NAVMAN WIRELESS

Jupiter 31

GPS receiver module

Data Sheet

SiRF Powered

Related documents

- Jupiter 31 Product brief LA010810
- Jupiter 31 Application Note: Comparison between Jupiter 31 and Jupiter 21/J21S LA010812
- J30 Write to Flash Application Note LA000266
- Low Power Operating Modes Application Note LA000513
- SiRF NMEA reference manual
- SiRF Binary Protocol reference manual

LA010811B

Contents

1.0 Introduction 5

2.0 Technical description 5

2.1 Product applications 5

2.2 Architecture 6

2.3 Physical characteristics 6

2.4 Mechanical specification 6

2.5 Environmental 6

2.6 Compliances 6

2.7 Marking/Serialization 7

3.0 Performance characteristics 7

3.1 TTFF (Time To First Fix) 7

3.1.1 Hot start 7
3.1.2 Warm start 7
3.1.3 Cold start 7

3.2 Acquisition times 7

3.3 Timing 1PPS output 7

3.4 TricklePower^{TM} mode 7

3.4.1 Adaptive TricklePower^{TM} mode 8
3.4.2 Push-To-Fix^{TM} mode 8

3.5 Differential aiding 8

3.5.1 Differential GPS (DGPS) 8
3.5.2 Satellite Based Augmentation Systems (WAAS/EGNOS/MSAS) 8

3.6 Navigation modes 8

3.7 Core processor performance 8

3.8 Sensitivity 9

3.9 Dynamic constraints 9

3.10 Position and velocity accuracy 9

3.11 Multi-mode aiding 9

4.0 Electrical requirements 10

4.1 Power supply 10

4.1.1 Primary power 10
4.1.2 Battery backup (SRAM/RTC backup) 10
4.1.3 Low supply voltage detector 10
4.1.4 RF (Radio Frequency) input 10
4.1.5 Antenna gain 10
4.1.6 Burnout protection 10
4.1.7 Jamming performance 10

4.2 Data input and output specifications 11

5.0 Interfaces 11

5.1 External antenna interface 11

5.2 External antenna voltage 12

5.3 External I/O connector 12

5.3.1 I/O connector signals 12
5.3.2 I/O connector pin dimensions 13

6.0 Software interface 14

6.1 NMEA data messages 14

6.1.1 Jupiter 31 NMEA variations 14
6.2 Navman proprietary NMEA messages 14
6.3 SiRF binary messages 15
6.4 Software functions and capabilities 15
6.4.1 Flash (write-to-flash) upgradability 15
7.0 Jupiter 21/31 comparison 16
7.1 Receiver architecture 16
7.2 Antenna specification 16
7.3 Electrical interface 16
7.4 Default baud rates 16
7.5 Acquisition 17
8.0 Jupiter 31 mechanical drawing 18
9.0 Jupiter 31 development kit 19
10.0 Product handling 19
10.1 Packaging and delivery 19
10.2 ESD sensitivity 19
10.3 Safety 19
10.4 RoHS compliance 19
10.5 Disposal 19
11.0 Ordering information 19
12.0 Glossary and acronyms 20

Figures

Figure 2-1: Jupiter 31 block diagram 6
Figure 5-1: The 20-pin interface connector (J1) 13
Figure 8-1: Jupiter 31 mechanical drawing 18

Tables

Table 3-1: Acquisition times.. 7
Table 3-2: GPS receiver sensitivity 9
Table 3-3: Position and velocity accuracy.. 9
Table 4-1: Operating power for the Jupiter 31 10
Table 4-2: Jamming performance 11
Table 4-3: Interface voltage levels 11
Table 5-1: External antenna voltages..12
Table 5-2: J1 connector pin functions..12
Table 6-1: Jupiter 31 default baud rates 14
Table 6-2: NMEA output messages 14
Table 6-3: Jupiter 31 NMEA message structure 14
Table 6-4: Jupiter 31 $PTTK error messages..15
Table 6-5: Jupiter 31 software capability..15
Table 7-1: Receiver architecture comparison 16
Table 7-2: Antenna specification comparison..16
Table 7-3: Electrical interface comparison 16
Table 7-4: Default baud rate comparison 16
Table 7-5: Acquisition comparison 17
Table 11-1: Jupiter 31 ordering information 19

1.0 Introduction

The Jupiter 31 is a 20 channel GPS receiver module based on the Jupiter 21 form factor that is significantly enhanced to take advantage of the SiRFStar III architecture. The Jupiter 31 offers a substantial increase in sensitivity, faster time to fix and lower power consumption. The Jupiter 31 acquires GPS positions faster under low signal conditions than other available GPS engines. Tracking continues in areas of dense foliage or built-up inner city environments and even indoors of sensitivity of greater than –159 dBm with the option of using either an active or passive antenna.

2.0 Technical description

The Jupiter 31 is a single board GPS module solution intended for a wide range of OEM products, and provides an easy migration path from the Jupiter 21.

The highly integrated receiver incorporates and enhances the established technology of the SiRF StarIII GSC3e/LP chipset. With a high navigation sensitivity, the Jupiter 31 is designed to meet the needs of the most demanding applications and environments. The interface configuration and form factor allows incorporation into many existing devices and legacy designs.

