



Jupiter 21 GPS receiver module

Development Kit guide.

Applies only to older models:

TU10-D007-403

TU10-D007-404



Jupiter 21 development unit

Related products

- TU21-D410-021 J21 (standard) with right angle OSX
- TU21-D410-031 J21 (standard) with straight OSX
- TU21-D410-041 J21 (standard) with right angle SMB
- TU21-D510-021 J21S (XTrac) with right angle OSX
- TU21-D510-031 J21S (XTrac) with straight OSX
- TU21-D510-041 J21S (XTrac) with right angle SMB

Related documents

- Jupiter 21 Product brief LA000515
- Jupiter 21 Data sheet/Integrator's Manual LA000516
- Low Power Operating Modes application note LA000513
- Navman NMEA reference manual MN000315
- SiRF Binary Protocol reference manual

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1.0 Introduction

The Jupiter 21 series development kits provide a hardware and software platform for testing and evaluating the Jupiter 21 GPS receiver module for integration into custom applications.

The kit contains all of the tools and equipment necessary to evaluate the Jupiter 21 module, including development board, antenna and cables. In addition to these items, the GPS software tools SiRFDemo and SiRFView are provided to allow communication with the Jupiter 21 GPS receiver through a serial port. These Windows-based packages present the receiver's raw data in graphical form, allowing detailed analysis and evaluation of both NMEA and SiRF Binary formats.

This user guide describes the hardware items supplied with the development kit and provides guidelines on the set-up and operation of the development unit. We recommend that you familiarise yourself with the configuration settings outlined in section 3.0 before applying power and operating the unit.

Technical information and performance characteristics relating to the Jupiter 21 can be found in the LA000516 Data sheet/Integrators Guide.

2.0 General description

This section provides a description of the equipment provided in the development kit.

2.1 Development kit contents

Your Jupiter 21 development kit contains the following items:

- Jupiter 21 GPS development unit
- active GPS antenna with 5 m cable
- serial interface cable
- 120 to 240 VAC universal power adapter
- cigarette lighter adapter with 2.3 m cable
- GPS software tools and Jupiter 21 technical documentation

These items are shown in Figure 2-1 and described further in the sections that follow.

1. Jupiter 21 GPS development unit

The development unit houses a GPS receiver board fitted with a Jupiter 21 module. The following resources are available on the unit:

- dual RS232 level serial data I/O ports
- selectable bias voltages for active GPS antennas
- backup power source for SRAM and RTC
- provision to insert a current measuring device to monitor both primary and backup power usage under various conditions
- regulated DC power supply to the Jupiter 21 module
- status indicator LEDs on the front panel
- configurable functionality using a DIP switch

2. GPS antenna with pre-amp, magnetic base and SMA connector

A magnetic-mount active antenna is supplied with an RF cable (RG-316) already terminated with the required connector for the unit. The nominal measured attenuation of the cable with connectors is approximately 5 dB. The supplied active antenna should be biased at +3.3 VDC, but an active antenna with a bias of +5 VDC may also be used.

Refer to Section 3.2 to ensure that the configuration switches on the front panel of the development unit are set to the appropriate bias voltage.



Figure 2-1: Jupiter 21 development kit contents

3. Serial interface cable

A serial cable is provided to interface between the development unit and your PC, or between the unit and a DGPS receiver. This cable is terminated at both ends with female connectors to match the male connectors on the development unit and the PC. If your PC only supports a USB port, a USB serial adapter can be used.

4. Power adapter for 120/240 VAC operation

DC power for the development unit is provided by either an AC/DC converter or car adapter (as supplied). The AC/DC converter operates from a nominal 120/240 VAC input and provides a 12VDC at 500 mA out.

5. Power adapter for 12 VDC vehicle operation

A car power adapter (12V) suitable for use with a cigarette lighter socket is provided for road testing.

The development kit also includes:

A CD-ROM containing the GPS analysis software (SiRFDemo and SiRFView) and the Jupiter 21 technical documentation. SiRFFlash is also provided for Flash programming.

2.2 PC requirements

Your PC system should meet the minimum system requirements:

- Windows 95/98, WinNT4.0 or higher
- 486 100MHz or higher
- SVGA at least 800x600 resolution
- 16 Megabytes of RAM
- 6 Megabytes (min) of disk space
- minimum of one serial port (if your PC only has USB, a USB serial adapter can be used)

3.0 Technical configuration

This section provides a description of the interfaces and configurable functionality of the Jupiter 21 GPS development unit.

