL board occupies a single expansion slot and up to 16 boards can be configured in a system with each board sharing the same interrupt level. The maximum number of lines that can be supported is dependent on the application, the amount of disk I/O required, and the host computer's CPU.

The D/42D-SL board shares a common hardware and firmware architecture with other Dialogic products for maximum flexibility and scalability. Features can be added or systems can grow while protecting investment in hardware and application code. With only minimum modifications, applications can be easily ported to lower or higher line-density platforms.

3.4.4. Software Support

For information on other operating system support, contact your Dialogic Sales Engineer. The development package includes all required libraries, drivers and

headers for simplified and seamless PBX integration. Diagnostics and demo programs provide additional tools and examples that allow developers to create complex multichannel voice applications.

3.5. D/42-NS Description

The D/42-NS™ is a PC AT® compatible voice processing board that interfaces directly to four-wire digital telephone ports on a Northern Telecom Norstar Key System Unit (KSU). The D/42-NS emulates four M7310 electronic telephones. Application programs using the D/42-NS board can answer incoming calls, place outbound calls, record and playback voice files, detect and generate tones, access the called/calling number ID for calls forwarded or transferred from within the KSU, access trunk ID for calls originating outside the KSU, and control message notification. The D/42-NS board also provides positive disconnect supervision to immediately detect when a caller has hung up.

When used with the Northern Telecom Norstar KSU, the D/42-NS board provides a flexible platform for developing integrated computer telephony applications. Dialogic developers can integrate current D/4x applications on the D/42-NS board with minimal software modifications and create more efficient applications for the PBX by offering value-added features.

The D/42-NS board has four channels that connect directly to four ports of a Northern Telecom Norstar KSU. The KSU supports M7310 digital station sets which have a 32 character display screen used to display status messages and feature keys for accessing advanced features.

3.5.1. Features

- voice board with four independent Norstar® TCM digital station interfaces that reduces the cost and complexity of application integration with a Norstar system
- interfaces directly to a Northern Telecom Norstar KSU
- emulates four M7310 digital station sets
- automatically answers calls
- detects Touch Tones

3. D/42 Series Overview

- plays voice messages to a caller
- digitizes, compresses and records voice signals
- places outbound calls and automatically reports the result
- retrieves called/calling number ID enable calls to be intelligently handled
- activates/deactivates message waiting indicators to provide message notification
- allows supervised (recommended) and blind transfers for automated attendant applications
- provides positive disconnect supervision immediately detects when a caller has hung up
- enables development of applications across a variety of PBX systems using the Unified API.

3.5.2. Functional Description

The D/42-NS board connects to four ports of a Northern Telecom Norstar KSU and emulates four M7310 digital station sets. These telephones have a 32-character display and feature keys for accessing advanced features of the KSU.

Each line interface on the D/42-NS board receives PCM (pulse code modulated) digital voice and control data from the Norstar KSU port. This digital voice is compressed by a DSP using an ADPCM (adaptive differential pulse code modulation) algorithm and then sent to the host PC to be stored.

Control data from the KSU passes through the digital duplexer to a command processor where it is converted from KSU format to D/41D format. This serial bit stream is then converted into a parallel bit stream that is sent via the local bus to the on-board control processor which either acts on the information or passes the event to the application - refer to Figure 3.

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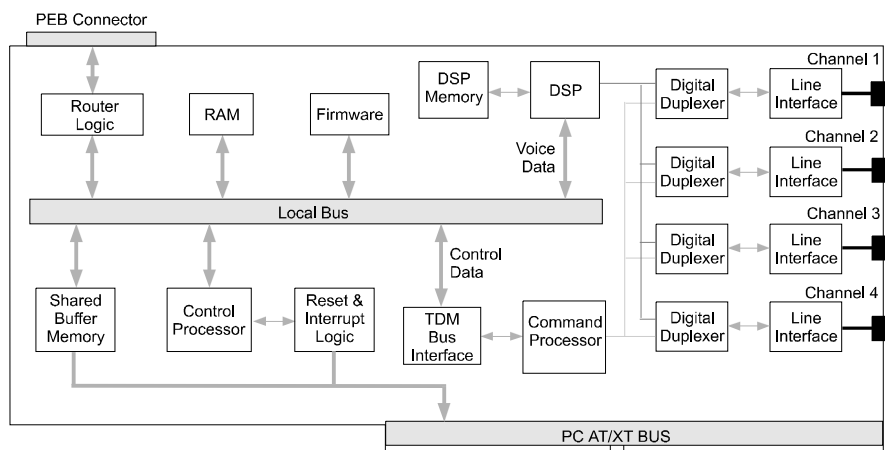


Figure 3. D/42-NS Functional Block Diagram

Incoming data for each channel is divided into separate voice and control data signaling parts. The voice portion contains the digitized voice data, while the control data signaling portion contains the telephone and special feature signaling information. The digitized voice data is compressed by the DSP and sent to the PC for storage. When sending stored voice data to the KSU, the digital voice data is sent from the PC to the DSP where it is uncompressed. It is then sent to the KSU via the digital duplexer.

In addition to having all the standard features of a Dialogic D/41D board, the D/42-NS board can access enhanced PBX features such as:

- call transfer/conference
- turn phone message waiting indicators on or off
- callback request
- calling number identification (Calling Number ID).

The D/42-NS has an on-board microprocessor and a high speed Digital Signal Processor (DSP) to provide voice and call processing. SpringWare™ voice processing firmware is downloaded from the host computer to RAM and DSP memory when the D/42-NS board is started. SpringWare offers several features including PerfectPitch™ Speed Control, PerfectLevel™ Volume Control, Global

3. D/42 Series Overview

Tone Detection™, and Positive Voice Detection™. Global Tone Detection allows applications to detect special intercept tones, fax tones, modem tones, non-standard PBX tones, or user-defined tones, such as tones in international networks.

Other DSP-based SpringWare features include variable voice sampling rates of 24 and 32 Kb/s ADPCM, and 48 and 64 Kb/s μ -law PCM. An application may dynamically switch between sampling rates and coding methods to meet specific requirements for voice quality and data storage. Enhanced algorithms provide reliable DTMF detection, DTMF cut-through, and talk off/play off suppression.

3.5.3. Configurations

The D/42-NS board connects to a Northern Telecom Norstar KSU (check specific KSU models and software releases for compatibility) to build sophisticated, computer telephony systems to which capabilities such as speech recognition, facsimile, and text-to-speech can be added. The D/42-NS board installs in IBM® PC XT®/AT® (ISA bus) and compatible computers (80286™, 80386™, 80486™ or Pentium™-based PC platforms). The D/42-NS board occupies a single expansion slot and up to 16 boards can be configured in a system with each board sharing the same interrupt level. The maximum number of lines that can be supported is dependent on the application, the amount of disk I/O required, and the host computer's CPU.

The D/42D-NS board shares a common hardware and firmware architecture with other Dialogic products for maximum flexibility and scalability. Features can be added or systems can grow while protecting investment in hardware and application code. With only minimum modifications, applications can be easily ported to lower or higher line-density platforms.

3.5.4. Software Support

For information on other operating system support, contact your Dialogic Sales Engineer. The development package includes all required libraries, drivers and headers for simplified and seamless PBX integration. Diagnostics and demo programs provide additional tools and examples that allow developers to create complex multichannel voice applications.

3.6. D/42-NE2 Description

The D/42-NE2™, is a PC AT® compatible voice processing board that interfaces directly to two-wire digital telephone ports on NEC's Electra™ Professional II key terminal systems (KTS), and NEAX® 2400 ICS and 2000 IVS PBX series. It emulates four DTERM® Series III electronic telephones. The D/42-NE2 can answer incoming calls, record and playback voice files, detect and generate tones, and signal. Patented call progress analysis algorithms and frequency analysis enable the D/42-NE2 to make outbound calls, detect when calls are answered, and distinguish between different network signals.

When used with NEC PBX and KTS switches, the D/42-NE2 provides a flexible platform for developing integrated call processing applications. Dialogic developers can integrate current applications on the D/42-NE2 with minimal software modifications and create more efficient applications through the use of the Unified API.

With the correct switch software load, application programs using the D/42-NE2 can access called/calling number ID for calls transferred within the switch, access trunk identification for calls originating outside the switch, and control message waiting indicators. The D/42-NE2 also provides positive disconnect supervision (Electra™ Professional II only) to immediately detect when a caller has hung up.

3.6.1. Features

- voice board with four independent digital interfaces to NEC Electra Professional Level II Key Telephone Systems and NEAX 2400 ICS and NEAX 2000 IVS PBX that reduces the cost and complexity of application integration
- emulates four DTERM Series III telephones
- automatically answers calls
- detects touch tones
- plays voice messages to a caller
- digitizes, compresses and records voice signals
- places outbound calls and automatically reports the result

3. D/42 Series Overview

- retrieves called/calling number ID to enable calls to be intelligently handled
- activates/deactivates message waiting indicators to provide message notification
- allows supervised (recommended) and blind transfers for automated attendant applications
- provides positive disconnect supervision to immediately detect when a caller has hung up (Electra Professional II only)
- provides voice response enhancements to the NEC installed base
- enables development of applications across a variety of PBX systems using the Unified API.

3.6.2. Functional Description

The D/42-NE2 board connects to four two-wire digital telephone ports of an NEC Electra Professional II key terminal system (KTS), and NEAX 2400 ICS and NEAX 2000 IVS PBX series switches.

Each line on the D/42-NE2 board receives PCM (pulse code modulated) digital voice and control data from the NEC port. This digital voice is compressed by a DSP using an ADPCM (adaptive differential pulse code modulation) algorithm and sent to the host PC to be stored.

Control data from the NEC switch passes through the digital duplexer on the D/42-NE2 to a command processor where it is converted from its native format to D/41D format. The resulting serial bit stream is then converted into a parallel bit stream that is sent via the local bus to the on-board control processor which either acts on the information or passes the event to the application - refer to Figure 4.

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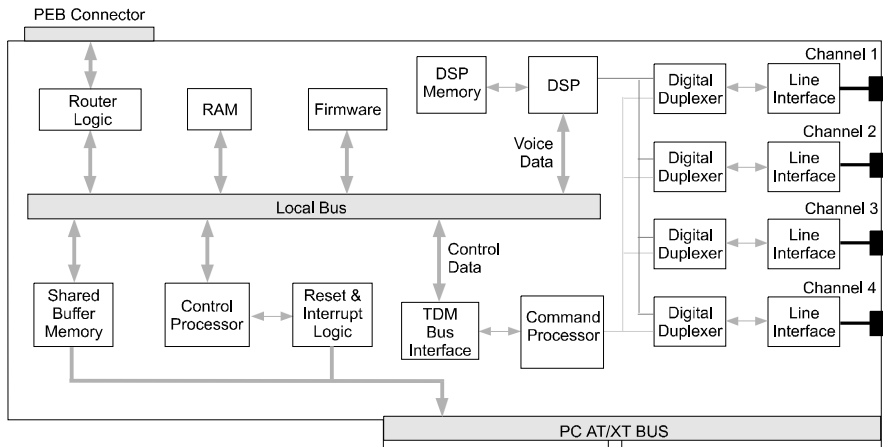


Figure 4. D/42-NE2 Functional Block Diagram

Incoming data for each channel is divided into separate voice and control data signaling parts. The voice portion contains the digitized voice data, while the control data signaling portion contains the telephone and special feature signaling information for every channel. The digitized voice data is compressed by the DSP and sent to the PC for storage. When sending stored voice data to the PBX, the digital voice data is sent from the PC to the DSP where it is uncompressed. It is then sent to the KSU via the digital duplexer.

In addition to having all the standard features of a Dialogic D/41D board, the D/42-NE2 board can access enhanced PBX features such as:

- call transfer/conference
- turn message waiting indicators on or off
- callback request
- calling number identification (Calling Number ID).

The D/42-NE2 has an on-board microprocessor and a high speed Digital Signal Processor (DSP) to provide voice and call processing. SpringWare™ voice processing firmware is downloaded from the host computer to RAM and DSP memory when the D/42-NE2 board is started. SpringWare offers several features including PerfectPitch™ Speed Control, PerfectLevel™ Volume Control, Global

3. D/42 Series Overview

Tone Detection™, and Positive Voice Detection™. Global Tone Detection allows applications to detect special intercept tones, fax tones, modem tones, non-standard PBX tones, or user-defined tones, such as tones in international networks.

Other DSP-based SpringWare features include variable voice sampling rates of 24 and 32 Kb/s ADPCM, and 48 and 64 Kb/s μ -law PCM. An application may dynamically switch between sampling rates and coding methods to meet specific requirements for voice quality and data storage. Enhanced algorithms provide reliable DTMF detection, DTMF cut-through, and talk off/play off suppression.

3.6.3. Configurations

The D/42-NE2 board can be connected to the NEC Electra Professional II key terminal systems (KTS), the NEAX 2400 ICS, and the NEAX 2000 IVS PBX series systems (check specific models and software releases for compatibility) to build sophisticated, computer telephony systems. The D/42-NE2 board installs in IBM® PC XT®/AT® (ISA bus) and compatible computers (80286™, 80386™, 80486™ or Pentium™-based PC platforms). The D/42-NE2 board occupies a single expansion slot and up to 16 boards can be configured in a system with each board sharing the same interrupt level. The maximum number of lines that can be supported is dependent on the application, the amount of disk I/O required, and the host computer's CPU.

The D/42-NE2 board shares a common hardware and firmware architecture with other Dialogic products for maximum flexibility and scalability. Features can be added or systems can grow while protecting investment in hardware and application code. With only minimum modifications, applications can be easily ported to lower or higher line-density platforms.

3.6.4. Software Support

For information on other operating system support, contact your Dialogic Sales Engineer. The development package includes all required libraries, drivers and headers for simplified and seamless PBX integration. Diagnostics and demo programs provide additional tools and examples that allow developers to create complex multichannel voice applications.

3.7. D/42-NE2 PCI Description

The D/42-NE2™ PCI, is a half-size voice processing board that interfaces directly to two-wire digital telephone ports on NEC's Electra™ Professional II key terminal systems (KTS), and NEAX® 2400 ICS and 2000 IVS PBX series. It emulates four DTERM® Series III electronic telephones. The D/42-NE2 PCI can answer incoming calls, record and playback voice files, detect and generate tones, and signals. Patented call progress analysis algorithms and frequency analysis enable the D/42-NE2 PCI to make outbound calls, detect when calls are answered, and distinguish between different network signals.

When used with NEC PBX and KTS switches, the D/42-NE2 PCI provides a flexible platform for developing integrated call processing applications. Dialogic developers can integrate current applications on the D/42-NE2 PCI with minimal software modifications and create more efficient applications through the use of the Unified API.

With the correct switch software load, application programs using the D/42-NE2 PCI can access called/calling number ID for calls transferred within the switch, access trunk identification for calls originating outside the switch, and control message waiting indicators. The D/42-NE2 PCI also provides positive disconnect supervision (Electra™ Professional II only) to immediately detect when a caller has hung up.

3.7.1. Features

- connects four independent digital interfaces to NEC Electra Professional Level II Key Telephone Systems and NEAX 2400 ICS and NEAX 2000 IVS PBX that provides call processing information for tighter applications
- emulates four DTERM Series III telephones
- automatically answers calls
- detects touch tones
- plays voice messages to a caller
- digitizes, compresses and records voice signals
- places outbound calls and automatically reports the result

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- retrieves called/calling number ID to enable calls to be intelligently handled
- activates/deactivates message waiting indicators to provide message notification
- allows supervised (recommended) and blind transfers for automated attendant applications
- provides positive disconnect supervision to immediately detect when a caller has hung up (Electra Professional II only)
- provides voice response enhancements to the NEC installed base
- enables development of applications across a variety of PBX systems using the Unified API.

3.7.2. Functional Description

The D/42-NE2 PCI board connects to four two-wire digital telephone ports of an NEC Electra Professional II key terminal system (KTS), and NEAX 2400 ICS and NEAX 2000 IVS PBX series switches.

Each line on the D/42-NE2 PCI board receives PCM (pulse code modulated) digital voice and control data from the NEC port. This digital voice is compressed by a DSP using an ADPCM (adaptive differential pulse code modulation) algorithm and sent to the host PC to be stored.

Control data from the NEC switch passes through the digital duplexer on the D/42-NE2 PCI to a command processor where it is converted from its native format to D/41D format. The resulting serial bit stream is then converted into a parallel bit stream that is sent via the local bus to the on-board control processor which either acts on the information or passes the event to the application.

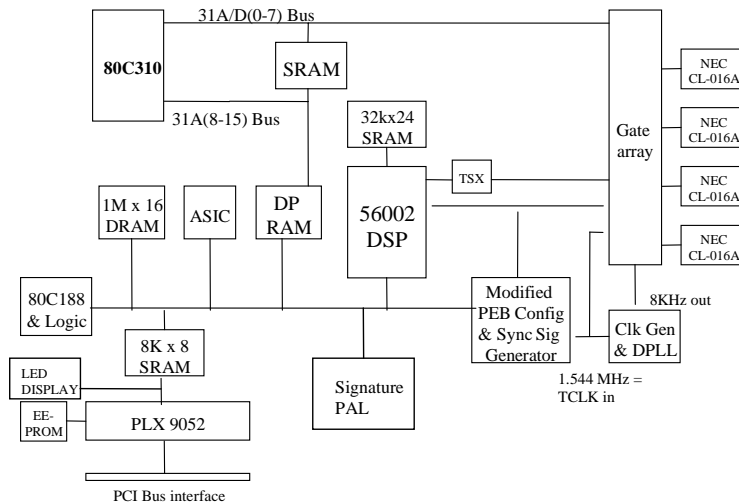


Figure 5. D/42-NE2 PCI Functional Block Diagram

Incoming data for each channel is divided into separate voice and control data signaling parts. The voice portion contains the digitized voice data, while the control data signaling portion contains the telephone and special feature signaling information for every channel. The digitized voice data is compressed by the DSP and sent to the PC for storage. When sending stored voice data to the PBX, the digital voice data is sent from the PC to the DSP where it is uncompressed. It is then sent to the KSU via the digital duplexer.

