# Jupiter 5V GPS Receiver, v2.30 Software Release

## *TU30-D140*

Conexant's Jupiter Global Positioning System (GPS) receiver is a single-board, 12 parallel-channel receiver engine intended as a component for an Original Equipment Manufacturer (OEM) product. The receiver (shown in Figures 1 and 2) continuously tracks all satellites in view, thus providing accurate satellite positioning data. It is designed for high performance and maximum flexibility in a wide range of OEM configurations including handhelds, panel mounts, sensors, and in-vehicle automotive products.

The highly integrated digital receiver uses the Zodiac chip set composed of two custom Conexant devices: the Gemini/Pisces Monopac™ and the Scorpio Digital Signal Processor (DSP). These two custom chips, together with suitable memory devices and a minimum of external components, form a complete low-power, high-performance GPS receiver solution for OEMs.

The Jupiter receiver decodes and processes signals from all visible GPS satellites. These satellites, in various orbits around the Earth, broadcast radio frequency (RF) ranging codes and navigation data messages. The receiver uses signals from all available satellites to produce a highly accurate and robust navigation solution that can be used in a wide variety of end product applications.

The Jupiter is packaged on a miniature printed circuit board intended for harsh industrial applications. The receiver requires conditioned DC power and a GPS signal from a passive or active antenna. The Jupiter receiver is available with a straight OSX, a right angle OSX, or a right angle SMB RF connector.

The all-in-view tracking of the Jupiter receiver provides robust performance in applications that require high vehicle dynamics and in applications that operate in areas of high signal blockage such as dense urban centers. The receiver continuously tracks all visible GPS satellites and uses all the measurements to produce an overdetermined, smoothed navigation solution. This solution is relatively immune to the position jumps induced by blockage that can occur in receivers with fewer channels.

## Features

- OEM product development is fully supported through applications engineering
- One of the smallest, most compact GPS receiver footprints measuring 2.800″ x 1.600″ x 0.442″ (approximately 71 x 41 x 11 mm)
- Twelve parallel satellite tracking channels for fast acquisition and reacquisition
- Support for true NMEA-0183 data protocol
- Direct, differential RTCM SC-104 data capability to dramatically improve positioning accuracy (in both Conexant binary and NMEA host modes)
- Enhanced algorithms provide superior navigation performance in "urban canyon" and dense foliage environments
- Adaptive threshold-based signal detection for improved reception of weak signals
- Static navigation enhancements to minimize wander due to Selective Availability (SA)
- Compatible with passive antennas for lowest total system cost or active antennas for installation flexibility
- Maximum navigation accuracy achievable with the Standard Positioning Service (SPS)
- Enhanced TTFF upon power-up when in a "Keep-Alive" power condition before start-up
- Meets rigorous shock and vibration requirements
- Automatic Altitude Hold Mode from Three-Dimensional to Two-Dimensional navigation
- Automatic cold start acquisition (when no initialization data is entered by the user)
- Maximum operational flexibility and configurability via user commands over the host serial port
- Ability to accept externally supplied initialization data, including almanacs and ephemerides, over the host serial port
- User selectable satellites
- User selectable visible satellite mask angle
- Different RF connectors available
- Standard 2x10 pin-field I/O connector
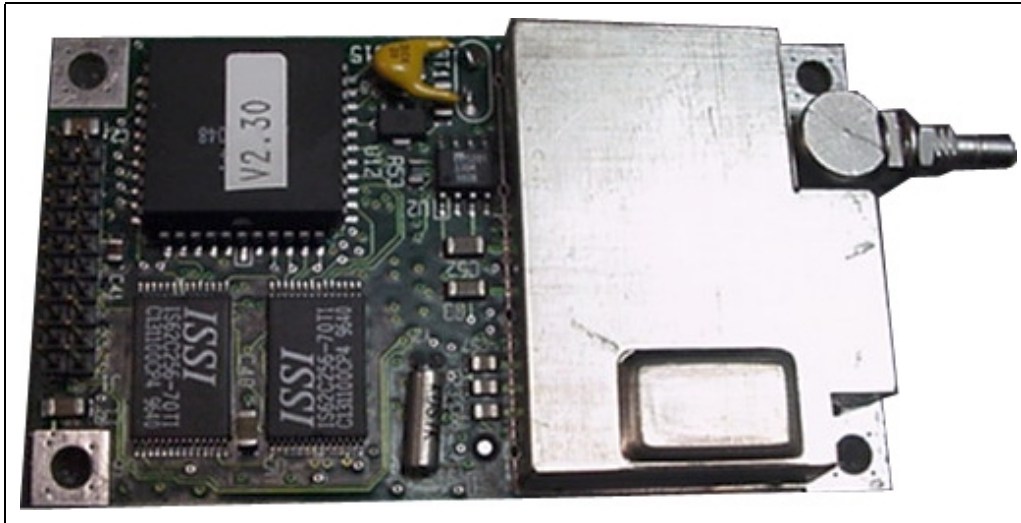- Operation/storage over an extended temperature range (–40° C to +85° C)

**Figure 1. The Conexant Jupiter GPS Receiver (-391) With Right Angle SMB RF Connector**
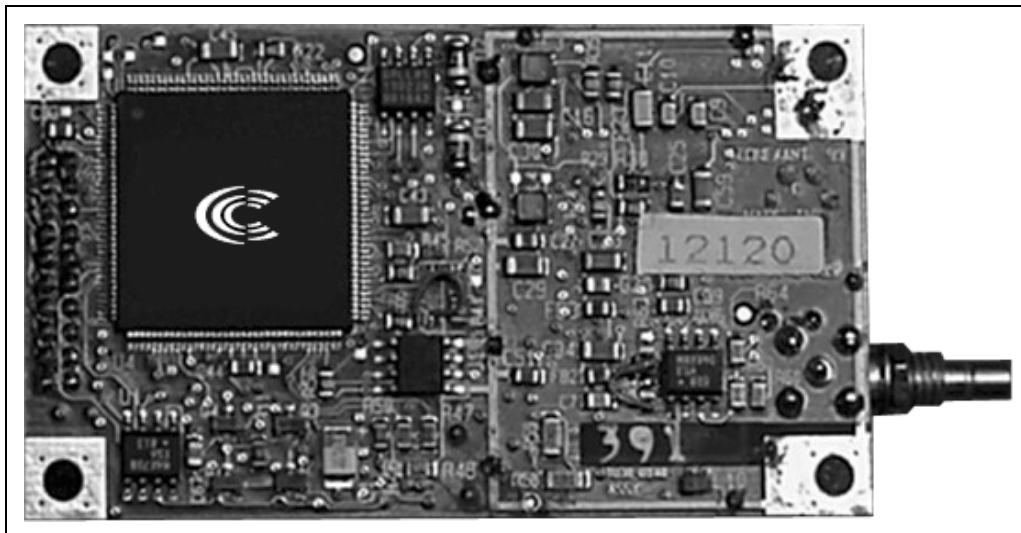**(Top View – Shown Approximately 1.5x Actual Size)**



**Figure 2. The Conexant Jupiter GPS Receiver (-391) With Right Angle SMB RF Connector**
**(Bottom View – Shown Approximately 1.5x Actual Size)**

The 12-channel architecture provides rapid Time-To-First-Fix (TTFF) under all startup conditions. While the best TTFF performance is achieved when time of day and current position estimates are provided to the receiver, the flexible signal acquisition system takes advantage of all available information to provide a rapid TTFF. Acquisition is guaranteed under all initialization conditions as long as visible satellites are not obscured.