Using the new and highly integrated GSC3e/LP from SiRF and carefully selected key components including TCXO, LNA and Flash, the Jupiter 31 offers faster acquisition, a wider operating voltage range and greater noise rejection than leading competitors' products using a similar architecture. The Jupiter 31 receiver decodes and processes signals from all visible GPS satellites. These satellites, in various orbits around the Earth, broadcast RF (radio frequency) ranging codes, timing information, and navigation data messages. The receiver uses all available signals to produce a highly accurate navigation solution. The 20-channel architecture provides rapid TTFF (Time To First Fix) under all start-up conditions. Acquisition is guaranteed under all initialization conditions as long as available satellites are not obscured.

Satellite-based augmentation systems, such as WAAS and EGNOS, are supported to improve position accuracy.

Protocols supported are selected NMEA-0183 (National Marine Electronics Association) data messages and SiRF binary, including: latitude,longitude, elevation, velocity, heading, time, satellite tracking status, command/control messages

2.1 Product applications

The Jupiter 31 is designed specifically for applications where rapid TTFF and operation under low signal levels are primary requirements. The module offers high performance and maximum flexibility in a wide range of OEM configurations such as asset tracking, fleet management and marine and vehicle navigation products. The high sensitivity of the module makes it particularly ideal for:

- navigation systems – where athermic glass, or an unsuitably positioned antenna inside the vehicle will reduce visibility and signal strength
- vehicle and people tracking devices – where satellites are obstructed by partially covered parking garages and walkways; Jupiter 31 will continue tracking indoors
- marine buoys – where multipath and unstable sea conditions make satellite visibility irregular
- asset tracking – where construction machinery is located in covered yards and areas of dense foliage

2.2 Architecture

A diagram of the Jupiter 31 architecture is shown in Figure 2-1.

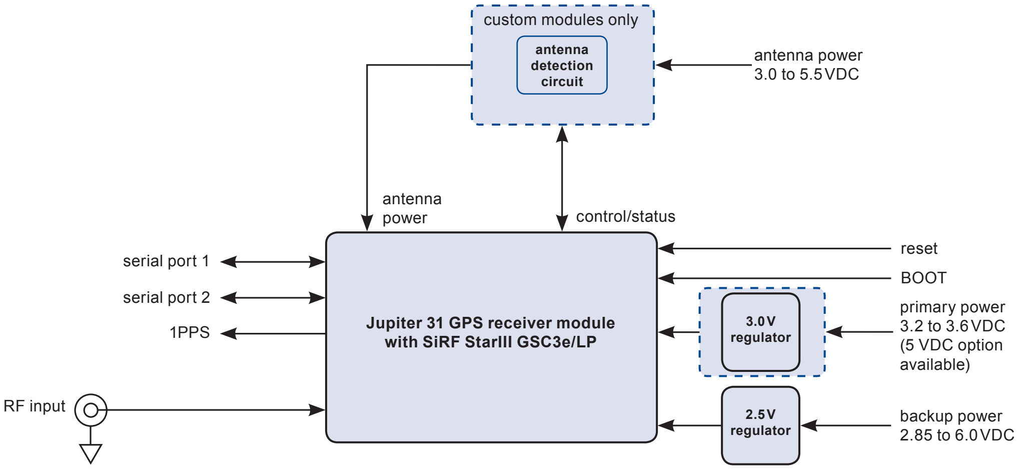


Figure 2-1: Jupiter 31 block diagram

2.3 Physical characteristics

The Jupiter 31 is compatible with the Jupiter 21 form factor. The receiver is available in several configurations (combination of core engine and antenna connector type). The configuration must be selected at the time of ordering and is not available for field retrofitting. Refer to Table 12-1 for Jupiter 31 part ordering information.

2.4 Mechanical specification

The physical dimensions of the Jupiter 31 are as follows:

length: 71.1 mm
width: 40.6 mm
thickness: 10.0 mm
weight: 25.0 g

Refer to Figure 9-1 for the Jupiter 31 mechanical drawing.

2.5 Environmental

The environmental operating conditions of the Jupiter 31 are as follows:

temperature: –40°C to +85°C
humidity: 95% non-condensing or a wet bulb temperature of +35°C
altitude: –300 m to 18 000 m
vehicle jerk: 5 m/s^3 max
vibration: random vibration IEC 68-2-64
shock (non-operating): 18 G peak, 5 ms
acceleration (operating): 4 G (39.2 m/s^2) max

2.6 Compliances

The Jupiter 31 complies with the following:

- Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)
- CISPR22 and FCC: Part 15, Class B for radiated emissions
- Automotive standard TS 16949
- Manufactured in an ISO 9000 : 2000 accredited facility

2.7 Marking/Serialisation

The Jupiter 31 supports a 128 barcode indicating the unit serial number. The Navman 13-character serial number convention is:

characters 1 and 2: year of manufacture (e.g. 06 = 2006, 07 = 2007)
characters 3 and 4: week of manufacture (1 to 52, starting first week in January)
character 5: manufacturer code
characters 6 and 7: product and type
character 8: product revision
characters 9-13: sequential serial number

3.0 Performance characteristics

All parameters specified in this section are based on room temperature conditions (22 ± 2°C) and a typical power supply voltage (3.3 ± 0.1 V or 5.0 ± 0.1 V) unless otherwise stated.

3.1 TTFF (Time To First Fix)

TTFF is the actual time required by a GPS receiver to achieve a position solution. This specification will vary with the operating state of the receiver, the length of time since the last position fix, the location of the last fix, and the specific antenna design. Use of battery backup is recommended for proper operation.

