KAM

Enhancement Board

Manual

Kantronics

RF Data Communications Specialists

The KAM Enhancement Board is a Kantronics hardware and software design incorporating the AX.25 Level 2 Version 2 Packet protocol as adopted by the American Radio Relay League. This manual contains information from earlier KPC-1, KPC-2, KPC-2400, KPC-3, KPC-4, KAM, and KAM Plus manuals and addendums, modified as appropriate.

We have attempted to make this manual technically and typographically correct as of the date of the current printing. Production changes may add errata or addendum sheets. We solicit your comments and/or suggested corrections. Please send these to Kantronics Co., Inc., 1202 E. 23rd Street, Lawrence, KS 66046.

Printed in the U.S.A.

Kantronics

RF Data Communications Specialists

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Order number   (913) 842-7745

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FAX number   (913) 842-2021

BBS number   (913) 842-4678   300 - 14,400 (MNP, V.32BIS) N,8,1

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Customer Service Department
Kantronics Company, Inc.
1202 E. 23rd Street
Lawrence, KS 66046

KAM Enhancement Board version 7.0 March 14, 1994

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KANTRONICS CO., INC.

LIMITED WARRANTY

Effective December 1, 1992

To be sure you will receive notice of future updates, new product information and prompt warranty service, please take a moment to fill in the Kantronics/rfconcepts Warranty Registration card **COMPLETELY** and return it along with a copy of proof of purchase (to establish purchase date) to Kantronics Co., Inc., 1202 East 23rd Street, Lawrence, Kansas 66046 USA. **Return of the Warranty Registration card and proof of purchase is a precondition to warranty coverage.**

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Applicable Products:

> UNITS:

> > KAM Plus, KAM, KPC-2, KPC-3, KPC-4, Data Engine, DVR2-2, D4-10, KTU, rfc 2/70, rfc 2/70G, rfc 2/70H, rfc 2-23, rfc 2-217, rfc 2-117, rfc 2-315, rfc 2-317, rfc 2-417, rfc 4-32, rfc 4-110, rfc 4-310, rfc 3-22, rfc 3-211, rfc 3-112, rfc 3-312, VHF1-60, UHF-50

> > > Applicable Warranty Period:
> > > > One (1) year from date of purchase.

ACCESSORIES:

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

Applicable Warranty Period:

Sixty (60) days from date of purchase.

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

Applicable Warranty Period:

One (1) year from date of purchase.

MEDIA:

EPROMS, diskettes, video or audio cassettes, manuals (however bound), specification and other supplemental pages or any other media on which firmware, software or documentation are supplied

Applicable Warranty Period:

Thirty (30) days from date of purchase.

6. EXCLUSIONS. This Limited Warranty does not apply to the cosmetic appearance of the Applicable Product; to broken or cracked cabinets; to any accessory not supplied by Kantronics which is used with the Applicable Product; to any product that has been subject to misuse abuse or overvoltage; to any product that has been modified by non-Kantronics personnel unless specifically authorized in writing by Kantronics; or to any product damaged or impaired by shipping (whether or not caused by poor packaging), neglect, accident, wiring not installed by Kantronics, improper parameter settings which are cleared by performing a hard reset, or use in violation of instructions furnished by Kantronics or of generally accepted industry practice. Kantronics does not warrant that the functions contained in any software will meet your requirements or achieve your intended results; or that operation of any software will be uninterrupted or error-free or without effect upon other software used with it. Responsibility for the selection of the hardware and software program to achieve your intended results rests with you.

7. REMEDY PROCEDURE. Should you need to make a warranty claim, first contact the dealer from whom you purchased the product. If the dealer is unable to assist you, contact Kantronics Co., Inc., by mail at 1202 East 23rd Street, Lawrence, Kansas 66046 USA; by fax at 913-842-2021; or by phone at our Customer Support number 913-842-4476. Contact us prior to returning an Applicable Product to receive a Return Authorization Number. (As a practical matter, problems can often be solved in such a manner without the product having to be returned to Kantronics for repair or replacement.)

Return of any Applicable Product for the enforcement of rights under this Limited Warranty shall be at your expense. Any product returned for warranty service which Kantronics determines to be without defect or not covered by this Limited Warranty shall be subject to a minimum charge of one-half hour labor rate and the product will be returned to you at your sole expense. Please note, no warranty service will be provided until Kantronics has been furnished with your Warranty Registration card and copy of proof of purchase establishing purchase date.

8. NON-ASSIGNMENT. This Limited Warranty is not assignable by you. Any attempt to assign or transfer any of the rights, duties, or obligations hereof is void.

9. OTHER RIGHTS. This Limited Warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

Kantronics Update Policy
Firmware and Software Products

Kantronics' products contain firmware and/or software that may be updated without notice. Kantronics wants to ensure that the customer who purchases a new unit or software purchases the latest version.

Customers who purchase new products *within 30 days prior to* the announcement of a new version or purchase after the eligibility date specified in the announcement, whichever is earlier, are eligible to receive a no-charge firmware/software update, subject to the following conditions:

1. Customers must submit to Kantronics the warranty card and a copy of the sales receipt which shows that purchase occurred within the eligibility period described above.

2. The warranty card and sales receipt must be submitted to Kantronics within 60 days of purchase.

Customers who purchase a new product *after the announcement date* of a new version but who do not receive the current version are eligible to receive a no-charge firmware/software update, subject to the following conditions:

1. Customer must submit to Kantronics the warranty card which shows that the unit is not at the current version and a copy of the sales receipt which shows that purchase occurred after the new version was announced.

2. The warranty card and sales receipt must be returned to Kantronics within 60 days of purchase.

Return/Repair Procedures

Consult the limited warranty policy in this manual for the service provisions offered by Kantronics at no charge. This warranty is considered to be in force only when the customer has submitted his completed warranty registration within 10 days of purchase, and when the stipulations of the warranty have been met. Violations of warranty clauses will automatically void the warranty and service or repairs will be charged to the owner.

Service outside the warranty will be charged at the cost of parts, labor, and return shipping. Units returned for service without a Return Authorization number will be subject to a minimum charge of 1/2 hour labor plus shipping and handling. Contact the Service Department (913-842-4476) to obtain a Return Authorization number. Repaired units will be returned via UPS C.O.D. These C.O.D. charges can be avoided by including your VISA or MasterCard number with your unit to be repaired. Shipping and repair may then be charged.

When service or repairs appear necessary, it may be wise to call or write Kantronics to determine if the problem can be solved without returning the unit. Should you encounter difficulty in getting your KAM to "talk" to your computer, you may wish to perform some limited checks before calling or writing. Carefully check your wiring connections to the RS-232 port. Verify your terminal baud rate. It may be useful to perform a "Hard Reset". (See Hard Reset section.)

When calling, report the product name and ask for the Amateur Radio Service Department. Should you find it necessary to call for assistance, please have the following information available:

1. The unit name and serial number (the serial number is found on the rear panel.)

2. The firmware version number (the version number is displayed when you give the Version command.)

If possible, you should have the KAM and your computer available to perform troubleshooting operations when you call.

The Service Department telephone hours are 9 am - noon and 2 pm - 5 pm Central Time 913-842-4476, Monday through Friday.

When writing, include a clear description of the problem, unit name, computer type, computer software used and if possible a DISPLAY listing from the KAM.

Returns to the factory for refund or exchange are strictly regulated. Any return for refund or exchange must be approved by the service department.

Callback procedure: Due to the volume of service calls and other duties of our telephone service personnel, we are unable to return calls concerning service problems. If you write or fax service questions, please include a complete return address or fax number. We will attempt to answer your questions by return letter or fax.

Additional International Support

International Returns

In case of unit problems, first contact the dealer from whom you purchased the product. If you must return a Kantronics product to us, please observe the steps outlined below. It will save both you, the customer, and Kantronics unnecessary difficulties and expense.

1. All returns must be shipped to the factory at 1202 East 23rd Street, Lawrence, KS 66046 USA.

2. All expenses of returning item(s) to Kantronics must be paid by you, including any duty/entry fees, whether the return is for warranty or non-warranty repair.

3. Usually, the best way to return item(s) to us is by mail. However, if you wish to use one of the courier services such as DHL, Federal Express, etc., be sure to use **DOOR-TO-DOOR** service. If you use one of these services, a commercial invoice may be required. Please check with your carrier before shipping.

4. Include in the description of the item(s) on the paperwork (whether postal or courier) the words:

   "U.S. GOODS RETURNED FOR REPAIR/REPLACEMENT."

   An additional description of "Amateur radio peripheral equipment", or "Data communications equipment", would be helpful. It would also be helpful (but not required) to include the code number 9801.00.1035 which tells U.S. Customs agents that the package contains "U.S. goods returned without improvement/enhancement". However, if the words "U.S. goods returned for repair/replacement" are on the paperwork, the number is not really necessary.

5. Provide a value for customs purposes. This is usually the value of the item(s) in their current condition. A $0 value is not acceptable for U.S. Customs.

6. Inside the package, with the item(s), include:

   - a fax number (if available) in case we need to contact you

   - a correct and full address for return

   - method of payment to be used for any charges (if MasterCard or VISA, include expiration date).

   - a brief description of the problem

   - a reference to any conversations with the technical/sales staff about the problem

   - and the Return Authorization number assigned.

