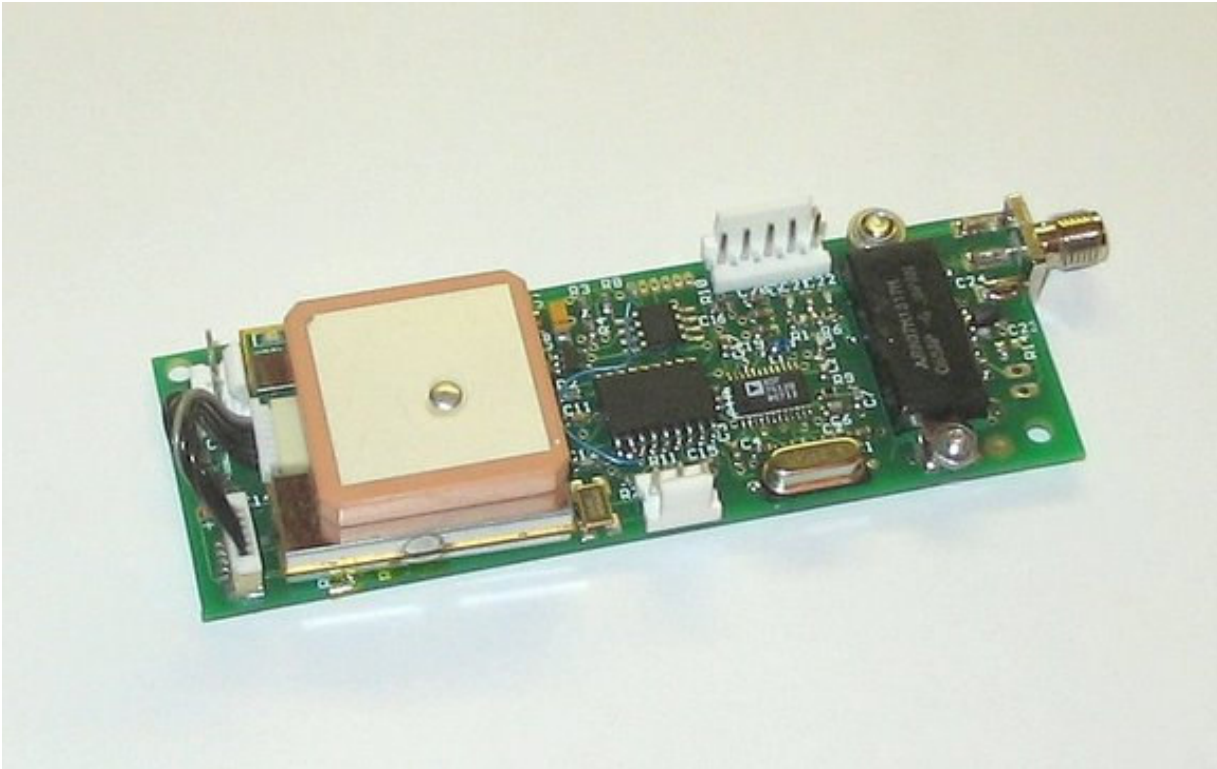


BeeLineGPS 2MHP

PRELIMINARY INFORMATION



1 Overview

The BeeLineGPS 2MHP is a small, highly integrated GPS and 2 meter radio design to receive GPS positions and broadcast APRS packets. It integrates a GPS, TNC (terminal node controller) and 5 watt RF transmitter into a single circuit board. Position can be sent at user defined intervals or use Smart Beaconsing™. The BeeLineGPS can also be configured for timeslotting, allowing multiple devices to transmit on the same frequency without transmitting at the same time. On board non-volatile memory can also record up to 1000 positions, and can be read back and viewed with Google Earth.

The design, layout and functionality are very similar to 70cm transmitters from BigRedBee. Please see the corresponding documentation (<http://www.bigredbee.com/BeeLineGPS.htm>) for a description of device pinouts, data packet formats, battery battery charging and firmware updates

2 Feature Comparison

	TX Frequency	RF Max Power	GPS Module	Digital Telemetry	Launch Detect
BLGPS 2MHP	144 - 148 Mhz	5 watts	Sirf III or Lassen IQ	No	No
BLGPS 70cm	420-340 Mhz	16 mwatts	Trimble Lassen IQ	Yes	Hardware of Smart

Trimble Lassen IQ is confirmed to work above 18000 meters.

Sirf III is confirmed to NOT work above 18000 meters.

