

**User Guide for
PBXLink and
PBXLink ISA**

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Chapter 1 Introduction

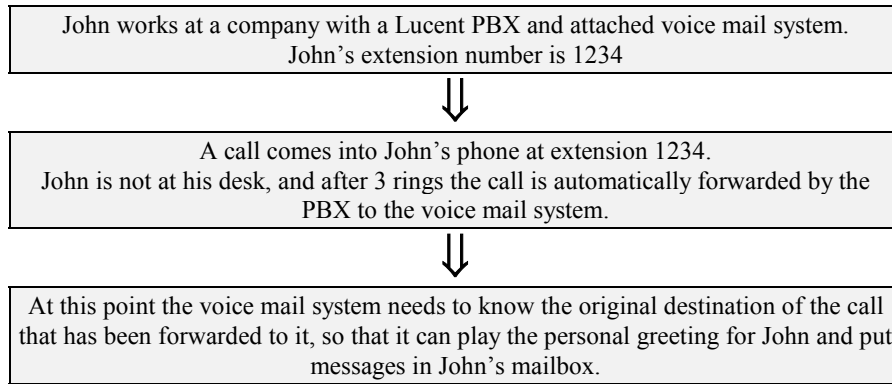
The CTL PBXLink provides integration services to allow certain digital PBXs to interface seamlessly with a Voice Messaging System. The PBXLink connects to the PBX using a digital telephone line and to the Voice Messaging System using an RS-232 link. The PBXs supported and the corresponding digital telephone that the PBXLink emulates is:

- Lucent ProLogix 8434
- Lucent Definity (2 wire) 8434
- Lucent Definity (4 wire) 7434
- Lucent System 75 7405
- Northern Telecom M2616

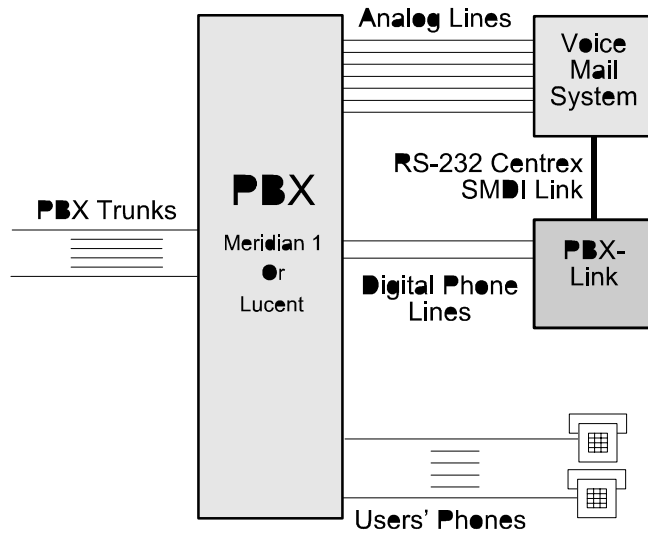
The PBXLink uses information appearing on the emulated digital set to determine the original source and destination of the calls being forwarded to the voice mail system. This information is then communicated to the voice mail system on an RS-232 serial link using the industry standard "Centrex SMDI" protocol. The PBXLink has been tested with SMDI-compatible voice mail systems from the following suppliers:

Active Voice
 Applied Voice
 Boston Technology
 Callware
 CDS Group
 Centigram
 Cobityx
 CTL Inc.
 Digital Speech
 Du Voice
 ESNA
 Executive Voice
 InnOvation
 KeyVoice
 NEC America
 Octel
 The Automatic Answer
 Trans Tel
 TRT
 Voice and Data Systems
 Wildcard

The SMDI information is important to the voice mail system in the following scenario:



This is where the PBXLink comes in. It provides this information to the voice mail system, which can determine which mailbox is being accessed by the incoming caller.



The PBXLink provides additional information, such as:

- Whether the call was transferred because John did not answer his phone (as in the above example), because his phone was forwarded, or because he was already on the phone. The voice mail system can then use this information to play different greetings.
- The caller's number, when available. The voice mail system can use this to allow users to reply to messages.
- Whether the call was directly to the voice mail system itself. This is useful to identify a voice mail subscriber, so that when John is at his desk and calls the voice mail system to pick up his voice messages, he only has to enter his password and not his mailbox number.

Another important function performed by the PBXLink is to set and clear the message waiting indicators on subscribers' phones. When a message waiting indicator needs to be set, the voice mail system sends a command to the PBXLink. The PBXLink then uses the message waiting indicator features of the of the digital phone set to turn on or off the lights.

PBXLink and PBXLink ISA

This manual is used for both the PBXLink, a 2 port standalone integration device, and the PBXLink ISA which is a single port PC card integration device. Both products share a great deal in terms of configuration of the PBX and use of menus via the serial ports on the products. Some parts of this manual are specifically for one product or the other. There are a number of similarities between the products and a few differences.

	<i>PBXLink</i>	<i>PBXLink ISA</i>
Form	External box	PC ISA card
Number of Digital PBX Ports	2	1
Management Port	On back panel	On end plate
SMDI Port	On back panel	Across ISA bus
SMDI Port Configuration	Through software	Switches on card
Configuration Method	Front Panel	SMDI port or Management port
Alternative Configuration	Management port or SMDI port	SMDI port or Management port

The PBXLink and PBXLink ISA use the same configuration menus. These can be accessed through the front panel of the PBXLink or through the either one of the serial ports of the devices. Some menu options do not appear if they are not required for the configuration. For example: the configuration option for which Lucent phone type is being emulated does not appear when the unit is configured for Meridian 1 and configuration options for PBX port B do not appear on the PBXLink ISA since it only has a PBX port A.

How It Works

Please take a few minutes to read and understand this description of how incoming voice mail system calls are processed, as this will enable you to make the correct system configuration decisions later on.

On Lucent PBXs, the PBXLink has two modes of operation: “Bridged Mode” and “Transfer Mode”. Bridged Mode provides the highest level of performance, however it requires the use of “Vectoring” on the PBX. If “Vectoring” is not available for your PBX, then “Transfer mode” is recommended.

On Nortel PBXs, only “Bridged Mode” is supported.

Bridged Mode

In this mode of operation the analog lines connected to the voice mail system are set up as a group, such that dialing the voice mail pilot number will have the call arrive at the first free analog line.

The voice mail system is connected to the PBX using a number of analog lines (4-8 in a small system, 72 or more in the largest systems.) These lines (up to 24 per PBXLink port) are assigned to feature keys on the digital station set that the PBXLink is emulating, as “Busy Indicators.” The PBXLink uses these indicators to determine which of the analog lines between the PBX and voice mail system are busy, and when calls arrive at the voice mail system the PBXLink gathers the call information from the display of the digital set. Larger systems will use both ports A and B of the PBXLink, and the largest systems will use multiple PBXLinks chained together.

The PBXLink is connected to the “Centrex SMDI” port of the voice mail system using an RS-232 cable. The sequence of events when a call comes in is as follows (the number of the first voice mail port is 2000, with 2001, 2002 etc. being the additional lines):

1. A call is made to John at extension 1234.
2. John does not answer and the PBX automatically forwards the call to the primary voice mail number, 2000. There are already two calls in progress at the voice mail system, so it rings on line 2002.
3. The PBXLink sees the ringing call on the line with extension 2002.

4. The PBXLink uses a digital phone “Display” or “Inquiry” feature to display call information for that line. It determines that the call was originally directed to the user “John 1234”, and that it was forwarded to voice mail because John did not answer.
5. The PBXLink formats an SMDI packet with the call information and sends it down the RS-232 link to the voice mail system. The voice mail system answers the incoming call and uses the SMDI packet to play the correct greeting for John’s mailbox.

Once this sequence of events is complete, the PBXLink is ready to handle further calls which may have arrived at the voice mail system while this was happening. The events above happen very quickly, typically taking less than a second per call.

Transfer Mode (Lucent only)

The PBXLink works by emulating a regular digital station. The phone number of this set is the primary voice mail pilot number. Call forward paths are set up so that calls to subscribers’ extensions which are busy or unanswered are forwarded to this number. The digital set has (typically) eight ‘line appearance’ buttons associated with this extension so that multiple calls can be handled sequentially. Calls arriving at this extension will ring on these line appearances until they are serviced by the PBXLink, providing a call queue of ringing lines.

The voice mail system is connected to the PBX using a number of analog lines (4-8 in a small system, 72 or more in the largest systems.) These lines are assigned to feature keys on the digital station set that the PBXLink is emulating as “Busy Indicators” (Lucent), or “Non Ringing Lines” (Nortel.) The PBXLink uses these indicators to determine which of the analog lines between the PBX and voice mail system are busy. Larger systems will use both ports A and B of the PBXLink, and the largest systems will use multiple PBXLinks.

The PBXLink is connected to the “Centrex SMDI” port of the voice mail system using an RS-232 cable. The sequence of events when a call comes in is as follows (the primary voice mail number, and the number of the digital set which the PBXLink is emulating, is 2000):

1. A call is made to John at extension 1234.
2. John does not answer and the PBX automatically forwards the call to the primary voice mail number, 2000.
3. The PBXLink sees the forwarded call to John appear as a ringing line on one of the call appearance buttons of the digital phone it is emulating.
4. The PBXLink picks up the call and uses the display information to determine that the call was originally directed to the user “John, 1234”, and that it was forwarded to voice mail because John did not answer.
5. The call must now be transferred to a free port on the voice mail system. The PBXLink checks the “Busy Indicator” keys to find a free port. If none are free the PBXLink will wait until one becomes available. Once there is a free port, the PBXLink transfers the call to that port using the Transfer feature of the telephone.
6. Finally the PBXLink formats an SMDI packet with the call information and sends it down the RS-232 link to the voice mail system. The voice mail system sees the incoming call and uses the SMDI packet to play the correct greeting for John’s mailbox.

Once this sequence of events is complete, the PBXLink is ready to handle further calls which may be waiting to be transferred. These other calls appear on one of the other “Call Appearance” keys, and up to eight can be pending at any one time.

The events above happen very quickly, typically taking less than eight seconds per call.

Chapter 2 Installing Your PBXLink

Overview

This chapter gives an overview of the steps necessary for a successful PBXLink installation. If you have a PBXLink ISA (PC card), see *Chapter 3 -- Installing Your PBXLink ISA* instead.

There is some amount of information you need to determine before you get started.

Packing List

You should have received the following items:

1. PBXLink system unit
2. Power Supply
3. A pair of RJ11 cables for connecting the PBXLink to a Lucent digital PBX port
4. A pair of RJ45 cables for connecting the PBXLink to a Nortel digital PBX port
5. This manual
6. A registration card

Please fill in and return the registration card now.

One Port or Two?

The PBXLink has the capability of emulating two digital phones. This feature should be used when the Voice mail system is expecting a large call volume. If more than 16 analog ports are being serviced by a PBXLink then it is recommended that you use both digital ports. There are three ways that the PBXLink can be configured; you should decide which is most suitable for the installation.

Size of Voice-Mail	Port A	Port B
Small System (4-8 ports)	Service Calls and Process MWIs	Disabled ⁺
Medium System (8-24 ports)	Process MWIs only	Service Calls Only
Very Large System (>24 ports) [*]	Service Calls Only	Service Calls Only

⁺ In this mode only one PBX port is required for both processing calls and setting message waiting indicators (MWIs). The advantage here is that this saves a digital port which may be valuable in smaller systems, *though if two digital ports are available it is recommended that they both be used.*

^{*} In this mode, if the PBXLink needs to set and clear message waiting indicators (MWIs) then it will be necessary to use more than one PBXLink in order to have a port to set and clear these. This can be arranged by daisy-chaining the units (see *Chapter 14 -- Advanced Options* for details).

You will need to ensure you have the following items before proceeding:

- ◇ Lucent Definity, System 75 or System 85 PBX or Northern Telecom Meridian One or SL 100 PBX.
- ◇ Voice mail system with Centrex SMDI capability, connected to some number of analog station ports.
- ◇ One or two digital lines from the PBX.
- ◇ Some number of Analog ports from the PBX.

Installation

To install the PBXLink you will need to have access to both the voice mail system and PBX programming terminal. Once you have all these items, follow these steps:

Step 1 - PBXLink Hardware Install

See below for details of how to connect the PBXLink hardware to your voice mail system and PBX.

Step 2 - PBX Programming

After installing the PBXLink it is necessary to set up the PBX for the voice mail system and PBXLink. To do this you will have had to make several design decisions regarding how you are going to configure the system, such as the number of analog ports going into the voice mail system, the extensions they will be assigned, the physical ports they are on in the PBX, how many PBXLink ports you will need, what their extensions will be, and how they are going to service the analog lines (bridged mode vs. transfer mode, etc.). You will need access to a PBX programming terminal for this step. See *Chapter 4 -- Programming Your Lucent PBX* or *Chapter 7 -- Programming Your Nortel PBX* for details.

Step 3 - PBXLink Configuration

You will need to configure the PBXLink in a way which corresponds to the configuration of your PBX and of your voice mail system; some of these will depend on your particular installation. This step is necessary because the PBXLink needs to know certain parameters to provide correct integration, and the PBX and voice mail systems can be configured in many different ways. This step requires configuring the PBXLink either with the LCD and keypad or using a serial terminal connected to the management port. See *Chapter 8 -- Configuring the PBXLink* for details.

Step 4 - Installation Testing

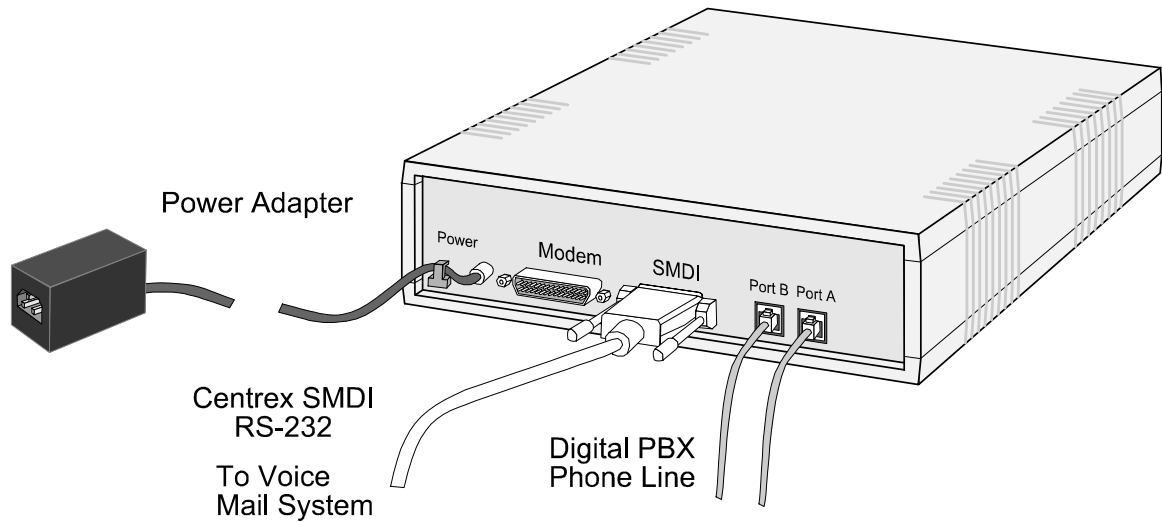
You are recommend to fully test the PBX configuration, PBXLink installation, and PBXLink configuration before you start the voice mail system. See *Chapter 9 -- Testing the PBXLink* for details.

Step 5 - Voice Mail Programming

Gives general hints on how to set up your voice mail system to correctly process the SMDI information sent and received by the PBXLink. You should consult your voice mail manual for details on this. By the end of step 4 you should have a fully integrated voice mail system.

PBXLink Connections

The PBXLink should be connected as in the following diagram:



The table below summarizes these connections:

Connector	Connects to
Port A	Primary PBX digital line
Port B	Secondary PBX digital line (optional)
Management	Connects to Modem or PC (via null modem cable) for remote configuration, diagnostics and firmware upgrades, and acts as an input for additional SMDI devices (optional).
SMDI	Voice Mail SMDI/Centrex port
Power	Supplied AC power supply

Connect the PBXLink as shown in the diagram and table above. Do not power the unit on yet.

PBX Cables

The PBXLink is supplied with two types of cable for connecting the PBXLink to one or two PBX digital lines: two of the cables have RJ11 connectors on the end, and two have RJ45 connectors on the end. You can tell them apart by the size of the connector: the RJ11 connectors are slightly larger than the RJ45 connectors.