3.1.1 Hot start

A hot 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. Battery backup of the SRAM and RTC during loss of power is required to achieve a hot start.

3.1.2 Warm start

A warm start typically results from user-supplied position and time initialization data or continuous RTC operation with an accurate last known position available in memory. In this state, position and time data are present and valid but ephemeris data validity has expired.

3.1.3 Cold start

A cold start acquisition results when either position or time data is unknown. Almanac information is used to identify previously healthy satellites.

3.2 Acquisition times

Table 3-1 shows the corresponding TTFF times for each of the acquisition modes.

Mode	@ -125 dBm	
	Typ	90%
Hot start TTFF	0.5 s	< 1 s
Warm start TTFF	31 s	36 s
Cold start TTFF	33 s	38 s
Re-acquisition (<10 s obstruction)	1 s	

Table 3-1: Acquisition times

3.3 Timing 1 PPS output

The 1 PPS output of the Jupiter 31 receiver is < 1 µs, typical ± 300 ns ref UTC. Refer to Table 6-2 for the default status on the Jupiter 31.

3.4 Power management

The Jupiter 31 offers two power saving modes: Adaptive TricklePower and Push-To-Fix, which can be set using NMEA or SiRF Binary messages.

3.4.1 Adaptive TricklePower^{TM} mode

The Jupiter 31 can use the Adaptive TricklePower (ATP) feature, which reduces power consumption by intelligently switching between full power in tough GPS environments and low power in strong GPS signal areas.

When signal levels drop, the receiver returns to full power so that message output rates remain constant. This results in variable power savings but much more reliable performance for a fixed output rate. Applications using ATP should give performance very similar to full power, but with significant power savings in strong signal conditions.

ATP is best suited for applications that require solutions at a fixed rate as well as low power consumption and still maintain the ability to track weak signals.

With ATP at a 1 second update, a power saving of 50% can easily be achieved with minimal degradation in navigation performance.

3.4.2 Push-To-Fix^{TM} mode

Unlike TricklePower, the operation in this mode is not cyclic. This mode always forces the GPS software to revert to a continuous sleep mode after a navigation position fix. It will stay in sleep mode until woken by activation of the reset input, and compute a fresh position.

If the ephemeris data becomes invalid, the RTC has the ability to self activate and refresh the data, thus keeping the restart TTFF very short.

This mode yields the lowest power consumption of the module, and is ideal where a battery powered application requires very few position fixes.

For further information on power management modes refer to the Low Power Operating Modes application note (LA000513).

3.5 Differential aiding

3.5.1 Differential GPS (DGPS)

DGPS is not available on the Jupiter 31.

3.5.2 Satellite Based Augmentation Systems, (SBAS)

The Jupiter 31 is capable of receiving SBAS differential corrections including WAAS, EGNOS and MSAS. SBAS improves horizontal position accuracy by correcting GPS signal errors caused by ionospheric disturbances, timing and satellite orbit errors.

3.6 Navigation modes

The Jupiter 31 GPS receiver supports 3D (three-dimensional) and 2D (two-dimensional) modes of navigation.

3D navigation: the receiver defaults to 3D navigation when at least four GPS satellites are being tracked. In 3D navigation, the receiver computes latitude, longitude, altitude, and time information from satellite measurements.

2D navigation: when less than four GPS satellite signals are available, or when a fixed altitude value can be used to produce an acceptable navigation solution, the receiver will enter 2D navigation using a fixed value of altitude determined by the host. Forced operation in 2D mode can be commanded by the host.

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

3.7 Core processor performance

The standard Jupiter 31 runs at a CPU clock speed of up to 50 MHz. An SDK (Software Development Kit) is available from SiRF to customise the Jupiter 31 firmware.

3.8 Sensitivity

Sensitivity of the Jupiter 31 is measured assuming a system noise value of 3 dB. The sensitivity values are shown in Table 3-2:

Parameter	C/No	
acquisition - cold start	–144 dBm	26 dBHz
acquisition - hot start	–155 dBm	15 dBHz
navigation	–157 dBm	13 dBHz
tracking	–159 dBm	10 dBHz

Table 3-2: GPS receiver sensitivity

3.9 Dynamic constraints

The Jupiter 31 receiver is programmed to deliberately lose track if more than one of the following operational limits are exceeded:

Velocity:	515 m/s (1,000 nautical miles per hour) maximum
Altitude:	18,000 m (60,000 ft) maximum referenced to MSL

3.10 Position and velocity accuracy

The position and velocity accuracy of the Jupiter 31 are shown in Table 3-3, assuming full accuracy C/A code. These values are the same in normal operation and when Adaptive TricklePower is active.

Parameter	Value
horizontal CEP*	2.5 m
horizontal (2 dRMS)	5.5 m
vertical VEP*	2.0 m
velocity (speed)**	< 0.01m/s
velocity (heading)**	< 0.01°

** position error 50% and under normal open sky conditions*
*** In 3D Kalman filtered mode in steady state oen sky conditions*

Table 3-3: Position and velocity accuracy

3.11 Multi-mode aiding

Multi-mode aiding technology makes navigation information available to GPS devices when enough Satellite Vehicles (SVs) are not visible due to obstruction. In autonomous operation mode, the GPS receiver requires a signal level of 28 dBHz or higher in four or more SVs to download ephemerides. This requires an uninterrupted full 30 seconds of data reception from each SV. If the data isn't received in full, the ephemeris data collection has to start again at the next cycle.