To minimize TTFF when prime power is removed from the receiver, an external OEM-supplied DC supply voltage is required to maintain power to the Static Random Access Memory (SRAM) and to the Real-Time Clock (RTC). In this case, the shortest possible TTFF is achieved by using the RTC time data and prior position data stored in the receiver's SRAM.

The receiver supports Two-Dimensional (2-D) operation when less than four satellites are available or when required by operating conditions. Altitude information required for 2-D operation is determined by the receiver or may be provided by the OEM application.

Communication with the receiver is established through two identical, independent, asynchronous serial I/O ports that support full duplex data communication. The receiver's primary serial port (the host port) outputs navigation data and accepts commands from the OEM application in National Marine Electronics Association (NMEA-0183) format or Conexant binary message format.
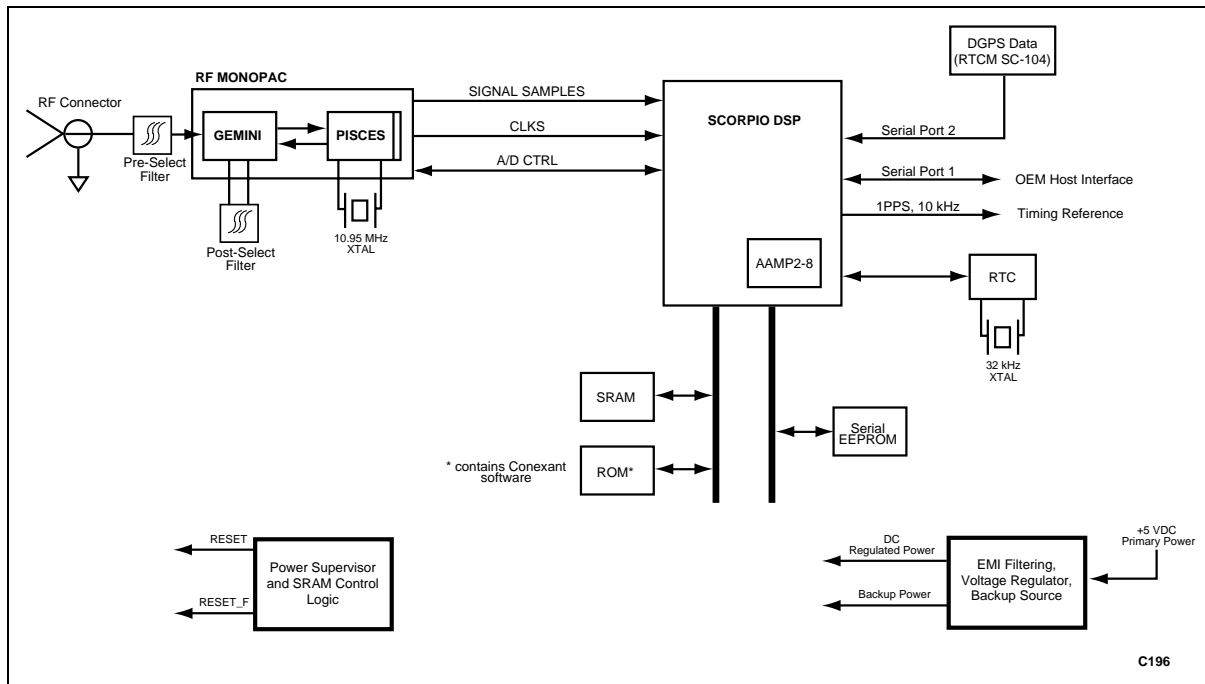
**Figure 3. Jupiter Receiver Architecture**

The secondary port (the auxiliary port) is configured to accept Differential GPS (DGPS) corrections in the Radio Technical Commission For Maritime Services (RTCM SC-104) format (a summary of the supported RTCM message types is listed in Table 10). A complete description of the serial data interface is contained in the Conexant document, *Zodiac GPS Receiver Family Designer's Guide.*

**Receiver Architecture.** The functional architecture of the Jupiter receiver is shown in Figure 3. The receiver design is based on the Conexant Zodiac chip set: the Gemini/Pisces Monopac™ and the Scorpio DSP, which contain the required GPS functionality. The Gemini/Pisces Monopac™ contains all the RF downconversion and amplification circuitry, and presents the In-Phase (I) and Quadrature-Phase (Q) Intermediate Frequency (IF) sampled data to the Scorpio device. The Scorpio device contains an integral microprocessor and all the required GPS-specific signal processing hardware. Memory and other external supporting components configure the receiver into a complete navigation system.

## Product Applications

The Jupiter GPS receiver is suitable for a wide range of OEM highly integrated GPS design applications such as:

- Handheld GPS receiver applications
- Automotive applications
- Marine navigation applications
- Aviation applications
- Timing applications

Figure 4 illustrates a typical architecture used to integrate the receiver with an applications processor that drives peripheral devices such as a display and keyboard. The interface between the applications processor and the receiver is through the serial data interface.

## Technical Description

**General Information**. The Jupiter GPS receiver requires +5V primary DC input power. The receiver can operate from either an active or passive GPS antenna, supplied by the OEM, to receive L1 band frequency GPS carrier signals.

Since the receiver determines its position by ranging signals from three or more GPS satellites orbiting the Earth, its antenna must have reasonable visibility of the sky. This is generally not a problem when the receiver is used outdoors in the open. However, when used indoors or inside of an automobile, the antenna should be positioned in such a way as to have an unobstructed "view" of the sky. To establish an initial navigation fix, the receiver requires a minimum of three satellites in track with good geometry (Geometric Dilution of Precision [GDOP] <10).

