SPS5 v9 SERIES PAGING SYSTEM MANUAL

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INTRO TO THE V9 PAGING SYSTEMS

       The SPS5 v9 series of paging systems transmit POCSAG messages and/or tones to Paging Data Receivers (PDRs). These messages can come in various paging protocols, or in various methods of delivery such as automatic transmission, manual typing of messages, and it can also receive messages from other devices as long as the paging data protocol is compatible with an SPS-5v9 system. Below is a picture of our current line of paging systems which will be broken down as well as any other systems that are compatible with the Paging Encoder Setup v9 software. Each paging encoder can be sold separately without the radio transceiver for your own custom build, and the main operation of the encoder does not change.

Figure 1: Current Paging System Lineup

SYSTEM OVERVIEW

       Your WaveWare v9 Series Paging System includes a UHF or VHF transceiver, an onboard RS-232 Serial COM port, and an Ethernet interface for communications and encoding paging messages for RF transmission using the industry standard POCSAG paging protocol. The v9 series Radio Transceiver maintains an input buffer, which can receive commands from a Host Device by a Serial or Ethernet connection while a page is being transmitted. When a command is received from the Host Device, the Encoder responds with a message back to the Host Device, encodes the paging message into POCSAG format, and transmits the encoded paging message to your paging receivers. The Paging Control Protocols, defined in this handbook and detailed in the appendices, allow you or others to develop software or devices to directly control the paging encoder.

MODELS & FEATURES

CURRENT SYSTEMS

Figure 2: Current Paging System Comparison

Model No.	Serial Ports	Ethernet Sockets	Paging Transmission Wattage	Duty Cycle Range	Serial Config.	Web Config.
SPS5 v9E	1	2	2 or 5 Watts	30% - 70%	Y	Y
SPS5 v9S	1	0	2 or 5 Watts	30% - 70%	Y	N
SPS5 v9E-XL	1	2	5 Watts	100%	Y	Y
SPS v9E-HP	1	2	10 - 25 Watts	80%	Y	Y

LEGACY SYSTEMS

These legacy systems will not be discussed in this manual, but they are able to be used with the WaveWare V9 Encoder Setup Software v9.3.xx.

Figure 3: Legacy System Comparison

Model No.	Serial Ports	Ethernet Sockets	Paging Transmission Wattage	Recommended Duty Cycle Range	Serial Config.	Web Config.
SPS5 v9	2	0	2 or 5 Watts	30%-70%	Y	N
SPS5 v8	1	0	2 or 5 Watts	30%-70%	Y	N

FEATURES & CAPABILITIES

The capabilities of the SPS5 Series Paging Systems is standard across the board with the exception of the **SPS5 v9S and Legacy Systems: These do not have an Ethernet Port and thus cannot be configured or receive messages over IP**.   Below is a comprehensive list of the features and capabilities you can expect from your WaveWare V9 Series Paging System:

- **SERIAL PORT CONTROLLED OPERATION** via the RS-232 Serial Port with programmable communication parameters. Valid serial baud rates are: 300, 1200, 2400, and 9600, with None, Even, or Odd parities. Default setting is 9600-None, unless specified differently by a customer requirement.

- **UHF & VHF BANDS** WaveWare has FCC Shared-Use Licenses for different frequencies in the UHF band (450-470 MHz). For VHF or any UHF frequencies we do not own, we can handle your site's application to the FCC for a fee. This only applies to U.S. installations.

- **ETHERNET PORT CONTROLLED OPERATION** via the Ethernet port with 2 simultaneous connections allowed. Since the paging system exists as a device on your network, the usual modifiable settings such as IP, Port, Gateway, DCHP, etc. are configurable via the Serial Port if you have trouble connecting it over IP.

- **INDEPENDENT CONFIGURATIONS** for the Serial port and for each of the Ethernet socket connections. Each of these configurations can exist and be used simultaneously with each other.

- **2 CONFIGURATION METHODS** using either the Windows V9 Encoder Setup Software to connect through the Serial port, or a web browser connecting through the Ethernet port.

- **2 TO 25 WATT OPTIONS** depending on the model chosen with an option to upgrade to 50 Watts using a TPL Amplifier Kit.

- **INDUSTRY STANDARD POCSAG** Paging Protocol Covering the Full Range of Paging Functions, Including:

  - 512, 1200 and 2400 bps RD Baud Rates

  - Alphanumeric (Text), Numeric and Tone/Vibe Only Paging Message Formats

  - Multiple Tone and Vibration Patterns

  - Batch Message Delivery up to 32 messages, with 240 Characters per Message (500 Characters in WaveWare Paging Protocol)

- **MULTIPLE PAGING PROTOCOLS** customizable for each connection. The compatible protocols are:

  - **TAP v1.8**: A bidirectional protocol that has the most robust and secure communications interface for radio paging.

  - **PET:** which provides human readable messaging prompts and also supports TAP protocol message formats.

  - **COMP1:** Delivers a <CR> or <CR><LF> delimited data to one more pagers.

  - **COMP2:** A command string composed of PagerID<CR>Message<CR>.

  - **Scope:** A proprietary single serial command string that Includes Cap Code, Function Code, RF Data Rate, and message values.

- o **WaveWare:** A similar protocol to Scope with the exception of having extended messages up to 500 characters.

- o **SNPP:** A bidirectional protocol originally designed as a paging gateway protocol into wide-area paging networks via Ethernet.

- **EXTENDED PAGER ID METHOD** TAP, COMP2, and SNPP compatible extended interface supporting embedded control characters and paging message encoding parameters appended to the Pager ID field.

- **PAGER ID AS CAP CODE MODE** This allows a pager ID value in the COMP2, TAP or SNPP protocols to be treated as a Cap Code, allowing a bypass of the Pager Database. This method reduces database configuration efforts and opens the Paging Encoder up to use of the full approximately 2 million POCSAG Cap Code values.

- **CARRIER SIGNAL DETECTION** an option that automatically delays your transmission while a nearby signal with the same frequency is operating.

- **CARRIER DETECT POLARITY** supports the integration of the WaveWare v9E/v9S Paging Encoder to a variety of radio transmitters. It can be set at 0 or 5 Volts.

- **PROGRAMMABLE PAGER DATABASE** Supporting 5,000+ pagers, and up to 10 Groups of 15 Pager IDs each, Stored in Non-Volatile EEPROM Memory. The Pager Database is "Not Required" for WaveWare Protocol, Scope Protocol, the Extended Pager ID Method, or Pager ID as Cap Code Mode. Windows Software, called WaveWare SPS-5 v9 "Paging Encoder Setup" is provided for Pager Database Programming, Com Port Settings, Ethernet settings, Range Testing, and General Messaging.

- **VERBOSE/NON-VERBOSE RESPONSE MODES:** Verbose Output means the paging system responses include more information than Non-Verbose responses.

- **TRANSMITTER DUTY CYCLE MANAGEMENT** in Percentage, from 0 to 100. A 0 value in this context means 100% as well.

- **DATA ENCODING POLARITY** supports the encoding of POCSAG messages for compatibility with different pager models. Can be set to Normal or Reverse Polarity.

- **VARIABLE BATCH MESSAGING SIZE** ranging from 1 to 32 messages per batch. Batch Messaging allows higher message throughput by outputting a single POCSAG preamble for the batch of messages.

- **TIMED MESSAGING FUNCTION** allows a paging system to monitor the host system, and automatically deliver alert paging messages if the host system does not communicate to the paging system within a 2 Min. time cycle. The Timer Triggered Messaging Function can also be used as a repetitive RF ping for Fully Supervised Applications. Predefined alert messages can be up to 60 characters in length.

- **FLOW CONTROL SIGNALING** accommodates a variety of methods of busy terminal signaling. Valid Flow Controls include:

  - None

  - Hardware (CTS)

  - Software (XOFF/XON)

  - Alt Hardware (CTS gets asserted before message response)

  - Alt Software (XOFF is outputted before message response)

- **DIRECT ENCODER CONTROL** (no pager database) is available in the following ways:

  - Setting Pager ID as Cap Code and running TAP or COMP2 Paging Protocols.

  - Using Extended Pager ID Encoding and running TAP, COMP2, or SNPP Paging Protocols.

  - Use the Scope or WaveWare Paging Protocols.

OBTAINING PAGERS FOR YOUR PAGING SYSTEM

You can use a wide variety of Paging Receiver types with WaveWare v9 Series Paging Systems, including Alphanumeric, Numeric and Tone/vibe and Wireless Message Centers. WaveWare Compatible Paging Receivers can be obtained from many sources including WaveWare Technologies. The Paging Receivers that you obtain for use with WaveWare v9 series paging systems should meet the following basic specifications:

- **FREQUENCY:** All paging receivers used with v9 series paging systems must have the same frequency and must match the frequency of the paging system transmitter.

- **POCSAG:** All paging receivers must be POCSAG compatible in order to be used with v9 series paging systems.

- **BAUD RATE:** Each paging receiver must have a baud rate of 512, 1200, or 2400 to be used. Different baud rates can be used in a single installation.

- **CAP CODES:** Each paging receiver must have at least one active cap code programmed into it.

Figure 4: POCSAG Device Examples

ALPHANUMERIC PAGERS

NUMERIC PAGERS

PAGING DATA RECEIVERS

PAGING DATA REPEATERS

WALLPAGERS

Your WaveWare v9 Series Paging System includes: 1 Transmitter Unit, a "Rubber Duck" Antenna, 1 RS-232 Cable, 1 Ethernet Cable (where applicable), Mounting Screws/Plastic Anchor Kit and a Power Supply. To install the paging system, please follow these steps:

1. **ATTACH THE "RUBBER DUCK" ANTENNA** to the transmitter output. In normal paging operations, the paging transmitter antenna should be oriented in a vertical position to maximize the paging range.

(**Note:** *Don't attempt to operate the system without the antenna connected to the paging transmitter, as damage to the paging transmitter may occur*.)

2. **REMOVE THE FRONT COVER OF THE PAGING SYSTEM AND HOLD IT UP AGAINST THE WALL** or a non-metallic vertical surface to mark where the 2 holes will go where you will mount the paging system.

3. **DRILL AND ATTACH THE TOP # 8 X ¾" SHEET METAL SCREW** to the wall or vertical surface (use the plastic anchors if needed).

4. **MOUNT THE SYSTEM ONTO THE TOP SCREW**, using the 1-slotted mounting hole near the top of the unit inside the enclosure. **PLACE THE 2ND SCREW** into the round hole near the bottom of the enclosure, **TIGHTEN BOTH SCREWS AND RE-ATTACH THE FRONT COVER** of the paging system.

5. **PLUG THE RS-232 CABLE** into an available DB9 Serial male connector on the back of the Host Device, and connect it to the DB9 female connector on the paging system.

(**Note:** *If the Host Device Serial port has a DB25 or USB connector, you will need the appropriate adapter, which are available from WaveWare or from a computer supply company.*)

6. **PLUG THE POWER SUPPLY** into an 110V AC power outlet and the adapter to the paging system.

(**Note:** *The green power LED indicator on the paging system should be ON when power is properly applied.*)

7. **PROGRAM THE PAGER DATABASE**, if needed, with the WaveWare v9 Encoder Setup Software, which is on our website at: https://www.wirelessmessaging.com/sps5-series-encoder-programming. Below are 2 guides about setting up a paging system using either Serial or Ethernet connections.