7. For warranty repairs, we will pay the shipping charges to return the item(s) to you via **air parcel post**. If you wish return by courier service, include your account number. To be eligible for repair under warranty, we must have a record that you sent your Warranty Registration card and copy of sales receipt to Kantronics, and the item(s) must still be within the warranty period at the time the return is authorized.

8. For non-warranty repairs, you must pay the return shipping charges.

About this manual

This manual is an addendum to the three-volume set for the KAM and is not intended to be a complete instructional manual. This manual includes step-by-step instructions for installation of the Enhancement Board, updating the firmware on the Enhancement Board, and discusses changes and additions to the firmware. If you have operational questions about a mode or commands other than those added with the Enhancement Board, refer to the *Operations* and *Commands Manuals* for the KAM.

Your Enhancement Board includes G-TOR and Pactor modes of operation. These modes are described in separate sections of this manual. The firmware now includes on-line help messages for each command. To display a HELP message, at the cmd: prompt just type HELP <command name>. In addition, the Enhancement Board provides 128K of static RAM memory, real-time clock, and lithium battery backup for your KAM.

If you are updating a KAM from version 4.0 or below, we strongly suggest you purchase the KAM *Commands* and *Operations Manuals*. To order these, contact the Kantronics order department.

Installing the Enhancement Board

Follow the step-by-step instructions listed below to install the Enhancement Board.

In addition to the features listed above, the Enhancement Board firmware features **new-user and expert command sets,** made popular in the KPC-3. If you've operated a KAM for some time, you may want to turn on the full command set during installation, using the **INTFACE** command. At the cmd: prompt, type INTFACE TERMINAL. If, by chance, you're installing a new KAM, or just want to investigate the new-user command set, leave the INTFACE command in NEWUSER, its default position.

Removal of add-on modems

If you have a Kantronics modem plugged into the KAM main board, such as the KM-2400, you'll have to remove it. There is not sufficient room within the case nor processor power to support the modem and the Enhancement Board at the same time. While this fact is printed on the box label, we're sorry if you missed it. Alternatively, you may retain the modem board instead of installing the Enhancement Board and still install the Pactor Option update (not the EPROM on the Enhancement Board), a firmware only change to the KAM.

Installing the Enhancement Board

1. Turn off the KAM and disconnect all cables from the rear panel.

2. Disassemble the KAM according to the instructions in the Installation Manual.

3. Remove any add-on modem you may have installed in the KAM.

4. Remove the EPROM from socket U-22.

5. Remove the EEPROM from socket U-25 (and U-24 if one is installed there).

6. Remove the 32K RAM from socket U-21. (Also remove the SmartWatch or Battery Backup socket if installed.)

7. Remove the self-test jumper from K6 on the main KAM board and install it on jumper J1 on the Enhancement Board.

FIGURE 1. INSTALLATION

KAM (main board)

DB-25

K8

Microprocessor

Enhancement Board

battery

K8

U25

U24

U22

U21

U20

Front of KAM
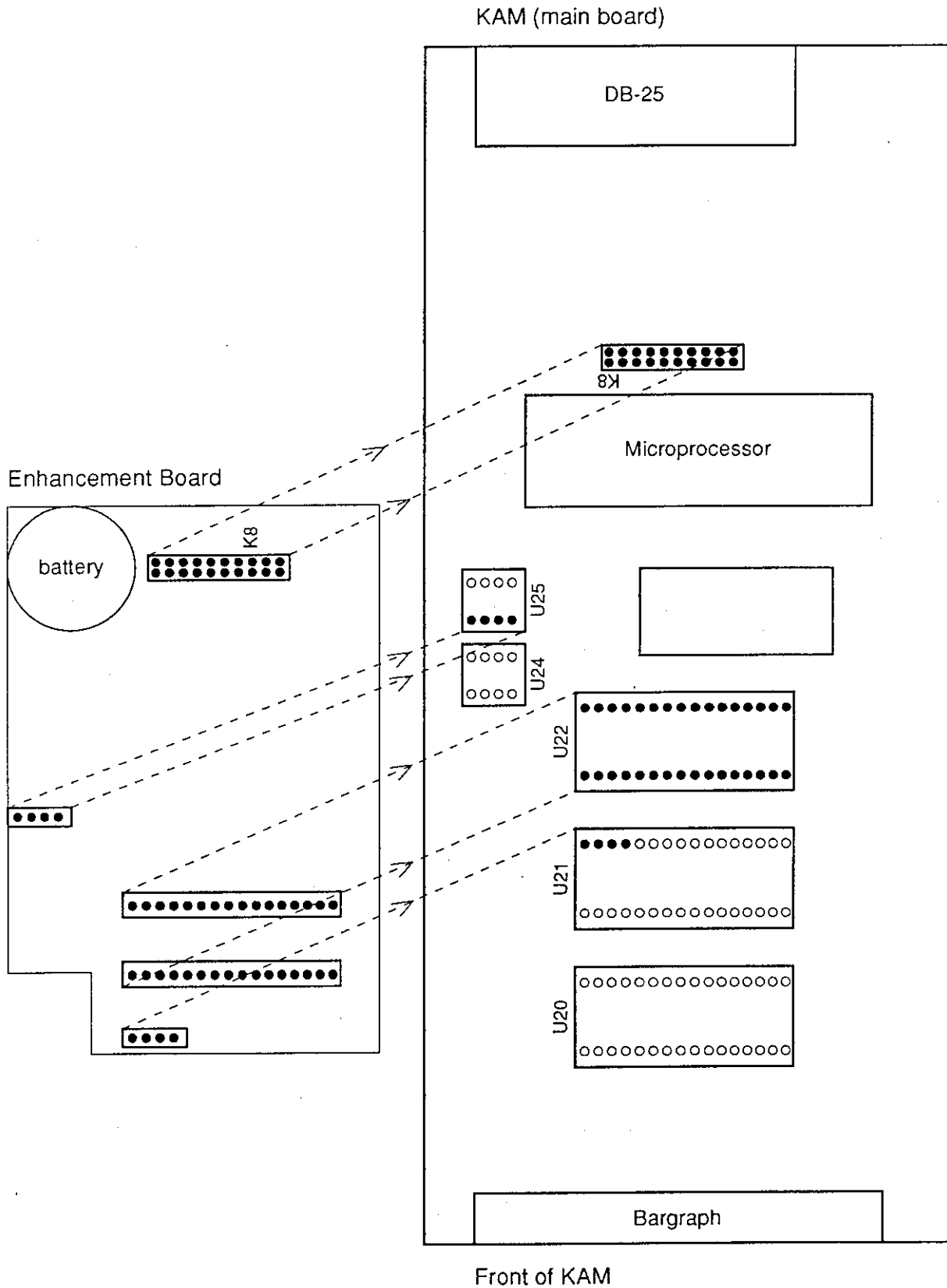
8. Install the Enhancement Board by carefully aligning the 20-pin header of the board with the pins of the modem disconnect header (K-8) on the main board. Be sure to also align the pins near the left edge of the board with the four holes of socket U-25 that are closest to the front of the KAM. This will allow the other pins to line up with the EPROM socket and the RAM socket as required. (See the diagram in Figure 1 for proper alignment of the add-on board.)

9. You may need to press firmly to seat the pins of the board into the KAM sockets. Press at 20 pin header first, then the other end of the board.

10. Perform a hard reset by placing jumper J1 on the Enhancement Board on the center post and the post marked T. Apply power to the enhanced KAM. If you connect the KAM to your computer and operate a standard terminal program at 1200 baud, you will be able to read the reset messages ("EPROM OK, RAM OK"). Turn the KAM off.

11. Move jumper J1 to the center post and the post marked N for normal operation.

12. Reassemble your KAM according to the instructions in your KAM Installation Manual.

13. A short jumper assembly (wire with two solder lugs) is included with the Enhancement Board. This "grounding jumper" should be installed between the back panel of your KAM and the case to insure good grounding. As you reassemble the unit, install one end of the jumper assembly under the back panel screw, right side, and the other lug under the connector and screw inserted into the RS-232 connector post. See Figure 2 as a guide. If you have difficulty attaching the jumper to the right side of the RS-232 connector, try the left side as denoted by the dotted line.

FIGURE 2. KAM BACK PANEL
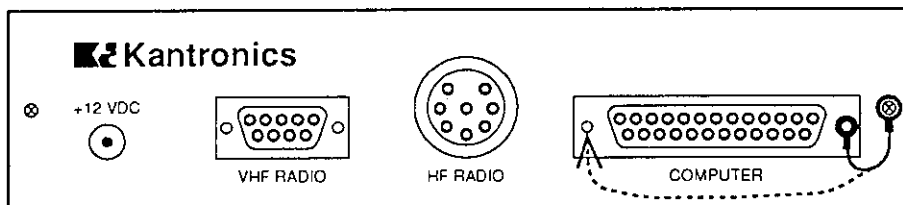
14. Reconnect the cables to your KAM. Your KAM with Enhancement Board is now ready to operate. You may need to reload all parameters in your KAM, as the KAM will not remember previous settings you may have made.

Updating the Enhancement Board

To update the firmware in your Enhancement Board you simply replace the EPROM in socket U-1 on the Enhancement Board. Note the direction of pin 1 (indicated by a notch on the EPROM). After you install new firmware, the KAM will automatically perform a complete reset, and all parameters will be set to the factory default values.