If satellite signals are blocked, the length of time for the receiver to receive those signals and determine its position is longer. If fewer than three satellites are being tracked, or if the satellite geometry is degraded, signal blockage may result in a failure to navigate.
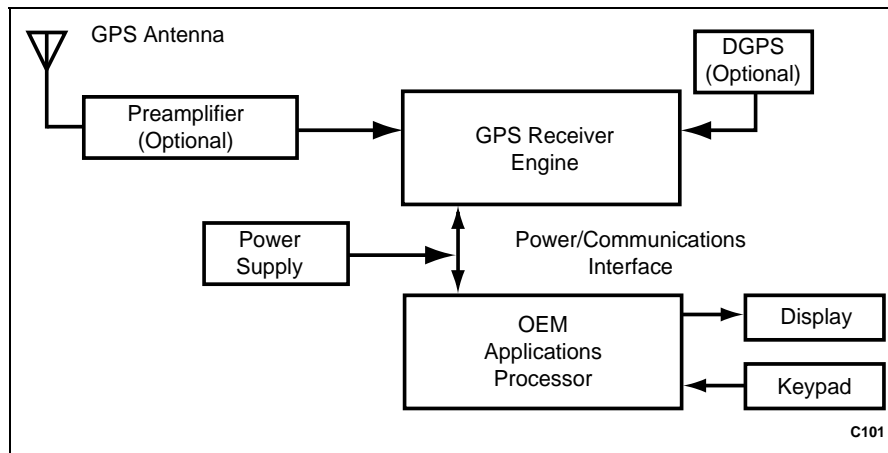
**Figure 4. Typical Jupiter/OEM Architecture**

**Table 1. Jupiter Receiver Signal Acquisition**

| Satellite Acquisition State | Time-To-First-Fix | | Initial Error Uncertainties (3 Sigma) | | | Maximum Almanac Age | Maximum Ephemeris Age |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | Typical (minutes) | 90% Probable (minutes) | Position (km) | Velocity (m/sec) | Time (minutes) | Weeks | Hours |
| Warm | 0.30 | 0.4 | 100 | 75 | 5 | 1 | 4 |
| Initialized | 0.8 | 1.0 | 100 | 75 | 5 | 1 | N/A |
| Cold | 2.0 | 2.5 | N/A | N/A | N/A | 1 | N/A |
| Frozen | (*) | (*) | N/A | N/A | N/A | N/A | N/A |

N/A = Not available in real-time to the receiver. Note that times are valid at 25 degrees Celsius with no satellite signal blockage.

(*) = Frozen start is considered to be a recovery mode. An "out-of-the-box" board that has not operated for a significant amount of time (months) may approximate this state because the data in EEPROM may be valid but expired or partially complete.

**Satellite Acquisition**. The Jupiter GPS receiver supports four types of satellite signal acquisition depending on the availability of critical data. Table 1 provides the corresponding TTFF times for each of the following acquisition states.

- **Warm Start**. A warm start results from a software reset after a period of continuous navigation or a return from a short idle period (i.e., a few minutes) that was preceded by a period of continuous navigation. In this state, all of the critical data (position, velocity, time, and satellite ephemeris) is valid to the specified accuracy and available in SRAM.
- **Initialized Start**. An initialized start typically results from user-supplied position and time initialization data or continuous RTC operation with an accurate last known position available from EEPROM. In this state, position and time data are present and valid but ephemeris data validity has expired.

- **Cold Start**. A cold start acquisition state results when position and/or time data is unknown, either of which results in an unreliable satellite visibility list. Almanac information is used to identify previously healthy satellites.
- **Frozen Start**. A frozen start acquisition state occurs if there are no valid internal data sources available.

**Navigation Modes.** The Jupiter GPS receiver supports three types of Navigation Mode operations: Three-Dimensional (3-D), Two-Dimensional (2-D), and DGPS. Each of these modes is briefly described below:

- **Three-Dimensional Navigation (3-D)**. The receiver defaults to 3-D navigation whenever at least four GPS satellites are being tracked. In 3-D navigation, the receiver computes latitude, longitude, altitude, and time information from satellite measurements. The accuracies that can be obtained in 3-D navigation are shown in Table 2.

**Table 2. GPS Receiver Navigational Accuracies**

| | Position (meters) | | | | Velocity |
|---|---|---|---|---|---|
| | Horizontal | | 3-D | Vertical | (meters/sec) |
| | CEP | (2 dRMS) | | | 3-D (2 sigma) |
| Full Accuracy C/A | 25 | 50 | 93 | 78 | 0.1 |
| Standard Positioning Service (SPS) | 50 | 100 (95%) | 200 (95%) | 173 (95%) | Note 1 |
| **Note 1**: Velocity accuracies for SPS are not specified for the GPS system. | | | | | |

- **Two-Dimensional Navigation (2-D)**. When less than four GPS satellite signals are available and when a fixed value of altitude can be used to produce an acceptable navigation solution, the Jupiter receiver enters the 2-D navigation mode from 3-D navigation. The receiver uses a fixed value of altitude determined either during prior 3-D navigation or as provided by the OEM. Forced operation in 2-D mode can be commanded by the OEM.

  In 2-D navigation, the navigational accuracy is primarily determined by the relationship of the fixed value of altitude to the true altitude of the antenna. If the fixed value is correct, the horizontal accuracies shown in Table 2 apply. Otherwise, the horizontal accuracies degrade as a function of the error in the fixed altitude.

- **DGPS Navigation**. DGPS corrections must be compliant with the RTCM recommended standards for differential Navstar GPS service, also known as RTCM SC-104. DGPS corrections are processed through the receiver's Auxiliary serial port (port 2). DGPS corrections are also processed using Conexant binary message 1351 (refer to the *Zodiac GPS Receiver Family Designer's Guide*) through the receiver's Host serial port (port 1). Binary message 1351 contains RTCM data.

  Depending on the DGPS configuration, navigational accuracies can be improved dramatically in 3-D DGPS mode and the Jupiter supports the accuracies described in the RTCM SC-104 document.

**Power Modes And Power Sequencing Requirements**. The Jupiter receiver has three power modes: Off, Operate, and "Keep-Alive." Table 3 summarizes the signal conditions and current requirements for each of these modes. The Off mode assumes that neither primary power nor external "Keep-Alive" voltage is available.

The Off mode implies that the receiver is completely de-energized. The Operate mode implies that the receiver is completely energized. The "Keep-Alive" mode implies that primary power has been removed but that an external DC voltage source is provided for backup of the SRAM and RTC.

- **Off mode**. The receiver is completely de-energized including all DC supply input signals, serial data input signals, and control input signals.

- **Operate mode**. The receiver enters its Operate power mode when the receiver's components are fully energized at +5 ± 0.25 VDC. The M_RST control signal must be asserted or at a CMOS "high" logic level.

- **"Keep-Alive" mode**. From Operate mode, the receiver enters a "Keep-Alive" mode when PWRIN voltage is removed, provided that an external DC supply voltage is available at the VBATT signal input. In this state, the external voltage supply provides power for the SRAM and RTC. If the board is subsequently powered up from this state, the receiver uses the current time maintained by the RTC as well as critical satellite data stored in SRAM to achieve rapid TTFF.