Lassen IQ is qualified for operations involving fast changing altitude (ie, High Power Rocketry)

3 Powerup Sequence

The powerup sequence begins when power is applied to the device.

- A 4 second delay occurs to allow the boot loader to gain control if necessary. Programming commands issued to the serial port may be ignored during this time.
- The status LED near the SMA antenna connector will blink three times, power to the GPS is enabled, and the LED on the GPS will turn on.
- The RF subsystem is initialized, and the board is now in *run mode*.
- The LED on the GPS will be ON until it obtains a good lock on the satellites required to obtain a fix, and then blink at a rate of once per second.

While in RUN mode, the unit will transmit packets, and store data into the onboard memory at the rate specified by the programming utility. The status LED will turn on while transmitting

4 Programming information

Once the device is in *run mode*, the programming utility can be used to view or modify the device parameters. Always issue a READ command first. Once a READ command has been issued., the device will be in *command mode*. While in *command mode*, no packets will be transmitted, and no data will be stored into the onboard memory

Read and write commands can now be utilized to modify and/or verify the device configuration.

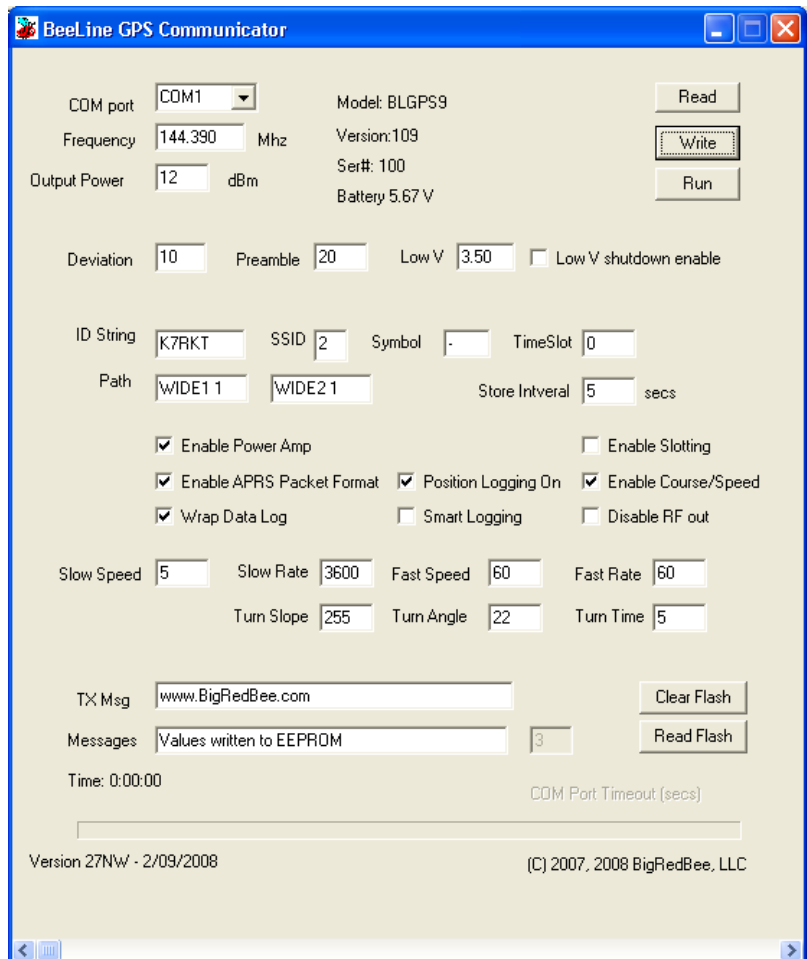
To return to *run mode*, it is necessary to push the RUN button on the programming interface, or cycle the power.

Transmitter Control

- **Com port:** Set the proper serial port. If you need a com port # that is not available in the drop-down menu, simply type the desired value into the text box.
- **Frequency:** This is the RF carrier frequency the packet will be sent out on. Possible values are between 144 and 148 Mhz
- **Output Power:** Set between -10 dBm and 12 dBm
- **Deviation:** Controls RF transmitter deviation. Default value is 8 (4.5 KHz) , do not change.
- **Preamble:** Number of IDLE characters sent before start of packet data: Default value is 20, do not change.
- **Low V Shutdown Enable:** Set this option if you wish the microcontroller to shut down the transmitter and GPS when the voltage gets below the value you set in "Low V".