If you have a Lucent PBX, use the cables with RJ45 (large) connectors. If you have a Nortel PBX, use the cables with RJ11 (small) connectors.

Serial Cable

For a PC-hosted voice mail system, the RS-232 cable should be a modem (straight through) cable. See *Chapter 16 -- Serial Cable Wiring* for wiring details.

Serial Protocol

The serial port protocol for the SMDI port and the Management port are factory set as follows:

Port	Baud Rate	Data Bits	Parity	Stop Bits	Handshaking
SMDI	1200	7	Even	1	No
Management	9600	8	No	1	No

These parameters may be changed - see the chapter on configuring the PBXLink. The PBXLink does not “auto-sense” the speed of the serial line in the same way that some modems do, so it is very important that the ports are set to the correct speed for the system it is being connected to. Note: If you are using daisy chaining then you must ensure that the management port of the unit attached to the voice mail system has the same parameters as the SMDI port of the unit downstream.

Power On the PBXLink

Insert the low voltage connector into the PBXLink - be sure to push it all the way in - and then feed the cable behind the clip on the back of the unit. This will prevent the power being accidentally pulled out. Use the AC lead supplied to plug the power supply into the AC supply and switch it on. Note that there is no power switch on the PBXLink itself - the unit will turn on as soon as power is applied. If power is being supplied then the green “Power” LED on the front of the unit should be lit and after a few seconds the PBXLink should display a screen such as this:

```
Press HELP for boot options...
```

Do not press the HELP key at this point. After another couple of seconds, the display shows:

```
PBXLink v2.70      OK=select      ↑
Configuration...  ↓
```

Pressing the HELP key during the first screen will enter the “boot loader”, which is only necessary when upgrading the firmware for the unit. In normal use you should not press the HELP key. If you enter the boot loader accidentally simply power the unit off and then on again.

Meaning of LEDs

The PBXLink has four LEDs on the front panel, each of which has a specific meaning depending on whether it is on, off or flashing.

Label	State	Meaning
Power	On	Power on
	Off	Power off
PBX A	On	Digital line A functioning normally
	Off	PBXLink is in boot-loader state
	Slow Flash	Digital line A is active but the PBX has not responded to PBXLink commands
	Fast Flash	No signal has been detected on digital line A
PBX B	On	Digital line B functioning
	Off	Digital line B has been disabled in the PBXLink configuration
	Slow Flash	Digital line B is active but the PBX has not responded to PBX Link commands
	Fast Flash	No signal has been detected on digital line B
V.Mail	Fast Flash	PBXLink is in boot-loader mode OR integration has been stopped in the PBXLink configuration
	Off	PBXLink is ready to perform integration
	Blink	This indicates activity on the SMDI link. It could be SMDI packets to or from the unit.

The Next Step

Having installed the PBXLink hardware, you can now configure the PBX for the PBXLink and voice mail system. This is explained in *Chapter 4 --Programming Your Lucent PBX* and *Chapter 7 -- Programming Your Nortel PBX*.

Chapter 3 Installing Your PBXLink ISA

Overview

This chapter gives an overview of the steps necessary for a successful PBXLink ISA installation. If you have a PBXLink (external box), see *Chapter 2 -- Installing Your PBXLink* instead.

There is some amount of information you need to determine before you get started.

Packing List

You should have received the following items:

1. PBXLink ISA card
2. This manual
3. A RJ11 cable for connecting the PBXLink to a Lucent digital PBX port
4. A RJ45 cable for connecting the PBXLink to a Nortel digital PBX port
5. A registration card

Please fill in and return the registration card now.

You will need to ensure you have the following items before proceeding:

- ◇ Lucent Definity, System 75 or System 85 PBX or Northern Telecom Meridian one or SL 100 PBX.
- ◇ PC based Voice mail system with Centrex SMDI capability, connected to some analog station ports.
- ◇ A digital line from the PBX.
- ◇ Some number of Analog ports from the PBX.

Number of Ports

The maximum number of analog voice mail ports supported by your PBXLink ISA varies depending on the type of PBXLink ISA purchased; for example some PBXLink ISAs support a maximum of 4 ports and others support a maximum of 16 ports. If you need to upgrade your PBXLink ISA to support a larger number of ports, please contact CTL.

Installation

To install the PBXLink ISA you will need to have access to both the voice mail system and PBX programming terminal. Once you have all these items, follow these steps:

Step 1 - PBXLink ISA Hardware Install

This chapter explains how to install the PBXLink ISA card into your PC based voice mail system and how to connect it to the PBX.

Step 2 - PBX Programming

Follow the instructions to set up the PBX for integration using the PBXLink ISA. To do this you will have had to make several design decisions regarding how you are going to configure the system, such as the number of analog ports going into the voice mail system, the extensions they will be assigned, the physical ports they are on in the PBX, what the extension of the digital port will be, and how it is going to service the analog lines (bridged mode vs. transfer mode, etc.). You will need access to a PBX programming terminal for this step.

Step 3 - PBXLink ISA Configuration

You will need to configure the PBXLink ISA in a way which corresponds to the configuration of your PBX and of your voice mail system; some of these will depend on your particular installation. This step is necessary because the PBXLink ISA needs to know certain parameters to provide correct integration, and the PBX and voice mail systems can be configured in many different ways. This step requires configuring the PBXLink ISA either with a terminal program through the built in SMDI port, or using an external terminal, connected with a NULL modem cable to the management port. See *Chapter 8 -- Configuring the PBXLink* for details.

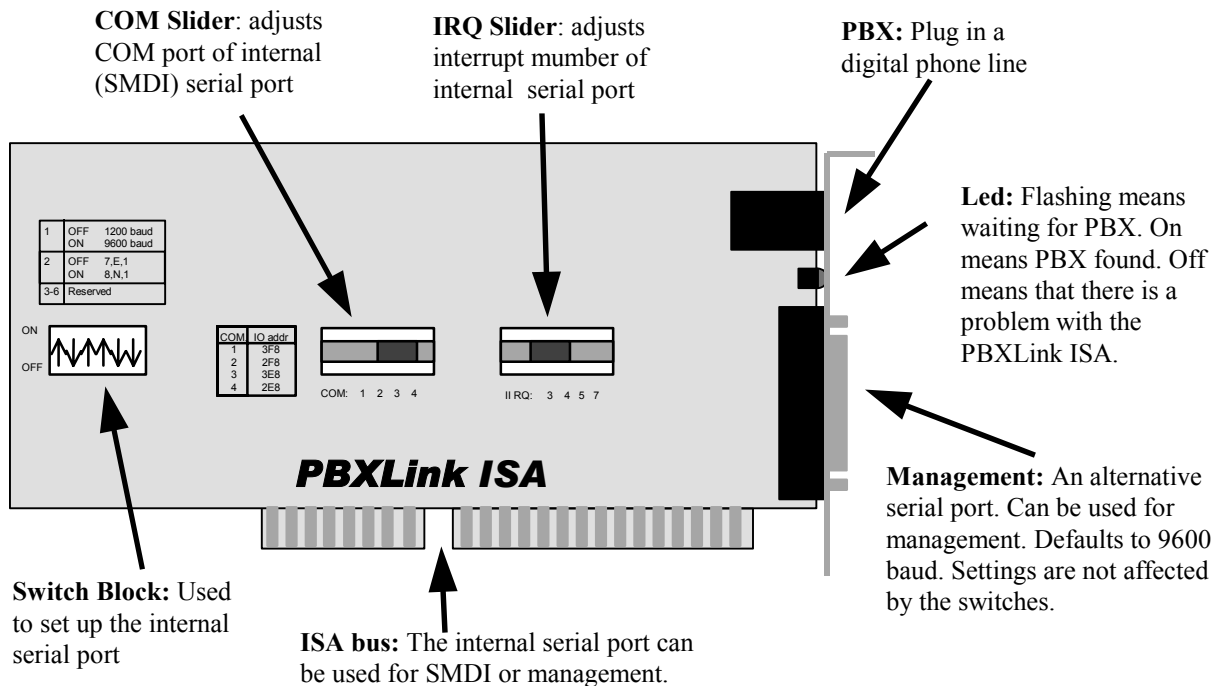
Step 4 - Installation Testing

You are recommend to fully test the PBX configuration, PBXLink installation, and PBXLink configuration before you start the voice mail system. See *Chapter 9 -- Testing the PBXLink* for details.

Step 5 - Voice Mail Programming

Gives general hints on how to set up your voice mail system to correctly process the SMDI information sent and received by the PBXLink ISA . You should consult your voice mail manual for details on this. By the end of step 4 you should have a fully integrated voice mail system.

Identifying the Parts



PBX Cables

The PBXLink ISA is supplied with two types of cable for connecting the PBXLink ISA to a PBX digital line: one of the cables has RJ11 connectors on the end, and one has RJ45 connectors on the end. You can tell them apart by the size of the connector: the RJ11 connectors are slightly larger than the RJ45 connectors.

If you have a Lucent PBX, use the cable with RJ45 (large) connectors. If you have a Nortel PBX, use the cable with RJ11 (small) connectors.

One end of the cable is fitted with a “ferrite” in a small plastic box. This end of the cable should be plugged into the PBXLink ISA

Serial Protocol

The serial port protocol for the SMDI port and the Management port are factory set as follows:

Port	Baud Rate	Data Bits	Parity	Stop Bits	Handshaking
SMDI	1200	7	Even	1	No
Management	9600	8	No	1	No

These parameters may be changed - see the chapter on configuring the PBXLink ISA. The PBXLink does not “auto-sense” the speed of the serial line in the same way that some modems do, so it is very important that the ports are set to the correct speed for the system using them.

Meaning of LED

The PBXLink ISA has an LED on the back plate of the card which is visible when the unit is installed in a PC. The LED has the following meaning.

State	Meaning
On	Digital line functioning normally
On, blipping off briefly every two seconds	Digital line functioning correctly, but integration disabled through the menus (see below)
Off	PBXLink ISA is in boot-loader state or is not functioning correctly
Slow Flash	Digital line is active but the PBX has not responded to PBXLink ISA commands
Fast Flash	No signal has been detected on digital line

Hardware Installation

To install the PBXLink ISA the following steps should be followed.

- a. Ensure that there is space for a COM port in the computer receiving the PBXLink ISA. This process is very similar to that of installing an internal modem. If you are unsure of how to do this see the section called Selecting a COM Port.
- b. Set the switches on the PBXLink ISA, and write down the values selected. The PBXLink ISA board is clearly marked with the various switch settings. The parameters that need to be selected are
 1. COM port for SMDI (COM Slider)
 2. Interrupt for SMDI COM port. (IRQ slider)
 3. Speed for SMDI serial port. The default is 1200. (9600 when switch 1 is ON)
 4. Parity for SMDI serial port. The default is E-7-1. (N-8-1 when switch 2 is ON)
 5. All other switches need to be in the OFF position.
- c. Shut down the computer and unplug it from its power source.
- d. Select an empty ISA slot in the computer, remove the blanking plate and insert the PBXLink ISA card fully into the slot. Always re-attach the screw holding PC cards into the computer.
- e. Replace all covers before powering up the computer.
- f. When the computer is running again run a terminal application to test the COM port settings and to configure the card. You should configure the card BEFORE you plug in a PBX phone cable. At this stage the LED on the back of the card should be on or flashing; if it is not, the card is not functioning and is either not plugged into its ISA slot or is faulty. If this occurs ensure that switches 3-6 are off.
- g. To test and configure the PBXLink ISA the following steps should be followed.

- h. Run a suitable terminal emulation program. In windows, **terminal.exe** or **hyperterminal** is good for this. Select the COM port, speed and parity setting matching what was selected when installing the card. If there is no such software available, for example on a proprietary system, then exactly the same procedure as described here can be carried out using the external management port. This requires a NUL modem cable to connect to a PC or terminal. The default parameters are 9600 baud, n-8-1.
- i. In the terminal window type M followed by Enter. This will stop the SMDI port from sending SMDI and will put the SMDI port into management mode. At this point you should see a some text similar to

PBXLink ISA v 2.70

- 1. Configuration...**
- 2. Monitor PBXLink...**
- 3. Reboot/Download...**

- j. At this point you can be sure the COM port is correctly configured and you can follow configuration instructions. The Configuration menus are the same whether being accessed through the internal SMDI port or through the external management port.
- k. NOTE. The SMDI port will not send any SMDI while it is in management mode. To return to SMDI mode continue to press **Esc** until menus all the menus have been exited. The screen will display a message similar to

Type M <ENTER> to return to menu

- l. At this point the port will continue to send SMDI as expected.

Selecting a COM port.

- a. Computers can support up to 4 standard COM ports (com1..com4).
- b. Most computers come with 2 COM ports built in, com1 and com2. If you don't need them both (some computers need 1 for a mouse and 1 for a modem), disable one and set the PBXLink ISA to the same settings. The COM port on the PBXLink ISA is setup using the slider marked Y. On most computers COM ports are disabled in the BIOS setup program.
- c. Each active COM port requires its own interrupt. By default com1 and com3 use interrupt 4; com2 and com4 use interrupt 3. Select an interrupt for the COM port on the PBXLink ISA using the slider Y.
- d. If your computer is to have more than 2 COM ports (e.g. by adding the PBXLink ISA) then one or more COM ports need to be set to a different interrupt. This can be done on the PBXLink ISA using slider Y. On most computers the interrupt for the built in COM ports can be selected using the BIOS setup procedure. Do *not* attempt to share an interrupt between two COM ports or other devices.
- e. If any COM port is set to a different interrupt then the operating system or software needs to be informed of this. In Windows this is done in the Control Panel, in the Advanced section of the Ports application. This varies with different operating systems.

The Next Step

Having installed the PBXLink ISA hardware, you can now configure the PBX for the PBXLink and voice mail system. This is explained in *Chapter 4 -- Programming Your Lucent PBX* and *Chapter 7 -- Programming Your Nortel PBX*.

Chapter 4 Programming Your Lucent PBX

This chapter describes the decisions that you must make before starting to program your Lucent PBX. If you have a Nortel PBX, see *Chapter 6 -- Programming Your Nortel PBX* instead.

There are three questions that must be answered at this stage:

A. Is the digital phone line connected to the PBXLink 2-wire or 4-wire?

If you have a System 75 PBX, then the answer is **4-wire**.

If you have a Definity G3 or ProLogix, then it can be determined by studying the line card being used for the PBXLink digital phone line. Line card type TN754 (and TN754B) supports **4-wire** and type TN2181 supports **2-wire**.

Use the answer to this question to correctly program the PBXLink parameter
Configuration... / Select PBX Type

B. Is the PBXLink going to use bridged mode or transfer mode?

If you have a System 75 PBX, then you must use transfer mode.

If you have a Definity G3 or ProLogix, then we recommend that you use bridged mode if:

your voice mail system has 4 ports or less; **or**
your voice mail system has 8 ports or less and has V5 software or later; **or**
your PBX supports Vectoring

otherwise you should use transfer mode

Use the answer to this question to correctly program the PBXLink parameter
Configuration... / PBX Options ... / Mode of Operation

C. What phone type should be programmed on the digital phone line connected to the PBXLink?

If you have a System 75 PBX, or you are using transfer mode (see above), then the answer is **7405D**.

If you have a Definity G3 or ProLogix and you are using bridged mode, then you should program the digital phone line as a **8434D** if your PBX software allows this, or a **7434D** otherwise.

Use the answer to this question to correctly program the PBXLink parameter
Configuration... / PBX Options ... / Phone Set

When you have made your choice of mode, please turn to the relevant chapter – Chapter 5 -- Lucent PBX: Using Transfer Mode or Chapter 6 -- Lucent PBX: Using Bridged Mode.

Chapter 5 Lucent PBX: Using Transfer Mode

This section explains how your Lucent PBX needs to be configured in order to use Transfer mode.

For the purposes of this chapter we will use the following conventions in the examples:

- The main voice mail number will be **2000**
- The additional extensions needed for voice mail analog lines will be **2001, 2002, 2003** and so on.
- Any additional digital extensions needed will be **2998** and **2999**.
- Information that needs to be entered during PBX programming will be in **bold**.

This chapter applies to both the PBXLink and the PBXLink ISA. For simplicity they will both be referred to as the PBXLink.

The work involved can be broken down into a number of separate tasks:

- Task 1: Setting up the Voice Mail analog lines
- Task 2: Setting up the PBXLink's digital line
- Task 3: Setting up the coverage path
- Task 4: Setting up the Voice Mail users' telephones

These tasks are covered in the sections below:

After configuring the PBX, you will need to configure the PBXLink. See *Chapter 8 -- Configuring the PBXLink* for details.