In addition to having all the standard features of a Dialogic D/41D board, the D/42-NE2 board can access enhanced PBX features such as:

- call transfer/conference
- turn message waiting indicators on or off
- callback request
- calling number identification (Calling Number ID).

The D/42-NE2 PCI has an on-board microprocessor and a high speed Digital Signal Processor (DSP) to provide voice and call processing. SpringWare™ voice processing firmware is downloaded from the host computer to RAM and DSP

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memory when the D/42-NE2 PCI board is started. SpringWare offers several features including PerfectPitch™ Speed Control, PerfectLevel™ Volume Control, Global Tone Detection™, and Positive Voice Detection™. Global Tone Detection allows applications to detect special intercept tones, fax tones, modem tones, non-standard PBX tones, or user-defined tones, such as tones in international networks.

Other DSP-based SpringWare features include variable voice sampling rates of 24 and 32 Kb/s ADPCM, and 48 and 64 Kb/s μ -law PCM. An application may dynamically switch between sampling rates and coding methods to meet specific requirements for voice quality and data storage. Enhanced algorithms provide reliable DTMF detection, DTMF cut-through, and talk off/play off suppression.

3.7.3. Configurations

The D/42-NE2 PCI board can be connected to the NEC Electra Professional II key terminal systems (KTS), the NEAX 2400 ICS, and the NEAX 2000 IVS PBX series systems (check specific models and software releases for compatibility) to build sophisticated, computer telephony systems. The D/42-NE2 PCI board installs in IBM® PC XT®/AT® (PCI bus) and compatible computers (80286™, 80386™, 80486™ or Pentium™-based PC platforms). The D/42-NE2 PCI board occupies a single expansion slot and up to 16 boards can be configured in a system with each board sharing the same interrupt level. The maximum number of lines that can be supported is dependent on the application, the amount of disk I/O required, and the host computer's CPU.

The D/42-NE2 PCI board shares a common hardware and firmware architecture with other Dialogic products for maximum flexibility and scalability. Features can be added or systems can grow while protecting investment in hardware and application code. With only minimum modifications, applications can be easily ported to lower or higher line-density platforms.

3.7.4. Software Support

For information on other operating system support, contact your Dialogic Sales Engineer. The development package includes all required libraries, drivers and headers for simplified and seamless PBX integration. Diagnostics and demo

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programs provide additional tools and examples that allow developers to create complex multichannel voice applications.

4. PBX Systems

4.1. MITEL SUPERSWITCH PBX

MITEL PBXs use digital signaling to control its station sets and analog signals for voice. The COV Line card provides an interface between the station sets and the switch.

The D/42D-SX board has four channels that are connected directly to a MITEL COV Line card. The COV Line card can be used in the SX-50, SX-100, SX-200, SX200D, and SX-2000 PBXs. These MITEL PBXs have many standard features that are supported by the D/42D-SX, such as:

- direct inward dialing (DID)
- hands free operation
- speed dialing
- hunt groups
- message waiting lamps
- call forwarding.

4.1.1. MITEL Switch Programming Requirements

There are no specific switch programming requirements for using a D/42D-SX with a MITEL SUPERSWITCH PBX. However, you must ensure that the features you want to access using the D/42D-SX and the Unified API are enabled on the extension(s) connected to your system. For example, if you want your application to be able to read the name assigned to an extension, the name must be programmed by PBX.

The PBX uses Class of Service (COS) to determine which features are available to an extension. The features available to an extension are shown in the telephone set's LCD Features display. Any feature not in the COS will not be displayed.

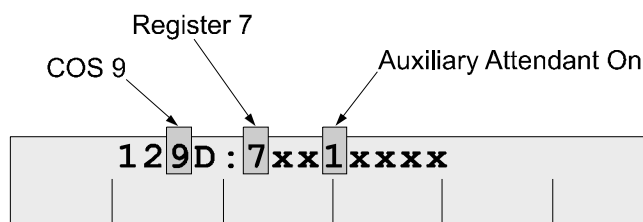
MITEL SX-50 Requirements for using MWI

If you are using a MITEL SX-50 and wish to use the set Message Waiting Indicators (MWI) feature, the D/42D-SX must be assigned to a COS with Auxiliary Attendant capabilities, and a line key must be set to act as the Attendant Console MWI. Use the following procedures only if you have a high degree of understanding of the MITEL SX-50 PBX and it's configuration. To configure MWI on a MITEL SX-50 you will:

- configure the COS that will be assigned to the D/42D-SX to include Auxiliary Attendant capabilities
- assign the COS to a channel on the Dialogic D/42D-SX
- program a Line Key on the D/42D-SX to act as an Attendant Console "Message Waiting" function key.

Configure a COS to have enhanced Auxiliary Attendant capabilities

1. From a test phone set, enter Programming Mode.
2. Enter the Command Number corresponding to the COS to which you want to add Auxiliary Attendant capabilities. Use commands 121 through 129 for COS 1 through COS 9. For example, if you want to change COS 9, use Command Number 129.
3. Set register 7, field "d" (Auxiliary Attendant Position) to 1 for the desired COS (1 - 9). The illustration below shows the Auxiliary Attendant feature enabled on COS 9.

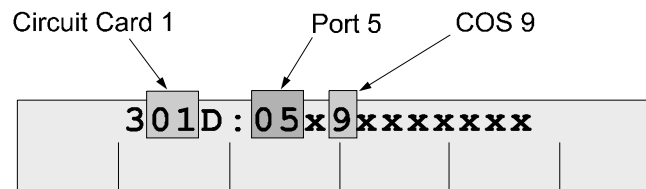


4. Press Exit.

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Assign ports connected to the D/42D-SX cards to have the newly configured COS.

1. Determine the circuit card number and port connected to your D/42D-SX. The PBX can have up to 10 circuit cards, and a COV circuit card has 8 ports. (example: circuit card 1, port 5).
2. From a test phone set, enter Programming Mode.
3. Enter the Command Number of the circuit connected to your D/42D-SX port (use commands 301 through 310 for circuit card 1 through 10). For example, if you are using a COV card in circuit card position 1, use Command Number 301.
4. Select the port connected to the D/42D-SX (example: port 5).
5. Set field “d” to the COS configured above. The illustration below shows COS 9 is assigned to circuit card 1, port 5.



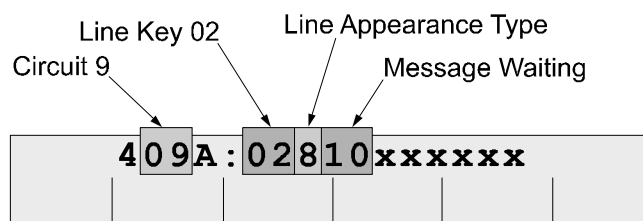
6. Press Exit.

Program a Line key on the D/42-SX to act as an Attendant Console “Message Waiting” function key.

1. Determine the circuit number connected to your D/42D-SX port. The PBX can have up to 10 circuit cards, and a COV circuit card has 8 ports. For example, if you have two COV cards and the D/42D-SX is connected to circuit card 2, port 1, the circuit number is 9.
2. From a test phone set, enter Programming Mode.
3. Enter the Command Number 4xx, where xx is the circuit number connected to your D/42D-SX port. For example, if you are using a COV card in circuit card position 2, port 1, use Command Number 409.
4. Select a Line key (other than 1) to use as the Message Waiting Indicator (example: Line Key 02). Set the Line Key field **c** (Line Appearance Type) to **8** (Attendant Function Key) and field **d** to 1 and field **e** to 0

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(Message Waiting). The illustration below shows that Line Key 2, for the D/42D-SX connected to Circuit 9, is assigned as a Message Waiting indicator.



5. Press Exit.

4.1.2. Using the D/42D-SX Board

The D/42D-SX board performs functions available to a SUPERSET 4 telephone set. A SUPERSET 4 telephone set uses two LCD displays to show line status (next to the line keys) and user prompts (above the soft keys) - refer to Figure 6). The D/42D-SX can:

- transfer calls
- set the message waiting indicator
- read the LCD alphanumeric display
- read the LCD features display
- read the LCD prompts display
- read LCD line indicators
- read the calling number ID
- press buttons.

4. PBX Systems

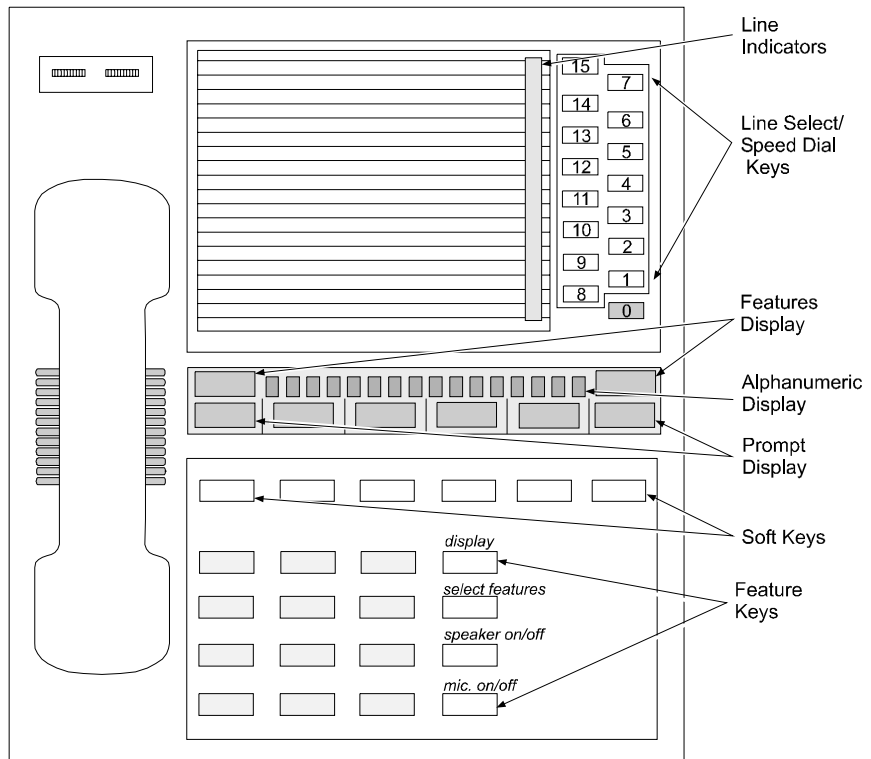


Figure 6. MITEL SUPERSET4 Telephone

4.1.3. Line Select/Speed Dialing Keys (15)

There are 15 Line Select/Speed Dialing keys located on the top-right of the SUPERSET 4 telephone - see Figure 6. These keys are configured when the PBX is programmed to select preassigned lines. Line keys that are not configured can be defined by the user (using the telephone set or the D/42D-SX) as speed dial keys. There is an LCD Line Indicator associated with each Line Select/Speed Dialing key.

NOTE: The indicator for the HOLD key is usually covered by the line identification card.

Each LCD Line Indicator is made up of two segments; a square and a circle. Each segment can take on one of the seven states listed in Table 1.

Table 1. SUPERSET 4 LCD Line Indicator States

State	Value (in HEX)
off	0
on	1
250 ms off, 250 ms on	2
500 ms off, 500 ms on	3
438 ms off, 62 ms on	4
62 ms off, 438 ms on	5
inverse flash rate of circle	F (square only)

Reading LCD Line Indicators

The D/42D-SX can determine the state of its Line Indicators by using the **d42_indicators()** function to retrieve the Line Indicators data. This function places the Line Indicator data (16 bytes) in an application buffer. Each byte (8 bits) contains data for both segments of an indicator (bits 0-3 represent the square, bits 4-7 represent the circle - see Table 1). Bytes 1-15 contain the indicator status for line keys 01-15, respectively. Byte 0 contains the status for Hold (see Table 2).

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Table 2. MITEL SUPERSET 4 LCD Line Indicators and Dial Strings

Byte	Key Description	Dial String
0	LINE KEY 0 (hold)	<ESC>KA
1	LINE KEY 1 (prime line)	<ESC>KB
2	LINE KEY 2 (line or speed dial)	<ESC>KC
3	LINE KEY 3 (line or speed dial)	<ESC>KD
4	LINE KEY 4 (line or speed dial)	<ESC>KE
5	LINE KEY 5 (line or speed dial)	<ESC>KF
6	LINE KEY 6 (line or speed dial)	<ESC>KG
7	LINE KEY 7 (line or speed dial)	<ESC>KH
8	LINE KEY 8 (line or speed dial)	<ESC>KI
9	LINE KEY 9 (line or speed dial)	<ESC>KJ
10	LINE KEY 10 (line or speed dial)	<ESC>KK
11	LINE KEY 11 (line or speed dial)	<ESC>KL
12	LINE KEY 12 (line or speed dial)	<ESC>KM
13	LINE KEY 13 (line or speed dial)	<ESC>KN
14	LINE KEY 14 (line or speed dial)	<ESC>KO
15	LINE KEY 15 (line or speed dial)	<ESC>KP

■ Example

An application uses the **d42_indicators()** function to retrieve the current data for the LCD Line Indicators for a given channel on a D/42D-SX. The data placed in the application buffer is shown below. If the data for byte 7 is 0x02, the circle segment corresponding to the Line Select/Speed Dial Key 7 is off and the square segment is flashing at 250 ms. - see Figure 7. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_indicators()** function.

	Hold	Line Key 01	Line Key 02	Line Key 03	Line Key 04	Line Key 05	Line Key 06	Line Key 07	Line Key 08	Line Key 09	Line Key 10	Line Key 11	Line Key 12	Line Key 13	Line Key 14	Line Key 15	
Data	00	00	00	00	00	00	00	02	00	00	00	00	00	00	00	00	xx xx xx xx xx xx xx xx
Byte	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16 17 18 19 20 21 22 23
Data	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx xx xx xx xx xx xx xx xx xx xx xx xx xx
Byte	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40 41 42 43 44 45 46 47

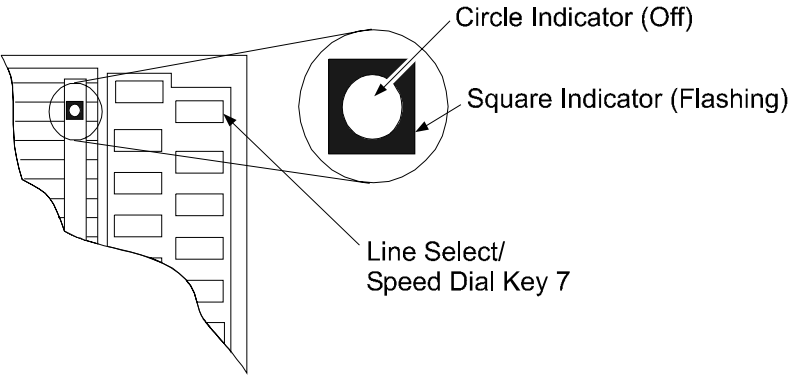


Figure 7. SUPERSET LCD Line Indicator

Pressing Line Select/Speed Dialing Keys

The D/42D-SX can “press” any of its Line Select/Speed Dial key using the **dial()** function. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys. Each Line Select/Speed Dial key on the SUPERSET telephone is assigned a dial string sequence (refer to Table 2). By using the **dial()** function and the appropriate dial string, the D/42D-SX can dial any Line Select/Speed Dial key.

4.1.4. Soft keys

There are six Soft Keys located below the LCD display - see Figure 6. These keys are associated with specific prompts depending on the current state of the phone. Figure 8 shows all the possible prompts that can be displayed.


PAGE EXIT SWAP SPLIT CAMP ON PROGRAM	NAME SAVE ON OFF CALLBACK NIGHT ANS	CALL FWD TRANS/CONF OVERRIDE PICKUP ✓	REMINDER ADD HELD SEND MSG HELP CALL	READ MSG PRIVACY REL CANCEL NO REDIAL ←	SPEED CALL NEXT YES HANG-UP RELEASE →
SOFT KEY 1	SOFT KEY 2	SOFT KEY 3	SOFT KEY 4	SOFT KEY 5	SOFT KEY 6

Figure 8. SUPERSET 4 Prompt Display

Reading Soft Key Prompts

The D/42D-SX can determine which of its prompts are currently displayed by using the **d42_lcdprompt()** function to retrieve the Prompt Display data. The function places the Prompt Display data (48 bytes) in an application buffer. Each byte represents a specific prompt and is either off (0x00) or on (0x01) - see Table 3. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_lcdprompt()** function.

Table 3. SUPERSET 4 Prompt Descriptions

Byte	Prompt	Byte	Prompt	Byte	Prompt
0	PROGRAM	16	PICKUP	32	REDIAL
1	CAMP	17	OVERRIDE	33	CANCEL
2	SWAP	18	TRANS	34	PRIVACY
3	PAGE	19	CALL	35	READ
4	PROGRAM	20		36	←
5	ON	21	OVERRIDE	37	NO
6	SPLIT	22	CONF	38	REL
7	EXIT	23	FWD	39	MSG
8	NIGHT	24	HELP	40	RELEASE
9	CALL	25	SEND	41	HANG
10	ON	26	ADD	42	NEXT
11	NAME	27	REMINDER	43	SPEED
12	ANS	28	CALL	44	→
13	BACK	29	MSG	45	UP
14	OFF	30	HELD	46	YES
15	SAVE	31	REMINDER	47	CALL

■ Example

An application uses the **d42_lcdprompt()** function to retrieve the current data for the Prompt Display on a given channel on a D/42D-SX. A simulation of the Prompt Display is shown in Figure 9. The data placed in the application buffer is shown below. Data of 0x01 in bytes 4, 23, and 29 indicate that the prompts **PROGRAM**, **FWD**, and **MSG** are on.