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*Caution*: *During the OFF or "Keep-Alive" modes, de-energizing (i.e., not driven to a CMOS "high" level) the following I/O functions is recommended:*

- *Master Reset (pin J1-5).*
- *NMEA Protocol Select (pin J1-7).*
- *ROM Default Select (pin J1-8).*
- *Time Mark Pulse (pin J1-19).*
- *Host Port Serial Data Output and Input (pins J1-11 and 12).*
- *Auxiliary Port Serial Data Input (pin J1-15).*

*Violation of the specified operating voltages results in erratic receiver operation. The voltage threshold level at which the receiver's power supervisory circuit places the receiver's microprocessor in reset is +4.5 (+0/-0.2) VDC, in which case PWRIN continues to supply power to the receiver. No damage occurs if PWRIN dwells in this uncertainty region, but power dissipation is affected. Also, critical SRAM data and RTC time keeping may become corrupted, affecting TTFF when the receiver is returned to normal operating conditions.*

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**Table 3. Jupiter GPS Receiver External Power Requirements**
**(Typical, Measured at 25° C)**

| Input Voltage | Requirement By Mode | | |
|---|---|---|---|
| | Operate | "Keep-Alive" (5 VDC) | "Keep-Alive" (3 VDC) |
| PWRIN Voltage | +5 ± 0.25V | 0V or GND | 0V or GND |
| PWRIN current (Typical) | 195mA (975mW) | N/A | N/A |
| PWRIN current (Maximum) | 230mA (1150mW) | N/A | N/A |
| PWRIN Ripple P-P | 100mV | N/A | N/A |
| VBATT Voltage | Note 1 | +5 ± 0.25V | +3 ± 0. 50V |
| VBATT Current | N/A | 75μA | 40μA |
| VBATT Maximum Power | N/A | 0.38mW | 0.12mW |
| **Note 1**: VBATT should not exceed PWRIN while in Operate Mode. | | | |

**Power-Up Sequencing.** The power-up sequence for the Jupiter receiver is the same from either the OFF mode or the "Keep-Alive" mode. Primary DC power, as specified in Table 3, is applied to the PWRIN pin of the receiver's OEM interface connector by the host system. If the M_RST pin on the interface connector is asserted high when DC power is applied, the receiver begins normal operation after 200 ms.

## Technical Specifications

**Operational Characteristics** _____

**Signal Acquisition Performance**. Refer to Table 1. The values shown are based on unobscured satellite signals.

**Accuracy**. Accuracy is a function of the entire Navstar system and geometry of the satellites at the time of measurement. In general, individual receivers have very little influence over the accuracy provided. Navigational accuracies using Full Accuracy C/A Code (SA Off) and the SPS (SA On) are shown in Table 2. These accuracies are based on a Position Dilution of Precision (PDOP) of 6.0 and the maximum vehicle dynamic of 500 m/sec.

**Solution Update Rate**. Once per second.

**Reacquisition**. 2 seconds typical with a 10 second blockage.

**RTCM SC-104 Differential Compatibility**. Direct data input over the Auxiliary serial port or indirect data input using Conexant binary message 1351 over the Host serial port (refer to the *Zodiac GPS Receiver Family Designer's Guide* for details).

**Time Mark**. Once per second.

**Serial Data Output Protocol**. Conexant binary serial I/O messages or NMEA-0183 serial I/O messages.

**Power Requirements** _____

Regulated power for the Jupiter GPS receiver is required according to the information provided in Table 3.

When the receiver is operated with an active GPS antenna, the antenna's maximum preamp "pass-through" current is 50 mA at voltages up to +12V. This current must be limited outside of the receiver.

**Radio Frequency Signal Environment** _____

**RF Input**. 1575.42 MHz (L1 band) at a level between –130 dBW and –163 dBW. The RF input connects to an OSX high-retention female connector for the -371 and -381 configurations or an SMB high retention female connector for the –391 configuration.

**Burnout Protection**. –10 dBW signal within a bandwidth of 10 MHz centered about the L1 carrier frequency.

**Physical** _____

**Dimensions**. 2.800" x 1.600" x 0.442" (71 mm x 41 mm x 11 mm) with 3 RF connector options: straight OSX, right angle OSX, or right angle SMB. The Jupiter board also provides a standard 2x10 pin-field I/O connector.

**Weight**. 0.85 ounces (23.8 gm)

**Environmental** _____

**Cooling (operating/storage)**. Convection

**Temperature (operating/storage)**. –40°C to +85°C

**Humidity**. Relative humidity up to 95% noncondensing or a wet-bulb temperature of +35° C, whichever is less.
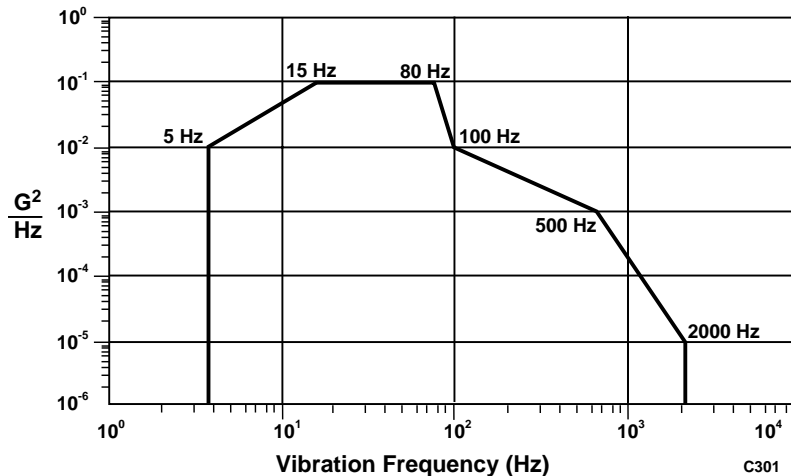
**Figure 5. SAE Composite Curve (Random Noise)**

**Altitude (operating/storage)**. –1000 feet to 60,000 feet.

**Maximum Vehicle Dynamic**. 500 m/sec (acquisition and navigation).

**Vibration**. Full Performance, see the composite SAE curve in Figure 5. Survival, 18G peak, 5 msec duration.

**Shock**. Shipping (in container): 10 drops from 75 cm onto a concrete floor.

**RF Connector** _____

The RF connector is a 50 Ohm standard straight OSX subminiature, snap-on coaxial RF jack receptacle. Optional right angle OSX and SMB connectors are also available.

**OEM Interface Connector** _____

The OEM communications interface is a dual row, straight 2x10 pin field connector header. The pins are spaced on 2.0 mm (0.0787 in) centers and the pin lengths are 7.62 mm (0.300 in) on the board configuration containing a straight or right angle OSX RF connector. The pin lengths are 10.16 mm (0.400 in) on the board configuration containing the right angle SMB connector. Figure 6 diagrams the pin 1 reference location (pin 4 is not installed).

**Mechanical Layout** _____

A mechanical drawing for the Jupiter 5V GPS receiver board is shown in Figure 7.

