

KWM - 1200 Plus **Operations Manual**

Supplements the KPC-3 Plus Manual and Addenda
For use with KWM-1200 Plus

Kantronics

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This supplement is intended for use with the KWM-1200 Plus in conjunction with the KPC-3 Plus manual and addenda. The "KWM Commands" section of this supplement contains commands which have been modified or added.

Introduction

The KWM-series of radio modems contains the AX.25 protocol found in the KPC-series modems plus other protocols that have the potential to be easily integrated into a variety of commercial applications.

AX.25 protocol operation is described in the KPC-series manuals along with the AX.25 commands used and cabling/installation instructions and other information.

Although AX.25 packet is a very robust protocol and assures near error-free exchange of data between Data Terminal Equipment (DTE) devices, it is somewhat cumbersome to implement. AX.25 requires that the user learn a highly-structured command set and the myriad of responses that can be received from the modem. Often, a long process of trial and error results in the realization that AX.25 may not be the most suitable protocol to use for a particular application.

Kantronics has developed the Transparent Unproto Packet (TUP) Mode, Poll Mode, Line Substitution (LINESUB) Mode, and Modem Mode protocols for the KWM-series in an effort to allow the modems to be more easily used with different types of installations. This manual supplement contains a detailed description of these protocols and their operation.

Setting up the Modem

Follow the instructions in the KPC-series manual to properly power and cable the modem to your computer. How to install an address (call sign) and set the *serial port* baud rate for communications between your computer and the modem is explained in the "Getting Started" section. The exercise of connecting to your personal mailbox will assure you that the computer is properly communicating and the modem is properly responding to command input.

Bench Test Set-up

The ideal bench set-up for testing the suitability of the operational characteristics of the selected modem protocol for an application is a pair of computer/modem "stations" with the modems cabled back-to-back. To set up the back-to-back "stations," connect the transmit audio of the first modem to the receive audio of the second modem and then connect the transmit audio from the second modem to the receive audio of the first. A common ground connection is also necessary to provide a return path for the audio signals. This allows the modems to communicate with each other using the "wire radio" just described. This preliminary step allows experimentation with the modems and the different protocol delays, responses, and characteristics without having to be concerned with an actual radio link.

After the proper protocol has been selected for a particular application, and has been demonstrated to work properly, the radios can be integrated into the test set-up. (See KPC-series manual for cabling information.) If problems appear at this stage, the radio link is probably at fault. The addition of the radio link will also add a significant amount of time to the data transfer because of transmitter key-up and return to receive delays which may require modification of initial parameter settings. Be sure that the application can tolerate the additional time that is required for the radio link!

Protocol Descriptions and Operation

Transparent Unproto Packet (TUP) Mode

TUP Mode Description

The TUP mode protocol utilizes the Unproto mode of the AX.25 protocol, allowing digipeaters (VIA path specified with UNPROTO command) to be used in order to effectively extend the range of a radio data system beyond simplex distance. This protocol uses the standard AX.25 CRC-16 error-checking to provide a high degree of data integrity. Data is sent and received in a totally transparent fashion, allowing all ASCII characters to be utilized (hex 00 through hex FF). Radio transmission is based on the PACTIME AFTER parameter setting of the modem, the setting of the carrier detect method, and the settings of the slot and persist channel access algorithm. Any data that is received by the modem via the radio is output to the serial port *only* if it contains no detectable errors. The received data will be *exactly* the same as the data that was sent to the input serial port of the transmitting mode, without any address headers or added formatting of the data. The modem is capable of selectively filtering monitored data from or to different modem addresses using the BUDLIST command.

If digipeaters must be used to extend the range of the system, the information frame sent by any modems in the system will be output to the serial ports of the receiving modems only once, regardless of how many times it was received correctly. Also, data sent by any modem will not be decoded by itself when the data is digipeated. The TUP mode protocol provides an automatic "Time to Live" timer that inhibits any modem from transmitting or receiving additional data until sufficient time has expired to allow in-progress data to travel through all the digipeaters specified in the UNPROTO field of the originating modem. Since the time for a given packet to travel the entire UNPROTO path may vary due to the presence of other signals or noise, TUPTIME is used to impose an additional delay time, if needed, during which each modem will be inhibited from decoding or transmitting new data. This setting can be determined experimentally. It is important to note that TUPTIME applies *only to the receiving modems* and should be set to the same value at all sites. It is the responsibility of the host system to insure that additional data is not transmitted until sufficient time has elapsed to allow data to travel to the last digipeater and the response, if any, to travel back to the host. Note that the automatic "Time to Live" timer and the TUPTIME timer are only in effect if packets are being digipeated.

