Pactor

for the KAM

Kantronics

RF Data Communications Specialists

Printed on
recycled paper

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Welcome to Pactor

Pactor was developed by a group of German Radio Amateurs and introduced to the world amateur radio community in 1991. Kantronics has since implemented the Pactor protocol in the KAM, including twelve new commands. Combining some of the best features of Packet radio and Amtor, this hybrid mode provides robust digital communications for high frequency (HF) data. Through the use of automatic baud rate selection, data compression, optimal message length, Memory-ARQ, and other techniques, Pactor delivers greater data throughput. Pactor also supports error-free data transfers through the use of a two-byte error detecting code (CRC), 8-bit data transfers and up to 8 bytes for identification, allowing full callsigns.

Data transmission can occur at either 100 or 200 baud, with the Pactor controllers automatically determining optimal speed given HF band conditions. If the link deteriorates during 200 baud operation, the controllers automatically switch to 100 baud. If operating at 100 baud and data transfers proceed without significant error, an increase to 200 baud is attempted.

Pactor also has the ability to compress data on-the-fly using Huffman compression techniques. At 200 baud, Pactor normally will transmit 20 characters of data with each frame. With compression it is possible to transmit more than 20. At 100 baud, each frame normally consists of 8 characters, but more may be transmitted with compression. Huffman compression is applied to each frame on a case-by-case basis, since it does not always lead to an increase in characters. Therefore, one frame may be compressed and the next not. This compression process is handled completely by the KAM. Additionally, data compression of transmitted data may be enabled or disabled with the KAM command PTHUFF. However, the KAM will decode received frames, whether compressed or not.

Finally, in Pactor, frames repeated due to errors are combined in an attempt to form a good frame. This process is called Memory-ARQ. When signal conditions are poor but potentially copyable, the KAM can often combine 2 or more frames to make a good one. Hence, there is no need to transmit frames until a perfect one is received.

Pactor activity, at present, is found on all the HF bands near Amtor and RTTY. CW will typically be found at the bottom of each band while Amtor, RTTY and Pactor are up the band in frequency. For example, on 20-meters, activity can be found generally as listed below. Note that Pactor and Amtor may tend to overlap.

CW	14.000 - 14.070 MHz
Amtor/Pactor	14.070 - 14.085 MHz
RTTY	14.080 - 14.095 MHz
Packet	14.095 - 14.111 MHz

Like packet, Pactor allows the full ASCII character set to be transmitted. This makes binary file transfers possible. Also, like packet, Pactor uses a 16 bit CRC (correction code) to insure error free data transfer from station to station. Unlike packet, however, Pactor does not allow multiple users on a single frequency. In addition the callsign is not transmitted with each frame, thus reducing overhead with each data transfer.

Pactor, like Amtor, provides both a linked mode and an FEC mode. The linked mode is called automatic repeat request (ARQ). In ARQ the transmitted frames are acknowledged by the receiving station as good or bad. If bad, the receiving station asks for a repeat. FEC is used for calling CQ or for broadcasting messages.

Pactor, unlike Amtor, allows communication over greater distances by allowing long-path connections. Pactor also transmits more data per frame, providing a higher throughput.

Pactor Operation

Operation is possible in two modes. The first mode is a "connected" or linked mode where two stations are in conversation with each other. This is normally referred to as ARQ mode. Complete error checking occurs in this mode, and the receiving station will request retransmission of any data frames containing errors.

The second mode of operation transmits data in an unconnected (or un-linked) state so that several stations can copy at the same time. This is referred to as the FEC mode and is the mode used for calling CQ or other broadcast transmissions.

Each Pactor station has a unique identification which normally consists of your amateur radio callsign. The identifier is set with the MYPTCALL command and may be up to 8 characters long. This callsign is sent to the other Pactor station immediately when a link is established.

All transceivers require a little time from the application of the PTT signal until the data is transmitted to allow the transceiver output to rise to full power. In the Pactor mode, this time delay is adjusted with the TXDAMTOR command (See the Commands Manual for your KAM).