Hard Reset

In most cases, you will not need to perform a hard-reset on your KAM Enhancement Board. If you are able to communicate with the KAM from your terminal program, use the "RESTORE D" command to completely reset the KAM to factory defaults. If, however, you find that you cannot communicate with the KAM, you can perform a hard reset in one of two ways.

After you have removed the KAM from its case, a hard reset may be performed by sliding a small piece of paper between the lithium battery and the contact on top of the battery. Leave this paper in place for 10 seconds, then remove the paper. This completely erases the RAM memory contents, returning the KAM to factory defaults.

The second option is to place jumper J1 on the center post and right post (marked T) and then apply power to the KAM for about 10 seconds. If you have the KAM connected to your computer when you do this, and your terminal program is operating at 1200 baud, you will see the reset messages from the KAM. Be sure to place the J1 jumper back on the center post and the left post (marked N) before re-assembling your KAM.

Commands: Deleted, Changed

In addition to the hardware features added to the KAM, a few commands have been deleted, several have been changed, and many more have been added. The deletions and changes are listed below, followed by a complete description of the new commands.

Deleted Commands

The following commands have been removed. The functions provided by these commands are either no longer required or are provided by new commands.

CCITT	Replaced by the CODE command
DAYUSA	Replaced by the DAYSTR command
EXTMODEM	Removed – An external modem cannot be used with the Enhancement Board
LCRTTY	Replaced by the CODE command
PERM	No longer required since all parameters are saved automatically by the lithium battery backup
TXDAMTOR	Replaced by the TXDTOR command

Changed Commands

The operations of the following commands have been changed.

ARQBBS	When ON, the PBBS in your KAM may be accessed by another station using AMTOR, G-TOR, or Pactor ARQ. When OFF, the PBBS may only be accessed on packet. NOTE that if ARQBBS is ON, you will not be able to transmit FEC from the Standby modes.
ARQID	When operating AMTOR, G-TOR or Pactor ARQ (PBBS or keyboard) the KAM will ID in CW every n minutes. The KAM will also key the CW key output and send the CWID with the FSK line. The ID will also be sent when a link is disconnected or after an unsuccessful link attempt.
DAYTIME	Date and time may now be entered without including the seconds (e.g. DAYTIME 9402142215 would set the clock to February 14, 1994 at 22:15:00).
DISPLAY	New categories are added to the display subgroups (AMTOR, ASCII, CW, GT, PT, RTTY). Several parameters may be displayed in more than one category.
FILTER	FILTER is now a dual port command (e.g. FILTER ON/OFF). The value before the / sets filtering for HF, the value after the / set VHF filtering.
HELP	The HELP command now provides on-line help for each command. Typing the command "HELP cmdname" will cause a one-line description of the command to be displayed.
INTFACE	Added INTFACE NEWUSER to simplify the command set. NOTE: This command defaults to NEWUSER. You will need to give the command INTFACE TERM to have access to the full Enhanced KAM command set.
INVERT	When ON transmitted and received AFSK tones will be inverted.

MONITOR	When ON, allows monitoring of AMTOR FEC signals in G-TOR mode and also allows monitoring of Pactor FEC and ARQ when in the Pactor Standby mode.
PARITY	Set to ODD, EVEN, MARK, SPACE, or NONE instead of being a number code.
PBHEADER	When ON messages forwarded into your PBBS from another BBS system will include all of the R: lines in the original message. When OFF, only the last R: line (the first BBS handling the message) will be saved. If you are going to set your PBBS to forward to another BBS system, we strongly recommend leaving PBHEADER ON.
PBPERSON	When ON, your PBBS becomes a PERSONAL system. This means that it will accept messages only if they are addressed to your MYCALL or your MYPBBS call. In addition, the PBBS will only forward messages to another BBS if they are FROM your MYCALL. When forwarding or reverse forwarding with PBPERSON ON, the PBBS will not include its own R: line.
PMODE	Accepts PACTOR or GTOR for the startup mode.
RESTORE	Accepts only (and requires) DEFAULTS as a parameter (RESTORE DEFAULTS). This will set all command parameters to those in the EPROM.
TRACE	This is now a dual port command (i.e. OFF/OFF). The setting before the slash is for HF, after the slash for VHF.

Internal PBBS changes

Now that the PBBS is larger, several changes have been made and enhancements added to the PBBS operation. Your PBBS can now initiate a forward to another BBS and can reverse forward with another system. In order for the forwarding to operate, you must set the HTEXT command. See the Kantronics PBBS section in this manual for more details.

L(ist) The LIST command in the PBBS has been enhanced to allow you to list messages between a range of numbers, or to list all messages starting with message number n:

> List n will list all messages starting with message number n through the latest message
>
> List n n will list all messages between and including the specified numbers.

R(ead) The READ command in the PBBS has been modified to display only the short form "path" that a message has taken to reach you. You may still read a message and display the complete R: line routing if desired:

> Read n This will read a message and display only a short PATH indicating the BBSs that have forwarded this message.
>
> RH n Using the RH with a message number will cause the PBBS to display all of the R: lines (routing) in their entirety. This enables you to see the time and date a message was handled by each BBS forwarding it.

SYSOP addition

The EDIT command (available only to a PBBS sysop) will now permit you to edit the text of a message. The format to edit text is:

> e # "string1" "string2"

Specify the message number in place of #. The Enhanced KAM will then replace the FIRST occurrence of string1 with string2. You may use either double quotes (") or single quotes (') to delimit the strings. Be careful when editing a message. For instance, if you try to replace "the" with "those" and the first occurrence of "the" happens to be in the word thermal, you would end up with thosermal. It may be wise to search for " the " if you want to replace the word "the".

DEFAULT changes

The default values for the following commands have been changed. The new default settings are shown below.

ABAUD	set by autobaud routine
AUTOCR	0
CRADD	OFF
CWSPEED	20
DAYTIME	01/01/93 00:00:00
FILTER	OFF/OFF
FLOW	ON
HEADERLN	ON
INTFACE	NEWUSER
MCOM	ON/ON
MRESP	ON/ON
PACLEN	64/128
PARITY	set by autobaud routine (NONE or EVEN)
PBBS	100
PBLO	NEW VARIABLE
POSTKEY	0
PREKEY	0
TRACE	OFF/OFF

Command Reference (New Commands)

This section describes the new commands available with your Enhancement Board as well as those commands that have changed since the version 5.0 three-volume manual set. The format of the commands listed here is the same as in the KAM three-volume manual set.

● **ARqbbs ON I OFF**   **v5.0**

default OFF   AMTOR/G-TOR/Pactor

When ON, the PBBS in your KAM may be accessed by another station using AMTOR, G-TOR, or Pactor ARQ. When OFF, the PBBS may only be accessed on packet. NOTE that if ARQBBS is ON, you will not be able to transmit FEC from the Standby modes.

See also: arqid, pbbs.

● **ARQId n   (n = 0 - 31)**   **v5.0**

default 9   AMTOR/G-TOR/Pactor

This command will cause your KAM to transmit a CWID every n minutes when operating in AMTOR, G-TOR or Pactor ARQ. The CWID will be transmitted at the speed set by the CWSPEED command. This includes an ARQ link to the PBBS (ARQBBS ON) as well as when you are operating from your keyboard. Note that U.S. regulations permit automatic CWID at speeds up to 20 wpm.

See also: arqbbs, cwaudio, cwptt

● **BIts n   (n = $00 - $FF)**   **v6.1**

default $00   RTTY/ASCII

This command specifies the bits to be inverted of a received RTTY or ASCII signal in an attempt to decode scrambled RTTY/ASCII signals. There is no effect on transmitted RTTY/ASCII signals.

● **CODe [Amtor I Rtty] [Ita2 I Us I Lcrtty I Aplink I Mars]**   **v6.1**

default AMTOR ITA2   AMTOR/RTTY
default RTTY ITA2

The CODE command allows you to select the alphabet used to send and receive RTTY and AMTOR. When set to ITA2, the International Telegraph Alphabet Number 2 will be used. When set to US, the United States alphabet will be used (not available for AMTOR). When set to LCRTTY, a complete printable character set as defined by Kantronics in cooperation with Peter Martinez (G3PLX) will be used. When set to Aplink, the code used in APLINK BBS systems, defined by Vic Poor (W5SMM) will be used. When set to MARS, special characters can be used as required by the Military Affiliate Radio System. (See the MARS Feature section of this manual.)

● **CWAudio ON I OFF**   **v6.1**

default ON   CW

When ON, the AFSK output of the KAM HF port will provide morse code with an on/off audio tone. This can be used to operate CW in an FM mode or as Modulated CW. You must also turn on the CWPTT command in order for the KAM to key your transmitter unless you are using VOX operation. Audio CW can also be used for identification when operate ARQ AMTOR, G-TOR, or Pactor.

See also: arqid, cwptt

● **CWFarnsw n** (n = 5 - 99)

default 15

This command will set the character speed used to transmit Farnsworth spaced CW. Farnsworth spacing will occur automatically if the CWSPEED is less than this value. To disable Farnsworth CW operation, set this command to 5.

See also: cwspeed

● **CWIDText text** (0 - 15 characters)

default DE mycall

The text specified by this command will be transmitted in CW when an ARQID is sent, or when the CWID time has expired and a CWID is sent.