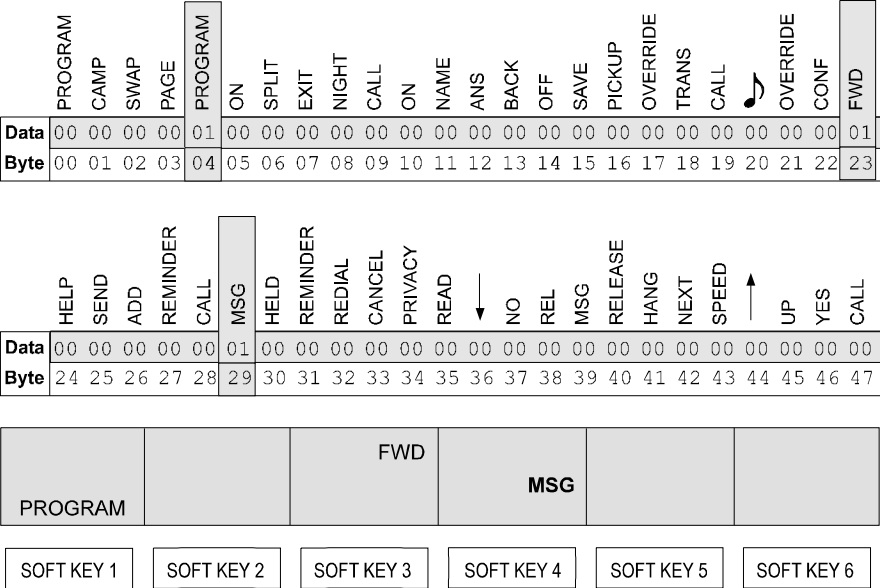


Figure 9. Example SUPERSET 4 Prompt Display

Pressing Soft Keys

The D/42D-SX can respond to a prompt and “press” its appropriate Soft Key using the **dial()** function. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys. Each soft key on the SUPERSET 4 telephone is assigned a dial string sequence (refer to Table 4). By using the **dial()** function and the appropriate dial string, the D/42D-SX can press any of its soft keys.

Table 4. MITEL SUPERSET 4 Direct Key Dialing Strings for Soft Keys

Dial String	Key Description
<ESC>K0	SOFT KEY 1
<ESC>K1	SOFT KEY 2
<ESC>K2	SOFT KEY 3
<ESC>K3	SOFT KEY 4
<ESC>K4	SOFT KEY 5
<ESC>K5	SOFT KEY 6

4.1.5. Supplementary Feature Keys

There are four Supplementary Feature Keys located next to the keypad keys - see Figure 6. The functions of these keys are as follows:

Display - Selects the type of information shown on the LCD Features display (see *Alphanumeric Display* below). The information to be displayed is selected by pressing the “display” key followed by a Line Select/Speed Dialing key or an appropriate soft key.

Select Features - Selects one of five features to be activated and is used in combination with a keypad key. Features are programmed by the PBX (i.e., do not disturb, auto answer, messaging, account code, and call forward). When the “select features” key is pressed, the features available are displayed on the Features Display. The D/42D-SX can determine which of its feature(s) are available by using the **d42_flags()** function to retrieve the Features Display data. The **d42_flags()** function places the Features Display data (16 bytes) in an

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application buffer. Each byte represents a specific message on the Feature Display and is either off (0x00), on (0x01), or flashing (0x02) - see Table 5. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_flags()** function.

NOTE: The **d42_flags()** function is only available in MS-DOS.

Table 5. SUPERSET 4 LCD Feature Display Descriptions

Byte	Flag	Byte	Flag
0	Undefined	8	Undefined
1	MIC ON	9	FWD
2	ACC CODE	10	NO DIST'B
3	MSG	11	AUTO ANS
4	→	12	1:
5	4:	13	2:
6	5:	14	3:
7	Undefined	15	Undefined

■ Example

To activate the Autoanswer feature, an application uses the **dial()** function to press the “select features” and “3” keys. To verify that the feature was activated, the application uses the **d42_flags()** function to retrieve the Feature Display data for the display shown in Figure 10 and check that bytes 14 (3:) and 11 (AUTO ANS) are on. The Features Display data is shown below.

	Undefined	MIC ON	ACC CODE	MSG	↑	4:	5:	Undefined	Undefined	FWD	NO DIST'B	AUTO ANS	1:	2:	3:	Undefined																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
Data	00	00	00	00	00	00	00	00	00	00	00	01	00	00	00	01	00	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
Byte	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
Data	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx

<div> <div>3: <i>AUTO ANS</i></div> <div>AUTOANS</div> </div>					
EXIT	ON				

SOFT KEY 1

SOFT KEY 2

SOFT KEY 3

SOFT KEY 4

SOFT KEY 5

SOFT KEY 6

Figure 10. Example SUPERSET 4 Features Display

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Speaker On/Off - Turns on the speaker and microphone then goes off hook (this is called hands free operation), or turns off the speaker and microphone and then goes on hook. The D/42D-SX can determine the state of its “speaker on/off “ key by using the **d42_lcdprompt()** function to retrieve the Prompt Display data and read the state of the HANG-UP prompt (bytes 41 and 45). The function places the Prompt Display data (48 bytes) in an application buffer. The prompt is either off (0x00) or on (0x01) - refer to Table 3.

■ Example

To activate the speaker phone feature, an application uses the **dial()** function to press the “speaker on/off” key on a specified D/42D-SX channel. To verify that the feature was activated, the application uses the **d42_lcdprompt()** function to retrieve the Prompt Display shown in Figure 11 and check that bytes 41 (HANG) and 45 (UP) are on. The Prompt Display data is shown below.

	PROGRAM	CAMP	SWAP	PAGE	PROGRAM	ON	SPLIT	EXIT	NIGHT	CALL	ON	NAME	ANS	BACK	OFF	SAVE	PICKUP	OVERRIDE	TRANS	CALL	🎵	OVERRIDE	CONF	FWD
Data	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
Byte	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23

	HELP	SEND	ADD	REMINDER	CALL	MSG	HELD	REMINDER	REDIAL	CANCEL	PRIVACY	READ	↓	NO	REL	MSG	RELEASE	HANG	NEXT	SPEED	↑	UP	YES	CALL
Data	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	01	00	00	00	01	00	00
Byte	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

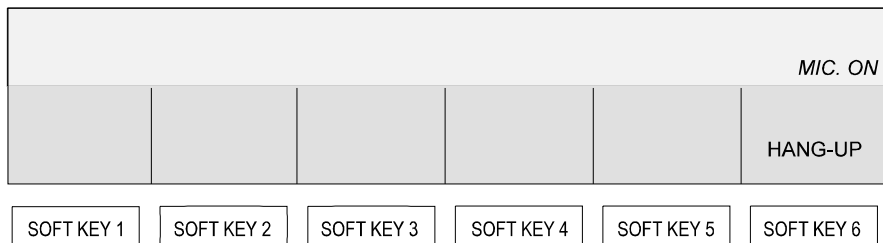


Figure 11. SUPERSET 4 Prompt Display for Speaker On/Off

MIC. On/Off - Turns the microphone off or on during hands free operation. The D/42D-SX can determine the state of its microphone using the **d42_flags()** function to retrieve the Features Display data and read the state of the MIC ON prompt (byte 1). The function places the Features Display data (16 bytes) in an application buffer. The prompt is either off (0x00), on (0x01), or flashing (0x02) - refer to Table 5. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_flags()** function.

■ Example

An application uses the **d42_flags()** function to retrieve the Features Display data for a specified channel on a D/42D-SX and check if byte 1 is on (the microphone is on). If the microphone is on, the application uses the **dial()** function to press the “mic. on/off” key and turn the microphone off. The Features Display data shown below (obtained using the **d42_flags()** function) is read for the MIC ON feature shown in Figure 11.

	Undefined		MIC ON	ACC CODE		MSG	↑	4:	5:	Undefined	Undefined	FWD	NO DISTB	AUTOANS	1:	2:	3:	Undefined																						
Data	00	01	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx						
Byte	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23																
Data	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx						
Byte	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47																

Pressing Supplementary Feature Keys

The D/42D-SX can “press” any of its supplementary feature key using the **dial()** function. Each supplementary feature key on the SUPERSET 4 telephone is assigned a dial string sequence (refer to Table 6). By using the **dial()** function and the appropriate dial string, the D/42D-SX can dial any of its supplementary feature keys. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys.

Table 6. SUPERSET 4 Direct Key Dialing Strings for Supplementary Features Keys

Dial String	Key Description
<ESC>K6	FEATURE KEY 0 (display)
<ESC>K7	FEATURE KEY 1 (select features)
<ESC>K8	FEATURE KEY 2 (speaker on/off)
<ESC>K9	FEATURE KEY 3 (mic. On/off)

4.1.6. Alphanumeric Display

The alphanumeric display is a 16-digit LCD that is used to show:

- date and time
- user name associated with the extension
- saved numbers (speed dialing)
- saved number for redial
- timed reminder setting
- call forward type and destination
- calling number ID
- trunk line ID.

The data used to display information in the alphanumeric display is in ASCII format. When the telephone is not in use, the display shows the date and time. The content of the display is changed automatically (e.g., receiving an incoming call, making an outgoing call, or activating a reminder). The content of the display can also be changed manually by pressing the following:

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Key	Function
display + line select/speed dial	calling number ID or saved number
display + redial	saved number for redial
display + reminder	timed reminder setting
display + call fwd	call forwarding type and destination
display + name	user name

The D/42D-SX can retrieve the information on its display using the **d42_display()** function. The function places the display data (16 bytes) in an application buffer. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_display()** function.

■ Example

An application uses the **dial()** function to press the “display” key and “call fwd” soft key on a specified channel on the D/42D-SX to display the call forwarding extension. The **d42_display()** function is then used to retrieve the display data and verify that a call forwarding extension has not been programmed. The display data is shown below.

	N O N E A C T I V E																							
Data	20	20	4E	4F	4E	45	20	41	43	54	49	56	45	20	20	20	xx	xx	xx	xx	xx	xx	xx	xx
Byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Data	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
Byte	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

Calling Number ID

When receiving a call on a D/42D-SX, the calling number ID (the extension of the telephone placing the call) is shown on the display and can be retrieved using the **d42_gtcallid()** function. The calling number ID data retrieved using this function is the same data that is sent to the display. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_gtcallid()** function.

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NOTE: On some manufacture's PBXs, the calling number ID data used for the display is **not** the same as the calling number ID data sent from the PBX to the phone set.

The calling number ID can also be obtained using the **d42_display()** function, however, you should use the **d42_gtcallid()** function so that your application will maintain functionality across different manufacturers' switches.

■ Example

An application uses **d42_gtcallid()** to retrieve the calling number ID for an incoming call received on a specified channel on a D/42D-SX. The calling number ID data and corresponding ASCII values are shown below.

text	bb 2 2 1 _ C A L L I N G																							
data	20	32	32	31	5F	43	41	4C	4C	49	4E	47	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
data	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
byte	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

4.1.7. Setting the Message Waiting Indicator

The D/42D-SX can set (on or off) the Message Waiting Indicator (4:MSG) of any extension using the **dial()** function and the appropriate dial string. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys.

The D/42D-SX can determine the state of its Message Waiting Indicator using the **d42_flags()** function to retrieve the Features Display data. Bytes 3 and 5 are used for the 4:MSG prompt and are either off (0x00), on (0x01), or flashing (0x02) - refer to Table 5. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_flags()** function.

	Undefined	MIC ON	ACC CODE	MSG	↑	4:	5:	Undefined	Undefined	FWD	NO DISTB	AUTO ANS	1:	2:	3:	Undefined										
Data	00	00	00	02	00	02	00	00	00	00	00	00	00	00	00	00	xx	xx	xx	xx	xx	xx	xx	xx	xx	
Byte	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Data	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	
Byte	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47		

The D/42D-SX can transfer calls using the **dial()** function. By using the **dial()** function and the appropriate dial string (&<extension>), the D/42D-SX can transfer a call to any extension connected to the switch. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys.

NOTE: The transfer function can be performed using the **dial()** function and the appropriate dial string to press the TRANS CONF soft key, however, you should use the **&.<extension>** dial string so your application will maintain functionality across different manufacturers' switches.

The D/42D-SX can perform both supervised and blind transfers (refer to *Sections 2.1. Supervised Call Transfer* and *2.2. Blind Call Transfer*). When a blind transfer is performed, the PBX controls where the call is routed if the called extension is busy or does not answer. When a supervised transfer is performed, your application can implement call progress analysis and called/calling number ID to intelligently control where the call is routed and what type of message is played if the called extension is busy or does not answer. Because of this capability, supervised transfer is the preferred method.

■ Example

An application answers an incoming call and plays a greeting message prompting the caller to enter the extension they wish to reach (the caller enters 221). Using the **dial()** function with the dial string (&,221), the application attempts to transfer (supervised) the call to extension 221. Call progress analysis is used to determine if extension 221 is answered, busy, or there is no answer. If extension 221 answers, the application hangs up and the transfer is complete. If the extension is busy or not answered, the application reconnects to the incoming call and plays a message asking the caller to choose between accessing voice mail or transferring to the operator.

4.2. Northern Telecom SL-1

The Northern Telecom SL-1 PBX use digital signaling to control its station sets and analog signals for voice. The D/42D-SL board has four channels that are connected directly to a SL-1 PBX. The SL-1 PBXs have many standard features that are supported by the D/42D-SL, such as:

- direct inward dialing (DID)
- hands free operation
- speed dialing
- hunt groups
- message waiting lamps
- call forwarding.

4.2.1. Northern Telecom SL-1 Switch Programming Requirements

Each port connected to a D/42D-SL must have the following Feature Keys assigned:

Feature Key 0	ACD or SCR - Automatic Call Distribution
Feature Key 1	TRN - Call Transfer
Feature Key 2	MIK - Message Indication

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Feature Key 3	MCK - Message Cancellation
Feature Key 4	SCR - Single Call Ringing
Feature Key 5	User programmable
Feature Key 6	User programmable
Feature Key 7	User programmable
Feature Key 8	Handsfree
Feature Key 9	RLS - Release

There are no other specific PBX programming requirements for using a D/42D-SL with a Northern Telecom SL-1 PBX. However, you must ensure that the features you want to access using the D/42D-SL and the Unified API are enabled on the extension(s) connected to your system.

4.2.2. Using the D/42D-SL Board

The D/42D-SL board performs functions available to a Northern Telecom Digit Display telephone set (see Figure 12). A Digit Display telephone set uses LED indicators to show line status (next to the feature keys) and user information (above the keypad). The D/42D-SL can:

- transfer calls
- set the message waiting indicator
- read the LED display
- read LED line indicators
- read the calling number ID
- press buttons.

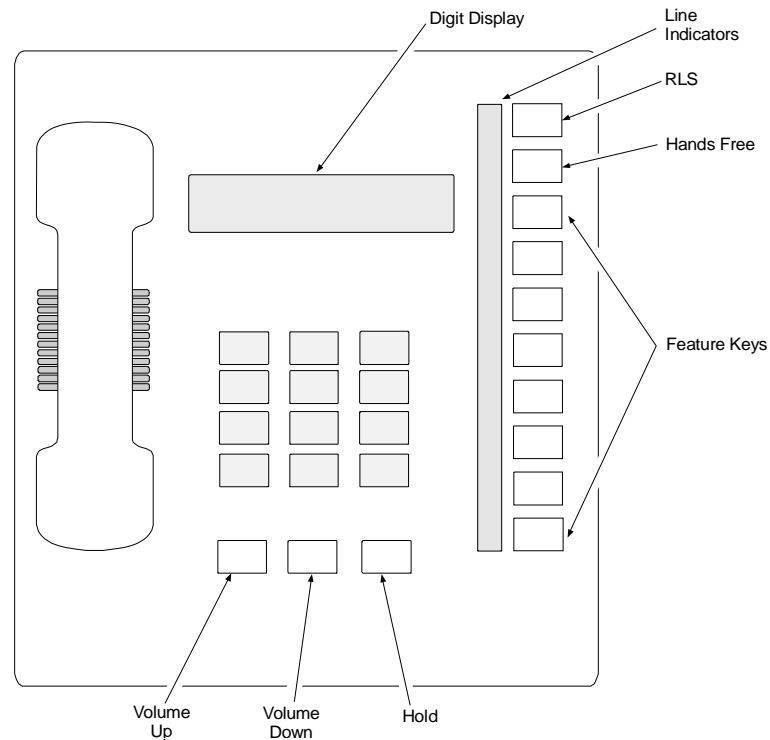


Figure 12. Northern Telecom Digit Display Telephone

4.2.3. Feature Keys (8)

There are eight Feature Keys located on the top-right of the Digit Display telephone - see Figure 12. These keys are configured when the PBX is programmed to any available station features. There is an LED Line Indicator associated with each Feature Key. Each Line Indicator can take on one the four states listed in Table 7.

NOTE: There are no Line Indicators for Feature Key 8 (RLS) and Feature Key 9 (Hands Free).

Table 7. Digit Display Line Indicator States

State	Value (in HEX)
off	0x00
wink (flash 120 Hz.)	0x01
flash (flash 60 Hz.)	0x02
on	0x03

Reading LED Line Indicators

The D/42D-SL can determine the state of its LED Line Indicators by using the **d42_indicators()** function to retrieve the Line Indicators data. This function places the Line Indicators data (8 bytes) in an application buffer. Each byte (8 bits) contains data representing one of the states listed in Table 7. Bytes 0-7 contain the indicator status for Feature Keys 0-7, respectively (see Table 8).

Table 8. SL-1 Dialing Strings for Feature Keys

Byte	Key Description	Dial String
0	Feature Key 0	<ESC>K0
1	Feature Key 1	<ESC>K1
2	Feature Key 2	<ESC>K2
3	Feature Key 3	<ESC>K3
4	Feature Key 4	<ESC>K4
5	Feature Key 5	<ESC>K5
6	Feature Key 6	<ESC>K6
7	Feature Key 7	<ESC>K7

■ Example

An application uses the **d42_indicators()** function to retrieve the current data for the LED Line Indicators on a given channel on a D/42D-SL. The data placed in the application buffer is shown below. If the data for byte 1 is 0x02, the LED Indicator for Feature Key 1 is flashing at 60 Hz. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_indicators()** function

[illegible]

Pressing Feature Keys

The D/42D-SL can “press” any of its Feature Keys using the **dial()** function. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys. Each Feature Key on the Digit Display telephone is assigned a dial string sequence (refer to Table 8). By using the **dial()** function and the appropriate dial string, the D/42D-SL can dial any Feature Key.

