CALCULATOR

CALCULATOR

Access Calculator Mode with the [CALC] Command. The keyboard remains in NUMBERS Mode.

PAGENTRY operates like a normal calculator in this mode, displaying results in 8 significant digits with an automatically adjusted decimal point. The operations are addition (+), subtraction (–), multiplication (*), and division (/). The equal sign (=) displays the result of calculations.

You can do ordinary "chain" calculations. For example:

If you type	PAGENTRY displays
8 * 5/12 =	3.3333333

You can also do constant calculations. The second operand is always the constant value. The most recent function "programs" the = key. For instance, the following key sequence yields the following results:

If you type	PAGENTRY displays
8 * 5 =	40.
9 =	45.
6 =	30.

In this example, *5 has become a constant operand.

[CLEAR] clears the accumulator (Memory) of the Calculator and the display will show 0. The [ERASE] key will clear the entry in the display.

TIME AND DATE

TIME & DATE

Formatting & Setting

The date format is set by selecting two PAGENTRY Commands. One determines whether the display will show as MONTH/DAY or DAY/MONTH. The second determines whether or not the year is included in the display.

Set Format of Date

The date for Christmas can be shown as:

Day/Month: [EXTRA] [D] [A] [F] [D]
(Displays: 25/12)

Month/Day: [EXTRA] [D] [A] [F] [M]
(Displays: 12/25)

Enable Year: [EXTRA] [D] [A] [Y] [E]
(Displays: 12/25/92)

Disable Year: [EXTRA] [D] [A] [Y] [D]
(Displays: 12/25)

Set Date

To set the date, enter the Command [EXTRA] [D] [A] [S]. The keyboard remains in NUMBERS Mode after execution of a Command. PAGENTRY will prompt for the date as follows:

Month: (1 to 12)
Day: (1 to 31)
Year: (0 to 99)

TIME AND DATE

Set Time

To set the time, type the command [EXTRA] [T] [I] [S]. The keyboard remains in NUMBERS Mode.

Three fields are displayed:

Hour: (0 to 23)
Minute: (0 to 59)
Second: (0 to 59)

The clock runs with the new time as soon as the [ENTER] key is pressed following the Second: field.

REMINDERS

ALARM CLOCK/REMINDERS

The Alarm is a Function which beeps at a preset date and time. A Reminder is like an Alarm, except that it displays a Message in addition to beeping. The Alarm and Reminder operate exactly the same, but if you choose not to enter a Reminder Message, the Alarm Function will beep and flash the message "ALARM." Otherwise it will show the Reminder you have stored. Many Reminders can be stored at one time. PAGENTRY automatically stores Reminders in chronological (date and time) order.

Accessing REMINDER Memory

Access REMINDER Memory with the [EXTRA] [R] Command. The Month: field of the first Reminder is displayed. The keyboard remains in NUMBERS Mode. If there are no Reminders in Memory, then the cursor is present and you are in Create Mode. You can enter data or quit.

If there is a Reminder, there is no cursor and you are in Scan Mode. You can scan through Memory with [ENTER], look at or edit a record with [SELECT], or go to the end of REMINDER Memory with [+] [ENTER] where you can create new Reminders.

Creating Reminders

At each of the six fields, type a value and press [ENTER]. After typing the message, you can create more Reminders.

Month: (1 to 12)
Day: (1 to 31)

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Year: (0 to 99)
Minute: (0 to 59)
Second: (0 to 59)
Message: (Any text including Canned Text entries)

PAGENTRY automatically stores Reminders in chronological order.

Set or Change a Reminder
At each of the seven fields, if there is a value, type over or erase and replace it. Press [ENTER] when the field you are in has the value you want.

To Delete a Reminder
You must be at the Month: field of the record. Select the entry using the [SELECT] key. Press [ERASE] [ENTER] to delete the Reminder from Memory.

When the Reminder Goes Off
PAGENTRY will beep and display the Reminder repeatedly until you hit any key. If there is no Message to display, the ALARM will continue to blink until any key is pressed. The Reminder is automatically deleted when a key is pressed to acknowledge it.

If the unit is turned off, PAGENTRY will automatically turn itself on to inform you of an Alarm or Reminder.

PRINTING
PAGENTRY can print out the contents of Memories and list its System Parameters to any Fax machine.

To Print Memories and System Parameters
To print, enter the command [EXTRA] [P] [R]. PAGENTRY has the ability to print all Memories and parameters as a single report, or, to selectively print only particular information. Upon entry of the print command, a prompt "Print All (Y/N)" will appear. If you answer Y (yes), all reports will be printed. If you enter any other response, PAGENTRY will ask you to specify which reports to print. The following messages will appear:

Directory (Y/N)
Group Mem (Y/N)
Canned Mem (Y/N)
Parameters (Y/N)
Page Mem (Y/N)
Fax Memory (Y/N)

If you answer Y (yes) to any one or more questions, those reports will be printed. You may enter any command if you choose not to print any reports. After the report(s) to print are selected, you will be asked to enter the Name of a Directory entry. Connect the unit to the telephone line via the RJ11 cable and type a Name followed by [ENTER]. The Fax will be sent to the Fax number in the Directory entry specified.

DATA SERVICE OPERATIONS
Accessing the Data Service
Access this function with the [DATA] Command. The Dial To: field is displayed. PAGENTRY will ask for the Directory Name which contains the telephone number of the Data Service. The Tel #: field is used as the number which will be dialed.

Dial To: (Directory name)

After entering the data in the field, press [ENTER]. The telephone number of the selected Directory will be used to dial out to the Data Service. Make sure the unit is connected to a phone line by plugging in the RJ11 cable between PAGENTRY and a telephone line modular jack. (See page 67.)

Once a connection is established to the remote system, PAGENTRY functions as an interactive data terminal. Information is displayed at the currently set PAGENTRY scroll speed. All data scrolls through the PAGENTRY window.

XON/XOFF Flow Control
Since data may be sent to PAGENTRY at a faster speed than the user is viewing the information, it is possible to overflow PAGENTRY's DATA Mode Receive Buffer. (A Buffer is temporary storage in PAGENTRY's memory. If the unit is turned off, the contents of the Buffer will be lost.) The user may enable the XON/XOFF data flow feature which controls the amount of data sent by the host computer to PAGENTRY.

To enable flow control, enter [EXTRA] [X] [E]. (This is the default value.) To disable flow control, enter [EXTRA] [X] [D].

Full and Half Duplex Operations
PAGENTRY normally operates in Full Duplex (FDX) communications mode. It may be switched to Half Duplex (HDX) mode via the command [EXTRA] [I] [O] [H] or back to FDX via the command [EXTRA] [I] [O] [F].

As characters from a remote computer are sent to the PAGENTRY unit, they scroll across its 16-character window at the current scroll speed (see [EXTRA] [S] [C], page 27). The rightmost character on the PAGENTRY display is the last character received. (If the remote computer sends a Form Feed character to PAGENTRY, the display screen is cleared.)

In FDX mode, the display window shows the last 16 characters received. As you type, each character is sent to the remote system as it's entered. The input is not "echoed onto" (shown on) the PAGENTRY display unless the remote computer system chooses to echo (show) the data sent by transmitting the received input back to PAGENTRY.

In HDX mode, characters entered at the PAGENTRY keyboard are echoed locally. Any data received from the remote system disappears from the display screen as soon as you begin entering a response. Each key entered is immediately displayed at the rightmost position of the display and simultaneously transmitted to the remote system.

In DATA Mode, data received is stored into a 256-character Receive Buffer. You can view the contents of this buffer whenever PAGENTRY is not receiving input data. The [←] key scrolls toward the beginning of the Receive Buffer, and the [→] key scrolls toward the end of the Buffer.