Tuning Pactor

Pactor signals are similar to RTTY signals, in that they are transmitted with MARK and SPACE tones. Hence the bargraph indicator will be lit at both ends when properly tuned. If the station you are tuning is in ARQ mode, the bargraph may seem to flash on and off as the station alternately transmits and then receives. When you link to a station on Pactor, the HF CON light will light showing that you are connected or linked.

Monitoring Pactor

To monitor Pactor you must place the KAM in the Pactor Listen mode (PTLISTEN). To do this from the command prompt (cmd:) type PTLISTEN and press return. This places the KAM in the listen mode where both ARQ and FEC modes of Pactor can be copied. To exit the listen mode and return to the command prompt, type Control-C then the letter X. This is the <Ctrl-C>X directive.

Calling CQ

In order to call CQ in Pactor, you must first enter the Pactor Standby mode. From the command prompt (cmd:) type Pactor and press return. The KAM will indicate that you have entered Pactor by displaying the message <Pactor STANDBY>. Next, type the directive <Ctrl-C>T to start transmitting, and type your CQ message. After you have entered your message, type <Ctrl-C>E to return to the Pactor Standby mode. You are then ready to receive a link from another station. Note that while you are transmitting in FEC, you may change the speed by using the <Ctrl-C>1 or the <Ctrl-C>2 directive.

Since your amateur callsign is used for connecting (or linking) to other stations on Pactor, and because Pactor uses a full CRC method of error checking, a SELCAL or "RYRY" type characters are not required. A typical Pactor CQ would consist of something like the following:

> CQ CQ CQ de WK5M WK5M WK5M
> CQ CQ CQ de WK5M WK5M WK5M
> CQ CQ CQ de WK5M WK5M WK5M
> K K K

Entering Pactor Standby mode

To enter the Pactor Standby mode, simply type PACTOR and press return from the command prompt (cmd:). Your KAM will then respond automatically to any attempt from another station to link to you in Pactor. You must have ARQBBS OFF if you wish to talk to other stations from your keyboard. If ARQBBS is ON, a station who links to you will be connected to the PBBS in your KAM.

Calling another station on Pactor

To call another station using Pactor, at the command prompt (cmd:) enter the PACTOR command with the callsign of the station you wish to talk to. For instance:

> cmd: PACTOR WØXI

Your KAM will begin transmitting a connect frame and if the other station is on the air in the Pactor Standby mode, that controller will respond to your connect request and you will see the message <LINKED to WØXI> on your screen. You can then start typing your message to the other station. Since you started the connection your station will be the "Information Sending Station" (ISS) once the link is established. After you have entered all that you want to say, use the <Ctrl-C>E directive to allow the other station to send data to you. This causes the KAM to send the Pactor

changeover sequence and you become the "Information Receiving Station" (IRS). While the other station is sending data to you, you may force a changeover by typing the <Ctrl-C>T directive. You then become the "Information Sending Station".

Once you have concluded your conversation, you may "disconnect" the link by typing the <Ctrl-C>D directive. This will send the proper QRT frame to the other station and return your KAM to Pactor Standby mode. Alternatively, you may use the <Ctrl-C>X directive which will also disconnect the link, but will return you to the cmd: prompt of the KAM, thus leaving the Pactor mode and returning the HF port to packet operation.

Long Path Connect

At times, you may need to talk to a station using the "long path", that is, someone who is greater than halfway around the world. By default, the KAM will allow you to establish a link on Pactor to any station within about 4500 miles using the normal Pactor connect. Stations over this distance will require the long-path link option. To do this, you must precede the callsign of the station with an exclamation point, telling the KAM to extend the timing for long path operation. For instance:

>> PACTOR !ZL2AB

When you attempt to link to a nearby station, it is possible that the transceivers (your's and the other station) may not switch fast enough to permit a link to occur. In this case, we suggest that both stations set the TXDAMTOR command to a higher value (try 7, 8, or 9) and then attempt to connect using the long path option (PACTOR !callsign). This has been proven to allow links on very short paths with very slow radios.