3.1 External interfaces

Figure 3-1 shows the connectors, switches and LEDs available on the development unit.

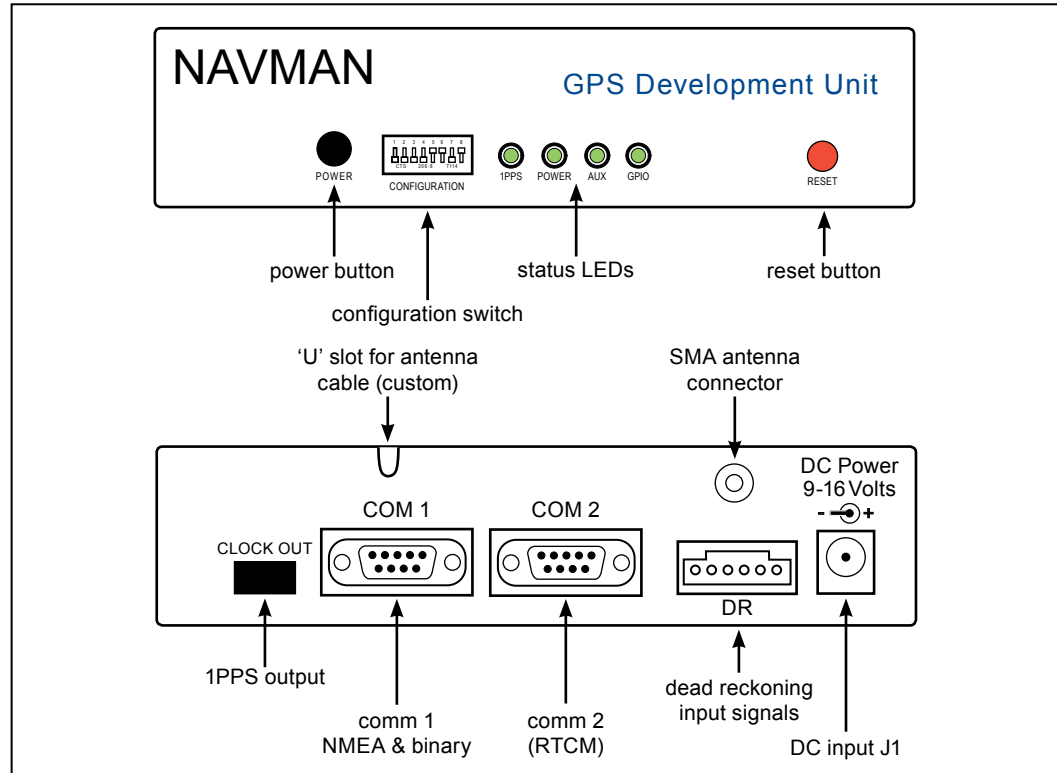


Figure 3-1: Front and back panels of the Jupiter 21 development unit

Power button (On/Off)

The Power button controls primary power to the receiver module inside. The green Power LED indicates the state of the unit: if lit, the module has primary power supplied.

If configuration DIP switch 5 is ON and Jumper JB5/6 linked, the module's secondary supply SRAM and RTC will continue to be powered when the power switch is OFF. Only the removal of the DC power input at the rear of the unit will stop secondary power being applied (assuming Jumper JB5/6 and switch 5 are correctly set). Having this secondary power supply applied means that the Jupiter 21 will have a hot start capability when primary power is re-applied within 4 hours, and a warm start thereafter, by maintaining last position, current time and satellite ephemerides.

Configuration DIP switch

The configuration DIP switch is used to configure the Jupiter 21 module, offering flexibility depending on the specific application. Refer to section 3.1.2 for more details.

Status LEDs

The four LEDs on the front panel indicate the current status of basic features associated with the development unit:

- 1PPS – flashes on with each transition of the 1 PPS (Pulse Per Second) output of the GPS receiver. This LED will begin flashing when the receiver is tracking a satellite. Note that the Jupiter 21S (XTrac) does not support 1 PPS.
- Power – indicates the presence of primary DC power to the module.
- Aux – shows activity on the auxiliary serial RS232 port (DGPS).
- GPIO – this LED provides no function on the Jupiter 21 development unit.

Reset button

The reset push button on the front panel can be used to generate a receiver system hardware reset.

Clock out connector

The Clock out connector provides an interface for all associated timing signals with the module. It gives access to the Time Mark (1PPS) signal. Refer to section 3.1.1 for more details.