Note: Your PBX configuration screens may not be exactly the same as those shown in this chapter, as they vary from one version of PBX software to another

Task 1: Setting up the Voice Mail analog lines

Analog lines need to be used to connect the voice mail system to the PBX. At this stage it is important to know how many there will be and the physical ports they occupy in the PBX. The analog ports are added using the command **add station 2001**; this produces the screen below.

```

                                                    Page 1 of 1
                                STATION
Extension: 2001
  Type: 2500                Lock Messages? n      COR:  ___
  Port: 1A0201             Security Code:      COS:  ___
  Name: VM Analog          Coverage Path:      Tests? n

FEATURE OPTIONS
  LWC Reception? n        Coverage Msg Retrieval Permission? n
  LWC Activation? n      Data Restriction? y
  Redirect Notification? n  Call Waiting Indication? n
  Off Premise Station? n  Distinctive Audible Alert? n
                           Message Waiting Indicator? n

ABBREVIATED DIALING
  List1: _____      List2: _____      List3: _____

HOT LINE DESTINATION
  Abbreviated Dialing List Number (From above 1, 2 or 3):
  Dial Code:

```

When completed press the soft key for **Enter**.
This process needs to be repeated for each analog line.

Task 2: Setting up the PBXLink's digital line

Configure the PBXLink's digital line as follows.

At this point you will need to know all the extensions of the analog lines connected to the voice mail system. Use the command **add station 2000** to obtain the screen below.

```

                                                    Page 1 of 4
                                STATION
Extension: 2000
  Type: 7405D                Lock Messages? n      COR:  ___
  Port: 1a0301             Security Code:      COS:  ___
  Name: Voice Mail          Coverage Path:  ___

FEATURE OPTIONS
  LWC Reception? n        Coverage Msg Retrieval? n
  LWC Activation? y      Auto Answer? n
  Redirect Notification? n  Data Restriction? y
  Bridged Call Alerting? n  Idle Appearance Preference? n
                           Restrict Last Appearance? y
  Data Module? n          Coverage Module? n
  Display Module? y

```

Use the **PageDown** soft key to go to the next screen.

```

                                                    Page 2 of 4
                                STATION
NON-SWITCH DATA
  Room:                    Headset: n
  Jack:
  Cable:

```

```

ABBREVIATED DIALING
  List1: _____      List2: _____      List3: _____

BUTTON ASSIGNMENTS
  1: call-appr          6: call-appr
  2: call-appr          7: call-appr
  3: call-appr          8: call-appr
  4: call-appr          9: call-appr
  5: call-appr         10: call-appr
    
```

Use the **PageDown** soft key to go to the next screen.

```

                                                    Page 3 of 4
                        STATION

FEATURE BUTTON ASSIGNMENTS

  1: busy-ind   TAC/Ext: 2001   13:
  2: busy-ind   TAC/Ext: 2002   14:
  3: busy-ind   TAC/Ext: 2003   15:
  4: busy-ind   TAC/Ext: 2004   16:
  5: busy-ind   TAC/Ext: 2005   17:
  6: busy-ind   TAC/Ext: 2006   18:
  7:                                     19:
  8:                                     20:
  9:                                     21:
 10:                                     22:
 11:                                     23:
 12:                                     24:
    
```

Add a “busy-ind” key for each analog voice mail port which will be serviced by this digital line. Use the soft key marked **PageDown** to go to the next screen. The order of the lines here should correspond with the order that they are used in the voice mail system; key 11 is the first LTN offered by the PBXLink. If The PBXLink is being used in a mode where Port A is being used only for MWIs then it is not necessary to program anything on keys 1 through 24 for port A.

```

                                                    Page 4 of 4
                        STATION

DISPLAY BUTTON ASSIGNMENTS

  1: normal
  2:
  3:
  4:
  5:
  6:
  7:
    
```

Use the **Enter** soft key when complete.

Task 3: Setting up the coverage path

Before adding users, you must provide a path to voice mail for unanswered calls. This is done using coverage paths. A coverage path is the place that the PBX sends a call which has not been answered, depending on whether the line was busy, the user did not answer, etc. The PBX can have multiple coverage paths, but a single path can often be provided for all users. To create a coverage path type **add coverage path 1**

COVERAGE PATH				Page 1 of 1
Coverage Path Number: 1				
Next Path Number:				
COVERAGE CRITERIA				
Station/Group	Status	Inside Call	Outside Call	
Active?		n	n	
Busy?		y	y	
Don't Answer?		y	y	Number of Rings: 3
All?		n	n	
COVERAGE POINTS				
	Point1:	2000	Point3:	
	Point2:			

Use the **Enter** soft key when complete.

Task 4: Setting up the Voice Mail users' telephones

Once the above tasks have been completed it is necessary to set up the users' direct lines on the system. There are two parts to this: the administration of the names, and the set up of coverage paths for the users. The PBXLink uses the name field programmed for a user's line to identify the extension of the user. Users must have their extension number appear in the first 16 characters of the name field, for example:

W. MacDonald 2631
Smith, John 1988
8142: Jim Brown
John Gump 2454

To modify the setup for a user so they can use voice mail use the command **change station 2454**, which will give a screen similar to the following. The fields of interest are **Name** and **Coverage Path**.

This is how a subscribers set up would look like for a user on coverage path 1.

```

                                                    Page 1 of 1
                                STATION
Extension: 2454
Type: 2500                Lock Messages? n        COR: __
Port: 1A0206             Security Code:      COS: __
Name: John Gump 2454    Coverage Path: 1    Tests? y

FEATURE OPTIONS
    LWC Reception? msa-spe Coverage Msg Retrieval Permission? n
    LWC Activation? n        Data Restriction? n
Redirect Notification? n        Call Waiting Indication? n
Off Premise Station? n        Distinctive Audible Alert? n
                                Message Waiting Indicator? y

ABBREVIATED DIALING
List1: _____          List2: _____          List3: _____

HOT LINE DESTINATION
Abbreviated Dialing List Number (From above 1, 2 or 3):
Dial Code:
    
```

Notes on Using Both Digital Ports

Note that this section does not apply to the PBXLink ISA.

If port A and port B are both to be used for processing calls then the digital line for port B must be programmed in a very similar way to Port A. A new extension needs to be defined; in this example it will be 2999. The easiest way to set this up is to define the other digital ports on the coverage path. If more than three digital ports are required (i.e. more than two PBXLinks are servicing calls) then it would be necessary to use the Next Path Number to specify additional digital ports to handle the calls. The diagram below shows a coverage path with two digital ports for handling calls.

```

                                                    Page 1 of 1
                                COVERAGE PATH
                                Coverage Path Number: 1
                                Next Path Number:
COVERAGE CRITERIA
Station/Group Status  Inside Call  Outside Call
    Active?            n            n
    Busy?              Y            Y
    Don't Answer?     Y            Y        Number of Rings: 3
    All?               n            n
COVERAGE POINTS
    Point1: 2000
    Point2: 2999
    Point3:
    
```

The most efficient configuration would be to have the analog ports equally spaced among all the PBXLink ports which are processing calls and for calls to be to arrive at each PBXLink digital port in a circular manner. This keeps the load evenly distributed among the PBXLink ports. This can be done by building a hunt group consisting of the PBXLink digital ports only. A extension can be given to the hunt group; this will be the voice mail access number. In the coverage path being built for voice mail insert **hx** as the Point1: entry, where **x** is the hunt group number. For this to operate correctly is necessary to enable the system wide feature **Multiple Call Handling**. See your Lucent manual on how to do this.

The Next Step

Having configured the PBX, you now need to configure the PBXLink. This is explained in *Chapter 8 -- Configuring the PBXLink*.

Chapter 6 Lucent PBX: Using Bridged Mode

This section explains how your Lucent PBX needs to be configured in order to use Bridged mode.

For the purposes of this chapter we will use the following conventions in the examples:

- The main voice mail number will be **2000**
- The additional extensions needed for voice mail analog lines will be **2001, 2002, 2003** and so on.
- Any additional digital extensions needed will be **2998** and **2999**.
- Information that needs to be entered during PBX programming will be in **bold**.

This chapter applies to both the PBXLink and the PBXLink ISA, for simplicity they will both be referred to as the PBXLink.

The work involved can be broken down into a number of separate tasks:

- Task 1: Setting up the Voice Mail analog lines
- Task 2: Setting up the PBXLink's digital line
- Task 3: Setting up the coverage path
- Task 4: Setting up the Voice Mail users' telephones

These tasks are covered in the sections below:

After configuring the PBX, you will need to configure the PBXLink. See *Chapter 8 --Configuring the PBXLink* for details.

Note: Your PBX configuration screens may not be exactly the same as those shown in this chapter, as they vary from one version of PBX software to another

Task 1: Setting up the Voice Mail analog lines

Analog lines need to be used to connect the voice mail system to the PBX. At this stage it is important to know how many there will be and the physical ports they occupy in the PBX. The analog ports are added using the command **add station 2000**; this produces the screen below.

```

                                                    Page 1 of 1
                                STATION
Extension: 2000
  Type: 2500                Lock Messages? n      COR: ___
  Port: 1A0201             Security Code:        COS: ___
  Name: VoiceMail 2000     Coverage Path: 2     Tests? n

FEATURE OPTIONS
  LWC Reception? n        Coverage Msg Retrieval Permission? n
  LWC Activation? n      Data Restriction? y
  Redirect Notification? n  Call Waiting Indication? n
  Off Premise Station? n  Distinctive Audible Alert? n
                           Message Waiting Indicator? n

ABBREVIATED DIALING
  List1: _____      List2: _____      List3: _____

HOT LINE DESTINATION
  Abbreviated Dialing List Number (From above 1, 2 or 3):
  Dial Code:

```

If you use a different name than that shown here, make sure the prime number (2000 in this example) appears within the first 16 characters of the name.

When completed press the soft key for **Enter**.

This process needs to be repeated for each analog line.

Task 2: Setting up the PBXLink's digital line

Configure the PBXLink's station as follows for using a Lucent system in bridged mode. Note that if you are using older software on your Lucent system you should use phone type **7434D** instead of **8434D**. To start we need to define the station which the PBXLink will be attached to. This is done using the command **add station 2999**. At this stage it is necessary to know the physical port the device will be attached to.

```

                                                    Page 1 of 4
                                STATION
Extension: 2999
  Type: 8434D                Lock Messages? n      COR: ___
  Port: 1a0301             Security Code:        COS: ___
  Name: VM Digital         Coverage Path: ___

FEATURE OPTIONS
  LWC Reception? n        Coverage Msg Retrieval? n
  LWC Activation? y      Auto Answer? n
  Redirect Notification? n  Data Restriction? y
  Bridged Call Alerting? n  Idle Appearance Preference? n
                           Restrict Last Appearance? y
  Data Module? n
  Display Module? y      Coverage Module? n

```

Use the **PageDown** soft key to go to the next screen.

STATION		Page 2 of 4
NON-SWITCH DATA		
Room:		Headset: n
Jack:		
Cable:		
ABBREVIATED DIALING		
List1: _____	List2: _____	List3: _____
BUTTON ASSIGNMENTS		
1: call-appr		6:
2: call-appr		7:
3: call-appr		8:
4: normal		9:
5: inspect		10: call-appr

Note: The normal key above is only used if the set being programmed is being set up as a **7434D** or **7405D**; it should be left blank if the line is being configured as a **8434D** set. The next page can be reached by pressing the soft key for **PageDown**. On this screen the analog lines are made to appear as indicators on the PBXLink line.

STATION		Page 3 of 4
FEATURE BUTTON ASSIGNMENTS		
11: abrdg-appr	Extn: 2000	23:
12: abrdg-appr	Extn: 2001	24:
13: abrdg-appr	Extn: 2002	25:
14: abrdg-appr	Extn: 2003	26:
15: abrdg-appr	Extn: 2004	27:
16: abrdg-appr	Extn: 2005	28:
17:		29:
18:		30:
19:		31:
20:		32:
21:		33:
22:		34:

NOTE: if you set the phoneType field above to **7405D**, the keys on this screen will be numbered 1 to 24 instead of 11 to 34 as shown here. In this case, program the **abrdg-appr**s onto keys 1 onwards instead of 11 onwards.

When completed press the soft key for **Enter**.

Task 3: Setting up the coverage path

Before adding users, you must provide a path to voice mail for unanswered calls. This is done using coverage paths. In bridged mode there are a number of options for how to set this up.

1. A simple method which works for systems with 4 or less voice mail ports.
2. A method which works for systems with 4 or less voice mail ports **and V5 software** (or later).
3. A general method which requires that vectoring is enabled on your system.

Note: Do not use a hunt-group for sending the calls to the analog lines.

Remember to put the extension in the name of the first analog line (pilot line) and to set it in the PBXLink configuration.

Small Systems (1-4 ports)

A coverage path is the place that the PBX sends a call which has not been answered, depending on whether the line was busy, the user did not answer, etc. The PBX can have multiple coverage paths, but a single path can often be used for all users. In the small system setup we define a single coverage path with three coverage points. Each coverage point is one of the analog lines of the voice mail system. In this example the PBX has 3 coverage points, the fourth analog line is used as the pilot number for the voice mail system, i.e. the number called when users want to pick up messages. We are setting up line **2000** to be the pilot number of the voice mail system and lines **2001** → **2003**, to be the lines used for leaving messages.

To create a coverage path type **add coverage path 1**.

```

                                                    Page 1 of 1
                                COVERAGE PATH
                                Coverage Path Number: 1
                                Next Path Number:
COVERAGE CRITERIA
    Station/Group Status  Inside Call  Outside Call
                                Active?           n           n
                                Busy?             y           y
    Don't Answer?         y           y           Number of Rings: 3
                                All?             n           n
COVERAGE POINTS
                                Point1: 2001
                                Point2: 2002
                                Point3: 2003

```

In this example we set up coverage path 1 to be used to get to three of the voice mail ports, this is the coverage path which is assigned to the users. An additional coverage path is required for the pilot line. Its coverage path would look like this

```

                                                    Page 1 of 1
                                COVERAGE PATH

                                Coverage Path Number: 2
                                Next Path Number:

COVERAGE CRITERIA

  Station/Group Status  Inside Call  Outside Call

      Active?           n             n
      Busy?             Y             Y
  Don't Answer?       n             n      Number of Rings: 3
      All?             n             n

COVERAGE POINTS
      Point1: 2001
      Point2: 2002
      Point3:

```

In this configuration, there is always one line reserved for users to pick up messages (2000) and there is always one line reserved for callers to leave messages (2003). There are two lines (2001 and 2002) which are shared for callers leaving messages and for users picking up messages. At no time can more than three callers leave messages and at no time can more than three callers pick up messages. This usually works well, if you have a call pattern where this is not satisfactory then you will need to use the configuration for large systems.

Small Systems (5-8 ports) which have V5 software (or later)

This setup is very similar to the one above, except that it uses the feature of the V5 software which provides for 6 coverage points within a single coverage path.

We are setting up line **2000** to be the pilot number of the voice mail system and lines **2001 → 2006**, to be the lines used for leaving messages.

To create a coverage path for the users type **add coverage path 1**.

```

                                                    Page 1 of 1
                                COVERAGE PATH

                                Coverage Path Number: 1
                                Next Path Number:

COVERAGE CRITERIA

  Station/Group Status  Inside Call  Outside Call

      Active?           n             n
      Busy?             Y             Y
  Don't Answer?       Y             Y      Number of Rings: 3
      All?             n             n

COVERAGE POINTS
      Point1: 2001
      Point2: 2002
      Point3: 2003
      Point4: 2004
      Point5: 2005
      Point6: 2006

```

To create a coverage path for the pilot number type **add coverage path 2**.

```

                                                    Page 1 of 1
                                COVERAGE PATH
                                Coverage Path Number: 2
                                Next Path Number:
COVERAGE CRITERIA
    Station/Group Status  Inside Call  Outside Call
        Active?           n           n
        Busy?             y           y
    Don't Answer?        n           n      Number of Rings: 3
        All?              n           n
COVERAGE POINTS
    Point1: 2007           Point4: 2004
    Point2: 2006           Point5: 2003
    Point3: 2005           Point6: 2002
    
```

Note that in this configuration, lines **2000** and **2007** can only be used for users picking up messages and line **2001** can only be used for people leaving messages. Lines **2002-2006** can only be used for either direct calls or for messages. If it is necessary to use all 8 analog lines for calls to users, then a second coverage path can be created and linked to the first. Then the first path can handle inside calls (say) to lines **2000 → 2005** and the second path can handle outside calls to lines **2002 → 2007**.