The type of multi-mode aiding currently supported by the Jupiter 32 xLP is Ephemeris Push. This feature supports live ephemeris data to be downloaded from application servers that allows hot start performance at all times including in weak conditions and moving start ups. The ephemeris would typically be valid for 4 hours until the live ephemeris is downloaded or new ephemeris data is provided.

To use with this Ephemeris Push, the live ephemeris data is collected at application servers and then transmitted to the GPS receiver through a network connection. An application note about Ephemeris Push is in preparation and will be available at a later date.

4.0 Electrical requirements

All parameters specified in this section are based on room temperature conditions (22 ± 2°C) and a typical power supply voltage (3.3 ± 0.1 V or 5.0 ± 0.1 V) unless otherwise stated.

4.1 Power supply

4.1.1 Primary power

The Jupiter 31 GPS receiver is designed to operate from a single supply voltage, meeting the requirements shown in Table 4-1.

Parameter	Value	Value
input voltage	3.3 VDC	5.0 VDC
average sustained power (after 1st solution)	<136 mW	<250 mW
average sustained acquisition power (before 1st solution)	<149 mW	<275 mW
average initial acquisition power (1.5–2 s)	<189 mW	<300 mW
power (typ) using ATP*	80 mW at 3.3 V	80 mW at 3.3 V
battery backup voltage**	2.85 to 6.0 VDC	2.85 to 6.0 VDC
battery backup current	5 to 6 μA (typ)	5 to 6 μA (typ)
ripple	not to exceed 50 mV peak to peak	not to exceed 50 mV peak to peak
*Using Adaptive TricklePower with a 1 s update **Battery backup voltage **must not** fall below 2.5 V		

Table 4-1: Operating power for the Jupiter 31

CAUTION! If battery backup is not used, the Jupiter 31 receiver will revert to default settings if power is removed.

4.1.2 Battery backup (SRAM/RTC backup)

During ‘powered down’ conditions, the SRAM and RTC (Real Time Clock) may be kept operating by supplying power from the VBATT as shown in Table 5-2.

4.1.3 Low supply voltage detector

The module will enter a reset mode if the main supply drops below 3.0 V.

4.1.4 RF (Radio Frequency) input

RF input is 1575.42 MHz (L1 Band) at a level between –135 dBm and –159 dBm into a 50 Ω impedance. This input may have a DC voltage impressed upon it to supply power to an active antenna. The maximum input return loss is –9 dB.

4.1.5 Antenna gain

The receiver will operate with a passive antenna with unity gain. However, GPS performance will be optimum when an active antenna is used. The gain of an active antenna at the input of the module is ideally 16 dB.

4.1.6 Burnout protection

The receiver accepts without risk of damage a signal of +10 dBm from 0 to 2 GHz carrier frequency, except in band 1560 to 1590 MHz where the maximum level is –10 dBm.

4.1.7 Jamming performance

The jamming performance of the receiver based upon a 3 dB degradation in C/N_0 performance is shown in Table 4-2. This is with reference to the external antenna. These results are determined using a CW (Continuous Wave) Jammer.

Frequency MHz	**Jamming signal power dBm**
200	3
400	4
800	–9
1400	–2
1425.42	–2
1530	–11
1555	–44
1575.42	–97
1625.42	–4
1725.42	–2

Table 4-2: Jamming performance

4.2 Data input output specifications

The I/O connector voltage levels measured at PWR-IN=3.3V and 5.0V are shown in Table 4-3.

Signal	**Parameter**	**Value at 3.3VDC**	**Value at 5.0VDC**
TXD & RXD GPIOs	V_{IH} (min)	2.0 V	2.0V
	V_{IH} (max)	5.5 V	5.5V
	V_{IL} (min)	-0.5 V	-0.5V
	V_{IL} (max)	0.8 V	0.8V
	V_{OH} (min) at I_{OH} -50uA	3.2V	4.9V
	V_{OH} (min) at I_{OH} -4mA	2.88 V	4.58V
	V_{OH} (max)	3.3 V	5.0V
	V_{OL} (min) at I_{OL} 50uA	0 V	0V
	V_{OL} (max) at I_{OL} 4mA	0.36 V	0.36V
Reset input*	max capacitance Cmax	100 pF	100pF
	Max rise and fall time	250 ms	250 ms
	Input current max	-600 uA	-600 uA

**Reset input should not be driven high external circuits. It is recommended this input is driven low by an open drain interface.*

Table 4-3: Interface voltage levels

5.0 Interfaces

5.1 External antenna interface

The Jupiter 31 is available with the following antenna connector configurations:

- OSX jack, straight (female)
- OSX jack, right angle (female)
- SMB jack, right angle (female)

Note that SMB connectors do not follow the same ‘gender’ convention as other RF connectors. The SMB right angle connectors are classed female even though it has a pin and would be classed male in other variations of connectors.

5.2 External antenna voltage

The Jupiter 31 provides DC power to the external active antenna through the antenna power input pad (VANT). The DC supply in the coax cable is vulnerable to over current if a fault occurs in the antenna or if the antenna cable gets damaged.

Typical values for the external antenna are shown in Table 5-1.

Parameter	J31
voltage (typ)	3 VDC
voltage max	12 VDC
antenna current limit	50 mA

Table 5-1: External antenna voltages

5.3 External I/O connector

The OEM communications interface is a dual row, straight 2 x 10-pin field connector header (J1). The pins are spaced on 2.0 mm centres and the pin lengths are 7.0 mm off the board surface with 1.3 mm at the base for plastic form. Figure 5-1 shows the 20-pin I/O connector. The mating female connector is an IDC receptacle.