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Using Canned Text in DATA Mode

You can transmit any Canned Text Messages while in DATA Mode. The desired Canned Text is selected in the normal way ([EXTRA] [n] [n] — "n" represents the number of your desired Canned Text entry).

Using Other Commands in DATA Mode

The [ERASE] and [CLEAR] keys will clear the display and the contents of the Receive Buffer. Hitting any Command key will request termination of the DATA Mode session. The [HELP] key provides Help information. Pressing any other key causes its ASCII (computer code language) equivalent to be transmitted to the remote computer.

DATA SERVICE

Parity

The parity of the transmitted data can be set entering [EXTRA] [P] [A] [R] [I] and then selecting from that Submenu.

To Leave DATA Mode

Terminate DATA Mode by entering any PAGENTRY Command. PAGENTRY will ask if you really want to disconnect, to insure that a key was not hit in error. None of the Extra Commands except Canned Text are functional while in DATA Mode.

SYSTEM PARAMETERS

Selecting the Baud Rate

PAGENTRY can transmit at either of two baud rates (speeds for transmission of computer data): Low (300 baud) or High (1200 baud). Which you should choose is determined by what is expected by the destination device.

Low: [EXTRA] [B] [L] High: [EXTRA] [B] [H]

(Note: Some PAGENTRY models transmit at 300 baud only.)

Power Up Mode

This command allows you to specify which PAGENTRY Function is operational when the unit is turned on. The various options are selected as follows:

CALCulator	[EXTRA] [P] [O] [C]
Dial DATA Service	[EXTRA] [P] [O] [D]
FAX	[EXTRA] [P] [O] [F]
KEEP/Store in Directory	[EXTRA] [P] [O] [K]
PAGENTRY Message (Default)	[EXTRA] [P] [O] [M]
PAGE Entry	[EXTRA] [P] [O] [P]
RECALL Directory	[EXTRA] [P] [O] [R]
Time Display Only	[EXTRA] [P] [O] [T] [O]
Time/Date Display	[EXTRA] [P] [O] [T] [D]

SYSTEM

Key Click On/Off

You can enable or disable the clicking sound that occurs when you press a PAGENTRY key. To enable, enter [EXTRA] [K] [E]. To disable, enter [EXTRA] [K] [D].

Scroll Speed

This command allows you to set the length of the pause (the duration the image "holds") when you move the text in the PAGENTRY window horizontally back and forth along a field. It also controls the rate at which long messages automatically scroll through the window. The value is specified in units of 10 milliseconds. (There are 1000 milliseconds in a second.) Press [EXTRA] [S] [C]. When the prompt appears, enter the new desired value, then hit [ENTER]:

Scroll Rate: 25

This causes a pause of 250 milliseconds (a quarter of a second) between each character as the display scrolls through the window. (25 times 10 milliseconds equals 250 milliseconds.)

SYSTEM

Security Password

This command allows you to enable (turn on) or disable (turn off) the Security Feature. When enabled, Security requires you to type a Security Code Password each time you enter a Command to access the Directory to RECALL or KEEP information.

To enable the Security Function, enter [EXTRA] [S] [E] [E].

New Password: (1 to 10 characters)

To disable Security enter [EXTRA] [S] [E] [D].

Password: (Current Password)

To change the Security Password: [EXTRA] [S] [E] [E].

Old Password: (Current Password)
New Password: (1 to 10 characters)

Press [ENTER] after typing the appropriate Password at each prompt.

IMPORTANT NOTE about the Security Feature:

As you see, you must know the current Password in order to disable the Security Feature or change the Password. If you forget the Password you will no longer be able to access the Directory!

There are several ways to fix this problem:

One way is to remove the battery for more than 5 minutes, in which case all of PAGENTRY's Memories will be erased along with the Password, including the entire Directory.

Another method is to use the Reset All Memories Command: [EXTRA] [P] [A] [R] [A] [C]. This has the same effect as removing the battery.

Finally, the Password can be removed without losing all data in PAGENTRY's Memories by returning the PAGENTRY unit to the dealer. (A service charge will be billed.)

SYSTEM

Brightness Control

As the battery begins to wear down, the brightness of the LCD display may decrease, making it more difficult to read the display. The brightness level can be increased by the [EXTRA] [+] command. After a

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new battery is installed, you can decrease the brightness again by entering the command [EXTRA] [-]. When this command is issued, the new brightness level is displayed numerically in the display. You can press the [+] or [-] keys repeatedly to further change the contrast until it is set as desired. Pressing any other key will terminate the brightness control command.

Pulse/Tone Dialing

Where Touch Tone telephone service is not available, it's necessary to change PAGENTRY's dial out mode to Pulse dial instead of Tone dialing which is the default. Enter [EXTRA] [0] [P]. When the unit is later connected to a telephone line capable of Tone dialing, enter [EXTRA] [0] [T].

SYSTEM

Modem Types

In North America, systems normally utilize Bell 103 signalling standards. PAGENTRY units delivered in North America are set to this default. In Europe and many other countries outside of North America, the CCITT V.21 signalling standard applies, so units delivered outside of North America typically have V.21 set as the default. To change the operating mode of the internal PAGENTRY modem, enter [EXTRA] [M] [0] [B] for Bell 103 or [EXTRA] [M] [0] [V] for V.21.

Multi-Lingual Mode

Messages and prompts can be displayed in different languages. The language of choice is given by the command [EXTRA] [M] [E], followed by the selection of the language. After entering this

command, a list of languages installed in the unit will appear. All units have English language prompts which can be selected via the command [EXTRA] [M] [E] [E].

Parity

Data communication services often require that a certain parity be set. Pages sent via the TAP protocol often require ODD parity. The parity is selected via the [EXTRA] [P] [A] [R] [I] command.

Displaying Time/Date

The current time and/or date is displayed by typing the command [EXTRA] [T] [D]. The display's format is based on the current settings for the date and time display format. The date format is set by the [EXTRA] [D] [A] [F], [EXTRA] [D] [A] [Y], and [EXTRA] [D] [A] [D] commands. The time format is set by the [EXTRA] [T] [I] [F] and the [EXTRA] [T] [I] [D] commands.

SYSTEM

Dialing Prefixes

If PAGENTRY is connected to a telephone line through a Private Branch Exchange (PBX), it may be necessary to dial a special prefix code and wait for a second dial tone. If a dial prefix is specified, it will be used before all telephone calls. Once PAGENTRY is removed from the PBX, the dial prefix should be erased.

The prefix itself usually consists of one or more digits and the letter "P" indicating that PAGENTRY should pause for a second dial tone. For example, 9P will dial a 9 then wait for a second dial

tone, a typical sequence used to access an outside line from a PBX. In this example, the key sequence is: [EXTRA] [D] [I] [9] [P] [ENTER].

Note: The Prefix Command may be permanently stored in the Directory for individual entries, if these entries are always accessed through a PBX using the same prefix code.

Software Version

The PAGENTRY software determines which features and capabilities are included in the product. The version number of the PAGENTRY software is displayed using the [EXTRA] [V] command. PAGENTRY manuals contain a section which lists the features available as of a certain version number of the software.

SYSTEM

PAGENTRY Test Diagnostics

When the PAGENTRY unit is first turned on, various self-tests are conducted automatically to check out the internal microprocessor and memory. Error Messages are displayed if any internal failures are detected.

In addition, there are several tests which can be selected with the [EXTRA] [T] [E] command. The tests are normally used by the dealer to insure that PAGENTRY is functioning properly.

The **Keyboard Test** displays each keyboard character as the key is depressed. An internal code used by service technicians is also displayed. This test is terminated by pressing the [ON/OFF] key.

The **Fax Test** sends a one-line test Fax to the Fax machine specified by the telephone number of a Directory entry which you are asked to

provide. During the trans-mission, call progress information is displayed.

