EB-E36-5HZ

GPS Module
User's Guide

Date: Dec, 2006
Version: 1.0

Manual Revision History

Revision	Date	Update Summary
Issue A	Dec, 2006	Initial release

---

1 Introduction

1.1 Overview

The EB-E36-5HZ GPS Receiver is intended for use in a wide range of applications. The receiver simultaneously tracks up to twelve satellites, provides accurate satellite positioning data with fast time-to-first-fix (TTFF) and low power consumption. It is designed for high performance and maximum flexibility in a wide range of applications including mobile asset tracking, in-vehicle automotive guidance, location sensing, telematics and so on. The highly integrated receiver achieves high performance, minimizes board size and power consumption requirements. The EB-E36-5HZ is designed to withstand harsh operating environments; however, it should be used inside an enclosure as a part of the application product designed by the system integrator.

1.2 Features

The EB-E36-5HZ GPS receiver offers following features:

- **EverMore Chipset 12 Channels all in view tracking**
- **Low Power Consumption**
- **High Sensitivity -143 dBm**
- **DGPS : WAAS/EGNOS**
- **Support Standard NMEA-0183 at 9600 bps baud rate**
- **NMEA output rate: 5Hz per second for high speed applications**
- **Support 1PPS output**
- **Lead Free , RoHS Compliant**

1.3 Applications:

- **Land/Marine Navigation**
- **Telematics**
- **Aviation**
- **Asset Tracking**
- **Timing Reference**

2 Receiver Operation

Upon power up, after initial self-test has completed, the EB-E36-5HZ will begin satellite acquisition and tracking process. Under normal open-sky condition, position-fix can be achieved within approximately 45 seconds (within 15 seconds if valid ephemeris data is already collected from recent use). After receiver position has been calculated, valid position, velocity and time information are transmitted through the on board serial interface.

The receiver uses the latest stored position, satellite data, and current RTC time to achieve rapid GPS signal acquisition and fast TTFF. If the receiver is transported over a large distance across the globe, cold-start automatic-locate sequence is invoked. The first position fix may take up to five minutes searching the sky for the GPS signal. The acquisition performance can be improved significantly if the host initializes the receiver with a rough estimate of time and user position.

As soon as GPS signal is acquired and tracked, the EB-E36-5HZ will transmit valid navigation information through its serial interface. The navigation data contains following information:

- Receiver position in latitude, longitude, and altitude
- Receiver velocity
- Time
- DOP error-magnification factor
- GPS signal tracking status

The EB-E36-5HZ will perform 3D navigation when four or more satellites are tracked. When three or fewer satellites are tracked, altitude-hold is enabled using the last computed altitude and 2D navigation mode is entered.

With signal blockage or rising and setting of the satellites, where a change in satellite constellation used for position fix occurred, large position error may result. The EB-E36-5HZ incorporates a proprietary algorithm to compensate the effect of satellite constellation change, and maintains an accurate smooth estimate of the receiver’s position, velocity, and heading.

2.1 EB-E36-5HZ GPS Module Specification

ITEMS	DESCRIPTION
General	L1 1575.42MHz, C/A code, 12-channel, Carrier-Aided with HWTrack©
Sensitivity	-143 dBm minimum
Update Rate	5Hz
Accuracy	Position: 15m CEP without S/A Velocity: 0.1 m/sec without S/A Time: ± 1μs
DGPS/WAAS Accuracy	Position: 5m CEP Velocity: 0.05 m/sec
Acquisition	Cold start: 50sec (average) Warm start: 38sec (average) Hot start: 8sec (average)
Reacquisition	0.1 sec
Dynamics	Altitude: 18,000m Velocity: 500 m/sec Acceleration: ±4g
Time Mark **1PPS**	Output 1 Pulse/Sec, The rising edge of the output pulse is accurate to +/-1usec with respect to the start of each GPS second.
Operation Temperature	-30°C to +80°C
Storage Temperature	-40°C to +90°C
Operating Humidity	5% to 95%
Primary Power	3.3Vdc, ±0.1Vp-p ripple
Power Consumption	65 mA
Serial Interface	Port 1: NMEA 0183 Output, Port 2: RTCM Input
Protocol	EverMore Private @ 4800/9600 baud, 8-None-1 NMEA-0183 v2.20 @ 4800 baud, 8-None-1
Datum	219 standard datum, default WGS-84
DGPS	WAAS/EGNOS
Antenna	MMCX / HFL Jack for external active antenna
NMEA Message	GGA,GSA, GSV, RMC , VTG , GLL
Dimension; Weight	45mm x 31 mm x 5 mm (1.77” L x 1.22” W x 0.20” H)
Weight	8g (0.28oz)