When using WaveWare's Paging Encoder Setup v9, all system communications are sent through a serial connection. Since most PCs do not have serial ports these days, **this is accomplished by using USB ports via a USB-Serial Adapter**.

VERSION REQUIREMENTS:

- **A Windows 8/10 PC is required to use version v9.3.xx.**

- **If you are using a Windows OS older than Windows 8, please download and install version v9.2.11**

- **Old/New SPS-5 software is available at:** wirelessmessaging.com/sps5-series-encoder-programming
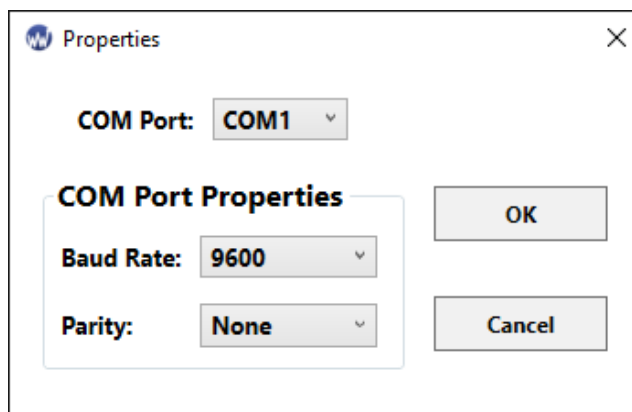
CONNECT TO THE SYSTEM

To choose your connection and its settings, navigate to COM PORT > PROPERTIES (*fig. 5*).

Figure 5: COM Menu
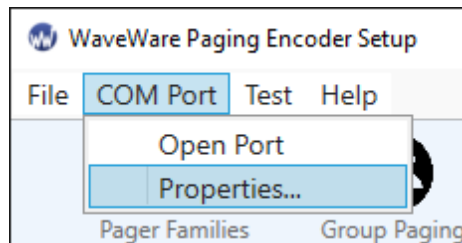
After opening the **COM PROPERTIES WINDOW** (*fig. 6*), you will see 3 separate dropdown menus that contain the settings needed to open a COM connection to your paging encoder.

Figure 6: COM Properties

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- **COM PORT** – This is a list of the current serial or USB-serial connections on your PC.

- **BAUD RATE** – This is a list of valid serial port transmission rates.

- **PARITY** – These are compatible data binary formats sent through the serial connection.

**PAGE 14 HAS A STEP-BY-STEP PROCESS OF CONNECTING TO THE CORRECT COM PORT:**

1. Make sure your system is on and connected. Navigate to COM PORT > PROPERTIES[1].

2. Look at the list and **write down or remember each active connection**.

3. Exit PROPERTIES and **unplug your serial connection to your paging system from the PC end**.

4. Open COM PORT > PROPERTIES and check the COM port menu for the missing COM port connection.

5. Exit PROPERTIES again and re-plug your serial connection back into the PC.

6. Open COM PORT > PROPERTIES again and chose the COM port that was missing before.

7. Press the OPEN COM button to detect and connect to the paging system (*fig. 7*).

8. After acknowledging that your paging system has been detected, press OK to start reading it.

Figure 7: Opening the Port

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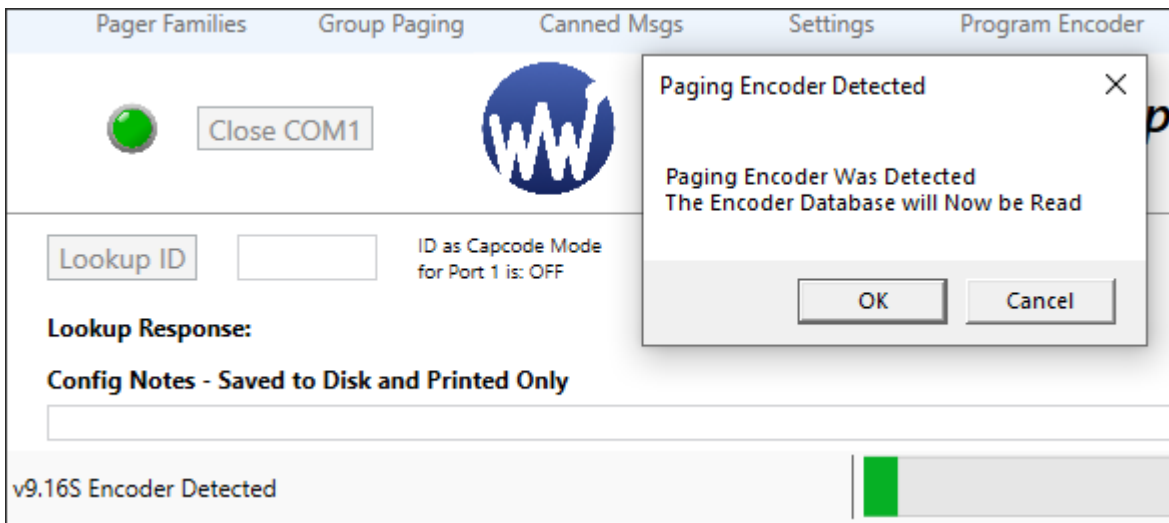
[1] If you have only one COM port or know which port is the correct one, select that port and skip steps 2-6

**Figure 8: Main Menu Options**
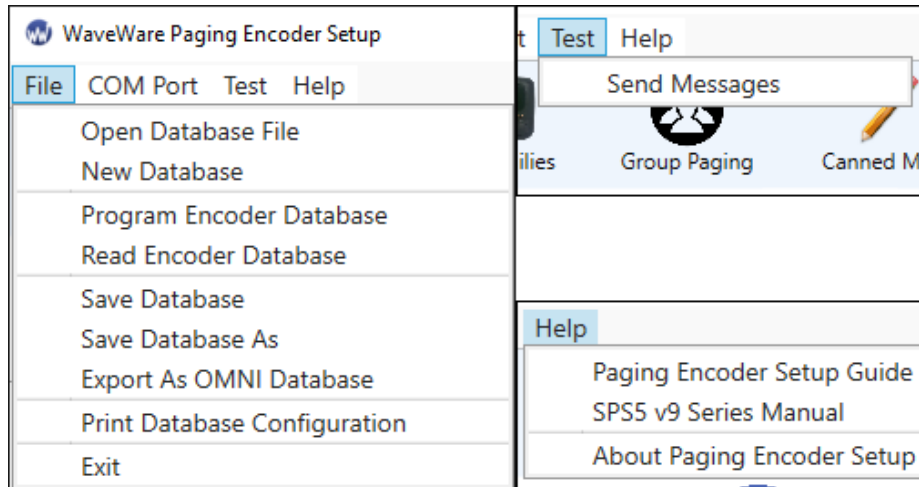
- **OPEN DATABASE FILE** – Loads a saved database configuration, replacing the current one.

- **NEW DATABASE** – Clears the current database configuration.

- **PROGRAM ENCODER DATABASE** – Programs the current database to the paging encoder.

- **READ ENCODER DATABASE** – Reads the paging encoder database, replacing the current one.

- **SAVE DATABASE** – Saves an already defined database configuration.

- **SAVE DATABASE AS** – Defines the database configuration file and saves it.

- **EXPORT AS OMNI DATABASE** – Save the current database as an OMNI Messaging Server database.

- **PRINT DATABASE CONFIGURATION** – Print the current database configuration.

- **EXIT** – Exits the software. This will automatically close any open port.

- **SEND MESSAGES** – Opens the **TEST ENCODER** window.

- **PAGING ENCODER SETUP GUIDE** – Opens this guide.

- **SPS5 V9 SERIES MANUAL** – Opens the manual for the SPS5 v9 series of paging systems.

- **ABOUT PAGING ENCODER SETUP** – Shows the splash screen.

This section will cover the main functions of the Paging Encoder Setup V9 Software (*fig. 9*).

Figure 9: Main Functions
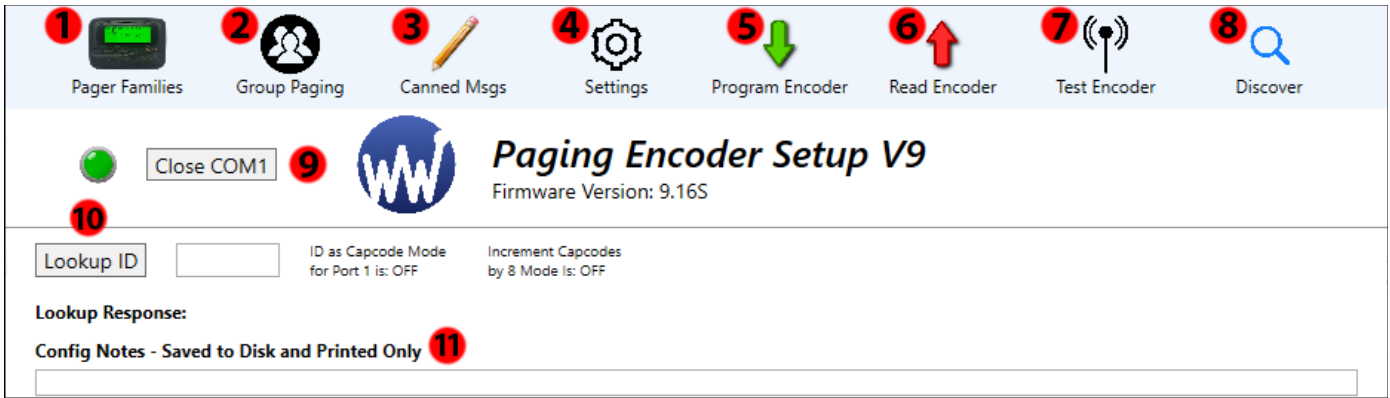
1. PAGER FAMILIES

PAGER FAMILIES (*fig. 10*) displays the current database's list of valid pager IDs, capcodes, and messaging formats used for transmitting pages, and **each row in the window is a separate Pager Family entry**. Each encoder can have up to 50 different Pager Family entries in a single database configuration.

Figure 10: Pager Family Row

1. **ACTIVE** – Controls if a Pager Family is checked when paging data is received from a Host Device.

2. **PAGER QTY** – Sets the range of ID and capcode pairings. It can be set from *1-999*.

3. **START ID** – Sets the first ID used in order to calculate the range. Valid IDs range from *1-9999*.

4. **END ID** – An unmodifiable display of the last calculated ID in the range.

5. **START CAPCODE** – Sets the first capcode used in order to calculate the range.

6. **END CAPCODE** – An unmodifiable display of the last calculated capcode in the range.

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7. **PAGER TYPE** – Changes the message type pagers receive from this Pager Family.

8. **FUNCTION CODE** – Sets the function code used by a pager when it receives a page from this Pager Family. Some pagers refer to function codes as letters. In this case: *1=A, 2=B, 3=C,* and *4=D*.

9. **DATA RATE** – Sets the transmission rate in this Pager Family. Choices are: *512, 1200,* and *2400*.

10. **PREFIX MSG** – Adds a prepended message from CANNED MSGS to pages from this Pager Family.

11. **SUFFIX MSG** – Adds an appended message from CANNED MSGS to pages from this Pager Family.

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2. GROUP PAGING

**Figure 11: Group Paging Column**

The **GROUP PAGING** Window (*fig. 11*) displays the current database's pager IDs bound together by a common group ID.

1. **REFERENCE** – A small tag to identify what the group is for.

2. **ACTIVE** – Controls if the group is checked when paging data is received from the Host Device.