## ESD Sensitivity

The Jupiter GPS receiver contains Class 1 devices. The following Electrostatic Discharge (ESD) precautions are recommended:

- Protective outer garments
- Handle device in ESD safeguarded work area
- Transport device in ESD shielded containers
- Monitor and test all ESD protection equipment

Treat the Jupiter GPS receiver as extremely sensitive to ESD.

## Hardware Interface

The electrical interface for the Jupiter receiver is a standard 2x10 pin field connector header that is used for all data input and output. A pinout description for this connector is provided in Table 4.

The following paragraphs describe the function of each pin on the 2x10 pin field interface connector. These functions are divided into three groups: Configuration and timing signals, serial communication signals, and DC input signals.

**Configuration And Timing Signals** _____

**Pin J1-5: Master Reset (M_RST) – Active Low**
This signal allows the OEM to generate a system hardware reset to the receiver. This signal is capable of being driven directly by an external microprocessor or by external logic without the need for any external pull-up or pull-down resistors. The OEM can generate a system reset to the receiver by pulling the M_RST control signal low to ground.

*Note:* *The M_RST signal must be pulled to a CMOS logic "high" level coincident with, or after, the application of prime DC power for the receiver to enter its Operate mode. The M_RST must be held at ground level for a minimum of 150 nanoseconds to assure proper generation of a hardware reset to the receiver.*
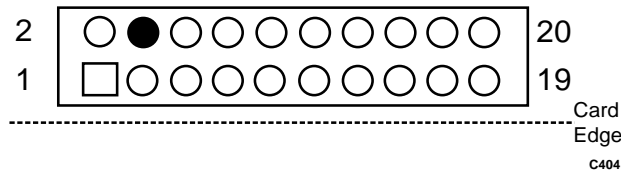
**Figure 6. 2x10 Pin Field Connector (J1) Pin 1 Reference Location (Top View)**

**Table 4. Jupiter Receiver Standard 2x10 Pin Field OEM Interface Connector Pinout**

| Pin # | Name | Description | Pin # | Name | Description |
|-------|------|-------------|-------|------|-------------|
| 1 | PREAMP | Preamp power input | 11 | SDO1 | Serial data output port #1 |
| 2 | PWRIN_5 | Primary +5 VDC power input | 12 | SDI1 | Serial data input port #1 |
| 3 | VBATT | Battery backup voltage input | 13 | GND | Ground |
| 4 | N/C | Reserved (no connect) | 14 | N/C | Reserved (no connect) |
| 5 | M_RST | Master reset input (active low) | 15 | SDI2 | Serial data input port #2 |
| 6 | N/C | Reserved (no connect) | 16 | GND | Ground |
| 7 | GPIO2 | NMEA protocol select | 17 | GND | Ground |
| 8 | GPIO3 | ROM default select | 18 | GND | Ground |
| 9 | GPIO4 | Reserved (no connect) | 19 | TMARK | 1 PPS time mark output |
| 10 | GND | Ground | 20 | 10KHZ | 10 kHz clock output |

This signal can also be used to provide control of the Jupiter receiver's Operate mode without removing primary input power from the receiver. When M_RST is pulled to ground, the receiver enters a low power state for as long as the M_RST signal is asserted low. In this state, a portion of the receiver's RF circuitry is de-energized, the SRAMs are transitioned into their low power data retention state, and the RTC device is maintained. When the receiver is placed into this low power state through the use of the M_RST control signal, the receiver continues to draw current from the primary input power (PWRIN) but at a reduced level.

When the M_RST signal is subsequently asserted high by the OEM, RF power is re-applied, a system reset is generated after a 0.25 second delay, and the receiver is returned to its normal Operate mode.

**Pin J1-6: Reserved**
This signal is reserved and **NO** electrical connections should be made to the OEM application.

*Note:* *All pins designated as GPIO pins (J1-7, J1-8, and J1-9) are only examined by the receiver at the time the receiver is reset with either: a hardware reset signal (J1-5); by removing and reapplying power; or by sending a software reset message (Conexant binary message 1303). For settings on these pins to be effective, they must be set immediately before a reset occurs.*

**Pin J1-7: NMEA Protocol Select (GPIO2)**
The Jupiter receiver has two hardware selectable message protocols that may be used to communicate over the host serial I/O port. These message protocols are a Conexant binary message format and a NMEA ASCII message format.

When this signal is pulled "low," the receiver communicates over the host serial port using the NMEA message format (4800 bps, no parity, 8 data bits, and 1 stop bit).

When this signal is pulled "high," the receiver communicates over the host serial I/O port using the format determined by the setting of the Read-Only Memory (ROM) Default Select pin (J1-8).

Binary and NMEA messages are both described in the Conexant document, *Zodiac GPS Receiver Family Designer's Guide.*

**Pin J1-8: ROM Default Select (GPIO3)**
This signal determines whether the message format, host port communication settings, receiver default message set, and initialization data parameters are obtained from default values stored in ROM or from user-configurable settings stored in SRAM/EEPROM. If this signal is pulled "low," the ROM-based factory default values are used.
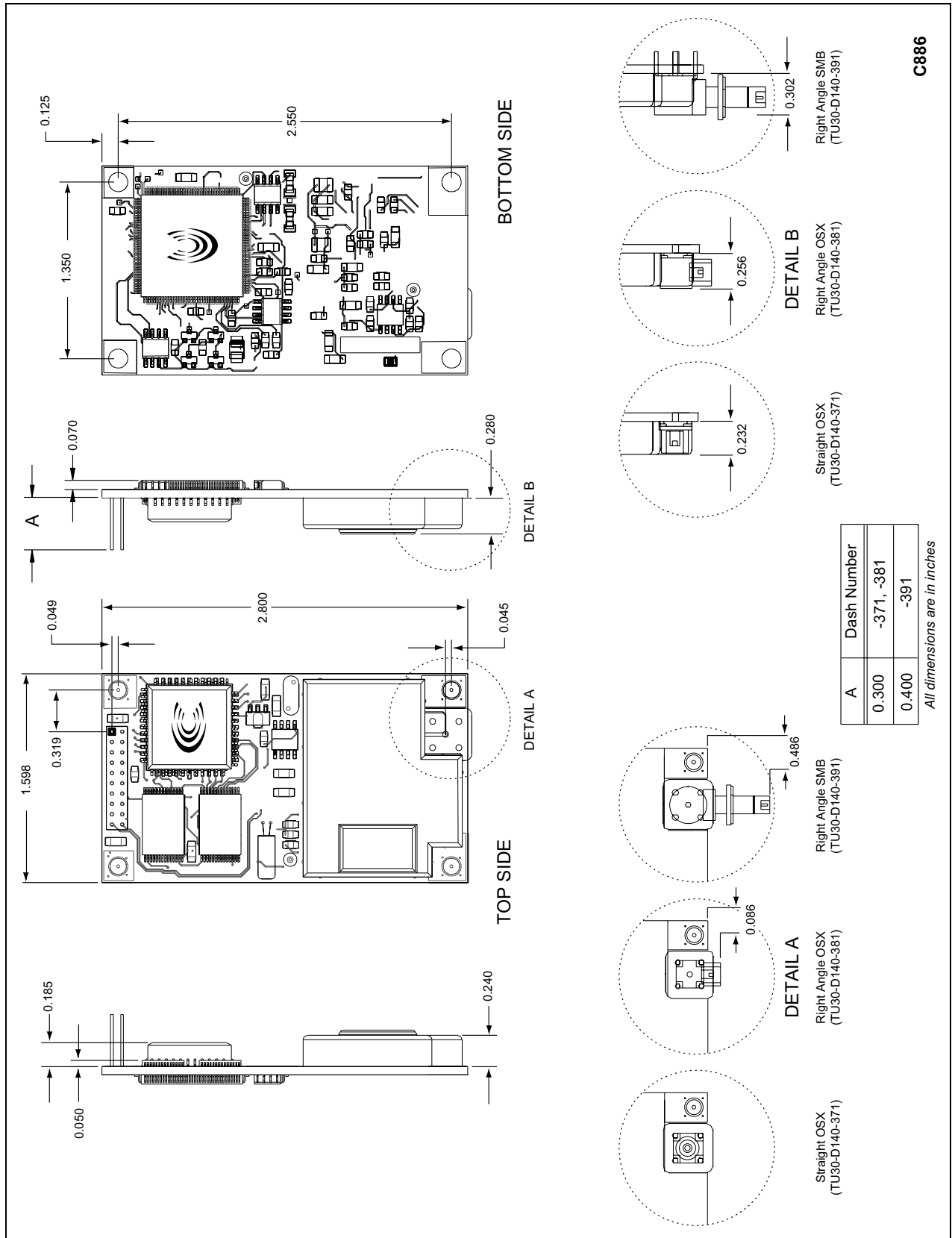
**Conexant – Preliminary**
Proprietary Information