Serial ports 1 and 2

The two serial ports on the development board are 9-way D-type connectors. Serial port 1 is the host port used to send and receive serial data. This port is used as the default, with transmission in NMEA format at the rate of 4800 Baud.

Serial port 2 is the auxiliary serial port, primarily used for the reception of RTCM SC-104 DGPS (Differential GPS) correction messages. Note that the Jupiter 21S (XTrac) does not support DGPS.

Antenna connector

The GPS antenna provided with the kit can be plugged into the SMA connector on the rear panel of the development unit.

DC power input

The supplied DC power adapter is to be plugged into the DC connector on the rear panel of development unit. The unit will accept voltages from 9 to 16VDC. The middle pin on J1 is of negative polarity, while the outer shell is positive.

3.1.1 Clock out connector

The pinout connections of the Clock out connector are described in Table 3-1, and illustrated in Figure 3-2. Note that this connector provides no function on the Jupiter 21S development unit.

| Pin number | Function |
|------------|----------------------|
| 1 | not used |
| 2 | inverted 1PPS signal |
| 3 | normal 1PPS signal |
| 4 | ground |

Table 3-1: Pin functions of the clock out connector

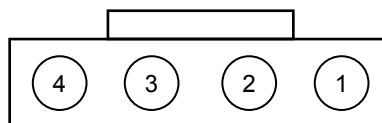


Figure 3-2: Pin layout of the clock out connector

A mating connector for the clock out connector is supplied with the development kit. The part number is shown in Table 3-2.

| Manufacturer | Part number |
|--------------|------------------|
| Molex | 70400 series 'G' |

Table 3-2: Mating connector part description

3.1.2 Configuration DIP switch

A typical setting of the Configuration DIP switch is shown in Figure 3-3.

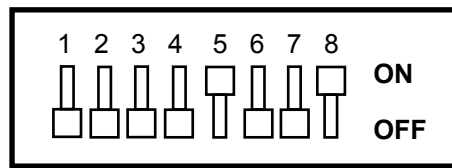


Figure 3-3: Configuration DIP switch

Table 3-3 outlines the available functionality and corresponding switch position for the Configuration DIP switch.

| Switch | Description | Typical setting |
|--------|---------------------|------------------|
| 1 | no connection | OFF (high) |
| 2 | reserved | OFF (high) |
| 3 | serial BOOT | OFF (normal run) |
| 4 | reserved | OFF (high) |
| 5 | RTC BACKUP POWER | ON (enabled) |
| 6 | PREAMP power select | OFF (3V) |
| 7 | PREAMP power select | OFF (12V) |
| 8 | PREAMP power enable | ON (enabled) |

Table 3-3: DIP switch settings

The receiver operating settings will not change after moving the position of a configuration switch while the unit is operating. Pressing the Reset button, or turning the unit OFF and ON will enable the settings to take effect in the receiver.

The recommended method for reconfiguration is to switch the unit OFF, modify the switch positions, then re-apply the power.

The functionality of each switch is described briefly below.

DIP switch 1

DIP switch 1 has no effect on Jupiter 21 modules.

DIP switch 2

DIP switch 2 is reserved and should remain in the typical setting (OFF).

DIP switch 3 – BOOT from serial mode

DIP switch 3 interfaces with the BOOT pin of the module and allows the user to upgrade the Flash memory. For normal operation the switch should be set OFF. To boot from the serial port the switch should be ON.

DIP switch 4

DIP switch 4 is reserved and should remain in the typical setting (OFF).

DIP switch 5 – RTC backup power enable

DIP switch 5 provides control of the RTC backup power to the module. When set to ON, the RTC backup power is applied to the module, allowing the RTC and SRAM to continue being powered when the primary source is removed. The jumper JB5/6 must also be in place for the backup power to be supplied. This power supply will be supplied to the module even with the main power switch in the off position.

DIP switch 6 – Antenna preamp power select (3.3V or 5/12V)

DIP switch 6 provides control of the antenna preamp voltage applied to the module. The position of the switch determines the supply voltage (off=3.3V, on = 5/12V). The positions of switches 7 and 8 also need to be considered when using the preamp function.

Note that the supplied antenna is a 3.3V type.

DIP switch 7 – Antenna preamp power select (5V or 12V)

DIP switch 7 also controls the antenna preamp voltage applied to the module. If switch 6 is ON, then switch 7 will determine the supply voltage to the active antenna (off= 12V, on=5V).

