

# **KAM Plus and Enhancement Board**

# **Manual Addendum**

## **Version 8.0 EPROM Upgrade**

GPS NMEA Interfacing Capability and  
G-TOR monitoring

**Kantronics**

# Table of Contents

---

Welcome!	1
An Overview of the GPS	1
GPS Interfacing Requirements	2
Cabling a GPS unit to the KAM Plus	2
Installing the Version 8.0 EPROM	3
Setup: Configuring the KAM Plus for GPS Operation	4
Setting Parameters in the KAM Plus	4
GPS Unit Initialization from the KAM Plus	5
GPS Operations	6
Starting the KAM Plus in GPS Mode	6
Exiting GPS Mode	6
Other GPS Features	6
Slotted Beacons	6
Tracking Without Beacons	6
Remote Access	7
Other Notes	7
GMON	7
Command Summary – New Commands for Version 8.0	8
Modified Commands	9
Kantronics Policies	10
Bibliography	10

# Welcome!

---

Congratulations on purchasing the KAM Plus and/or the Version 8.0 EPROM Upgrade. This document is an addendum to your KAM Plus manual, describing the features and commands of the 8.0 upgrade.

Version 8.0 of the firmware adds Global Positioning System (GPS) interfacing capability and the ability to monitor G-TOR QSOs. Eight new commands are added and two commands are modified.

Since this addendum and its EPROM are an upgrade, we assume that you are familiar with your KAM Plus. Therefore, no tutorial information on packet radio operations is included. However, we've added some introductory material on the GPS and GPS interfacing, and we've included a brief bibliography on GPS for your convenience.

If by chance you purchased your KAM Plus and this upgrade at the same time (two packages or the EPROM is already installed), we recommend that you familiarize yourself with the basic features of the KAM Plus first. You can determine whether or not version 8.0 is already installed by checking the labeling on the shipping box or by using the VERSION command (type VER after the command prompt cmd: and the KAM Plus will report its current firmware version.)

## An Overview of the GPS

---

The GPS was developed for military use initially by the U.S. Department of Defense to provide worldwide positioning and navigation information for U.S. military forces. The GPS also has a broad range of civilian, commercial, and amateur radio applications. All GPS units use the most accurate and sophisticated navigational system available – based on 24 satellites; each satellite continuously transmits positioning information which is received by GPS units and used to compute location. This information can then be transmitted from the GPS units by any means possible to report their locations.

Most GPS units sold today are NMEA compatible. That means that not only can they display latitude, longitude, and time on an LCD screen, but the information can be presented to your computer or KAM Plus via the GPS unit's serial data port. The information is presented in ASCII in the form of NMEA "sentences." A number of these sentences are available – with varying kinds of information, but the one used most often for amateur radio activities is "\$GPGGA." This sentence contains latitude, longitude, and altitude; and time in UTC, derived from the satellite clocks. The KAM Plus, in GPS Mode, can receive and retransmit this information as beacons and/or store these sentences in a large tracking buffer for later retrieval. The KAM Plus, in GPS Mode, also updates its clock to UTC, derived from the satellites. Hence, the location of your remote packet station, recorded at a specific time, can be tracked by other packet stations.

Amateurs the world over have discovered GPS and are combining this exciting new technology with packet radio for reporting the position of their vehicles, following balloon launches, finding hidden transmitters, and determining location information for other applications as well. For these applications, **packet** and **GPS** technology can combine effectively for fun or serious uses. The key to success is the National Marine Electronics Association (NMEA) 0183 interfacing standard for GPS units<sup>1</sup>.

No doubt a number of software programs will be developed by amateurs to use packet and GPS. One shareware program that has emerged already is the Automatic Packet Reporting System (APRS), written by Bob Bruninga (WB4APR). An APRS system may consist of a GPS unit, a computer, and (optionally) a packet unit. In APRS, NMEA data, from a GPS unit, is passed to the computer, and it is the computer's job to display the information and, if desired, transmit that location via a packet unit using unproto packets. Any firmware version of the KAM Plus may be used with APRS. With **version 8.0 firmware**, the KAM Plus may receive the NMEA information directly; hence, it may be combined with a GPS unit alone to broadcast position via packet radio.

# GPS Interfacing Requirements

---

To set up a packet GPS station that can be tracked, you'll need the following equipment:

- a transceiver and antenna,
- a KAM Plus with version 8.0 firmware, and
- a GPS unit with NMEA interface and portable or external antenna.