Information

- **Model Number:** BLGPS9 for the 2-Meter Amplified version



- **Version:** Firmware version
- **Serial Number:** The serial number stored in read only memory
- **Battery:** Current battery voltage

APRS parameters

- **ID String:** Your amateur radio callsign. Not more than 6 characters in length
- **SSID:** The SSID in the APRS packet. The default is 1, possible values are 1 thru 15
- **Symbol:** The symbol character in the APRS packet. The default is '-'
- **TimeSlot:** Number of seconds to delay if slotting is enabled.
- **Path:** Each is 7 characters in length. If you're not familiar with AX-25 digipeating protocols, it's best to leave these values alone. *Placing an 'x' in the first character of the first path will eliminate the path from the transmitted packet.*
- **Store Interval:** Number of seconds between position writes writes to on-board memory

Misc Controls

- **Enable Power Amp:** Disable for testing, must be enabled during normal use
- **Enable Slotting:** Turn Time Slotting ON. See below. If NOT enabled, then Smartbeaconing is enabled
- **Position Logging On:** Position and altitude data will be logged into o-board memory.
- **Enable Course/Speed:** The coarse and speed are transmitted as part of the data packet
- **Disable RF Out:** Disables RF transmissions
- **Wrap Data Log:** When set, data is overwritten starting at the beginning after the end is reached.
- **Smart Logging:** See Below

Smart Beaconing Parameters

These options set up SmartBeaconing, an algorithm created by Steve Bragg for adjusting the transmit rate by monitoring the speed and heading from the GPS. SmartBeaconing also uses CornerPegging to cause transmissions to occur when the heading changes.

- **Slow Speed:** Lower speed limit (MPH)
- **Slow Rate:** Beacon rate if speed is below "Slow Speed"
- **Fast Speed:** Upper speed limit (MPH)
- **Fast Rate:** Beacon rate if speed is above "Fast Speed"
- **Turn Slope:** The lower the slope, the quicker the BeeLine will transmit due to turning
- **Turn Angle:** Turns less than the turn angle will not be transmitted
- **Turn Time:** Transmissions will not occur within TURN TIME from last transmission.

```

IF (speed < low_speed)
{
    beacon_rate = slow_rate;
}
ELSE
{
    IF (speed > high_speed) // Adjust beacon rate according to speed
    {
        beacon_rate = fast_beacon_rate;
    }
    ELSE
    {
        beacon_rate = fast_beacon_rate * high_speed / speed;
    }

    // Corner pegging - ALWAYS occurs if not "stopped"
    // Note turn threshold is speed-dependent

    turn_threshold = turn_min + turn_slope / mph;

    IF ((heading_change_since_beacon > turn_threshold) AND
        (secs_since_beacon > turn_time))
    {
        secs_since_beacon = beacon_rate;
    }
}

IF (secs_since_beacon > beacon_rate)
    // ... send beacon

```

More information on SmartBeaconing can be found at <http://www.hamhud.net> .

SmartBeaconing and time slotting are mutually exclusive:

- **Clear Flash:** Data memory is read from the BeeLine GPS and stored to disk in the working directory in a file called beegps.kml. If the file exists, an error is displayed. The .kml file is an ascii file with headers and footers designed to be compatible with Google Earth.
- **Read Flash** Erases the on-board flash memory

5 Electrical Characteristics

Vmin	Minimum Voltage Input Level	3.5 Volts
VMax	Maximum Voltage Input Level	9.6 Volts
I(idle)	Idle Current Draw	100 mAmps
I(tx)	Transmit Current Draw	approx 2 Amps
P(l)	Power output at 4 volts	1 watt
P(h)	Power output at 7.5 volts	5 watts

