TAP Interface Specifications

This appendix is included for those who want to develop their own paging control software or add an interface for the **WaveWare v8 Paging Encoder** to their existing software applications.

A simple definition of the **TAP Protocol** is that the TAP Protocol normally requires a connect and disconnect process and normally assumes that the Host system maintains a database of pager reference numbers called IDs, and that 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 **WaveWare TAP Interface** is 245 minus the ID field length. With an ID value of 5, you can transmit up to 245 characters per message. With an ID value of 1233425120, you can transmit up to 235 characters per message.

To configure your **WaveWare v8 Paging Encoder** to use the TAP Paging Protocol, you may be required to configure the com port settings in the paging encoder. Please refer to **Appendix B – Com Port Settings**, for details on configuring communication protocols.

Your **WaveWare v8 Paging System** typically communicates with a PC or other host device via RS-232 at 9600 Baud, 8 data bits and 1 stop bit. The eighth data bit is ignored (no parity). You can configure the paging system for other serial communication parameters. Please refer to **Appendix B – Com Port Settings**, for details on serial communication parameters.

The **WaveWare v8 Paging Encoder** maintains 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 D – TAP Response Codes for a listing of the response codes.

The **WaveWare v8 Paging Encoder** encodes paging messages into **POCSAG** paging format and transmits the encoded paging message. If the **Carrier Detect** function is enabled, transmissions will be delayed while interfering signals are detected.

Control characters recognized by the paging system in **TAP Protocol** mode include:

CARRIAGE RETURN	**<CR>**	**$0D**
START OF TEXT	**<STX>**	**$02**
END OF TEXT	**<ETX>**	**$03**
END OF TRANSMISSION	**<EOT>**	**$04**
SUBSTITUTE	**<SUB>**	**$1A**
ESCAPE	**<ESC>**	**$1B**

Control characters generated by the **WaveWare v8 Paging System** in **TAP Protocol** mode include:

LINE FEED	**<LF>**	**$0A**
CARRIAGE RETURN	**<CR>**	**$0D**
ACKNOWLEDGE	**<ACK>**	**$06**
NEGATIVE ACKNOWLEDGE	**<NAK>**	**$15**
ABANDON TRANSACTION	**<RS>**	**$1E**
ESCAPE	**<ESC>**	**$1B**
END OF TRANSMISSION	**<EOT>**	**$04**
XON	**<XON>**	**$13**
XOFF	**<XOFF>**	**$11**

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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 v8 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 the WaveWare paging transmitter recognizes a command formatted as **ATI<CR>**, the transmitter responds with the following message:

WaveWare Paging Encoder v8.00<CR>

(The firmware version number is subject to change)

PAGING SESSION LOGIN

The **v8 Paging Session Login** mode allows a **Host Device**, sometimes called a Remote Entry Device, to initiate communications with the paging system. With the **WaveWare v8 Paging System**, the Login process is optional. The **WaveWare v8 Paging System** will automatically login a Host Device and process the paging message if it recognizes a properly formatted TAP message block at any point in its operation.

The **Host Device** initiates the Login process by transmitting a carriage return **<CR>** character every two seconds until the paging system properly responds or until the Host Device times out and notifies the operator of a bad connection. The paging system will respond with **"ID=<CR>"** (Note: the quotation characters are used here only for reference and are not included in the transactions). The **"ID=<CR>"** will not be repeated or timed out by the paging system.

The **Host Device** should respond to the paging system with:

<ESC>PG1<CR> or **<ESC>pg1<CR>**

The **WaveWare v8 Paging System** will then respond with:

110 1.8<CR>WaveWare Paging Encoder v7.29<CR><ACK><CR>

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. The paging system then notifies the Host Device that it is ready to accept messages as follows:

<ESC>[p<CR>

This completes the Login process.

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PAGING OPERATION

Paging transactions are transmitted in blocks of characters, where one transaction is sent per block. Each block sent by the Host Device is acknowledged by the paging system. The Host Device must wait for this acknowledgement before sending the next block. The **WaveWare v8 Paging System** provides acknowledgement in the form of an **<ACK>** character.