**Figure 7.** **Mechanical Drawing of the Jupiter 5V GPS Receiver Board**

**Conexant – Preliminary**
Proprietary Information

| A | Dash Number |
|---|---|
| 0.300 | -371, -381 |
| 0.400 | -391 |

*All dimensions are in inches*

*Note:    When the ROM defaults select signal (GPIO3) is pulled "low," each power cycle or reset of the receiver results in a longer TTFF. This is because the receiver uses default initialization parameters stored in ROM rather than the current initialization parameters that may be available in SRAM or EEPROM.*

The default values for NMEA protocol are 4800 bps Rx/Tx, no parity, 8 data bits, and 1 stop bit. The default values for binary protocol are 9600 bps Rx/Tx, no parity, 8 data bits, and 1 stop bit.

If this signal is pulled "high," the port configuration parameters are accessed in the following priority:

1.    If SRAM checksums are valid, the communication parameters and initialization data parameters are read from SRAM.
2.    If SRAM checksums are invalid and EEPROM checksums are valid, the communication parameters and initialization data parameters are read from EEPROM.
3.    If SRAM checksums are invalid and EEPROM checksums are invalid, the default values in ROM are used.

The relationship between the user-selectable functions (GPIO2 and GPIO3) is shown in Table 5.

### Pin J1-9: Reserved (GPIO4)
This signal is reserved and **NO** electrical connections should be made to the OEM application.

### Pin J1-14: Reserved
This signal is reserved and **NO** electrical connections should be made to the OEM application.

*Note:    Both the configuration and timing signals, and the serial communication signals described in the next two sections must be applied according to the limits shown in Table 6.*

### Pin J1-19: UTC Time Mark Pulse (TMARK)
The Time Mark output provides a one pulse-per-second (1 pps) signal to the OEM application processor. When the receiver provides a valid navigation solution, the rising edge of each TMARK pulse is synchronized with the UTC one second epochs to within ±300 nsec (3σ).

When the receiver operates using the Conexant binary message protocol, the receiver's software produces a message containing the UTC time associated with each time mark pulse. The relationship between the UTC Time Mark Pulse Output message and the TMARK pulse is shown in Figure 8. When the receiver's serial data communication port is set to 9600 bps, the UTC Time Mark Pulse Output message precedes the TMARK pulse by 400 to 500 ms (typically).
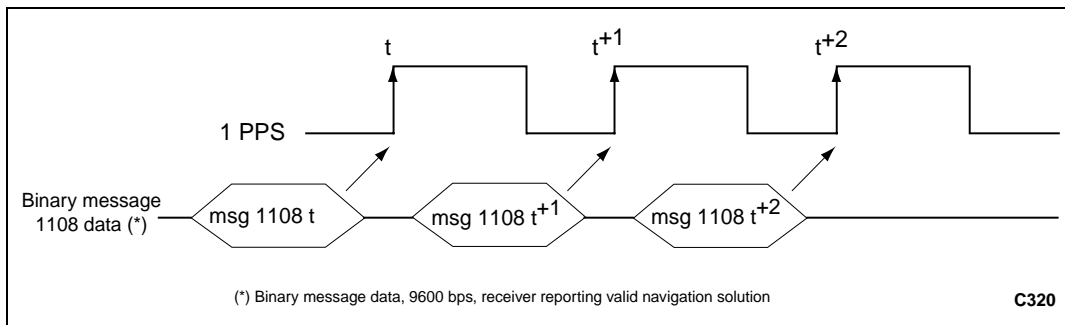
The TMARK pulse waveform is shown in Figure 9. This signal is a positive logic, buffered CMOS level output pulse that transitions from a logic "low" condition to a logic "high" at a 1 Hz rate. The TMARK output pulse rise time is typically less than 2 ns and the pulse duration is typically 25.6 ms.

**Table 5. Jupiter Receiver Serial Port Configuration Truth Table**

| NMEA Protocol Select (Pin 7) | ROM Default Select (Pin 8) | Result |
|---|---|---|
| 0 | 0 | NMEA message format; host port communication settings = 4800 bps, no parity, 8 data bits, 1 stop bit. The receiver operates from default initialization values stored in ROM and outputs the default NMEA message set from ROM. |
| 0 | 1 | NMEA message format; host port communication settings = 4800 bps, no parity, 8 data bits, 1 stop bit. The receiver selects the default NMEA output message set and uses initialization values from the data stored in SRAM or EEPROM (Note 1). |
| 1 | 0 | Binary message format; host port communication settings = 9600 bps, no parity, 8 data bits, 1 stop bit. The receiver operates from default initialization values stored in ROM. |
| 1 | 1 | Data stored in SRAM or EEPROM determines message format, host port communication settings, and default message set (Note 1). |
| **Note 1**: For further information, refer to the description of the ROM Default Select pin (J1-8) below. | | |