DIP switch 8 – Antenna preamp power enable

DIP switch 8 provides the ability to enable/disable the antenna preamp voltage to the module depending on the antenna being used. Typically this switch is ON, enabling 3V to be applied to the active antenna supplied with the kit.

CAUTION! Ensure that the power antenna switches are properly set before connecting the antenna (DIP switches 6 and 7). An antenna designed for +3VDC operation will be damaged if connected to a 12VDC source.

3.2 Internal configuration

It should not be necessary to open the development unit unless changing the internal switches for DR operation or accessing the internal test pins. Most combinations of I/O can be made from the front panel configuration switch. However, in the event that it is necessary to open the unit, Figure 3-4 illustrates the internal layout of the development unit.

Figure 3-4 shows the links that can be configured to provide functionality depending on the application. Table 3-4 lists the functions available.

| Pins | Function when linked |
|---------|--|
| JB1/2 | Current link for 5V supply. Can be used to determine current on 5V rail. |
| JB3/4 | Current link for the primary power 3.3V supply. Can be used to determine current on 3.3V rail. |
| JB5/6 | Current link for the secondary power RTC supply. Can be used to determine supply current for RTC rail. |
| JB10/11 | 5V supplied to pin 1 of the DR connector |
| JB11/12 | 3.3V supplied to pin 1 of the DR connector |
| JB16/17 | Internal interface enable (normally fitted) |

Table 3-4: Link functionality

In addition to the configurable jumpers, there is a set of test points on the board. The signals available on the test points are shown in Table 3-5.

| Test point | Function |
|-------------------------------|----------|
| E1 | TXA |
| E2 | RXA |
| E3 | TXB |
| E4 | RXB |
| E6 | 1PPS* |
| E7 | not used |
| E8 | ground |
| E9 | ground |
| *not supported by Jupiter 21S | |

Table 3-5: Signals available on the test points

There are some settings that should not be changed when using the standard Jupiter 21 module with the development unit. These are as follows:

- Link for JB16/17 must be fitted
- SW3 DIP switches must all be OFF except SW3.3