More than 50 vendors produce GPS units and most offer NMEA data interfacing which is essential. Hence, to add GPS capability to your portable packet station, enter the required GPS parameters into your KAM Plus (from your PC), set ABAUD to 4800, and then cable your KAM Plus to the NMEA data port of your GPS unit.

**Note.** Most GPS units have a fixed NMEA data port rate of 4800 baud; however, some advanced units allow other baud rates.

In some applications, you may wish to keep your PC or terminal attached to the KAM Plus for packet operations yet switch serial port connection to the GPS unit periodically – just to update your location. This arrangement is handy when only one comm port is available. This can be accomplished with a mechanical switch or you might consider installing a transistor switch. A number of RS-232 serial port transistor switches have been reported and used by amateurs; check for bulletins on these at your local BBS.

## Cabling a GPS unit to the KAM Plus

---

The NMEA standard specifies that the signals in the GPS data port follow the EIA-422 standard. However, many vendors simply use "TTL" voltage levels (+5 volts and 0 volts) but use the same polarity as RS-232. These units are capable of driving the KAM Plus RS-232 serial data port input pin. However, some GPS vendors invert the sense of this signal (true TTL), and these units will not directly interface with a TNC. In this case you might consider using a TTL-to-RS-232 converter.

To connect the data port of a GPS unit to your KAM Plus, you'll need a three-wire cable. A shielded cable is preferred. Refer to your GPS manual to determine which pins are used for signal ground, data output to an RS-232 device, and data input from an RS-232 device (such as the KAM Plus). At least two of these wires must be connected at both ends of the cable:

- connect the signal ground wire of the GPS data port to pin 7 of the KAM Plus's serial port. This wire may be identified as "NMEA-" by some GPS vendors.
- connect the "data output pin" of the GPS data port to pin 2 of the KAM Plus's serial port. The data output pin may be identified as "NMEA+" by some GPS vendors; this is the line that supplies the NMEA sentences to your KAM Plus.

Some GPS units may allow for programming of parameters. If so, this is accomplished by passing commands to the GPS unit from a terminal (or KAM Plus) via an additional pin in the data port. **Warning:** The KAM Plus serial port is RS-232; that is, it provides for signals that swing plus and minus approximately 8 volts. Check your GPS manual before connecting this wire to make sure that the unit is capable of handling these voltages. Kantronics is not responsible for damage wherein the KAM Plus is attached to other devices; see the warranty.

If your GPS unit accepts the setting of parameters, you may wish to connect the third wire of your cable from the input data pin of the GPS data port to pin 3 of the KAM Plus serial port. Again, consult your GPS manual for the name of this pin; names vary by vendor.

# Installing the Version 8.0 EPROM

---

## If you have the KAM Plus

To install the EPROM, you need to remove the case of the KAM Plus, locate and remove the old EPROM, insert the new 8.0 EPROM, perform a hard reset (with power on and using jumper K6), and then reattach the cover. Make sure the power and cabling are removed from the KAM Plus while installing the EPROM. Note the orientation of the old EPROM before removing it. The new one will be socketed with the same orientation. When inserting the new EPROM, be careful to not bend any of the pins underneath the socket.

- Disassembly/assembly instructions can be found on page 63 of the KAM Plus Reference Manual.
- Instructions on performing a hard reset are also included in the Reference Manual on pages 63 and 64.
- K6 is located near the microprocessor (U23).

## If you have the Enhancement Board

Refer to the instructions on page 10 of the Enhancement Board Manual.

# Setup: Configuring the KAM Plus for GPS Operation

---

To configure and run your KAM Plus in GPS Mode, you must set several KAM Plus command parameters from your PC keyboard and turn the KAM Plus off and then back on:

- set parameters for GPS operation,
- set the KAM Plus to power up in GPS Mode.

In the GPS Mode, the KAM Plus can search for specific strings of data from the GPS unit and store them in up to four Location Text buffers (LT). These LT buffers may then be transmitted at periodic intervals as a beacon. The frequency of the beacons is controlled independently for each LT buffer and each radio port, by the BLT command (which stands for Beacon LText). You may also set the destination address and the path for each of the four LT beacons independently using the LTP command. You determine which GPS strings will be stored in the LT buffers by entering the string header with the GPSHEAD command.

In addition to transmitting the beacons periodically, the KAM Plus can store the transmitted beacons in a location buffer (LTRACK) for later review. The size of the LTRACK buffer is set by a command from the keyboard.

## Setting Parameters in the KAM Plus

---

To set up your KAM Plus for GPS operation, you must first be communicating with your KAM Plus via your terminal (Command Mode or with a Host Mode program). You must send several commands to the KAM Plus to configure it for GPS operation.