3. **GROUP ID** – The ID that triggers a group page. **It must be an ID not used in any Pager Family.**

4. **PAGER IDs** – A list of up to 15 Pager IDs in the paging group. **It must be an ID in a Pager Family.**

5. **TIMER ACTIVE** - This will send a page **every 2 minutes** to the pagers listed in that Group unless the Host Device issues a Reset Command.

6. **TIMER MSG #** - The message, **created in Canned Msgs,** that pages to the associated Paging Group when the timer's 2 minutes have passed.

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3. CANNED MSGS

The **CANNED MSGS. WINDOW** (*fig. 12*) is very simple with only text prompts for up to 15 messages programmed to the encoder **for use as a prefix, a suffix, or as a timed message.** The messages will save if the CLOSE button is used instead of the OK button.
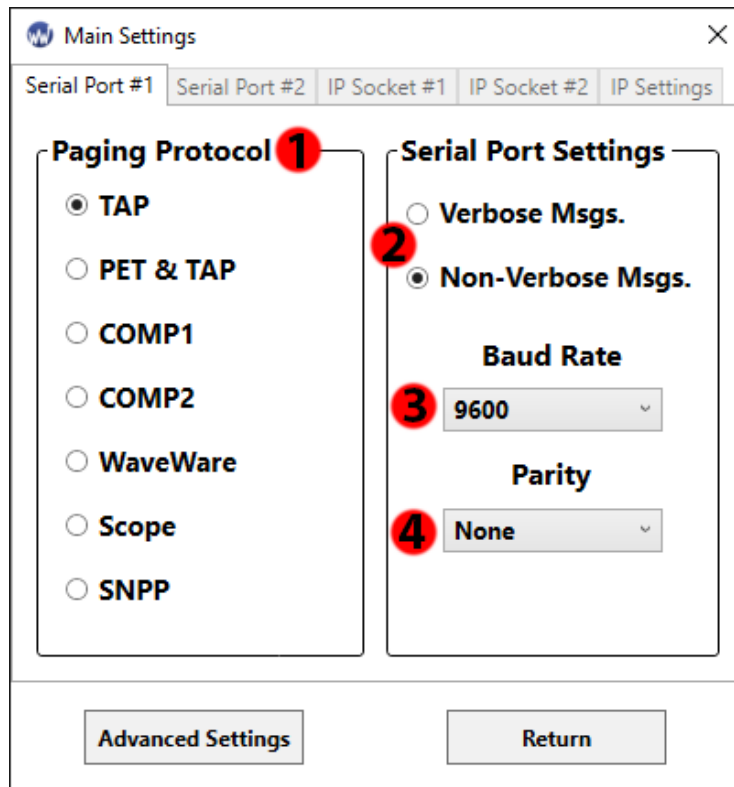
Figure 12: Canned Msgs. Window
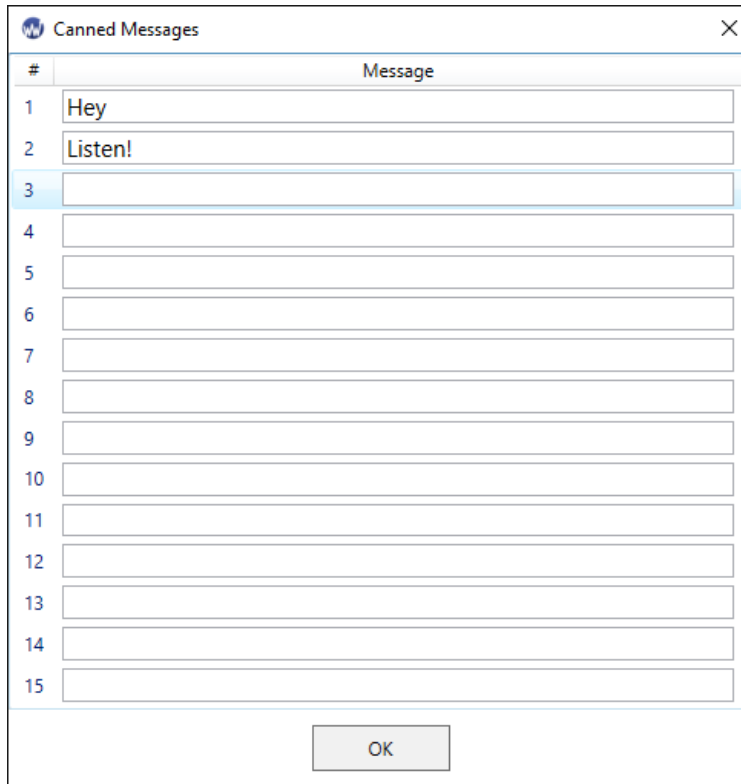
4. SETTINGS

SERIAL SETTINGS

Figure 13: Serial Settings Tab

1. **PAGING PROTOCOL** – Determines the data format the Encoder is looking for when the Host Device sends paging data.

2. **[NON-]/VERBOSE MSGS.** – Controls how paging system replies are sent to a host device.

3. **BAUD RATE** – Controls the transmission rate the serial port input is looking for from a host device.

4. **PARITY** – Controls the byte format the input is looking for from a host device.

ETHERNET (IP) SETTINGS

Figure 14: IP Socket Tab	Figure 15: IP Network Tab

1. **PAGING PROTOCOL** –the data format the encoder is looking for when the host device sends pages.

2. **[NON-]/VERBOSE MSGS.** – Controls how paging system replies are sent to a host device.

3. **ASSUME PAGER ID AS CAPCODE** – The encoder looks for capcodes instead of translating IDs.

4. **IP PORT** – The port a paging system looks at when searching for data from a host device.

5. **MAC ADDRESS** – The address of the Network Interface Card in the paging system.

6. **DEVICE NAME** – The name that appears in the Discover and Reset Tool and on the network.

7. **ETHERNET ACTIVITY RESET OF TIMED PAGING** – Controls if a timed group message can be reset.

8. **USE DHCP** – Controls if the IP address and network is set automatically or if it is entered manually.

9. **IP ADDRESS** – The network address of the paging system.

10. **SUBNET MASK** – Sets how your network is sub-divided.

11. **PRIMARY/SECONDARY DNS** – Sets the 2 IPs of Domain Name Servers used by your network.

12. **DEFAULT GATEWAY** – The address connecting the paging system's LAN to other networks.

ADVANCED SETTINGS

You shouldn't need Advanced Settings for most installations unless you know what changes you need. (Password is: maint)

Figure 16: Advanced Settings

1. **CARRIER DETECT POLARITY** – a transmitter compatibility setting for detecting carrier signals.

2. **DATA POLARITY** – allows paging messages to be encoded with normal or inverted data decoding.

3. **TRANSMITTER DUTY CYCLE** – Controls the amount of time the radio is active in a cycle.

4. **MESSAGES PER BATCH** – Controls how many messages are sent by the transmitter in a single cycle.

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5. **CARRIER SIGNAL DETECTION** – Controls if the paging system will check for carrier signals.

6. **INCREMENT CAPCODES BY 8** – Changes whether the capcodes number sequentially or by 8 for each ID in PAGER FAMILIES.

7. **PAGING SITE LICENSE CALL SIGN** – Issued to paging systems so the FCC knows it's a valid paging site.

8. **SERIAL PORT RESET OF TIMED PAGING** – Controls if a timed group message can be reset.

9. **ASSUME PAGER ID AS CAPCODE** – The encoder looks for capcodes instead of translating IDs.

10. **DISCARD <LF> CHARS IN COMP1** – Removes all Line Feed characters from any COMP1 message.

11. **DISCARD BLANK MSGS IN COMP1** – Prevents empty COMP1 messages from transmitting.

12. **FLOW CONTROL** – Controls how the encoder interacts with host device requests and messages.

13. **RESET TO DEFAULTS** – Wipes the current database and resets it to default values.

5. TEST ENCODER & RANGE TEST

Figure 17: Test Encoder Window

1. **PAGER ID/CAPCODE** – Enter an ID that's in PAGER FAMILIES, or a capcode if *ID as Capcode* is turned on. If capcodes are used, the first Family sets the *Data Rate*, *Pager Type*, and *Function Code*.

2. **FUNCTION CODE** – Sets the function code manually. Only used with Scope protocol testing.

3. **RF DATA RATE** – Sets the data rate manually. Used with Scope and WaveWare protocol testing.

4. **SEND** – Pushes a single page to the radio transmitter using the parameters set in Test Encoder.

5. **PAGER MESSAGE** – A textbox where any valid paging message can be written. You can also type out any messages you want to save.

6. **SAVED MESSAGES** – A repository of messages saved to disk. Best used for OTA Commands. The ADD, REPLACE, and DELETE buttons allow users to easily change the repository.

7. **COM PORT LOG** – Shows easily readable serial responses from the paging system.

8. **LOG TO FILE** – Toggles whether any Test Encoder or Range Test activity is logged.

The START RANGE TEST button takes you to the **RANGE TEST** window (*fig. 18*), which allows you to repeatedly send messages to a specific pager ID.

Figure 18: Range Test Window
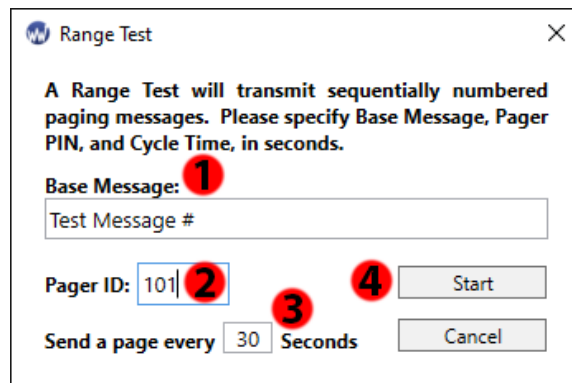
1. **BASE MESSAGE** – The message you want to send during the range test. The message number is appended to the end of the base message.

2. **PAGER ID/CAPCODE** – Enter a valid ID that exists in PAGER FAMILIES, or any capcode if *ID as Capcode* is turned on.

3. **REPEAT TIMER** – Sets the amount of time between pages.

4. **START/CANCEL** – Starts/Exits RANGE TEST. You can press *Start* during a range test to update the pager ID and base message. This causes the message number to reset.