The **Phone Tests** insure the proper operation of the hook switch and the output of DTMF digits.

The **Display Test** insures that each position of the LCD display is capable of showing all characters. It will terminate when any key is depressed.

HELP Command

The HELP Command can be accessed at any time by pressing the [HELP] key. In HELP Mode, the current display is temporarily replaced with a scrolling message which provides information regarding the Function you are currently performing.

Automatic Shut-Off

When first delivered, the PAGENTRY unit is set up so that if the keyboard is not used within 3 minutes the unit automatically shuts off to conserve the battery. The length of time before automatic shut-off can be changed by the user. Battery life is affected by changes to this value.

To change the time before shut-off, type [EXTRA] [P] [A] [R] [A] [2]. The automatic shut-off period does not apply during the transmission of Faxes or Pages.

When the unit is first turned on, the user has 30 seconds to press any key or the unit will automatically shut down. This avoids wasting the battery if the unit is accidentally turned on.

SYSTEM

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Low Power Indication
When PAGENTRY's battery is low, a "BATTERY LOW" message will flash periodically. If the battery power is so low that it cannot light the display, nothing will happen when the unit is turned on. However, enough power is reserved in the battery to save the information in all Memories.

The Restart Command
PAGENTRY performs all of its functions through the use of its built-in microprocessor. A mechanism has been provided to manually restart the microprocessor in the event that the PAGENTRY unit appears to be locked up in some operating mode and is not reacting to commands or even the On/Off key. If a restart is requested, PAGENTRY will be re-initialized and started as if the [ON/OFF] key had been pressed while the unit is off. PAGENTRY's Memories are unaffected by this command.

The Restart Command is entered by holding down the [R] and [E] keys simultaneously. As soon as they are released the until will restart.

Aborting Displays
PAGENTRY is designed to help speed up message entry. You can enter information even if a message is currently scrolling across the display. If a key is depressed during a display, the current display stops scrolling and the input process begins as if you had waited for the message to complete.

For example, if you press the [ENTER] key while the field prompts are appearing requesting you to enter information into the Directory, these prompts will quickly scroll by and you will immediately be positioned at the next field.

SYSTEM

Available Memory
As information is saved into PAGENTRY, Memory space is reserved to hold the information specified. Short term information such as Radio Page and Fax Messages use up Memory space as does long term information like Directory data. After short term information is transmitted, the Memory used to hold this data is made available for new information.

The amount of Memory which is still available in a PAGENTRY unit can be determined through the use of the [HELP] Command. If HELP is requested when viewing the blinking PAGENTRY prompt, two messages scroll across the display. The first message indicates what is happening while the PAGENTRY prompt is blinking. The second message reports the amount of available memory in the PAGENTRY unit.

If you wish to view the Available Memory Message without waiting for the first HELP Message to complete, hit any character on the keyboard while the first HELP Message is scrolling. The Available Memory Message will begin immediately.

The blinking PAGENTRY prompt can be made to appear by going into EXTRA Mode, pressing [ENTER], then hitting the [EXTRA] key a second time.

SYSTEM

MISCELLANEOUS EXTRA COMMANDS
This section reviews EXTRA Commands which are not explained in other section.

Fax Line Counts – [EXTRA] [F] [L]
This command is used to set the Fax parameters which control:
- The number of blank lines at the top of every Fax page
- The number of blank lines at the bottom of every Fax page
- The maximum number of lines on a single Fax page. Multiple pages will be sent if the number of lines in a Fax exceeds the maximum number of lines on one page. PAGENTRY automatically determines the number of lines required to print each paragraph. It will put as many complete words as possible on each page, but no more than 78 characters per line.

Upper and Lower Case
[EXTRA] [U] – Shifts the keyboard into Upper case
[EXTRA] [L] – Shifts the keyboard into Lower case

As characters are typed on the PAGENTRY keyboard, they are normally entered in Lower case. If the [EXTRA] [U] command is given, the keyboard changes so that characters typed from that point forward are input in Upper case. The [EXTRA] [L] Command changes the keyboard back to the Lower case default. The case can be changed any number of times during the entry of a message to use Upper and Lower case characters in a Message.

SYSTEM

Message Language – [EXTRA] [M] [E]
This command is used to display all PAGENTRY prompts and messages in a different language. The Message Language Submenu shows the list of installed languages.

Name of Owner – [EXTRA] [N]
The Name of Owner command changes the default text which appears on the From: line in Fax Messages. The first time information is entered at the From: prompt, it becomes the default. Once the default text is defined, it can only be changed via this command.

Parameters Command – [EXTRA] [P] [A] [R] [A]
This command allows various internal PAGENTRY Parameters to be changed. These Parameters are not normally changed, but are provided for the rare circumstances where special situations require a variation of the default PAGENTRY settings. The modified values should be changed by a dealer familiar with the meanings of the parameters.

The special Parameter Command [EXTRA] [P] [A] [R] [A] [C] is used to reset all PAGENTRY Memories and Parameters back to their default settings. The Directory will be cleared (erased) by this command. When this Command is given, you will be asked if you really intend to clear all Memories prior to actually clearing them. This Command has the same result as if the battery were removed for several minutes.

SYSTEM

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The On/Off Hook Parameter controls the amount of time the telephone line is put back on hook between multiple telephone calls to deliver Fax or Radio Page Messages.

Parameter Default Values

The Parameter default values are:

1	–	30	9	–	80
2	–	180	A	–	200
3	–	6	B	–	5
4	–	2	C	–	20
5	–	2	D	–	450
6	–	5	E	–	10
7	–	20	F	–	50
8	–	80	G	–	20
			H	–	100

See pages 25–26 for additional information on Parameters.

SYSTEM

SEND Mode Monitor – [EXTRA] [S] [M]

The SEND Mode Monitor allows the user to display detailed call progress information during the transmission of Fax and Page Messages. The monitor is normally used by technicians who are familiar with Fax and Paging transmission protocols. The default value for the SEND Mode Monitor is disabled (off).

XON/XOFF Control (Flow Control) – [EXTRA] [X]

The XON/XOFF control is used in DATA Mode. The default value is Flow Control enabled. If Flow Control is not supported by the computer system to which PAGENTRY will be connected, this Command can be used to disable Flow Control.

Paging Messages Control – [EXTRA] [P] [M]

PAGENTRY can send messages to Paging systems through the use of a communications protocol known as TAP (Telocator Alphanumeric Protocol). With the default settings of Paging Message Control parameters, PAGENTRY sends its Paging messages simultaneously with the display of response messages received from the Paging system. Since response messages are scrolled across the display, it is possible for PAGENTRY to get far ahead of the response messages shown. In fact, PAGENTRY could transmit all of its messages and even hang up the telephone while the user is viewing old response messages. The default parameters are set to transmit paging messages as quickly as possible and to disconnect.

Responses received are "buffered" (stored) in a special PAGENTRY Memory until they are displayed. Because of limited memory space, it is possible that some response messages could be lost even if the Page was properly transmitted. PAGENTRY will display a message if it finds it could not display every response message it received.

PAGENTRY displays the messages, "Sending..." and "Waiting..." between each message. When there is limited memory space available to hold response messages which have not been displayed, PAGENTRY will stop showing these status messages in order to conserve memory space.

The default settings of Pagentry can be set via the command [EXTRA] [P] [M] [B], [EXTRA] [P] [M] [P] and set this parameter to "N" (No) and [EXTRA] [P] [M] [S] and set this paramter to "N" (No).

GENERAL

It is possible to set up PAGENTRY to show all TAP messages as they occur (in "Real Time"), rather than buffering responses. This will increase the time of the telephone call since new pages are not sent until each response message is displayed. Some Paging systems will not work in this mode, since the display of messages delays the transmissions of new pages too long. The "Real Time" message display mode is set via the [EXTRA] [P] [M] [R] command.