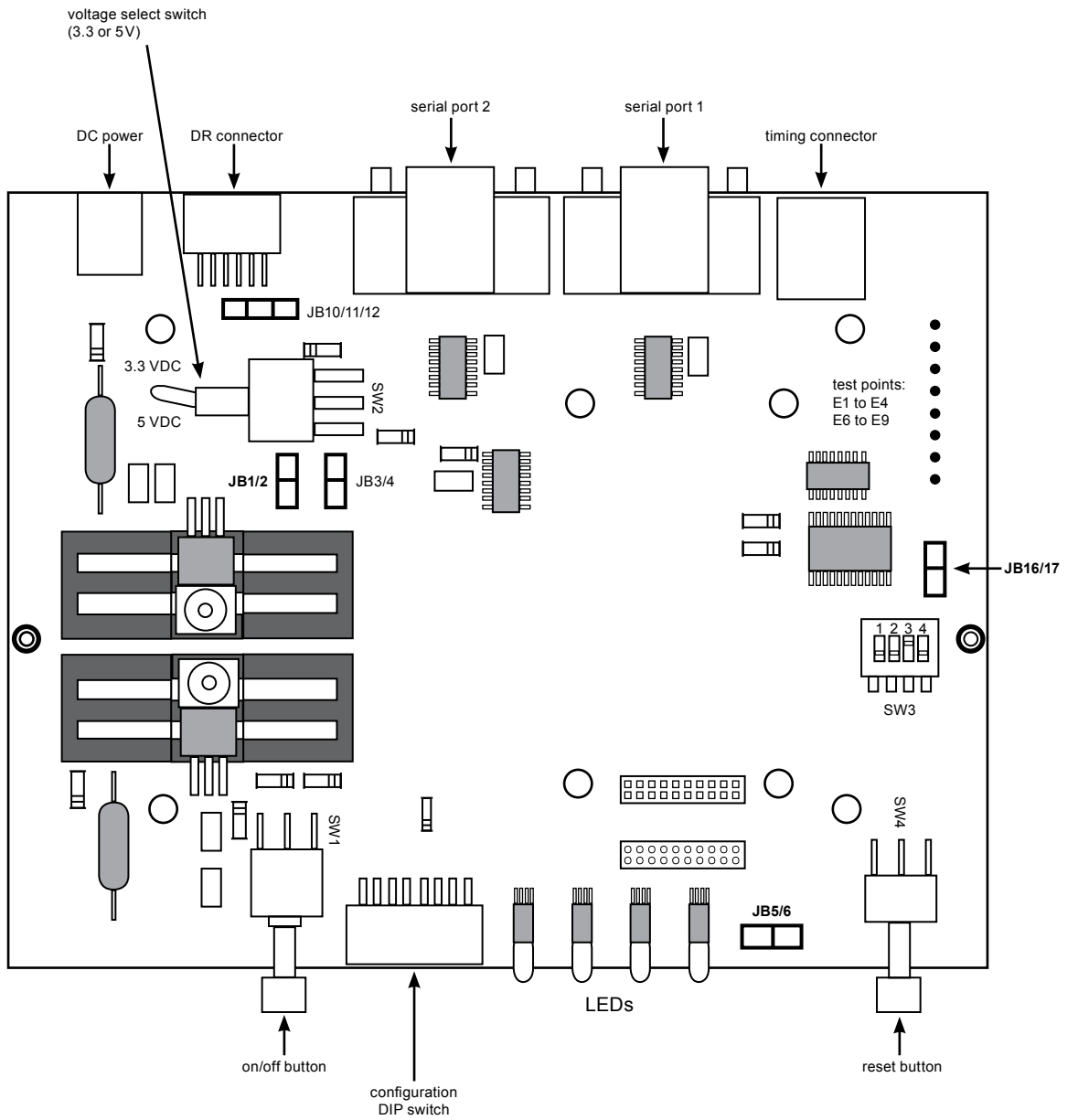


Figure 3-4: Internal layout of the development unit

4.0 Jupiter 21 development board

Figure 4-1 shows the Jupiter 21 development board with the position of the connectors.

Table 4-1 lists the pin configurations for the J1 and J2 connectors.

| Jupiter function | J2 (2.54 mm pitch header) pin no. | J1 (2 mm pitch header) pin no. |
|-------------------------|-----------------------------------|--------------------------------|
| V_ANT | 1 | 1 |
| PWRIN | – | 2 |
| VCC_RF | 2 | – |
| V_BATT | 3 | 3 |
| PWRIN | 4 | 4 |
| RESET | 5 | 5 |
| GPIO3/ANTSC*/NC/GYRO_IN | 6 | – |
| NC/GYRO_IN | – | 6 |
| GPIO15/ANTOC*/FR | 7 | – |
| RES/FR | – | 7 |
| BOOT | 8 | 8 |
| GPIO1/ANTCNTRL*/W_TICKS | 9 | – |
| RES/W_TICKS | – | 9 |
| RF ON | 10 | – |
| GND | – | 10 |
| TXA/SDO1 | 11 | 11 |
| RXA/SDI1 | 12 | 12 |
| GPIO5/SDI* | 13 | – |
| GND | – | 13 |
| TXB/SDO2 | 14 | 14 |
| RXB/SDI2 | 15 | 15 |
| GPIO7/SCK* | 16 | – |
| GND | – | 16 |
| GND | 17 | 17 |
| GPIO6/SDO* | 18 | – |
| GND | – | 18 |
| 1PPS† | 19 | 19 |
| GPS_FIX | 20 | 20 |

*3 V logic only, †no output on Jupiter 21S
 NC=no connection, RES= allocated for future enhancements