4.2.4. Pressing Control Keys

There are five control keys available on the Digit Display telephone.

- Hold
- RLs (Feature Key 9)
- Handsfree (Feature Key 8)
- Volume Up
- Volume Down

There are no indicators associated with the control keys. The D/42D-SL can “press” any of its control key using the **dial()** function. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys. Each control key on the Digit Display telephone is assigned a dial string sequence (refer to Table 9). By using the **dial()** function and the appropriate dial string, the D/42D-SL can press any control key.

Table 9. SL-1 Dialing Strings for Control Keys

Dial String	Key Description
<ESC>K8	Handsfree (Feature Key 8)
<ESC>K9	RLS - Release (Feature Key 9)
<ESC>KA	Volume up
<ESC>KB	Volume down
<ESC>KC	Hold

4.2.5. Digit Display

The display is a 16-digit LED that is used to show:

- calling number ID (last 3 or 4 digits)
- trunk line ID
- date and time.

The data used to display information on the display is in ASCII format. The content of the display is updated automatically when receiving an incoming call. The D/42D-SL can retrieve the information on its display using the **42_display()** function. The function places the display data (16 bytes) in an application buffer. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_display()** function.

■ Example

An application uses the **dial()** function to press the appropriate Feature Key on a specified channel on a D/42D-SL to display the date and time. The **42_display()** function is then used to retrieve the display data to read the date and time. The Digit Display data is shown below.

	0 4 1 5 1 0 - 0 8 - 9 6																											
data	20	30	34	20	31	35	20	20	31	30	2D	30	38	2D	39	36	xx	xx	xx	xx	xx	xx	xx	xx				
byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23				
data	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx				
byte	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47				

NOTE: The format of the date and time may vary depending on the PBX and the PBX configuration.

Calling Number ID

When receiving a call on a D/42D-SL, the calling number ID (the extension of the telephone placing the call) is shown on the display and can be retrieved using the **d42_gtcallid()** function. The calling number ID data retrieved using this function is the same data that is sent to the display. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using **d42_gtcallid()** function.

NOTE: On some manufacture's PBXs, the calling number ID data used for the display is **not** the same as the calling number ID data sent from the PBX to the phone set.

The calling number ID can also be obtained using the `d42_display()` function, however, you should use the `d42_gtcallid()` function so that your application will maintain functionality across different manufacturers' switches.

■ Example

An application uses **d42_gtcalled()** to retrieve the calling number ID for an incoming call received on a specified channel on a D/42D-SL. The calling number ID data and corresponding ASCII values are shown below.

text	bb bb bb bb bb bb bb bb bb bb bb bb 2 2 1																							
data	20	20	20	20	20	20	20	20	20	20	20	20	20	32	32	31	xx	xx	xx	xx	xx	xx	xx	
byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
text																								
data	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	
byte	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

4.2.6. Setting the Message Waiting Indicator

The D/42D-SL can set the Message Waiting Indicator (LED associated with Feature Key 2) of any extension using the **dial()** function and an appropriate dial string. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys.

The D/42D-SL can determine the state of its Message Waiting Indicator using the **d42_indicators()** function to retrieve the LED Line Indicator data. Byte 2 corresponds to the LED indicator associated with the Feature Key 2 (Message indication) and is either off (0x00), on (0x03), or flashing (0x01 or 0x02). Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_indicators()** function.

■ Example

An application uses the **d42_indicators()** function to retrieve the Line Indicator data for a specified channel on the D/42D-SL to check if the Feature Key 2 LED is flashing. The Line Indicator data is shown below.

	Feature Key 0 (ACD)	Feature Key 1 (TRN)	Feature Key 2 (Mik)	Feature Key 3 (MCK)	Feature Key 4 (SCR)	Feature Key 5	Feature Key 6	Feature Key 7																		
Data	00	00	02	00	00	00	00	02	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
Byte	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Data	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
Byte	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47		

4.2.7. Transfer a Call

The D/42D-SL can transfer calls using the **dial()** function. By using the **dial()** function and the appropriate dial string (&<extension>), the D/42D-SL can transfer a call to any extension connected to the switch. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys.

NOTE: The transfer function can be performed using the **dial()** function and the appropriate dial string to press Feature Key 1, however, you should use the &<extension> dial string so your application will maintain functionality across different manufacturers' switches.

The D/42D-SL can perform both supervised and blind transfers (refer to *Sections 2.1. Supervised Call Transfer and 2.2. Blind Call Transfer*). When a blind transfer is performed, the PBX controls where the call is routed if the called extension is busy or does not answer. When a supervised transfer is performed, your application can implement call progress analysis and called/calling number ID to intelligently control where the call is routed and what type of message is played if the called extension is busy or does not answer. Because of this capability, supervised transfer is the preferred method.

■ Example

An application answers a call and plays a greeting message prompting the caller to enter the extension they wish to reach (the caller enters 221). Using the **dial()** function with the dial string (&221), the application attempts to transfer (supervised) the call to extension 221. Call progress analysis is used to determine if extension 221 is answered, busy, or there is no answer. If extension 221 answers, the application hangs up and the transfer is complete. If the extension is busy or not answered, the application reconnects to the incoming call and plays a message asking the caller to choose between accessing voice mail or transferring to the operator.

4.3. Northern Telecom Norstar KSU

The Norstar Modular product family includes the Compact Key Service Unit (KSU) and the expandable Modular KSU. The D/42-NS can be used with either of

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these switches. The KSUs use digital signaling to control their station sets and digitized voice. KSUs use plug-in station modules to connect to station sets, and trunk modules to connect to trunk lines.

The D/42-NS board has four channels that are connected directly to a station module in a Northern Telecom KSU. The KSU switch has many standard features that are supported by the D/42-NS, such as:

- direct inward dialing (DID)
- hands free operation
- speed dialing
- hunt groups
- message waiting indication
- user programmable feature keys
- called/calling number identification
- call forwarding.

4.3.1. Norstar KSU Switch Programming Requirements

There are specific switch programming requirements for using a D/42-NS with a Norstar Modular or Compact KSU. You must ensure that these features are set exactly (and assigned to the right keys) so that the D/42-NS and the Unified API function correctly.

Table 10 lists the menu structure used when configuring a Norstar Modular/Compact KSU (with DR5 installed). The shaded areas indicate the actual menu items to change in order to use the KSU with a D/42-NS. For details about programming a Norstar KSU, refer to the appropriate Norstar manual.

The table only shows the configuration for one trunk line (001) and one extension (221). If you are using more than one trunk line, configure each trunk line the same. If you are using more than one extension, ensure that all the extensions are configured the same with the exception of the *Forward on busy* and *Forward no answr* options. For these menu items, the first extension should be forwarded to the second extension and the second extension should be forwarded to the third extension, and so on. The last extension should be forwarded back to the first extension.

Table 10. Norstar KSU Configuration Requirements (DR5)

Menu Option/Default Value	New Value
A-Configuration	
1. Trk/Line Data	
a) Show line: <i>Enter Trunk #</i>	001
b) Trunk data	
Line001: Loop*	
Trunk mode:Unspr	
Dial mode: Pulse	Tone
Full AutoHold:N	
c) Line data	
Line type: Public	PoolA
Prime set: 21	221*
Aux. ringer: Y	
Auto privacy:Y	
2. Line Access	
a) Show set: <i>Enter extension</i>	221
b) Line assignment (<i>no changes required</i>)	
c) Answer DNs (<i>no changes required</i>)	
d) Ringing (<i>no changes required</i>)	
e) Line pool access (<i>no changes required</i>)	
f) Intercom keys:1	1
g) Prime line: None	I/C
3. Call Handling	
a) Held reminder:N	
b) DRT to prime: Y	N
c) Trnsfr callbk: 3	12
d) Park prefix:1	

* Extension number assignment is system dependent.

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Table 10. Norstar KSU Configuration Requirements (DR5) - (Cont.)

Menu Option/Default Value	New Value
e) Park timeout:45	
f) Camp timeout:45	
g) Directed pickup:Y	
h) On hold:Tones	
4. Miscellaneous (<i>no changes required</i>)	
5. System Data (<i>no changes required</i>)	
B-General admin	
1. Sys speed dial (<i>no changes required</i>)	
2. Names (<i>no changes required</i>)	
3. Time and date (<i>no changes required</i>)	
4. Direct-Dial (<i>no changes required</i>)	
5. Capabilities	
a) Dialing filters (<i>no changes required</i>)	
b) Rem access pkgs (<i>no changes required</i>)	
c) Set abilities	
Show set: <i>Enter extension</i>	221
(1) Set filter:02	
(2) Line/set filters (<i>no changes req'd</i>)	
(3) Set lock:None	
(4) Full handsfree: N	Y
(5) Auto handsfree: N	Y
(6) HF answerback: Y	N
(7) Pickup group:NO	
(8) Paging: Y	N
(9) Paging zone: 1	NO
(10) Aux. ringer:N	
(11) Direct-dial:Set1	
(12) Forward on busy	
(a) Forward to: None	222
(13) Forward no answr	
(a) Forward to: None	222
(b) Forward delay: 3	2
(14) Allow redirect:N	

Table 10. Norstar KSU Configuration Requirements (DR5) - (Cont.)

Menu Option/Default Value	New Value
(15) Redirect ring:Y	
(16) Hotline:None	
(17) Priority call:N	
d) Line abilities (<i>no changes required</i>)	
e) COS passwords (<i>no changes required</i>)	
6. Service Modes	
a) Control sets	
Show line: <i>Enter line #</i>	001
(1) Line001:	221
(2) Line002:	221
through	
(3) Line008:	221
(4) Name1:Night	
(a) Setting:Manual	
(b) Trunk answer:Y	N
(c) Extra-dial:	221
(5) Name2:Evening	
(a) Setting:Manual	
(b) Trunk answer:Y	N
(c) Extra-dial:	221
(6) Name3:Lunch	
(a) Setting:Manual	
(b) Trunk answer:Y	N
(c) Extra-dial:221	
5. Password (<i>no changes required</i>)	
6. Log Defaults (<i>no changes required</i>)	
7. Call Services (<i>no changes required</i>)	
C-Set copy (<i>no changes required</i>)	
D-Maintenance (<i>no changes required</i>)	

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Memory Buttons 00 through 03 must be programmed as follows:

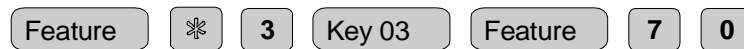
Memory Button 00	Handsfree/mute
Memory Button 01	Intercom
Memory Button 02	Unsigned
Memory Button 03	Transfer (Feature 70)

To determine the current setting of a Memory Button, press



then press the Memory Button you want to check. The display shows the name of the feature programmed.

Memory Button 00 is automatically assigned as the Handsfree/mute key when Full Handsfree is set to Y [refer to Table 10, B. 5. (c) (4)]. Memory Button 01 is automatically set as the Intercom key when the number of intercom keys is set to 1 [refer to Table 10, A. 2. (f)]. To assign Memory Button 03 to Transfer press:



4.3.2. Using the D/42-NS Board

The D/42-NS board performs functions available to a M7310 telephone set (see Figure 13). An M7310 telephone set uses two LCD displays to show key status (between the line keys) and user prompts and messages (above the display buttons). The D/42-NS can:

- transfer calls
- set the message waiting indicator
- read the LCD display
- read LCD indicators
- read the called/calling number ID
- press buttons.

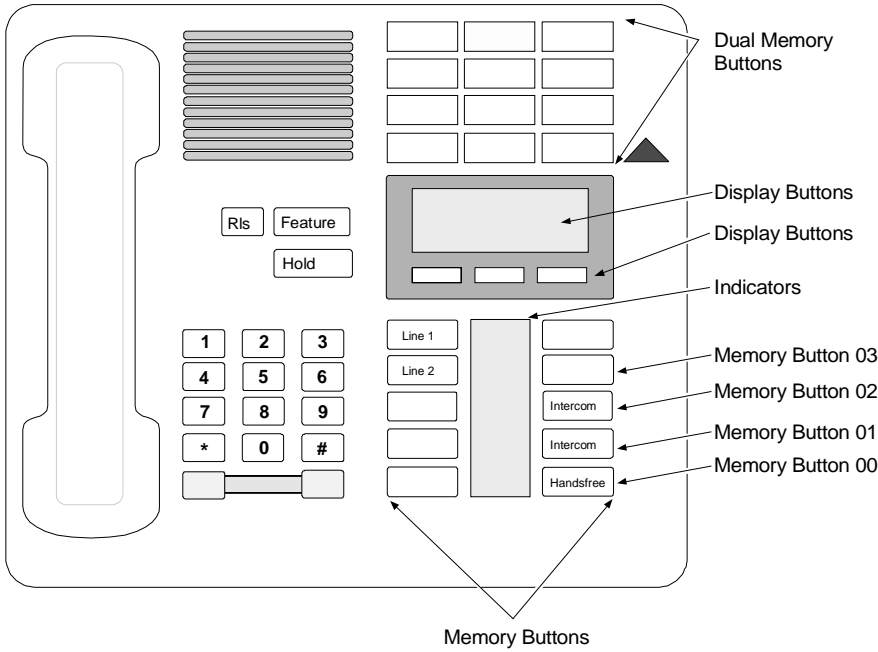


Figure 13. Northern Telecom M7310 Telephone

4.3.3. Programmable Memory Buttons (10)

There are 10 Programmable Memory Buttons located below the display on the M7310 telephone - see Figure 13. These keys are configured either during KSU installation or by the user (using the telephone set or the D/42-NS). The Line, Intercom, Answer, and Handsfree buttons are assigned during KSU configuration and cannot be programmed the user. There is an LCD Indicator associated with each Memory Button. The LCD Indicators are triangular and can take on one of the five states listed in Table 11.

Table 11. M7310 LCD Indicator States

State	Value (Hex)
off	0x00
on	0x01
alerting	0x02
Ihold	0x03
Uhold	0x04

NOTE: Ihold appears only on the phone where the call was put on hold. Other phone sets are prevented from picking up the call.

Uhold appears on all extension showing the same line. Any phone set can pick up the call.

Reading LCD Indicators

The D/42-NS can determine the state of its LCD Indicators by using the **d42_indicators()** function to retrieve the LCD Indicators data. This function places the Line Indicator data (10 bytes) in an application buffer. Bytes 0-9 contain the indicator status for Memory Buttons 00-09, respectively (see Table 12).

Table 12. M7310 Direct Key Dialing Strings for Memory Buttons

Byte	Key Description	Dial String
0	Memory Button 00 - Handsfree/Mute	<ESC>K0
1	Memory Button 01 - Intercom	<ESC>K1
2	Memory Button 02 - Intercom	<ESC>K2
3	Memory Button 03 - Transfer	<ESC>K3
4	Memory Button 04	<ESC>K4
5	Memory Button 05	<ESC>K5
6	Memory Button 06	<ESC>K6
7	Memory Button 07	<ESC>K7
8	Memory Button 08	<ESC>K8
9	Memory Button 09	<ESC>K9

■ Example

An application uses the **d42_indicators()** function to retrieve the current data for the LCD Indicators on a given channel on a D/42-NS. The data placed in the application buffer is shown below. If the data for byte 1 is 0x01, the triangular indicator for Memory Button 1 is on. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_indicators()** function.

	Memory Button 00		Memory Button 01		Memory Button 02		Memory Button 03		Memory Button 04		Memory Button 05		Memory Button 06		Memory Button 07		Memory Button 08		Memory Button 09																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
Data	00	01	00	00	00	00	00	00	00	00	00	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	

Pressing Memory Buttons Keys

The D/42-NS can “press” any of its Memory Button using the **dial()** function. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys. Each Memory Button on the M7310 telephone is assigned a dial string sequence (refer to Table 12). By using the **dial()** function and the appropriate dial string, the D/42-NS can press any Memory Button.

4.3.4. Display Buttons

There are three Display Buttons located below the LCD display - see Figure 13. These keys are associated with specific prompts shown on the LCD display depending on the current state of the phone (shown on the bottom row of the LCD display).

Reading Display Button Prompts

The D/42-NS can determine which of its prompts are currently displayed by using the **d42_display()** function to retrieve display data and read the information for the bottom row (last 16 characters). The total length of the display data is 32 bytes. The data location for the Display Buttons is as follows:

Display Button 00	bytes 16 - 20
Display Button 01	bytes 22 - 26
Display Button 02	bytes 28 - 31

Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_display()** function.

■ Example

An application uses the **d42_display()** function to retrieve the prompt data displayed for Display Button 00 shown in Figure 14. The data placed in the application buffer is shown below. Data in bytes 16 through 20 indicate that the prompt **EXIT** is displayed below Display Button 00.

NOTE: Bytes 00-15 represent the top row of the display. Bytes 16-31 represent the bottom row of the display.

data	50	72	65	73	73	20	61	20	62	75	74	74	6F	6E	20	20
byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

data	45	58	49	54	20	20	20	20	20	20	20	20	20	20	20	20
byte	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

data	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
byte	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

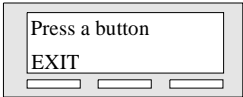


Figure 14. Example M7310 Display Buttons

Pressing Display Buttons

The D/42-NS can respond to a prompt and “press” the appropriate Display Button using the **dial()** function. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys. Each Display Button on the M7310 telephone is assigned a dial string sequence (refer to Table 13). By using the **dial()** function and the appropriate dial string, the D/42-NS can press any of its Display Buttons.

Table 13. M7310 Direct Key Dialing Strings for Display Buttons

Dial String	Key Description
<ESC>KP	Display Button 00 (left)
<ESC>KQ	Display Button 01 (middle)
<ESC>KR	Display Button 02 (right)

4.3.5. Dual Memory Buttons

There are 12 Dual Memory Buttons located on top of the M7310 telephone - refer to Figure 13. Each Dual Memory Button can be programmed to perform two different functions (using the Shift key). Dual Memory Buttons can be programmed by the user (or by the D/42-NS) to perform any valid feature available to a phone set.