PAGENTRY can be set up to quickly display its own "Page Accepted" and "Page Rejected" messages, rather than the responses from the Paging system. This mode can be set via the command [EXTRA] [P] [M] [P].

As mentioned previously, if Memory space is low, the status messages "Sending..." and "Waiting..." are eliminated. If you wish to always have these displayed between every Paging system response, use the command [EXTRA] [P] [M] [S] and set this paramter to "Y" (Yes). The default setting is "N" (No).

GENERAL

Call Progress Detection

Whenever PAGENTRY is dialing a telephone number, it listens for various tones from the line in order to keep track of the progress of the call. It first listens for a dial tone, then detects ringing or busy signals, and then listens for the expected response from the device to which PAGENTRY is to connect.

There are two parameters associated with call progress detection which will handle 99% of all calls. These parameters can be modified if necessary.

Parameter "E" is the maximum delay after going off hook and beginning to dial a telephone number. This is normally set

for 1 second. If dial tone is detected before this maximum period, dialing will begin immediately. If dial tone is not detected, a warning message will appear and the dialing process will continue.

Parameter "H" is the maximum delay before the first ring signal should be detected. This is normally set for 10 seconds. Ringing is expected to be heard within 10 seconds of placing a call. This parameter is important for communicating with certain equipment which does not cause a ringing signal to be heard before it answers the telephone. If the first ring signal is not heard before the end of the period set by this parameter, then PAGENTRY will immediately start looking for the exptected signals directly from the device to which it is connecting, in order to determine that the line has been answered. A remote computer will generate a tone upon answering the incoming call and a Fax machine will generate a specific answer tone.

Fax Minimum Line Time –

[EXTRA] [P] [A] [R] [A] [G]

Some Fax machines require that each line of Fax information it receives not be sent any faster than a certain period of time. The default setting for PAGENTRY is 20 milliseconds per line. If a Fax machine seems to be receiving partial messages, this paramter may be modified in an attempt to correct the transmission error. This value can vary from 0 to 80 milli-seconds. The default value should be adequate for 99% of all existing Group III Fax machines.

GENERAL

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GENERAL

Replacing the Battery
[Information not specified in this release of the PAGENTRY User Manual.]

RJ11 Cable
PAGENTRY comes with a special cable which connects the unit to a telephone line. When a radio Page is to be sent, a message is to be transmitted to a Fax machine, or when calling in to a remote computer system (DATA Command), PAGENTRY is first connected to the telephone network via this special RJ11 cable. PAGENTRY acts like a telephone. It goes off hook, dials the required number, automatically connects to the remote device, then begins transmission.

Acoustic Coupler
PAGENTRY may be connected to pay telephones and to other telephones where an RJ11 connection may not be available, by the use of an optional acoustic coupler. This device attaches to the top and bottom parts of a telephone handset and to the PAGENTRY unit. Its use is documented separately in the manual which comes with the coupler.

SERVICE

SERVICE
[Information not specified in this release of the PAGENTRY User Manual.]

WARRANTY

WARRANTY
[Information not specified in this release of the PAGENTRY User Manual.]

COMPLIANCE

SPECIFICATIONS
[Information not specified in this release of the PAGENTRY User Manual.]

U.S. FCC/CANADIAN DOC AND OTHER COUNTRIES' COMPLIANCE INFORMATION
[Information not specified in this release of the PAGENTRY User Manual.]

RTS
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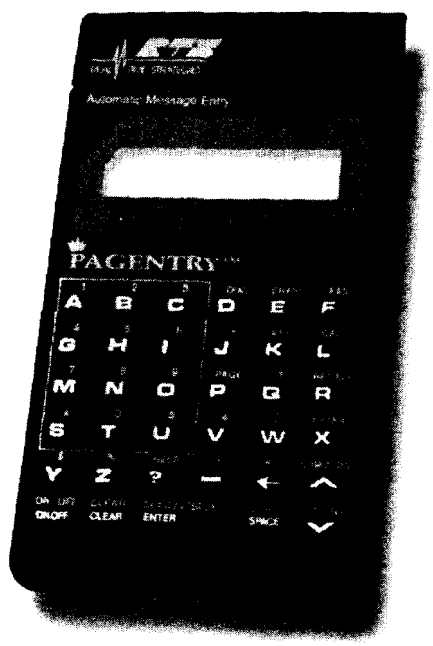
INSIDE

Product Line 2
New License Awarded 2
Alpha-Tone™ Introduced 3
TNPP Committee Activities 3
Statistics Package for IntelliPage™ 3
RTS Welcomes New Customers 3
RTS Systems Link US & Canada 3
Creating Networks of Dissimilar Paging Terminals 4
Trunk Sharing Now Available for Paging And Voice Mail 4

RTS Introduces Pagentry™

Real Time Strategies announced a significant advancement in **alphanumeric page message entry**, when it introduced its state-of-the-art product known as **PAGENTRY™** at the Telocator/RadioComm Mobile Communications North America convention in Toronto in April.



Compact and Affordable

The hand-held, pocketsize, battery-operated, **radio page message entry device sells for under $100.**

Using the PAGENTRY keyboard, a user may enter an alphanumeric radio page request at any time, then forward it to a paging terminal whenever they are near a telephone line. The device utilizes the Telocator Alphanumeric Protocol (TAP) to automatically send stored page requests to remote paging systems.

Page Entry Plus, Plus, PLUS!

RTS engineers weren't satisfied with merely providing "plain vanilla" page entry.

According to Real Time Strategies founder and CEO, Jay Moskowitz, "If we're going to ask people to keep our data entry device with them at all times, then we had to design a product that does a lot more than just page entry."

And that's exactly what RTS has accomplished. PAGENTRY also functions as a 5-function calculator and an electronic file for names, addresses, and telephone numbers. It supports automatic group calling, and allows canned alpha message segments to be utilized for faster message creation. Users can even customize PAGENTRY to better suit their individual needs.

As if all this weren't enough, **PAGENTRY is the first hand-held device ever to have the ability to transmit alphanumeric messages directly to Group III Facsimile machines!**

Cont'd p. 2

REAL TIME STRATEGIES

RTS's Products

The major RTS products are summarized below. Each of these products are software intensive and easily expanded to meet specific customer requirements. Any of the features and capabilities of any product can be integrated with the features of any other RTS product.

PAGENTRY™

Hand-held alphanumeric page entry and fax transmission for less than $100.

The ADVANTAGE

A telephone trunk concentrator and voice call processor.

Alpha PipeLine

An alphanumeric paging front end processor and port concentrator.

IntelliPage™

A system for providing Reliability and accountability in forwarding radio page requests from voice mail, fax store and forward, electronic mail and other message communication systems, to radio paging systems.

DataSpeak™

Numeric and alphanumeric paging input directly from spoken input.

Trunk Sharer

Allows radio paging and voice mail (or other message communication systems) to share a common set of End-to-End or D.I.D. input trunks.

Port Expander

Provides host computer port expansion for BBL, Glenayre, SCE and other paging terminals.

Protocol Converter

Allows the communication protocols of one paging terminal to be converted to the protocols of another paging terminal.

Distributed Data Base

Allows the data bases of many different paging terminals to appear as if they were a single centralized data base, allowing callers to access any subscriber in a network of dissimilar paging terminals.

TNPP Networker

Provides a standard TNPP network interface to any paging terminal.

PAGENTRY, cont'd from p.1

With the PAGENTRY product, RTS has also introduced a new communications mechanism, trademarked as **Alpha-Tone™** (see article page 3).

Alpha-Tone is a specially designed protocol for sending alphanumeric pages to paging systems through the use of analog Touch Tone (DTMF) signals, rather than the digital signals used by modems (as in TAP communications).