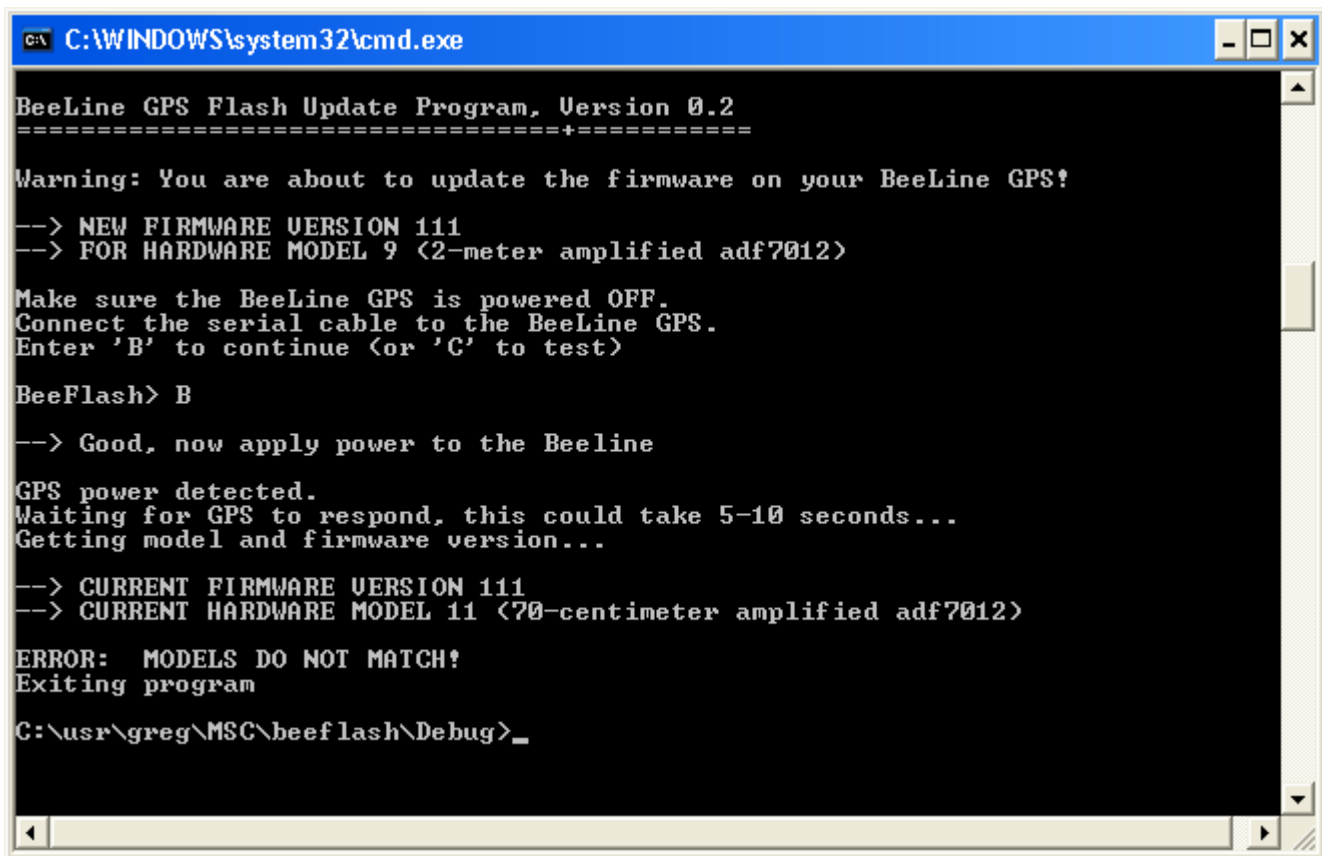
6 Model and Version Numbers

With the introduction of new hardware to support high RF power output levels and 2 meter / 70 centimeter version, there are now many different models available. The model number and firmware revision will be visible in the windows programming utility and are summarized here

Frequency (Mhz)	Amplified?	RF chip	Model Number
440	No	CC0150	BLGPS0
440	Yes	CC0150	BLGPS1
144	No	ADF7012	N/A
144	Yes	ADF7012	BLGPS9
440	No	ADF7012	N/A
440	Yes	ADF7012	BLGPSB

It is important to note that even though the PCB's for model numbers BLGPS9 and BLGPSB are the same, the component values differ slightly. It is not possible to load firmware intended for the BLGPS 9 board onto the BLGPSB board.

The flash programming utility will check the model number of the current board, and ensure that the correct firmware is being loaded. It will also check for incompatible firmware revisions within the same model number.



```
C:\WINDOWS\system32\cmd.exe
BeeLine GPS Flash Update Program, Version 0.2
=====+=====
Warning: You are about to update the firmware on your BeeLine GPS!
--> NEW FIRMWARE VERSION 111
--> FOR HARDWARE MODEL 9 (2-meter amplified adf7012)
Make sure the BeeLine GPS is powered OFF.
Connect the serial cable to the BeeLine GPS.
Enter 'B' to continue (or 'C' to test)
BeeFlash> B
--> Good, now apply power to the Beeline
GPS power detected.
Waiting for GPS to respond, this could take 5-10 seconds...
Getting model and firmware version...
--> CURRENT FIRMWARE VERSION 111
--> CURRENT HARDWARE MODEL 11 (70-centimeter amplified adf7012)
ERROR: MODELS DO NOT MATCH!
Exiting program
C:\usr\greg\MSC\beeflash\Debug>_
```