■ Example

An application can assign “Do not Disturb” (DND) to Dual Memory Button 00 (DMB 00), then verify that it was programmed correctly. The following functions are performed:

1. Program Dual Memory Button 00 using the **dial()** function and the appropriate dial string (<ESC>KN, <ESC>KK, <ESC>KD, <ESC>KS, <ESC>KN, <ESC>KA, <ESC>KF) to press the following keys:



2. Determine when programming is complete using the **d42_display()** function to retrieve the display data, then read the information for the top row (first 16 characters) of the display. When programming is complete, the message *Programmed* appears in the display. The data placed in the application buffer is shown below. Data in bytes 00 through 15 indicate that the word *Programmed* is displayed.

NOTE: Bytes 00-15 represent the top row of the display. Bytes 16-31 represent the bottom row of the display.

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	P r o g r a m m e d															
data	50	72	6F	67	72	61	6D	6D	65	64	20	20	20	20	20	20
byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

data	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
byte	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

data	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
byte	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

3. Verify that Dual Memory Button 00 was programmed correctly by using the **dial()** function and the appropriate dial string (<ESC>KN, <ESC>KK, <ESC>KA, <ESC>KS) to press the following keys:



4. Use the `d42_display()` function to retrieve the display data, then read the information for the top row (first 16 characters) of the display. When the button query is complete, the message *Do Not Disturb* appears in the display. The data placed in the application buffer is shown below. Data in bytes 00 through 15 indicate that the words *Do Not Disturb* are displayed.

data	44	6F	20	4E	6F	74	20	44	69	73	74	75	73	62	20	20
byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

data	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
byte	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

data	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	
byte	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

- Exit the button query by using the **dial()** function and the appropriate dial string (<ESC>KP) to press Display Button 00 under the EXIT prompt - see Figure 14.

Pressing Dual Memory Buttons

The D/42-NS can “press” any of its Dual Memory Button using the **dial()** function. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys. Each Dual Memory Button on the M7310 telephone is assigned a dial string sequence (refer to Table 14). By using the **dial()** function and the appropriate dial string, the D/42-NS can press any Dual Memory Button.

Table 14. M7310 Direct Key Dialing Strings for Dual Memory Buttons

Dial Code	Key Description
<ESC>KS	Dual Memory button 00 (top left)
<ESC>KT	Dual Memory button 01
<ESC>KU	Dual Memory button 02
<ESC>KV	Dual Memory button 03
<ESC>KW	Dual Memory button 04
<ESC>KX	Dual Memory button 05
<ESC>KY	Dual Memory button 06
<ESC>KZ	Dual Memory button 07
<ESC>Ka	Dual Memory button 08
<ESC>Kb	Dual Memory button 09
<ESC>Kc	Dual Memory button 10
<ESC>Kd	Dual Memory button 11
<ESC>Ke	Dual Memory button 12 (Shifted button 00)
<ESC>Kf	Dual Memory button 13 (Shifted button 01)
<ESC>Kg	Dual Memory button 14 (Shifted button 02)
<ESC>Kh	Dual Memory button 15 (Shifted button 03)

Table 14. M7310 Direct Key Dialing Strings for Dual Memory Buttons (Cont.)

Dial Code	Key Description
<ESC>Ki	Dual Memory button 16 (Shifted button 04)
<ESC>Kj	Dual Memory button 17 (Shifted button 05)
<ESC>Kk	Dual Memory button 18 (Shifted button 06)
<ESC>Kl	Dual Memory button 19 (Shifted button 07)
<ESC>Km	Dual Memory button 20 (Shifted button 08)
<ESC>Kn	Dual Memory button 21 (Shifted button 09)
<ESC>Ko	Dual Memory button 22 (Shifted button 10)
<ESC>Kp	Dual Memory button 23 (Shifted button 11)

4.3.6. Alphanumeric Display

The alphanumeric display is a two row, 32-digit LCD that is used to show the activity of the phone. Some examples are:

- date and time
- feature names
- error messages
- called/calling identification
- phone status
- line selection
- Display Button prompts.

The data used to display information in the LCD alphanumeric display is in ASCII format. When the telephone is not in use, the display normally shows the date and time. The content of the display is changed automatically (e.g., receiving an incoming call, making an outgoing call, or activating a feature).

The D/42-NS can retrieve the information on its alphanumeric display using the **d42_display()** function. The function places the display data (32 bytes) in an application buffer. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_display()** function.

■ Example

An application uses the **dial()** function and the appropriate dial string (ESC>KN, <ESC>KK, <ESC>KA, <ESC>K3) to press keys to display which feature is assigned to Memory Button 03. Then, the **d42_display()** function is used to retrieve the display data and place it in an application buffer (shown below). The information for the top row (first 16 characters) of the display is checked. Data in bytes 00 through 15 indicate that *Transfer* is assigned to Memory Button 3.

data	54	72	61	6E	73	66	65	72	20	20	20	20	20	20	20
byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

data	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
byte	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

data	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
byte	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46

Called/calling Number ID (within the KSU)

When receiving a call on a D/42-NS from another extension, the KSU sends calling number ID data (by default, the extension number of the telephone placing the call) to the station set between the first and second rings. The station set *processes* the data and sends an ID message to the display. The calling number ID data sent from the KSU to the station set differs from the calling number ID data presented on the display.

When placing a call to another extension, the called number ID (by default, the extension of the telephone being called) is shown in the display.

Both the calling and called number IDs can be retrieved using the **d42_gtcallid()** function. The **d42_gtcallid()** function retrieves the called/calling number ID message sent from the KSU to the station set, not the data sent to the display. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using **d42_gtcallid()** function.

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The contents of the called/calling number ID is shown in Table 15 (as seen by the receiver of the call).

Table 15. Called/calling Number ID Data for the Norstar KSU

Call Route	Called/calling Number ID Data
Call received from trunk line 1	_0-1
Call received from station set 221	_221
Call originally received on trunk line 1, then transferred to station set 223	223_0-1
Call originally received by extension 221, then transferred to extension 224	224_221

NOTE: The called/calling number ID can also be obtained using the **d42_display()** function, however, you should use the **d42_gtcalledid()** function so that your application will maintain functionality across different manufacturers' switches.

■ **Example**

An application uses the **d42_gtcallid()** function to retrieve the calling number ID for a call received on a specified channel on a D/42-NS. The calling number ID data and corresponding ASCII values are shown below.

text	bb 2 2 1 _ 2 2 4																							
data	20 32 32 31 5F 32 32 34 xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx																							
byte	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23																							
text																								
data	xx xx																							
byte	24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47																							

4.3.7. Setting the Message Waiting Indicator

The D/42-NS can set the Message Waiting display (on or off) on another extension using the **dial()** function and the appropriate dial string. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys.

NOTE: Message Waiting can also be set using the **dial()** function and appropriate dial string to press the Memory Button assigned to send messages (Feature 1), however, you should use the **dial()** function as described so that your application will maintain functionality across different manufacturers' switches.

The D/42-NS can determine the state of its Message Waiting display using the **d42_display()** function to retrieve the display data. Bytes 00 through 15 are used for the message waiting prompt and will display *Message for you*. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_display()** function.

■ Example

An application uses the **d42_display()** function to retrieve the display data for a specified channel on the D/42-NS to determine if a message is waiting - see Figure 15. The display data is shown below.

NOTE: Bytes 00-15 represent the top row of the display. Bytes 16-31 represent the bottom row of the display.

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data	4D	65	73	73	61	67	65	00	66	6F	72	00	79	6F	75	20
byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

data	4D	53	47	20	20	20	20	20	20	20	20	20	20	20	20	20
byte	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

data	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
byte	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

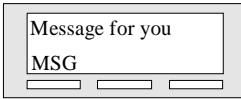


Figure 15. M7310 Message Waiting Display

4.3.8. Transferring a Call

The D/42-NS can transfer calls using the **dial()** function. By using the **dial()** function and the appropriate dial string (&<extension>), the D/42-NS can transfer a call to any extension connected to the switch. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys.

NOTE: The transfer function can be performed using the **dial()** function and the appropriate dial string (<ESC>KN, <ESC>KH, <ESC>KA; or <ESC>KN70) to press Feature 70. This method does not depend on Memory Button 03 being programmed correctly, however, you should use the &<extension> dial string so your application will maintain functionality across different manufacturers' switches.

The D/42-NS can perform both supervised and blind transfers (refer to *Sections 2.1. Supervised Call Transfer and 2.2. Blind Call Transfer*). When a blind transfer is performed, the KSU controls where the call is routed if the called extension is busy or does not answer. When a supervised transfer is performed, your application can implement call progress analysis and called/calling number ID to intelligently control where the call is routed and what type of message is

played if the called extension is busy or does not answer. Because of this capability, supervised transfer is the preferred method

■ Example

An application answers a call and plays a greeting message prompting the caller to enter the extension they wish to reach (the caller enters 221). Using the **dial()** function with the dial string (&221), the application attempts to transfer (supervised) the call to extension 221. Call progress analysis is used to determine if extension 221 is answered, busy, or there is no answer. If extension 221 answers, the application hangs up and the transfer is complete. If the extension is busy or not answered, the application reconnects to the incoming call and plays a message asking the caller to choose between accessing voice mail or transferring to the operator.

4.4. NEC Electra Professional Level II KTS

The Electra Professional Level II is comprised of a Key System Unit and plug-in modules. It is a fully digital Key Telephone System (KTS) that can support up to 56 CO/PBX lines. The KTS use digital signaling to control its station sets and digitized voice. The KTS has five interface slots, each of which can support up to eight ports (total of 40 ports). The Expansion KSU has three interface slots to allow you to add 16 ports (total of 56 ports).

The D/42-NE2 board has four channels that are connected to ports on the KTS. The Electra Professional Level II KTS switch has many standard features that are supported by the D/42-NE2, such as:

- direct inward dialing (DID)
- hands free operation
- speed dialing
- hunt groups
- message waiting indication
- user programmable feature keys
- called/calling number identification
- call forwarding.

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NOTE: D/42-NE2 refers to both the ISA and PCI board except in reference to specific board installation.

4.4.1. NEC Electra Professional Level II Programming Requirements

There are specific switch programming requirements for using a D/42-NE2 with a NEC Electra Professional Level II KTS. You must ensure that these features are set exactly (and assigned to the right keys) so that the D/42-NE2 and the Unified API function correctly.

Ports (or connectors) on the KTS are numbered starting at 01. Ports 01 and 02 are used to program the KTS and cannot be connected to a D/42-NE2. When programming, port numbers are used, not station numbers (3-digit extension numbers). The following procedure assumes that you are using a Dterm Series III phone set connected to port 1 or 2.

NOTE: The D/42-NE2 must be connected to ports configured for digital voice mail. Since ports 1 and 2 must be used to program extensions on the KTS, and cannot be configured as digital voice mail ports, the D/42-NE2 cannot be used to program the KSU.

Enter the Programming mode by pressing FNC, HOLD, #, 0, *.

Telephone Type Assignment

All D/42-NE2 channels connected to the KTS must be set to Digital Voice Mail. To set the Telephone:

1. Enter Programming Mode.
2. Press Line Key (LK) 7, then LK 2 to enter KTU mode (the TEL selection starts at station 01).
3. Enter the port number connected to the first channel on the D/42-NE2.
4. Press LK 6 to select Digital Voice Mail.

NOTE: If Digital Voice Mail is not an available option, the KTS software must be upgraded to at least revision 5.0.

5. Press TRF to save the selection and advance to the next port number.

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6. Repeat steps 4 and 5 until all ports connected to the D/42-NE2 are configured as Digital Voice Mail.
7. Press SPKR to exit the programming mode.

NOTE: If you power up the KTS with its default configuration, the KTS can automatically configure the ports connected to D/42-NE2 as Digital Voice Mail only if the D/42-NE2 is running and firmware is successfully downloaded. (Note to MS-DOS users - the D/42 driver does not have to be started.)

If the D/42-NE2 does not function after this procedure, ensure that the KTS software is at least revision 5.0.

Station Number Assignment

In order for a KTS port to function properly, it must be assigned a station number.

NOTE: When the KTS is powered up the first time, ports with phone sets connected to them will have station numbers automatically assigned.

To assign a Station Number:

1. Enter Programming Mode.
2. Press LK 4, then enter 10 on the keypad (the STA selection starts at port 01).
3. Press CNF to advance to the first port connected to a D/42-NE2 channel.
4. Enter the Station Number you wish to assign to this port.
5. Press TRF to save the selection and advance to the next port number.
6. Repeat steps 4 and 5 until all ports connected to the D/42-NE2 are assigned a Station Number.
7. Press SPKR to exit the programming mode.

Intercom Ring Pattern

The Intercom Ring Pattern must be set to Pattern B (default) and the Intercom Tone set to Tone A (default) for Call Progress Analysis to perform accurately. To set the intercom Ring Pattern:

1. Enter Programming Mode and press LK 1, LK 2, then enter 19 on the keypad.

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2. Ensure that Pattern B is selected.
3. Press TRF to save the selection and advance to 20-Intercom Ring Tone.
4. Ensure that Tone A is selected.
5. Press TRF to save the selection.
6. Press SPKR to exit the programming mode.

Voice Mail/Auto Attendant Application Considerations

When using the D/42-NE2 in a Voice Mail/Auto Attendant environment, the following items must be considered:

- hunt groups
- call forwarding
- trunk lines must be able to ring the extensions
- determine if an incoming call goes to Voice Mail or receives a greeting.

Setting Up a Hunt Group

A hunt group is used to enable the D/42-NE2 to answer multiple incoming calls. The hunt group contains all the station numbers connected to the D/42-NE2 and is configured in a circular fashion so that when one station is busy, the next available station will receive the incoming call. To create a hunt group do the following:

- I. Determine the port numbers/station numbers connected to the D/42-NE2 (for example: port 3=101, port4=102, port5=103, and port6=104).
- II. Ensure that each station is programmed as Digital Voice Mail (see procedure above).
- III. Set each station number to Master Hunt as follows:
 - A. Enter Programming Mode and press LK 4, then enter 14 on the keypad (the MSTER selection starts at port 01).
 - B. Press CNF to advance to the first port connected to a D/42-NE2 channel (port03).
 - C. Press LK 2 to set Master to Yes.

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- D. Press TRF to save the selection and advance to the next function (15).
 - E. Press * and then 4 to return to function 14.
 - F. Press CNF to advance to the next port connected to a D/42-NE2 channel (port04).
 - G. Repeat this procedure (steps b through e) until all ports connected to the D/42-NE2 are assigned as Master. Press SPKR to exit the programming mode.
- IV. Set the hunt to progress through the stations numbers in chronological order (i.e., 101 to 102, 102 to 103, 103 to 104, 104 to 101).
- NOTE:** For each port connected to the D/42-NE2, you will enter the station number to hunt next. For example, port 3 goes to station 102, port 4 goes to 103, port 5 goes to 104, port 6 goes to 101.
- A. Enter Programming Mode and press LK 4, then enter 15 on the keypad (the CMFWD selection starts at port 01).
 - B. Press CNF to advance to the first port connected to a D/42-NE2 channel (port03).
 - C. Enter the station number you want port 03 to hunt (e.g., station 102).
 - D. Press TRF to save the selection and advance to the next function (17).
 - E. Press * twice and then 5 to return to function 15.
 - F. Press CNF to advance to the next port connected to a D/42-NE2 channel (port 04).
 - G. Repeat this procedure (steps b through e) until all ports in the hunt group are configured. Press SPKR to exit the programming mode.
- V. Set the Trunk Lines to ring the pilot station (station 101). You may set trunk termination to day/night/both. The selection depends on your application requirements.
- A. Set Day Mode (DIT Assignment)
 - 1. Enter Programming Mode and press LK 3, then enter 42 on the keypad (the DIT D selection starts at trunk 01).
 - 2. If necessary, press CNF to advance to the first trunk connected to a D/42-NE2 channel.

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3. Enter the number of the pilot station of the hunt group (e.g., 101). If you do not want the hunt group activated in Day Mode, leave the field blank.
 4. Press TRF to save the selection and advance to function 15-ANA Assignment.
 5. If you do not want to set Night Mode, press SPKR to exit the programming mode.
- B. Set Night Mode (ANA Assignment)
1. Enter the number of the pilot station of the hunt group (e.g., 101). If you do not want the hunt group activated in Night Mode, leave the field blank.
 2. Press TRF to save the selection.
 3. Press SPKR to exit the programming mode.

Call Transfer

To transfer a call using the **dial()** function, the Transfer Key (TRF) must be enabled on the port connected to the D/42-NE2.

Incoming calls to the hunt group can be forwarded by either blind transfers or supervised transfers. If you intend to use blind transfers in a Voice Mail/Auto Attendant environment, the stations receiving the transfers must be programmed to forward calls to the pilot station in the hunt group on Ring/No Answer and Busy. If the stations are not configured this way, any calls transferred back to the KTS because of Ring/No Answer or Busy will not be able to be placed in a mailbox. The Voice Mail/Auto Attendant application can use called/calling number ID to determine how to answer calls transferred back to the KTS.

If you intend to use supervised transfers in a Voice Mail/Auto Attendant environment, the stations receiving the transfers must be programmed **not** to forward calls to the pilot station in the hunt group on Ring/No Answer and Busy. The Voice Mail/Auto Attendant application can use call progress analysis to determine how to answer calls that could not be forwarded.

4.4.2. Using the D/42-NE2 Board with the NEC KTS

The D/42-NE2 uses different firmware depending on which switch it is connected to (Electra Professional Level II KTS or the NEAX 2400 ICS and NEAX 2000 IVS PBXs). During software installation, you will be asked to choose the type of NEC switch connected to your D/42-NE2 board (KTS or PBX). The installation program will install the appropriate files. Refer to the documentation that contains the software installation procedures for more information.

The D/42-NE2 board performs functions available to a Dterm Series III telephone set (see Figure 16). A Dterm Series III telephone set uses LED indicators to show line key status (on the line keys), function key status (on the function keys), and an LCD display to show user prompts and messages (above the line keys). The D/42-NE2 can:

- transfer calls
- set the message waiting indicator
- read the LCD display
- read LED indicators
- read the called/calling number ID
- press buttons.