5.3.1 I/O connector signals

Table 5-2 shows the name and function of each connector pin:. A further description of each pin follows these tables.

J1	Name	Type	Description
1	VANT	P	external power supply for active antenna
2	PWRIN	P	primary VDC power input
3	VBATT	P	backup battery input
4	PWRIN	P	primary VDC power input
5	RESET	I	master reset (active low)
6	GPIO 14	I/O	reserved - no connect
7	GPIO 15	I/O	reserved - no connect
8	BOOT	I	serial boot (active low; can be held high or open circuit for normal operation)
9	GPIO 1	I/O	reserved - no connect
10	GND	P	ground
11	TXA	O	CMOS level asynchronous output for UART A
12	RXA	I	CMOS level asynchronous input for UART A
13	GND	P	ground
14	TXB	O	CMOS level asynchronous output for UART B
15	RXB	I	CMOS level asynchronous input for UART B
16	GND	P	ground
17	GND	P	ground
18	GND	P	ground
19	PPS	O	pulse per second output 1uS wide
20	WAKE-UP	I	PTF wake-up, active on positive-going edge

Table 5-2: J1 connector pin functions

Pin 1: VANT
This pin supplies DC power to the external antenna. Refer to Section 5.2 for more details.

Pin 2 & 4: PWRIN
Jupiter 31 supports either 3.2 VDC to 3.6 VDC or 4.75VDC to 5.25VDC. The main power must be regulated and have maximum ripple of 50 mV. Contact your distributor or Navman Wireless for more information.

Pin 3: VBATT
The VBATT (battery backup) pin can supply power to the SRAM and RTC (Real Time Clock) during ‘powered down’ conditions (refer to Table 4-1). The Jupiter 31 can accept slow VBATT supply rise time due to an on-board voltage detector.

Pin 5: RESET
This active low input allows the user to restart the software from an external signal. In normal operation this pin should be left floating or activated by an open drain driver. Active pull-up is not recommended.

Pin 8: BOOT
The firmware programmed in the Flash memory may be upgraded via the serial port. The user can control this by pulling the Serial BOOT pin (8) low at startup, then downloading the code from a PC with suitable software (e.g. SiRFFlash). In normal operation this pin should be left floating for minimal current drain. It is recommended that in a user application, the BOOT pin is connected to a test pad for use in future software upgrades.

Pins 11, 12, 14 and 15: serial data ports
Serial port A (pins 11 and 12), also called the host port, is the primary communications port of the receiver. Commands to the receiver are entered through pin 12 (RXA) and data from the receiver is transmitted through pin 11 (TXA). Binary or NMEA messages are transmitted and received across the host port’s serial I/O interface.

Serial port B (pins 14 and 15) is, also called the auxiliary port. By default serial port B is at 38400 baud and Null on protocol.

Pin 19: 1PPS time mark pulse
The Jupiter 31 receiver generates a 1PPS positive-going output pulse of 1 µs, typical ±300 ns which is aligned to Universal Time Coordinated (UTC) second.

Pin 20: Wake-up
Wake-up pin input only to be activated in Push-To-Fix mode once the device has been commanded into this mode and the device is in Hibernate mode. This input is activated by a positive going pulse.

5.3.2 I/O connector pin dimensions

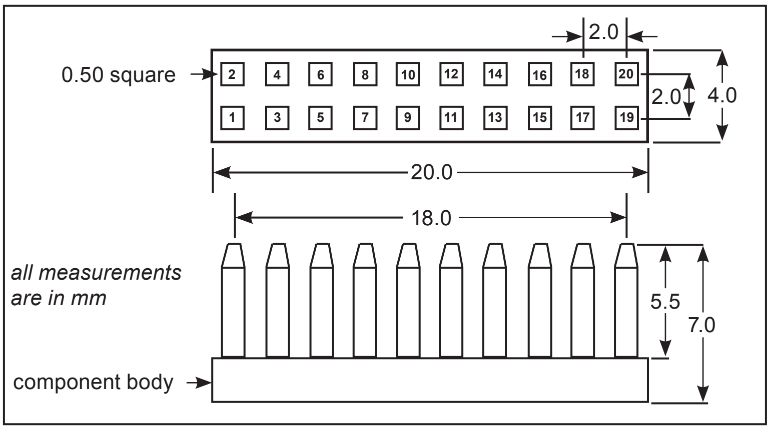


Figure 5-1: The 20-pin interface connector (J1)

6.0 Software interface

The host serial I/O port of the receiver's serial data interface supports full duplex communication between the receiver and the user. The default serial modes are shown in Table 6-1.

Port	J31
Port A	NMEA, 4800
Port B	NULL, 38400

Table 6-1: Jupiter 31 default baud rates

6.1 NMEA data messages

The output NMEA (0183 v2.2) messages and refresh rates of the Jupiter 31 receiver are listed in Table 6-2. A complete description of each NMEA message is contained in the SiRF NMEA reference manual.