TUP Mode Operation

Commands Used

Basic TUP Operation involves just a few commands:

MYCALL - The MYCALL command determines the MODEM address. This must be entered after the autobaud routine has detected an asterisk (*).

TXDELAY - The TXDELAY (TXD) command determines how long the modem will assert the Push-to-Talk line of the radio before sending data. This time will have to be determined experimentally since it will vary from radio to radio. If the TXD is set too short, the data transmitted will not be received by other units in the system. Setting TXD too long will reduce channel capacity. NOTE: Since TXD is used in the computation of the automatic timer used to inhibit transmission until a digipeated packet has had time to reach its destination, TXD must be set to the same value in all modems in the system

PACTIME - The PACTIME parameter determines how long the modem will wait after receiving data to be transmitted from the DTE before beginning the radio key-up sequence. Normally, this parameter should be set to AFTER 1 (100 ms) in order to minimize "dead air" time on the system.

PACLEN - PACLEN sets the maximum size of the data packet(s). Most applications do not require large amounts of data to be transferred so the default value (128) will probably be satisfactory, allowing packets up to 128 bytes. If the amount of data to be sent exceeds the PACLEN parameter setting, the transmission will be composed of multiple packets containing the data.

PERSIST and **SLOTTIME** - These parameters determine how aggressively the modem will attempt to access a multi-user channel based on carrier detect. See KPC-series manual for a full explanation of these parameters.

Entering TUP Mode

Use the INTFACE command to begin TUP operation. Set the INTFACE command to TUP:

```
cmd:INTFACE TUP <cr>
```

and turn the unit off and then back on.

Exiting TUP Mode

If you want to exit the TUP mode to "fine tune" parameter settings (or for any other reason), the Command mode of the modem can be regained by using the transparent data escape sequence, i.e., by sending a series of three control-Cs (unless a different control character for COMMAND has been defined). (See TRANS command in the Reference manual).

Poll Mode

Poll Mode Protocol Description

The POLL mode is generally used in system applications that implement a polled-response protocol between a central site (Control Site) and one or more remote locations (Remote Site). The POLL mode is similar to the TUP mode since it uses a data transparent broadcast mode and a packet protocol with CRC-16 error-checking to insure the integrity of the received data. All ASCII characters (hex 00 through FF) can be transmitted and received. The POLL mode differs from TUP mode by allowing an application program to address specific locations without changing any modem parameters. All data sent by the application program at the central sit must begin with the address (POLLID) of the intended remote modem. When any remote modem receives data from the radio, the data is checked for errors and the received POLLID is compared with its own POLLID. If they match, the POLLID is stripped and the data that follows is sent to the serial port. All data received by the central site from the remote location will arrive with the POLLID of the remote site automatically attached to the beginning of the data.

It is the responsibility of the application program to: (1) address data to be sent to the remote sites, (2) determine if the data was received, and (3) recognize responses that contain the remote site's POLLID and data. *Digipeating is not allowed*

Poll Mode Operation

Commands Used

Each modem is set up differently depending upon whether it is to be a Control modem or a Remote modem.

Control Site

Control Site Configuration - The POLLID command in the Control modem must be set to 0000 and the INTFACE command must be set to POLL. (See "Entering POLL Mode" below.)

Control Site Transmit Format - All data sent to the Control modem via the RS-232 serial port *must* begin with a POLLID (four digit remote address between 0001-9999) and be followed immediately by the poll data. The data sent by the application to the Control modem must contain less than PACLEN bytes. If the poll data contains more characters than allowed by the setting of the PACLEN command, the data will be fragmented and multiple packets will be formed and transmitted by the modem. These additional packets will contain *only* the balance of the data received by the modem. Since these packets do not begin with a POLLID, they will be ignored by all Remote modems.

Control Site Receive Format - All Remote transmissions received by the Control modem shall consist of the Remote POLLID followed immediately by the Remote data. Both POLLID and data will be sent to the control DTE via the RS-232 port.

Remote Site

Remote Site Configuration - The POLLID command in each of the Remote modems must be set to a different number between 0001 and 9999. This assures that data is received by just one remote device.

The INTFACE command in each modem must be set to POLL. (See "Entering POLL Mode" below.)