2.2 Start-up Modes

Definitions	DESCRIPTION
Cold Start	The Cold Start takes the longest startup time among EMT GPS receivers. In this scenario, the receiver has no acknowledgment on the last position, time, and satellite constellation. The receiver is initiated to search blindly for satellite signals in the cold start mode. Another situation is that when no backup battery is connected, the GPS receiver will be in the cold start mode and there is no data stored in SRAM. Execute cold start of the test tool when first use. By this way can speed up position fix time.
Warm Start	In this scenario, the receiver was off less than one week but more than 2-hour time. The receiver knows its last position, time and almanac because it has a backup battery to keep current almanac, position and time stored in SRAM. In the warm start mode, the receiver can quickly acquire satellites and get a position fix faster than it does in the cold start mode.
Hot Start	In this scenario, the receiver was off less than 2-hour time. With the back up battery connected and the current almanac, position, time and ephemeris stored in SRAM, the receiver applies its last ephemeris data to calculate and get a position fix.
Reacquisition	In the reacquisition mode, the receiver takes time to lock on satellites if buildings or obstacles are blocking the signals for a short while. This is very common in urban areas, but please be noted that reacquisition time has nothing to do with the time-to-first-fix (TTFF).

3 Hardware Interface

3.1 EB-E36-5HZ System Block Diagram

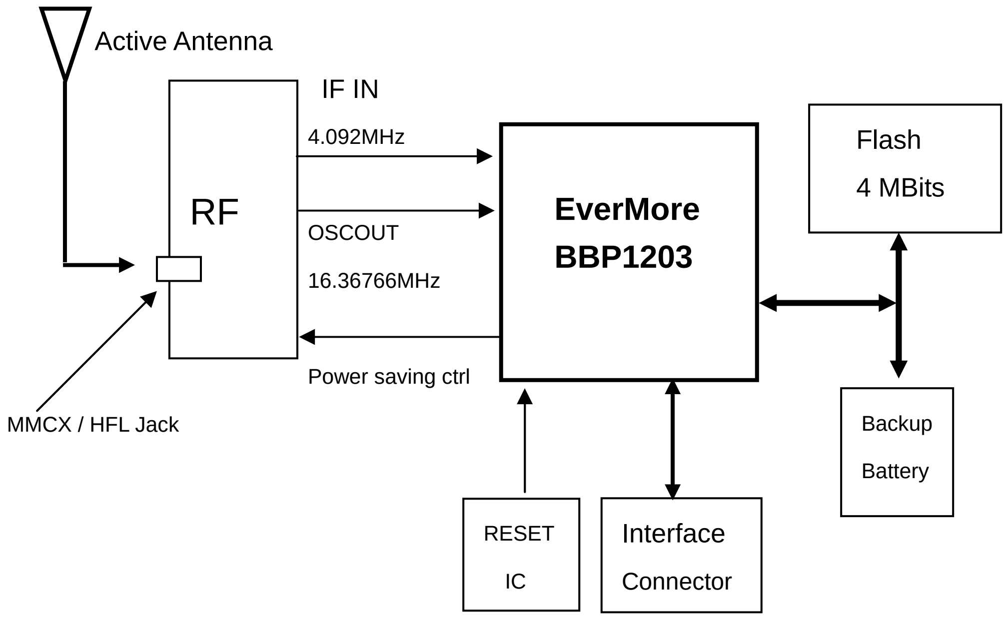

Figure 1: System Block Diagram for EB-E36-5HZ

Outline:

The GPS receiver completes signal processing that starts from antenna gains to serial output, and the above diagram illustrates such process. With at least four satellites, the receiver can evaluate satellite signals to determine a three-dimensional position fix by calculating longitude, latitude, height, time, speed, and acceleration. The GPS receiver provides information of the satellite constellation, satellite status, the number of visible satellites, etc.