Table 4-1: Connections J1 and J2

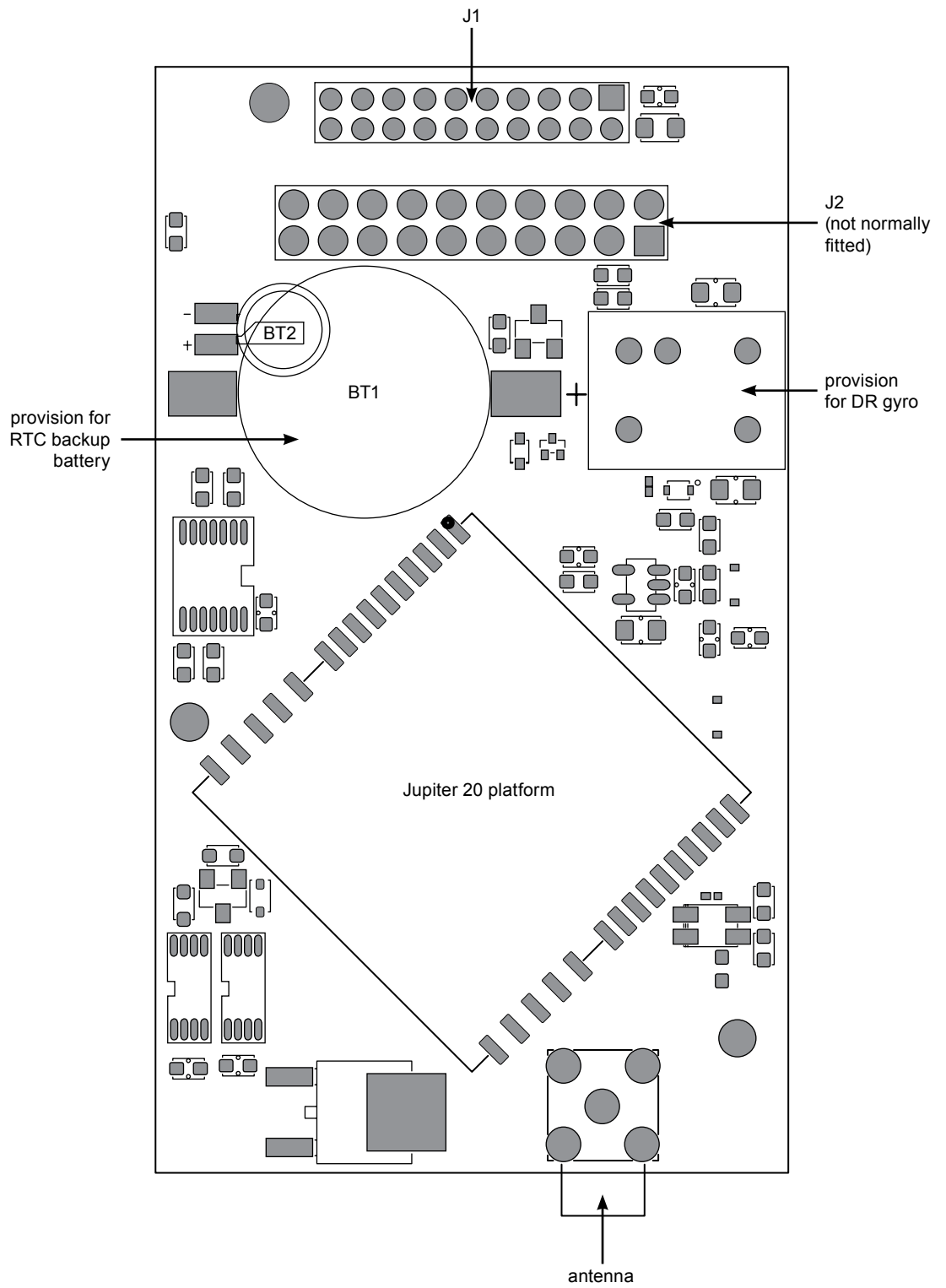


Figure 4.1: Jupiter 21 development board

5.0 Setting up the equipment

This section provides guidelines on setting up and operating the GPS development unit.

5.1 Initial connection and operation

The following steps describe how to connect and operate the GPS development unit (see Figure 5-1).

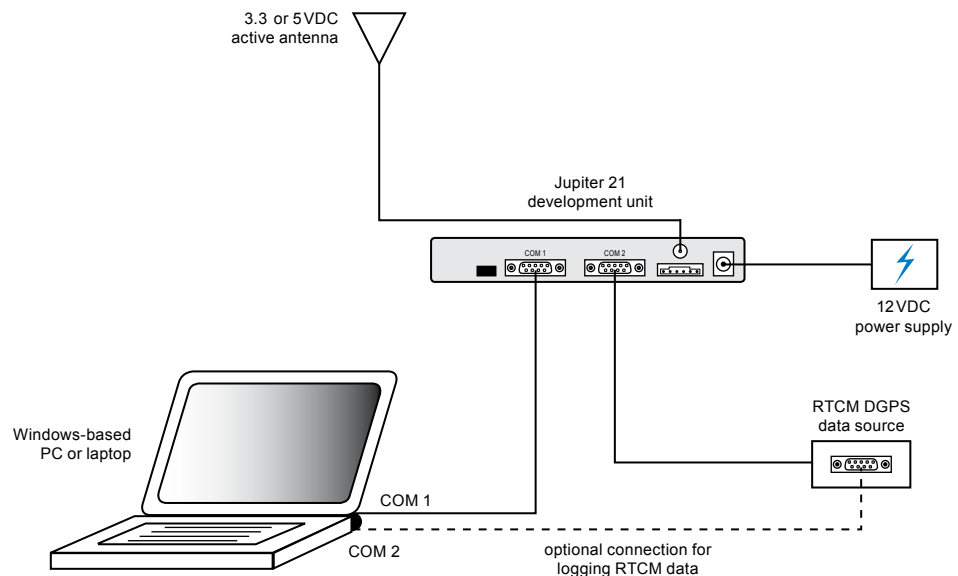


Figure 5-1: Jupiter 21 development unit test equipment

Install the supplied SiRFDemo on your PC

1. Insert the supplied software and documentation CD-ROM into the appropriate drive.
2. Open the zipped SiRFDemo software file. Double-click the SiRFDemo executable file and follow the installation process.