First, set the GPSHEAD command to capture specific sentences from the GPS unit. For instance, if you want the KAM Plus to store the \$GPGGA string in LT buffer number 1, use the command:

```
GPSHEAD 1 $GPGGA
```

You can set up to four strings to be stored (one each) in the LT buffers. The command would be `GPSHEAD n string` where `n` is the LT buffer number, and `string` is the GPS string to be stored.

In order to beacon an LT buffer, you must set the LTP and the BLT commands for that LT buffer. The commands used for LT buffer number 1 would be

```
LTP 1 xxxxxxxxxxxx  
BLT 1 xxxxxxxx.
```

Full details of the LTP and BLT commands can be found in the commands section, but here's an example. If you want LT 1 to beacon with a destination address of APRS via three digipeaters (called WIDE, RELAY, and RELAY), and you want the beacon to occur every 30 minutes, use the following commands:

```
LTP 1 APRS via WIDE,RELAY,RELAY  
BLT 1 EVERY 00:30:00
```

You can also set up a "tracking buffer" to store the most recently transmitted LT information for later retrieval. The size of the buffer and which LT buffers to store, is controlled by the LTRACK command. For instance, the command

```
LTRACK 5 LT1 LT2
```

would set the size of the LTRACK buffer to approximately 5 Kbytes and store the LT 1 and LT 2 buffers whenever they are transmitted (as set by the BLT command).

## GPS Unit Initialization from the KAM Plus

Some GPS receivers require reception of a special string of characters for initialization before they will send any information. You can tell your KAM Plus to send the initialization string to your GPS unit by entering the required string using the GPSINIT command. For instance, if your GPS receiver requires the string \$PGRMO,GPGGA,1 to be sent, you would give the command

```
GPSINIT $PGRMO,GPGGA,1
```

to your KAM Plus. Upon power up, the KAM Plus will then send that string via its serial port to the GPS unit (when the KAM Plus INTFACE command is set to GPS.)

# GPS Operations

---

## Starting the KAM Plus in GPS Mode

---

Once you have the KAM Plus parameters set for GPS, you need to set the KAM Plus to start in GPS Mode on power up. To do this, set the INTFACE command to GPS. When the KAM Plus resets (either from a RESET command or through turning the KAM Plus off and then on) the KAM Plus will be in the GPS Mode, and the GPSINIT string (if any) will be sent to the serial port.

Normally, you would set the INTFACE command to GPS, turn off the KAM Plus, connect your GPS unit, and then turn on the GPS unit and the KAM Plus.

When operating in the GPS Mode, the KAM Plus will automatically update the LT buffers every time it receives the designated NMEA strings from the GPS receiver.

## Exiting GPS Mode

---

If you want to exit the GPS Mode (perhaps to set new parameters or just to use the KAM Plus as a normal TNC), connect your computer or terminal to the serial port of the KAM Plus and type three <Ctrl-C> characters. The KAM Plus will reset and the INTFACE command will be set to TERMINAL.

## Other GPS Features

---

### Slotted Beacons

---

The BLT command provides for the ability to specify not only the interval between beacons, but also a starting time for the beacons. This permits a "slotted" system of beacons by numerous stations. For instance, let's say your local area has 30 stations that each should beacon their location every 30 minutes. A beacon would be transmitted every n minutes from the time the user sets the time that the beacon should be transmitted. As an example, if you set the BLT command for LT 1 (BLT 1) with the command:

```
BLT 1 EVERY 00:30:00 START 00:00:01
```

the KAM Plus would transmit a beacon at 00:00:01 (time after midnight) and every 30 minutes after that. The second user could set the BLT with the command `BLT 1 EVERY 00:30:00 START 00:01:01`.

In this case, these two users would never beacon at the same time, in fact they would beacon 1 minute apart. Using this system for our example, it is possible to set all thirty users to beacon one minute apart, avoiding collisions.

The BLT command also allows you to specify a different interval and start time for each radio port.

### Tracking Without Beacons

---

You may configure the KAM Plus to store the LT "beacons" in the LTRACK buffer without transmitting the beacons. To do this, set the LTP to NONE for the associated LT buffer:

```
LTP 1 NONE
```

When the destination call is set to NONE, the KAM Plus will not transmit the beacon, but since the BLT command is still active, the data will be stored in the LTRACK buffer.



## Remote Access

---

When the KAM Plus is in GPS Mode, the serial port is expecting data only from a GPS unit, hence, it cannot process any "normal" commands. Should you need to change any of the KAM Plus commands, however, there are two options: 1) exit the GPS Mode using a terminal, or 2) connect to the KAM Plus remotely (MYREMOTE) and change the commands.