RF:

The RF amplifier acts like the mixer, the A/D converter, and the producer of 16.367667MHz reference oscillator that offers the necessary carrier wave for frequency conversion. The analogue intermediate frequency is converted into digital format by means of a 1-bit ADC.

BBP1203 Base Band Functions:

The BBP1204 Base Band performs the following functions:

1. Processes IF 4.124MHz signal
2. Provides 12 parallel satellite channels that can be shut down individually
3. Built-in carrier/code close-loop control
4. Built-in RTC with timeout interrupt
5. Buffered demodulated data bits
6. 1pps output
7. CPU and I/O interface

BBP1203 Processor Functions:

The BBP1203 processor performs the following functions:

1. Calculating longitude, latitude, height, speed and acceleration to figure out position
2. Storing the above data to SRAM
3. Initiating and configuring the whole system
4. Executing the firmware installed
5. Converting NMEA-0183 code into proprietary EMT binary code

Flash:

The Flash stores firmware that allows the system to run automatically. The Flash also allows users to update with newer firmware versions via specific application programs.

Backup Battery:

The Backup Battery supplies SRAM with data retention current and voltage to store GPS data. Being button like, the battery also supplies real time clock power. With the rechargeable lithium backup battery, the time-to-first-fix (TTFF) can be reduced.

RESET IC:

The Reset IC sends a “reset” signal to initiate the processor.

Interface Connector:

Interface connector provides input power that includes VCC, battery and antenna power. The connector also provides RXD, TXD, 1PPS and LED digital signals.

MMCX / HFL Jack:

The MMCX / HFL Jack is a connector for external active antenna.

3.2 EB-E36-5HZ TOP View Picture

Figure 1 :

3.3 Antenna Connector

The RF connector is a 50 ohm straight MMCX / HFL snap-on coaxial RF jack receptacle.

3.4 Interface Connector Type

There are three interface connectors, the first is a 16-pin golden finger, and the second is a 10-pin header.