Speed changes

The HF VAL light on the front of the KAM will indicate the speed of the Pactor signal you are receiving or transmitting. When lit, the Pactor signal is 200 baud, and when not lit the speed is 100 baud.

Pactor operates at 200 or 100 baud. Normally the speed is automatically selected based on the quality of the link between the two stations. A link will begin at 200 baud if the receiving station has decoded the 200 baud portion of the connect request. If the receiving station then detects a number of incorrectly received packets (set by PTDOWN) it will request the sending station to slow down to 100 baud. While operating at 100 baud, if the receiving station receives a number of correct packets in a row (set by PTUP) then the receiver will request the sending station to speed up to 200 baud.

While you are linked to another station the receiving station (IRS) controls the speed of the link. If you are the IRS, you can force the other station to send at 100 baud by using the <Ctrl-C>1 directive. Your KAM will then send the speed change command to the other unit (if needed) to change to 100 baud mode. Once the change occurs, your KAM will not request the other station to speed up again until a changeover has occurred or you set your KAM back to auto-speed with the <Ctrl-C>0 directive. If the change fails to occur for any reason, the KAM will revert to the speed it was operating prior to the <Ctrl-C>1 directive.

If you are the IRS and wish to speed up to 200 baud, you can use the <Ctrl-C>2 directive. This causes your KAM to request the other station to change to 200 baud. If the change is successful, your KAM will not request the other unit to slow down even if the band conditions change such that 200 baud is no longer possible unless you set the KAM back to auto-speed with the <Ctrl-C>0 directive. We strongly recommend that you leave your KAM in the normal mode which is automatic baud rate selection.

If you have selected either the forced 100 or 200 baud mode, you can return your KAM to automatic speed selection by using the <Ctrl-C>0 directive.

Pactor Mailbox

Your KAM allows access to its PBBS (mailbox) using Pactor mode. To enable a user to access the PBBS on Pactor, you must set the ARQBBS command ON and place your KAM in the Pactor Standby mode using the PACTOR command.

If you link to another station who is using the KAM, you will normally be communicating with the operator at the other end. If that station has the ARQBBS command ON, you will automatically be connected to his PBBS and will receive the mailbox prompt.

There are some computer-based Pactor BBS systems in operation, and the commands for these may differ from the KAM mailbox commands. Most of these systems will show you a complete list of available commands if you type HELP.

You may also connect to another brand of Pactor controller which has a slightly different method of accessing its internal mailbox. One example of such a controller is the SCS Pactor controller. The commands to access this mailbox begin with two slash characters (//). The commands used on this controller are: (You must end each command with the changeover).

//WRITE *file* – Write a message into the mailbox. The file parameter can be any alphanumeric name from 1 to 8 characters long. The file will be saved with the name given in the file parameter. End the file by entering the changeover sequence (<Ctrl-C>E directive).

//READ *file* – Reads a file from the remote mailbox. You can stop reading the file at any time by sending a changeover.

//SEND *file* – Identical to the //READ command.

//DIR – Lists the directory of the remote mailbox.

//DELETE *file* – Deletes files in the personal mailbox. As a user connected over the radio, you may only delete files that you sent or those addressed to you.

//FREE – This shows the amount of free space available for messages in the remote mailbox.

Formatting Data

When operating Pactor, several of the KAM commands, including the following, will apply to formatting your transmitted and received data. The following commands will apply to Pactor as well as to the other modes indicated in the Commands Manual.

> CRADD – adds a CR after every CR you send from the terminal.
>
> LFADD – adds a LF after every CR you send from the terminal.
>
> CRSUP – suppresses every OTHER consecutive CR from the TNC
>
> LFSUP – suppresses all LF characters from the TNC

You should also remember that any special characters defined in the KAM (DISP C) must be "passed" in order to transmit them from a standard terminal program.