See also: arqid, cwaudio, cwptt

● **CWWeight n** (n = 0 - 15) (0.1 increment)

default 0

This command sets the CW weighting used. This is most useful at higher CW speeds. Normally a dash is 3.0 times the duration (time) of a dot. When weighting is used, the dash will be lengthened by 0.1 * n. For instance, if CWWEIGHT is 7, then a dash will be 3.7 times the duration of a dot.

● **DAYStr dayform**

default mm/dd/yy hh:mm:ss

This command sets the format for the date/time display. Enter the letters m, d, y, h, and s to indicate the format to be used for displaying the time and date. **DO NOT ENTER AN ACTUAL DATE WITH THIS COMMAND.** When setting up your time/date format, a single m, d, y, h, or s will display the corresponding element with a single digit if the value is less than 10. For instance, the command:

        DAYSTR m/d/y h:m:s

would display January 3, 1993 as "1/3/93" and a time of 6:03:09 would be displayed as "6:3:9". Entering two m's, d's, y's, h's, or s's would result in two digits being displayed for all values. If you set DAYSTR as:

        DAYSTR mm-dd-yy hh:mm:ss

January 3, 1993 would display as "01-03-93" and the time 6:03:09 would display "06:03:09".

You may also enter the month as three m's. This causes the month to be displayed as a three character abbreviation. Using the above date and time example, if you set:

        DAYSTR mmm/dd/yy hh:mm:ss

the resulting display would be "JAN/03/93 06:03:09".

The lower case characters m, d, y, h, and s have special meaning to this command and will be replaced with data from the software clock. The lower case m will be replaced with the minutes the first time it appears after a lower case h.

This display is used for all time stamps, including the PBBS, KA-Node, Mheard list, etc. You may also enter any other text you wish, allowing you to add such things as your time zone.

Caution: When entering real text into the display, ALL lower case m, d, y, h, and s characters WILL be translated. Some samples of possible format strings and the resulting display:

DAYSTR dayform	Resulting display
mm/dd/yy hh:mm:ss	02/18/93 11:30:00
d.m.y h:mm:ss	18.2.93 11:30:00
d.mm.yy h:mm	18.02.93 11:30
mmm d 19yy h:mm CST	FEB 18 1993 11:30 CST
TIME hh:mm DATE: mmm dd, 19yy	TIME 11:30 DATE: FEB 18, 1993

WARNING: If you type an actual date/time as an argument to the DAYSTR command, your clock will appear to stop! Use the m, d, y, h, and s character to enter your format. This means that if you give the command "DAYSTR APR 15, 1993 12:04:15" to the KAM, ALL times displayed will be APR 15, 1993 12:04:15 and will NEVER CHANGE EVEN THOUGH YOUR CLOCK IS STILL RUNNING. To display the date and time in this format, the correct command would be "DAYSTR mmm dd, 19yy hh:mm:ss". ONLY LOWER CASE m, d, y, h, or s characters are replaced with real time/date values.

● **DAytime yymmddhhmm[ss]**

default 01/01/93 00:00:00

This command reads or sets the real-time and software clock/calendar in the Enhanced KAM. The clock determines date and time display in conjunction with CSTAMP, MHEARD, MSTAMP, and PBBS/Node messages. When entering the daytime digits to set the clock, enter in pure number sequence with no spaces, dashes or slashes. For example: 930218113000 would indicate 1993, February 18, at 11:30:00 hours. Entering the seconds digits is optional, and if not entered, the seconds will be set to 00.

See also: daystr

● **DISPlay**
[Async l AMtor l ASCii l Char l CW l Gt l Id l Link l Monitor l Pbbs l PT l Rtty l Timing l Xtra]

immediate

This command causes the KAM to display a list of all the parameters in the KAM. You may also display a selected class of parameters by specifying the class identifier for that group. When using the display command with a class, be sure to use a space between the DISPLAY command and the class. Class categories are:

(A)sync	asynchronous port parameters (TNC to computer)
(AM)tor	parameters affecting AMTOR (ARQ and FEC) and NAVTEX/AMTEX modes
(ASC)ii	parameters affecting ASCII mode
(C)haracter	Special TNC characters
(CW)	parameters affecting CW mode
(G)tor	parameters affecting G-TOR mode
(I)d	Identification parameters
(L)ink	parameters affecting packet link (TNC to TNC)
(M)onitor	monitoring parameters
(P)bbs	mailbox parameters
(PT)	parameters affecting Pactor mode
(R)tty	parameters affecting RTTY mode
(T)iming	timing parameters
(X)tra	some transmission related commands, such as FSKINV

Individual parameter values can be displayed by entering the command name followed by <CR>.

● **FIlter ON I OFF**

default OFF/OFF   Packet/RTTY/ASCII

When ON this command will inhibit the printing of control characters (hex $00 - $1F) which may be present in monitored data. This command may be useful if you are monitoring traffic which includes binary file transfers or protocol data. Embedded control characters can have strange and unpredictable effects during monitoring. All control characters except carriage return ($0D) and line feed ($0A) will be filtered. This command does not affect receipt of control characters in packets received from a "connected" station when MONITOR or MCON is OFF.

This command also inhibits the printing of control characters in the RTTY and ASCII modes.

See also: monitor

● **GSCAN r,m,s,f**   v7.0

immediate

GSCAN is a general scan function that will sample the audio signal applied at the HF port of the KAM. The signal is sampled r times per second, and the resulting binary data is sent to the computer through the serial port. The first sample will be in the Most Significant Bit (MSB) of the byte. Valid sample rates are from 1 to 4800 samples per second. The m, s, and f values, if specified, set the MARK frequency, SPACE frequency, and demodulated filter output bandwidth. If not specified, m defaults to the MARK command setting, s defaults to the SPACE command setting, and f is set to the HBAUD setting for the HF port (normally 300). **NOTE: You must set MAXUSERS to n/0 (disabling the VHF port) to use the GSCAN mode.**

We have provided a program for PC computers which allows monitoring of G-TOR ARQ links using the GSCAN function. Documentation for this program can be found on the diskette provided in a file called "GMON.DOC".

● **GTDown n   (n = 2 - 30)**   v7.0

default 6   G-TOR

Sets the number of consecutive bad frames received before switching to the next lower speed.

● **GTErrs n   (n = 30 - 255)**   v7.0

default 40   G-TOR

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

● **GTFuzzy n   (n = 0 - 3)**   v7.0

default 3   G-TOR

Sets the number of bits in a data acknowledgment that may be corrupted.

● **Gtor [xxxxxxxxxx]**   v7.0

immediate   G-TOR

Entering GTOR with no parameters will place the Enhanced KAM in G-TOR Standby, allowing you to respond to an incoming link request or transmit a CQ or other broadcast. If you also have MONITOR ON, you can monitor FEC G-TOR broadcasts. By using the optional callsign parameter, this command will initiate a link attempt with station xxxxxxxxxx. You can discontinue the link attempt, or break an existing link, with the <Ctrl-C>D directive, which will leave you in the G-TOR Standby mode, or with the <Ctrl-C>X directive which returns you to Packet Mode (cmd: prompt). **NOTE: If ARQBBS is on, you cannot transmit FEC and you will not be able to monitor FEC.**

● **GTTries n   (n = 0 - 9)**   v7.0

default 2   G-TOR

Sets the maximum number of attempts to speed up. If unsuccessful after n attempts, the KAM will return to its previous G-TOR speed until it receives GTUP consecutive good frames.

● **GTUp n   (n = 2 - 30)**   v7.0

default 3   G-TOR

Sets the number of consecutive good frames received before switching to 300 baud operation.

● **Help [cmdname]**

immediate

This command displays a list of all commands in the KAM. If the optional cmdname is given (i.e. HELP TXDTOR) the KAM will display a one-line help message about the command.

● **HText text   (0 - 31 characters)**   v6.1

default (blank)   PBBS

This command is used to set the hierarchical portion of your packet address. Your KAM PBBS will not forward (or reverse forward) any messages to another BBS if this command is empty and PBPERSON is OFF. We suggest you read the section on the Kantronics PBBS to become familiar with BBS operation and hierarchical addressing. You should ask your local BBS sysop if you are unsure of the proper hierarchical address for your station.

● **INtface NEWUSER I TERM I BBS I HOST I KISS**

default NEWUSER

When set to NEWUSER, a limited command set available to simplify operation. When set to TERMINAL, the TNC will operate with a standard terminal or computer running a terminal emulation program. When set to BBS, the TNC deletes certain messages (i.e. *** connect request, ***FRMR, etc.) for greater compatibility with full-service BBS programs. When set to HOST, the TNC will communicate with the attached computer using the Kantronics Host mode. When set to KISS, the KISS code as specified by Phil Karn is implemented for communication to the attached computer.

● **INVert ON I OFF**

default OFF   Non-packet

When ON, signals received in RTTY, ASCII, AMTOR, G-TOR, and Pactor, or transmitted using AFSK are inverted. When operating in these modes, entering a <Ctrl-C>I command will toggle the inversion ON and OFF.

● **Monitor ON I OFF**

default ON/ON

When ON, unconnected packets will be monitored unless prohibited by SUPLIST, BUDLIST, CONLIST, or LLIST. In addition, other packets permitted by special monitor commands will be monitored. The MONITOR command acts as a master switch for the MALL, MCOM, MCON, MRESP, MRPT and MXMIT commands. The addresses in the packet are displayed along with the data portion of the packet. Callsigns (to and from fields) are separated by a ">"; and the Secondary Station Identifier (SSID) is displayed if it is other than 0. If any data is contained in a monitored packet which is not described in the AX.25 protocol, it is displayed in curly braces on the header line. All monitor functions are disabled in the Transparent Mode.