6. DISCOVER

The **DISCOVER WINDOW** (*fig. 14*) is a fairly simple function that allows you to find WaveWare devices on your network. This is usually your Ethernet connection if you also have a Wifi connection. When you click the DISCOVER button, a list will populate containing all the IP addresses and types of WaveWare products on your network (*fig. 15*).
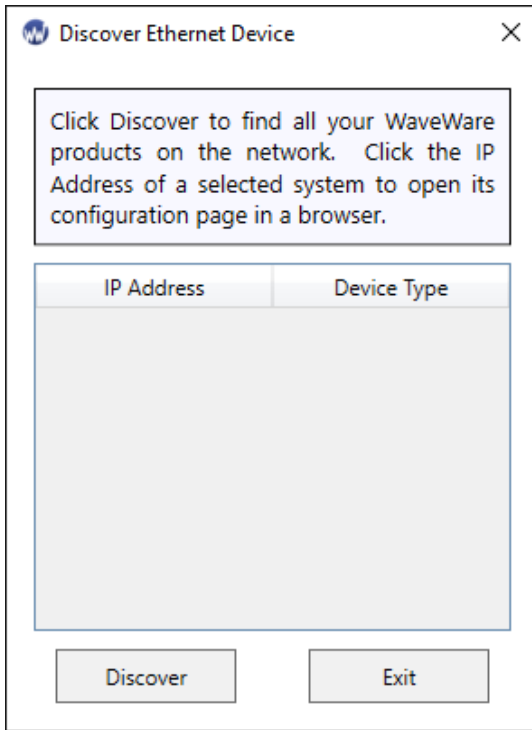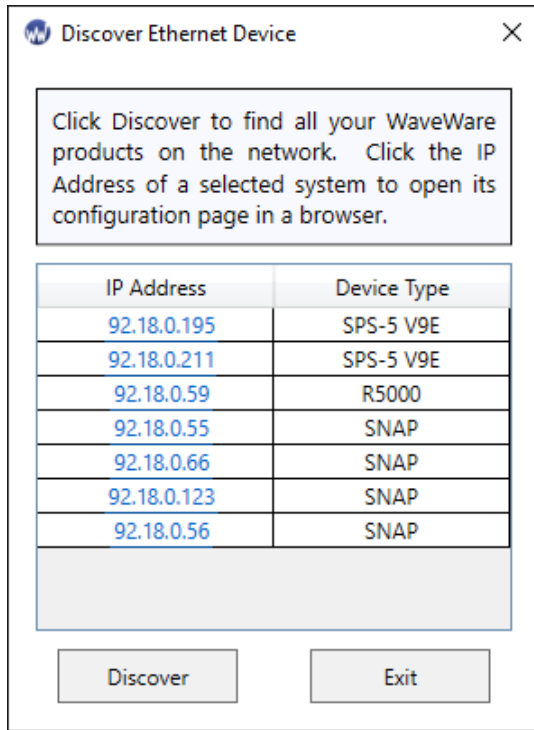
Figure 14: Discover Window: OFF	Figure 15: Discover Window: ON

Discover Ethernet Device ✕

Click Discover to find all your WaveWare products on the network. Click the IP Address of a selected system to open its configuration page in a browser.

IP Address	Device Type

Discover   Exit

Discover Ethernet Device ✕

Click Discover to find all your WaveWare products on the network. Click the IP Address of a selected system to open its configuration page in a browser.

IP Address	Device Type
92.18.0.195	SPS-5 V9E
92.18.0.211	SPS-5 V9E
92.18.0.59	R5000
92.18.0.55	SNAP
92.18.0.66	SNAP
92.18.0.123	SNAP
92.18.0.56	SNAP

Discover   Exit

WEB CONFIGURATION GUIDE

CONNECTING TO THE SYSTEM

(**Note:** *These methods will only work if your network is using DHCP or if the static IP settings have already been programmed into the system. Otherwise, the IP & Network Settings will have to be set using the WaveWare Paging Encoder Setup Software before using Web Configuration*.)

1. Connect the paging system to the same network as the PC you will use to setup the paging system.

2. There are 3 different ways to open up the web browser configuration page. Each one of these accomplish the same goal so choose whichever method is best for you.

a. **V9 Encoder Software Method**:
   i. Open the WaveWare Paging Encoder Setup v9 Software.
   ii. Click the DISCOVER icon and then the *Discover* button when the window opens.
   iii. Click on the IP ADDRESS that is matched with the SPS5 v9E.

b. **Discover & Reset Tool Method**:
   i. Download the WaveWare Discover & Reset Tool from our website at https://www.wirelessmessaging.com/waveware-discover-reset-tool and open it.
   ii. Click the DISCOVER BUTTON.
   iii. Click on the IP ADDRESS that is matched with a SPS5-v9E.

c. **Direct IP Method**:
   i. Check your Network's List of connected devices and locate the newest addition's IP.
   ii. If you are unable to locate the correct IP, unplug your system and see which IP disappears.
   iii. Open up an Internet Browser App and type the IP into the address bar.

MESSAGING

The **MESSAGING** tab (*fig. 16*) is the first tab you should see when connecting to a v9E system's WEB CONFIGURATION. It is a very simple tab that allows users to send manual messages and to translate pager IDs to capcodes using the *Ask Sever to Decode Pager ID* button.

Figure 16: Messaging Tab

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The Pager Families tab (*fig. 17*) functions in the exact same way as the Paging Encoder Setup software, but it does have visual differences. It defines what IDs and capcodes will be used with the paging system as well as a few messaging format options.

Figure 17: Pager Families Tab

1. **FAMILY** – A row designation for each Pager Family.

2. **ENABLE** – Controls if a Pager Family is checked when paging data is received from a *HOST DEVICE*.

3. **PAGER QTY** – Sets the range of ID and capcode pairings. It can be set from *1-999*.

4. **START ID** – Sets the first ID used in order to calculate the range. Valid IDs range from *1-9999*.

5. **END ID** – An unmodifiable display of the last calculated ID in the range.

6. **START CAPCODE** – Sets the first capcode used in order to calculate the range.

7. **END CAPCODE** – An unmodifiable display of the last calculated capcode in the range.

8. **PAGER TYPE** – Changes the message type pagers receive from this Pager Family.

9. **FUNCTION CODE** – Sets the function code used by a pager when it receives a page from this Pager Family. Some pagers refer to function codes as digits or letters instead of binary memory values. In this case: *00 = 0 = A, 01 = 1 = B, 10 = 2 = C,* and *11 = 3 = D*.

10. **DATA RATE** – Sets the transmission rate in this Pager Family. Choices are: *512, 1200,* and *2400*.

11. **PREFIX** – Adds a prepended message from PREDEFINED MSGS to pages from this Pager Family.

12. **SUFFIX** – Adds an appended message from PREDEFINED MSGS to pages from this Pager Family.

13. **CLEAR ALL** – Resets all Pager Families to default values.

14. **SORT BY START ID** – Changes which row a Pager Family belongs to, based on ascending ID digit order.

15. **INCREMENT CAPCODES BY 8** - Changes whether the capcodes number sequentially or by 8 for each ID.

16. **SORT BY START CAPCODE** - Changes which row a Pager Family belongs to, based on ascending capcode digit order.

17. **SAVE CHANGES** – Writes the current state of the Pager Families configuration to the paging encoder. If you switch tabs before saving, all changes will be lost.

The **PAGER GROUPS** tab (*fig. 18*) shows all of the current pager IDs bound together by a common group ID.

Figure 18: Pager Groups Tab

1. **GROUP ACTIVE** – Controls if the group is checked when paging data is received from a Host Device.

2. **GROUP ID** – The ID that triggers a group page. **It must be an ID not used in any Pager Family.**

3. **PAGER IDs** – A list of up to 15 Pager IDs in the paging group. **It must be an ID in a Pager Family.**

4. **TIMER ACTIVE** – Sends a page **every 2 min.** to its group unless a host device sends a reset command.

5. **TIMER MESSAGE** – The message, **created in Canned Msgs,** that pages to the associated Paging Group when the timer's 2 minutes have passed.

6. **CLEAR ALL** – Resets all Pager Groups to default values.

7. **SAVE CHANGES** – Writes the current state of the Pager Families configuration to the paging encoder. **If you switch tabs before saving, all changes will be lost.**

PREDEFINED MSG.

The **PREDEFINED MSG.** tab (*fig. 19*) is very simple with only text prompts for up to 15 messages programmed to the encoder **for use as a prefix, a suffix, or as a timed message.**

Figure 19: Predefined Msg. Tab

The Serial Port tab (*fig. 20*) allows users to program the serial port settings through the web configuration, **but you have to reboot the paging system for the changes to take effect**.

Figure 20: Serial Port Tab

1. **PROTOCOL** – Selects which paging protocol will be used on the serial port.

2. **USE VERBOSE RESPONSES** – Controls how much data a paging system reply sends to a host device.

3. **SERIAL PORT BAUD RATE** – Sets the serial cable speed the system is looking for from a host device.

4. **SERIAL PARITY, DATABITS, STOP BITS** – Sets the binary data formatting for serial transmissions.

5. **FLOW CONTROL** – Controls how the paging system interacts with a host device request or message.

6. **SERIAL PORT ACTIVITY RESETS TIMED PAGING** – Controls if a timed group message can be reset.

7. **ASSUME PAGER ID AS CAPCODE FOR SERIAL PORT** – The encoder looks for capcodes instead of translating IDs.

Figure 21: Network Tab

1. **SPS-5 V9E MAC ADDRESS** – The address of the Network Interface Card in the paging system.

2. **SPS-5 V9E HOST NAME** – The name that appears in the Discover and Reset Tool and on the network.

3. **ENABLE DHCP** – Controls if the IP address and network is set automatically or if it is entered manually.

4. **IP ADDRESS** – The network address of the paging system.

5. **SUBNET MASK** – Sets how your network is sub-divided.

6. **PRIMARY/SECONDARY DNS** – Sets the 2 IPs of Domain Name Servers used by your network.

7. **GATEWAY IP** – The address connecting the paging system's LAN to other networks.

8. **NETWORK ACTIVITY RESETS TIMED PAGING** – Controls if a timed group message can be reset.

9. **PORT NUMBER FOR IP CONNECTION #** – The port a paging system can receive data from a host device.

10. **PROTOCOL FOR IP CONNECTION #** – the data formats a system can use when a host device sends pages.

11. **VERBOSE PROTOCOL RESPONSES FOR IP CONNECTION #** – Controls how much data a paging system reply sends to a host device.

12. **ASSUME PAGER ID IS CAPCODE FOR IP CONNECTION #** – Controls if the encoder looks for capcodes instead of translating IDs.

RF

Figure 22: RF Tab

1. **IGNORE RF CARRIER DETECT** – Controls if the paging system will check for carrier signals.

2. **CARRIER DETECT POLARITY** – a transmitter compatibility setting for detecting carrier signals.

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3. **INVERT MODULATION DATA** – allows messages to be encoded with normal or inverted data encoding.

4. **MAXIMUM MESSAGES PER TRANSMISSION** – Controls how many messages are sent in a single cycle.

5. **STATION IDENTIFIER** – Issued to paging systems so the FCC knows it's a valid paging site.

6. **STATION IDENTIFIER INTERVAL** – Sets how much time is between broadcasts of the Station Identifier.

7. **TRANSMITTER DUTY CYCLE** – Controls the amount of time the radio is active in a cycle.

STATUS

Figure 23: Status Tab

The **STATUS** tab (*fig. 23*) shows many statistics, timers, and data points associated with your paging system. **This feature is only available to the Web Configuration** since a paging system has to be taken out of your communications infrastructure to be examined using the serial software method.

This appendix is included for those who want to develop their own paging control software or add an interface for the SPS5 v9 Series Paging Systems to their existing software applications.

TAP (*Telelocator Alphanumeric Protocol*) normally requires a connect and disconnect process and also normally assumes that a Host Device maintains a database of pager reference numbers called IDs. **The paging system maintains a database of all paging parameters associated with each ID.**

The TAP Interface supports paging messages up to 244 characters in length. The actual maximum length of transmitted messages in The SPS5 Paging Systems' TAP Interface is 245 minus the ID field length. With an ID value of 5, you can transmit up to 244 characters per message. With an ID value of 1233, you can transmit up to 241 characters per message.

To configure your paging system for TAP, you may be required to configure the COM port settings for your paging system's serial input. Your paging system typically communicates with a PC or a host device via RS-232 at: **9600 Baud, 1 stop bit, and 8 data bits with the eighth data bit ignored.** You can configure the paging system for other serial communication parameters: *See Appendix B – Com Port Settings*, for details on serial communication parameters.