**Conexant – Preliminary**
March 8, 2000

**Table 6. Jupiter GPS Receiver Digital Signal Requirements**

| Symbol | Parameter | Limits (Note 1) | Units |
|--------|-----------|-----------------|-------|
| PWRIN_5 | Primary Power Input to the Jupiter (+5 VDC) | 4.75 to 5.25 | volts |
| VIH (min) | Minimum High-Level Input Voltage | 0.7 x PWRIN | volts |
| VIH (max) | Maximum High-Level Input Voltage | PWRIN | volts |
| VIL (min) | Minimum Low-Level Input Voltage | −0.3 | volts |
| VIL (max) | Maximum Low-Level Input Voltage | 0.3 x PWRIN | volts |
| VOH (min) | Minimum High-Level Output Voltage | 0.8 x PWRIN | volts |
| VOH (max) | Maximum High-Level Output Voltage | PWRIN | volts |
| VOL (min) | Minimum Low-Level Output Voltage | 0 | volts |
| VOL (max) | Maximum Low-Level Output Voltage | 0.2 x PWRIN | volts |
| tr, tf | Input Rise and Fall Time | 50 | nanoseconds |
| C out | Maximum Output Load Capacitance | 25 | picofarads |
| **Note 1**: PWRIN refers to a +5 VDC power input (PWRIN_5). | | | |



(*) Binary message data, 9600 bps, receiver reporting valid navigation solution     **C320**

**Figure 8. UTC Time Mark Pulse Output Message/UTC TMARK Pulse Relationship**
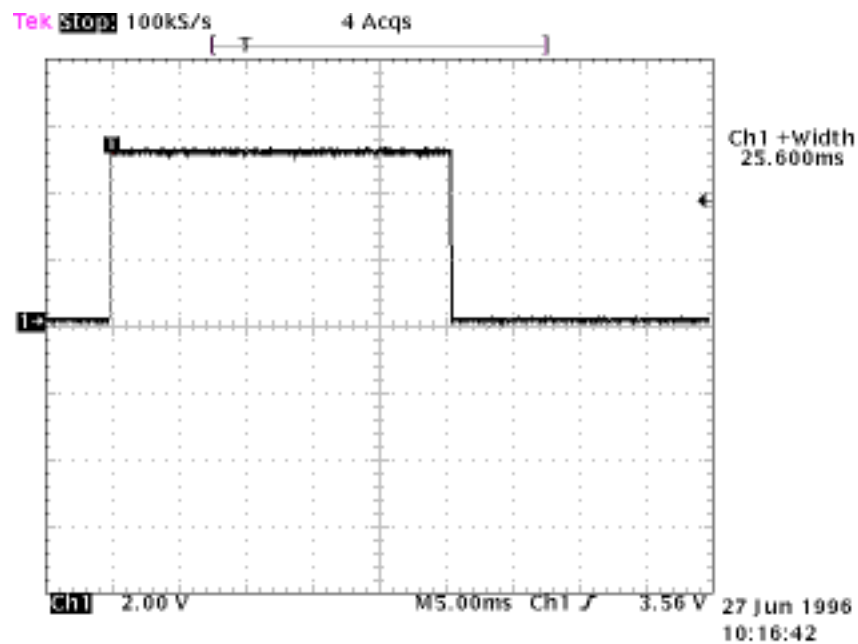
**Figure 9. Jupiter GPS Receiver Time Mark Pulse Waveform**

**Pin J1-20: 10 kHz UTC Synchronized Clock**

The UTC TMARK pulse starts on the rising edge of the 10 kHz clock pulse most closely associated with the start of the GPS second, and falls on the 256th pulse after the start. Figure 10 shows the relationship between the start of the UTC TMARK pulse and the 10 kHz clock. This clock signal is a positive logic, buffered CMOS output.

**Serial Communication Signals** _____

*Note:    Both serial ports have default settings for baud rate, parity, data, and stop bits. However, either port can be reconfigured to standard rates, parity, and number of bits using the Conexant binary message 1330.*

**Pins J1-11 and 12**: Host Port Serial Data Output And Input (SDO1 and SDI1)

The host port consists of a full-duplex asynchronous serial data interface. Both binary and NMEA initialization and configuration data messages are transmitted and received across this port.

When the NMEA Protocol Select pin (J1-7) is "low" during reset initialization, the Host port is set to NMEA protocol, 4800 baud, no parity, 8 data bits, and 1 stop bit. Otherwise, the last saved setting is used.

If there is no last saved setting, the port is set to Conexant binary protocol, 9600 baud, no parity, 8 data bits, and 1 stop bit.

The OEM application must provide any Line Driver/Line Receiver (LD/LR) circuitry to extend the range of the interface. Port idle is nominally a CMOS logical high (+5 VDC).

**Pin J1-15: Auxiliary Port Serial Data Input (SDI2)**

The auxiliary port consists of a second half-duplex asynchronous serial data interface. This port is configured to receive RTCM DGPS correction data messages.

When the NMEA Protocol Select pin (J1-7) is "low" during reset initialization, the Auxiliary Port Serial Data input defaults to 9600 baud, no parity, 8 data bits, and 1 stop bit. Otherwise, the last saved setting is used.

The OEM application must provide any LD/LR circuitry to extend the range of the interface. Port idle is nominally a CMOS logical high (+5 VDC).

**DC Input Signals** _____

**Pin J1-1: Preamp Power Input (PREAMP)**

The OEM may optionally supply power to a preamplifier using the antenna cable center conductor. The maximum voltage is +12 VDC and the current must not exceed 50 mA. If the OEM uses a passive antenna, Conexant recommends that this pin be grounded to help reduce noise in the RF input.

*Warning*:    *Do not apply power to a passive antenna or damage to the receiver may occur.*

**Pin J1-2: Power Input (PWRIN_5)**

This signal is the primary power input to the Jupiter receiver. Regulated DC power requirements are shown in Table 3.