Remote Site Transmit Format - Remote sites generally do not have much computing capacity. . Therefore, the transmitted format of the data is, of necessity, straightforward. All data recelved via the serial port will be formed into packets and transmitted with the address (POLLID) attached to the beginning of each data packet.

Remote Site Receive Format - All data received by the Remote via the radio is first examined for errors using a CRC-16 error-checking algorithm. Data packets that contain errors are discarded. If the data contains no errors, it is then checked for a match of the received POLLID and its own POLLID. If there is not a match, the data is discarded. If there is a match, the POLLID is stripped and the raw data is passed to the RS-232 serial port for processing. The received data format will be *exactly* the same as the data sent to the Control Modem by the application program.

The CONMODE parameter affects when data will be sent in Poll Mode.

If CONMODE is set to CONYERS (default), data will be transmitted when any of the following conditions is met:

1. The SENDPAC character is received by the modem. The default SENDPAC character is a carriage return and can be changed to suit an existing application. The SENDPAC character can be either stripped or appended to the data by setting the CR command ON to append, or OFF to strip.
2. PACLEN is exceeded. *CAUTION: MASTER (Control Site) operation will be unusable if PACLEN is exceeded since each packet of data sent MUST begin with a Slave (Remote Site) POLLID (0001-9999).* Remote transmission may exceed the setting of PACLEN since each packet transmitted from the Remote will contain the proper POLLID. If fragmentation of data occurs, the application program is responsible for reconstructing the data. PACLEN determines the *maximum* size of data packets (default 128 characters). Normally, the amount of data to be transmitted will be considerably less than this.
3. CPACTIME is on and PACTIME expires. If CPACTIME is ON, data will be periodically transmitted based on PACTIME timeout.

If CONMODE is set to TRANS, data will be transmitted when:

1. PACLEN is exceeded, or
2. PACTIME expires.

Suggested Settings

Usually, the CONMODE command is set to TRANS and the PACTIME command is set to AFTER 1. The CONMODE TRANS command makes the modem data transparent to the Remote device. The PACTIME AFTER 1 command allows the modem to transmit the data received via the serial port with as little delay as possible. This speeds up the response time of the system by reducing "dead-air" time.

It is also recommended to set the PACLEN command to zero. This allows the modem to send a single packet of data to the radio of any size between 1 and the maximum of 256 characters. If the response data from the remote contains more characters than the PACLEN command allows, the data will be transmitted in multiple packets with the Remote POLLID automatically attached to the beginning of each data packet. In such a case, it is the responsibility of the Control Application Program to reassemble the data.

CAUTION: Allowing the Control Site application to send more data than that permitted by the PACLEN command is the most common cause of failure using the POLL mode. **BE ABSOLUTELY SURE THAT CONTROL SITE TRANSMISSIONS NEVER EXCEED THE PACLEN LIMIT!**

Entering POLL Mode

When you have entered the POLLID of the unit and made any desired changes from the default settings in the parameters, use the INTFACE command to begin POLL operation. Set the INTFACE command to POLL:

```
cmd:INTFACE POLL <cr>
```

and turn the unit off and then back on.

Exiting POLL Mode

If you want to exit POLL mode to "fine tune" parameter settings (or for any other reasons), the command mode of the modem can be regained as follows:

If CONMODE = CONV

Enter: 0000QUIT<cr> (NOTE: MUST BE IN UPPER CASE)

If CONMODE = TRANS

Use the transparent data escape sequence, i.e., send a series of three control-Cs (unless a different control character has been defined). (See TRANS command in the Reference Manual).

Line Substitution (LINE SUB) Mode

LINE SUB Mode Protocol Description

The LSUB mode of operation provides a method of transmitting-and receiving raw ASCII data via a radio. Data is sent and received in a totally transparent fashion, allowing all ASCII characters to be utilized (hex 00 through hex FF). There is no addressing, error-detection or automatic retransmission of the data. When the receiving modem detects the proper Start-of-Data sequence generated by the transmitting modem, it will output the data that follows to its; serial port. At the end of the received data there is an End-of-Data sequence that permits the receiving modem to recognize the end of the data and quit translating the receiver audio. This allows the modems to operate with open squelch audio from the radios. Since the protocol constitutes a very small portion of the transmission, the effective data throughput is very nearly that of the radio baud rate (HBAUD).