The SPS5 v9 Series Paging Systems maintain an input buffer which can receive commands from the PC while a page is being transmitted. The input buffer should be able to contain approximately ten paging messages before getting full. When a command is received from the PC, the paging system responds with a message that includes error messages if the command was not understood or not properly transmitted. The first three digits of each paging system response conform to the response codes defined in the TAP v1.8 specification. *See Appendix E – TAP Response Codes* for a listing of the response codes.

CONTROL CHARACTERS RECOGNIZED BY THE SPS5 V9 PAGING SYSTEMS IN TAP MODE INCLUDE:

- **CARRIAGE RETURN** – <CR> | 13

- **START OF TEXT** – <STX> | 02

- **END OF TEXT** – <ETX> | 03

- **END OF TRANSMISSION** – <EOT> | 04

- **SUBSTITUTE** – <SUB> | 26

- **ESCAPE** – <ESC> | 27

CONTROL CHARACTERS GENERATED BY THE WAVEWARE V9 PAGING SYSTEM IN TAP MODE INCLUDE:

- **LINE FEED** – <LF> | 10

- **CARRIAGE RETURN** – <CR> | 13

- **ACKNOWLEDGE** – <ACK> | 06

- **NEGATIVE ACKNOWLEDGE** – <NAK> | 21

- **ABANDON TRANSACTION** – <RS> | 30

- **ESCAPE** – <ESC> | 27

- **END OF TRANSMISSION** – <EOT> | 03

- **XON** – <XON> | 17

- **XOFF** – <XOFF> | 19

THE OPERATIONAL MODES AVAILABLE FOR PAGING USING THE TAP PAGING PROTOCOL INCLUDE:

- **SYSTEM IDENTIFICATION COMMAND**

- **PAGING SESSION LOGIN**

- **PAGING OPERATION**

- **PAGING SESSION LOGOUT**

SYSTEM IDENTIFICATION COMMAND

The System Identification Command allows installation programs and other software applications to poll serial ports for the existence of a WaveWare v9E Paging Encoder using the **STANDARD ATI COMMAND**. This can be used for a supervised process (*also called keep-alive*) where the host system periodically polls the paging system for a response.

WHEN A PAGING SYSTEM READS A COMMAND FORMATTED AS: ATI<CR>, IT RESPONDS WITH:

WaveWare Paging Encoder v9.00<CR>

(*The firmware version changes due to model, manufacturing date, or if updates have been applied to it.*)

PAGING SESSION LOGIN

The v9 Paging Session Login mode allows a host device, sometimes called a REMOTE ENTRY DEVICE, to initiate communications with the paging system. **With the WaveWare v9E Paging Systems, the login process is optional**, because, it will automatically login to a host device and process paging messages if it recognizes a properly formatted TAP message block at any point in its operation. Below is a step by step breakdown of the login process.

1. The host device initiates the Login process by transmitting a carriage return **<CR>** character
    a. The system should respond with: ***ID=<CR>*** (*The ID=<CR> will not be repeated or timed out.*)

2. The host device should respond with: **<ESC>PG1<CR> or <ESC>pg1<CR>**
    a. The system should respond with: ***110 1.8<CR>WaveWare Paging Encoder v9.00<CR><ACK><CR>*** [2]

3. The system then notifies the host device that it is ready to accept messages with: ***<ESC>[p<CR>***

PAGING OPERATION

Paging transactions are transmitted in blocks of characters, where one transaction is sent per block. Each block sent by a host device is acknowledged by the paging system. The Host Device must wait for this acknowledgement before sending the next block. **The WaveWare v9E Paging Systems provide acknowledgement in the form of an <ACK> character.**

SPS5 Paging Systems support TAP message blocks up to 253 characters in length, with a 235 to 244 character message, from 1 to 10 characters for ID, plus 5 control characters, and a 3 character checksum.

THE TAP MESSAGE LENGTH EQUATION IS AS FOLLOWS:
253 − ID length − 5 ctrl char. − 3 checksum char.

THE TAP MESSAGE BLOCK FORMAT IS AS FOLLOWS:
<STX>ID<CR>Message<CR><ETX>Checksum<CR>

Leading zeroes are not required for the ID field; the message field may be empty except for the carriage return in the data block; the checksum field provides a sum of the digits for the previous portion of the TAP message block, which is checked before transmission to detect errors in the data. *See Appendix C – TAP Checksum Calculation, for sample code to create the checksum field.*

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[2] The "110 1.8" message indicates that the system conforms to TAP specification version 1.8 and should be backward compatible with earlier TAP implementations.

ALPHANUMERIC MESSAGES: All 7-bit ASCII "non-control" characters are valid except ^, ~, and _.

NUMERIC MESSAGES: Valid characters are the numbers 0 through 9, - (hyphen), and space.

CONTROL CHARACTERS: these can be embedded into paging messages so that high end alpha pagers and paging data receivers can respond with formatted displays and formatted serial outputs. Control characters can be embedded in messages by using the TRANSPARENCY OPTION. The Transparency Option replaces a control character with the <SUB> character followed by the control code offset by 40 Hex. *See Appendix D - Embedded Control Characters* for details on how to embed control characters in paging messages.

1. ID field lengths from 1 to 4 digits will cause a **PAGER DATABASE LOOKUP**. ID fields of this format must contain numeric digits only. The numeric ID value will be compared to the ID values stored in the SPS5 Paging System's onboard PAGER FAMILIES.

2. ID field lengths from 5 to 10 digits will cause **EXTENDED ID PROCESSING**. Extended ID processing assumes that the last 3 digits of the ID field define paging message encoding attributes, while the preceding digits define the pager cap code. **Extended ID processing avoids having to configure and check Pager Families** in WaveWare SPS5 v9 Series Paging Systems. *See Appendix F – Extended ID Processing* for details on how to format the ID field.

When a host device delivers a TAP MESSAGE BLOCK to the SPS5 Paging System, if the message block is properly formatted and the ID field matches an ID in the system's Pager Families, the paging system will respond with an initial response code as follows: **211 Page(s) Sent Successfully<CR>**. If the input buffer of the paging system has capacity for another TAP message block, the paging system will send the following message: **<ACK><CR>.** The response can be used as a FLOW CONTROL METHOD to prevent overflow and lost messages or our alternate flow controls can be used.

HARDWARE FLOW CONTROL MODE: The RS-232 CTS signal will be de-asserted when the input buffer doesn't have capacity for another TAP Message Block, and re-asserted when capacity exists in the input buffer.

SOFTWARE FLOW CONTROL MODE: An <XOFF> Character (0x11) will be outputted in the response string to indicate that the input buffer doesn't have the capacity for another TAP Message Block. When capacity is available, an <XON> Character (0x13) will be outputted.

When the Host Device delivers a TAP Message Block and a CHECKSUM ERROR occurs, the paging system will respond with an error message and a **<NAK><CR>**, which tells the Host Device to resend the transaction. *See Appendix E – TAP Response Codes* for more information on paging system response messages.

AN EXAMPLE <NAK> ERROR MESSAGE SEQUENCE:

514 Checksum Error – Exp. 2:9 Got 2:X<CR><NAK><CR>

If the TAP Message Block's checksum is OK, but the TAP Message Block has a FORMATTING ERROR, the paging system will respond with an error message and an **<RS><CR>**, which tells the host device to abandon the transaction.

AN EXAMPLE <RS> ERROR MESSAGE SEQUENCE:

511 Invalid pager ID - not in database<CR><RS><CR>

PAGING SESSION LOGOUT

PAGING SESSION LOGOUT allows a host device to stop communications with the paging system. **With the WaveWare v9E Paging System, the logout process is optional.** The SPS5 v9 Series Paging System will automatically logout from a host device if the paging system detects a serial disconnection at any point in its operation.

To initiate a logout sequence, the host device should send the following to the paging system: **<EOT><CR>**

The paging system will respond with: **PAGING EXCHANGE DISCONNECT<CR><ESC><EOT><CR>.**

You may be required to configure the COM port settings in the paging system to establish the operating mode and serial parameters. These are programmable using the Paging Encoder Setup v9 Software available on our website at: https://www.wirelessmessaging.com/sps5-series-encoder-programming. To get to the COM port settings in the Paging Encoder Setup v9 Software, in the **MAIN WINDOW** click on SETTINGS. Some of the less used settings will be under ADVANCED SETTINGS. You can also use Web Configuration (*pgs. 20-21*) to make these changes as well.

Your WaveWare v9E Paging System typically communicates with a PC or other host system via RS-232 at **9600 Baud, No Parity, 8 data bits, and 1 stop bit**. You can configure the paging system for other serial communication parameters.

THE AVAILABLE OPERATING MODES INCLUDE:

TAP & COMP2 VERBOSE: The paging system includes readable replies after each paging request is received.

WAVEWARE & SCOPE: Both of these use proprietary single serial commands that include capcode, function code, RF baud rate, and message values. Either protocol can be used in a Simplex or Duplex Operation.

TAP NON-VERBOSE: It reduces the paging system response to 3-digit numeric codes.

COMP2 NON-VERBOSE: In the COMP2 Non-Verbose mode the response is reduced to none at all.

COMP1: Any data received on the serial port will be sent to all pagers in Group 1 stored in PAGER GROUPS. *Refer to Appendix H for a definition of the COMP1 Protocol.*

The Non-Verbose modes are useful in situations where you want to minimize the serial data throughput requirements which tend to allow paging messages to be delivered more quickly, or to achieve compatibility with legacy host systems. *Refer to Appendix A for a definition of the TAP Protocol and Appendix I for a definition of the COMP2 Verbose and Non-Verbose Protocols*. Independent of operating modes, you can configure the Serial Port Baud and Parity, and you can configure whether Hardware or Software Flow Control is used.

THERE ARE 2 FLOW CONTROL METHODS:

HARDWARE FLOW CONTROL MODE: The RS-232 CTS signal will be de-asserted when the input buffer doesn't have capacity for another Message Block, and re-asserted when capacity exists in the input buffer.

SOFTWARE FLOW CONTROL MODE: An <XOFF> Character (0x11) will be outputted in the response string to indicate that the input buffer doesn't have capacity for another Message Block. When capacity is available, an <XON> Character (0x13) will be outputted.

THE FOLLOWING IS THE VB .NET CODE THAT CREATES THE STRING TO BE SENT TO THE PAGING ENCODER WITH THE CHECKSUM APPENDED TO IT:

'Functions take any values given to them, execute their section of code, and return a value to the caller.

Public Function CreateTapMsg(ByVal PIN As String, ByVal Msg As String)

'The PIN and Msg values are the Pager Families ID and the message needed to be sent respectively.

    Dim Sum As Integer = 0, B As String, D As Integer *'Variables needed for the code to execute*

    Dim char3 As Integer, char2 As Integer, char1 As Integer

    'The string that the checksum is calculated on:

    Dim TAPMsgBlock As String = Chr(2) & PIN & Chr(13) & MSG & Chr(13) & Chr(3)

    'chr() converts integers to ASCII characters. Chr(2) = <STX> , Chr(3) = <ETX> , Chr(13) = <CR>

'For loops define how many times and with what range of integers a section of code should be run at.