**Pin J1-3: Battery Backup Power Input (VBATT)**

This signal is used to provide a DC power input to the SRAM and RTC devices only. The receiver automatically switches to the VBATT input signal when primary DC power (PWRIN) is removed from the board.
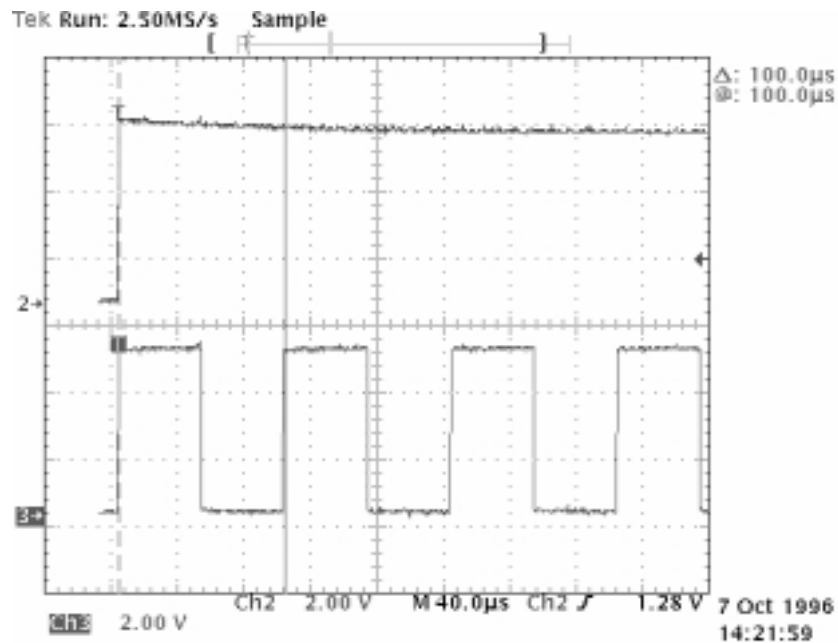
**Figure 10. 10 kHz Clock Waveform/UTC TMARK Pulse Relationship**

This feature is intended to provide the receiver with a "warm start" capability by maintaining an accurate time source and using position and satellite data stored in SRAM after prime input power (PWRIN) has been removed from the receiver.

In the standby mode, the receiver draws only a few microamps (see Table 3). This current level is appropriate for battery use. However, the battery voltage must be equal to, or less than, the normal PWRIN voltage so that during periods when the receiver operates on normal power, the battery is not required to supply full SRAM power. Since the SRAM chips do not require more than 3V to maintain their memory, it is acceptable to supply them with a 3V battery even when the rest of the system is 5V.

**Pin J1-4: Reserved**
This signal is reserved and no electrical connections should be made to the OEM application.

**Pins J1-10, 13, 16, 17, and 18: Ground (GND)**
DC grounds for the board. All grounds are tied together through the receiver's printed wiring board (PWB) ground plane and should all be grounded externally to the receiver.

## Software Interface

The host serial I/O port of the Jupiter's serial data interface supports full duplex communication between the receiver and the OEM application. Data messages can be in the Conexant binary format or NMEA-0183 format. The receiver also contains an auxiliary port dedicated to direct processing of the RTCM SC-104 messages for DGPS corrections.

**Binary Data Messages**. All of the output and input binary messages for the Jupiter receiver are listed in Table 7, along with their corresponding message IDs. A complete description of each binary message is contained in the Conexant document, *Zodiac GPS Receiver Family Designer's Guide*.

**NMEA Data Messages**. The Jupiter LP supports NMEA v2.01 data messages. All of the output and input NMEA messages for the Jupiter receiver are listed in Table 8 along with their corresponding message IDs. A complete description of each NMEA message is contained in the Conexant document, *Zodiac GPS Receiver Family Designer's Guide*.

**RTCM SC-104 Data Messages**. Table 9 lists those messages defined in the RTCM SC-104 standard that are used by the Jupiter receiver to form a DGPS position solution (not all DGPS messages are necessary for DGPS operation).

**Table 7. Jupiter Receiver Binary Data Messages**

| Output Message Name | Message ID | Input Message Name | Message ID |
|---|---|---|---|
| Geodetic Position Status Output (*) | 1000 | Geodetic Position and Velocity Initialization | 1200 |
| Channel Summary (*) | 1002 | User-Defined Datum Definition | 1210 |
| Visible Satellites (*) | 1003 | Map Datum Select | 1211 |
| Differential GPS Status | 1005 | Satellite Elevation Mask Control | 1212 |
| Channel Measurement | 1007 | Satellite Candidate Select | 1213 |
| ECEF Position Output | 1009 | Differential GPS Control | 1214 |
| Receiver ID (**) | 1011 | Cold Start Control | 1216 |
| User-Settings Output | 1012 | Solution Validity Criteria | 1217 |
| Raw Almanac Output | 1040 | User-Entered Altitude Input | 1219 |
| Raw Ephemeris Output | 1041 | Application Platform Control | 1220 |
| Raw Ionospheric and UTC Corrections Output | 1042 | Nav Configuration | 1221 |
| Built-In Test Results | 1100 | Raw Almanac Input | 1240 |
| UTC Time Mark Pulse Output (*) | 1108 | Raw Ephemeris Input | 1241 |
| Frequency Standard Parameters In Use | 1110 | Raw Ionospheric and UTC Corrections Input | 1242 |
| Serial Port Communication Parameters In Use | 1130 | Perform Built-In Test Command | 1300 |
| EEPROM Update | 1135 | Restart Command | 1303 |
| EEPROM Status | 1136 | Frequency Standard Input Parameters | 1310 |
| Frequency Standard Table Output Data | 1160 | Serial Port Communication Parameters | 1330 |
| Error/Status | 1190 | Message Protocol Control | 1331 |
|  |  | Factory Calibration Input | 1350 |
|  |  | Raw DGPS RTCM SC-104 Data | 1351 |
|  |  | Frequency Standard Table Input Data | 1360 |

(*) Enabled by default at power-up.

(**) Output by default once at power-up or reset.

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**Table 8. Jupiter Receiver NMEA v2.01 Data Messages**

| Output Message Name | Message ID | Input Message Name | Message ID |
|---|---|---|---|
| Conexant Proprietary Built-In Test (BIT) Results | BIT | Conexant Proprietary Built-In Test (BIT) Command | IBIT |
| Conexant Proprietary Error/Status | ERR | Conexant Proprietary Log Control Message | ILOG |
| GPS Fix Data (*) | GGA | Conexant Proprietary Receiver Initialization | INIT |
| GPS DOP and Active Satellites (*) | GSA | Conexant Proprietary Protocol Message | IPRO |
| GPS Satellites in View (*) | GSV | Standard Query Message | Q |
| Conexant Proprietary Receiver ID (**) | RID | | |
| Recommended Minimum Specific GPS Data (*) | RMC | | |
| Track Made Good and Ground Speed | VTG | | |
| Conexant Proprietary Zodiac Channel Status (*) | ZCH | | |
| (*) Enabled by default at power-up. | | | |
| (**) Output by default once at power-up or reset. | | | |

**Table 9. Jupiter Receiver RTCM SC-104 Data Messages**

| Message ID | Title | Used For DGPS Corrections? |
|---|---|---|
| 1 | Differential GPS Corrections | Yes |
| 2 | Delta DGPS Corrections | Yes |
| 3 | Reference Station Parameters | No |
| 6 | Null Frame | No |
| 9 | Partial Satellite Set Differential Corrections | Yes |

## Ordering Information

| Model Name | Manufacturing Part Number | Product Revision |
|---|---|---|
| Jupiter | TU30-D140 | |
| w/straight OSX | | -371 |
| w/right angle OSX | | -381 |
| w/right angle SMB | | -391 |

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