Message description	Message ID	Value
GPS fix data	GGA	1 s
GPS DOP and active satellites	GSA	1 s
GPS satellites in view	GSV	1 s
recommended minimum specific GPS data	RMC	1 s
track made good and ground speed	VTG	1 s
latitude, longitude, UTC of position fix and status	GLL	1 s
PPS timing message	ZDA	1 s

Table 6-2: NMEA output messages

Message name	J31 NMEA structure	J21 NMEA structure
GGA	$GPGGA,161229**.487**,3723.2475,N,12158.3416,W,1,07,1.0,9.0,M,1.0,M,,**0000***18	$GPGGA,161229,3723.2475,N,12158.3416,W,1,07,1.0**0**,9.0,M,1.0,M, , *18
GSA	$GPGSA,A,3,07,02,26,27,09,04,15, , , , , ,1.8,1.0,1.5*33	$GPGSA,A,3,07,02,26,27,09,04,15, , , , , ,1.8**0**,1.0**0**,1.5**0***33
RMC	$GPRMC,161229**.487**,A,3723.2475,N,12158.3416,W,0.13,309.6**2**,120598,,*10	$GPRMC,161229,A,3723.2475,N,12158.3416,W,0.13**0**,309.6,120598,**23.1**,**E***10
VTG	$GPVTG,309.6**2**,T,,M,0.13,N,0.2,K*23	$GPVTG,309.6,T,286.5,M,0.13**0**,N,0.2**00**,K**,A***23
ZDA	$GPZDA,181813.00**0**,14,10,2003,,*4F	$GPZDA,181813**.00**,14,10,2003,**00,00***4F

Table 6-3: Jupiter 31 NMEA message structure

For detailed software comparison between J31 and J21 please refer to Comparison between Jupiter 31 and Jupiter 21/J21S (LA010812).

6.2 Navman proprietary NMEA messages

Navman has added a number of proprietary NMEA input messages to configure the TricklePower and Push-To-Fix modes.

These are described in the J30 Write to Flash Application Note LA000266 and the Low Power Operating Modes Application Note LA000513.

If an input message or communication error occurs a $PTTK error message will be output:

Description	Error
BufferFull	(0xF4)
ParityError	(0xF5)
RcvFullError	(0xF6)
RcvOverrunError	(0xF7)
FrameError	(0xF8)
BreakInterrupt	(0xF9)
BufferTerminated	(0xFA)
TransportDataError	(0xFB)
CheckSumError	(0xFC)
LengthError	(0xFD)
MessageTypeError	(0xFE)

Table 6-4: Jupiter 31 $PTTK error messages

6.3 SiRF binary messages

A complete description of each binary message is contained in the SiRF Binary Protocol reference manual.

6.4 Software functions and capabilities

Table 6-6 shows the software features available with the Jupiter 31 configurations.

Feature	Description	J31
SBAS capability	improves position accuracy by using freely available satellite-based correction services called SBAS (Satellite-Based Augmentation Systems)	A
Adaptive TricklePower	intelligently switches between TricklePower and full power depending on the current GPS signal level (when TricklePower is enabled)	A
Push-to-Fix	provides an on-demand position fix mode designed to further improve battery life	A
Ephemeris Push	allows hot start performance at all times including in weak conditions and moving start ups	yes
almanac to flash	improves cold start times by storing the most recent almanac to flash memory	yes
low signal acquisition	acquires satellites in low signal environments	yes
low signal navigation	continues navigating in extremely low signal environments	yes
1 PPS	a timing signal generated every second on the second	yes
Write to Flash	saves and restores user configurations and preferences to Flash memory. Refer to the J30 Application Note LA000266	yes
yes = always enabled A = available, but not enabled by default		

Table 6-5: Jupiter 31 software capability

6.4.1 Flash (write-to-flash) upgradability

The J31 supports the ability to store configuration of most serial communications and navigation parameters in flash memory. There are also user selectable navigation profiles for specific applications. Please refer to the Write to Flash application note (LA000266) for more information.

7.0 Jupiter 21/31 comparison

This section highlights the differences between the Jupiter 21 and Jupiter 31 to assist with upgrade in legacy applications. For more detailed information refer to the Jupiter 31 Application Note: Comparison between Jupiter 31 and Jupiter 21/J21S (LA010812).

7.1 Receiver architecture

Feature	Jupiter 21	Jupiter 31	Performance differences
receiver design	SiRFStarIIe/LP chipset	SiRFStarIII GSC3e/LP chipset	1) J31 has faster TTFF 2) J31 has lower power consumption 3) J31 has greater receiver sensitivity

Table 7-1: Receiver architecture comparison

7.2 Antenna specification

Feature	Jupiter 21	Jupiter 31
antenna gain	active antenna gain should be in the range of 20 to 30 dB	best results achieved with an active antenna gain of 16 dB at the module input

Table 7-2: Antenna specification comparison

7.3 Electrical interface

The following table highlights the differences between the electrical connector pin configurations.

pin	Jupiter 21 name	Jupiter 31 name	Differences
15	RXB	RXB	J21: second serial data input port. J21/J21D only receives DGPS messages in RTCM (J21S does not support DGPS).
			J31: does not support DGPS messages. Defaults to Null port.
20	GPSFIX (active low)	WAKEUP	J21: outputs low when the receiver has a fix, high otherwise
			J31: Push-to-fix wakeup on positive going edge.

Table 7-3: Electrical interface comparison

7.4 Default baud rates

Port	J21	J31
Port A	NMEA, 4800	NMEA, 4800
Port B	DGPS, 9600	NULL, 38400*

**Jupiter 31 does not support DGPS*

While these are the default baud rates, they can be changed using the "write-to-flash" feature. Refer to the Application note for WTF.