When OFF, you will monitor only those stations connected to you, no matter how other monitor commands are set. Any header information displayed will be determined by the settings of STREAMCA and STREAMEV.

When monitor is ON, the KAM will copy ARQ or FEC Pactor signals in the Pactor Standby mode, and will also copy AMTOR FEC signals in the G-TOR Standby mode.

See also: budlist, conlist, headerln, llist, mall, mbeacon, mcom, mcon, mresp, mrpt, mstamp, pid, streamca, streamev, suplist

● **MXmit ON I OFF**   **v 6.1**

default ON/ON   Packet

When ON, the KAM will display transmitted packets as monitored data on your screen. Repeated packets will be displayed as they are sent over the radio. NOTE: If you are connected, you must have MCON ON to see monitored data. The frames displayed by the MXMIT command will also be controlled by the MONITOR, MCOM, MCON, and MRESP commands, and will obey the settings of TRACE, MSTAMP, HEADERLN, 8BITCONV, CRSUP, LFSUP, and FILTER commands.

● **MYGTcall xxxxxxxxx**   **v 7.0**

default MYCALL   G-TOR

Establishes the callsign used for G-TOR link. Up to 10 printable ASCII characters/numbers may be entered.

● **MYPTcall xxxxxxx**   **v 6.1**

default MYCALL   Pactor

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

● **NAVLog**   **v 6.1**

immediate   NAVTEX/AMTEX

This command displays a list of the NAVTEX messages which have been properly received and therefore are ineligible to be printed if received again. To allow any of these messages to be printed when received, use the NAVCLR command.

See also: navclr

● **PACTOr [!][xxxxxxx]**   **v 6.1**

immediate   Pactor

Entering PACTOR with no parameters will place the Enhanced KAM in Pactor Standby, allowing you to respond to an incoming link request or transmit a CQ or other broadcast. If you also have MONITOR ON, you can monitor ARQ and FEC Pactor stations. By using the optional callsign parameter, this command will initiate a link attempt with station xxxxxxx. 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). **NOTE: If ARQBBS is on, you cannot transmit FEC and you will not be able to monitor FEC or ARQ.**

● **PARity ODD I EVEN I MARK I SPACE I NONE**

default None or Even (determined by autobaud routine)

The command sets the Parity mode for communication with the attached terminal or computer.

The autobaud routine sets PARITY based on what is received when the * is pressed. If the 8th bit is set, PARITY is set to Even. If the 8th bit is not set, PARITY is set to None. This command corresponds to the setting of parity in your communications program. The TNC can only send serial output with 8 data bits and one stop bit. Setting the PARITY parameter defines the eighth bit.

When transmitting in Packet Mode or ASCII mode, the 8th bit is stripped (i.e. set to 0) if the PARITY command is set to Odd, Even, Mark or Space. If PARITY is set to None, all 8 bits from the computer may be transmitted if the 8BITCONV command is ON.

See also: 8bitconv

● **PBForwrd bbscall [V call1,call2,...call8] [Hf I VHf] [Every I After] [n]**
       (n = 1 - 24)   (1 hour increment)   v6.1

default NONE VHF EVERY 0   PBBS

This command will cause your PBBS to attempt to initiate a forward of any eligible mail to another BBS system periodically. If PBPERSON is OFF, you must have your hierarchical address in the HTEXT command before forwarding is possible.

Any message in your PBBS which contains and @BBS field and is not being HELD (H) or has not previously been FORWARDED (F) is eligible to forward. If the keyword EVERY is used, the PBBS will attempt to forward once every n hours. If you specify the keyword AFTER, the PBBS will attempt to forward whenever a user disconnects from the PBBS, and every n hours after that. Changing the time interval will cause the PBBS to attempt to forward immediately.

● **PBHeader ON I OFF**   v5.0

default ON   PBBS

When ON, messages forwarded into your PBBS from another BBS system will include all of the R: lines in the original message. When OFF, only the last R: line (the first BBS handling the message) will be saved. If you are going to set your PBBS to forward to another BBS system, we strongly recommend leaving PBHEADER ON.

● **PBHOld ON I OFF**   v6.1

default ON   PBBS

When ON, any message received over the radio will automatically be held by your PBBS for you, the SYSOP, to review. You may then release the message for forwarding by editing it and changing the H flag (for example, to edit message number 4: E 4 H). When OFF, messages received over the radio are not held, but may immediately be forwarded from your PBBS. (Note that any message addressed TO or @ your MYCALL or MYPBBS call will be held regardless.)

● **PBKillfw ON I OFF**   v6.1

default ON   PBBS

When ON, private and traffic messages will be killed (deleted) from your PBBS automatically after they have been forwarded to another BBS. When OFF, these messages will not be killed, but will be marked with the forwarded flag (F) to prevent them from forwarding again.

● **PBPerson ON I OFF** v 6.1

default OFF PBBS

When OFF, your PBBS will accept messages addressed to any station. If the message is then forwarded to another BBS, your PBBS will add an R: line indicating that the message was forwarded by your system.

When ON, your PBBS becomes a PERSONAL system. This means that it will only accept messages addressed to your MYCALL or your MYPBBS call. In addition, the PBBS will only forward messages to another BBS if they are FROM your MYCALL. When forwarding or reverse forwarding with PBPERSON ON, the PBBS will not include its own R: line.

● **PBRevers ON I OFF** v 6.1

default OFF PBBS

When OFF and your KAM initiates a forward (PBFORWRD command) it will send all eligible messages to the other BBS. After all messages have been sent, the KAM will then disconnect from the other station.

When ON, the KAM will poll the other BBS for any messages after it has forwarded the KAM messages to the other BBS and before disconnecting.

● **PHClear** v 6.1

immediate PBBS

Giving this command will clear the list of stations who have connected to your PBBS.

See also: pheard

● **PHeard** v 6.1

immediate PBBS

This command will display a list of the last several stations connecting to your PBBS. You may clear this list using the PHCLEAR command.

See also: phclear

● **PMode None I Ascii I AMtor I CW I Fec I Gtor I Pactor I Rtty I NAvtex**

default NONE

This command is used to determine the mode the TNC will be in at power-on, if INTFACE is not set to KISS or HOST. For example, if PMODE RTTY is used, the TNC will power-on in RTTY, ready to operate at the baud rate specified in RBAUD, and no command prompt (cmd:) will appear.

See also: intface

● **PTDown n   (n = 2 - 30)** v 6.1

default 6 Pactor

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

● **PTERrs n   (n = 30 - 255)** v 6.1

default 80 Pactor

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

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● **PTFecspd 100|200**   v6.1

default 100   Pactor

This command sets 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.

● **PTHuff ON|OFF**   v6.1

default OFF   Pactor

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

● **PTListen**   v6.1

immediate   Pactor

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)**   v6.1

default 2   Pactor

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**   v6.1

default OFF   Pactor

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)**   v6.1

default 5   Pactor

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)**   v6.1

default 2   Pactor

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)**   v6.1

default 3   Pactor

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

● **RESTORE Defaults** v 3.0

immediate

Giving this command will cause the Enhanced KAM to return all parameters to their factory default values. The KAM will also perform its autobaud routine and ask for a callsign. CAUTION: Any messages in the mailbox will be deleted.

● **TRACe ON I OFF**

default OFF/OFF Packet/AMTOR/G-TOR/Pactor/RTTY

When ON, all received frames are displayed in their entirety, in hexadecimal, including all header information. All packets which are also eligible for monitoring will be displayed in normal text. When operating AMTOR, G-TOR or Pactor with TRACE turned on, your transmitted and received data will be displayed in hexadecimal format as it is being sent/received. Trace is not available in host programs. You can toggle the trace function on/off while operating AMTOR, G-TOR, or Pactor by typing <Ctrl-C><Ctrl-T>.

● **TXDTor n   (n = 0 - 15)** v 7.0

default 5 AMTOR/G-TOR/Pactor

This command establishes the transmit key-up delay used in AMTOR, G-TOR and Pactor operation. Each number increment sets a multiple of 10 ms.

G-TOR Mode

G-TOR, short for Golay-TOR, is an innovation of Kantronics. G-TOR was implemented in the KAM Plus and Enhancement Board for the KAM in early 1994 and establishes a completely new hybrid-ARQ HF digital communications system for the amateur service. Golay error correction coding forms the basis for G-TOR.

The benefits of G-TOR are exceptional compared to previous multi-mode HF digital modes: 1) substantially higher effective data rates (throughput), 2) apparent reduction in the effects of interference and multi-path, and 3) low cost for error-correcting systems. The key features of G-TOR are atypical: 1) extended Golay forward error correction coding, 2) full-frame interleaving, 3) on-demand Huffman and run-length encoding, 4) link-quality-based baud rate: 300, 200, 100, 5) 2.4 second hybrid-ARQ cycle, 6) reduced data frame overhead, and 7) use of standard AFSK tone pairs (mark and space).