Hints for Pactor Operation

When you are linked to another station and you want to break the link, you should use the <Ctrl-C>A directive. This directive will attempt to send the proper QRT sequence to the other station, but if the KAM receives an invalid response sequence (unrecognized CS code) the KAM will immediately return to standby and discard any pending data. If you attempt to break the link with the <Ctrl-C>X directive, then the KAM will attempt the QRT sequence, but will only return to standby after receiving the proper acknowledgment (CS code) or after PTTRIES attempts to break the link. This could take some time.

When you attempt to link to a nearby station, it is possible that the transceivers (your's and the other station) may not switch fast enough to permit a link to occur. In this case, we suggest that both stations set the TXDAMTOR command to a higher value (try 7, 8, or 9) and then attempt to connect using the long path option (PACTOR !callsign). This has been proven to allow links on very short paths with very slow radios.

If you use an external amplifier with your HF transceiver, you may set a time delay to key your transmitter before the audio is sent to your radio by using the PREKEY command. This will allow your amplifier to turn on before full transmitter power is applied. You may also set the POSTKEY command to stop the transmit audio before releasing the PTT line to your transceiver. (Note that the PREKEY adds delay time before data begins.)

NOTE: Do not change the TXDAMTOR, PREKEY, or POSTKEY values while you are linked. This is only possible with Host mode programs, but changing these values will cause the link to fail.

Summary of Pactor Directives

<Ctrl-C>A	Abort a link or abort an attempt to link after the first invalid response code.
<Ctrl-C>D	Disconnect
<Ctrl-C>E	Changeover from ISS to IRS (ARQ mode) Return to receive when transmit buffer is empty (FEC Mode)
<Ctrl-C>R	Return to receive immediately
<Ctrl-C>T	Seize the link if IRS (ARQ mode) Enter transmit mode (FEC mode)
<Ctrl-C>X	Disconnect the link (if linked) and return to Packet
<Ctrl-C>0	Set automatic baud rate
<Ctrl-C>1	Force 100 baud mode
<Ctrl-C>2	Force 200 baud mode

Commands for Pactor Mode in KAM

● **MYPTcall xxxxxxxx**

default mycall

Establishes callsign used for Pactor link. Up to 8 characters/numbers may be entered.

● **PACTOr [!][xxxxxxxx]**

Entering PACTOR with no parameters will place the KAM in Pactor Standby, allowing you to respond to an incoming link request, or allowing you to transmit a CQ or other broadcast. By using the optional callsign parameter, this command will initiate a link attempt with station xxxxxxxx. If the optional ! is given, the attempt will use the long-path protocol, allowing longer distance communications. You can discontinue the link attempt, or break an existing link with the <Ctrl-C>D directive, which will leave you in the Pactor Standby mode, or with the <Ctrl-C>X directive which returns you to Packet Mode (cmd: prompt).

● **PTDown n (n = 2 - 30)**

default 6

Sets the number of consecutive bad packets received before switching to 100 baud Pactor.

● **PTERrs n (n = 30 - 255)**

default 80

Sets the time-out attempts for Pactor. When attempting to link with another station, unit times out after n attempts without response. When already linked, reception of n consecutive faulty blocks results in timeout.

● **PTFecspd 100 I 200**

default 100

This command will set the speed to be used for Pactor FEC transmissions. When set to 100, all FEC transmissions will be at 100 baud, and when set to 200, FEC transmissions will be at 200 baud.

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● **PTHuff ON|OFF**

default OFF

When ON, allows Huffman compression of 7-bit data. When OFF, Huffman compression is disabled, resulting in 8-bit ASCII for all transmissions.

● **PTListen**

Places the KAM in the Pactor Listen mode. This will allow you to copy FEC or LINKED stations using Pactor. Use the <Ctrl-C>X directive to return to the command prompt.

● **PTRpt n (n = 2 - 5)**

default 2

When sending an unproto (FEC) message (i.e. calling CQ) the information will be transmitted n times. This means that each frame will be transmitted n times before the next frame, but the receiving station will normally display the frame only once.