Larger Systems which have V5 software (or later)

The above method can be used to create larger systems. For example a 12 port system could use a different coverage path for internal calls, external calls, calls forwarded on busy and calls forwarded on no answer. Using 4 linked coverage paths in this way a the analog lines can be better utilized without the need for vectoring. It still limits 6 callers for any given reason, but with a PBX receiving general use this would work well.

Extension	Path 2 for the Pilot Number	Path 1. Internal No Answer	Path 3 External No Answer	Path 4 Busy
2000 (pilot)				
2001	X			X
2002	X			X
2003	X	X		X
2004	X	X		
2005	X	X		
2006	X	X	X	
2007		X	X	
2008		X	X	
2009			X	X
2010			X	X
2011			X	X

Large Systems

In this example we have set up a coverage path for six voice mail ports. In order to route calls to a larger set of analog ports it necessary to use a call vector. To set up a call vector use the command **add vdn 2000**. This adds a Vector Directory Number of 2000, which will be our voice mail pilot number. The VDN screen looks like this:

```

Page 1 of 1
VECTOR DIRECTORY NUMBER

Extension: 2000
Name: VoiceMail 2000
Display Override? n
COR: 1
Vector Number: 1

Measured: none

```

The Vector Number entered on the above screen should be a vector which has been assigned for the voice mail system. Use the command **add vector 1** or **change vector 1** to define a suitable vector. For example a vector for a six line system may look like this:

```

Page 1 of 1
CALL VECTOR

Number: 1 Name voicevec
ASAI Routing? n Basic? y Prompting? n

01 wait time 0 secs hearing ringback
02 route to number 2001 if unconditionally
03 route to number 2002 if unconditionally
04 route to number 2003 if unconditionally
05 route to number 2004 if unconditionally
06 route to number 2005 if unconditionally
07 route to number 2006 if unconditionally
08 busy
09
10
11
12
13

```

The first step in the vector takes up no extra time and it allows the callers to hear a ringback tone while the PBX is working down the list of vectors. This prevents users from feeling that their call is lost. The final step in the process is “busy”; this means that if all the voice mail ports are in use then the caller will hear a busy tone. The alternative would be to add an extra call to route the calls to an operator.

Very Large Systems

The following example considers how to set up a system which has 20 voice mail ports, and they are being serviced by two PBXLink digital ports. The voice mail ports are in 2 groups of 10. The first group is from 2001 to 2010 and these will be bridged to Port A of the PBXLink. The second group are from 3001 to 3010 and will be bridged to Port B of the PBXLink. We are going to set up the vector so that calls will alternate between Port A and Port B as they arrive at the voice mail system. We will also need to link two vectors together since there are more than 13 analog ports. The setup would look like follows:

```

Page 1 of 1

                                CALL VECTOR

Number: 1                        Name voicevec1
ASAI Routing? n                 Basic? y           Prompting? n

01 wait           time 0     secs hearing ringback
02 route          to number 2001         if unconditionally
03 route          to number 3001         if unconditionally
04 route          to number 2002         if unconditionally
05 route          to number 3002         if unconditionally
06 route          to number 2003         if unconditionally
07 route          to number 3003         if unconditionally
08 route          to number 2004         if unconditionally
09 route          to number 3004         if unconditionally
10 route          to number 2005         if unconditionally
11 route          to number 3005         if unconditionally
12 route          to number 2006         if unconditionally
13 goto           vector 2  if unconditionally

```

```

Page 1 of 1

                                CALL VECTOR

Number: 2                        Name voicevec2
ASAI Routing? n                 Basic? y           Prompting? n

01 route          to number 3006         if unconditionally
02 route          to number 2007         if unconditionally
03 route          to number 3007         if unconditionally
04 route          to number 2008         if unconditionally
05 route          to number 3008         if unconditionally
06 route          to number 2009         if unconditionally
07 route          to number 3009         if unconditionally
08 route          to number 2010         if unconditionally
09 route          to number 3010         if unconditionally
10 busy
11
12
13

```

Task 4: Setting up the Voice Mail users' telephones

Once the above tasks have been completed it is necessary to set up the users' direct lines on the system. There are two parts to this: the administration of the names, and the set up of coverage paths for the users. The PBXLink uses the name field programmed for a user's line to identify the extension of the user. Users must have their extension number appear in the first 16 characters of the name field, for example:

```
W. MacDonald 2631
Smith, John 1988
8142: Jim Brown
John Gump 2454
```

To modify the setup for a user so they can use voice mail use the command **change station 2454**, which will give a screen similar to the following. The fields of interest are **Name** and **Coverage Path**.

This is how a subscribers set up would look like for a user on coverage path 1.

STATION			Page 1 of 1
Extension:	2454		
Type:	2500	Lock Messages? n	COR: __
Port:	1A0206	Security Code:	COS: __
Name:	John Gump 2454	Coverage Path: 1	Tests? y
FEATURE OPTIONS			
LWC Reception?	msa-spe	Coverage Msg Retrieval Permission?	n
LWC Activation?	n	Data Restriction?	n
Redirect Notification?	n	Call Waiting Indication?	n
Off Premise Station?	n	Distinctive Audible Alert?	n
		Message Waiting Indicator?	y
ABBREVIATED DIALING			
List1:	_____	List2:	_____
		List3:	_____
HOT LINE DESTINATION			
	Abbreviated Dialing List Number (From above 1, 2 or 3):		
	Dial Code:		

Notes on Using Both Digital Ports

Note that this section does not apply to the PBXLink ISA.

If port A and port B are both to be used for processing calls then the digital line for port B must be programmed in a very similar way to Port A. It is important that none of the analog lines which appear bridged onto port A are also bridged onto port B. A new digital extension needs to be defined; in this example it will be **2998**. It is recommended that the system is set up with an equal number of ports being serviced by port A and port B. It is also recommended that the call vector is set up in a way which allows calls to be handled by alternate ports as they arrive.

The Next Step

Having configured the PBX, you now need to configure the PBXLink. This is explained in *Chapter 8 -- Configuring the PBXLink*.

Chapter 7 Programming Your Nortel PBX

This chapter describes how to configure a Northern Telecom Meridian 1 PBX for the PBXLink. If you have a Lucent PBX, see *Chapter 1 -- Programming Your Lucent PBX* instead.

to integrate a voice mail system with the Meridian 1. It is necessary to ensure that your PBX has the correct level of software to operate with the PBXLink. These are outlined below. All Meridian 1 systems with these options can support Bridged mode operation so there is no need for transfer mode on Meridian 1.

Throughout this chapter the convention will be used that **bold** type are things that need to be entered. For example:

CUST	0	[Example only]
------	----------	----------------

CUST	- this is printed by the PBX
0	- this is entered by you
[Example only]	- this is just a comment

In our examples the analog lines for the voice mail system will be **2000, 2001, 2002** etc. The main voice mail number (or “pilot number”) will be **2000**.

The work involved can be broken down into a number of separate tasks:

- Task 1: Preparing the PBX
- Task 2: Setting up the Voice Mail analog lines
- Task 3: Setting up the PBXLink’s digital line
- Task 4: Setting up the Voice Mail users’ telephones

These tasks are covered in the sections below:

After configuring the PBX, you will need to configure the PBXLink. See *Chapter 8 -- Configuring the PBXLink* for details.

<i>Note: Your PBX configuration options may not be exactly the same as those shown in this chapter, as they depend on installed options and the PBX software version</i>
--

Task 1: Preparing the PBX

Before starting any programming of the PBX, it is strongly recommended that you obtain a hard copy of the current PBX configuration.

This task consists of three parts:

- PBX Software Confirmation
Checking that the PBX is running the right software
- Customer Data Block setup
Ensuring that the Customer Data Block has the correct privileges
- Programming Calling Party Name Display
Ensuring that the reason for a call being forwarded is sent to the PBXLink

PBX Software Confirmation

It is necessary to ensure that the correct software packages have been installed, for the PBXLink to operate correctly. To ensure this use overlay 22 as follows

```
>LD 22
REQ  PRT
TYPE PKG
OPTF  1
CUST  2
CTY   5
DNNDI 9
EES  10
MSB  17
DDSP 19
MWC  46
DSET 88
CPND 95
ARIE 170
```

If the options underlined above are not present in the list of optional packages then you will need to upgrade the PBX software.

Customer Data Block Setup

It is necessary to enable certain options in the Customer Data Block to ensure correct operation of the digital line used by the PBXLink.

>LD 15		
REQ	CHG	
TYPE	CDB	
CUST	0	[Example only]
LDNO		
DGRP		
NITE	2000	[The pilot number if night calls go to Voice Mail]
TSTL		
SPRE		
ATDN		
NCOS		
OPT	CFO	[Call forwarding Originating Party COS]
	MCI	[Message Centre Included]
	IDP	[Include Digit Display]
INTR		
RTIM		
CDR		
ICI		
FLSH		
CHLN		
FCAF		
SPWD		
FNAD	FDN	[Call Forward No Answer DID]
FNAN	FDN	[Call Forward No Answer NONDID]
FNAT	FDN	[Call Forward No Answer Trunk]
FNAL	FDN	[Call Forward No Answer Local]
CFNA	6	[Rings for Call Forward No Answer NONDID]
DFNA	6	[Rings for Call Forward No Answer DID]
PHDT		
AQTT		
AODN	2000	[Attendant overflow sent to Voice Mail]
SRCD		
ATAC		
CWCL		
CWTM		
CWBZ		
DNDT		
CCRS		
MDID	YES	[No Answer DID to Voice Mail]
NDID	YES	[No Answer NONDID to Voice Mail]
MWFB	YES	[Busy DID to Voice Mail]
MATT		
CONG		
LLT		
DLT		
DIND		

DIDT		
LDTT	6	[Line Disconnect Tone Timer for 500/255 phones]
BOTO		
NFCR		
EEST	NO	[Enable End-to-End signaling for digital phones]

Programming Call Party Name Display

When the PBX forwards a call, it displays a 4 letter string on the display which explains why the call was forwarded. These 4 letter strings can be changed by the PBX administrator -- this is done in LD 95.

The relevant strings and their reasons for being displayed are:

- CFWD -- call forwarded because all calls have been forwarded to voice mail
- CFNA -- call forwarded because there was no answer
- HUNT -- call forwarded because the extension was busy

This LD95 session sets up the default strings:

```
>LD 95
REQ      CHG
TYPE     CPND
CUST     0      [Example only]
CNFG
MXLN
STAL
DFLN
DES
RESN     YES
CFWD     CFWD
CFNA     CFNA
HUNT     HUNT
PKUP
XFER     T
AAA      A
```

If your system does not use the default strings, then you must configure your PBXLink with the strings that you use. This is done in:

```
Configuration...
PBX Options...
Call Forward Display...
```

Task 2: Setting up the Voice Mail analog lines

Analog lines need to be used to connect the voice mail system to the PBX. At this stage it is important to know how many there are going to be and have extensions assigned for them. In bridged mode the PBX is configured to send calls directly to the analog port. For this reason the first analog port has an extension of **2000**.

This is how to set up an analog line.

```

>LD 10
REQ    NEW
TYPE   500
TN     0 0 3 1      [Example only]
CDEN   SD          [SD if QPC60, DD if QPC452, 4D if QPC594]
DES
CUST   0           [Example only]
DIG
DN     2000
HUNT   2001
TGAR
NCOS
RNPG
CLS    HTA FBD DTN XFA FND MWD LDTA
          [HTA: Hunting allowed (REQUIRED)]
          [FBD: Forward-on-busy disallowed (REQUIRED)]
          [DTN: DTMF Dialing Allowed (RECOMMENDED)]
          [XFA: Transfer allowed (RECOMMENDED)]
          [FND: Forward-no-answer disallowed (RECOMMENDED)]
          [MWD: Message Waiting disallowed (RECOMMENDED)]
          [LDTA: Line disconnect tone allowed (RECOMMENDED)]
FTR

```

Note that LDTA is only provided on Release 17 and later.

Repeat this process for each of the analog ports, using the appropriate DN and TN. In each case the HUNT extension should be the DN of the next analog line connected to the voice mail system. This way a call will arrive at the first port and the PBX will hunt for a free analog line and deliver the call ringing to it.

Task 3: Setting up the PBXLink's digital line

Configure the digital line being used for the PBXLink as a 2616 with 1 add on module. Key 0 is the primary DN for the digital line and can be set to any value. Keys 16 onwards are bridged appearances of the analog ports going to the voice mail system.

This example has 6 voice mail ports, starting with extension 2000.

```

>LD 11
REQ   NEW
TYPE  2616
TN    0 0 1 4           [Example only]
DES
CUST  0                 [Example only]
AOM   1
FDN
TGAR
NCOS
RNPG
SSU
CLS   ADD HFD CNDA DNDA
HUNT  000
LHK
KEY   00 SCR 2999      [This can be any DN]
KEY   12 DSP
KEY   13 MIK
KEY   14 MCK
KEY   16 SCN 2000     [Pilot number for the voice mail system]
MIX
KEY   17 SCN 2001
MIX
KEY   18 SCN 2002
MIX
KEY   19 SCN 2003
MIX
KEY   20 SCN 2004
MIX
KEY   21 SCN 2005
MIX
KEY                                     [Add more extensions here as needed...]

```

Using Both Digital Ports

This section does not apply to the PBXLink ISA.

To use the second digital ports program up a second digital line exactly the same way as the first, on a different TN and with each analog line appearing bridged to only one of the digital lines. It is recommended that the analog lines alternate between each of the digital lines as they proceed along the hunt group. This ensures that there is an even work load on each of the digital PBX lines.

Task 4: Setting up the Voice Mail users' telephones

Users need to have their phones set up so that their calls are forwarded to the voice mail system if they do not answer or if they are on the phone. It is also important to ensure that the PBXLink is able to illuminate the message waiting indicator on the users phone, or if they don't have a light then allow stuttered dial tone.

The exact way that this is done depends upon the sort of set that the user has: analog, digital or SL-1.

Setting up a user's analog set

If the user has an analog set then the setup will look like this.

```
>LD 10
REQ    CHG
TYPE   500
TN     0 0 2 4
C DEN
DES
CUST
DIG
DN
HUNT   2000
TGAR
NCOS
RNPG
CLS    HTA FNA MWA LPA CFTA SFA
FTR    FDN 2000
       EFD 2000
       EHT 2000
```

Setting up a user's digital set

A digital set, say a 2008, would be set up like this:

```
>LD 11
REQ    CHG
TYPE   2008
TN     0 0 4 3
ECHG
DES
FDN    2000
TGAR
NCOS
RNPG
SSU
CLS    HTA FNA MWA CFTA
EFD    2000
HUNT   2000
EHT    2000
LHK
```

Setting up a user's SL-1 set

If the user has an SL-1 set then it could be set up like this.

```
>LD 11
REQ   CHG
TYPE  SL1
TN    0 0 6 2
CDEN
DES
CUST
KLS
FDN   2000
TGAR
NCOS
RNPG
SSU
CLS   HTA FNA MWA CFTA
EFD   2000
HUNT  2000
EHT   2000
LHK
KEY   04 MWK 2000
```

The Next Step

Having configured the PBX, you now need to configure the PBXLink. This is explained in *Chapter 8 -- Configuring the PBXLink*.

Chapter 8 Configuring the PBXLink

You need to configure the PBXLink to tell it how your PBX and voice mail system are configured. There are many settings which can be changed, and these are all described in *Chapter 11 -- Configuration Parameters*. However most of these can be left at the default setting on most systems, and only a few important ones need changing. These are described below.

Configuration Menus

The PBXLink is configured through menus. If you have a PBXLink ISA, these are accessed through either the built-in SMDI serial port, or through the external management serial port, as described below. If you have a PBXLink box, you can also access the menus through the front panel keypad and LCD. Operation of the keypad and LCD is described in *Chapter 12 -- Using the LCD and Key Pad - PBXLink*.

To access the configuration menus through the SMDI port, you will need to have got the SMDI port working with suitable terminal emulation software, as described in *Chapter 2 -- Installing Your PBXLink* or *Chapter 3 - - Installing Your PBXLink ISA*. You can also access the menus through the management serial port if you have this set up.

When you type

M <enter>

on the terminal, you will see the main menu displayed. This looks similar to

```
PBXLink ISA v 2.70

1. Configuration...
2. Monitor PBXLink...
3. Reboot/Download...
```

Then type

1 <enter>

to enter the main configuration menu. This offers several sub-menus, and looks similar to:

```
Configuration

1 - Integration [Started]
2 - PBX Type...
3 - PBX Options...
4 - SMDI Options...
5 - Serial Port Options...
6 - Remote Access...
7 - Reset to Factory Default...
```

Check the following menu options:

Configuration.../PBX Type

This must be set to the type of PBX you have. When this setting is set correctly, the port LED will stop flashing (this is the LED on the bracket of the PBXLink ISA, and the LED labeled PBX A on the PBXLink box).