Set up the hardware

1. Connect the DC power adapter to the power input (J1) on the unit.
2. Connect the antenna cable to the SMA coaxial antenna connector on the rear panel of the unit.
3. Connect the DB9 serial data cable between the PC serial communication port and Serial Port 1.
4. Place the antenna in a site with an unobstructed (360°) view of the sky (refer to section 5.2).
5. Run the GPS analyser software on the PC (refer to section 5.4).
6. Connect the power supply to a suitable AC outlet.
7. Push the Power button on the front of the unit On to provide primary power to the receiver. When power is applied the green Power LED is lit.

5.2 Positioning the GPS antenna

The GPS antenna should be located with a clear view of the sky for optimal reception of the satellite signals.

GPS signals may be severely attenuated or totally obscured by roofs, solid walls, dense foliage, or even coated glass (found in many office structures and car windows). The antenna unit should be outside, or on the roof of a building to effectively evaluate receiver performance. With stationary developments, care should be taken to keep the antenna away from the side of a building as GPS signals can reflect off metal or coated glass. These reflections have a longer path than direct signals and can cause multi-path errors.

5.3 Connecting an RTCM differential source

The development unit, PC and the RTCM SC-104 differential correction source are connected as shown in Figure 5-1. If the RTCM cable is not connected to the receiver's auxiliary port (COM 2), DGPS operation will not be possible. When RTCM data is being received the Aux LED will be lit. If RTCM SC-104 data needs to be logged at the same time it is sent to the receiver, the OEM must supply a cable with three connectors to connect the RTCM correction source to the development unit's auxiliary port and to an unused serial port on the PC.

5.4 Operating the GPS analyser software

There are three software packages supplied with the GPS development kit: SiRFDemo, SiRFFlash and SiRFView. The VisualGPS program can be downloaded for free from the VisualGPS website (www.visualgps.net/VisualGPS/).

5.4.1 SiRFDemo

SiRFDemo software can provide analysis of receiver output in either SiRF binary or NMEA protocols. When enabled in NMEA format, the only analysis provided is raw data being transmitted by the receiver. While the module is transmitting serial data in NMEA format, it is suggested that VisualGPS is used for analysis, rather than SiRFDemo.

To provide graphical presentation of the data, the receiver can be set to output in SiRF binary format.

To set the receiver output to SiRF binary

1. Open the SiRFDemo software.
2. When the Data Source Setup window is displayed, select the appropriate COM port and 4800 Baud from the Baud Rate list.
3. Select Action/Open Data Source. If the development board is powered, and Serial port 1 is connected to the PC, NMEA data should appear in the Debug View window.
4. To change to SiRF binary, select Action/Switch to SiRF Protocol.

Information should now display in each window, similar to that of VisualGPS. While enabled in SiRF binary protocol, more of the analysis software's functionality can be accessed. To switch back to NMEA mode, select Action/Switch to NMEA Protocol. Select 4800 for the baud rate and click on the Send button.

Note: All settings (including the current output protocol) are reset if power is removed from the board. For more information, refer to the SiRFDemo and SiRFFlash User Guides.

5.4.2 VisualGPS

VisualGPS graphically presents the serial data transmitted by the receiver. The receiver output must be enabled in the NMEA protocol for this software to be used.

To enable the receiver output:

1. Open the VisualGPS software installed on the PC.
2. Select the Settings/Communications tab.
3. When the Communications Settings window is displayed, select the correct COM Port and set the Baud rate to 4800 baud.

When the receiver output has been enabled and the development board is powered, raw NMEA data should appear in the NMEA Monitor Window. For more information on any of the analysis windows, use the Help function in the VisualGPS menu bar.

5.4.3 SiRFView

SiRFView can be used to analyse GPS data that has been collected using SiRFDemo. The GPS data is logged in the *.gps file format that can be imported into SiRFView and presented on screen in a number of numeric and graphical forms.

For further information about using SiRFView, refer to the User guide provided with this development kit.