    For j As Integer = 1 To Len(TAPMsgBlock) *'Len() Function measures the size of strings*

      B = Mid(TAPMsgBlock, j, 1) *'Mid() Function pulls parts of strings; in this case, each character individually*

      D = Asc(B)   *'Asc() Function converts characters to an ASCII decimal integer.*

      Sum += D   *'+= means take the current value and add to it. In this case, it adds the ASCII*

    Next   *decimal integer value of each character in the entire message block.*

'Create the three characters' ASCII decimal integer that represents this checksum. The ASCII decimal integers are generated in reverse order but will be ordered correctly when put together.

    char3 = 48 + Sum - Int(Sum / 16) * 16 *'Int() Function converts non-integer values to integers (ex: 4.2 to 4)*

    Sum = Int(Sum / 16)

    char2 = 48 + Sum - Int(Sum / 16) * 16

    Sum = Int(Sum / 16)

    char1 = 48 + Sum - Int(Sum / 16) * 16

'Convert the ASCII decimal integers to the actual character

    Dim CheckSum As String = Chr(char1) & Chr(char2) & Chr(char3)

    TAPMsgBlock = TAPMsgBlock & CheckSum & Chr(13) *'Create complete string to be sent*

    Return TAPMsgBlock *'send the new formatted TAP Message Block to whatever called this function.*

End Function *'marks the end of the function's section of code.*

To embed a control character in TAP mode, **a <SUB> control character is required followed by an offset version of the control character you want.** You offset the control character by adding 64 to the control character's ASCII Decimal Value to make the character printable. Adding 64 to *Carriage Return (13)* gives you *M (77)*. Adding 64 to *Line Feed (10)* gives you *J (74)*. The character combination of **<SUB>M** causes a Carriage Return control character to be embedded in the encoded paging message, while **<SUB>J** causes a Line Feed control character to be embedded.

THE FOLLOWING CODE, IN VB .NET, DEFINES THE EMBEDDED CONTROL CHARACTER STRING TO BE DELIVERED THROUGH THE SERIAL PORT TO THE PAGING SYSTEM, SENDS IT, AND READS THE REPLY:

Imports System.IO.Ports   *'Imports the code library containing SerialPort among other things.*

Dim SerialP As SerialPort = New SerialPort With   {
                                                           .PortName = "COM1",
'These are the default values for making a serial   **.BaudRate = 9600,**
connection to a WaveWare v9 Series Paging System.   **.Parity = None,**
'The port name changes to the port that is the   **.Databits = 8,**
connection between the host device and the system.   **.Stopbits = 1**
                                                           }

'Subs execute code without returning a value to whatever called for it.
Public Sub Write2Lines(ByVal MsgLine1 As String, ByVal MsgLine2 As String, ByVal ID as String)
'ByVal variables need to have their value assigned to them by whatever section of code calls for this Sub.

    Dim CRSub As String = Chr(26) & "M"   *'chr(26) = <SUB>, chr(13) = <CR>, chr(13 + 64) = M*
    Dim LFSub As String = Chr(26) & "J"   *'chr(26) = <SUB>, chr(10) = <LF>, chr(10 + 64) = J*

    Dim MSG As String = MsgLine1 & CRSub & LFSub & MsgLine2   *'Combine everything into one string*

    MSG = CreateTapMsg(ID, MSG) *'See Appendix C – TAP Checksum Calculation to see changes in the string.*

    SerialP.Open()   *'Opens the connection between the device running this code and the paging system.*
    SerialP.Write(MSG) *'Sends the TAP Message to the paging system*
    Dim RXstring As String = SerialP.ReadTo(chr(13))   *'ReadTo() reads serial data until you come across a*
    RXstring += SerialP.ReadTo(chr(13))   *specific character or string. This is done twice bec-*
    Console.Write(RXstring)   *-ause TAP has two <CR> in its replies.*
    SerialP.Close()   *'Closes the connection between the device running this code and the paging system.*

End Sub

When using WaveWare Protocol it is not necessary to make use of the <SUB> control character for <CR> or <LF>, since the WaveWare protocol doesn't use either control character in its message format.

The following is a table of response codes supported by the WaveWare v9E Paging Encoder. Please note that a <NAK> response typically means the message should be resent by the host, and an <RS> response typically means the message should be abandoned by the host.

Figure 24: Response Codes Table

RESPONSE CODE	DEFINITION
110 1.8	Paging system supports TAP Specification v1.8.
211 Page(s) Sent Successfully	Paging message(s) successfully delivered. This message is accompanied by an <ACK>.
510 Invalid character in pager ID	Pager ID field contains illegal characters. This message is accompanied by an <RS>.
511 Invalid pager ID - not in database	Pager ID was legal, but it didn't match database lookup. This message is accompanied by an <RS>.
512 Temporarily cannot deliver. Queue full.	Try later Paging System input buffer is full. This message is accompanied by an <RS>.
514 Checksum Error. Exp XXX; Got: YYY	Checksum didn't match the message block. This message is accompanied by a <NAK>.

(***Note:*** *<ACK>, <NAK>, and <RS> are only representations of the lower order ASCII control characters output by the paging system. <ACK> represents DEC 06, <NAK> represents DEC 21, and <RS> represents DEC 30.*)

APPENDIX F – EXTENDED ID PROCESSING

The WaveWare v9E TAP Interface and COMP2 interfaces support ID field lengths from 1 to 10 digits.

THE ID FIELD CAN BE FORMATTED AS FOLLOWS:

STANDARD METHOD - ID field lengths from 1 to 4 digits will cause a pager database lookup. ID fields of this format must contain numeric digits only. The numeric ID value will be compared to the ID values stored in the WaveWare v9E Paging Encoder's onboard pager database.

EXTENDED ID METHOD - ID field lengths from 5 to 10 digits will cause Extended ID processing to be used. Extended ID processing assumes that the last 3 digits of the ID field define paging message encoding attributes, while the preceding digits define the pager cap code. *Extended ID processing allows you to avoid the process of configuring a pager database in the WaveWare v9E Paging Encoder.* Incorrect formatting of extended ID fields causes a <NAK> response combined with an explanation message.

THE EXTENDED ID FIELD IS REPRESENTED IN THE FORMAT CCCCCCCERF:

CCCCCCC: A 2 to 7 digit numeric value representing a pager cap code. Leading zeroes are optional except in the case of cap codes 8 and 9, which should be represented with at least one leading zero, e.g. 08 or 09.

E: The message encoding type, where "0" (zero), "n", or "N" represent "numeric encoding", and "1", "a", or "A" represent "alphanumeric encoding". The numeric values for E are provided to support numeric-only ID fields in paging control software.

R: The RF data rate, where "5" represents 512 bps, "1" represents 1200 bps, and "2" represents 2400 bps.

F: The function code to be delivered, where 1 = A, 2 = B, 3 = C, and 4 = D. A function code of 0 causes the default function code for a particular Message Encoding Type ("E") to be substituted. The default value for F is "4" when the E value is "alphanumeric encoding", and "1" when the E value is "numeric encoding".

THESE ARE VALID EXAMPLE ID FIELDS THAT CAUSE EXTENDED ID PROCESSING:

08A20 – Causes delivery of an alphanumeric message to cap code 0000008 at 2400 bps with the default function code for alphanumeric pages (4/D).

08A24 – Same result as above

0008124 – Same result as above

0000008124 – Same result as above

11A53 – Causes delivery of an alphanumeric message with function code 3 to cap code 0000011 at 512 bps

0000011A53 – Same result as above

11N53 – Causes delivery of a numeric message with function code 3 to cap code 0000011 at 512 bps

038N52 – Causes delivery of a numeric message with function code 2 to cap code 0000038 at 512 bps

This appendix is included for those who want to develop their own paging control software or add an interface for the WaveWare v9E Paging Encoder to their existing software applications.

The difference between WaveWare and TAP protocols is that the WaveWare protocol is **a dedicated connection that doesn't require a login process and it assumes that the host device maintains a database of all paging parameters** associated with a pager, including capcode, encoding method, and RF data rate. The WaveWare Interface supports paging message blocks up to 512 characters in length while the TAP interface supports paging message blocks up to 256 characters in length, group paging, and timed messaging. Each protocol has its advantages and disadvantages, but both accomplish the process of causing POCSAG encoded paging messages to be delivered to local area pagers.

THE COMMANDS FOR SERIAL PORT PAGING USING THE WAVEWARE PAGING PROTOCOL INCLUDE:

PAGING MESSAGE

SETUP COMMAND

STATUS CHECK

PAGING MESSAGE FORMAT

THE PAGING MESSAGE COMMAND IS FORMATTED AS FOLLOWS:

FORMAT 1:

<SOH>TBC...C<STX>XXXX...XXX<ETX><EOT>

FORMAT 2:

<SOH>T,B,C...C,<STX>XXXX...XXX<ETX><EOT><CR><LF>

Note: *The commas, the <CR> character, and the <LF> character are optional in the Paging Message command. They are used for appearance purposes to separate subparts of the command string and for formatting the echoed output while troubleshooting the system.*

<SOH> – Used to mark the start of a message. This character resets the paging system and can be used to abort an incomplete paging command at any point prior to transmission.

T – Alphanumeric character representing the type of paging message to be transmitted: A = ALPHANUMERIC, N = NUMERIC, 1 = ONE BEEP, 2 = TWO BEEPS, 3 = THREE BEEPS, 4 = FOUR BEEPS (alphanumeric pagers).

B – Numeric character representing the data rate, in bits per second, at which the paging message is to be transmitted: 5 = 512 BPS, 1 = 1200 BPS, 2 = 2400 BPS.

C...C – 1 to 7 decimal digits representing the capcode of the paging receiver to which the message will be transmitted. Leading zeroes are not required to be included in a numeric string if you use comma delimiters.

<STX> – Used to mark the beginning of the message to be transmitted. **If you are using message types 1 to 4 beeps**, this character and all following characters are ignored by the paging system, until another <SOH> is encountered.

X...X – A string of up to 500 alphanumeric message characters to be transmitted.

<ETX> – Used to mark the end of the message to be transmitted.

<EOT> – *Used to mark the end of a Transmit Paging Message command.* All following characters are ignored by the paging system until a <SOH> character is encountered.

<CR><LF> – These optional characters are ignored by the paging system unless contained within a message string and are used only for formatting output on a PC.

<div align="center">

PAGING MESSAGE EXAMPLES:

</div>

EXAMPLE 1:

<SOH>A,5,46180,<STX>This is a test<ETX><EOT><CR><LF>

Will send the message "This is a test" at 512 bps to an alphanumeric pager with cap code 0046180.

Note: *The POCSAG alphanumeric character set is the entire ASCII 7 bit character set.*

EXAMPLE 2:

<SOH>N,5,0765155,<STX>412-3433<ETX><EOT><CR><LF>

Will send the message "412-3433" at 512 bps to a numeric pager with Cap Code 0765155.

Note: *The POCSAG numeric character set allows Hyphen (-), space, left bracket ([ ), and right bracket ( ]) characters in addition to the normal numeric character set.*

EXAMPLE 3:

<SOH>N1765155<STX>412-3433<ETX><EOT>

Will send the message "412-3433" at 1200 bps to a numeric pager with cap code 0765155. Note the lack of commas and the implied leading zeroes on the cap code.

EXAMPLE 4:

 <SOH>3,1,145678<EOT>

Will send a three beep tone message at 1200 bps to pager with cap code 0145678 with multiple tone/vibe cadence capability. Certain paging receiver models may not be designed to respond to multiple tone/vibe cadence messages.