The significant advantage of Alpha-Tone is that radio paging companies can now use the same telephone trunk groups to receive tone only, numeric, voice and full alphanumeric pages.

Alpha-Tone has the unique capability of transmitting an 80-character alphanumeric message in the same period of time it takes an individual to enter a 10-digit numeric display message! Alpha-Tone can provide carriers with a substantial savings in line costs and equipment. Of course the paging terminal must be able to support the Alpha-Tone protocol.

The Real Time Strategies ADVANTAGE system, which can act as a telephone concentrator for page entry, has been upgraded to include Alpha-Tone support. An ADVANTAGE placed in front of a paging terminal will be able to handle all types of paging requests on the same group of trunks.

RTS intends to license other paging terminal manufacturers on its proprietary Alpha-Tone protocol.

New License Awarded

Real Time Strategies has granted a license to Spectrum Communications & Electronics Corp. (SCE) to utilize the RTS implementation of the TNPP protocol in the PX-2000 radio paging terminal.

The license will permit SCE to provide a fully integrated version of the TNPP protocol in its paging systems.

Alpha-Tone™ Introduced

The PAGENTRY™ product (see article page 1) is the first device ever to support the transmission of radio pages through the use of the Alpha-Tone™ telecommunications protocol. A protocol is a list of rules for transmitting and receiving data.

Alpha-Tone is known as an analog transmission protocol since it forwards information through the use of touch tone signals. Utilizing specially designed techniques which employ data compression technology, alphanumeric radio page requests are pre-processed in the PAGENTRY device and are then converted to a special sequence of touch tone signals.

The mechanism to convert alphanumeric messages to tone signals is too complex for a human to enter messages directly via a telephone and requires the use of a computer to process the message.

The techniques employed can result in the ability to represent an 80-character message as a sequence of tones which take less than 9 seconds to transmit!

The entire time to send an alphanumeric message using the Alpha-Tone protocol will generally be equivalent to the average time to receive a numeric page request.

Alpha-Tone and PAGENTRY are exciting new products which will assist radio paging service providers in making alphanumeric paging easier and more affordable for their current and new customers.

Real Time Strategies, the leader in the application of state-of-the-art technology to the radio paging industry, continues to be:

"Your Strategy For Success in Communications"

TNPP Committee Activities

Jay Moskowitz, Chairman of the TNPP Committee and President of RTS, is continually promoting the use of the TNPP protocol as a means of communicating between paging systems.

Recently he contacted ETSI, the European organization responsible for the development of the European Radio Message System (ERMES) standards. The ERMES standard is to be utilized in order to create a Pan-European Radio Paging network.

Moskowitz has been invited by ETSI to attend ERMES meetings in Europe to discuss the potential integration of the TNPP standard into the ERMES network designs.

RTS Welcomes New Customers

Real Time Strategies would like to welcome some of its newest customers: CANTEL, CONTEL, NYNEX Mobile, and PACTEL Cellular.

PACTEL Cellular will be utilizing an IntelliPage system for high volume reliable paging out of their OCTEL Sierra systems in the Los Angeles cellular marketplace.

NYNEX Mobile will be utilizing an IntelliPage system to service their Boston Technology voice mail system which is connected to their cellular switch

U S WEST NewVector Group has awarded RTS a contract which will further increase the number of IntelliPage systems installed throughout their cellular network.

Real Time Strategies is also happy to announce that it has received a letter of intent from another Regional Bell Operating Company for the installation of IntelliPage systems. Additional information about this application will appear in a future edition of *The Real Timely News.*

Statistics Package for IntelliPage™ Systems

A statistical information gathering and analysis package has been added to the IntelliPage™ product.

IntelliPage is a system which provides reliable and accountable delivery of radio page requests from voice mail, fax store-and-forward, electronic mail, telephone answering and message dispatch systems.

The IntelliPage statistics package analyzes paging requests received from the communication system which it is servicing, as well as radio page deliveries which are made over analog and digital communication links. The reports which are automatically generated by the system assist the administrative staff in measuring the delivery performance and traffic handling capabilities of an IntelliPage system.

Using these reports, a system administrator can determine when to add additional incoming, dial-out or dedicated communication links to a system, in order to handle increased volumes of radio paging message traffic.

The statistical analysis utilizes actual performance measurements to predict the theoretical maximum traffic handling capability of a system. In this way, a system upgrade can be installed prior to subscribers experiencing delays in the receipt of their radio pages.

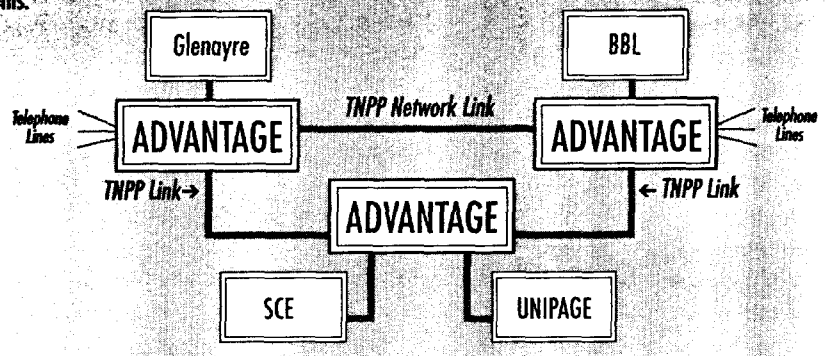
RTS Systems Link U.S. to Canada

SkyTel has recently extended its United States paging coverage into Canada, through its connection to an RTS ADVANTAGE system at Rogers Cantel Paging. The ADVANTAGE is acting as a gateway to connect the SkyTel U.S. system to the CANTEL Canada-wide radio paging network.

Creating Networks of Dissimilar Paging Terminals

With all the acquisitions taking place in the marketplace today, it is not uncommon to find an RCC which operates several different manufacturers' paging terminals. The ADVANTAGE system has the unique capability to allow callers to access subscribers in any paging terminal as if they were all part of a single cohesive telecommunications network.

The ADVANTAGE makes the individual data bases of each of the paging terminals accessible to dial in callers as if a single centralized data base existed. Tone only, numeric, alphanumeric and voice paging calls which enter an ADVANTAGE system can be paged on directly connected paging terminals or paged on terminals connected to remote nodes in a network of ADVANTAGE systems. The ADVANTAGE provides all of the intersystem networking requirements.



Trunk Sharing Now Available For Paging & Voice Mail

If your firm is providing radio paging and voice mail services over separate sets of trunks, you may wish to consider using an ADVANTAGE trunk sharing system. A single set of trunks can be utilized to provide both services.

The total number of trunks required could be significantly reduced when a single set of lines are utilized to service the entire customer base. And, the ADVANTAGE will provide new features and services at the same time.

Radio page requests can be entirely accepted directly by the ADVANTAGE and forwarded digitally to the paging terminal. Voice mail requests are switched through the system and directed into lines on the voice mail system. The ADVANTAGE may also be utilized to share incoming lines with other message communication systems.

Call routing is based upon the telephone number or account number being accessed.

REAL TIME STRATEGIES

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U S WEST CELLULAR INSTALLING RTS' INTELLIPAGE INTEGRATION PRODUCT

Real Time Strategies Inc. has signed with several major firms to provide its Intellipage product, a paging system that tells customers messages are waiting on their voice mail, telephone answering machines, electronic mail and dispatch systems, and fax store-and-forward.

Intellipage works by sending page requests from a computer into any manufacturer's paging terminal. It can forward page requests in either digital or analog format, and one system can send out page requests to more than 50 telephone lines. Several Intellipage systems can be combined to serve additional telephone lines.