G-TOR operates as a synchronous ARQ mode, like AMTOR and Pactor. At 300, 200, or 100 baud, G-TOR's ARQ cycle remains at 2.4 seconds. All data frames are 1.92 seconds in duration and contain one control byte and two checksum bytes (CRC). Data frames contain 69, 45, and 21 data bytes at 300, 200, and 100 baud respectively. Acknowledgments are 0.160 seconds in duration. The effective performance of two stations linked in G-TOR relies on the combined use of forward error correction, data interleaving, and its ARQ cycle with CRC checking. Operation in the G-TOR mode is described in the following sections.

G-TOR 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, G-TOR, and Pactor are higher up the band in frequency. For example, on 20 meters, activity can generally be found as listed below. Note that G-TOR, Pactor, and AMTOR may tend to overlap.

CW	14.000 - 14.070 MHz
AMTOR, G-TOR, Pactor	14.070 - 14.085 MHz
RTTY	14.080 - 14.095 MHz
Packet	14.095 - 14.111 MHz

G-TOR operation

The G-TOR protocol is a linked mode where two stations are communicating with each other. Although the G-TOR mode does not incorporate an FEC mode, G-TOR uses AMTOR FEC for its FEC broadcasts (from G-TOR Standby), such as calling CQ. If you have the MONITOR command turned on when you enter the G-TOR mode, you will be able to monitor AMTOR FEC transmissions, and this is the mode for calling CQ for G-TOR.

The following example illustrates a suggested method for using G-TOR with your KAM.

Turn the MONITOR command ON by typing MONITOR ON at the command prompt (cmd:) and press return. This will enable you to copy CQ calls.

The G-TOR mode will use the MARK and SPACE tones set in your KAM, regardless of the setting of the SHIFT command. The default values for these are MARK 1600 and SPACE 1800. You may wish to change these to permit use of filtering or IF shift tuning in your radio. You should be sure they are set for a 200 Hz difference.

Next, place your KAM in G-TOR mode by typing GTOR at the cmd: prompt and pressing return. Your KAM will respond with <GTOR STANDBY>. If you now tune your KAM to a station transmitting AMTOR FEC, you'll be able to copy that transmission.

To call CQ, type <Ctrl-C>T (that's a control-c followed by the letter T). Your KAM will enter the AMTOR FEC transmit mode, key your radio, and start sending AMTOR.

Type your CQ message on the keyboard. It is very important that you include in your CQ the fact that you are waiting for a G-TOR contact. For instance, you might send:

CQ CQ CQ DE WØXI WØXI WØXI — GTOR
CQ CQ CQ DE WØXI WØXI WØXI — GTOR
CQ CQ CQ DE WØXI WØXI WØXI — GTOR
PSE ARQ IN GTOR MODE ONLY
K K K

Be sure you include your callsign (as set by MYGTCALL) in the transmission. After you have typed your entire CQ message, type <Ctrl-C>E. This will return your KAM to G-TOR Standby mode after all of the message has been transmitted. Your KAM is then ready to respond if someone calls you in G-TOR.

Tuning G-TOR

G-TOR signals are similar to AMTOR or Pactor signals in that MARK and SPACE tones are used. Hence the bargraph indicator will be lit at both ends when properly tuned. When you are linked to another G-TOR station, the HF CON LED will be lit. The HF STA LED is used in G-TOR to indicate the G-TOR speed. When the STA LED is off, the G-TOR rate is 100 baud, when FLASHING 200 baud, and when the STA light is lit constantly, 300 baud.

Monitoring G-TOR

In the G-TOR Standby mode, your KAM will monitor G-TOR CQ calls or other G-TOR FEC broadcasts, which use the AMTOR FEC mode. In order to monitor two stations that are linked to each other, you must use the GMON.EXE program (for PC compatible computers) which we have provided on the enclosed diskette. Real-time monitoring of linked G-TOR stations will require a fairly fast computer (286/16 or better). This monitoring uses the GSCAN function of your KAM firmware and processes the data in your computer. For slower computers, you may use the GSCAN function and capture the raw data to a disk file. This allows you to use the GMON program to view the data, although it will not be real-time.

Entering G-TOR Standby mode

To enter G-TOR Standby mode simply type GTOR and press return from the command prompt (cmd:). Your KAM will then respond to any attempt from another station to link to you in G-TOR. 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 your KAM PBBS.

Calling another station on G-TOR

To call another station using G-TOR, at the command prompt (cmd:) enter the GTOR command and the callsign of the station you wish to link to. For instance:

cmd:GTOR WK5M

Your KAM will begin transmitting a link establishment frame and, if the other station is on the air and in G-TOR Standby mode, that station will respond to your link request and you will see the message <LINKED to WK5M> on your screen. You can then start typing your message to the other station. Since you started the link, your station will be the "Information Sending Station" (ISS). 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 G-TOR changeover sequence and you become the "Information Receiving Station" (IRS). While the other station is sending data to you, you may force a changeover (seize the link) by typing the <Ctrl-C>T directive. You then become the ISS again.

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Once you have concluded your conversation, you may break 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 G-TOR Standby mode. Alternatively you may use the <Ctrl-C>X directive which will also break the link, and return you to the cmd: prompt, thus leaving the G-TOR mode.

Speed changes

The HF VAL light on the front of the KAM will indicate the speed of the G-TOR signal you are receiving or transmitting. When lit the G-TOR signal is 300 baud, when flashing 200 baud, and when OFF 100 baud.

The baud rate is automatically selected based on the quality of the link between the two stations. A link will begin at 100 baud. If the receiving station then detects a number of correctly received frames (set by GTUP) it will request a speed change to 300 baud. When operating at 300 baud or 200 baud the receiving station will request a lower speed when it receives a number of incorrect frames in a row (set by GTDOWN).

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. The KAM will then send the speed change command to the other unit (if needed) to change to 100 baud. Once the change occurs, your KAM will not direct 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 at prior to the <Ctrl-C>1 directive.

If you are the IRS and wish to speed up, you can use the <Ctrl-C>2 directive to switch to 200 baud, or the <Ctrl-C>3 directive to switch to 300 baud. The KAM will then send the proper speed change command to the other unit, and if successful, your KAM will not request the other unit to slow down even if the band conditions change 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 the automatic baud rate selection.

If you have selected a forced speed, you can return the KAM to automatic speed selection by using the <Ctrl-C>0 directive.

G-TOR Mailbox

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

If you link to another station who is using a KAM, you will normally communicate 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.

Formatting Data

When operating G-TOR, several of the KAM commands, including the following, will apply in formatting your transmitted data.

> 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 G-TOR Operation

If you choose to use the FSK mode of your transceiver, you must connect the FSK output from the KAM (Pin 5) to the FSK input of your radio. The actual tones transmitted are controlled by your radio in this mode, and you must set your MARK and SPACE commands in the KAM to match these tones. For instance, the default MARK and SPACE in the FT-1000 are 2110 Hz for MARK and 2310 Hz for SPACE. Since the KAM uses the switched capacitance filters for receive, you must have SPACE set to 2310 and MARK set to 2110 to receive the other station's signal.

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) it **will immediately return to G-TOR 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 packet mode after receiving the proper acknowledgment (CS code) or after GTERRS attempts to break the link. This could take a long time.

When you attempt to link to a nearby station, it is possible that the transceivers (yours 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 TXDTOR command to a higher value (try 7, 8, or 9). This has been proven to allow links on very short paths with very slow radios.

If you use an external power 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 PREKEY adds delay time before data begins.)

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

Binary Files and G-TOR

The G-TOR mode provides complete data transparency, allowing binary file transfers between G-TOR stations. The ability to send and receive binary files in this mode will depend on the terminal program you are using. Since G-TOR provides complete error detection and correction, binary files should be send in a raw data mode – that is, no error correction protocol (such as X-modem) needs to be used from your terminal program.

Host mode programs simply include the raw binary data in the data stream, however if you are using a standard telephone communications program, it is possible to allow the KAM to send raw binary data. To do this, once you are linked to another station in G-TOR and wish to send a raw binary file, type the <Ctrl-C>B directive. This places the KAM in a data transparent mode, allowing ALL characters to be transmitted from the computer.

NOTE: When you have done this, there are no special characters recognized by the KAM, and there are no directives available. This means that typing <Ctrl-C>E, for instance, will NOT cause a changeover, it will simply transmit the <Ctrl-C> character and the E to the other station. To exit this data transparency mode, you MUST send a modem break signal. Most telephone communications programs support this feature. (Procomm Plus, for instance, sends a modem break when you press ALT-B). **If your communications program does not support the modem break, you will NOT be able to leave the data transparency mode.**

The KAM will automatically exit data transparency if the other station disconnects from you, or at any time your KAM leaves the linked state (due to errors or retries).