LSUB Mode Operation

Commands Used

TXDELAY - The TXDELAY (TXD) command determines how long the modem must key the Push-to-Talk line of the radio before sending data. This time will have to be determined experimentally since it will vary from radio to radio. If the TXD is set too short, the data transmitted will be garbled and not received by other units in the system. Setting TXD too long will reduce channel capacity.

PACTIME - The PACTIME parameter determines how long the modem will wait after receiving data to be transmitted from the DTE before beginning the radio key-up sequence. Normally, this parameter should be set to AFTER 1 (100 ms.) in order to minimize "dead-air" time on the system.

PERSIST and **SLOTTIME** - These parameters determine how aggressively the modem will attempt to access a multi-user channel based on carrier detect. See KPC-series manual for a full explanation of these parameters.

Entering LSUB Mode

When you have made any desired changes from the default settings for the above parameters, use the INTFACE command to begin LSUB operation. Set the INTFACE command to LINESUB:

```
cmd:INTFACE LINESUB <cr>
```

and turn the unit off and then back on. Be aware that there is *no* data flow control.

Exiting LSUB Mode

If you want to exit LSUB mode to "fine tune" parameter settings (or for any other reason), the Command mode of the modem can be regained by using the transparent data escape sequence, i.e., by sending a series of three control-Cs (unless a different control character has been defined). (See TRANS command in the Reference Manual).

Modem Mode

Modem Mode Protocol Description

It is important to note that when the MODEM mode is used, the modem is acting as a pure modulator/demodulator and uses the RTS and CTS lines of the serial port to control transmission of the data. There is *no* addressing, error correction, error detection, or flow control of the data as it is transmitted or received. The audio tones generated and received by the modem will directly mimic the data in composition and speed. Because of this, it is essential that all Data Terminal Equipment (DTE) associated with this mode have identical serial port parameters in use.

EXAMPLE: 1200 baud, No parity, 8 data bits, 1 stop bit

Modem Mode Operation

Commands Used

The TXDELAY (TXD) command sets the parameter to control the time necessary (in 10 ms steps) for the transmitter to be keyed prior to transmitting data tones. TXD is the only command in the manual that affects the MODEM mode of operation. This timing interval can be adjusted to suit a particular radio by changing the value of the TXD parameter.

Entering MODEM Mode

When you have set the TXD parameter as desired, use the INTFACE command to begin MODEM operation. Set the INTFACE command to MODEM:

```
cmd:INT MODEM <cr>
```

Turn the unit OFF and then back ON *with RTS held low*.

The idle state of the CTS and RTS lines between the DTE and the modem is normally low (negative voltage). When the RTS line is asserted by the DTE, the modem will immediately key the transmitter, sending a "Mark Hold" tone and return CTS to the DTE after the TXDELAY (TXD) time period has expired. The return of CTS indicates to the DTE that the radio is transmitting and that the modem is ready to accept data via the serial port at any speed up to 1200 baud. Releasing the RTS signal from the DTE to the modem will cause the modem to release the Push-To-Talk line to the radio and drop the CTS to the DTE.

Exiting MODEM Mode

Since all data appearing on the serial input to the modem is regarded as data to be sent, the Command mode of the modem *cannot* be regained by using the transparent data escape sequence, i.e., by sending a series of three control-Cs as described in the TRANS command in the Reference manual. If you wish to exit MODEM mode to change the TXD parameter (or for any other reason), holding the RTS line high during power-up will restore the unit to the Command mode.

KWM Commands

This section contains only those commands which have been added or modified for use with the KWM-1200 Plus. All other commands are found in the command section in the KPC-3 Plus Reference manual or addenda.

Added Commands

POLLid 0000-9999 {default 0000}

Pollid is used with the Poll Mode. The four-digit POLLID determines if the modem is a Control or a Remote modem. If the modem is a Remote, POLLID also sets the Remote address. If POLLID is equal to 0000, the modem is a Control Modem. If POLLID is 0001 to 9999, the modem is a Remote Modem.

TUptime n (n = 0 - 225) {default 1}

TUPTIME is used *only* in TUP mode and imposes an additional time to live (in 100 ms increments) for digipeated packets.

Modified Commands

INTface Terminal | KISS | XKISS | HOST | GPS | LINESUB | MODEM | TUP | POLL {default TERMINAL}

The TUP, POLL, LINESUB (LSUB), and MODEM modes have been added to the INTFACE command for the KWM-1200 Plus. NEWUSER has been deleted from the KWM firmware.