EXAMPLE 5:

<SOH>2,1,145678<STX>412-3433<ETX><EOT>

Will send a two beep tone/vibe only message at 1200 bps to a paging receiver with cap code 0145678.

Note: *that the portion of the string after the cap code is ignored by the paging system because the paging message type was a paging message type of one to four beeps.*

EXAMPLE 6:

<SOH>450006123<EOT><CR><LF>

Will send a four beep tone only message at 512 bps to a paging receiver with cap code 0006123.

RESPONSE TO ALL COMMANDS

The SPS5 v9 Series Paging Systems will respond immediately to all commands, including Paging Message commands, Setup Commands, and Status Commands, by echoing the Paging Message command back to the PC, and appending the echoed command with a status message in one of the following formats:

<SOH><ACK>V…V,QQ,D,C,II<EOT>

The ACK response is sent to the host device following a command that was understood by the paging encoder.

<SOH><NAK>EE<EOT>

The NAK response is sent to the host device immediately following a command if errors occur.

<SOH> – used to mark the start of a message.

<ACK> – used to indicate acknowledgement of valid reception of a command from the host system.

V...V – Alphanumeric string that indicates the version number of the firmware in the paging encoder. The version number is followed by a comma character.

QQ – A one to two numeric character string that indicates the quantity of paging messages that have been received by the paging encoder and not yet transmitted (Input Queue).

This parameter should be monitored if you intend to use software handshaking between your paging control software and the paging encoder. The paging encoder Input Queue overflows if the QQ value tries to exceed 14. **Your software should stop sending data at a QQ value of 12 and resume sending data when the QQ value reaches 10 or less.** You can query the size of the Input Queue by submitting a Status Command.

D – Numeric character that indicates whether the carrier detect circuit in the paging encoder is currently detecting a carrier signal or not. Valid values are:

0 = CARRIER SIGNAL NOT DETECTED / 1 = CARRIER SIGNAL DETECTED

Note: *The carrier detect signal status is passed to the PC whether or not the paging encoder has been programmed to avoid transmitting when a carrier signal has been.*

C – A single numeric value used to indicate the On/Off state of the Carrier Detect mode. The numeric character is followed by a comma.

Valid values (**C**) are: 0 = OFF / 1 = ON

II – A two hexadecimal digit value that is reserved for future use.

<EOT> – used to mark the end of a message

<NAK> – used to indicate non-acknowledgment of a command from the host system.

<EE> – Two numeric characters that indicate the particular error that caused no acknowledgment of a command from the host system.

01 – Invalid Message Type. Indicates a message type other than A, N, 1-4 was transmitted.

02 – Invalid Data Rate. Indicates a data rate other than 5, 1, or 2 was transmitted.

03 – Invalid Cap Code. Indicates an invalid cap code was transmitted. Invalid cap codes are: 0-7, 2007664-2007671, 2045056-2045063, 2097144+.

04 – Input Buffer Overflow. Indicates the serial data input buffer in the paging encoder has overflowed. This condition would likely be caused by the host system not recognizing the CTS signal.

05 – Paging Buffer Overflow. Indicates the encoded paging message output buffer in the paging encoder has overflowed. This condition would likely be caused by excessive carrier signal detection while the Carrier Detect mode was enabled.

06 – Invalid Status/Setup Command. Indicates that the command was recognized as a Status or Setup command but the entire command string was not fully interpreted by the paging encoder.

07 – EEPROM Write Error. Indicates an internal system error in the paging encoder with regard to the proper storage of configuration information. This condition would likely indicate that paging encoder repair is required.

08 – Invalid Command Format. Indicates that the command was not fully recognized as a valid paging encoder command.

EXAMPLE 1:

<SOH>A,5,46180,<STX>This is a test<ETX><EOT><SOH><ACK>V9.21E,00,0,1,1A<EOT>

Echoes the paging message command and acknowledges proper receipt of a command by appending the ACK, indicating paging encoder firmware version is 9.21E, no paging messages in queue, no carrier signal is being detected, and Carrier Detect mode is set to "ON". The last field does not currently provide useful information.

EXAMPLE 2:

<SOH>4,5,0000006<EOT><SOH><NAK>03<EOT><CR><LF>

Echoes the paging message command and indicates an error in receiving a command due to an invalid paging receiver capcode in a Paging Message command. Includes a <CR> and <LF> at the end of the response string if they were included in the paging message command.

SETUP COMMAND

You may program the WaveWare SPS5 v9 Series Paging Systems to monitor for interference using the Carrier Detect mode. If the Carrier Detect mode is turned "ON", the paging encoder will hold paging messages in queue until an offending carrier signal is no longer detected at the transmission frequency of the paging encoder. The settings programmed by the Setup command will be remembered by the paging system even if power is removed from the paging system.

The Setup command is formatted as follows:

<SOH>S,X,V<EOT>

S indicates Setup Mode, **X** is the command type, and **V** is the value. The comma delimiters are optional.

Valid values (**X**) are: 1 = CARRIER DETECT MODE

Valid values (**V**) are: 0 = OFF 1 = ON

EXAMPLE 1:

<SOH>S,1,0<EOT>

Sets the Carrier Detect function to the "Off" status.

EXAMPLE 2:

<SOH>S11<EOT>

Sets the Carrier Detect function to the "On" status.

STATUS COMMAND

You may request the paging encoder to respond with its programmed settings using the Status command.

THE STATUS COMMAND IS FORMATTED AS FOLLOWS:

<SOH>S?<EOT>

Where the **S?** Requests the paging encoder to respond with the status of its current programmed settings. The Status Command can be used in supervisory controlled applications to ensure the encoder is still functioning, without causing unwanted paging transmissions.

The COMP1 protocol allows raw ASCII data to be sent to all pagers in PAGER GROUP #1 in the SPS5 v9 Series **PAGING GROUP DATABASE**. The COMP1 interface supports paging message blocks up to 255 characters in length, contact monitoring, and timed messaging.

CONTROL CHARACTERS RECOGNIZED BY THE PAGING SYSTEM IN COMP1 PROTOCOL MODE INCLUDE:

- **CARRIAGE RETURN** - <CR> | 13

- **LINEFEED** – <LF> | 10

CONTROL CHARACTERS GENERATED BY THE PAGING SYSTEM IN SOFTWARE FLOW CONTROL INCLUDE:

- **XON** – <XON> | 17

- **XOFF** – <XOFF> | 19

In COMP1, the paging system does not provide feedback response other than flow control signals, when in Non-Verbose mode.

COMP1 OPERATION IS AS FOLLOWS:

When incoming data is detected, one of three things will happen:

1. A carriage return character is detected in the data stream.

2. A time period of about 10 seconds elapses after receipt of the last character on the serial port.

3. 256 characters or more accumulate in the serial port input buffer.

If any of these three events occur, **the paging system will strip any carriage return and linefeed characters and transmit the remainder of the data stream to all pagers defined in the system's PAGER GROUP DATABASE**. If the serial port input buffer becomes filled with greater than 1000 characters, the system will output a hardware or software flow control response depending on your flow control settings. Once the input buffer drops below 450 characters, the paging system will use flow control signals to indicate that it is no longer busy and that additional data can be delivered to the serial port.

NOTE: *When setting up for COMP1 operation, you should limit the pager quantity in the Group Pager Database to no more than a few pagers, in order to avoid excessive paging transmissions.*

A COMP2 PROTOCOL PAGING MESSAGE IS FORMATTED AS:

PagerID<CR>Message<CR>

The COMP2 interface supports paging message blocks up to 256 characters in length, group paging, contact monitoring, and timed messaging. The pager ID can be from 1 to 10 characters in length. Pager ID field lengths from 5 to 10 digits are assumed to be Extended Pager IDs (*See Appendix E*). Carriage Return (*<CR>*) and the tilde (~) character are the normal delimiters in COMP2 protocol.

A COMP2 PROTOCOL SUPERSET IS ALSO AVAILABLE WHERE THE MESSAGE FORMATTED AS:

PagerIDX<CR>Message<CR>

The message will be delivered using function code value of X. Values of X include: **A** (*1*), **B** (*2*), **C** (*3*), or **D** (*4*).

AN EXAMPLE OF COMP2 MESSAGE USING FUNCTION CODE A AND PAGER ID 101 IS:

101A<CR>Test Message<CR>

CONTROL CHARACTERS RECOGNIZED BY SPS5 V9 SERIES PAGING SYSTEMS IN COMP2 MODE INCLUDE:

- **CARRIAGE RETURN** – <CR> | 13

- **LINEFEED** – <LF> | 10

- **TILDE** – ~ | 126

- **DELETE** – <DEL> | 127

CONTROL CHARACTERS GENERATED BY THE V9 SERIES PAGING SYSTEMS IN COMP2 MODE INCLUDE:

- **CARRIAGE RETURN** – <CR> | 13

- **XON** – <XON> | 17

- **XOFF** – <XOFF> | 19

- **ABANDON TRANSACTION** – <RS> | 30

SINGLE MESSAGE EXAMPLE USING CARRIAGE RETURN AS DELIMITER:

PagerID<CR>Message<CR>

SINGLE MESSAGE EXAMPLE USING TILDE AS DELIMITER:

PagerID~Message~

TONE/VIBE ONLY EXAMPLE:

PagerID<CR><CR>

MULTIPLE MESSAGE EXAMPLE:

PagerID1<CR>Message1<CR>PagerID2<CR>Message2<CR>

FORCED RESYNCHRONIZATION EXAMPLE:

<DEL><DEL><DEL>PagerID<CR>Message<CR>

The original COMP2 protocol has an inherent weakness of using the <CR> character to delimit both the Pager ID Field and the Message Field. This approach allows the possibility of an extra or missing <CR> character to cause the host device and the paging system to get out of synch with each other. A more robust version of the COMP2 protocol uses Three <DEL> characters as indicators of the beginning of a COMP2 command string. The use of three <DEL> characters at the beginning of each output message assures that out-of-synch conditions will not occur.

MULTIPLE MESSAGES USING FORCED RESYNCHRONIZATION EXAMPLE:

<DEL><DEL><DEL>PagerID<CR>Message 1<CR><DEL><DEL><DEL>PagerID<CR>Message 2<CR>

WHEN INCOMING DATA IS DETECTED ON THE SERIAL PORT, ONE OF THREE THINGS WILL HAPPEN:

1) The data in the serial port input buffer contains properly formatted COMP2 command strings.

2) A time period of approximately 10 seconds elapses after receipt of the last character on the serial port. If the 10 Second Timeout occurs while waiting for all of the characters required for a properly formatted COMP2 message to arrive on the serial port, the data in the serial port input buffer will be discarded.

3) 256 characters or more accumulate in the serial port input buffer. The serial port data is analyzed to see if a properly formatted message block string exists. If it contains any properly formatted message block strings, then the message(s) will be transmitted to the specified Pager ID(s). Any portions of the serial input buffer that do not have the COMP2 message formatting requirements are discarded.

If the serial input buffer becomes filled with greater than 600 characters, the paging system will output a hardware or a software flow control response, depending how it is configured. Once the serial input buffer drops below 450 characters, the paging system will use flow control signals to indicate that it is no longer busy and that additional data can be delivered to the serial port.