Summary of G-TOR Directives

<Ctrl-C>A	Abort a link or abort an attempt to link after the first invalid response code.
<Ctrl-C>B	Enter data transparency mode (for binary file transfer)
<Ctrl-C>D	Disconnect from the station you are linked to. A changeover will be performed if required, and the KAM will return to G-TOR Standby mode.
<Ctrl-C>E	Changeover from ISS to IRS when all pending data has been transmitted. (ARQ mode)
	Return to receive when transmit buffer is empty (used when calling CQ). (FEC mode – AMTOR FEC)
<Ctrl-C>R	Changeover from ISS to IRS immediately.
	Return to receive immediately (FEC mode – AMTOR FEC)
<Ctrl-C>T	Seize the link if IRS (ARQ mode)
	Enter AMTOR FEC transmit mode
<Ctrl-C>X	Disconnect the link (if linked) and return to Packet
<Ctrl-C>0	Set automatic baud rate selection
<Ctrl-C>1	Force 100 baud operation (IRS only)
<Ctrl-C>2	Force 200 baud operation (IRS only)
<Ctrl-C>3	Force 300 baud operation (IRS only)
<Ctrl-C><Ctrl-T>	Toggle TRACE mode ON/OFF
MODEM BREAK	Exit data transparency mode

Host Mode commands

This section is provided for those individuals who have written Host mode programs so they may be updated to support G-TOR. If you are a software writer, this information will be useful to you.

All of the above directives are available to Host mode programs, and are implemented as follows:

FEND A FEND	Abort a link or abort an attempt to link after the first invalid response code.
FEND D FEND	Disconnect
FEND E FEND	Changeover from ISS to IRS when all pending data has been transmitted. (ARQ mode)
	Return to receive when transmit buffer is empty (used when calling CQ). (FEC mode – AMTOR FEC)
FEND R FEND	Changeover from ISS to IRS immediately.
	Return to receive immediately (FEC mode – AMTOR FEC)
FEND T FEND	Seize the link if IRS (ARQ mode)
	Enter AMTOR FEC transmit mode
FEND X FEND	Disconnect the link (if linked) and return to Packet
FEND 0 FEND	Set automatic baud rate selection

FEND 1 FEND	Force 100 baud operation (IRS only)
FEND 2 FEND	Force 200 baud operation (IRS only)
FEND 3 FEND	Force 300 baud operation (IRS only)
FEND ? FEND	Return KAM HF port status. This command will cause the KAM to return a special Host STATUS response. The format of the response and a description of the coding is included below.

Host Mode Status response

When the KAM receives a FEND ? FEND command in Host Mode, it will return several bytes to indicate the current status of the HF operating mode. The response from the KAM, and the meaning of the data is:

FEND ?0MSXY FEND

The ?0 is always returned to indicate a response from the status query. It is possible that future versions may use a different number in place of the 0 to indicate different types of status.

Coding is:

M = mode
S = submode
X = status A
Y = status B

M (Mode) coding:

Packet	A
RTTY	B
ASCII	C
AMTOR	D
FEC	E
SELFEC	F
LAMTOR	G
PACTOR	H
PTLISTEN	I
GTOR	J
NAVTEX	K
CW	L

S (Submode) coding:

Standby	0
Phasing	1
Connected	2
Disconnecting	3
FEC	4
SELFEC	5
PTFEC	6

X (Status A) coding:

Bit 0 = IDLE
Bit 1 = ERR
Bit 2 = Combined receive (Error correction used)
Bit 3 = RQ
Bit 4 = Huffman compression
Bit 5 = ISS
Bits 6 & 7 = SPEED   00 = 100, 01 = 200, 10 = 300

Y (Status B) coding:

        Bit 0 = UNUSED
        Bit 1 = PTT active
        Bit 2 = Changeover in progress
        Bits 3 - 7 = UNUSED

The meaning of the Status A codes would be:

Idle   indicates that the currently received or transmitted frame contains only idle characters.

ERR   IF IRS – The received frame failed the CRC check

        IF ISS – The received ACK code was not valid (within fuzzy)

RQ   IF ISS – Received ACK calls for repeat of previous frame.

        IF IRS – ISS sent frame already received.

Pactor Mode

Pactor was developed by a group of German Radio Amateurs and introduced to the world amateur radio community in 1991. Kantronics has since implemented this mode in the KAM. Pactor combines some of the best features of Packet radio and AMTOR to provide robust digital communications for high frequency (HF) data. Through the use of automatic baud rate selection, data compression, Memory-ARQ, and other techniques, Pactor delivers greater data throughput than either packet or AMTOR. 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, 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, G-TOR, and AMTOR may tend to overlap.

CW	14.000 - 14.070 MHz
AMTOR, G-TOR, 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 TXDTOR command.

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 TXDTOR 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 TXDTOR 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 TXDTOR, 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
<Ctrl-C><Ctrl-T>	Toggle TRACE mode ON/OFF

MARS Feature

When you set CODE RTTY MARS in your KAM several special functions are enabled for RTTY operation.

    A. Typing <Ctrl-G> on the keyboard automatically sends (FIGS)JJJJJSSSSS(LTRS) over the radio. This is an attention signal.

    B. When you first enter the transmit mode (with <Ctrl-C>T), the KAM will transmit 5 SPACES followed by <CR><CR><LF> before any other data.

    C. Typing <Ctrl-P> will signify a page break in a long message by transmitting <CR><CR><LF><LF><LF><LF>.

    D. Typing <Ctrl-Z> will transmit the end-of-message signal as <CR><CR><LF><LF><LF><LF>NNNN and 12 LTRS shift characters.

In order to fully comply with the MARS RTTY guidelines published in FM 11-490-7, you will need to set CRADD ON, LFADD ON, AUTOCR 69, AUTOLF OFF, CRSUP OFF, and LFSUP OFF.

CRADD ON and LFADD ON causes the KAM to transmit a <CR><CR><LF> whenever you press the return key on your terminal. AUTOCR 69 causes the KAM to insert a <CR><CR><LF> into your transmitted text after 69 characters have been received from your terminal without a carriage return. These commands insure your transmitted data meets the guidelines.

In order to receive exactly what the other station is sending, you will need to set CRSUP OFF and LFSUP OFF so your KAM does not suppress any carriage return or line feed characters.

Kantronics PBBS

Your Kantronics TNC includes a Personal Bulletin Board System (PBBS) which is capable
of storing and forwarding messages for you and other users. This PBBS provides the same
message facilities as a computer based BBS (normally referred to as a full-service BBS),
including the forwarding of Bulletins, Private mail, and NTS traffic.

Before explaining details of your Kantronics PBBS, it is important that you understand the
basics of a full-service BBS system. Each user should select one (and only one) full-service BBS
that will normally be used to send and receive mail. This BBS is then called your "HOME BBS"
and should not be changed unless you move to a new location. When you connect to your home
bulletin board system and list the messages (using the L command), you will see a list con-
taining information about each message on the system. A recent list of messages on one local
system might look like this:

```
Msg #   TSL   Size  To     @ BBS    From    Date/Time  Subject
======  ===   ====  =====  =======  ======  ====/====  =======
59765   B$    1491  NASA   @ALLUS   N5IST   1004/1529  GALILEO STATUS 09/30/93
59764   BNL    468  WX              NONEJ   1012/1017  KC Forcast 10/12  400am
59763   BNL    659  WX              NONEJ   1012/1017  MO Forcast 10/12  400am
59759   B$    2240  NASA   @ALLUS   N5IST   1004/1529  MARS OBSERVER STATUS Pt1
59758   B$    1642  NASA   @ALLUS   N5IST   1004/1529  MARS OBSERVER STATUS Pt2
```

This list shows the message number, type and status information, size of the message, the
addressee (TO field), distribution (@BBS field) and originator (FROM field). In addition
the list shows the date and time the message was received at this BBS and a short subject
for the message.

Under current FCC requirements, BBS systems that can store and forward messages without
an operator being present must have the capability to provide a record of the path the message
has taken from its origination. To accomplish this, BBSs include a routing line, beginning with
R:. This R: line includes the date/time the message was received, message number, BBS call
and hierarchical routing information.

When you read a message using the R command (e.g. R 59765) you see the header displayed.
For example:

```
From          : N5IST
To            : NASA   @ALLUS
Type/status   : B$
Date/time     : 04-Oct 15:29
Bid           : NASA0930.GAL
Message #     : 59765
Title         : GALILEO STATUS 09/30/93
Path: !WK5M!N0LLY!N0OER!N0OBM!NX0R!AG0N!N7MMC!KT0H!KA0WIN!N5IST!
```

The Path: statement in the header lists the most recent BBS systems that have been used
to relay this message from its origin to the BBS you read it from. This path information is
required by the FCC to allow them complete traceability for any message in the system. What
you see in the PATH statement is not the complete information on the routing, but simply a
summary of the systems that have handled the message. To see the complete information, BBS
systems allow a second version of the READ command (RH or V) that will display more routing
information. A routing list from a recent bulletin appears below.

```
R:931012/1107  27268@WK5M.#NEKS.KS.USA.NOAM
R:931012/1025  16433@N0LLY.#NEKS.KS.USA.NOAM
R:931011/2021  928@N0OER.#NEKS.KS.USA.NA
R:931008/1814  20728@N0OBM.#NCKS.KS.USA.NA
R:931008/2003  19520@NX0R.#NKS.KS.USA.NA
R:931008/1153  30798@AG0N.#WNE.NE.USA.NA
R:931007/1147  35850@N7MMC.#SEWY.WY.USA.NA
R:931007/1712  49403@KT0H.#NECO.CO.USA
R:931007/1639  63792@KA0WIN.#SECO.CO.USA.NA
R:931004/1529  46383@N5IST.#WTX.TX.USA.NOAM
```

KAM Enhancement Board   version 7.0   March 14, 1994

By examining this list from the bottom up, we may see that the message entered the system on October 4, 1993 at 15:29 (R:931004/1529). It was message number 46383 on the N5IST BBS (@N5IST) which is located in West Texas (#WTX), which is in Texas (TX), which is in the United States (USA) which is in North America (NOAM). From this station, it was relayed on October 7 at 16:39 to the KA0WIN BBS in Southeastern Colorado. By following this information it is possible to determine where the message traveled and when it was relayed from each station. The information following the @BBS callsign is called the **hierarchical routing information** (in this case .#WTX.TX.USA.NOAM).