If you have a Nortel Meridian 1 or SL-100 PBX, choose the **Nortel M1** option.

If you have a Lucent PBX, you need to choose **Lucent 2 wire** or **Lucent 4 wire** as appropriate. If you have a 4 wire system, try the **Lucent 4 wire** option first; if this does not stop the LED flashing, try the **Lucent Old 4w** option. If you are not sure whether you have a 2-wire or 4-wire system, you can try all the options to see which stops the LED flashing without risk of damage.

Note that when you change the PBX type, the PBXLink will restart. This means that you will be back outside the menu systems so, after allowing it a few seconds, you will have to type **M <enter>** again to get back into the configuration menus.

Configuration.../Integration

This should be set to **Started**.

Configuration.../PBX Options.../Mode of Operation (Lucent only)

In *Chapter 4 -- Programming Your Lucent PBX*, you set up your PBX for either bridged mode or transfer mode. This option should be set accordingly.

Configuration.../PBX Options.../Phone Set (Lucent only)

This should be set according to the PBX setting for the PBXLink digital port.

Configuration.../PBX Options.../Voice Coding (Lucent only)

This should be set to Mu Law (the default) if you are in the US or Canada. Otherwise, set it to A Law.

Configuration.../PBX Options.../Analog Ports on A

This should be set according to the number of analog lines connected to your voice mail system.

Configuration.../PBX Options.../Configure Port A

This should be set to **Calls + MWI**, the default.

Configuration.../PBX Options.../Prime number (Nortel and Lucent bridged mode only)

This should be set to the extension number that voice mail users call to pick up their voice mail..

Configuration.../PBX Options.../Message Waiting Ind...(Lucent only)

These settings must match those in the Feature Access Codes pages of the PBX programming, and are the prefixes that are dialed before an extension number to turn on or off a Message Waiting Indicator.

The defaults are *4 and #4, which are the defaults for most PBXs.

Configuration.../PBX Options.../Call Forward display...(Nortel only)

These settings must match those in LD 95 of PBX programming (see *Chapter 7 -- Programming Your Nortel PBX*), and indicate what the PBX should expect on the display of the digital phone it is emulating. There are three settings: one for all calls forwarded, one for forward on no answer, and one for forward on busy.

The Next Step

Having configured both the PBX and the PBXLink, you can now test the installation. This is best done without yet starting the voice mail system, as explained in *Chapter 9 -- Testing the PBXLink*.

Chapter 9 Testing the PBXLink

The following steps show how to test and verify that the PBX and PBXLink are working independently of the voice mail system. It is also very useful to follow these steps after installing the PBXLink before connecting it to the voice mail system.

The steps to test the system are:

1. Check the PBX port
2. Use terminal software to ensure that you can communicate with the SMDI port.
3. Use terminal software to ensure you can communicate with the management port (optional).
4. Dial a direct call to the voice mail prime number and check the SMDI information.
5. Dial a second direct call to the voice mail prime number and check the SMDI information
6. Dial a call which gets forwarded to the voice mail system and check the SMDI information.
7. Manually enter an MWI set and clear command and ensure that they both work
8. Test with the voice mail system

These steps are detailed below.

Step 1: Check the PBX port

The PBXLink ISA has an LED on the bracket which indicates the state of the PBX connection. The PBXLink box has two LEDs labeled PBX A and PBX B on the front panel which indicate the state of the two PBX ports.

Symptom	Check
The PBX port B LED is off (not PBXLink ISA)	<ul style="list-style-type: none"> • This is normal when port B has been disabled, as it is by default. It can be enabled with the <code>Configuration.../PBX Options.../Configure Port B</code> option.
The PBX port LED is off	<p>PBXLink ISA:</p> <ul style="list-style-type: none"> • Check the card is properly inserted into the PC slot and that the power is on. Try powering the system off and then back on. • If you have previously been trying to upgrade the software on the card, it may be waiting for new program code to be downloaded through the SMDI serial port. Use a terminal to check this. • Check that switches 3 to 6 of the switch block on the card are off (see <i>Chapter 3 -- Installing Your PBXLink ISA</i>). <p>PBXLink:</p> <ul style="list-style-type: none"> • Check that the power LED is on. • If you have previously been trying to upgrade the software in the PBXLink, it may be waiting in the boot loader. Choose the <code>Restart PBXLink...</code> option to restart the PBXLink normally.
The PBX port LED is flashing	<ul style="list-style-type: none"> • Check that the <code>Configuration.../PBX Type</code> menu option is set correctly. Ensure that it is set to the type of PBX you have. In particular, if you have a Lucent PBX, check that you have set the menu option to 2-wire or 4-wire, as appropriate. (With Lucent PBXs, it can take up to two minutes for the LED to stop flashing.)

The PBX port LED is mostly on but blips off briefly every 2 seconds (PBXLink ISA)	<ul style="list-style-type: none"> • Check on the PBX console that the PBX has not disabled the port. • Check the wiring between the PBXLink and the PBX wall socket by unplugging the PBX cable from the PBXLink and plugging into a digital phone, and checking that the phone works. • Try plugging the PBXLink into a different digital PBX port to see if the LED stops flashing. If it does, there is a wiring problem on the original port (with a Lucent 4-wire PBX, it is possible to have a wiring problem that stops the PBXLink working even though a digital phone works). • Integration is not enabled. Set the Configuration.../Integration menu option to Started.
The V.Mail LED is flashing (not PBXLink ISA)	<ul style="list-style-type: none"> • Integration is not enabled. Set the Configuration.../Integration menu option to Started.
The PBX port LED is ON	<ul style="list-style-type: none"> • This indicates that the port is working. <p>Nortel:</p> <ul style="list-style-type: none"> • Note, however, that many Meridian PBXs are configured to disable digital lines that have been unused for an extended period of time, and if this happens the PBXLink LED may remain on. This can be checked by plugging in a digital phone in place of the PBXLink. The port can be re-enabled using the enlu <tn> command under overlay 32 on the Meridian 1 programming console

Step 2: Use a terminal to ensure that you can communicate with the SMDI port.

Using terminal emulation software is possible to access the configuration menus through the SMDI serial port by typing **M <enter>**. This verifies that the PBXLink SMDI port is working. Suitable terminal emulation software includes Procomm for MS-DOS, Terminal for Windows 3.x, and Hyperterminal for Windows 95 or NT. Ensure that the voice mail software is not running.

If you do not see the menu:

PBXLink ISA:

- Check that the COM port you have selected on the PBXLink ISA is disabled in the PC BIOS. For example, if you have selected COM 1, make sure that any internal serial port of the PC that is normally on COM 1 is disabled.
- Check that the COM port and interrupt you have selected on the PBXLink ISA is available, and that the interrupt you are using is correct for the COM port. This may require configuration of the operating system. If you change the settings it is necessary to power the system off and back on again.
- Check that the baud rate and parity settings selected by the switches on the PBXLink ISA match the settings used by the terminal emulation software you are using. If you change the settings it is necessary to power the system off and back on again.
- Check that there are no other applications attempting to access the SMDI COM port.

PBXLink box:

- Check that the RS-232 serial cable you are using is correct. It should be the same sort of cable used for a modem (also known as a straight-through cable).
- Check that the baud rate and parity settings selected by the Configuration.../Serial Port Options.../SMDI Port options match the settings used by the terminal emulation software you are using.

Step 3: Use a terminal to ensure that you can communicate with the management port (optional)

Use of the management port is optional. It can be used to configure and monitor the operation of the PBXLink and PBXLink ISA independently of the SMDI port. By attaching a modem it is possible to remotely access the PBXLink. It is particularly useful for use with the PBXLink ISA as it allows the PBXLink ISA to be configured and monitored without shutting down the voice mail system.

If you are not planning to use the management port, proceed to step 4 below.

To use the management port, connect it to a spare serial port on your PC and run terminal emulation software to communicate with that serial port. By default the management port uses 9600 baud, no parity, 8 data bits.

Typing **M** <enter> will display the serial menu as in step 2 above. If you do not see the menu:

PBXLink ISA:

- Check that the baud rate, parity and number of data bits in the Configuration.../Management Port Options... are the same as your terminal is using. You need to have a terminal working on the SMDI port to do this.

PBXLink:

- Check that the baud rate, parity and number of data bits in the Configuration.../Serial Port.../Management Port... option are the same as your terminal is using.

Step 4: Dial a direct call to the voice mail extension and check the SMDI information.

Having verified with the terminal emulation software that the SMDI port is working, make a call to the voice mail system prime number. This should produce some SMDI information on the terminal. The SMDI information should look similar to:

```
MD0010001D 0001234
<ctrl-Y>
```

The first 001 is the Message Desk Number specified in Configuration.../SMDI Options.../Msg Desk Number, and will be a different number if you have changed this option.

The second 0001 is the analog port number (NOT extension number) and normally starts at 0001 unless you have changed the Configuration.../SMDI Options.../Port A LTNs... option.

The D is a reason code, which in this case means “direct”, as it was a direct call to the voice mail system.

The 0001234 represents the extension you called the prime number from.

An ASCII control-Y character is sent at the end of the SMDI. This may or may not be displayed, or maybe displayed as a graphic character, depending on the terminal software.

If you do not see any SMDI information:

- Check that the Configuration.../Integration menu option is set to Started.
- Check that no warning messages are being displayed in the Monitor PBXLink.../Monitor Warnings... option.
- Check that the Configuration.../PBX Options.../Configure Port A option is set to Calls Only or Calls+MWI.

- Look at the `Monitor PBXLink.../View Statistics` option to see if the PBXLink is attempting and failing to process the call, or whether it is not seeing the call in the first place.

Nortel, or Lucent in bridged mode:

- Check that the number dialed was *not* the number of the PBXLink port. It is the number of the first analog voice mail line that should be called.
- Check that the analog voice mail line is actually ringing by plugging an analog phone in place of the voice mail system.

Nortel:

- Check with the PBX programming console that the Display key is in the correct place on the PBXLink's digital port and that the analog lines are on the add on module.
- Check that the CLS (Class of Service) for the PBXLink digital port is correct.
- Note that many Meridian PBXs are configured to disable digital lines that have been unused for an extended period of time, and if this happens the PBXLink LED may remain on, but the PBXLink will not produce SMDI. This can be checked by plugging in a digital phone in place of the PBXLink. The port can be re-enabled using the `enlu <tn>` command under **overlay 32** on the Meridian 1 programming console

Lucent in bridged mode:

- Check with the PBX programming console that the extension numbers of the users are included in the extension names.
- Check with the PBX programming console that the Inspect and Normal functions are programmed onto the correct keys on the PBXLink digital port.
- Check with the PBX programming console that the analog lines are programmed onto the appropriate keys on the PBXLink digital port as `abrddg`.
- Check that you are not using a hunt group to access the analog lines (numbers dialed through a hunt group do not appear on the digital PBXLink line).

Lucent in Transfer mode:

- Check that the number dialed was *not* the number of an analog line. It is the number of the PBXLink port that should be called.
- Check with the PBX programming console that there is no Inspect key and that the analog voice mail lines are programmed as `busy-ind`.

Step 5: Dial a second direct call to the voice mail extension and check the SMDI extension

While the first extension is occupying a voice mail analog line, use a second extension to dial the voice mail prime number, and check the SMDI information displayed on the terminal. This verifies that the PBX and PBXLink have been set up correctly to forward the call to the next free analog line. The SMDI information should look similar to:

```
MD0010002D 0001234
<ctrl-Y>
```

This is similar to the SMDI information above, except that the second number is 0002, indicating that the second analog port is now being used.

If the SMDI displayed on the terminal is not as expected:

Nortel, and Lucent bridge mode:

- Check the `Configuration.../PBX Options.../Prime Number` option. This should be the voice mail system prime number i.e. the number that users call to reach voice mail, and the number you have just dialed in this test.

Lucent bridge mode:

- Check with the PBX programming console that the name of the first analog voice mail line contains the prime number (in the same way as users' extensions names contain their extension number).

Step 6: Dial a call which gets forwarded to the voice mail system and check the SMDI information.

Having obtained correct SMDI information for a direct call to the voice mail system, test that calls indirectly forwarded to the voice mail system work. This tests that the PBX has been programmed to do the forwarding correctly and that the PBXLink options connected with forwarding are set up correctly.

There are three reasons for a call being forwarded to voice mail:

1. The called party was busy
2. The called party did not answer after some (pre-determined) number of rings
3. The called party has forwarded all calls to voice mail

These produce similar SMDI to a direct call, except that the reason code that is D for a direct call is B, N or A for Busy, No answer and All calls forwarded respectively. There is also another number, which is the number of the called party:

```
MD0010001B0001234 00005678
<ctrl-Y>
```

Here The reason code is B, the caller is 1234 as before, and the number that was called but busy is 5678.

If you do not get the expected reason code or the extension numbers are wrong:

- Check that there are no warning messages displayed with the `Monitor PBXLink.../Monitor Warnings...` option.

Nortel, or Lucent bridged mode:

- Check that the call really is being forwarded by plugging an analog phone in place of the voice mail system and checking that it rings when the forwarded extension is called.
- Check that the `Configuration.../PBX options.../Prime Number` option is set up correctly

Lucent:

- Check with the PBX programming console that the users' extensions contain their extension numbers.

Lucent transfer mode:

- Check that the call really is being forwarded by plugging a digital phone in place of the PBXLink and checking that it rings when the forwarded extension is called.

Nortel:

- If you get a reason code of U, check that the `Configuration.../PBX options.../Call Forward Display...` match your PBX options.

Step 7: Manually enter an MWI set and clear command and ensure that they both work

The voice mail system sends the PBXLink special SMDI commands to turn Message waiting Indicators on and off. You can type these yourself into the terminal to check the operation and configuration of the PBXLink.

To turn a Message Waiting Indicator on, type: OP:MWI 1234<enter>
To turn a Message Waiting Indicator off, type: RMV:MWI 1234<enter>

When entering these, note the following points:

- Here 1234 is the extension number - replace with a number as appropriate
- The space before the extension number is important.
- The commands must be entered in upper case, as shown.
- You must have exited the menus before entering the commands
- As you type, you will be typing “blind”, and characters you type will not be displayed
- If you make a mistake while typing, press <enter> a couple of times and start again

If you cannot get Message Waiting Indicators to work:

- Check that the Configuration.../Integration menu option is set to Started.
- Check that the Monitor PBXLink.../View Warnings option is not displaying a warning message.

Lucent:

- Check that the Configuration.../Message Waiting Ind.../Msg Wait On and Msg Wait Off options are set according to the Feature Access Codes programmed in your PBX
- Check that the Configuration.../PBX Options.../Voice Coding option is set to Mu Law in the US or Canada, or A Law in Europe
- If you have a digital phone handy, replace the PBXLink with the phone and check that you can manually turn the Message Waiting Indicator on and off using the digital phone to dial *4<extension> and #4<extension> (replacing *4 and #4 if necessary with the number programmed in the Configuration.../Message Waiting Ind... option).
- Check with the PBX programming console that the PBXLink digital port has line-appr programmed onto key 10.
- Check with the PBX programming console that the PBXLink digital port has LWC Activation set to msa-spe, and that the users' extensions have LWC Reception set to y.
- Check with the Monitor PBXLink.../View Statistics... option to see if the PBXLink is attempting but failing to set a Message Waiting Indicator, or whether it is not even seeing the request.
- Set the Configuration.../PBX Options.../Message Waiting Ind.../Confirm MWI option to Yes, and observe any response that is displayed on the terminal. The responses you may see are:
INV An invalid extension was dialed
BKL The operation could not be completed; for example, attempting to switch off an MWI that is already off.
- Note that the same extension that turns on a Message Waiting Indicator must also be the extension that turn it off. Thus if you have manually turned on a Message Waiting Indicator from a different extension, the voice mail system will not be able to turn it off.

Nortel:

- Check with the PBX programming console that the PBXLink's digital port is set with MIK and MCK functions on keys 13 and 14.
- Check with the PBX programming console that the users' extensions CLS (Class Of Service) includes MWA (Message Waiting Allowed).
- If you have a 2616 phone, replace the PBXLink with the 2616 phone and check that you can manually turn the Message waiting Indicator of the user extension on and off.

Step 8: Test with the voice mail system

The above steps test all aspects of the PBXLink functionality. The final step is to start the voice mail system and verify that it is able to use the SMDI information that the PBX link is producing.