IF A PAGER ID DOESN'T EXIST IN THE PAGER DATABASE, AN ERROR MESSAGE WILL BE SENT BY THE PAGING ENCODER IN VERBOSE MODE AS FOLLOWS:

Invalid character in pager ID<CR><CR><RS><CR>

There are two possible response modes for COMP2, the Verbose and Non-Verbose modes. The Verbose response mode has been designed to have human readable responses to message inputs. The Non-Verbose response mode has no readable responses in it.

APPENDIX J – SCOPE INTERFACE SPECIFICATIONS

A simple definition of the difference between the Scope and TAP Protocols is that the Scope Protocol is a dedicated connection that doesn't require a login process and it assumes that the host device (e.g. nurse call system) maintains a database of all paging parameters associated with a pager, including capcode, encoding method, and RF data rate. The Scope Interface supports paging messages up to 512 characters in length.

PAGING MESSAGE COMMAND

THE SCOPE PROTOCOL PAGING MESSAGE COMMAND IS FORMATTED AS FOLLOWS:

AN1234567DMessage<CR>

A – Alphanumeric character that represents the type of paging message to be transmitted: *A = Alphanumeric N = Numeric*.

N – Alphanumeric character representing the data rate, in bits per second, at which the paging message is to be transmitted *N = 512 bps*, *F = 1200 bps*, *S = 2400 bps*.

1234567 – 7 digits representing the pager cap code, including leading zeroes as required.

D – Alphanumeric character representing the function code value to be delivered with the message. Valid values include: **A** (1), **B** (2), **C** (3), and **D** (4).

AN0046180DThis is a test<CR>

This sends the message "This is a test" at 512 bps to an alphanumeric pager with Cap Code 0046180.

(**Note:** *The POCSAG alphanumeric character set is the entire ASCII 7 bit character set*.)

EXAMPLE 2:

NN0765155B412-3433<CR>

Will send the message "412-3433" at 512 bps to a numeric pager with Cap Code 0765155.
(**Note:** *The POCSAG numeric character set allows Hyphen (-), space, left bracket ([ ), and right bracket ( ])*.)

EXAMPLE 3:

AF0145678C<CR>

Will send a three beep tone only message at 1200 bps to a pager with Cap Code 0145678 and multiple tone cadence capability. Certain paging receivers aren't designed to respond to multiple tone cadence messages.

RESPONSE TO ALL COMMANDS

RESPONSES TO PAGING MESSAGE COMMANDS COME IN THE FOLLOWING FORMATS:

Page Queued Okay<CR><LF>

The Page Queued Okay response is sent by the paging encoder to the host system immediately following a command if the command was understood by the paging encoder.

FOLLOWING ARE SOME EXAMPLE ERROR MESSAGES OUTPUT WITH SCOPE PROTOCOL:

- **Error – Invalid Pager ID<CR><LF>**

- **Error – Invalid pager type. Expected A or N<CR><NAK><CR><LF>**

- **Error – Beep code invalid. Expected A,B,C,D<CR><NAK><CR><LF>**

NEGATIVE ACKNOWLEDGEMENT <NAK> | 21 – indicates the refusal of a host device command due to errors or bad formatting.

The TIMED MESSAGING FUNCTION is designed to allow the WaveWare v9E Paging Encoders to be used for purposes of automatically transmitting pre-defined messages upon timer related conditions and is activated during the process of programming the **GROUP PAGING** database.

THE TIMED MESSAGING FUNCTION OPERATES AS FOLLOWS:

Concurrent with the encoder monitoring the serial port for normal paging messages, **the Timed Messaging Function uses an internal 2 minute timer cycle to determine whether or not to transmit predefined messages.** If the timer is not reset by the host device while the Timed Messaging Function is active, the paging system will transmit predefined messages as defined in the pager database configuration.

(**Note:** *Either Ethernet Activity Resets Timed Paging or Serial Activity Resets Timed Paging must be active in order to be able to reset the timer, depending on the input used to send paging data*.)

THE TIMER RESETS UNDER THESE CONDITIONS WHILE THE TIMED MESSAGING FUNCTION IS ACTIVE:

- **RECEPTION OF A VALID TAP OR COMP2 FORMATTED STRING ON THE SERIAL PORT.**

- **RECEPTION OF THE ATI<CR> CONTROL STRING ON THE SERIAL PORT.**

When programming the WaveWare v9E Paging Encoder's pager database, each of the ten pager groups of up to 15 pagers per group in the pager database can be associated with the Timed Messaging Function and associated with one of up to 15 configurable predefined messages. If a pager group has the Timed Messaging Function active, all pagers in that pager group will receive a predefined message.

SOME PRACTICAL APPLICATIONS OF THE TIMED MESSAGING FUNCTION ARE AS FOLLOWS:

In mission critical environments, **the Timed Messaging Function can be used to monitor the host device and notify someone's pager that the host system needs attention**. To accomplish this, program the host control software to output a TAP message or the ATI<CR> command every minute. If the host gets disconnected from the paging system or the host stops functioning, the Host Monitoring Function will come into play.

Use the Timed Messaging Function in a supervisory controlled paging system environment to **allow other portions of the system to know that the paging system's encoder and transceiver are functioning properly**, by monitoring for the predefined message being transmitted automatically by the paging system.
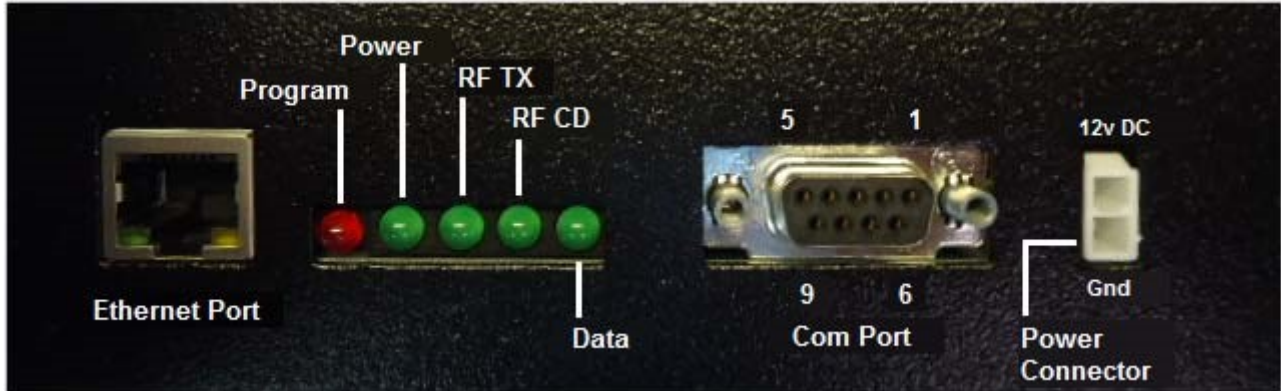
Figure 25: SPS5 V9E Connectors and Indicators

Figure 26: Indicator and Pin-Out Definition Table

LED Indicators		RS-232 DB-9 Connector Pin-Outs	
Program:	RED LED – Shows when the system is in or out of programming mode. It also lights up if one or more error(s) are found in the paging system.	**(1) CD:**	Not used.
		(2) RD:	Data Output by the paging system.
		(3) TD:	Data Received by the paging system.
Power:	GREEN LED – Shows Power is on.	**(4) DTR:**	Not used.
RF TX:	GREEN LED – Shows transmission of page.	**(5) GND:**	Grounding Pin.
RF CD:	GREEN LED – Shows Carrier Detect Status.	**(6) DSR:**	Signal output by the paging system.
Data:	GREEN LED – Shows if a RS-232 serial cable is connected to a host device.	**(7) RTS:**	Signal input to the paging system. Needed for Hardware Flow Control.
Ethernet Port:	GREEN LED and ORANGE LED – Both LEDs being active indicates normal operation.	**(8) CTS:**	Signal output by the paging system. Needed for Hardware Flow Control.
		(9) RI:	Not Used

Figure 27: SPS5 v9E-HP Fan Button

(**Note:** *If you are using a SPS5 V9E-XL or a V9E-HP, the system will also have a momentary button for the fan located on top of the system's radio transmitter for troubleshooting purposes*.)

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Some installation sites might cause paging reception problems. In these cases, it's usually beneficial to perform a site survey by monitoring the radio waves in the area that you want to install a system. In addition, it also might be beneficial to perform a range test to find out of the installed signal will be strong enough to be received in all of the areas you want to cover. A site survey consists of both monitoring for radio signals on your channel, and verifying that the paging system has the power to cover the expected area.

PERFORM A SITE SURVEY IF PAGING CONDITIONS MEET ONE OR MORE OF THESE CRITERIA:

- **HOSPITAL OR MEDICAL FACILITY**

- **UNOBSTRUCTED LINE OF SIGHT DISTANCE EXCEEDING 1 1/2 MILES**

- **BUILDING ABOVE 5 STORIES**

- **BUILDING GREATER THAN 50,000 SQUARE FT.**

- **MULTI-BUILDING FACILITY**

- **VICINITY OF SEAPORTS AND SHIPYARDS**

- **PAGER RECEPTION PROBLEMS OCCUR**

- **EXCESSIVE CARRIER SIGNAL DETECTION CONDITIONS OCCUR AT THE PAGING SYSTEM**

You can monitor for radio signals using a simple multi-channel UHF band scanner. You listen to the scanner for any audio output on that channel (**Note:** *The louder the audio, the stronger the signal*). If the scanning results in excessive use of that radio channel, consider changing the paging system to operate on another radio frequency channel. Use the scanner to identify the lowest traffic of those channels available to you. You may need to monitor for several minutes to determine which channels are busier than others.

You can use a PC connected to a SPS5 paging system to perform a range test using the WaveWare Paging Encoder Setup Software (*see pg. 19 for details*). If pager reception problems occur without excessive foreign traffic on that channel, then consider boosting the strength of the paging signal. Typically, when you boost a signal, you will need to change the paging system equipment and pagers to a channel that allows higher power transmissions, measured in Watts.

WARRANTY: **WaveWare Technologies, Inc. warranties this system to operate properly for a period of one year from *date of shipment* from WaveWare Technologies, Inc.** Warranty includes parts and WaveWare factory labor, but ***does not include shipping charges.*** The warranty becomes void if the equipment is physically damaged by any external events.

DISCLAIMER: This equipment has not been designed to operate as a primary means of life and safety communications, and should only be used as a secondary means of communications. The nature of radio paging is such that alert messages are not guaranteed to be delivered to pagers, due to a variety of causes, some of which are out of the control of the equipment manufacturer and the user of the equipment. The WaveWare paging equipment uses a one-way radio paging protocol called POCSAG, which relies upon proper operating frequency coordination and licensing, proper external environmental conditions, and proper equipment maintenance, in order to deliver messages to pagers in a reasonably reliable manner. **WaveWare Technologies, Inc. is not liable for damages caused by failure of delivery of messages from WaveWare equipment to pagers, beyond the normal warranted equipment repair or replacement during the warranty period.**

NOTE: 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 when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at "His Own Expense". **Changes, tampering, or modifications to the equipment not expressly approved in writing by WaveWare Technologies, Inc. could void the user's authority to operate the equipment and void the warranty.**

SITE LICENSING: This equipment, when attached to a radio transmitter, requires a site license from the FCC in order to be operated. The site licensing can be obtained through several means, including **Shared-Use Site Licensing from WaveWare and FCC Site Licensing through WaveWare.** Directly from FCC licensed Frequency Coordination agencies, or from anyone that can help you fill out the proper FCC forms payment submittal requirements. Good for the USA Only.