Introduced last April, the Intellipage system will be installed systemwide by its first customer, U S West Cellular. The MSO signed on for Intellipage to relay messages from its voice mail system to pagers in Seattle and Tacoma, Wash.; Denver, Colo.; Minneapolis, Minn.; San Diego, Calif.; Albuquerque, N.M.; Salt Lake City, Utah; and Phoenix and Tucson, Ariz. U S West Cellular plans to install Intellipage in a total of 26 MSAs and 14 RSAs by mid year, the company said. .

"We're increasing the synergies between cellular, voice mail, and paging -- the ultimate mobile communications triangle," said Judy Houppert, manager of U S West Cellular's Message Center products. Prior to adopting Intellipage, U S West Cellular depended on its voice mail system to dial pagers, Houppert said. But the voice mail was often unreliable and inefficient, she said.

U S West Cellular also upgraded its voice mail and paging Message Center service to handle up to 25 messages, each of which can be up to five minutes long. New messages will be saved for a week, other messages can be stored for up to two weeks, and customers can record a personal greeting.

PacTel Cellular also has contracted with RTS for an Intellipage system, an RTS spokesman said. PacTel's Intellipage system should be installed in May, RTS said. Two other carriers also are currently negotiating contracts, RTS said.

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Issue #44

TECHNOLOGY BRINGS PAGING CLOSER TO CELLULAR VOICE MAIL SYSTEMS

New and improved software is now available for carriers to interface their voice mail services with local paging companies. Paging appears to be gaining stature as an enhanced feature as cellular carriers upgrade their paging notification systems.

U'S West, NewVector Group Inc. has installed several of the IntelliPage™ interfaces into its Octel Aspen voice mailboxes. The units will be used to forward radio page alerts to cellular telephone and other subscribers.

IntelliPage™, from Real Time Strategies, Hicksville, N.Y., is a software-intensive system that interfaces with all paging systems and their protocols--potentially hundreds of paging systems--to voice messaging systems. When cellular subscribers are away from their phones, their calls are forwarded to voice mail that is then converted into a message on a paging system.

"It is a natural flow that voice mail would need to talk to a paging system. In the office, you use a message-waiting light and in the car, you use a pager," said Paul Buboltz, manager, network projects.

The need from a customer's point of view is for a real-time reliable paging notification, according to Buboltz, and IntelliPage™ is more reliable than other analog paging interfaces.

"IntelliPage™ is a clean, intelligent way of delivering the messages. It can communicate in either analog or digital protocols," Buboltz said. "It bridges the gap between the voice mail and the paging terminal with an intelligent handshake."

In addition to interfacing with fully automated systems, such as voice messaging and facsimile, IntelliPage's™ page alerting can be done from a semi-automated system or manual system. It can be also used in hospitals or large organizations that do centralized dispatching of field service engineers.

Cellular, Paging 'Need Each Other'

"They [cellular and paging] both need each other. There are many cellular subscribers that have pagers," said Spencer Kravitz, executive vice president, Real Time Strategies. "The subscriber gets immediate notification that there are messages waiting for him. It is a way of alerting them as quickly as possible--it keeps the information timely. And it also keeps the subscriber from having to call in for messages periodically."

"It is definitely a marrying of the 2 technologies, and it provides a value-added enhancement for subscribers of each technology," Kravitz said.

"Service providers are providing cellular subscribers with pagers. It is good for the paging company as well as the cellular company."

"From the subscriber's point of view, he is getting messages even when he is away from his car. It also helps proliferate paging, by getting paging to subscribers that otherwise would not have had a need," he added.

While the system is new, the company plans on installing hundreds of units over the next year. U S West was the first order.

IntelliPage™ is not limited to bringing together paging and cellular. That is just a subset. The product is also capable of interfacing paging with voice messaging, facsimile store and forward systems, electronic mail systems, telex systems as well as centralized communications systems.

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Hicksville, New York 11801

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PAGENTRY Fax Transmission Date: 06/01/92 Time: 11:40:48 Page: 1

MEMO

TO: Jay Moskowitz
FROM: Henry Zachs
SUBJECT: Meeting change

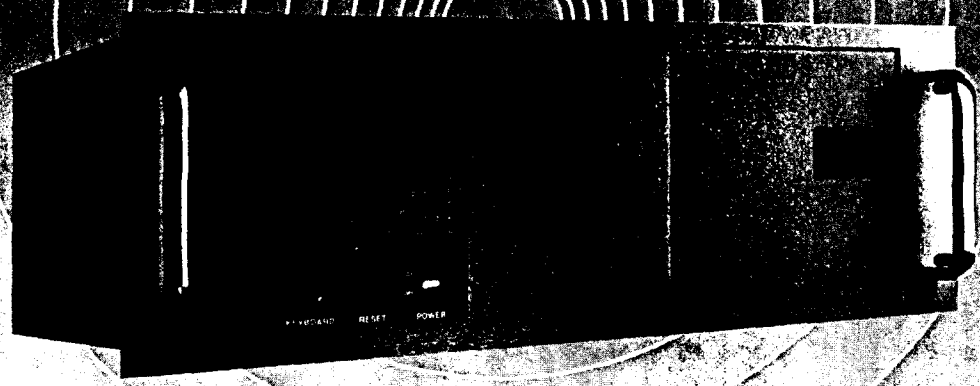
MESSAGE:

I received your radio page regarding the change to the location of our meeting. No problem, I will see you there.

--This message has been transmitted via a PAGENTRY hand held fax machine--

DataSpeak™

ALPHANUMERIC PAGER MESSAGE ENTRY FROM THE HUMAN VOICE



We don't need to remind you of the difficulties in marketing alphanumeric paging. In the past, message entry has been cumbersome and sometimes expensive. Now the Technological Innovator in the paging industry brings you the ability to input alphanumeric & numeric–only display messages from any telephone with the ultimate message entry device: **THE HUMAN VOICE**

DataSpeak™ offers you the ability to economically mass-market alphanumeric paging without operators or awkward data entry devices. Callers simply dial the appropriate access number and speak the message they wish transmitted. Voice prompts instruct the caller on the proper call sequence. In addition, other valuable features are available such as T1 interfacing, trunk concentration and TNPP Networking. As an intelligent, total front end call processing system, the **DataSpeak™** can bring many competitive features to your present paging system or open new markets in distant cities. Now you can benefit from technological breakthroughs without throwing out your present paging terminal. As a highly flexible, software intensive front end processor, **DataSpeak™** can be tailored to your company's specific objectives. Unlike other manufacturers, your special requests are our business.

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"Your Strategy For Success In Communications"

DataSpeak™

ALPHANUMERIC PAGER MESSAGE ENTRY FROM THE HUMAN VOICE

Features & Specifications

Standard Features

- Translation of English Language Voice Messages to Alphanumeric Text
- Works with any Standard Telephone
- Interfaces with any Paging Terminal
- Utilizes State-of-the-Art, Speaker Independent Voice Recognition Technology
- Processes Numeric-Only Calls Without Touch Tone Phones
- Voice Prompts
- End-to-End Signalling
- Utilizes Data Base From Host Terminal For Validation
- Traffic & Statistical Reporting
- Combines Multiple Enhanced Features into One Call Processor
- Remote or Local Trunk Concentration

Technical Specifications

- Maximum Input Ports: 32
  (Multiple units can be networked to increase capacity to any level of trunking.)
- Input Power Requirements:
  110 VAC, 220 VAC or 48 VDC (optional)
- Programming Interface: RS-232
- Maximum Subscribers Base: Same as host
- Input Ports Supported DID (Pulse, DTMF, MF) End-To-End, T1, IXO/TAP
- Voice Page Delivery to host Terminal: Dedicated or Dial-Up

OPTIONS

- TNPP Networking
- Tone & Voice Paging With Voice Storage
- T1 Interface
- MF Signalling
- Recognition of Foreign Languages
- Host Terminal Prompt Emulation
- DID Signalling (Pulse, DTMF. MF)

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An Introduction to IntelliPage™ Cascading

The Cascading option for the IntelliPage™ Page Alert Delivery system, adds a new dimension to insuring that messages are retrieved by subscribers. IntelliPage is a system whose primary function is to provide reliable and accountable delivery of Radio Paging Alerts to paging systems, when a message is deposited in a Voice Mail, Fax Store-and-Forward, Electronic Mail or Message Dispatch system. When IntelliPage is connected to one of these systems, the communication system it is servicing hands off all requests for page alerting to IntelliPage, whenever it is determined that it is time to inform a subscriber to call into the system to retrieve information.