Table 7-4: Default baud rate comparison

7.5 Acquisition

Mode	J21 @-125 dBm		J31 @-125 dBm	
	Typ	90%	Typ	90%
TTFF hot (valid almanac, position, time & ephemeris)	8 s	12 s	0.5 s	<1 s
TTFF warm (valid almanac, position & time)	38 s	42 s	31 s	36 s
TTFF cold (valid almanac)	44 s	55 s	33 s	38 s
re-acquisition (<10 s obstruction with valid almanac, position, time & ephemeris)	1 s	1 s	1 s	1 s

Table 7-5: Acquisition comparison

8.0 Jupiter 31 mechanical drawing

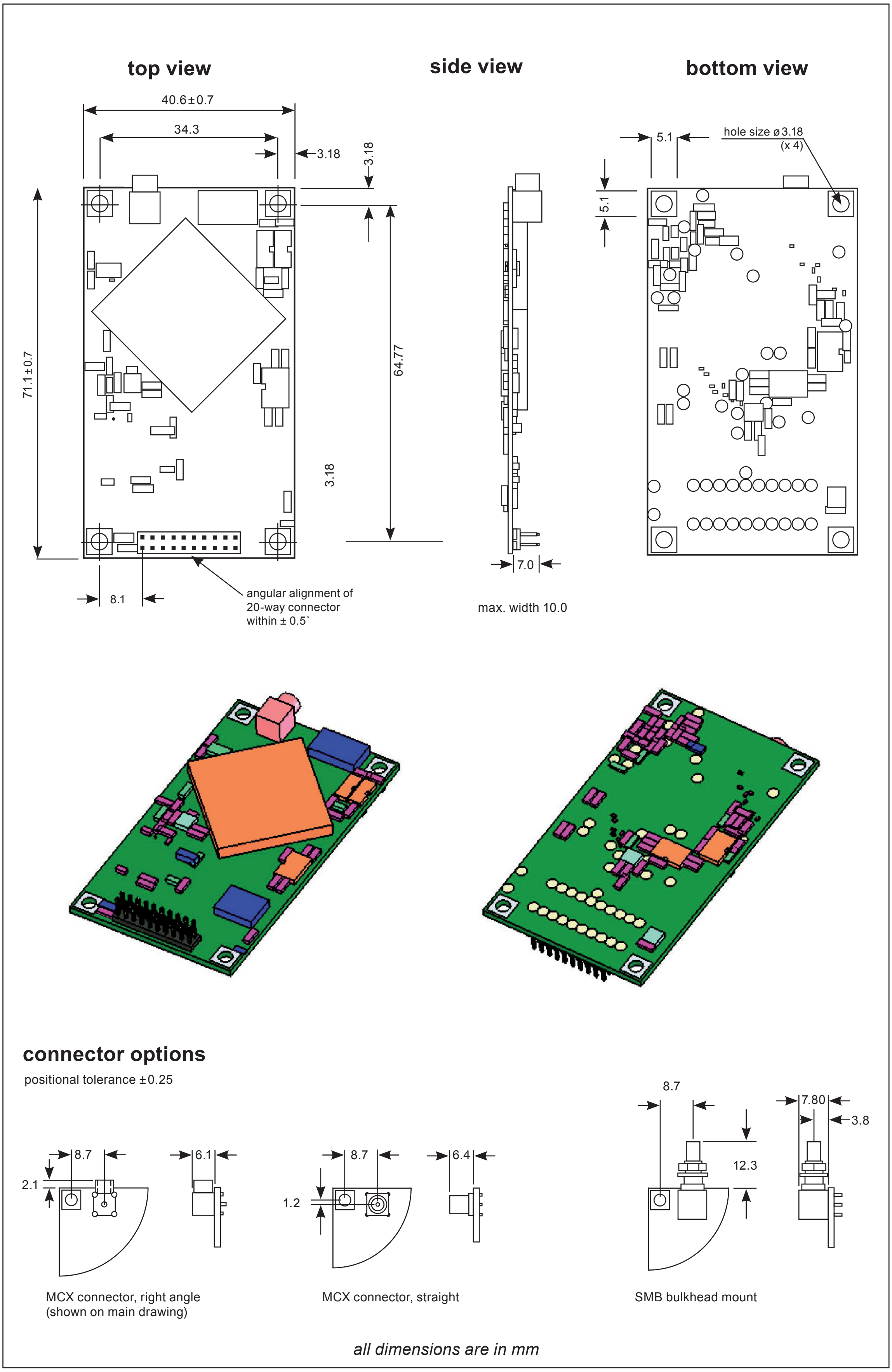


Figure 8-1: Jupiter 31 mechanical drawing

9.0 Jupiter 31 development kit

Since the Jupiter 31 module is similar to earlier Jupiter modules, a development kit is not currently planned for this product. A legacy development kit contains all the necessary hardware to carry out a thorough evaluation of the Jupiter 31 module. Additional information is provided in the Jupiter 31 Application Note: Comparison between Jupiter 31 and Jupiter 21/J21S (LA010812) from Navman Wireless.

10.0 Product handling

10.1 Packaging and delivery

The Jupiter 31 modules are packed in quantities of 10 in an anti-static tray with fitted lid. The lid is labelled with an ESD Caution. Five such trays are shipped in a box.