3.5 Mechanical Dimensions and Interface Connector

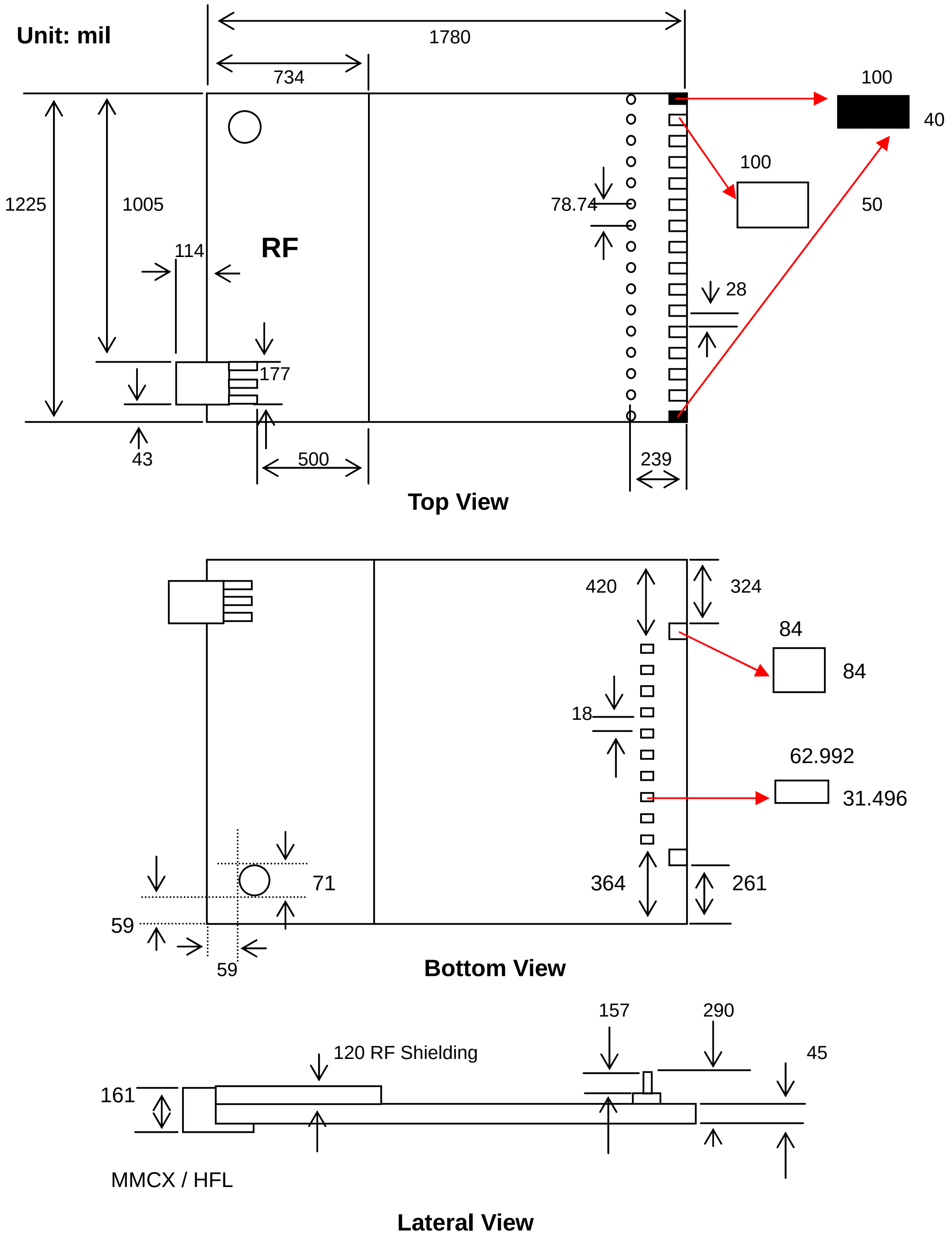

Figure 4

3.6 Interface Connector Pin Out

3.6.1 Pin Header Connector JP2 16-Pin Header

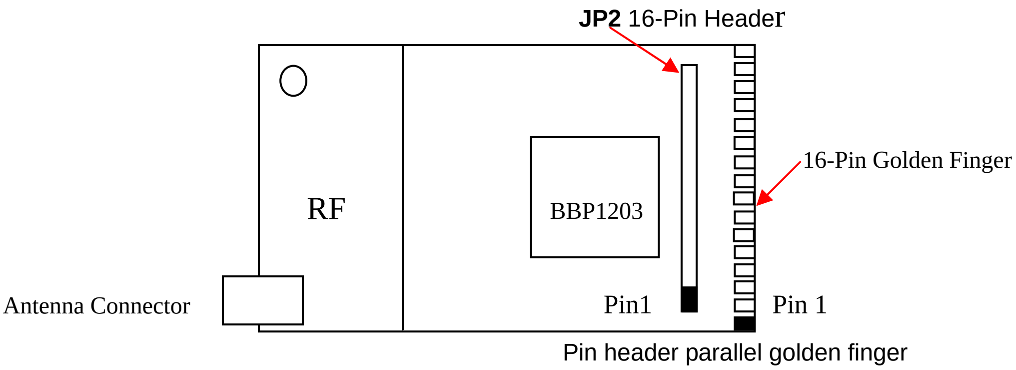

Figure 6

Pin	Function	Input/Output	Level	Pin	Function	Input/Output	Level
1	PIO1	In/Out	LVTTL	2	PIO10	In/Out	LVTTL
3	PIO11	In/Out	LVTTL	4	TXD0	Output	LVTTL
5	RXD0	Input	LVTTL	6	PWR_IN	Input	3.3V
7	GND	Ground	0V	8	LED0	In/Out	LVTTL
9	1PPS	Output	LVTTL	10	TXD1	Output	LVTTL
11	RXD1	Input	LVTTL	12	VBAT	Input	3.3V
13	ANT PWR	Input		14	PIO12	In/Out	LVTTL
15	PIO13	In/Out	LVTTL	16	PIO14	In/Out	LVTTL

The following is a functional description of the pins on the 16-pin interface connector.