It will probably be necessary to configure the voice mail system to match the configuration of the PBX and the PBXLink. This will vary widely from one type of voice mail system to another. - please see the documentation supplied with the voice mail system for details.

If you experience problems getting the voice mail system to work, refer to *Chapter 10 -- Troubleshooting*.

Chapter 10 Troubleshooting

If your voice mail system and PBXLink are not working correctly, use the following table to help pinpoint and correct the problem. If you are unable to fix the problem using this table, stop the voice mail system refer to *Chapter 9 -- Testing the PBXLink*, which explains how to test the PBX and PBXLink configuration without the voice mail system.

The PBXLink has been tested with voice mail systems from the following suppliers:

Active Voice
 Applied Voice
 Boston Technology
 Callware
 CDS Group
 Centigram
 Cobityx
 CTL Inc.
 Digital Speech
 Du Voice
 ESNA
 Executive Voice
 InnOvation
 KeyVoice
 NEC America
 Octel
 The Automatic Answer
 Trans Tel
 TRT
 Voice and Data Systems
 Wildcard

Symptom	Check
Calls to the voice mail prime number ring indefinitely (i.e. the call does not get answered by the voice mail system).	<p>Nortel, or Lucent in bridged mode:</p> <ul style="list-style-type: none"> • Check that the number dialed was not the number of the PBXLink port. It is the number of the first analog voice mail line that should be called. • Check that the voice mail system is seeing a ringing line if the voice mail system has a facility to do so. Otherwise, unplug the line from the voice mail system and use an analog phone to check that the line rings. • Check that the voice mail system is configured to answer the line that is ringing. • Follow step 3 above to check that the PBXLink is producing SMDI. • Check that the voice mail system is configured correctly for the SMDI serial port, and that it is receiving the SMDI. <p>Lucent in Transfer mode:</p> <ul style="list-style-type: none"> • Check that the Configuration.../Integration menu option is set to Started. • Check that the Monitor PBXLink.../View Warnings option is not displaying a warning message. • Start the call ringing, and then use the Monitor PBXLink.../View Indicators option to check that the PBXLink can see a line ringing. If not, check the button programming on the PBX for the PBXLink's digital port.
Calls to the voice mail prime number are	<p>Nortel, or Lucent in bridged mode:</p> <ul style="list-style-type: none"> • Check that the Configuration.../Integration menu option is set to

<p>answered, but the caller hears silence</p> <p>or</p> <p>Calls to the voice mail prime number are answered, but then hung up without a greeting message being heard</p>	<p>Started.</p> <ul style="list-style-type: none"> Follow step 3 above to check that the PBXLink is producing SMDI. Check that the voice mail system is configured correctly for the SMDI serial port, and that it is receiving the SMDI. <p>Lucent in Transfer mode:</p> <ul style="list-style-type: none"> Check that the Monitor PBXLink.../View Warnings option is not displaying a warning message Check that the Configuration.../PBX Options.../Voice Coding option is set to Mu Law in the US or Canada, or A Law in Europe
<p>The default greeting message is heard, regardless of why a call went to voice mail</p>	<ul style="list-style-type: none"> Check that the Configuration.../Integration menu option is set to Started. Check that the Monitor PBXLink.../View Warnings option is not displaying a warning message. Follow step 3 above to check that the PBXLink is producing SMDI. Check that the voice mail system is configured correctly for the SMDI serial port, and that it is receiving the SMDI. Configure the voice mail system to wait for a longer time before playing the greeting if it has the facility to do this. <p>Lucent:</p> <ul style="list-style-type: none"> Check that all voice mail user extension names have their extension number in the name <p>Lucent in Transfer mode:</p> <ul style="list-style-type: none"> Check that the Configuration.../SMDI options.../Call-Msg Order option is set appropriately for your voice mail system
<p>The wrong greeting is heard</p>	<ul style="list-style-type: none"> Check that the Monitor PBXLink.../View Warnings option is not displaying a warning message. <p>Nortel, and Lucent in Bridged mode:</p> <ul style="list-style-type: none"> Check that the Configuration.../PBX Options.../Prime Number option is set correctly <p>Nortel:</p> <ul style="list-style-type: none"> Check that the Configuration.../PBX Options.../Call Forward Display... CFWD, CFNA, and HUNT options are set according to your PBX programming <p>Lucent:</p> <ul style="list-style-type: none"> Check that all voice mail user extension names have their extension number in the name <p>Lucent in Transfer mode:</p> <ul style="list-style-type: none"> Check that the Monitor PBXLink.../View Warnings option is not displaying a warning message
<p>Lucent DNIS does not work</p>	<p>Lucent:</p> <ul style="list-style-type: none"> The Lucent trunk group name needs to have a number programmed into it in the same way as users' extensions have their extension numbers in them. For example TOLL-FREE-234 would give DNIS information 234, or LOCAL-123 would give 123 as the DNIS. The PBXLink will detect these numbers and output them in the SMDI.

Chapter 11 Configuration Parameters

All of the configuration parameters are arranged in a tree hierarchy. The parameters can be configured from either the keypad on the PBXLink or on through either serial port on the PBXLink or the PBXLink ISA. Some of the options are not available in certain configurations. For example the SMDI port is configured with switches on the PBXLink ISA so does not appear in the menu tree. The entire tree looks like this:

- Configuration...
 - Integration [Started/Stopped]
 - PBX Type...
 - Select PBX Type
[Lucent (2)/Lucent (4)/Lucent (old 4)/ Nortel M1]
 - PBX Options...
 - Mode of Operation [Bridged/Transfer]
 - Phone Set [7434D / 8434D / 7405D]
 - Voice Coding [Mu Law/A Law]
 - Extension Length [4-8]
 - Analog Ports on A [1-24]
 - Analog Ports on B [1-24]
 - Configure Port A [Calls Only/MWI Only/Calls + MWI]
 - Configure Port B [Calls Only/Disabled]
 - Prime Number []
 - Message Waiting Ind ...
 - Msg Wait On [*4]
 - Msg Wait Off [#4]
 - Confirm MWI [No/Yes]
 - Call Forward Display ...
 - CFWD
 - CFNA
 - HUNT
 - SMDI Options...
 - Msg Desk Number [###]
 - Call-Msg Order [Call-Message/Message-Call]
 - CPID Length [7/10]
 - CPID Mask [#####]
 - Port A LTNs...
 - Mode of Operation [Sequential/Random]
 - *if sequential:* First LTN
 - *if random:* Setup Random LTNs...
 - Port B LTNs...
 - Mode of Operation [Sequential/Random]
 - *if sequential:* First LTN
 - *if random:* Setup Random LTNs...
 - Serial Port Options...
 - SMDI Serial Port...
 - Baud Rate [1200/2400/4800/9600]
 - Flow Control [On/Off]
 - Parity etc. [N,8,1/E,7,1]
 - Management Serial Port...

- Baud Rate [1200/2400/4800/9600/19200]
 - Flow Control [On/Off]
 - Parity etc. [N,8,1/E,7,1]
- Remote Access...
 - Modem Initialization [AT&F]
 - Dial Prefix [#...]
 - Phone Number [#...]
 - Initialize Modem...
 - Dial Modem...
- *PBXLink ISA only*: Activation Code
 - Serial Number #####
 - Activation Code [###-###-####]
 - Maximum Number of Ports ##
- Monitor PBXLink...
 - Monitor Warnings...
 - Monitor Display A...
 - Monitor Display B...
 - Monitor Indicators...
 - View Statistics...
 - Zero Stats...
 - Calls: total []
 - Calls: good []
 - Calls: warn []
 - Calls: busy []
 - SMDI: no buffer []
 - RX-A: no buf []
 - RX-B: no buf []
 - TX-A: no buf []
 - TX-B: no buf []
 - RX-A: too big []
 - RX-B: too big []
 - RX-A: crc errs []
 - RX-B: crc errs []
 - View Performance...
 - PBX Port Status
 - Idle Screen [Warnings/Display A/Display B/Indicators]
- *if using LCD and keypad*: Reboot/Download...
 - Reboot PBXLink...
 - Download Code/Config...
- *if using serial port*: Reboot/Download...
 - Reboot ...
 - Reboot & Download Code...
 - Reboot & Download Loader...
 - Reboot & Download Config...
 - Reboot & Send Code...
 - Reboot & Send Config...
 - Reboot & Send ROM Image...

This section explains the meaning of the various parameters.

- Parameter: Configuration... / Integration
 Values: Started
 Stopped
 Explanation: This parameter controls whether the PBXLink is active, i.e. is it enabled for sending SMDI information. If integration is stopped then the PBXLink will not 'press' any keys on the telephone it is emulating, therefore will not answer calls or read the display. If integration is stopped the V-Mail LED on the front of the PBXLink will flash slowly.
- Parameter: Configuration... / Select PBX Type
 Values: Lucent (2)
 Lucent (4)
 Lucent Old 4
 Nortel M1
 Explanation: This selects which type of PBX the PBXLink will interface to, and applies to both ports A and B. This parameter must have Integration stopped in order to work, as changing the PBX type has serious consequences. Selecting the wrong type of PBX will mean that the PBX LED on the PBXLink will flash quickly. Care must be taken when configuring this parameter since some Lucent phones (the 8000 series) will work on both 2 wire and 4 wire systems, while the older (7000 series) are 4 wire only. Lucent Old 4 is the signaling method used by the very first Definity phones. Modern 4 wire line cards will work with both the old style and the new style, (the line card distinguishes the two based on the signal level transmitted by the phone). This mode should only be used if the PBX LED fails to stop flashing when Lucent (4) is selected and a 4-wire PBX line card is being used.
- Parameter: PBX Options... / Mode of Operation
 Values: Bridged
 Transfer
 Only needed: On Lucent systems
 Explanation: This controls how the PBXLink will obtain the SMDI information from the PBX and it is essential that this corresponds to the way in which the PBX lines were configured. The parameter applies to both ports. In bridged mode the PBXLink will use the inspect or display key to obtain the call information from the voice mail ports which are bridged to the digital set. In transfer mode the calls will be forwarded to the PBXLink which will answer them, gather the call information, and then transfer them to a free voice mail port.
- Parameter: PBX Options... / Voice Coding
 Values: Mu Law
 A Law
 Default: Mu Law
 Only needed: On Lucent systems
 Explanation: This parameter controls how the media samples are encoded digitally on the wire. The United States and Canada use Mu Law and the rest of the world uses A Law.
- Parameter: PBX Options... / Phone Set
 Values: 7434D
 8434D
 7405D
 Default: 7434D
 Only needed: On Lucent systems
 Explanation: This parameter is used to configure whether the line which the PBXLink is connected to is programmed as a 7434 set or as an 8434 set. In general 8434 will be used on newer 2 wire systems and 7434 will be used on older 4 wire systems. The PBXLink will work as either, but the line programming is slightly different, so make sure that this parameter and the line programming correspond to one another.
 On a System 75 the 7434 phone is not supported so it is necessary to configure the line as a 7405, in this case set this option on the PBXLink to be a 7434.

Parameter:	PBX Options... / Analog Ports on X
Values:	2 - 24
Explanation:	This controls how many analog voice mail ports are monitored by this port. There is one parameter for each of the two PBXLink ports. It is not necessary for the two PBXLink ports to monitor the same number of analog voice mail ports.
Parameter:	PBX Options... / Configure Port X
Values:	Calls Only Calls + MWI MWI Only Disabled
Explanation:	This parameter controls the operation of this port, and is separately configurable for each port. The options available on one port may be different from the other, or may change by the changing options on the other. For example port A cannot be disabled, but port B can.
Parameter:	PBX Options... / Prime Number
Values:	[ext number]
Explanation:	This parameter informs the PBXLink of the voice mail systems pilot number. When subscribers call the pilot number to retrieve messages it is important that they are given the appropriate greeting. The PBXLink uses this number to determine if calls made were to the Pilot number or to subscribers extensions.
Parameter:	PBX Options... / Call Forward Display... / CFWD
Values:	XXXX
Default:	CFWD
Only needed:	On Nortel systems
Explanation:	This parameter should be set to the value of the CFWD parameter in LD95 for your PBX.
Parameter:	PBX Options... / Call Forward Display... / CFNA
Values:	XXXX
Default:	CFNA
Only needed:	On Nortel systems
Explanation:	This parameter should be set to the value of the CFNA parameter in LD95 for your PBX.
Parameter:	PBX Options... / Call Forward Display... / HUNT
Values:	XXXX
Default:	HUNT
Only needed:	On Nortel systems
Explanation:	This parameter should be set to the value of the HUNT parameter in LD95 for your PBX.
Parameter:	PBX Options... / Message Waiting Ind... / Msg Wait On
Values:	#####
Default:	*4
Only needed:	On Lucent systems
Explanation:	This parameter informs the PBXLink of the code to dial in order to set a message waiting indicator on a user's phone set. After dialing the code, the PBXLink dials the extension number.
Parameter:	PBX Options... / Message Waiting Ind... / Msg Wait Off
Values:	#####
Default:	#4
Only needed:	On Lucent systems
Explanation:	This parameter informs the PBXLink of the code to dial in order to clear a message waiting indicator on a user's phone set. After dialing the code, the PBXLink dials the extension number.

Parameter: SMDI Options... / Msg Desk Number
Values: ###
Explanation: This is a three digit number which the PBXLink uses as its Message Desk Number (MDN) which is part of the SMDI specification. Both ports A and B use the same message desk number, so it is important to assign different Logical Terminal Numbers (LTNs) to the analog ports serviced by each of the ports. If you are using multiple PBXLinks then you could arrange for the LTNs to be the same on both the PBXLinks and for the MDNs to be different.

Parameter: SMDI Options... / Call-Msg Order
Values: Call-Message
Message-Call
Explanation: This parameter is only applicable in transfer mode. It controls whether the PBXLink sends the SMDI information to the voice mail system before or after the call has been transferred to one of the voice mail ports. Sending the call first is more reliable since it means the SMDI information will not get sent unless the call is transferred successfully. The transfer may fail if the voice mail system picks up the analog line after the PBXLink has decided to send the SMDI information but before the call has been transferred. This would lead to SMDI information arriving at the voice mail system with the wrong LTN. This parameter is in place for compatibility reasons only. CTL recommends that it remain in the Call-message setting.

Parameter: SMDI Options... / CPID Length
Values: 7 or 10
Explanation: This parameter controls whether the PBXLink produces 7 or 10 digit numbers in the SMDI information which it sends to the voice mail system. If your PBX is using extension numbers which have fewer digits than this parameter then they will be padded on the left with the digits in the CPID mask, see below.

Parameter: SMDI Options... / CPID Mask
Values: #####
Explanation: This is a field which is either 7 or 10 digits in length. If your PBX is using extension numbers which have fewer digits than the CPID length (see above), then each extension number that is sent to the voice mail system in the SMDI information is padded to the CPID length by taking the appropriate number of digits from the front of the CPID mask, and adding them to the front of the extension number.

Parameter: Port X LTNs.../ Mode of Operation
Values: Sequential
Random
Explanation: This controls how the LTNs are assigned to the analog ports that are controlled by the PBXLink port. The LTNs correspond to the analog ports assigned to the PBXLink's digital port. Most systems can use a sequential numbering system for LTNs, for example with the first one being number 0001, the second being 0002, and so on. In a more advanced configuration the voice mail system may want to use specific LTNs for specific ports, and this is done using the random setting. This allows you to specify any LTN for any port; it does not mean that the PBXLink will assign random LTNs to the ports.

- Parameter: Port X LTNs.../ Mode First LTN
 Values: #####
 Explanation: This is the first number to be given to a series of sequentially numbered LTNs for a port. This parameter is not available when LTNs are numbered in random mode (see above). If using two ports it is necessary to use a different base LTN for each port, and to select numbers which mean there is no overlap. For example, if you are using two ports with four analog lines on each, you could set the first LTN on port A to 0001 and the first LTN for port B to 0005. An alternative scheme which is more flexible would be to use something like 1001 as the first LTN for port A and 2001 for the first LTN on port B.
- Parameter: Port X LTNs.../ Setup Random LTNs... / LTN for Port Y
 Values: #####
 Explanation: This parameter is only available when the LTNs are numbered in random mode (see above). As you scroll through the LTNs with the up and down keys, the next or previous LTN value will appear. The value of the port will vary from one to the number of analog ports on that digital port (X).
- Parameter: Serial Port Options...
 Values: SMDI Serial Port...
 Management Serial Port ...
 Explanation: This gives access to sub menus for configuring the serial ports on the device. The menus below these two branches are the same.
- Parameter: Serial Port Options... / X Serial Port... / Baud Rate
 Values: 1200
 2400
 4800
 9600
 19200 (available only on management port)
 Explanation: This is the baud rate of the serial port. Note these serial ports do not auto configure or detect baud rate, so they must be set up to the same speed as the communications equipment connected to them.
- Parameter: Serial Port Options... / X Serial Port... / Flow Control
 Values: On
 Off
 Explanation: This controls whether hardware flow control is to be used by the PBXLink. If set to No then the PBXLink will ignore the RTS line. The PBXLink always set CTS.
- Parameter: Serial Port Options... / X Serial Port... / Parity etc.
 Values: N,8,1
 E,7,1
 Explanation: This controls the parity, number of data bits, and stop bits used on the serial link. These need to be set the same at both ends of the link for correct operation. The N,8,1 setting means No parity, 8 data bits, and 1 stop bit. The E,7,1 setting means Even parity, 7 data bits and 1 stop bit.