The **WaveWare v8 Paging System** supports **TAP** message blocks up to 253 characters in length, with a 235 to 244 character message, from 1 to 10 characters for ID (pager number), plus 5 control characters, and a 3 character checksum. (Message field length is restricted as follows: when a 1 character ID is used, a 244 character message can be accommodated, and so on, for a total of 253 characters, such that when a 4 character ID is used, a 241 character message can be accommodated. The maximum ID field length of 10 causes a maximum message field length of 235 characters). A block always carries two fields with their associated carriage returns. The message field may be empty, but its carriage return must be included in the data block. The **TAP** message block format is as follows:

<STX>ID<CR>Message<CR><ETX>Checksum<CR>

The **ID Field** is a one to ten character pager number. Leading zeroes are not required. The Message field accommodates up to 235 alphanumeric characters. The Checksum field provides a checksum for the previous portion of the **TAP** message block. See **Appendix C – TAP Checksum Calculation**, for sample code to create the checksum field.

The Message field can be formatted as follows:

- **For Alphanumeric** paging messages, all 7-bit ASCII “non-control” characters are valid except ^, ~, and _ (underscore)
- **For Numeric** paging messages, valid characters are the numbers 0 through 9, - (hyphen), and space
- **Control Characters** can be embedded into paging messages so that high end alpha pagers and paging data receivers can respond with formatted screen displays and with formatted serial output, as required. Control characters (typically **<CR> and <LF>**) can be embedded in messages by using the Transparency Option. The Transparency Option replaces a non-printable control character with the **SUB** (Hex 1A) character immediately followed by the control code offset by 40 Hex. See **Appendix F - Embedded Control Characters** for details on how to embed control characters in paging messages.

The WaveWare **TAP Interface** supports ID field lengths from 1 to 10 digits. The ID field can be formatted using two different methods, as follows:

- **Method 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 **WaveWare v8 Paging System**’s onboard pager database.
- **Method 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 capcode. Extended ID processing allows you to avoid the process of configuring a pager database in the **WaveWare v8 Paging System**. See **Appendix E – Extended ID Processing** for details on how to format the ID field.

When the **Host Device** delivers a **TAP** Message Block to the **WaveWare v8 Paging System**, if the message block is properly formatted, and a 1 to 4 digit ID field matches the pager database, the paging system will respond with an initial response code as follows:

211 Page(s) Sent Successfully<CR>

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If your **WaveWare v8 Paging System** is configured to operate using **TAP** Non-Verbose mode, the paging system will respond only with an initial response code of:

211<CR>

Following the first part of the **TAP** Message Block response, 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 **<ACK><CR>** response can be used as a flow control method to prevent overflow and lost messages. As alternative flow control methods, you can use either hardware or software flow control. If the paging system is configured for 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. If the paging system is configured for software flow control mode, an **XOFF** Character (0x11) will be output in the response string to indicate the input buffer doesn't have capacity for another **TAP** Message Block. When capacity is available, an **XON** Character (0x13) will be output.

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 D – TAP Response Codes for more information on paging system response messages. If the **TAP** Message Block checksum is OK, but the Message Block violates formatting rules, the paging system will respond with an error message and an **<RS><CR>**, which tells the Host Device to abandon the transaction. An example error message sequence follows:

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

PAGING SESSION LOGOUT

The Paging Session Logout mode allows a Host Device, sometimes called a Remote Entry Device, to stop communications with the paging system. With the **WaveWare v8 Paging System**, the Logout process is optional. The **WaveWare v8 Paging System** will automatically login a Host Device and process the paging message if it recognizes a properly formatted **TAP** message block at any point in its operation.

To initiate a logout (disconnect sequence) the **Host Device** should send the following to the paging system:

<EOT><CR>

Upon recognizing a logout command, the paging system will respond with:

PAGING EXCHANGE DISCONNECT<CR><ESC><EOT><CR>

This Completes the "Paging Operation"

This Completes the "TAP Interface Specifications"