When the cascading option is installed, one or more pagers may be simultaneously alerted when an urgent message is received at the messaging system being serviced by IntelliPage. Pages are sent periodically in an attempt to alert the subscriber to retrieve their urgent messages. After repeated attempts to alert the subscriber fails to result in the retrieval of the urgent message, IntelliPage can increase the Cascading Alert Level and begin alerting another set of pagers, leave messages on other systems, or call home, office or mobile telephone numbers in an attempt to reach the subscriber.

Cascading operates in conjunction with a Local Data Base maintained within the IntelliPage system. For those accounts which wish to utilize the cascading feature, an entry is made into this data base. Page alerts from the communication system being serviced by IntelliPage are received over an SMDI link. This type of link provides IntelliPage with Message Waiting Activation and Deactivation signals, indicating when there are outstanding messages still pending in a mailbox as well as when messages have been retrieved.

Cascading operates under an escalating priority mechanism. Upon the initiation of the cascading page alert functions, the cascade level is set to 1. The data base entry for the subscriber being alerted, defines information associated with each of the pagers which should be simultaneously alerted at level 1. IntelliPage will utilize its normal page delivery mechanisms to reliably forward page alerts to each of these pagers.

Associated with a cascading level is a repetition count and a repetition rate. The repetition rate indicates how long IntelliPage should wait before it should attempt to alert the same set of pagers another time. If the message pending on the system serviced by IntelliPage has not been retrieved prior to the expiration of this interval, then IntelliPage will send out a new set of page alerts. This process will continue until the number of sets of page alerts which have been attempted has reached the repetition count associated with the cascading level.

Upon reaching the maximum number of delivery attempts defined at a cascade level, IntelliPage automatically escalates the cascading level to the next higher level. The data base entry at level 2 will define information associated with each pager to alert at this level as well as a repetition count and repetition interval for this level. The same page alert process will now proceed at this level until a caller retrieves the message which initiated cascading, or until it is time to escalate cascading to the next higher level. IntelliPage does not limit the number of cascading levels which may be programmed for an account.

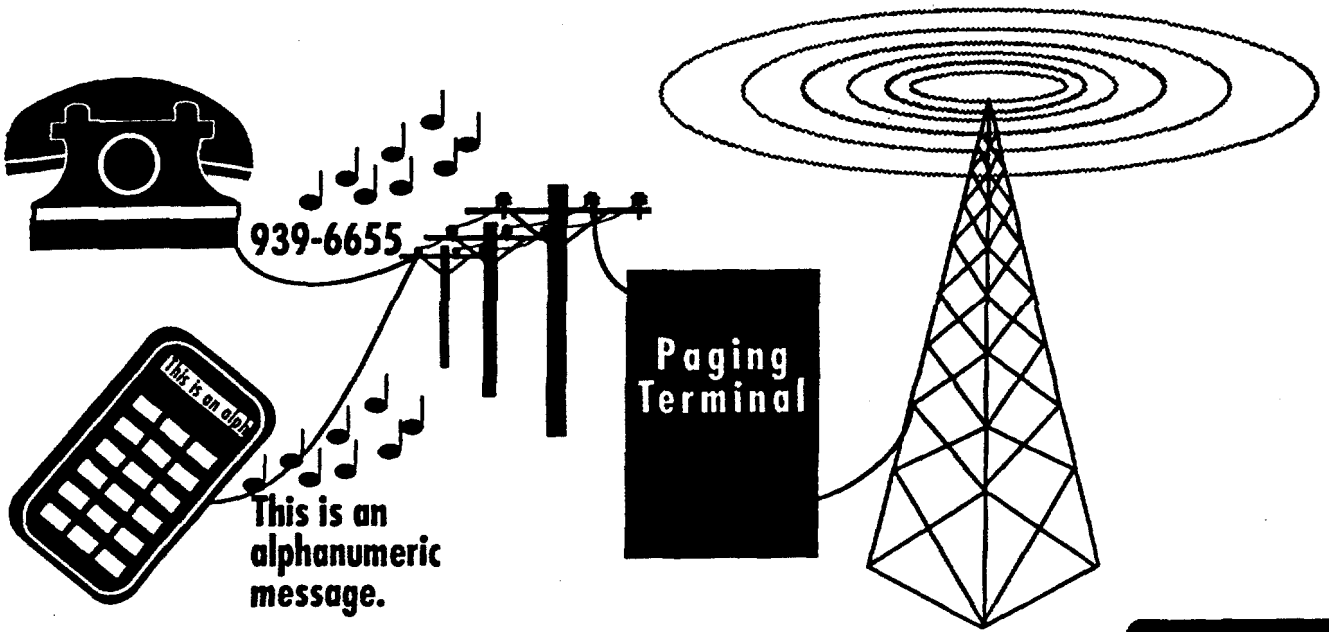
Each time a set of page alerts are initiated, a real time call log entry is generated for each page in order to provide complete accountability of the page alerting process. When all attempts to alert a subscriber at a given cascade level have failed, a special message is generated to the call log indicating that cascading has moved to a higher priority. If all attempts to alert the subscriber at all cascading levels have failed, another message is added to the call log to indicate that all attempts have failed.

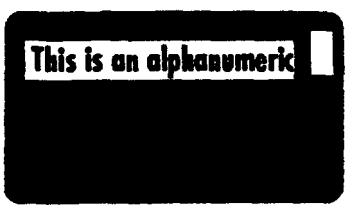
The cascading feature is essential when a team of individuals are on alert in emergency situations. For example, an oil burner repair company may have a single person on call during the night in case a "no heat" emergency call is received. The caller with the emergency might leave a voice mail message in a mailbox. The depositing of this message causes IntelliPage to begin its page alerting process. Cascading parameters might indicate that page alerts should be sent to the oil burner repair person currently on call, every 3 minutes up to 3 times. Nine minutes after paging is initiated, if the voice mail message has not been retrieved, IntelliPage will automatically escalate cascading and will now begin paging the backup team that an emergency has been reported and the individual on call has not picked up the emergency message. If, after repeated attempts to contact the backup team still has not resulted in the retrieval of the emergency messages, then supervisors and managers can be alerted.

Because IntelliPage is also capable of delivering canned voice messages to any desired telephone number, at each level of cascading, the system can call home telephone numbers, answering machines, business numbers, etc., to leave emergency messages.

IntelliPage is normally a "back-end" processing system which is used by a service provider to improve their level of reliability. But, with the Cascading feature installed, IntelliPage can become a revenue producing system. The service provider can charge a monthly fee for providing the escalating page alert functions since they provide value added capabilities over a simple paging process.

Contact Real Time Strategies for the pricing associated with the cascading option.





NOW...

Receive Alpha Messages Using Your Numeric Paging Trunks!

Receive an 80-character message on your numeric trunks in 10 seconds by using: Alpha-Tone™!

In the past, you had to have dedicated trunks and modems for your alphanumeric paging customers. Now with Alpha-Tone, your numeric paging trunks can receive an 80-character alphanumeric message in the same time that it takes to receive a numeric page request from a typical subscriber!!

Your paging terminal manufacturer needs to install Alpha-Tone telephone input software into their paging terminal or you can install an ADVANTAGE call processor and trunk concentrator in front of your paging terminal.