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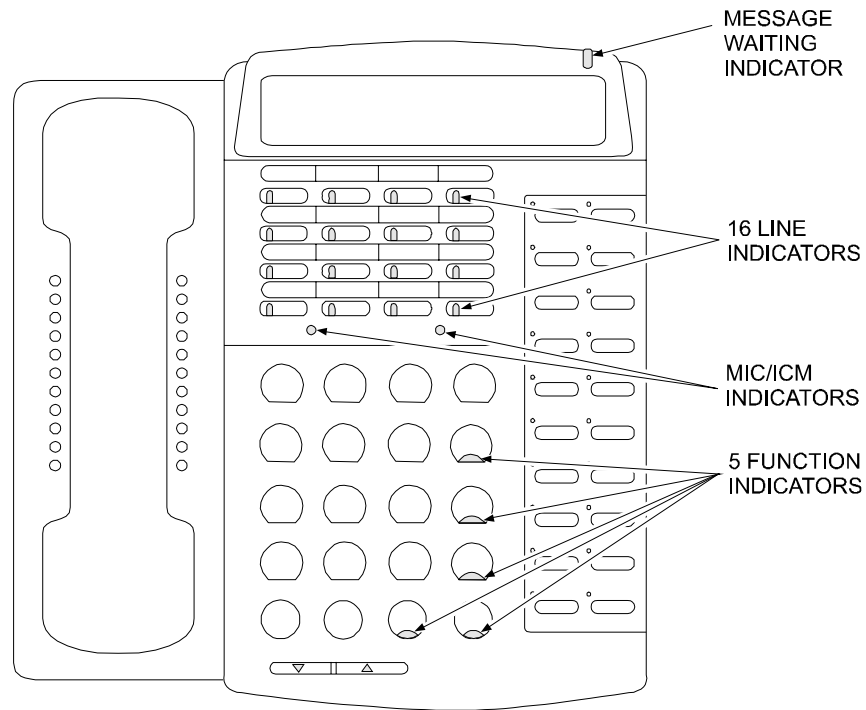


Figure 16. NEC Dterm Series III Telephone (KTS)

4.4.3. Flexible Line Keys (16)

There are 16 Flexible Line keys located on the top of the Dterm Series III telephone - see Figure 16. These keys are configured by the system programmer to perform many different functions. When programming the telephone, the Flexible Line keys are used to select the programming mode or sub-mode. There is a two-color LED Indicator associated with each Flexible Line key. The LEDs can take on one of the states listed in Table 16.

Table 16. LED Indicator Status Data for the Dterm Series III (KTS)

Binary	Value (Hex)	Description
0000 0000	0x00	off
0000 0001	0x01	flutter (red)
0000 0010	0x02	wink (red)
0000 0011	0x03	rapid wink (red)
0000 0100	0x04	interrupted rapid wink (red)
0000 0101	0x05	interrupted wink (red)
0000 0110	0x06	interrupted unlit (red)
0000 0111	0x07	steady on (red)
0000 1001	0x09	flutter (green)
0000 1010	0x0A	wink (green)
0000 1011	0x0B	rapid wink (green)
0000 1100	0x0C	interrupted rapid wink (green)
0000 1101	0x0D	interrupted wink (green)
0000 1110	0x0E	interrupted unlit (green)
0000 1111	0x0F	steady on (green)

Reading LED Indicators on the Flexible Line Keys

The D/42-NE2 can determine the state of its LED Indicators on the Flexible Line keys by using the **d42_indicators()** function to retrieve the LED Indicators data. This function places the LED Indicators data (26 bytes) in an application buffer. Bytes 0-15 contain the indicator status for Flexible Line Keys 01-16, respectively - see Table 17.

NOTE: The total length of the LED Indicators data is 26 bytes and represents the 24 LED Indicators on a Dterm Series III telephone. Two bytes (16 and 20) are not used.

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Table 17. Flexible Line Key Indicators for the Dterm Series III (KTS)

Byte	Description	Dial Code
0	Flexible Line Key 1	<ESC>KW
1	Flexible Line Key 2	<ESC>KX
2	Flexible Line Key 3	<ESC>KY
3	Flexible Line Key 4	<ESC>KZ
4	Flexible Line Key 5	<ESC>Ka
5	Flexible Line Key 6	<ESC>Kb
6	Flexible Line Key 7	<ESC>Kc
7	Flexible Line Key 8	<ESC>Kd
8	Flexible Line Key 9	<ESC>Ke
9	Flexible Line Key 10	<ESC>Kf
10	Flexible Line Key 11	<ESC>Kg
11	Flexible Line Key 12	<ESC>Kh
12	Flexible Line Key 13	<ESC>Ki
13	Flexible Line Key 14	<ESC>Kj
14	Flexible Line Key 15	<ESC>Kk
15	Flexible Line Key 16	<ESC>Kl

■ Example

An application uses the **d42_indicators()** function to retrieve the current data for the LED Indicators for a given channel on a D/42-NE2. The data placed in the application buffer is shown below. If the data for byte 1 is 0x0F, the indicator for Flexible Line Key 2 is green and on. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_indicators()** function.

	Line Key 1		Line Key 2		Line Key 3		Line Key 4		Line Key 5		Line Key 6		Line Key 7		Line Key 8		Line Key 9		Line Key 10		Line Key 11		Line Key 12		Line Key 13		Line Key 14		Line Key 15		Line Key 16		not used		MWI		CNF Key		FCN Key		not used		LNR/SPD Key		ANS Key		SPKR Key	
Data	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
Byte	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

NOTE: You can determine if an indicator is red or green by checking if bit 3 is 0 (red) or 1 (green). The example below shows the binary data for On and Wink.

	Bit	7	6	5	4	3	2	1	0
On (0x07 red)		0	0	0	0	0	1	1	1
On (0x0F green)		0	0	0	0	1	1	1	1
Wink (0x02 red)		0	0	0	0	0	0	1	0
Wink (0x0A green)		0	0	0	0	1	0	1	0

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Pressing Flexible Line Keys

The D/42-NE2 can “press” any of its Flexible Line Keys using the **dial()** function. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys. Each Flexible Line Key on the Dterm Series III telephone is assigned a dial string sequence (refer to Table 17). By using the **dial()** function and the appropriate dial string, the D/42-NE2 can press any Flexible Line Key.

4.4.4. Feature Keys (5)

There are five Feature Keys located next to the dial pad keys (FNC, CNF, LNR/SPD, SPKR, and ANS). There is a two-color LED Indicator associated with each Feature Key. The LED Indicators can take on any one of the states listed in Table 16.

Reading LED Indicators on the Feature Keys

The D/42-NE2 can determine the state of its LED Indicators on the Feature Keys by using the **d42_indicators()** function to retrieve the LED Indicators data. This function places the LED Indicator data (26 bytes) in an application buffer. Bytes 18-23 (byte 20 is not used) contain the LED Indicator status for the Feature Keys (see Table 18). Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_indicators()** function.

Table 18. Feature Key Indicators for the Dterm Series III (KTS)

Byte	Description	Dial Code
18	CNF key LED	<ESC>KI
19	FCN key LED	<ESC>KL
20	not used	
21	LNR/SPD key LED	<ESC>KH
22	ANS key LED	<ESC>KM
23	SPKR key LED	<ESC>KN

■ Example

An application uses the **d42_indicators()** function to retrieve the current data for the LED Indicators for a given channel on a D/42-NE2. The data placed in the application buffer is shown below. If the data for byte 23 is 0x07, the indicator for SPKR is red and on. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_indicators()** function.

	Line Key 1	Line Key 2	Line Key 3	Line Key 4	Line Key 5	Line Key 6	Line Key 7	Line Key 8	Line Key 9	Line Key 10	Line Key 11	Line Key 12	Line Key 13	Line Key 14	Line Key 15	Line Key 16	not used	MWI	CNF Key	FCN Key	not used	LNR/SPD Key	ANS Key	SPKR Key
Data	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	xx	00	00	00	xx	00	00	07
Byte	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23

	ICM	MIC																								
Data	00	00	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
Byte	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47		

Pressing Feature Keys

The D/42-NE2 can “press” any of its Feature Keys using the **dial()** function. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys. Each Feature Key on the Dterm Series III telephone is assigned a dial string sequence (refer to Table 18). By using the **dial()** function and the appropriate dial string, the D/42-NE2 can press any Feature Key.

4.4.5. MIC/ICM LED Indicators

The MIC and ICM indicators are located between the Flexible Line keys and the keypad. In normal operation these indicators show the status of the microphone and the intercom. During programming, these indicators are used as prompts. The MIC and ICM LED Indicators can take on any one of the red states (0x00 - 0x07) listed in Table 16.

Reading MIC/ICM LED Indicators

The D/42-NE2 can determine the state of its MIC and ICM LED indicators by using the **d42_indicators()** function to retrieve the LED Indicators data. This function places the LED Indicator data (26 bytes) in an application buffer. Bytes 24 and 25 contain the indicator status for MIC and ICM indicators. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_indicators()** function.

■ Example

An application uses the **d42_indicators()** function to retrieve the current data for the LED Indicators for a given channel on a D/42-NE2. The data placed in the application buffer is shown below. If the data for byte 24 is 0x07, the indicator for MIC is on. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_indicators()** function.

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		Line Key 1	Line Key 2	Line Key 3	Line Key 4	Line Key 5	Line Key 6	Line Key 7	Line Key 8	Line Key 9	Line Key 10	Line Key 11	Line Key 12	Line Key 13	Line Key 14	Line Key 15	Line Key 16	not used	MWI	CNF Key	FCN Key	not used	LNR/SPD Key	ANS Key	SPKR Key
Data		00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	xx	00	00	00	xx	00	00	00
Byte		00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23

	ICM	MIC																								
Data	07	00	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
Byte	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47		

4.4.6. Alphanumeric Display

The alphanumeric display is a two row 32-digit LCD that is used to show the activity of the phone. Some examples are:

- date and time
- feature names
- error messages
- called/calling identification
- phone status
- line selection.

The data used to display information in the LCD alphanumeric display is in ASCII format. When the station set is not in use, the display shows the date and time. The content of the display is changed automatically (e.g., receiving an incoming call, making an outgoing call, or activating a feature).

The D/42-NE2 can retrieve the information on its alphanumeric display by using the **d42_display()** function. The function places the display data (32 bytes) in an application buffer. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_display()** function.

■ Example

An application uses the **dial()** function and the appropriate dial string to press keys to enter the programming mode. The **d42_display()** function is then used to retrieve the display data and verify that the program mode has started. The display data is shown below.

	P R O G R A M M O D E														
data	20	50	52	4F	47	52	41	4D	00	4D	4F	44	45	20	20
byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

data	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
byte	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

data	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
byte	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46

Called/calling Number ID (within the KTS)

When receiving a call on a D/42-NE2 from another extension, the KTS sends calling number ID data (by default, the extension number of the telephone placing the call) to the station set between the first and second rings. The station set processes the data and sends an ID message to the display. The calling number ID data sent from the KTS to the station set differs from the calling number ID data presented on the display.

When placing a call to another extension, the called number ID (by default, the extension of the telephone being called) is shown in the display.

Both the calling and called number IDs can be retrieved using the **d42_gtcallid()** function. The **d42_gtcallid()** function retrieves the called/calling number ID message sent from the KTS to the station set, not the data sent to the display. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using **d42_gtcallid()** function.

The contents of the called/calling number ID is shown in Table 19 (as seen by the receiver of the call).

Table 19. Called/calling Number ID Data for the NEC Electra Professional Level II

Call Route	Called/calling Number ID Data
Call received from trunk line 1	_0-1000
Call received from station set 201	_201
Call originally received on trunk line 1, then transferred to station set 200	200_0-1000
Call originally received by extension 200, the transferred to extension 203	203_200

NOTE: The called/calling number ID can also be obtained using the **d42_display()** function, however, you should use the **d42_gtcallid()** function so that your application will maintain functionality across different manufacturers' switches.

■ Example

An application uses the **d42_gtcallid()** function to retrieve the called/calling number ID for a call received on a specified channel on a D/42-NE2. The called/calling number ID data is shown below.

text	bb 2 0 0 _ 2 0 3																								
data	20	32	30	30	5F	32	30	33	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
text																									
data	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
byte	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	

4.4.7. Setting the Message Waiting Indicator

The D/42-NE2 can set the Message Waiting Indicator (on or off) on another extension using the **dial()** function and the appropriate dial string. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys.

NOTE: The Message Waiting Indicator can also be set using the **dial()** function and appropriate dial string to press the Flexible Line Key assigned to

send messages (MSG), however, you should use the **dial()** function as described so that your application will maintain functionality across different manufacturers' switches.

The D/42-NE2 can determine the state of its Message Waiting Indicator using the **d42_indicators()** function to retrieve the LED Indicators data. Byte 17 contains the Message Waiting indicator status (0x00 is off; 0x07 is on). Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_indicators()** function.

■ Example

An application uses the **d42_indicators()** function to retrieve the LED Indicators data for a specified channel on the D/42-NE2 to determine if a message is waiting. The LED indicators data is shown below. The data 0x00 shows that the MWI indicator is off (there are no messages waiting).

[illegible]

4.4.8. Transferring a Call

The D/42-NE2 can transfer calls using the **dial()** function. By using the **dial()** function and the appropriate dial string (&.<extension>), the D/42-NE2 can transfer a call to any extension connected to the switch. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys.

NOTE: The transfer function can be performed using the **dial()** function and the appropriate dial string to press the Flexible Line Key assigned to transfer however, you should use the **&,<extension>** dial string so your

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application will maintain functionality across different manufacturers' switches.

The D/42-NE2 can perform both supervised and blind transfers (refer to *Sections 2.1. Supervised Call Transfer and 2.2. Blind Call Transfer*). When a blind transfer is performed, the KTS controls where the call is routed if the called extension is busy or does not answer. When a supervised transfer is performed, your application can implement call progress analysis and called/calling number ID to intelligently control where the call is routed and what type of message is played if the called extension is busy or does not answer. Because of this capability, supervised transfer is the preferred method.

■ Example

An application answers an incoming call and plays a greeting message prompting the caller to enter the extension they wish to reach (the caller enters 221). Using the **dial()** function with the dial string (&,221), the application attempts to transfer (supervised) the call to extension 221. Call progress analysis is used to determine if extension 221 is answered, busy, or there is no answer. If extension 221 answers, the application hangs up and the transfer is complete. If the extension is busy or not answered, the application reconnects to the incoming call and plays a message asking the caller to choose between accessing voice mail or transferring to the operator.

4.5. NEC NEAX 2400 ICS and NEAX 2000 IVS PBXs

The NEAX 2400 ICS and 2000 IVS are full-featured PBXs that can provide thousands of ports and many PBX voice and data features. The PBXs use digital signaling to control their station sets and digitized voice.

The D/42-NE2 board has four channels that are connected to ports on the PBX. Both PBXs have many standard features that are supported by the D/42-NE2, such as:

- direct inward dialing (DID)
- hands free operation
- speed dialing
- hunt groups

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- message waiting indication
- user programmable feature keys
- called/calling number identification
- call forwarding.

4.5.1. NEC NEAX 2400 ICS and NEAX 2000 IVS PBXs Programming Requirements

There are specific switch programming requirements for using a D/42-NE2 with a NEAX 2400 ICS or NEAX 2000 IVS PBX. You must ensure that these features (described below) are set exactly (and assigned to the right keys) so that the D/42-NE2 and the Unified API function correctly.

Transfers

Allow the ports connected to the D/42-NE2 permission to use the transfer key.

Message Waiting Indicator (MWI)

The default access dial strings for the D/42-NE2 are set to ****9** (on) and **##9** (off). If the PBX has not been set to use these dial strings, you must:

use the **d42_setparm()** function to change **D4BD_MSGACCESSION** and **D4BD_MSGACCESSOFF** to the dial string programmed on the PBX ,

or

change the PBX access dial string to ****9** (on) and **##9** (off).

Call Progress Analysis

If your application does not use Call Progress Analysis, there is a possibility that under some load conditions your application may receive a busy signal when going off-hook. Depending on your switch configuration, the PBX can only provide a fixed number of simultaneous dial tones. Refer to the *Voice Features Guide for MS-DOS* (contained in the *Voice Software Reference for MS-DOS - Volume 1*) for more information about Call Progress Analysis.

Telephone Type Assignment

Ports connected to the D/42-NE2 should be configured as if they were connected to a Dterm Series III telephone.

Call Transfer

To transfer a call using the **dial()** function, the Transfer Key (TRF) must be enabled on the port connected to the D/42-NE2.

Incoming calls to the hunt group can be forwarded by either blind transfers or supervised transfers. If you intend to use blind transfers in a Voice Mail/Auto Attendant environment, the stations receiving the transfers must be programmed to forward calls to the pilot station in the hunt group on Ring/No Answer and Busy. If the stations are not configured this way, any calls transferred back to the PBX because of Ring/No Answer or Busy will not be able to be placed in a mailbox. The Voice Mail/Auto Attendant application can use called/calling number ID to determine how to answer calls transferred back to the PBX.

If you intend to use supervised transfers in a Voice Mail/Auto Attendant environment, the stations receiving the transfers must be programmed **not** to forward calls to the pilot station in the hunt group on Ring/No Answer and Busy. The Voice Mail/Auto Attendant application can use call progress analysis to determine how to answer calls that could not be forwarded.

4.5.2. Using the D/42-NE2 Board with an NEC PBX

The D/42-NE2 uses different firmware depending on which switch it is connected to (Electra Professional Level II KTS or the NEAX 2400 ICS and NEAX 2000 IVS PBXs). During software installation, you will be asked to choose the type of NEC switch connected to your D/42-NE2 board (KTS or PBX). The installation program will install the appropriate files. Refer to the documentation that contains the software installation procedures for more information.