When you connect to your local BBS and send a message, that BBS automatically generates this R: line. As the message is sent to its destination, each BBS adds its own R: line to the message. Besides the requirement of the FCC, the R: line provides a method for any user, anywhere in the world, to send a reply or respond to your message. As the message is passed through the many BBSs, each BBS will add you into its White Pages – a directory of packet users. Each BBS makes note that you (the originator of the message) sent the message, and that you entered the message at the BBS listed in the last R: line in the message.

Because of this, a distant user can simply send a reply using the send reply (SR) command of his local BBS. That BBS will then address the message to you using the @BBS and hierarchical routing information in the last R: line of the message you sent. A user may also simply use the send private command (SP) to send a message to you. If the user does not enter complete addressing on his SP command, the BBS will attempt to look up your call in its White Pages and add the routing automatically. However, if the user supplied complete addressing information, the BBS would normally assume it is correct and not check the White Pages.

BBSs use this hierarchical information to send the message back to you. The message someone sent to you (using the above example) would be addressed to URCALL @ N5IST.#WTX.TX.USA.NOAM. As the message passes through the BBS system for forwarding, the BBS first looks at the callsign of the addressee (URCALL). If that BBS doesn't know how to forward the message to you, it then looks at the @BBS field (N5IST). If it doesn't have any information on how to forward to N5IST, it looks at the first part of the hierarchical address (#WTX), not knowing that, it would then look at the next part of the hierarchical address (TX). Assuming this BBS is in the United States, it knows TX means Texas and knows that this message needs to be relayed to a station in that area.

Once the message reaches the first BBS in Texas, that system must use the previous field for forwarding (#WTX). Once it reaches a system in West Texas, the forwarding occurs based on the @BBS.

When the message reaches the BBS specified in the @BBS field, it can forward the message directly to you, since you are using that system as your HOME BBS.

When you enter a message into your Kantronics PBBS and supply the routing information, that message may be forwarded automatically to another BBS. When the message is forwarded from your Kantronics mailbox, an R: line is included as the originating BBS. This line includes the same information as any other BBS. This R: line consists of the date/time the message was entered into your PBBS, the message number, your MYCALL (URCALL) and the HTEXT you have set. For instance, your R: line might be:

```
R:931008/1255 23@URCALL.#WTX.TX.USA.NOAM
```

Some BBS operator groups are insisting that your system is NOT a BBS, and therefore should not include R: lines. Their reasoning is that in the above example, EVERY BBS in West Texas would have to know how to send messages to your callsign – not just to your HOME BBS. One solution to this is to include the callsign of your HOME BBS as part of your HTEXT. This would change your R: line to:

```
R:931008/1255 23@URCALL.N5IST.#WTX.TX.USA.NOAM
```

As this forwards through the system, all West Texas BBSs can still forward the message to N5IST because his call is a part of the hierarchical routing.

As of this writing, there seem to be at least two groups with strong opinions on the use of, or prohibition of, R: lines by TNC based PBBSs. Some think the volunteer BBS network may be overloaded by personal boards including the R: lines; others insist that the R: lines are required by regulations. We suggest you adapt to "local custom" by turning the R: line feature ON or OFF accordingly.
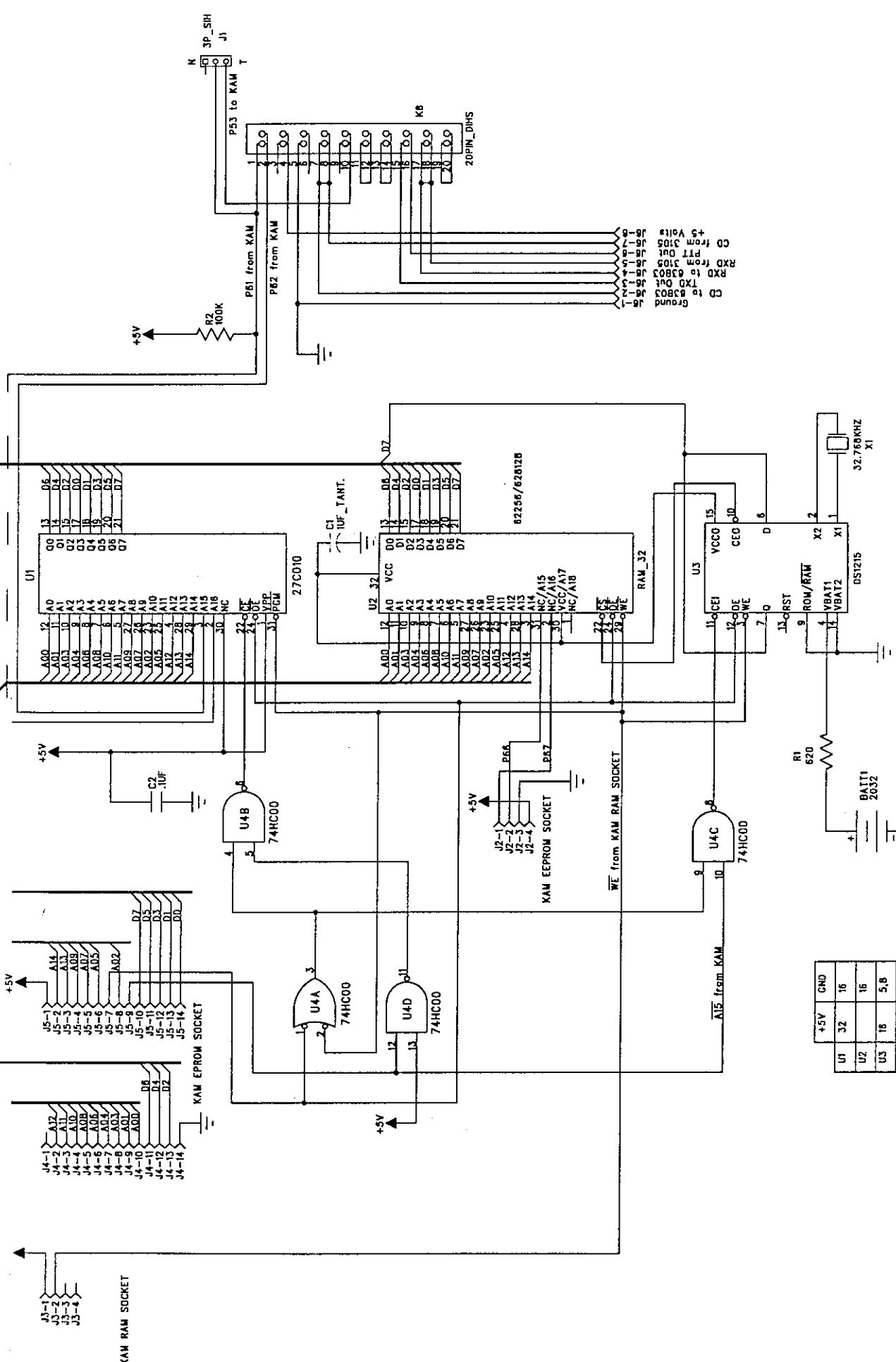
If your local SYSOP demands that you not add R: lines to your messages, you must set the PBPERSON command ON. This will limit your PBBS to receiving messages addressed ONLY to your MYCALL or your MYPBBS call. In addition, your PBBS will only forward messages from YOU (no third-party messages) and will not add the R: line to the routing.

Parts List

Reference	Part Type
BATT1	2032
C1	1µF tant
C2	0.1µF
J1	3P SIH
J2	4P SIH
J3	4P SIH
J4	14P SIH
J5	14P SIH
J6	8P SIH
K8	20 PIN DIHS
R1	620
R2	100K
U1	27C010
U2	628128
U3	DS1215
U4	74HC00
X1	32.768 KHz
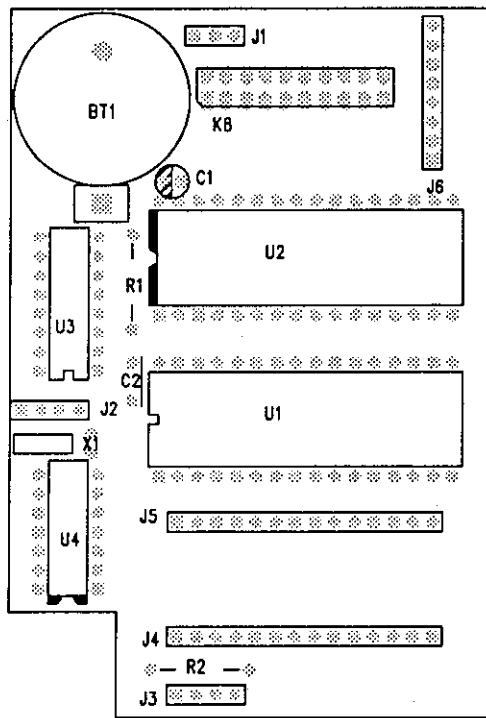
Enhancement Board
Parts Layout

Enhancement Board – KAM

3/10/93