When you connect remotely to the KAM Plus (and properly respond to the password security check) you can change any parameters including the GPS parameters. For example, you may wish to send a new initialization string to your GPS unit. This is accomplished with the RPRINT command. For example, to send the string \$PGRMO,GPGSA,1 to the GPS unit, connect to the MYREMOTE of the TNC, verify the password, and send

```
RPRINT $PGRMO,GPGSA,1
```

to the MYREMOTE. The KAM Plus simply sends this string to its serial port (which is connected to the GPS receiver).

## Other Notes

---

The LT buffers, LT beacons and LTRACK buffer can be used even without a GPS unit attached. You can manually set the LT buffers to any text you want (up to 128 characters total) using the LT command:

```
LT 1 This is ltext buffer number 1
```

The LT buffers will be transmitted based on the BLT command and stored according to the LTRACK command even when the KAM Plus is not in GPS Mode.

## GMON

---

Version 8.0 for your KAM Plus or Enhancement Board adds the ability to monitor G-TOR QSOs. When using a Host Mode program (such as Host Master II+) it is possible to monitor G-TOR while you are connected to other stations on VHF packet.

When monitoring G-TOR, the KAM does not respond to link attempts – you must be in the G-TOR or TOR Standby Mode for someone to link to you.

# Command Summary – New Commands for Version 8.0

---

Since 8.0 is an upgrade, we assume that you're familiar with the syntax for the KAM Plus commands. If not, consult the KAM Plus Reference Manual on command syntax. Version 8.0 firmware adds eight new commands and modifies two commands, adding GPS interfacing capability. A description of these commands is listed below.

● **BLT** *n* **EVERY|AFTER** *hh:mm:ss* [**START** *hh:mm:ss*] (*n* = 1 - 4) v8.0

default EVERY 00:00:00/EVERY 00:00:00

This command sets the interval between beacons for the associated LT string. *n* identifies which LT is used (1-4). If **EVERY** is specified, the LT will be transmitted at the interval specified by the *hh:mm:ss* parameter. This is set in hours:minutes:seconds, and all characters must be specified. The values before the / apply to the HF port and the values after the / apply to the VHF port. If the optional key word **START** is given followed by a time (in 24 hour format), the beacons will not be transmitted until the specified time. The beacon will then be transmitted according to the setting of the **EVERY** parameter. (NOTE: If the current time is past the start time, the beacon will start at the next scheduled interval based on the start time.)

If **AFTER** is specified, the beacon will be transmitted once after no activity is detected on the channel for *hh:mm:ss* time. Selecting **AFTER** does not allow the optional **START** parameter.

For example, setting **BLT 3 EVERY 00:15:00 START 03:30:00** would cause the third LT string (LT 3) to be transmitted every 15 minutes, with the first transmission each day occurring at 03:30:00.

● **GMON** v8.0

immediate

The **GMON** command places the KAM in the monitor mode, allowing you to monitor G-TOR QSOs. To exit the **GMON** Mode and return to the command prompt, type <CTRL-C>X.

● **GPShead** *n* **string** (*n* = 1 - 4) (string up to 8 characters) v8.0

default 1 \$GPGGA

This command determines which GPS NMEA sentences will be stored in the LT buffers. *n* determines which buffer will be used to store the data (1-4), and *string* is a NMEA sentence header.

When the string is received, the KAM Plus will store the up to 128 characters in the associated LT.

● **GPSInit** **string** Initial text sent to terminal in GPS Mode (string up to 128 characters) v8.0

default (blank)

This command establishes a string which will be sent to the attached GPS unit upon power-up. This may be useful to configure your GPS unit to provide only the information you require. Some GPS units may require more than one sentence; consult your GPS unit manual. To send more than one, enter a <Ctrl-N> at the end of each sentence, and the KAM Plus will send a CR/LF sequence to the GPS unit.

● **LT** *n* **text** (*n* = 1 - 4) (text up to 128 characters) v8.0

default (blank)

This command fills the specified Locate Text (LT) buffer with "text." *n* specifies which buffer to use (1-4). If **GPSHEAD** is set for this buffer, and if the **INTFACE** command is set to **GPS**, the buffer contents will be updated automatically by the GPS data.

● **LTP** *n* **dest** [via call1[,call2,...]] (*n* = 1 - 4)

v8.0

default GPS/GPS

This command sets the destination callsign and the digipeaters used to transmit the LT strings. *n* specifies which string (1-4). The destination callsign defaults to GPS; however, you may want to change it to APRS, LOCATE, POSIT, or some other destination. Up to 8 digipeater callsigns may be specified. The values before the / apply to the HF port and the values after the / apply to the VHF port.