- Parameter: Remote Access.../Modem initialization
 Values: *blank*
 AT&F
 AT
 ATSO=1
 etc.
 Explanation: This controls the string sent out the management port to the modem at start up. If a modem is going to be used it is important that something is sent to it at start up so that the modem can detect the serial port speed which the PBXLink has been set for. Without this the PBXLink will not recognize the RING string from the modem. This string is sent to the modem at start up or when the *Initialize modem* command is selected. When using the LCD and keypad to program this field, letters can be selected by repeatedly pressing the numeric key with that letter on it, the display will cycle through the possible letters and number. To use select a symbol (* & = %) press the * key and it will cycle round those symbols. To select a more unusual symbol use the # key to cycle round those.
- Parameter: Remote Access.../Dial prefix
 Values: [9,]
 Explanation: This controls the prefix required to get an outside line with the attached modem. All numbers as well as comma (for a pause) or # and * can be used. When using the keypad a comma is produced with the down arrow key.
- Parameter: Remote Access.../Phone Number
 Values: [408...]
 Explanation: This is the phone number which the modem will be requested to dial. The default value is the PBX Link bulletin board. The boot loaded has the capability of dialing this number logging into the bulletin board and downloading new firmware automatically.
- Parameter: Remote Access.../Initialize Modem...
 Values: none
 Explanation: This option makes the PBXLink send the modem initialization string to the modem. This is useful to hang up the modem, or if the modem has been attached after the PBXLink was powered on.
- Parameter: Remote Access.../Dial Modem...
 Values: none
 Explanation: This option makes the PBXLink send a dial command to the modem, along with the prefix. When it dials it does not attempt to download code or perform any functions down the modem channel. Its is the responsibility of the other end to activate the management commands.
- Parameter: Activation Code.../ Serial Number
 Values: #####
 Explanation: This is the serial number of your PBXLink ISA, which cannot be changed. If you need to upgrade your PBXLink ISA to support more analog voice mail ports, please call CTL, who will ask you for your serial number and issue you a new Activation Code (see below).
- Parameter: Activation Code.../ Activation Code
 Values: ###-###-####
 Explanation: If you need to upgrade your PBXLink ISA to support more analog voice mail ports, please call CTL who will issue you a new activation code, which should be entered here. *Do not* change this parameter in other circumstances.
- Parameter: Activation Code.../Max Number of Ports
 Values: ##

Explanation: This is the maximum number of analog voice mail ports that your PBXLink ISA supports. If you need to increase this number, please call CTL who will issue you with a new Activation Code (see above).

Chapter 12 Using the LCD and Key Pad - PBXLink

This chapter explains the basic operation of the PBXLink front panel, using the backlit LCD and keypad. The keypad and LCD are used both to enter information into the PBXLink and to monitor its operation. This chapter explains what the various monitor displays mean and how to navigate and enter information, but it is not intended to explain each item that can be configured - please see the appropriate configuration chapter for this. All the parameters which can be configured through the menus can also be configured through a terminal connected to the management port.

Menu Navigation

The main screen of the PBXLink after power-on looks like this:

```
PBXLink v1.06      OK=select      ↑
Configuration...  ↓
```

The top line of the display contains the PBXLink software version number (1.06, in this case) and tells which keys can be used. For example the 'OK' key will select the current option, which is displayed on the lower line of the display. The up and down arrows at the right indicate that the up and down arrow keys can be used to display different options.

The PBXLink menus are arranged in a tree. Pressing the up and down arrow keys display other options at the same level of the tree, and if you keep hitting 'up' or 'down' you will eventually return to the first option. For example, hitting 'down' on the screen above will display in turn the options "Monitor PBXLink...", "Reboot/Download...", and then go back to "Configuration...".

Options in the tree which end in "..." lead to new menus, and pressing 'OK' on these will display a new set of options on the lower line. For example pressing 'OK' while at the screen above will lead to this screen:

```
Configuration      OK=edit      ↑
Integration         Stopped      ↓
```

The top line now displays the current sub-menu name ("Configuration") and the line below shows the options available in this menu. Pressing the 'down' key reveals these to be "PBX Type...", "PBX Options...", "SMDI Options", "Serial Port Options...", and "Remote Access...". To return to the previous menu use the 'Cancel' key. To select a new sub-menu again press 'OK' on an option ending in "...".

Options on the lower line which do not end in "..." are parameters which can be changed. For example in the screen above the "Integration" parameter is currently set to "Stopped." To change this parameter hit 'OK', which will result in the following screen:

```
<>=Select Cancel=quit OK=keep
Integration          [Stopped]
```

Use the left and right arrow keys to change the value of this parameter, followed by 'OK' to keep the change or 'Cancel' to revert to the previously set value.

Note: Changes take effect and are recorded in non-volatile memory as soon as you hit the 'OK' button to keep the change. You do not need to explicitly "save" the changes.

The Integration parameter is an example of a multiple-choice parameter, where you choose from several pre-set values using the left and right arrow keys. The other parameter type you will encounter is the edit field. For example, the SMDI Message Desk Number is set in a screen like this:

```

Cancel=quit OK=keep ↑=Del
Msg Desk Number [001]

```

You can edit this field using the left and right arrow keys to position the flashing cursor. Pressing a number on the keypad will overtype the character at the cursor position, and the up arrow key can be used to delete a character.

If you do not press any keys for five minutes, the display will change to one of several monitor displays, which shows some aspect of the PBXLink's activity. Exactly what is displayed is selectable, but by default the screen looks like:

```

Calls+MWIs:      0  Failed:      0
Last warning: None

```

Pressing the Cancel key will revert to the menus.

The Main Menu

As mentioned above, the menu options form a tree.

The main menu presents the following choices (by using the up and down arrow keys):

- Configuration...
- Monitor PBXLink...
- Reboot/Download...

All of these 'top level' menu items are themselves menus, and you can navigate into them by pressing 'OK' and back again by pressing 'Cancel'. If you keep pressing 'Cancel' you will always eventually reach this top level menu (pressing 'Cancel' at the top level has no effect.)

Most of the options needed to configure the PBXLink during normal operations are in the "Configuration..." menu. To monitor the PBXLink while it is in use select one of the options from "Monitor PBXLink..." The "Reboot/Download" option is for advanced use such as upgrading the software in the PBXLink by downloading new code.

In many cases the options available in these menus are self explanatory. The following sections will describe the more important items from the various menus and sub-menus.

The Configuration Sub-Menu

The **Configuration...** menu contains most of the options needed to configure the PBXLink during normal operation, such as selecting the PBX type, entering SMDI options, setting serial port speeds, etc.

The most important item of these options is the PBX Type, and unless this is set correctly the PBXLink will not function correctly. The PBX Type cannot be set unless integration is stopped.

Note: Most of the other options can be changed while integration is active, and you should take care when changing options that could affect the operation of the PBXLink.

Note that some of the options are controlled by other options, for example the "Analog Ports on B" option will not appear unless Port B is enabled.

For explanation of the items in the configuration menu tree please see *Chapter 11 - Configuration Parameters*.

The Monitor PBXLink Sub-Menu

This menu has the following sub-menus:

- Monitor Warnings...
- Monitor Display A...
- Monitor Display B...
- Monitor Indicators...
- View Statistics...
- View Performance...
- Idle Screen []

The **Monitor Warnings...** option displays the total number of call and message waiting indicator operations that the PBXLink has performed since it was last turned on, and any warning messages about failed operations that might have occurred:

```

Calls+MWIs:      123   Failed:      3
Last warning: None
  
```

As the PBXLink operates correctly, the number displayed after “Calls+MWIs” increases. If any operations are failing, the number displayed after “Failed” increases instead, and a message is displayed on the bottom line of the display to indicate the nature of the failure. The warning message can be reset back to “None” by pressing the **Cancel** key; it is recommended that you do this once you have taken note of the message so that you can tell when a new message is displayed. *Note: These numbers are aggregate numbers for both PBX port A and B (if B is enabled.)*

This display is exited by pressing the **Cancel** key when the warning message is None. Thus, if there is a warning message displayed, you will have to press the **Cancel** key twice: firstly to clear the message, and secondly to exit the display.

The **Monitor Display A/B...** options allow monitoring of the LCD screens of the digital phones which the PBXLink is emulating. For example, a Lucent PBXLink would display the following:

```

Monitoring A [           ]
Cancel=Quit  [           ]
  
```

The space to the right between the square brackets displays the two-line LCD display of the digital phone. If the unit has integration stopped then this screen looks like this:

```

Emulating A  [           ]
OK=hook [-]  [           ]
  
```

In this mode the PBXLink is allowing the user to control the functions of the phone for testing and diagnostic purposes. The symbol [-] indicates that the line is On Hook. Pressing the **OK** key takes the line Off Hook and the symbol will change to [O] to indicate the line is Off Hook. The keypad can be used to dial numbers to test the outgoing call capability of the unit. This is useful if you are unsure whether your system uses A-Law or U-Law to encode the media. If the correct encoding scheme is not selected then the unit will be unable to dial numbers. To Hang Up the line press the **OK** key once again and the indicator will return to [-] .

Monitor Indicators... displays the following:

```
PbxA [ *O----- ] VM [ | | | ]
PbxB [ ----- ] VM [ | | | ]
```

The top line represents the indicators on the digital phone on port A. The first area between the [] characters represents the 9 “call appearance” lines used for MWI calls and the call queue when in Transfer Mode. Each character represents one indicator, and can have several states:

- means the line is not in use (indicator is off)
- * means the line is ringing
- O means the line is in use (picked-up)
- H means the line is on hold
- T means the line is in the middle of a transfer
- E means the line is in an error condition

The second set of indicators to the right of the “VM” label represent the analog ports, and the size of this area depends on how many analog ports have been configured on the PBXLink. Each line is either in use (a solid vertical bar), ringing (a flashing vertical bar) or idle (blank space.)

The **View Statistics...** menu displays statistics for various operations performed by the PBXLink, including counts of calls processed, errors detected, etc. The statistics are not stored in non-volatile memory and hence will start at zero every time the PBXLink is restarted, and can be reset to zero during operation with the “Zero Stats...” option.. Statistics are not updated while displayed - you will need to use the up/down keys to re-display the statistic value.

The **View Performance...** option displays the following:

```
Calls Hr: 231   Min: 15   Queued: 2
MWI   Hr: 123   Min: 5    Queued: 0
```

The top line gives performance information for processing incoming calls. The number after “Hr:” is the number of incoming calls processed (integration supplied) in the previous 60 minutes. The number after “Min:” is the number in the last minute, and the number after “Queued:” is the number of incoming calls which have not yet been processed. *Note: These numbers are aggregate numbers for both PBX port A and B (if B is enabled.)*

The bottom line displays the same information for Message Waiting Indicator commands from the voice mail system. The “Queued:” number in this case indicates the number of entries in the MWI Queue which are waiting to be processed.

Note that the “Hr:” figures will not be displayed until the PBXLink has been powered on for at least an hour, and the “Min:” figures will not be displayed until the PBXLink has been on for at least one minute.

The **Idle Screen** option allows you to select which monitoring screen is displayed if you leave the PBXLink displaying a menu choice for five minutes or more without pressing a key. You can choose this to be the **Monitor Warnings** screen, the **Monitor Display A** or **B** screen, or the **Monitor Indicators** screen,

The Reboot/Download... Sub-Menu

This menu has two options, neither of which is used during normal PBXLink operation:

- Reboot PBXLink...
- Download Code/Config...

The **Reboot PBXLink...** option, which can only be selected if integration is stopped, will re-start the PBXLink as if the power had been cycled.

The **Download Code/Config . . .** option will also re-start the PBXLink but will go immediately into the “Boot Loader”, which allows downloading of new code to the unit, synchronization of configuration and code between different units, etc. See the “Boot Loader” chapter for further information.

Chapter 13 Configuration Using Serial Ports

All of the parameters which can be set using the key pad and LCD can also be set using one of the serial ports. There are some special considerations when using the serial ports to perform management including:

1. Either the SMDI port or the Management port can be used for this function.
2. Any terminal software (e.g. terminal.exe or Hyperterminal) can be used to do the management.
3. Only one serial port can be performing the management function at any time.
4. If the SMDI port is in management mode then it will stop sending SMDI information.
5. If the Management port is in this mode it will stop performing its daisy chaining function.
6. Either port gets into management mode by pressing **M<enter>**
7. Management mode is exited by leaving all menus (pressing **<Esc>**) until the top level menu has been exited and no more menus are displayed.
8. Selecting an option which causes the PBXLink to reboot (e.g. changing PBX type) will reset the serial port being used so that it is no longer in management mode, requiring **M<enter>** to be pressed again.

There are a number of additional functions which can be accessed through the management port which are not available from the LCD and key pad, such as downloading new software into the unit.

Linking to the Management Port

The management port is designed to be connected to a modem so that the PBXLink or PBXLink ISA can be administered remotely, but it can also be connected to a computer using a Null Modem Cable. The PBXLink does not auto detect serial port speed, so these need to be set up correctly at both ends before any communication will happen. This can be done using the key pad of the PBXLink or the switches on the PBXLink ISA. Once communication has been set up the other port can be changed through the software menus. See *Chapter 16 -Serial Cable Wiring* for serial cable wiring details.

If a modem is being used to dial *out* from the PBXLink, it is necessary to force the PBXLink to dial the modem using the commands in the **Configure.../Remote Access** menu. After attaching a modem, enter the number of the remote terminal to be dialed; this will usually be the number of your support organization. When **Enter** is pressed on the **Dial Modem...** command the PBXLink will dial the number and attempt to connect to another modem.

If a modem is being used to dial *into* the PBXLink then the modem needs to be pre-set to the correct serial speed for the PBXLink, and have that speed set as the default for the modem.. How this is done varies from modem to modem, but will usually require the modem to be plugged into a computer. Once the modem has been set up appropriately from the computer, it can be installed onto the PBXLink management port and a phone line attached. As soon as the modem sends a **RING** signal to the PBXLink, the PBXLink will attempt to answer and connect using the **ATA** command.

Serial Port Menus

Once connected to the PBXLink, the top level menu can be activated by pressing **m <enter>**. The menu looks like this:

PBXLink v2.48

```
1 - Configuration...
2 - Monitor PBXLink...
3 - Reboot/Download...
```

```
Q - Quit
```

Enter choice [Q]:

Pressing enter on its own is exactly the same as entering the option in [braces] followed by the enter key. Pressing <Escape> exits the menu, and you will have to press m<enter> again to re-display it.

You will notice that the set of choices here is exactly the same as the set of choices on the Main menu when using the LCD and key pad. To select an option enter its number followed by <enter>. Pressing Q followed by <enter> is the same as pressing Cancel on the key pad. Any options which are followed by ... means that there is a sub-menu below. Any Options which represent a value have the current value displayed after the option, such as Integration on the following screen.

Configuration

```
1 - Integration [Started]
2 - PBX Options...
3 - SMDI Options...
4 - Serial Port Options...
5 - Remote Access...
Q - Quit
```

Enter choice [Q]:

To change a multiple choice configuration item, select its item number then select the choice required from a screen which looks like this.

Integration

```
1 - Stopped
2 - [Started]
Q - Quit
```

Enter choice [Q] :

Note that on all screens the title line is the same as the option selected on the previous screen.

Downloading New Firmware

The PBXLink and PBXLink ISA stores all its firmware and parameters in non-volatile memory. This means they remain the same even when the PBXLink is powered off, but it also means that they can be easily upgraded. When using the management port it is possible to download new firmware or parameters to the PBXLink. It is also possible to upload parameters or firmware from a PBXLink. This can be useful if it is desired to clone the functionality from one to another.