PAGENTRY,™ the hand-held alphanumeric entry device for under $100, can send messages using the Alpha-Tone protocol (for tone trunks) or TAP (for trunks with modems).

Speak with RTS to learn more about receiving Alpha Messages using your normal paging trunks.

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7 Channel Capacity

Channel capacity is the maximum number of pagers that can be put on a channel. This value depends largely on calling patterns; a better value might be the paging rate, for instance, pages per second. However, calling patterns are fairly predictable and may be considered as fixed. Therefore, the capacity is the value used in this section for comparison as it is the value most interesting to carriers.

The factor that converts pages/second into total number of pages on a channel is the "busy-hour-call-rate". This value is determined by measuring the portion of the total pager population on one channel that is called in one hour, usually the busiest hour of the day. The relationship between these factors may be expressed as follows: if N is the number of numeric pages transmitted per second on a particular channel in a particular format, and *bhcr* is the busy-hour-call-rate, P is the total number of pagers (numeric) that can fit on this channel:

$$P = \frac{N}{bhcr} \times 3600$$

Both POCSAG and ERMES come in several flavours: tone-only, numeric, alphanumeric, and "transparent data" in the case of ERMES. Most paging channels would contain the first three and for the purposes of comparison, we will not include transparent data in this discussion. A formula can be developed to estimate the capacity of a channel with a mix of pager types (all of one encoding format). The following paragraphs describe how this formula is derived.

Suppose that the channel was using 80% of the available numeric capacity. That would leave 20% for something else, either tone-only, alphanumeric, or both. If we called n' the fraction of numeric capacity used, t' the fraction of tone-only capacity used, and a' the same for alphanumeric, we could make a more general formula. Also, call T the rate for tone-only pagers and A the rate for alphanumerics:

$$P = t' \times T + n' \times N + a' \times A \times \frac{3600}{bhcr}$$

This equation is not particularly useful yet because it is more convenient to use the fraction of the pager population rather than the fraction of the capacity. These values are different because the different pager types vary in the amount of airtime used to send a page. If we call C_n the number of codewords used for a numeric page, C_t the same for tone-only

pages, and C_a the same for alphanumeric pages, we can normalize the capacity fractions to t, n, and a, the population fractions for tone-only, numeric, and alphanumeric respectively.

$$t' = \frac{tC_t}{tC_t + nC_n + aC_a}$$

$$n' = \frac{nC_n}{tC_t + nC_n + aC_a}$$

$$a' = \frac{aC_a}{tC_t + nC_n + aC_a}$$

So far, the general formula for the maximum number of pagers on a channel is:

$$P = \frac{tC_tT + nC_nN + aC_aA}{(tC_t + nC_n + aC_a)\,bhcr} \times 3600$$

where t, n, and a are the fractions of the pager populations for tone-only, numeric, and alphanumeric pagers respectively, C_t, C_n, and C_a are the number of codewords to transmit a tone-only, numeric, or alphanumeric page respectively, and T, N, and A are the rates of transmission for tone-only, numeric, and alphanumeric pages respectively in units of pages per second.

However, this equation may be simplified because of the following relations:

$$C_tT = C_nN = C_aA = R$$

$$t + n + a = 1$$

The constant R is the number of codewords per second for the specific paging format. Therefore, the basic digital channel formula is:

$$P = \frac{R}{(tC_t + nC_n + aC_a)\,bhcr} \times 3600$$

Equation 1: Basic Mixed Channel Capacity Formula

The value R is the actual usable number of codewords per second, not the basic codeword transmission rate. Code overhead must be considered in calculating R. In the POCSAG code, this is easy; every POCSAG packet starts with a preamble and every batch starts with a synchronization codeword. These are unusable for real data and are considered overhead. For ERMES, it is more difficult. Every batch starts with a preamble and syn-

chronization codeword, but inside the data portion, there is an address partition terminator of variable size and some amount of filler codewords in the data codeblocks when messages do not align to the codeblock size.

One factor that affects efficiency is the basic ability to pack data into the formats. Some paging terminals have been observed to pack data into the POCSAG format at 100% theoretical efficiency. So far, there is not very much practical experience with the ERMES format, but the data packing is far more complicated than with POCSAG. There may be added inefficiencies with ERMES because of this complication, but it will not be considered here.

7.1 POCSAG Codeword Rate

The POCSAG codeword rate, including overhead may be calculated as follows: POCSAG specifies 576 bits for the preamble and 512 bits for each batch separated by a 32-bit synchronization codeword. The packet length could be infinite, but we will use a practical value of thirty batches per packet. With this information, we can calculate the number of usable codewords per second in a thirty batch packet at 2400 bits per second:

$$\frac{2400 \times (30 \times 16)}{[576 + 30 \times (512 + 32)]} \approx 68.2$$

The maximum practical rate for 2400 bits/second POCSAG is about 68.2 codewords/second, with almost 10% of the total bits transmitted considered pure overhead.

7.2 ERMES Codeword Rate

The ERMES codeword rate is a bit more complicated to calculate. We will calculate the overhead based on one of the first fifteen batches in a subsequence; the sixteenth batch is a different size. In a batch, there are 154 codewords, but five are used for synchronization and system information. At the end of the address partition are terminator codewords and inside the message partition are message delimiters. As there may be between one and nine address partition terminators, we will settle on an average value of five. The message delimiters will be counted along with the message but there is one at the beginning of the message partition that will be included here. As well, there will generally be some unused codewords in a codeblock, which also must be counted here. We will say that there are always two extra codewords because of this. Therefore, out of 154 possible codewords, 5 + 5 + 1 + 2, i.e. 13, are overhead.

At 154 codewords per batch, 141 of them usable, thirty bits per codeword and 6250 bits per second, the number of usable codewords per second is:

$$\frac{141 \times 6250}{154 \times 30} \approx 191$$

The maximum practical rate for ERMES is about 191 codewords/second with just over 9% of the bits transmitted considered pure overhead.

7.3 POCSAG Paging Rates

The next step is to set the number of codewords required to send a page. With POCSAG, the following is the case:

- a tone-only page is always one codeword
- a numeric page, with 5 to 10 characters, is one address plus two data codewords, total of three
- an 48-character alphanumeric page is one address plus 17 codewords, total of 18
- a 200-character alphanumeric page is 71 codewords

Therefore, the maximum rates for the three types of pagers are:

- Tone-only: 68.2 pages/second
- Numeric: 22.7 pages/second
- Alphanumeric: 3.78 pages/second for 48-character messages (0.97 pages/second for 200-character messages)

7.4 ERMES Paging Rates

The above is repeated for ERMES:

- a tone-only page is always four codewords
- a numeric page, with 5 to 9 characters, is one address, two message header, two message, and one message terminator codewords, total of six
- a 48-character alphanumeric page is one address, two message header, 19 message, and one message terminator, total of 23 codewords
- a 200-character alphanumeric page is 82 codewords

Therefore, the maximum rates for the three types of pagers are:

- Tone-only: 47.8 pages/second
- Numeric: 31.8 pages/second
- Alphanumeric: 8.3 pages/second for 48-character messages (2.33 pages/second for 200-character messages)

7.5 Typical Paging Channels

The typical paging channel in metropolitan American cities is heavily weighted toward numeric paging. A typical distribution of pager types may be 85% numeric, 5% alphanumeric, and 10% tone-only. However, with higher speeds, alphanumeric paging may increase its share of the distribution. Also, message lengths may increase. Four paging channel scenarios will be considered:

1. Pure numeric channel
2. Heavy numeric channel, 85% numeric, 10% tone-only, 5% alpha
3. Heavy alpha channel, 50% numeric, 45% alpha (messages around 50 characters in length), 5% tone-only