● **PTSi ON|OFF**

default OFF

When PTSI is OFF supervisory information exchanged between two Pactor units is not displayed. When ON supervisory information is displayed.

● **PTSUM n (n = 0 - 120)**

default 5

When linked in Pactor, the KAM will attempt to assemble up to n received frames to obtain a valid frame. This process is called memory ARQ. When a frame is received, the KAM checks the CRC-16 checksum and if it is invalid, that frame is stored in memory. The sending station will then repeat the frame, and the KAM will check again to see if the frame is completely correct. If not, the KAM attempts to assemble a good frame by combining the frames received.

● **PTTries n (n = 0 - 9)**

default 2

Sets the maximum number of attempts to speed up to 200 baud. If unsuccessful after n attempts, the KAM will remain at 100 baud until it receives PTUP consecutive good frames.

● **PTUp n (n = 2 - 30)**

default 3

Sets the number of consecutive good packets received before requesting a switch to 200 baud Pactor.

Directives for use in Pactor

● **<Ctrl-C>A**

Abort the link immediately. If linked, the KAM discards any untransmitted data that was to be sent to another station and then enters the Pactor Standby mode. If you are attempting to link to a station and have not yet established the link, this directive aborts any further attempts to make the link and returns the KAM to STANDBY.

● **<Ctrl-C>D**

Disconnect the link. This sends the proper QRT packet to the other station and then enters the Pactor Standby mode. Any pending data is discarded. This sequence may require some time depending on link quality.

● **<Ctrl-C>E**

Enter the receive mode after all data in the transmit buffer has been sent. This directive will also perform a changeover when you are linked to another station and you are the sending station. Using the <Ctrl-C>R directive will return the KAM to receive or perform a changeover immediately, even if data remains in the transmit buffer.

● **<Ctrl-C>R**

Enter the receive mode immediately, even if data remains in the transmit buffer. This directive will also perform a changeover when you are linked to another station and you are the sending station. Using the <Ctrl-C>E directive will return to receive or perform a changeover after all data has been transmitted.

● **<Ctrl-C>T**

Enter transmit mode from Pactor Standby. This is useful for calling CQ or other broadcast transmissions. If you are linked to another station and currently receiving (IRS), this directive will also allow you to seize the link (become the sending station – ISS) from the other station.

● **<Ctrl-C>X**

Exit. This directive will disconnect an existing link with another station and return
the KAM to Packet mode (cmd: prompt). If you are not linked, it will simply return to
Packet mode. If you have started to link to another station but have not yet received
the link message, it will abort the link attempt and return to Packet.

**The following directives may be used only when your station is the
Information Receiving Station (IRS), or when you are transmitting FEC
Pactor.**

● **<Ctrl-C>0**

This directive will set the speed to AUTO, allowing automatic speed changes based
on link conditions. (Not used in FEC)

● **<Ctrl-C>1**

This directive forces the link to a 100 baud speed.

● **<Ctrl-C>2**

This directive forces the link to a 200 baud speed.

KANTRONICS CO., INC.

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<u>Applicable Warranty Period:</u>

One (1) year from date of purchase.

ACCESSORIES:

Anemometer, Rain Gauge, Temperature Sensor (for KTU units)

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DE1200 modem, DE19K2/9K6 modem, DE Jumper Board, MSK modem, Watchdog Timer

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MEDIA:

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errata for PACTOR for the KAM Manual
01-25-93

Note to new users of PACTOR
from Kantronics technical staff,

We have found that some users of PACTOR
have trouble when linking (connecting)
to another station due to the key up/down
delays in their transceivers.

In most cases, if a linking problem
exists, it can be fixed by shortening
the prekey and postkey default times
set in the KAM at the factory to zero.

To do this set the PREKEY and POSTKEY
command parameters to zero.

Second, some users of the HOSTMASTER II+
program have forgotten to turn their
Num-Lock KEY on their keyboard off when
attempting a changeover. If you run
with Hostmaster II+, leave numlock off.

Thanks.