The D/42-NE2 board performs functions available to a Dterm Series III telephone set (see Figure 17). A Dterm Series III telephone set uses LED indicators to show line key status (on the line keys), function key status (on the function keys), and an LCD display to show user prompts and messages (above the line keys). The D/42-NE2 can:

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- transfer calls
- set the message waiting indicator
- read the LCD display
- read LED indicators
- read the called/calling number ID
- press buttons.

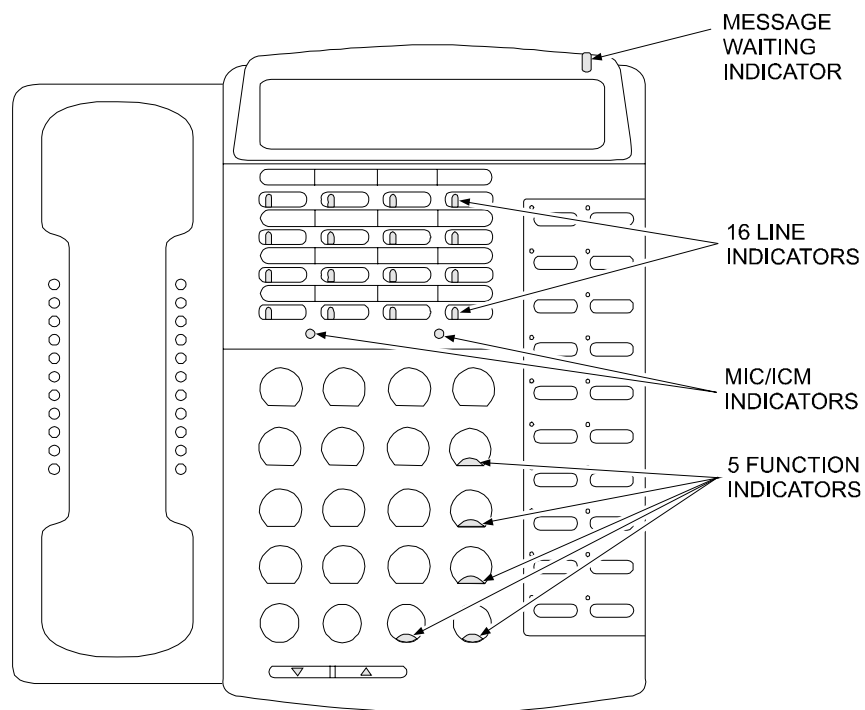


Figure 17. NEC Dterm Series III Telephone (NEC PBX)

4.5.3. Flexible Line Keys (16)

There are 16 Flexible Line keys located on the top of the Dterm Series III telephone - see Figure 17. These keys are configured by the system programmer to perform many different functions. When programming the telephone, the Flexible

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Line keys are used to select the programming mode or sub-mode. There is a two-color LED Indicator associated with each Flexible Line key. The LEDs can take on one of the states listed in Table 20.

Table 20. LED Indicator Status Data for the Dterm Series III (PBX)

Binary	Value (Hex)	Description
0000 0000	0x00	off
0000 0001	0x01	flutter (red)
0000 0010	0x02	wink (red)
0000 0011	0x03	rapid wink (red)
0000 0100	0x04	interrupted rapid wink (red)
0000 0101	0x05	interrupted wink (red)
0000 0110	0x06	interrupted unlit (red)
0000 0111	0x07	steady on (red)
0000 1001	0x09	flutter (green)
0000 1010	0x0A	wink (green)
0000 1011	0x0B	rapid wink (green)
0000 1100	0x0C	interrupted rapid wink (green)
0000 1101	0x0D	interrupted wink (green)
0000 1110	0x0E	interrupted unlit (green)
0000 1111	0x0F	steady on (green)

Reading LED Indicators on the Flexible Line Keys

The D/42-NE2 can determine the state of the LED Indicators on the Flexible Line keys by using the **d42_indicators()** function to retrieve the LED Indicators data. This function places the LED Indicator data (26 bytes) in an application buffer. Bytes 0-15 contain the indicator status for Flexible Line Keys 01-16, respectively - see Table 21.

NOTE: The total length of the LED Indicators data is 26 bytes and represents the 24 LED Indicators on a Dterm Series III telephone. Two bytes (16 and 20) are not used.

Table 21. Flexible Line Key Indicators for the Dterm Series III (PBX)

Byte	Description	Dial Code
0	Flexible Line Key 1	<ESC>KW
1	Flexible Line Key 2	<ESC>KX
2	Flexible Line Key 3	<ESC>KY
3	Flexible Line Key 4	<ESC>KZ
4	Flexible Line Key 5	<ESC>Ka
5	Flexible Line Key 6	<ESC>Kb
6	Flexible Line Key 7	<ESC>Kc
7	Flexible Line Key 8	<ESC>Kd
8	Flexible Line Key 9	<ESC>Ke
9	Flexible Line Key 10	<ESC>Kf
10	Flexible Line Key 11	<ESC>Kg
11	Flexible Line Key 12	<ESC>Kh
12	Flexible Line Key 13	<ESC>Ki
13	Flexible Line Key 14	<ESC>Kj
14	Flexible Line Key 15	<ESC>Kk
15	Flexible Line Key 16	<ESC>Kl

■ Example

An application uses the **d42_indicators()** function to retrieve the current data for the LED Indicators on a given channel on a D/42-NE2. The data placed in the application buffer is shown below. If the data for byte 1 is 0x0F, the indicator for Flexible Line Key 2 is green and on. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_indicators()** function.

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[illegible]

NOTE: You can determine if an indicator is red or green by checking if bit 3 is 0 (red) or 1 (green). The example below shows the binary data for On and Wink.

	Bit	7	6	5	4	3	2	1	0
On (0x07 red)		0	0	0	0	0	1	1	1
On (0x0F green)		0	0	0	0	1	1	1	1
Wink (0x02 red)		0	0	0	0	0	0	1	0
Wink (0x0A green)		0	0	0	0	1	0	1	0

Pressing Flexible Line Keys

The D/42-NE2 can “press” any of its Flexible Line Keys using the **dial()** function. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys. Each Flexible Line Key on the Dterm Series III telephone is assigned a dial string sequence (refer to Table 21). By using the **dial()** function and the appropriate dial string, the D/42-NE2 can press any Flexible Line Key.

4.5.4. Feature Keys (5)

There are five Feature Keys located next to the dial pad keys (FNC, CNF, LNR/SPD, SPKR, and ANS). There is a two-color LED Indicator associated with each Feature Key. The LED Indicators can take on any one of the states listed in Table 20.

Reading LED Indicators on the Feature Keys

The D/42-NE2 can determine the state of its LED Indicators on the Feature Keys by using the **d42_indicators()** function to read the LED Indicators data. This function places the LED Indicator data (26 bytes) in an application buffer. Bytes 18-23 (byte 20 is not used) contain the LED indicator status for the Feature Keys (see Table 22). Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_indicators()** function.

Table 22. Feature Key Indicators for the Dterm Series III (PBX)

Byte	Description	Dial Code
18	CNF key LED	<ESC>KI
19	FCN key LED	<ESC>KL
20	not used	
21	LNR/SPD key LED	<ESC>KH
22	ANS key LED	<ESC>KM
23	SPKR key LED	<ESC>KN

■ Example

An application uses the **d42_indicators()** function to retrieve the current data for the LED Indicators for a given channel on a D/42-NE2. The data placed in the application buffer is shown below. If the data for byte 23 is 0x07, the indicator for SPKR is red and on. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_indicators()** function.

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	Line Key 1	Line Key 2	Line Key 3	Line Key 4	Line Key 5	Line Key 6	Line Key 7	Line Key 8	Line Key 9	Line Key 10	Line Key 11	Line Key 12	Line Key 13	Line Key 14	Line Key 15	Line Key 16	not used	MWI	CNF Key	FCN Key	not used	LNR/SPD Key	ANS Key	SPKR Key
Data	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	xx	00	00	00	xx	00	00	07
Byte	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23

	ICM		MIC																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
Data	00	00	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx

Pressing Feature Keys

The D/42-NE2 can “press” any of its Feature Keys using the **dial()** function. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys. Each Feature Key on the Dterm Series III telephone is assigned a dial string sequence (refer to Table 22). By using the **dial()** function and the appropriate dial string, the D/42-NE2 can press any Feature Key.

4.5.5. MIC/ICM Indicators

The MIC and ICM indicators are located between the Flexible Line keys and the keypad. In normal operation these indicators show the status of the microphone and the intercom. During programming, these indicators are used as prompts. The MIC and ICM LED indicators can take on any one of the red states (0x00 - 0x07) listed in Table 20.

Reading MIC/ICM LED Indicators

The D/42-NE2 can determine the state of its MIC and ICM LED indicators by using the **d42_indicators()** function to read the LED Indicators data. This function places the LED Indicator data (26 bytes) in an application buffer. Bytes 24 and 25 contain the indicator status for MIC and ICM indicators. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_indicators()** function.

■ Example

An application uses the **d42_indicators()** function to retrieve the current data for the LED Indicators on a given channel on a D/42-NE2. The data placed in the application buffer is shown below. If the data for byte 24 is 0x07, the indicator for MIC is on. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_indicators()** function.

[illegible]

4.5.6. Alphanumeric Display

The alphanumeric display is a two row 32-digit LCD that is used to show the activity of the phone. Some examples are:

- date and time
- feature names
- error messages
- called/calling identification
- phone status
- line selection.

The data used to display information in the LCD alphanumeric display is in ASCII format. When the station set is not in use, the display shows the date and time. The content of the display is changed automatically (e.g., receiving an incoming call, making an outgoing call, or activating a feature).

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The D/42-NE2 can retrieve the information on the alphanumeric display by using the **d42_display()** function. The function places the display data (32 bytes) in an application buffer. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_display()** function.

■ Example

An application uses the **dial()** function and the appropriate dial string to press keys to enter the programming mode. The **d42_display()** function is then used to retrieve the display data and verify that the program mode has started. The display data is shown below.

	P R O G R A M M O D E															
data	20	50	52	4F	47	52	41	4D	00	4D	4F	44	45	20	20	20
byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
data	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
byte	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
data	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
byte	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

Called/calling Number ID (within the PBX)

When receiving a call on a D/42-NE2 from another extension, the PBX sends calling number ID data (by default, the extension number of the telephone placing the call) to the station set between the first and second rings. The station set processes the data and sends an ID message to the display. The calling number ID data sent from the PBX to the station set differs from the calling number ID data presented on the display.

When placing a call to another extension, the called number ID (by default, the extension of the telephone being called) is shown in the display.

Both the calling and called number IDs can be read using the **d42_gtcallid()** function. The **d42_gtcallid()** function retrieves the called/calling number ID message sent from the KSU to the station set, not the data sent to the display.

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Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using **d42_gtcallid()** function.

The contents of the called/calling number ID is shown in Table 23 (as seen by the receiver of the call).

Table 23. Called/calling Number ID Data for the NEC NEAX 2400 ICS and NEAX 2000 IVS PBXs

Call Route	Called/calling Number ID Data
Call received from trunk line 1	_0-1000
Call received from station set 201	_201
Call originally received on trunk line 1, then transferred to station set 200	200_0-1000
Call originally received by extension 200, the transferred to extension 203	203_200

NOTE: The called/calling number ID can also be obtained using the **d42_display()** function, however, you should use the **d42_gtcallid()** function so that your application will maintain functionality across different manufacturers' switches.

■ Example

An application uses the **d42_gtcallid()** function to retrieve the called/calling number ID for a call received on a specified channel on a D/42-NE2. The called/calling number ID data is shown below.

text	bb 2 0 0 _ 2 0 3																							
data	20	32	30	30	5F	32	30	33	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

text																								
data	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
byte	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

4.5.7. Setting the Message Waiting Indicator

The D/42-NE2 can set the Message Waiting Indicator (on or off) on another extension using the **dial()** function and the appropriate dial string. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys.

NOTE: The Message Waiting Indicator can also be set using the **dial()** function and appropriate dial string to press the Flexible Line Key assigned to send messages (MSG), however, you should use the **dial()** function as described so that your application will maintain functionality across different manufacturers' switches.

The D/42-NE2 can determine the state of its Message Waiting Indicator using the **d42_indicators()** function to read the LED Indicators data. Byte 17 contains the Message Waiting indicator status (0x00 is off; 0x07 is on). Refer to the *D/42 Series Software Reference* for your particular operating system for more information about using the **d42_indicators()** function.

■ Example

An application uses the **d42_indicators()** function to retrieve the LED Indicators data for a specified channel on the D/42-NE2 to determine if a message is waiting. The LED indicators data is shown below. The data 0x00 shows that the MWI indicator is off (there are no messages waiting).

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	Line Key 1	Line Key 2	Line Key 3	Line Key 4	Line Key 5	Line Key 6	Line Key 7	Line Key 8	Line Key 9	Line Key 10	Line Key 11	Line Key 12	Line Key 13	Line Key 14	Line Key 15	Line Key 16	not used	MWI	CNF Key	FCN Key	not used	LNR/SPD Key	ANS Key	SPKR Key
Data	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	xx	00	00	00	xx	00	00	00
Byte	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23

	ICM	MIC																						
Data	07	00	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
Byte	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

4.5.8. Transfer a Call

The D/42-NE2 can transfer calls using the **dial()** function. By using the **dial()** function and the appropriate dial string (&,<extension>), the D/42-NE2 can transfer a call to any extension connected to the switch. Refer to the *D/42 Series Software Reference* for your particular operating system for more information about dialing programmable keys.

NOTE: The transfer function can be performed using the **dial()** function and the appropriate dial string to press the Flexible Line Key assigned to transfer however, you should use the &,<extension> dial string so your application will maintain functionality across different manufacturers' switches.

The D/42-NE2 can perform both supervised and blind transfers (refer to *Sections 2.1. Supervised Call Transfer and 2.2. Blind Call Transfer*). When a blind transfer is performed, the PBX controls where the call is routed if the called extension is busy or does not answer. When a supervised transfer is performed, your application can implement call progress analysis and called/calling number ID to intelligently control where the call is routed and what type of message is played if the called extension is busy or does not answer. Because of this capability, supervised transfer is the preferred method.

■ Example

An application answers an incoming call and plays a greeting message prompting the caller to enter the extension they wish to reach (the caller enters 221). Using

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the **dial()** function with the dial string (&,221), the application attempts to transfer (supervised) the call to extension 221. Call progress analysis is used to determine if extension 221 is answered, busy, or there is no answer. If extension 221 answers, the application hangs up and the transfer is complete. If the extension is busy or not answered, the application reconnects to the incoming call and plays a message asking the caller to choose between accessing voice mail or transferring to the operator.

Appendix A

Technical Specifications

D/42D-SX

Technical Specifications*

Number of ports/card	4
Total ports/system	64
Max. boards/system	16
Microprocessor	Intel® 80C188
Digital signal processor	Motorola DSP56001 @ 20 Mhz, 24-bit
Host Interface	
Bus compatibility	IBM PC XT/AT (ISA)
Bus speed	4-12 Mhz, 70 nsec back-to-back bus cycle
Shared memory	8 KB page, switch selectable on 8 KB boundaries
Base addresses	D000h (default), A000h or C000h
Interrupt level	IRQ2 to IRQ7 jumper selectable. One IRQ is shared by all D/42D-SX boards.
Telephone Interface	
Support	MITEL Superset Line Circuit board in a Mitel Superswitch PBX
Impedance	600 Ohms nominal
Receive signal/noise ratio	70 dBm, referenced to -15 dBm
Cross talk coupling	-70 dB at 1KHz channel to channel
Frequency response	300Hz to 3400Hz ± 3 dB (transmit and receive)
Connectors	2 RJ-14 type

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Power Requirements	
+5 VDC	1.25 A
+12 VDC	40 mA
12 VDC	40 mA
Operating temperature	0°C to +50°C
Storage temperature	-20°C to +70°C
Humidity	8% to 80% noncondensing
Form Factor	
PC XT, 13.3 in. long, 0.774 in. wide, 3.85 in. high (excluding edge connector)	
Safety & EMI Certifications	
United States	FCC part 68 ID#: not required UL: E96804
Canada	DOC: not required CSA: LR-84340-14

Firmware Specifications*

Audio Signal	
Transmit	9 dBm (weighted average)**
Receive range	42 to +2.5 dBm
Silence detection	38 dBm, software adjustable**
Frequency response	24 Kb/s: 300 Hz to 2600 Hz \pm 3 dB 32 Kb/s: 300 Hz to 3400 Hz \pm 3 dB 48 Kb/s: 300 Hz to 2600 Hz \pm 3 dB 64 Kb/s: 300 Hz to 3400 Hz \pm 3 dB
Audio Digitizing	
Method	OKI ADPCM, μ -law PCM
Sampling rates	6 kHz, 8 kHz
Data rates	OKI ADPCM: 24 Kb/s, 32 Kb/ μ -law PCM: 48 Kb/s, 64 Kb/s

Appendix A

Tone Dialing	
DTMF digits	0 to 9, *, #, A, B, C, D
MF digits	0 to 9, KP, ST, ST1, ST2, ST3
Level	Network compatible
Rate	10 digits/s maximum, software adjustable
Pulse Dialing	
10 digits	0 to 9
Pulsing rate	10 pulses/s, nominal
Break ratio	60%
DTMF Tone Detection:	
DTMF digits	0 to 9, *, #, A, B, C, D per Bellcore LSSGR Sec 6
Dynamic range	-36 dBm to +0 dBm per tone**
Minimum tone duration	32 ms, software adjustable
Acceptable twist	Meets Bellcore LSSGR Sec 6 and EIA 464 requirements
Signal/noise ratio	10 dB (referenced to lowest amplitude tone)
Talk off	Detects 0 digits while monitoring MITEL speech tape #CM7291. Detects less than 10 digits while monitoring Bellcore TR-TSY-000763 standard speech tapes (LSSGR requirements specify detecting no more than 470 total digits).
MF Tone Detection	
MF digits	0 to 9, KP, ST, ST1, ST2, ST3
Speed Control	
Pitch controlled	Available for 24 and 32 Kb/s data rates
Adjustment range	50%
Volume Control	
Adjustment range	40 dB, with programmer-definable increments

* All specifications are subject to change without notice.