10.2 ESD sensitivity

The Jupiter 31 GPS receiver contains class 1 devices and is ESDS (ElectroStatic Discharge Sensitive). Navman recommends the two basic principles of protecting ESDS devices from damage:

- Only handle sensitive components in an ESD Protected Area (EPA) under protected and controlled conditions
- Protect sensitive devices outside the EPA using ESD protective packaging

All personnel handling ESDS devices have the responsibility to be aware of the ESD threat to reliability of electronic products.

Further information can be obtained from the IEC Technical Report IEC61340-5-1 & 2: Protection of electronic devices from electrostatic phenomena.

10.3 Safety

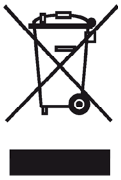
Improper handling and use of the Jupiter GPS receiver can cause permanent damage to the receiver and may even result in personal injury.

10.4 RoHS compliance

This product complies with Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

10.5 Disposal

We recommend that this product should not be treated as household waste. For more detailed information about recycling of this product, please contact your local waste management authority or the reseller from whom you purchased the product.



11.0 Ordering information

The part numbers of the Jupiter 31 variants are shown in Table 11-1.

Part Number	Description
AA003041-G	Jupiter 31 with right angle OSX 3.3Volt
AA003042-G	Jupiter 31 with straight OSX 3.3Volt
AA003043-G	Jupiter 31 with right angle SMB 3.3Volt
AA003045-G	Jupiter 31 with right angle OSX 5Volt
AA003046-G	Jupiter 31 with straight OSX 5Volt
AA003047-G	Jupiter 31 with right angle SMB 5Volt

Table 11-1: Jupiter 31 ordering information

12.0 Glossary and acronyms

2dRMS: twice distance Root Mean Square

Almanac: A set of orbital parameters that allows calculation of approximate GPS satellite positions and velocities. The almanac is used by a GPS receiver to determine satellite visibility and as an aid during acquisition of GPS satellite signals. The almanac is a subset of satellite ephemeris data and is updated weekly by GPS Control.

C/A code: Coarse Acquisition code
A spread spectrum direct sequence code that is used primarily by commercial GPS receivers to determine the range to the transmitting GPS satellite.

C/No: Carrier to Noise ratio
A measure of the received carrier strength relative to the strength of the received noise (measured in dB).

DGPS: Differential GPS
A technique to improve GPS accuracy that uses pseudo-range errors recorded at a known location to improve the measurements made by other GPS receivers within the same general geographic area.

GDOP: Geometric Dilution of Precision
A factor used to describe the effect of the satellite geometry on the position and time accuracy of the GPS receiver solution. The lower the value of the GDOP parameter, the less the error in the position solution. Related indicators include PDOP, HDOP, TDOP and VDOP.

EGNOS: European Geostationary Navigation Overlay Service
The system of geostationary satellites and ground stations developed in Europe to improve the position and time calculation performed by the GPS receiver.

Ephemeris: A set of satellite orbital parameters that is used by a GPS receiver to calculate precise GPS satellite positions and velocities. The ephemeris is used to determine the navigation solution and is updated frequently to maintain the accuracy of GPS receivers.

GPS: Global Positioning System
A space-based radio positioning system that provides accurate position, velocity, and time data.

OEM: Original Equipment Manufacturer

Re-acquisition: The time taken for a position to be obtained after all satellites have been made invisible to the receiver.

SBAS: Satellite Based Augmentation System
Any system that uses a network of geostationary satellites and ground stations to improve the performance of a Global Navigation Satellite System (GNSS). Current examples are EGNOS and WAAS.

SRAM: Static Random Access Memory

TTFF: Time To First Fix
The actual time required by a GPS receiver to achieve a position solution. This specification will vary with the operating state of the receiver, the length of time since the last position fix, the location of the last position fix, and the specific receiver design.

UTC: Universal Time Co-ordinated
The international time standard, a successor to GMT (Greenwich Mean Time).

WAAS: Wide Area Augmentation System
The system of satellites and ground stations developed by the FAA (Federal Aviation Administration) that provides GPS signal corrections. WAAS satellite coverage is currently only available in North America.

Information in this document is provided in connection with Navman Wireless ('Navman') products. These materials are provided by Navman as a service to its customers and may be used for informational purposes only. Navman assumes no responsibility for errors or omissions in these materials. Navman may make changes to specifications and product descriptions at any time, without notice. Navman makes no commitment to update the information and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to its specifications and product descriptions. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document. Except as provided in Navman's Terms and Conditions of Sale for such products, Navman assumes no liability whatsoever.

THESE MATERIALS ARE PROVIDED 'AS IS' WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, RELATING TO SALE AND/OR USE OF NAVMAN PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, CONSEQUENTIAL OR INCIDENTAL DAMAGES, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. NAVMAN FURTHER DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. NAVMAN SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS, WHICH MAY RESULT FROM THE USE OF THESE MATERIALS.

Navman products are not intended for use in medical, lifesaving or life sustaining applications. Navman customers using or selling Navman products for use in such applications do so at their own risk and agree to fully indemnify Navman for any damages resulting from such improper use or sale. Product names or services listed in this publication are for identification purposes only, and may be trademarks of third parties. Third-party brands and names are the property of their respective owners. Additional information, posted at www.navmanwireless.com/oem, is incorporated by reference.

For technical questions, contact your local Navman Wireless OEM sales office or field applications engineer. Please refer to Navman Wireless OEM Solutions at www.navmanwireless.com/oem