6.0 Jupiter 21 DR (Dead Reckoning) configuration

The DR connector on the rear panel of the development unit provides an interface with the external inputs under DR operation. This functionality is only to be used when evaluating Jupiter 21D (DR) custom modules only.

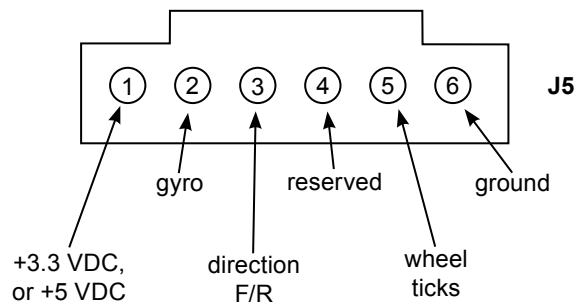


Figure 6-1: DR interface connector

The connector is used for signals transmitted by:

- An angular rate sensor (gyro)
- A wheel ticks source
- A forward/reverse indicator

These signals are present on many late model vehicles and may be used to assist the DR receiver in determining position accuracy during the loss of signal conditions. Direct connection to the vehicle is not normally possible as the inputs need to be 3V logic level signals.

Note: When using the Jupiter 21D version in a development unit, the front panel switches 1, 2, 3 and 4 should be isolated by turning the internal switches SW3 OFF. If the front panel DIP switch 3 is still required, leave the internal switch SW3.3 ON.

6.1 DR connector pin configuration

The following sections describe the functions of the DR connector pins.

Pin 1 – DC power supply

This pin can be used to power at either 3.3 or 5VDC for external devices used in the DR operation. To modify the supply voltage, refer to section 3.2 for details of the jumper positioning.

Pin 2 – Heading rate gyro input

Table 6-1 details the gyro requirements. It is important to ensure that the rate gyro signals have the following characteristics:

- Range: 0 to 5V
- Output (no gyro rotation): 2.5V
- Clockwise rotation of the gyro causes the output voltage to rise
- Maximum voltage deviation due to rotation should occur with a turning rate of 90° per second or less

The gyro should be mounted so that its sensitive axis is as near vertical as practical. Deviations from the vertical will reduce sensitivity for heading changes in the horizontal direction. Experiments have shown that acceptable performance can be achieved with mounting deviations of several degrees, but a better performance is achieved when the gyro is mounted closer to vertical.

Pin 3 – Direction F/R sensor

Input from a signal that is normally at +0V, but rises to +12V when the vehicle is in the reverse gear. Use of this signal is optional; if it is not used, the effect of occasional reversing by the vehicle will not significantly degrade navigation performance. To ensure minimum current under backup power, be sure that this input is not pulled up external to the board.

If this signal is not connected, switch SW3.2 should be left ON, with DIP switch 2 also ON to select 'forward'.

Pin 4 – Speed pulses

The input to this pin is a pulse train generated in the vehicle. If this signal is derived from the vehicle's electrical system, external level shifting for this signal is required. The pulse frequency is proportional to the vehicle velocity. These pulses, or wheel ticks, are generated in most vehicles by the ABS (Anti-lock Braking System), the transmission, or the drive shaft. System design must restrict the pulses between 0 and 12V.

Detection limits are as follows:

- Minimum detectable rate: 1 Hz
- Maximum detectable rate: 4 kHz

The gyro input specification is shown in Table 6-1.

| Characteristics | Symbol | Condition | Min. | Standard | Max. | Unit |
|-------------------------------|--------------|--|-------|----------|-------|----------|
| Supply voltage | Vcc | | +4.5 | +5.0 | +5.5 | VDC |
| Max. angular velocity | ω max | | -80 | | +80 | deg/s |
| Output | Vo | angular velocity = 0 at -30 ~ 80°C | 2.200 | 2.500 | 2.800 | VDC |
| Scale factor | Sv | at -30 ~ 80°C | 19.3 | 22.2 | 25.1 | mV/deg/s |
| Asymmetry CW & CCW | | | | | 3 | deg/s |
| Temp coefficient scale factor | | reference temp: -30 ~ 80°C | | | ±10 | %FS |
| Temp coefficient drift | | reference temp: -30 ~ 80°C | | | 9 | deg/s |
| Noise level | | 7kHz noise | | | 20 | mVrms |
| Linearity | | in the maximum angular velocity range | | | 0.5 | %FS |
| Operating temp range | Topr | | -40 | | 85 | °C |

Table 6-1: Gyro input specification

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