Pin 1. PIO1: Reserved I/O port 1 from CPU

Pin 2. PIO10: Reserved I/O port 10 from CPU

Pin 3. PIO11: Reserved I/O port 11 from CPU

Pin 4. TXD0: Serial port output # 1 (GPS navigation output)

Pin 5. RXD0: Serial port input # 1 (command input)

Pin 6. PWR_IN: Power supply input, regulated 3.3V

Pin 7. GND: Ground

Pin 8. LED0: Reserved I/O port 31 from CPU

Pin 9. 1PPS: 1-pulse-per-second output.

Pin 10. TXD1: Serial port output #2 (currently unused)

Pin 11. RXD1: Serial port input #2 (DGPS input)

Pin 12. VBAT: External backup battery charging input

Pin 13. ANT PWR: External active antenna power input

Pin 14. PIO12: Either Reserved I/O port 12 from CPU or INT5

Pin 15. PIO13: Either Reserved I/O port 13 from CPU or INT6

Pin 16. PIO14: Reserved I/O port 14 from CPU

3.6.2 Pin Header Connector JP2 10-Pin Header

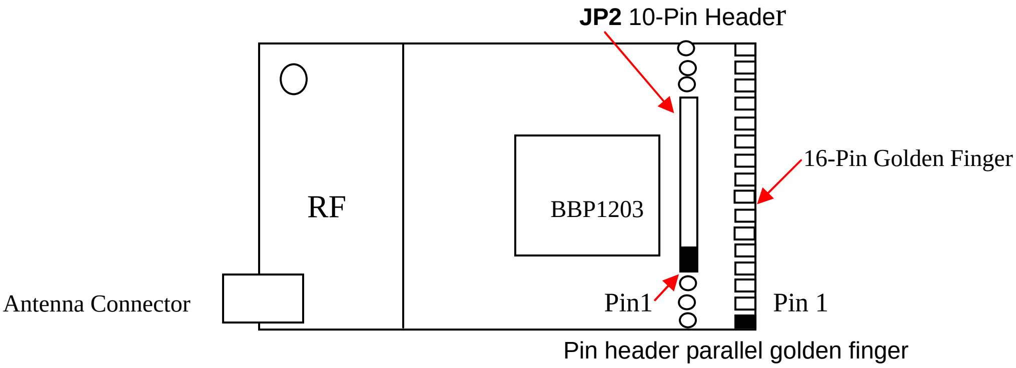

Figure 7

Pin	Function	Input/Output	Level	Pin	Function	Input/Output	Level
1	TXD0	Output	LVTTL	2	RXD0	Input	LVTTL
3	PWR_IN	Input	3.3V	4	GND	Ground	0V
5	LED0	In/Out	LVTTL	6	1PPS	Output	LVTTL
7	TXD1	Output	LVTTL	8	RXD1	Input	LVTTL
9	VBAT	Input	3.3V	10	ANT PWR	Input	

The following is a functional description of the pins on the 16-pin interface connector.

Pin 1. TXD0: Serial port output # 1 (GPS navigation output)

Pin 2. RXD0: Serial port input # 1 (command input)

Pin 3. PWR_IN: Power supply input, regulated 3.3V

Pin 4. GND: Ground

Pin 5. LED0: Reserved I/O port 31 from CPU

Pin 6. 1PPS: 1-pulse-per-second output.

Pin 7. TXD1: Serial port output #2 (currently unused)

Pin 8. RXD1: Serial port input #2 (DGPS input)

Pin 9. VBAT: External backup battery charging input

Pin 10. ANT PWR: External active antenna power input

3.7 One-Pulse-Per-Second Output

The one-pulse-per-second output is provided for applications requiring precise timing measurements. The output pulse is 1usec in duration. The rising edge of the output pulse is accurate to +/-1usec with respect to the start of each GPS second. The accuracy of the one-pulse-per-second output is maintained only when the receiver has valid position fix.

3.8 RTCM Differential Data

By using differential GPS (DGPS) correction data in RTCM SC-104 format with message types of 1, 2, 3, and 9, position accuracy of less than 5 meters can be achieved. RXD1, pin-8 of the 10-pin Molex connector shown in figure 2, or pin-11of the 16-pin header shown in figure 3,is used as the DGPS input. Differential correction is applied automatically when the correction data is received at 9600 baud.