**Analog levels: 0 dBm0 corresponds to a level of +3dBm at tip-ring analog point.

System Requirements

- 80286, 80386, 80486 or Pentium IBM PC AT (ISA) bus or compatible computer. Operating system hardware requirements vary according to the number of channels being used.
- MITEL Superset (COV) Line Circuit board in a MITEL Superswitch
- PBX model SX-50, SX-100, SX-200, SX-200D, or SX-2000.

D/42D-SL

Technical Specifications*

Number of ports/card	4
Total ports/system	64
Max. boards/system	16
Microprocessor	Intel® 80C188
Digital signal processor	Motorola DSP56001 @ 20 Mhz, 24-bit
Host Interface	
Bus compatibility	IBM PC XT/AT (ISA)
Bus speed	4-12 Mhz, 70 nsec back-to-back bus cycle
Shared memory	8 KB page, switch selectable on 8 KB boundaries
Base addresses	D000h (default), A000h or C000h
Interrupt level	IRQ2 to IRQ7 jumper selectable. One IRQ is shared by all D/42D-SL boards.
Telephone Interface	
Support	Northern Telecom SL-1 line circuit board; QPC61, 4 circuit; QPC451, 8 circuit
Impedance	600 Ohms nominal
Receive signal/noise ratio	70 dBm, referenced to -15 dBm
Cross talk coupling	-70 dB at 1KHz channel to channel
Frequency response	300Hz to 3400Hz ± 3 dB (transmit and receive)
Connectors	4 RJ-14 type

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Power Requirements	
+5 VDC	1.25 A
+12 VDC	40 mA
-12 VDC	40 mA
Operating temperature	0°C to +50°C
Storage temperature	-20°C to +70°C
Humidity	8% to 80% noncondensing
Form Factor	
PC XT, 13.3 in. long, 0.774 in. wide, 3.85 in. high (excluding edge connector)	
Safety & EMI Certifications	
United States	FCC part 68 ID#: not required UL: E96804
Canada	DOC: not required CSA: LR-84340-14
Warranty	36 months standard

Firmware Specifications*

Audio Signal	
Transmit	-9 dBm (weighted average)**
Receive range	-42 to +2.5 dBm
Silence detection	-38 dBm, software adjustable**
Frequency response	24 Kb/s: 300 Hz to 2600 Hz ± 3 dB 32 Kb/s: 300 Hz to 3400 Hz ± 3 dB 48 Kb/s: 300 Hz to 2600 Hz ± 3 dB 64 Kb/s: 300 Hz to 3400 Hz ± 3 dB
Audio Digitizing	
Method	OKI ADPCM, μ -law PCM
Sampling rates	6 kHz, 8 kHz
Data rates	OKI ADPCM: 24 Kb/s, 32 Kb/s μ -law PCM: 48 Kb/s, 64 Kb/s

Appendix A

Tone Dialing	
DTMF digits	0 to 9, *, #, A, B, C, D
MF digits	0 to 9, KP, ST, ST1, ST2, ST3
Level	Network compatible
Rate	10 digits/s maximum, software adjustable
Pulse Dialing	
10 digits	0 to 9
Pulsing rate	10 pulses/s, nominal
Break ratio	60%
DTMF Tone Detection	
DTMF digits	0 to 9, *, #, A, B, C, D per Bellcore LSSGR Sec 6
Dynamic range	-36 dBm to +0 dBm per tone**
Minimum tone duration	32 ms, software adjustable
Acceptable twist	Meets Bellcore LSSGR Sec 6 and EIA 464 requirements
Signal/noise ratio	10 dB (referenced to lowest amplitude tone)
Talk off	Detects 0 digits while monitoring MITEL speech tape #CM7291. Detects less than 10 digits while monitoring Bellcore TR-TSY-000763 standard speech tapes (LSSGR requirements specify detecting no more than 470 total digits).
MF Tone Detection	
MF digits	0 to 9, KP, ST, ST1, ST2, ST3
Speed Control	
Pitch controlled	Available for 24 and 32 Kb/s data rates
Adjustment range	50%
Volume Control	
Adjustment range	40 dB, with programmer-definable increments

* All specifications are subject to change without notice.

** Analog levels: 0 dBm0 corresponds to a level of +3dBm at tip-ring analog point.

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Components

Additional components include

Cable connecting D/42D-SL board to SL-1 board:

- 26 AWG - max. length is 2100 feet
- 22 or 24 AWG - max. length is 3000 feet

System Requirements

- 80286, 80386, 80486 or Pentium IBM PC AT (ISA) bus or compatible computer. Operating system hardware requirements vary according to the number of channels being used.
- Northern Telecom PBX with SL-1 line circuit board. Example: QPC451 - 8 circuit board; QPC61 - 4 circuit board

D/42-NS

Technical Specifications*

Number of ports/card	4
Total ports/system	64
Max. boards/system	16
Resource sharing bus	PEB
Microprocessor	Intel® 80C188
Digital signal processor	Motorola DSP56001 @ 27 Mhz, 24-bit
Host Interface	
Bus compatibility	IBM PC XT/AT (ISA), 16 bit
Bus speed	4-12 Mhz, 70 nsec back-to-back bus cycle
Shared memory	8 KB page, switch selectable on 8 KB boundaries
Base addresses	D000h (default), A000h or C000h
Interrupt level	IRQ3 to IRQ15 jumper selectable. One IRQ is shared by all D/42-NS boards.
Telephone Interface	
	Meets all specifications set by Northern Telecom for the Norstar TCM station interface.
Connectors	4 RJ-11 type
Power Requirements	
+5 VDC \pm 5%	2.0 A
Operating temperature	0°C to +50°C
Storage temperature	-20°C to +70°C
Humidity	8% to 80% noncondensing
Form Factor	
PC XT/AT, 13.3 in. long, 0.774 in. wide, 3.85 in. high (excluding edge connector)	
Safety & EMI Certifications	
United States	FCC part 68 does not apply
Canada	CSO3 does not apply
Warranty	36 months standard

Firmware Specifications*

Audio Signal	
Transmit	-12.5 dBm0 (weighted average)**
Receive range	-42 to +2.5 dBm
Silence detection	-38 dBm0, software adjustable**
Frequency response	24 Kb/s: 300 Hz to 2600 Hz ± 3 dB 32 Kb/s: 300 Hz to 3400 Hz ± 3 dB 48 Kb/s: 300 Hz to 2600 Hz ± 3 dB 64 Kb/s: 300 Hz to 3400 Hz ± 3 dB
Audio Digitizing	
Method	OKI ADPCM, μ -law PCM
Sampling rates	6 kHz, 8 kHz
Data rates	OKI ADPCM: 24 Kb/s, 32 Kb/s μ -law PCM: 48 Kb/s, 64 Kb/s
Tone Dialing:	
DTMF digits	0 to 9, *, #, A, B, C, D
MF digits	0 to 9, KP, ST, ST1, ST2, ST3
Level	Network compatible
Rate	10 digits/s maximum, software adjustable
Pulse Dialing	
10 digits	0 to 9
Pulsing rate	10 pulses/s, nominal
Break ratio	60%
DTMF Tone Detection:	
DTMF digits	0 to 9, *, #, A, B, C, D per Bellcore LSSGR Sec 6
Dynamic range	-39 dBm0 to +0 dBm0 per tone**
Minimum tone duration	32 ms, software adjustable
Acceptable twist	Meets Bellcore LSSGR Sec 6 and EIA 464 requirements
Signal/noise ratio	10 dB (referenced to lowest amplitude tone)

Appendix A

Talk off	Detects 0 digits while monitoring MITEL speech tape #CM7291. Detects less than 10 digits while monitoring Bellcore TR-TSY-000763 standard speech tapes (LSSGR requirements specify detecting no more than 470 total digits).
MF Tone Detection:	
MF digits	0 to 9, KP, ST, ST1, ST2, ST3
Speed Control	
Pitch controlled	Available for 24 and 32 Kb/s data rates
Adjustment range	50%
Volume Control	
Adjustment range	40 dB, with programmer-definable increments

*All specifications are subject to change without notice.

** Digital levels: 0 dBm0 corresponds with 3 dB below μ -law full scale on digital PEB products.

System Requirements

- 80286, 80386, 80486 or Pentium IBM PC AT (ISA) bus or compatible computer.
- Operating system hardware requirements vary according to the number of channels being used.
- Norstar Compact DR2*, DR3*, DR5 Maintenance Release
- Norstar Modular DR2*, DR3*, DR5 Maintenance Release
- Norstar-Plus Modular ICS Release 1

* These are obsolete software revisions and may contain limitations. Dialogic recommends that switch software be upgraded to the DR5 Maintenance Release.

D/42-NE2

Technical Specifications*

Number of ports/card	4
Resource-sharing bus	PEB™
Microprocessor	Intel 80C188
Digital signal processor	Motorola DSP56001
Host Interface	
Bus compatibility	IBM PC AT
Bus speed	4-12 Mhz, minimum 70 nsec back-to-back bus cycle
Shared memory	8 KB, switch selectable on 8 KB boundaries
Base addresses	D000H (default), A000H, C000H
Maximum boards/system	16
Interrupt level	IRQ3 to IRQ15, jumper selectable. One IRQ shared by all boards.
Telephone interface	
	meets all specifications set by NEC for the 2-wire Dterm Series III PBX Telephone and the 2-wire Electra Professional Key System Telephone
Connectors:	4 RJ-11 type
Power Requirements:	
+5 Vdc	2.5 A
Environmental	
Operating temperature	0°C to +50°C
Storage temperature	20°C to +70°C
Humidity	8% to 80% noncondensing
Form factor	
PC XT/AT, 13.3 in. long. 0.774 in. wide, 3.85 in. high (excluding edge connector)	
Safety & EMI Certifications	
United States	FCC part 68 does not apply
Canada	CSO3 does not apply
Warranty	36 months standard

Firmware Specifications*

Audio Signal	
Transmit	-12.5 dBm0 (weighted average)**
Receive range	-63 to +2.5 dBm0 (AGC above -21 dBm0)**
Silence detection	-41 dBm0, software adjustable**
Frequency response	24 Kb/s: 300 Hz to 2600 Hz \pm 3 dB 32 Kb/s: 300 Hz to 3400 Hz \pm 3 dB 48 Kb/s: 300 Hz to 2600 Hz \pm 3 dB 64 Kb/s: 300 Hz to 3400 Hz \pm 3 dB
Audio Digitizing:	
Method	ADPCM, μ -law PCM
Sampling rates	6 kHz, 8 kHz
Data Rates	ADPCM: 24 Kb/s, 32 Kb/s μ -law PCM: 48 Kb/s, 64 Kb/s
Tone Dialing:	
DTMF digits	0 to 9, *, #, A, B, C, D
MF digits	0 to 9, KP, ST, ST1, ST2, ST3
Level	Network compatible
Rate	10 digits/s maximum, software adjustable
Pulse Dialing:	
10 digits	0 to 9
Pulsing rate	10 pulses/s, nominal
Break ratio	60%
DTMF Tone Detection:	
DTMF digits	0 to 9, *, #, A, B, C, D
Dynamic range	-39 dBm0 to +0 dBm0 per tone**
Minimum tone duration	32 ms, software adjustable
Acceptable twist:	10 dB
Signal/noise ratio	10 dB (referenced to lowest amplitude tone)

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Talk off	Detects 0 digits while monitoring MITEL speech tape #CM 7291. Detects less than 20 digits while monitoring Bellcore TR-TSY-000763 standard speech tapes (LSSGR requirements specify detecting no more than 470 total digits).
MF Tone Detection:	
MF digits	0 to 9, KP, ST, ST1, ST2, ST3
Speed control	Pitch controlled; available for 24 and 32 Kb/s data rates

* All specifications are subject to change without notice.

** Digital levels: 0 dBm0 corresponds to 3 dB below μ -law full scale on digital PEB products. Analog levels: 0 dBm0 corresponds to a level of +3 dBm at tip-ring analog point.

D/42-NE2 PCI**Technical Specifications***

Number of ports/card	4
Resource-sharing bus	None
Microprocessor	Intel 80C188
Digital signal processor	Motorola DSP56002
Host Interface	
Bus compatibility	PCI Local Bus
Bus speed	33 MHz
Shared memory	8 KB
Base address	D0000 (default)
Maximum boards/system	16
Interrupt level	INTA
Telephone interface	
	Meets all specifications set by NEC for the 2-wire Dterm Series III PBX Telephone and the 2-wire Electra Professional Key System Telephone
Connectors:	4 RJ-11 type
Power Requirements:	
+5 Vdc	2.5 A
Environmental	
Operating temperature	0°C to +50°C
Storage temperature	-20°C to +70°C
Humidity	8% to 80% noncondensing
Form factor	
PCI short format card, 6.875 in. long, 0.79 in. wide, 4.2 in. high (excluding edge connector).	
Safety & EMI Certifications	
United States	FCC part 68 does not apply
Canada	CSO3 does not apply
Warranty	36 months standard

Firmware Specifications*

Audio Signal	
Transmit	-12.5 dBm0 (weighted average)**
Receive range	-63 to +2.5 dBm0 (AGC above -21 dBm0)**
Silence detection	-41 dBm0, software adjustable**
Frequency response	24 Kb/s: 300 Hz to 2600 Hz \pm 3 dB 32 Kb/s: 300 Hz to 3400 Hz \pm 3 dB 48 Kb/s: 300 Hz to 2600 Hz \pm 3 dB 64 Kb/s: 300 Hz to 3400 Hz \pm 3 dB
Audio Digitizing:	
Method	ADPCM, μ -law PCM
Sampling rates	6 kHz, 8 kHz
Data Rates	ADPCM: 24 Kb/s, 32 Kb/s μ -law PCM: 48 Kb/s, 64 Kb/s
Tone Dialing:	
DTMF digits	0 to 9, *, #, A, B, C, D
MF digits	0 to 9, KP, ST, ST1, ST2, ST3
Level	Network compatible
Rate	10 digits/s maximum, software adjustable
Pulse Dialing:	
10 digits	0 to 9
Pulsing rate	10 pulses/s, nominal
Break ratio	60%
DTMF Tone Detection:	
DTMF digits	0 to 9, *, #, A, B, C, D
Dynamic range	-39 dBm0 to +0 dBm0 per tone**
Minimum tone duration	32 ms, software adjustable
Acceptable twist:	10 dB
Signal/noise ratio	10 dB (referenced to lowest amplitude tone)

Appendix A

Talk off	Detects 0 digits while monitoring MITEL speech tape #CM 7291. Detects less than 20 digits while monitoring Bellcore TR-TSY-000763 standard speech tapes (LSSGR requirements specify detecting no more than 470 total digits).
MF Tone Detection:	
MF digits	0 to 9, KP, ST, ST1, ST2, ST3
Speed control	Pitch controlled; available for 24 and 32 Kb/s data rates

* All specifications are subject to change without notice.

** Digital levels: 0 dBm0 corresponds to 3 dB below μ -law full scale on digital PCI products. Analog levels: 0 dBm0 corresponds to a level of +3 dBm at tip-ring analog point.

Glossary

Analog Signal A continuously variable signal. Voice signals on telephone lines are usually analog (i.e., transmitted electronically in a form analogous to the spoken form). A representation of an analog signal is a sine wave.

Attendant The “operator” of a phone system console. Usually directs incoming calls to the proper person or department. May also assign outgoing lines or trunks. The operator may be a person or an automated system.

Automatic call distribution A system used to systematically distribute incoming calls to a number of operators (called agents). Agents are usually sales or service people.

Call Forwarding A service which allows a call to be directed to an extension other than the one that was dialed. This is accomplished by the called party programming into the phone system the extension the incoming calls should be forwarded to.

DID Direct Inward Dialing - The capability to dial an extension (inside the PBX system) without going through the attendant.

Digital Signal A discontinuous signal. One whose state consists of discrete elements representing specific information. Logically, a digital signal can be thought of as a pattern of ones and zeros representing a specific value.

Handset the part of the telephone held in the hand. Contains a transmitter and a receiver.

Hold Temporarily leave a phone call without disconnecting. You can return to it at any time.

Hunt The process of a call reaching a group of lines. If the first line is busy, it will be forwarded to the second line. If the second line is busy, it will be forwarded to the third line, and so on.

Hybrid System A term used to describe a telephone system that has attributes of both Key Systems and PBXs. Usually means that incoming

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lines (trunks) appear on the phone set, and outbound calls require the use of an access code (typically a "9").

KTS Key Telephone System - A telephone system in which the station sets have multiple buttons permitting the user to select outgoing or incoming CO phone lines. You do not have to dial an access code (typically "9") to access CO lines.

KSU Key Service Unit - The main cabinet which contains all the electronics to run a Key Telephone System.

LCD Liquid Crystal Display - An alphanumeric display using liquid crystals sealed between two pieces of glass. Usually a gray background with black characters.

LED Light Emitting Diode - A diode which emits light. Can be used as a single indicator or combined with other LEDs to create an alphanumeric display.

Line Card A plug-in electronic printed circuit board for a PBX or KSU that operates lamps, ringing, holding, and other features associated with several telephone lines.

On-hook When the handset is resting in its cradle. The phone is not connected to any line.

Off-hook When the handset is lifted from its cradle. Alerts the CO (or PBX) that it is ready (usually ready to receive a dial tone).

On-hook Dialing A feature that allows the caller to dial without lifting the handset. After dialing, the caller can listen to the progress of the call through the built-in speaker.

PBX Private Branch Exchange - A private phone system allowing communications within a business and between the business and the outside world. Outside lines are not accessible to the station set. An access code (typically "9") is required to connect to an outside line.

Speakerphone A telephone that has a speaker and a microphone for hands-free conversation

Station Set A telephone used with a PBX or KTS.

Glossary

TDM Time Division Multiplex - A technique used for transmitting separate data, voice, or video messages simultaneously over one phone line by interleaving elements of each message in fast time sequences.

Tip and Ring Another way of saying plus and minus, or positive and ground, in electrical circuits.

Trunk A telephone communication path or channel between two points, one being a CO and the other a PBX or KSU.

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