A PBXLink or PBXLink ISA can be upgraded using the management port alone. This is the simpler method of upgrading the firmware as it does not require any knowledge of the boot loader.

1. Connect to the management port, using a modem or a null modem cable and a terminal. As an example we will use Windows terminal. See *Chapter 16 - Serial Cable Wiring*, for serial cable wiring details.
2. Press **M** <enter> to display the main menu.
3. Press 3<enter> to choose **Reboot/Download**, and then 2<enter> to choose **Reboot & Download Code**.

4. At this point the PBXLink is waiting for the new Firmware to be sent to it. It may display strange characters on the screen.
5. Select **Transfer** and **Binary File** on the terminal menu. Then select the file to be downloaded. These are of the form PBXLINK.100 and are usually about 100k in size.
6. When complete the PBXLink will reboot and resume operations.

The new firmware will be checked once it has been downloaded. If it is incorrect then the PBXLink will continue to run normally. If the new firmware has new features then it may require that to be re-configured. If the download process failed and a corrupt image has been sent then the unit will not run correctly. In this case the PBXLink ISA will try to download the firmware again from the beginning and after checking the new image for correctness the above procedure should be continued from step 4. If bad firmware is sent to a PBXLink then the PBXLink will go straight to the boot loader and it will necessary to select the download option from the LCD menu.

Chapter 14 The Boot Loader

The boot loader is a portion of the firmware which does not normally get changed when the firmware is upgraded. Thus if incomplete or corrupt firmware is downloaded to the PBXLink, it is still possible to download good firmware, as the boot loader remains intact. The boot loader behaves slightly differently on the PBXLink and on the PBXLink ISA. On the PBXLink the keypad can be used to specify special instruction to the boot loader when the unit is in boot loader mode.

The boot loader can be entered manually or automatically. When boot loader is entered manually (through the front panel) it behaves a little differently than when automatically entered. When manually selected the boot loader uses a different menu tree and parameters for the management port than when entered. Manual entry is only possible on the PBXLink and can be accessed in one of two ways.

1. Firstly when the PBXLink is switched on, the message **Press HELP for boot options... appears on the LCD**. If the **Help** key is pressed at this time the PBXLink will go into “Boot Loader” mode of operation, and it is this mode of operation which allows new firmware to be downloaded.
2. The second way of accessing the boot loader is by choosing the **Reboot/Download...** option from the LCD or from a terminal connected to the management serial port. This will stop integration, reboot the unit and bring it back up in the boot loader ready to download new firmware.

The boot loader can be automatically accessed by selecting one of the download or upload options when performing configuration through the management port. This is the only way to access the boot loader on the PBXLink ISA.

The menu tree for the boot loader on the PBXLink looks like this.

- Restart PBXLink...
- Baud Rate [1200/2400/4800/9600/19200]
- Dial Prefix [9,]
- BBS Number [4082496474]
- Version [000]
- Modem [Dial Out/Answer/None]
- Login [Yes/No]
- Download Code...
- Download Config...
- Download Loader...
- Send Code...
- Send Config...
- Send Debug...

The various settings are saved in non-volatile memory and so are preserved when the PBXLink is powered down. The serial port baud rate setting is independent of the normal PBXLink serial port settings, so must set correctly even if you have already done this during normal PBXLink operation.

Download from BootLoader

1. Power on the PBXLink and press the **Help** key within five seconds to enter boot loader mode.
2. Use the arrow keys to set the serial port **Baud Rate**. Default is 9600, but 19200 is fastest.
3. If downloading code from a remote location set the phone number correctly.

4. Use the **Modem** option to specify whether a modem is being used to dial out, whether a modem is being used to dial in (in which case the serial speed of the modem needs to be pre-set), or whether no modem is being used at all. In this case a null-modem cable will be required to connect to a computer.
5. The **Login** and **Filename** are parameters which are used if the file is to be downloaded from a Bulletin Board Service. The PBXLink is compatible with Procomm Plus bulletin boards. It will login to the BBS and download the file **pbxlink.xxx** where xxx is the value in the **Filename** field.
6. To download, select the option **Download Code...** and the PBXLink will dial the modem and login to the BBS (if required) and will then attempt to download the file using the **X-modem** protocol.
7. To abort and return to normal operation, select the **Restart PBXLink...** option.
8. If downloading is selected, the PBXLink will show the following screen:

```

Downloading Code.          Cancel=Quit
Received 12K (21%)   Ver=1.06  Errs=0
```

9. At this point if the firmware is being downloaded from a terminal (rather than a BBS) it is necessary to instruct the terminal to send the new firmware to the PBXLink. This varies depending on the software being used. On Procomm Plus this is the **PgDn** key and on Windows terminal use **Transfer / Binary File** and specify the filename of the new firmware.
10. When downloading is complete the PBXLink can be restarted by pressing **OK**. During the download the process can be stopped by pressing **Cancel**, but this is likely to leave the main firmware in an invalid state, and the PBXLink will only work in the boot loader mode.

Chapter 15 Advanced Options

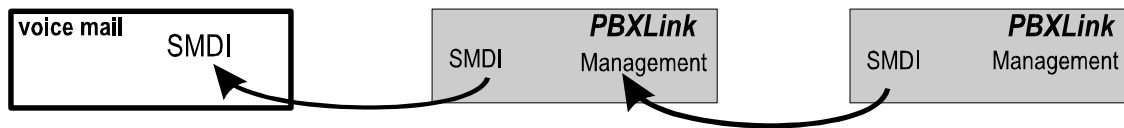
Daisy Chaining

Daisy chaining allows more than one PBXLink to be attached to a single port on the voice mail system. This is achieved by having the SMDI output from one PBXLink be fed into the management port of the second PBXLink. This connection is made using a straight through serial cable. SMDI information is only sent towards the voice mail system. This means that message waiting indicator commands will not get sent from the first PBXLink to the second. Therefore port A of the first PBXLink must be configured to do the MWI notifications. PBXLink ISAs do not support daisy chaining.

The PBXLink passing on the SMDI messages makes no attempt to check them for validity. Ensure that either a different **Message Desk Number** is being used for the second PBXLink, or that the **LTNs** for the ports on each PBXLink to not overlap.

The picture below shows how this would be set up. The arrows represent serial cables. PBXLink requires no additional configuration to do this.

Note: It is very important that the management port of the unit nearest to the voice mail system is configured identically to the SMDI port of the downstream unit.



Cloning

Cloning is the ability to make one PBXLink identical to another, and either the configuration can be cloned or the firmware. The process is very straight forward. It involves connecting the PBXLinks together, using a null modem cable connected between the management ports.

Power both units on, pressing the **Help** key to bring them into boot loader mode. Set both of them to have **Login** set to NO and to have **Modem** set to none. Then select either:

- a) **Send Code...** on one and **Download Code...** on the other to clone the firmware,

or

- b) **Send Config...** on one and **Download Config...** on the other to clone the configuration information

Care must be taken to **Send** from the unit to be copied and to **Download** to the unit to be changed.

Chapter 16 Serial Cable Wiring

SMDI Port to PC

As the PBXLink ISA contains a built-in PC serial port, it does not require a cable to connect the SMDI port to the PC.

To connect a PBXLink to a PC-based voice mail system, a modem cable should be used (also known as a straight through cable). The PBXLink end of the cable should have a male 25-pin connector, and the PC end should have a female 9-pin or 25-pin connector, as appropriate for the PC.

The connections required in the cable are:

Signal	Input / Output	Usage	PBXLink 25-way Pin		PC 9-way Pin	PC 25-way Pin
TD	Input	Data received from voice mail	2	connects to	3	2
RD	Output	Data sent to voice mail	3	connects to	2	3
RTS*	Input	Handshaking line	4	connects to	7	4
GND	N/A	Ground	7	connects to	5	7

* Only required if the hardware flow control option is selected

Management Port to Modem

To connect a modem to a PBXLink or PBXLink ISA management port, a modem cable should be used (also known as a straight-through cable). The PBXLink end of the cable should have a female 25-pin connector, and the modem end should normally have a male 25-pin connector.

The connections required in the cable are:

Signal	Input / Output	Usage	PBXLink 25-way Pin		Modem 25-way Pin
TD	Input	Data received from voice mail	2	connects to	2
RD	Output	Data sent to voice mail	3	connects to	3
RTS*	Input	Handshaking line	4	connects to	4
GND	N/A	Ground	7	connects to	7

* Only required if the hardware flow control option is selected

Management Port to PC

To connect a PC to a PBXLink or PBXLink management port, a null modem cable should be used (also known as a cross-over cable). The PBXLink end should have a male 25-pin connector, and the PC end should have a female 9-pin or 25-pin connector, as appropriate for the PC.

The connections required in the cable are:

Signal	Input / Output	Usage	PBXLink 25-way Pin		PC 9-way Pin	PC 25-way Pin
TD	Input	Data received from voice mail	2	connects to	3	2
RD	Output	Data sent to voice mail	3	connects to	2	3
RTS*	Input	Handshaking line	4	connects to	7	4
GND	N/A	Ground	7	connects to	5	7

* Only required if the hardware flow control option is selected

Chapter 17 SMDI Specification

SMDI interface of the PBXLink

The Simple Message Desk Interface (SMDI) is a Bellcore standard and was devised for sending call information about incoming calls to subscribers of Centrex systems. A single ASCII serial stream can send information about multiple lines of incoming calls. One of the most common uses for it is for getting call information to a voice mail system, but it could also be used for applications such as logging the caller ID of calls into a call center. The SMDI packets are sent down a serial port providing information about calls as they arrive at the voice mail system. The information consists of several key parts: the original number called; the identity of the source (could be caller ID or incoming line number); the reason the call arrived at one of these lines (original number was busy etc.); and an identifier (called a Logical Terminal Number or LTN) for the line carrying the call about which the information refers.

The PBXLink gathers this information by using a digital phone line from a Meridian 1 or Lucent PBX. The PBXLink emulates the digital phone which is programmed with a display and with 'bridged' appearances of the lines to be monitored. When calls ring at one of the bridged lines the PBXLink uses the digital phone to get the call information on to the display of the digital phone. It parses the display and generates an SMDI packet. This process can only be done while the line is ringing and takes less than half a second. The PBXLink will send one SMDI packet for every call. The format of an SMDI packet if using 7 digit station identifiers is:

```
[CR][LF]MDmmm111rxxxxxxx[SP]yyyyyy [SP][CR][LF][CtrlY]
```

and for 10 digit station identifiers is:

```
[CR][LF]MDmmm111rxxxxxxxxxx[SP]yyyyyyyyyy [SP][CR][LF][CtrlY]
```

All SMDI packets are preceded by carriage return and line feed characters and are followed by a carriage return, line feed and control Y characters.

[CR]	ASCII carriage return (13 hex.)
[LF]	ASCII line feed (10 hex.)
[SP]	ASCII space (20 hex.)
[CtrlY]	ASCII control-Y (19 hex.)

mmm Message Desk Number (001 - 999): The PBXLink always sends the same message desk number. The message desk number can be configured on the PBXLink and is send in every packet. It could be used to distinguish between different PBXLinks connected to the same voice mail system. Its is usually left at the default value of 001.

111 Logical Terminal Number (0001-9999): This is the value assigned to a physical port being monitored and is used to identify which of the physical ports the information in the packet refers to. By default the first port has an LTN of 0001 and the nth port has an LTN of 000n. However it is possible to assign any 4 digit number as the first LTN with the remainder incrementing from there, or to assign any LTN to any port.

r Reason code: The reason code explains why the call has arrived at the monitored line. This reason code is deduced from what appears on the LCD of the phone being emulated by the PBXLink. The following codes are supported.

D: Direct: This is a call that has been made directly to the pilot number of the voice mail system. The PBXLink deduces this information by considering several factors. One of the more important factors is if the number dialed is the same as the Prime Number field configured in the PBXLink.

B: Busy:

N: No Answer

A: All calls forwarded

These three reason codes are given when the reason is understood. The PBXLink deduces these from the reason code letter which appears on Lucent display phones and from the 4 digit reason explanation available on Meridian 1. The explanations on Meridian 1 are user configurable, so care must be taken to ensure the PBXLink has been configured to recognize them correctly.

U: Unknown: This is the reason code given when the call was forwarded to voice mail by the PBX, as opposed to arriving as a result of someone dialing the pilot number, and that there was no reason code available for the call. This can happen because of a fairly simple configuration error. Software should note this information but continue to process the call.

xxxxxxx This is the number dialed by the original caller. It can be distinguished from the calling number as it comes before the space in the packet. The preceding zeros come from a mask the end of which gets overwritten by the extension number. This mask is user configurable on the PBXLink and defaults to 0000000. In a voice mail system this would be the extension of the user whose outgoing message is to be played. On an IVR system when using call vectors on a Lucent PBX, different Vector Directory Numbers (VDNs) could be set up to point to the same set of analog lines. In that case the VDN would be reported in this field and could be used to support multiple applications on the same system, for example a fax back system and an auto-attendant. The VDN which is stored in the Prime Number field of the PBXLink will be reported as a direct call.

yyyyyyy Calling Number ID: This is the extension of the caller. It can be distinguished from the called number as it comes after the space in the packet. The preceding zeros come from a mask the end of which gets overwritten by the extension number. This mask is user configurable on the PBXLink and defaults to 0000000. If caller ID is required it is necessary to use 10 digit fields for the number instead of 7 digit fields as seen here. If caller ID is not available and the PBX is configured to provide trunk ID for incoming calls then this will be stored in this field, and can be used to determine the source of the call. For example, a voice mail system which reports who a message is from in the envelope information could use this information to state that the call was local, or from an 800 number based on the incoming trunk ID.

Examples

In these examples the CR, LF and Ctrl Y are not shown. Spaces are represented by underscore (_).

Example 1.

```
MD0010008D_0001234_
```

This is a direct call to the pilot number of the system for the user with extension 1234. The call arrived at port number 8.

Example 2.

```
MD0010001B0005678_0001234_
```

This call was made to extension 5678 by the user at extension 1234. User 5678 was on the phone so the call was sent to the first port (0001) of our system by the PBX.

Example 3.

```
MD0010022N0001234__
```

In this example a call was made to the user at extension 1234, who did not answer, and the PBXLink was unable to determine the source of the call. It could be an outside call on a trunk which does not have trunk IDs set up.

Example 4.

```
MD0010001A0000005678_4082494339_
```

This is a call to extension 5678. The user has his calls redirected to the system (usually done with the function key or code at the desk). The call was an outside call on a trunk ((408) 249 4339) with caller ID enabled, and the PBXLink has been configured to use 10 digit identifiers.

Message Waiting Commands

The PBXLink accepts 2 commands for message waiting lights.

```
OP:MWI[SP]xxxxxxx![Control D]
```

```
RMV:MWI[SP]xxxxxxx![Control D]
```

On: OP: This message will switch on the light for extension xxxxxxx. Leading zeros are stripped from the number.

Off: RMV: This message will switch of the light for extension xxxxxxx. Leading zeros are stripped from the number..

The extension should be padded to 7 or 10 digits with 0s. The PBXLink will accept a [CR][LF] at the end of the packet instead of the Ctrl D. This is to allow installers to test the system by typing in MWI commands from simple terminal. It should not be relied on in software implementations as this prevent portability.

For example:

```
OP:MWI 0001234!
```

This will switch on the message light for extension 1234.

If the PBXLink carries out the request without an error it will not respond. If an error is detected a packet will be sent back with the following format:

```
[CR][LF]MWIxxxxxxx[SP]aaa[CR][LF][Control Y]
```

xxxxxxx This is the station identifier which encountered the error.

aaa This is the error code. Two error codes are supported.

INV This is a fatal error. The cause is usually that the extension number in the extension field does not exist.

BLK This is a non fatal error. It usually indicates that an attempt was made to switch off a light which was already off.

If the PBXLink has a queue of MWI operation pending then it will discard any duplicate commands already in the queue - a command to put a light on followed by a command to put a light off will be replaced by a single command to put a light off.

There is a special MWI command that can be given which always generates an error:

```
OP:MWI[SP]5551212![Control D]
```

This can be useful for testing.

Chapter 18 Limited Warranty, License Agreement and FCC Statement

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FCC Certification

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions.

- This device may not cause harmful interference.
- This device may accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference to radio communications, when the equipment is operated in a commercial environment. This equipment generates, uses and can reradiate radio frequency energy. If it is not installed and used in accordance with the instruction manual, or if it is operated in a residential area, it may cause harmful interference to radio communications. In this case, users will be required to correct the interference at their own expense.

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