● **LTRack** *n* [LT1] [LT2] [LT3] [LT4] [SYSOP] [TIME]

v8.0

default 0

This command allocates memory for a special tracking buffer used to store LT messages. *n* defines the amount of memory (Kbytes) set aside for the LT messages (limited by available RAM). Specifying the LT1 through LT4 parameters determines which messages will be stored in the tracking buffer. If SYSOP is specified, only a user with SYSOP privileges may access the tracking buffer, and if TIME is specified, a time stamp will be appended to the front of the LT message.

The LTRACK buffer is accessed by connecting to the mailbox (MYPBBS) and using the LTRACK command.

● **RPrint** *text* (*text* up to 128 characters)

v8.0

immediate

This is an immediate command which sends the "text" string from the serial port of the KAM Plus to the attached device (e.g. GPS unit). It is intended to allow a remote SYSOP (connected to the KAM Plus with the MYREMOTE callsign) to send a string to a unit attached to the KAM Plus serial port. This can be used to change the configuration of a GPS unit.

## Modified Commands

---

● **INtfacE** **TERMINAL**|**NEWUSER**|**BBS**|**KISS**|**HOST**|**GPS**

default NEWUSER

When this command is set to GPS, the KAM Plus will enter GPS Mode upon power up. Data from the serial port will be parsed according to the GPSHEAD command, text will be placed into the LT buffers, and beacons will be transmitted according to the setting of the BLT commands.

To have the KAM Plus exit GPS Mode, connect a PC or terminal to it and issue three <Ctrl-C> characters.

● **PMoDe** **NONE**|**CONV**|**TRANS**|**RTTY**|**ASCII**|**AMTOR**|**PACTOR**|**GTOR**|**TOR**|**CW**

default NONE

The PMODE command controls the mode your KAM Plus will be in when it is first powered up or reset. When set to NONE, the KAM Plus will produce a sign-on message followed by the command prompt. When set to CONV, the unit will be in the Convers Mode. Setting PMODE TRANS sets the KAM Plus in Transparent Mode. Exiting Transparent Mode with three <Ctrl-C>s will set the PMODE command to the default value (NONE).

# Kantronics Policies

---

The product with which this manual addendum is associated contains SOFTWARE on Programmable Read Only Memory (PROM) which is protected by both United States copyright law and international treaty provisions. The firmware is the copyrighted property of Kantronics Co., Inc. If you install or use the product, you will be deemed to be bound by the terms of the SOFTWARE license printed in the front of your KAM Plus Reference Manual.

Please refer to your KAM Plus Getting Started and Reference manuals for these items:

- software/firmware license agreement
- limited warranty
- return/repair procedures
- international support.

## Bibliography

---

For more information on the Global Positioning System, we recommend the following resources:

### General Information

Bruninga, Bob, WB4APR, "Automatic packet reporting system (APRS)," *13th ARRL Digital Communications Conference Proceedings*, 1994.

Mannes, George, "Finding yourself," *Popular Mechanics*, January 1994.

Sproul, Keith, WU2Z, "MacAPRS," *13th ARRL Digital Communications Conference Proceedings*, 1994.

West, Gordon, "Boat GPS sets on land and sea," *Nuts and Volts Magazine*, January 1995.

### Technical Information

Collins, J., et al., *GPS Theory and Practice*, Second Edition, Springer-Verlag, 1993.

Etherington, Michael, "FM subcarrier network extends differential GPS nationwide," *Mobile Radio Technology*, February 1994.

Kaplan, Elliot, "The global positioning system (GPS)," *Communications Quarterly*, Summer 1994.

Langley, R., "The mathematics of GPS," *GPS World Magazine*, July/August 1991.

"NMEA 0183 ASCII Interface Standard," (NMEA 0183 version 2.0), NMEA, P.O. Box 50040, Mobile, AL 36605.

### Some of the more than 50 vendors supplying GPS units:

Garmin, 9875 Widmer Rd., Lenexa, KS 66215

ICOM America, Inc., 2380 116th Ave. N.E., Bellevue, WA 98004.

Magellan Systems Corp., 960 Overland Ct., San Dimas, CA 91773.

Sony Electronics Inc., 1 Sony Dr., Park Ridge, NJ 07656.

Trimble - Mobile Computing Products, 645 N. Mary Ave., P.O. Box 3642, Sunnyvale, CA 94088-3642.

### Additional Contacts:

APRSIG@TAPR.ORG (internet)

APRS telephone BBS: (410)280-2503